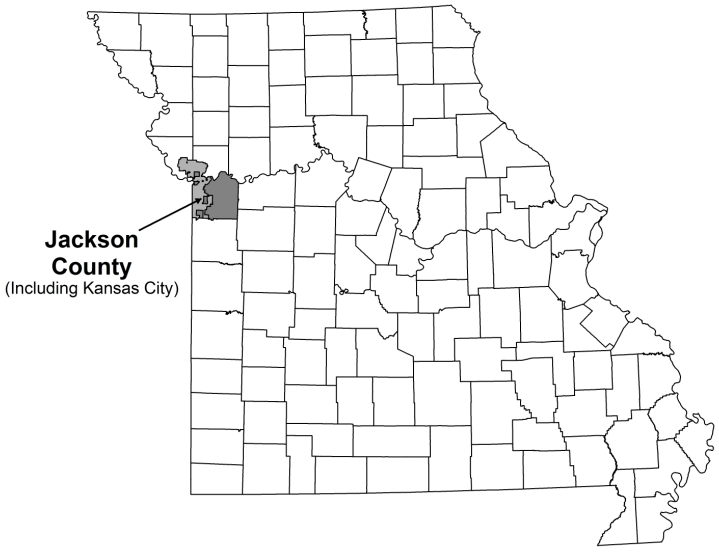
FLOOD INSURANCE STUDY

JACKSON COUNTY, MISSOURI
AND INCORPORATED AREAS AND
KANSAS CITY
VOLUME 1 OF 8

COMMUNITY NAME	COMMUNITY NUMBER
BLUE SPRINGS, CITY OF	290169
BUCKNER, CITY OF	290170
GRAIN VALLEY, CITY OF	290737
GRANDVIEW, CITY OF	290171
GREENWOOD, CITY OF	290711
INDEPENDENCE, CITY OF	290172
JACKSON COUNTY (UNINCORPORATED AREAS)	290492
KANSAS CITY	290173
LAKE LOTAWANA	290697
*LAKE TAPAWINGO, CITY OF	290699
LEE'S SUMMIT, CITY OF	290174
LEVASY, CITY OF	290175
LONE JACK, VILLAGE OF	290853
OAK GROVE, CITY OF	290694
RAYTOWN, CITY OF	290176
RIVER BEND, TOWN OF	290923
SIBLEY, VILLAGE OF	290177
SUGAR CREEK, CITY OF	290178
*UNITY, VILLAGE OF	290513



Preliminary
October 10, 2014

*No Special Flood Hazard Areas Identified

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER

29095CV001B

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program (NFIP) have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) report may not contain all data available within the Community Map Repository.. Please contact the Community Map Repository for any additional data.

The Federal Emergency Management Agency (FEMA) may revise and republished part or all of this FIS report at any time. In addition, FEMA may revise part of this FIS report by the Letter of Map Revision process, which does not involve republication or redistribution of the FIS Report. Therefore, users should consult with community officials and to check the Community Map Repository to obtain the most current FIS report components.

Selected Flood Insurance Rate Map panels for the community contain information that was previously shown separately on the corresponding Flood Boundary and Floodway Map panels (e.g., floodways, cross sections). In addition, former flood hazard zone designations have been changed as follows:

Old Zone	New Zone
A1 through A30	AE
V1 through V30	VE
B	X
C	X

Effective Date: September 29, 2006

Revised Countywide FIS Effective Date: To be determined

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PUBLISHED SEPARATELY:
Exhibit 2 - Flood Insurance Rate Map Index
Flood Insurance Rate Map

FLOOD INSURANCE STUDY
JACKSON COUNTY, MISSOURI AND INCORPORATED AREAS
AND KANSAS CITY, MISSOURI

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study (FIS) report revises and supersedes the FIS report and the Flood Insurance Rate Maps (FIRMs) in the geographic area of Jackson County, Missouri, (with the exception of a small portion of the City of Pleasant Hill and the Lake City Ammunition Plant) including: the Cities of Blue Springs, Buckner, Grain Valley, Grandview, Greenwood, Independence, Kansas City, Lake Lotawana, Lake Tapawingo, Lee's Summit, Levasy, Oak Grove, Raytown, Sugar Creek; the Town of River Bend, the Villages of Lone Jack, Sibley, and Unity; and the unincorporated areas of Jackson County, (hereafter referred to collectively as Jackson County), and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood-risk data for various areas of the communities that will be used to establish actuarial flood insurance rates. This information will also be used by Jackson County to update existing floodplain regulations as part of the Regular Phase of the National Flood Insurance Program (NFIP) and by local and regional planners to further promote sound land use and floodplain development. Minimum floodplain management requirements for participation in the NFIP are set forth in the Code of Federal Regulations at 44 CPR, 60.3.

Please note that the City of Independence is geographically located in Clay and Jackson County. The City of Kansas City is geographically located in Cass, Clay, Platte and Jackson County. The City of Lee's Summit is geographically located in Cass and Jackson Counties. The City of Oak Grove is geographically located in Lafayette and Jackson Counties.

The Cities of Independence, Kansas City, Lee's Summit, and Oak Grove are included in their entirety in this FIS report.

Please note that the City of Lake Tapawingo and the Village of Unity have no special flood hazard areas identified.

The cover of this FIS Report lists Jackson County and Incorporated Areas and Kansas City, Missouri because Town officials and Federal, State, and regional agencies wanted to make sure flooding information is available not only in its entirety for Kansas City, but also for the immediate surrounding areas for ease of use. In order to facilitate this, the FIRMs (Exhibit 2) will expand to the edge of each panel past the Kansas City political boundary, and this FIS Report will show the profiles (Exhibit 1) and Floodway Data Tables (Table 4) for the entire stretch of detailed studies of any stream crossing in or out of Kansas City.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the State (or other jurisdictional agency) will be able to explain them.

The Digital Flood Insurance Rate Map (DFIRM) and FIS Report for this countywide study have been produced in digital format. Flood hazard information was converted to meet the FEMA DFIRM database specifications and Geographic Information System (GIS) format requirements. The flood hazard information was created and is provided in a digital format so that it can be incorporated into a local GIS and be accessed more easily by the community.

1.2 Authority and Acknowledgments

The sources of authority for this FIS are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. Information on the authority and acknowledgements for each of the previously printed FIS reports for communities within Jackson County was compiled and is shown below.

City of Blue Springs: The hydrologic and hydraulic analyses for the March 15, 1978 FIS (Reference 1) were performed by the USACE, Kansas City District (the Study Contractor) for FEMA, under Inter-Agency Agreement No.H-7-76, Project Order No. 13.

For the January 18, 1983 revision (Reference 2) the hydrologic and hydraulic analyses were performed by Howard, Needles, Tammen & Bergendoff, Architects, Engineers and Planners for FEMA. This study was completed in January 1982.

City of Buckner: The hydrologic and hydraulic analyses for the March 1978 FIS (Reference 3), were performed by the USACE, Kansas City District, for FIA, under Inter-Agency Agreement No. H-7-76, Project Order No. 13. The work was completed in June 1977.

City of Grain Valley: The hydrologic and hydraulic analyses for the February 1979 FIS (Reference 4), were performed by Black & Veatch, Inc., for FIA, under Contract No. H-4527. The work was completed in April 1978.

City of Grandview: The hydrologic and hydraulic analyses for the May 4 1987 FIS (Reference 5), were performed by the USACE, Kansas City District, for FIA, under Inter-Agency Agreement No. H-7-76, Project Order No. 13. The work was completed in June 1977.

City of Greenwood: The hydrologic and hydraulic analyses for the July 1978 FIS (Reference 6), were performed by the USACE, Kansas City District, for FIA, under Inter-Agency Agreement No. IAA-H-7-76, Project Order No. 13. The work was completed in June 1977 .

City of Independence: The hydrologic and hydraulic analyses for the August 1981 FIS (Reference 7), were performed by the USACE, Kansas City District, for FEMA. The work was completed in August 1981.

For the September 29, 1989 revision (Reference 8), the hydrologic and hydraulic analyses were obtained from a USACE, Kansas City District report (Reference 9). The work was completed in February 1987.

For the March 21, 2000, revision (Reference 10), the hydrologic and hydraulic analyses were performed by Black and Veatch, Inc., for FEMA, under Contract No. EMW-90-C-3097. The work was completed in July 1997.

Jackson County (Unincorporated Areas) The hydrologic and hydraulic analyses for the September 1978 FIS (Reference 11), were performed by the USACE, Kansas City District, for FEMA, under Inter-Agency Agreement Nos. H-7-76 and H-9-79, Project Order Nos. 13 and 4. The work was completed in May 1977 and June 1981.

For the September 4, 1986 FIS (Reference 12), a revision was made due to the disincorporation of the Village of Tarsney Lakes. All flood delineations that were previously shown in the FIS for the Village of Tarsney Lakes (Reference 13) were updated and delineated in the FIS report for Jackson County, Missouri (Unincorporated Areas).

Jackson County (Unincorporated Areas) (continued)	For the November 3, 1989, revision (Reference 14), the hydrologic and hydraulic analyses were obtained from a USACE, Kansas City District, report (Reference 9). The work was completed in February 1987. The hydrologic and hydraulic analyses for the September 29, 2006 countywide study were performed by George Butler Associates, Inc., for FEMA, under Contract No. EMW-1999- CO-0504. The work was completed in October 2000. The exceptions being the hydrologic analyses for Blue Branch, Sni-A-Bar Creek, Swiney Branch, and Yennie Avenue Drain, which were performed by the USACE, Kansas City District, and completed in October 2000. The hydrologic and hydraulic analyses for Cedar Creek were performed by the City of Lee's Summit, under Contract No. EMK-2001-CA-0027. The work was completed in September 2002. (Reference 15)
City of Kansas City:	The hydrologic and hydraulic analyses completed for the September 14, 1990 FIS (Reference 16) were performed by United States Army Corps of Engineers USACE, Kansas City District for FEMA, under Inter-Agency Agreement No. IAA-H-18-78, Project Order No. 25. This study was completed in January 1982. The hydrologic analysis and hydraulic data for Burlington Creek were provided by USACE, and the hydraulic analysis was performed by FEMA.
City of Lee's Summit:	The hydrologic and hydraulic analyses for the June 1977 FIS (Reference 17), were performed by the USACE, Kansas City District, for FIA, under Inter-Agency Agreement No. H-7-76, Project Order No. 13. The work was completed in May 1977. For the August 3, 1989, revision (Reference 18), the hydrologic and hydraulic analyses were performed by Booker Associates, Inc., for FEMA, under Contract No. EMW-C-0952. The work was completed in December 1983. The hydrologic and hydraulic analyses for the Little Blue River and the East Fork Little Blue River were obtained from a USACE, Kansas City District, report (Reference 9) completed in February 1987.

City of Lee's Summit (continued):	For the December 6, 1999, revision (Reference 19), the results of a Letter of Map Revision (LOMR) dated June 20, 1996, were incorporated
City of Levasy:	The hydrologic and hydraulic analyses for the March 1978 FIS (Reference 20), were performed by the USACE, Kansas City District, for FIA, under Inter-Agency Agreement No. H-7-76, Project Order No. 13. The work was completed in June 1977.
City of Oak Grove::	The hydrologic and hydraulic analyses for the March 1979 FIS (Reference 21), were performed by Black & Veatch, Inc., for FIA, under Contract No. H-4527. The work was completed in February 1978.
City of Raytown:	The hydrologic and hydraulic analyses for the March 1978 FIS (Reference 22), were performed by the USACE, Kansas City District, for FIA, under Inter-Agency Agreement No. H-7-76, Project Order No. 13. The work was completed in June 1977.
Village of Sibley:	The hydrologic and hydraulic analyses for the November 15, 1984, FIS (Reference 23), were obtained from a USACE, Kansas City District, report (Reference 24).
City of Sugar Creek::	The hydrologic and hydraulic analyses for the 1978 FIS (Reference 25) were performed by the USACE, Kansas City District, for FIA, under Inter-Agency Agreement No. H-7-76, Project Order No. 13. The work was completed in May 1977.

There were no previously separate printed FIS reports for the cities of Lake Lotawana, Lake Tapawingo, the Town of River Bend and the Village of Lone Jack, and Unity.

All hydrologic and hydraulic analyses for this revised countywide FIS report were performed by AMEC Environment and Infrastructure, Inc. as contracted by the State of Missouri Emergency Management Agency (SEMA) for the Federal Emergency Management Agency (FEMA) under Cooperative Agreement No. EMK-2008-CA-8010. This study was completed March 2012. Floodplain boundaries were delineated using a digital elevation model surface created from Light Detection and Ranging (LiDAR) data provided by the Jackson County GIS Department.

The hydrologic and hydraulic analyses for the Missouri River were performed by theUnited States Army Corps of Engineers (USACE) as part of the Upper Mississippi River System Flow Frequency Study (UMRSFFS) (Reference 26). This study was a collaboration of effort between the Rock Island, St. Louis, Kansas City, Omaha, and St. Paul districts and was completed in 2003. The 1-percent-annual-chance flood water surface profile and floodway computations on the Missouri River were performed within HEC-RAS for FEMA under Interagency Agreement No. HSFE07-06-X-0012 by the Kansas City and Omaha districts and were completed in 2007.

Planimetric base map information shown on all FIRM panels was derived from multiple sources. Road centerlines were provided by the Missouri Spatial Data Information Service and stream centerlines and areas were downloaded from the National Hydrography Dataset provided by the U.S. Geological Survey. Political boundary files were provided by the Jackson County GIS Department. Users of this FIRM should be aware that minor adjustments may have been made to specific base map features by using updated aerial photography taken by the USDA-FSA Aerial Photography Field Office. This imagery was acquired for the National Agriculture Imagery Program (NAIP) in October of 2010. Topographic data for Jackson County consisted of a 2 foot Digital Elevation Model (DEM) which was created from LiDAR.

The coordinate system used for the production of this FIRM is State Plane Missouri West, FIPS 2403, feet, North American Datum of 1983 (NAD 83), GRS 80 spheroid. Corner coordinates shown on the FIRM are in latitude and longitude referenced to the Universal Transverse Mercator (UTM) projection, NAD 83. Differences in the datum and spheroid used in the production of FIRMs for adjacent counties may result in slight positional differences in map features at the county boundaries. These differences do not affect the accuracy of information shown on the FIRM.

1.3 Coordination

Consultation Coordination Officer's (CCO) meetings may be held for each jurisdiction in this countywide FIS. An initial CCO meeting is held typically with representatives of FEMA, the community, and the study contractor to explain the nature and purpose of an FIS and to identify the streams to be studied by detailed methods. A final CCO meeting is held typically with representatives of FEMA, the community, and the study contractor to review the results of the study.

For this revision, three initial Consultation Coordination Officer (CCO) meetings was held on August 21 and August 22, 2007 in Blue Springs, Raytown and Kansas City, Missouri. The Blue Springs meeting was at 9:30 AM August 21 and Blue was attended by representatives of FEMA, SEMA, AMEC, and the Cities of Blue Springs, Grain Valley, Independence, Lake Lotawana, Levasy, and Oak Grove. The Raytown meeting was at 1:30 PM August 21 and was attended by representatives of FEMA, SEMA, AMEC, and the Cities of Grandview, Lee's Summit, and Raytown. The Kansas City meeting was at 1:00 PM August 22 and was attended by representatives of FEMA, SEMA, AMEC, and

Jackson County. Coordination with Town officials and Federal, State, and regional agencies produced information pertaining to floodplain regulations, community maps, flood history, and other hydrologic data.

The results of the study were reviewed at the final CCO meeting held on *(to-be-determined)*, and attended by representatives of *(to-be- determined)*. All problems raised at that meeting have been addressed in this study.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS covers the geographic area of Jackson County, Missouri, including the incorporated communities listed in Section 1.1. The areas studied by detailed methods were selected with priority given to all known flood hazards and areas of projected development or proposed construction through July 2011.

In order to facilitate the ease of use for Kansas City, the full extent of any detailed stream crossing the Kansas City corporate boundary has been included in this FIS Report. In other words, some stream data, geographically located within Clay and Platte County, is included for informational purposes.

For this study, AMEC incorporated the UMRSFFS obtained from USACE (Reference 26) and performed new detailed studies by incorporating recent development, updated ground surface information and updated hydrology and hydraulics on the streams mentioned below.

The new detailed studies covered Blue River, Blue River Tributary 1, Blue River Tributary 2, Blue River Tributary 4, Blue River Tributary 4.1, Blue River Tributary 5, Blue River Tributary 6, Blue River Tributary 7, Blue River Tributary 9, Blue River Tributary 10, Blue River Tributary 11, Blue River Tributary 12, Blue River Tributary 13, Blue River Tributary 14, Blue River Tributary 17, Brush Creek, Brush Creek (Platte County, MO), Brush Creek Tributary 1, Brush Creek Tributary 8, Buckeye Creek, Buckeye Creek Tributary 1, Burlington Creek, Burlington Creek Tributary 1, Burlington Creek Tributary 2, Dyke Branch, East Creek, East Creek Tributary 1, East Fork Line Creek, East Fork Line Creek Tributary 1, East Fork Line Creek Tributary 1.2, East Fork Shoal Creek, East Fork Shoal Creek Tributary 1, East Fork Shoal Creek Tributary 2, East Fork Shoal Creek Tributary 3, First Creek, First Creek Tributary 1, Fishing River, Fishing River Tributary 1, Fishing River Tributary 1.1, Fishing River Tributary 1.2, Hickman Mills Creek, Hickman Mills Creek Tributary 1, Hickman Mills Creek Tributary 2, Indian Creek, Jumping Branch, Line Creek, Line Creek Tributary 1, Line Creek Tributary 2, Little Blue River, Little Blue River Tributary 1, Little Blue River Tributary 4, Little Blue River Tributary 5, Little Blue River Tributary 7, Little Blue River Tributary 16, Little Blue River Tributary 17, Little Cedar Creek Tributary 2, Little Shoal Creek, Little Shoal Creek Tributary 1, Lumpkins

Fork, Lumpkins Fork Tributary 2, Mill Creek (Clay County, MO), Mill Creek Tributary 1, Missouri River, Old Maid's Creek, Randolph Creek, Rock Creek (Clay County, MO), Rock Creek Gladstone, Rock Creek Tributary 11, Rock Creek Tributary 11.2, Rocky Branch, Rocky Branch Tributary 1, Round Grove Creek (within Kansas City), Round Grove Creek Tributary 1, Round Grove Creek Tributary 2, Round Grove Creek Tributary 3, Searcy Branch, Searcy Branch Tributary 1, Second Creek, Second Creek West Branch, Shoal Creek, Shoal Creek Tributary 6, Shoal Creek Tributary 8, Shoal Creek Tributary 9, Shoal Creek Tributary 20, Shoal Creek Tributary 20.1, Todd Creek, Town Fork Creek, , Tributary to Todd Creek, Walnut Creek, White Oak Creek Tributary 1, Wildcat Branch, Wildwood Creek, Wildwood Creek Tributary 1 and Wilkerson Creek.

The following streams were redelineated on new topography based on information published in the Flood Insurance Study for Jackson County and Incorporated Areas of September 29, 2006 (Reference 15): Adair Creek, Adair Creek Tributary 1, Adair Creek Tributary 2, Big Creek, Blue Branch, Blue Branch Creek Tributary 1, Blue Branch Creek Tributary 2, Bundschu Creek, Burr, Oak Creek, Burr Oak Creek Tributary, Cedar Creek, Crackerneck Creek, East Fork Little Blue River, Fire Prairie Creek, Horseshoe Creek, Horseshoe Creek Tributary, May Brook, Middle Fork Mill Creek, Mill Creek, Mouse Creek, North Fork Crackerneck Creek, North Fork Spring Branch, North Fork Sugar Creek, Oil Creek, Rock Creek, Round Grove Creek (outside Kansas City), SB1 Tributary Sni-A-Bar Creek, SB2 Tributary Sni-A-Bar Creek, SB3 Tributary Sni-A-Bar Creek, SB4 Tributary Sni-A-Bar Creek, Seminary Creek, Sni-A-Bar Creek, South Fork Spring Branch, Spring Branch, Sugar Creek, Swiney Branch, Swiney Branch Tributary, Tributary A1 to East Fork Little Blue River, Tributary A2 to East Fork Little Blue River, Tributary B1 to Big Creek, Tributary B2 to Big Creek, Tributary B3 to Big Creek, Tributary C1 to Cedar Creek, Tributary C2 to Cedar Creek, Tributary C3 to Cedar Creek, Tributary C4 to Cedar Creek, Tributary C5 to Cedar Creek, Tributary C6 to Cedar Creek, Tributary G1 to Lake Winnebago, Tributary G2 to Raintree Lake, Tributary J1, Tributary L1 to Lakewood Lakes, Tributary L2 to Lakewood Lakes, Tributary M1, Tributary M2, Tributary M3, Tributary M4, Tributary M5, Tributary M6, Tributary No C1, Tributary No C2, Tributary No S1, Tributary No S2, Tributary No S3, Tributary No S3a. Tributary No S4, Tributary No S5, Tributary P1 to Prairie Lee Lake, Tributary P2 to Prairie Lee Lake, Tributary P3 to Prairie Lee Lake, Tributary P4 to Prairie Lee Lake, Tributary P5 to Prairie Lee Lake, Tributary to Tributary B2 to Big Creek, Tributary to West Fork Sni-A-Bar Creek, Tucker Branch, Tucker Branch Tributary, West Branch Crawford Creek, West Fire Prairie Creek, West Fork Sni-A-Bar Creek, White Oak Creek and Yennie Avenue Drain. Since the previous Flood Insurance Study was created in NAVD88, no conversion from NGVD29 to NAVD88 was necessary.

The flooding sources studied by detailed methods and their respective study limits are shown in Table 1 – "Detailed Study Limits":

TABLE 1 – DETAILED STUDY LIMITS

Stream	Limits of Detailed Study
Adair Creek	From confluence with Little Blue River to approximately 100 feet upstream of South Noland Road
Adair Creek Tributary 1	From confluence with Adair Creek to approximately 100 feet upstream of Interstate 70
Adair Creek Tributary 2	From confluence with Adair Creek to approximately 200 feet upstream of Interstate 70
Big Creek	From confluence with East Branch Wilson Creek to approximately 1,000 feet upstream of State HWY 291
Blue Branch	From confluence with Sni-A-Bar Creek to approximately 1.7 miles upstream of State Highway AA
Blue Branch Creek Tributary 1	From confluence with Blue Branch to approximately 1.8 miles upstream of Union Pacific Railroad
Blue Branch Creek Tributary 2	From confluence with Blue Branch Creek Tributary No. 1 to approximately 1 mile upstream of I-70
Blue River	From confluence with Missouri River to the Jackson County border at Kenneth Road
Blue River Tributary 1	From confluence with Blue River to approximately 1,750 feet upstream of Highway D
Blue River Tributary 2	From confluence with Blue River to approximately 1,450 feet upstream of Highway 150
Blue River Tributary 4	From confluence with Blue River to approximately 1 mile upstream of 129th Street
Blue River Tributary 4.1	From confluence with Blue River to approximately 200 feet upstream of Prospect Avenue

TABLE 1 – DETAILED STUDY LIMITS

Stream	Limits of Detailed Study
Blue River Tributary 5	From confluence with Blue River to approximately 1,250 feet upstream of Wornall Road
Blue River Tributary 6	From confluence with Blue River to approximately 700 feet upstream of the Dam
Blue River Tributary 7	From confluence with Blue River to approximately 350 feet upstream of Red Bridge Road
Blue River Tributary 9	From confluence with Blue River to approximately 1,600 feet upstream of 85th Street
Blue River Tributary 10	From confluence with Blue River to approximately 800 feet upstream of 78th Street
Blue River Tributary 11	From confluence with Blue River to approximately 1,000 feet upstream of Interstate 435
Blue River Tributary 12	From confluence with Blue River to approximately 200 feet upstream of the unnamed culvert
Blue River Tributary 13	From confluence with Blue River to approximately 1.1 miles upstream of Lakeside Drive
Blue River Tributary 14	From confluence with Blue River to approximately 0.5 miles upstream of Blue Parkway Drive
Blue River Tributary 17	From confluence with Blue River to approximately 0.9 miles upstream of confluence with Blue River
Brush Creek	From confluence with Blue River to approximately 350 feet upstream of Ward Parkway Bridge
Brush Creek (Platte County, Mo)	From a point 600 feet downstream of 76th Street to approximately 8 miles upstream of that point
Brush Creek Tributary 1	From confluence with Brush Creek to approximately 100 feet upstream of 104th Street
Brush Creek Tributary 8	From confluence with Brush Creek to approximately 1.3 miles upstream of confluence with Brush Creek

TABLE 1 – DETAILED STUDY LIMITS

Stream	Limits of Detailed Study
Buckeye Creek	From confluence with Missouri River to approximately 100 feet upstream of Montgall Avenue
Buckeye Creek Tributary 1	From confluence with Buckeye Creek to approximately 1,600 feet upstream of 42nd and Sunnybrook
Bundschu Creek	From confluence with Little Blue River to approximately 50 feet upstream of Northern Powell Road
Burlington Creek	From confluence with Missouri River to approximately 1,950 feet upstream of Access Road
Burlington Creek Tributary 1	From confluence with Burlington Creek to approximately 1,920 feet upstream of the confluence with Burlington Creek
Burlington Creek Tributary 2	From confluence with Burlington Creek to approximately 1,000 feet upstream from the Platte County boundary
Burr Oak Creek	From confluence with Little Blue River to approximately 1.1 miles upstream from Northwest Saunders Road
Burr Oak Creek Tributary	From confluence with Burr Oak Creek to approximately 0.9 miles upstream from the confluence with Burr Oak Creek
Cedar Creek	From confluence with Little Blue River to approximately 1,600 feet with Southwest Lakeview Boulevard
Crackerneck Creek	From confluence with Little Blue River to approximately 50 feet upstream of East Partridge Street
Dyke Branch	From confluence with Indian Creek to approximately 500 feet upstream of 92nd Street
East Creek	From confluence with Line Creek to approximately 50 feet upstream of 61st Street Northwest

TABLE 1 – DETAILED STUDY LIMITS

Stream	Limits of Detailed Study
East Creek Tributary 1	From confluence with East Creek to approximately 0.4 miles upstream of US Highway 69
East Fork Line Creek	From confluence with Line Creek to approximately 1,400 feet upstream of NW 82nd Street
East Fork Line Creek Tributary 1	From confluence with East Fork Line Creek to approximately 1,200 feet upstream of Arrowhead Trafficway
East Fork Line Creek Tributary 1.2	From confluence with East Fork Line Creek to approximately 380 feet upstream of Northwest Arrowhead Trafficway
East Fork Little Blue River	From confluence with Little Blue River to approximately 1.3 miles upstream of Southeast Winburn Trail
East Fork Shoal Creek	From confluence with Shoal Creek to approximately 700 feet upstream of Staley Road
East Fork Shoal Creek Tributary 1	From confluence with East Fork Shoal Creek to approximately 0.6 miles upstream of Hardesty Avenue
East Fork Shoal Creek Tributary 2	From confluence with East Fork Shoal Creek to approximately 200 feet upstream of Barry Road
East Fork Shoal Creek Tributary 3	From confluence with East Fork Shoal Creek to approximately 400 feet upstream of Highway 152
Fire Prairie Creek	From confluence with Missouri River to approximately 450 feet upstream of U.S. Highway 24
First Creek	From confluence with Second Creek to approximately 550 feet upstream of the Clay County boundary
First Creek Tributary 1	From confluence with First Creek to approximately 1,500 feet upstream of North Summit Street
Fishing River	From confluence with Missouri River to approximately 2.2 miles upstream of North Stark Avenue

TABLE 1 – DETAILED STUDY LIMITS

Stream	Limits of Detailed Study
Fishing River Tributary 1	From confluence with Fishing River to approximately 150 feet upstream of NE 108th Street
Fishing River Tributary 1.1	From confluence with Fishing River Tributary 1 to approximately 1.6 miles upstream of confluence with Fishing River Tributary 1
Fishing River Tributary 1.2	From confluence with Fishing River Tributary 1 to approximately 0.8 miles upstream of Mid Continent Drive
Hickman Mills Creek	From confluence with Blue River to approximately 150 feet upstream of Red Bridge Road
Hickman Mills Creek Tributary 1	From confluence with Hickman Mills Creek to approximately 450 feet upstream of Interstate 435
Hickman Mills Creek Tributary 2	From confluence with Hickman Mills Creek to approximately 150 feet upstream of Interstate 470
Horseshoe Creek	From confluence with Sni-A-Bar Creek to approximately 1,450 feet upstream of Northeast Third Street
Horseshoe Creek Tributary	From the confluence with Horseshoe Creek to approximately 200 feet upstream of South Broadway Street
Indian Creek	From confluence with Blue River to approximately 0.4 miles upstream of 103rd Street
Jumping Branch	From confluence with Line Creek to approximately 350 feet upstream of U.S. Highway 635
Line Creek	From confluence with Missouri River to approximately 3.2 miles upstream of NW 68th Street
Line Creek Tributary 1	From confluence with Line Creek to approximately 50 feet upstream of Northwest Barry Road

TABLE 1 – DETAILED STUDY LIMITS

Stream	Limits of Detailed Study
Line Creek Tributary 2	From confluence with Line Creek to approximately 1,900 feet upstream of NW 72nd Terrace
Little Blue River	From just downstream of Lee Summit Road to just upstream of Highway 71
Little Blue River Tributary 1	From confluence with Little Blue River to approximately 1.1 miles upstream
Little Blue River Tributary 4	From confluence with Little Blue River to approximately 1,600 feet upstream of Raytown Road
Little Blue River Tributary 5	From confluence with Little Blue River to approximately 0.4 miles upstream of Raytown Road
Little Blue River Tributary 7	From confluence with Little Blue River to East 99th Street
Little Blue River Tributary 16	From confluence with Little Blue River to approximately 1,600 feet upstream of Noland Road
Little Blue River Tributary 17	From confluence with Little Blue River to approximately 1,250 feet upstream of Railroad
Little Cedar Creek	From confluence with Little Blue River to approximately 0.9 miles upstream of Interstate 470
Little Cedar Creek Tributary 2	From confluence with Little Cedar Creek to approximately 0.7 miles upstream of confluence with Little Cedar Creek
Little Shoal Creek	From confluence with Shoal Creek to approximately 2.3 miles upstream of Shoal Creek Valley Drive
Little Shoal Creek Tributary 1	From confluence with Shoal Creek to approximately 0.4 miles upstream of Access Road

TABLE 1 – DETAILED STUDY LIMITS

Stream	Limits of Detailed Study
Lumpkins Fork	From confluence with Little Blue River to approximately 100 feet upstream of East 155th Street
Lumpkins Fork Tributary 2	From confluence with Lumkins Fork to approximately 0.7 miles upstream of Peterson Road
May Brook	From confluence with Little Blue River to approximately 300 feet upstream of Northeast Maybrook Road
Middle Fork Mill Creek	From confluence with Mill Creek to approximately 350 feet upstream of East Salisbury Road
Mill Creek	From confluence with Shoal Creek to approximately 0.6 miles upstream of N Highland Street
Mill Creek (Clay County, MO)	From confluence with Shoal Creek to approximately 8.1 miles upstream of confluence with Shoal Creek
Mill Creek Tributary 1	From confluence with Mill Creek to approximately 1,650 feet upstream of confluence with Mill Creek
Missouri River	From West county boundary to 41 miles downstream at the East county boundary
Mouse Creek	From Southwest Scherer Road to approximately 0.5 miles upstream of the confluence of Tributary M6
North Fork Crackerneck Creek	From confluence with Crackerneck Creek to approximately 0.5 miles upstream of Viking Drive
North Fork Spring Branch	From confluence with Spring Branch to approximately 1,750 feet upstream of Cheyenne Drive
North Fork Sugar Creek	From confluence with Sugar Creek to approximately 950 feet upstream of South Claremont Avenue
Oil Creek	From confluence with Little Blue River to approximately 1.9 miles upstream of State Highway 150

TABLE 1 – DETAILED STUDY LIMITS

Stream	Limits of Detailed Study
Old Maid's Creek	From confluence with Line Creek to approximately 1,100 feet upstream of NW Arrowhead Trafficway
Randolph Creek	From confluence with Missouri River to approximately 0.5 miles upstream of Access Road
Rock Creek	From confluence with Missouri River to approximately 200 feet upstream of Vivon Road
Rock Creek (Clay County, MO)	From confluence with Missouri River to approximately 3.8 miles upstream of confluence with Missouri River
Rock Creek Gladstone	From confluence with Mill Creek to approximately 4.1 miles upstream of confluence with Mill Creek
Rock Creek Tributary 11	From confluence with Rock Creek Tributary 11.2 to approximately 750 feet upstream of confluence with Rock Creek Tributary 11.2
Rock Creek Tributary 11.2	From confluence with Rock Creek to approximately 2.7 miles upstream of confluence with Rock Creek
Rocky Branch	From confluence with Wilkerson Creek to approximately 350 feet upstream of 115th Terrace Bridge
Rocky Branch Tributary 1	From confluence with Rocky Branch to approximately 50 feet upstream of 114th Terrace
Round Grove Creek	From confluence with Blue River to approximately 200 feet upstream of 52nd Terrace
Round Grove Creek Tributary 1	From confluence with Round Grove Creek to approximately 150 feet upstream of 47th Street
Round Grove Creek Tributary 2	From confluence with Round Grove Creek to approximately 400 feet upstream of Sni-A-Bar Road
Round Grove Creek Tributary 3	From confluence with Round Grove Creek to approximately 1,050 feet upstream of 42nd Street

TABLE 1 – DETAILED STUDY LIMITS

Stream	Limits of Detailed Study
SB1 Tributary Sni-A- Bar Creek	From confluence with Sni-A-Bar Creek to approximately 650 feet upstream of South Hillside School Road
SB2 Tributary Sni-A- Bar Creek	From confluence with Sni-A-Bar Creek to approximately 0.5 miles upstream of East Cummings Road
SB3 Tributary Sni-A- Bar Creek	From confluence with Sni-A-Bar Creek to approximately 0.7 miles upstream of East JW Cummins Road
SB4 Tributary Sni-A-Bar Creek	From confluence with Sni-A-Bar Creek to approximately 0.5 miles upstream of East Tapscott Road
Searcy Branch	From confluence with Buckeye Creek to approximately 700 feet upstream of Drury Avenue
Searcy Branch Tributary 1	From confluence with Searcy Branch to approximately 1.1 miles upstream of confluence with Searcy Branch
Second Creek	From confluence with Little Platte River to approximately 0.7 miles upstream of 100th Street
Second Creek West Branch	From confluence with Second Creek to approximately 1.1mi upstream of Northwest 108th Street
Seminary Creek	From the confluence with Sni-A-Bar Creek to approximately 1.4 miles upstream of East Truman Road / State Highway H / State Highway FF
Shoal Creek	From confluence with Missouri River to approximately 1,450 feet upstream of State Highway 152
Shoal Creek Tributary 6	From confluence of Shoal Creek to approximately 2.2 miles upstream of Railroad
Shoal Creek Tributary 8	From confluence with Shoal Creek to approximately 700 feet upstream of NE 96th Street
Shoal Creek Tributary 9	From confluence with Shoal Creek to approximately 1 mile upstream of State Highway 152 off ramp

TABLE 1 – DETAILED STUDY LIMITS

Stream	Limits of Detailed Study
Shoal Creek Tributary 20	From confluence with Shoal Creek to approximately 1,500 feet upstream of Elm Road
Shoal Creek Tributary 20.1	From confluence with Shoal Creek to approximately 1,600 feet upstream of Kaill Road
Sni-A-Bar Creek	From confluence with Missouri River to approximately 4.8 miles upstream of East Colbern Road
South Fork Spring Branch	From confluence with Spring Branch to approximately 100 feet upstream of Lee's Summit Road
Spring Branch	From confluence with Little Blue River to approximately 100 feet upstream of West Kiger Road
Sugar Creek	From confluence with Missouri River with approximately 50 feet upstream of North Park Avenue
Swiney Branch	From confluence with Sni-A-Bar Creek with approximately 0.6 miles upstream of South Tyer Road
Swiney Branch Tributary	From confluence with Swiney Branch to approximately 1.3 miles upstream of South Rust Road
Todd Creek	From approximately 3.8 miles upstream of confluence with Little Platte River to approximately 150 feet upstream of Canberra Street
Town Fork Creek	From confluence with Brush Creek to approximately 1,700 feet upstream of Park Avenue
Tributary A1 to East Fork Little Blue River	From confluence with East Fork Little Blue River to approximately 600 feet upstream of Windsboro Drive
Tributary A2 to East Fork Little Blue River	From confluence with Tributary A1 to East Fork Little Blue River to approximately 950 feet upstream of Southeast Battery Point
Tributary B1 to Big Creek	From confluence with Big Creek to approximately 0.5 miles upstream of the confluence with Big Creek

TABLE 1 – DETAILED STUDY LIMITS

Stream	Limits of Detailed Study
Tributary B2 to Big Creek	From confluence with Big Creek to approximately 1,900 feet upstream of State Highway 291
Tributary B3 to Big Creek	From confluence with Big Creek to approximately 1.6 miles upstream of Union Pacific Railroad
Tributary C1 to Cedar Creek	From confluence with Cedar Creek to approximately 200 feet upstream of Southwest 3rd Street
Tributary C2 to Cedar Creek	From confluence with Cedar Creek to approximately 850 feet upstream of US Highway 50
Tributary C3 to Cedar Creek	From confluence with Cedar Creek to approximately 900 feet upstream of Union Pacific Railroad
Tributary C4 to Cedar Creek	From confluence with Cedar Creek to approximately 300 feet upstream of Southwest Lakeview Boulevard
Tributary C5 to Cedar Creek	From confluence with Cedar Creek to approximately 1,100 feet upstream of Southwest Forest Park Boulevard
Tributary C6 to Cedar Creek	From confluence with Cedar Creek to approximately 1,950 feet upstream of Southwest Pacific Drive
Tributary G1 to Lake Winnebago	From above County Line Rd to approximately 50 feet upstream of State Highway 291
Tributary G2 to Raintree Lake	From confluence with Raintree Lake to approximately 0.7 miles upstream of the confluence with Raintree Lake
Tributary J1	From approximately 500 feet upstream of Leinweber Road to approximately 0.9 miles upstream of Leinweber Road
Tributary L1 to Lakewood Lakes	From confluence with Lakewood Lakes to approximately 0.6 miles upstream of Gregory Boulevard
Tributary L2 to Lakewood Lakes	From above Gregory Boulevard to approximately 1,450 feet upstream of Beachwood Drive

TABLE 1 – DETAILED STUDY LIMITS

Stream	Limits of Detailed Study
Tributary M1	From confluence with Mouse Creek to approximately 0.6 miles upstream of the confluence with Mouse Creek
Tributary M2	From confluence with Mouse Creek to approximately 0.5 miles upstream of the confluence with Mouse Creek
Tributary M3	From confluence with Mouse Creek to approximately 0.5 miles upstream of the confluence with Mouse Creek
Tributary M4	From confluence with Mouse Creek to approximately 900 feet upstream of Southwest Eagle Drive
Tributary M5	From confluence with Mouse Creek to approximately 1,800 feet upstream of the confluence with Mouse Creek
Tributary M6	From confluence with Mouse Creek to approximately 1,750 feet upstream of the confluence with Mouse Creek
Tributary No C1	From confluence with Tributary No. C-2 to approximately 1.6 miles upstream of State Highway 150
Tributary No C2	From confluence with West Branch Crawford Creek to approximately 0.4mi upstream of State Highway 150
Tributary No S1	From above County Highway H to approximately 0.8 miles upstream of Northern Jim Owens Road
Tributary No S2	From confluence with Sni-A-Bar Creek to approximately 0.7 miles upstream of Northeast Jim Owens Road
Tributary No S3	From confluence with Sni-A-Bar to approximately 1,800 feet upstream of South Outer Belt Road/State Highway AA
Tributary No S3a	From confluence with Tributary No. S-3 to approximately 0.9 miles upstream of Northeast Jim Owens Road

TABLE 1 – DETAILED STUDY LIMITS

Stream	Limits of Detailed Study
Tributary No S4	From confluence with Sni-A-Bar Creek to approximately 1,400 feet upstream of East Pink Hill Road
Tributary No S5	From confluence with Sni-A-Bar Creek to approximately 1.7 miles upstream of South Brown Road
Tributary P1 to Prairie Lee Lake	From confluence with Prairie Lee Lake to approximately 0.4 miles upstream of State Highway 291
Tributary P2 to Prairie Lee Lake	From confluence with Prairie Lee Lake to approximately 1.6 miles upstream of Northeast Tudor Road
Tributary P3 to Prairie Lee Lake	From the confluence with Tributary P2 to Prairie Lee Lake to approximately 900 feet upstream of Ritter Plaza
Tributary P4 to Prairie Lee Lake	From the confluence with Tributary P2 to Prairie Lee Lake to approximately100 feet upstream of State Highway 291
Tributary P5 to Prairie Lee Lake	From approximately 550 feet upstream of the confluence with Prairie Lee Lake to approximately 1.6 miles upstream of Northeast Blackwell Road
Tributary to Todd Creek	From confluence with Todd Creek to approximately 1.1 miles upstream of Airport Service Road
Tributary to Tributary B2 to Big Creek	From confluence with Tributary B2 to Big Creek to approximately 1,550 feet upstream of the confluence with Tributary B2 to Big Creek
Tributary to West Fork Sni-A-Bar Creek	From confluence with West Fork Sni-A-Bar Creek to approximately 1.5 miles upstream of East Major Road
Tucker Branch	From confluence with Sni-A-Bar Creek to approximately 1 mile upstream of South Fields Road
Tucker Branch Tributary	From confluence with Tucker Branch to approximately 1.2 miles upstream of East Truman Road/State Highway F

TABLE 1 – DETAILED STUDY LIMITS

Stream	Limits of Detailed Study
Walnut Creek	From confluence with Rush Creek to approximately 300 feet upstream of 80th Street
West Branch Crawford Creek	From approximately 1mi upstream of County Line Road to approximately 0.4 miles upstream of Gammon Road
West Fire Prairie Creek	From approximately 100 feet upstream of County Highway FF to approximately 0.6 miles upstream of East Flynn Road
West Fork Sni-A-Bar Creek	From confluence with Sni-A-Bar Creek to approximately 2 miles upstream of Northeast Colbern Road
White Oak Creek	From confluence with Little Blue River to approximately 0.5 miles upstream of East 79th Street
White Oak Creek Tributary 1	From confluence with White Oak Creek to approximately 400 feet upstream of Elm Avenue
Wildcat Branch	From confluence with Todd Creek to approximately 0.5 miles upstream of Interstate 435
Wildcat Creek	From confluence with Little Blue River to approximately 1.6 miles upstream of Woodson Road
Wildcat Creek Tributary 1	From confluence with Wildcat Creek to approximately 650 feet upstream of Woodson Street
Wilkerson Creek	From confluence with Little Platte River to approximately 2.2 miles upstream of 132nd Street
Yennie Avenue Drain	From confluence with Sni-A-Bar Creek to approximately 1500 feet upstream of Yennie Avenue

The following tabulation presents the Incorporated Letters of Map Change (LOMC), which include Letters of Map Revision (LOMR), incorporated into this countywide study.

TABLE 2 – INCORPORATED LOMC

LOMC	Case-Number	Date-Issued	Project-Identifier
LOMR	05-07-0483P	May 4, 2006	Blue River Channelization
LOMR	04-07-A556P	August 31, 2006	Missouri River Levee System
LOMR	11-07-2613P	July 13, 2012	Harmony West
LOMR	09-07-1328P	December 13, 2010	Tributary P3 to Prairie Lee Lake Ritter Plaza Second Plat
LOMR	07-07-1749P	August 14, 2008	Blue Branch Creek & Tributary AA Highway & Sni-A-Bar Parkway
LOMR	07-07-0438P	January 17, 2007	Unnamed Tributary to East Fork of Little Blue River Fox Hollow
LOMR	07-07-1680P	November 9, 2007	Swiney Branch Creekside Villages Phase 1
LOMR	07-07-0238P	December 28, 2006	Blue Branch Old Towne Marketplace
LOMR	07-07-1867P	December 10, 2002	Tributary M4 to Mouse Creek Eagle Creek
LOMR	04-05-531P	November 29, 2004	Mill Creek

Approximate analyses were used to study those areas having a low development potential or minimal flood hazards.

The scope and methods of study were proposed, and agreed upon, by FEMA Representatives of Jackson County and Incorporated Areas.

2.2 Community Description

Jackson County and Incorporated Areas:

Jackson County, established in 1826 by Missouri State Legislature and named after President Andrew Jackson, had a 2010 population of 674,158 and has an area of approximately 605 square miles (Reference 27). Jackson County is situated on the western border of Missouri, along the Kansas state line. Counties surrounding Jackson County include Clay and Ray Counties to the north, Lafayette and Johnson Counties to the east, Cass County to the south, and Johnson and Wyandotte Counties, Kansas to the west. U.S. Interstates 70, 470, and 435, and State Highways 50, 350, and 71 provide access to and from the county (Reference 15).

Jackson County, Missouri, is one of seven counties which comprise the Kansas City Metropolitan Area which is included in its entirety with this FIS Report. The unincorporated portion is limited to the eastern half of the county and includes the area east of the corporate limits of the Cities of Greenwood, Independence, Lee's Summit, and Sugar Creek. Due to the expanding population of the metropolitan area, the smaller communities and rural areas surrounding Kansas City are experiencing population increases (Reference 15).

The City of Independence is the fourth largest city in the state of Missouri. It was founded in 1827 as the gateway city to the rugged unknown frontier. The spot where countess pioneers and emigrants outfitted themselves for their

journey west on the Santa Fe, Oregon or California Trails. It is also the location where President Harry Truman began his political career (Reference 28).

Unlike most counties in Missouri, Jackson County is not governed by a three- member administrative "Court" and independently elected officials heading administrative departments. In 1970 the voters of Jackson County adopted a Constitutional Home Rule Charter for the County, establishing a County Executive position and the County legislature (Reference 29).

Some of Jackson County's historic sites include Fort Osage, and the Truman Courthouse. Fort Osage was a combined military garrison/trading post that served as the gateway to the West. In 1808, William Clark of Lewis & Clark fame built the fort as the first outpost in the Louisiana Purchase. The Truman Courthouse is the courthouse that launched Harry S. Truman on the political path that would lead to the White House. Truman served as a County presiding judge from the mid1920's through 1934 (Reference 29).

The Jackson County area has a modified continental climate. Moist air currents from the Gulf of Mexico, dry air currents from the semiarid Southwest, and cold polar continental currents all affect the weather in the area. The wide range of potential influences produces weather that is variable and subject to rapid change, particularly during the spring season. Normal annual precipitation (recorded at Kansas City International Airport) totals 37 inches. Normal monthly precipitation ranges from 1.25 inches in January and February to 4.37 inches in July. Nearly 70 percent of the normal annual precipitation falls during the warm season of April through September, generally in the form of showers and thunderstorms (Reference 15). The metropolitan area of Kansas City exert a significant and measurable effect on the climate. Temperatures are elevated by a few degrees, an effect known as "urban heat island" (Reference 30).

The summers are warm and moderately humid, while the winters are relatively dry, but not severely cold. July is the warmest month, with a normal monthly temperature of 78.8 degrees Fahrenheit (°F) and January is the coldest month, with a normal monthly temperature of 27.8°F (Reference 15). According to the newly released 1981-2010 "normals" from the National Oceanic and Atmospheric Administration (NOAA), temperatures across the United States have increased by 0.5 degrees F (Reference 31).

The topography of Jackson County consists of plains and low, open hills. Fifty to eighty percent of the land is gently sloping; steep slopes are found generally along streams. Soils along the floodplains in Jackson County range from alluvial silts along the Missouri River to loessial types of good drainage and permeability in the upland areas (Reference 15).

City of Kansas City:

The City of Kansas City is located in west-central Missouri. The city is situated approximately 260 miles west of St. Louis, 170 miles northwest of Springfield, and 150 miles southeast of Omaha. The Missouri River lies along part of the western edge of Kansas City, and then bisects the city, forming the Clay-Jackson county boundary. In the southern part of the city, the Blue and Little Blue Rivers form the major drainage networks; in the northern portion, the major drainage basins consist of Shoal Creek, Line Creek, and the Fishing River (Reference 16). In 2006, the population of Kansas City was reported to be 447,306 (Reference 27).

Kansas City annexed a large area in Clay County in 1946, and annexations continued well into the 1950s. During this time, people in many areas grouped together and incorporated their communities into villages, towns, and cities to avoid annexation. Such areas in Clay County included Gladstone, Pleasant Valley, Claycomo, and Avondale; in Platte County, Riverside, Northmoor, Houston Lake, Platte Woods, and Ferrelview were incorporated for the same reason (Reference 16). Although the city of Independence retains its status as the original county seat, Kansas City serves as the second county seat and the center of county government (Reference 29).

Vegetative cover varies throughout the area. In the rural areas in the Northern and southern extremities of the city, the land is covered with either large wooded areas or cultivated fields. The more urbanized areas contain grassy areas spotted with timber growth (Reference 16).

Kansas City contains the full development cycle, from rural to heavy industrial. Along the Missouri River and in the lower part of the Blue River, floodplains are highly developed and are an industrial and productive part of the city. Basins in the upland parts of the city have extensive urban and suburban developments together with rural areas that are' rapidly becoming urban in nature (Reference 16).

2.3 Principal Flood Problems

In the Kansas City region, all runoff eventually drains into the Missouri River, the world's 15th longest river. The Missouri River watershed drains one-sixth of the water in the United States, from the mountains of western Montana to its confluence with the Mississippi River in St. Louis, MO (Reference 32).

The four major floods on the Missouri River occurred in 1844, 1903, 1951, and 1993. The 1951 flood caused extensive damage to developed areas of Jackson County. The unincorporated parts of the county, however, are sparsely developed and flood damage is limited to agricultural land and improvements, and to small, unincorporated communities. Historical flood discharges for the U.S. Geological Survey (USGS) gaging station (Station No. 06893000) located on the Hannibal Railroad Bridge at Kansas City with a drainage area of 484,100 square miles are listed below (Reference 33).

Date	Gage Height (feet)	Peak Streamflow (cfs)[1]
June 16, 1844	48.00	625,000
July 14, 1951	36.20	573,000
June 02, 1903	34.95	548,000
July 27, 1993	48.87	541,000
April 24, 1952	30.63	400,000
June 18, 1943	29.10	366,000
October 13, 1974	28.86	313,000
April 24, 1944	27.67	311,000
May 8, 2007	35.47	286,000
June 27, 1947	*	261,000
June 22, 1967	25.26	255,000
June 05, 1929	23.40	254,000
September 28, 1973	24.86	252,000
April 04, 1960	22.95	251,000
July 1, 2011	32.41	244,000
June 18, 1945	25.30	242,000
June 11, 1984	*	239,000
June 06, 1935	23.80	230,000
July 21, 1965	22.80	225,000
May 29, 1987	22.95	224,000
March 04, 1979	*	220,000
May 19, 1995	33.77	220,000
June 13, 1941	24.66	215,000
October 11, 1986	21.11	212,000
June 18, 2010	29.95	212, 000
June 29, 1999	33.40	211,000
March 21, 1948	21.25	208,000
June 22, 1942	24.25	206,000
September 13, 1977	22.85	206,000
June 28, 2011	9.25	203,000
June 13, 2008	29.02	201, 000

'Cubic feet per second
*Data not available

City of Kansas City:

Situated at the confluence of two great rivers, the Missouri and Kansas Rivers, it is obvious that Kansas City would be a target for flooding from those major streams, either separately or simultaneously. Three major floods of record and a number of lesser ones have overrun the floodplains now occupied by important segments of the municipal and industrial developments of Kansas City (Reference 16).

When the 1951 floodwaters topped the levees and floodwalls, inconceivable devastation and destruction were experienced in the inundated areas. Flood damages in Kansas City alone amounted to more than $187 million. Since the 1951 flood, however, higher levees have been built and upstream flood control reservoirs have been completed to aid in the prevention of such a disaster in the future. The Blue River probably ranks second to the Missouri River as a major flood problem for Kansas City. Development within the floodplain of the Blue River has been a continuous process and covers the full range of development from heavy industrial to commercial and residential (Reference 16).

Another large stream having flood damage potential in southern Kansas City is the Little Blue River. Development within the floodplain of the Little Blue River is not as extensive as that of the Blue River. Floods have occurred many times on the Little Blue River, causing damage to structures, transportation systems, and utility lines. Records of past flood events within the area of Kansas City north of the Missouri River are sparse because of the city's relatively short urban population span (Reference 16).

Flooding in recent times has been noted at local areas along Shoal Creek and its tributaries and along Line Creek. High-intensity rainfall of 4 to 5 inches or more could cause considerable damage to property along creeks and streams. Flood-potential rainfalls usually occur in the spring, during the months of April, May, and June. Flooding along the Fishing River and its tributaries in Kansas City has been relatively unknown because the area is relatively unpopulated, although some commercial and light industrial development exists in this area. It is apparent that flood intensities and frequencies are increasing as development in the northern portion of Kansas City increases (Reference 16).

2.4 Flood Protection Measures

Jackson County and Incorporated Areas:

The Missouri River has had upstream flood control measures in place since the 1951 flood. Levees provide a 0.2-percent-annual-chance flood level of protection for the Missouri River industrial bottomlands. Agricultural levees in the reach of the Missouri River from Atherton to Sibley, provide a 1-percent-annual-chance flood level of protection (Reference 16).

The Atherton (MRLS 351-R Section 1) Levee System provides protection against the 1-percent-annual-chance flood event on the Missouri River and Little Blue River. The levee has been certified to 65.10 and is ready to continue to show accredited.

Within this jurisdiction there are one or more levees that have not been demonstrated by the community or levee owner(s) to meet the requirements of 44 CFR Part 65.10 of the NFIP regulations as it relates to the levee's capacity to provide 1-percent-annual-chance flood protection. Please refer to the Notice to Flood Insurance Study Users page at the front of this FIS report for more information.

The Atherton Blue-Mills (MRLS 351-R Section 2) does not provide protection against the 1-percent-annual-chance along Mills Creek.

Private levees constructed along both banks of Fire Prairie Creek in the detailed study reach do not provide a 1-percent-annual-chance level of protection (Reference 16).

Reservoirs were also built by Jackson County in the East Fork watershed to provide flood control and recreational assets to the county (Reference 34).

The Blue River channel improvement project is located west of I-435 along the Blue River from its mouth at the Missouri River continuing upstream to 63rd Street. The channel runs through a long standing industrial and manufacturing district and many residential neighborhoods. It consists of 12 miles of channel modification to reduce the 1-pct-annual chance flood levels by an average of 6-8 feet. This project is still ongoing and is not complete yet (Reference 34).

Due to the degradation of the stream channel and flooding of buildings or structures along Sugar Creek, there is also a plan to design stormwater control measures on Sugar Creek at 24 Highway North of Norldege that has been funded by Jackson County storm management and is expected to be complete in 2012 (Reference 34).

City of Kansas City:

An extensive system of flood-control reservoirs and levees now protects most of the industrial areas of Kansas City in the Missouri River floodplain. Protection levels up to the 0.2-percent-annual-chance flood are now afforded to floodplain areas protected by the Central Industrial District levee, the North Kansas City levee, the Northeast Industrial District levee, and the Birmingham District levee. Large reservoirs on the upper Missouri River and on the Kansas River provide for floodwater control from the upper basins. A significant hazard still exists, however, in the unprotected areas along the Missouri River (Reference 16).

The Kansas City, Missouri Levee System which consists of 3 units, was initially authorized by the 1936 Flood Control Act and modified by subsequent acts as a system to provide uniform flood protection to the industrial and commercial

areas at the confluence of the Missouri and Kansas Rivers. The system was designed to pass a related set of design discharges on the Kansas and Missouri Rivers and has been analyzed and modified subsequently as a system with uniform level of protection. In 2007 a study was undertaken to seek to reduce flood damages and reduce the flood risks for four of the seven levee units within the existing Kansas Cities levee system which are mentioned below. The levee units are located in both Kansas and Missouri and encompass several city and county jurisdictions with the primary entities including Kansas City, Missouri (Reference 35).

Within this jurisdiction there are one or more levees that have not been demonstrated by the community or levee owner(s) to meet the requirements of 44 CFR Part 65.10 of the NFIP regulations as it relates to the levee's capacity to provide 1 1-percent-annual-chance flood protection. Please refer to the Notice to Flood Insurance Study Users page at the front of this FIS report for more information.

East Bottoms Levee Unit: The East Bottoms Levee protects against the 1-percent-annual-chance along the Missouri River and Blue River. The Levee currently does not met the criteria of 65.10 and will be secluded. The flood hazard within the secluded area will be evaluated at a later date.

The MO Central Industrial District CID Levee System provides protection against the 1-percent-annual-chance flood event on the Missouri River and Kansas Rivers. The levee has been certified to 65.10 and is ready to continue to show accredited.

North Kansas City Levee Lower U n i t provides protection against the 1-percent-annual-chance flood event on the Missouri River and Kansas Rivers. The levee has been certified to 65.10 and is ready to continue to show accredited. The Hillside reach of the North KC levee system was not certified as part of the North Kansas City Lower Unit because it did not meet the requirements. The area protected by this levee will be secluded.

Birmingham Levee System provides protection against the 1-percent-annual-chance flood events on the Missouri Rivers and Shoal Creek. The levee has been certified to 65.10 and will continue to be shown as accredited.

The Bannister GSD Complex Levee provides protection against the 1-percent-annual-chance flood event on the Blue River. The levee is currently shown as accredited on the effective FIRM.

There are also 2 big reservoirs within Kansas City which are operated by the United States Army Corps of Engineers. They are Longview Lake, which consists of a drainage area of 50.3 square miles with a maximum discharge of record near the Dam Site of 18,700 cfs in August 13, 1982, and Blue Springs Lake, which consists of a contributing drainage area of 32.8 square miles with a maximum discharge of record near the Dam Site of 11,000 cfs on August 14, 1982 (Reference 16).

The United States Army Corps of Engineers is currently conducting a reconnaissance study of the Missouri River Bed Degradation. The study encompasses the geographic reach of the River from Rulo, NE to the mouth of the river in St. Louis, MO. The Missouri River has exhibited degradation and scour of the riverbed to varying degrees throughout the study area. There is a good deal of variation in current impacts. In recent years, the rate of bed degradation has increased. This is especially true within the Kansas City reach (RM 350 to RM 400), where communities have and are currently incurring costs for repairs and/or upgrades to infrastructure. A growing concern is the significant threat to critical infrastructure along the river (e.g., the Kansas Citys [see Note below] Metropolitan Levee System, water supply intake structures, and utility intake structures) and smaller infrastructure on the tributaries where head cuts and bank erosion are occurring. Note: The Kansas Citys Metropolitan Levee System is also known as the Kansas Cities Seven Levees System and the Kansas Cities Flood Protection System. The spelling of "Citys" in the levee system's name comes from title used in the system's congressional authorization (Reference 36).

Erosion of foundation materials caused by bed degradation threatens bank stability, affecting the primary levee system along the Missouri River in Kansas City, water intakes, and drainage outfall structures. Although the impacts have not been fully evaluated and inventoried, a review of existing hydrographic data indicates that the toes of revetments supporting critical levee structures have eroded due to the degraded channel conditions. The condition of the eroded revetments poses a significant risk for failure of the levee system. During a major flood event, sloughing or a series of successive bank failures could result in partial or sudden and total failure of the affected levee segment. The evidence of the eroded areas resulting from normal to moderate flows indicates that a major flood event would pose high risks of severe erosion and the probability of levee system failure. Many of the levees and floodwalls are founded on the revetment protected slopes. Similarly, drainage outfalls are built into the revetment protected slopes. If the slopes supporting these outfall structures fail, the outfall structures would be impacted. During a large flood event the erosion would not be visible or easily monitored; a response after a levee section failure would be difficult (Reference 36).

Flood warning and forecasting services for the city are performed by the National Oceanic and Atmospheric Administration, National Weather Service, which in turn alerts the news media and local officials when serious flooding is imminent (Reference 37).

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long time average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 1-percent-annaul-chance flood in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

Note: Within this jurisdiction there are one or more levees that have not been demonstrated by the community or levee owner(s) to meet the requirements of 44 CFR Part 65.10 of the NFIP regulations as it relates to the levee's capacity to provide 1-percent-annual-chance flood protection. Please refer to the Notice to Flood Insurance Study Users page at the front of this FIS report for more information.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for each flooding source studied by detailed methods affecting the community.

Major Upper Mississippi River Basin flooding during the 1990s resulted in significant losses, as well as raised questions regarding the frequency of the associated flood events. Reevaluation of the Upper Mississippi River System became necessary to address the questions resulting from the Great Flood of 1993, and was facilitated based on the availability of new topographic data, new computational techniques, and about 20 more years of recorded hydrologic data since the previous study of the Mississippi River had been performed in 1979. This is generally true for the Missouri River as well. The last major effort to comprehensively determine Missouri River flow frequencies was in 1962. The additional record of more than 35 years included the major events of 1993 downstream of Nebraska City and the 1997 large volume flood in the upper reaches of the Missouri River (Reference 26).

The UMRSFFS was undertaken starting in 1998 with the purpose to update the discharge-frequency relationships and associated water-surface profiles for the Mississippi River from St. Paul, Minnesota to the confluence of the Ohio River; for the Illinois River from Lockport, Illinois to its mouth; and for the Missouri River from Gavins Point Dam to its mouth. Five USACE Districts participated in the study: Rock Island, St. Louis, St. Paul, Kansas City, and Omaha. The study was completed in 2003. The hydrologic analysis for the UMRSFFS utilized a combination of the following methods and approaches to determine discharge-frequency relationships: 100 years of record from 1898 to 1998; the log-Pearson Type III distribution for unregulated flows at gages; main stem flows between gages determined by interpolation of the mean and standard deviation for the annual flow distribution based on drainage area in conjunction with a regional skew; flood control reservoir impacts defined by developing regulated versus non- regulated relationships for discharges; extreme events determined by factoring in major historic events; HEC-HMS and/or HEC-1 models for the main tributaries; and the UNET unsteady flow program to address hydraulic impacts. In situations where historic records were not adequate or appropriate to develop discharge- frequency relationships or to verify the results, hydrologic modeling was used to create synthetic flows based on rainfall. Gage records for all streams were carefully evaluated.

The computation of unregulated flow frequency relationships on the Missouri River upstream of the Kansas River required special consideration due to the combination of the two historic peak flow periods consisting of the plains snowmelt of the early spring and the mountain snowmelt and plains rainfall of the late spring/early summer. An additional concern related to the Missouri River was flow depletion due to irrigation and reservoir evaporation. Historic depletions were added to the observed flow record to help obtain unregulated flows, while historic depletions were adjusted to present level depletions for computation of the regulated flow record.

The result of the hydrologic aspects of the study was a discharge and related frequency of occurrence for stations or given cross-section located along each of the principle main stem rivers. For more detailed information on each of the hydrologic methodologies used to determine discharges on the Missouri River, the reader is encouraged to consult the report cited as Reference 26 in Section 9.0 of this FIS.

As for the Blue River watershed and portions of the Little Blue River watershed in Jackson County, detailed rainfall-runoff models were utilized to develop peak discharges. All subbasin boundaries were reviewed against the 2ft DEM created from LiDAR data in order to identify any required adjustments. The total contributing drainage area for the extent of the Blue River watershed study area is approximately 272 square miles. Within the

Blue River watershed there are approximately 53 miles of new detailed hydraulics which includes the Blue River from the confluence with the Missouri River to the Jackson County, MO – state political boundary. The total contributing drainage area of the rainfall-runoff model for the Little Blue River watershed study area is approximately 98 square miles. Within the Little Blue River rainfall-runoff model there are approximately 47.8 miles of new detailed hydraulics.

In addition to rainfall runoff analyses, statistical gage analyses were performed as part of an Atherton Levee Certification effort to develop storm hydrographs for 8.8 miles of the Little Blue River from the confluence with the Missouri River up to approximately 980 feet upstream of Blue Mills Road. Hydrographs developed from the statistical gage analysis were then routing through an unsteady-state model to develop peak discharges and water surface stages. This analysis of the Little Blue River has been incorporated as part of the countywide update.

XP-SWMM models provided by Kansas City, MO (KCMO) were upgraded to XP-SWMM 2010 SP3 Version 12.3 (Reference 38) for the rainfall-runoff analysis of the Little Blue River Watershed and the Blue River Watershed including Brush Creek, Round Grove Creek (within the City of Kansas City) and Town Fork Creek. From the confluence with the Missouri River upstream 11 miles along the Blue River XP-SWMM hydrology hydrographs were routed using an unsteady- state HEC-RAS model to develop peak discharges. Where applicable, inflow hydrographs were utilized from the Johnson County, KS effective FIS (Reference 38). First Creek Watershed and Second Creek Watershed were modeled using XP SWMM Version 10.6 (Reference 39).

Peak discharges were calculated for Dyke Branch, Hickman Mills Creek, Hickman Mills Creek Tributary 1, Hickman Mills Creek Tributary 2 and Indian Creek using the USACE HEC-HMS modeling program version 3.5 (Reference 40).

There were approximately 10 storage areas included in four models for Little Blue River watershed. Through observation of aerial images, site photos, topography, and storm sewer network data it was determined that these impoundments would be effective in attenuating design event flows and thus were included in the model. Elevation-Area-Volume relationships were determined for each reservoir using GIS process and the DEM data. Outlet data was entered using the best available data for culvert outlets, dam tops, weirs, etc.

For Longview Reservoir the principal spillway rating curve was provided by the USACE and was utilized to relate stage versus outflow. The stage-storage table was also provided by the USACE. In addition to Longview Reservoir two additional lakes were included on Lumpkin's Fork and Little Cedar Creek Trib. 2. The dam as-built information and normal pool elevation were derived

from FEMA LOMR 08-07-1446 on Lumpkin's Fork.

Where applicable peak discharges computed for the Blue River and Little Blue River Watershed were verified utilizing USGS gage data.

It should be noted that though hydrologic computations were carried out up to drainage areas less than one square mile, the scope of this study was to develop detailed hydrology for those areas studied by detailed hydraulics. For those areas beyond the extents of this study further detailed analyses or methods may be necessary.

Peak discharges were calculated for the following streams using the USACE HEC-HMS modeling program Version 3.2 or 3.3 (Reference 40): Brush Creek (Platte County), Brush Creek Tributary 1, Burlington Creek, Burlington Creek Tributary 1, Burlington Creek Tributary 2, East Creek, East Creek Tributary 1, East Fork Line Creek, East Fork Line Creek Tributary 1, East Fork Line Creek Tributary 1.2, East Fork Shoal Creek, East Fork Shoal Creek Tributary 1, East Fork Shoal Creek Tributary 2, East Fork Shoal Creek Tributary 3, Fishing River, Fishing River Tributary 1, Fishing River Tributary 1.1, Fishing River Tributary 1.2, Jumping Branch, Line Creek, Line Creek Tributary 1, Line Creek Tributary 2, Little Shoal Creek, Little Shoal Creek Tributary 1, Mill Creek (Clay County), Mill Creek Tributary 1, Old Maids Creek, Randolph Creek, Rock Creek (Clay County), Rock Creek Gladstone, Rock Creek Tributary 11, Rock Creek Tributary 11.2, Rocky Branch, Rocky Branch Tributary 1, Shoal Creek, Shoal Creek Tributary 6, Shoal Creek Tributary 8, Shoal Creek Tributary 9, Shoal Creek Tributary 20, Shoal Creek Tributary 20.1, Todd Creek, Tributary to Todd Creek, Walnut Creek, Wildcat Branch and Wilkerson Creek.

XP-SWMM Version 10.6 (Reference 39) was used to develop peak discharges for Buckeye Creek, Buckeye Creek Tributary 1, Searcy Branch, and Searcy Branch Tributary 1.

For Blue Branch, Sni-A-Bar Creek, Swiney Branch, and Yennie Avenue Drain, the USACE, Kansas City District, used HEC-HMS (version unknown) (Reference 40) to define discharge-frequency data for each flooding source (Reference 15).

The peak flows of Tributary P5 to Prairie Lee Lake that is downstream of Legacy Lake were calculated using TR-55 (Reference 41) and HEC-1 (Reference 42). Discharge-frequency data were calculated using a USGS Water-Resources Investigation Report 94-4002 (Reference 43) for the following streams: Big Creek, Cedar Creek, Horseshoe Creek Tributary, SB-1 Tributary to Sni-A-Bar Creek, SB-2 Tributary to Sni-A-Bar Creek, SB-3 Tributary to Sni-A-Bar Creek, SB-4 Tributary to Sni-A-Bar Creek, Tributary Al to East Fork Little Blue River, Tributary A2 to East Fork Little Blue River, Tributary B 1 to Big Creek, Tributary B2 to Big Creek, Tributary C 1 to Cedar Creek, Tributary C2 to Cedar Creek, Tributary C3 to Cedar Creek,

Tributary C4 to Cedar Creek, Tributary C5 to Cedar Creek, Tributary C6 to Cedar Creek, Tributary G1 to Lake Winnebago, Tributary G2 to Raintree Lake, Tributary Ll to Lakewood Lakes, Tributary P1 to Prairie Lee Lake, Tributary P2 to Prairie Lee Lake, Tributary P3 to Prairie Lee Lake, Tributary P4 to Prairie Lee Lake, Tributary P5 to Prairie Lee Lake, Tributary to Tributary B2 to Big Creek, Tributary to West Fork Sni-A-Bar Creek, and portions of East Fork Little Blue River within Lee's Summit. The National Flood Frequency Program method for urban flood-frequency estimates was also utilized for areas with significant development (Reference 15).

Peak discharge values for May Brook were adopted from an existing Missouri Department of Natural Resources HEC-1 hydrologic analysis (Reference 42) with minor modifications by George Butler Associates, Inc (Reference 15).

The Missouri River Basin Comprehensive Framework Study (Reference 44) was used to determine the discharge values for Little Cedar Creek (upstream of I-470), Mouse Creek, Tributary B3 to Big Creek, Tributary J1, Tributary M1, Tributary M2, Tributary M3, Tributary M4, Tributary M5, Tributary M6, and a portion of the Little Blue River within the City of Lee's Summit (Reference 15).

The hydrologic analyses for Adair Creek Tributary No. 1, Adair Creek Tributary No. 2, Middle Fork Mill Creek, North Fork Crackerneck Creek, North Fork Spring Branch, North Fork Sugar Creek, South Fork Spring Branch, and the portion of Mill Creek within the City of Independence, were based on the generalized flood frequency estimates for urban areas in Missouri (Reference 45). Natural Resources Conservation Service Technical Release No. 20 (Reference 46) was used in the development of hydrologic models for Adair Creek, Bundschu Creek, Crackerneck Creek, Rock Creek, Spring Branch, Tributary L2 to Lakewood Lakes, and the portion of Sugar Creek within the City of Independence (Reference 15).

The hydrologic analyses for the portions of East Fork Little Blue River and Little Blue River within the City of Independence were obtained from a USACE, Kansas City District, project evaluation report (Reference 9 and 15).

Peak discharge computations for Blue Branch Creek Tributary No. 1, Blue Branch Creek Tributary No. 2, Burr Oak Creek, Burr Oak Creek Tributary, Fire Prairie Creek, Horseshoe Creek, Oil Creek, the portion of Round Grove Creek outside the City of Kansas City, Seminary Creek, Swiney Branch Tributary, Tributary No. C-1, Tributary No. C-2, Tributary No. S-1, Tributary No. S-2, Tributary No. S-3, Tributary No. S-3A, Tributary No. S-4, Tributary No. S-5, Tucker Branch, Tucker Branch Tributary, West Branch Crawford Creek, West Fire Prairie Creek, West Fork Sni-A-Bar Creek, the portion of Sugar Creek within the City of Sugar Creek, and the portions of Mill Creek within Jackson County, were based on a basin modeling technique of the

Environmental Protection Agency "Storm Water Management Model" (Reference 47) as adopted by the USACE (Reference 15).

This update also includes the incorporation of detailed hydrologic and hydraulic analyses of Shoal Creek and Little Shoal Creek from an appeal brought forward by the Birmingham Drainage District (Docket No. FEMA-B-1192). As part of that appeal detailed hydrologic and hydraulic analyses, previously developed and approved by FEMA, were developed by updating with more detailed modeling methods. The hydrologic analysis includes a rainfall-runoff analysis using HEC-HMS. Additional storage area considerations were utilized to develop peak discharges and hydrographs. The rainfall-runoff hydrographs were then routed using an unsteady-state HEC-RAS model which evaluated various levee scenarios.

New hydrology was performed for previous approximate (Zone A) studies or those streams with a contributing drainage area of 1 square mile or greater. USGS Rural Regression analysis was derived from USGS Fact Sheet 015-01 dated March 2001 (Reference 48). Region 1 regression equation was selected for these studies and the calculated variables were drainage area and stream channel slope. Some approximate studied (Zone A) streams that fell within the watershed of a detailed Zone AE model utilized results from the detailed watershed hydrology models instead of regression equations.

Peak discharges for the 10-, 2-, 1-, and 0.2-percent-annual-chance flood of each flooding source studied in detail in the county are shown in Table 3, "Summary of Discharges."

TABLE 3 – SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
ADAIR CREEK						
At confluence with Little Blue River	5.5	2,860	N/A	4,510	5,400	10,000
Approximately 1,020 feet upstream of Pleasant Grove Road	4.0	2,510	N/A	3,860	4,740	9,150
Just upstream of confluence with Adair Creek Tributary No. 1	2.4	1,610	N/A	2,360	2,970	6,000
Just upstream of confluence with Adair Creek Tributary No. 2	0.7	630	N/A	900	1,030	1,730
ADAIR CREEK TRIBUTARY 1						
At confluence with Adair Creek	1.1	900	N/A	1,300	1,610	2,910
ADAIR CREEK TRIBUTARY 2						
At confluence with Adair Creek	1.0	500	N/A	840	1,320	3,140
BIG CREEK						
At Ranson Road	8.6	2,600	N/A	4,800	6,100	10,000
Approximately 1,800 feet upstream of Ranson Road	5.9	2,000	N/A	3,700	4,750	7,750
Approximately 0.4 miles downstream of Southeast Hamblen Road	2.9	1,250	N/A	2,250	2,850	4,700
Approximately 0.6 miles downstream of State Highway 291	2.1	950	N/A	1,750	2,300	3,700
Approximately 700 feet downstream of State Highway 291	1.3	700	N/A	1,250	1,700	2,700
At State Highway 291	0.7	450	N/A	800	1,100	1,750
BLUE BRANCH						
At confluence with Sni-A-Bar Creek	15.9	5,290	N/A	8,330	9,850	13,460
Approximately 0.6 miles upstream of South Buckner Tarsney Road	14.6	5,160	N/A	8,030	9,480	12,980

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
BLUE BRANCH (CONT'D)						
Approximately 1,750 feet downstream of Sni-A-Bar Boulevard	13.9	5,110	N/A	7,980	9,380	12,780
Just upstream of confluence of Blue Branch Creek Tributary No. 1	5.7	2,450	N/A	3,830	4,470	6,060
Approximately 2 miles upstream of confluence of Blue Branch Creek Tributary No. 1	2.4	1,300	N/A	1,970	2,280	3,160
Approximately 3.9 miles upstream of confluence of Blue Branch Creek Tributary No. 1	1.5	910	N/A	1,390	1,590	2,160
BLUE BRANCH CREEK TRIBUTARY 1						
Approximately 0.4 miles upstream of confluence of Blue Branch Creek Tributary No. 2	2.9	1,950	N/A	3,150	3,670	4,930
BLUE BRANCH CREEK TRIBUTARY 2						
At confluence with Blue Branch Creek Tributary No. 1	3.8	2,150	N/A	3,700	4,390	6,060
Approximately 1,750 feet upstream of confluence with Blue Branch Creek Tributary No. 1	3.3	1,860	N/A	3,120	3,780	5,250
Approximately 200 feet upstream of I-70	1.5	810	N/A	1,410	1,720	2,400

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
BLUE RIVER						
At railroad crossing approximately 12200 feet upstream of the confluence with Missouri River	272.0	29,665	34,178	39,982	43,264	53,958
Just upstream of Gregory Blvd	205.0	25,685	31,040	37,405	40,930	58,219
Approximately 7300 feet upstream of Gregory Blvd	201.0	27,068	32,948	39,900	43,312	62,910
Just downstream of the confluence with Blue River Tributary 6	121.0	21,210	27,750	32,144	37,292	53,717
Approximately 0.6 miles upstream of Kenneth Road	46.0	22,936	29,399	33,319	39,295	57,273
BLUE RIVER TRIBUTARY 1						
Approximately 1,842 feet upstream of the confluence	2.0	2,141	2,534	3,054	3,792	4,914
Approximately 0.6 miles downstream of Holmes Road	1.7	2,380	2,814	3,360	4,142	5,270
Approximately 0.5 miles downstream of Holmes Road	1.4	1,786	2,100	2,498	3,069	3,822
Approximately 835 feet downstream of Holmes Road	1.3	1,612	1,900	2,240	2,743	3,413
Approximately 1,161 feet upstream of Holmes Road	1.0	1,527	1,816	2,196	2,793	3,729
Approximately 1,772 feet upstream of Holmes Road	0.8	989	1,200	1,459	1,911	2,539

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
BLUE RIVER TRIBUTARY 2						
Approximately 750 feet upstream of Holmes Road	0.8	1,705	2,129	2,373	2,650	3,505
Approximately 1,249 feet upstream of the confluence with Blue River	0.8	1,710	2,136	2,378	2,654	3,545
Approximately 424 feet upstream of Wyandotte Street	0.6	1,712	2,109	2,337	2,599	3,450
Approximately 1,290 feet upstream of Missouri Highway 150	0.2	1,567	1,933	2,127	2,349	3,109
BLUE RIVER TRIBUTARY 4						
Approximately 223 feet upstream of the confluence with Blue River	2.8	4,044	4,829	5,757	7,085	9,243
Approximately 607 feet upstream of the confluence with Blue River	2.8	4,320	5,085	6,017	7,324	9,568
Approximately 470 feet upstream of Blue River Road	2.6	4,196	4,892	5,753	6,991	9,109
Approximately 100 feet downstream of 129th Street	1.1	1,045	1,248	1,500	1,863	2,488
Approximately 1,990 feet upstream of 129th Street	0.6	489	593	724	915	1,264
BLUE RIVER TRIBUTARY 4.1						
Approximately 1,304 feet upstream of the confluence with Blue River Tributary 4	1.4	2,989	3,455	4,026	4,858	6,263

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
BLUE RIVER TRIBUTARY 4.1 (CONT'D)						
Approximately 1,071 feet downstream of Blue Ridge Boulevard	0.2	475	550	644	802	1,046
BLUE RIVER TRIBUTARY 5						
Approximately 208 feet upstream of the confluence with Blue River	2.1	2,525	2,992	3,530	4,257	5,510
Approximately 923 feet upstream of the confluence with Blue River	1.9	2,706	3,147	3,687	4,394	5,643
Approximately 730 feet downstream of Charlotte Street	1.7	2,544	2,904	3,331	3,915	4,946
Approximately 840 feet downstream of Wornall Road	1.2	2,323	2,648	3,016	3,559	4,534
Approximately 245 feet downstream of Wornall Road	1.1	2,124	2,412	2,745	3,233	4,099
Approximately 660 feet upstream of Wornall Road	0.9	1,901	2,154	2,462	2,885	3,634
BLUE RIVER TRIBUTARY 6						
Approximately 464 feet upstream of Blue River Road	2.8	1,919	2,503	3,210	4,048	5,640
Approximately 1,161 feet downstream of Martha Truman	2.6	2,431	2,912	3,514	4,361	5,924
Approximately 819 feet upstream of Martha Truman	1.6	1,773	2,113	2,540	3,134	4,230
Approximately 478 feet upstream of Cleveland Avenue	1.1	1,516	1,819	2,181	2,678	3,523

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
BLUE RIVER TRIBUTARY 6 (CONT'D)						
Approximately 1,670 feet upstream of Cleveland Avenue	0.4	708	826	967	1,165	1,483
BLUE RIVER TRIBUTARY 7						
At the confluence with Blue River	1.3	2,812	2,899	3,010	3,275	3,606
Approximately 314 feet downstream of Blue River Road	1.3	2,013	2,355	2,756	3,308	4,254
Approximately 0.4 mile upstream of Blue River Road	1.0	1,835	2,110	2,434	2,884	3,636
Approximately 0.6 mile upstream of Blue River Road	0.8	1,316	1,498	1,715	2,023	2,561
Approximately 1,937 feet downstream of Red Bridge Road	0.6	805	904	1,021	1,190	1,462
Approximately 657 feet downstream of Red Bridge Road	0.5	519	569	623	720	865
Just downstream of Red Bridge Road	0.3	254	267	281	299	328
Approximately 170 feet upstream of Red Bridge Road	0.3	341	379	405	427	504
BLUE RIVER TRIBUTARY 9						
Approximately 276 feet upstream of 87th Street	0.8	1,826	2,062	2,328	2,692	3,458
Approximately 800 feet downstream of 82nd Street	0.3	217	285	358	458	761

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
BLUE RIVER TRIBUTARY 9 (CONT'D)						
Just downstream of Railroad approximately 2400 feet upstream of confluence with Blue River	2.6	3,096	3,338	3,630	4,457	6,130
Just downstream of Euclid Ave	2.4	3,925	4,308	4,819	5,740	7,349
Approximately 485 feet upstream of Euclid Avenue	2.1	3,639	4,129	4,723	5,635	7,323
Approximately 1,836 feet downstream of Troost Avenue	2.0	3,338	3,793	4,322	5,116	6,670
Approximately 123 feet downstream of Troost Avenue	1.4	2,450	2,815	3,206	3,755	4,833
Approximately 956 feet upstream of Holmes Road	1.1	1,852	2,093	2,376	2,763	3,554
BLUE RIVER TRIBUTARY 10						
Aproximately 1700 feet upstream of confluence with Blue River	1.5	7[1]	15[1]	104[1]	405[1]	992[1]
Aproximately 2800 feet upstream of confluence with Blue River	1.1	5[1]	10[1]	15[1]	37[1]	347[1]
Approximately 1,794 feet downstream of Highway 71	1.0	623	623	623	639	973
Approximately 68 feet downstream of Highway 71	1.0	1,122	1,167	1,219	1,283	1,445
Approximately 790 feet downstream of Agnes	0.9	1,125	1,189	1,271	1,380	1,568
Approximately 410 feet downstream of Prospect Avenue	0.8	974	1,006	1,039	1,072	1,128

[1]Represents surface peak discharge computed from flows exceeding stormwater capacity.

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
BLUE RIVER TRIBUTARY 11						
Approximately 117 feet downstream of Blue River Road	2.9	2,663	3,135	3,661	4,263	6,106
Approximately 1,018 feet upstream of Blue River Road	2.9	3,596	3,732	4,398	5,288	7,160
Approximately 0.4 miles downstream of Oldham Road	2.5	3,078	3,442	3,959	4,752	6,233
Approximately 60 feet downstream of Oldham Road	1.9	2,838	3,171	3,564	4,078	4,947
Approximately 785 feet upstream of Oldham Road	1.2	1,606	1,721	1,845	1,979	2,138
Approximately 123 feet upstream of I-435	1.1	1,445	1,526	1,615	1,693	1,776
BLUE RIVER TRIBUTARY 12						
Approximately 806 feet upstream of the confluence with Blue River	1.2	1,421	1,565	1,809	2,207	3,339
Approximately 1,027 feet downstream of Jackson Avenue	1.2	1,424	1,606	1,857	2,314	3,449
BLUE RIVER TRIBUTARY 13						
Approximately 600 feet upstream of the confluence with Blue River	1.4	1,496	1,878	2,253	2,734	3,399
Approximately 189 feet downstream of Lakeside Drive	1.4	1,810	2,118	2,488	3,031	3,998
Approximately 1,193 feet upstream of Lakeside Drive	1.3	1,607	1,871	2,186	2,660	3,496

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
BLUE RIVER TRIBUTARY 13 (CONT'D)						
Approximately 1.06 miles upstream of Lakeside Drive	1.0	1,448	1,672	1,949	2,389	2,994
Approximately 1,018 feet upstream of Blue River Road	0.8	1,348	1,548	1,787	2,141	2,786
BLUE RIVER TRIBUTARY 14						
Just upstream of 63rd Trafficway	2.3	4,045	4,708	5,328	6,440	8,590
Approximately 654 feet downstream of Beacon Drive	2.0	3,976	4,664	5,238	6,444	8,525
Approximately 628 feet downstream of Winchester Avenue	1.9	3,943	4,815	5,612	6,305	7,899
Approximately 740 feet upstream of Winchester Avenue	1.4	3,277	3,692	4,126	4,795	5,997
Approximately 487 feet upstream of Missouri Highway 350	0.8	2,218	2,526	2,897	3,391	4,241
Just upstream of Missouri Highway 350	0.5	664	755	870	1,022	1,284
BLUE RIVER TRIBUTARY 17[1]						
Approximately 450 ft downstream of 31st Street	1.9	2,168	2,562	3,063	3,827	5,734
Just downstream of I-70	1.5	2,168	2,562	3,063	3,804	5,288
BRUSH CREEK						
Approximately 1,246 feet upstream of the confluence with Blue River	30.1	15,431	17,106	20,166	21,784	24,615

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
BRUSH CREEK (CONT'D)						
Approximately 748 feet upstream of Elmwood Avenue	29.3	15,402	17,062	20,088	21,617	25,223
Approximately 387 feet upstream of Prospect Avenue	22.9	14,767	17,989	20,344	21,570	25,856
Approximately 1,523 feet upstream of Michigan Avenue	21.0	15,237	18,870	21,768	22,947	28,041
Approximately 817 feet upstream of Troost Avenue	18.0	12,618	15,552	17,981	19,054	24,021
Approximately 395 feet upstream of Ward Parkway Median Crossing	14.6	10,337	13,255	15,696	16,763	22,338
Approximately 280 feet upstream of Roanoke Parkway	14.1	10,051	12,941	15,418	16,438	22,433
BRUSH CREEK (PLATTE COUNTY)						
Just upstream of the confluence with Missouri River	21.2	9,041	N/A	12,621	15,325	20,053
Just downstream of the confluence with Naylor Creek	15.9	8,374	N/A	11,433	13,866	18,162
1400 feet downstream of Highway 152	9.9	6,128	N/A	8,384	10,143	13,017
100 feet downstream of Hampton Road	7.0	5,113	N/A	6,921	8,208	10,521
660 feet downstream of Childress Road	4.1	3,969	N/A	5,287	6,165	7,895
625 feet downstream of Amity Avenue	1.0	1,157	N/A	1,559	1,860	2,362
BRUSH CREEK TRIBUTARY 1						
Just upstream of the confluence with Brush Creek	1.0	1,122	N/A	1,466	1,722	2,145

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
BRUSH CREEK TRIBUTARY 1 (CONT'D)						
Just downstream of Northwest 104th Street	0.5	508	N/A	667	785	981
BRUSH CREEK TRIBUTARY 8[1]						
Near the intersection of Tracy Ave and 47th Street	1.7	10	40	270	690	1,670
Near the intersection of Troost Ave and 47th Street	1.7	50	200	540	1,080	2,150
Just downhill from the intersection of Gillham Road and Brush Creek Blvd	1.6	0	100	330	730	1,470
Just uphill from the intersection of Gillham Road and Brush Creek Blvd	1.6	180	460	1,050	1,980	3,120
Just downhill from the intersection of Campbell Street and Gillham Road	1.5	470	930	1,630	2,400	3,490
Just uphill from the intersection of Campbell Street and Gillham Road	1.4	260	650	1,220	1,910	3,010
Near intersection of 44th Street and Gillham Road	1.4	150	370	750	1,320	2,530
Near intersection of 43rd Street and Gillham Road	1.4	1,010	1,320	1,820	2,480	3,790
Just downstream of the intersection of 41st Street and Gillham Road	1.2	560	810	1,260	1,890	3,020

[1]Represents surface peak discharge computed from flows exceeding stormwater capacity.

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
BRUSH CREEK TRIBUTARY 8[1] (CONT'D)						
Near intersection of 41st Street and Gillham Road	1.2	610	940	1,290	1,890	2,970
Near intersection of 39th Street and Gillham Road	1.1	470	790	1,110	1,520	2,330
BUCKEYE CREEK						
Approximately 600 feet upstream of the confluence with the Missouri River	4.8	2,832	N/A	3,989	4,622	5,606
150 feet downstream of Birmingham Road	3.0	1,661	N/A	2,268	2,755	3,541
1,300 feet upstream of 38th Street	2.2	1,901	N/A	2,317	2,541	2,888
590 feet upstream of Cleveland Avenue	0.8	912	N/A	1,336	1,598	2,739
BUCKEYE CREEK TRIBUTARY 1						
280 feet upstream of North Spruce Avenue	0.4	563	N/A	749	863	1,023
Approximately 0.6 miles upstream of North Spruce Avenue	0.2	332	N/A	451	541	691
BUNDSCHU CREEK						
At confluence with Little Blue River	5.0	2,910	N/A	4,410	5,360	8,600
BURLINGTON CREEK						
Just upstream of the confluence with Missouri River	3.4	2,760	N/A	3,883	4,742	6,234
Just downstream of North Lucerne Avenue	2.1	2,925	N/A	4,121	5,021	6,601

[1]Represents surface peak discharge computed from flows exceeding stormwater capacity.

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
BURLINGTON CREEK (CONT'D)						
Just downstream of Tom Watson Parkway	0.4	955	N/A	1,288	1,535	1,943
BURLINGTON CREEK TRIBUTARY 1						
Just downstream of Northwest 62nd Terrace	0.4	955	N/A	1,289	1,535	1,943
BURLINGTON CREEK TRIBUTARY 2						
Approximately 1,000 feet upstream of the confluence with Burlington Creek	0.5	650	N/A	1,014	1,302	1,806
Approximately 1,500 feet upstream of the confluence with Burlington Creek	0.5	524	N/A	817	1,050	1,462
BURR OAK CREEK						
Approximately 1,500 feet downstream of Northwest Pink Hill Road	4.3	1,400	N/A	2,900	3,600	5,200
At Northwest Pink Hill road	1.7	800	N/A	1,700	2,100	3,000
BURR OAK CREEK TRIBUTARY						
Approximately 500 feet upstream of confluence with Burr Oak Creek	1.6	610	N/A	1,200	1,500	2,200
CEDAR CREEK						
At confluence with Little Blue River	*	3,900	N/A	5,780	6,750	8,240
At Northwest Chipman Road	*	3,840	N/A	5,710	6,680	8,180
Approximately 0.8 miles upstream of Northwest Chipman Road	*	3,470	N/A	5,130	5,990	7,310

*Data not available.

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
CEDAR CREEK (CONT'D)						
Approximately 1,870 feet downstream of Southwest 3rd Street	*	2,760	N/A	4,070	4,740	5,780
Approximately 580 feet upstream of Southwest Pryor Drive	*	1,710	N/A	2,520	2,900	3,540
Approximately 1,040 feet downstream of Union Pacific Railroad	*	1,480	N/A	2,140	2,470	2,990
Approximately 990 feet upstream of Union Pacific Railroad	*	1,040	N/A	1,500	1,720	2,090
Approximately 580 feet downstream of Southwest Lakeview Boulevard	*	536	N/A	766	869	1,050
CRACKERNECK CREEK						
At confluence with Little Blue River	6.7	4,610	N/A	7,580	9,180	15,370
DYKE BRANCH						
At confluence with Indian Creek	6.9	4,250	5,030	5,850	7,330	9,520
At Holmes Road	6.9	4,240	5,010	5,810	7,320	9,510
At Bannister Road	6.8	4,220	4,990	5,740	7,290	9,470
Approximately 800 ft upstream of Bannister Road	6.7	4,210	4,980	5,720	7,270	9,450
Approximately 2200 feet downstream of Wornall Road	6.5	4,160	4,920	5,660	7,190	9,340
Approximately 775 feet downstream of Wornall Road	6.4	4,140	4,900	5,650	7,200	9,350
Approximately 580 feet downstream of Wornall Road	5.9	4,010	4,750	5,470	6,950	9,000

*Data not available.

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
DYKE BRANCH (CONT'D)						
Just upstream of Wornall Road	5.9	3,970	4,710	5,420	6,880	8,910
Near Ward Pkwy approximately 600 feet downstream of 92nd St	5.6	4,280	5,060	5,900	7,700	10,030
Approximately 460 feet downstream of 92nd Street	5.3	4,210	4,980	5,810	7,580	9,860
At Ward Pkwy	5.3	4,200	4,980	5,820	7,600	9,860
Just upstream of State Line Road	4.9	4,040	4,800	5,620	7,340	9,460
EAST CREEK						
At the confluence with Line Creek	3.8	4,349	N/A	5,959	7,211	9,374
Approximately 420 feet downstream of Northwest Vivon Road	3.5	4,156	N/A	5,654	6,915	8,919
EAST CREEK TRIBUTARY 1						
Approximately 100 feet upstream of the confluence with East Creek	1.5	2,015	N/A	2,732	3,303	4,191
Approximately 520 feet upstream of US-69	1.4	1,883	N/A	2,527	3,042	3,876
EAST FORK LINE CREEK						
Just upstream of the confluence with Line Creek	4.3	4,865	N/A	6,867	8,185	10,651
EAST FORK LINE CREEK TRIBUTARY 1						
Approximately 1,250 feet upstream of Arrowhead Trafficway	0.9	1,528	N/A	2,073	2,513	3,247

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
EAST FORK LINE CREEK TRIBUTARY 1.2						
Just upstream of the confluence with East Fork Line Creek	0.5	620	N/A	817	965	1,218
Tributary 1 Approximately 380 feet upstream of Northwest Arrowhead Trafficway	0.2	282	N/A	369	435	544
EAST FORK LITTLE BLUE RIVER						
At confluence with Little Blue River	4.4	2,500	N/A	3,700	4,200	5,100
At confluence of Tributary A1 to East Fork Little Blue River	2.3	1,700	N/A	2,400	2,800	3,300
At Southeast Todd George Road	1.9	1,500	N/A	2,100	2,400	2,800
At East Langsford Road	1.4	1,100	N/A	1,600	1,800	2,200
Approximately 0.8 miles upstream of Southeast Winburn Trail	0.7	850	N/A	1,300	1,400	1,700
EAST FORK SHOAL CREEK						
Approximately 1,100 feet downstream of lower most Interstate 435 crossing	12.7	7,904	N/A	11,113	13,736	18,173
Approximately 0.5 miles downstream of upper most Interstate 435 crossing	8.8	6,977	N/A	9,653	11,821	15,486
Approximately 900 feet downstream of upper most Interstate 435 crossing	3.9	2,804	N/A	3,869	4,719	6,167
Approximately 0.5 miles upstream of Brighton Avenue	3.2	2,575	N/A	3,578	4,345	5,627

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
EAST FORK SHOAL CREEK (CONT'D)						
Approximately 1,280 feet downstream of 100th Street	2.6	2,218	N/A	3,069	3,684	4,709
Approximately 650 feet upstream of lower most Staley Road crossing	2.1	1,959	N/A	2,702	3,234	4,143
Approximately 1,800 feet upstream of lower most Staley Road crossing	1.9	1,769	N/A	2,431	2,914	3,735
Approximately 700 feet upstream of upper most Staley Road crossing	0.8	837	N/A	1,139	1,366	1,747
EAST FORK SHOAL CREEK TRIBUTARY 1						
Approximately 500 feet upstream of 96th Street	4.4	4,053	N/A	5,703	6,970	9,079
Approximately 0.4 miles upstream of 96th Street	3.3	3,165	N/A	4,444	5,421	7,048
Approximately 0.6 miles downstream of Interstate 435	2.8	2,733	N/A	3,834	4,675	6,081
Approximately 1,500 feet upstream of Interstate 435	1.7	1,590	N/A	2,244	2,749	3,589
Approximately 0.6 miles upstream of Hardesty Avenue	1.4	1,380	N/A	1,932	2,359	3,053
EAST FORK SHOAL CREEK TRIBUTARY 2						
Approximately 450 feet downstream of Interstate 435 on ramp	1.1	1,145	N/A	1,613	1,978	2,652
Approximately 570 feet upstream of State Highway 152	1.0	1,047	N/A	1,464	1,808	2,413
Approximately 140 feet upstream of	0.9	938	N/A	1,319	1,632	2,155

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
Barry Road						
EAST FORK SHOAL CREEK TRIBUTARY 3						
Approximately 1 mile upstream of confluence with East Fork Shoal Creek	1.2	1,003	N/A	1,461	1,715	2,330
Approximately 120 feet upstream of Brighton Avenue	1.0	980	N/A	1,360	1,568	2,181
Approximately 900 feet upstream of 80th Street	0.9	873	N/A	1,180	1,386	1,925
Approximately 370 feet upstream of State Highway 152	0.6	691	N/A	955	1,155	1,492
FIRE PRAIRIE CREEK						
Approximately 1.9 miles downstream of State Highway H	36.3	6,100	N/A	8,000	8,400	9,400
At State Highway H	35.4	6,200	N/A	7,600	7,900	8,700
Approximately 0.4 miles upstream of Union Pacific Railroad	24.3	5,400	N/A	11,000	13,500	19,000
Approximately 1,500 feet downstream of O'Donnell Road	22.9	5,300	N/A	11,000	13,500	18,500
At North Sibley Street	18.2	4,700	N/A	9,600	12,000	16,000
At US-24/ West Monroe Street	3.2	1,200	N/A	2,600	3,200	4,500
FIRST CREEK						
Just upstream of the confluence with Second Creek (Clay County)	10.2	2,325	N/A	3,243	3,984	5,398
Just upstream of Martin Road (Clay County)	8.9	2,305	N/A	3,193	3,959	5,321
Just downstream of Highway 435	3.6	1,689	N/A	2,356	2,820	3,614

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
FIRST CREEK TRIBUTARY 1						
Just upstream of the confluence with First Creek	1.8	1,419	N/A	1,983	2,481	3,068
FISHING RIVER						
Approximately 320 feet upstream of Greenwood Road W	223.8	27,450	N/A	46,510	5,630	80,360
Just upstream of State Highway H	187.5	24,330	N/A	41,130	50,080	71,150
Approximately 1,620 feet upstream of US-69	138.2	22,500	N/A	36,210	42,820	61,710
Approximately 1.2 miles upstream of Plattsburg Road	45.2	11,150	N/A	18,020	21,140	30,080
Approximately 0.95 miles upstream of State Highway A	9.6	5,850	N/A	9,450	11,190	15,560
Approximately 350 feet upstream of N Home Avenue	6.4	4,490	N/A	7,240	8,570	12,220
Approximately 380 feet downstream of N Stark Avenue	2.0	1,660	N/A	2,650	3,130	4,380
Approximately 0.9 miles downstream of NE 120th Street	1.6	1,430	N/A	2,260	2,660	3,650
Just upstream of NE 120th Street	0.3	280	N/A	450	530	720
FISHING RIVER TRIBUTARY 1						
Just upstream of NE 112th Street	3.7	2,610	N/A	4,380	5,250	7,380
Approximately 900 feet upstream of Cookingham Drive	0.4	430	N/A	640	750	990
FISHING RIVER TRIBUTARY 1.1						
Just upstream of 112th Street	1.0	990	N/A	1,530	1,780	2,410
FISHING RIVER TRIBUTARY 1.2						
Approximately 840 feet upstream of NE 104th Street	0.4	360	N/A	560	660	890

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
HICKMAN MILLS CREEK						
At the confluence with Big Blue River	8.2	8,890	10,210	11,580	14,260	18,520
Approximately 550 ft US of Blue River Road; Just downstream of the confluence with Hickman Mills Creek Tributary 1	8.2	9,380	10,780	12,220	14,930	19,600
Approximately 0.4 miles downstream of Bannister Road	5.8	6,640	7,680	8,770	11,360	14,970
Just US of approximately 0.4 miles downstream of Bannister Road	5.0	5,760	6,650	7,590	10,040	13,200
At Bannister Road	5.0	5,770	6,660	7,600	10,400	13,430
Approximately 550 ft upstream of Hickman Mills Drive	4.9	5,680	6,560	7,490	8,840	10,990
Below Interstate 435 East overpass near Marion Park Drive	3.6	4,260	4,970	5,720	6,780	8,480
At Hickman Mills Drive	3.2	3,610	4,230	4,820	5,660	6,970
Near the overpass of Interstate 470 and State Highway 71 which is approximately 700 ft west of Hickman Mills Drive and 103rd Street	3.1	3,460	4,060	4,620	5,420	6,680
At State Highway 71 South to Interstate	2.8	3,030	3,560	4,060	4,770	5,800
470 West just upstream of State Highway 71 South to Interstate 470 West	2.6	2,950	3,460	3,960	4,660	5,670
Just upstream of approximately 175 ft upstream of Interstate I-470 West; Just upstream of confluence with Hickman Mills Creek Tributary 2	1.3	1,850	2,150	2,410	2,780	3,280

State Highway 71 North to Interstate 470
East just upstream of State Highway 71
South to Interstate 470 West

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
HICKMAN MILLS CREEK (CONT'D)						
Just downstream of Ramp US-71 N to I-470 E	1.3	1,770	2,060	2,320	2,690	3,190
Just upstream of Ramp US-71 N to I-470 E	1.3	1,850	2,170	2,510	3,020	3,850
Approximately 330 ft DS of Red Bridge Road	0.8	1,380	1,610	1,870	2,230	2,850
At Red Bridge Road	0.2	500	590	690	830	1,060
HICKMAN MILLS CREEK TRIBUTARY 1						
At the confluence with Hickman Mills Creek	2.0	2,560	2,900	3,230	3,690	4,410
At 87th Street	1.8	2,330	2,600	2,860	3,240	3,830
Just upstream of 87th Street	1.4	1,780	1,990	2,200	2,460	2,870
At I-435 East	1.1	1,560	1,710	1,840	2,000	2,240
HICKMAN MILLS CREEK TRIBUTARY 2						
Approximately 350 feet downstream of I-470 W	0.9	1,030	1,170	1,300	1,460	1,680
At I-470 East	0.7	820	920	1,000	1,110	1,240
HICKMAN MILLS CREEK TRIBUTARY 2						
Just upstream of approximately 175 ft upstream of I-470 W; At confluence with Hickman Mills Creek	1.3	1,320	1,520	1,720	1,990	2,420
At Hillcrest Road	1.2	1,250	1,440	1,620	1,860	2,240

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
HORSESHOE CREEK						
At confluence with Sni-A-Bar Creek	13.2	3,800	N/A	6,600	7,930	10,350
Approximately 500 feet upstream of East Gillespie Road	8.5	2,660	N/A	4,700	5,500	7,020
Approximately 0.7 miles upstream of East Gillespie Road	7.4	2,420	N/A	4,200	5,030	6,410
Approximately 1.4 miles upstream of East Gillespie Road	6.8	2,140	N/A	3,260	3,730	4,820
HORSESHOE CREEK TRIBUTARY						
At confluence with Horseshoe Creek	1.6	1,100	N/A	1,700	1,900	2,400
Approximately 0.4 miles upstream of confluence with Horseshoe Creek	1.0	900	N/A	1,400	1,600	1,900
Approximately 1,000 feet downstream of South Broadway Street	0.4	650	N/A	1,000	1,100	1,400
INDIAN CREEK						
At confluence with Blue River	74.9	19,520	24,100	28,380	32,900	43,900
At Lydia Avenue	74.8	19,520	24,100	28,380	32,900	43,890
Just downstream of confluence with Dykes Branch	74.7	19,560	24,110	28,380	32,910	43,870
Just upstream of confluence with Dykes Branch	67.0	18,390	22,700	26,810	31,110	41,640
At Holmes Road	66.8	18,400	22,700	26,810	31,090	41,620
Approximately 0.4 miles downstream of Wornall Road near 103rd Street	66.4	18.410	22,700	26,790	31,070	41,590

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
INDIAN CREEK (CONT'D)						
Approximately 1,200 feet downstream of Wornall Road	65.8	18,350	22,640	26,720	30,980	41,490
At Wornall Road	65.4	18,310	22,590	26,660	30,920	41,410
Near Indian Creek Road and 104th Street	65.0	18,280	22,550	26,620	30,870	41,350
Just downstream of State Line Road	64.6	18,250	22,510	26,570	30,810	41,280
Just upstream of State Line Road	64.2	18,210	22,460	26,520	30,750	41,210
JUMPING BRANCH						
Just upstream of the confluence with Line Creek	2.0	1,355	N/A	1,869	2,272	2,662
Approximately 0.4 miles upstream of Northwest Vivon Road	1.8	1,312	N/A	1,820	2,214	2,526
Just upstream of I-635	1.4	1,085	N/A	1,494	1,810	1,890
LINE CREEK						
At the confluence with Missouri River	21.1	13,089	N/A	18,780	23,029	30,142
Approximately 0.7 miles upstream of Interstate HWY 29	13.9	11,727	N/A	16,516	20,141	26,314
Just downstream of the confluence with East Fork Line Creek	12.1	9,905	N/A	13,983	16,898	22,250
Approximately 100 feet upstream of Northwest 64th Street	7.3	5,083	N/A	7,202	8,836	11,568
Approximately 0.7 miles upstream of Northwest 68th Street	3.5	3,404	N/A	4,729	5,719	7,384
Approximately 0.4 miles downstream of the confluence with Line Creek Tributary 1	2.7	3,123	N/A	4,316	5,257	6,772

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
LINE CREEK (CONT'D)						
Just downstream of the confluence with Line Creek Tributary 1	2.5	3,049	N/A	4,169	5,033	6,495
LINE CREEK TRIBUTARY 1						
At the confluence with Line Creek	1.6	2,079	N/A	2,862	3,451	4,435
Approximately 750 feet downstream of North Green Hills Road	1.0	1,486	N/A	1,980	2,353	2,950
Just upstream of Northwest Barry Road	0.6	1,053	N/A	1,413	1,680	2,111
LINE CREEK TRIBUTARY 2						
At the confluence with Line Creek	2.9	1,301	N/A	1,827	2,250	2,994
Approximately 190 feet upstream of Northwest Bryan Avenue	2.8	1,263	N/A	1,771	2,176	2,901
Approximately 0.4 miles downstream of Northwest South Shore Drive	2.1	671	N/A	977	1,230	1,670
LITTLE BLUE RIVER						
At confluence with Missouri River	224.0	10,390	N/A	15,390	17,660	24,180
Approximately 980 feet upstream of Blue Mills Road	210.0	11,190	N/A	16,760	19,250	25,440
At confluence of Burr Oak Creek	184.0	N/A	N/A	N/A	17,400	30,300
At confluence of East Fork Little Blue River	114.0	N/A	N/A	N/A	12,800	21,950
At confluence of Adair Creek	108.3	N/A	N/A	N/A	12,300	20,960
At confluence with May Brook	95.6	N/A	N/A	N/A	11,200	19,100

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
LITTLE BLUE RIVER (CONT'D)						
At confluence with Wildwood Creek	93.0	8,773	10,189	11,631	13,945	17,955
Approximately 4800 feet downstream of confluence of Little Cedar Creek	83.7	7,775	8,988	10,384	12,525	16,028
At confluence of Little Cedar Creek	83.4	7,619	8,958	10,357	12,253	15,601
At confluence of Cedar Creek	66.4	6,885	7,463	9,437	11,025	12,754
Just downstream of I-470	55.8	3,518	4,353	4,794	5,636	6,538
At confluence of Little Blue River Tributary 7	53.8	4,318	5,228	6,013	7,102	8,830
Approximately 1700 feet downstream of Longview Dam	50.4	1,678	1,938	2,229	2,624	3,414
Just downstream of Longview Dam	49.4	1,133	1,142	1,152	1,164	1,180
Just upstream of Longview Dam	47.9	15,932	18,199	20,965	24,456	31,218
Approximately 7500 feet downstream of Highgrove Road	35.8	12,792	14,581	16,891	20,165	25,876
At confluence with Lumpkins Fork	31.0	11,629	13,326	15,504	18,742	24,127
Approximately 4000 feet upstream of confluence with Lumpkins Fork	16.2	10,244	11,682	13,491	15,835	19,848
At Kelly Road	15.3	8,700	N/A	12,100	14,600	22,700
At East 139th Street	13.4	8,000	N/A	11,300	13,500	21,000
At confluenc of Oil Creek	4.1	2,600	N/A	3,800	4,600	7,100
LITTLE BLUE RIVER TRIBUTARY 1						
Approximately 645 feet upstream of confluence with Little Blue River	6.4	2,768	3,232	3,678	4,390	5,476
Approximately 1,212 feet upstream of Missouri Pacific RR	2.0	2,615	3,059	3,542	4,256	5,396

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
LITTLE BLUE RIVER TRIBUTARY 1 (CONT'D)						
Approximately 0.8 miles upstream of Missouri Pacific RR	1.0	990	1,170	1,356	1,628	2,065
LITTLE BLUE RIVER TRIBUTARY 4						
Approximately 1,245 feet upstream of Raytown Road	0.3	670	782	898	1,064	1,338
LITTLE BLUE RIVER TRIBUTARY 5						
At Raytown Road	1.0	1,003	1,121	1,264	1,478	1,908
Approximately 0.6 miles upstream of Raytown Road	0.5	923	1,060	1,242	1,454	1,749
LITTLE BLUE RIVER TRIBUTARY 7						
Approximately 0.4 miles upstream of confluence with Little Blue River	2.9	3,906	4,822	5,712	6,769	8,108
Approximately 915 feet upstream of I-470	2.7	3,785	4,681	5,541	6,586	7,889
At Lane Ave	2.4	3,569	4,625	5,511	6,379	7,870
Approximately 1,175 feet upstream of James A. Reed Road	1.3	2,348	2,725	3,129	3,679	4,552
At 99th Street	0.5	1,128	1,329	1,533	1,835	2,332
LITTLE BLUE RIVER TRIBUTARY 16						
Approximately 5,700 feet upstream of confluence with Little Blue River	2.0	2,326	2,691	3,068	3,425	4,309
Approximately 370 feet upstream of Railroad	1.6	1,989	2,338	2,701	3,152	3,923

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
LITTLE BLUE RIVER TRIBUTARY 16 (CONT'D)						
Approximately 1,500 feet upstream of Route V	1.2	1,677	2,003	2,317	2,707	3,378
LITTLE BLUE RIVER TRIBUTARY 17						
Approximately 3,500 feet downstream of Route V	1.4	2,267	2,639	2,977.0	3,490	4,291
At Route V	0.8	1,529	1,724	1,944	2,239	2,692
Approximately 380 feet downstream of Railroad	0.6	1,288	1,442	1,579	1,780	2,087
Approximately 1,100 feet upstream of Railroad	0.5	905	1,006	1,102	1,212	1,341
LITTLE CEDAR CREEK						
Approximately 2,623 feet upstream of 79th Street	5.6	4,669	5,575	6,454	7,742	9,695
At confluence of Little Cedar Creek Tributary 2	5.0	4,467	5,349	6,183	7,405	9,182
Approximately 1,200 feet downstream of railroad	3.0	2,837	3,270	3,688	4,236	5,167
Approximately 241 feet upstream of Colbern Road	1.9	1,982	2,258	2,537	2,930	3,588
Approximately 153 feet upstream of I-470	1.2	1,534	1,741	1,952	2,254	2,759
From approximately 153 feet upstream of I-470 to upstream limit	See Figure 1					

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
LITTLE CEDAR CREEK TRIBUTARY 2						
Approximately 1,200 feet upstream of confluence with Little Cedar Creek	1.9	2,718	3,070	3,442	3,968	4,799
Approximately 3,700 feet upstream of confluence of Little Cedar Creek	1.4	2,294	2,584	2,897	3,340	4,053
LITTLE CEDAR CREEK TRIBUTARY 2 (CONT'D)						
Approximately 0.9 miles upstream of Confluence with Little Cedar Creek	1.0	1,766	1,992	2,229	2,569	3,131
LITTLE SHOAL CREEK						
Just upstream of confluence with Shoal Creek	13.7	3,090	N/A	3,930	4,030	5,370
Just downstream of railroad	10.7	5,490	N/A	7,590	9,360	12,280
Approximately 700 feet upstream of Campbell Drive	7.7	4,967	N/A	7,033	8,692	11,853
Approximately 780 feet downstream of 76th Street	5.1	4,150	N/A	5,974	7,441	10,115
Approximately 0.6 miles downstream of State HWY 152	2.3	1,875	N/A	2,791	3,493	4,704
Approximately 380 feet upstream of Shoal Creek Valley Drive	1.8	1,760	N/A	2,554	3,167	4,220
Approximately 1.5 miles upstream of Shoal Creek Valley Drive	1.3	1,556	N/A	2,207	2,702	3,548
Approximately 2.3 miles upstream of Shoal Creek Valley Drive	1.0	1,271	N/A	1,795	2,194	2,872

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
LITTLE SHOAL CREEK TRIBUTARY 1						
Approximately 0.4 miles downstream of State HWY 152	1.9	2,595	N/A	3,630	4,441	5,809
Approximately 1,100 feet upstream of State HWY 152	1.6	2,212	N/A	3,176	3,940	5,205
LITTLE SHOAL CREEK TRIBUTARY 1 (CONT'D)						
Approximately 0.4 miles downstream of Flintlock Road	1.4	1,661	N/A	2,384	3,618	4,734
Approximately 0.7 miles upstream of NE 88th Street	0.4	857	N/A	1,150	1,369	1,733
LUMPKINS FORK						
Approximately 1,083 feet upstream of confluence with Little Blue River	12.6	4,654	5,503	6,484	7,807	10,248
Approximately 3,000 feet downstream of Raytown Road	12.2	4,153	4,849	5,629	6,953	8,931
At confluence of Lumpkins Fork Tributary 2	9.9	4,539	5,351	6,216	7,318	9,124
Approximately 2,000 feet downstream of 155th Street	6.6	4,179	5,014	5,909	7,020	8,672
At 155th Street	6.1	4,116	4,831	5,583	6,531	8,575
LUMPKINS FORK TRIBUTARY 2						
At confluence with Lumpkins Fork	1.6	1,380	1,591	1,925	2,291	2,522
Approximately 3,400 feet upstream of Peterson Road	1.0	1,115	1,308	1,474	1,687	2,073
Approximately 4,500 feet upstream of Peterson Road	0.3	460	547	640	770	975

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
MAY BROOK						
Approximately 1.3 miles upstream of confluence with Little Blue River	6.3	600	N/A	1,000	1,300	2,200
MIDDLE FORK MILL CREEK						
At confluence with Mill Creek	1.3	1,060	N/A	*	2,010	3,150
MILL CREEK						
At Union Pacific Railroad	9.1	4,800	N/A	8,000	9,400	13,000
MILL CREEK (CONT'D)						
At East Courtney Atherton Road	7.7	4,200	N/A	7,100	8,400	11,000
At State HWY 291	4.7	3,000	N/A	4,800	5,700	7,800
MILL CREEK (CLAY COUNTY)						
Just upstream of Brighton Avenue	5.4	5,586	N/A	7,637	9,400	12,406
Approximately 240 feet upstream of Indiana Avenue	2.2	2,381	N/A	3,293	3,962	5,075
300 feet downstream of Northeast 56th Street	1.6	2,119	N/A	2,909	3,484	4,418
250 feet upstream of North Garfield Avenue	1.1	1,847	N/A	2,548	3,064	3,933
500 feet upstream of North Highland Avenue	0.9	1,497	N/A	2,068	2,492	3,229
At approximately 0.6 miles upstream of North Highland Avenue	0.6	1,051	N/A	1,468	1,783	2,314
MILL CREEK TRIBUTARY 1						
Approximately 0.31 miles upstream of the confluence with Mill Creek	0.2	387	N/A	544	664	867

*Data not available.

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
MISSOURI RIVER						
At the confluence with Brush and Line Creek	423,553	192,000	N/A	257,000	289,000	358,000
At the confluence with Platte River	423,409	191,000	N/A	238,000	287,000	356,000
At the confluence with Bee Creek	420,906	178,000	N/A	238,000	266,000	330,000
At the confluence with Sugar Creek	420,675	177,000	N/A	236,000	264,000	328,000
MOUSE CREEK	See Figure 1					
NORTH FORK CRACKERNECK CREEK						
At confluence with Crackerneck Creek	1.4	1,520	N/A	2,270	2,670	4,360
Approximately 1,000 feet upstream of Jackson Drive	0.7	930	N/A	1,450	1,720	2,730
NORTH FORK SPRING BRANCH						
At confluence with Spring Branch	5.1	3,000	N/A	*	6,000	8,600
NORTH FORK SUGAR CREEK						
OIL CREEK						
At confluence with Little Blue River	6.6	3,900	N/A	5,400	6,500	9,700
At State HWY 150	6.1	3,200	N/A	4,600	5,600	8,300
OLD MAIDS CREEK						
Just upstream of the confluence with Line Creek	1.7	1,967	N/A	2,705	3,285	4,243
Approximately 1,800 feet upstream of Northwest 60th Street	1.4	1,785	N/A	2,439	2,945	3,773

*Data not available.

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
RANDOLPH CREEK						
Approximately 480 feet upstream of lower most I-435 crossing	1.7	3,247	N/A	4,335	5,143	6,520
Approximately 350 feet downstream of upper most I-435 crossing	1.0	1,703	N/A	2,374	2,871	3,712
Approximately 750 feet upstream of upper most I-435 crossing	0.8	1,427	N/A	1,993	2,418	3,132
Approximately 1,250 feet downstream of Parvin Road	0.6	1,047	N/A	1,493	1,826	2,387
Approximately 600 feet downstream of Parvin Road	0.5	912	N/A	1,295	1,585	2,089
Approximately 1,000 feet upstream of Parvin Road	0.4	606	N/A	871	1,074	1,420
Approximately 0.5 miles upstream of Parvin Road	0.2	485	N/A	686	841	1,105
Approximately 0.6 miles upstream of Parvin Road	0.2	397	N/A	564	692	910
Approximately 0.8 miles upstream of Parvin Road	0.2	331	N/A	466	569	744
ROCK CREEK						
At Union Pacific Railroad	9.3	6,870	N/A	10,740	12,590	19,520
At East Truman Drive / State HWY 12	7.4	6,090	N/A	9,540	11,220	17,860
At South Northern Boulevard	5.1	4,860	N/A	8,040	9,680	16,400
Approximately 200 feet upstream of Sterling Ave	2.6	2,240	N/A	3,690	4,400	7,650

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
ROCK CREEK (CLAY COUNTY)						
Approximately 400 feet upstream of Rock Creek Parkway North	5.8	5,409	N/A	7,621	9,202	11,843
Approximately 280 feet upstream of Parvin Road	2.7	2,857	N/A	3,969	4,811	6,233
Approximately 700 feet downstream of NE Davidson Road	2.0	2,148	N/A	2,940	3,547	4,577
Approximately 560 feet upstream of NE Davidson Road	1.9	1,948	N/A	2,680	3,239	4,188
Approximately 170 feet upstream of Vivion Road	1.6	1,396	N/A	1,925	2,332	3,024
ROCK CREEK GLADSTONE						
Approximately150 feet downstream of 64th Street	2.6	3,419	N/A	4,800	5,867	7,661
Approximately 800 feet upstream of 64th Street	2.0	3,115	N/A	4,374	5,311	6,854
Approximately 0.5 miles upstream of Prospect Avenue	1.5	2,491	N/A	3,454	4,174	5,371
Approximately 0.3 miles downstream of North Woodland Avenue	1.2	2,136	N/A	2,969	3,585	4,604
Approximately 200 feet upstream of 72nd Street	0.9	1,719	N/A	2,347	2,809	3,588
ROCK CREEK TRIBUTARY 11						
Approximately 500 feet downstream of the intersection of Holmes Street and 32nd Street	1.2	1,300	N/A	1,797	2,183	2,835

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
ROCK CREEK TRIBUTARY 11 (CONT'D)						
Just upstream of the intersection of Holmes Street and 32nd Street	1.1	1,253	N/A	1,722	2,085	2,694
ROCK CREEK TRIBUTARY 11.2						
Approximately 1,200 feet upstream of confluence with Rock Creek	2.5	2,268	N/A	3,171	3,809	4,870
Approximately 1,000 feet downstream of I-35	2.2	2,003	N/A	2,799	3,383	4,326
Approximately 0.5 miles upstream of I-35	0.7	672	N/A	956	1,175	1,517
Approximately 1.4 miles upstream of I-35	0.4	455	N/A	627	757	976
Approximately 1.9 miles upstream of I-35	0.3	405	N/A	551	660	844
ROCKY BRANCH						
Approximately 580 feet upstream of the confluence with Wilkerson Creek	7.5	2,366	N/A	3,443	4,396	6,075
Approximately 160 feet downstream of I-435	1.7	2,367	N/A	3,127	3,529	4,157
Approximately 1,500 feet upstream of I-435	0.4	768	N/A	1,056	1,284	1,660
Approximately 360 feet upstream of 115th Terrace	0.2	503	N/A	670	794	1,000
ROCKY BRANCH TRIBUTARY 1						
Approximately 280 feet downstream of 114th Terrace	0.5	1,108	N/A	1,464	1,663	2,003

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
ROCKY BRANCH TRIBUTARY 1 (CONT'D)						
Just upstream of 114th Terrace	0.4	728	N/A	944	1,078	1,322
ROUND GROVE CREEK						
Approximately 626 feet upstream of Eastern Avenue	8.5	5,078	6,030	6,977	7,676	8,265
Approximately 996 feet downstream of Raytown Road	7.2	5,054	5,963	6,932	8,018	8,657
Approximately 1,073 feet downstream of Raytown Road	6.6	5,006	5,840	6,795	7,791	8,337
Approximately 532 feet upstream of Raytown Road	5.6	4,564	5,234	5,773	6,529	6,961
Approximately 258 feet downstream of the confluence with Round Grove Creek Tributary 3	5.5	4,571	5,103	5,609	6,359	6,554
Approximately 300 feet upstream of the confluence with Round Grove Creek Tributary 2	3.8	3,251	3,663	4,090	4,675	5,618
Just downstream of the confluence with Round Grove Creek Tributary 1	3.1	2,644	2,983	3,342	3,844	4,610
Approximately 1,196 feet upstream of the confluence with Round Grove Creek Tributary 1	1.5	1,560	1,803	2,058	2,424	3,034
Just downstream of Raytown Road	1.1	1,099	1,271	1,451	1,712	2,145
ROUND GROVE CREEK TRIBUTARY 1						
Approximately 1,080 feet downstream of Pittman Road	1.4	1,127	1,227	1,335	1,523	1,781

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
ROUND GROVE CREEK TRIBUTARY 1 (CONT'D)						
Just upstream of 47th Street	0.2	270	315	363	434	550
Approximately 1,400 feet upstream of Pittman Road	1.2	1,051	1,182	1,335	1,523	1,781
Approximately 2,000 feet upstream of Pittman Road	0.9	1,001	1,123	1,250	1,415	1,656
Approximately 780 feet downstream of Sterling Avenue	0.5	486	542	587	627	660
Approximately 200 feet downstream of 50th Street	0.4	427	464	503	532	563
Approximately 230 feet downstream of Vermont Avenue	0.4	382	429	461	503	550
ROUND GROVE CREEK TRIBUTARY 2						
Approximately 650 feet upstream of confluence with Round Grove Creek	0.4	416	453	485	531	593
Approximately 400 feet upstream of Sni-A-Bar Road	0.3	330	388	448	503	537
ROUND GROVE CREEK TRIBUTARY 3						
Just upstream of railroad	1.8	1,429	1,624	1,845	2,156	2,668
Just downstream of Blue Ridge Cutoff	1.8	1,431	1,624	1,845	2,181	2,668
Approximately 3,100 feet downstream of 43rd Street	1.5	1,239	1,408	1,618	1,906	2,414
Approximately 700 feet downstream 43rd Street	0.8	1,090	1,219	1,328	1,450	1,711

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
ROUND GROVE CREEK TRIBUTARY 3 (CONT'D)						
Just upstream of Pittman Road	0.7	1,090	1,219	1,328	1,448	1,626
Approximately 350 feet upstream of Pittman Road	0.4	741	834	913	1,007	1,139
At I-70	0.1	310	355	401	470	580
SB1 TRIBUTARY SNI-A -BAR CREEK						
Approximately 500 feet downstream of South Stillhouse Road	1.9	1,100	N/A	1,700	2,000	2,500
Approximately 650 feet upstream of South Hillside School Road	0.9	600	N/A	950	1,100	1,400
SB2 TRIBUTARY SNI-A -BAR CREEK						
Approximately 1,500 feet downstream of South Stillhouse Road	1.5	700	N/A	1,100	1,200	1,600
At South Hillside School	1.0	650	N/A	1,000	1,200	1,500
SB3 TRIBUTARY SNI-A- BAR CREEK						
At South Stillhouse Road	11.4	2,500	N/A	3,800	4,300	5,400
At State HWY F / South Broadway Street	8.9	2,400	N/A	3,600	4,100	5,200
Approximately 0.4 miles upstream of East J.W. Cummins Road	0.7	350	N/A	550	600	750

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
SB4 TRIBUTARY SNI-A- BAR CREEK						
At confluence with Sni-A-Bar Creek	9.9	2,600	N/A	3,900	4,500	5,800
Approximately 0.5 miles downstream of South Hunt Road	7.4	2,200	N/A	3,300	3,800	4,900
At State HWY F / South Broadway Street	5.5	1,900	N/A	2,900	3,300	4,300
SEARCY BRANCH						
Approximately 850 feet upstream of Northeast Parvin Road	1.2	940	N/A	1,421	1,746	2,373
Approximately 950 feet downstream of Northeast 44th Terrace	0.5	617	N/A	956	1,139	1,421
Approximately 715 feet upstream of Drury Avenue	0.2	290	N/A	373	422	495
SEARCY BRANCH TRIBUTARY 1						
Approximately 1.1 miles upstream of the confluence with Searcy Branch	0.0	40	N/A	54	64	82
Approximately 0.73 miles upstream of the confluence with Searcy Branch	0.1	258	N/A	421	596	844
SECOND CREEK						
Just upstream of the confluence with Little Platte River (Clay County)	30.9	5,088	N/A	7,256	8,671	12,069
Just downstream of the confluence with First Creek (Clay County)	30.1	5,131	N/A	7,255	8,644	12,085

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
SECOND CREEK (CONT'D)						
At Cookingham Drive/ HWY 291	12.0	3,961	N/A	5,434	6,772	9,012
At Northwest 108th Drive	4.2	1,817	N/A	2,573	3,353	4,170
SECOND CREEK WEST BRANCH						
At the confluence with Second Creek	3.4	1,000	N/A	2,800	3,800	6,800
SEMINARY CREEK						
At confluence with Sni-A-Bar Creek	3.6	1,100	N/A	2,100	2,550	4,010
Approximately 0.6 miles upstream of State HWY FF / State HWY H / East Truman Road	2.2	580	N/A	1,100	1,370	2,150
SHOAL CREEK						
Just upstream of confluence with Missouri River	72.8	7,120	N/A	8,580	10,400[1] 10,670 7,970	14,090[1] 14,790 10,590
Approximately 500 feet upstream of Highway 291	63.9	7,220	N/A	8,730	11,130[1] 10,920 8,210	16,640[1] 16,230 10,790
Approximately 1850 feet upstream of Highway 291	63.8	6,650	N/A	6,790	7,180[1] 7,180 8,530	7,490[1] 7,490 11,140
Approximately 2100 feet downstream of railroad	63.6	9,250	N/A	9,910	11,200[1] 11,200 11,500	12,960[1] 12,960 16,250
Approximately 5300 feet upstream of railroad	56.7	10,640	N/A	13,110	18,280[1] 18,280 12,850	26,790[1] 26,800 18,710

[1]Represents peak discharge noted as Left Overbank/Riverward/Right Overbank independent levee analyses.

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
SHOAL CREEK (CONT'D)						
Approximately 2300 feet downstream of Birmingham Rd	56.2	11,330	N/A	14,560	20,720[1] 20,720 20,100	29,580[1] 29,580 30,590
Approximately 850 feet upstream of Birmingham Rd	56.1	11,550	N/A	12,720	14,870[1] 14,870 16,270	17,340[1] 17,340 19,800
Just downstream of confluence with Little Shoal	55.8	12,650	N/A	14,840	21,280[1] 21,280 20,880	30,790[1] 30,790 31,800
Just downstream of Liberty Boulevard	29.6	9,090	N/A	13,080	16,180[1] 16,180 16,180	21,410[1] 21,410 21,410
Just downstream of confluence of East Fork Shoal Creek	25.4	14,644	N/A	20,740	25,505	33,799
Approximately 1,000 feet upstream of North Agnes Avenue	8.7	7,836	N/A	10,995	13,469	17,604
Approximately 0.7 miles downstream of NE Barry Road	7.5	7,232	N/A	9,999	12,157	15,949
Approximately 0.7 miles downstream of North Oak Trafficway	3.4	5,090	N/A	6,918	8,299	10,657
Approximately 1,015 feet downstream of North Oak Trafficway	1.7	2,384	N/A	3,272	3,944	5,084
Just upstream of North Oak Trafficway	1.5	2,093	N/A	2,874	3,464	4,447
Just upstream of State HWY 152	1.2	1,733	N/A	2,388	2,882	3,709

[1]Represents peak discharge noted as Left Overbank/Riverward/Right Overbank independent levee analyses.

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
SHOAL CREEK (CONT'D)						
Approximately 1,400 feet upstream of State HWY 152	0.9	1,302	N/A	1,803	2,185	2,819
SHOAL CREEK TRIBUTARY 6						
Approximately 0.4 miles upstream of confluence with Shoal Creek	1.6	1,630	N/A	2,298	2,816	3,725
Approximately 2.1 miles upstream of confluence with Shoal Creek	0.7	948	N/A	1,245	1,467	1,868
Approximately 2.7 miles upstream of confluence with Shoal Creek	0.5	817	N/A	1,050	1,221	1,504
SHOAL CREEK TRIBUTARY 8						
Approximately 1,400 feet downstream of 96th Street	1.3	2,575	N/A	3,451	4,087	5,111
Just upstream of 96th Street	1.1	2,148	N/A	2,887	3,428	4,287
Approximately 700 feet upstream of 96th Street	0.9	1,864	N/A	2,480	2,928	3,668
SHOAL CREEK TRIBUTARY 9						
Approximately 0.4 miles upstream of State HWY 152 off ramp	1.5	2,098	N/A	2,856	3,428	4,410
Approximately 1 mile upstream of State HWY 152 off ramp	0.9	1,462	N/A	1,991	2,391	3,094
SHOAL CREEK TRIBUTARY 20						
Approximately 390 feet downstream of Pleasant Valley Road	1.1	1,650	N/A	2,260	2,710	3,455
Approximately 600 feet upstream of Boucher Circle	1.0	1,435	N/A	1,980	2,375	3,040

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
SHOAL CREEK TRIBUTARY 20.1						
Approximately 0.3 miles upstream of Kaill Road	0.5	780	N/A	1,050	1,250	1,570
SNI-A-BAR CREEK						
Approximately 0.6 miles downstream of confluence of Seminary Creek	139.0	9,880	N/A	16,200	19,680	28,000
Approximately 1,000 feet downstream of confluence of Swiney Branch	106.0	8,680	N/A	14,400	17,420	24,900
At confluence of Blue Branch	84.6	7,610	N/A	12,900	15,340	22,000
At confluence of West Fork Sni-A-Bar Creek	45.7	5,760	N/A	9,700	11,800	17,000
At confluence of Tributary No. S-5	22.3	3,810	N/A	6,600	7,960	11,600
SOUTH FORK SPRING BRANCH						
At confluence with Spring Branch	1.2	1,470	N/A	2,230	2,940	4,350
SPRING BRANCH						
At confluence with Little Blue River	9.6	7,350	N/A	11,210	12,980	18,660
Just upstream of confluence of North Fork Spring Branch	5.8	5,800	N/A	8,350	9,430	12,260
Approximately 450 feet downstream of Berry Road	3.3	4,200	N/A	5,780	6,390	7,930
At Union Pacific Railroad	1.4	1,720	N/A	2,430	2,750	4,600
SUGAR CREEK						
At confluence with Missouri River	3.6	2,983	N/A	4,350	5,000	9,600
Approximately 0.8 miles upstream of confluence with Missouri River	1.6	1,600	N/A	2,150	2,430	6,200

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
SUGAR CREEK (CONT'D)						
At Union Pacific Railroad / US-24	1.6	2,100	N/A	4,100	4,700	6,200
At East Independence Avenue	1.5	1,940	N/A	2,900	3,390	5,190
At East Truman Road	0.9	1,900	N/A	2,900	3,400	4,500
Just downstream of confluence of North Fork Sugar Creek	0.6	860	N/A	1,270	1,480	2,240
At confluence of North Fork Sugar Creek	0.5	510	N/A	*	1,000	1,350
SWINEY BRANCH						
At confluence with Sni-A-Bar Creek	3.6	1,270	N/A	2,050	2,430	3,410
Approximately 800 feet upstream of State HWY BB / South Buckner Tarsney Road	1.6	570	N/A	910	1,070	1,500
SWINEY BRANCH TRIBUTARY						
At confluence with Swiney Branch	1.4	570	N/A	1,070	1,330	2,090
Approximately 0.4 miles upstream of South Rust Road	1.0	520	N/A	940	1,200	1,710
TODD CREEK						
Approximately 200 feet south the extension of Todd Creek Road	15.5	9,469	N/A	12,848	15,396	19,621
At the confluence with Wildcat Branch	14.1	9,081	N/A	12,252	14,685	18,705
Just upstream of North Winan Avenue	7.7	5,282	N/A	6,983	8,271	10,393
Just downstream of Bern Street	3.3	3,140	N/A	4,041	4,697	5,784
TOWN FORK CREEK						
At the confluence with Brush Creek	5.3	4,842	5,536	5,980	6,434	7,340

*Data not available.

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
TOWN FORK CREEK (CONT'D)						
Approximately 320 feet upstream of Indiana Avenue	4.9	4,471	5,199	5,450	5,985	7,450
Approximately 398 feet downstream of 55th Street	4.8	4,464	5,227	5,469	5,945	7,422
Approximately 341 feet upstream of 55th Street	4.7	4,268	4,892	5,081	5,574	7,281
Approximately 369 feet downstream of 57th Street	4.7	4,226	4,832	5,011	5,498	7,253
Approximately 405 feet upstream of 57th Street	4.6	4,252	5,139	5,332	5,680	7,222
Approximately 345 feet downstream of 59th Street	4.1	3,494	3,870	4,120	4,936	6,532
Approximately 168 feet downstream of I-71	3.8	3,361	3,470	3,952	4,717	6,266
Approximately 547 feet downstream of Park Avenue	3.5	2,861	3,240	3,663	4,326	5,820
Approximately 211 feet upstream of Park Avenue	3.4	2,840	3,224	3,645	4,289	5,775
Just downstream of Citadel Drive	3.3	2,795	3,178	3,592	4,208	5,688
TRIBUTARY A1 TO EAST FORK LITTLE BLUE RIVER						
At confluence with Little Blue River	1.8	1,500	N/A	2,200	2,500	3,000
At confluence of Tributary A2 to East Fork Little Blue River	0.8	700	N/A	1,000	1,200	1,400
At East Langsford Road	0.6	600	N/A	850	1,000	1,200

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
TRIBUTARY A2 TO EAST FORK LITTLE BLUE RIVER						
At confluence with Tributary A1 to East Fork Little Blue River	0.8	700	N/A	1,100	1,200	1,500
At East Langsford Road	0.7	650	N/A	950	1,100	1,300
TRIBUTARY B1 TO BIG CREEK						
At confluence with Big Creek	0.5	370	N/A	650	820	1,400
TRIBUTARY B2 TO BIG CREEK						
At confluence with Big Creek	2.6	1,150	N/A	2,050	2,650	4,300
Approximately 0.4 miles upstream of Hamblen Road	1.9	900	N/A	1,700	2,200	3,500
At confluence of Tributary to Tributary B2 to Big Creek	0.9	520	N/A	920	1,300	2,050
TRIBUTARY B3 TO BIG CREEK	See Figure 1					
TRIBUTARY C1 TO CEDAR CREEK						
At confluence with Cedar Creek	0.8	800	N/A	1,300	1,500	1,900
Approximately 1,000 feet downstream of Southwest 3rd Street	0.5	500	N/A	800	950	1,200
TRIBUTARY C2 TO CEDAR CREEK						
At confluence with Cedar Creek	1.6	1,500	N/A	2,200	2,600	3,100
At Southwest 3rd Street	1.3	1,500	N/A	2,100	2,500	3,000

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
TRIBUTARY C2 TO CEDAR CREEK (CONT'D)						
Approximately 200 feet downstream of U.S. HWY 50 / Southwest Oldham Parkway	0.7	850	N/A	1,200	1,400	1,700
TRIBUTARY C3 TO CEDAR CREEK						
At confluence with Cedar Creek	0.6	550	N/A	800	900	1,200
Approximately 600 feet downstream of Southwest Ward Road	0.5	450	N/A	700	800	1,000
At Union Pacific Railroad	0.3	300	N/A	500	550	700
TRIBUTARY C4 TO CEDAR CREEK						
At confluence with Cedar Creek	0.3	450	N/A	650	700	900
TRIBUTARY C5 TO CEDAR CREEK						
At confluence with Cedar Creek	0.8	700	N/A	1,100	1,200	1,500
Approximately 1,200 feet upstream of Southwest 3rd Street	0.6	450	N/A	700	800	1,000
TRIBUTARY C6 TO CEDAR CREEK						
At confluence with Cedar Creek	0.6	450	N/A	700	800	1,000
At Southwest Pacific Drive	0.5	400	N/A	600	700	850
TRIBUTARY G1 TO LAKE WINNEBAGO						
At County Line Road	0.9	550	N/A	1,000	1,350	2,150
Approximately 0.5 miles downstream of State HWY 291	0.3	270	N/A	480	600	1,000

TABLE 3 – SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
TRIBUTARY G2 TO RAINTREE LAKE						
At confluence with Raintree Lake	0.8	510	N/A	900	1,250	2,000
TRIBUTARY J1	See Figure 1					
TRIBUTARY L1 TO LAKEWOOD LAKES						
At confluence with Lakewood Lakes	0.6	500	N/A	750	850	1,100
Approximately 500 feet upstream of Gregory Boulevard	0.3	250	N/A	350	400	500
TRIBUTARY L2 TO LAKEWOOD LAKES						
At Beachwood Road	1.2	850	N/A	1,290	1,570	2,110
TRIBUTARY M1	See Figure 1					
TRIBUTARY M2	See Figure 1					
TRIBUTARY M3	See Figure 1					
TRIBUTARY M4	See Figure 1					
TRIBUTARY M5	See Figure 1					
TRIBUTARY M6	See Figure 1					
TRIBUTARY NO C1						
At confluence with Tributary No. C-2	2.1	690	N/A	1,280	1,550	2,160
Approximately 1.3 miles upstream of State HWY 150	1.3	430	N/A	800	990	1,370
TRIBUTARY NO C2						
At confluence with West Branch Crawford Creek	3.4	1,070	N/A	2,000	2,420	3,420
Just upstream of confluence of Tributary No. C-1	1.3	380	N/A	700	860	1,250

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
TRIBUTARY NO C2 (CONT'D)						
Approximately 200 feet downstream of State HWY 150	0.3	100	N/A	190	230	360
TRIBUTARY NO S1						
Approximately 0.7 miles downstream of County HWY H	0.7	340	N/A	600	720	1,110
Approximately 1,750 feet downstream of County HWY H	0.4	210	N/A	370	460	700
At Northeast Jim Owens Road	0.2	100	N/A	185	230	350
TRIBUTARY NO S2	*	*	*	*	*	*
TRIBUTARY NO S3						
At confluence with Sni-A-Bar Creek	3.4	970	N/A	1,790	2,160	3,010
Approximately 0.5 miles upstream of confluence with Sni-A-Bar Creek	2.3	650	N/A	1,180	1,460	2,050
Approximately 400 feet downstream of Northeast Jim Owens Road	2.1	640	N/A	1,130	1,410	1,980
Approximately 1,200 feet upstream of Jim Owens Road	1.7	520	N/A	920	1,140	1,610
Approximately 0.4 miles upstream of South Outer Belt Road	0.9	300	N/A	550	680	960
Approximately 0.9 miles upstream of South Outer Belt Road	0.4	130	N/A	240	300	420
TRIBUTARY NO S3A						
At confluence with Tributary No. S-3	0.8	307	N/A	560	673	940

*Data not available.

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
TRIBUTARY NO S3A (CONT'D)						
Approximately 700 feet upstream of confluence with Tributary No. S-3	0.6	249	N/A	445	537	752
TRIBUTARY NO S4						
At confluence with Sni-A-Bar Creek	4.8	1,730	N/A	3,000	3,560	4,840
Approximately 1,975 feet upstream of confluence with Sni-A-Bar Creek	4.8	1,500	N/A	2,600	3,140	4,300
Approximately 0.7 miles upstream of confluence with Sni-A-Bar Creek	3.1	1,120	N/A	2,000	2,380	3,320
At Seymour Road	2.6	980	N/A	1,720	2,085	2,910
Approximately 500 feet upstream of State HWY BB / South Buckner Tarsney Road	2.1	865	N/A	1,520	1,860	2,580
TRIBUTARY NO S5						
At confluence with Sni-A-Bar Creek	5.6	1,925	N/A	3,200	3,980	5,440
At South Gibson Road	4.7	1,680	N/A	2,800	3,460	4,750
Approximately 600 feet upstream of East Hammond Road	2.2	780	N/A	1,410	1,740	2,420
Approximately 600 feet upstream of South Brown Road	1.2	480	N/A	860	1,070	1,520
Approximately 1.7 miles upstream of South Brown Road	0.9	330	N/A	620	750	1,070
TRIBUTARY P1 TO PRAIRIE LEE LAKE						
At confluence with Prairie Lee Lake	1.4	1,300	N/A	1,900	2,100	2,600
Approximately 0.4 miles upstream of confluence with Prairie Lee Lake	1.2	1,200	N/A	1,800	2,000	2,500

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
TRIBUTARY P1 TO PRAIRIE LEE LAKE (CONT'D)						
Approximately 750 feet downstream of State HWY 291	0.6	700	N/A	1,000	1,100	1,400
TRIBUTARY P2 TO PRAIRIE LEE LAKE						
At confluence with Prairie Lee Lake	2.9	2,400	N/A	3,400	3,900	1,800
Approximately 0.5 miles upstream of confluence with Prairie Lee Lake	2.7	2,200	N/A	3,200	3,700	4,400
At confluence of Tributary P3 to Prairie Lee Lake	1.9	1,900	N/A	2,800	3,200	3,800
Approximately 1,900 feet downstream of confluence of Tributary P4 to Prairie Lee Lake	1.7	1,800	N/A	2,600	3,000	3,600
At confluence of Tributary P4 to Prairie Lee Lake	0.7	1,000	N/A	1,400	1,600	1,900
TRIBUTARY P3 TO PRAIRIE LEE LAKE						
At confluence with Tributary P2 to Prairie Lee Lake	0.6	650	N/A	950	1,100	1,300
At State HWY 291	0.4	450	N/A	650	750	900
TRIBUTARY P4 TO PRAIRIE LEE LAKE						
At confluence with Triburary P2 to Prairie Lee Lake	0.8	1,100	N/A	1,500	1,700	2,100

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
TRIBUTARY P5 TO PRAIRIE LEE LAKE						
Approximately 1,960 feet downstream of Northeast Scruggs Road	2.9	1,182	N/A	2,040	2,437	3,980
Approximately 900 feet upstream of Northeast Blackwell Road	1.8	850	N/A	1,600	2,100	3,400
Approximately 0.9 miles upstream of Northeast Blackwell road	1.4	750	N/A	1,400	1,800	2,800
Approximately 1.3 miles upstream of Northeast Blackwell road	0.8	500	N/A	880	1,200	1,900
TRIBUTARY TO TODD CREEK						
Just downstream of Northwest 112th Street	0.4	762	N/A	969	1,121	1,373
Just upstream of Airport Service road	1.1	1,474	N/A	1,915	2,242	2,779
TRIBUTARY TO TRIBUTARY B2 TO BIG CREEK						
At confluence with Tributary B2 to Big Creek	0.3	150	N/A	200	250	300
TRIBUTARY TO WEST FORK SNI-A-BAR CREEK						
At South Buckner Tarsney Road/County HWY 20	1.5	800	N/A	1,200	1,400	1,800
Approximately 1,000 feet upstream of East Major Road	1.1	650	N/A	950	1,100	1,400
Approximately4,500 feet upstream of East Major Road	0.9	550	N/A	850	1,000	1,300

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
TUCKER BRANCH						
At confluence with Sni-A-Bar Creek	5.3	1,950	N/A	3,600	4,500	6,910
At South Gardner Road	2.2	950	N/A	1,790	2,180	3,270
Approximately 1,500 feet downstream of South Fields Road	1.9	900	N/A	1,650	2,020	3,030
Approximately 200 feet upstream of South Fields Road	1.8	850	N/A	1,550	1,900	2,850
TUCKER BRANCH TRIBUTARY						
At confluence with Tucker Branch	2.0	880	N/A	1,700	2,210	3,410
Approximately 500 feet downstream of East Truman Road / State HWY FF	1.6	790	N/A	1,410	1,780	2,720
Approximately 0.4 miles upstream of East Truman Road / State HWY FF	1.1	590	N/A	1,050	1,280	1,960
WALNUT CREEK						
Just upstream of the confluence with Rush Creek	4.6	3,484	N/A	4,969	6,107	8,092
Just upstream of Cross Road	3.0	3,077	N/A	4,291	5,204	6,733
Just downstream of Northwest 73rd Terrace	0.7	1,026	N/A	1,412	1,705	2,195
WEST BRANCH CRAWFORD CREEK						
At Stringtown Road	7.8	2,270	N/A	4,200	5,110	7,150
Just upstream of confluence of Tributary No. C-2	4.1	1,170	N/A	2,180	2,640	3,690

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
WEST BRANCH CRAWFORD CREEK (CONT'D)						
Approximately 200 feet downstream of State HWY 150	3.4	950	N/A	1,780	2,160	3,030
WEST FIRE PRAIRIE CREEK						
At State HWY FF / East Truman Road	2.9	1,460	N/A	2,650	3,300	5,040
Approximately 600 feet upstream of East Flynn Road	1.8	510	N/A	880	1,070	1,620
Approximately 0.4 miles upstream of East Argo Road	0.7	290	N/A	520	650	1,000
WEST FORK SNI-A-BAR CREEK						
Approximately 0.4 miles downstream of East Litchford Road	28.2	5,360	N/A	7,990	9,370	12,370
Approximately 0.6 miles downstream of Lake Latawana Road	13.5	2,640	N/A	3,700	4,220	5,040
WHITE OAK CREEK						
Approximately 0.9 miles upstream of confluence with Little Blue River	5.9	5,995	7,072	7,968	8,917	10,896
Approximately 300 feet downstream of Military Club Road	5.6	5,789	6,849	7,766	8,729	10,741
Approximately 1.3 miles upstream of Military Club Road	2.5	3,899	4,315	4,437	4,795	6,141
WHITE OAK CREEK TRIBUTARY 1						
Approximately 1,535 feet upstream of confluence with White Oak Creek	2.0	1,989	2,343	2,712	3,232	4,216

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
WHITE OAK CREEK TRIBUTARY 1 (CONT'D)						
Approximately 145 Feet downstream of Raytown Road	1.5	1,710	1,984	2,269	2,672	3,334
Just downstream of Westridge Road	1.1	1,131	1,296	1,446	1,667	2,060
Approximately 449 feet upstream of Elm Ave	0.7	618	688	758	874	1,131
WILDCAT BRANCH						
Approximately 700 feet upstream of 128th Street	3.2	3,063	N/A	4,120	4,902	6,181
Just upstream of Cookingham Drive	0.7	1,511	N/A	1,982	2,330	2,926
WILDWOOD CREEK						
Approximately 0.6 miles upstream of confluence with Little Blue River	6.5	5,852	7,033	8,358	10,297	13,430
At confluence of Wildwood Creek Tributary 1	5.9	6,498	7,913	9,308	11,380	14,627
Approximately 2,200 feet upstream of confluence of Wildwood Creek Tributary 1	2.2	3,034	3,624	4,192	5,041	6,447
Approximately 2,400 feet upstream of confluence of Wildwood Creek Tributary 1	2.1	2,926	3,469	4,020	4,838	6,229
Approximately 2,600 feet downstream of Woodson Road	1.2	1,751	2,015	2,314	2,736	3,474
Approximately 1,000 feet downstream of Woodson Road	1.1	1,435	1,654	1,882	2,220	2,818
Just downstream of Woodson Road	0.03	83	94	104	119	143

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
WILDWOOD CREEK TRIBUTARY 1						
Approximately 675 feet upstream of Woodson Road	2.0	4,535	5,189	5,901	6,908	8,694
Approximately 1.1 miles upstream of confluence with Wildcat Creek	2.7	5,189	5,963	6,841	8,169	10,427
WILKERSON CREEK						
Approximately 0.8 miles upstream of State HWY 92	17.3	7,342	N/A	10,180	12,527	16,634
Approximately 1.1 miles upstream of 132nd Street	3.6	4,967	N/A	6,768	8,135	10,426
Approximately 1.7 miles upstream of 132nd Street	2.5	3,513	N/A	4,852	5,881	7,537
Approximately 2.2 miles upstream of 132nd Street	1.1	1,856	N/A	2,544	3,063	3,943
YENNIE AVENUE DRAIN						
At confluence with Sni-A-Bar Creek	0.9	600	N/A	870	980	1,350
At South Main Street	0.5	400	N/A	600	680	920
Approximately 1,510 feet upstream of Yennie Avenue	0.2	230	N/A	330	370	490

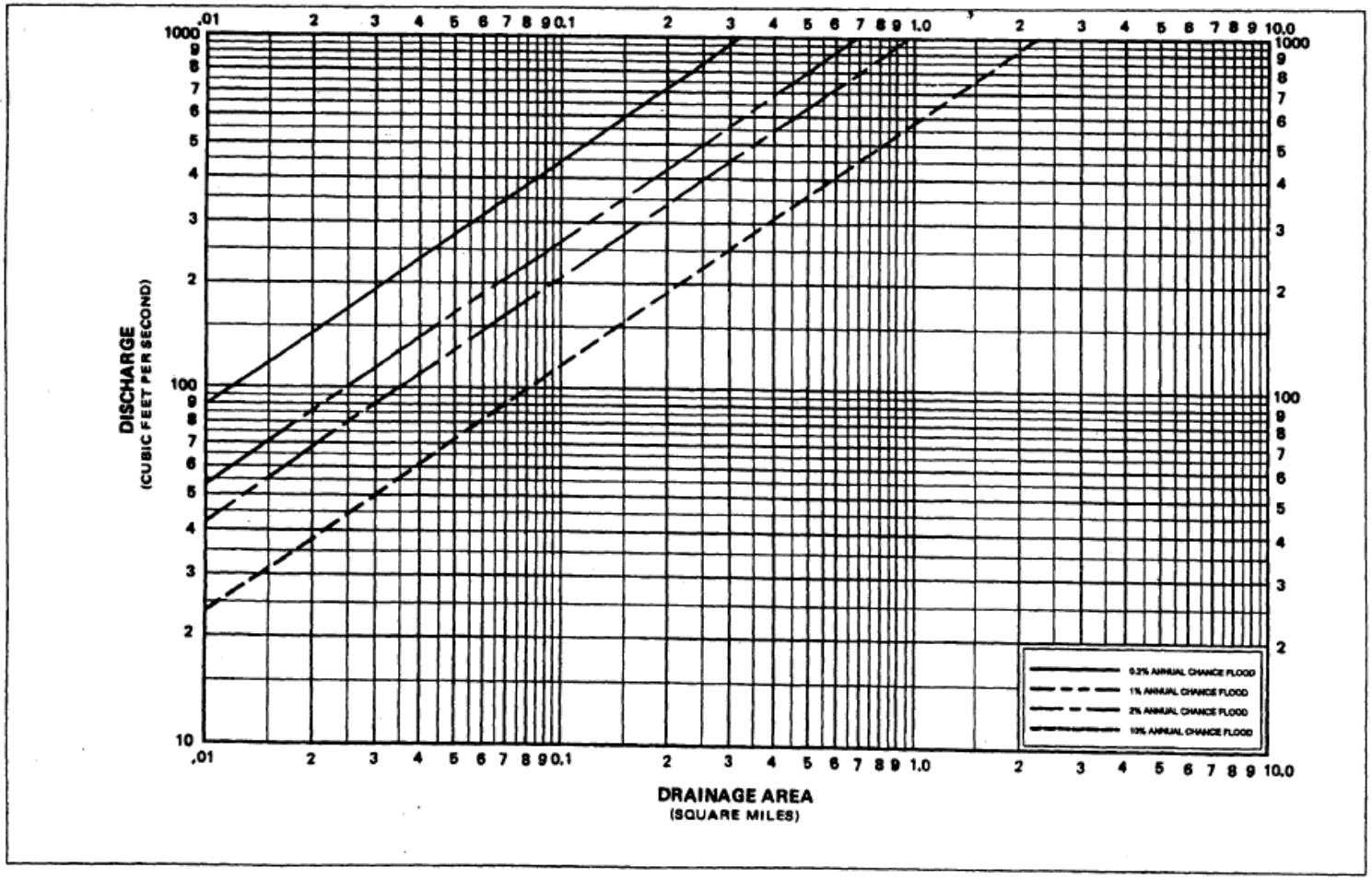

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

JACKSON COUNTY, MO
AND INCORPORATED AREAS

FREQUENCY DISCHARGE, DRAINAGE AREA CURVES

LITTLE CEDAR CREEK, LITTLE CEDAR CREEK TRIBUTARY, MOUSE CREEK, TRIBUTARY B3 TO BIG CREEK, TRIBUTARY J1, TRIBUTARY M1, TRIBUTARY M2, TRIBUTARY M3, TRIBUTARY M4, TRIBUTARY M5, AND TRIBUTARY M6

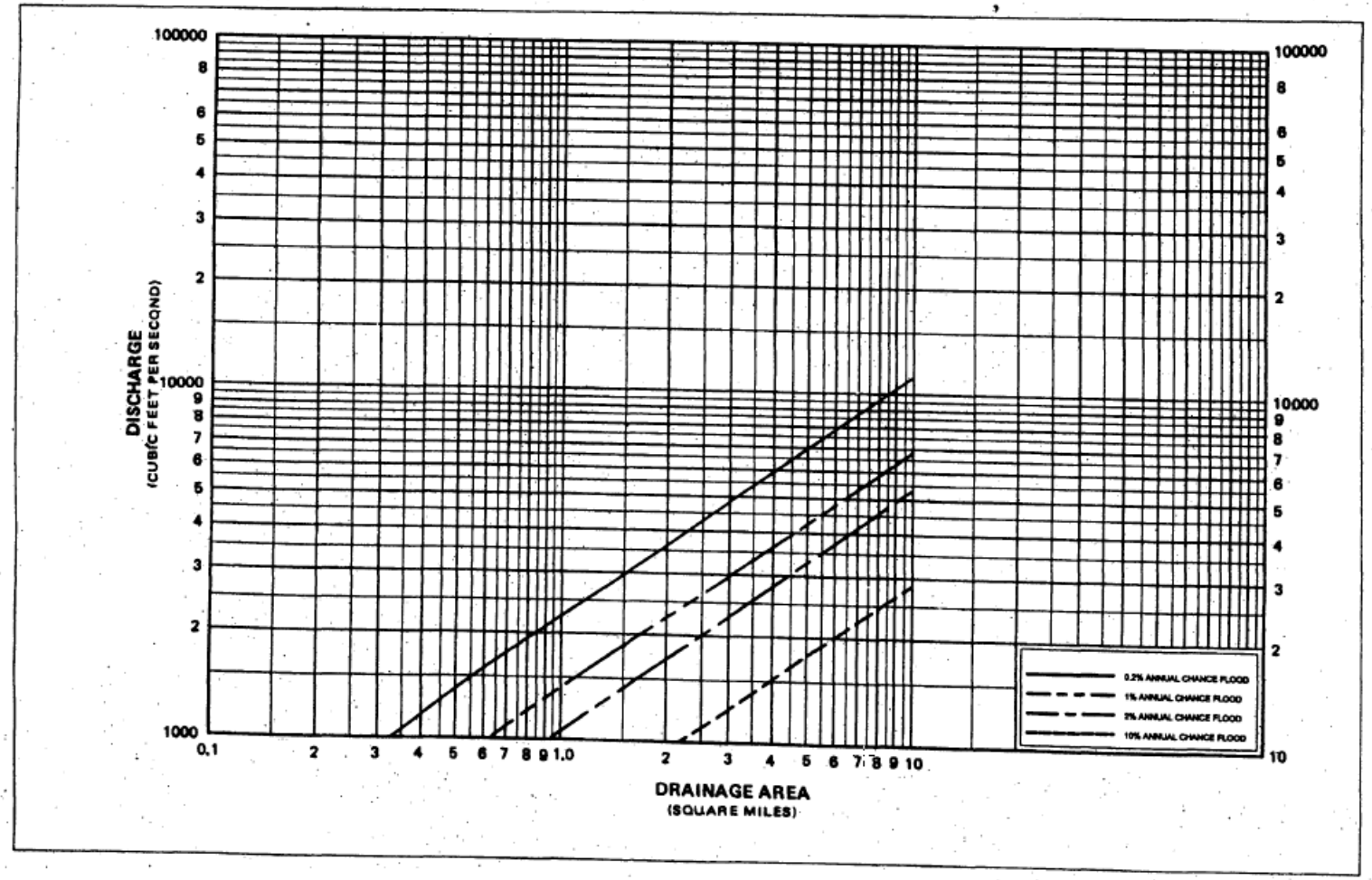

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

JACKSON COUNTY, MO
AND INCORPORATED AREAS

FREQUENCY DISCHARGE, DRAINAGE AREA CURVES

LITTLE CEDAR CREEK, LITTLE CEDAR CREEK TRIBUTARY, MOUSE CREEK, TRIBUTARY B3 TO BIG CREEK, TRIBUTARY J1, TRIBUTARY M1, TRIBUTARY M2, TRIBUTARY M3, TRIBUTARY M4, TRIBUTARY M5, AND TRIBUTARY M6

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals. Users should be aware that flood elevations shown on the Flood Insurance Rate Map (FIRM), (Exhibit 2) represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles or in the Floodway Data tables in the FIS report. Flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS report in conjunction with the data shown on the FIRM.

The main hydraulic tool used to determine flood elevations along the Missouri River was the UNET unsteady flow computer modeling program (Reference 49). Included in the UNET model were the main stem of the Mississippi River, several of its main tributaries, navigation dams, and the levees and levee systems. Hydrographic surveys were assembled from navigation channel maintenance surveys, dam periodic inspection surveys, and environment management project surveys. These surveys date from 1997 or later. For areas where no digital hydrographic surveys were available, such as in some side channels and chutes, depths were estimated from the most current printed surveys available. Bluff-to-bluff digital terrain data collected in 1995 and 1998 were used to supplement the channel survey data (Reference 50). Model development consisted of constructing HEC-RAS models from the original cross-sections, adding in ineffective flow areas or obstructions as necessary, and then converting the models to UNET.

The UNET model was calibrated to reproduce recorded flood hydrographs for a selected period of record. The UNET model was calibrated to both stage and discharge at gaging locations primarily by adjusting roughness coefficients and estimated lateral inflows. Annual peak flows and peak stages from the period of record run of the calibrated UNET model were used to develop rating curves for each cross-section location. Using these station rating curves and the station frequency flows developed during the hydrology phase, frequency elevation points were obtained for each cross-section location. Connecting the corresponding points resulted in flood frequency profiles. These profiles were coordinated among the computational teams and appropriate adjustments were made to assure consistency.

Some special considerations and techniques were required to address especially complex flow reaches. The confluences of the Missouri and Illinois Rivers with the Mississippi relied primarily on development of graphical stage-probability relationships for backwater-impacted cross-sections. These were created using a graphical Weibull approach. The graphical period-of-record stage-probability curves were combined to blend a consistent and reasonable profile for each probability flood. Confluences of many other smaller streams with the main stem also exhibited backwater effects resulting in discontinuities in the profiles. A computer routine was developed to smooth the profile in these reaches so as to form a consistent, reasonable transition through the zone of backwater.

Upon completion of the UMRSFFS, FEMA funded the USACE to compute a floodway for the studied reach of the Missouri River. This floodway determination consisted of converting the hydraulic data from UNET to HEC-RAS version 3.1.3 (Reference 51), calibrating the HEC-RAS steady-state models to the UMRSFFS results for the 1-percent-annual-chance profile, and performing the floodway computations. The 10-, 2-, 1- and 0.2-percent-annual-chance elevations shown on the flood profiles were plotted using the original UNET elevations.

The cross-section stationing used in the Missouri River model was based on existing USACE River Mile markers of 1960 (Reference 52). The reach length between cross-sections is based on a model of centerline developed for the HEC-RAS converted model of the UMRSFFS. The distances between cross-sections shown in the floodway data table and flood profile were created using the cross-section stations based on the 1960 River Miles. While the calculated distance between cross-sections using the 1960 River Miles are similar to the measured distance along the model centerline, some differences may occur. This difference in distance does not affect the calculated water surface elevation at each cross-section shown on the floodway data table and flood profile, nor does it affect the placement of the BFEs on the map.

All new detailed hydraulic modeling was performed using HEC-RAS, version 4.1, from the United States Army Corps of Engineers (USACE), Hydrologic Engineering Center (HEC) (Reference 53). Basic modeling data for the detailed hydraulic analysis was performed using GeoRAS, a Geographic Information Systems (GIS) interface developed by HEC for the preparation of hydraulic models. All bridges and culverts were surveyed to obtain elevation data and structural geometry for these new hydraulic models. The new detailed studies covered Blue River, Blue River Tributary 1, Blue River Tributary 2, Blue River Tributary 4, Blue River Tributary 4.1, Blue River Tributary 5, Blue River Tributary 6, Blue River Tributary 7, Blue River Tributary 9, Blue River Tributary 10, Blue River Tributary 11, Blue River Tributary 12, Blue River Tributary 13, Blue River Tributary 14, Blue River Tributary 17, Brush Creek, Brush Creek (Platte County, MO), Brush Creek Tributary 1, Brush Creek Tributary 8, Buckeye Creek, Buckeye Creek Tributary 1, Burlington Creek, Burlington Creek Tributary 1, Burlington Creek Tributary 2, Dyke Branch, East Creek, East Creek Tributary 1, East Fork Line Creek, East Fork Line Creek Tributary 1, East Fork Line Creek Tributary 1.2, East Fork Shoal Creek,

East Fork Shoal Creek Tributary 1, East Fork Shoal Creek Tributary 2, East Fork Shoal Creek Tributary 3, First Creek, First Creek Tributary 1, Fishing River, Fishing River Tributary 1, Fishing River Tributary 1.1, Fishing River Tributary 1.2, Hickman Mills Creek, Hickman Mills Creek Tributary 1, Hickman Mills Creek Tributary 2, Indian Creek, Jumping Branch, Line Creek, Line Creek Tributary 1, Line Creek Tributary 2, Little Blue River, Little Blue River Tributary 1, Little Blue River Tributary 4, Little Blue River Tributary 5, Little Blue River Tributary 7, Little Blue River Tributary 16, Little Blue River Tributary 17, Little Cedar Creek Tributary 2, Little Shoal Creek, Little Shoal Creek Tributary 1, Lumpkins Fork, Lumpkins Fork Tributary 2, Mill Creek (Clay County, MO), Mill Creek Tributary 1, Missouri River, Old Maid's Creek, Randolph Creek, Rock Creek (Clay County, MO), Rock Creek Gladstone, Rock Creek Tributary 11, Rock Creek Tributary 11.2, Rocky Branch, Rocky Branch Tributary 1, Round Grove Creek (within Kansas City), Round Grove Creek Tributary 1, Round Grove Creek Tributary 2, Round Grove Creek Tributary 3, Searcy Branch, Searcy Branch Tributary 1, Second Creek, Second Creek West Branch, Shoal Creek, Shoal Creek Tributary 6, Shoal Creek Tributary 8, Shoal Creek Tributary 9, Shoal Creek Tributary 20, Shoal Creek Tributary 20.1, Todd Creek, Town Fork Creek, , Tributary to Todd Creek, Walnut Creek, White Oak Creek Tributary 1, Wildcat Branch, Wildwood Creek, Wildwood Creek Tributary 1 and Wilkerson Creek.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the Flood Profiles (Exhibit 1) are thus considered valid only if hydraulic structures remain unobstructed, operated properly, and do not fail.

Cross sections were field surveyed in 2009 and 2011 and were located at close intervals above and below bridges in order to compute the backwater effects of these structures in urbanized areas. Field survey notes consisting of structure dimensions and channel geometry, as well as structure material (i.e. corrugated metal pipe), were used in conjunction with survey data to most accurately represent the structures. Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway is computed (Section 4.2), selected cross section locations are also shown on the FIRM.

As part of this current update, areas previously studied by detailed methods were redelineated; see section 2.1 for a listing of streams. The previous models were used to extract structure and channel data, which were then combined with updated overbank data from the 2ft DEM created from LiDAR points. All structure data available from the previously studied models was utilized. In some cases structure data was not available, and structures were supplemented with survey data collected by AMEC in 2009 and 2011. Channel data obtained from the previously studied models was considered to be more accurate especially in the vicinity of structures or where water is visible in the aerial photographs. In the case that channel data obtained from the previously studied model was not in agreement with what was visible on the aerials or was indicated by the LIDAR data, then LIDAR data was used to define the channel geometry. Also, minor adjustments were made to structures, ineffective areas and the floodway in order to account for inconsistencies created in the update of leverage data.

On the previous areas studied by detailed methods water surface elevations (WSELs) for the 10-, 2-, 1-, and 0.2-percent-annual-chance floods on Little Cedar Creek, Little Cedar Creek Tributary, Mouse Creek, Tributary J1, Tributary M1, Tributary M2, Tributary M3, Tributary M4, Tributary M5, and Tributary M6, were computed using the Soil Conservation Service (SCS) WSP-IN step-backwater computer program (Reference 54). Tributary B3 to Big Creek and Tributary L2 to Lakewood Lakes WSELs were computed using the SCS WSP-2 step-backwater computer program (Reference 55). For Big Creek, Blue Branch, Cedar Creek, East Fork Little Blue River, Horseshoe Creek Tributary, May Brook, SB-1 Tributary to Sni-A-Bar Creek, SB-2 Tributary to Sni-A-Bar Creek, SB-3 Tributary to Sni-A-Bar Creek, SB-4 Tributary to Sni-A-Bar Creek, Swiney Branch, Tributary A1 to East Fork Little Blue River, Tributary A2 to East Fork Little Blue River, Tributary B1 to Big Creek, Tributary B2 to Big Creek, Tributary C1 to Cedar Creek, Tributary C2 to Cedar Creek, Tributary C3 to Cedar Creek, Tributary C4 to Cedar Creek, Tributary C5 to Cedar Creek, Tributary C6 to Cedar Creek, Tributary G1 to Lake Winnebago, Tributary G2 to Raintree Lake, Tributary L1 to Lakewood Lakes, Tributary P1 to Prairie Lee Lake, Tributary P2 to Prairie Lee Lake, Tributary P3 to Prairie Lee Lake, Tributary P4 to Prairie Lee Lake, Tributary P5 to Prairie Lee Lake, Tributary to Tributary B2 to Big Creek, Tributary to West Fork Sni-A-Bar Creek, and Yennie Avenue Drain, the USACE computer program HEC-RAS version 2.2 (Reference 56) was used to determine the WSELs. For all of the remaining flooding sources studied in detail, the USACE HEC-2 step-backwater computer program (Reference 57) was utilized to obtain the WSELs. Staring WSELs for the Blue Branch Creek Tributary No.1 Blue Branch Creek Tributary No. 2, Fire Prairie Creek, Mill Creek (Jackson County), Oil Creek, Sni-A-Bar Creek, and Sugar Creek were determined by assuming normal depth. Starting WSELs for Adair Creek Tributary No. 2 were obtained from Adair Creek due to the coincident peak discharge with Adair Creek. Round Grove Creek (Jackson County) and White Oak Creek both had staring WSELs taken from another study (Reference 58). May Brook starting WSELs were developed from existing profiles. For all of the remaining flooding sources studied in detail, the slope-area method was used to determine the starting WSELs.

The detail-studied streams that were not restudied as a part of this map updated may include a profile base line on the maps. This profile base line provides a link to the flood profiles included in the FIS report. The detail-studied stream centerline may have been digitized or redelineated as part of this revision. The profile base lines for these streams were based on the best available data at the time of their study and are depicted as they were on the previous FIRMs. In some cases where improved topographical data was used to redelineate floodplain boundaries, the profile base line may deviate significantly from the channel centerline or may be outside the SFHA.

Brush Creek Tributary 8 and Blue River Tributary 17 were both modeled as closed systems in hydrology therefore the only the overland flow component of flow is modeled in Hydraulics. No channel survey data was entered for these two streams but flow was allowed to travel down natural conveyances shown in the LiDAR data. Additionally, no floodway or floodway data table was generated.

Roughness coefficients (Manning's "n") used in the hydraulic computations were chosen by engineering judgment, available data and field inspection. Starting water surface elevations were computed using a normal depth boundary condition. Channel and overbank values for the streams studied in detail are shown in Table 4 "Manning's "N" Values".

TABLE 4: MANNING'S "N" VALUES

Flooding Source	Channel "n"	Overbank "n"
Adair Creek	0.035-0.060	0.040-0.150
Adair Creek Tributary 1	0.035-0.060	0.100
Adair Creek Tributary 2	0.035-0.060	0.040-0.150
Big Creek	0.030-0.055	0.030-0.120
Blue Branch	0.030-0.050	0.030-0.120
Blue Branch Creek Tributary 1	0.040-0.070	0.050-0.080
Blue Branch Creek Tributary 2	0.040-0.070	0.050-0.080
Blue River	0.014-0.05	0.025-0.210

TABLE 4: MANNING'S "N" VALUES

Flooding Source	Channel "n"	Overbank "n"
Blue River Tributary 1	0.045	0.030-0.120
Blue River Tributary 2	0.045	0.050-0.100
Blue River Tributary 4	0.050	0.060-0.120
Blue River Tributary 4.1	0.045-0.055	0.050-0.120
Blue River Tributary 5	0.045-0.060	0.050-0.120
Blue River Tributary 6	0.045-0.055	0.050-0.120
Blue River Tributary 7	0.030-0.050	0.070-0.100
Blue River Tributary 9	0.033-0.060	0.080-0.120
Blue River Tributary 10	0.045-0.050	0.045-0.100
Blue River Tributary 11	0.045	0.040-0.120
Blue River Tributary 12	0.055	0.070-0.120
Blue River Tributary 13	0.030-0.055	0.016-0.120
Blue River Tributary 14	0.040-0.055	0.013-0.120
Blue River Tributary 17	0.016	0.030
Brush Creek	0.015-0.040	0.014-0.090
Brush Creek (Platte County, MO)	0.035-0.045	0.030-0.100
Brush Creek Tributary 1	0.040	0.030-0.100
Brush Creek Tributary 8	0.045	0.100
Buckeye Creek	0.010-0.045	0.030-0.100
Buckeye Creek Tributary 1	0.015-0.045	0.035-0.100
Bundschu Creek	0.035-0.060	0.100
Burlington Creek	0.040-0.060	0.015-0.100
Burlington Creek Tributary 1	0.040	0.016-0.100
Burlington Creek Tributary 2	0.040	0.016-0.100
Burr Oak Creek	0.075	0.080
Burr Oak Creek Tributary	0.075	0.080
Cedar Creek	0.035-0.045	0.030-0.120
Crackerneck Creek	0.035-0.060	0.050-0.150
Dyke Branch	0.045	0.080-0.100
East Creek	0.040-0.045	0.016-0.120
East Creek Tributary 1	0.035-0.045	0.016-0.060
East Fork Line Creek	0.040-0.050	0.016-0.100
East Fork Line Creek Tributary 1	0.045	0.050-0.100
East Fork Line Creek Tributary 1.2	0.045	0.050-0.080
East Fork Little Blue River		
East Fork Shoal Creek	0.035-0.050	0.040-0.090
East Fork Shoal Creek Tributary 1	0.030-0.053	0.040-0.100
East Fork Shoal Creek Tributary 2	0.040-0.005	0.030-0.100
East Fork Shoal Creek Tributary 3	0.030-0.055	0.035-0.200

TABLE 4: MANNING'S "N" VALUES

Flooding Source	Channel "n"	Overbank "n"
Fire Prairie Creek		
First Creek	0.045	0.080-0.120
First Creek Tributary 1	0.035-0.050	0.060-0.080
Fishing River	0.032	0.032-0.100
Fishing River Tributary 1	0.032	0.020-0.100
Fishing River Tributary 1.1	0.032-0.045	0.040-0.100
Fishing River Tributary 1.2	0.032	0.040-0.100
Hickman Mills Creek	0.040-0.055	0.015-0.250
Hickman Mills Creek Tributary 1	0.045-0.055	0.080-0.120
Hickman Mills Creek Tributary 2	0.045	0.060-0.120
Horseshoe Creek	0.030-0.050	0.050-0.090
Horseshoe Creek Tributary	0.030-0.045	0.030-0.120
Indian Creek	0.045	0.080-0.100
Jumping Branch	0.045-1.000	0.060-0.120
Line Creek	0.030-0.050	0.020-0.100
Line Creek Tributary 1	0.035-0.050	0.070-0.120
Line Creek Tributary 2	0.045-0.050	0.055-0.120
Little Blue River	0.035-0.045	0.035-0.100
Little Blue River (Unsteady-State HECRAS)	0.040	0.040-0.100
Little Blue River Tributary 1	0.035-0.045	0.050-0.100
Little Blue River Tributary 4	0.040-0.045	0.060-0.100
Little Blue River Tributary 5	0.035-0.045	0.035-0.100
Little Blue River Tributary 7	0.040-0.045	0.050-0.100
Little Blue River Tributary 16	0.045	0.045-0.100
Little Blue River Tributary 17	0.045	0.060-0.120
Little Cedar Creek	0.040-0.045	0.050-0.100
Little Cedar Creek Tributary 2	0.030-0.045	0.050-0.100
Little Shoal Creek	0.035-0.055	0.025-0.100
Little Shoal Creek (Unsteady-State HECRAS)	0.040	0.040-0.100
Little Shoal Creek Tributary 1	0.040-0.050	0.050-0.090
Lumpkins Fork	0.035-0.045	0.040-0.100
Lumpkins Fork Tributary 2	0.045	0.060-0.100
May Brook	0.030-0.045	0.030-0.120
Middle Fork Mill Creek	*	*
Mill Creek	0.035-0.060	0.070-0.100
Mill Creek (Clay County, MO)	0.035-0.060	0.040-0.120
Mill Creek Tributary 1	0.045	0.090
Missouri River	0.014-0.038	0.030-0.200
Mouse Creek	*	*
North Fork Crackerneck Creek	0.035-0.060	0.050-0.150
North Fork Spring Branch	*	*

*Data not available

TABLE 4: MANNING'S "N" VALUES

Flooding Source	Channel "n"	Overbank "n"
North Fork Sugar Creek	*	*
Oil Creek	0.035	0.055
Old Maid's Creek	0.045-0.055	0.065-0.120
Randolph Creek	0.035-0.100	0.013-0.100
Rock Creek	0.035-0.060	0.025-0.150
Rock Creek (Clay County, MO)	0.035-0.055	0.02-0.100
Rock Creek Gladstone	0.025-0.060	0.040-0.100
Rock Creek Tributary 11	0.040-0.050	0.020-0.070
Rock Creek Tributary 11.2	0.035-0.055	0.020-0.075
Rocky Branch	0.045-0.050	0.060-0.120
Rocky Branch Tributary 1	0.040-0.050	0.050-0.120
Round Grove Creek	0.034-0.070	0.050-0.090
Round Grove Creek Tributary 1	0.035-0.050	0.080-0.130
Round Grove Creek Tributary 2	0.045	0.060-0.080
Round Grove Creek Tributary 3	0.035-0.050	0.070-0.120
SB1 Tributary Sni-A-Bar Creek	0.030-0.045	0.030-0.120
SB2 Tributary Sni-A-Bar Creek	0.030-0.045	0.030-0.120
SB3 Tributary Sni-A-Bar Creek	0.030-0.045	0.030-0.120
SB4 Tributary Sni-A-Bar Creek	0.030-0.045	0.030-0.120
Searcy Branch	0.045-0.050	0.040-0.100
Searcy Branch Tributary 1	0.045	0.100
Second Creek	0.045-0.055	0.070-0.100
Second Creek West Branch	0.040	0.050
Seminary Creek	0.040-0.070	0.050-0.080
Shoal Creek	0.045-0.057	0.045-0.110
Shoal Creek (Unsteady-State HECRAS)	0.040	0.040-0.100
Shoal Creek Tributary 6	0.045-0.100	0.035-0.100
Shoal Creek Tributary 8	0.040-0.045	0.070-0.090
Shoal Creek Tributary 9	0.045	0.080-0.090
Shoal Creek Tributary 20	0.044-0.060	0.030-0.080
Shoal Creek Tributary 20.1	0.045-0.060	0.050-0.080
Sni-A-Bar Creek	0.030-0.070	0.050-0.080
South Fork Spring Branch	0.035-0.060	0.100-0.150
Spring Branch	0.035-0.060	0.050-0.150
Sugar Creek	0.035-0.075	0.040-0.150
Swiney Branch	0.030-0.045	0.030-0.120
Swiney Branch Tributary	*	*
Todd Creek	0.040-0.050	0.060-0.120
Town Fork Creek	0.045-0.080	0.080-0.135
Tributary A1 to East Fork Little Blue River	0.030-0.045	0.030-0.120
Tributary A2 to East Fork Little Blue River	0.030-0.045	0.030-0.120
Tributary B1 to Big Creek	0.030-0.045	0.030-0.120

*Data not available

TABLE 4: MANNING'S "N" VALUES

Flooding Source	Channel "n"	Overbank "n"
Tributary B2 to Big Creek	0.030-0.045	0.030-0.120
Tributary B3 to Big Creek	*	*
Tributary C1 to Cedar Creek	0.030-0.045	0.030-0.120
Tributary C2 to Cedar Creek	0.030-0.045	0.030-0.120
Tributary C3 to Cedar Creek	0.030-0.045	0.030-0.120
Tributary C4 to Cedar Creek	0.030-0.045	0.030-0.120
Tributary C5 to Cedar Creek	0.030-0.045	0.030-0.120
Tributary C6 to Cedar Creek	0.030-0.045	0.030-0.120
Tributary G1 to Lake Winnebago	0.030-0.045	0.030-0.120
Tributary G2 to Raintree Lake	0.030-0.045	0.030-0.120
Tributary J1	*	*
Tributary L1 to Lakewood Lakes	0.030-0.045	0.030-0.120
Tributary L2 to Lakewood Lakes	*	*
Tributary M1	*	*
Tributary M2	*	*
Tributary M3	*	*
Tributary M4	*	*
Tributary M5	*	*
Tributary M6	*	*
Tributary No. C1	*	*
Tributary No. C2	*	*
Tributary No. S1	0.040-0.070	0.050-0.080
Tributary No. S2	0.040-0.070	0.050-0.080
Tributary No. S3	0.040-0.070	0.050-0.080
Tributary No. S3a	0.040-0.070	0.050-0.080
Tributary No. S4	0.040-0.070	0.050-0.080
Tributary No. S5	0.040-0.070	0.050-0.080
Tributary P1 to Prairie Lee Lake	0.030-0.045	0.030-0.120
Tributary P2 to Prairie Lee Lake	0.030-0.045	0.030-0.120
Tributary P3 to Prairie Lee Lake	0.030-0.045	0.030-0.120
Tributary P4 to Prairie Lee Lake	0.030-0.045	0.030-0.120
Tributary P5 to Prairie Lee Lake	0.030-0.045	0.030-0.120
Tributary to Todd Creek	0.017-0.050	0.060-0.120
Tributary to Tributary B2 to Big Creek	0.030-0.045	0.030-0.120
Tributary to West Fork Sni-A-Bar Creek	0.030-0.045	0.030-0.120
Tucker Branch	*	*
Tucker Branch Tributary	*	*
Walnut Creek	0.040-0.045	0.050-0.100
West Branch Crawford Creek	0.035	0.050
West Fire Prairie Creek	*	*

*Data not available

TABLE 4: MANNING'S "N" VALUES

Flooding Source	Channel "n"	Overbank "n"
West Fork Sni-A-Bar Creek	0.040-0.070	0.050-0.080
White Oak Creek	0.045	0.045-0.100
White Oak Creek Tributary 1	0.040-0.045	0.050-0.100
Wildcat Branch	0.040-0.050	0.060-0.100
Wildwood Creek	0.045	0.020-0.100
Wildwood Creek Tributary 1	0.045	0.050-0.100
Wilkerson Creek	0.045	0.050-0.100
Yennie Avenue Drain	0.030-0.050	0.030-0.120

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals. In cases where the 10-, 2-, 1- , 0.2-percent-annual-chance flood elevations are close together, due to limitations of the profile scale, only the 1-percent-annual-chance profile has been shown.

Approximate (Zone A) hydraulic modeling was performed using HEC-RAS, version 4.0, from the USACE, HEC (Reference 53). AMEC's program, Automated Floodplain Generator (AFG), was used to assist in the development of the geometries and resulting floodplains throughout the county and was delineated using automated GIS methods. Floodplains were mapped to include backwater effects that govern each flooding source near its downstream extent.

All qualifying benchmarks within a given jurisdiction that are catalogued by the National Geodetic Survey (NGS) and entered into the National Spatial Reference System (NSRS) as First or Second Order Vertical and have a vertical stability classification of A, B or C are shown and labeled on the FIRM with their 6-character NSRS Permanent Identifier.

Benchmarks catalogued by the NGS and entered into the NSRS vary widely in vertical stability classification. NSRS vertical stability classifications are as follows:

- Stability A: Monuments of the most reliable nature, expected to hold position/elevation (e.g., mounted in bedrock)

- Stability B: Monuments which generally hold their position/elevation (e.g., concrete bridge abutment)

- Stability C: Monuments which may be affected by surface ground movements (e.g., concrete monument below frost line)

- Stability D: Mark of questionable or unknown vertical stability (e.g., concrete monument above frost line, or steel witness post)

In addition to NSRS benchmarks, the FIRM may also show vertical control monuments established by a local jurisdiction; these monuments will be shown on the FIRM with the appropriate designations. Local monuments will only be placed on the FIRM if the community has requested that they be included, and if the monuments meet the aforementioned NSRS inclusion criteria

To obtain current elevation, description, and/or location information for benchmarks shown on the FIRM for this jurisdiction, please contact the Information Services Branch of the NGS at (301) 713-3242, or visit their Web site at www.ngs.noaa.gov.

3.3 Vertical Datum

All FIS reports and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum in use for newly created or revised FIS reports and FIRMs was the NGVD29. With the finalization of the NAVD88, many FIS reports and FIRMs are being prepared using NAVD88 as the referenced vertical datum. The elevations provided in the previous FIS for Jackson County have already been converted to NAVD88, using a conversion factor of 0.306 feet. The same conversion factor was used for the City of Kansas City.

All flood elevations shown in this FIS report and on the FRIM are referenced to NAVD88. Structure and ground elevations in the community must, therefore, be referenced to NAVD88. It is important to note that adjacent communities may be referenced to NGVD29. This may result in differences in Base Flood Elevations (BFEs) across the corporate limits between communities.

The studied reach of Missouri River spans multiple counties in multiple states, and the river forms the actual border between adjacent counties. The UMRSFFS was originally performed using the NGVD29 vertical datum. Applying an average countywide datum shift to convert to NAVD88 would have resulted in a mismatch of elevations between counties. Therefore, in order to perform the most accurate vertical datum conversion possible, and to maintain consistency in approach across county lines, the datum conversion for the Missouri River was performed on a cross-section by cross-section basis, rather than by applying an average county-wide or stream-wide value.

For more information on NAVD88, see the FEMA publication entitled *Converting the National Flood Insurance Program to North American Vertical Datum of 1988* (FEMA, June 1992). To obtain current elevation, description, and/or location information for benchmarks shown on the FIRM for this jurisdiction or for further information on NAVD88 contact the Vertical network Oceanic and Atmospheric Administration, at the following address:

Communications and Outreach Branch
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242
(301) 713-4172 (fax)
http://www.ngs.noaa.gov)

Temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, they may be found in the Technical Support Data Notebook associated with the FIS report and FIRM for this community. Interested individuals may contact FEMA to access these data.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each FIS provides 1-percent-annual-chance flood elevations and delineations of the 1- and 0.2-percent-annual-chance floodplain boundaries and 1-percent-annual-chance floodway to assist communities in developing floodplain management measures. This information is presented on the FIRM and in many components of the FIS report, including Flood Profiles, Floodway Data table and Summary of Stillwater Elevations Table. Users should reference the data presented in the FIS report as well as additional information that may be available at the local map repository before making flood elevation and/or floodplain boundary determinations.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1- percent-annual-chance flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent-annual-chance flood is employed to indicate additional areas of flood risk in the community.

For each stream studied by detailed methods, the 1- and 0.2-percent-annual-chance floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:300, with a contour interval of 2 feet (Reference 59).

The 1-and 0.2-percent-annual-chance floodplain boundaries are shown on the FIRM (Exhibit 2). On this map, the 1-percent annual-chance floodplain boundary corresponds to the boundary of the areas of special flood hazard areas (Zones A and AE); and the 0.2-percent-annual-chance floodplain boundary corresponds to the boundary areas of moderate flood hazards. In cases where the 1- and 0.2-percent-annual-chance floodplain boundaries are close together, only the 1-

percent-annual-chance floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For streams studied by approximate methods, only the 1-percent-annual-chance floodplain boundary is shown on the FIRM (Exhibit 2). These were delineated and interpolated using topographic maps at a scale of 1:300, with a contour interval of 2 feet (Reference 59).

Within this jurisdiction there are one or more levees that have not been demonstrated by the community or levee owner(s) to meet the requirements of 44 CFR Part 65.10 of the NFIP regulations as it relates to the levee's capacity to provide 1-percent-annual-chance flood protection. As such, the floodplain boundaries in this area are subject to change. Please refer to the Notice to Flood Insurance Study Users page at the front of this FIS report for more information on how this may affect the floodplain boundaries shown on this FIRM.

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 1-percent-annual-chance floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 1-percent-annual-chance flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

Upon completion of the UMRSFFS, FEMA funded the USACE to compute a floodway for the studied reaches of the Missouri River. This floodway determination consisted of converting the hydraulic data from UNET to HEC-RAS, calibrating the HEC-RAS steady-state models to the UMRSFFS results, and performing the floodway computations.

The floodway presented in this FIS report and on the FIRM was computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain, while allowing a maximum surcharge of 1 foot Floodway widths were computed at cross sections.

Between cross-sections, the floodway boundaries were interpolated. In cases where the floodway and 1-percent-annual-chance floodplain boundaries are either close together or collinear, only the floodway boundary is shown.

The area between the floodway and 1-percent-annual-chance floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water surface elevation (WSEL) of the 1-percent-annual-chance flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 1.

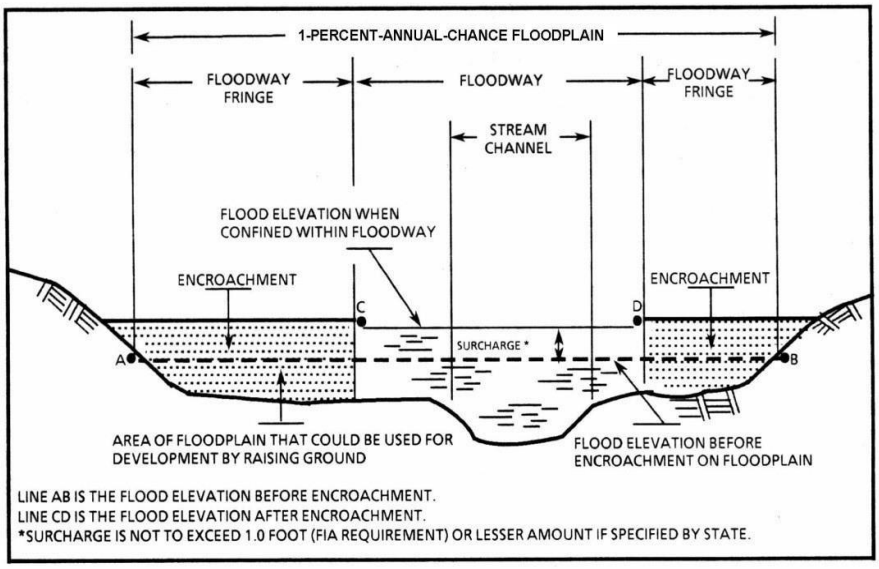

FIGURE 2: FLOODWAY SCHEMATIC

Near the mouths of streams studied in detail, floodway computations are made without regard to flood elevations on the receiving water body. Therefore, "Without Floodway" elevations presented in Table 5 for certain downstream cross sections are lower than the regulatory flood elevations in that area, which must take into account the 1 percent annual chance flooding due to backwater from other sources.

Encroachment into areas subject to inundation by floodwaters having hazardous velocities aggravates the risk of flood damage, and heightens potential flood hazards by further increasing velocities. A listing of stream velocities at selected cross-sections is provided in Table 5, “Floodway Data,” which can be found in Volumes 2 and 3 of this FIS report. In order to reduce the risk of property damage in areas where the stream velocities are high, the community may wish to restrict development in areas outside the floodway.

Please note that there is no Floodway Data Table associated with Middle Fork Mill Creek, SB1 Tributary Sni-A-Bar Creek, SB2 Tributary Sni-A-Bar Creek, SB3 Tributary Sni-A-Bar Creek, SB4 Tributary Sni-A-Bar Creek, Tributary J1, Tributary M1, Tributary M2, Tributary M3, Tributary M4, Tributary M5, Tributary M6 and Tributary to West fork Sni-A-Bar Creek because they have no floodway.

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 1-percent-annual-chance floodplains that are determined in the FIS report by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base (1-percent-annual- chance) flood elevations (BFEs) or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 1-percent-annual-chance floodplains that are determined in the FIS report by detailed methods. In most instances, whole-foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AH

Zone AH is the flood insurance rate zone that corresponds to areas of 1-percent-annual-chance shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to areas of 1-percent-annual-chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the detailed hydraulic analyses are shown within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 0.2-percent-annual-chance floodplain, areas within the 0.2-percent-annual-chance floodplain, areas of 1-percent-annual-chance flooding where average depths are less than 1 foot, areas of 1-percent-annual-chance flooding where the contributing drainage area is less than 1 square mile (sq. mi.), and areas protected from the 1 – percent-annualchance flood by levees. No BFEs or depths are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

The FIRM is designed for flood insurance and floodplain management applications. For flood insurance applications, the map designates flood insurance risk zones as described in Section 5.0 and, in the 1-percent-annual-chance floodplains that were studied by detailed methods, shows selected whole foot BFEs or average depths. Insurance agents use zones and BFEs in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 1- and 0.2-percent-annual-chance floodplains, floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

This countywide FIRM presents flooding information for the entire geographic ara of Jackson County and Kansas City. Previously, FIRMs were prepared for each incorporated community and the unincorporated areas of the County identified as flood-prone. This countywide FIRM also includes flood-hazard information that was presented separately on Flood Boundary and Floodway Maps (FBFMs), where applicable. Historical data relating to the maps prepared for each community are presented in Table 6, "Community Map History."

Within this jurisdiction there are one or more levees that have not been demonstrated by the community or levee owner(s) to meet the requirements of 44 CFR Part 65.10 of the NFIP regulations as it relates to the levee's capacity to provide 1-percent-annual-chance flood protection. Please refer to the Notice to Flood Insurance Study Users page at the front of this FIS report for more information on how this may affect the FIRM.

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	FIRM EFFECTIVE DATE	FIRM REVISIONS DATE
Blue Springs, City of	June 28, 1974	May 21, 1976	September 15, 1978	July 18, 1983 September 29, 2006
Buckner, City of	December 21, 1973	None	September 15, 1978	September 29, 2006
Grain Valley, City of	July 16, 1976	None	August 15, 1979	September 29, 2006
Grandview, City of	July 19, 1974	January 23, 1976	June 15, 1979	May 4, 1987 September 29, 2006
Greenwood, City of	June 4, 1976	None	January 3, 1979	September 29, 2006
Independence, City of	April 12, 1974	May 28, 1976	February 1, 1979	August 18, 1981 June 18, 1987 September 29, 1989 March 21, 2000 September 29, 2006
Jackson County, (Unincorporated Areas)	February 21, 1975	None	September 29, 1978	September 1, 1983 September 4, 1986 November 3,1989 September 29, 2006

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

JACKSON COUNTY, MO
AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	FIRM EFFECTIVE DATE	FIRM REVISIONS DATE
Kansas City, City of	November 8, 1974	None	September 29, 1978	September 29, 2006
Lake Lotawana, City of	November 19, 1976	None	November 1, 1979	September 29, 2006
Lake Tapawingo, City of	September 29, 2006	None	September 29, 2006	
Lee's Summit, City of	June 21, 1974	None	April 3, 1978	August 3, 1989 December 6, 1999 September 29, 2006 January 1, 2012
Levasy, City of	December 20, 1974	None	September 29, 1978	September 29, 2006
Lone Jack, Village of	September 29, 2006	None	September 29, 2006	
Oak Grove, City of	July 11, 1975	None	September 5, 1979	September 29, 2006

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

JACKSON COUNTY, MO
AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	FIRM EFFECTIVE DATE	FIRM REVISIONS DATE
Raytown, City of	December 21, 1973	None	September 15, 1978	September 29, 2006
River Bend, Town of	September 29, 2006	None	September 29, 2006	
Sibley, Village of	July 5, 1984	None	May 15, 1985	September 29, 2006
Sugar Creek, City of	December 17, 1976	None	January 3, 1979	September 29, 2006
Unity, Village of	September 29, 2006	None	September 29, 2006	

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

JACKSON COUNTY, MO
AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

7.0 OTHER STUDIES

This FIS report either supersedes or is compatible with all previous studies published on streams studied in this report and should be considered authoritative for the purposes of the NFIP.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting Federal Insurance and Mitigation Division, FEMA Region VII, 9221 Ward Parkway, Suite 300, Kansas City, Iowa 64114-3372.

Future revisions may be made that do not result in the republishing of the FIS report. To ensure that any user is aware of all revisions, it is advisable to contact the map repository of flood hazard data located in the community.

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