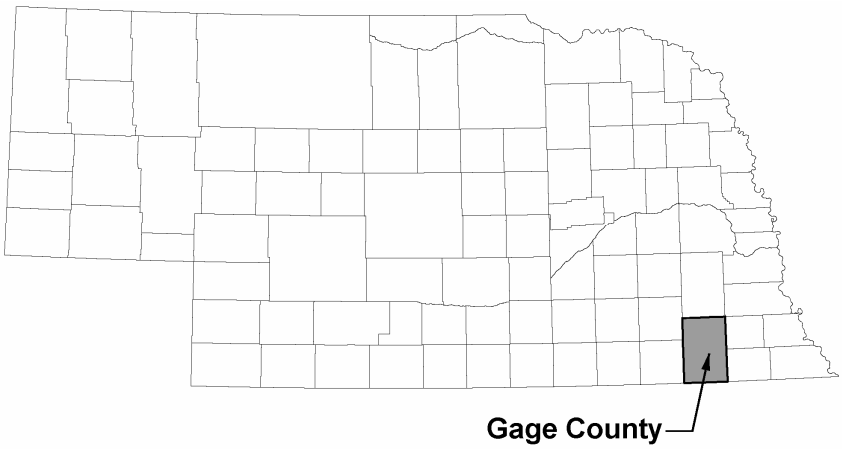
FLOOD INSURANCE STUDY

GAGE COUNTY, NEBRASKA
AND INCORPORATED AREAS

COMMUNITY NAME	COMMUNITY NUMBER
ADAMS, VILLAGE OF	310089
BARNESTON, VILLAGE OF	310090
BEATRICE, CITY OF	310091
BLUE SPRINGS, CITY OF	310092
CLATONIA, VILLAGE OF	310093
CORTLAND, VILLAGE OF	310264
* FILLEY, VILLAGE OF	315612
GAGE COUNTY (UNINCORPORATED AREAS)	310088
LIBERTY, VILLAGE OF	315613
ODELL, VILLAGE OF	310094
PICKRELL, VILLAGE OF	315614
* VIRGINIA, VILLAGE OF	315615
WYMORE, CITY OF	310095

* NON-FLOODPRONE



June 18, 2010

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
31067CV000A

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program 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 republish 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 check the Community Map Repository to obtain the most current FIS report components.

Initial Countywide FIS Effective Date: **June 18, 2010**

Revised Date(s):

Selected Flood Insurance Rate Map panels for this 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(s)	New Zone
A1 through A30	**AE**
B	**X (shaded)**
C	**X**

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Published Separately –

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Flood Insurance Rate Map

FLOOD INSURANCE STUDY

GAGE COUNTY, NEBRASKA AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study (FIS) revises and supersedes the FIS reports and/or Flood Insurance Rate Maps (FIRMs), in the geographic area of Gage County, Nebraska, including the Cities of Beatrice, Blue Springs, and Wymore, the Villages of Adams, Barneston, Clatonia, Cortland, Filley, Liberty, Odell, Pickrell, and Virginia, and the unincorporated areas of Gage County (hereinafter referred to collectively as Gage 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 community that will be used to establish actuarial flood insurance rates. This information will also be used by Gage 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 CFR, 60.3.

Please note that the Villages of Filley and Virginia are non-floodprone.

Please note that the Villages of De Witt, Firth and Hallam are communities whose extraterritorial jurisdiction (ETJ) boundaries extend into Gage County. However, flood hazard information for these communities is not included in the Gage County FIS report.

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 FEMA DFIRM database Specifications and Geographic Information System (GIS) format requirements. The flood hazard information was created and is provided in digital format so that it can be incorporated into a local GIS and be accessed more easily by the community.

1.2 Authority and Acknowledgements

The sources of authority for this FIS report are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

Pre-Countywide

Village of Barneston. The hydrologic and hydraulic analyses for the October 1984 FIS for the Village of Barneston (Reference 1) were obtained from "Floodplain Study, Big Blue River" (Reference 2).

City of Beatrice. The hydrologic and hydraulic analyses for the September 1977 FIS for the City of Beatrice (Reference 3) were performed by L. Robert Kimball Consulting Engineers for the Federal Insurance Administration, under Contract No. H-3811. This work, which was completed in November 1976, covered all significant flooding sources affecting the City of Beatrice, Nebraska.

The flood hazard information for Big Blue River and Indian Creek was revised in January 1985 to reflect new discharge values, to extent the flooding into the ETJ limits, to reflect the backwater effects of Big Blue River on Indian Creek, and to incorporate new floodplain conditions.

City of Blue Springs. The hydrologic and hydraulic analyses for the June 1986 FIS for the City of Blue Springs (Reference 4) were obtained from "Floodplain Study, Big Blue River, Volume 1: Gage County, Nebraska" (Reference 2).

Countywide

The hydrologic and hydraulic analyses for Big Blue River Tributary 44 were performed for FEMA by Stantec Consulting Services, Inc. (Stantec), under Contract No. EMK-2001-CO-2018, Task Order No. HST0040. This work was completed in 2010.

The revised hydrologic and hydraulic analyses for the approximate zones were performed by the Nebraska Department of Natural Resources (NDNR) for FEMA and were incorporated into this countywide study by Stantec under Contract No. EMK-2001-CO-2018, Task Order No. HST0040. This work was completed in 2007.

In addition to incorporating the existing FISs within Gage County, this countywide FIS includes approximate studies from NDNR and the digital conversion of all detailed effective floodplains, except Big Blue River Tributary 44, which was restudied as indicated above. The vertical datum was shifted to the North American Vertical Datum of 1988 (NAVD88). The projection used for the production of this FIRM is Nebraska State Plane FIPS Zone 2600. The horizontal datum was NAD83. Differences in the datum, spheroid, projection or state plane zones used in the production of FIRMs in adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of the FIRM.

1.3 Coordination

The purpose of an initial Consultation Coordination Officer's (CCO's) meeting is to discuss the scope of the FIS. A final CCO meeting is held to review the results of the study. The dates of the initial and final CCO meetings held for prior FISs for the incorporated communities within Gage County are shown in Table 1.

Table 1. CCO Meeting Dates for Prior FISs

Community Name	Initial CCO Date	Final CCO Date
Barneston, Village of	*	March 7, 1984
Beatrice, City of	*	September 30, 1976
Blue Springs, City of	*	July 22, 1985

* Not available

For this FIS, an initial CCO meeting was held on January 4, 2007. The meeting was attended by representatives from Gage County, Black & Veatch (B&V), NDNR and FEMA. The final CCO meeting was held on November 20, 2009. The meeting was attended by representatives of Gage County, NDNR, FEMA, and Stantec.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS covers the geographic area of Gage County, Nebraska, including the incorporated communities listed in Section 1.1 and unincorporated areas.

For this FIS update, Big Blue River Tributary 44 was studied by detailed methods. The reach studied is 1.2 miles in length, beginning from its confluence with the Big Blue River and continuing to just north of Scott Street in Beatrice as shown in Figure 1.

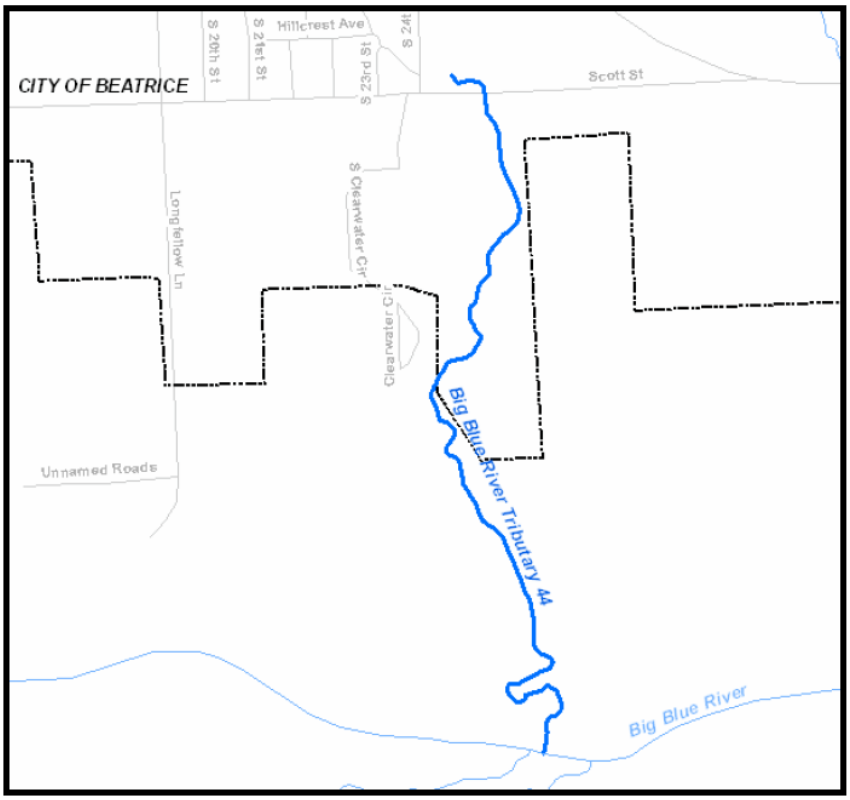


Figure 1 - Big Blue River Tributary 44 Study Reach

Floodplains for steams studied previously by detailed methods (Big Blue River and Indian Creek) were digitally converted using information from the effective FIS reports for the Village of Barneston, the City of Beatrice and the City of Blue Springs. The limits of the detailed studies are listed in Table 2.

Streams mapped as Zone A by the NDNR, which were all streams draining greater than a square mile, have been incorporated into this FIS.

2.2 Community Description

Gage County is located in southeastern Nebraska. It is bordered on the north by Lancaster County, on the west by Saline and Jefferson Counties, on the east by Johnson and Pawnee Counties, and on the south by the state of Kansas (Marshall and

Table 2. Limits of Detailed Studies

Flooding Source	Limits of Detailed Study
Big Blue River	Approximately 1560 feet downstream of South 10th Road to approximately 2.3 miles upstream of West Court Street.
Big Blue River Tributary 44	From the confluence with Big Blue River to just north of Scott Street in Beatrice.
Indian Creek	From the confluence with Big Blue River to approximately 1.8 miles upstream of Sargent Street.

Washington Counties). According to the U.S. Census Bureau, the 2006 estimated population of Gage County is reported as 23,365 (Reference 5).

The City of Beatrice, the largest urban area and county seat, lies near the intersection of Interstate 77 and U.S. Route 136. Other incorporated areas in the county are Adams, Barneston, Blue Springs, Clatonia, Cortland, Filley, Liberty, Odell, Pickrell, Virginia and Wymore.

Gage County lies within two distinct watersheds, Big Blue and the Nemaha.

The City of Beatrice is located in central Gage County. Beatrice was settled in July 1857, incorporated October 3, 1871, and granted its city charter on March 18, 1873. Early businesses included a steam saw mill and flour mill. The growth of the railroads helped agriculture and manufacturing flourish. Today, Beatrice is the marketing and distribution center for the surrounding agricultural area. Its diversified economy also includes many types of manufacturing. According to the 2006 census, the population of Beatrice is 12,921 (Reference 5).

For many years, the majority of the Big Blue River floodplain has been developed. The right bank area, from Riverside Park to Chautauqua Park, is primarily residential with some small businesses and community services located along Court Street. Left bank development downstream from Indian Creek includes the public water supply, livestock sales pavilion, two railroad yards, and various other businesses and community services. These facilities have suffered severe flooding on several occasions.

Both commercial and industrial developments are beginning to grow in the Indian Creek floodplain along U.S. Highway 77. A motel, bowling alley, farm machinery company, gasoline stations, and other businesses have recently been built along the highway. The Indian Creek Mall Shopping Center is in the floodplain on the right bank and west side of the highway. The Glenover residential area is also located along the right bank of Indian Creek.

The City of Blue Springs is located in south-central Gage County. The city is bordered on the south by the City of Wymore and on all other sides by the unincorporated areas of Gage County. According to the 2006 census, the population of Blue Springs is 376 (Reference 5).

The main channel of the Big Blue River flows in a southeasterly direction along the eastern edge of the city and drains 4,560 square miles in southeastern Nebraska. Floodplain development in Blue Springs is primarily agricultural and residential.

The Village of Barneston is located in southern Gage County, three miles north of the Nebraska-Kansas state line. The Union Pacific Railroad generally parallels the Big Blue River as it traverses the western portion of the community. The population of the village was 122 in 2006 (Reference 5).

The Big Blue River basin comprises approximately 2,920,000 acres in southeastern Nebraska. Precipitation for this area varies, but it is approximately 30 inches per year, with 80 percent of the precipitation falling during the growing season (Reference 2).

2.3 Principal Flood Problems

Low-lying areas of Beatrice are subject to periodic flooding caused by the overflow of the Big Blue River and Indian Creek.

The four bridges on the Big Blue River in Beatrice constrict flood flow from Court Street to Sixth Street. These constrictions raise the water-surface elevations upstream of the bridges, causing local flood problems.

Indian Creek has heavy undergrowth on the overbanks from the mouth to Irving Street and along both banks downstream from the county road bridge. Major constrictions on Indian Creek are caused by the Hoyt Street Bridge, the Irving Street Bridge, the culvert downstream of the Highway 77 Bridge, the Highway 77 Bridge, and the county road bridge. The four largest floods of record in Beatrice occurred in September 1941, June 1947, June 1951, and the largest, October 1973, which was approximately a 2.5-percent-annual-chance flood.

Streamflow records indicate that, on an average, a flood occurs every two years somewhere within the Big Blue River basin. Intense rainfall combined with snowmelt and saturated soil causes problems on two types of land in the area. In the lowland areas, ponding water causes extensive crop loss in areas where the topography is flat and channels are poorly defined. In the lowland areas, rapidly moving floodwaters that carry brush, trees, and other debris jam the river channel and destroy bridges and buildings within the floodplain.

Intense rainfall and snowmelt frequently cause severe flooding problems along the Big Blue River. In areas where the topography is flat and the river channel is poorly defined, lack of drainage and ponding of flood waters often contribute to flood damage.

No gage information is available for the City of Blue Springs, although historic flood data are available in conjunction with the gage at Beatrice, which is located approximately 14 miles upstream of Blue Springs. According to the gage information recorded at Beatrice, the largest flood on record occurred in October 1973 when Blue Springs suffered $7,000 in damage.

2.4 Flood Protection Measures

No flood protection measures exist within the Village of Barneston or the City of Blue Springs. In Barneston, the Union Pacific Railroad embankment serves as a breakwater against the less frequent flooding events.

In the City of Beatrice, a small earth levee was built along the left bank of the Big Blue River above the mouth of Indian Creek. There is a 6-foot levee that extends from Bluff to Front Streets along the right bank of the Big Blue River. A new channel for Indian Creek was constructed between the mouth and Irving Street. A levee 4 feet high has been constructed on the right bank of Indian Creek beginning approximately 700 feet west of its confluence with the Big Blue River. This levee ties into the left bank levee of the Big Blue River and runs east to the mouth of the Indian Creek. It then proceeds upstream along the right bank and ends near the Chicago, Burlington, and Quincy Railroad fill. On the left bank of Indian Creek, a levee, approximately 1000 feet long and 12 feet high, was constructed between the Chicago, Burlington,

and Quincy Railroad and Union Pacific Railroad fills. The levees located in Beatrice do not provide adequate protection from the 1-percent-annual-chance flood.

3.0 ENGINEERING METHODS

For the flooding sources studied by detailed methods within the County, 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- or 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-term 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-annual-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.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail affecting the community.

This FIS report includes information from previously published FIS reports where streams were studied in detail. It also includes information for streams studied by approximate methods by NDNR.

Pre-Countywide

Detailed Studies

Peak discharges for 10-, 2-, 1- and 0.2-percent-annual-chance floods of each flooding source studied in detail in previous FIS reports are shown in Table 3. Hydrologic analyses were carried out to establish peak discharge-frequency relationships for each flooding source studied by detailed methods

City of Beatrice. The discharges for Big Blue River were obtained from "Magnitude and Frequency of Floods in Nebraska" (Reference 6). The discharges are summarized in Table 3. Statistical analyses methods were used to compute the 2-, 1-, and 0.2-percent-annual-chance floods.

City of Blue Springs. The 1-percent-annual-chance discharge used in this analysis was obtained from a United States Geological Survey (USGS) publication entitled, "Magnitude and Frequency of Floods in Nebraska" (Reference 6).

The 10-percent-annual-chance discharge was determined by a relationship between the 10-percent and 1-percent-annual-chance regional equations and the published 1-percent-annual-chance flow in the Big Blue River Floodplain Study (Reference 2).

Peak discharges for the 10-percent and 1-percent-annual-chance floods of each flooding source studied in detail in the community are shown in Table 3.

Village of Barneston. The discharges used in this study were obtained from the report "Magnitude and Frequency of Floods in Nebraska" (Reference 6). Peak discharges for the 10-percent and 1-percent-annual-chance floods of the flooding source studied in detail in the community are shown in Table 3.

Countywide

New Detailed Study

For this FIS, a hydrologic analysis was carried out to establish peak discharge-frequency relationships for Big Blue River Tributary 44. In accordance with the Performance Work Statement (PWS) for this project, regression equations were used to determine the discharge rates for flood events with recurrence intervals of 10-, 50-, 100- and 500-years. These events have a 10-, 2-, 1- and 0.2-percent chance, respectively, of being equaled or exceeded during any given year. Hydrologic calculations for this report were performed using the Beckman regression equations. These equations are presented in the USGS Water Resources Investigation Report (WRIR) 76-109 (Reference 6). WRIR 76-109 was prepared by the USGS in cooperation with the Nebraska Department of Roads. In the report, the entire state was divided into five regions of influence (Regions 1 through 5) and different regression equations were provided for the different regions for recurrence intervals up to the 1-percent-annual-chance event.

Since the Beckman regression equations are only applicable for storms with recurrence intervals up to the 1-percent-annual-chance event, the 0.2-percent-annual-chance discharge values were estimated based on the results obtained for the 10-, 2- and 1-percentannual-chance events. For each sub-basin, the discharge values calculated using the Beckman regression equations for the 10-, 2- and 1-percent-annual-chance storms were plotted in Microsoft Excel and a logarithmic trendline was plotted on the chart. The equation for the logarithmic trendline was then used to estimate the discharge value for the 0.2-percent-annual-chance storm for each sub-basin.

The watershed for Big Blue River Tributary 44 is located in Region 5. Therefore, multi-variable regression equations that are applicable to Region 5 were used to determine the 10-, 2- and 1-percent-annual-chance discharges.

Table 3. Summary of Discharges

Flooding Source and Location	Drainage Area (square miles)	Peak Discharges (cubic feet per second)			
		10-percent-annual-chance	2-percent-annual-chance	1-percent-annual-chance	0.2-percent-annual-chance
Big Blue River					
At Confluence of Indian Creek	3,900	N/A	48,000	60,000	90,860
At Blue Springs	3,901	28,800	N/A	61,000	N/A
At State Highway 8	N/A	16,000	N/A	62,000	N/A

N/A- Data Not Available

Approximate Studies

Peak discharges for the 1-percent-annual-chance (100-year) storm event were determined for all approximate study reaches in Gage County (streams draining greater than a square mile) by NDNR in 2007. Hydrologic calculations were performed using the 1976 Beckman Equations. For Big Blue River, there were three annual peak flow USGS gaging stations and hence a peak flow-frequency analysis was performed following Bulletin17B guidelines using the USGS software PKFQWin (Version 5).

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 the floods of the selected recurrence intervals. Users should be aware that flood elevations shown on the FIRM represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles or in the Floodway Data table 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 hydraulic analyses for this study are based only on the effects of unobstructed flow. The flood elevations shown on the Flood Profiles are, thus, considered valid only if hydraulic structures remain unobstructed, operate properly and do not fail.

This FIS report includes information from previously published FIS reports where streams were studied in detail, new information for Big Blue River Tributary 44, which was studied in detail for this FIS, and information from approximate reaches studied by the NDNR.

Pre-Countywide

Detailed Studies

City of Blue Springs. Cross-sections for Big Blue River were field surveyed during the period of August 1974 to February 1975. Adjustments were made to the valley cross-sections to eliminate areas which would be ineffective in conveyance of flood waters.

Locations of selected cross-sections used in the hydraulic analyses are shown on the Flood Profiles. For stream segments for which a floodway was computed (Section 4.2), selected cross-section locations are also shown on the FIRM.

The roughness coefficients (Manning's "n") were assigned on the basis of field inspections. The "n" values ranged from 0.030 to 0.050 for the channel and from 0.060 to 0.070 for the overbank areas.

The flood profile for the 1-percent-annual-chance event flood was generated through the use of the U.S. Army Corps of Engineers' (USACE) HEC-2 computer program (Reference 7).

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals.

City of Beatrice. Cross-sections for Big Blue River and Indian Creek in the hydraulic analyses were obtained from surveys done in the summer and autumn of 1975 by L. Robert Kimball Surveyors. Additional cross-sections were obtained from a study being conducted by the USACE (unpublished). Bridge and culvert geometry was secured from the same sources. Locations of selected cross-sections used in the hydraulic analyses are shown on the Flood Profiles. For stream segments for which a floodway is computed (Section 4.2), selected cross-section locations are also shown on the FIRM

In addition to the sections shown, another cross-section was located at each bridge structure, as required in the HEC-2 computer model (Reference 7). This program was used to determine profiles for the 10-, 2-, 1-, and 0.2-percent-annual-chance flood discharges. Twenty-four cross-sections were used in the Big Blue River analysis and thirty in the Indian Creek analysis.

The roughness coefficients, which were sensitized to adjust the profiles, were determined from site investigation, topographic mapping, and aerial photographs. At each cross-section, several values were used to describe the variation in lateral roughness. The channel roughness value for the Big Blue River was set at 0.040, and the overbank values varied from 0.045 to 0.120. For Indian Creek, the channel roughness values varied from 0.035 to 0.070, and the overbank values varied from 0.035 to 0.120. The roughness coefficients quoted are before sensitization.

Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals (Exhibit 1). The 2-percent and 1-percent-annual-chance profiles for both the Big Blue River and Indian Creek developed by the USACE (Reference 8) were adopted for use in this study because the profiles compared well to the profiles determined using the HEC-2 computer program (Reference 7).

The flood hazard information for Big Blue River and Indian Creek was revised in January 1985. The entire length of the Big Blue River within the ETJ limits of Beatrice was revised to reflect new discharge values and to extend flooding to the ETJ limits. Indian Creek was revised to reflect the latest Big Blue River backwater effects, to incorporate new floodplain conditions, and to extend flooding to the ETJ limits.

The USACE's HEC-2 hydraulic analysis (Reference 7) for the Big Blue River was revised to incorporate the revised peak discharges. The 10-percent-annual-chance flood was not calculated due to insufficient data. Zone designation information was obtained by approximate methods. Starting water surface elevations, cross-section locations, and roughness coefficients were still considered valid from the initial analysis and were not changed for this reanalysis.

The USACE's HEC-2 hydraulic analysis (Reference 7) for Indian Creek was revised to show the placement of fill in the overbank. Approximately 5 cross-section locations were field surveyed and added to the initial hydraulic analysis to show the location and extent of fill. The starting water surface elevations and roughness coefficients were still considered valid from the initial analysis and were not changed for the 1985 reanalysis.

Village of Barneston. Water-surface elevations were determined through use of the USACE's HEC-2 computer program (Reference 7). Cross-sections used for

input into the program were field surveyed, and values for Manning's coefficient were selected for each cross-section based on channel and overbank conditions. Adjustments were made to the cross-sections so that areas of non-effective flow would not be included in the computer analysis.

The cross-sections used in the analysis of the Big Blue River are located outside the community.

Flood profiles were drawn showing the computed water-surface elevations for the 1-percent-annual-chance flood.

Countywide

New Detailed Study

For this countywide study, water surface profile computations on Big Blue River Tributary 44 were carried out to determine flood elevations for the 10-, 2-, 1- and 0.2-percent-annual-chance floods and to facilitate floodway computation. Hydraulic analyses were performed using the USACE's HEC-RAS (v.3.1.3) computer program (Reference 9). Data entry and manipulation for the HEC-RAS model were performed largely using GIS techniques and the HEC-GeoRAS software extension for ESRI's ArcGIS software package.

The topographic, cross-section, and hydraulic structure surveys were performed by JEO Consulting Group, Inc. (JEO), of Wahoo, Nebraska. Field work was completed in June 2007.

HEC-GeoRAS was used to extract the cross-sections, stream centerline, reach lengths and initial bank stations from the GIS into HEC-RAS. Manning's "n" values were estimated and assigned based on data obtained during the survey and during field reconnaissance. The Manning's "n" values ranged from 0.010 to 0.100.

Hydraulic structures were modeled using the survey data provided by JEO. The HEC-RAS model consists of six sets of two cross-sections at the six structures and 22 additional cross-sections over the 1.2 mile length of the detailed study reach. Discounting the structure inlet and outlet cross-sections, this amounts to approximately one cross-section per every 300 feet. Stream flows were input at three locations.

Regulatory floodway limits were calculated for Big Blue River Tributary 44. The floodway was calculated by initially using Method 4 and then importing the results into Method 1 in the HEC-RAS computer program and following guidelines in Appendix C of FEMA's Guidelines and Specifications for Flood Hazard Mapping Partners. The target rise is 1.0 feet.

Approximate Streams Hydraulics

For the 2007 NDNR study, flood depths were computed in ArcView 3.2 using Manning's equation in a flood depth calculator developed by NDNR. Streams draining one square mile or more, as calculated during the hydrology step, were digitized by hand to match digital elevation contours, or adapted from 24,000 scale streams from the National Hydrographic Dataset (NHD). Station and elevation data were calculated at each point where the digitized cross-section line intersects the digital contours and the digitized stream. Flood depths were calculated using the 1-

percent-annual-chance probability discharge, the channel cross-section, Manning's n value (0.05), and channel slope. The 1-percent-annual-chance water surface elevation was written to the cross-section shape file.

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.

All flood elevations shown in this FIS report and on the FIRM 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. Effective information for this FIS was converted from NGVD29 to NAVD88. An average conversion of 0.38 feet (NGVD29 + 0.38 = NAVD88) was applied uniformly across the county to convert all effective BFEs and other profile elevations.

For more information on NAVD88, see the FEMA publication entitled *Converting the National Flood Insurance Program to the North American Vertical Datum of 1988* (FEMA, June 1992), or contact the Vertical Network Branch, National Geodetic Survey, Coast and Geodetic Survey, National Oceanic and Atmospheric Administration, Silver Spring, Maryland 20910. (Internet address 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 (TSDN) 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 the 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 and Floodway Data Tables. 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

In order to provide a national standard without regional discrimination, the 1-percent-annual-chance flood has been adopted by FEMA as the base for floodplain management purposes. The 0.2-percent-annual-chance floods are 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.

The 1- and 0.2-percent-annual-chance floodplain boundaries are shown on the FIRM (published separately). On this map, the 1-percent-annual-chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A and AE); and the 0.2-percent-annual-chance floodplain boundaries correspond to the boundary of the areas of moderate flood hazards (Zone X). 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 on the FIRM (published separately). 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 the streams studied by approximate methods, only the 1-percent-annual-chance floodplain boundary is shown on the FIRM (published separately).

Pre-Countywide

Village of Barneston. For each stream studied in detail, the boundaries of the 1-percent-annual-chance flood were delineated using aerial photographs at a scale of 1:12,000 (Hoskins-Western-Sonderegger Consulting Engineers, May 1976).

City of Beatrice. For each stream studied in detail, the boundaries of the 1-percent-annual-chance and the 0.2-percent-annual-chance flood were delineated using the flood elevations determined at each cross-section; between cross-sections, the boundaries were interpolated using USGS 7.5-minute series topographic maps at a scale of 1:9,600, with a contour interval of 10 feet (Beatrice East, 1957; Beatrice West, 1957; Blue Springs, 1964; and Odell Northeast, 1970).

City of Blue Springs. For each stream studied in detail, the boundaries of the 1-percent-annual-chance flood were delineated using the flood elevations determined at each cross-section. Between cross-sections the boundaries were interpolated using aerial photographs at a scale of 1:12,600 (Hoskins-Western-Sonderegger Consulting Engineers, May 1976).

For streams studied by approximately methods, only the 1-percent-annual-chance floodplain boundary was delineated using the Flood Hazard Boundary Map for Gage County, Nebraska (U.S. Department of Housing and Urban Development, August 1977).

Countywide

For this FIS, floodplain mapping was completed using 2006 orthophotography produced by the USDA/FSA – Aerial Photography Field office as a base map. The orthophotography was at a scale of 1:12,000.

Topographic data for the new detailed study area, Big Blue River Tributary 44, is based on a topographic field survey with a contour interval of 2 feet completed by JEO, in June of 2007. For the remainder of the county, only USGS 1:24,000 quadrangle maps and 1/3 arc second Digital Elevation Models (DEMs) were available.

The Big Blue River Tributary 44 floodplain was delineated to the topographic data provided by JEO. The rest of the detailed studies in the county were digitally converted from rectified effective flood maps.

Where there were conflicts between topographic data and orthophotography, the floodplain boundaries were adjusted to match the new base map data in accordance with FEMA's Guidelines and Specifications for Mapping Partners, Sections C.6.1.4 and C.6.1.5.

Because the effective maps are community based, several of the detailed studies stop at corporate boundaries on effective maps. This is the case for Big Blue River in both Blue Springs and Barneston. In order to produce a seamless countywide map, the floodplains past the corporate boundaries were digitally converted from the original study titled "Floodplain Study Big Blue River". The study was completed by the Nebraska Natural Resources Commission and dated March 1977. A copy of the study was provided by the NDNR. Studies were converted as detailed (Zone AE) where a corresponding profile was present in the effective FIS report.

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 existing-conditions 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 standards of FEMA limit such increases in flood heights 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.

The floodways presented in this FIS and on the FIRMs were directly obtained from the previous FIS reports' Floodway Data Tables. They were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross-sections. Between cross-sections, the floodway boundaries were interpolated. The results of the floodway computations were tabulated at selected cross-sections in Table 4. In cases where the floodway and 1-percent-annual-chance floodplain boundaries are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and the 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 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 2.

The floodways in this report are recommended to local agencies as minimum standards that can be adopted or used as a basis for additional studies.

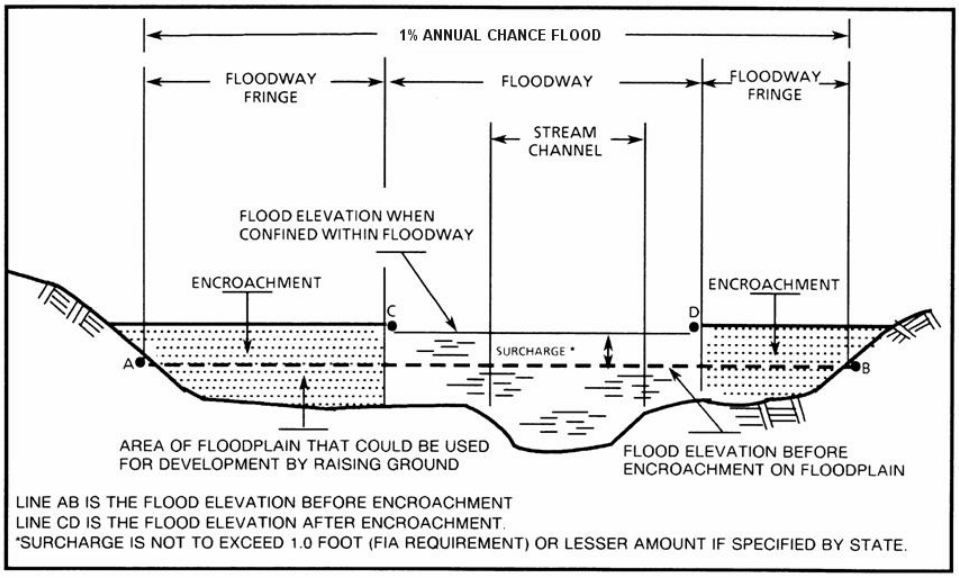


Figure 2. Floodway Schematic

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE (FEET)
Big Blue River								
A	75,134	2,199	15,789	3.8	1217.4	1217.4	1218.3	0.9
B	137,766	1,048	28,393	2.4	1253.5	1253.5	1254.5	1.0
C	141,716	1,103	24,978	3.5	1254.1	1254.1	1255.1	1.0
D	144,416	1,378	31,589	3.8	1254.6	1254.6	1255.6	1.0
E	147,016	1,475	35,342	2.1	1254.9	1254.9	1255.9	1.0
F	148,446	1,632	35,177	3.8	1255.1	1255.1	1256.1	1.0
G	149,496	1,863	31,551	4.3	1255.4	1255.4	1256.4	1.0
H	150,271	1,234	24,008	5.3	1255.7	1255.7	1256.7	1.0
I	150,796	1,500	34,069	3.8	1255.9	1255.9	1256.9	1.0
J	151,186	2,076	14,852	5.3	1256.1	1256.1	1256.9	0.8
K	152,380	1,650	12,497	5.6	1257.1	1257.1	1257.5	0.4
L	153,583	2,600	38,088	4.2	1258.4	1258.4	1258.9	0.5
M	154,983	2,095	36,409	4.0	1258.8	1258.8	1259.3	0.5
N	155,983	2,157	32,159	4.4	1259.1	1259.1	1259.6	0.5
O	158,245	2,715	43,409	3.7	1259.9	1259.9	1260.4	0.5
P	159,255	2,544	39,543	2.9	1260.0	1260.0	1260.6	0.6
Q	162,255	3,499	49,521	2.8	1260.4	1260.4	1261.0	0.6

[1]Feet above State Boundary

Table 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

GAGE COUNTY, NE
AND INCORPORATED AREAS

FLOODWAY DATA

BIG BLUE RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE (FEET)
Big Blue River Tributary 44								
A	2,107	76	362	5.8	1254.2	1243.2 [2]	1244.1	0.9
B	3,247	130	1,391	1.5	1259.2	1259.2	1259.6	0.4
C	4,739	46	201	8.9	1262.7	1262.7	1262.9	0.2
D	5,720	115	612	2.9	1272.2	1272.2	1273.1	0.9

[1]Feet above confluence with Big Blue River [2]Elevations without considering backwater effect from Big Blue River

Table 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

GAGE COUNTY, NE
AND INCORPORATED AREAS

FLOODWAY DATA

BIG BLUE RIVER TRIBUTARY 44

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE (FEET)
Indian Creek								
A	3,129	300	2,743	5.4	1259.2	1252.2 [2]	1252.4	0.2
B	4,129	500	3,889	2.8	1259.2	1253.3 [2]	1254.2	0.9
C	4,403	500	7,345	0.8	1259.2	1254.7 [2]	1255.2	0.5
D	5,380	650	1,835	6.6	1259.2	1254.8 [2]	1255.6	0.8
E	7,135	500	1,553	6.2	1259.2	1255.9 [2]	1256.8	0.9
F	7,167	500	1,733	5.7	1259.2	1256.2 [2]	1256.9	0.7
G	7,787	225	2,056	6.1	1259.2	1257.0 [2]	1257.4	0.4
H	9,912	400	4,908	2.3	1263.4	1263.4	1264.0	0.6
I	13,577	250	2,633	3.8	1267.3	1267.3	1267.9	0.6
J	14,827	710	6,031	1.8	1268.4	1268.4	1269.3	0.9
K	16,777	425	4,397	2.1	1269.3	1269.3	1270.2	0.9
L	20,557	928	1,648	3.6	1271.2	1271.2	1271.9	0.7
M	23,377	1,000	5,701	0.9	1273.6	1273.6	1274.3	0.7

[1]Feet above Confluence with Big Blue River [2]Elevations without considering backwater effect from Big Blue River

Table 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

GAGE COUNTY, NE
AND INCORPORATED AREAS

FLOODWAY DATA

INDIAN CREEK

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 — The flood insurance risk zone that corresponds to the 1-percent-annual-chance floodplains that are determined in the FIS by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no BFEs or base flood depths are shown within this zone.

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

Zone X — The flood insurance risk 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, and areas protected from the 1-percent-annual-chance flood by levees. No BFEs or base flood depths are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP (FIRM)

The FIRM is designed for flood insurance and floodplain management applications.

The FIRM for Gage County is, for insurance purposes, the principal result of the FIS. This map (published separately) contains the official delineation of flood insurance zones and BFE lines. BFE lines show the locations of the expected whole-foot water-surface elevations of the base flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by FEMA.

For flood insurance applications, the map designates flood insurance rate 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 base flood elevations or average depths. Insurance agents use the zones and base flood elevations for existing conditions 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-chance-annual floodplains. Floodways for the 1-percent-annual-chance flood extent and the locations of selected cross-sections used in the hydraulic analyses and floodway computations are shown where applicable. This FIRM included flood hazard information that was presented separately on the Flood Boundary and Floodway Maps in previously printed FISs in Gage County, Nebraska.

The current FIRM presents flooding information for the entire geographic area of Gage County. Previously, separate FIRMs were prepared for each identified floodprone incorporated community and for the unincorporated areas of the county. Historical data relating to the maps prepared for each community are presented in Table 5.

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.

Village of Barneston. This countywide FIS supersedes the September 1974 Flood Hazard Boundary Map (Reference 10) and the October 3, 1984 FIS for the Village of Barneston (Reference 1).

City of Beatrice. This countywide FIS supersedes the September 1977 and the January 3, 1985 FIS for the City of Beatrice (References 11 and 3).

City of Blue Springs. This countywide FIS supersedes the December 1975 Flood Hazard Boundary Map (Reference 12) and the June 3, 1986 FIS for the City of Blue Springs (Reference 4).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting the Flood Insurance and Mitigation Division, FEMA, Region V11, 9221 Ward Parkway, Suite 300, Kansas City, Missouri 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.

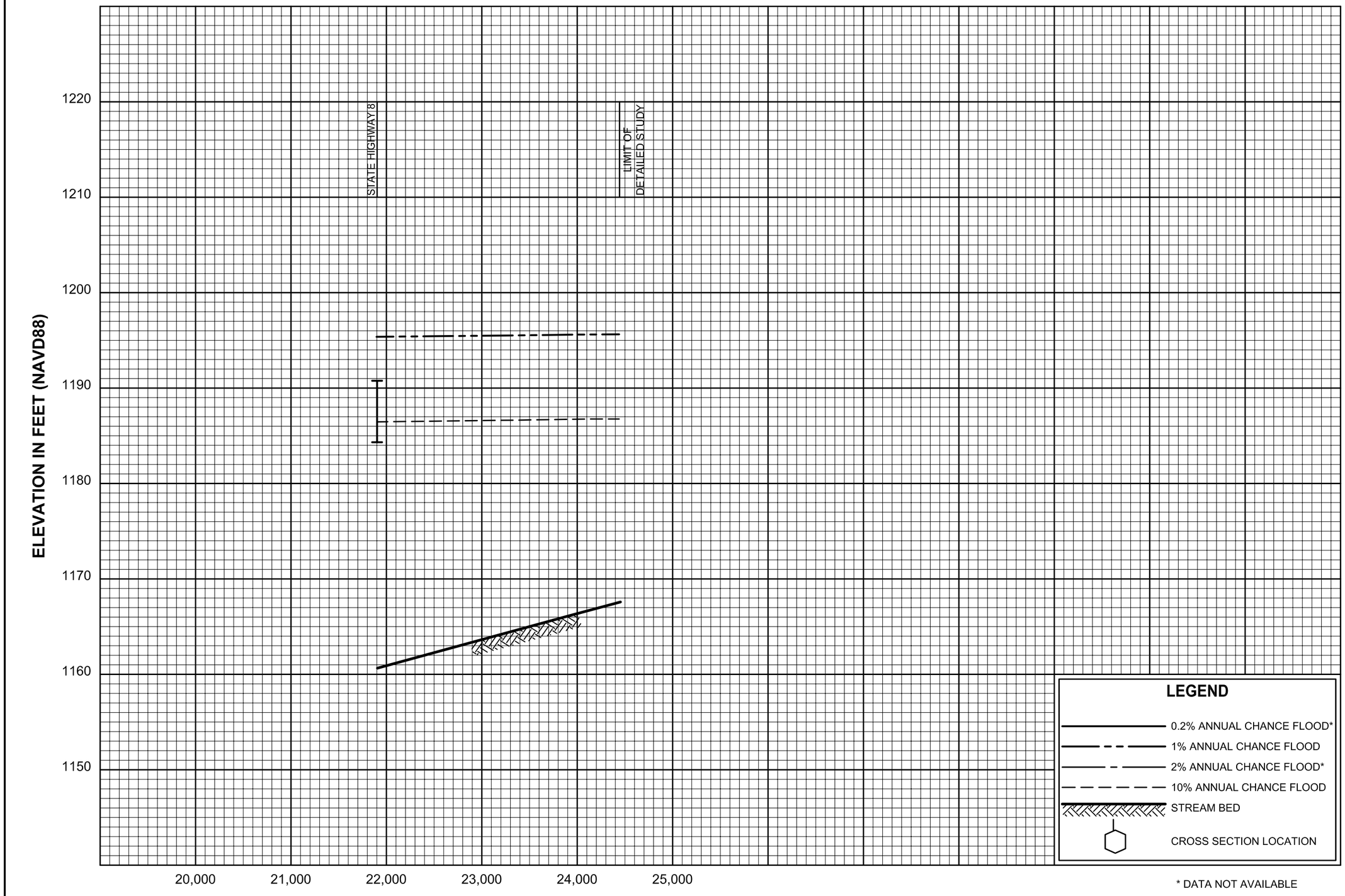
Community Map History

Community Name	Initial Identification	Flood Hazard Boundary Map Revisions Date	FIRM Effective Date	FIRM Revisions Date
Adams,Village of	June 18, 2010	None	June 18, 2010	
Barneston, Village of	September 6, 1974	November 21, 1975	April 3, 1985	None
Beatrice, City of	August 6, 1976	None	September 30, 1977	January 3 ,1985
Blue Springs, City of	January 9, 1974	December 5, 1975	June 3, 1986	None
Clatonia, Village of	November 29, 1974	None	September 18, 1985	None
Cortland, Village of	N/A	N/A	N/A	N/A
* Filley, Village of	N/A	N/A	N/A	N/A
Gage County (Unincorporated Areas)	August 9, 1977	None	May 1, 1990	None
Liberty, Village of	June 18, 2010	None	June 18, 2010	
Odell, Village of	September 6, 1974	November 28, 1975	June 1, 1987	None
Pickrell, Village of	June 18, 2010	None	June 18, 2010	
* Virginia, Village of	N/A	N/A	N/A	N/A
Wymore, City of	May 3, 1974	September 3, 1976	July 2, 1987	None

* Non-Floodprone

9.0 BIBLIOGRAPHY AND REFERENCES

1. Federal Emergency Management Agency, Flood Insurance Study, Village of Barneston, Nebraska, October 1984.
2. Nebraska Natural Resources Commission, Flood Plain Study, Big Blue River, Volume 1, Gage County, Nebraska, March 1977.
3. Federal Emergency Management Agency, Flood Insurance Study, City of Beatrice, Nebraska, January 1985.
4. Federal Emergency Management Agency, Flood Insurance Study, Village of Blue Springs, Nebraska, June 1986.
5. U.S. Census Bureau's 2006 Population Estimate for Gage County, Nebraska; retrieved June 25, 2008, from http://factfinder.census.gov.
6. U.S. Geological Survey, Water Resources Investigation Report (WRIR) 76-109, Magnitude and Frequency of Floods in Nebraska. Beckman, October 1976.
7. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water-Surface Profiles Generalized Computer Program, Davis, California, November 1976.
8. U.S. Army Corps of Engineers, Kansas City District, Flood Plain Information Report, Big Blue River and Indian Creek, Beatrice, Nebraska, June 1970.
9. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-3.1.3 Water-Surface Profiles Generalized Computer Program, Davis, California, May 2005.
10. _____, Federal Insurance Administration, Flood Hazard Boundary Map, Village of Barneston, Nebraska, September 1974.
11. _____, Federal Insurance Administration, Flood Hazard Boundary Map, Village of Beatrice, Nebraska, December 1975.
12. _____, Federal Insurance Administration, Flood Hazard Boundary Map, City of Blue Springs, Nebraska, December 1975.



FLOOD PROFILES

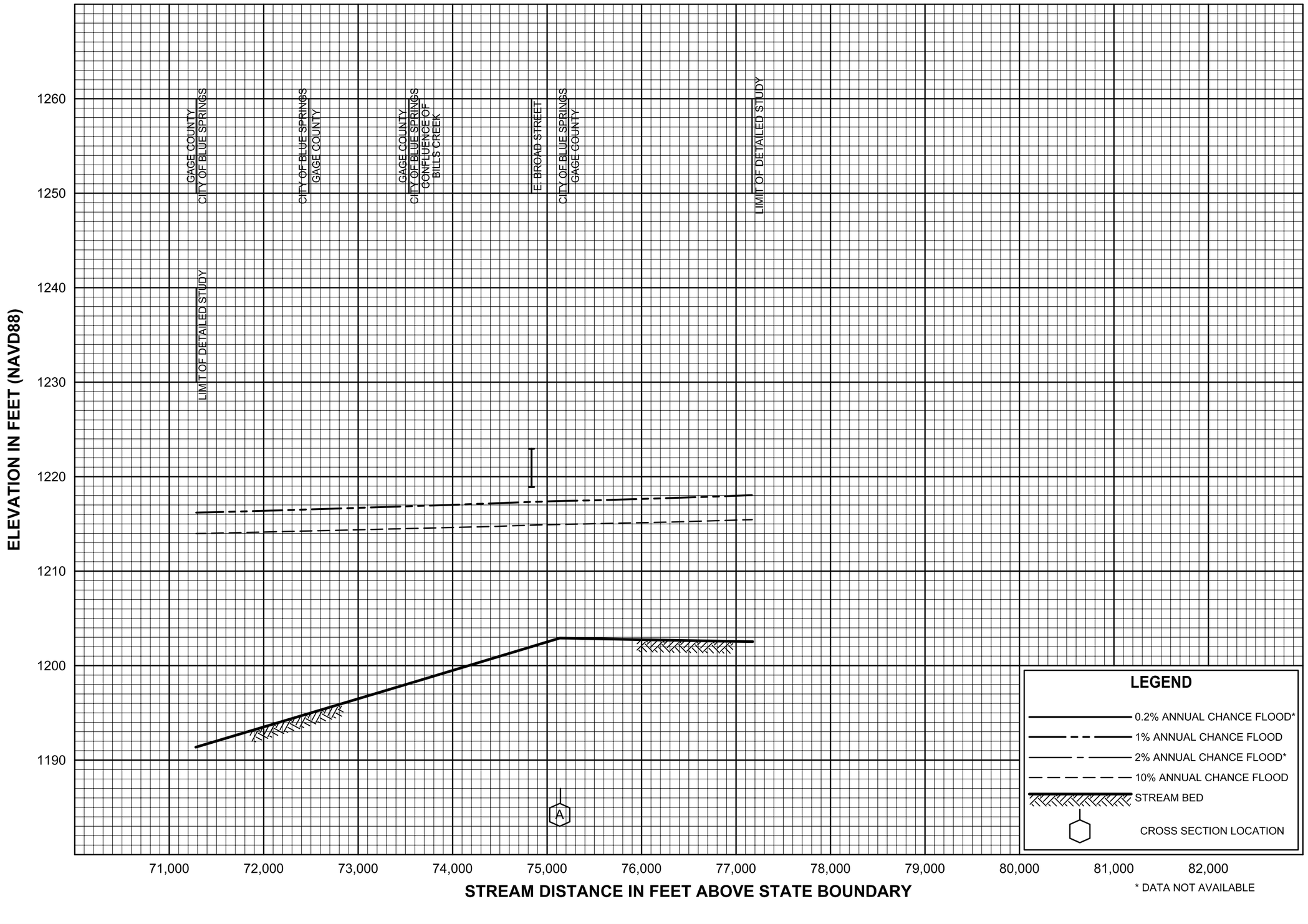
BIG BLUE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

GAGE COUNTY, NE

AND INCORPORATED AREAS

01P



FLOOD PROFILES

BIG BLUE RIVER

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GAGE COUNTY, NE

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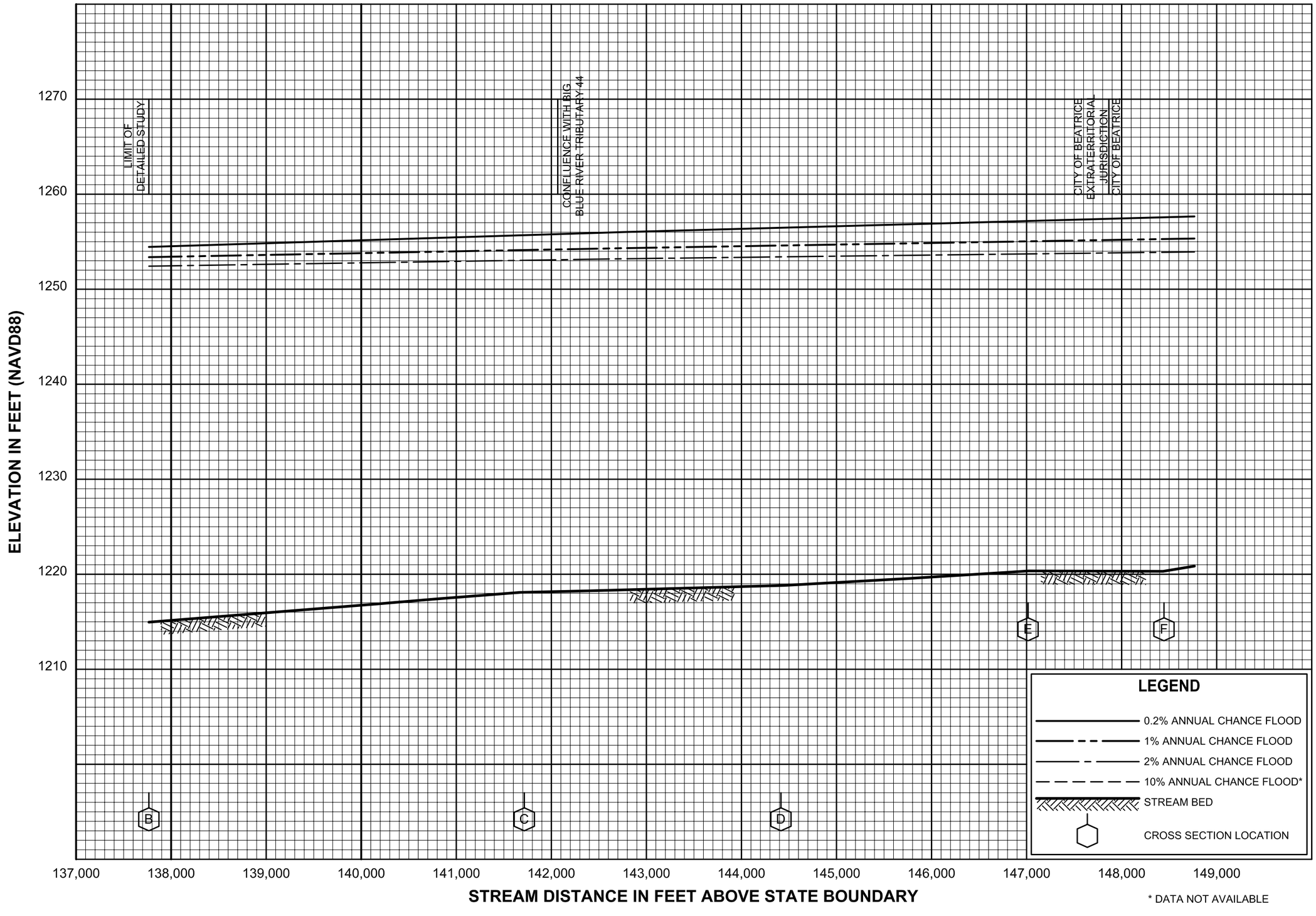

FLOOD PROFILES

BIG BLUE RIVER

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GAGE COUNTY, NE

AND INCORPORATED AREAS

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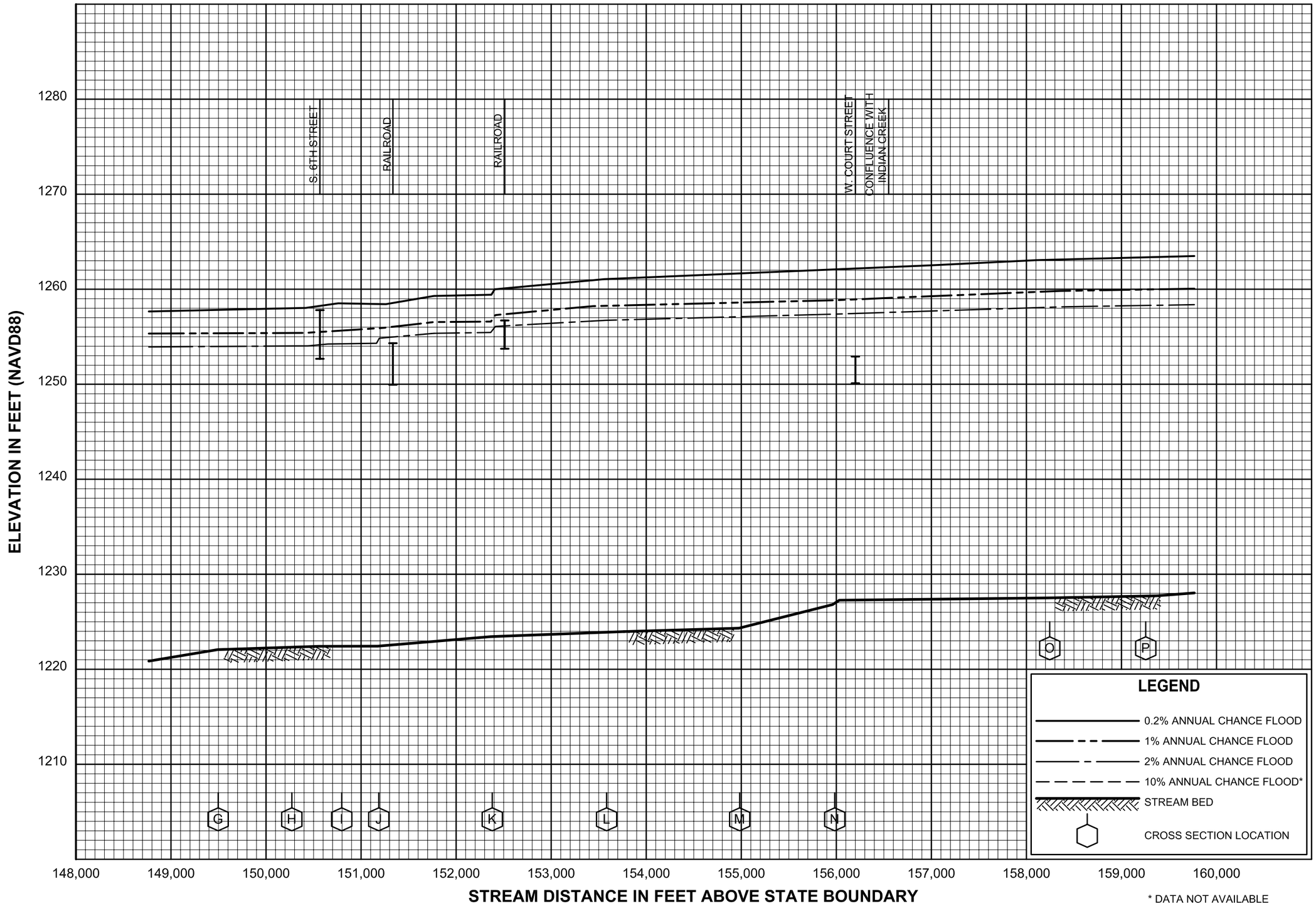

FLOOD PROFILES

BIG BLUE RIVER

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GAGE COUNTY, NE

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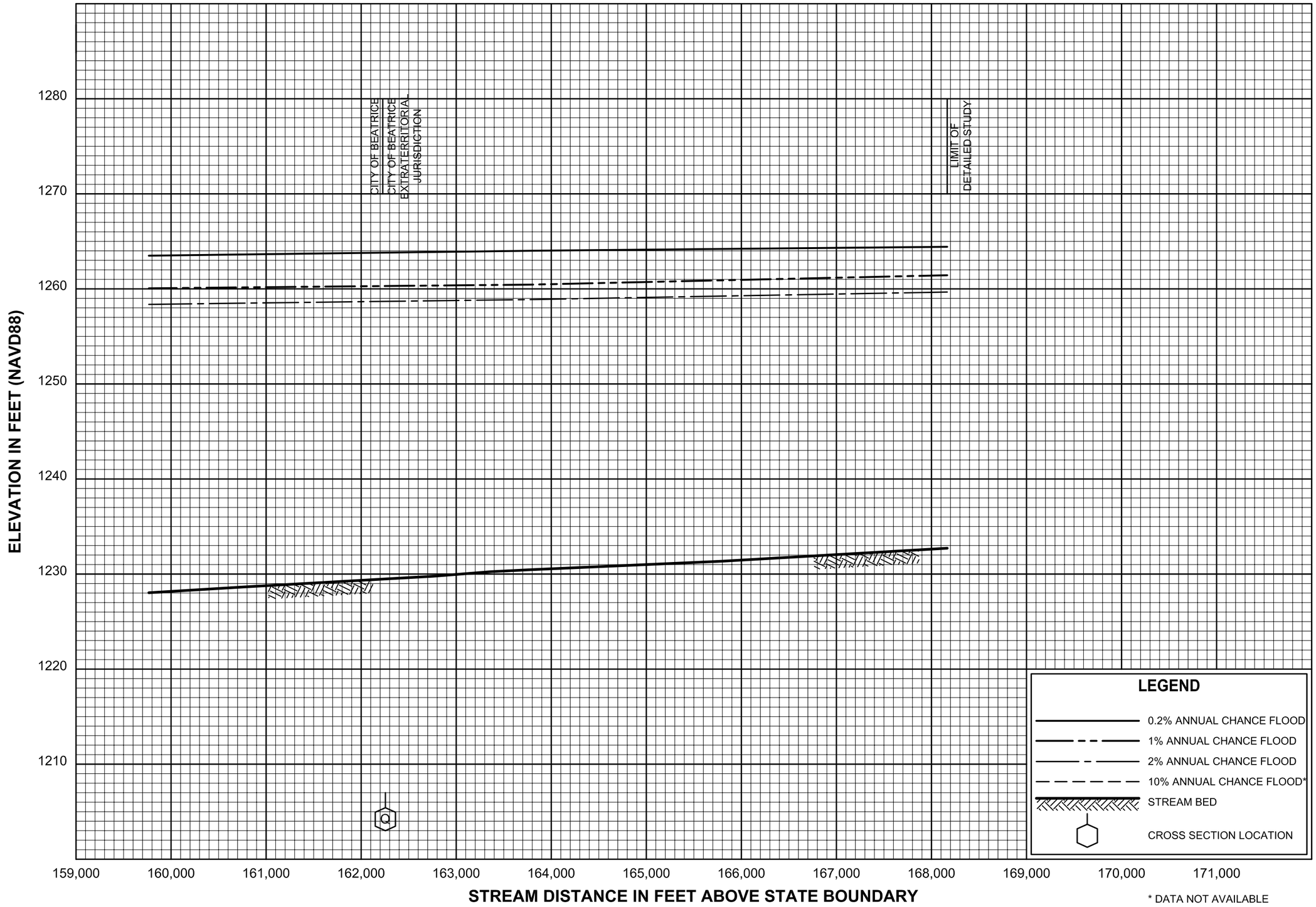

FLOOD PROFILES

BIG BLUE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

GAGE COUNTY, NE

AND INCORPORATED AREAS

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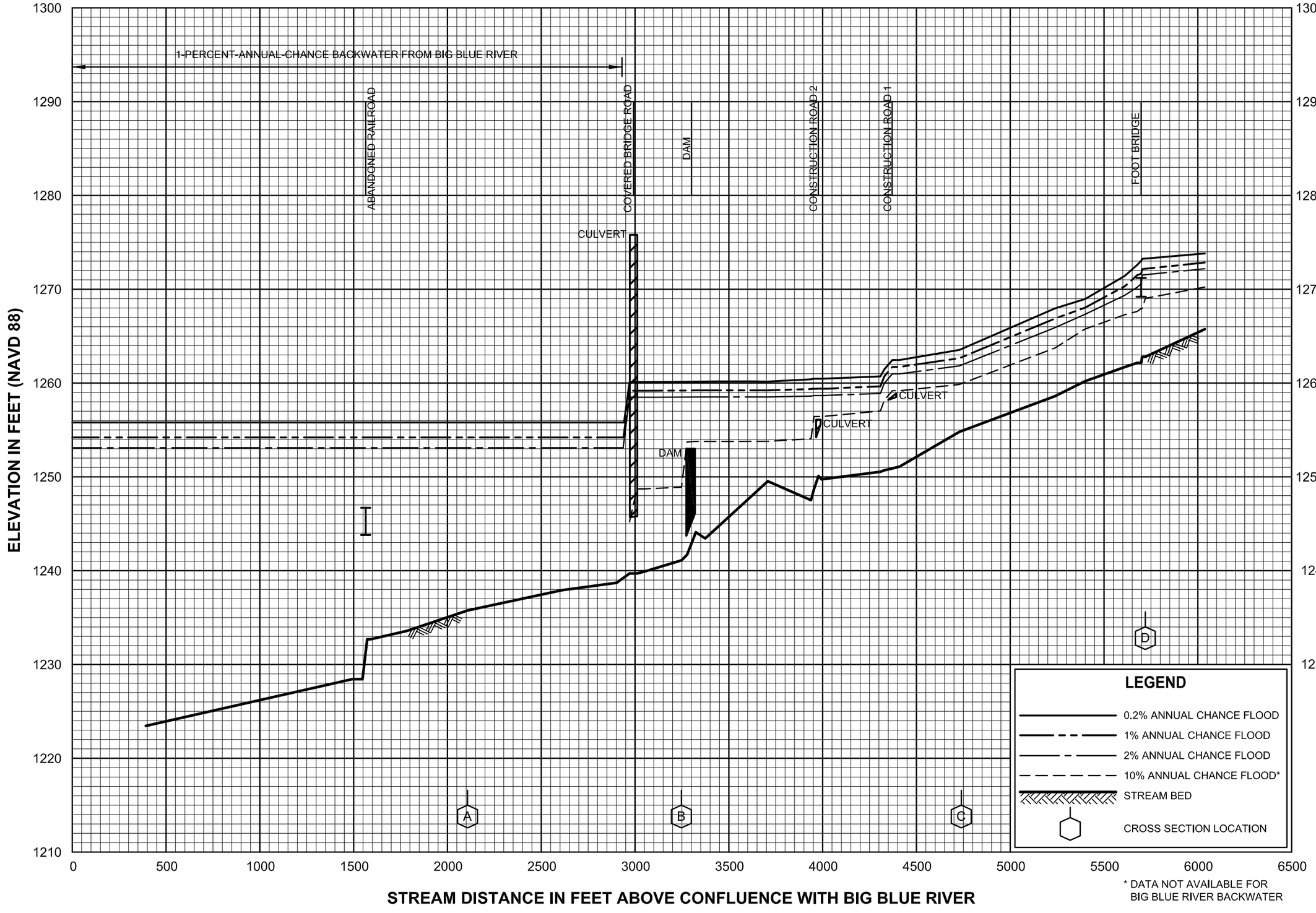
FLOOD PROFILES

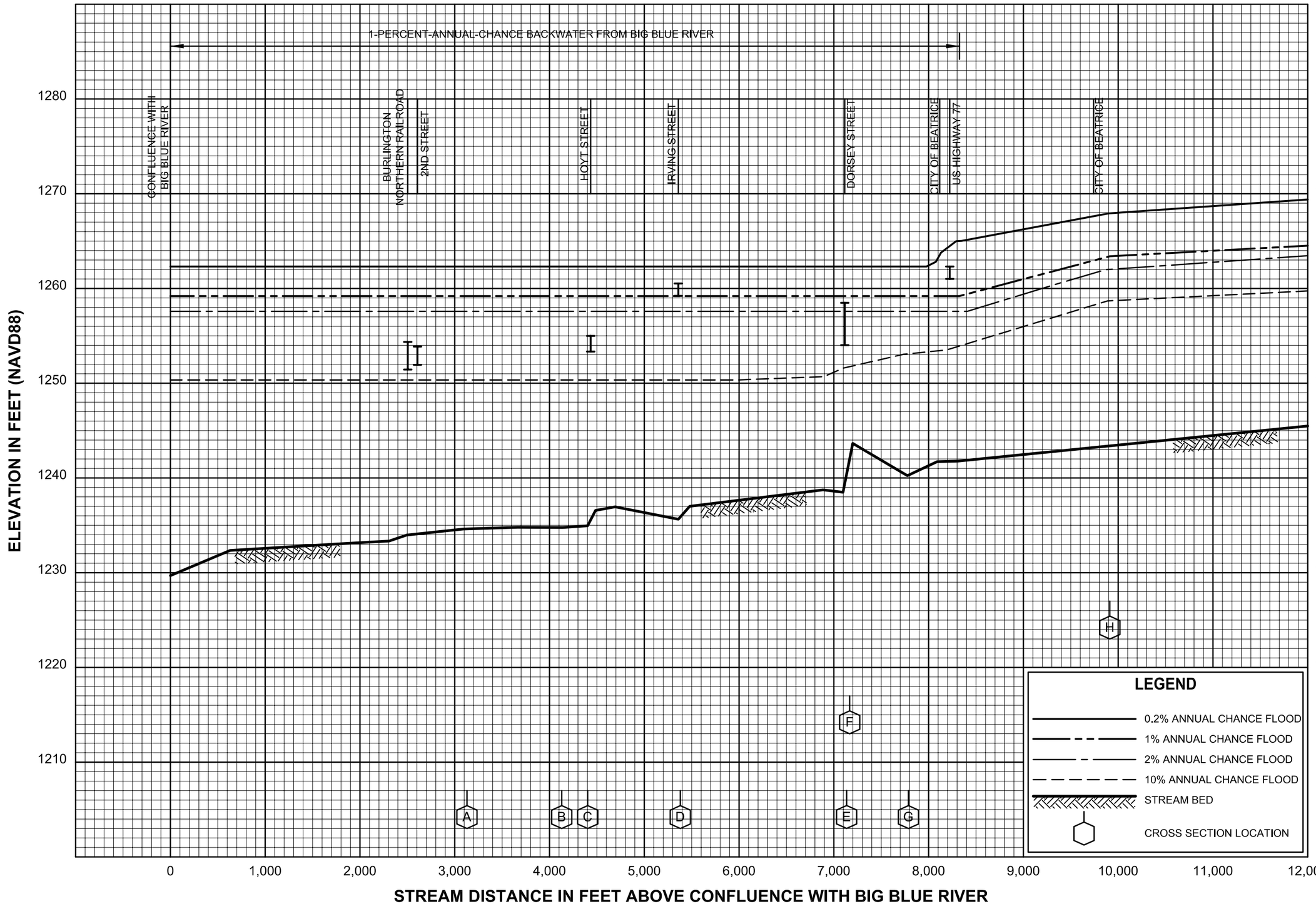
BIG BLUE RIVER TRIBUTARY 44



FEDERAL EMERGENCY MANAGEMENT AGENCY

GAGE COUNTY, NE

AND INCORPORATED AREAS



FLOOD PROFILES

INDIAN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

GAGE COUNTY, NE

AND INCORPORATED AREAS

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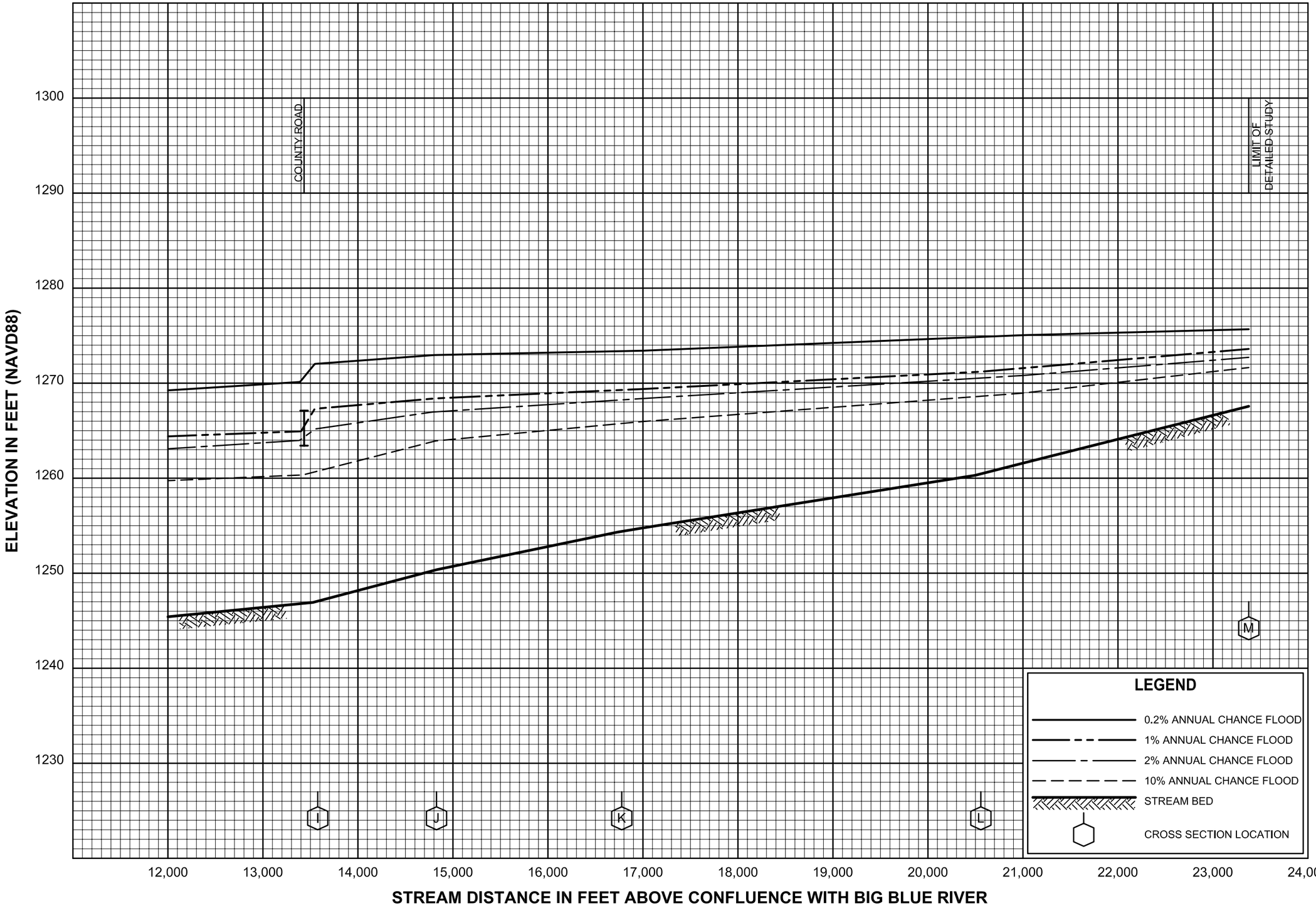

FLOOD PROFILES

INDIAN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

GAGE COUNTY, NE

AND INCORPORATED AREAS

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