FLOOD INSURANCE STUDY

VOLUME 1 OF 4

BOULDER COUNTY, COLORADO

AND INCORPORATED AREAS

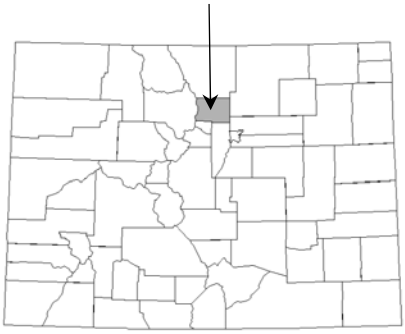
Notice

This preliminary FIS report includes only revised Flood Profiles and Floodway Data Tables. See "Notice to Flood Insurance Study Users" page for additional details.

Community Name	*Community Number*
BOULDER, CITY OF	080024
BOULDER COUNTY (UNINCORPORATED AREAS)	080023
ERIE, TOWN OF	080181
JAMESTOWN, TOWN OF	080216
LAFAYETTE, CITY OF	080026
LONGMONT, CITY OF	080027
LOUSIVILLE, CITY OF	085076
LYONS, TOWN OF	080029
NEDERLAND, TOWN OF	080255
SUPERIOR, TOWN OF	080203
*WARD, TOWN OF	080292

* No Special Flood Hazard Areas Identified

Boulder County



Preliminary
July 23, 2015

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
08013CV001C

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 2, 1995

Revised FIS Dates: May 6, 1996
October 4, 2002
December 18, 2012
'month' 'day', 'year'

This FIS report was revised on 'month' 'day', 'year'. Users should refer to Section 10.0, Revisions Description, for further information. Section 10.0 is intended to present the most up-to-date information for specific portions of this FIS report. Therefore, users of this report should be aware that the information presented in Section 10.0 may supersede information in Sections 1.0 through 9.0 of this FIS report.

NOTE: The South Boulder Creek floodplain, flood profiles and base flood elevations are based on two-dimensional modeling which provides highly detailed results that reveal multiple flow paths and significant variations in base flood elevations across the floodplain. The multiple profiles and the highlighted base flood elevations (BFEs) provide some detail that can be used to establish flood hazard at various locations across the floodplain. However, use of BFEs from the MIKE FLOOD BFE contour mapping or inundation raster GIS data is recommended to ensure accurate determination of BFEs for any given location.

The Preliminary FIS report does not include those Floodway Data Tables and flood profiles that are not impacted by this revision. These un-impacted components will appear in the final FIS report. In addition, profiles presented in the Preliminary FIS report are printed letter-size for easer of printing. Should you require full-size profiles for review, please consult the digital data provided to your community, or contact your local FEMA office.

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FLOOD INSURANCE STUDY
BOULDER COUNTY, COLORADO 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 Boulder County, Colorado, including the Cities of Boulder, Lafayette, Longmont, and Louisville, and the Towns of Erie, Jamestown, Lyons, Nederland, Superior, and Ward, and unincorporated areas of Boulder County (hereinafter referred to collectively as Boulder 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 Boulder 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 City of Longmont and the Town of Erie are geographically located in Boulder and Weld Counties. The Town of Superior is geographically located in Boulder and Jefferson County. The City of Longmont and Towns of Erie and Superior are included in their entirety in the Boulder County FIS report. Also note that there are no special flood hazard areas shown in the Town of Ward.

The City and County of Broomfield has a separately published FIS report and FIRM panels with an effective date of August 18, 2004. Broomfield has been removed from this FIS report and any references made on the Boulder County FIRM panels are for informational purposes only.

The Town of Erie has a separately published FIS report and FIRM panels with an effective date of December 2, 2004. This data has been incorporated in its entirety into this FIS.

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.

1.2 Authority and Acknowledgments

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

The countywide FIS was prepared by combining data from the Cities of Boulder, Lafayette, Longmont, and Louisville, and the Towns of Erie, Jamestown, Lyons, Nederland, and Superior, and unincorporated areas of Boulder County. Information on the authority and acknowledgements as compiled from their previously printed individual FIS reports is shown below.

Boulder County (Unincorporated Areas)

The hydrologic and hydraulic analyses for the original study for the unincorporated areas of Boulder County were performed by the U.S. Soil Conservation Service (SCS), for the Federal Emergency Management Agency (FEMA), under Interagency Agreement No. IAAA-H-16-72, Project Order No. 5. This study was completed in August 1974.

City of Boulder

The hydrologic and hydraulic analyses for the original study for the City of Boulder were performed by the U.S. Army Corps of Engineers (USACE), for FEMA, under Interagency Agreement No. IAA-H-15-72, Project Order Nos. 2 and 3, Amendment No. 1. This work was completed in October 1975.

The original hydrologic and hydraulic analyses completed for South Boulder Creek was developed by Greenhorne and O'Mara, Inc. in 1986 using a traditional floodplain mapping approach. The hydrologic and hydraulic analyses for South Boulder Creek were updated by HDR Engineering, Inc. (HDR). This work was completed in 2009.

Revised hydrologic and hydraulic analyses for the City of Boulder for Boulder Creek were completed in January 1983 by Muller Engineering Co, Inc.

Revised hydrologic and hydraulic analyses for the City of Boulder for Wonderland, Fourmile Canyon, Skunk Canyon, Bear Canyon, Twomile, and Goose Creeks were performed by MSM/SP Group, for FEMA, under Contract No. EMW-C-0709. This work was completed in April 1985.

Revised hydrologic and hydraulic analyses for the City of Boulder for Sunshine Canyon, Gregory Creek, Bluebell Canyon, and Fourmile Canyon Creeks and Kings Gulch were done by Greenhorne and O'Mara, Inc. This work was completed in August 1983.

Town of Erie

The hydrologic and hydraulic analyses for the area north of Perry Street, dated April 1978, were performed by Gingery Associates, Inc. (GAI), for FEMA, under Contract No. H-4017. Subsequent refinements of this hydrologic and hydraulic data were developed by Water Resources Consultants, Inc (WRC), in August 1980, and Michael Baker, Jr., Inc., in March 1981.

The hydrologic and hydraulic analyses for the reach of Coal Creek, south of the Union Pacific Railroad (UPRR), were performed by the U.S. Department of the Interior, Bureau of Reclamation, for FEMA, under Contract No. EMW-87-E-2551. This study was completed in August 1988.

Town of Jamestown

The hydrologic and hydraulic analyses for the original study for the Town of Jamestown were performed by Howard, Needles, Tammen & Bergendorff, for FEMA, under Contract No. H-4016. This work, which was completed in February 1978, covered all significant flooding sources.

City of Lafayette

The hydrologic and hydraulic analyses for the original study for the City of Lafayette were performed by Howard, Needles, Tammen & Bergendorff, for FEMA, under Contract No. H-4016. This work was completed September 1977.

City of Longmont

The hydrologic and hydraulic analyses for the original study for the City of Longmont were performed by Gingery Associates, Inc., for FEMA, under Contract No. H-3716. This work was completed in March 1976.

The additional hydrologic and hydraulic analyses for the City of Longmont for the revised study were performed by Gingery Associates, Inc., Simons, Lee and Associates, and Water Resources Consultants, Inc., for the Colorado Water Conservation Board (CWCB), as reported in floodplain information reports for Lefthand Creek, and for Dry Creek No. 1 and St. Vrain Creek.

City of Louisville

The hydrologic and hydraulic analyses for the original study for the City of Louisville were performed by the Soil Conservation Service (SCS), for FEMA, under Interagency Agreement No. IAA-H-16-72, Project Order No. 16. This work was completed in January 1973.

Town of Lyons	The hydrologic and hydraulic analyses for the initial study for the Town of Lyons were performed by Howard, Needles, Tammen & Bergendorff, for FEMA, under Contract No. H-4016. This work, which was completed in October 1977, covered all significant flooding sources affecting the Town of Lyons.
Town of Nederland	The hydrologic and hydraulic analyses for the original study for the Town of Nederland were performed by Howard, Needles, Tammen & Bergendorff, for FEMA, under Contract No. H-4016. This work was completed in November 1978.
Town of Superior	The hydrologic and hydraulic analyses for the original study for the Town of Superior were performed by Howard, Needles, Tammen & Bergendorff, for FEMA, under Contract No. H-4016. This work was completed October 1977.

There was no previously printed Flood Insurance Study for the Town of Ward.

The revised hydrologic and hydraulic analyses for these studies were performed by various engineering firms for the purposes of floodplain evaluation and are discussed in Section 7.0.

The digital base mapping information was provided by the FEMA Map Service Center, P.O. Box 1038, Jessup, Maryland 20794-1038, and the Boulder Area Spatial Information Cooperative (BASIC), P.O. Box 471, Boulder, CO 80306. Additional input was provided by the Town of Erie, P.O. Box 750, Erie, CO 80516, and the City of Longmont, 350 Kimbark Street, Longmont, CO 80501. The road and railroad data for Boulder County were provided by the Boulder County GIS Department. Further information about these road and railroad files can be obtained by contacting the GIS Department. Road data was also obtained from the Town of Erie, and was created at a scale of 1:20,000 or better. Further information about the Erie road information can be obtained by contacting the Town of Erie. The Boulder County and Erie road data were then merged into 1 database that met FEMA specifications. The coordinate system used for the projection of the FIRMs is Colorado State Plane North FIPS 0501 Feet, North American Datum of 1983, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of information shown on the FIRMs.

1.3 Coordination

For this revision of the countywide FIS, the initial CCO meeting was held on XXXX XX, XXXX, and was attended by representatives of FEMA, CWCB, and the City of Boulder. Additional coordination meetings were held between the City of Boulder, Boulder County, and the study contractor (Michael Baker Jr., Inc) to resolve issues during map production. The City of Boulder holds its own public review and comment process, which took place prior to the initiation of this revision.

The resulting maps were officially presented in preliminary format at a Final CCO meeting held on XXXX, XX, 2015, which was attended by City of Boulder and Boulder County officials, FEMA, CWCB, and the study contractor. A public open house was also held following the Final CCO Meeting.

For the December 18, 2012 revision, the initial CCO meeting was held on October 2, 2003, and was attended by representatives of FEMA, CWCB, UDFCD, Boulder County, City of Boulder, Town of Erie, Town of Jamestown, City of Lafayette, City of Longmont, City of Louisville, Town of Lyons, Town of Superior, and the study contractor.

An intermediate CCO meeting was held on December 9, 2004, and was attended by representatives of FEMA, CWCB, Boulder County, City of Boulder, Town of Erie, City of Jamestown, City of Longmont, Town of Lyons, and the study contractor. The purpose of this meeting was to present preliminary results of the study to the communities.

The results of the study were reviewed at a CCO meeting held on August 16, 2005, and attended by representatives of FEMA, CWCB, Boulder County, City of Boulder, Town of Erie, Town of Longmont, Town of Lafayette, and the study contractor. All problems raised at the meeting were addressed.

The results of the revised study were reviewed at the final CCO meeting held on July 7, 2010, and attended by representatives of FEMA, CWCB, Boulder County, City of Boulder, Town of Erie, Town of Longmont, Town of Lafayette, and the study contractor. All problems raised at the meeting have been addressed.

For the October 4, 2002 revision of the countywide FIS, the initial Consultation Coordination Officer (CCO) meeting was held on August 4, 1993. This meeting was attended by representatives of Boulder County, the Cities of Broomfield and Lafayette, the Towns of Erie and Superior, CWCB, the Urban Drainage and Flood Control District (UDFCD), and the study contractor.

The countywide FIS was prepared by combining data from the Cities of Boulder, Lafayette, and Longmont, and the Towns of Erie, Jamestown, Lyons, Nederland, and Superior, and unincorporated areas of Boulder County. Information on the coordination of the original studies as compiled from their previously printed individual FIS reports is shown below.

Boulder County (Unincorporated Areas)

During the preparation of the original study for the unincorporated areas of Boulder County, the following were contacted: the USACE, Omaha District; the U.S. Geological Survey (USGS), Water Resources Division, Colorado District Office; the U.S. Weather Bureau; Denver Regional Council of Governments; UDFCD; CWCB; Boulder County; and the City of Longmont.

The final coordination meeting for the original study for the unincorporated areas of Boulder County was held on July 13, 1976, and attended by representatives of FEMA, the study contractor, and the county. Comments from county officials and citizens were taken into account.

City of Boulder

An initial coordination meeting for the revision of the original study for the City of Boulder was held in Boulder on July 30, 1981. This meeting, attended by representatives of the City of Boulder, FEMA, MSM/SP Group, UDFCD, CWCB, and Boulder County, was held to discuss the nature and purpose of the study and the scope and limits of work.

The following agencies and individuals were contacted and supplied information used in the preparation of this revised study: USGS; USACE, Omaha District; CWCB; the City of Boulder Engineering Department; the Boulder County Engineering Department; UDFCD; and the Colorado Department of Highways.

Town of Erie

Initial meetings to identify streams requiring detailed study within the Town of Erie were held on March 31 and April 16, 1976. These meetings were attended by representatives of the CWCB, FEMA, the Weld County Planning Department, and GAI. Another meeting was held on January 28, 1977, and was attended by representatives of FEMA, the Major and Town Clerk of Erie, and GAI. The purpose of this meeting was to gather flooding information and to outline study procedures for the reach of Coal Creek, north of the UPRR, near Perry Street. The U.S. Soil Conservation Service (SCS) (now the Natural Resources Conservation Service) was also contacted for information concerning flood hazards.

A final coordination meeting for this reach of the study was held on November 7, 1977. The meeting was attended by FEMA, officials from the Town of Erie, interested local groups, and GAI.

On October 6, 1987, a meeting was held between

representatives of FEMA, the Town of Erie, and the U.S. Department of the Interior, Bureau of Reclamation. The purpose of this meeting was to discuss the detailed analysis of flood hazards along Coal Creek, south of the UPRR. The Town of Erie provided maps, which were used in the analysis.

In addition, the SCS, USGS, USACE, and the CWCB were contacted for pertinent technical information regarding flood hazards within the Town of Erie. The SCS provided a copy of its flood hazard analysis, "Coal Creek and Rock Creek, Boulder and Weld Counties, Colorado," dated October 1976. The SCS also provided hydraulic backwater computer model input for Coal Creek near Erie. The USGS provided copies of flood prone area maps for the study area. The USACE indicated that it had no pertinent technical information that could be included in the Coal Creek Study.

The CWCB provided a copy of the Technical Addendum, "Floodplain Information, Flood Control and Floodplain Management Plan for Coal Creek at Erie, Colorado," prepared by WRC, dated August 1980. The addendum contained copies of the HEC-2 computer modeling for a portion of the study area. Robinson Engineering, Inc. (REI) was contacted in response to a recommendation from the Town of Erie. REI provided detailed topographic mapping for a portion of the study area.

Town of Jamestown

An initial coordination meeting for the original study for the Town of Jamestown was held on February 25, 1977, and attended by representatives of FEMA, the Mayor, several town council members, and the study contractor to discuss the areas to be studied and methods to be used.

A number of Federal agencies, including the SCS, the U.S. Forest Service, the USACE, and the CWCB were contacted for available data.

A general information search was made at the State Historical Society, the Denver Public Library, the Boulder County Courthouse, and the *Boulder Daily Camera* for historical background information, available publications, and photographs of past floods.

The final coordination meeting was held on August 7, 1978, and was attended by representatives of FEMA, the study contractor, and the town. All problems raised at the meeting were resolved.

City of Lafayette

An initial coordination meeting for the original study for the City of Lafayette was held on February 18, 1977, with representatives of FEMA, the City Manager, and Howard, Needles, Tammen & Bergendorff to discuss areas to be studied, and methods to be used. The SCS, CWCB, the Boulder County Courthouse, the USGS, and the State Historical Society were contacted for available data.

The results of the original study were reviewed at a final community coordination meeting held on July 18, 1978. Attending the meeting were representatives of FEMA, the study contractor, and the city. All problems raised at the meeting were resolved.

City of Longmont

The Longmont Engineering Department supplied zoning and corporate boundary maps for use in the initial study for the City of Longmont, as well as various detailed drawings for channel improvements, such as final construction plans for the Spring Gulch Linear Park and storm drainage facilities, dated January 1973, and the structural plans for the Pratt Street bridge, over St. Vrain Creek. The Longmont Planning Department supplied a copy of the St. Vrain Comprehensive Plan (Reference 5), which describes the comprehensive plan for what is called the Prime Urbanized Area (PMA) of Longmont. The Planning Department also provided a copy of the floodplain and floodway zoning ordinance, and various historical aspects of flooding and community development. Meetings were held with the City Planning and Engineering Department's staff on July 23, 1974; May 14, 1975; and December 30, 1975; to discuss detailed aspects regarding the streams studied.

The USACE, Omaha District, provided mapping of St. Vrain Creek and parts of Lefthand Creek, Dry Creek No. 1, and Spring Gulch (Reference 6). Computer input regarding the hydrology and hydraulic analyses for St. Vrain Creek and Lefthand Creek were also provided by the USACE. The floodplain information reports completed by the USACE in January 1969 for Lefthand Creek (Reference 7) and in June 1972 for Lower St. Vrain Creek (Reference 8) served as an important basis for comparison in the study. On October 16, 1974, a conference was held with the USACE to gather additional information on Longmont and to review potential problems.

The USGS was contacted to obtain historic flood flow data (References 9, 10, and 11). Maps of flood prone areas, prepared by the USGS, showing approximate floodplain

delineations at a scale of 1:2,400 were also reviewed (Reference 12).

At a meeting on August 27, 1974, attended by representatives of the UDFCD, FEMA, and Gingery Associates, Inc., study reaches and methods for the initial study were decided. An additional meeting was held on January 24, 1975, in Washington, D.C., to further clarify the purpose of the study and the methods used for floodplain delineations.

Other agencies and individuals contacted for background information included the CWCB, the Colorado Highway Department, and the Longmont *Daily Times-Call* newspaper. Private citizens of Longmont were also interviewed regarding past floods, high-water marks, and flood damage.

A final community coordination meeting for the initial study was held on January 7, 1976, by the Longmont Planning Department.

In April 1985, FEMA authorized the revision of the FIS for Longmont to incorporate the aforementioned floodplain information reports (References 1 through 4).

On August 5, 1986, the results of the revised study were discussed at the final community coordination meeting, which was attended by representatives of FEMA, the study contractor, and the community. All significant problems raised at that meeting were addressed in the revised study.

Town of Lyons

An initial coordination meeting for Lyons was held on February 25, 1977, and was attended by representatives of FEMA, the study contractor, and the Mayor of Lyons, to discuss areas to be studied and methods to be used. The USACE and CWCB were contacted for available data.

A general information search was made at the Denver Public Library and at the Boulder County Courthouse for historical background information, available publications, and photographs of past floods. The USGS and the State Historical Society were also contacted.

A final community coordination meeting, held on June 19, 1978, was attended by representatives of FEMA, the CWCB, the study contractor, city officials, and interested citizens. The study incorporated all appropriate comments,

and all problems were resolved.

Town of Nederland

An initial coordination meeting for Nederland was held on February 18, 1977, attended by the study contractor, Nederland officials, and a representative of FEMA to discuss areas to be studied and methods to be used.

A number of Federal agencies, including the SCS, the U.S. Forest Service, and the USACE were contacted for available data. The CWCB was also contacted.

A general information search was made at the State Historical Society, the Denver Public Library, the Boulder County Courthouse, and the *Boulder Daily Camera* for historical background information, available publications, and photographs of past floods.

Peak discharge-drainage area relationships used in the study were reviewed by the CWCB and were found to be acceptable.

The results of the study were reviewed at a final community coordination meeting held on July 11, 1978. Attending the meeting were representatives of FEMA, the study contractor, and the town. No problems were raised at the meeting.

Town of Superior

An initial coordination meeting for Superior was held on April 21, 1976, and attended by a representative of FEMA, the Mayor of Superior, and representatives of the Boulder County Planning and Public Works Department, the CWCB, and Howard, Needles, Tammen & Bergendorff. The purpose was to discuss areas to be studied and methods to be used. On February 18, 1977, representatives of FEMA, and Howard, Needles, Tammen & Bergendorff met in Superior to review the study limits.

The SCS, the CWCB, the Boulder County Courthouse, the USGS, and the State Historical Society were contacted for available data.

The results of the study were reviewed at a final community coordination meeting held on July 18, 1978. Attending the meeting were representatives of FEMA, the study contractor, the Boulder County Planning and Public Works Department, the CWCB, and the town. The study incorporated all appropriate comments, and all problems were resolved.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS covers the geographic area of Boulder County, Colorado including the Cities of Boulder, Lafayette, Longmont, and Louisville, and the Towns of Erie, Jamestown, Lyons, Nederland, Superior, and Ward, and unincorporated areas of Boulder County.

The streams studied by detailed methods are presented in Table 1.

The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through 2004.

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 to, and agreed upon by, FEMA and Boulder County.

The following are streams for which only approximate flood hazards are presented: Anderson Ditch, Bluebell Canyon Creek, David's Draw, Gregory Creek, Kings Gulch, Little Dry Creek, Sunshine Gulch, and the upper and lower reaches of St. Vrain Creek.

Table 1 – Streams Studied by Detailed Methods

55th Street Split Flow	Clover Basin Tributary
Arapahoe Avenue Spill Flow	Coal Creek
Balarat Creek	Dry Creek
Bear Canyon Creek	Dry Creek Ditch No. 2
Boulder Creek	Dry Creek No. 1
Boulder Creek- 13th Street Split	Dry Creek No. 1 (Old Channel)
Boulder Creek- 14th Street Split	Dry Creek No. 2
Boulder Creek- 15th St- Arapahoe Ave- Marine St Split	Dry Creek No. 2 Ditch Split Flow
Boulder Creek- 16th Street Split	Dry Creek No. 3
Boulder Creek- 17th Street Split	Elmers Twomile Creek
Boulder Creek- 18th Street Split	Fourmile Canyon Creek
Boulder Creek- 21st Street Split	Fourmile Canyon Left Bank Overflow
Boulder Creek- 22nd Street Split	Fourmile Creek
Boulder Creek- 38th Street Split	Goose Creek
Boulder Creek- 55th Street Split	Gregory Canyon Creek
Boulder Creek- 55th St Split (500-year)	Highway 93 Split Flow
Boulder Creek- Arapahoe Ave Split	James Creek
Boulder Creek- Arapahoe Ave East Split	Lefthand Creek
Boulder Creek- Arapahoe Ave West- 20th St Split	Lefthand Creek (North Overflow Channel)
Boulder Creek- Canyon Boulevard Split	Lefthand Creek (South Overflow Channel)
Boulder Creek- Canyon Blvd at 6th St Split	Little James Creek
Boulder Creek- Downstream RR to 55th St Split (500-year)	Little Thompson River
Boulder Creek- Downstream Valmont Split	Middle Boulder Creek
Boulder Creek- Flatiron Parkway Split	Middle St. Vrain Creek
Boulder Creek- Goss Street Split	North Beaver Creek
Boulder Creek- Grove Street Split	North Goose Creek
Boulder Creek- Harvest House Split	North St. Vrain Creek
Boulder Creek- Pearl Street Split	Prince Tributary, East Branch
Boulder Creek- Railroad Overtopping	Prince Tributary, West Branch
Boulder Creek- Railroad Overtopping (500-year)	Rock Creek
Boulder Creek- Railroad Split Flow	St. Vrain Creek
Boulder Creek- Skunk Creek Split	St. Vrain Creek Secondary Channel
Boulder Creek- Taft Drive Split	St. Vrain Creek (Vicinity of Lyons)
Boulder Creek- Valmont Split	Skunk Creek
Boulder Creek- Valmont Split North Split	South Boulder Creek
Boulder Creek- Valmont Split West Split	South St. Vrain Creek
Boulder Creek- Walnut St Split (500-year)	Spring Gulch
Boulder Slough	Steele Lakes Tributary
Boulder Slough- 22nd Street Split Flow	Twomile Canyon Creek
Boulder Slough- Goss Street Split Flow	West Valley Split Flow
Bullhead Gulch	Wonderland Creek
Canyon Boulevard Overflow	

2.2 Community Description

Boulder County (Unincorporated Areas)
The 2013 Flood resulted in extensive damage to residential and business property, as well as to Boulder County roads, bridges, creeks, and open space. Long-term recovery efforts continue to dominate Boulder County programs and projects. Recovery for community infrastructure and ecology is happening simultaneously and progress in one area is intricately tied to progress in the other areas. Areas continue to recover and rebuild, so consult County officials for the latest updates on recovery efforts.

Boulder County is located in north-central Colorado, approximately 50 miles south of the Colorado-Wyoming state line. In 2010, the population of Boulder County was 294,567 (Reference 13), an increase of 1 percent from a population of 291,288 in 2000 (Reference 14).

Boulder Creek is a steep mountain stream draining a portion of the eastern slope of the Rocky Mountains in Boulder County. The creek extends 22 miles eastward from the Continental Divide to emerge from the mountains and pass through the City of Boulder. Boulder Creek then flows 18 more miles to enter St. Vrain Creek five miles east of the City of Longmont. Boulder Creek drains an area of 440 square miles. Slightly more than one-half of the drainage area is in the mountains.

South Boulder Creek is a major tributary to Boulder Creek. This stream runs a parallel course to Boulder Creek through the mountains and emerges at El Dorado Springs. South Boulder Creek then turns north and joins Boulder Creek approximately two miles east of the City of Boulder.

The Bear Canyon Creek, Fourmile Canyon Creek, Skunk Creek, and Twomile Canyon Creek Basins originate in the foothills west of the City of Boulder. The terrain of these upstream subbasins is steep and rocky, and consists of topsoil in the C and D hydrologic soils groups, as classified by the SCS (Reference 15).

The entire reaches of Bear Canyon, Elmers Twomile, Fourmile Canyon, and Skunk Creeks consist of well-defined channels. Wonderland Creek has a well-defined channel, except for the reach southeast of Valmont Road. Both Goose and Twomile Canyon Creeks have extensive reaches without well-defined channels.

The Lefthand Creek watershed extends approximately 30 miles eastward from its headwaters in the Roosevelt National Forest to its confluence with St. Vrain Creek at the City of Longmont. Most of the watershed lies in the mountains and varies in elevations from 5,600 to 11,000 feet. The remainder of the watershed lies in the high plains. Until recently, the floodplain was devoted entirely to agriculture. Now, because of expanding population and industrialization, urban development has begun at both ends and in the middle of the study reach.

St. Vrain Creek is a continuously flowing stream that drains the east slope of the Continental Divide by way of North and South St. Vrain Creeks. From the confluence of these creeks at the Town of Lyons, St. Vrain Creek flows southeasterly through the City of

Longmont, then northeasterly to the South Platte River. Dry Creek No. 1, Lefthand Creek, Spring Gulch, and Loomiller Basin join St. Vrain Creek within the City of Longmont.

The climate of the study area is classified as semiarid. The average annual precipitation is 18.3 inches, which includes an average annual snowfall of 83 inches (Reference 33). Location with respect to the foothills west of the City of Boulder has a slight influence on the total precipitation depths in the study-area subbasins. Those areas east of the foothills receive more precipitation (a few tenths of an inch per event) than the areas adjacent to the foothills. The occurrence of precipitation varies; however, most of the rainfall is concentrated in May. Thunderstorms also occur irregularly throughout the summer months. The temperature extremes in Boulder County are evidenced by mean maximums ranging from 46.3 degrees Fahrenheit (°F) in January to 88.3°F in July, and by mean minimums ranging from 21.6°F in January to 61.0°F in July.

City of Boulder

The City of Boulder is located in central Boulder County, along the foothills of the Front Range. In 2010, the City of Boulder had a population of 97,385 (Reference 13), an increase of 3 percent from a population of 94,673 in 2000 (Reference 14). This population growth is expected to continue with further expansion into identified floodplain areas.

The study area includes the drainage basins of seven streams located throughout the City of Boulder area. All study streams are tributaries to Boulder Creek, with a total drainage area of approximately 23.2 square miles. The elevation of the City of Boulder ranges from 8,520 feet at the headwaters of Fourmile Canyon Creek to 5,155 feet at the confluence of Fourmile Canyon Creek with Boulder Creek.

All stream reaches east of the foothills are located within urbanized areas with occasional open-space and park areas. The terrain of these subbasins consists of mild slopes with topsoil in the B and C hydrologic soils group with some D soils. Vegetation for most of the stream reaches is characteristic of urban areas. Vegetation along the downstream reaches of Bear, Goose, Skunk, and Wonderland Creeks consists of natural grasses and weeds.

Town of Erie

The town of Erie is approximately 40 miles north of Denver, in the southwest corner of Weld County and the northeast corner of Boulder County, in north-central Colorado.

In the late 1800's, coal mining led to the development of the Town of Erie along the banks of Coal Creek. Today, Erie is mostly a commercial and residential community with some agricultural development in the surrounding area. The estimated population of Erie was 6,291 in 2000 (Reference 14) and rose to 18,132 in 2010 (Reference 13), an increase of 188 percent.

The average annual precipitation in Erie is 12.7 inches, and the normal mean temperature is 48.6°F. Vegetation in the area consists primarily of native grass. The soils in the area are shallow, very gravelly and stony, and in the rock outcrop Juget-Baller Association. The topography in the developed part of Erie is relatively flat and gradually slopes toward Coal Creek. Both residential and commercial developments exist in the floodplain area.

Coal Creek flows northerly along Erie's eastern corporate limits and empties into Boulder Creek. Recently, the Town of Erie has annexed areas that include floodplains along Coal Creek, Prince Tributary East Branch, Prince Tributary West Branch and Bullhead Gulch from Boulder and Weld Counties.

Town of Jamestown

Jamestown is a small mountain community located in the central northwest section of Boulder County, approximately 10 miles northwest of the City of Boulder. The 2000 population was 205 (Reference 14) and was estimated at 274 (Reference 13) in 2010.

Historically a mining town, Jamestown is now a residential community. Most of its residents are commuters to the Cities of Boulder, Denver, and Longmont.

Little James Creek, draining an area of approximately three square miles, joins James Creek in Jamestown. James Creek, with a drainage area of 14.5 square miles at the downstream study limit, is a tributary to Lefthand Creek, which flows eastward to join St. Vrain Creek near Longmont. Rainfall in the basin averages nearly 24 inches annually.

The terrain is mountainous with steep slopes. The soils of the Allen Park Series, which formed on the mountain slopes between elevations of 6,300 and 8,200 feet, are loamy colluviums and weathered granite residuum. The surface layer, approximately two inches thick, is dark-gray, gravelly sandy loam. The subsurface layer is light brownish-gray, gravelly sandy loam. The Fern Cliff Series is loamy mixed alluvium on short fans and valley side slopes in the mountain area in the same elevations range. The top layer of this series is light gray, stony sandy loam. The barren areas are predominantly exposed bedrock that consist of mixed materials, including granite, sandstone, shale, and limestone. The dominant land cover species is Ponderosa pine; above an elevation of 8,000 feet, there are some Douglas fir and lodge pole pines.

Little James Creek flows into town from the north, through mostly vacant land. Existing development in Jamestown is located on both sides of James Creek, from the confluence with Little James Creek at Ward Street to 13th Street. Land use is primarily residential, single-family homes, with some business and commercial uses.

City of Lafayette

Lafayette is located in southeastern Boulder County, approximately 20 miles north of Denver. The population of Lafayette was 23,197 (Reference 14) in 2000, and was 24,453 in 2010 (Reference 13). Nearby communities include the following: Louisville, two miles west; the City of Boulder, 11 miles west; Superior, approximately six miles southwest; and Broomfield, seven miles south. Lafayette is surrounded by unincorporated Boulder County.

The Coal Creek and Rock Creek watersheds drain approximately 79 square miles, most of which are located in southeastern Boulder County. Coal Creek flows northeasterly, joining Boulder Creek in east-central Boulder County. Boulder Creek flows into St. Vrain Creek, a major tributary to the South Platte River. These drainages are in the South Platte subregion of the Missouri River Water Resources Region, as designated by the U.S. Water

Resources Council. Rock Creek is a tributary to Coal Creek, joining it just east of Lafayette.

Coal Creek and Rock Creek flow through primarily agricultural land. The southwestern part of the city, the land occupied by Coal Creek, is zoned open agricultural, with primarily residential land uses and zoning adjacent to it. Where it crosses the southeastern part of the city, zoning is open agricultural and industrial. Rock Creek enters the southeastern part of the city just east of the Burlington Northern and Santa Fe Railway and flows through open agricultural-zoned land.

The upstream drainage area originates in the foothills east of the Rocky Mountains, and the geology is characterized by a series of folded and faulted sedimentary strata. For the most part, the strata are classified as Fox Hills Sandstone and Laramie formation. Soils are shallow, very gravelly, and stony, and in the rock outcrop Juget-Baller association. Ground cover consists of native grasses and woodland. Except for a narrow fringe of Rocky Mountain juniper, Ponderosa pine makes up the bulk of the woodland cover. The woodlands are very picturesque, and most of the area is used for grazing and home sites, with both year-round and summer homes. Average annual precipitation is approximately 18.5 inches and the normal mean temperature is 51.8°F. Extremes of annual precipitation have varied from a maximum of 29.09 inches in 1938 to a minimum of 10.91 inches in 1954. The mean maximum and minimum temperatures in July are 85.3°F and 59.0°F, respectively.

City of Longmont

Longmont is located in northeastern Boulder County, approximately 38 miles north of Denver. Agriculture is the economic base of Longmont, although nearby Denver and Boulder have influenced the growth of new commercial and industrial development. This is reflected in the population trends of Longmont. Recently, the population has increased from 71,093 in 2000 (Reference 13) to 86,270 in 2010 (Reference 14).

The climate is temperate. Daily average temperatures are 65°F for May to September and 37°F for October to April. The average annual precipitation is 12 inches for Longmont with an average monthly rate of 1.5 inches from April to September.

The city lies within the St. Vrain Creek Basin; headwaters extend by way of North and South St. Vrain Creeks into the Rocky Mountains up to the Continental Divide. Elevations range from 4,900 feet in Longmont to more than 14,000 feet at Longs Peak. The water of St. Vrain Creek has been appropriated for municipal and irrigation usage.

The topography of Dry Creek No. 1, Lefthand Creek, and St. Vrain Creek Basins ranges from rugged and heavily forested Rocky Mountain canyons in the west, to slightly rolling prairie land near Longmont, where pasture land and cropland border stream banks lined with brush, willow, and cottonwood trees. Spring Gulch has a basin that extends to Terry Lake, but it has a channel only from 15th Avenue to St. Vrain Creek in Longmont. Loomiller Basin lies entirely within Longmont.

Dry Creek No. 1, Lefthand Creek, and Spring Gulch originate outside the PMA of Longmont in the Rocky Mountain foothills and follow generally easterly courses through

the city. Spring Gulch consists of an improved channel that starts south of East 15th Avenue and continues as a concrete-lined channel through Spring Gulch Linear Park to Third Avenue, then down to St. Vrain Creek. Loomiller Basin is a depression oriented in a northwest-southeast direction through central Longmont. Floodwater accumulates in the depression and subsequently drains into Spring Gulch Basin near Third Avenue and Atwood Street. A large portion of the area within the PMA of Longmont limits and adjoining the streams is fully developed.

Commercial and residential developments exist in the floodplains of all the streams studied. On St. Vrain Creek, from Airport Road to the confluence with Dry Creek No. 1, industrial and commercial buildings, farms, and mobile home parks share the floodplain with gravel-mining sites. The Dry Creek No. 1 floodplain is occupied by both commercial buildings and single-family dwellings from Sunset Street to the confluence with St. Vrain Creek. Development along Spring Gulch is also represented by pastureland and a linear park bounded by single-family dwellings from 15th Avenue to Third Avenue. Commercial and industrial buildings occupy the Spring Gulch floodplain from Third Avenue to the confluence with St. Vrain Creek. Loomiller Basin is totally developed with residential and commercial buildings.

Town of Lyons

Lyons is located in north-central Boulder County, approximately 40 miles north of Denver. In 2000, the population of Lyons was 1,585 (Reference 14), and was estimated at 2,033 in 2010 (Reference 13). Nearby communities include Longmont, 11 miles southeast; the City of Boulder, 16 miles south; and Estes Park, 20 miles northwest. Lyons is bordered on all sides by unincorporated Boulder County.

Rainfall in the mountains west of Lyons averages approximately 17 inches annually. The average annual temperature in the basin is approximately 40°F. The basin topography changes from forested mountain terrain on the west, to rolling plains on the east, which are primarily pasture and cultivated fields. The drainage area at Lyons is 219 square miles, with 125 square miles on North St. Vrain Creek and 94 square miles on South St. Vrain Creek.

North St. Vrain Creek enters the town on vacant land near the northwestern corner of the community. In the areas south and west of U.S. Highway 36, the existing zoning, and land use is primarily residential, consisting of mobile and single-family permanent homes. West of Fifth Avenue, the land is vacant. Between Fifth Avenue and Second Avenue, the creek flows through a single-family residential area, north of the business community.

South St. Vrain Creek parallels State Highway 7, enters the town near Fifth Avenue, and flows through residential land that is partially developed with single-family residences and mobile homes.

St. Vrain Creek roughly parallels the Burlington Northern and Santa Fe Railway east of Second Avenue and flows through open land zoned medium-density residential.

Town of Nederland

Nederland is a small mountain community located approximately 13 miles west of the City of Boulder. The population, based on the 2000 census, was 1,394 (Reference 14), and was estimated to be 1,445 in 2000 (Reference 13). Communities adjacent to Nederland are Ward, approximately seven miles north, and Central City, approximately 12 miles south.

North Beaver Creek, draining approximately 5.2 square miles, joins Middle Boulder Creek at Nederland. Middle Boulder Creek, with a drainage area of 36.2 square miles at the downstream study limit, is a tributary to Barker Reservoir. This reservoir, located approximately 12 miles upstream from the City of Boulder and completed in 1910, has a storage capacity of 11,500 acre-feet and reduces the peak flows of floods originating from Middle Boulder Creek and North Beaver Creek. Rainfall in the basins averages 24 inches annually. Land use adjacent to the streams is primarily residential, with some commercial buildings.

The terrain is mountainous with steep slopes. Soil types within the study area vary. The soils of the Allen Park Series, which formed on the mountain slopes between 6,300- and 8,200-foot elevations, are loamy colluviums and weathered granite residuum. The surface layer, approximately 2 inches thick, is dark-gray, gravelly, sandy loam. The subsurface layer is light brownish-gray, gravelly, sandy loam. The Fern Cliff Series is loamy mixed alluvium on short fans and valley side slopes in the mountain area in the same elevation range. The top layer of this series is dark grayish-brown, stony, sandy loam and the subsurface layer is light-gray, stony, sandy loam. The barren areas are predominantly exposed bedrock that consist of mixed materials, including granite, sandstone, shale, and limestone. The dominant land-cover species is Ponderosa pine, and, above 8,000 feet elevation, there are some Douglas fir and lodge pole pines.

Town of Superior

Superior is located in southeastern Boulder County, approximately 20 miles northwest of Denver. In 1990, the population of Superior was 255. In 2000, the population rose to 9,011 (Reference 13), and rose again to 12,483 in 2010 (Reference 14). Nearby communities are Louisville, five miles northeast; the City of Boulder, six miles northwest; Lafayette, approximately seven miles northeast; and Broomfield, seven miles southeast. The unincorporated areas of Boulder County surround Superior.

Coal Creek flows through primarily agricultural land. Land use, which is not zoned within Superior, is primarily residential.

Average annual precipitation is approximately 18.5 inches and the normal mean temperature is 51.8°F. Extremes of annual precipitation have varied from a maximum of 29.09 inches in 1938 to a minimum of 10.91 inches in 1954. The mean maximum and minimum temperatures in July are 85.3°F and 59.0°F, respectively.

2.3 Principal Flood Problems

Boulder County (Unincorporated Areas)

Flooding in Boulder County is due mainly to snowmelt combined with heavy rainfall, although heavy rainfall, especially in the form of cloudbursts, is alone capable of causing

flooding. Floods caused by rainstorms can peak within a few hours of the rainfall, leaving little time for evacuation. Much of the floodplain away from the mountains and canyons is used for agriculture, thus the flood damage is mainly to crops, irrigation equipment, roads, and bridges. In mountain canyons, flood damages result from fast moving water and affect roads, bridges, and homes. Damage to residential and industrial areas occurs in and around several communities that are excluded from the study area. However, many of these communities are experiencing rapid growth, and thus are increasing encroachment on the adjacent floodplains.

Beginning on September 11, 2013, significant flash flooding occurred in north-central Colorado on the eastern side of the Continental Divide. Flooding in most major and minor drainageways in the County resulted from historic rainfall, which reached over 17 inches recorded by September 15, 21013, and brought yearly precipitation levels to over 30 inches (the most rain recorded in 120 years of hydrological record). The rainfall and flash flooding caused debris flows, significant erosion and deposition of sediment, and threatened reservoirs in the county. Large sections of roads were washed away, and most bridges and culverts in the county were either damaged or destroyed. Many homes were completely destroyed by fast moving water and debris, while countless others were affected by flood inundation. Thousands of inhabitants were rescued or evacuated once the flooding began. Hazards were differentiated by terrain, with fast-moving, erosive flows affecting the mountain canyons, and expansive flood impacts and deposition of sediment on the plains. Boulder County has worked with the State, FEMA, and other organizations on both short-term and long-term flood recovery projects and flood mitigation planning.

Other significant floods occurred in the South Boulder and Boulder Creek watersheds in 1894, 1914, and 1938; a somewhat smaller flood occurred in 1938. Flooding occurred in the Lefthand Creek watershed in 1864, 1876, 1894, 1921, 1938, 1949, and 1951.

City of Boulder

The principal cause of flooding problems on the study streams in the City of Boulder is intense localized thunderstorms.

The 2013 Flood impacted Boulder Creek and all other drainageways throughout the City. On Boulder Creek, the event was categorized as approximately a 25-year event. Other drainages experienced serious debris flows (including, but not limited to, Bear Canyon Creek, Twomile Canyon Creek, and Fourmile Canyon Creek) that damaged roadways and homes, and rainfall triggered landslides from the foothills above town. City infrastructure (including parks and open space lands and trails) damages totaled approximated $49M.

Numerous other floods have occurred in the City of Boulder area, with the most extensive flood occurring in 1894. This flood generally has been designated as the 1-percent-annual chance flood; however, there is little documentation of the flooding on streams other than Boulder Creek. Flooding was widespread during the 1894 flood, and nearly all bridges in the city were washed out.

Another large flood occurred on May 7 and 8, 1969. Damages were estimated to be approximately $325,000. Bear Canyon, Skunk and Twomile Canyon Creeks all

overflowed their banks according to newspaper accounts. On May 8, 1969, the *Boulder Daily Camera* reported "motorists were still being routed around the intersection of Table Mesa Drive and Broadway, where Bear Creek raged out of its banks, flooding the entire area Wednesday."

Past studies of the South Boulder Creek floodplain have identified a riverine floodplain that is generally confined to areas along the main channel. Historic records of flooding have indicated that the floodplain is more expansive than reported in the past mapping efforts and includes areas of the west valley along the Foothills Parkway corridor.

Twomile Canyon Creek has frequently overtopped its banks with silt-laden floodwater. The worst flood on Twomile Canyon Creek occurred in September 1933, while others occurred in 1909, 1941, 1942, 1949, and 1965. On August 19, 1965, the *Boulder Daily Camera* headline read: "Twomile Canyon Gully Washer Spews Mud Across Broadway and Into Yards." The article stated "Water cascading down normally-dry Twomile Canyon Creek spewed mud across sections of Broadway and silted yards and basements of 8 or 10 homes near Broadway and Iris Avenue Wednesday afternoon."

Fourmile Canyon Creek has flooded occasionally, with notable events occurring in 1916, 1941, and 1951. In 1916 and 1941, railroad bridges were washed out (Reference 16). Localized flooding along the lower reaches of Fourmile Canyon Creek occurs frequently, according to local residents. Damages and losses along Fourmile Canyon Creek in the past were generally been low, because the area was primarily undeveloped. Presently Fourmile Canyon Creek flows through urbanized areas.

Significant flooding along Goose Creek occurred in August 1951 and July 1954. The 1954 event damaged an addition to the Community Hospital, which was under construction.

These floods are just a few that have occurred in the area. Major, area-wide floods also occurred in 1904, 1909, 1914, 1921, and 1923. During May 1973, flooding caused an estimated $70,000 worth of damage. No estimates of the recurrence intervals of the historic floods have been made. There has been little documentation of flooding on Elmers Twomile, Skunk, and Wonderland Creeks.

There is a history of debris blockage and flow diversions throughout the City of Boulder.

Town of Erie

The main sources of flooding in the Town of Erie are heavy thunderstorms in spring and summer. Flooding can become especially severe when these thunderstorms follow either rapid snowmelt or prolonged rainy weather (Reference 18).

The 2013 event produced over 9 inches of rain in a 24-hour period in Erie, flooding streets and houses (mostly basements) and downing power lines across town.

The 1876 flood is the largest recorded at Erie and approximates the 1-percent-annual recurrence interval, as determined by the SCS (Reference 18), using synthetic methods for

flood routing. The most recent floods in the watershed occurred on June 9, 1949; May 9, 1957; and May 1969.

Town of Jamestown

Floods in the Jamestown study area usually occur during the period of May through September. Mountain snowmelt in May and June contributes significant runoff, but serious flooding does not occur unless rainfall accompanies the snowmelt.

Peak flooding will usually occur within a few hours after a single rainfall event. Flooding is generally of short duration, but may be prolonged significantly by snowmelt runoff.

The steep stream slopes create swift currents during a flood, which produce added damages. Debris carried by the fast-moving water not only threatens bridges and culverts, but batters houses and other structures on the floodplain. The bridge and culvert crossings often result in channel restriction, raising the water surface elevation (WSEL). Erosion undercuts and destroys structures that would otherwise receive little damage from inundation. Large quantities of rock are often deposited in portions of the channel, leaving little capacity for future floods.

The 2013 flood event damaged or destroyed 62 homes within the corporate limits of Jamestown. 90% of the town was evacuated by helicopter and displaced for many months. The town's drinking water plant was severely damaged, and over 50% of the distribution system was destroyed. Public infrastructure loss in Jamestown approached $11.5M.

In June 1894, a flood roared down James Creek and washed away much of the low-lying area of the town. Heavy rains accompanied by heavy spring runoff caused the flood. Most of the houses on the north side of Main Street were ruined or washed away, as was much of the road. A similar flood occurred in August 1913, damaging or destroying almost every house along James Creek. All wagon bridges and footbridges were destroyed, and it took two weeks to open the road to traffic.

In August 1955, a brief cloudburst, lasting approximately 30 minutes, damaged four bridge and culvert crossings and deposited several inches of mud in local residences.

The town was also flooded in 1965, and again in May 1969, following three days of heavy snow and rain. The floodwaters left the normal channel, destroying a number of buildings and the town water supply.

Readings by members of the University Institute of Arctic and Alpine Research showed snow content or rainfalls of 6.56 inches at 10,000 feet, 9.10 inches at 8,500 feet, and 8.90 inches at 7,200 feet (Reference 17). Flood damage estimates in a 9-county area were $7,000,000, including $700,000 for roads and bridges in Boulder County alone.

City of Lafayette and Town of Superior

Historical documentation of flood damage is meager in the area of Lafayette and Superior. This is probably due to the small stream size and lack of extensive urbanization. Major flood damages in the watershed are to roads, bridges, irrigation structures, and agricultural

land. Duration of flooding is brief, due to steep slopes and small drainage area. In general, peak flows last from 1 to 4 hours during a flooding period of 6 to 24 hours.

In Lafayette, trails and utilities along both Coal Creek and Rock Creek were damaged by the 2013 flood. The Dillon Road crossing of Rock Creek was completely washed out and sent 3 vehicles into the river. 2 of the victims required swiftwater rescue to be removed from their flooded and overturned vehicles.

In Superior, the 2013 event produced split flows from Coal Creek that impacted streets and houses in old town Superior. Bank erosion near bridges occurred, and debris was deposited throughout town and on open space land.

The following additional floods have been reported: The floods of 1876; 1891; June 3, 1921; and May 26, 1935; were caused by rapid snowmelt in the mountains and heavy rainfall in the area of Lafayette.

City of Louisville

The 2013 flood event impacted homes, public infrastructure, and trails, and damaged the public golf course. The storm stranded 85 fifth-graders and 14 adults from Fireside Elementary in Louisville who were on a field trip to the Cal-Wood Educations Center in the mountains west of Boulder. All were rescued by air on Saturday, September 14th.

A flood occurred in June 1896 that was reported as the maximum of record in the part of the valley near Louisville. The flood of September 2, 1938, was caused by cloudbursts in the mountains and foothills, resulting in a flood slightly higher than that of 1935. Using slope-area measurements, the USACE estimated the flood discharges on Coal Creek near Erie to be 13,200, 7,800, and 3,500 cubic feet per second (cfs) in 1876, 1921, and 1938, respectively (Reference 18).

The following are recorded accounts of flood damage on Coal Creek and Rock Creek:

> September 2, 1938. "Parts of the residential area in Louisville were under several inches of water, but the business district was not damaged. One person was killed in an automobile accident on the flooded highway east of Louisville. The bridge at Empire Drive and State Highway 42 was on the verge of failure, but was saved."
>
> June 9, 1949. "The bridge at the junction of Coal Creek and Rock Creek, 3 miles north and 1/4 mile west of Erie was threatened and closed to traffic. The bridge over Coal Creek, ¾ mile east of Superior, went out."
>
> May 1969. "Damage to land irrigation structures and agriculture totaled approximately $75,000."

City of Longmont

St. Vrain Creek flows through the City of Longmont in a broad channel bed of shifting sandbars bounded by banks 10 to 15 feet high. Dry Creek No. 1, Lefthand Creek, and

Spring Gulch flow in relatively steep, narrow channels. The overbanks of all the streams studied are relatively flat, with the exception of the north overbanks of St. Vrain Creek and Lefthand Creek, which rise more steeply.

As is characteristic of the region, flooding on these streams generally occurs between May and September. Peak annual flows usually occur in May and June, however, resulting from a combination of snowmelt runoff and spring rains. Floods having the most damaging effect in the Longmont area, such as the flood of June 2-7, 1921, occur when a long-duration rainstorm forms over the St. Vrain Creek Basin with the heaviest rainfall accumulation downstream of the Lyons gaging station. Extensive damage was done to bridges, with severe erosion nearby to roads and along the channel banks. Public and private property damage amounted to $50,000.

Longmont experienced between a 100 and 500-year event on St. Vrain and Lefthand Creeks during the 2013 flood event. Significant damage to streets, bridges, parks, trails, drainage systems, public buildings, and utilities were a result, costing the city nearly $55M in repairs. Countless homes and businesses were also flooded. A breach along St. Vrain Creek upstream of the City sent floodwaters through a series of gravel mining pits and into a developed neighborhood where many homes were damaged. In some areas, the flood inundation was more than a mile wide.

Lefthand Creek also produced a large flood on May 7-8, 1969, with the primary damage being done to the South Pratt Parkway Bridge, which was ultimately destroyed by the floodwater. There is little known regarding floods of record other than what was stated concerning the gaged discharges. There are no existing stage data for the floods on Lefthand Creek later than May 1957. Prior to the 2013 event, the largest flood on record was the one that occurred in June 1949.

Flood problems in the area have been the result of not only rare storm events, but also improper floodplain development. Visual accounts of floods have noted the debris collected by the floodwater, including natural debris such as trees, rocks, and soil, but consisting chiefly of items foreign to the floodplain, such as houses, bridges, automobiles, heavy equipment, lumber, house trailers, and butane storage tanks. With these items obstructing bridges and culverts, flood levels rise and cause more extensive damage. Property that was not structurally damaged by flood depths and velocities experienced much damage and cleanup expense resulting from mud, silt deposition, and erosion.

Town of Lyons

Lyons lies in a natural bowl, on gently sloping land surrounded by sandstone hills on all sides. The steep stream slopes create swift currents during a flood, which produce additional damage. Debris carried by the fast-moving water not only threatens bridges, but also may batter houses or other structures on the floodplain. The bridge crossings are often the points of channel restriction, thus raising the water-surface profile. Erosion undercuts and destroys structures that would otherwise receive little damage from inundation. Large quantities of rocks have been deposited in portions of the channel, leaving little capacity for future floods.

The 2013 event produced floods of record for both the North and South St. Vrain Creeks, which converge in downtown Lyons. At its peak, the estimated volume of the St. Vrain was 10 times its normal amount, reaching 100-year flood levels and well-surpassing those (500-1,000-year) in certain areas. The floodwaters washed out roads and bridges, including the new McConnell Drive bridge, which isolated property owners from evacuation and rescue routes. The town's wastewater treatment facility was inundated and damaged during the flood, and other utilities, such as water lines serving downstream communities, were completely destroyed.

Early records of floods in the study reach are fragmented and lacking in detail. Flooding occurred on St. Vrain Creek in 1864, 1876, 1894, 1919, 1941, 1949, 1951, 1957, and 1969. The floods of June 1864 and May 1876 were severe and much valley farmland was flooded. The flood of May 31, 1894, inundated the entire lower part of town. Although 20 homes at Lyons were washed away, no lives were lost. This flood had an estimated peak discharge of 9,800 cfs at Lyons, with most of the flow coming from South St. Vrain Creek.

In late July 1919, a series of severe thunderstorms caused flash flooding along St. Vrain Creek. The following is from the *Lyons Recorder*, dated August 2, 1919:

> "The heaviest and most destructive cloudburst . . . in the memory of the oldest inhabitant visited Lyons on Wednesday, July 30, between 2:30 and 3:45 P.M. It took out all the bridges on the North St Vrain for about 5 miles up and 5 miles downstream. The Longmont and Lyons water mains up the canyon were torn out along the narrow canyon."
>
> "The people living . . . along the banks of the river were flooded out, and many abandoned their homes for higher ground and safety . . . homes (in the lower part of town) . . . were in a roaring sea of water 2 and 3 feet deep."

Another crest on the following day flooded houses again in the lower areas of town and washed out 300 yards of railroad track east of Lyons. The peak discharge on July 30 was later computed to be 9,400 cfs. The right bank of North St. Vrain Creek was flooded to a width of 300 feet (Reference 19).

The largest peak discharge of record on St. Vrain Creek at Lyons was 10,500 cfs on June 22, 1941. This flood originated mostly on South St. Vrain Creek, and the creek peaked very rapidly with floodwaters receding quickly. It is assumed that an extremely localized cloudburst occurred over South St. Vrain Creek a short distance upstream from Lyons.

The effects of the June 4, 1949, flood were felt largely downstream of Lyons. Prolonged rainfall and heavy snowmelt kept St. Vrain Creek out of its banks in rural areas during most of the month of June. Bridges, roads, and irrigation headworks were damaged.

Lyons received 6.3 inches of rain from a cloudburst storm that began at approximately 6 p.m. on August 3, 1951. This combined with generally heavy rains over the basin to cause flooding from Lyons to the mouth of St. Vrain Creek. The flood lasted for less than 12 hours. Severe damage resulted to State Highway 7 along South St. Vrain Creek. In the rural areas downstream from Lyons, many grain shocks were washed from the fields.

On May 8 and 9, 1957, approximately 3 to 5 inches of rain fell over the entire basin of St. Vrain Creek. The rain began at approximately 10 p.m. and stopped at approximately 6 a.m. On May 9, at approximately 1 a.m., St. Vrain Creek peaked at Lyons at 3,060 cfs. The flood damaged and destroyed irrigation diversion works and bridges downstream from Lyons.

In 1969, heavy rainfall combined with snowmelt caused prolonged high flows on St. Vrain Creek. The worst flooding occurred on May 7 and 8 and from June 15 to June 21. Roads and bridges along the stream were extensively damaged, stream banks were eroded, and farmlands were flooded. On May 7, the peak discharge at Lyons was 2,900 cfs.

The steep stream slopes create swift currents during a flood, which produces added damages. Debris carried by the fast-moving water not only threatens bridges and culverts, but batters houses or other structures on the floodplain. The bridge and culvert crossings often result in channel restriction, raising the water-surface profile. Erosion undercuts and destroys structures that would otherwise receive little damage from inundation. Large quantities of rocks are often deposited in portions of the channel, leaving little capacity for future floods. Vegetative growth in the channel also reduces the channel capacity and causes increased overbank flow during high floods. Major flood damages in the study area are to roads, culverts, and residential buildings.

Town of Nederland

While the 2013 flood event generally spared the Town, it was cut off from the front range communities as travel through the mountain canyons was impossible. Many residents of Nederland rely on the front range communities, including Boulder and Longmont, for work and provisions. It would be months before these canyon roads were restored.

Early records of floods in Nederland study area are fragmented and lacking in detail. A description of the more-recent floods follows:

June 22, 1951 - *Boulder Daily Camera*:

> Nederland reservoir at the head of Boulder Canyon is full for the first time in two years.
>
> With water pouring over the 132-foot-high spillway at the dam and heavy rains falling in the mountains, a flood threat developed in Boulder Creek Thursday night but there was little damage. Contrary to broadcast reports, the water did not reach the canyon highway or cause any interference with road bridges . . . It is not unusual for the reservoir to fill; it has happened more than half of the years since the dam was completed in 1910. But with the dam unable to hold any more water, it means a possible flooding of Boulder Creek if there are heavy rains and fast thaws of snow at the headwaters.

May 16, 1957 - *Boulder Daily Camera*:

> Nederland reservoir of the Public Service Company is now half full, The Camera was informed today. Rumor had it that water was spilling over the dam for the first time in many years. Prospects are good for the reservoir filling but not until later in the summer.
>
> Meantime reservoirs in Boulder Valley are rapidly filling with floodwater, and irrigation ditches (not those running through Boulder) are carrying a full load to the reservoirs they service.

2.4 Flood Protection Measures

All communities impacted by the 2013 flood event endured a short-term flood recovery period where protection of life and property was paramount. Federal agencies such as the Natural Resources Conservation Service (NRCS) carried out their Emergency Watershed Protection (EWP) program, providing temporary and permanent bank stabilization measures and channel capacity work to ensure adequate protection for spring runoff in 2014. Nearly 2 years after the event, many private residents continue to rebuild, repair, and protect homes, bridges, culverts, and stream banks damaged or destroyed by the flood. Many communities and organizations participated in Long-term master planning to develop flood mitigation solutions and to continue to help the watersheds recover from an event that changed the landscape, ecosystems, and drainage patterns in Boulder County. Far too many flood protection measures to mention in this FIS have been or will be designed and constructed following the 2013 event.

While reservoirs throughout the county do provide some flood attenuation, Barker Reservoir on Boulder Creek and Gross Reservoir on South Boulder Creek are far enough upstream from the areas studied by detailed methods that their flood protection effects are negligible. Since 1971, Boulder County has undertaken an active program of floodplain management.

Past urbanization in the City of Boulder has encroached drainage ways and reduced stream storage, thereby increasing runoff peaks and volumes. Undersized culverts and channels exist throughout the city. A few measures have been taken to alleviate these problems on some of the study streams and are discussed below. This discussion excludes drainage improvements constructed to provide protection from erosion. The degree to which the flood-control measures discussed protect from return interval floods is unknown at this time.

The improved Bear Canyon Creek channel along Table Mesa Drive from Broadway to Gillespie Street (upstream limit of detailed study) will efficiently convey moderate flood flow downstream; however, major storms will continue to cause flooding problems. The channel improvements in Martin Park completed under a UDFCD maintenance project were not designed to contain the 1-percent annual chance flood flow in the channel (Reference 23).

For flood protection from Boulder Creek, a levee was constructed around the 75th Street Wastewater Treatment Plant. The levee was found to provide protection from the 1-

percent annual chance flood, and it meets all of the requirements set forth in Section 65.10 of the NFIP regulations (Reference 64).

The University of Colorado South Campus Levee provides protection from the 1-percent-annual-chance flood event.

Flood protection measures along Dry Creek include channelization and construction of a new bridge at Flatirons Parkway (Reference 24).

Three adjacent detention ponds on Elmers Twomile Creek were constructed by the City of Boulder to control runoff. These ponds are located just south of Iris Avenue behind the K-Mart store. These ponds will attenuate the 1-percent annual chance peak flood discharge from 615 to 510 cfs.

Flood protection measures along Fourmile Canyon Creek include channelization through the Palo Park Subdivision (Reference 25), and construction of a culvert at Sumac Avenue.

Flood protection measures along Goose Creek include channelization of North and South Goose Creeks.

Flood protection measures along Skunk Creek include the channelization of the stream between Morehead Avenue and U.S. Highway 36.

A small detention/siltration pond on Twomile Canyon Creek just upstream of Linden Avenue will control moderate flows; however, it does not attenuate the 1-percent annual chance peak flood flow.

Flood-protection measures along Wonderland Creek consist of Wonderland Lake (Reference 20); the ponding area between Wonderland Lake and Broadway; the channelization projects along the Winding Trail Village and Aspen Grove developments, located between the Longmont Diagonal and 26th Street (Reference 21); the constructed 26th Avenue Crossing culvert and drop inlet (Reference 21); the detention pond east of 47th Street (Reference 22), and channelization from approximately 130 feet downstream of Valmont Drive to approximately 1,070 feet upstream of Valmont Drive. Wonderland Lake, while not designed to provide flood protection, will attenuate the 1-percent annual chance peak flood flow from 400 to 100 cfs. For the routing analysis, Wonderland Lake will be considered filled to the spillway crest at the time of storm runoff routing. The area between Wonderland Lake and Broadway creates an unplanned flood-control structure, because the culvert at Broadway will convey very little flow and a considerable ponding volume is available. This unplanned flood reservoir was not included in the hydrologic analysis. Spill flow from Fourmile Canyon Creek to the north will also reach Wonderland Creek at this location.

The 26th Avenue Crossing culvert and drop structure have been constructed and are designed to contain the 1-percent annual chance flood flow (Reference 16). The pond east of 47th Street will have little effect on the 1-percent annual chance peak flow.

Flood protection measures along Coal Creek in the Town of Erie include channelization and the construction of levees from approximately 5,700 feet downstream to approximately 600 feet upstream of the UPRR (Reference 95). As a result of this project, the base flood and floodway are contained within the channel from approximately 2,750 feet downstream to the UPRR. The flooding associated with the Coal Creek West Line Overflow through the town has been eliminated.

There are no flood protection measures along the segments of Bullhead Gulch and the Prince Tributaries in the Town of Erie.

No flood protection structures or measures exist or are planned for the flooding sources of Jamestown.

No flood protection structures exist or are planned within and adjacent to Lafayette. Lafayette has building ordinances along the floodplains that prohibit certain types of construction.

There is little evidence of flood protection measures along the study segment of St. Vrain Creek in Lyons, except the channelization between Sunset Street and the Burlington Northern and Santa Fe Railway Bridge. There is a line of low levees along the trailer park on the south side of this segment. There are three dams in the upper mountain segments of St. Vrain Creek. Button Rock Dam was completed on North St. Vrain Creek in 1969, six miles west of Lyons, to store the municipal water supply. It was not designed to store floodwater; but, during the May 1969 flood, it reduced the magnitude of the discharge that could have inundated Longmont. Both the Longmont Dam, located one mile downstream of the Button Rock Dam, and Beaver Reservoir, near the South St. Vrain Creek headwaters, have no effect on the flood discharge in Longmont.

Lefthand Creek has been channelized along the segment from Pike Road (State Highway 22) to the mouth. The channel from Pike Road to South Pratt Parkway is grass-lined and is designed to contain a flow of approximately 3,650 cfs. From South Pratt Parkway to its mouth, Lefthand Creek has been channelized; however, the overbanks remain unimproved. Other flood protection measures include construction of a side channel north of the existing channel, construction of a cutoff channel parallel to South Main Street from Lefthand Creek to approximately 2,000 feet south, and channelization along Lefthand Creek from just downstream to approximately 1,200 feet downstream of South Main Street.

Various structural improvements such as grass- or concrete-lined channels, detention ponds, and outfall culverts have been implemented on Spring Gulch in the segment from Ninth Avenue to Third Avenue. These improvements are inadequate to contain even the 10-percent annual chance flood discharge.

No flood protection measures have been taken in Loomiller Basin, except for using Loomiller Pond as a flood-storage facility. Various properties along the streets in Loomiller Basin have low retaining walls along the street frontage to prevent yard flooding.

Flood protection measures along Dry Creek No. 1 include channel improvements from downstream of a private road to approximately 1,450 feet downstream of Airport Road, the construction of four 12-foot by 8-foot box culverts at Airport Road, channelization from approximately 400 feet downstream of South Fordham Street to South Fordham Street, the construction of box culverts under South Fordham Street, realignment and channelization from approximately 1,450 feet downstream to just downstream of Grandview Meadows Drive, replacement of an existing culvert under Grandview Meadows Drive, and construction of a flood-detention basin along Dry Creek No. 1 approximately 600 feet upstream of Grandview Basin Tributary. Clover Basin Tributary has been channelized from just upstream to approximately 400 feet upstream of its confluence with Dry Creek No. 1.

In addition to the physical flood prevention measures mentioned, Longmont initiated an ordinance in May 1973 for floodplain regulation, and has followed with floodplain management policies outlined in the St. Vrain Comprehensive Plan (Reference 5).

Lyons practices non-structural floodplain management through a restrictive building code for structures located within the floodplain.

No flood protection structures or measures exist or are planned along Middle Boulder Creek and North Beaver Creek within Nederland.

No floodplain structures either exist or are planned within and adjacent to Superior.

Boulder County is provided some protection from floods through flood warning and forecasting by the National Oceanic and Atmospheric Administration (NOAA), National Weather Service.

3.0 ENGINEERING METHODS

For the flooding sources studied by detailed methods 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-, and 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 annual 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); 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.

3.1 Hydrologic Analyses

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

Hydrologic data from the various engineering reports discussed in Section 7.0 have been used extensively for the revised study of Boulder County, including peak discharges and starting WSELs.

Boulder County (Unincorporated Areas)
Frequency-discharge data for Boulder Creek were based on information published in the Flood Hazard Area Delineation for Boulder Creek report (Reference 60). The hydrology of the Boulder Creek basin was studied in conjunction with a report by the USACE on Boulder Creek for the Metropolitan Denver and South Platte River Study using the EPA's SWMM program (Reference 94). Historical Stream gage records were used to check the results from the SWMM model. Rainfall data used in the SWMM model was obtained from the N OAA Atlas 2, Volume III, Colorado, 1973 (Reference 33).

The hydrologic analysis completed by the USACE was used to establish peak discharges for the 10-, 2-, 1-, and 0.2-percent annual chance flood events for Boulder Creek. The 0.2-percent annual chance values were estimated by extrapolating on arithmetic-probability paper. A diffusion routing technique developed by the USACE, Missouri River Division, was used for the flood routing calculations.

Additional information on Boulder Creek and its various split flows through the City of Boulder can be found in Section 10.0, "Revisions Descriptions".

A hydrologic analysis for Dry Creek No. 2 Ditch Split Flow and Highway 93 Split Flow was completed by the USACE to determine the peak discharges of the 10-, 4-, 2-, 1-, and 0.2-percent annual chance flood events. Discharge-probability relationships were computed using the EPA's SWMM program (Reference 94). Rainfall data used in the SWMM model was obtained from the NOAA Atlas 2, Volume III, Colorado, 1973 (Reference 33). Rainfall hyetographs having six-hour storm durations were input into the model for each respective frequency storm. Soil infiltration rates of 0.5 inch per hour in the plains and 1.0 inch per hour in the mountains were used for the pervious areas in the hydrologic model. The impact of Gross Reservoir was evaluated by routing storm runoff through the reservoir pool. Significant reductions in peak discharges resulted with the various frequency routed storms. The 0.2-percent annual chance event was extrapolated from a frequency curve drawn through the plotted 10-, 4-, 2-, and 1-percent annual chance discharges for the different locations.

For South St. Vrain Creek and Middle St. Vrain Creek, the frequency-discharge relationships were based on a log-Pearson Type III distribution using the streamflow records at ten USGS gaging stations located in the upper St. Vrain Creek and Big Thompson River basins (Reference 77).

The hydrologic analyses for Bullhead Gulch and Prince Tributary (East and West Branches) were based on modeling performed for UDFCD by Advanced Sciences, Inc. (ASI), for Lafayette and Louisville (Reference 84). Stream data were not available for Bullhead Gulch, and Prince Tributary (East and West Branches); therefore, rainfall-runoff analysis was used to determine flood discharges. The procedure used to determine the 10-, 2-, and 1-percent annual chance discharges involved the following three computer programs: Hydrocad (Reference 92), CUHPE/PC (Reference 86), and UDSWM2-PC (Reference 93). The Hydrocad program was used to digitize the sub-basin area, soil type, land use and drainage flow path information. Individual storm hydrographs were developed by CUHPE using the data from Hydrocad along with user input for rainfall depth and depression losses for pervious and impervious areas. These hydrographs were then routed and combined using the SWMM computer program. The rainfall depths were taken from the Boulder County Storm Drainage Criteria manual (Reference 87). TEA modified the hydrology by ASI to include additional storage facilities. Only facilities, which communities agreed to operate and maintain for flood control, were considered. TEA also adjusted percent impervious values to approximate existing conditions, and development proposed by the Town of Erie Master Plan (Reference 88).

For Fourmile Creek, the discharge probability relationships were determined using the EPA's SWMM computer model (Reference 94). The model was calibrated using data collected from the flood hydrograph of May 1973 for the uncontrolled area of Cherry Creek located downstream from Cherry Creek Dam. Rainfall input for the model was derived from the NOAA Atlas for Colorado (Reference 33). Values for the 0.2-percent-annual-chance storm were extrapolated.

City of Boulder

For South Boulder Creek, the hydrologic information was taken from the South Boulder Creek Climatology and Hydrology Summary Report (Reference 101). Much of the South Boulder Creek watershed lies above Eldorado Springs; however, important tributary flows from the Viele Channel and Bear Canyon Creek basins are generated in the lower part of the watershed. That, in combination with the dynamic nature of the MIKE FLOOD simulation, resulted in a departure from the standard of practice for input of runoff hydrographs.

The City of Boulder, Colorado, has been identified as having one of the largest potentials for loss of life to flash flooding within Colorado. Boulder is lined to the west by a series of foothills canyons that drain into the City. The three primary foothills watersheds from north to south include Four Mile Creek, Boulder Creek and South Boulder Creek. Numerous smaller tributaries flow into these three main streams. Each of these streams is a source for flash flooding and flooding within the City and the adjacent foothills. The hydro-climatological study focuses on South Boulder Creek.

The lower basin is flat with a northeast-southwest orientation with most of the basin's elevation below 6,000 feet. The lower basin ends abruptly at the Flatiron's interface. The middle basin shows a distinct southeast to northwest orientation with elevations rising from almost 6,000 feet to over 9,000-10,000 feet along the basin's north and south boundaries. This portion of the basin extends one to two miles west of Gross Reservoir. The upper

portion of the basin faces an almost due east-west orientation and extends from about 8,500 feet to over 13,000 feet along the Continental Divide.

The South Boulder Creek basin is unusual among those in the Denver/Boulder metropolitan area. It is one of the few that extends up to the continental divide and flows through a highly urbanized metropolitan area. As such, the hydrologic response of the basin is not easily characterized by conventional approaches. The citizens of Boulder recognized this when they suggested that a new and different approach was necessary to fully understand the flood hazard along South Boulder Creek. The study was commissioned to develop the most scientifically defensible floodplain delineation using state of the art hydrologic tools balanced against a careful investigation of the recorded and physical record of floods within the basin.

To accomplish this objective, the City developed a hydrologic evaluation that was built upon several different approaches. The approach employs a comprehensive computer model to simulate basin response under a variety of conditions. In this way, the approach is similar to many other studies used in the area. However, the level of attention given to assuring that the model reflects basin conditions accurately is well beyond that of conventional flood studies. Further, the study relies heavily on several other approaches to estimate peak flood flows. These other methodologies lack the flexibility necessary to evaluate flood hazard at several places within the watershed and under various conditions; however, they offer estimates that are based on physical observations of flood in the watershed. These provide an important point against which the computer model can be measured and offer data that can be used to improve the ability of the computer model to replicate actual watershed conditions.

Finally, this study departs from traditional studies in one other important way: it comprehensively incorporates the impacts of floodplain storage in the floodplain delineation process. The simulation of floodplain storage in a watershed such as South Boulder Creek is important, but extremely difficult to do. Most studies do include large flood control facilities or other impoundments such as Gross Reservoir that may affect peak flow. These have been incorporated herein. However, the simulation of ponding behind roadway and railroad embankments, the storage seen in broad floodplains through agricultural or open space areas, or the diversion of flows into irrigation ditches is seldom included in studies of this nature. The effort is extreme and the data is often lacking. This study does incorporate these effects as part of the detailed floodplain hydraulic simulations where ponding and backwater impacts are included.

Together, the level of effort made to assure that the hydrologic computer model represents real watershed responses, along with the incorporation of the effects of floodplain storage, make this study one that represents a scientifically defensible approach with higher resolution, detail and verification than any other study devoted to South Boulder Creek.

Discharges for Bear Canyon Creek, Elmers Twomile Creek, Fourmile Canyon Creek, Goose Creek, Skunk Creek, Twomile Canyon Creek, and Wonderland Creek were taken from the Flood Hazard Area Delineation report for Boulder and Adjacent County Drainageways (Reference 25). Because no stream gage data are available for the study streams through Boulder, a rainfall-runoff analysis was conducted on the watersheds to

determine the flood discharges. This was accomplished by using the UDFCD CUHP-B rainfall-runoff computer program to develop the storm hydrographs (Reference 26) and the USACE HEC-1 computer program for the stream and reservoir routings (Reference 27). For the analysis, basin characteristics of the watershed, as well as rainfall amounts based on the selected recurrence intervals, are used to compute flood hydrographs for various design points in the basin. All stream and reservoir routings were accomplished using the Modified Puls Method.

The 0.2-percent-annual-chance runoff values for various locations along each stream were extrapolated from the discharge-frequency curves.

A more detailed description of the input variables for the CUHP-B and the HEC-1 rainfall-runoff analysis, as well as the CUHP-B computer output and the summary of the final HEC-1 computer output, is located in a technical addendum to this FIS report (Reference 28).

Town of Erie

The peak discharges for the 10-, 2-, 1-, and 0.2-percent annual chance floods for Coal Creek were developed by the SCS in a report entitled "Flood Hazard Analyses, Coal Creek and Rock Creek, Boulder and Weld Counties, Colorado" (Reference 18). The SCS used synthetic rainfall-runoff procedures, as described in the SCS National Engineering Handbook (Reference 32), and the TR-20 computer program for flood routing (Reference 35) to establish the selected discharges along the stream.

The hydrologic analyses for Bullhead Gulch and Prince Tributary (East and West Branches) were based on modeling performed for UDFCD by Advanced Sciences, Inc. (ASI), for Lafayette and Louisville (Reference 84). Stream data were not available for Bullhead Gulch, and Prince Tributary (East and West Branches); therefore, rainfall-runoff analysis was used to determine flood discharges. The procedure used to determine the 10-, 2-, and 1-percent annual chance discharges involved the following three computer programs: Hydrocad (Reference 92), CUHPE/PC (Reference 86), and UDSWM2-PC (Reference 93). The Hydrocad program was used to digitize the sub-basin area, soil type, land use and drainage flow path information. Individual storm hydrographs were developed by CUHPE using the data from Hydrocad along with user input for rainfall depth and depression losses for pervious and impervious areas. These hydrographs were then routed and combined using the SWMM computer program. The rainfall depths were taken from the Boulder County Storm Drainage Criteria manual (Reference 87). TEA modified the hydrology by ASI to include additional storage facilities. Only facilities, which communities agreed to operate and maintain for flood control, were considered. TEA also adjusted percent impervious values to approximate existing conditions, and development proposed by the Town of Erie Master Plan (Reference 88).

Town of Jamestown

Discharges for James Creek and the downstream portion of Little James Creek through Jamestown were taken from a USACE report (Reference 30). Technical Manual No. 1, developed by the USGS (Reference 31), was used to obtain peak discharges on the upstream portion of Little James Creek and Balarat Creek.

City of Lafayette and Town of Superior

Hydrologic data for flooding sources affecting Lafayette and Superior are based on the data generated for the October 1976 study of Coal Creek and Rock Creek, performed by the SCS (Reference 18). Since there are no stream flow records for Coal Creek and Rock Creek, the SCS used synthetic rainfall-runoff procedures to determine the flows for various frequency storms. Analyses were based on storm duration of 24 hours, Type II, and IIA distribution, as described in the SCS National Engineering Handbook, Section 4 (Reference 32). The amount of rainfall was obtained from the precipitation frequency atlas (Reference 33), and a real adjustment was applied to convert the point precipitation values to average precipitation over the watershed area. The studies were conducted using runoff computations based on information regarding the type and location of existing and planned land use provided by the SCS (Reference 19). Hydrologic soil cover complexes and associated Runoff Curve Numbers were extracted from the SCS reports (Reference 15) and field checked. Values of 10-, 2-, 1-, and 0.2-percent annual chance peak discharges were obtained using the SCS computer programs WSP2 and TR20 (References 34 and 35).

City of Longmont

Frequency-discharge data for two of the streams studied in detail in Longmont are based on information published in USACE Flood Plain Information reports for Lefthand and St. Vrain Creeks (References 7 and 8). The 1-percent annual chance flood discharges on Lefthand Creek and St. Vrain Creek are 4,250 cfs and 10,200 cfs, respectively. The 0.2-percent annual chance flood discharges for these two streams equal the discharges for the standard project floods as published in the Flood Plain Information reports (References 7 and 8). These relationships are based on a Log-Pearson Type II analysis of peak runoff data recorded at gages on St. Vrain Creek near Lyons and Platteville (Reference 36). The years of record vary from 79 years at the Lyons gage to 47 years at the Platteville gage.

Discharge-frequency relationships for Spring Gulch were computed using the USACE HEC-1 Flood Hydrograph Package (Reference 37). Synthetic flood hydrographs computed by this method reflect the effects of characteristics of the basin: precipitation, ground cover, slope, drainage area, and other physical characteristics of the drainage basin. Where available, hydrologic data were compared with other studies completed in the area (References 38 and 39). The effects of detention storage near State Highway 66 and at Long Peak Dam on Spring Gulch were studied (Reference 38) and found to be insignificant for the magnitude of the floods considered in the study. That portion of the Spring Gulch Basin located north and east of Terry Lake is considered to be contained completely by Terry Lake.

Rainfall data for the synthetic hydrologic analysis were taken from a rainfall/runoff information report (Reference 40). The discharges computed using the HEC-1 program were verified using the Plains Region equations developed by the USGS (Reference 31). Peak discharges were also verified by the SCS runoff prediction method (Reference 41).

Discharges for the 0.2-percent annual chance floods of all streams were checked by straight-line extrapolation of frequencies previously determined using the procedure of the USGS (References 9 and 10), and compared to the USACE Standard Project Flood data when available.

The 10-, 2-, 1-, and 0.2-percent annual chance peak discharges for Dry Creek No. 1, Dry Creek No. 1 (Old Channel), Clover Basin Tributary, and Steele Lakes Tributary were taken from the Floodplain Information and Flood Control and Drainage Plan for Dry Creek No. 1 (Reference 3). Discharge-frequency relationships were developed using the EPA's SWMM computer program (Reference 94). Rainfall data used in the SWMM model was obtained from the NOAA Atlas 2, Volume III, Colorado, 1973 (Reference 33). Rainfall infiltration rates were estimated using the "Boulder County Soil Survey" (Reference 15). In the SWMM model floods were routed through five of the reservoirs to account for their effect on peak flows.

The major portion of the Dry Creek No. 1 Basin is located outside the limits of the study area. Runoff from this area contributing to peak discharges within the study reach is limited by the Burlington Northern and Santa Fe Railway, which diverts most of the upstream runoff north to St. Vrain Creek.

Discharges for Lefthand Creek North Overflow Channel and Lefthand Creek South Overflow Channel were determined by the USACE HEC-2 water surface profiles program (Reference 45) during a new hydraulic analysis along Lefthand Creek.

The hydrologic analyses for this study were revised to include information presented in floodplain information reports for Lefthand Creek, Dry Creek No. 1, and St. Vrain Creek (References 1 through 4) and in the LOMR dated May 14, 1999 for Lefthand Creek North Overflow Channel and Lefthand Creek South Overflow Channel.

Town of Lyons

The Lyons stream flow gage, located on the left bank of St. Vrain Creek 0.4 mile downstream from the confluence of North St. Vrain Creek and South St. Vrain Creek, has been in operation since 1895. The flows recorded are partly regulated by small diversions above the gage station. Significant peak flood discharges and stages recorded during this period are presented in Table 2 (Reference 42).

Table 2 – Historic Flood Peak Discharges and Stages at Lyons Gage, St. Vrain Creek

Date	Stage (feet)	Maximum Discharge (cfs)
July 30, 1919	7.90	9,400
June 22, 1941	8.06	10,500
August 3, 1951	5.37	3,920

This report is based upon data generated for the June 1972 and September 1972 studies of Lower and Upper St. Vrain Creek by the USACE (References 8 and 43).

The discharge-frequency relationships in the St. Vrain Creek Basin at Lyons were based on a statistical analysis of the stream gaging records of the St. Vrain Creek at Lyons. Synthetic unit hydrographs were developed for the St. Vrain Creek Basin and its subdrainage basins of North St. Vrain Creek and South St. Vrain Creek to help define the flow characteristics within the basin. The hydrographs were used for stream routing through Button Rock Dam to Lyons, and downstream from Lyons to determine the discharges throughout the length of the stream.

Town of Nederland

A continuous record of flows at the USGS Nederland gage, located on Middle Boulder Creek, is available from 1907 to the present. Significant peak flood discharges and stages during the period from 1945 to 1975 are presented in Table 3. Flow measurements prior to 1945 could not be verified as being either average daily measurements or daily peak measurements. Following U.S. Water Resources Council Bulletin 17 (Reference 44), discharge-frequency relationships in the Middle Boulder Creek Basin were determined by statistical analysis of the stream gaging records of Middle Boulder Creek at Nederland, using 32 years of record and a weighted skew coefficient of -0.252.

Table 3 – Historic Flood Peak Discharges and Stages at Nederland
(Recorded on Middle Boulder Creek)

Year	Date	Stage (feet)	Maximum Discharge (cfs)
1949	June 13, 1949	4.66	674
1951	June 18, 1951	4.75	800
1953	June 13, 1953	3.98	730
1957	June 29, 1957	4.25	745
1965	July 24, 1965	4.25	640

For North Beaver Creek, peak discharges for the respective frequencies were determined using USGS Technical Manual No. 1 (Reference 31).

The procedure outlined in Technical Manual No. 1 was also used to develop peak discharges at various locations in the Middle Boulder Creek Basin and its subdrainage basin of North Beaver Creek to help define the flow characteristics within both basins.

Peak discharge-drainage area relationships for streams studied in detail are shown in Table 4.

Table 4 – Summary of Discharges

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs)			
		10-Percent Annual Chance	2-Percent Annual Chance	1-Percent Annual Chance	0.2-Percent Annual Chance
Arapahoe Avenue Spill Flow					
Approximately 800 feet downstream of the divergence from Gregory Canyon Creek	--[1]	323	975	1,209	2,149
Balarat Creek					
At Upstream Limit of Detailed Study	0.5	30	150	270	760
Bear Canyon Creek					
At Confluence with Boulder Creek	8.24	2,050	3,762	4,880	7,500
At Confluence of Skunk Creek	5.35	1,170	2,360	3,070	5,100
At Baseline Road	4.96	1,110	2,352	2,930	5,000
At U.S. Highway 36	4.34	820	1,780	2,210	3,850
At Broadway	4.08	680	1,512	1,930	3,400
At Upstream Limit of Detailed Study	3.71	480	1,190	1,600	3,000
Boulder Creek					
At Confluence with Fourmile Canyon Creek	--[1]	3,650	10,100	14,400	29,600
At Valmont Drive	--[1]	3,450	9,200	13,000	23,000
At 28th Street	--[1]	2,200	7,800	8,000	20,600
At County Road 54	--[1]	350	1,560	2,340	4,770
Boulder Creek- 13th Street Split	--[1]	--[1]	275.13	1,084.78	--[1]
Boulder Creek- 14th Street Split	--[1]	--[1]	331.50	954.07	--[1]
Boulder Creek- 15th St/Arapahoe Ave/Marine St					
At Grove St.	--[1]	--[1]	172.65	437.79	--[1]
At Confluence with Boulder Creek	--[1]	--[1]	331.50	954.07	--[1]
Boulder Creek- 16th Street Split	--[1]	--[1]	18.58	112.79	--[1]
Boulder Creek- 17th Street Split	--[1]	--[1]	17.96	126.17	--[1]
Boulder Creek- 18th Street Split	--[1]	--[1]	3.49	30.02	--[1]

Table 4 – Summary of Discharges (Continued)

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs)			
		10-Percent Annual Chance	2-Percent Annual Chance	1-Percent Annual Chance	0.2-Percent Annual Chance
Boulder Creek- 21st Street Split	--[1]	--[1]	86.66	216	--[1]
Boulder Creek- 22nd Street Split	--[1]	--[1]	11.53	47.39	--[1]
Boulder Creek- 38th Street Split	--[1]	--[1]	313.16	595.88	--[1]
Boulder Creek- 55th Street Split					
Downstream of Pearl Street	--[1]	--[1]	2,481.25	4,130.10	--[1]
Boulder Creek- 55th Street Split (500-year)					
At 55th Street	--[1]	--[1]	--[1]	--[1]	944.56
Boulder Creek- Arapahoe Avenue Split					
Upstream of 30th Street	--[1]	--[1]	1,688.22	3,658.75	--[1]
At Folsom Street	--[1]	--[1]	204.71	677.83	--[1]
Boulder Creek- Arapahoe Avenue East Split					
Upstream of 38th Street	--[1]	--[1]	246.99	646.34	--[1]
Boulder Creek- Arapahoe Ave West/20th St					
At 23rd Street	--[1]	--[1]	11.50	110.61	--[1]
At 21st Street	--[1]	--[1]	54.16	326.61	--[1]
Boulder Creek- Canyon Boulevard Split					
At 28th Street	--[1]	--[1]	32.52	93.05	--[1]
At Broadway	--[1]	--[1]	865.00	2,905.13	--[1]
Boulder Creek- Canyon Blvd at 6th St Split					
Along Canyon Boulevard	--[1]	--[1]	0.0	79.71	--[1]
Just upstream of 6th Street	--[1]	--[1]	0.0	795.73	--[1]
Boulder Creek- Downstream Railroad to 55th St Split (500-year)					
At Valmont Road	--[1]	--[1]	--[1]	--[1]	19,293.64
At Central Avenue	--[1]	--[1]	--[1]	--[1]	31.13

Table 4 – Summary of Discharges (Continued)

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs)			
		10-Percent Annual Chance	2-Percent Annual Chance	1-Percent Annual Chance	0.2-Percent Annual Chance
Boulder Creek- Downstream Valmont Split					
At Cross-Section A	--[1]	580.40	3,564.79	6,366.64	12,563.36
Boulder Creek- Flatiron Parkway Split					
Downstream of 55th Street	--[1]	--[1]	142.60	207.00	--[1]
Boulder Creek- Goss Street Split					
At Folsom Street	--[1]	--[1]	13.27	65.57	--[1]
Boulder Creek- Grove Street Split					
At Folsom Street	--[1]	--[1]	137.38	285.65	--[1]
	--[1]	--[1]			--[1]
Boulder Creek- Harvest House Split					
Upstream of 28th Street	--[1]	--[1]	882.24	1,322.19	--[1]
At Folsom Street	--[1]	--[1]	1,079.10	2,262.30	
Boulder Creek- Pearl Street Split					
Upstream of 55th Street	--[1]	--[1]	79.80	619.91	--[1]
Boulder Creek- Railroad Overtopping					
At railroad crossing	--[1]	--[1]	6,396.02	10,255.54	--[1]
Boulder Creek- Railroad Overtopping (500-yr)					
At railroad crossing	--[1]	--[1]	--[1]	--[1]	15,479.86
Boulder Creek- Railroad Split Flow				6.12	
At railroad crossing					
Boulder Creek- Skunk Creek Split					
Upstream of Foothills Parkway	--[1]	--[1]	1,175.70	1,611.36	7,307.32
Boulder Creek- Taft Drive Split					
Upstream of 28th Street	--[1]	--[1]	335.61	521.82	--[1]

Table 4 – Summary of Discharges (Continued)

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs)			
		10-Percent Annual Chance	2-Percent Annual Chance	1-Percent Annual Chance	0.2-Percent Annual Chance
Boulder Creek- Valmont Split					
Between Boulder Creek and Valmont Road	--[1]	1,486.80	3,390.80	5,102.12	--[1]
Boulder Creek- Valmont Split North Split					
Along Valmont Road	--[1]	1,507.00	3,320.68	4,229.51	--[1]
Boulder Creek- Valmont Split West Split					
Along Valmont Road	--[1]	20.30	2,233.12	3,384.36	--[1]
Boulder Creek- Walnut Street Split (500-year)					
At Foothills Parkway	--[1]	--[1]	--[1]	--[1]	6,154.07
Boulder Creek (Right Bank Overflow)					
Approximately 800 feet Upstream of Foothills Parkway	--[1]	--[1]	1,609	2,523	11,469
Boulder Slough					
Bullhead Gulch					
Just Upstream of Confluence with Boulder Creek	8.85	1,421	1,300	4,532	6,109
Bullhead Gulch (continued)					
Just Downstream of Confluence of Prince Tributary	8.16	1,474	3,581	4,772	6,275
Just Upstream of Confluence of Prince Tributary	5.61	683	1,935	2,639	3,474
Just Downstream of Confluence of Indian Peaks	2.14	374	970	1,333	1,811
Just Upstream of Confluence of Indian Peaks	1.59	190	532	760	1,251
At Upstream Limit of Detailed Study	0.64	294	575	774	1,041

Table 4 – Summary of Discharges (Continued)

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs)			
		10-Percent Annual Chance	2-Percent Annual Chance	1-Percent Annual Chance	0.2-Percent Annual Chance
Clover Basin Tributary					
At 75th Street	--[1]	178	400	495	854
Coal Creek					
Near Erie Municipal Airport	68.61	5,970	9,670	11,850	17,860
At Union Pacific Railroad near Erie	76.86	6,160	10,020	12,250	18,340
At Briggs Street	77.48	6,160	10,040	12,280	18,380
At Confluence of Rock Creek	59.3	5,120	8,740	10,640	15,920
At a Point 65,250 feet above Mouth	37.6	2,860	3,620	4,250	6,260
At Burlington Northern and Santa Fe Railway	36.3	2,330	3,490	4,120	6,170
At U.S. Highway 287	35.6	2,370	3,480	4,110	6,160
At a Point 70,350 feet above Mouth	33.7	2,230	3,420	4,040	6,060
At Denver-Boulder Turnpike	27.9	1,740	3,070	3,820	6,030
At McCaslin Boulevard	26.7	1,400	2,980	3,770	5,990
Dry Creek					
At Confluence with Dry Creek No. 2 Ditch Split Flow	--[1]	--[1]	--[1]	4,030	--[1]
At Downstream Limit of Detailed Study	--[1]	--[1]	--[1]	6,630	--[1]
Dry Creek No. 1					
Just Upstream of Steele Lakes Tributary	--[1]	271	674	987	1,812
Just Upstream of the Confluence of Clover Basin Tributary	--[1]	568	1,268	1,726	3,112
Just Upstream of State Highway 119	--[1]	340	845	1,170	2,127
Dry Creek No. 1 (Old Channel)					
Just Downstream of State Highway 119	--[2]	260	330	350	415
Just Upstream of the confluence with St. Vrain Creek	--[1]	320	627	802	1,199

[1] Data Not Available
[2] Data Not Available

Table 4 – Summary of Discharges (Continued)

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs)			
		10-Percent Annual Chance	2-Percent Annual Chance	1-Percent Annual Chance	0.2-Percent Annual Chance
Dry Creek No. 2					
At North 107th Street	--[3]	900	1,900	2,600	4,295
Dry Creek No. 2 Ditch Split Flow					
Just Upstream of the Confluence with Dry Creek	--[1]	0	2,680	4,030	8,850
At Upstream Limit of Study	--[1]	0	100	300	800
Dry Creek No. 3					
Just Downstream of Arapahoe Road	13.6	--[1]	--[1]	1,300	--[1]
Elmers Twomile Creek					
At Confluence with Goose Creek	0.54	373	681	883	1,500
At Iris Avenue	0.32	249	508	630	1,010
At Upstream Limit of Detailed Study	0.13	160	315	384	520
Fourmile Canyon Creek					
At Confluence with Boulder Creek	10.03	119	366	500	1,020
At Longmont Diagonal	9.09	913	2,396	3,336	6,800
At 28th Street	8.60	865	2,566	3,468	6,800
At Broadway	7.92	735	2,662	3,581	6,900
At Upstream Limit of Detailed Study	3.93	350	1,170	1,750	4,000
Fourmile Creek Left Bank Overflow					
At Downstream Limit of Detailed Study	--[1]	715	2,071	2,862	5,780
Fourmile Creek Right Bank Overflow					
At Violet Avenue	--[1]	2	1,319	2,054	4,998
Fourmile Creek					
At Confluence with Boulder Creek	25.0	1,420	4,440	6,230	11,640

[3] Data Not Available

Table 4 – Summary of Discharges (Continued)

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs)			
		10-Percent Annual Chance	2-Percent Annual Chance	1-Percent Annual Chance	0.2-Percent Annual Chance
Goose Creek					
At Confluence with Boulder Creek	5.46	2,865	5,065	6,315	9,325
At Confluence of Elmers Twomile Creek	3.63	1,050	2,100	2,680	4,300
At Confluence of Twomile Canyon Creek	1.32	670	1,270	1,590	2,400
At 19th Street	1.28	700	1,320	1,600	2,450
At Upstream Limit of Detailed Study	0.48	260	520	620	1,000
Gregory Canyon Creek					
At Marine Street	2.29	673	1,672	2,092	3,700
Downstream of College Avenue	--[4]	600	1,504	1,900	3,300
At Upstream Limit of Detailed Study	1.56	400	1,060	1,450	2,600
Highway 93 Split Flow					
At Downstream Limit	--[1]	0	600	1,660	5,000
At Upstream Limit	--[1]	0	2,580	3,850	7,750
James Creek					
At Cross Section A	14.5	355	2,180	3,930	10,880
At Main Street Bridge	12.2	300	1,785	3,205	8,850
At Confluence of Little James Creek	12.1	300	1,760	3,160	8,725
At Upstream Limit of Detailed Study	8.9	200	1,190	2,140	6,010
Lefthand Creek					
At Confluence with St. Vrain Creek	72.0	520	2,480	4,610	10,320
Lefthand Creek (North Overflow Channel)					
At Divergence from Lefthand Creek	--[1]	--[1]	--[1]	333	--[1]
At Confluence with Lefthand Creek	--[1]	--[1]	--[1]	333	--[1]
Lefthand Creek (South Overflow Channel)					
At Divergence from Lefthand Creek	--[1]	--[1]	--[1]	472	--[1]
At Confluence with Lefthand Creek (North Overflow Channel)	--[1]	--[1]	--[1]	798	--[1]

[4] Data Not Available

Table 4 – Summary of Discharges (Continued)

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs)			
		10-Percent Annual Chance	2-Percent Annual Chance	1-Percent Annual Chance	0.2-Percent Annual Chance
Little James Creek					
At Confluence with James Creek	2.8	130	650	1,160	3,220
At Confluence of Balarat Creek	2.25	130	650	1,160	3,220
Little James Creek (continued)					
At Upstream Limit of Detailed Study	1.8	109	544	970	2,690
Little Thompson River					
At Larimer-Weld County Line	--[5]	2,800	5,500	7,200	12,800
Middle Boulder Creek					
At Cross Section A	36.3	693	884	960	1,130
At Cross Section G	29.9	596	760	825	971
Middle St. Vrain Creek					
At Confluence with South St. Vrain Creek	32.4	590	1,430	2,000	4,070
North Beaver Creek					
At Cross Section A	5.3	74	117	135	185
At Cross Section T	5.0	70	112	129	178
North Goose Creek					
At Confluence with Goose Creek	--[1]	3,865	3,865	3,865	6,075
North St. Vrain Creek					
At Confluence with St. Vrain Creek and South St. Vrain Creek	125.0	1,000	2,850	4,310	10,630
Prince Tributary[6]					
Just Downstream of Confluence with Bullhead Gulch	8.16	--[7]	--[2]	4,772	--[2]

[5] Data Not Available
[6] Separate Data for East and West Branches Not Available
[7] Data Not Available

Table 4 – Summary of Discharges (Continued)

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs)			
		10-Percent Annual Chance	2-Percent Annual Chance	1-Percent Annual Chance	0.2-Percent Annual Chance
Prince Tributary (cont'd)					
Just Upstream of Confluence with Bullhead Gulch	2.55	--[2]	--[2]	2,130	--[2]
At Upstream Limit of Detailed Study	0.58	--[2]	--[2]	423	--[2]
Rock Creek					
At Confluence with Coal Creek	21.6	2,870	5,350	6,690	10,240
Rock Creek (continued)					
At 2,400 feet Upstream of Confluence with Coal Creek	21.5	2,900	5,400	6,710	10,270
At South 120th Street	21.3	2,910	5,410	6,740	10,310
At 16,450 feet Upstream of Confluence with Coal Creek	18.7	2,900	5,360	6,640	10,050
At Denver-Boulder Turnpike	9.3	1,256	3,229	4,520	9,176
At McCaslin Boulevard	4.9	594	1,800	2,717	7,000
At Upstream Limit of Detailed Study	4.1	504	1,587	2,396	6,182
St. Vrain Creek					
At Boulder-Weld County Line	351.0	5,520	10,950	14,850	28,670
At 85th Street	241.0	3,160	6,890	9,580	19,680
Just Downstream of the Confluence of North St. Vrain Creek and South St. Vrain Creek	211.0	2,040	6,670	8,880	20,260
St. Vrain Creek (Vicinity of Lyons)					
At Second Avenue	219.0	2,040	5,570	8,880	20,260
Skunk Creek					
At Confluence with Bear Canyon Creek	2.83	980	1,830	2,230	3,500
At Madison Avenue	2.43	920	1,580	1,870	2,650
At U.S. Highway 36	2.08	650	1,130	1,350	1,900
At Broadway	1.36	210	520	710	1,320

[2]Separate Data for East and West Branches Not Available

Table 4 – Summary of Discharges (Continued)

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs)			
		10-Percent Annual Chance	2-Percent Annual Chance	1-Percent Annual Chance	0.2-Percent Annual Chance
Skunk Creek (continued)					
At Upstream Limit of Detailed Study	1.20	180	460	640	1,200
South Boulder Creek					
Near Eldorado Springs	--[8]	1,310	2,640	4,340	7,400
At State Highway 93	--[1]	1,450	3,270	6,200	9,950
At US Highway 36	--[1]	1,300	3,530	7,240	11,640
At Baseline Road	--[1]	1,390	3,050	5,610	9,210
At Confluence with Boulder Creek	--[1]	1,570	3,180	4,980	7,750
Spring Gulch					
At Confluence with St. Vrain Creek	--[1]	1,950	3,150	3,650	4,200
Steele Lakes Tributary					
At 75th Street	--[1]	494	1,165	1,512	2,428
Twomile Canyon Creek					
At Confluence with Goose Creek	2.9	360	840	1,120	2,000
At Broadway	1.68	210	675	890	1,800
At Upstream Limit of Detailed Study	1.40	210	540	710	1,430
Wonderland Creek[9]					
At Confluence with North Goose Creek	1.91	607	1,419	2,107	4,620
At 28th Street	1.35	404	1,032	1,484	3,799
At Broadway	0.85	205	415	531	1,600
At Upstream Limit of Detailed Study	0.38	92	192	253	860

[8] Data Not Available
[9] Includes Flow Diversions From Fourmile Canyon Creek

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) 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.

Hydraulic data from the various engineering reports discussed in Section 7.0 have been used extensively for the revised study of Boulder County.

The hydraulic analyses for the flooding sources studied by approximate methods were based upon data derived from the sources used to establish the peak discharges for these streams.

Boulder County (Unincorporated Areas)
Hydraulic analysis data for Boulder Creek are based on information published in the Flood Hazard Area Delineation for Boulder Creek report (Reference 60). The WSELs for the 10-, 2-, 1-, and 0.2-percent annual chance flood events were computed using the USACE HEC-2 Water Surface Profile program (Reference 45). Starting WSELs were obtained from the Omaha District USACE.

Cross section data used in the analysis was obtained photogrammetrically by digitizing sections marked on the aerial photography flown in April 1981 (Reference 98). All bridge cross sections were field surveyed to obtain elevation data and geometry.

Manning's "n" values were estimated by field inspection of the study area. The roughness values for the main channels ranged from 0.035 to 0.065, and for the overbanks from 0.04 to 0.20.

The hydraulic analysis for Dry Creek No. 2 Ditch Split Flow and Highway 93 Split Flow was completed using the USACE HEC-2 step-backwater program (Reference 45). Starting WSELs were based on a study by Simons, Li and Associates, Inc. (Reference 63) as well as bridge rating curves for the C&S Railroad crossing developed by Leonard Rice Consulting Water Engineers, Inc. (Reference 91).

Manning's "n" values were evaluated using a published paper by Jarrett (1984) entitled "Hydraulics of High Gradient Streams" as a guide. The roughness values for the main channels ranged from 0.045 to 0.085, and for the overbanks from 0.05 to 0.10.

Water-surface profiles for the 10-, 2-, 1-, and 0.2-percent annual chance floods for South St. Vrain Creek and Middle St. Vrain Creek were developed using the USACE HEC-2 step backwater computer program (Reference 45).

Cross sections were digitized from topographic maps (Reference 99). The cross sections for above and below bridges and culverts were field-surveyed at close intervals to account for the backwater effects of these structures.

Manning's "n" values were assigned based on field inspection of the floodplain areas. The roughness values for the main channels ranged from 0.030 to 0.040, and for the overbanks from 0.040 to 0.060.

For Bullhead Gulch and Prince Tributary (East and West Branches), the water-surface profiles for the 10-, 2-, 1-, and 0.2-percent annual chance floods were calculated using the USACE HEC-2 water surface computer model (Reference 45). The 10- and 1-percent annual chance starting WSELs for Bullhead Gulch were estimated using the slope area method. The starting WSELs for Prince Tributary (East and West Branches) were based on the backwater flood elevation at the time to peak.

The cross sections were digitized from aerial photography. All major culverts and bridges were field inspected and measured.

Manning's "n" values ranged from 0.035 to 0.045 in the channel areas and 0.04 to 0.45 in the overbank areas.

Water-surface profiles for the 10-, 2-, 1-, and 0.2-percent annual chance floods for Fourmile Creek were developed using the USACE HEC-2 step backwater computer program (Reference 45). Starting WSELs were obtained by assuming that the Colorado Highway 119 bridge was blocked for the 2-, 1-, and 0.2-percent annual chance floods, but open for the 10-percent-annual-chance flood. Flow over the roadway for the 2-, 1-, and 0.2-percent annual chance floods were determined by weir computations. Flow through the bridge for the 10-percent annual chance flood was determined by pipe flow computations.

Cross section data used in the analysis was obtained photogrammetrically from the aerial photography flown October 26, 1977 (Reference 100). Bridge data was supplied by USACE and Boulder County.

Manning's "n" values ranged from 0.065 to 0.080 in the channel. A roughness value of 0.080 was used in the overbank areas.

City of Boulder

A comprehensive computer model, MIKE FLOOD, was developed to simulate the movement of flood flows along the South Boulder Creek channel and floodplain. MIKE FLOOD is a computer model that represents the total floodplain with a one-dimensional representation of major channel liked to a two-dimensional representation of overbank floodplain areas.

The upstream portion of the South Boulder Creek hydraulic model, from Eldorado Springs to approximately 2100 feet upstream of Highway 93 can be classified as a confined channel. This section of South Boulder Creek, where there is a clearly defined flow path,

was modeled using MIKE FLOOD with a one-dimensional only setting; meaning the one-dimensional model was not coupled to a two-dimensional floodplain in this reach. For the downstream portion of the South Boulder Creek hydraulic model, the flow paths are less well defined having multiple flow splits and highly braided flows. In this area MIKE FLOOD was fully implemented, coupling the one-dimensional model to the two-dimensional model. Approximately 2100 feet upstream of Highway 93, the one-dimensional only model interfaces with the fully coupled domain.

In the one-dimensional channels, a Manning's n-value of 0.067 was applied in the upper reaches of South Boulder Creek, from the headwaters through the mouth of the canyon where South Boulder Creek exits onto the plains. In these upstream reaches, the channel is confined, and the bed material can be classified as large cobbles and boulders. At the canyon mouth, South Boulder Creek transitions for the mountainous channelized streambed to a channel that flows through the plains. In these downstream reaches, South Boulder Creek has a flatter profile, and the streambed is characterized by cobbles with dirt banks. In these reaches, both the channel and geologic floodplain are well defined. For the lower reaches of South Boulder Creek, from where South Boulder Creek exits the canyon through the confluence with Boulder Creek, a Manning's n-value of 0.045 was applied. With the predominance of undeveloped land during calibration of the 1969 flood event, a constant Manning's resistance value was deemed to be appropriate in the floodplain areas. The calibrated resistance value, Manning n=0.06, represents the base Manning's number in the floodplain. Because the level of development in the South Boulder Creek drainage basin was relatively low during the 1969 flood event, the calibrated base resistance value represents the floodplain resistance due to surface due to surface irregularities and vegetative cover, in undeveloped areas.

In areas that remain largely unaltered from the 1969 flood event, the base Manning's "n" roughness value of 0.06 will be applied. In areas where development or disturbance of the land warrants, a higher Manning's "n" resistance value of 0.08 will be applied. The increase in the Manning's "n" value resulting from obstruction and increased vegetation was determined from two reference papers, the "USGS Water Supply Paper 2339", and the "Computed Roughness Coefficients for Skunk Creek above Interstate 17, Maricopa County, Arizona". The USGS Water Supply paper was used to determine an appropriate increase in the floodplain roughness, and the Skunk Creek paper was used to verify the increase in floodplain resistance was reasonable.

In addition to the higher roughness value for developed land, the two-dimensional flow model in MIKE FLOOD, internally adjusts friction losses as a function of depth. The algorithm used computes losses based on bed shear stress. This computation results in losses that increase geometrically as a function of decreasing flow depth. For more detailed information, please see the MIKE 21 User Guide (M21HD.pdf file includes as referenced in Appendix A), Section 6.2, Bed Resistance, on page 48.

The hydraulic analyses for Bear Canyon Creek, Elmers Twomile Creek, Fourmile Canyon Creek, Goose Creek, Skunk Creek, Twomile Canyon Creek, and Wonderland Creek were taken from the Flood Hazard Area Delineation report for Boulder and Adjacent County Drainageways (Reference 25). For these streams studied, the WSELs of floods of the

selected recurrence intervals were computed using the USACE HEC-2 step-backwater computer program (Reference 45).

Cross sections used in the backwater analyses for the streams were developed photogrammetrically using aerial photography flown in October 1981 (Reference 46). All bridges, dams, and culverts were field surveyed to obtain elevation data and geometry.

Roughness factors (Manning's "n") used in the hydraulic computations for the detailed-study streams were chosen by engineering judgment and based on field observations of the flooding sources and floodplain areas. Roughness values for the main channel of the detailed-study streams ranged from 0.020 to 0.100; floodplain roughness values ranged from 0.040 to 0.130.

Starting WSELs were determined by the slope-area method, critical depth, or elevations at confluences if the timing of the peaks coincided.

The hydraulic analyses for this study were based on partially obstructed flow, as defined by Boulder and FEMA through field inspection. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

Town of Erie

Water-surface elevations (WSELs) for floods of the selected recurrence intervals of Coal Creek were computed using the USACE HEC-2 step backwater computer program (Reference 45).

Cross-section data for Coal Creek in the area north of the UPRR were obtained photogrammetrically from topographic maps (Reference 96). Field measurements were taken by the SCS to obtain elevation data and structural geometry of all bridges and culverts.

Manning's "n" for Coal Creek, north of the UPRR, were determined by the SCS through field inspections. The roughness values range from 0.085 to 0.120 for the channel and overbank areas.

Manning's "n" for Coal Creek, south of the UPRR, were determined by WRC (Reference 69). The roughness values range from 0.075 in the channel to 0.055 in the overbank areas.

For Bullhead Gulch and Prince Tributary (East and West Branches), the Water-surface profiles for the 10-, 2-, 1-, and 0.2-percent annual chance floods were calculated using the USACE HEC-2 water surface computer model (Reference 45). The 10- and 1-percent annual chance starting WSELs for Bullhead Gulch were estimated using the slope area method. The starting WSELs for Prince Tributary (East and West Branches) were based on the backwater flood elevation at the time to peak.

The cross sections were digitized from aerial photography. All major culverts and bridges were field inspected and measured.

Manning's "n" values for Bullhead Gulch and Prince Tributary (East and West Branches) ranged from 0.035 to 0.045 in the channel areas and 0.04 to 0.45 in the overbank areas.

Town of Jamestown
The results obtained from the HEC-2 computer model for James Creek, Little James Creek, and Balarat Creek were verified by comparing them to ground photographs of the 1969 flood through Jamestown.

Cross sections were obtained by field measurements. Bridges in this study were analyzed using a blockage criteria dependent upon bridge construction and water depth. Concrete and steel bridges were assumed unobstructed until the upstream WSEL reached the bridge "low steel" elevation, at which time the bridge was assumed fully obstructed. Wooden bridge decks were assumed destroyed due to debris. This type of bridge was assumed unobstructed at all discharges with wingwalls and abutments in place but the deck removed. Head losses at fully obstructed bridges were determined by weir computations. Unobstructed bridge losses were computed by using the normal bridge routine in HEC-2.

Manning's "n" values were estimated by field investigation using a paper by V.V. Golubtstov (Reference 47). The roughness values for the main channels ranged from 0.030 to 0.750, and for the overbanks from 0.060 to 0.100. WSELs for James Creek were started at normal depth. WSELs for Little James Creek and Balarat Creek were started at their respective confluence elevations resulting from coincident discharges.

City of Lafayette and Town of Superior
The water surface elevations for the selected recurrence intervals on Coal Creek and Rock Creek were computed using HEC-2 (Reference 45). The starting WSELs for Coal Creek were obtained from the report by Hurst and Associates, Inc. (Reference 90). The starting WSELs for Rock Creek were obtained using a rating curve generated with the Federal Highway Administration (FHA) HY-8 hydraulic computer program for culvert analysis that was adjusted for bend losses.

The hydraulic analysis for Coal Creek is complicated by three flow splits that occur at the Community and Coal Creek Ditch crossings and at the abandoned railroad embankment upstream of Second Avenue. No Coal Creek flow is assumed to be conveyed in the ditches. However, the diversion structures in the creek, and the ditch banks, cause portions of the Coal Creek flow to leave the creek, follow the ditch banks, and overtop the ditch banks further downstream to return to the creek. The ditches potentially divert and spill flows along their length, but other than the impact of the ditch banks described above, ditch spilling and flooding is not modeled or shown on the FIRM. The flow splits for the ditches and the railroad are modeled using the HEC-2 split flow routine.

Manning's "n" values used in the hydraulic computations for the detailed study of Coal Creek were taken from the data generated in the SCS report (Reference 18). On Coal Creek, roughness values for the main channel ranged from 0.09 to 0.11. Overbank roughness values ranged from 0.07 to 0.09. The roughness values appear high. However, they should be used for all future LOMRs in order to be consistent with the SCS hydrology calculations. Roughness factors used in the hydraulic computation for the detailed study of Rock Creek were chosen by engineering judgment and based on field observations

(Reference 85). On Rock Creek, roughness values for the main channel ranged from 0.035 to 0.08. Overbank roughness values ranged from 0.03 to 0.085. Manning's roughness values at structures ranged from 0.013 to 0.03.

Cross section data for Coal Creek and Rock Creek were taken from photography and mapping of the study area. Base mapping for Rock and Coal Creeks was compiled by CH2M Hill, for ASI and TEA, at a scale of 1:2,400 from December 1994 aerial photography. Modifications to the base mapping were made by Taggart Engineering Associates, Inc. (TEA) to incorporate structures to be built by April 1997 (Reference 89). Information for the modification was obtained from design drawings prepared by individual consulting firms. All existing bridges and culverts were field surveyed to obtain elevation data and structural geometry.

City of Longmont

WSELs of floods of the selected recurrence intervals were computed through the use of the USACE HEC-2 water-surface profiles computer program (Reference 45). Starting WSELs for Lefthand Creek and Spring Gulch correspond to the computed WSELs for the St. Vrain Creek at the confluence of the two streams.

The flooding in Loomiller Basin is in the form of sheet runoff, in which velocities are low, in depths less than 1.0 foot.

Detailed cross section data for St. Vrain Creek were obtained from the USACE and supplemented with additional cross sections taken from maps at a scale of 1:4,800, with a contour interval of 2 feet, also prepared by the USACE (Reference 6). Detailed cross sections for Lefthand Creek, and Spring Gulch were field surveyed in September 1975. The cross sections were located at close intervals above and below bridges and culverts in order to accurately compute backwater effects at these structures. USGS topographic mapping enlarged to a scale of 1:6,000, with a contour interval of 10 feet, was used to supplement field-survey data (Reference 48).

Manning's "n" values for these computations were assigned on the basis of field inspection of the floodplain areas and engineering judgment. Bridge geometry and elevation information was obtained from the Colorado State Highway Department and Longmont, when available, and measured in the field.

The hydraulic analyses for Dry Creek No. 1, Dry Creek No. 1 (Old Channel), Clover Basin Tributary, and Steele Lakes Tributary were taken from the Floodplain Information and Flood Control and Drainage Plan for Dry Creek No. 1 (Reference 3). The WSELs for the 10-, 2-, 1-, and 0.2-percent annual chance floods were computed using the USACE HEC-2 step backwater computer program (Reference 45). Starting WSELs for Dry Creek No. 1 correspond to the computed WSELs for the St. Vrain Creek at the confluence.

Cross sections were digitized from aerial photography flown March 24, 1979 and provided by the Colorado Water Conservation Board (Reference 97). The City of Longmont conducted field surveys to provide information related to the first floor elevations of all improvements made in the floodplain. Additional field surveys were conducted to obtain bridge and culvert geometry and to verify the computed limits of flooding.

Manning's "n" values were estimated from two separate field investigations. The roughness values ranged from 0.030 to 0.060 for the main channels and from 0.040 to 0.070 for the overbank areas.

For Lefthand Creek North Overflow Channel and Lefthand Creek South Overflow Channel, the water-surface profiles for the 1-percent annual chance flood were calculated using the USACE HEC-2 water surface computer model (Reference 45). The cross sections were determined from field and aerial sources. The starting WSELs for Lefthand Creek North Overflow Channel were determined by the slope/area method. The starting WSELs for Lefthand Creek South Overflow Channel were obtained from the combined flow of the Lefthand Creek North Overflow Channel and the study reach. Manning's "n" values for both channels were 0.03 for the main channels and 0.03 for the overbank areas.

The hydraulic analyses for this study were revised to include information presented in floodplain information reports for Lefthand Creek, Dry Creek No. 1, and St. Vrain Creek (References 1 through 4) and in the LOMR issued on May 14, 1999 for Lefthand Creek North Overflow Channel and Lefthand Creek South Overflow Channel.

Town of Lyons

For St. Vrain Creek (Vicinity of Lyons) through the Lyons area, the analyses used field conditions represented by bridge and valley cross sections surveyed in 1971. Water-surface profiles were determined from backwater computations employing the Standard Step Method (Reference 45). Starting WSELs were taken from the USACE report concerning St. Vrain Creek (References 8 and 43).

The roughness coefficients used in the study were determined by field survey and ranged from 0.045 to 0.055 for the main channels, and from 0.060 to 0.100 for the overbank. Head losses at bridges were computed using data published by the U.S. Department of Transportation (Reference 49).

Town of Nederland

Water-surface profiles for the 10-, 2-, 1-, and 0.2-percent annual chance floods for Middle Boulder Creek and North Beaver Creek through Nederland were developed using the SCS WSP2 computer program (Reference 34). Starting WSELs were determined using stream slope at the starting valley cross sections.

Cross section data were obtained by field measurements. All bridges, culverts, and other structures were surveyed to obtain elevation data and structural geometry.

Roughness coefficients were estimated by field investigation and from pictures of each stream and its respective floodplain using USGS Water-Supply Paper 1849 (Reference 50), *Open Channel Hydraulics*, by Ven Te Chow (Reference 51), and *Handbook of Applied Hydraulics*, by Davis and Sorenson (Reference 52). The roughness values for the main channels ranged from 0.040 to 0.075, depending on the locations. The roughness coefficients for the floodplain ranged from 0.016 to 0.160.

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 was computed (Section 4.2), selected cross section locations are also shown on the FIRM (Exhibit 2).

The hydraulic analyses for this study were based on unobstructed flow, unless otherwise noted. The flood elevations shown on the Flood Profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

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 National Geodetic Vertical Datum of 1929 (NGVD29). With the finalization of the North American Vertical Datum of 1988 (NAVD88), many FIS reports and FIRMs are being prepared using the NAVD88 as the referenced vertical datum.

All flood elevations shown in this FIS report and on the FIRM are referenced to NAVD88. Elevation Reference Marks (ERMs) shown on the FIRM represent those used during the preparation of this and previous FIS reports. Users should be aware that these ERM elevations may have changed since the publication of this FIS report. To obtain up-to-date elevation information on National Geodetic Survey (NGS) ERMs shown on this map, please contact the Information Services Branch of the NGS at (301) 713-3242, or visit their website at www.ngs.noaa.gov. Map users should seek verification of non-NGS ERM monument elevations when using these elevations for construction or floodplain management purposes. It is important to note that adjacent communities may be referenced to NGVD. This may result in differences in Base Flood Elevations (BFEs) across the corporate limits between communities.

For this revision, a vertical datum conversion was completed for each studied reach. The range of conversion factors was prohibitively high; therefore, a standard conversion factor was not applied for the entire community. The Profile Panel and FDT conversion from NGVD29 to NAVD88 was carried out in accordance to the procedure outlined in the FEMA document Map Modernization – Guidelines and Specifications for Flood Hazard Mapping Partners Appendix B: Guidance for Converting to the North American Vertical Datum of 1988.

Using the multiple conversion factor approach, an average conversion factor for each flooding source was developed by establishing separate conversion factors at the upstream end, at the downstream end and at an intermediate point of the studied reach. From this data, the average conversion factors for each reach were developed. In some cases, it was necessary to divide each reach into multiple sections in order for the maximum offset from the average conversion factor to be less than or equal to 0.25 feet.

A separate elevation datum conversion was performed for the part of Coal Creek within the corporate limits of the Town of Erie. The latest revision of the FIS report and FIRMs for

the Town of Erie dated December 2004 were incorporated into this study (Reference 95). All elevations are now referenced to the NAVD using a datum conversion factor of 3.0 feet (NAVD = NGVD + 3.0).

South Boulder Creek, 55th Street Split Flow, Dry Creek Ditch No. 2, and West Valley Split Flow did not require a datum conversion since the new study was performed in NAVD88.

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, Rockville, 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 associated with the FIS report and FIRM for this community. Interested individuals may contact FEMA to access this data.

Conversion factors for each studied reach are shown in Table 5.

Table 5 – Datum Conversion Factors

Stream/Reach	Average Conversion	Beginning Station	End Station
Arapahoe Avenue Overflow	3.2	Entire Reach	
Arapahoe Avenue Spill Flow	3.4	Entire Reach	
Balarat Creek	4.1	Entire Reach	
Bear Canyon Creek	3.3	Entire Reach	
Boulder Creek	4.2	Uppermost Point of Reach	Approx. 160,000' Upstream of Confluence
	3.7	Approx. 160,000' Upstream of Confluence	Confluence w/ Fourmile Creek
	3.3	Confluence w/ Fourmile Creek	E. County Line Road
Boulder Creek High School Overflow	3.3	Entire Reach	
Boulder Creek (Right Bank Overflow)	3.2	Entire Reach	
Bullhead Gulch	3.1	Entire Reach	
Canyon Boulevard Overflow	3.3	Entire Reach	
Clover Basin	3.2	Entire Reach	

Stream/Reach	Average Conversion	Beginning Station	End Station
Tributary			
Coal Creek	3.3	Entire Reach Except for Portion within Erie	
Coal Creek (Erie)	3.0	Portion of Reach that is within Erie	
Dry Creek	3.2	Entire Reach	
Dry Creek No. 1	3.2	Entire Reach	
Dry Creek No. 1 (Old Channel)	3.2	Entire Reach	
Dry Creek No. 2	3.2	Entire Reach	
Dry Creek No.2 Ditch Split Flow	3.2	Entire Reach	
Dry Creek No. 3	3.1	Entire Reach	
Elmers Twomile Creek	3.3	Entire Reach	
Fourmile Canyon Creek	3.3	Entire Reach	
Fourmile Creek	4.6	Uppermost Point of Reach	Eldorado Dr. & Artesian Rd
	4.2	Eldorado Dr. & Artesian Rd	At Baseline Road
	3.8	At Baseline Road	Confluence w/ Boulder Creek
Goose Creek	3.3	Entire Reach	
Gregory Canyon Creek	3.4	Entire Reach	
Highway 93 Split Flow	3.3	Entire Reach	
James Creek	4.4	Just Upstream of Confluence w/ Little James Creek	Approx. 2200' Upstream of Confluence w/ Little James Creek
	3.9	Confluence w/ Lefthand Creek	Just Downstream of Confluence w/ Little James Creek
Lefthand Creek	4.7	Uppermost Point of Reach	Just Downstream of Lefthand Canyon Dr & Sawmill Rd
	4.3	Just Downstream of Lefthand Canyon Dr & Sawmill Rd	Just Downstream of Lick Skillet Gulch
	3.8	Just Downstream of Lick Skillet Gulch	Just Downstream of James Creek
	3.4	Just Downstream of James Creek	At Confluence w/ St. Vrain Creek
Lefthand Creek North Overflow Channel	3.2	Entire Reach	

Stream/Reach	Average Conversion	Beginning Station	End Station
Lefthand Creek South Overflow Channel	3.2	Entire Reach	
Little James Creek	4.1	Entire Reach	
Little Thompson River	3.3	Entire Reach	
Middle Boulder Creek	4.5	Entire Reach	
Middle St. Vrain Creek	4.6	Uppermost Point of Reach	Approx. 33,000' Upstream of Confluence South St. Vrain Creek
	4.2	Approx. 33,000' Upstream of Confluence South St. Vrain Creek	Confluence w/ South St. Vrain Creek
North Beaver Creek	4.5	Entire Reach	
North Goose Creek	3.2	Entire Reach	
North St. Vrain Creek	3.5	Entire Reach	
Prince Tributary, East Branch	3.1	Entire Reach	
Prince Tributary, West Branch	3.1	Entire Reach	
Rock Creek	3.2	Entire Reach	
St. Vrain Creek	3.2	Entire Reach	
St. Vrain Creek (Vicinity of Lyons)	3.3	Entire Reach	
Skunk Creek	3.3	Entire Reach	
South St. Vrain Creek	4.6	Uppermost Point of Reach	Approx. 79,000' Upstream of Confluence w/ St. Vrain Creek
	4.1	Approx. 79,000' Upstream of Confluence w/ St. Vrain Creek	Approx. 36,000' Upstream of Confluence w/ St. Vrain Creek
	3.6	Approx. 36,000' US of Confluence w/ St. Vrain Creek	Confluence w/ St. Vrain Creek
Spring Gulch	3.2	Entire Reach	
Steele Lakes Tributary	3.2	Entire Reach	
Twomile Canyon	3.4	Entire Reach	

Stream/Reach	Average Conversion	Beginning Station	End Station
Creek			
Wonderland Creek	3.3	Entire Reach	

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 and Floodway Data 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.

For South Boulder Creek, the 1- and 0.2-percent-annual-chance floodplain boundaries have been delineated using the flood elevations determined with MIKE FLOOD. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:1,200, with a contour interval of one foot.

The South Boulder Creek Flood Mapping Study employed the use of MIKE FLOOD, a one-dimensional and two-dimensional linked hydraulic model. Model results for the floodplain provide a detailed grid of four-meter by four-meter pixel cells. All “wetted” grid cells where flood water depths are determined to be more than 0.01 feet are highlighted to reflect the extent of 1-percent-annual-chance flood inundation.

Derived using the MIKE FLOOD grid cell inundation results, an electronic flood zone map was produced and manually enhanced by conducting a detailed visual review. These results are projected in ARC-GIS with the City’s 2003 six-inch pixel aerial photography and one-foot topographic contours. The 2003 topography was used to create the digital elevation model (DEM) used in the MIKE FLOOD two-dimensional analysis. This quality assurance review offers a “physical reality check” to process the flood zone mapping.

For Bear Canyon Creek, Elmers Twomile Creek, Fourmile Canyon Creek, Goose Creek, Skunk Creek, Twomile Canyon Creek and Wonderland Creek, the floodplain boundaries between cross sections were interpolated using topographic maps at scale 1:2,400, with contour intervals of 2 feet (Reference 46). For Lefthand Creek and Spring Gulch, the floodplain boundaries between cross sections were interpolated using topographic maps at scale 1:6,000 (enlarged from 1:24,000), with contour intervals of 10 feet (Reference 48). Floodplain boundaries between cross sections for Balarat Creek, James Creek and Little James Creek were interpolated from topographic maps at scale 1:1,200, with contour intervals of 2 feet (Reference 53). The floodplain boundaries for Coal Creek in Erie were interpolated using topographic maps at scale 1:4,800, with contour intervals of 2 feet and 4 feet (Reference 96). For Dry Creek No. 1 and Clover Basin Tributary, the floodplain boundaries between cross sections were interpolated using topographic maps at scale 1:200, with contour intervals of 2 feet (Reference 97). The floodplain boundaries between cross sections for St. Vrain Creek were interpolated using topographic maps at scale 1:4,800, with contour intervals of 2 feet (Reference 6). For Coal Creek and Rock Creek, the floodplain boundaries between cross sections were interpolated using topographic maps at scale 1:4,800, with contour intervals of 4 feet (Reference 57). For Coal Creek and Rock Creek in Lafayette, the floodplain boundaries between cross sections were interpolated using topographic maps at scale 1:4,800, with contour intervals of 4 feet (Reference 54). The floodplain boundaries for North Beaver and Middle Boulder Creeks were interpolated using topographic maps at scale 1:4,800, with contour intervals of forty feet (Reference 56). For St. Vrain, North St. Vrain and South St. Vrain Creeks in Lyons, the floodplain boundaries were interpolated using topographic maps at scale 1:6,000, with contour intervals of forty feet (Reference 55).

Floodplain boundaries in other portions of Boulder County have been revised to include boundary information shown on topographic work maps included with the reports referenced in Section 7.0.

The 1-percent annual chance floodplain boundaries for Anderson Ditch, David's Draw, Little Dry Creek, and Viele Channel, studied by approximate methods, were taken from the previous FIRM for the City of Boulder (Reference 58).

The 1-percent annual chance floodplain boundaries for Gregory Creek, Bluebell Canyon Creek, Kings Gulch, Sunshine Gulch, upper reaches of Bear Canyon Creek, and Skunk Canyon Creek, were taken from the Boulder and Adjacent County Drainageways - Flood Hazard Area Delineation prepared by G&O (Reference 25).

Approximate 1-percent annual chance floodplain boundaries in some portions of the study area were taken directly from the Flood Hazard Boundary Map for the Town of Nederland (Reference 59).

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

4.2 Floodways

Encroachment on flood plains, 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.

The floodways presented in this FIS report and the FIRM 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 have been tabulated for selected cross sections (Table 6). 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 of the 1-percent annual chance flood by 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.

Floodway computations are performed to assess the impact of floodplain encroachment on the water level and the energy gradient during a flooding event. Traditional floodway computations performed with one-dimensional hydraulic models are performed by manipulating user-defined cross-sections by inserting encroachment stations, thus encroaching the cross-sectional area and causing a rise in water level as a result. Typically, this process is performed iteratively until a specified rise in water level has been achieved. Because the simulation of flooding events for South Boulder Creek is being performed with MIKE FLOOD, a dynamically coupled one-dimensional and two-dimensional model, the floodway computations must be performed using a non-traditional approach. It is impossible to simply encroach the user specified cross-sections in the one-dimensional

portion of the model. Encroaching only the user specified cross-sections would simply give rise to additional spillage onto the two-dimensional floodplain and the desired rise in water level along a defined floodway would not be observed.

Given the fully developed conditions in the west valley of South Boulder Creek and that no clearly defined west valley channel exists, a single designated floodway along the main South Boulder Creek corridor was modeled. All flow splits were eliminated, confining flow to the designated floodway, by full encroachments into the two-dimensional model topography. In addition to modifying the two-dimensional topography to confine flooding to the main channel of South Boulder Creek, all one-dimensional structures not located on the South Boulder Creek main stem were removed from the model.

The resulting water levels of the floodway computations were compared with the water surface elevations from the floodplain model to determine what level of increase occurs. If more than a 0.5-foot rise in water surface elevations within city boundaries and a 1-foot rise in water surface elevations in unincorporated areas occurs ,the floodway was defined as the entire floodplain in the east valley main creek corridor, and an assessment of the need to consider a floodway in the west valley should be made.

In Boulder County, floodplains above 6,000 feet in elevation (essentially, floodplains in the mountain canyons) are regulated as floodways by the County, even though a floodway may not be depicted on the FIRM. For more information on Boulder County regulations, please Contact the County's Transportation Department.

The City of Boulder and the UDFCD regulate a floodway (Conveyance Zone) and a High Hazard Zone that is more restrictive than the floodway required by FEMA. Contact the City of Boulder or UDFCD for this floodway information.

No floodway is shown for Lefthand or South St. Vrain Creeks in Longmont as a result of the latest analyses of these drainages. Also, no floodway is shown for Bullhead Gulch, Dry Creek No. 2, Dry Creek No. 2 Ditch Split Flow, Dry Creek No. 3, Fourmile Creek, Highway 93 Split Flow, Lefthand Creek (North and South Overflow Channels), Little Thompson River, Middle St. Vrain, Price Tributary (East and West Branches), portions of St. Vrain Creek, and Steele Lakes Tributary.

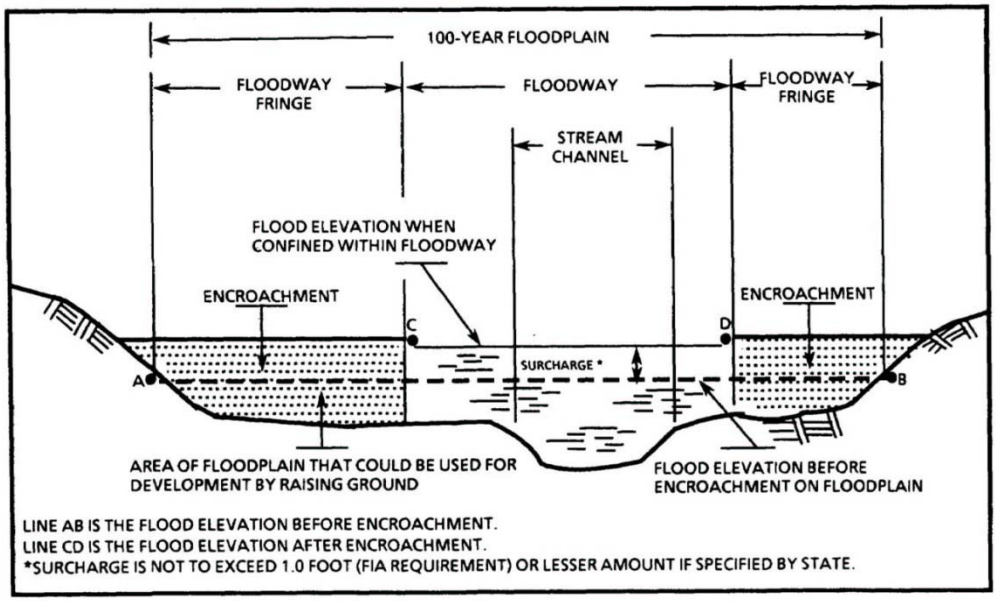

Figure 1 – Floodway Schematic

Table 6 – Floodway Data

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
ARAPAHOE AVENUE SPILL FLOW								
A	842	73	134	6.7	5,360.1	5,360.1	5,360.6	0.5
B	1,210	101	185	6.5	5,376.0	5,376.0	5,376.5	0.5

[1]Feet above confluence with Boulder Creek

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

ARAPAHOE AVENUE SPILL FLOW

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BALARAT CREEK								
A	240	18	34	7.9	7,275.3	7,275.3	7,275.3	0.0

[1]Feet above confluence with Little James Creek

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

BALARAT CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BEAR CANYON CREEK								
A	1,380	93	526	9.3	5,241.3	5,239.8[2]	5,240.4	0.6
B	2,480	199	914	3.4	5,247.4	5,247.5	5,248.0	0.5
C	3,380	447	460	6.7	5,258.7	5,258.7	5,258.7	0.0
D	4,191	70	321	9.6	5,267.4	5,267.4	5,267.4	0.0
E	4,498	78	362	8.5	5,272.4	5,272.4	5,272.4	0.0
F	4,844	138	389	7.9	5,273.8	5,273.8	5,273.8	0.0
G	6,512	70	272	11.3	5,290.3	5,290.3	5,290.3	0.0
H	7,489	300	987	3.1	5,306.2	5,306.2	5,307.0	0.8
I	7,567	100	796	3.9	5,307.4	5,307.4	5,307.7	0.3
J	8,363	335	539	5.4	5,319.6	5,319.6	5,319.6	0.0
K	8,498	276	590	5.0	5,322.1	5,322.1	5,322.3	0.2
L	9,474	260	658	4.4	5,332.2	5,332.2	5,333.1	0.9
M	9,855	175	492	6.0	5,336.2	5,336.2	5,336.8	0.6
N	11,104	51	217	10.2	5,360.6	5,360.6	5,360.6	0.0
O	11,717	73	386	4.1	5,374.4	5,374.4	5,374.4	0.0
P	12,334	137	275	7.6	5,384.8	5,384.8	5,384.8	0.0
Q	12,536	101	256	8.2	5,390.1	5,390.1	5,390.1	0.0
R	13,695	65	199	10.0	5,416.3	5,416.3	5,416.3	0.0
S	14,807	99	208	8.8	5,443.6	5,443.6	5,443.6	0.0
T	15,213	116	204	8.5	5,455.7	5,455.7	5,455.7	0.0
U	15,553	121	205	8.5	5,465.6	5,465.6	5,465.6	0.0
V	15,910	133	218	7.6	5,477.1	5,477.1	5,477.1	0.0

[1]Feet above confluence with Boulder Creek
[2]Elevation computed without consideration of flooding controlled by Boulder Creek

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

BEAR CANYON CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BEAR CANYON CREEK (cont.)								
W	16,390	49	158	10.1	5,492.4	5,492.4	5,492.5	0.1
X	16,676	154	270	5.9	5,503.7	5,503.7	5,503.7	0.0
Y	17,443	151	266	5.8	5,533.6	5,533.6	5,533.6	0.0
Z	18,180	41	150	10.7	5,560.2	5,560.2	5,560.4	0.2
AA	18,798	159	239	6.7	5,581.1	5,581.1	5,581.1	0.0
AB	19,588	159	248	6.5	5,608.7	5,608.7	5,608.7	0.0
AC	20,334	88	209	7.7	5,644.5	5,644.5	5,644.5	0.0
AD	20,845	68	199	8.1	5,667.1	5,667.1	5,667.2	0.1
AE	21,670	65	175	9.1	5,707.7	5,707.7	5,707.7	0.0
AF	22,338	66	169	9.5	5,739.8	5,739.8	5,739.8	0.0

[1]Feet above confluence with Boulder Creek

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

BEAR CANYON CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BOULDER CREEK								
A	93,875	1,320	6,312	2.1	5170.8	5170.8	5171.2	0.4
B	94,313	1,064	3,385	3.9	5171.1	5171.1	5171.5	0.4
C	95,403	1,163	3,565	3.7	5172.1	5172.1	5172.5	0.4
D	95,912	929	3,144	4.2	5172.5	5172.5	5172.8	0.3
E	96,374	326	925	7.5	5177.9	5177.9	5177.9	0.0
F	96,977	602	1,729	6.6	5181.1	5181.1	5181.3	0.2
G	97,408	697	2,351	5.7	5183.4	5183.4	5183.4	0.0
H	97,706	956	3,858	3.5	5185.3	5185.3	5185.4	0.1
I	98,089	361	1,763	2.7	5186.6	5186.6	5186.7	0.1
J	98,450	418	2,119	2.3	5187.0	5187.0	5187.0	0.0
K	98,929	292	1,072	4.5	5187.5	5187.5	5187.5	0.0
L	99,346	134	475	10.1	5190.1	5190.1	5190.2	0.1
M	99,574	358	2,402	2.0	5197.9	5197.9	5198.2	0.3
N	99,693	530	2,595	3.1	5197.9	5197.9	5198.2	0.3
O	100,562	460	1,674	7.1	5199.8	5199.8	5199.8	0.0
P	101,377	618	4,604	2.7	5206.3	5206.3	5206.3	0.0
Q	101,771	479	2,703	4.8	5206.5	5206.5	5206.5	0.0
R	102,211	419	1,623	8.0	5206.9	5206.9	5206.9	0.0
S	102,586	523	1,637	8.0	5208.8	5208.8	5208.8	0.0
T	103,543	1,253	5,676	7.8	5214.6	5214.6	5214.6	0.0
U	103,883	1,151	4,598	3.9	5218.7	5218.7	5218.7	0.0
V	104,765	113	471	3.3	5221.8	5221.8	5221.9	0.1
W	105,358	88	250	6.3	5224.3	5224.3	5224.3	0.0

[1] Feet above mouth

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

BOULDER CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BOULDER CREEK (cont.)								
X	106,247	58	198	6.9	5,230.6	5,230.6	5,231.0	0.4
Y	106,885	700	2,220	5.3	5,234.7	5,234.7	5,234.9	0.2
Z	107,160	750	2,040	5.8	5,236.0	5,236.0	5,236.3	0.3
AA	107,666	880	2,013	5.9	5,239.1	5,239.1	5,239.2	0.1
AB	108,419	782	2,040	3.9	5,245.3	5,245.3	5,245.3	0.0
AC	108,883	166	645	9.7	5,248.7	5,248.7	5,248.7	0.0
AD	109,338	325	1,377	5.2	5,255.3	5,255.3	5,255.3	0.0
AE	109,688	301	929	9.2	5,256.4	5,256.4	5,256.4	0.0
AF	110,563	365	1,809	5.7	5,262.5	5,262.5	5,262.8	0.3
AG	111,076	505	1,439	7.3	5,264.7	5,264.7	5,264.8	0.1
AH	111,530	814	1,746	6.0	5,268.3	5,268.3	5,268.5	0.2
AI	111,797	591	1,421	7.9	5,271.6	5,271.6	5,271.6	0.0
AJ	112,279	1248	3,170	4.8	5,275.7	5,275.7	5,275.7	0.0
AK	112,767	106	575	13.7	5,277.2	5,277.2	5,277.2	0.0
AL	113,250	217	796	9.8	5,283.1	5,283.1	5,283.1	0.0
AM	113,786	810	3,279	3.3	5,291.3	5,291.3	5,291.3	0.0
AN	113,904	314	1,377	5.7	5,291.3	5,291.3	5,291.3	0.0
AO	114,440	320	990	7.9	5,294.4	5,294.4	5,294.6	0.2
AP	115,244	435	2,184	5.1	5,304.4	5,304.4	5,304.4	0.0
AQ	115,827	728	2,217	5.0	5,309.6	5,309.6	5,309.6	0.0
AR	116,267	209	1,061	10.5	5,310.6	5,310.6	5,311.1	0.5
AS	116,747	269	1,258	8.8	5,315.4	5,315.4	5,315.5	0.1
AT	116,920	333	1,830	6.5	5,319.3	5,319.3	5,319.4	0.1

[1] Feet above mouth

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

BOULDER CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BOULDER CREEK (cont.)								
AU	117,303	196	1,070	10.4	5,320.9	5,320.9	5,321.0	0.1
AV	118,038	184	1,440	7.7	5,330.0	5,330.0	5,330.4	0.4
AW	118,757	220	1,488	7.5	5,336.0	5,336.0	5,336.5	0.5
AX	119,108	450	1,338	7.6	5,338.8	5,338.8	5,338.8	0.0
AY	119,820	420	2,026	5.6	5,349.7	5,349.7	5,350.2	0.5
AZ	120,159	775	1,763	6.9	5,352.3	5,352.3	5,352.3	0.0
BA	120,532	366	1,942	6.3	5,356.3	5,356.3	5,356.6	0.3
BB	121,227	340	1,206	10.1	5,362.1	5,362.1	5,362.1	0.0
BC	121,836	465	1,353	9.0	5,368.3	5,368.3	5,368.3	0.0
BD	122,300	209	1,940	6.3	5,380.1	5,380.1	5,380.4	0.3
BE	122,807	151	905	13.2	5,382.1	5,382.1	5,382.2	0.1
BF	123,440	99	954	12.5	5,391.7	5,391.7	5,392.2	0.5
BG	124,185	179	988	12.1	5,406.3	5,406.3	5,406.6	0.3
BH	124,717	187	1,000	11.9	5,416.8	5,416.8	5,416.9	0.1
BI	125,374	93	1,007	11.6	5,437.4	5,437.4	5,437.4	0.0
BJ	125,713	98	886	13.1	5,440.1	5,440.1	5,440.1	0.0
BK	126,177	148	858	13.6	5,447.4	5,447.4	5,447.4	0.0
BL	126,403	154	871	13.4	5,454.6	5,454.6	5,454.6	0.0

[1] Feet above mouth

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

BOULDER CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BOULDER CREEK - 13th STREET SPLIT								
A	81	82	292	3.7	5,344.0	5,344.0	5,344.0	0.0
B	544	65	135	8.1	5,344.2	5,344.2	5,344.3	0.1

[1] Feet above Arapahoe Avenue

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

BOULDER CREEK – 13th STREET SPLIT

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BOULDER CREEK – 14th STREET SPLIT								
A	51	46	116	8.2	5,337.8	5,337.8	5,338.2	0.4
B	585	68	146	6.5	5,340.7	5,340.7	5,341.1	0.4

[1] Feet above Arapahoe Avenue

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

BOULDER CREEK – 14th STREET SPLIT

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BOULDER CREEK – 15th STREET/ARAPAHOE AVENUE/MARINE STREET SPLIT								
A	91	34	73	1.3	5,320.3	5,320.3	5,320.5	0.2
B	475	36	22	4.3	5,323.5	5,323.5	5,323.5	0.0
C	955	22	19	5.0	5,328.3	5,328.3	5,328.7	0.4
D	1,540	52	24	3.9	5,332.7	5,332.7	5,333.2	0.5
E	2,107	36	60	7.3	5,335.4	5,335.4	5,335.8	0.4
F	2,312	37	60	7.3	5,337.8	5,337.8	5,338.0	0.2

[1] Feet above Boulder Creek Cross Section AT (approximately 10 feet upstream of Pedestrian Bridge #2 along Boulder Creek)

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

BOULDER CREEK - 15th STREET/ARAPAHOE AVENUE/MARINE STREET SPLIT

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BOULDER CREEK – 16th STREET SPLIT								
A	350	29	33	3.4	5,333.1	5,333.1	5,333.5	0.4
B	478	28	22	5.1	5,335.3	5,335.3	5,335.4	0.1

[1] Feet above Grove Street

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

BOULDER CREEK – 16th STREET SPLIT

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BOULDER CREEK – 17th STREET SPLIT								
A	387	74	96	1.3	5,329.4	5,329.4	5,329.9	0.5
B	570	38	26	4.8	5,330.7	5,330.7	5,331.0	0.3

[1] Feet above Grove Street

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

BOULDER CREEK – 17th STREET SPLIT

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BOULDER CREEK – 18th STREET SPLIT								
A	418	35	37	0.8	5,326.4	5,326.4	5,326.9	0.5
B	597	32	10	3.1	5,327.0	5,327.0	5,327.0	0.0

[1] Feet above Grove Street

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

BOULDER CREEK – 18th STREET SPLIT

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BOULDER CREEK – 21st STREET SPLIT								
A	55	30	36	6.1	5,313.0	5,313.0	5,313.1	0.1
B	235	25	34	6.3	5,314.0	5,314.0	5,314.1	0.1

[1] Feet above Arapahoe Avenue

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

BOULDER CREEK – 21st STREET SPLIT

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BOULDER CREEK – 22nd STREET SPLIT								
A	87	38	14	3.4	5,307.7	5,307.7	5,307.7	0.0
B	269	37	16	2.9	5,308.7	5,308.7	5,308.8	0.1

[1] Feet above Goss Street

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

BOULDER CREEK – 22nd STREET SPLIT

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BOULDER CREEK – 38th STREET SPLIT								
A	120	72	98	6.1	5,248.2	5,248.2	5,248.2	0.0
B	436	38	75	8.0	5,250.8	5,250.8	5,251.1	0.3
C	824	56	86	6.9	5,253.9	5,253.9	5,254.3	0.4
D	1,089	75	95	6.3	5,257.2	5,257.2	5,257.2	0.0

[1] Feet above Boulder Creek Cross Section AB (approximately 360 feet upstream of Foothills Parkway along Boulder Creek)

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

BOULDER CREEK – 38th STREET SPLIT

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BOULDER CREEK – 55th STREET SPLIT								
A	406	385	608	6.8	5,199.4	5,199.4	5,199.4	0.0
B	507	325	499	7.0	5,200.7	5,200.7	5,200.7	0.0

[1] Feet above Boulder Creek Cross Section N (approximately 40 feet upstream of Valmont Road along Boulder Creek)

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

BOULDER CREEK – 55th STREET SPLIT

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BOULDER CREEK – ARAPAHOE AVENUE SPLIT								
A	442	244	499	7.2	5,279.7	5,279.7	5,280.2	0.5
B	763	179	432	8.5	5,283.0	5,283.0	5,283.5	0.5
C	1,210	409	756	3.4	5,287.6	5,287.6	5,287.6	0.0
D	1,669	227	350	7.0	5,291.4	5,291.4	5,291.5	0.1
E	2,180	204	351	7.0	5,298.9	5,298.9	5,298.9	0.0
F	2,482	725	975	0.7	5,300.3	5,300.3	5,300.8	0.5

[1] Feet above Confluence with Boulder Creek Cross Section AJ (approximately 250 feet upstream of 30th Street along Boulder Creek)

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

BOULDER CREEK – ARAPAHOE AVENUE SPLIT

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BOULDER CREEK – ARAPAHOE AVENUE EAST SPLIT								
A	424	123	121	5.3	5,261.0	5,261.0	5,261.2	0.2
B	1,037	88	105	6.2	5,266.4	5,266.4	5,266.7	0.3
C	1,367	91	106	6.1	5,269.2	5,269.2	5,269.4	0.2
D	1,548	95	107	6.0	5,270.7	5,270.7	5,271.2	0.5

[1] Feet above Boulder Creek Cross Section AE (approximately 490 feet upstream of Arapahoe Avenue Eastbound along Boulder Creek)

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

BOULDER CREEK – ARAPAHOE AVENUE EAST SPLIT

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BOULDER CREEK – ARAPAHOE AVENUE WEST/20th STREET SPLIT								
A	346	37	50	6.6	5,302.6	5,302.6	5,302.7	0.1
B	768	59	65	5.0	5,307.7	5,307.7	5,308.2	0.5
C	1,056	60	65	5.0	5,311.5	5,311.5	5,311.9	0.4
D	1,472	36	24	4.7	5,314.5	5,314.5	5,314.5	0.0
E	1,679	33	34	3.2	5,315.8	5,315.8	5,315.9	0.1
F	1,854	56	28	3.9	5,317.5	5,317.5	5,317.5	0.0

[1] Feet above Folsom Street

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

BOULDER CREEK – ARAPAHOE AVENUE WEST/20th STREET SPLIT

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BOULDER CREEK – CANYON BOULEVARD SPLIT								
A	70	70	26	3.5	5,288.2	5,288.2	5,288.3	0.1
B	608	62	25	3.7	5,291.9	5,291.9	5,291.9	0.0
C	1,160	65	26	3.5	5,297.7	5,297.7	5,297.7	0.0
D	1,626	66	26	3.6	5,303.3	5,303.3	5,303.3	0.0
E	2,102	58	25	3.8	5,308.5	5,308.5	5,308.6	0.1
F	2,672	57	32	4.3	5,315.2	5,315.2	5,315.3	0.1
G	3,270	60	34	4.2	5,322.5	5,322.5	5,322.6	0.1
H	3,807	61	41	4.6	5,329.5	5,329.5	5,329.5	0.0
I	4,412	62	71	6.0	5,336.8	5,336.8	5,337.0	0.2
J	4,911	74	132	6.5	5,339.7	5,339.7	5,339.9	0.2
K	5,324	95	231	7.9	5,343.0	5,343.0	5,343.5	0.5
L	5,902	179	450	6.5	5,349.2	5,349.2	5,349.7	0.5

[1] Feet above 28th Street

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

BOULDER CREEK – CANYON BOULEVARD SPLIT

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BOULDER CREEK – CANYON BOULEVARD AT 6th STREET SPLIT								
A	250	51	22	3.7	5371.2	5371.2	5371.2	0.0
B	471	65	44	4.2	5375.9	5375.9	5375.9	0.0
C	657	116	237	3.3	5380.3	5380.3	5380.3	0.0

[1] Feet above Boulder Creek Cross Section BC (approximately 780 feet downstream of 9th Street along Boulder Creek)

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

BOULDER CREEK – CANYON BOULEVARD AT 6th STREET SPLIT

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BOULDER CREEK – DOWNSTREAM VALMONT SPLIT								
A	525	1,018	4,084	1.6	5,172.9	5,172.9	5,173.2	0.3
B	1,126	515	863	7.3	5,177.7	5,177.7	5,177.7	0.0
C	1,577	865	2,339	0.8	5,178.8	5,178.8	5,178.8	0.0

[1] Feet above Boulder Creek Cross Section D (approximately 2,450 feet upstream of 61st Street along Boulder Creek)

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

BOULDER CREEK – DOWNSTREAM VALMONT SPLIT

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BOULDER CREEK – FLATIRON PARKWAY SPLIT								
A	72	158	60	3.4	5,203.7	5,203.7	5,203.7	0.0
B	389	73	89	2.3	5,206.9	5,206.9	5,206.9	0.0
C	652	127	58	3.6	5,207.7	5,207.7	5,207.7	0.0

[1] Feet above Dry Creek Ditch No. 2

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

BOULDER CREEK – FLATIRON PARKWAY SPLIT

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BOULDER CREEK – GOSS STREET SPLIT								
A	325	20	14	4.8	5,302.8	5,302.8	5,302.8	0.0
B	614	33	19	3.4	5,305.3	5,305.3	5,305.4	0.1
C	1,089	35	7	2.5	5,309.9	5,309.9	5,310.0	0.1
D	1,357	21	6	3.0	5,313.5	5,313.5	5,313.9	0.4
E	1,785	38	11	1.7	5,319.2	5,319.2	5,319.7	0.5
F	1,992	25	9	1.9	5,321.2	5,321.2	5,321.3	0.1
G	2,251	39	9	1.9	5,322.6	5,322.6	5,322.9	0.3

[1] Feet above Folsom Street

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

BOULDER CREEK – GOSS STREET SPLIT

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BOULDER CREEK – GROVE STREET SPLIT								
A	310	31	43	6.6	5,303.7	5,303.7	5,304.2	0.5
B	885	32	44	6.5	5,310.0	5,310.0	5,310.1	0.1
C	1,448	41	73	6.9	5,316.2	5,316.2	5,316.7	0.5
D	1,896	37	78	7.8	5,319.7	5,319.7	5,320.2	0.5
E	2,174	32	75	8.1	5,322.3	5,322.3	5,322.8	0.5
F	2,487	31	71	8.2	5,326.5	5,326.5	5,326.9	0.4
G	2,772	33	63	7.3	5,329.8	5,329.8	5,330.3	0.5
H	3,194	34	53	6.4	5,332.9	5,332.9	5,333.4	0.5

[1] Feet above Folsom Street

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

BOULDER CREEK – GROVE STREET SPLIT

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BOULDER CREEK – HARVEST HOUSE SPLIT								
A	269	136	218	6.5	5,291.7	5,291.7	5,291.7	0.0
B	657	65	163	8.7	5,294.6	5,294.6	5,294.6	0.0
C	890	71	194	9.2	5,296.9	5,296.9	5,296.9	0.0

[1] Feet above Boulder Creek Cross Section AM (approximately 290 feet upstream of 28th Street along Boulder Creek)

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

BOULDER CREEK – HARVEST HOUSE SPLIT

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BOULDER CREEK – PEARL STREET SPLIT								
A	379	121	114	5.4	5,204.3	5,204.3	5,204.3	0.0
B	928	82	72	0.0	5,206.1	5,206.1	5,206.4	0.3

[1] Feet above 55th Street

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

BOULDER CREEK – PEARL STREET SPLIT

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BOULDER CREEK – RAILROAD OVERTOPPING								
A	325	1,010	3,907	2.6	5,222.1	5,222.1	5,222.2	0.1
B	555	770	4,374	4.1	5,225.7	5,225.7	5,226.2	0.5
C	1,700	576	1,411	7.4	5,231.1	5,231.1	5,231.4	0.3

[1] Feet above Boulder Creek Cross Section V (approximately 870 feet downstream of Railroad Bridge along Boulder Creek)

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

BOULDER CREEK – RAILROAD OVERTOPPING

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BOULDER CREEK – SKUNK CREEK SPLIT								
A	3,525	240	373	7.1	5,248.3	5,248.3	5,248.6	0.3
B	3,896	61	152	8.9	5,251.0	5,251.0	5,251.0	0.0
C	4,238	247	203	2.2	5,256.1	5,256.1	5,256.1	0.0
D	4,582	65	65	3.6	5,257.8	5,257.8	5,257.8	0.0

[1] Feet above Boulder Creek Cross Section AA (approximately 400 feet downstream of Foothills Parkway along Boulder Creek)

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

BOULDER CREEK – SKUNK CREEK SPLIT

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BOULDER CREEK – VALMONT SPLIT								
A	189	168	814	6.3	5,188.9	5,188.9	5,189.1	0.2
B	253	182	1,061	4.8	5,189.4	5,189.4	5,189.8	0.4
C	577	390	1,322	3.9	5,191.6	5,191.6	5,191.8	0.2
D	1,249	540	961	7.0	5,193.1	5,193.1	5,193.1	0.0
E	1,526	628	1,685	6.6	5,194.6	5,194.6	5,194.6	0.0
F	1,831	425	702	3.0	5,195.8	5,195.8	5,195.8	0.0
G	1,975	328	622	2.6	5,195.9	5,195.9	5,195.9	0.0

[1] Feet above Boulder Creek Cross Section I (approximately 1,360 feet downstream of Old Valmont Road along Boulder Creek)

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

BOULDER CREEK – VALMONT SPLIT

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BOULDER CREEK – VALMONT SPLIT NORTH SPLIT								
A	128	172	637	6.6	5,195.3	5,195.3	5,195.3	0.0
B	361	143	502	8.4	5,196.8	5,196.8	5,196.8	0.0

[1] Feet above Boulder Creek – Valmont Split Cross Section E (approximately 1,150 feet upstream of Valmont Road along Boulder Creek – Valmont Split)

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

BOULDER CREEK – VALMONT SPLIT NORTH SPLIT

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BOULDER CREEK – VALMONT SPLIT WEST SPLIT								
A	601	241	1,004	3.3	5,186.0	5,186.0	5,186.0	0.0
B	926	242	452	7.3	5,190.8	5,190.8	5,190.9	0.1

[1] Feet Above Boulder Creek Cross Section I (approximately 1,360 feet downstream of Old Valmont Road along Boulder Creek)

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

BOULDER CREEK – VALMONT SPLIT WEST SPLIT

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BOULDER SLOUGH								
A	718	21	77	9.3	5,264.0	5,264.0	5,264.0	0.0
B	1,696	24	125	3.9	5,272.6	5,272.6	5,273.1	0.5
C	3,572	24	46	3.4	5,290.6	5,290.6	5,290.6	0.0
D	4,491	17	42	1.9	5,297.7	5,297.7	5,297.7	0.0
E	4,972	20	35	2.3	5,302.0	5,302.0	5,302.0	0.0
F	5,267	9	12	6.6	5,304.2	5,304.2	5,304.2	0.0
G	5,663	39	83	2.8	5,309.8	5,309.8	5,310.2	0.4
H	5,610	19	46	5.0	5,314.7	5,314.7	5,314.7	0.0
I	6,741	19	53	4.4	5,318.6	5,318.6	5,318.6	0.0
J	7,181	20	78	2.9	5,322.5	5,322.5	5,322.8	0.3

[1] Feet upstream of Burlington Northern and Santa Fe Railroad

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

BOULDER SLOUGH

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL CHANCE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
BOULDER SLOUGH – 22ND STREET SPLIT								
A	131	65	29	3.8	5,291.8	5,291.8	5,291.9	0.0
B	628	63	30	3.4	5,297.3	5,297.3	5,297.3	0.0
C	1,440	155	69	2.6	5,302.4	5,302.4	5,302.4	0.0
D	1,873	150	88	2.6	5,306.8	5,306.8	5,306.8	0.0

[1] Feet upstream of 26th Street

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

BOULDER SLOUGH – 22ND STREET SPLIT

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
CLOVER BASIN TRIBUTARY								
A	260	28	59	8.3	5,042.6	5,042.2[2]	5,042.6[2]	0.4

[1]Feet above confluence with Dry Creek No. 1
[2]Elevations computed without consideration of backwater effects from Dry Creek No. 1

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

CLOVER BASIN TRIBUTARY

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
COAL CREEK								
A	12,460	806	3,402	3.6	5,007.7	5,007.7	5,008.7	1.0
B	13,070	732	2,847	4.3	5,009.6	5,009.6	5,010.6	1.0
C	13,570	760	2,627	4.7	5,011.5	5,011.5	5,012.4	0.9
D	14,450	221	1,570	7.8	5,015.2	5,015.2	5,015.3	0.1
E	15,020	118	1,166	10.5	5,015.8	5,015.8	5,016.0	0.2
F	15,320	153	1,254	9.8	5,016.6	5,016.6	5,017.1	0.5
G	16,741	187	1,362	7.4	5,020.8	5,020.8	5,020.8	0.0
H	17,516	159	1,664	10.4	5,022.2	5,022.0	5,022.0	0.0
I	18,086	175	1,303	9.4	5,023.8	5,023.8	5,023.8	0.0
J	18,164	169	1,248	9.8	5,023.9	5,023.9	5,023.9	0.0
K	18,274	122	1,137	10.8	5,025.2	5,025.2	5,025.2	0.0
L	19,099	565	2,182	5.6	5,030.6	5,030.6	5,030.6	0.0
M	20,799	154	1,703	7.2	5,034.8	5,034.8	5,035.0	0.2
N	22,049	275	2,813	4.4	5,038.1	5,038.1	5,038.8	0.7
O	26,829	686	4,603	2.7	5,050.1	5,050.1	5,050.1	0.1
P	30,589	783	3,731	3.3	5,059.0	5,059.0	5,059.6	0.6
Q	33,269	729	3,596	3.4	5,063.2	5,063.1	5,064.1	1.0
R	35,039	213	2,386	5.0	5,068.4	5,068.4	5,069.2	0.8
S	36,660	1,192	5,482	2.2	5,072.7	5,072.7	5,072.7	0.0
T	38,420	753	2,375	5.0	5,076.0	5,075.9	5,076.1	0.2
U	40,490	616	2,878	4.1	5,082.6	5,082.6	5,083.5	0.9
V	41,730	175	1,599	7.4	5,087.2	5,087.2	5,088.2	1.0

[1]Feet above confluence with Boulder Creek

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

COAL CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
COAL CREEK (cont.)								
W	44,170	811	3,889	3.0	5,092.4	5,092.4	5,093.4	1.0
X	46,360	135	1,700	6.8	5,096.1	5,096.1	5,096.6	0.5
Y	65,300	211	14,756	2.9	5,145.8	5,145.8	5,146.8	1.0
Z	66,210	540	2,545	1.6	5,148.6	5,148.6	5,149.6	1.0
AA	66,600	349	1,691	2.4	5,151.2	5,151.2	5,152.2	1.0
AB	67,210	230	913	4.5	5,155.9	5,155.9	5,156.9	1.0
AC	71,760	1,650	3,048	1.4	5,190.7	5,190.7	5,191.7	1.0
AD	72,960	196	1,047	4.1	5,197.9	5,197.9	5,198.9	1.0
AE	76,870	113	664	6.1	5,236.2	5,236.2	5,237.2	1.0
AF	78,140	151	883	4.6	5,248.9	5,248.9	5,249.9	1.0
AG	79,990	194	903	4.5	5,260.8	5,260.8	5,261.8	1.0
AH	98,059	223	706	4.9	5,447.7	5,447.7	5,448.3	0.6
AI	99,540	430	2,326	1.6	5,467.2	5,467.2	5,467.3	0.1
AJ	100,297	440	1,610	2.3	5,471.3	5,471.3	5,472.0	0.7
AK	100,924	196	794	4.8	5,479.1	5,479.1	5,479.1	0.0
AL	101,526	290	1,145	3.3	5,488.0	5,488.0	5,488.4	0.4
AM	102,160	150/130[2]	763	5.0	5,494.3	5,494.3	5,495.3	1.0
AN	102,352	627	813	4.6	5,500.5	5,500.5	5,500.6	0.1
AO	103,127	324	1,345	2.8	5,507.9	5,507.9	5,508.3	0.4
AP	103,944	506	825	4.4	5,519.7	5,519.7	5,520.3	0.6
AQ	104,489	457	1,262	2.9	5,526.4	5,526.4	5,526.5	0.0
AR	105,919	482	1,099	3.4	5,539.9	5,539.9	5,540.4	0.5

[1]Feet above confluence with Boulder Creek
[2]Left channel/right channel

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

COAL CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
COAL CREEK (cont.)								
AS	106,906	162	724	5.2	5,553.6	5,553.6	5,553.6	0.0
AT	107,952	373	868	4.3	5,568.0	5,568.0	5,568.1	0.1
AU	109,503	322	1,171	3.2	5,584.3	5,584.3	5,584.8	0.5
AV	110,196	280	926	4.1	5,591.2	5,591.2	5,591.7	0.5
AW	111,353	490	1,517	2.5	5,606.2	5,606.2	5,606.3	0.1
AX	112,506	362	1,232	3.1	5,617.8	5,617.8	5,618.5	0.7
AY	113,836	294	1,299	2.9	5,631.9	5,631.9	5,632.0	0.1
AZ	114,689	250	882	4.3	5,639.5	5,639.5	5,340.1	0.6
BA	115,490	290	938	4.0	5,651.8	5,651.8	5,652.5	0.7
BB	116,589	204	807	4.7	5,668.6	5,668.6	5,669.2	0.6
BC	117,261	151	784	4.8	5,678.8	5,678.8	5,679.5	0.7

[1]Feet above confluence with Boulder Creek

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

COAL CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
DRY CREEK NO. 1								
A	15,235	58	305	7.8	5,027.9	5,027.9	5,028.7	0.8
B	15,840	94	346	6.9	5,031.6	5,031.6	5,031.9	0.3
C	16,330	78	428	5.5	5,033.8	5,033.8	5,034.3	0.5
D	17,270	534	6,923	0.3	5,040.8	5,040.8	5,040.8	0.0
E	17,880	569	4,035	0.5	5,040.8	5,040.8	5,040.8	0.0
F	21,320	296	664	2.6	5,049.2	5,049.2	5,049.9	0.7
G	21,925	152	669	2.6	5,050.0	5,050.0	5,050.7	0.7

[1]Feet above confluence with St. Vrain Creek

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

DRY CREEK NO. 1

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
ELMERS TWOMILE CREEK								
A	232	39	283	3.1	5,291.4	5,291.4	5,291.4	0.0
B	889	53	266	2.7	5,297.9	5,297.9	5,297.9	0.0
C	1,303	40	202	4.0	5,299.6	5,299.6	5,299.6	0.0
D	2,044	98	129	7.1	5,310.6	5,310.6	5,310.6	0.0
E	2,580	30	98	6.3	5,317.1	5,317.1	5,317.1	0.0
F	3,297	102	176	3.9	5,320.4	5,320.4	5,320.4	0.0
G	3,832	31	70	8.7	5,324.8	5,324.8	5,324.8	0.0
H	4,306	38	96	5.4	5,332.0	5,332.0	5,332.0	0.0
I	4,881	161	364	1.4	5,335.8	5,335.8	5,335.8	0.0
J	5,437	37	106	3.6	5,337.2	5,337.2	5,337.2	0.0

[1]Feet above confluence with Goose Creek

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

ELMERS TWOMILE CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
FOURMILE CANYON CREEK								
A	212	27	30	1.5	5,167.5	5,167.5	5,167.5	0.0
B	736	85	89	0.5	5,171.6	5,171.6	5,171.8	0.2
C	1,398	36	72	2.6	5,180.4	5,180.4	5,180.9	0.5
D	1,972	485	380	3.3	5,189.0	5,189.0	5,189.2	0.2
E	2,716	392	549	2.3	5,198.8	5,198.8	5,198.9	0.1
F	3,106	344	448	2.8	5,202.6	5,202.6	5,202.7	0.1
G	3,673	206	325	3.9	5,208.5	5,208.5	5,208.6	0.1
H	3,996	117	281	4.5	5,211.5	5,211.5	5,211.7	0.2
I	4,612	142	358	3.5	5,217.3	5,217.3	5,217.3	0.0
J	6,240	127	274	4.6	5,234.8	5,234.8	5,234.9	0.1
K	8,551	191	366	3.4	5,256.7	5,256.7	5,256.9	0.2
L	9,688	562	500	2.5	5,272.2	5,272.2	5,272.4	0.2
M	10,232	48	176	7.2	5,279.6	5,279.6	5,280.0	0.4
N	10,718	79	340	3.6	5,287.9	5,287.9	5,288.0	0.1
O	11,036	70	150	8.2	5,289.7	5,289.7	5,289.7	0.0
P	11,756	343	367	3.4	5,299.2	5,299.2	5,299.2	0.0
Q	12,452	258	242	5.1	5,312.0	5,312.0	5,312.2	0.2
R	13,767	91	293	4.2	5,327.0	5,327.0	5,327.2	0.2
S	14,305	78	211	5.8	5,331.4	5,331.4	5,331.7	0.3
T	14,961	102	171	7.2	5,344.9	5,344.9	5,344.9	0.0
U	15,607	104	216	5.7	5,355.0	5,355.0	5,355.0	0.0
V	16,303	61	153	9.0	5,367.1	5,367.1	5,367.1	0.0

[1]Feet above confluence with Boulder Creek

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

FOURMILE CANYON CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
FOURMILE CANYON CREEK (Cont.)								
W	16,780	420	432	3.2	5,374.3	5,374.3	5,374.3	0.0
X	17,376	150	277	4.9	5,385.7	5,385.7	5,385.7	0.0
Y	17,868	215	560	2.4	5,398.0	5,398.0	5,398.4	0.4
Z	18,817	234	375	3.6	5,411.0	5,411.0	5,411.3	0.3
AA	19,491	127	306	4.5	5,424.2	5,424.2	5,424.6	0.4
AB	20,982	376	408	3.6	5,453.3	5,453.3	5,453.4	0.1
AC	21,305	163	504	2.9	5,461.1	5,461.1	5,461.1	0.0
AD	21,958	114	243	6.1	5,472.8	5,472.8	5,473.0	0.2
AE	22,401	97	208	7.1	5,480.9	5,480.9	5,481.0	0.1
AF	22,973	70	256	5.8	5,492.7	5,492.7	5,493.0	0.3
AG	24,266	125	295	7.3	5,526.1	5,526.1	5,526.1	0.0
AH	24,514	87	424	5.5	5,532.9	5,532.9	5,532.9	0.0
AI	25,804	358	622	5.3	5,567.6	5,567.6	5,567.9	0.3
AJ	27,081	145	419	8.6	5,601.0	5,601.0	5,601.4	0.4
AK	28,292	158	418	8.2	5,640.6	5,640.6	5,641.1	0.5
AL	29,215	112	367	9.4	5,675.1	5,675.1	5,675.3	0.2
AM	30,853	148	428	7.7	5,695.5	5,695.5	5,695.6	0.1
AN	31,345	116	721	4.4	5,718.5	5,718.5	5,718.5	0.0
AO	32,295	147	408	7.4	5,750.5	5,750.5	5,750.5	0.0
AP	32,745	121	372	8.1	5,766.3	5,766.3	5,766.3	0.0
AQ	33,115	112	328	8.8	5,781.3	5,781.3	5,781.3	0.0
AR	34,075	99	275	9.9	5,824.9	5,824.9	5,824.9	0.0

[1]Feet above confluence with Boulder Creek

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

FOURMILE CANYON CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
FOURMILE CANYON CREEK (Cont.)								
AS	34,925	79	287	9.0	5,863.0	5,863.0	5,863.0	0.0
AT	35,525	75	240	103.0	5,885.3	5,885.3	5,885.3	0.0
AU	36,265	71	323	7.6	5,914.8	5,914.8	5,914.8	0.0
AV	36,725	52	233	10.1	5,934.6	5,934.6	5,935.2	0.6
AW	37,205	93	367	6.1	5,961.5	5,961.5	5,961.5	0.0
AX	37,665	63	412	5.4	5,980.6	5,980.6	5,980.6	0.0
AY	38,345	75	226	10.9	6,009.1	6,009.1	6,009.1	0.0
AZ	38,975	62	205	11.1	6,038.1	6,038.1	6,038.1	0.0
BA	39,525	70	215	10.4	6,064.6	6,064.6	6,064.6	0.0
BB	40,135	50	174	11.3	6,094.7	6,094.7	6,094.7	0.0

[1]Feet above confluence with Boulder Creek

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

FOURMILE CANYON CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
FOURMILE CANYON CREEK LEFT BANK OVERFLOW								
A	1,805	223	392	2.7	5,171.6	5,171.6	5,171.7	0.1
B	2,465	309	387	2.8	5,177.7	5,177.7	5,177.8	0.1
C	2,870	405	920	1.2	5,182.3	5,182.3	5,182.4	0.1

[1]Feet above confluence with Boulder Creek

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

FOURMILE CANYON CREEK LEFT BANK OVERFLOW

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
FOURMILE CANYON CREEK – 61ST STREET SPLIT								
A	749	65	35	4.2	5,170.8	5,168.5[2]	5,168.8[2]	0.3
B	1,226	51	32	4.6	5,174.4	5,174.4[2]	5,174.4[2]	0.0

[1]Feet above confluence with Boulder Creek [2]Elevation computed without consideration of flooding controlled by Boulder Creek

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

FOURMILE CANYON CREEK - 61ST STREET SPLIT

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
GOOSE CREEK								
A	1,000	212	640	9.9	5,212.1	5,207.6[2]	5,207.6[2]	0.0
B	2,075	81	245	10.0	5,221.2	5,220.8[2]	5,220.8[2]	0.0
C	3,330	80	235	9.8	5,230.7	5,230.7	5,230.7	0.0
D	4,160	45	242	9.5	5,237.3	5,237.3	5,237.3	0.0
E	4,900	71	270	5.9	5,246.0	5,246.0	5,246.0	0.0
F	8,068	228	734	4.9	5,276.2	5,276.2	5,276.2	0.0
G	8,824	58	327	10.6	5,282.8	5,282.8	5,282.8	0.0
H	10,184	80	455	5.9	5,295.5	5,295.5	5,295.5	0.0
I	10,418	46	216	12.4	5,303.2	5,303.2	5,303.2	0.0
J	10,778	77	267	10.1	5,312.6	5,312.6	5,312.6	0.0
K	11,226	241	373	7.2	5,317.4	5,317.4	5,317.5	0.1
L	12,290	200	512	3.1	5,334.7	5,334.7	5,335.0	0.3
M	12,670	230	435	3.7	5,341.2	5,341.2	5,341.4	0.2
N	13,150	150	395	4.1	5,347.2	5,347.2	5,347.5	0.3
O	13,800	170	1,066	1.5	5,352.5	5,352.5	5,353.5	1.0
P	14,420	132	656	2.0	5,353.5	5,353.5	5,354.4	0.9
Q	14,900	163	352	3.8	5,356.0	5,356.0	5,356.0	0.0
R	15,450	195	190	5.5	5,363.0	5,363.0	5,363.4	0.4
S	15,940	282	486	2.2	5,368.2	5,368.2	5,368.7	0.5
T	16,280	178	428	2.2	5,376.5	5,376.5	5,377.1	0.6
U	16,700	100	134	6.0	5,381.9	5,381.9	5,382.0	0.1
V	17,280	200	523	1.2	5,382.9	5,382.9	5,383.7	0.8

[1]Feet above confluence with Boulder Creek [2]Elevation computed without consideration of flooding controlled by Boulder Creek

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

GOOSE CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
GREGORY CANYON CREEK								
A	292	73	126	7.0	5,375.7	5,375.7	5,375.7	0.0
B	843	222	378	5.5	5,398.7	5,398.7	5,398.8	0.1
C	1,220	285	782	2.7	5,411.7	5,411.7	5,412.2	0.5
D	1,835	163	319	6.0	5,437.9	5,437.9	5,437.9	0.0
E	2,240	155	380	5.0	5,458.2	5,458.2	5,458.3	0.1
F	2,541	110	236	8.1	5,475.1	5,475.1	5,475.5	0.4
G	2,999	76	203	8.4	5,500.2	5,500.2	5,500.4	0.2
H	3,549	158	421	4.0	5,537.5	5,537.5	5,537.9	0.4
I	4,107	60	189	9.0	5,566.9	5,566.9	5,567.0	0.1
J	4,665	36	148	11.5	5,604.4	5,604.4	5,604.4	0.0
K	5,287	35	133	10.9	5,645.5	5,645.5	5,645.5	0.0
L	5,874	70	325	4.5	5,694.7	5,694.7	5,695.1	0.4
M	6,317	90	829	1.8	5,736.1	5,736.1	5,736.1	0.0

[1]Feet above confluence with Boulder Creek

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

GREGORY CANYON CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
JAMES CREEK								
A	12,862	181	702	5.6	6,810.8	6,810.8	6,810.8	0.0
B	13,590	49	282	13.3	6,836.1	6,836.1	6,836.1	0.0
C	14,070	90	466	8.4	6,851.1	6,851.1	6,851.1	0.0
D	14,431	61	320	12.1	6,859.3	6,859.3	6,859.3	0.0
E	14,963	133	487	7.9	6,875.9	6,875.9	6,875.9	0.0
F	15,408	150	402	8.0	6,891.9	6,891.9	6,891.9	0.0
G	15,693	82	285	11.3	6,901.5	6,901.5	6,901.5	0.0
H	16,017	264	456	7.0	6,915.8	6,915.8	6,915.8	0.0
I	16,066	273	550	5.8	6,918.0	6,918.0	6,918.0	0.0
J	16,488	64	264	12.1	6,930.9	6,930.9	6,930.9	0.0
K	16,824	220	352	9.0	6,945.0	6,945.0	6,945.0	0.0
L	16,852	214	727	4.4	6,947.3	6,947.3	6,947.3	0.0
M	17,256	66	273	11.6	6,960.3	6,960.3	6,960.3	0.0
N	17,880	69	221	9.7	6,988.6	6,988.6	6,988.6	0.0
O	18,191	55	202	10.6	7,001.4	7,001.4	7,001.4	0.0
P	19,090	106	271	7.9	7,031.9	7,031.9	7,031.9	0.0
Q	19,690	80	213	10.5	7,061.8	7,061.8	7,061.8	0.0

[1]Feet above confluence with Lefthand Creek

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

JAMES CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
LEFTHAND CREEK								
A	11,200	316	584	8.9	4,977.3	4,977.3	4,977.3	0.0
B	11,431	256	1,186	4.8	4,978.5	4,978.5	4,978.9	0.4
C	11,751	195	1,173	4.4	4,979.0	4,979.0	4,979.3	0.3
D	12,427	154	662	7.1	4,980.9	4,980.9	4,981.0	0.1
E	13,191	254	1,746	3.0	4,983.0	4,983.0	4,984.0	1.0
F	15,293	73	382	13.6	4,990.7	4,990.7	4,990.7	0.0

[1]Feet above confluence with St. Vrain Creek

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

LEFTHAND CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
LITTLE JAMES CREEK								
A	285	102	460	2.5	6,982.0	6,982.0	6,982.0	0.0
B	460	40	119	9.8	6,986.4	6,986.4	6,986.4	0.0
C	600	30	970	1.2	6,994.5	6,994.5	6,994.5	0.0
D	700	48	130	8.9	7,026.7	7,026.7	7,026.7	0.0
E	900	40	122	9.5	7,037.3	7,037.3	7,037.3	0.0
F	1,100	41	140	8.3	7,046.0	7,046.0	7,046.0	0.0
G	1,385	66	213	5.5	7,061.0	7,061.0	7,061.0	0.0
H	1,640	23	98	11.8	7,078.7	7,078.7	7,078.7	0.0
I	2,150	33	111	10.5	7,105.0	7,105.0	7,105.0	0.0
J	2,270	65	391	3.0	7,115.9	7,115.9	7,115.9	0.0
K	3,070	41	115	10.1	7,164.4	7,164.4	7,164.4	0.0
L	3,220	43	121	9.6	7,171.3	7,171.3	7,171.3	0.0
M	3,870	57	133	8.7	7,204.9	7,204.9	7,204.9	0.0
N	4,610	74	145	8.0	7,242.0	7,242.0	7,242.0	0.0
O	4,730	216	3,121	0.4	7,267.4	7,267.4	7,267.4	0.0
P	4,940	106	590	1.7	7,267.4	7,267.4	7,267.4	0.0

[1]Feet above confluence with James Creek

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

LITTLE JAMES CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
MIDDLE BOULDER CREEK								
A	0	86	205	4.7	8,189.2	8,189.2	8,190.2	1.0
B	740	52	155	5.5	8,205.2	8,205.2	8,206.2	1.0
C	1,700	89	147	5.8	8,227.7	8,227.7	8,228.7	1.0
D	1,790	75	201	4.2	8,230.7	8,230.7	8,231.7	1.0
E	2,660	68	148	5.6	8,247.8	8,247.8	8,248.8	1.0
F	3,460	92	174	4.7	8,271.8	8,271.8	8,272.8	1.0
G	4,650	82	180	4.6	8,323.7	8,323.7	8,324.7	1.0

[1]Feet above confluence with Barker Reservoir

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

MIDDLE BOULDER CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
NORTH BEAVER CREEK								
A	400	20	24	5.7	8,200.6	8,200.6	8,200.6	0.0
B	480	47	144	0.9	8,205.2	8,205.2	8,206.2	1.0
C	560	56	45	3.0	8,206.4	8,206.4	8,206.4	0.0
D	640	38	37	3.7	8,211.2	8,211.2	8,211.2	0.0
E	1,200	25	37	3.7	8,226.1	8,226.1	8,226.1	0.0
F	1,290	24	90	1.5	8,230.0	8,230.0	8,231.0	1.0
G	1,490	35	46	2.9	8,231.5	8,231.5	8,231.5	0.0
H	1,580	31	25	5.3	8,236.3	8,236.3	8,236.3	0.0
I	1,670	16	22	6.1	8,238.9	8,238.9	8,238.9	0.0
J	1,770	19	49	2.8	8,244.0	8,244.0	8,244.0	0.0
K	1,930	23	33	4.1	8,245.7	8,245.7	8,245.7	0.0
L	2,020	22	85	1.6	8,249.4	8,249.4	8,250.4	1.0
M	2,540	47	39	3.5	8,260.8	8,260.8	8,260.8	0.0
N	2,640	21	65	2.1	8,266.4	8,266.4	8,267.4	1.0
O	2,920	26	35	3.6	8,270.0	8,270.0	8,270.0	0.0
P	3,060	74	38	3.4	8,274.4	8,274.4	8,274.4	0.0
Q	3,260	18	22	5.9	8,279.2	8,279.2	8,279.2	0.0
R	3,370	26	80	1.6	8,282.5	8,282.5	8,283.5	1.0
S	3,670	23	31	4.1	8,289.8	8,289.8	8,289.8	0.0
T	4,410	36	80	1.6	8,307.1	8,307.1	8,308.1	1.0

[1]Feet above confluence with Middle Boulder Creek

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

NORTH BEAVER CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
NORTH GOOSE CREEK								
A	430	141	570	6.8	5,214.8	5,214.8	5,214.8	0.0
B	1,000	167	818	4.7	5,222.9	5,222.9	5,222.9	0.0
C	1,500	80	414	9.3	5,228.5	5,228.5	5,228.5	0.0
D	2,290	102	445	5.5	5,232.0	5,232.0	5,232.0	0.0
E	2,890	92	366	6.3	5,236.1	5,236.1	5,236.1	0.0
F	3,690	94	389	5.9	5,241.4	5,241.4	5,241.4	0.0

[1]Feet above confluence with Goose Creek

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

NORTH GOOSE CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
NORTH ST. VRAIN CREEK								
A	1,530	157	511	8.4	5,338.1	5,338.1	5,338.1	0.0
B	2,550	60	331	13.0	5,347.0	5,347.0	5,347.0	0.0
C	3,500	202	612	7.0	5,359.9	5,359.9	5,359.9	0.0
D	5,090	98	361	12.0	5,373.6	5,373.6	5,373.6	0.0
E	6,103	93	516	8.4	5,381.9	5,381.9	5,382.0	0.1
F	8,721	115	436	9.9	5,404.3	5,404.3	5,404.6	0.3
G	9,616	113	458	9.4	5,414.6	5,414.6	5,415.3	0.7
H	10,346	53	327	13.2	5,423.1	5,423.1	5,423.1	0.0

[1]Feet above confluence with St. Vrain Creek and South St. Vrain Creek

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

NORTH ST. VRAIN CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
ROCK CREEK								
A	2,700	210	1,646	4.1	5,139.4	5,139.4	5,140.4	1.0
B	5,140	170	1,583	4.3	5,147.4	5,147.4	5,148.4	1.0
C	5,960	155	1,562	4.3	5,150.3	5,150.3	5,151.3	1.0
D	7,170	198	1,496	4.5	5,156.5	5,156.5	5,157.5	1.0
E	9,020	320/180[2]	2,066	3.3	5,163.9	5,163.9	5,164.9	1.0
F	11,700	840/50[3]	2,374	2.9	5,174.4	5,174.4	5,175.4	1.0
G	13,990	590	2,248	2.6	5,184.0	5,184.0	5,185.0	1.0
H	15,310	620	2,220	2.4	5,190.3	5,190.3	5,191.3	1.0
I	46,364	249	833	4.9	5,382.7	5,382.7	5,382.8	0.1
J	47,006	363	715	5.8	5,387.7	5,387.7	5,388.3	0.6
K	47,682	158	532	7.6	5,396.0	5,396.0	5,396.1	0.1
L	48,847	111	466	8.2	5,412.2	5,412.2	5,412.2	0.0
M	49,532	108	422	9.1	5,417.4	5,417.4	5,417.4	0.0
N	49,977	101	341	10.7	5,422.9	5,422.9	5,422.9	0.0
O	51,029	138	416	7.9	5,434.2	5,434.2	5,434.3	0.1
P	52,029	82	308	10.7	5,447.0	5,447.0	5,447.0	0.0
Q	52,728	120	455	6.6	5,456.1	5,456.1	5,456.1	0.0
R	53,830	100	415	7.2	5,465.8	5,465.8	5,466.7	0.9
S	54,579	414	955	3.1	5,476.6	5,476.6	5,476.6	0.0
T	55,209	163	680	4.1	5,485.8	5,485.8	5,485.8	0.0
U	56,250	49	226	12.3	5,499.1	5,499.1	5,499.1	0.0
V	57,291	157	333	8.2	5,511.6	5,511.6	5,511.7	0.1

[1]Feet above confluence with Coal Creek [2]Left area of floodway/right area of floodway [3]Width/width within study area limits

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

ROCK CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
ROCK CREEK (Cont.)								
W	58,373	295	581	4.7	5,524.4	5,524.4	5,524.6	0.2
X	59,536	213	490	5.5	5,544.3	5,544.3	5,544.7	0.4
Y	61,028	203	501	5.3	5,561.2	5,561.2	5,561.8	0.6
Z	62,363	59	242	9.9	5,581.3	5,581.3	5,581.5	0.2
AA	65,477	134	344	7.0	5,613.1	5,613.1	5,613.5	0.4
AB	67,292	67	227	10.6	5,637.0	5,637.0	5,637.6	0.6

[1]Feet above confluence with Coal Creek

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

ROCK CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
SKUNK CREEK								
A	1,020	103	304	6.6	5,247.1	5,247.1	5,247.1	0.0
B	2,020	126	375	5.9	5,254.9	5,254.9	5,254.9	0.0
C	2,721	148	593	3.8	5,259.8	5,259.8	5,260.2	0.4
D	3,637	100	759	2.9	5,273.1	5,273.1	5,273.3	0.2
E	3,913	218	497	4.5	5,279.9	5,279.9	5,280.7	0.8
F	4,218	310	783	2.8	5,282.8	5,282.8	5,283.7	0.9
G	4,518	190	455	4.9	5,287.2	5,287.2	5,287.4	0.2
H	4,848	287	1,025	1.8	5,289.3	5,289.3	5,289.8	0.5
I	5,223	196	538	3.3	5,294.0	5,294.0	5,295.0	1.0
J	5,468	190	318	5.6	5,297.4	5,297.4	5,297.8	0.5
K	5,618	150	326	5.5	5,301.2	5,301.2	5,301.2	0.0
L	6,233	670	541	3.1	5,306.9	5,306.9	5,307.3	0.4
M	6,588	43	456	3.5	5,319.3	5,319.3	5,319.6	0.3
N	7,058	65	178	8.6	5,323.8	5,323.8	5,323.8	0.0
O	7,633	52	150	9.6	5,340.2	5,340.2	5,340.2	0.0
P	7,978	37	133	5.1	5,347.8	5,347.8	5,348.0	0.2
Q	8,428	38	211	6.4	5,359.4	5,359.4	5,359.8	0.4
R	8,698	68	296	4.6	5,365.6	5,365.6	5,365.8	0.2
S	9,018	49	187	6.8	5,372.9	5,372.9	5,373.0	0.1
T	9,318	79	257	5.0	5,378.0	5,378.0	5,378.4	0.4
U	9,753	420	1,471	0.9	5,394.4	5,394.4	5,394.7	0.3
V	10,338	40	127	5.3	5,406.2	5,406.2	5,406.2	0.0
W	10,758	22	86	7.9	5,418.1	5,418.1	5,418.2	0.1

[1]Feet above confluence with Bear Canyon Creek

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

SKUNK CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
SOUTH BOULDER CREEK								
A	35,823	565	1,248	5.4	5,508.4	5,508.4	5,509.2	0.9
B	37,347	1,060	1,861	3.6	5,525.9	5,525.9	5,526.6	0.8
C	38,207	1,070	1,514	4.4	5,538.1	5,538.1	5,538.8	0.7
D	39,261	1,232	1,377	4.8	5,552.3	5,552.3	5,553.0	0.7
E	40,289	972	1,141	5.4	5,565.1	5,565.1	5,565.8	0.7
F	41,051	852	819	7.5	5,574.7	5,574.7	5,575.3	0.6
G	42,243	662	963	6.3	5,590.1	5,590.1	5,590.9	0.8
H	42,985	698	1,120	5.1	5,598.7	5,598.7	5,599.4	0.7
I	43,543	476	986	5.6	5,606.6	5,606.6	5,607.2	0.6
J	43,843	376	903	6.1	5,611.2	5,611.2	5,611.7	0.5
K	44,302	421	602	9.1	5,619.3	5,619.3	5,619.9	0.6
L	44,512	451	882	6.2	5,622.0	5,622.0	5,622.5	0.5
M	45,205	534	907	5.8	5,634.3	5,634.3	5,634.8	0.5
N	46,025	681	1,083	4.8	5,644.9	5,644.9	5,645.8	0.9
O	47,028	450	985	5.2	5,663.0	5,663.0	5,663.5	0.5
P	47,814	210	594	8.5	5,677.2	5,677.2	5,677.8	0.6
Q	48,382	312	696	7.2	5,688.5	5,688.5	5,689.1	0.6
R	48,865	284	552	9.0	5,699.3	5,699.3	5,699.9	0.6
S	49,541	179	563	8.8	5,714.1	5,714.1	5,714.6	0.5
T	49,917	88	537	9.1	5,723.3	5,723.3	5,723.8	0.5

[1]Feet above confluence with Boulder Creek

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

SOUTH BOULDER CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
SOUTH BOULDER CREEK (cont.)								
U	50,192	141	409	11.9	5,729.5	5,729.5	5,729.6	0.2
V	50,714	51	324	14.7	5,740.1	5,740.1	5,740.1	0.0
W	51,143	87	390	12.0	5,753.5	5,753.5	5,753.5	0.0
X	51,422	58	303	15.3	5,763.2	5,763.2	5,763.2	0.0
Y	51,781	42	260	17.6	5,776.6	5,776.6	5,776.6	0.0
Z	52,147	74	285	15.8	5,799.9	5,799.9	5,799.9	0.0
AA	52,566	80	322	14.0	5,819.6	5,819.6	5,819.9	0.2

[1]Feet above confluence with Boulder Creek

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

SOUTH BOULDER CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
SPRING GULCH								
A	1,780	80	81	4.3	4,936.7	4,936.7	4,936.7	0.0
B	2,085	70	81	4.3	4,937.5	4,937.5	4,937.5	0.0
C	2,338	40	81	4.3	4,938.2	4,938.2	4,938.2	0.0
D	3,840	50	567	6.3	4,959.3	4,959.3	4,959.3	0.0
E	4,081	140	614	5.8	4,960.4	4,960.4	4,960.4	0.0
F	4,537	125	522	6.8	4,962.1	4,962.1	4,962.1	0.0
G	4,953	140	541	6.6	4,963.8	4,963.8	4,963.8	0.0
H	5,163	210	769	4.6	4,965.5	4,965.5	4,965.5	0.0
I	5,260	215	912	3.7	4,966.0	4,966.0	4,966.0	0.0
J	5,365	220	711	4.7	4,966.0	4,966.0	4,966.0	0.0
K	5,800	225	698	4.8	4,969.2	4,969.2	4,969.2	0.0
L	5,922	190	850	3.9	4,970.8	4,970.8	4,970.8	0.0
M	6,158	255	1,002	3.3	4,971.5	4,971.5	4,971.5	0.0
N	6,480	245	745	4.5	4,973.4	4,973.4	4,973.4	0.0
O	7,550	335	986	3.4	4,978.8	4,978.8	4,979.3	0.5
P	7,770	500	634	5.3	4,979.9	4,979.9	4,980.1	0.2
Q	7,840	555	2,155	1.6	4,983.2	4,983.2	4,983.2	0.0
R	8,390	370	1,133	3.0	4,983.5	4,983.5	4,983.5	0.0
S	8,880	255	528	6.2	4,985.0	4,985.0	4,985.0	0.0
T	9,914	115	503	6.2	4,991.7	4,991.7	4,991.9	0.2
U	10,116	53	272	11.4	4,992.1	4,992.1	4,992.4	0.3
V	10,357	38	275	11.3	4,993.7	4,993.7	4,994.4	0.7

[1]Feet above confluence with St. Vrain Creek

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

SPRING GULCH

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
SPRING GULCH (Cont.)								
W	10,576	74	596	5.2	4,995.0	4,995.0	4,995.7	0.7
X	10,770	82	487	6.4	4,996.9	4,996.9	4,997.5	0.6
Y	10,873	96	620	5.0	4,997.3	4,997.3	4,998.2	0.9
Z	11,086	95	388	8.0	5,001.2	5,001.2	5,001.2	0.0
AA	11,757	110	618	5.0	5,001.8	5,001.8	5,002.2	0.4
AB	12,173	99	422	7.3	5,003.5	5,003.5	5,003.9	0.4

[1]Feet above confluence with St. Vrain Creek

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

SPRING GULCH

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
ST. VRAIN CREEK (VICINITY OF LYONS)								
A	166,708	205	936	9.5	5,267.8	5,267.8	5,267.8	0.0
B	167,408	166	817	10.9	5,273.3	5,273.3	5,274.3	1.0
C	167,828	220	973	9.1	5,277.4	5,277.4	5,278.3	0.9
D	168,708	608	2,052	4.3	5,281.6	5,281.6	5,282.5	0.9
E	169,848	500	1,283	6.9	5,290.3	5,290.3	5,290.6	0.3
F	170,278	226	904	9.8	5,296.5	5,296.5	5,296.8	0.3
G	170,688	251	1,262	7.0	5,299.3	5,299.3	5,300.3	1.0
H	171,603	320	1,117	8.0	5,305.9	5,305.9	5,306.0	0.1
I	172,378	624	1,511	5.9	5,311.4	5,311.4	5,311.4	0.0
J	173,167	597	3,032	2.9	5,319.8	5,319.8	5,319.9	0.1

[1]Feet above mouth

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

ST. VRAIN CREEK (VICINITY OF LYONS)

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
TWOMILE CANYON CREEK								
A-F[1]								
G	7,115	266	212	3.5	5,471.9	5,471.9	5,471.9	0.0
H	7,615	177	239	3.5	5,488.9	5,488.9	5,488.9	0.0
I	8,325	120	171	5.0	5,513.6	5,513.6	5,513.7	0.1
J	8,865	206	184	4.3	5,538.1	5,538.1	5,538.2	0.1
K	9,540	244	169	4.7	5,572.6	5,572.6	5,572.7	0.1
L	10,215	155	135	5.5	5,610.2	5,610.2	5,610.3	0.1
M	10,660	44	84	8.0	5,639.0	5,639.0	5,639.0	0.0
N	10,920	38	99	7.3	5,658.5	5,658.5	5,659.0	0.5

[1]Floodway removed by LOMR dated April 5, 1994
[2]Feet above confluence with Goose Creek

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

TWOMILE CANYON CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
WONDERLAND CREEK								
A	65	106	211	7.9	5,228.6	5,228.6	5,225.7	0.0
B	388	202	315	5.9	5,229.9	5,229.9	5,229.9	0.0
C	1,229	60	201	8.6	5,234.4	5,234.4	5,234.7	0.3
D	1,675	130	240	7.2	5,253.0	5,253.0	5,253.0	0.0
E	2,484	93	273	6.4	5,261.5	5,261.5	5,261.5	0.0
F	3,303	155	396	4.4	5,271.0	5,271.0	5,271.2	0.2
G	3,855	90	286	6.2	5,277.6	5,277.6	5,277.8	0.2
H	4,502	165	488	4.0	5,285.3	5,285.3	5,285.3	0.0
I	5,026	238	677	3.2	5,290.0	5,290.0	5,290.3	0.3
J	5,798	192	357	6.1	5,296.1	5,296.1	5,296.1	0.0
K	6,374	205	588	3.7	5,303.5	5,303.5	5,303.7	0.2
L	7,233	146	377	5.8	5,309.0	5,309.0	5,309.5	0.5
M	7,452	30	384	7.3	5,318.6	5,318.6	5,318.6	0.0
N	8,065	270	763	2.9	5,324.7	5,324.7	5,324.7	0.0
O	8,423	390	963	2.3	5,330.6	5,330.6	5,330.8	0.2
P	8,805	76	396	3.8	5,333.4	5,333.4	5,333.4	0.0
Q	10,069	85	218	6.9	5,356.3	5,356.3	5,356.3	0.0
R	10,319	103	313	7.2	5,357.8	5,357.8	5,358.0	0.2
S	11,060	91	274	8.2	5,367.9	5,367.9	5,368.4	0.5
T	11,912	285	1,388	1.6	5,388.5	5,388.5	5,388.5	0.0
U	12,636	206	352	6.4	5,393.3	5,393.3	5,393.4	0.1
V	13,219	186	312	7.2	5,407.5	5,407.5	5,407.6	0.1

[1]Feet above confluence with North Goose Creek

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

WONDERLAND CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
WONDERLAND CREEK (Cont.)								
W	14,388	161	353	6.5	5,421.1	5,421.1	5,421.2	0.1
X	15,180	210	303	7.6	5,436.1	5,436.1	5,436.1	0.0
Y	15,702	150	306	7.5	5,444.6	5,444.6	5,444.6	0.0
Z	16,591	75	218	9.6	5,460.2	5,460.2	5,460.3	0.1
AA	17,187	32	77	9.0	5,471.5	5,471.5	5,471.5	0.0
AB	17,756	66	118	5.9	5,484.3	5,484.3	5,484.3	0.0
AC	18,320	228	1,121	0.5	5,501.9	5,501.9	5,501.9	0.0
AD	19,022	43	44	5.7	5,505.7	5,505.7	5,505.7	0.0

[1]Feet above confluence with North Goose Creek

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

WONDERLAND CREEK

5.0 INSURANCE APPLICATIONS

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 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

Zone AE is 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 AH

Zone AH is the flood insurance risk zone that corresponds to the 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 risk zone that corresponds to the 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 base flood depths derived from the detailed hydraulic analyses are shown within this zone.

Zone X

Zone X is 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

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 the 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.

The current FIRM presents flooding information for the entire geographic area of Boulder County. Previously, separate FIRMs were prepared for each identified flood prone incorporated community and for the unincorporated areas of the county. Historical data relating to the maps prepared for each community are presented in Table 7.

7.0 OTHER STUDIES

Reports detailing the following streams were utilized in preparation of the Boulder FIS report: Bear Canyon, Elmers Twomile, Fourmile Canyon, Goose, Skunk, Twomile Canyon and Wonderland Creeks (References 61, 25 and 28); Arapahoe Avenue Overflow (Reference 60); Boulder Creek (References 60, 62, 63, 64, 72 and 91); South Boulder Creek (References 101 and 102); Dry Creek (Reference 61). Information from those reports has also been incorporated into this revised study.

Additional reports or studies prepared for the CWCB, UDFCD, or FEMA have been utilized in this FIS report for the following streams in Boulder County: Bullhead Gulch (Reference 84); Coal Creek (References 18, 67, 68, 69, 90 and 96); Coal Creek in Town of Erie (Reference 18, 69 and 95); Dry Creek (Reference 71 and 72); Dry Creek No. 1 (References 3 and 70); Clover Basin Tributary and Steel Lakes Tributary (Reference 3); Dry Creek No. 2 (Reference 71); Dry Creek No. 3 (Reference 72); Fourmile Creek (Reference 62); James Creek, Little James Creek, and Balarat Creek (Reference 30 and 73); Lefthand Creek (References 1, 2 and 7); Little Thompson River (Reference 74); Middle Boulder Creek and North Beaver Creek (Reference 75); Rock Creek (References 18, 67 and 89); St. Vrain Creek (Reference 8); St. Vrain Creek in Longmont (Reference 4 and 5); St. Vrain Creek (Vicinity of Lyons) and North St. Vrain Creek (Reference 76); Middle and South St. Vrain Creeks (Reference 77); and Spring Gulch (Reference 70).

Table 7 – Community Map History

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDAY MAP REVISION DATE	INITIAL FIRM EFFECTIVE DATE	FIRM REVISION DATE
Boulder, City of	June 14, 1974	March 5, 1976	July 17, 1978	February 24, 1981 August 4, 1988 May 3, 1990
Boulder County (Unincorporated Areas)	February 1, 1979	N/A	February 1, 1979	July 15, 1988 July 3, 1990
Erie, Town of	June 28, 1974	November 28, 1975	October 17, 1978	September 14, 1982 September 28, 1990 December 2, 2004
Jamestown, Town of	July 11, 1975	N/A	July 18, 1983	None
Lafayette, City of	May 24, 1974	January 16, 1976	March 18, 1980	None
Longmont, City of	October 26, 1973	N/A	July 5, 1977	August 1, 1983 September 18, 1987
Louisville, City of	May 4, 1973	N/A	May 4, 1973	July 1, 1974 July 25, 1975 June 23, 1978 December 1, 1978 January 5, 1982

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO.
AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDAY MAP REVISION DATE	INITIAL FIRM EFFECTIVE DATE	FIRM REVISION DATE
Lyons, Town of	December 21, 1973	April 2, 1976	August 1, 1980	None
Nederland, Town of	August 22, 1975	N/A	August 1, 1979	None
Superior, Town of	June 4, 1976	N/A	September 28, 1979	None
Ward, Town of *	N/A	N/A	N/A	N/A

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO.
AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

City of Boulder
To ensure the reliability of the results of the study in the City of Boulder, the FIS report flows were compared with flows developed in other studies in the area. A number of floodplain hydrology studies in the north metro/Boulder area were examined for use in this report. Reports used for comparison purposes were selected based on having drainage areas of less than 10 square miles and the absence of upstream flow regulation (flood-storage reservoirs).

A chart was developed to compare the flows for this study with flows developed in three studies, all of which were prepared for UDFCD by Wright-McLaughlin Engineers (References 16, 78, and 29). The Lena Gulch flows (Reference 29) are based on future (developed) conditions. The other studies are based on existing conditions, with proposed channel improvements throughout Boulder. All three studies are based on previous rainfall data and unit hydrograph procedures.

An approximate upper and lower boundary was drawn based on the above studies. Flows developed in this area are expected to plot close to the upper limit (the final flows will be somewhat lower due to more precise stream routing). The flows for Bear Canyon, Goose, Skunk, Twomile Canyon, and Wonderland Creeks all plot very well on the chart. The Elmers Twomile Creek flow plots on the high side. The basin is completely urbanized and channelized; therefore, the flow seems reasonable.

In the previous Boulder study, flows in the Bluebell Canyon Creek and Kings Gulch Basins were to be diverted to Boulder Creek and were not included in the Bear Canyon Creek and Skunk Creek calculations. Therefore, the remaining flows are 11 to 44 percent lower due to the inclusion of existing channel and overbank storage.

Town of Erie
A report concerning the potential flood hazards of Coal Creek in the area around the Town of Erie, entitled "Flood Hazard Analyses, Coal Creek and Rock Creek", was prepared in October 1980 by WRC in its report entitled "Floodplain Information, Flood Control and Floodplain Management" (Reference 69). This revision also includes the results of hydraulic analyses performed in support of a support of a LOMR application prepared by WRC Engineering Inc. (WEI), which was completed in April 1996 and was subsequently revised by a LOMR dated November 16, 1998; the corrected effective model prepared by Stantec Consulting Inc., completed June 2003; and the corrected effective model, completed October 2003, submitted in support of a request for a LOMR by Muller Engineering Company.

A revised hydraulic analysis for Coal Creek from approximately 200 feet downstream of the UPRR to approximately 4,500 feet downstream of the railroad spur was completed by Stantec Consulting Inc. in June 2003. This analysis was prepared in coordination with the Town of Erie Engineer, the FEMA Region VIII Office, and the FEMA Map Coordination Contractor.

Town of Jamestown
No flood studies have been completed or published that are pertinent to Jamestown.

A Flood Hazard Boundary Map for the Town of Jamestown was published on July 11, 1975 (Reference 79).

City of Lafayette
FEMA published a Flood Hazard Boundary Map for the City of Lafayette on May 24, 1974, which was revised on January 16, 1976 (Reference 80).

City of Longmont
A Floodplain Information report was prepared in January 1969 for Lefthand Creek by the USACE, Omaha District (Reference 7). The 1-percent annual chance elevations plotted in that report do not agree with those used in this study. The difference is due to channel improvements implemented along the study reach in the interim that confine water to the channel during low-frequency events. Previously, large floods were allowed to spread out over the presently developed floodplain. The improvements generally consist of a 20-foot-wide channel, 10 feet deep, with 2:1 side slopes that will convey the 1-percent-annual-chance flood. The 0.2-percent annual chance flood will be conveyed in part along Missouri Avenue and in the yards of the adjacent properties. In June 1972, the SCS completed an FIS report encompassing the unincorporated areas of Boulder County in which Lefthand Creek was studied in detail (Reference 81). Water-surface profiles and floodplains for Lefthand Creek from the SCS study do not agree with this study for the same reasons stated above.

A Floodplain Information report was completed in June 1972, also by the USACE, Omaha District, for Lower St. Vrain Creek (Reference 8). The 1-percent annual chance WSELs computed for this study are generally within 0.5 foot of those plotted in the St. Vrain Creek Floodplain Information report.

Two previous hydrologic investigations were conducted for Longmont on Spring Gulch. The first investigation was completed in June 1971 by the USACE, Omaha District. The 100-year flood discharge computed for this study at 9th Avenue was 3,200 cfs (Reference 39). A second study completed in 1973 by Bruns, Inc. (Reference 38), gave a 1-percent-annual-chance flood discharge of 2,117 cfs at the Oligarchy Ditch crossing of Spring Gulch. This discharge, however, was based on the assumption that certain detention facilities would be constructed upstream. These improvements have neither been constructed nor funded. Both the USACE and Bruns, Inc. were contacted to verify assumptions made in their runoff calculations. Based on existing conditions, the discharges computed for this study agree with those computed by the USACE.

No published reports or information are available regarding possible flooding on Loomiller Basin pertaining to flood profiles and floodplain boundaries referred to in this study.

Town of Lyons
FEMA published a Flood Hazard Boundary Map for the Town of Lyons on December 21, 1973 (Reference 82).

The USACE completed and published two reports covering flooding in Lyons (References 8 and 43). Floodplain resolutions based on these reports have been approved by the CWCB and are in agreement with this FIS report.

Town of Nederland
No flood studies pertinent to Nederland have been completed or published. FEMA published a Flood Hazard Boundary Map for the Town of Nederland on August 22, 1975 (Reference 59).

Town of Superior
FEMA published a Flood Hazard Boundary Map for the Town of Superior on June 4, 1976 (Reference 83).

The SCS completed a study of Coal Creek and Rock Creek in October 1976 (Reference 18). Hydrologic and hydraulic source material and methodology used in the SCS study was reviewed and found to be satisfactory and acceptable. The flood data generated by the SCS form the basis for this report.

A Flood Insurance Study was previously published in 1979 for unincorporated areas of Boulder County (Reference 37). A countywide Flood Insurance Study was previously published in 1995 for Boulder County and was revised in 2002. This study supersedes the previous Flood Insurance Study.

This FIS report either supersedes or is compatible with all previous studies on streams studied in this report and should be considered authoritative for purposes of the NFIP.
Table 8 contains all letters of map change (LOMCs) that have been incorporated into the FIS since the original effective date.

Table 8 – Summary of LOMCs

Type of LOMC	Case Number	Effective Date	Project Identifier
LOMR	95-08-129P	June 14, 1995	Boulder Creek, Canyon Boulevard Overflow, Boulder High School Overflow
LOMR	95-08-140P	June 16, 1995	Dry Creek No. 1
LOMR	95-08-158P	June 3, 1995	Corrects street locations in Autumn Ridge Subdivision in Lafayette
LOMR	95-08-241P	November 1, 1995	Dry Creek No. 2 Ditch Split Flow
LOMR	96-08-019P	January 16, 1996	Goose Creek
LOMR	96-08-269P	August 2, 1996	Goose Haven One
LOMR	96-08-301P	September 6, 1996	Coal Creek
LOMR	97-08-260P	September 24, 1997	Dry Creek No. 1
LOMR	97-08-394P	May 14, 1999	Lefthand Creek, Lefthand Creek (North & South Overflow Channels)
LOMR	98-08-169P	November 9, 1999	Goose Creek

Type of LOMC	Case Number	Effective Date	Project Identifier
LOMR	99-08-260P	October 5, 1999	Lefthand Creek
LOMR	99-08-343P	October 12, 1999	Goose Creek, Fourmile Canyon Creek, Boulder Creek
LOMR	00-08-382P	April 25, 2001	Lefthand Creek
LOMR	02-08-082P	March 25, 2002	Dry Creek No. 1, Clover Basin Tributary
LOMR	02-08-340P	October 29, 2002	Bear Canyon Creek
LOMR	02-08-481P	August 27, 2002	Bullhead Gulch
LOMR	03-08-0410P	April 15, 2004	Bear Canyon Creek
LOMR	03-08-0444P	June 18, 2003	Corporate Limit correction
LOMR	03-08-0493X	October 10, 2003	Bear Canyon Creek
LOMR	03-08-0580P	October 7, 2004	Lefthand Creek, St. Vrain Creek, Dry Creek No. 1 (Old Channel)
LOMR	04-08-0098P	September 16, 2004	Goose Creek
LOMR	04-08-0259P	September 1, 2004	Rock Creek
LOMR	04-08-0463P	December 16, 2004	Lefthand Creek
LOMR	04-08-0494P	November 1, 2004	Twomile Canyon Creek
LOMR	05-08-0364P	February 8, 2006	Erie Commons
LOMR	06-08-B060P	September 25, 2006	Harvest Junction South
LOMR	06-08-B252P	February 28, 2007	Lyons Valley Park
LOMR	06-08-B289P	March 28, 2007	Fourmile Canyon Creek Restudy & Wonderland Creek Restudy
LOMR	07-08-0163P	May 29, 2007	Village at Creekside
LOMR	07-08-0506P	December 13, 2007	St. Vrain Creek at Airport Road
LOMR	08-08-0011P	July 17, 2009	Harvest Junction North
LOMR	08-08-0701P	October 10, 2008	Wonderland Creek Underpass and Channel Improvements at Highway 119 and 30th
LOMR	08-08-0872P	December 24, 2008	2890 Table Mesa Drive
LOMR	09-08-0486P	December 14, 2009	3787 Spring Valley Road
LOMR	09-08-0608P	March 6, 2010	Coal Creek LOMR
LOMR	10-08-0267P	October 15, 2010	Gregory Canyon Creek
LOMR	10-08-0754P	September 7, 2011	Elmer’s Two Mile Creek

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Flood Insurance and Mitigation Division, FEMA, Denver Federal Center, Building 710, Box 25267, Denver, Colorado 80225-0267.

9.0 BIBLIOGRAPHY AND REFERENCES

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10.0 REVISION DESCRIPTIONS

This section has been added to provide information regarding significant revisions made since the FIS report and FIRM were printed for the original DFIRM conversion on December 18, 2012. Future revisions may be made that do not result in the republishing of the FIS report. All users are advised to contact the Community Map Repositories listed on the FIRM Index Panel to obtain the most up-to-date flood hazard data.

10.1 First Revision (Revised ‘month’ ‘day’, ‘year’)

a. Acknowledgments

The analyses of Boulder Creek and its numerous distributary flow paths as well as Boulder Slough through the City of Boulder were performed by Anderson Consulting Engineers, Inc. for the City of Boulder for the “Boulder Creek Floodplain Mapping Study,” (Reference 1) and “Boulder Slough Floodplain Mapping Study,” (Reference 2). FEMA reviewed and accepted these data for the

purposes of this revision (The Boulder Creek study was reviewed as a LOMR, case no. 13-08-205P).

b. Scope

Based on better topographic data, updated hydraulic roughness information, and flood mitigation measures implemented by the City of Boulder, hydraulic modeling was conducted using HEC-RAS of a 6.2-mile reach of Boulder Creek from approximately 61st Street upstream to the mouth of Boulder Canyon. Hydraulic modeling was also conducted for an additional 7.5 miles along 30 distributary flow paths within the Boulder Creek corridor, as well as a 1.3-mile reach of Boulder Slough from approximately 100 feet downstream of 18th Street to approximately 300 feet downstream of 30th Street.

c. Hydrologic and Hydraulic Analyses

An evaluation of the effective hydrology for Boulder Creek (Reference 3) was conducted by Anderson Consulting Engineers, Inc. (Reference 4) for the City of Boulder as part of the Boulder Creek Floodplain Mapping Study. This hydrologic evaluation concluded that the effective 1-percent annual chance discharges are still reasonable and appropriate for use in conducting floodplain studies along Boulder Creek through the City of Boulder. Effective flood discharges along Boulder Creek were retained for use in the hydraulic modeling conducted for this revision.

Hydraulic analysis data for Boulder Creek and its 30 distributary split flow paths are based on information published in "Boulder Creek Floodplain Mapping Study," (Reference 1). WSELs for the 10-, 4-, 2-, 1- and 0.2-percent annual chance flood events were computed using the USACE HEC-RAS River Analysis System program Version 4.0 (Reference 5). Starting WSELs were obtained from the effective FIS for the detailed study reach of Boulder Creek directly downstream of the current study reach.

Cross section data used in the analysis was obtained from both photogrammetrically-produced and LiDAR-based 1-foot contours prepared in 2003 and 2004, provided by the City of Boulder, supplemented in many locations with more recent field survey data and as-built topographic information, as documented in the "Boulder Creek Floodplain Mapping Study," (Reference 1). All bridge structures and cross sections were field surveyed to obtain elevation data and geometry.

Manning's "n" values for Boulder Creek and natural overbank areas were estimated based on field inspection of the study area and using Cowen's Method and the "Guide for Selecting Manning's Roughness Coefficients for Natural Channels and Flood Plains," (Reference 6). Roughness coefficients for urbanized overbank areas within the floodplain were assigned based on generally accepted values presented in "Open-Channel Hydraulics," (Reference 7). For the Boulder Creek channel, Manning's n values range from 0.040 to 0.060. For overbank areas within the Boulder Creek floodplain, Manning's n values generally range from 0.030 to 0.065,

with the following exceptions: (a) where ponds or other water impoundments would result in water flowing over water or where streets provide longitudinal conveyance as part of a broader hydraulic modeling cross section, a roughness coefficient of 0.020 was utilized; (b) for other paved areas such as parking lots where curbs and other appurtenances are present, a Manning's "n" value of 0.025 was utilized; and (c) in the heavily-wooded natural area north of the BNRR where Manning's "n" values of 0.110 and 0.120 were defined. For all streets that serve as distributary flow paths, the curb-to-curb Manning's "n" value was defined as 0.020. Roughness coefficients for overbank areas along streets range from 0.025 to 0.045.

For Boulder Slough, an evaluation was conducted to verify the effective flows at the upstream end by estimating the 100-year discharge intercepted by Boulder Slough from the Boulder Creek floodplain between Canyon Boulevard and 18th Street. The limiting conveyance capacity of the Slough through this reach was determined to be nearly equivalent to the 225 CFS cited in the effective study at 18th Street.

The effective Muller hydrologic calculations included several "diverted outflows" due to irrigation diversions and a street overflow. In order to maintain consistency across flood studies, whereby it is generally assumed that irrigation ditches and canals are running full when the peak discharge arrives, the City of Boulder requested that these otherwise diverted outflows be included in the hydraulic model. This assumption also provides the City with flexibility with respect to floodplain administration if changes are made to diversion structures or roads such that these outflows are eliminated in the future.

Hydraulic modeling for Boulder Slough was conducted using HEC-RAS Version 4.1.0 for open channel reaches and StormCAD Version 5.5 for the closed conduit reach. Hydraulic modeling included analysis of the 100-year event, as well as analyses to support delineation of the conveyance zone (equivalent to the ½-foot rise floodway) and the high hazard zone. In addition to the main Boulder Slough channel corridor, a 0.4-mile long split flow path starting just upstream of 22nd Street was identified; this split flow largely reconnects with the main channel just west of 26th Street. Spills between the main channel and the 22nd Street Split Flow Path were modeled using the lateral weir functionality of HEC-RAS. The starting water surface elevation at the downstream end of Boulder Slough was based on normal depth using a computed bed slope at Cross Section 2850 of 0.0125 ft/ft.

The primary base topography for Boulder Slough was provided by the City of Boulder and consists of a LiDAR based Digital Elevation Model (DEM) and 1-foot contours, produced in 2013. Base topography throughout the study reach was supplemented by field survey data collected at all bridge and culvert crossings, including channel cross sections associated with these structures. In addition, field survey data were collected to supplement the base topography in areas where the original topography on which this study was founded (1-foot contours from 2004) did not accurately reflect local topography, or in areas where it was necessary to more closely define specific topographic features.

Manning's n roughness coefficients for Boulder Slough were estimated using Cowen's Method and the "Guide for Selecting Manning's Roughness Coefficients for Natural Channels and Flood Plains," [Reference 6]. Roughness coefficients for urbanized overbank areas within the floodplain were assigned based on generally accepted values presented in "Open-Channel Hydraulics," [Reference 7]. For the Boulder Slough channel, Manning's n values range from 0.015 to 0.150. For the few overbank areas within the Boulder Slough floodplain, Manning's n values range from 0.015 to 0.200. The concrete pipe system extending from 26th Street to east of 28th Street was modeled using a Manning's n value of 0.013. For the streets that serve as distributary flow paths, the curb-to-curb Manning's n value was defined as 0.025. Roughness coefficients for overbank areas along streets range from 0.025 to 0.050.

d. Other Studies

This revision is in agreement with the published FIS for Boulder County, Colorado (Reference 8). This revision impacts flood hazard information for both the City of Boulder and unincorporated portions of Boulder County.

Following the 2013 flood event, the State of Colorado Water Conservation Board updated discharges along many drainages in the county. In certain watersheds, those discharges are likely be used for future studies in the county. Other studies currently underway in the county include Coal and Rock Creeks, Lower Bear Canyon Creek, and Sunshine Canyon Creek. These studies will be incorporated into the FIRM and FIS report at a later date. Additional studies will become available as permanent flood recovery road construction and stream restoration projects are completed. For additional Stream restoration project information, please consult the post-flood watershed master plans completed for most of the major drainages in the county, or contact the Boulder County Transportation Department.

e. References

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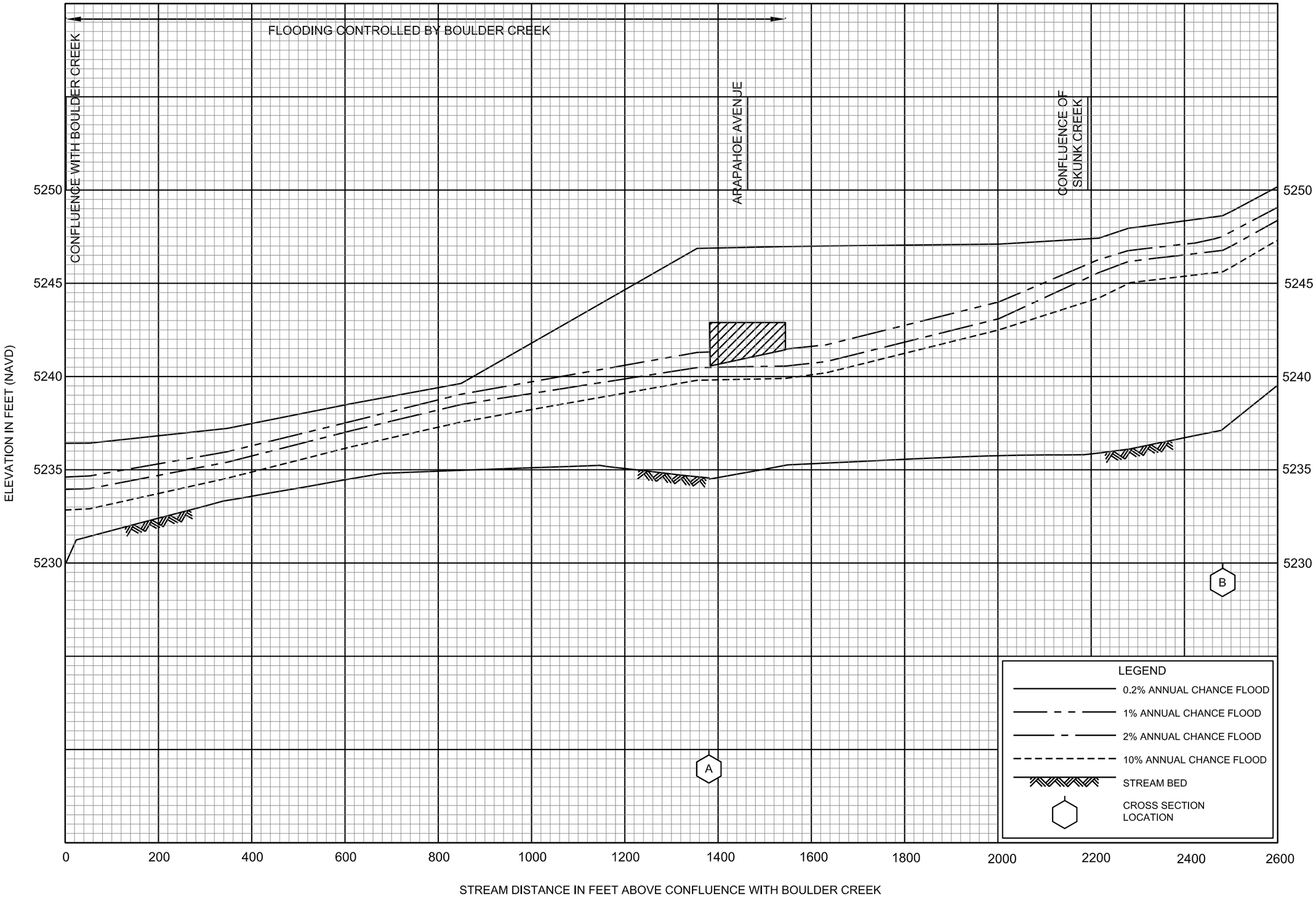
11.0 COMMUNITY MAP REPOSITORIES

Community map repository information has been removed from the FIRM Index and is listed in Table 9.

Table 9 – Community Map Repositories

Community	Building/Department Name	Repository Address	City/Town	State	Zip Code
Boulder, City of	Municipal Building Plaza	1777 Broadway	Boulder	CO	80302
Boulder County (unincorporated areas)	Boulder County Transportation Department	2525 13th Street, Suite 203	Boulder	CO	80306
Erie, Town of	Town Hall	645 Holbrook St	Erie	CO	80516
Jamestown, Town of	Town Hall	118 Main Street	Jamestown	CO	80455
Lafayette, Town of	City Hall	1290 South Public Rd	Lafayette	CO	80026
Longmont, City of	Service Center	1100 South Sherman St	Longmont	CO	80501
Louisville, City of	City Hall	749 Main Street	Louisville	CO	80027
Lyons, Town of	Town Hall	432 Fifth Avenue	Lyons	CO	80540
Nederland, Town of	Town Hall	45 West First Street	Nederland	CO	80466
Superior, Town of	Town Hall	124 E Coal Creek Dr	Superior	CO	80027
Ward, Town of	Town Office	1 Columbia Street	Ward	CO	80841



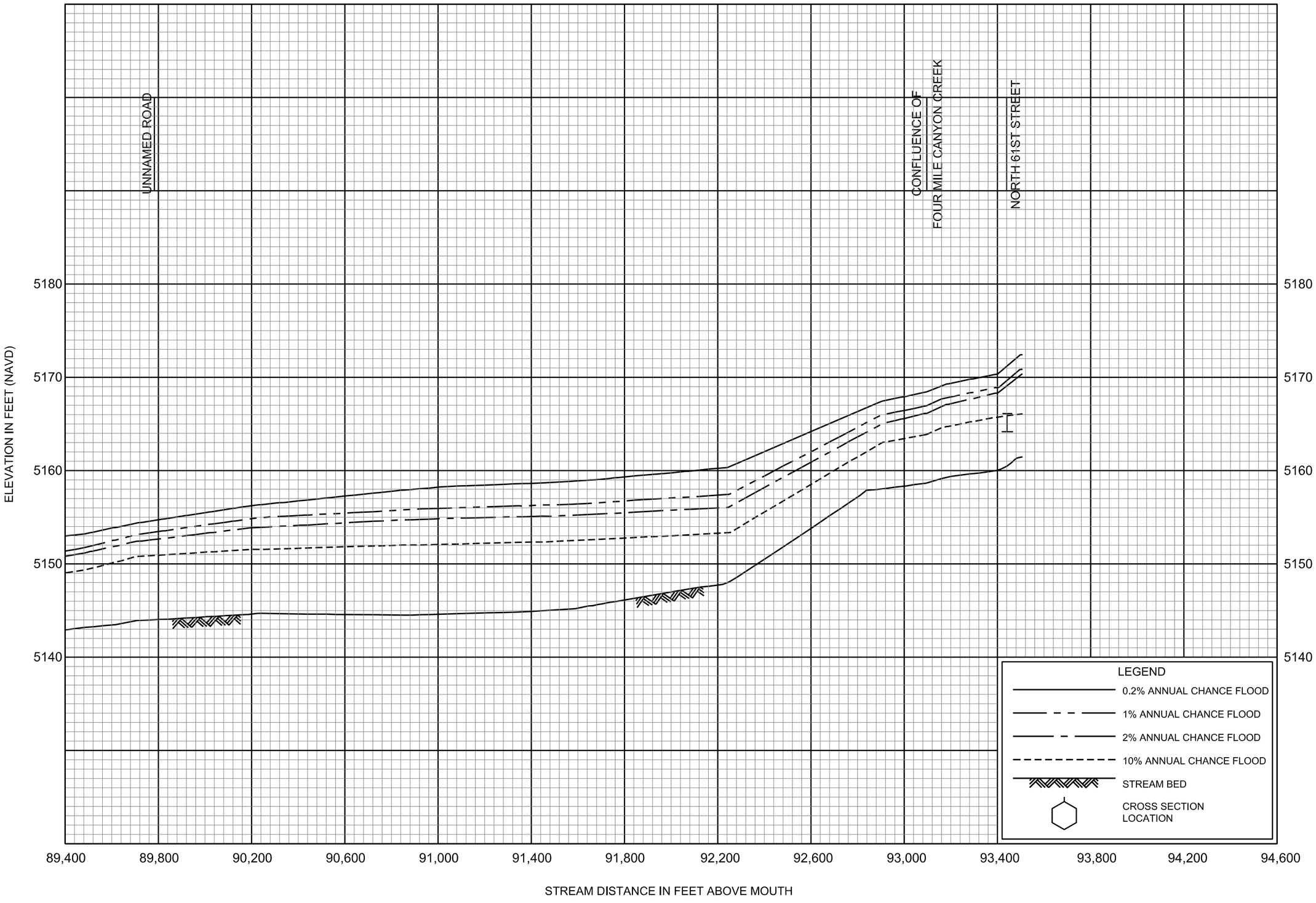
FLOOD PROFILES

BEAR CANYON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

AND INCORPORATED AREAS



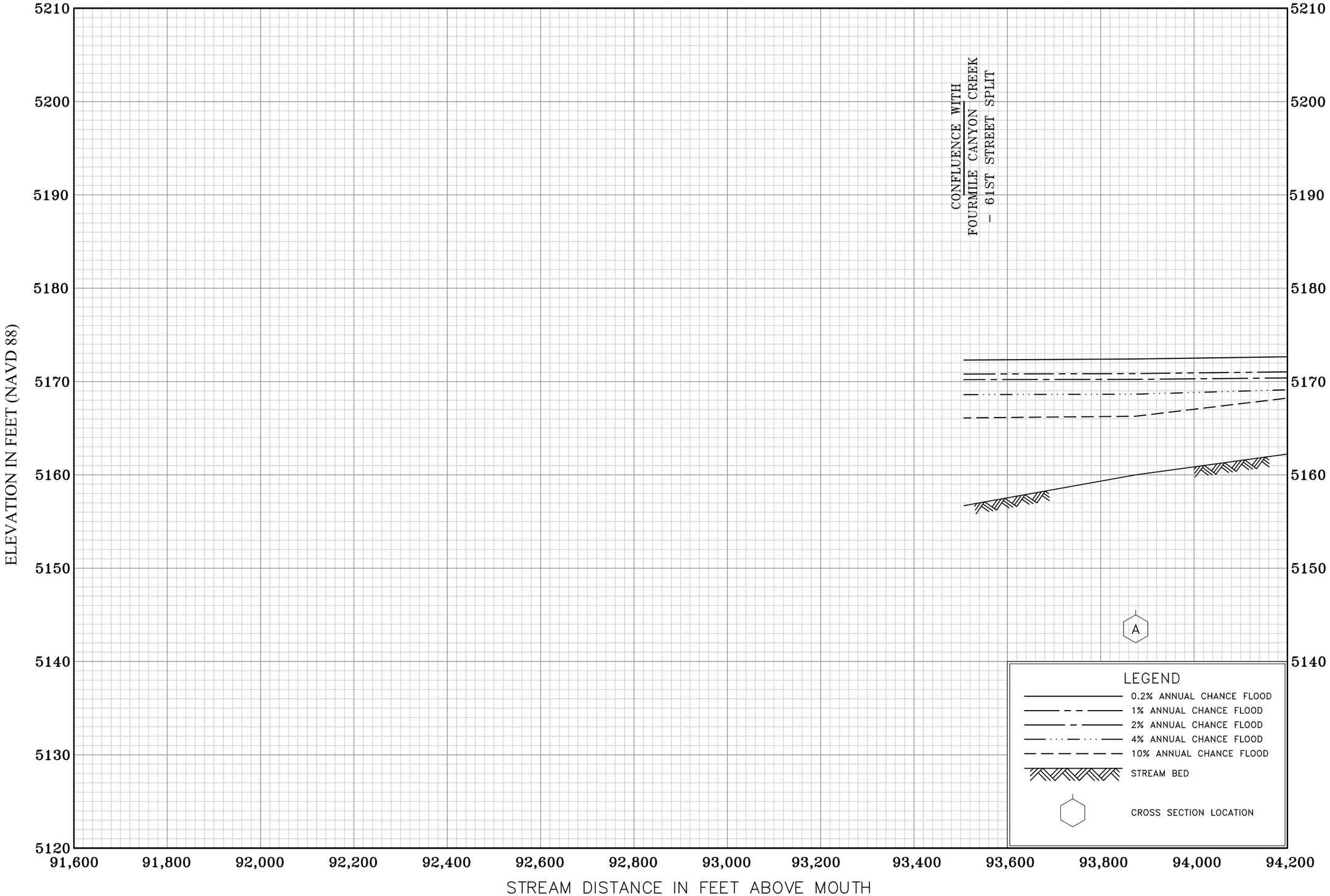
FLOOD PROFILES

BOULDER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

AND INCORPORATED AREAS



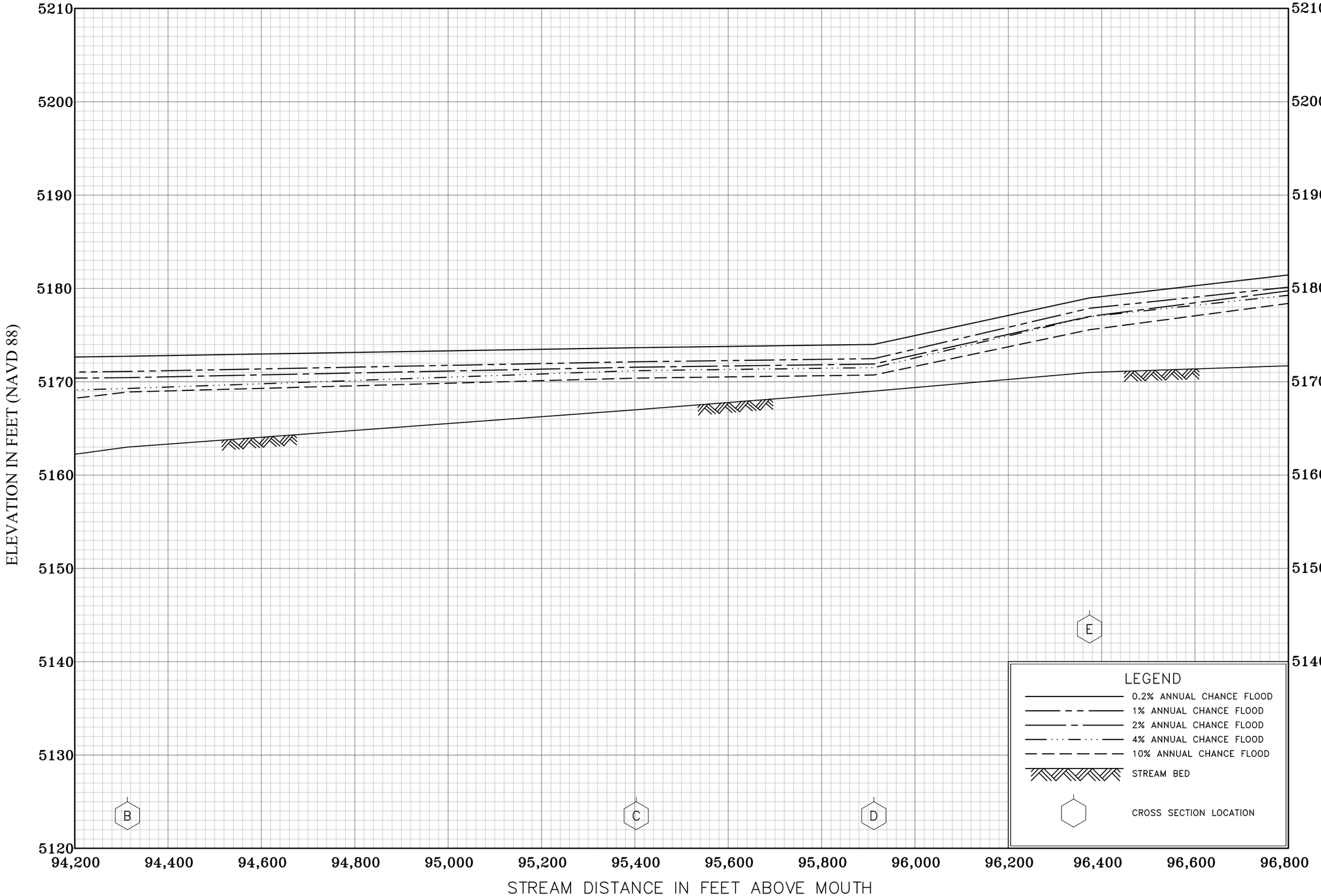
FLOOD PROFILES

BOULDER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

(AND INCORPORATED AREAS)



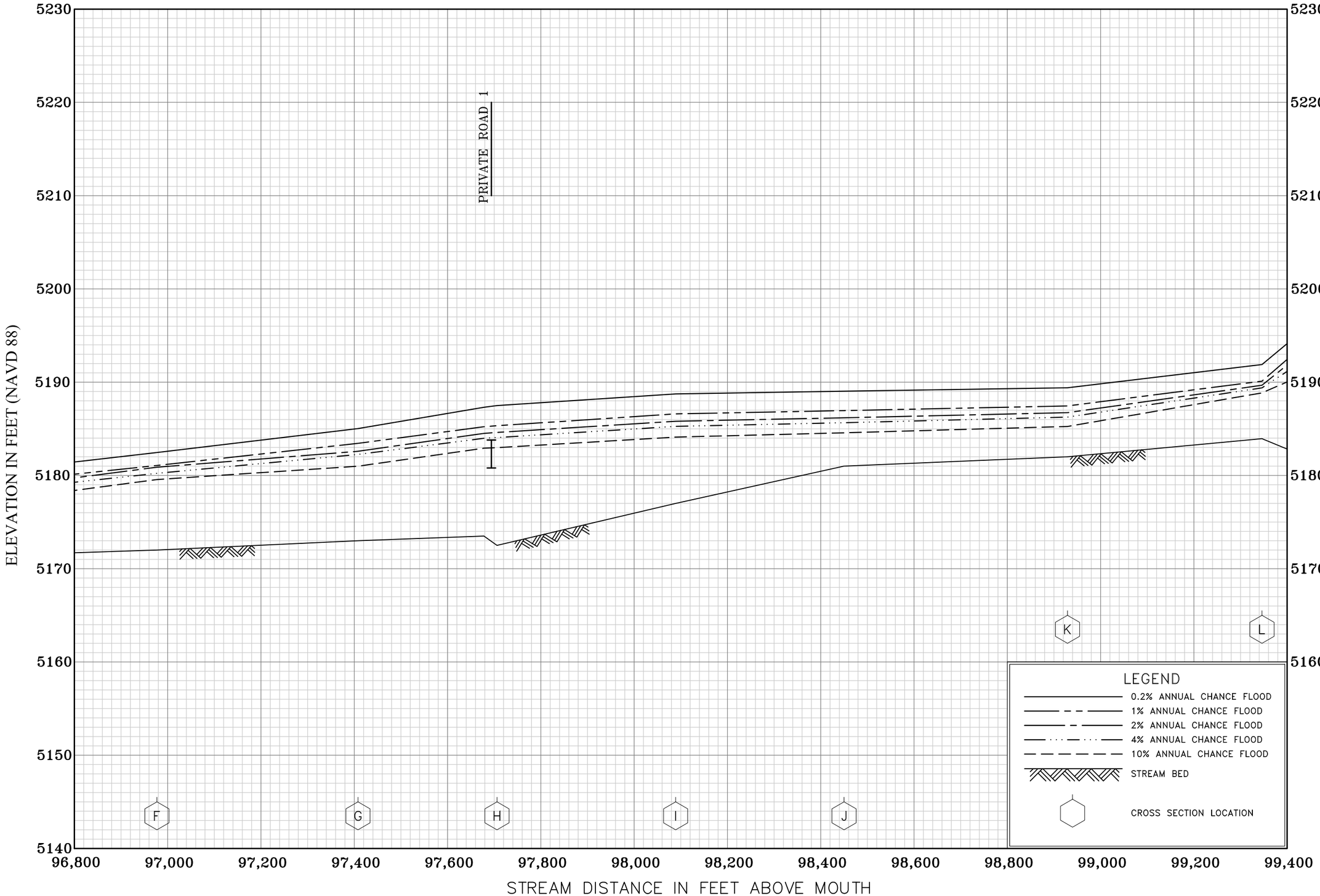
FLOOD PROFILES

BOULDER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

(AND INCORPORATED AREAS)



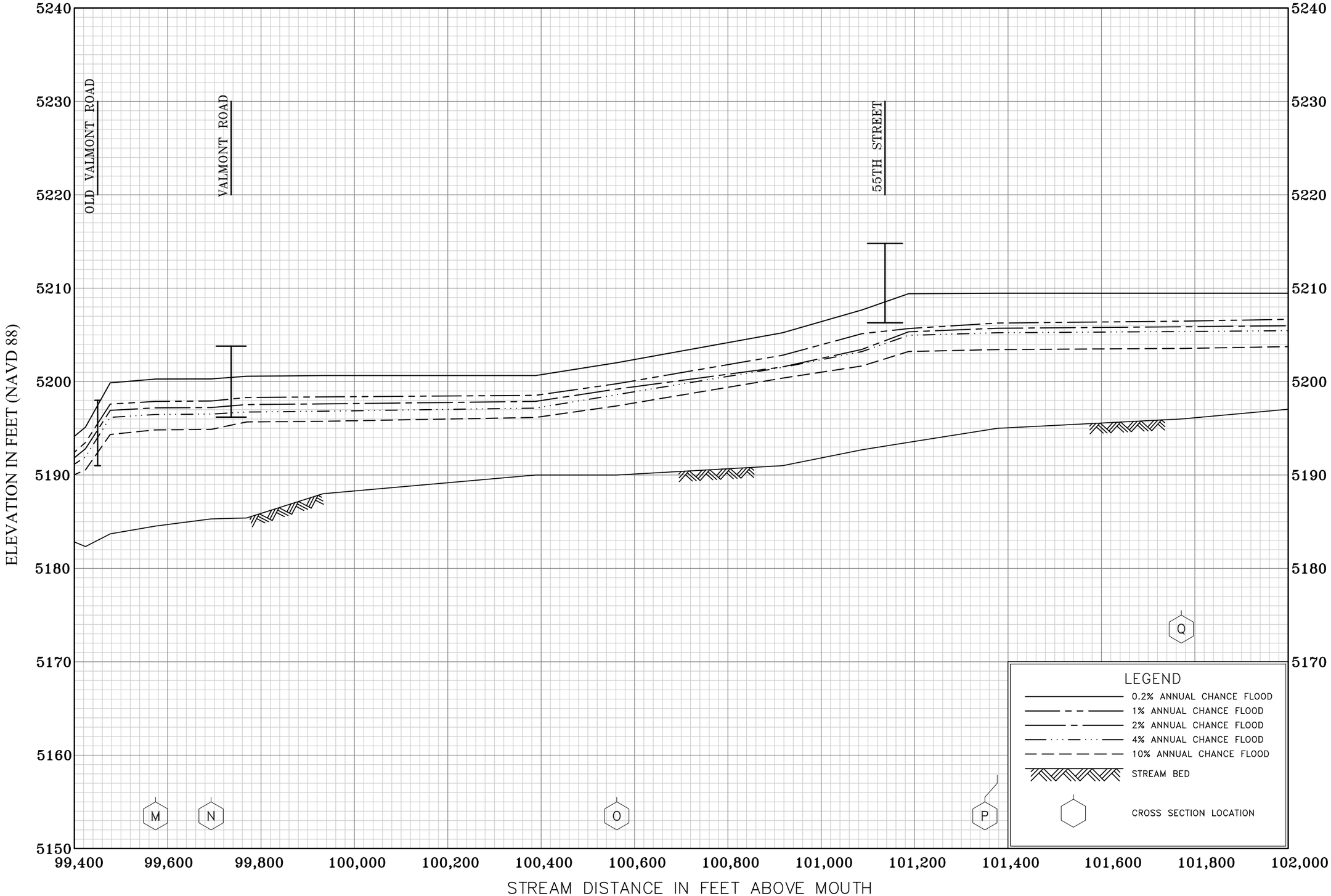
FLOOD PROFILES

BOULDER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

(AND INCORPORATED AREAS)



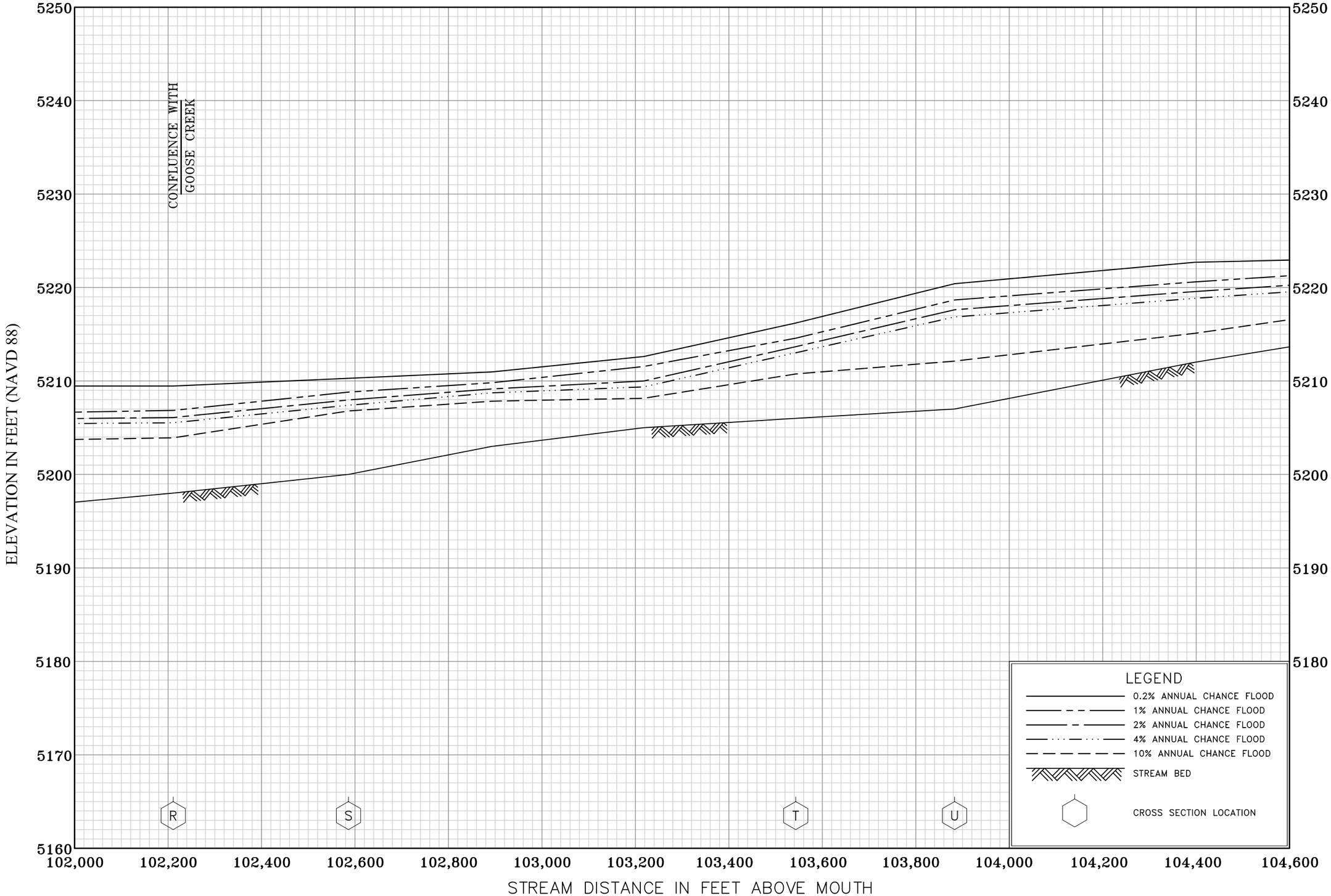
FLOOD PROFILES

BOULDER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

(AND INCORPORATED AREAS)



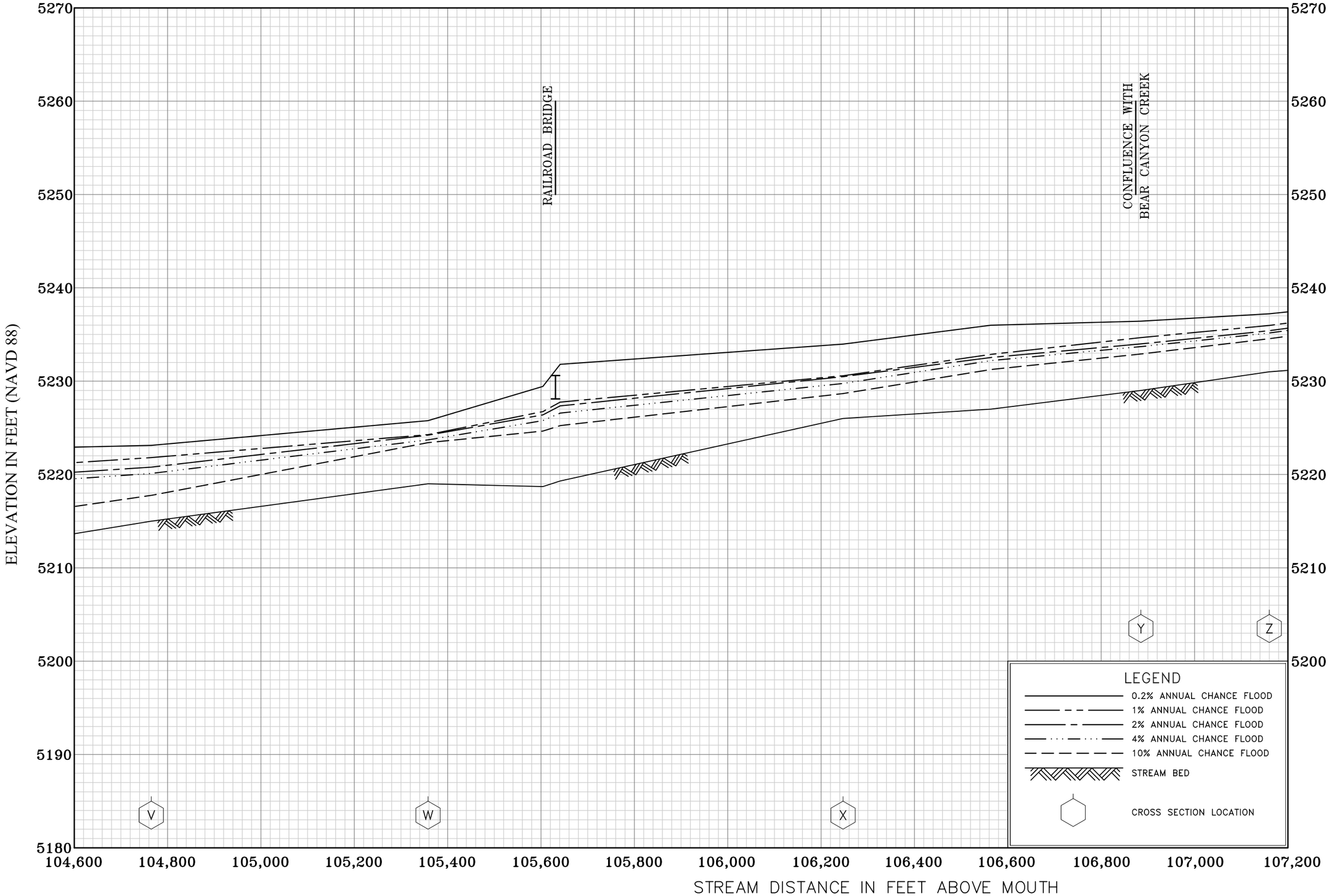
FLOOD PROFILES

BOULDER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

(AND INCORPORATED AREAS)



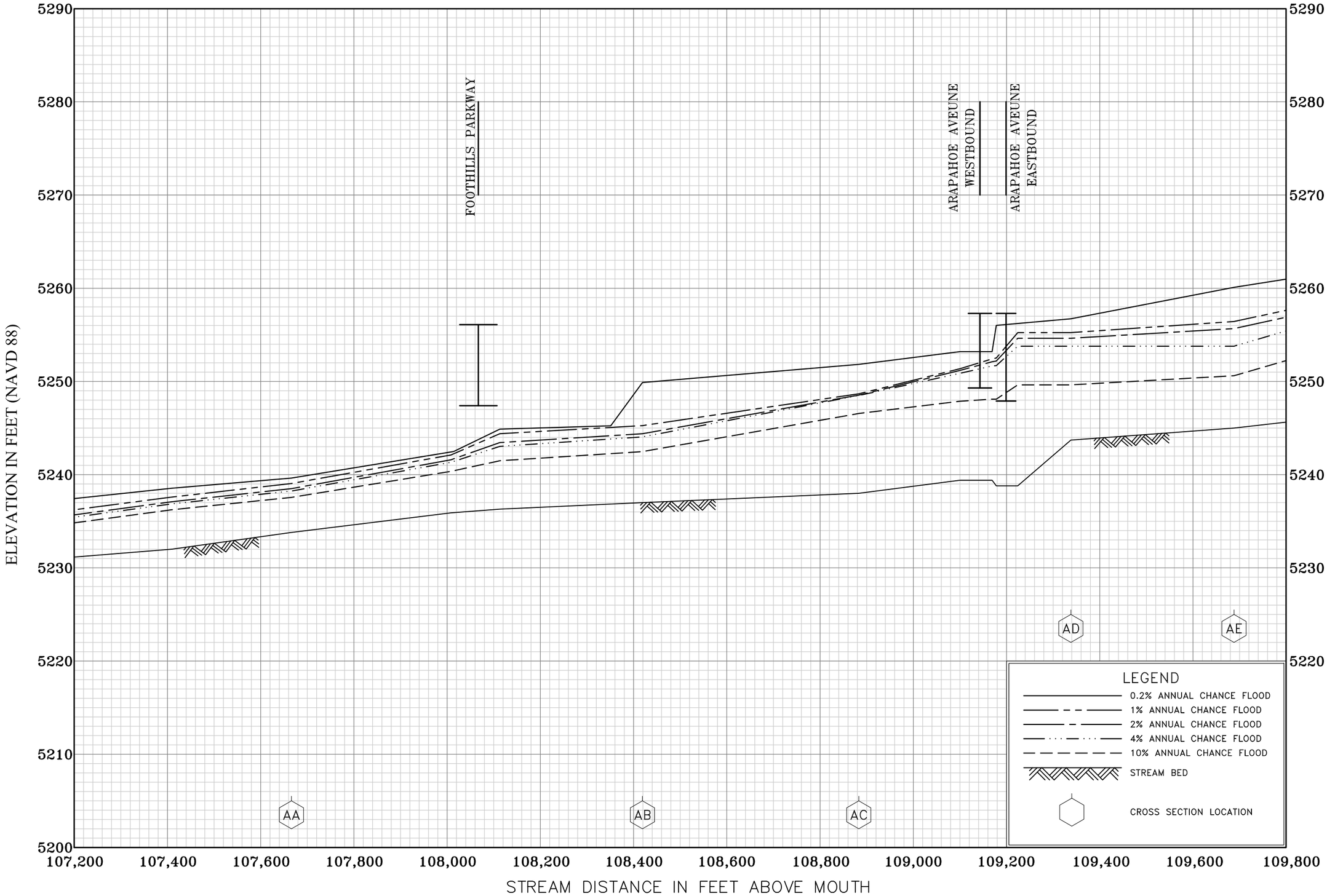
FLOOD PROFILES

BOULDER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

(AND INCORPORATED AREAS)



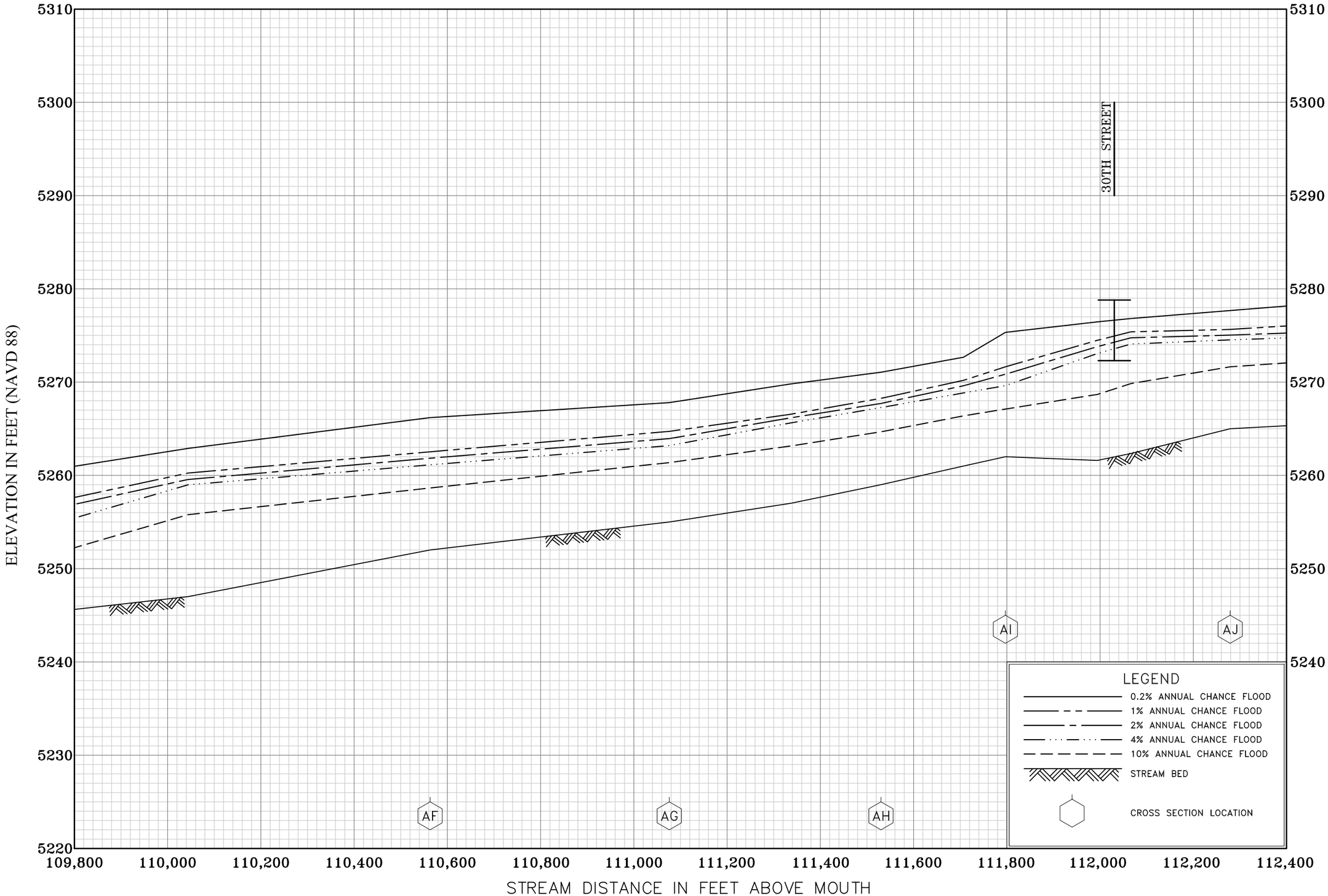
FLOOD PROFILES

BOULDER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

(AND INCORPORATED AREAS)



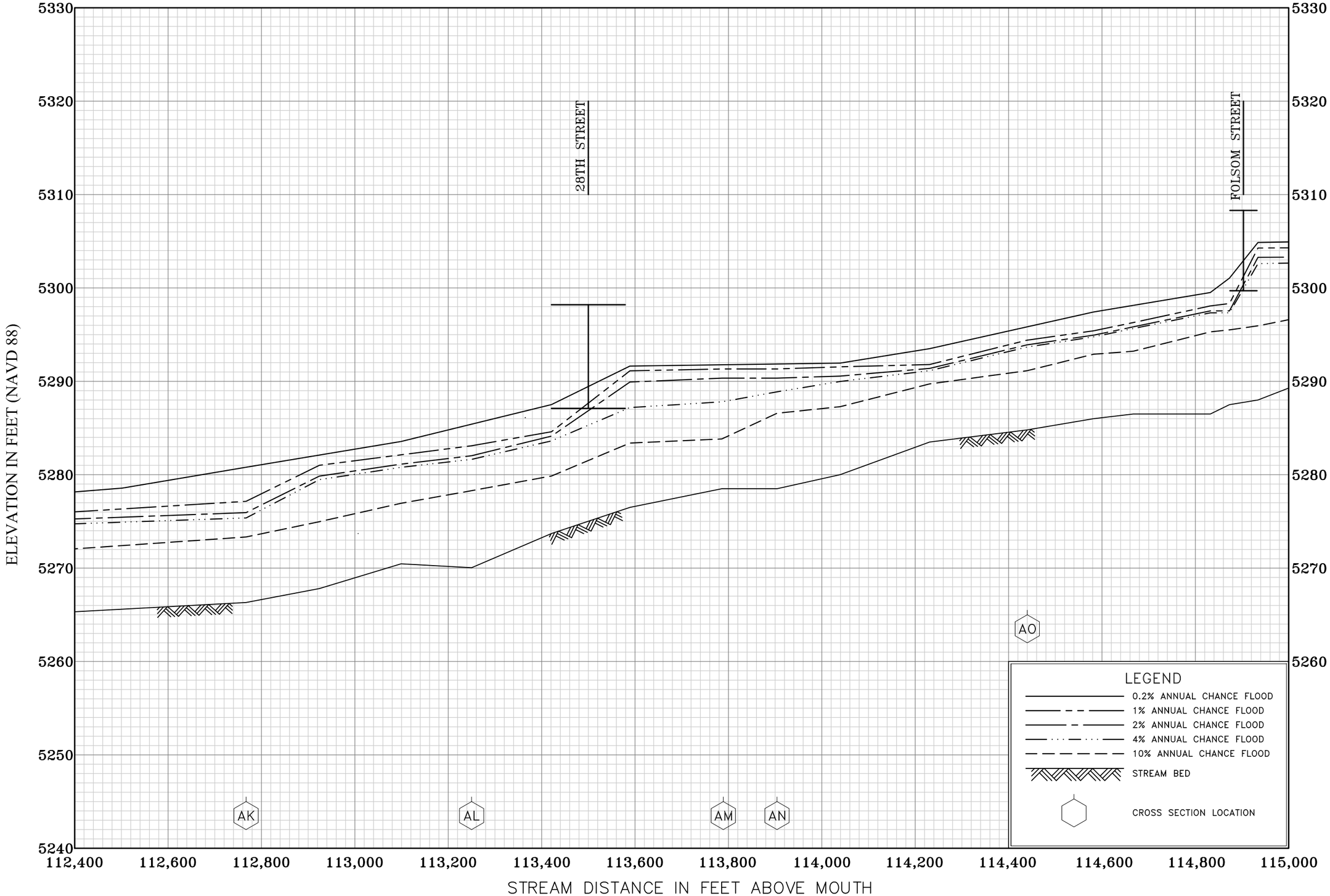
FLOOD PROFILES

BOULDER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

(AND INCORPORATED AREAS)



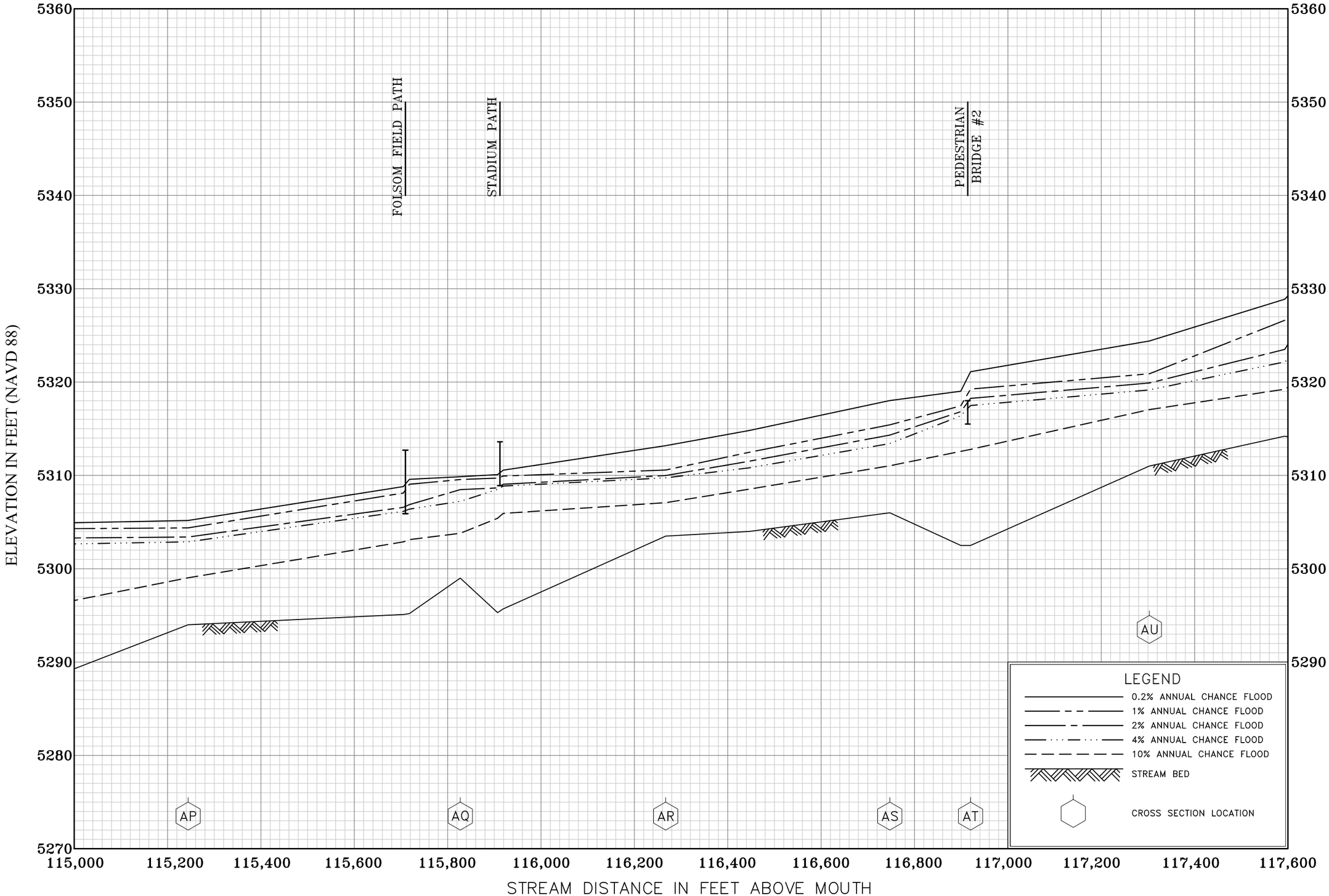
FLOOD PROFILES

BOULDER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

(AND INCORPORATED AREAS)



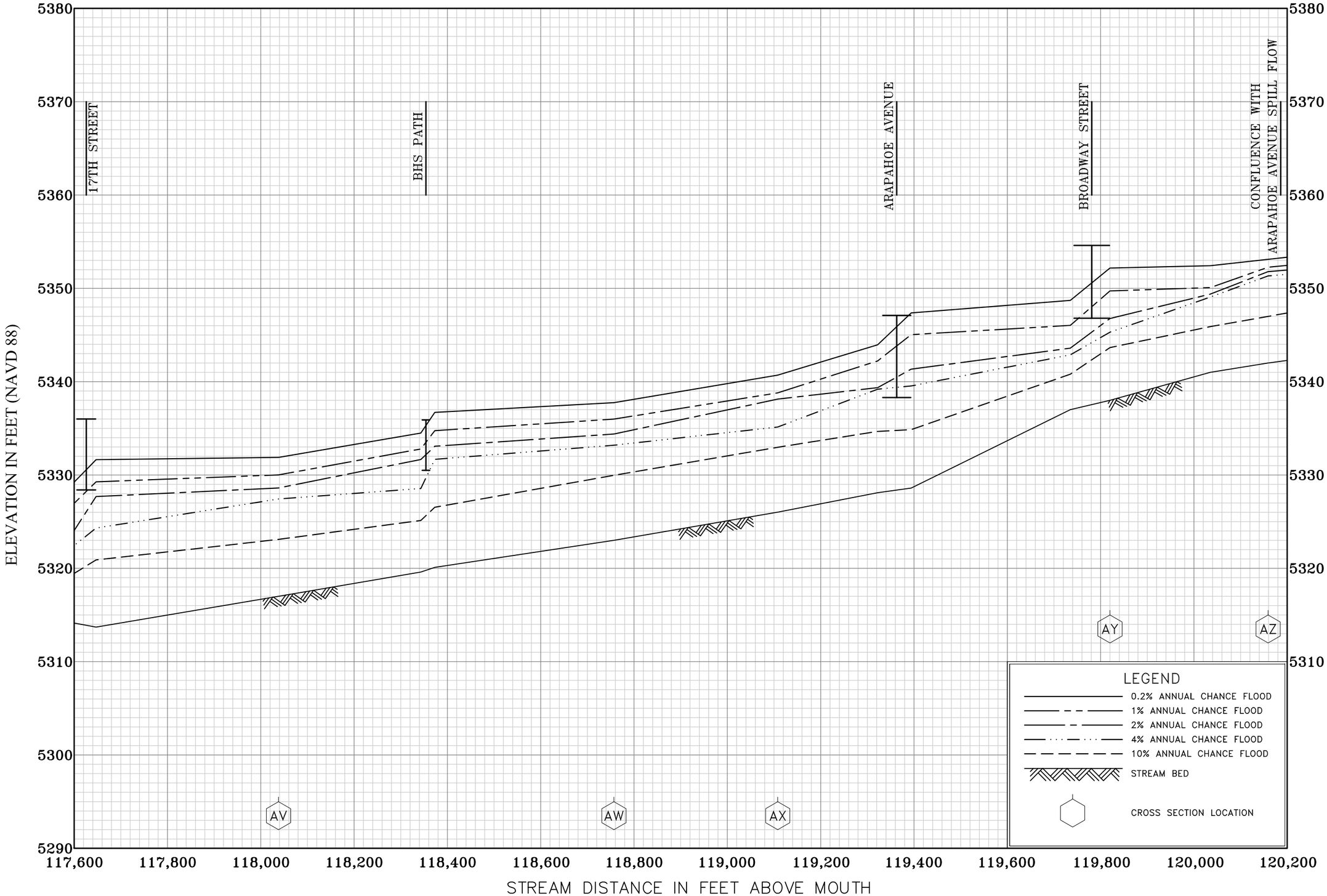
FLOOD PROFILES

BOULDER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

(AND INCORPORATED AREAS)



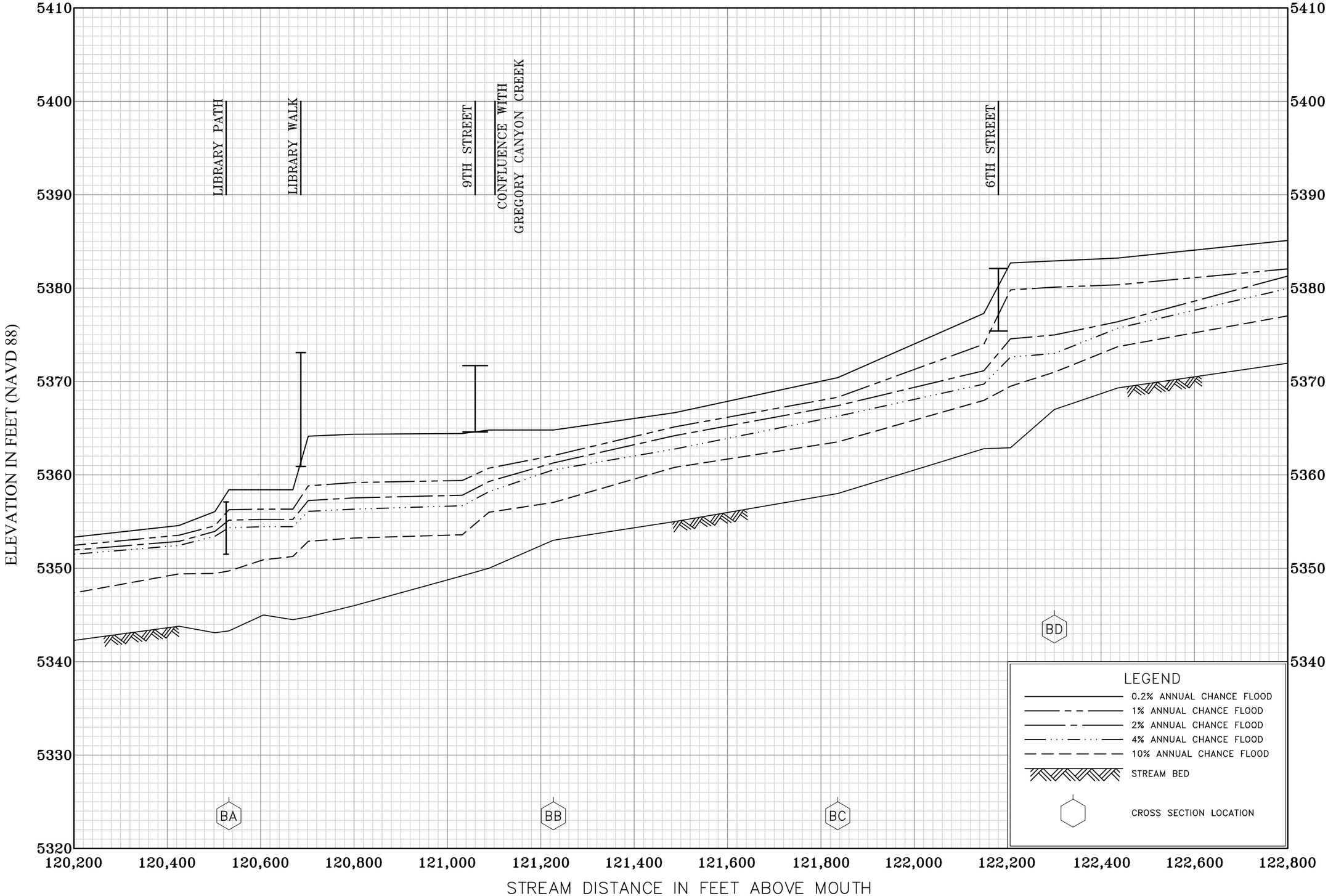
FLOOD PROFILES

BOULDER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

(AND INCORPORATED AREAS)



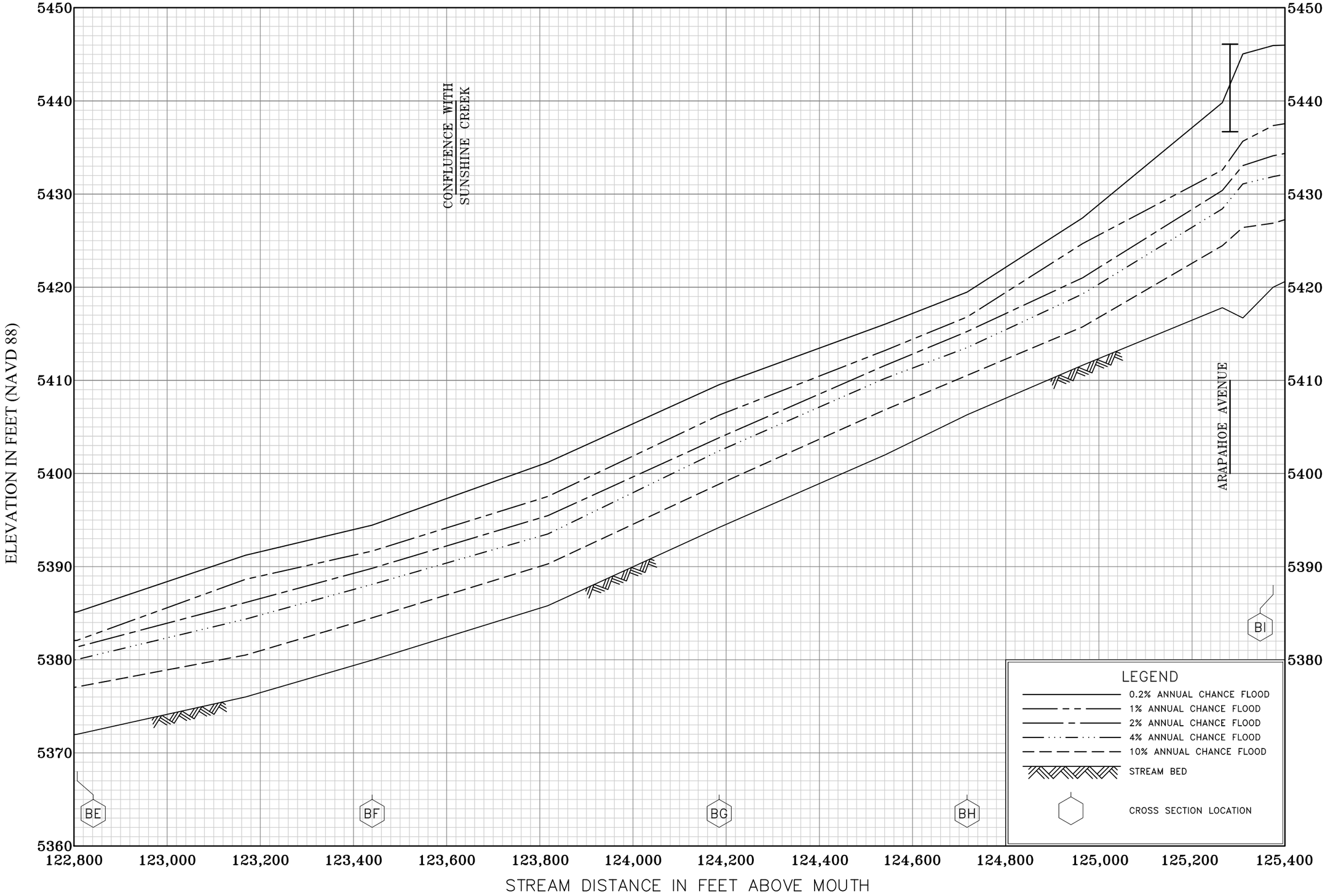
FLOOD PROFILES

BOULDER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

(AND INCORPORATED AREAS)



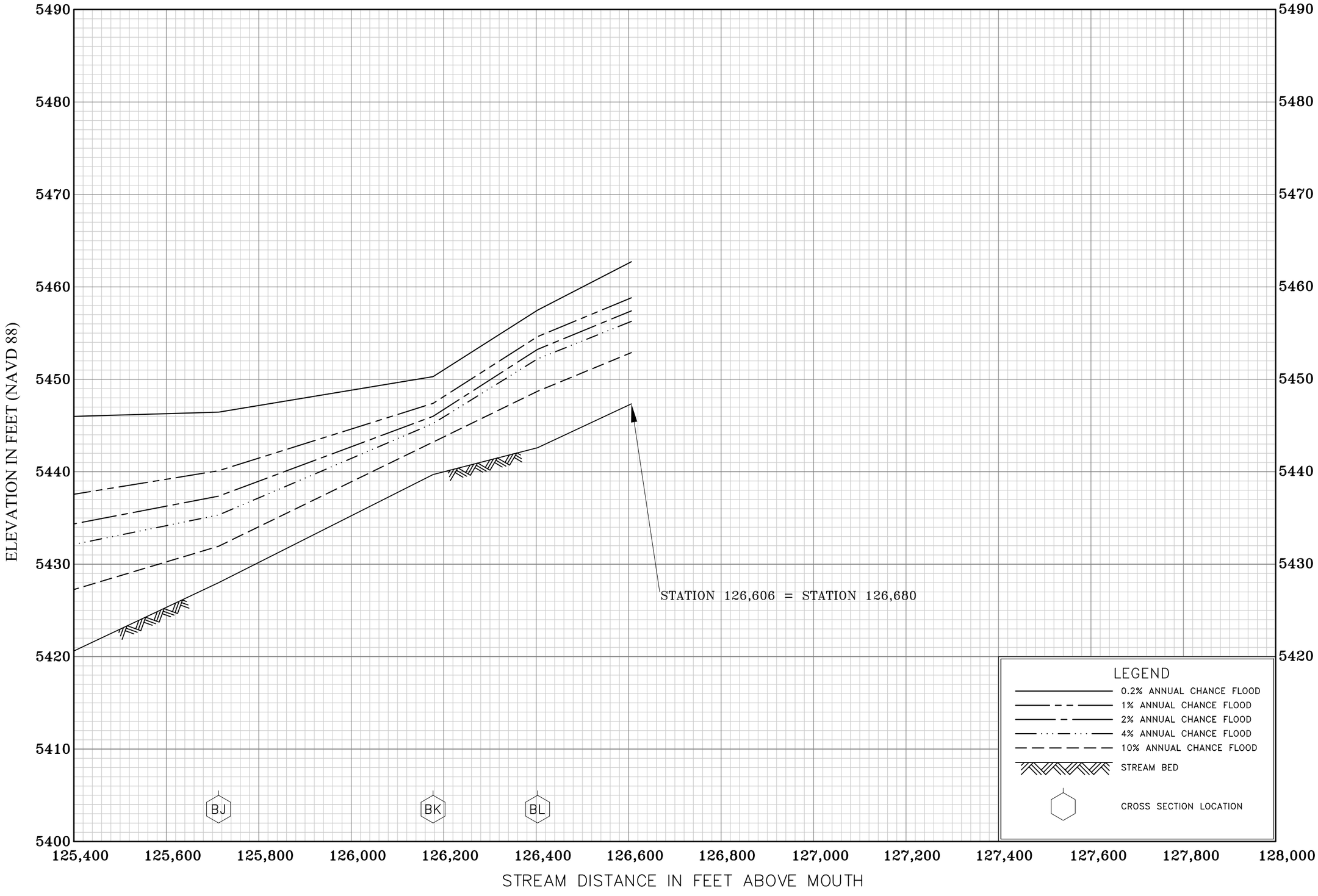
FLOOD PROFILES

BOULDER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

(AND INCORPORATED AREAS)



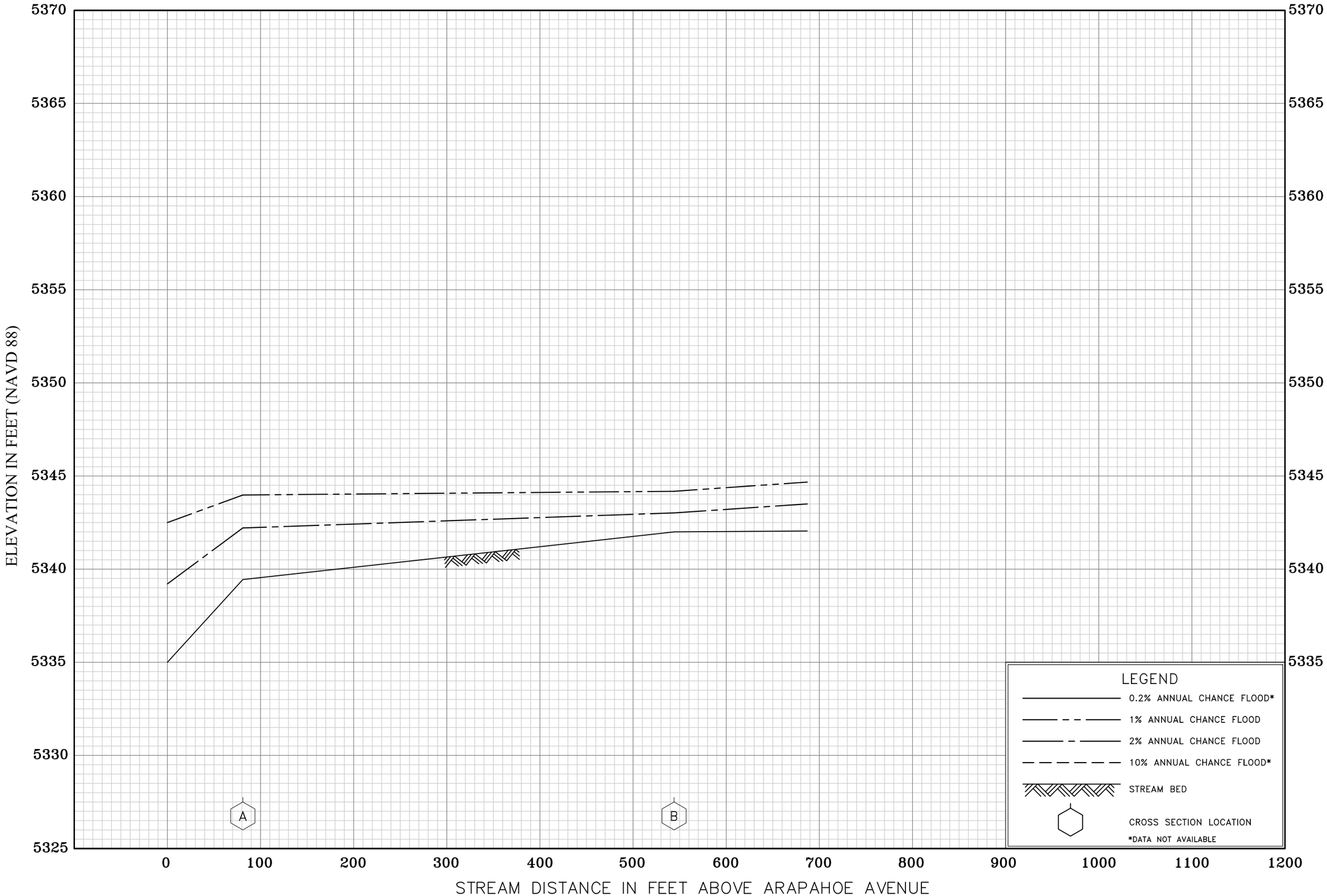
FLOOD PROFILES

BOULDER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

(AND INCORPORATED AREAS)



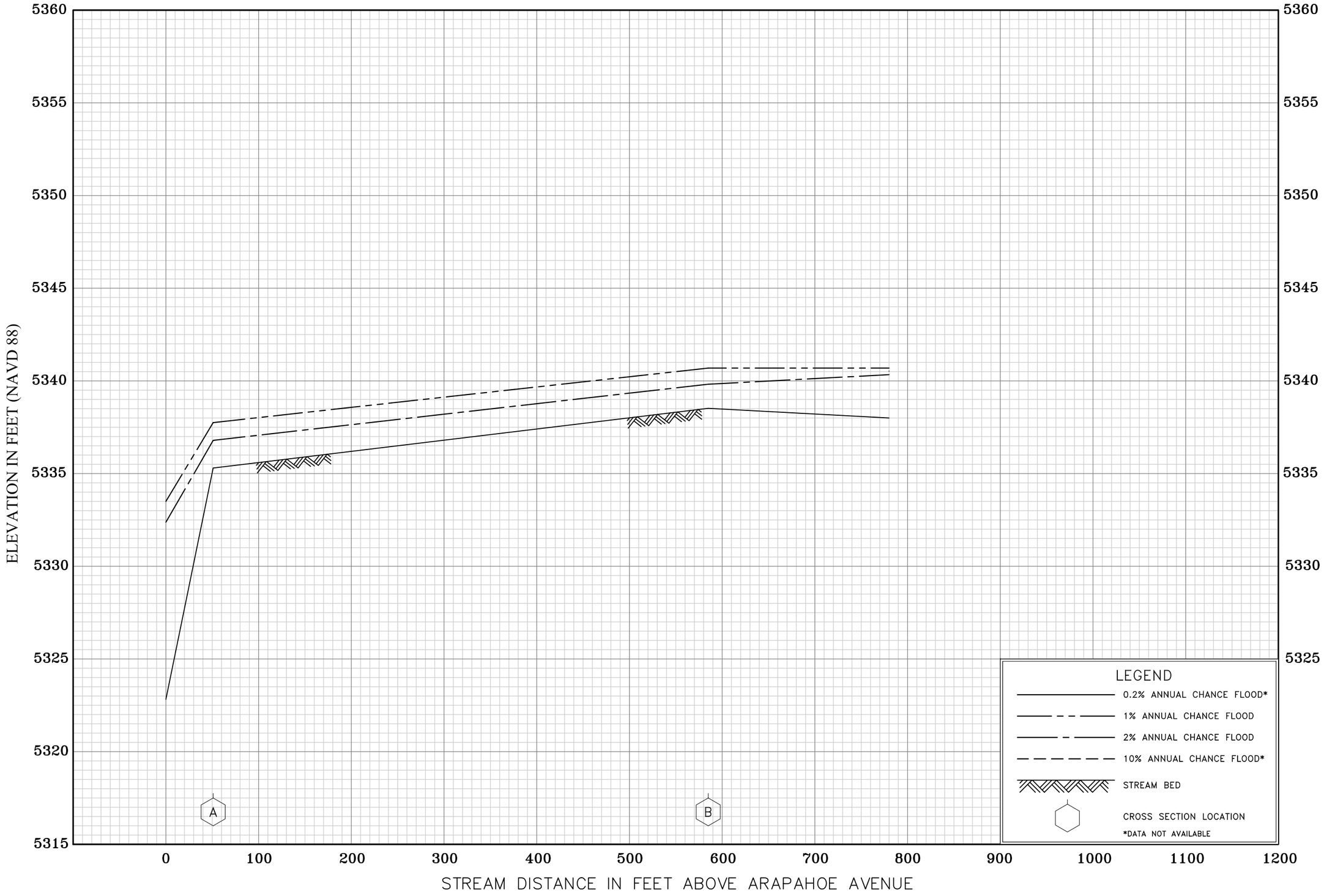
FLOOD PROFILES

BOULDER CREEK – 13TH STREET SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

(AND INCORPORATED AREAS)



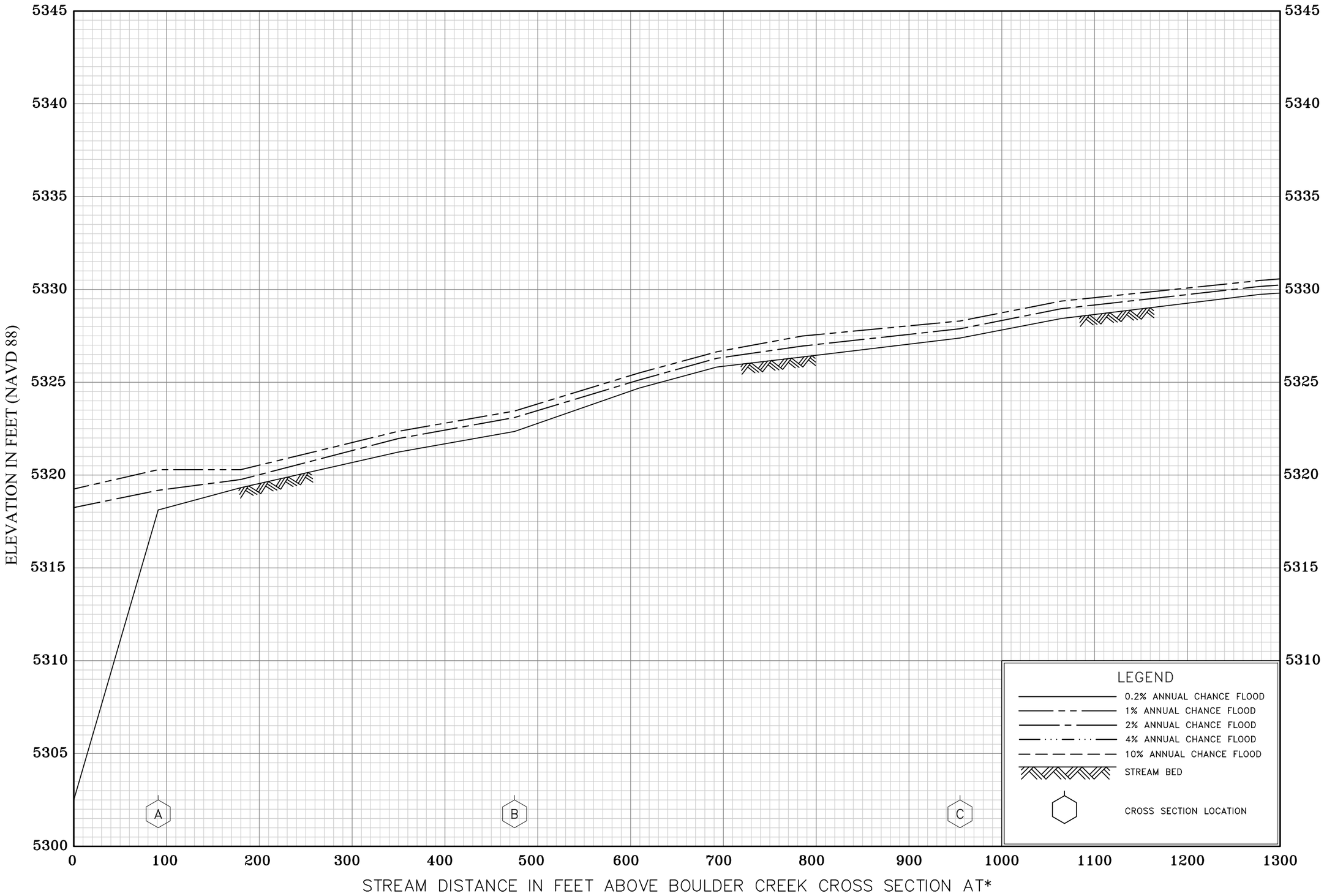
FLOOD PROFILES

BOULDER CREEK – 14TH STREET SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

(AND INCORPORATED AREAS)



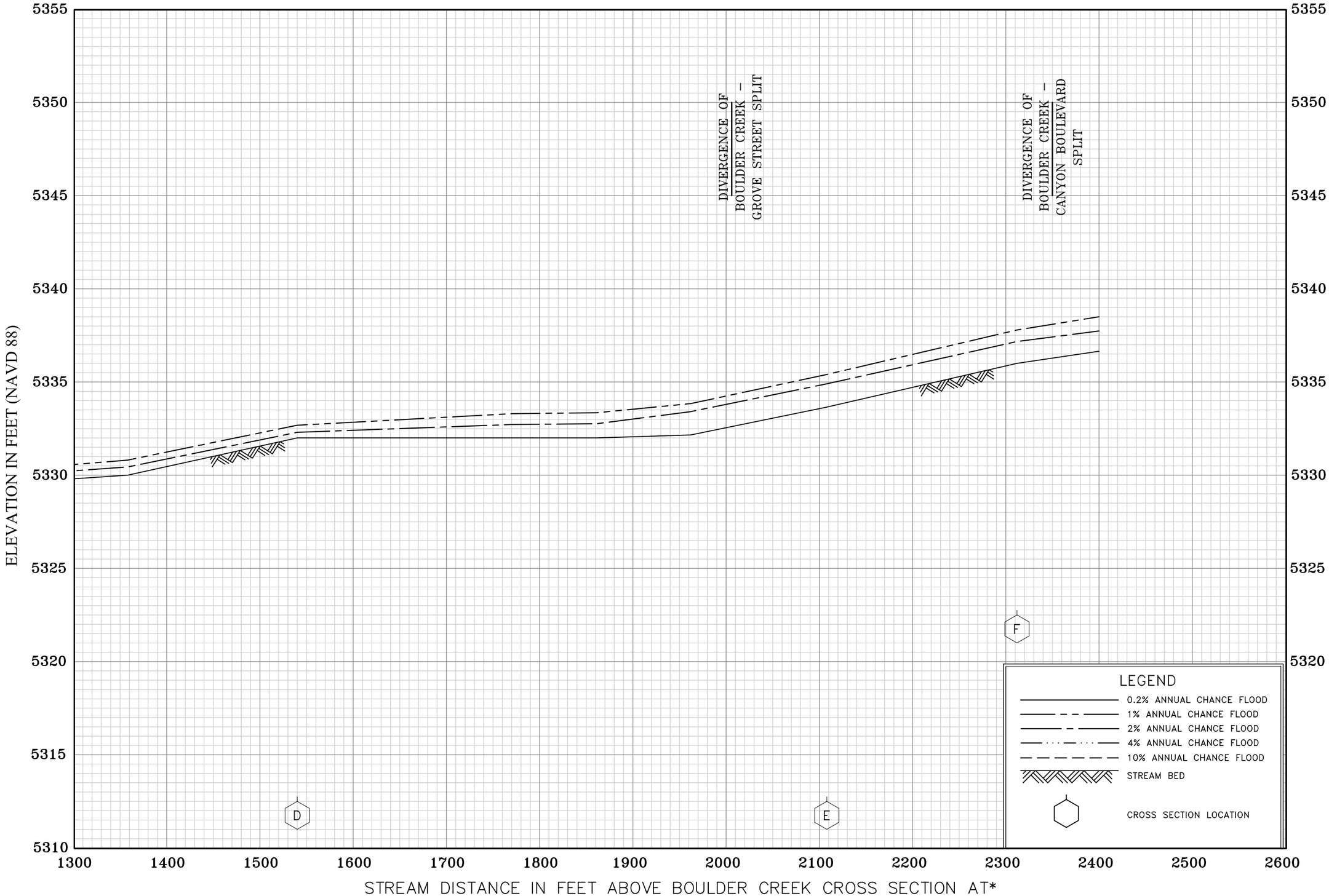
*= APPROXIMATELY 10 FEET UPSTREAM OF PEDESTRIAN BRIDGE #2 ALONG BOULDER CREEK

FLOOD PROFILES

BOULDER CREEK – 15TH STREET/
ARAPAHOE AVENUE/MARINE STREET SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
(AND INCORPORATED AREAS)



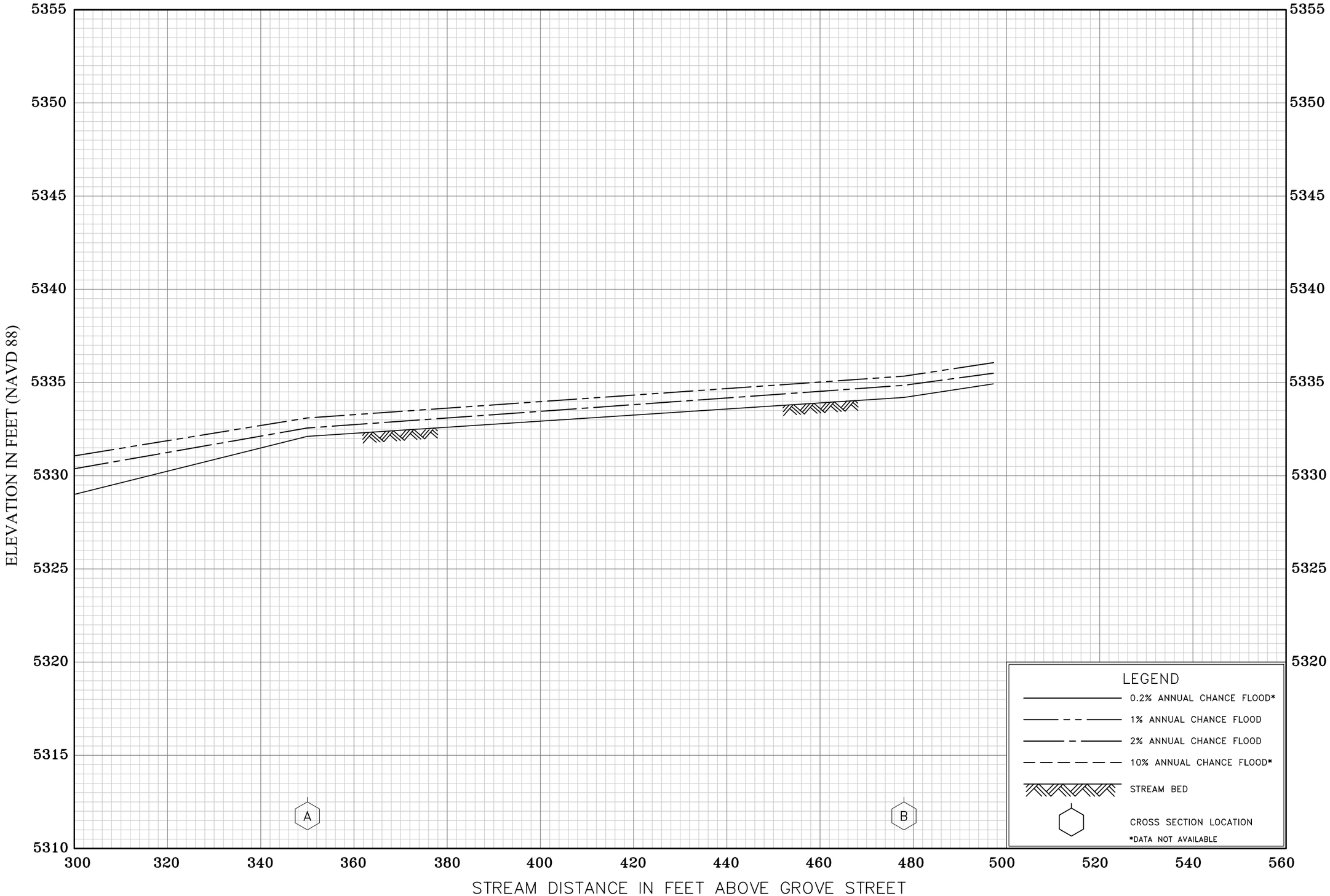
*= APPROXIMATELY 10 FEET UPSTREAM OF PEDESTRIAN BRIDGE #2 ALONG BOULDER CREEK

FLOOD PROFILES

BOULDER CREEK – 15TH STREET/ ARAPAHOE AVENUE/MARINE STREET SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
(AND INCORPORATED AREAS)



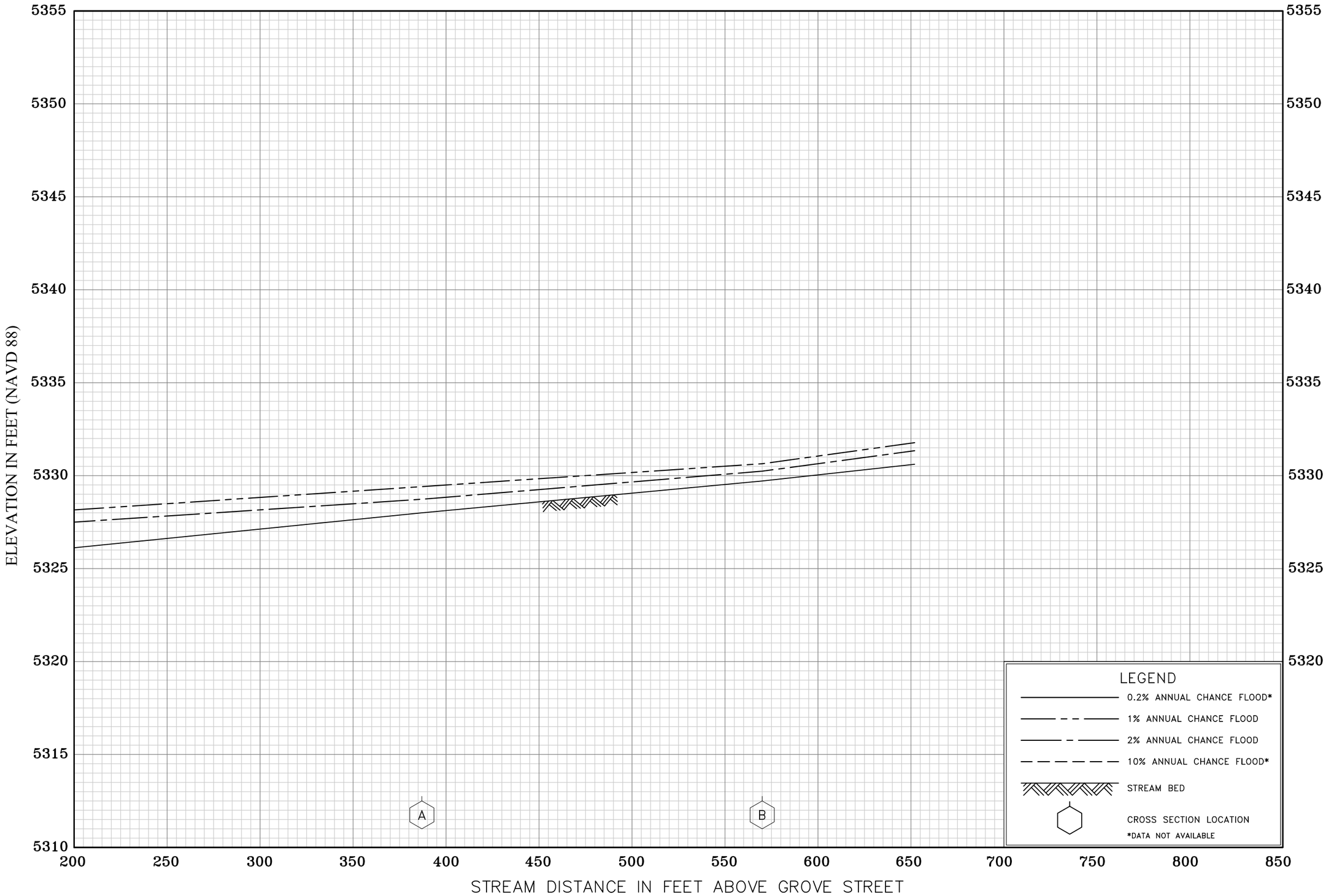
FLOOD PROFILES

BOULDER CREEK – 16TH STREET SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

(AND INCORPORATED AREAS)



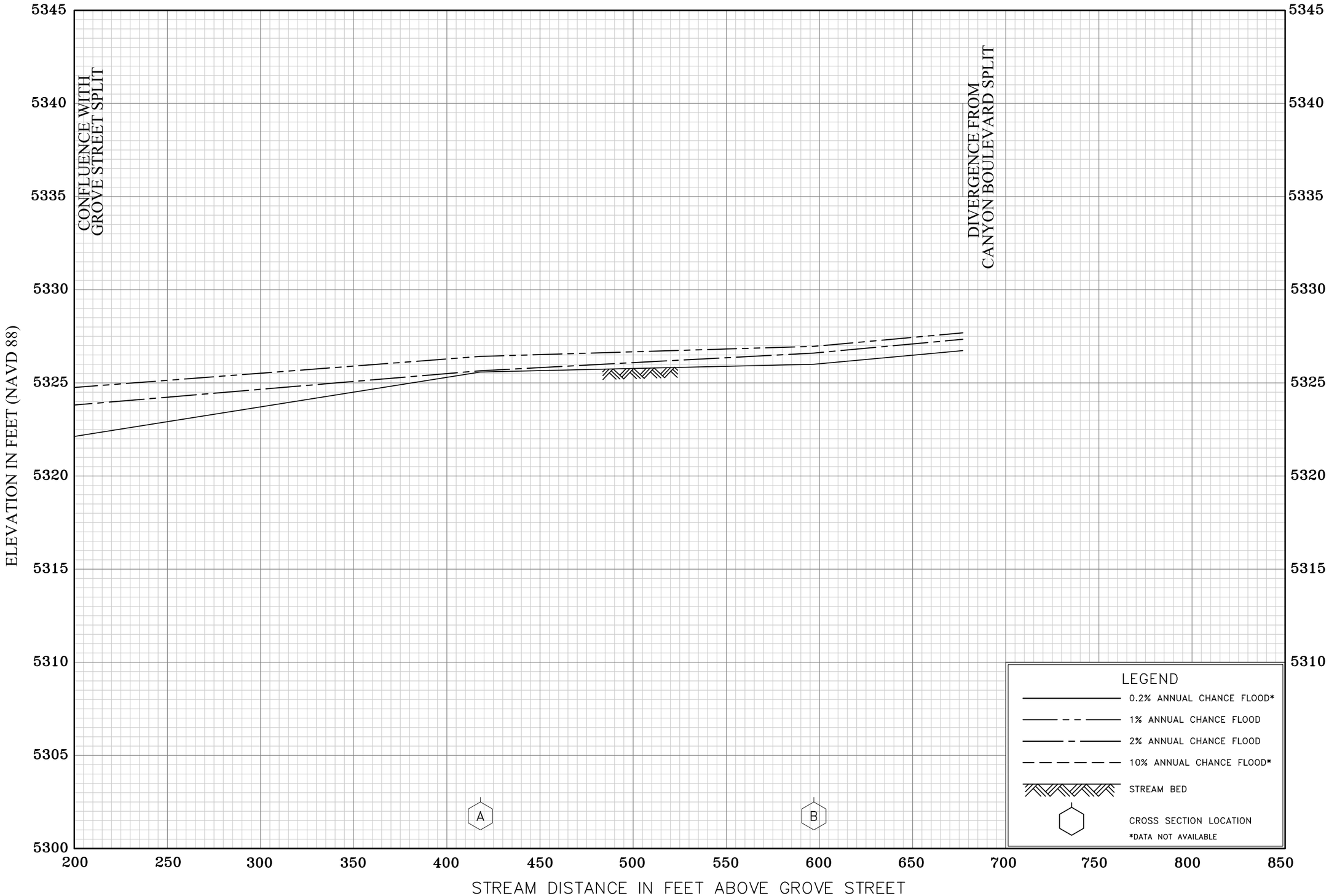
FLOOD PROFILES

BOULDER CREEK – 17TH STREET SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

(AND INCORPORATED AREAS)



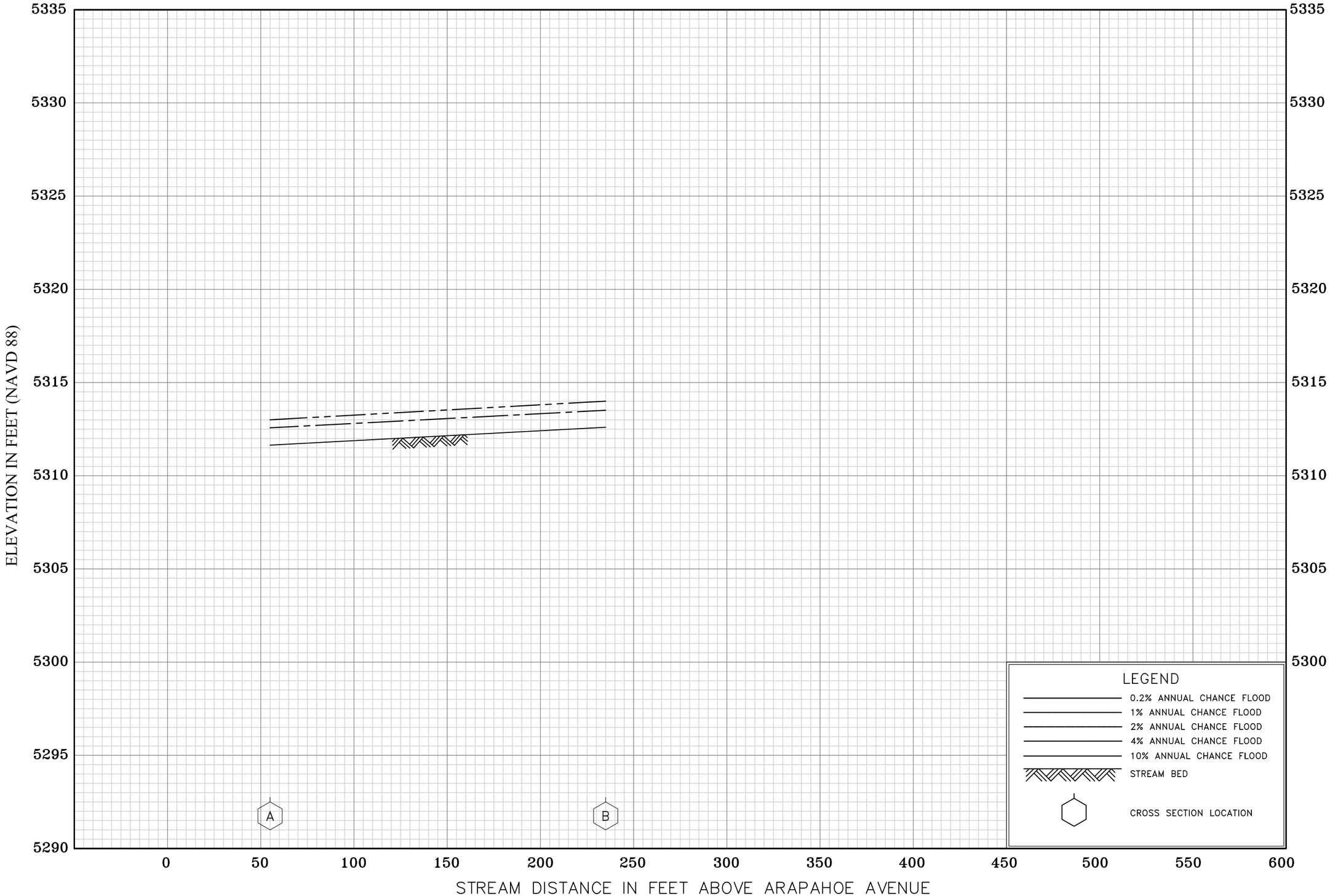
FLOOD PROFILES

BOULDER CREEK – 18TH STREET SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

AND INCORPORATED AREAS



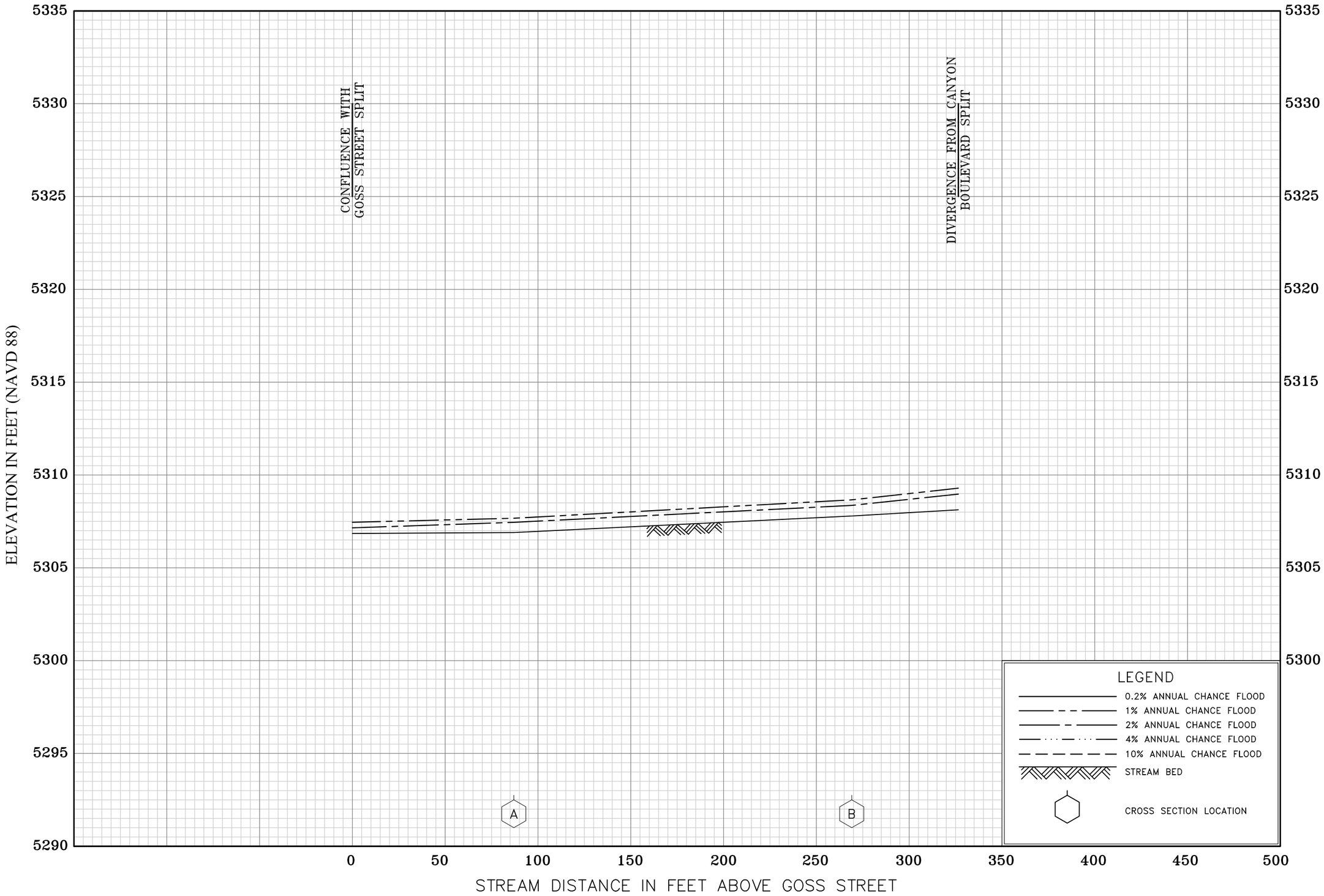
FLOOD PROFILES

BOULDER CREEK – 21ST STREET SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

(AND INCORPORATED AREAS)



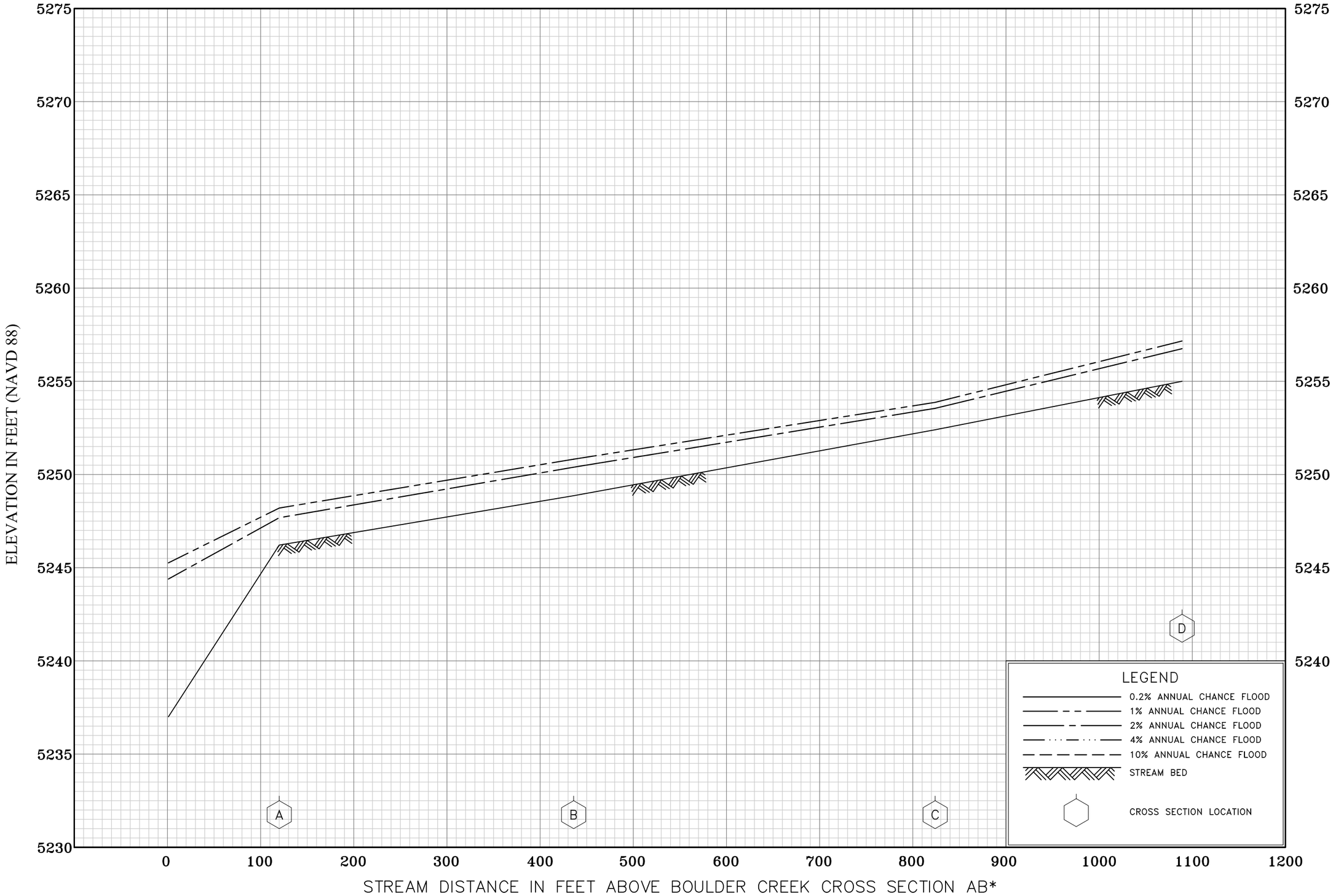
FLOOD PROFILES

BOULDER CREEK – 22ND STREET SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

(AND INCORPORATED AREAS)



*= APPROXIMATELY 360 FEET UPSTREAM OF FOOTHILLS PARKWAY ALONG BOULDER CREEK

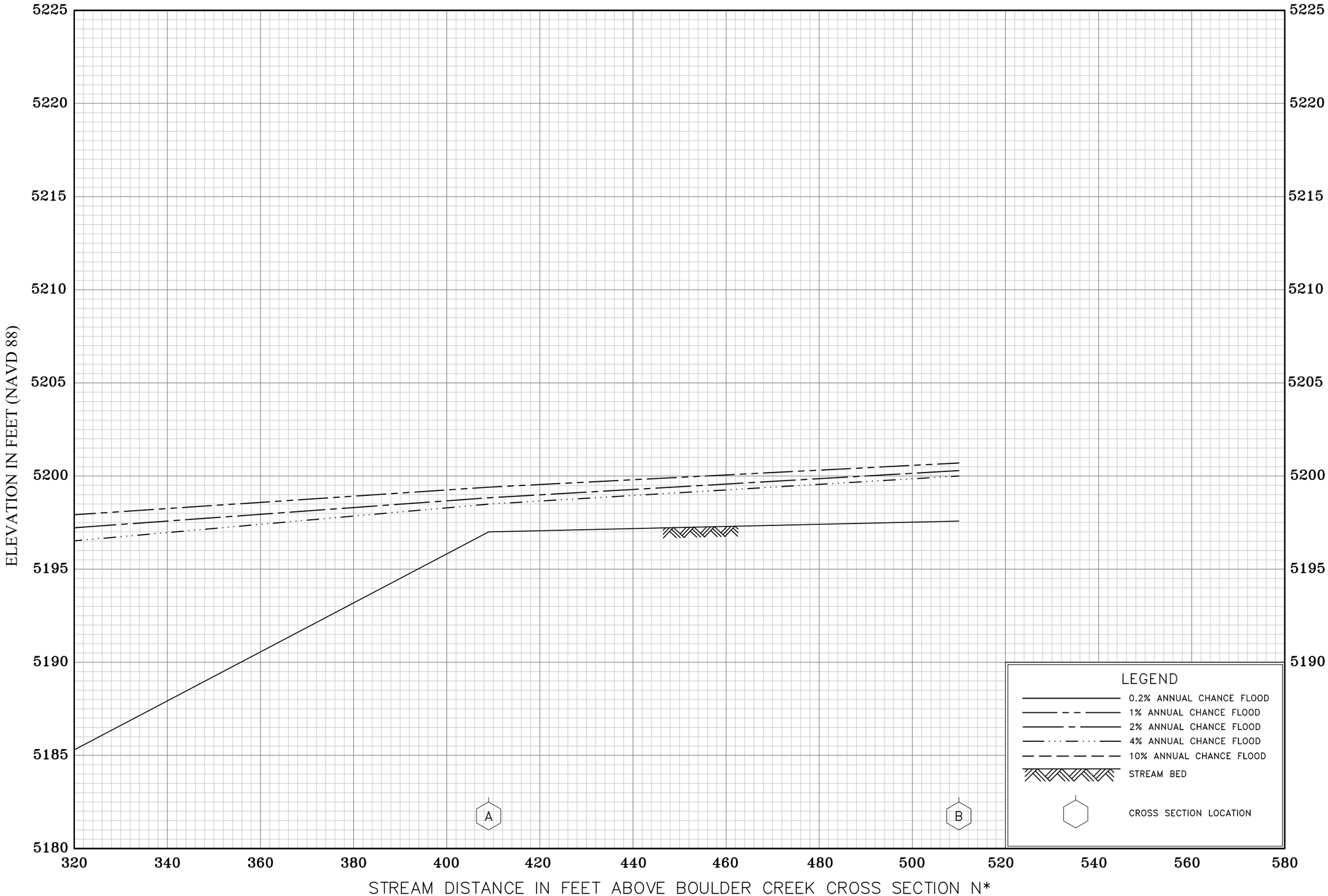
FLOOD PROFILES

BOULDER CREEK – 38TH STREET SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

(AND INCORPORATED AREAS)



*= APPROXIMATELY 40 FEET UPSTREAM OF VALMONT ROAD ALONG BOULDER CREEK

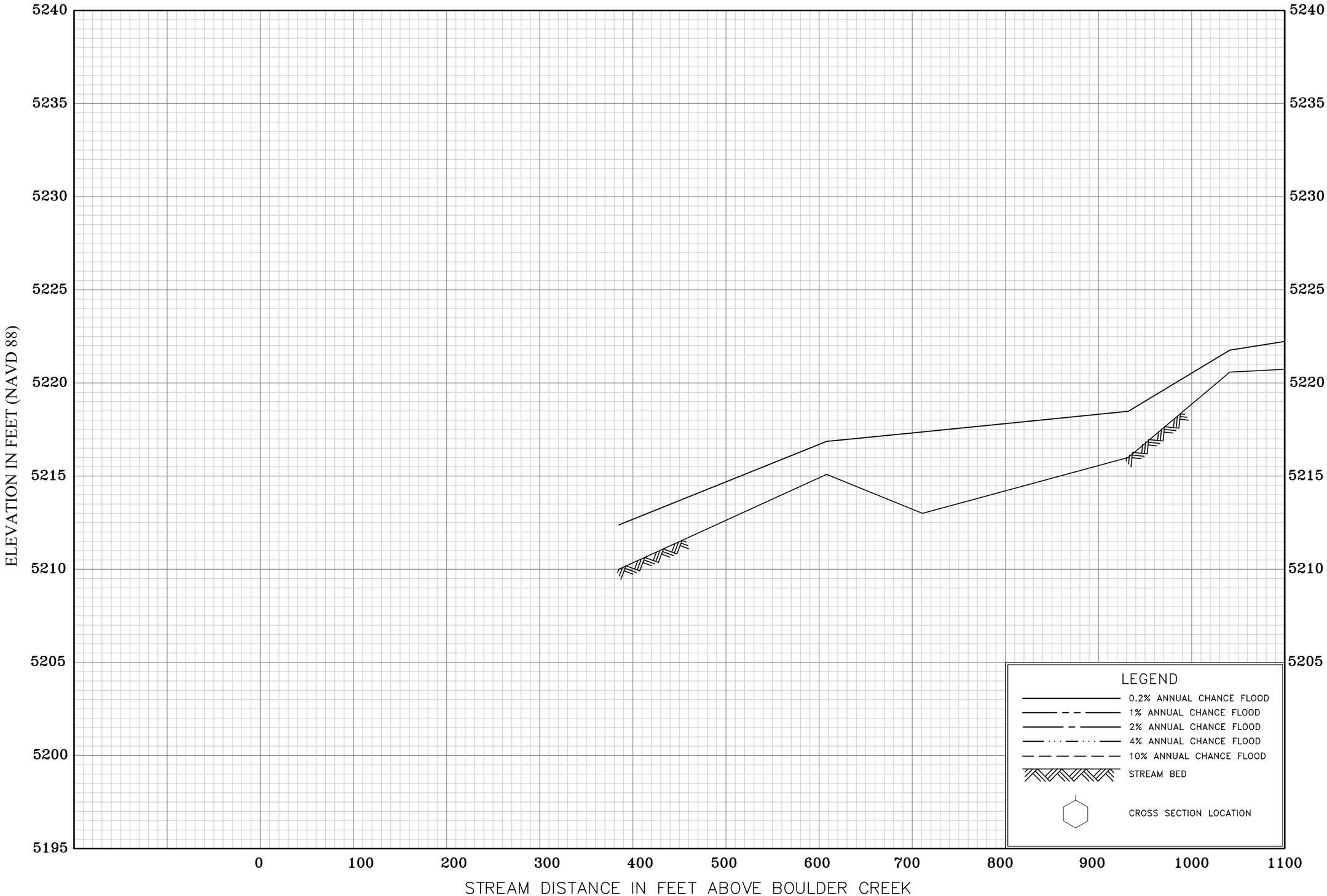
FLOOD PROFILES

BOULDER CREEK – 55TH STREET SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

AND INCORPORATED AREAS



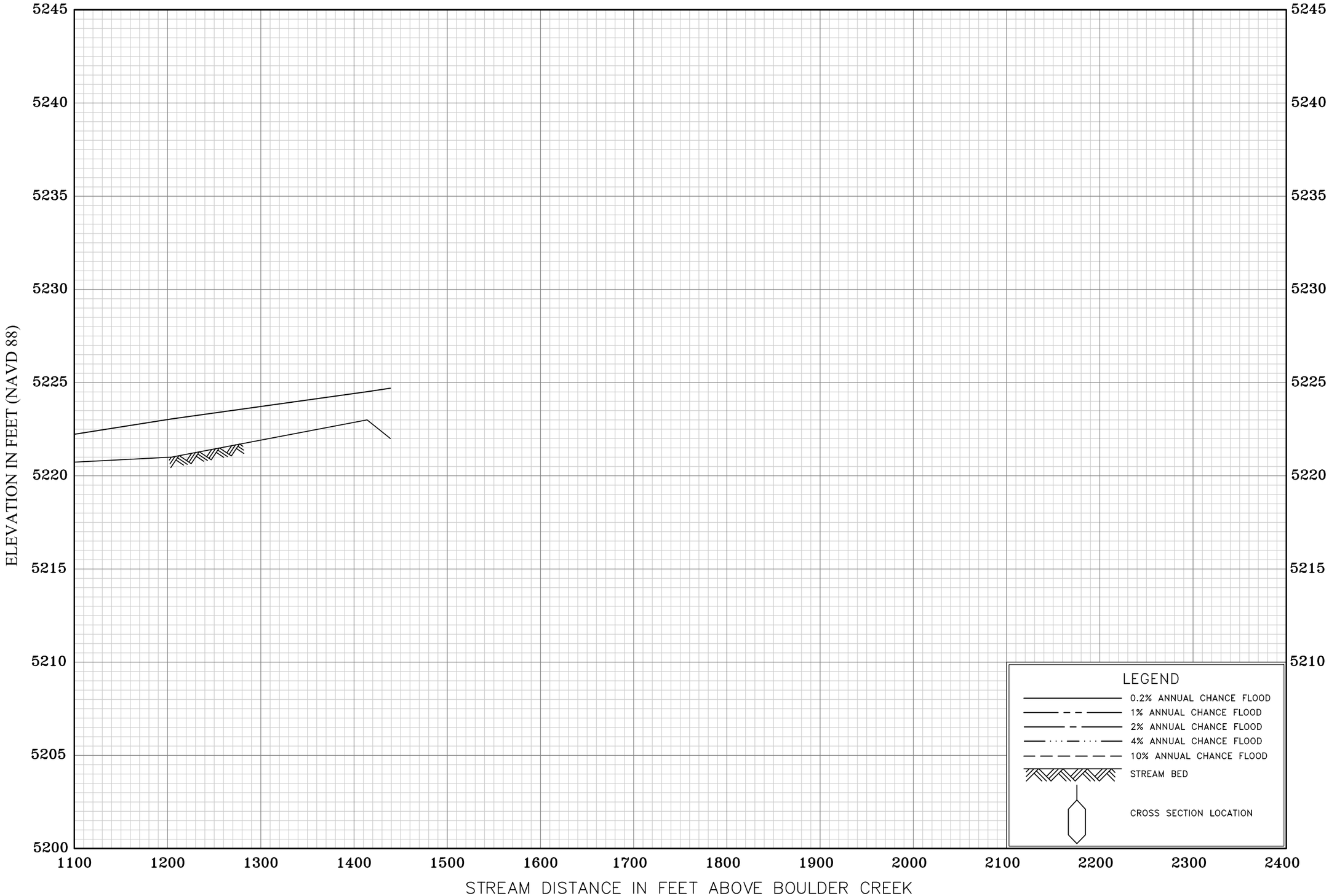
FLOOD PROFILES

BOULDER CREEK – 55TH STREET SPLIT–500 YR

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

(AND INCORPORATED AREAS)

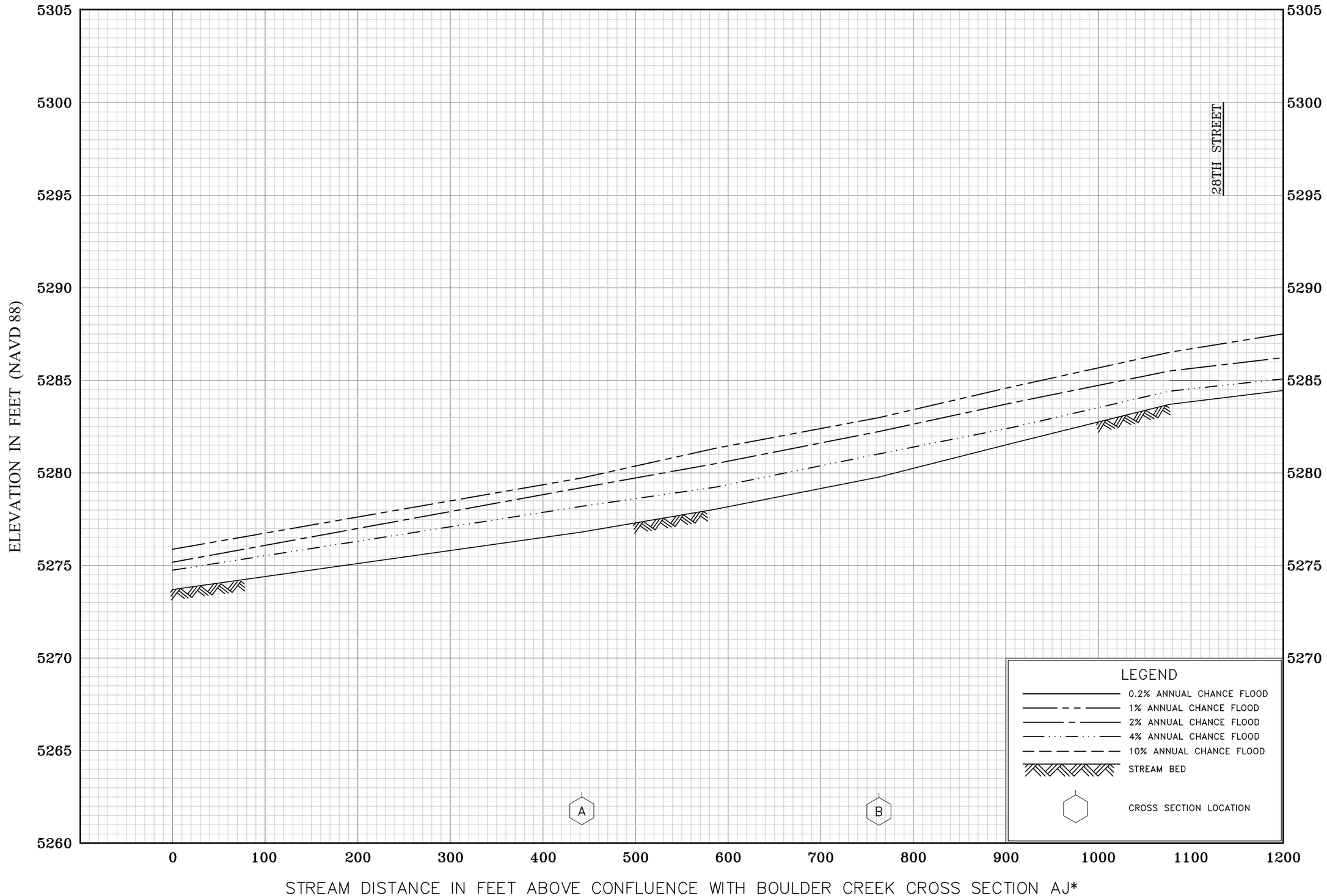


FLOOD PROFILES

BOULDER CREEK –
55TH STREET SPLIT-500 YR

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
(AND INCORPORATED AREAS)



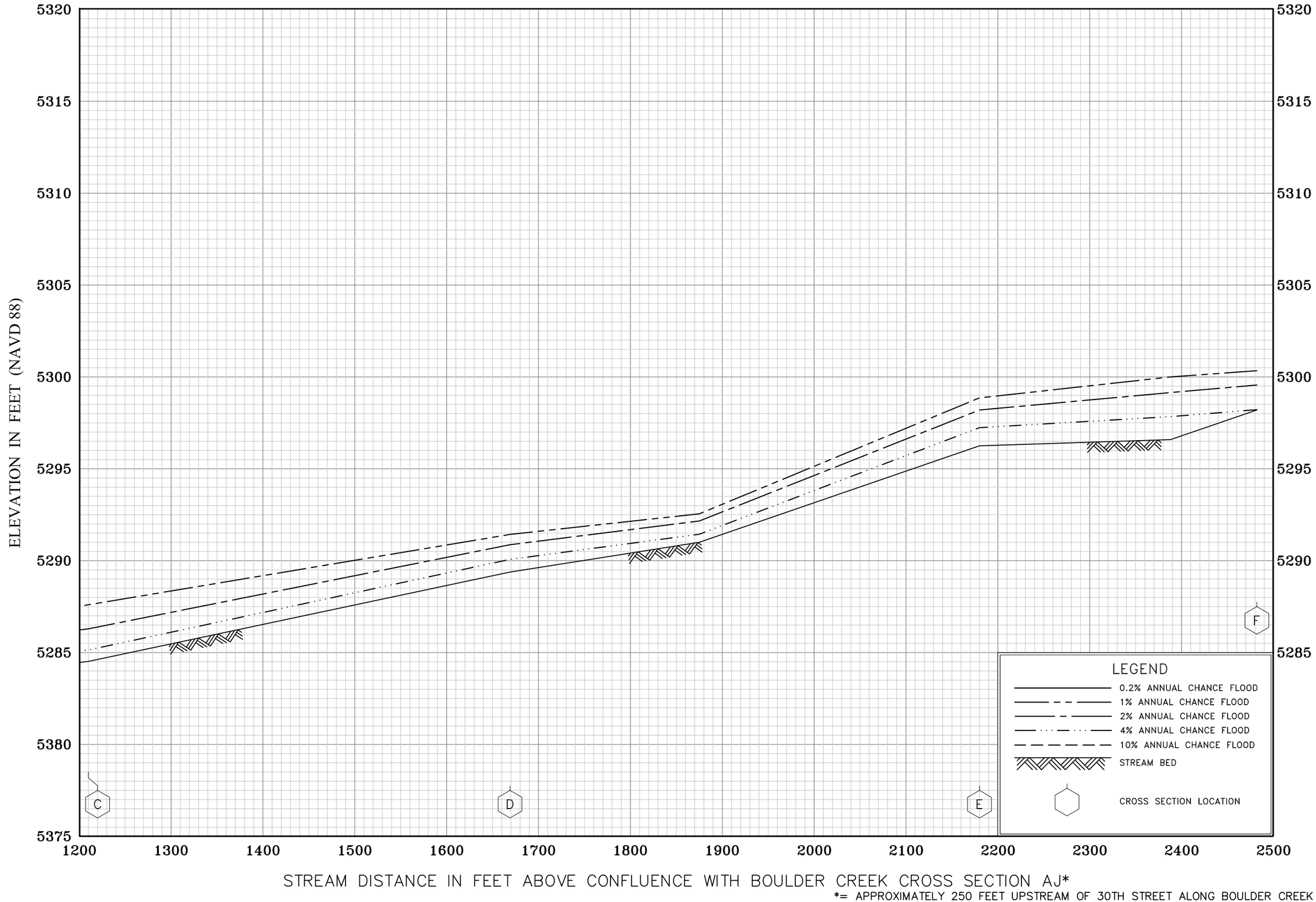
FLOOD PROFILES

BOULDER CREEK – ARAPAHOE AVENUE SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

AND INCORPORATED AREAS



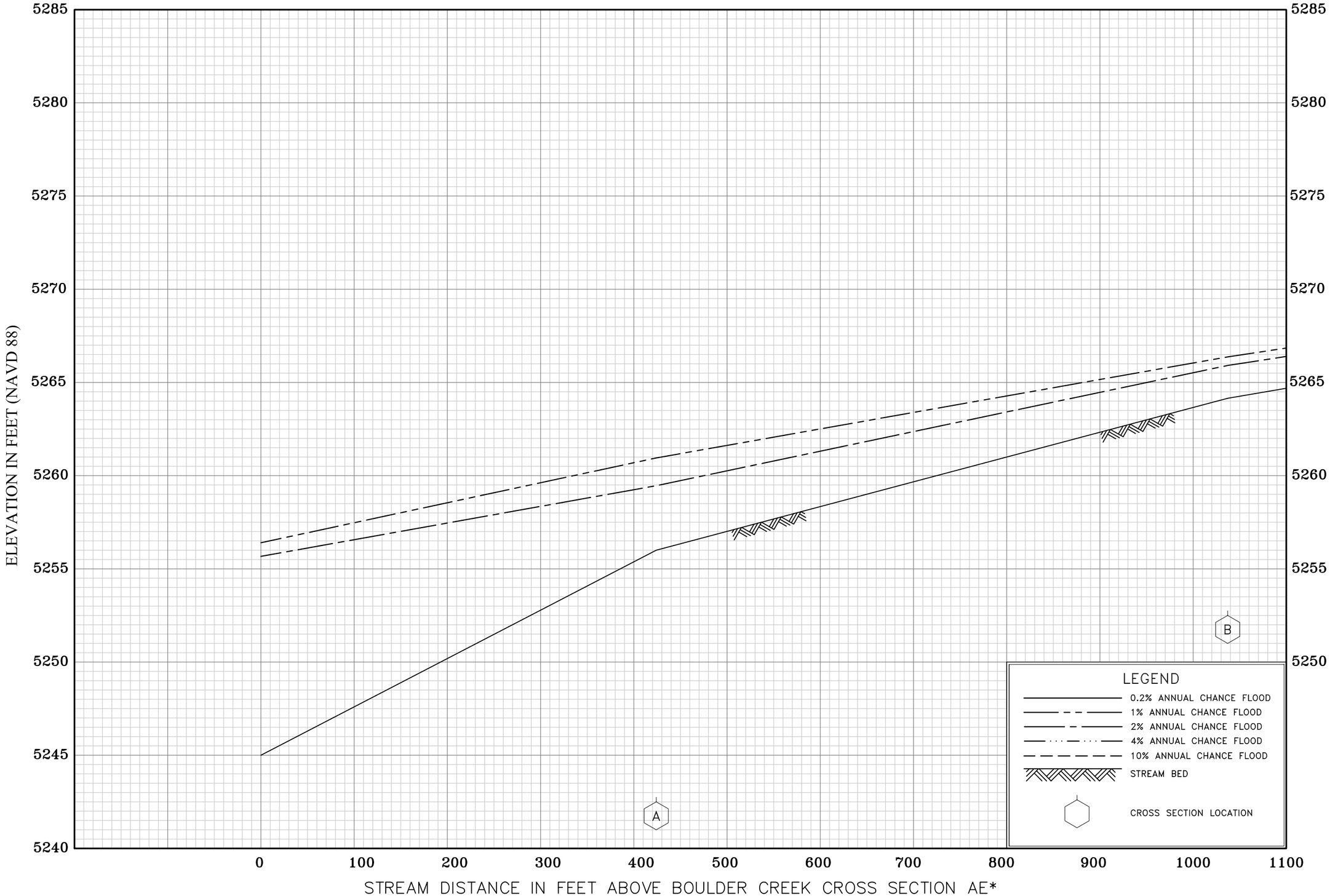
FLOOD PROFILES

BOULDER CREEK – ARAPAHOE AVENUE SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

AND INCORPORATED AREAS



*= APPROXIMATELY 490 FEET UPSTREAM OF ARAPAHOE AVENUE EASTBOUND ALONG BOULDER CREEK

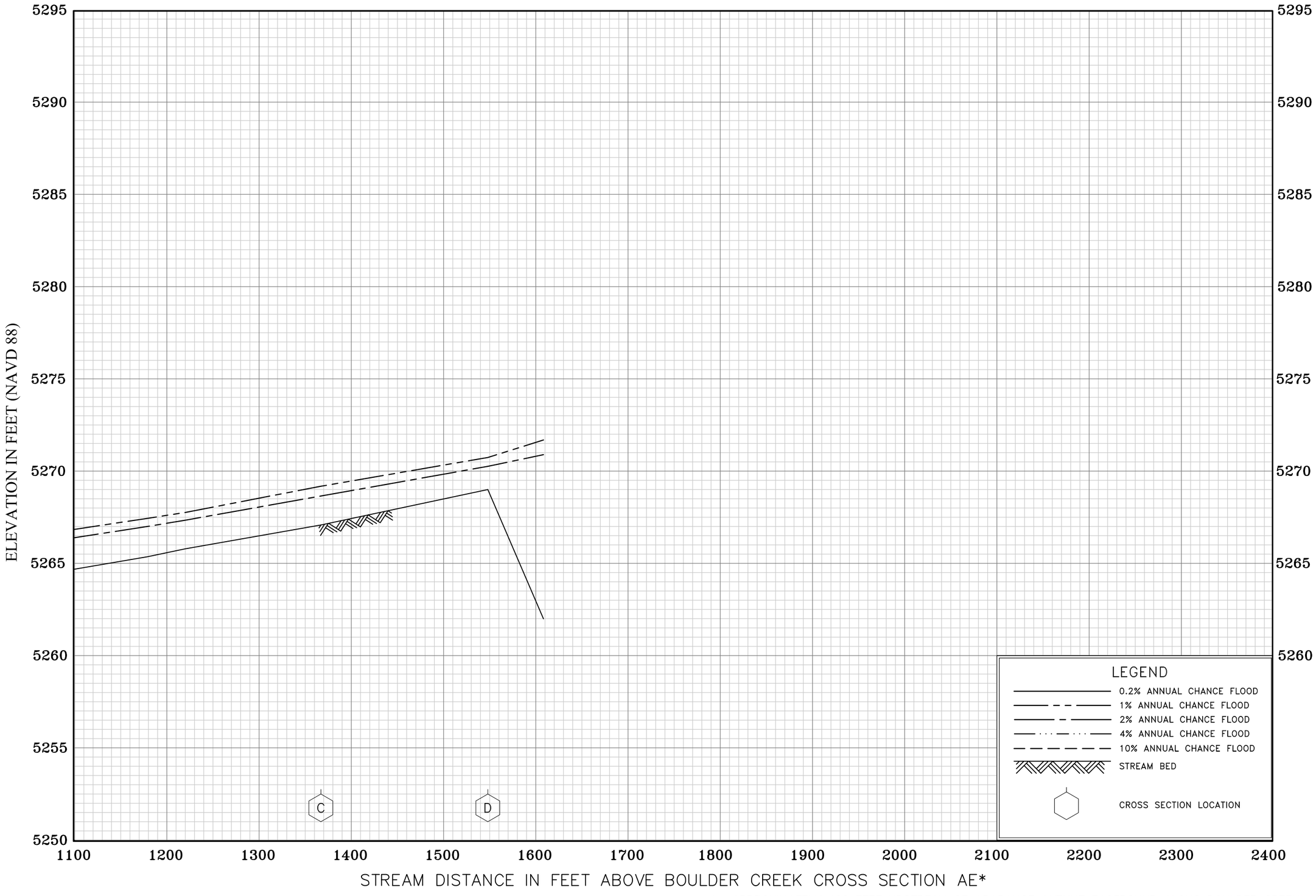
FLOOD PROFILES

BOULDER CREEK – ARAPAHOE AVENUE EAST SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

AND INCORPORATED AREAS



*= APPROXIMATELY 490 FEET UPSTREAM OF ARAPAHOE AVENUE EASTBOUND ALONG BOULDER CREEK

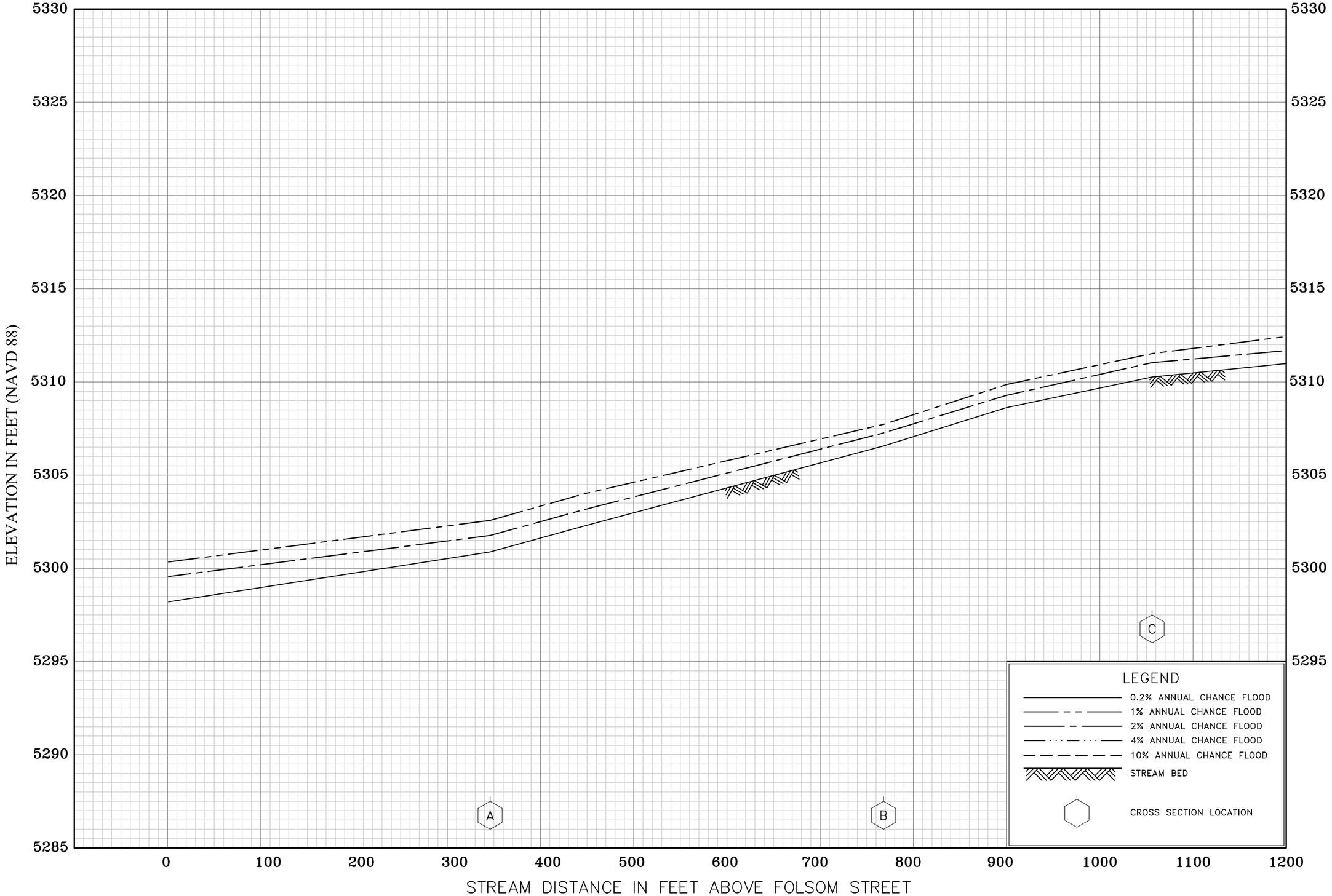
FLOOD PROFILES

BOULDER CREEK – ARAPAHOE AVENUE EAST SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

AND INCORPORATED AREAS

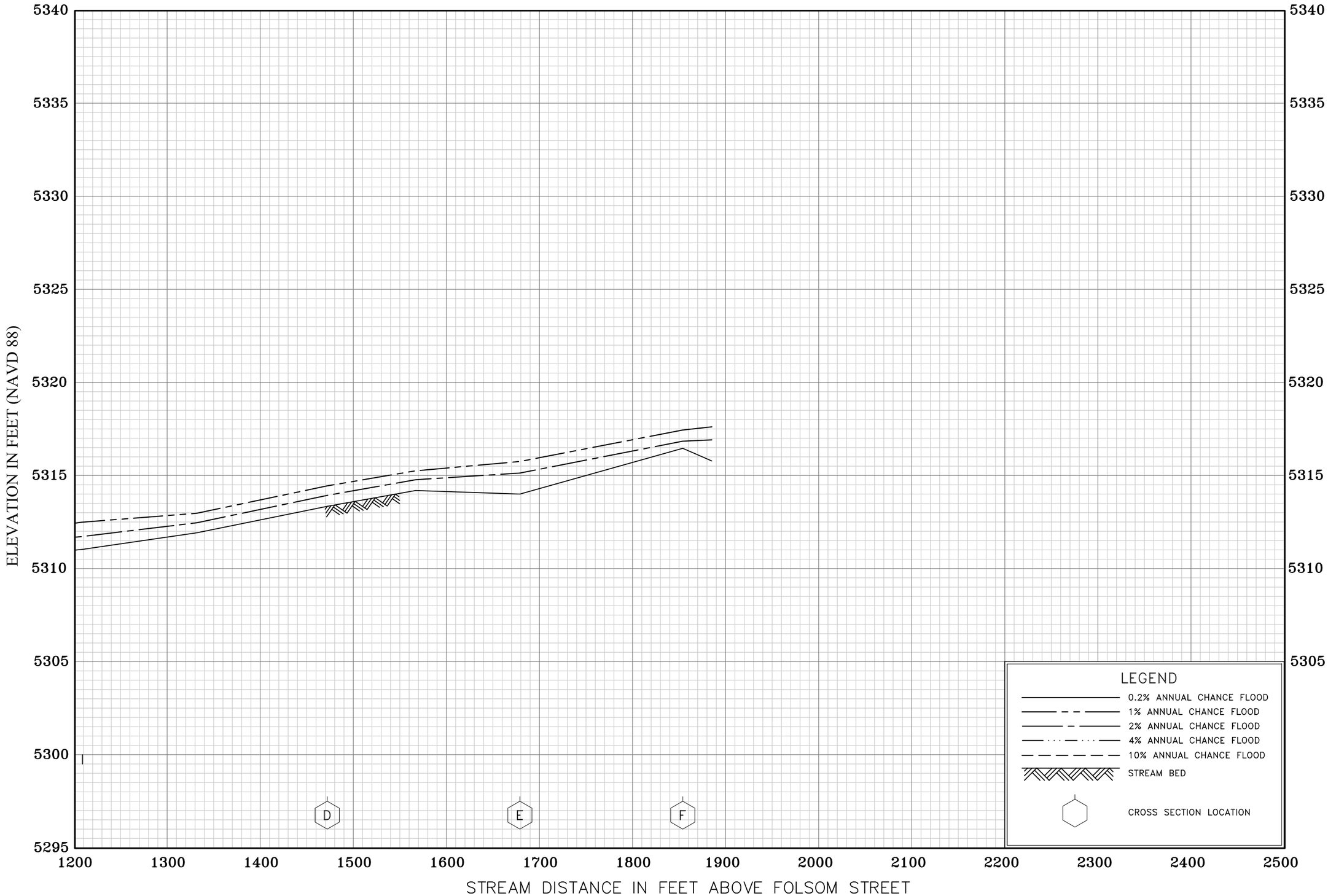


FLOOD PROFILES

BOULDER CREEK – ARAPAHOE AVENUE WEST/20TH STREET SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS

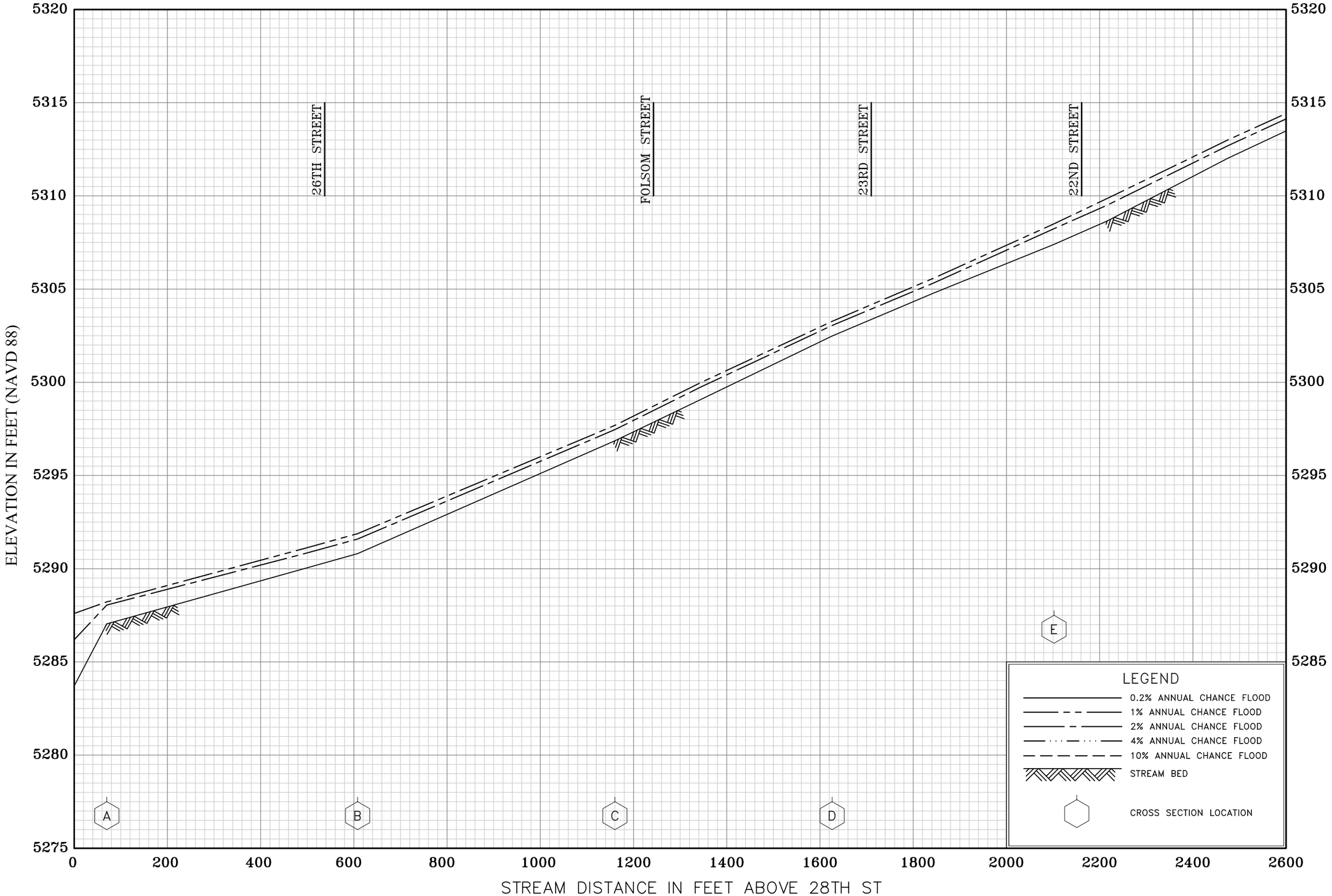


FLOOD PROFILES

BOULDER CREEK – ARAPAHOE AVENUE WEST/20TH STREET SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS



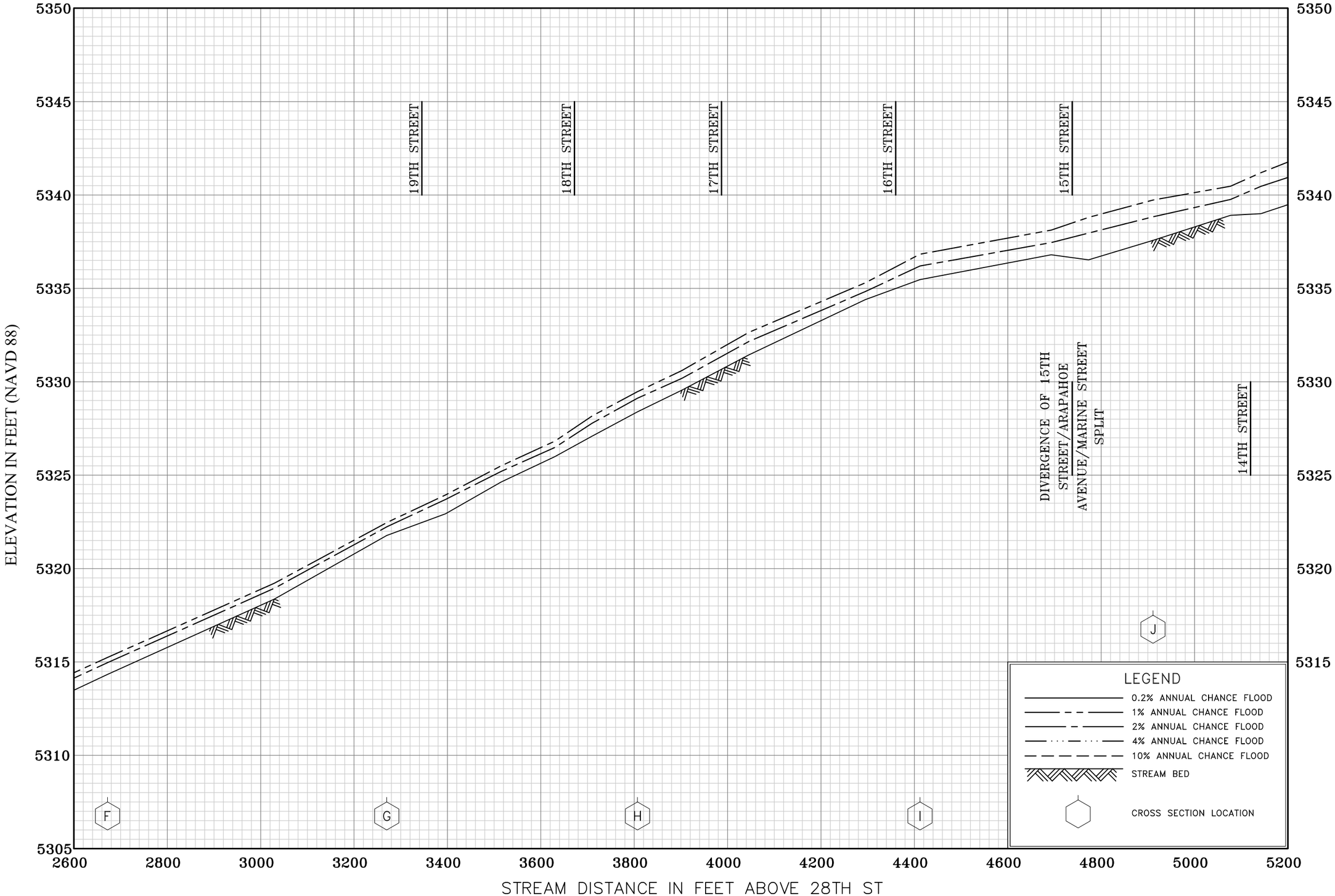
FLOOD PROFILES

BOULDER CREEK – CANYON BOULEVARD SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

AND INCORPORATED AREAS



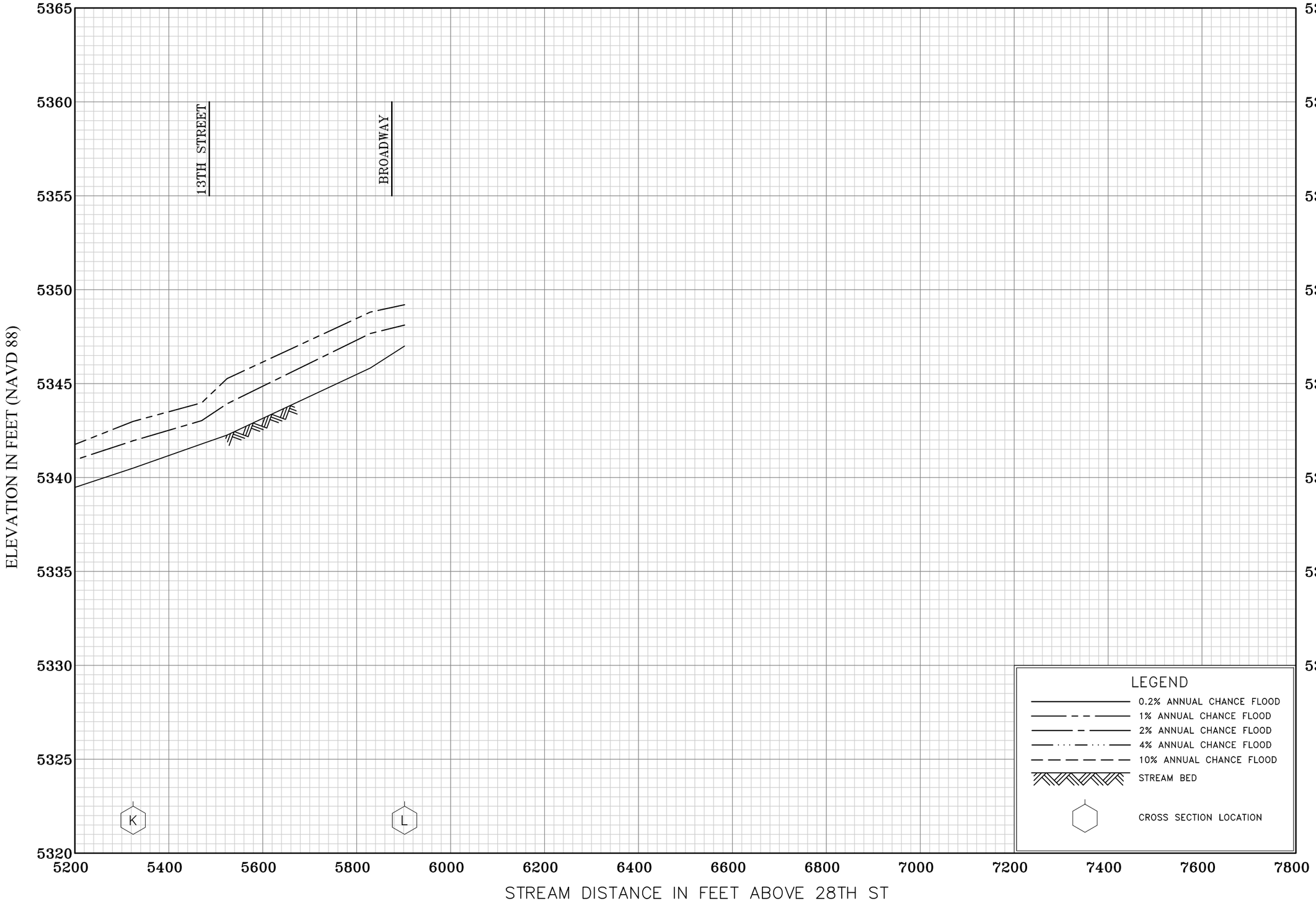
FLOOD PROFILES

BOULDER CREEK – CANYON BOULEVARD SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

AND INCORPORATED AREAS



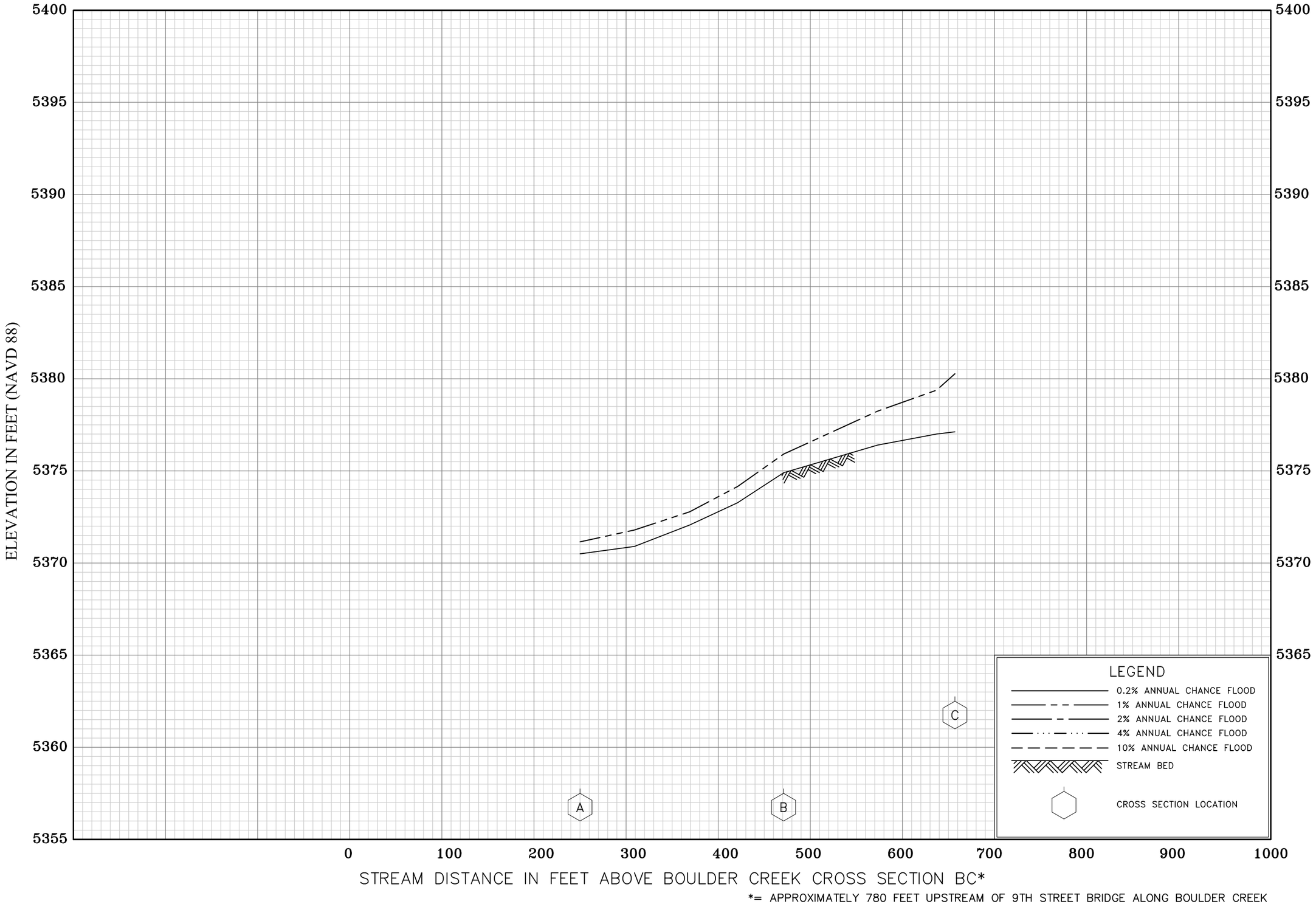
FLOOD PROFILES

BOULDER CREEK – CANYON BOULEVARD SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

AND INCORPORATED AREAS



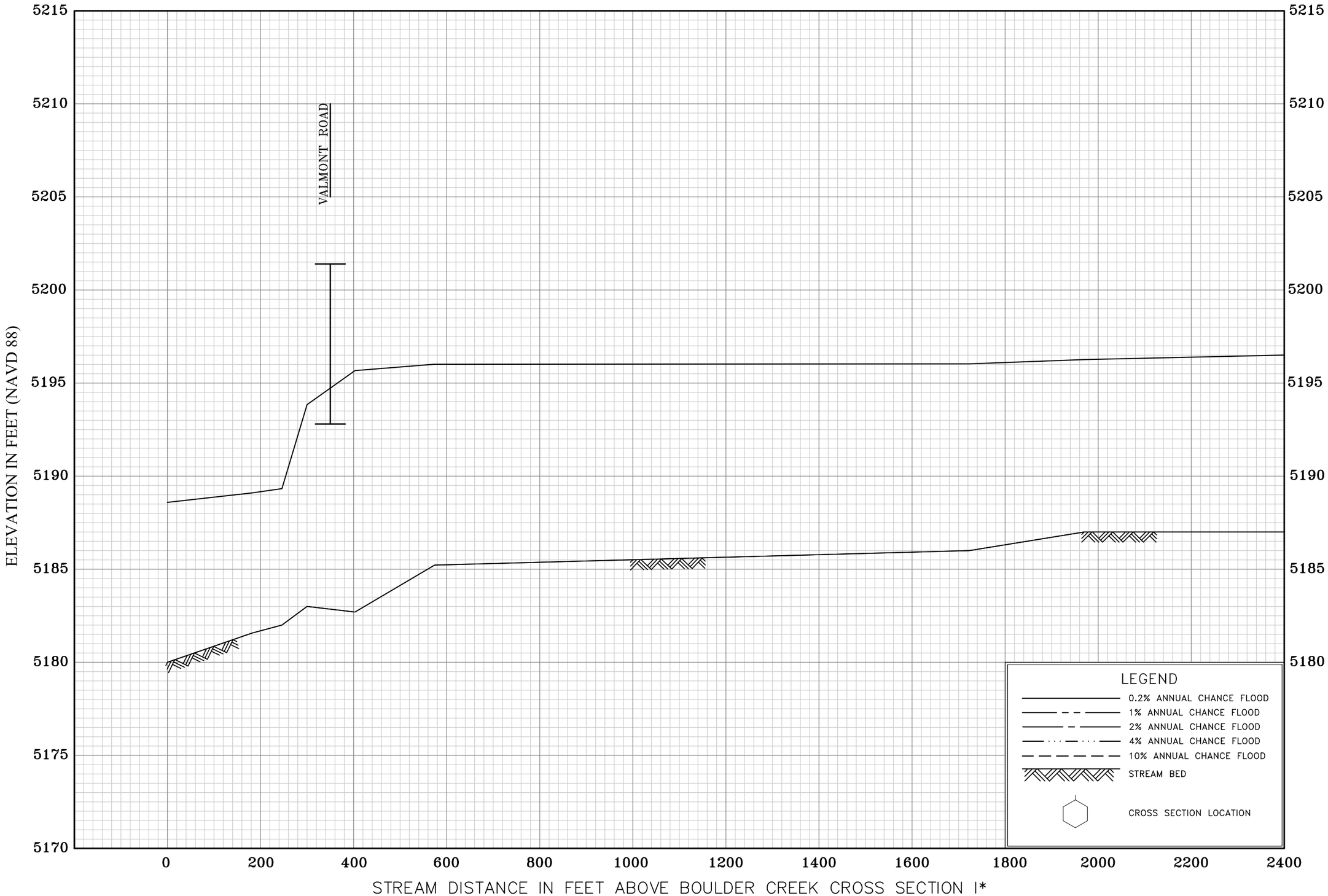
*= APPROXIMATELY 780 FEET UPSTREAM OF 9TH STREET BRIDGE ALONG BOULDER CREEK

FLOOD PROFILES

BOULDER CREEK – CANYON BOULEVARD AT 6TH STREET SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS



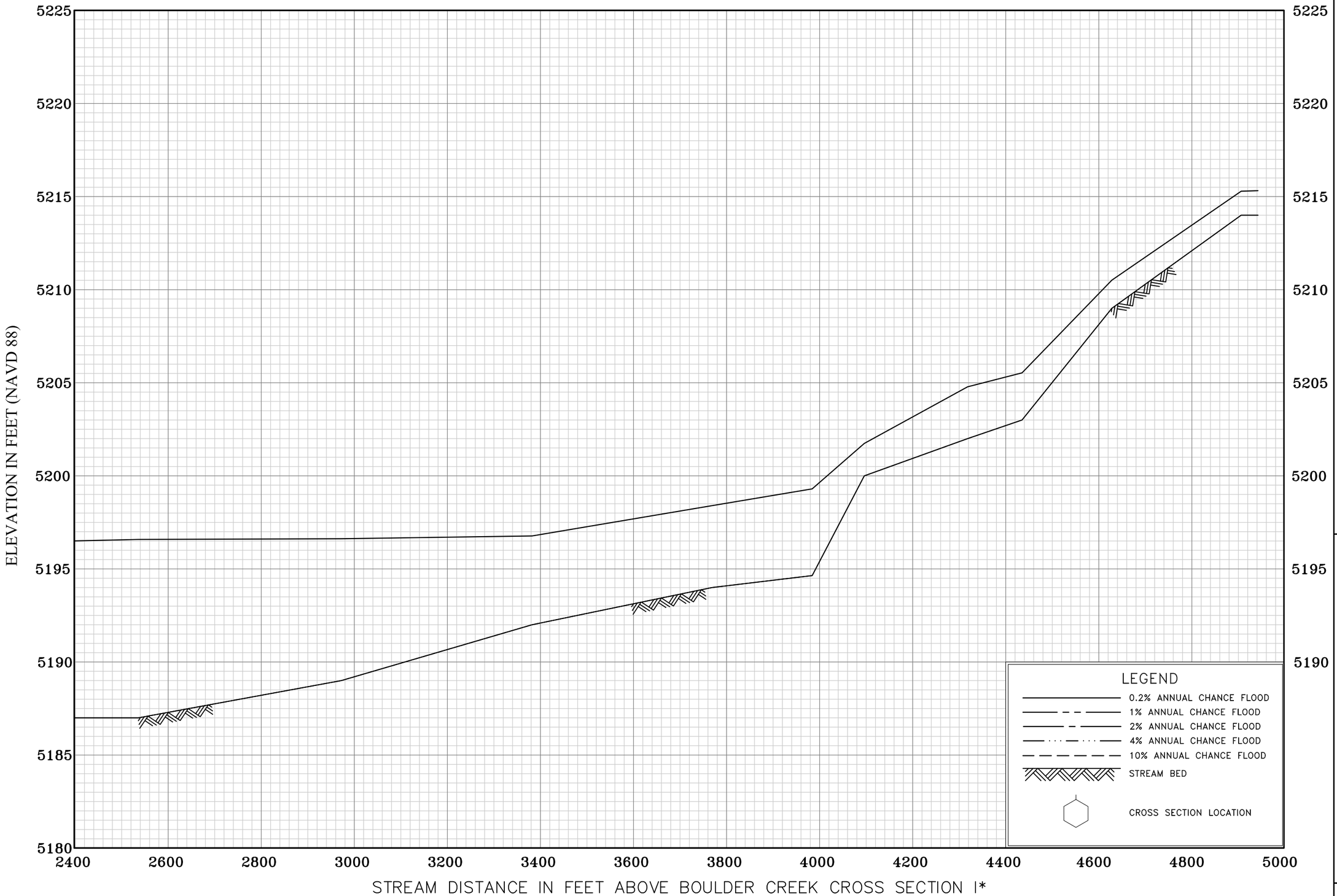
*= APPROXIMATELY 1,360 FEET DOWNSTREAM OF OLD VALMONT ROAD ALONG BOULDER CREEK

FLOOD PROFILES

BOULDER CREEK – DOWNSTREAM RAILROAD TO 55TH STREET SPLIT – 500-YEAR

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS



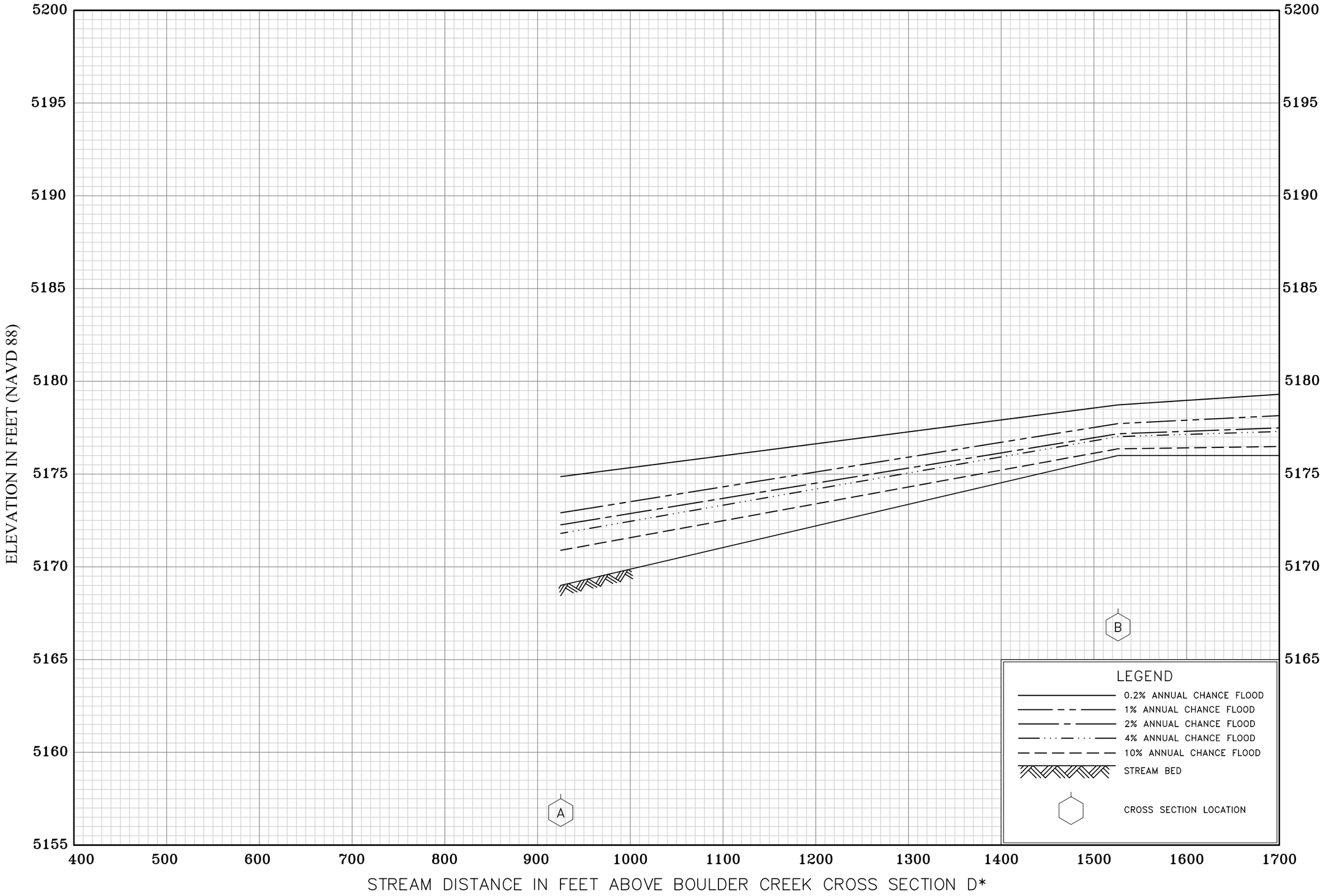
*= APPROXIMATELY 1,360 FEET DOWNSTREAM OF OLD VALMONT ROAD ALONG BOULDER CREEK

FLOOD PROFILES

BOULDER CREEK – DOWNSTREAM RAILROAD TO 55TH STREET SPLIT – 500-YEAR

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS



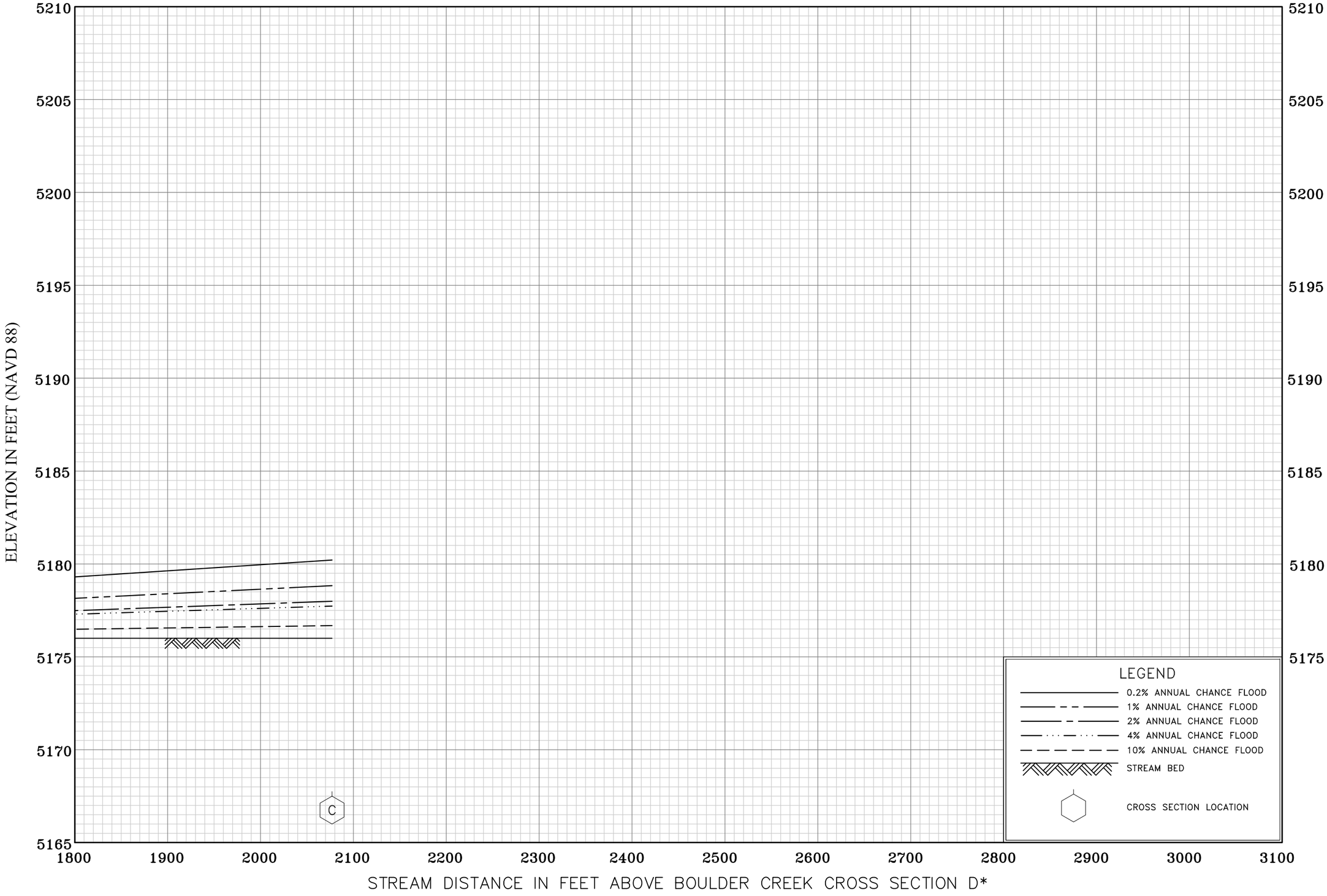
*= APPROXIMATELY 2,450 FEET UPSTREAM OF 61ST STREET ALONG BOULDER CREEK

FLOOD PROFILES

BOULDER CREEK – DOWNSTREAM
VALMONT SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS



*= APPROXIMATELY 2,450 FEET UPSTREAM OF 61ST STREET ALONG BOULDER CREEK

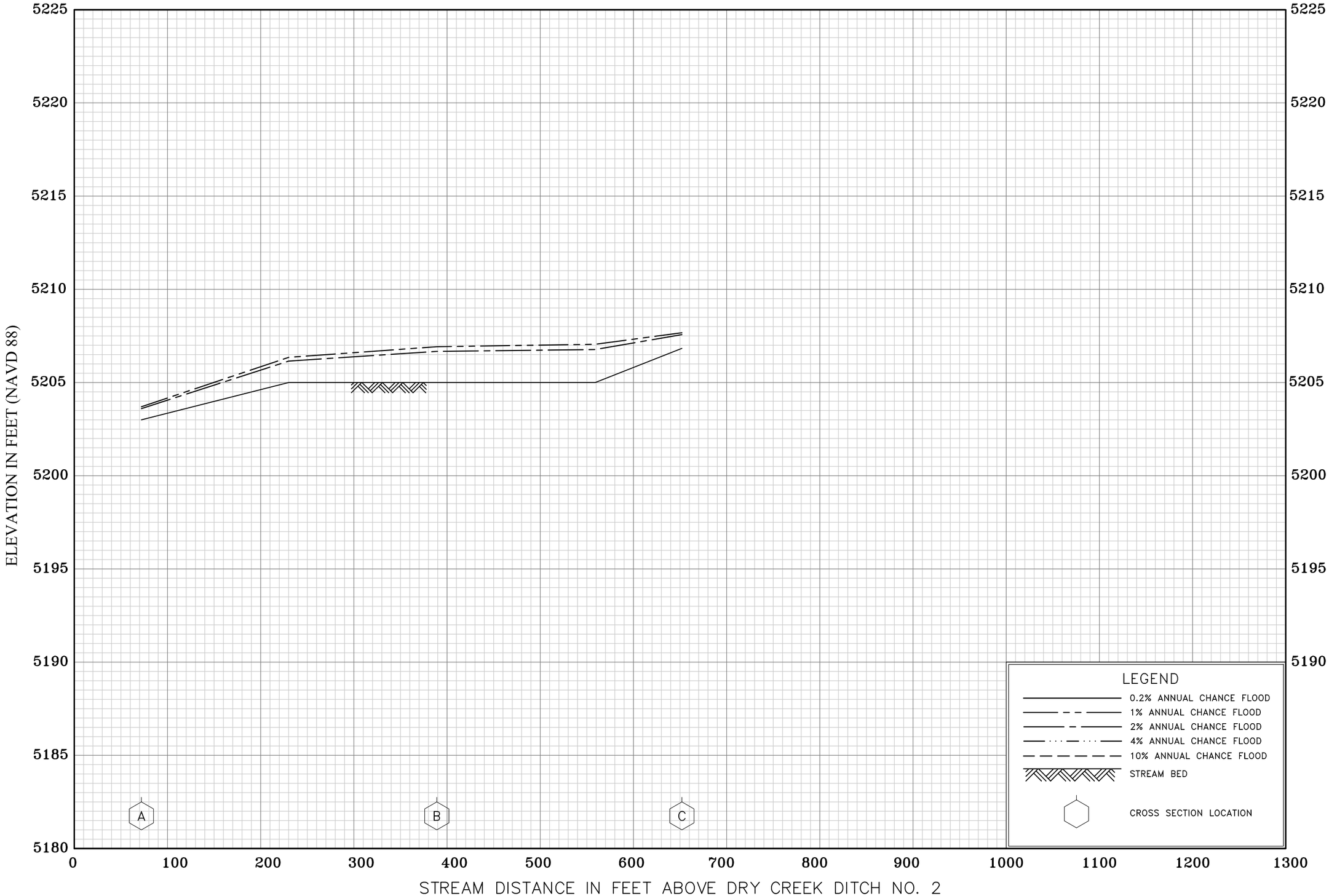
FLOOD PROFILES

DOWNSTREAM VALMONT SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

AND INCORPORATED AREAS



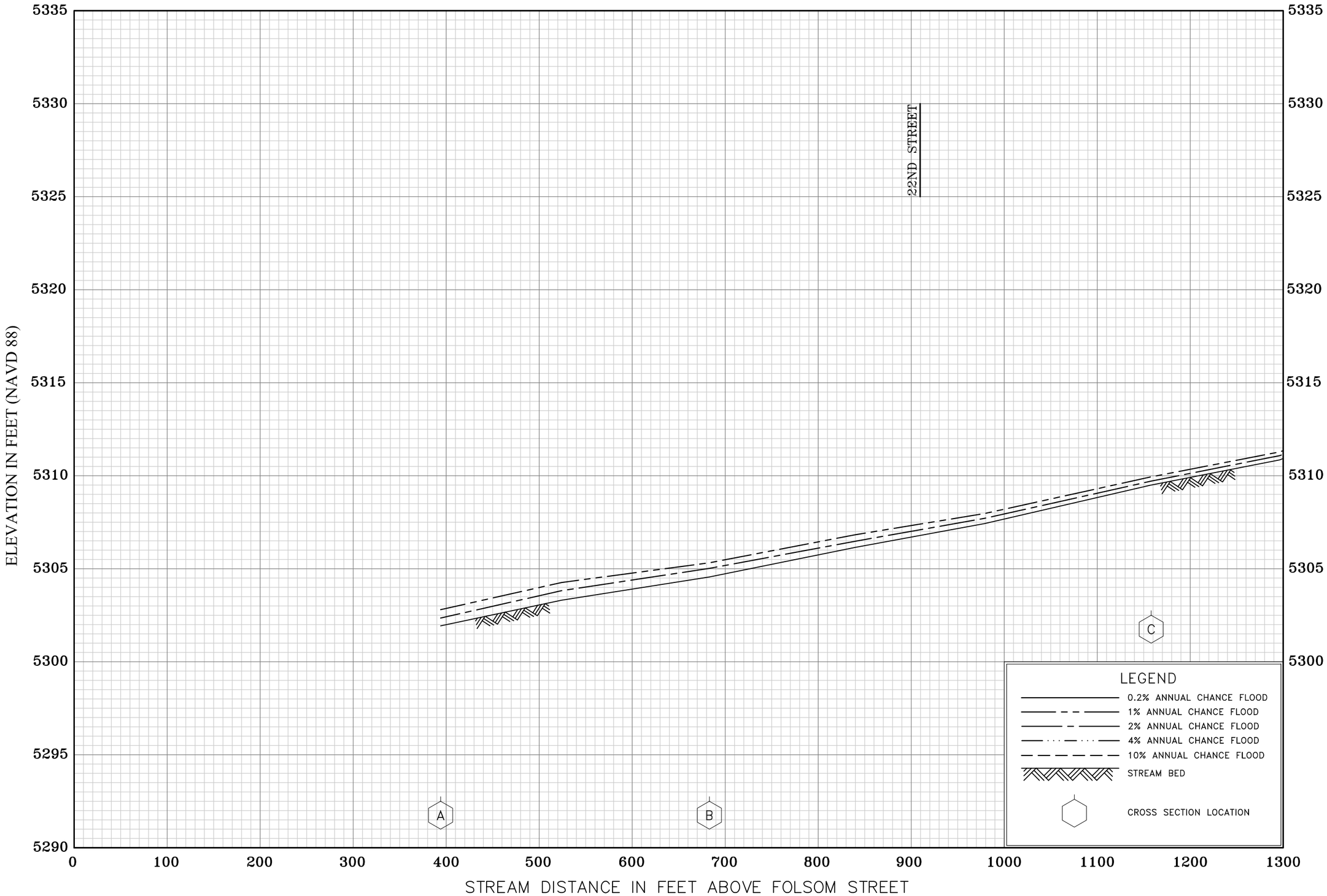
FLOOD PROFILES

BOULDER CREEK – FLATIRON PARKWAY SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

AND INCORPORATED AREAS



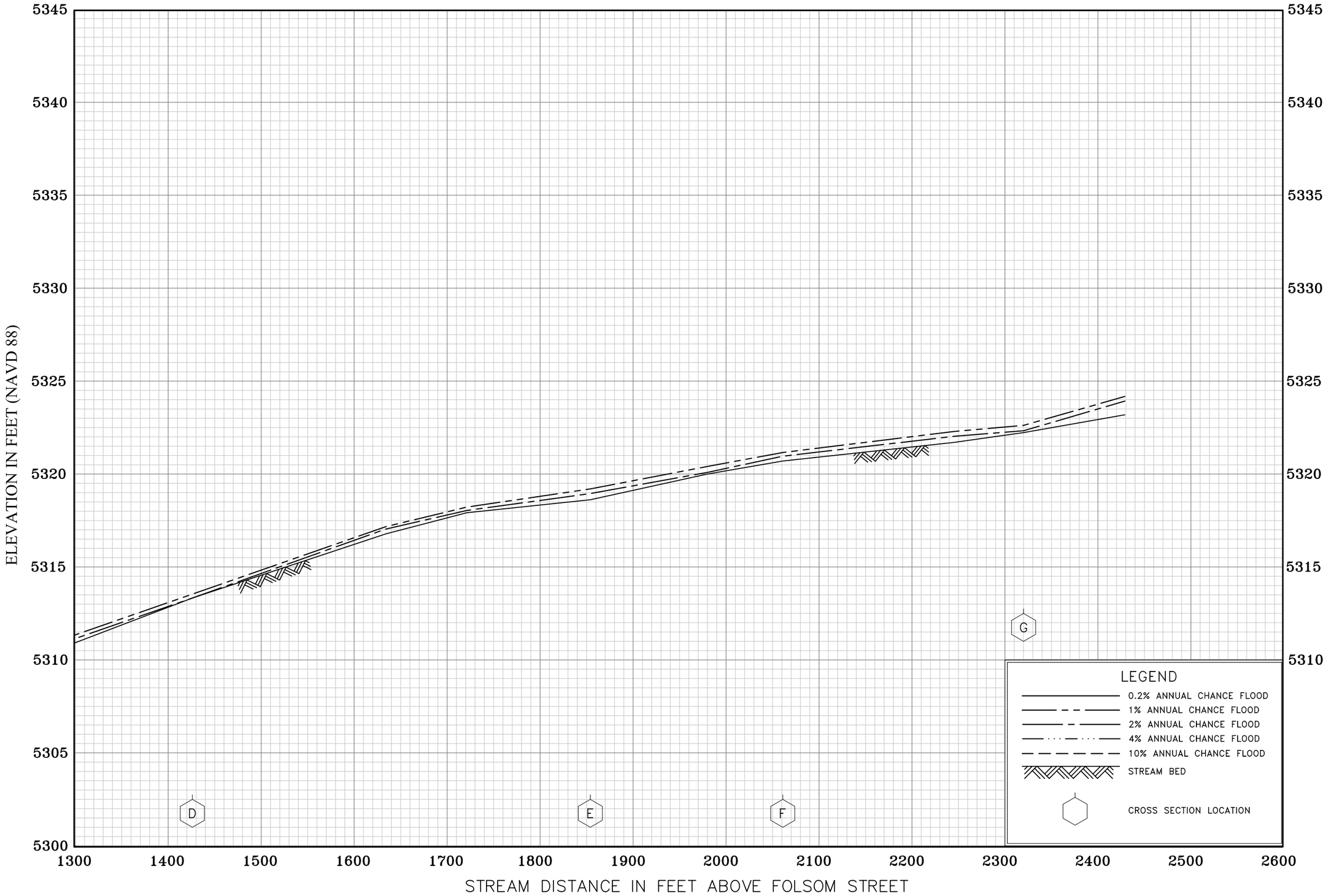
FLOOD PROFILES

BOULDER CREEK – GOSS STREET SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

AND INCORPORATED AREAS



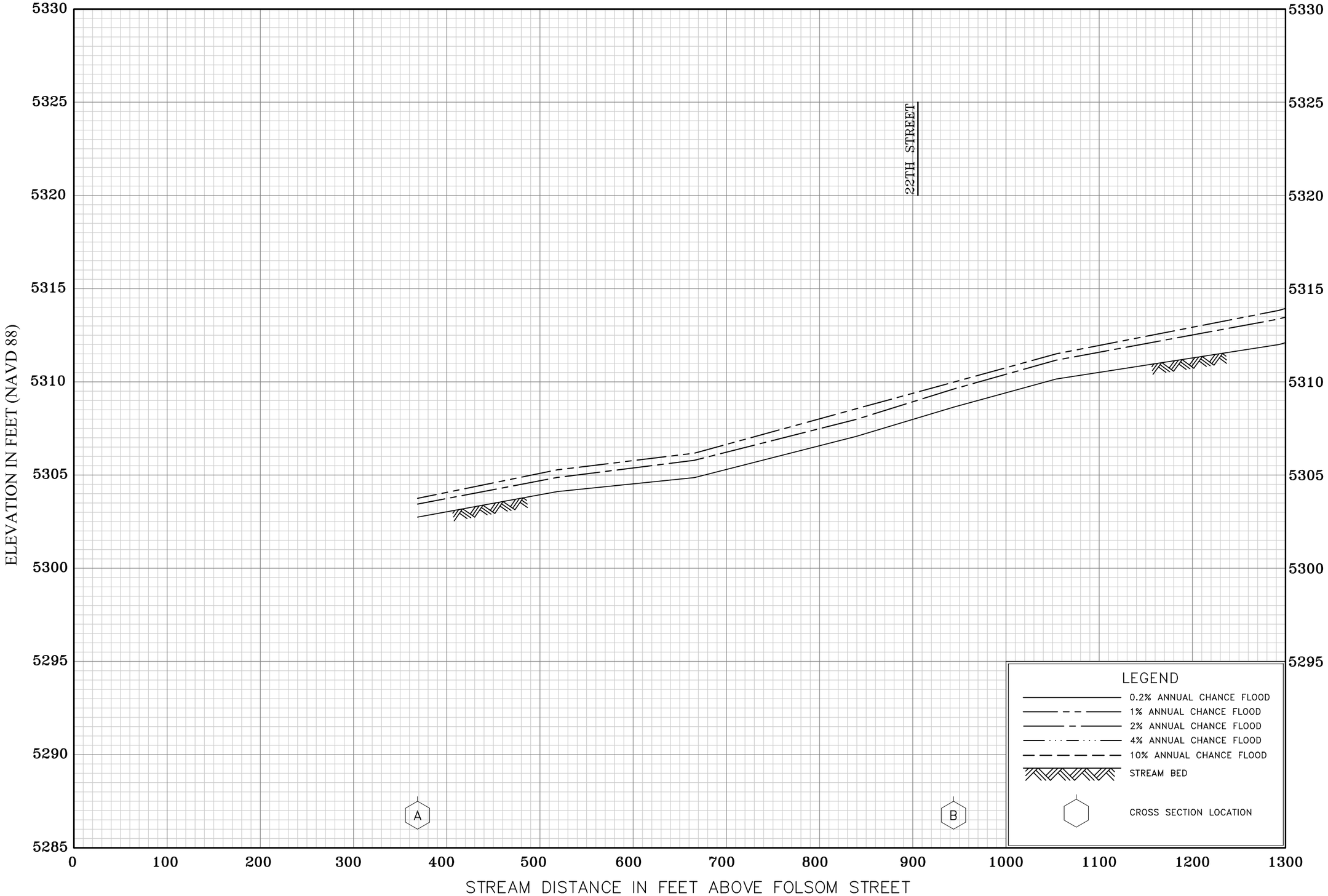
FLOOD PROFILES

BOULDER CREEK – GOSS STREET SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

AND INCORPORATED AREAS



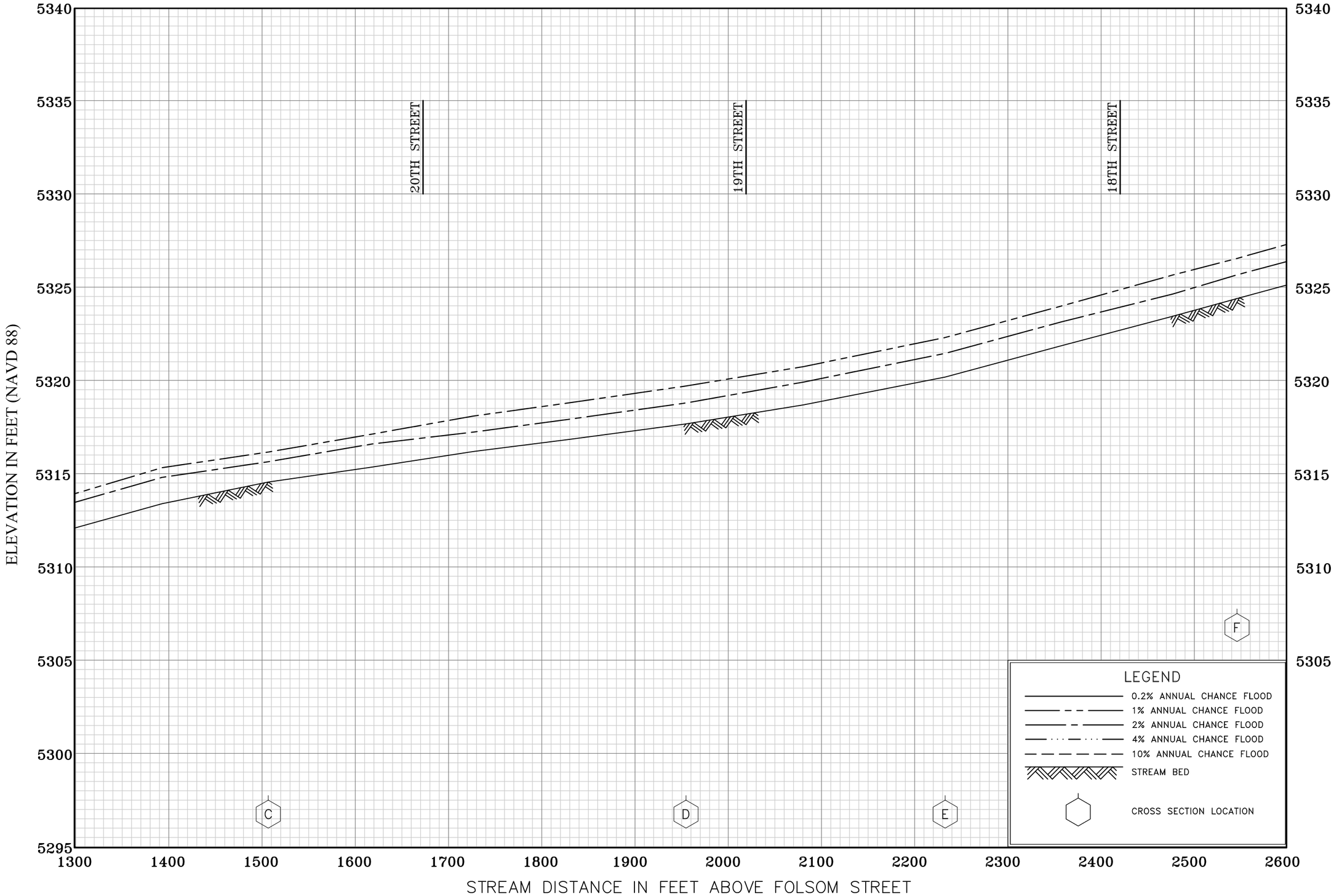
FLOOD PROFILES

BOULDER CREEK – GROVE STREET SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

AND INCORPORATED AREAS



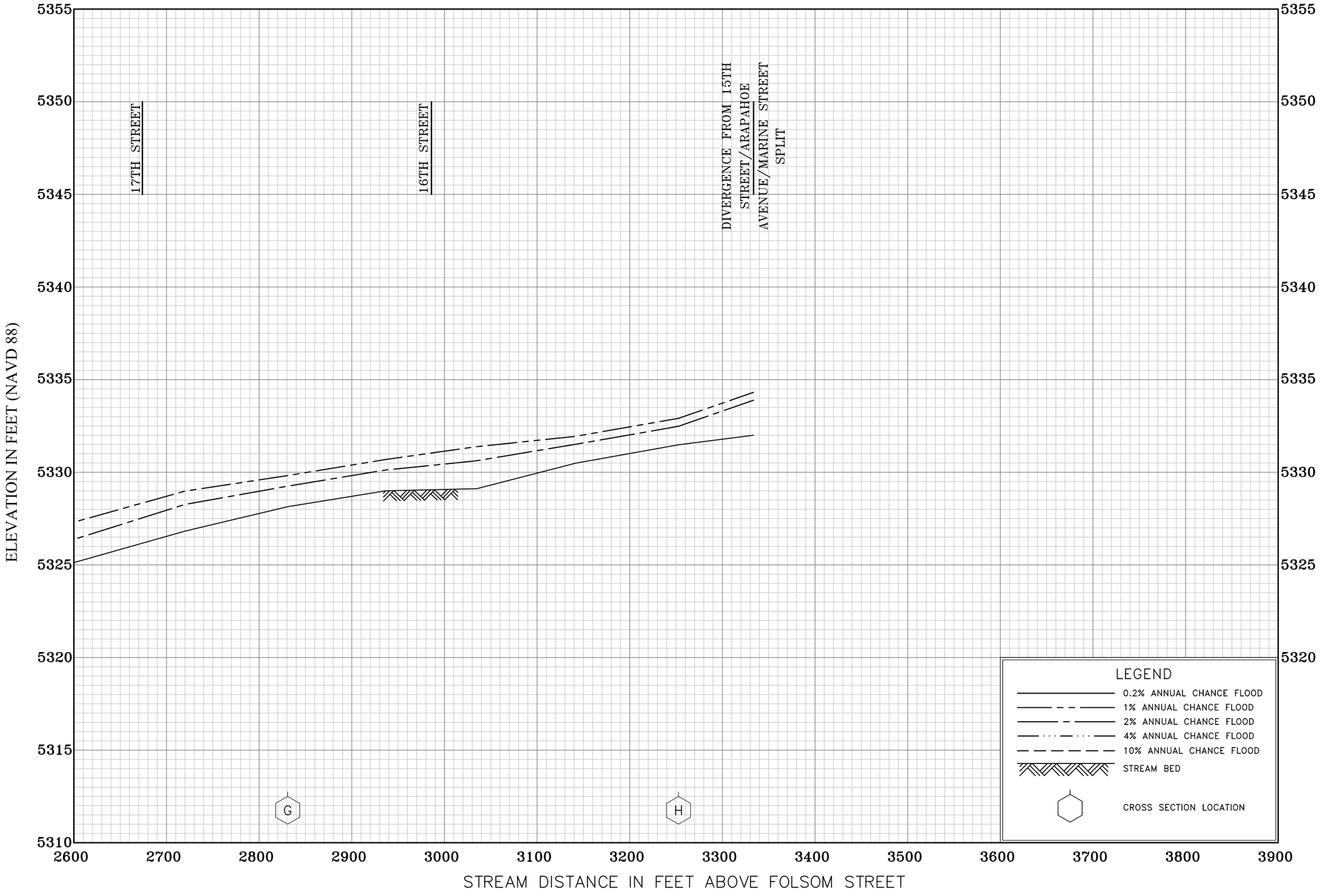
FLOOD PROFILES

BOULDER CREEK – GROVE STREET SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

AND INCORPORATED AREAS



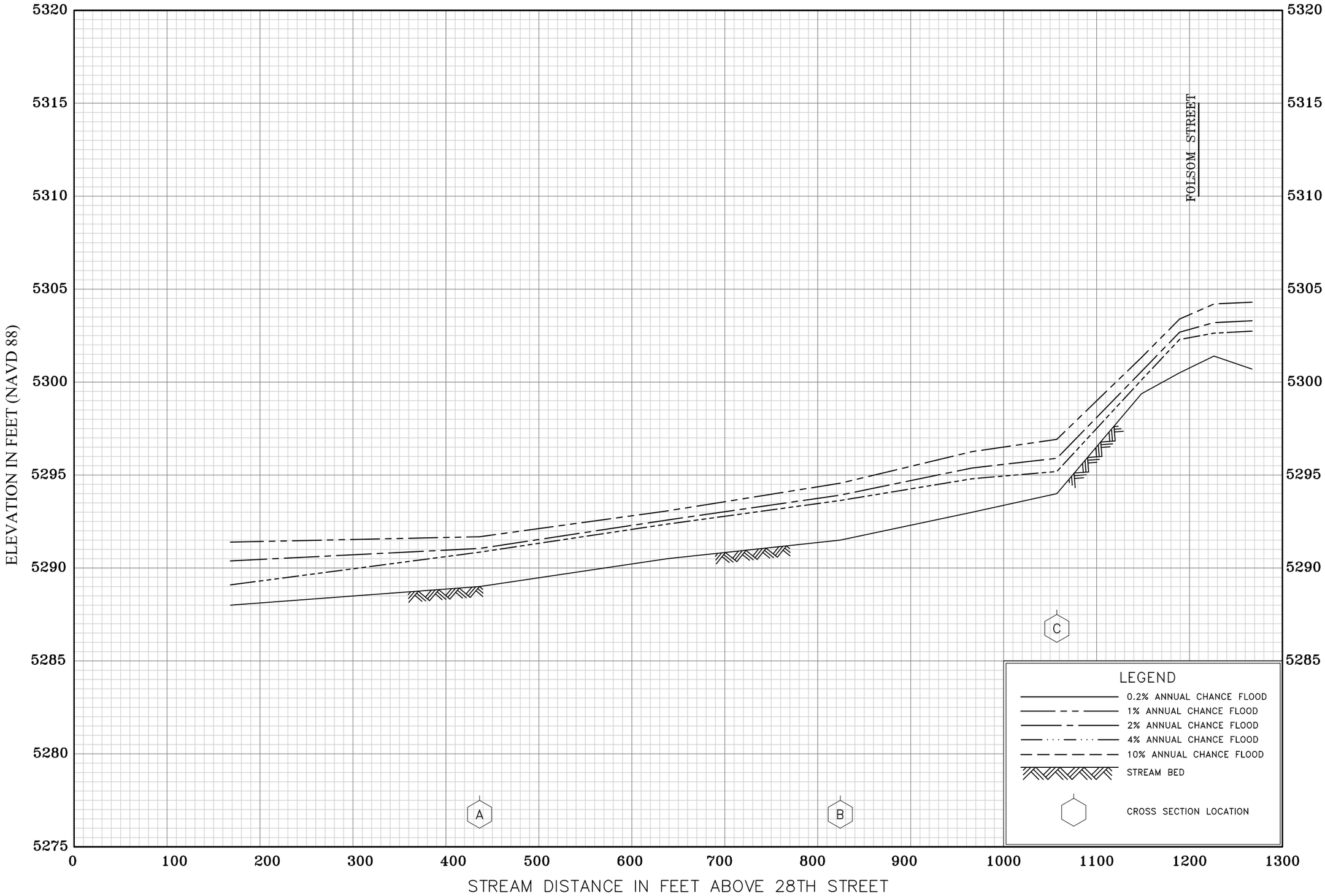
FLOOD PROFILES

BOULDER CREEK – GROVE STREET SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

AND INCORPORATED AREAS



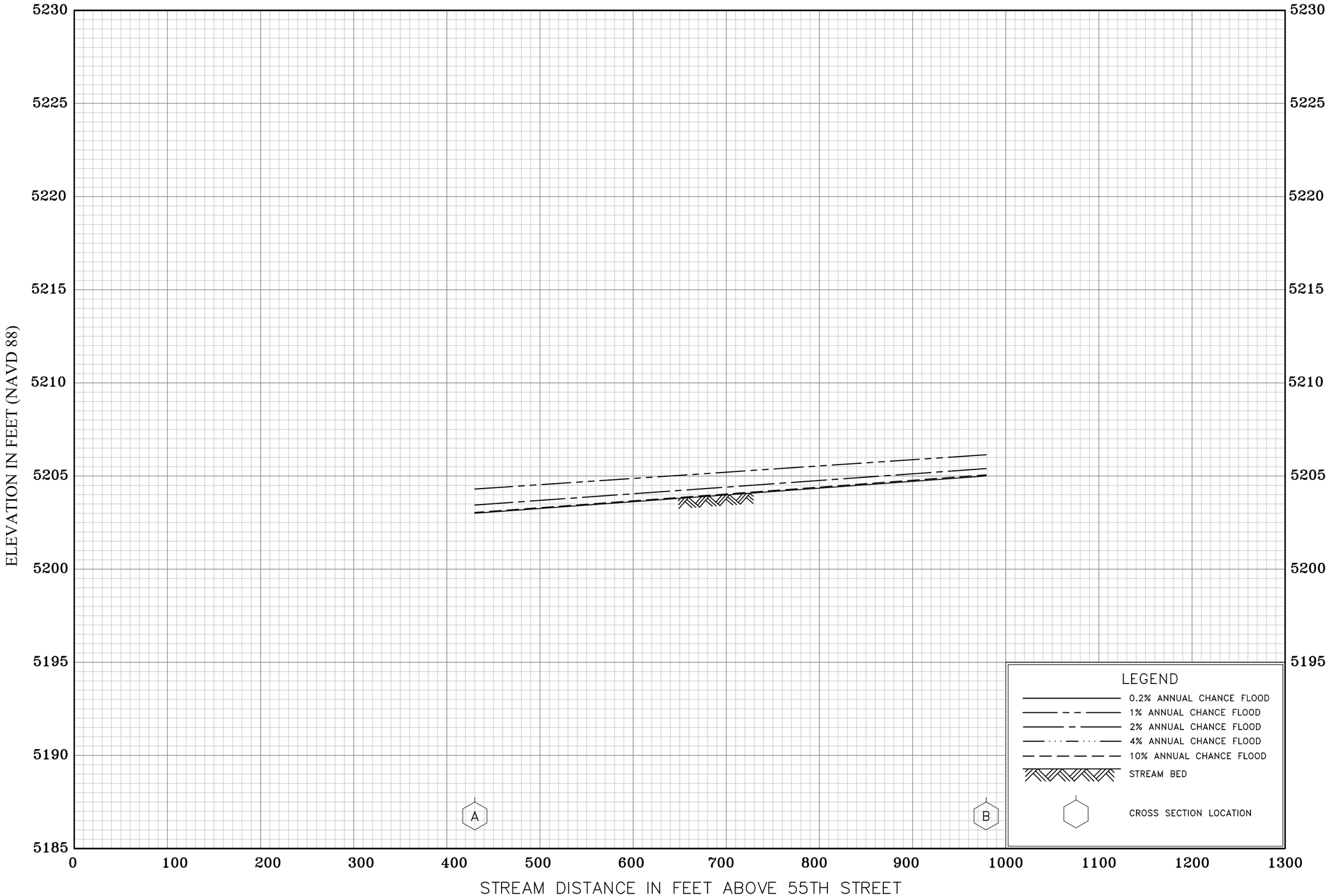
FLOOD PROFILES

BOULDER CREEK – HARVEST HOUSE SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

AND INCORPORATED AREAS



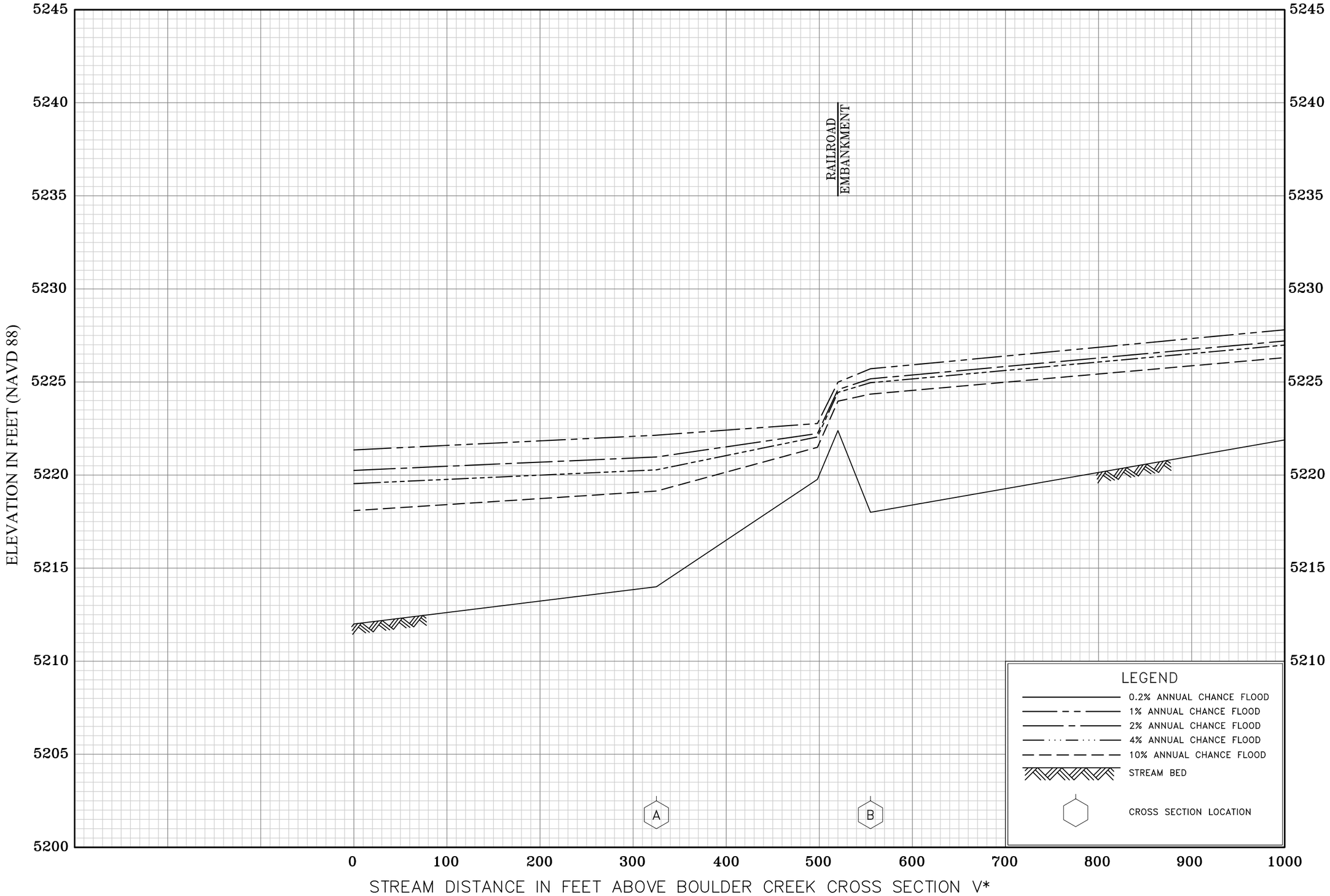
FLOOD PROFILES

BOULDER CREEK – PEARL STREET SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

AND INCORPORATED AREAS



*= APPROXIMATELY 870 FEET DOWNSTREAM OF RAILROAD BRIDGE ALONG BOULDER CREEK

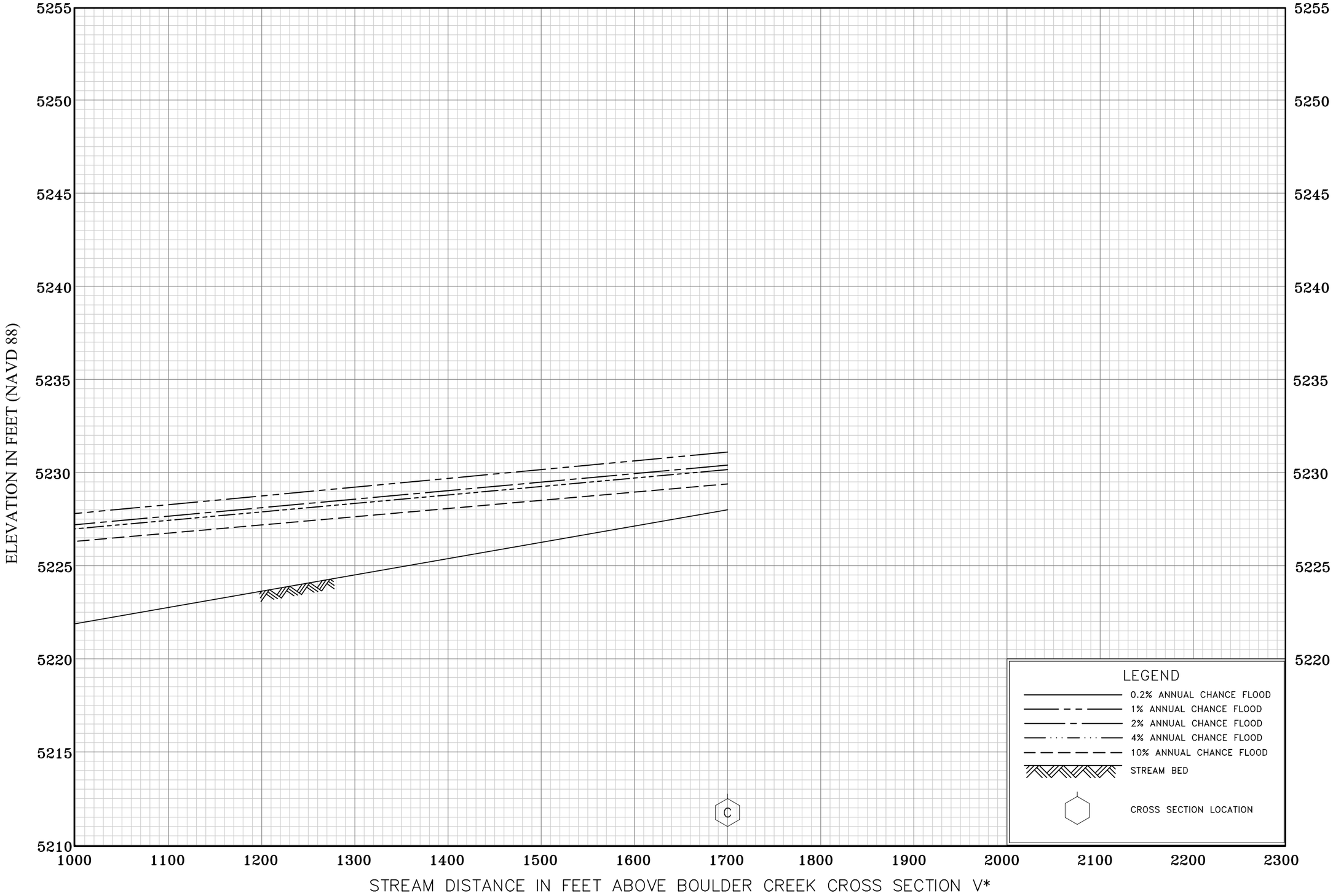
FLOOD PROFILES

BOULDER CREEK – RAILROAD OVERTOPPING

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

AND INCORPORATED AREAS



*= APPROXIMATELY 870 FEET DOWNSTREAM OF RAILROAD BRIDGE ALONG BOULDER CREEK

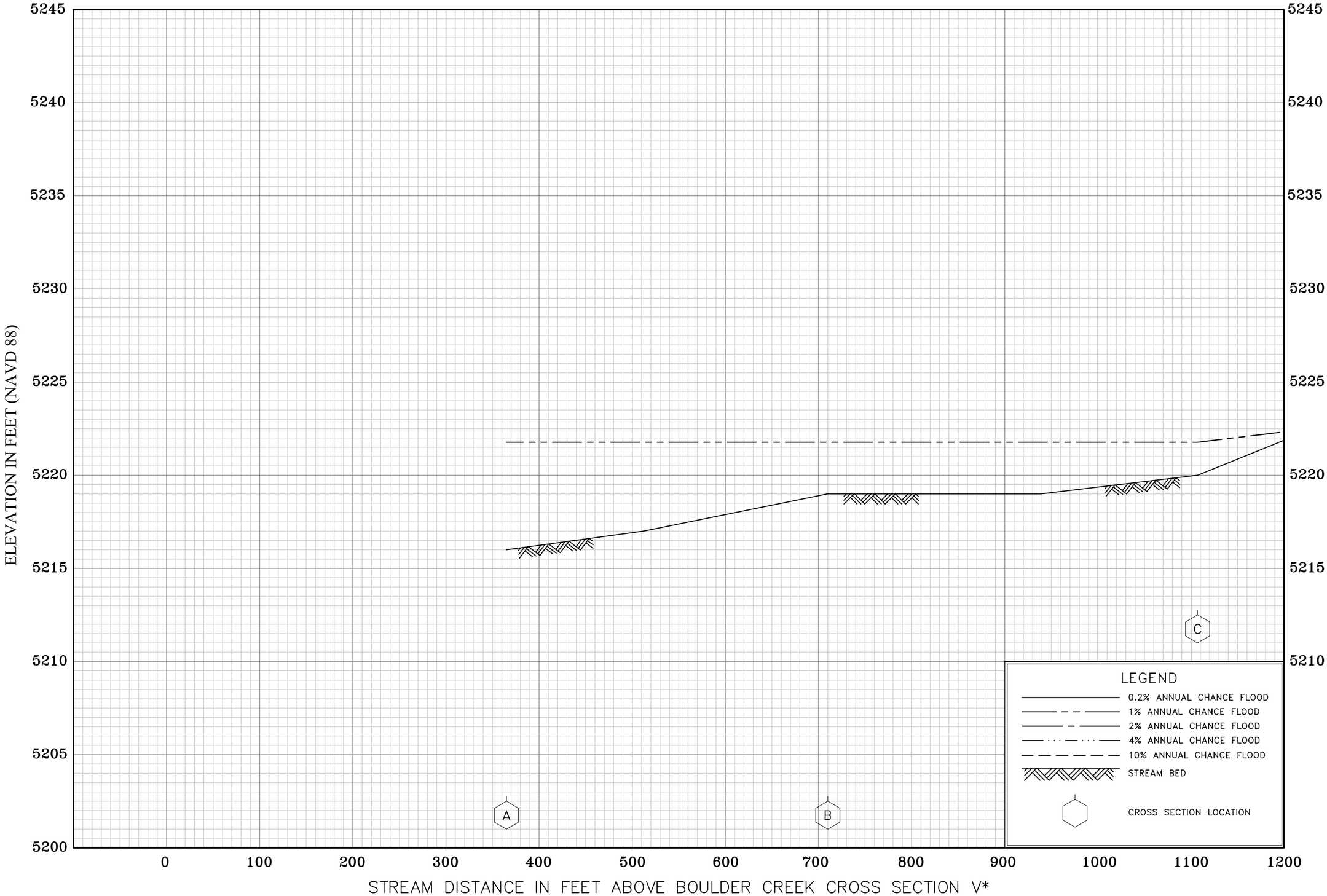
FLOOD PROFILES

BOULDER CREEK – RAILROAD OVERTOPPING

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

AND INCORPORATED AREAS



*= APPROXIMATELY 870 FEET DOWNSTREAM OF RAILROAD BRIDGE ALONG BOULDER CREEK

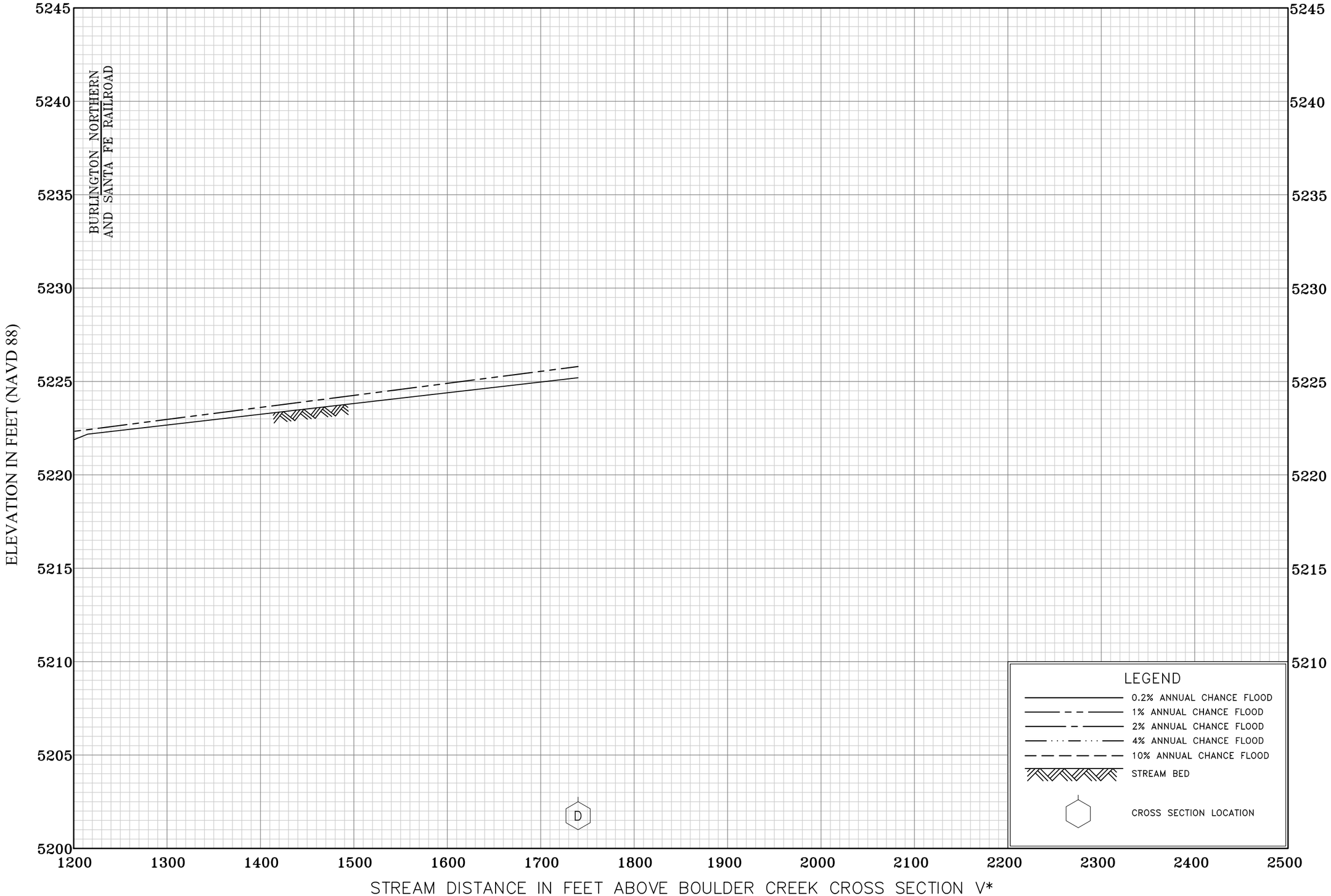
FLOOD PROFILES

BOULDER CREEK – RAILROAD SPLIT FLOW

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

AND INCORPORATED AREAS



*= APPROXIMATELY 870 FEET DOWNSTREAM OF RAILROAD BRIDGE ALONG BOULDER CREEK

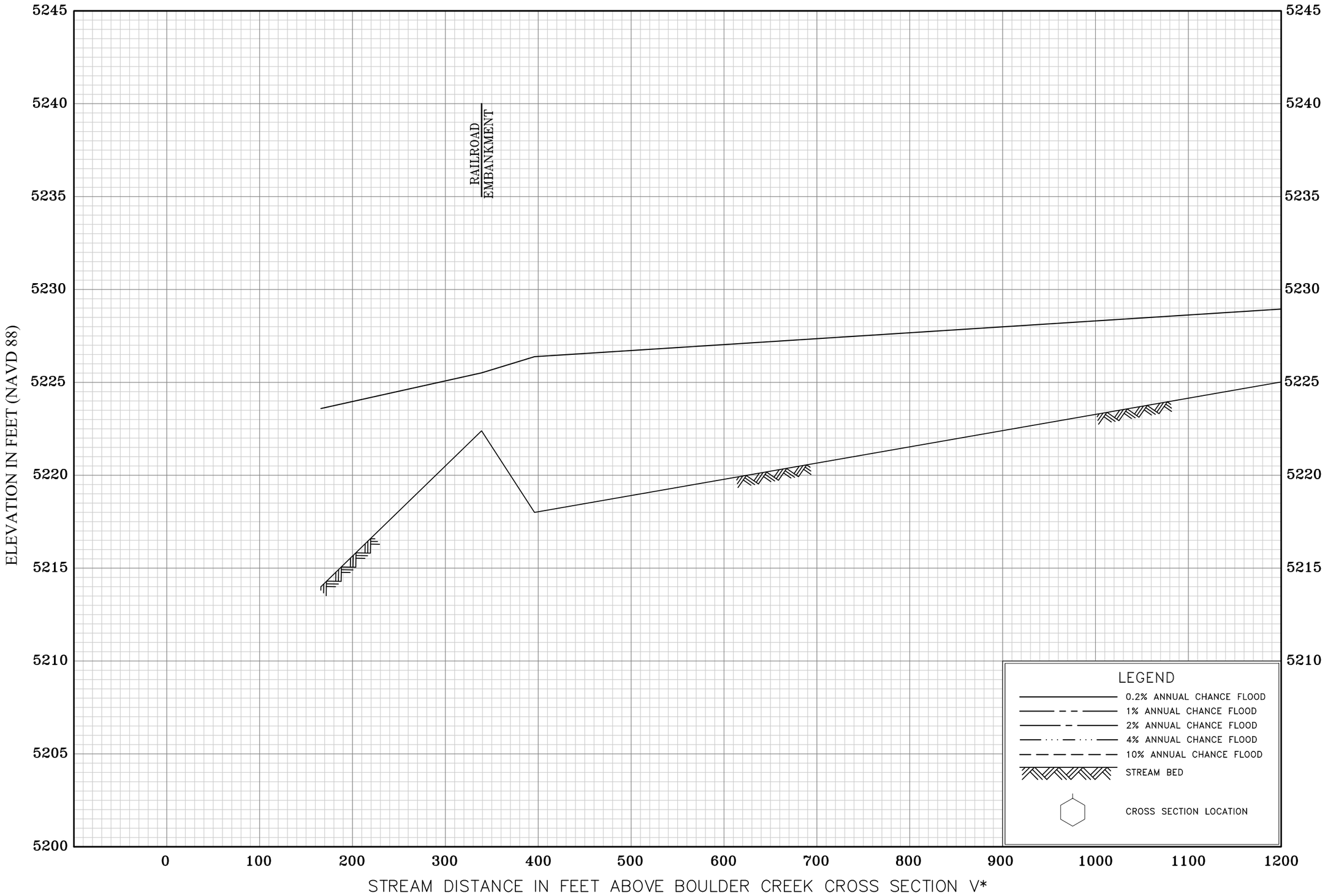
FLOOD PROFILES

BOULDER CREEK – RAILROAD SPLIT FLOW

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

AND INCORPORATED AREAS



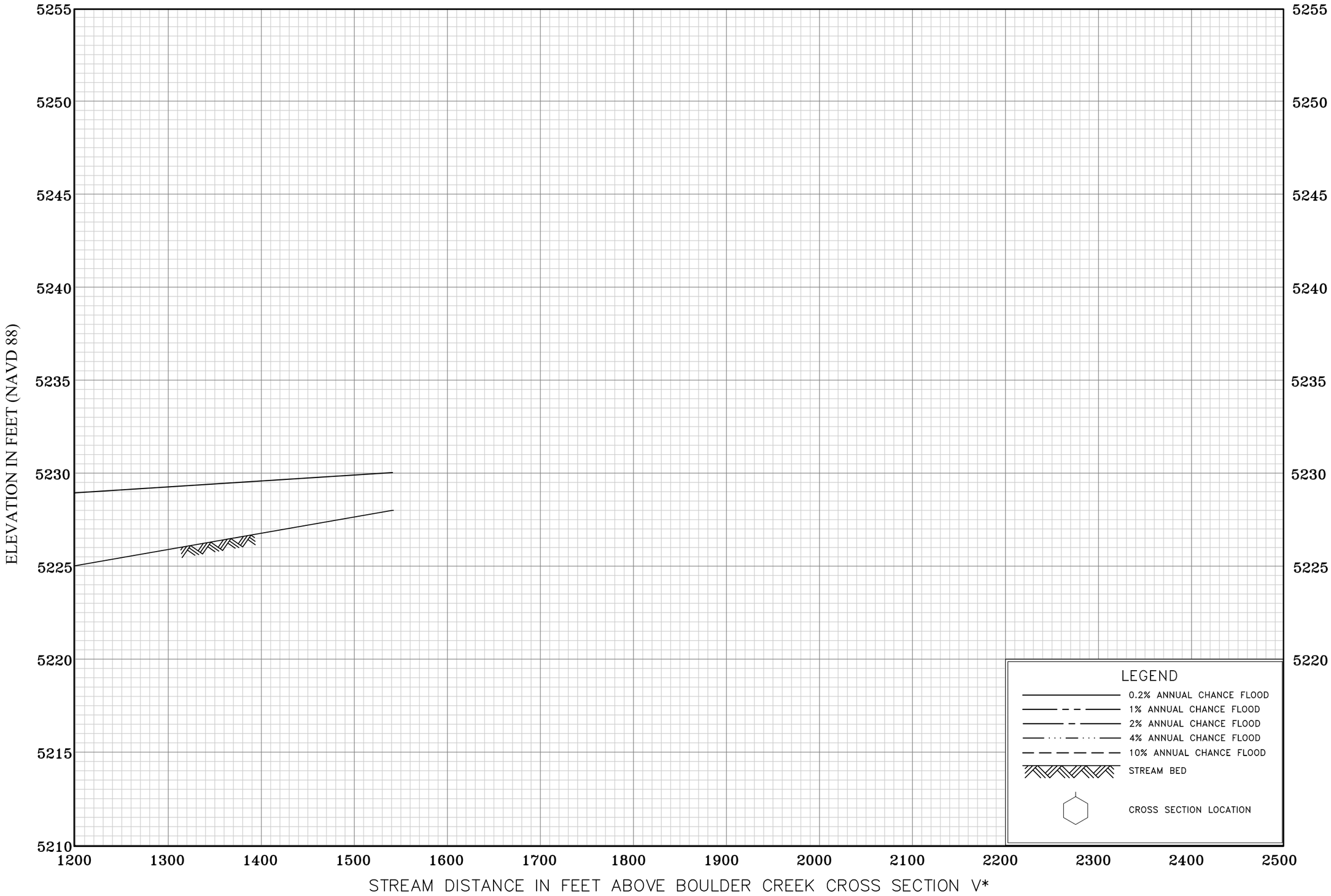
*= APPROXIMATELY 870 FEET DOWNSTREAM OF RAILROAD BRIDGE ALONG BOULDER CREEK

FLOOD PROFILES

BOULDER CREEK – RAILROAD OVERTOPPING
500-YEAR

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS



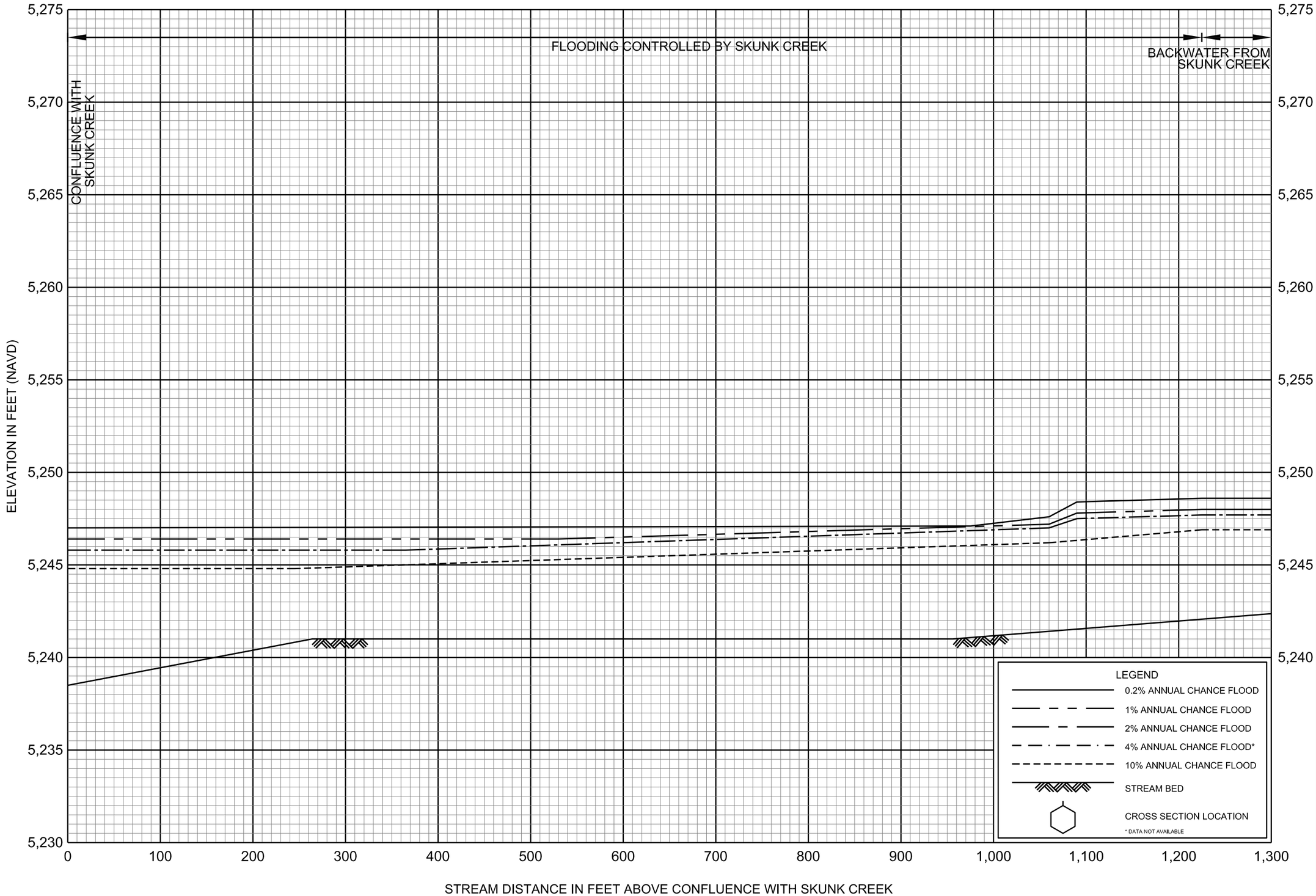
*= APPROXIMATELY 870 FEET DOWNSTREAM OF RAILROAD BRIDGE ALONG BOULDER CREEK

FLOOD PROFILES

BOULDER CREEK – RAILROAD OVERTOPPING
500-YEAR

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS



FLOOD PROFILES

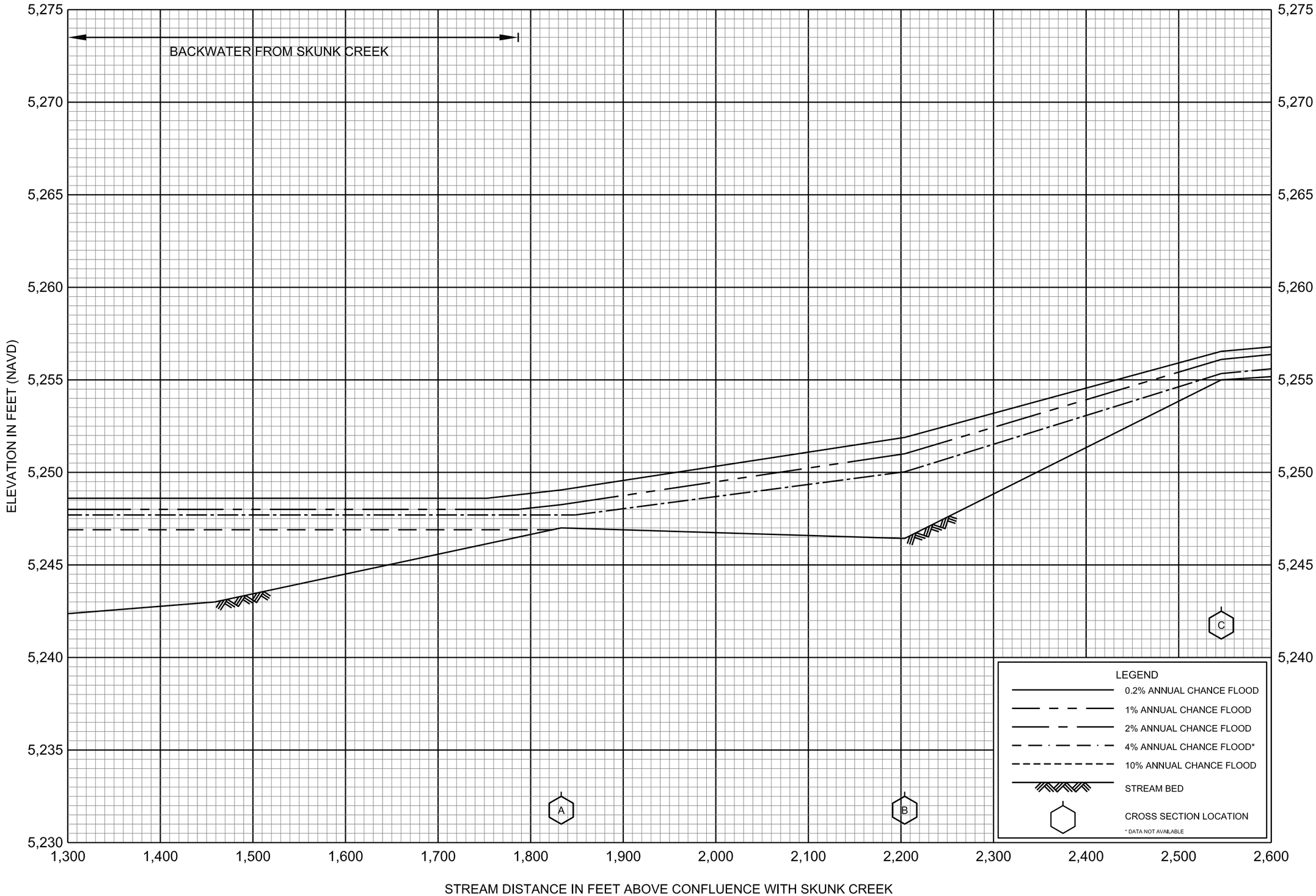
BOULDER CREEK - SKUNK CREEK SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

(AND INCORPORATED AREAS)

101P



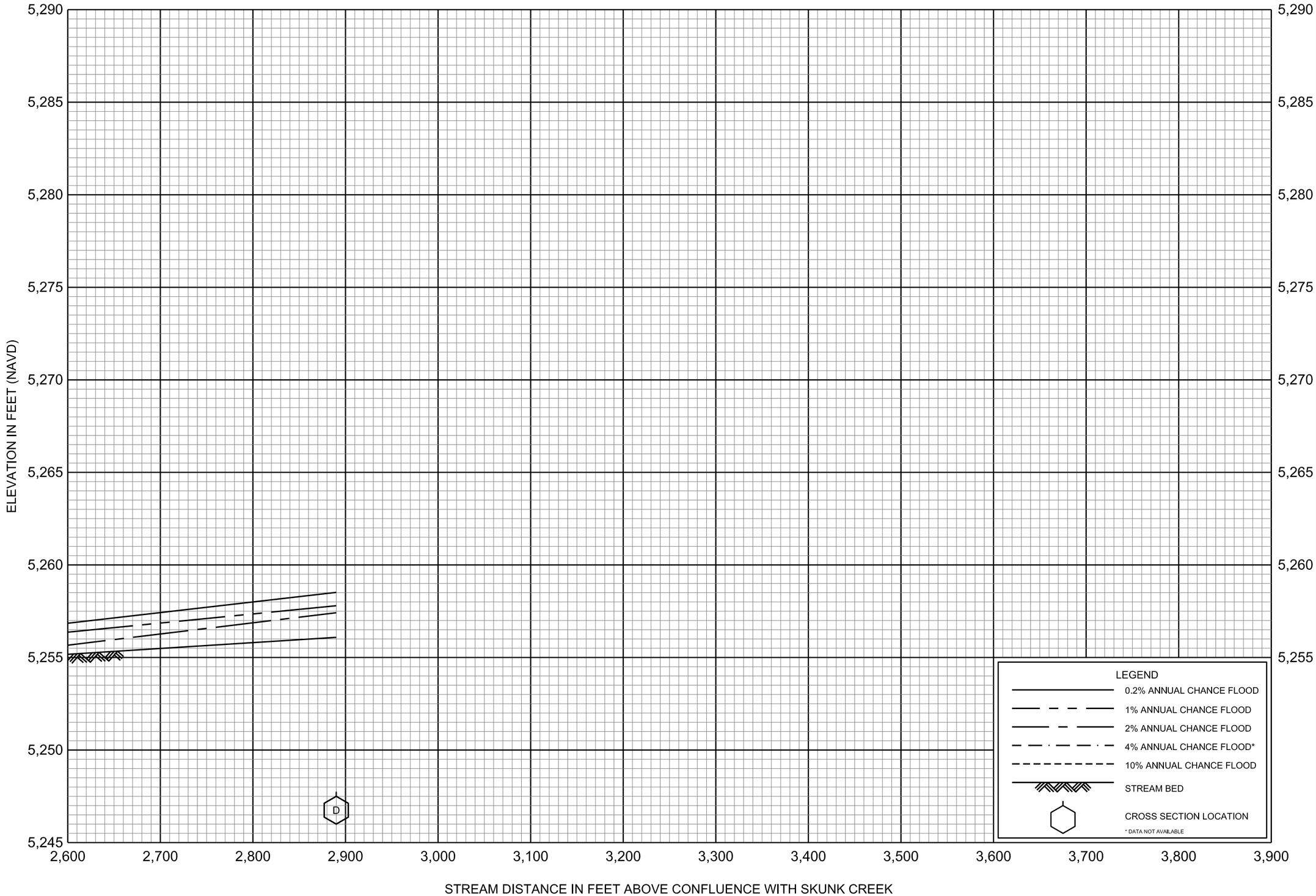
FLOOD PROFILES

BOULDER CREEK - SKUNK CREEK SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

(AND INCORPORATED AREAS)



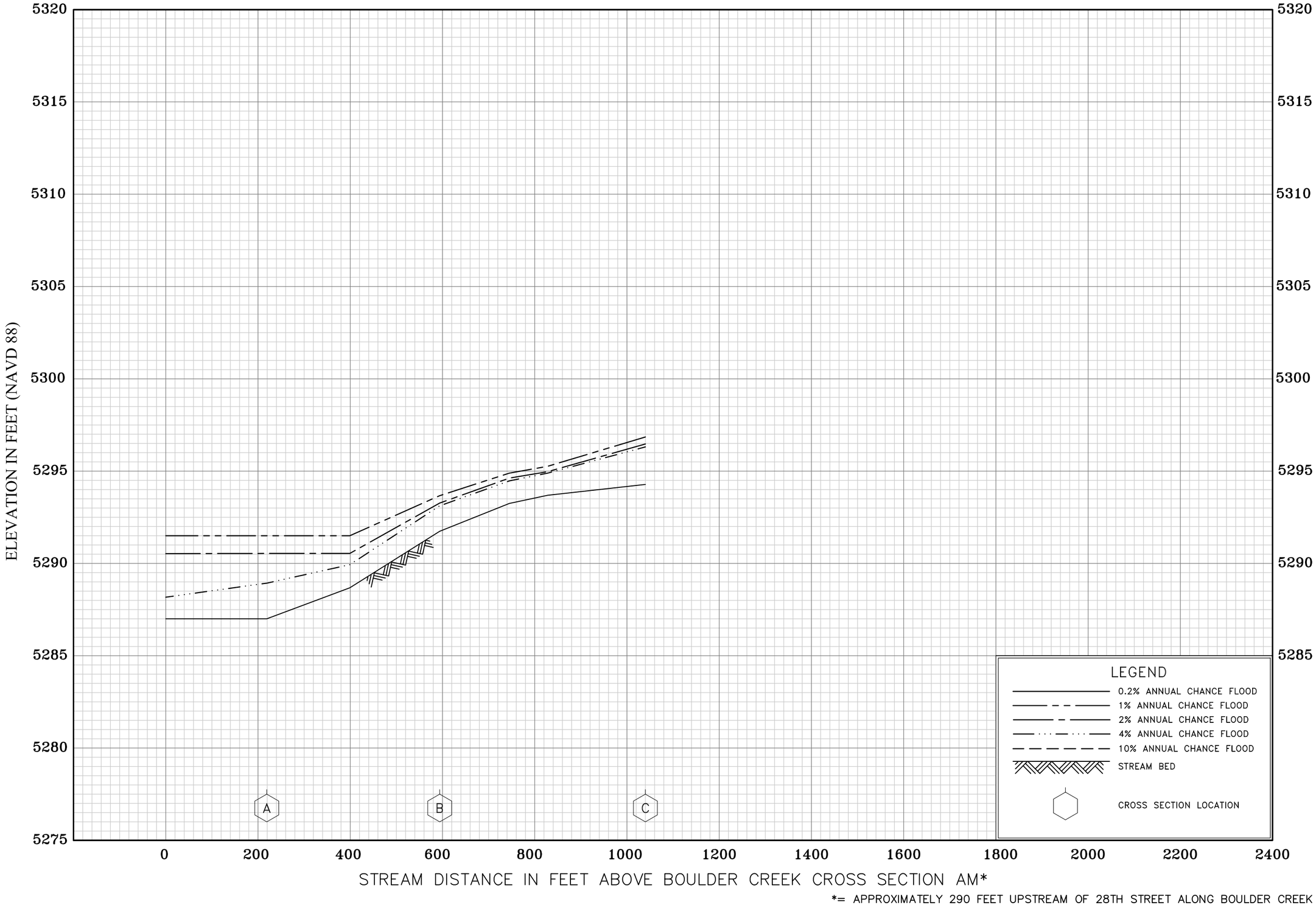
FLOOD PROFILES

BOULDER CREEK - SKUNK CREEK SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

(AND INCORPORATED AREAS)



*= APPROXIMATELY 290 FEET UPSTREAM OF 28TH STREET ALONG BOULDER CREEK

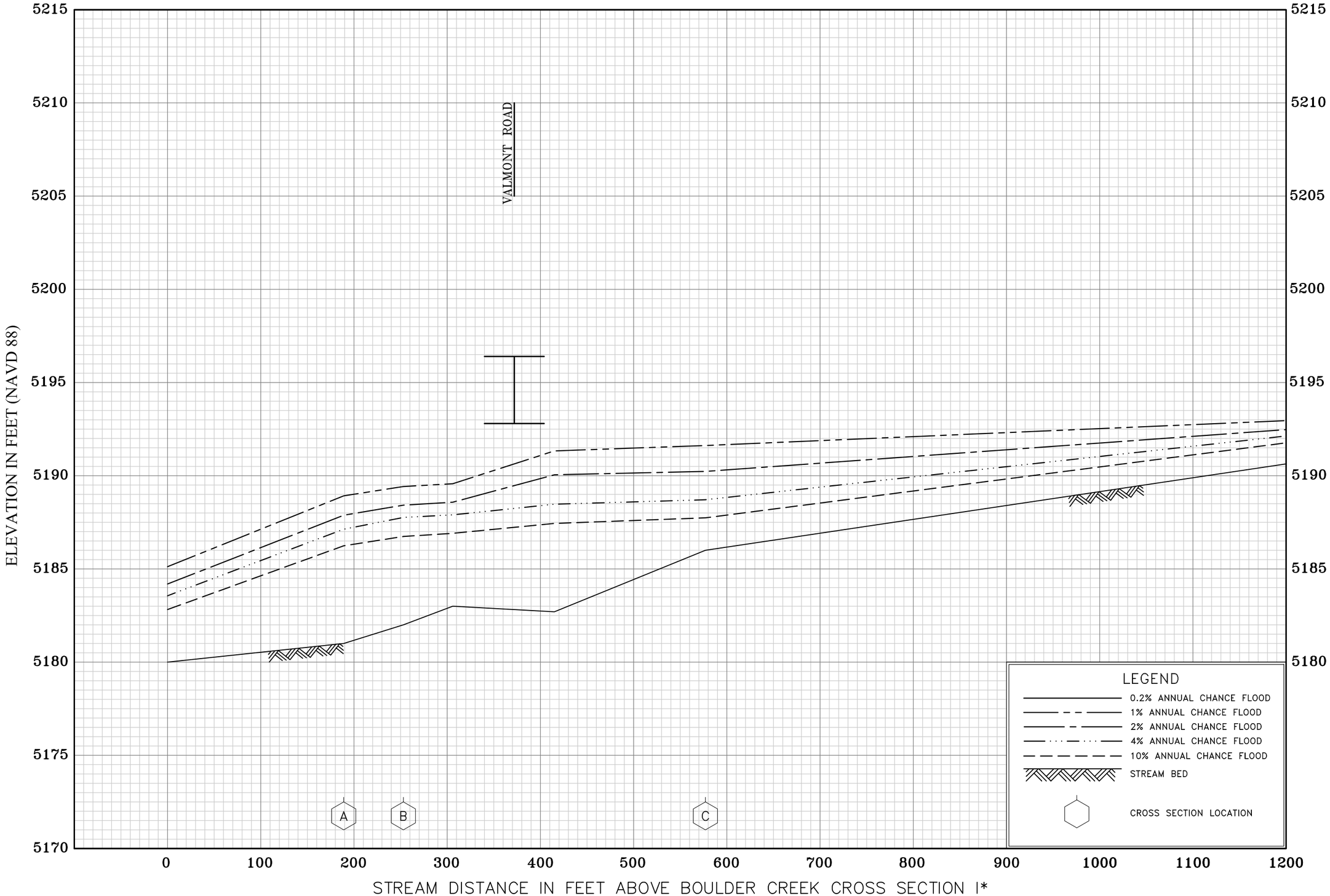
FLOOD PROFILES

BOULDER CREEK – TAFT DRIVE SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

AND INCORPORATED AREAS



*= APPROXIMATELY 1,360 FEET DOWNSTREAM OF OLD VALMONT ROAD ALONG BOULDER CREEK

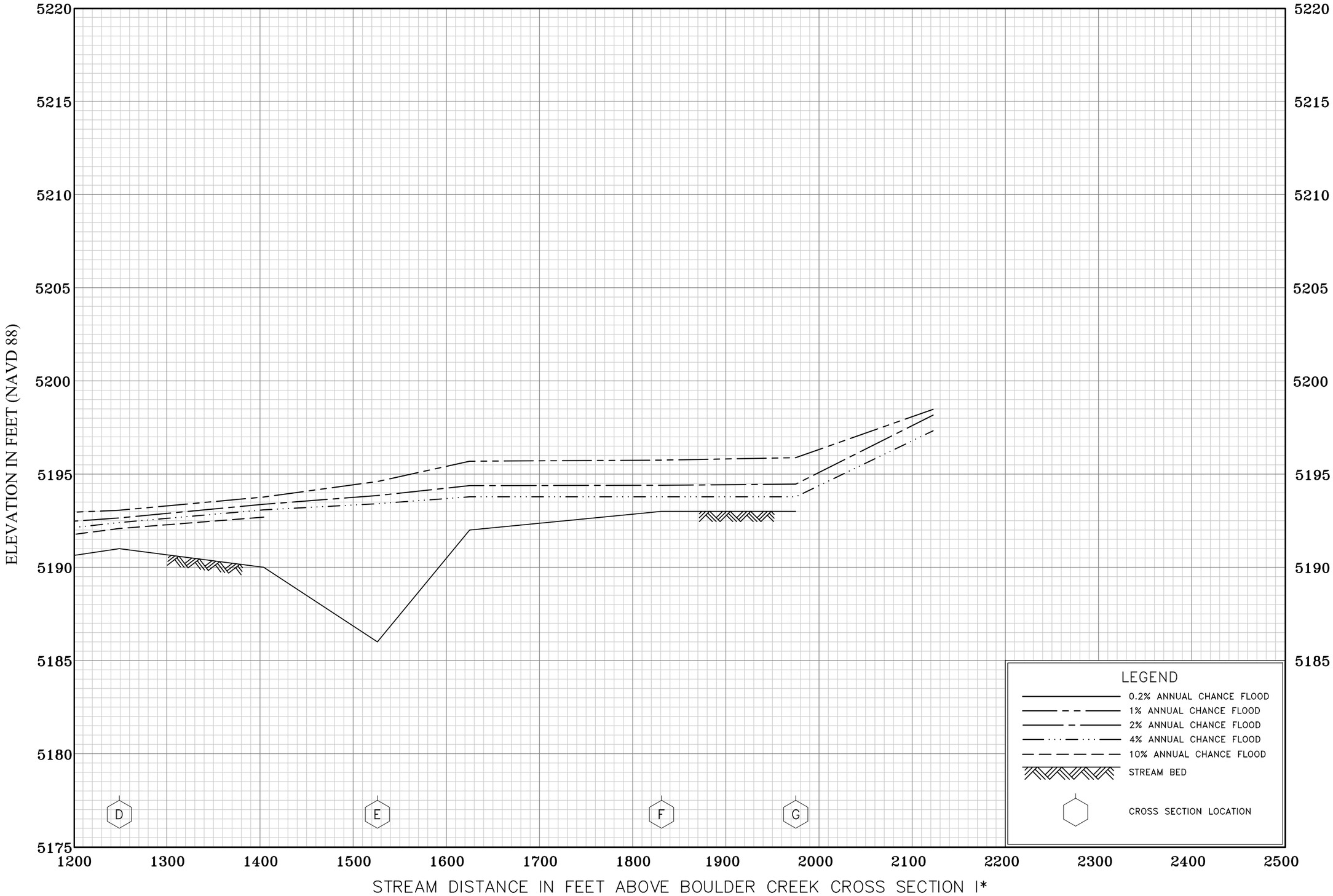
FLOOD PROFILES

BOULDER CREEK – VALMONT SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

AND INCORPORATED AREAS



*= APPROXIMATELY 1,360 FEET DOWNSTREAM OF OLD VALMONT ROAD ALONG BOULDER CREEK

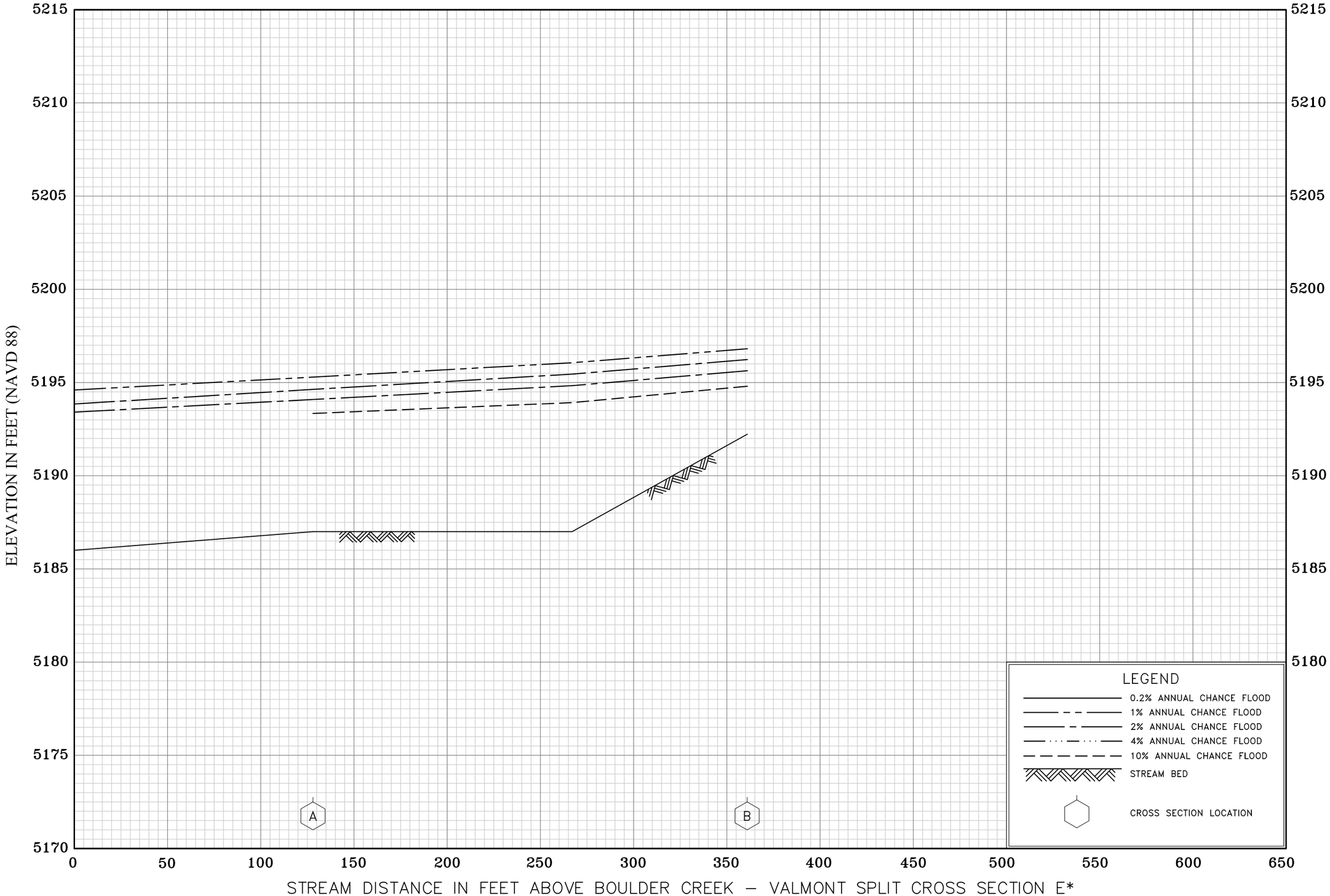
FLOOD PROFILES

BOULDER CREEK – VALMONT SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

AND INCORPORATED AREAS



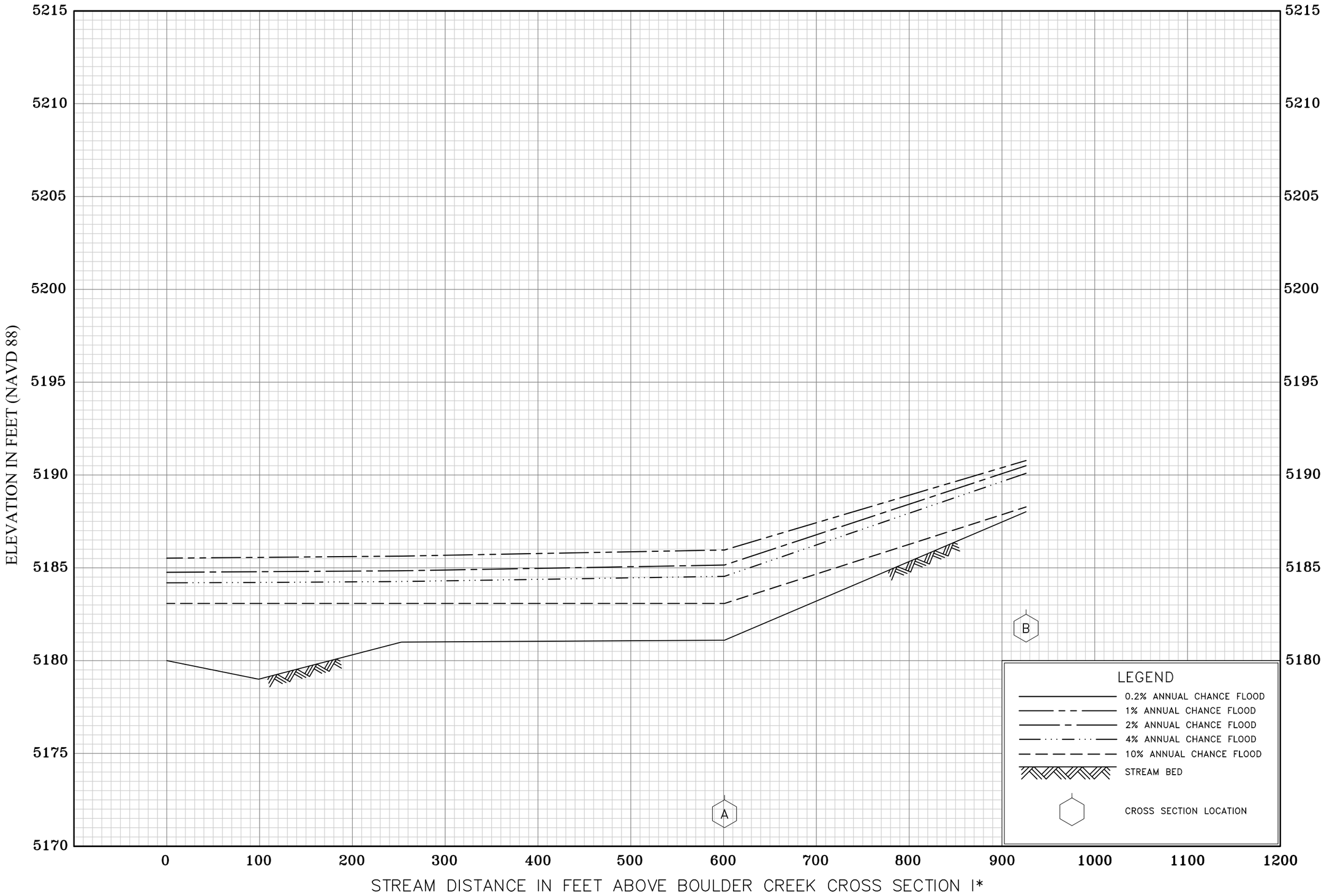
*= APPROXIMATELY 1,150 FEET UPSTREAM OF VALMONT ROAD ALONG BOULDER CREEK – VALMONT SPLIT

FLOOD PROFILES

BOULDER CREEK – VALMONT SPLIT
NORTH SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS



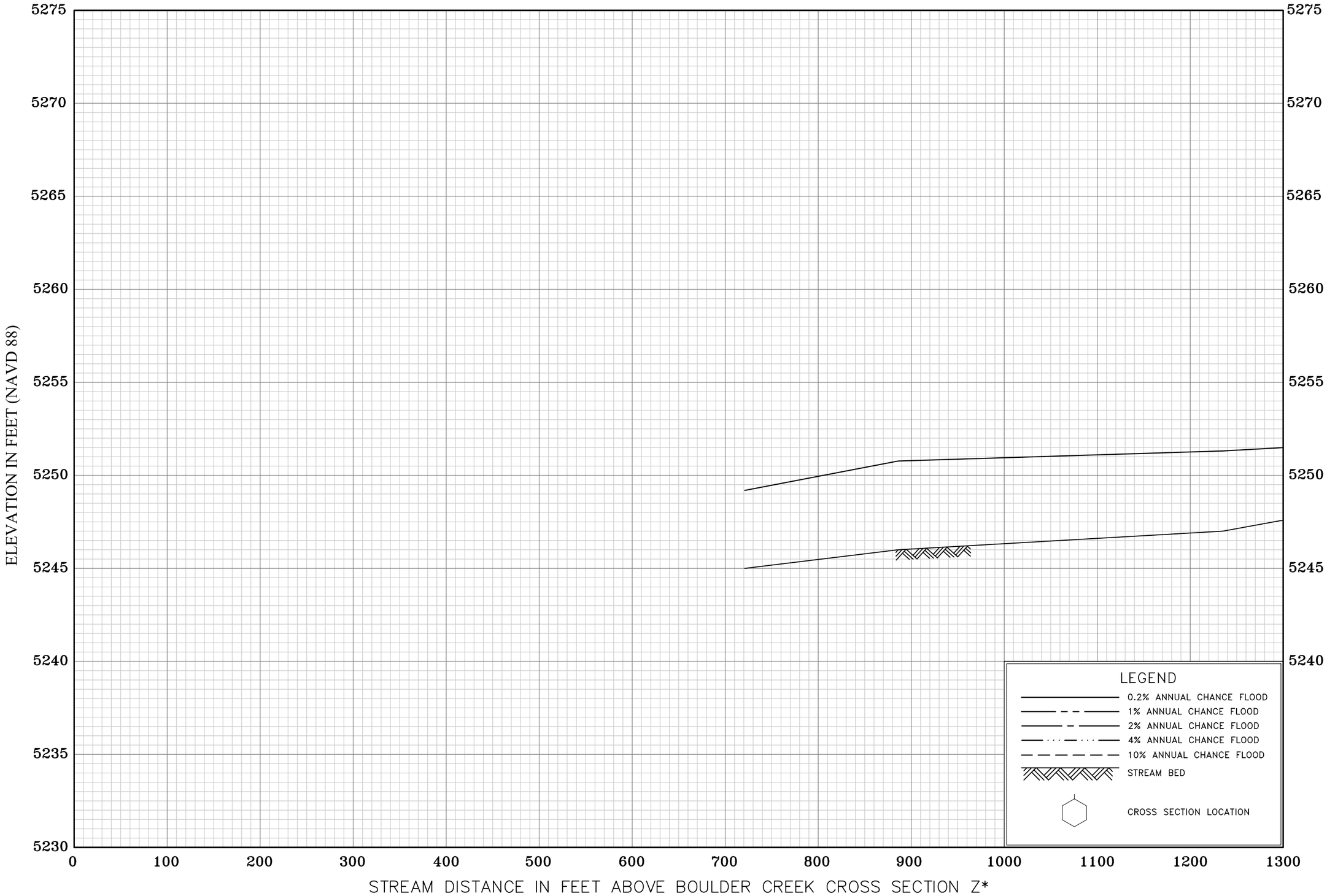
*= APPROXIMATELY 1,360 FEET DOWNSTREAM OF OLD VALMONT ROAD ALONG BOULDER CREEK

FLOOD PROFILES

BOULDER CREEK – VALMONT SPLIT
WEST SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS



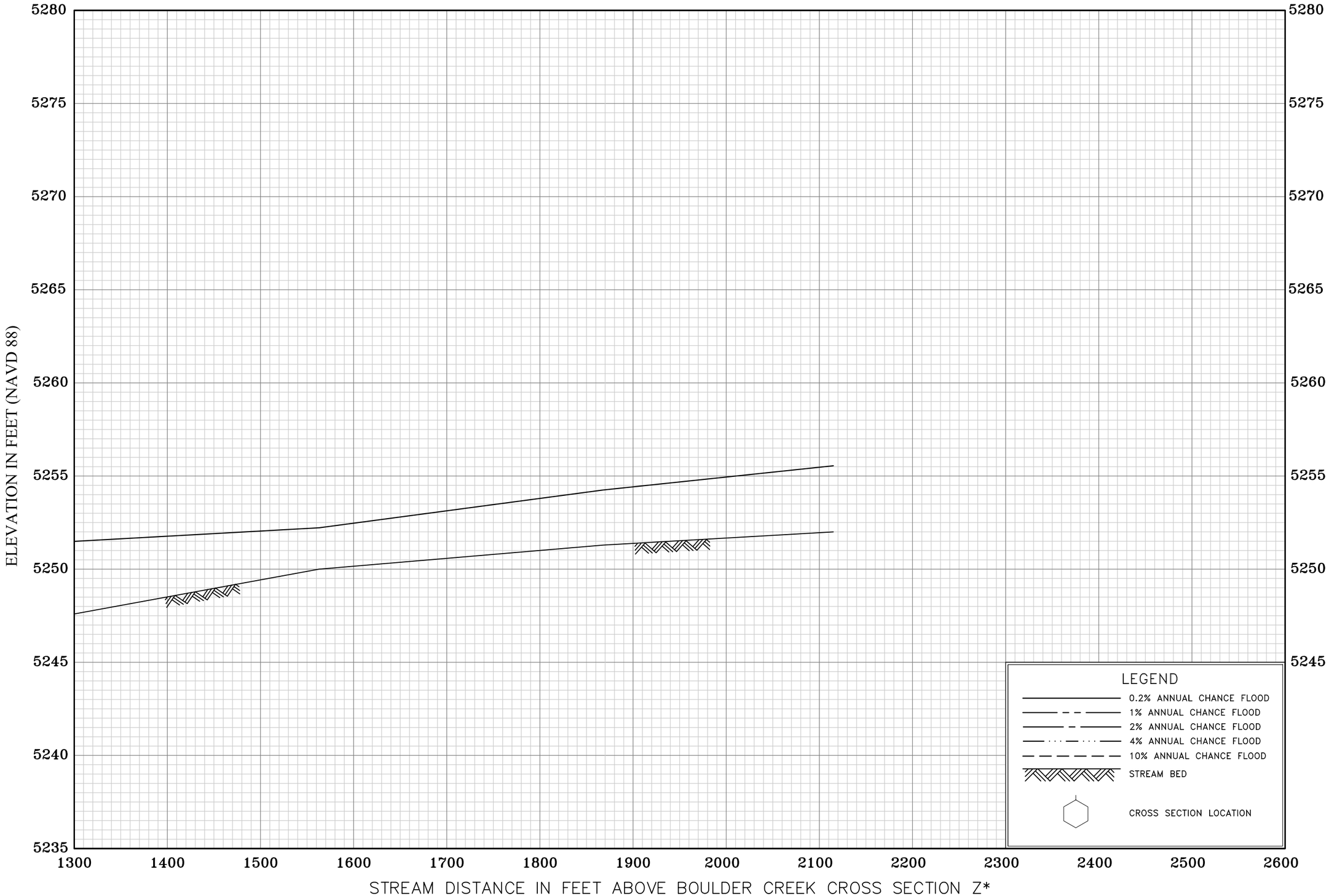
*= APPROXIMATELY 910 FEET DOWNSTREAM OF FOOTHILLS PARKWAY ALONG BOULDER CREEK

FLOOD PROFILES

BOULDER CREEK – WALNUT STREET SPLIT–
500–YEAR

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS



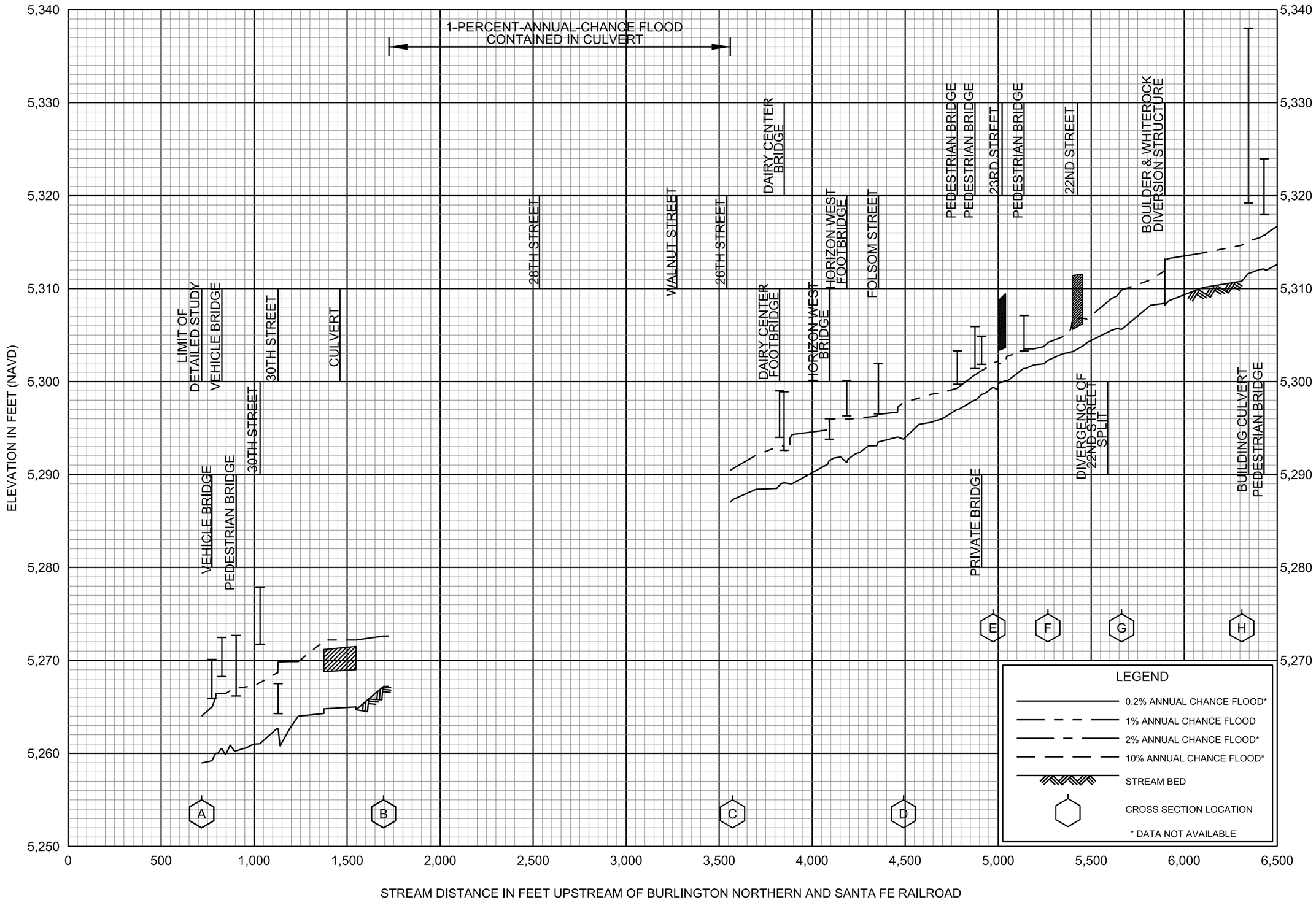
*= APPROXIMATELY 910 FEET DOWNSTREAM OF FOOTHILLS PARKWAY ALONG BOULDER CREEK

FLOOD PROFILES

BOULDER CREEK – WALNUT STREET SPLIT–
500–YEAR

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO
AND INCORPORATED AREAS



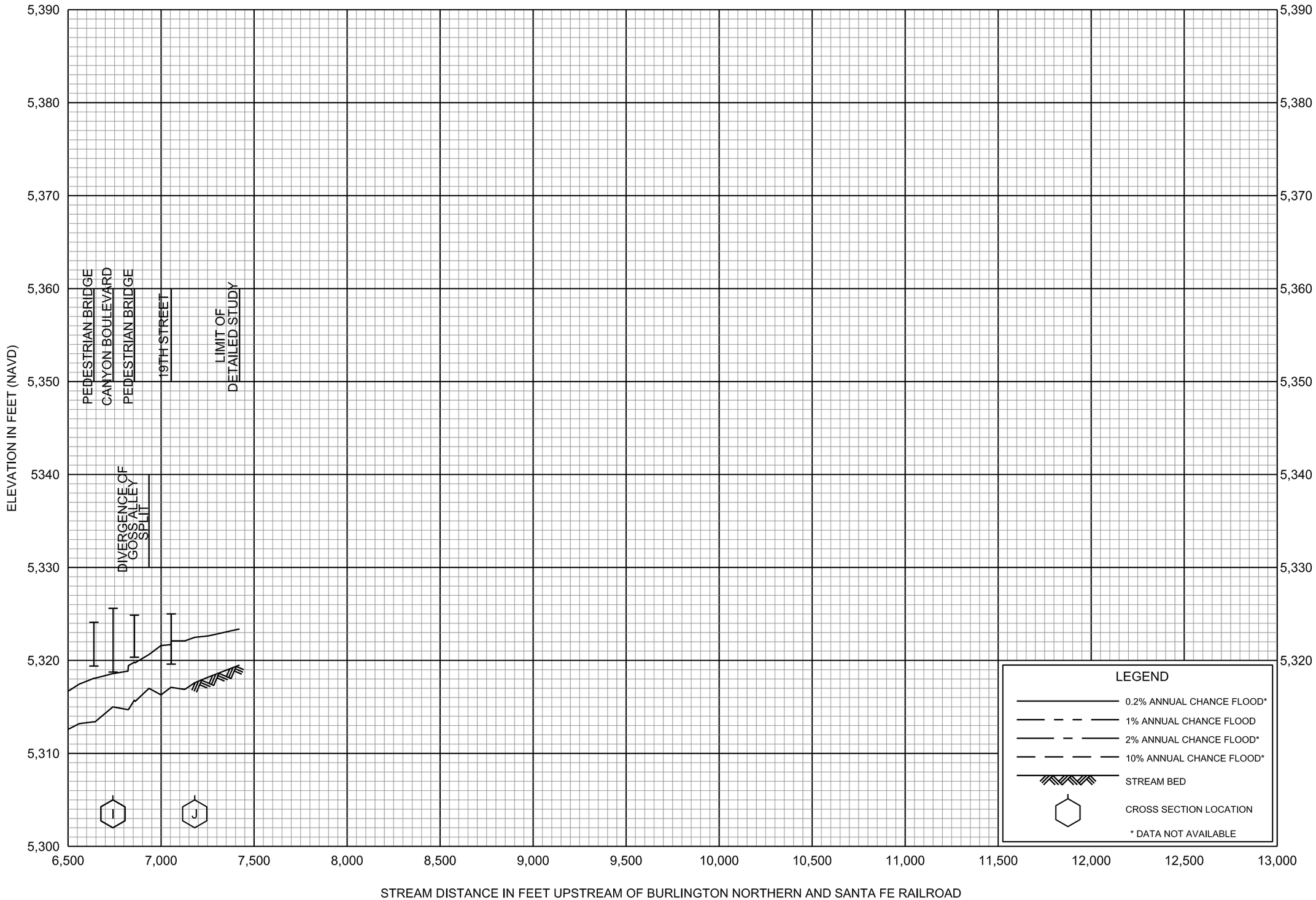
FLOOD PROFILES

BOULDER SLOUGH

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

AND INCORPORATED AREAS



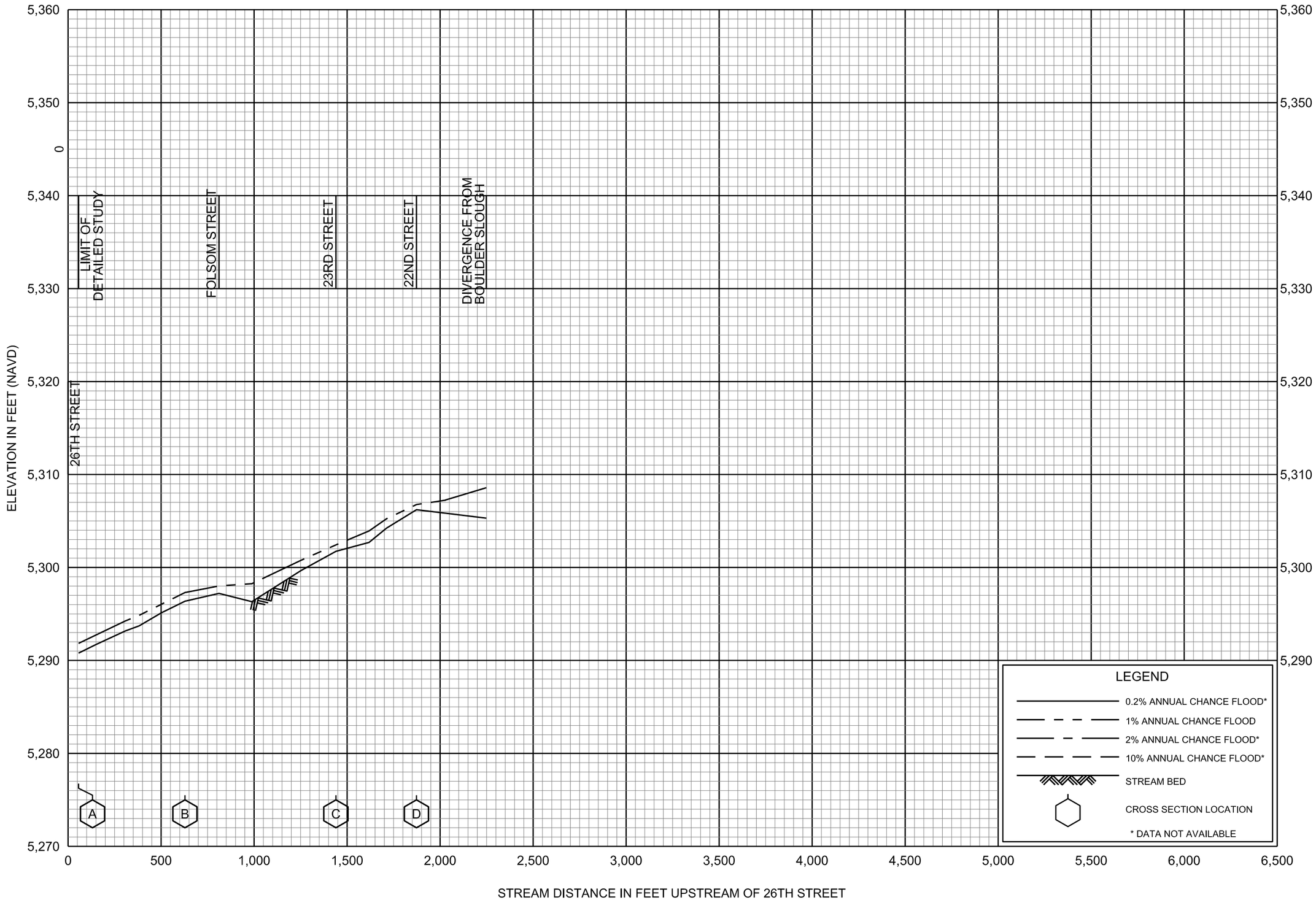
FLOOD PROFILES

BOULDER SLOUGH

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

AND INCORPORATED AREAS



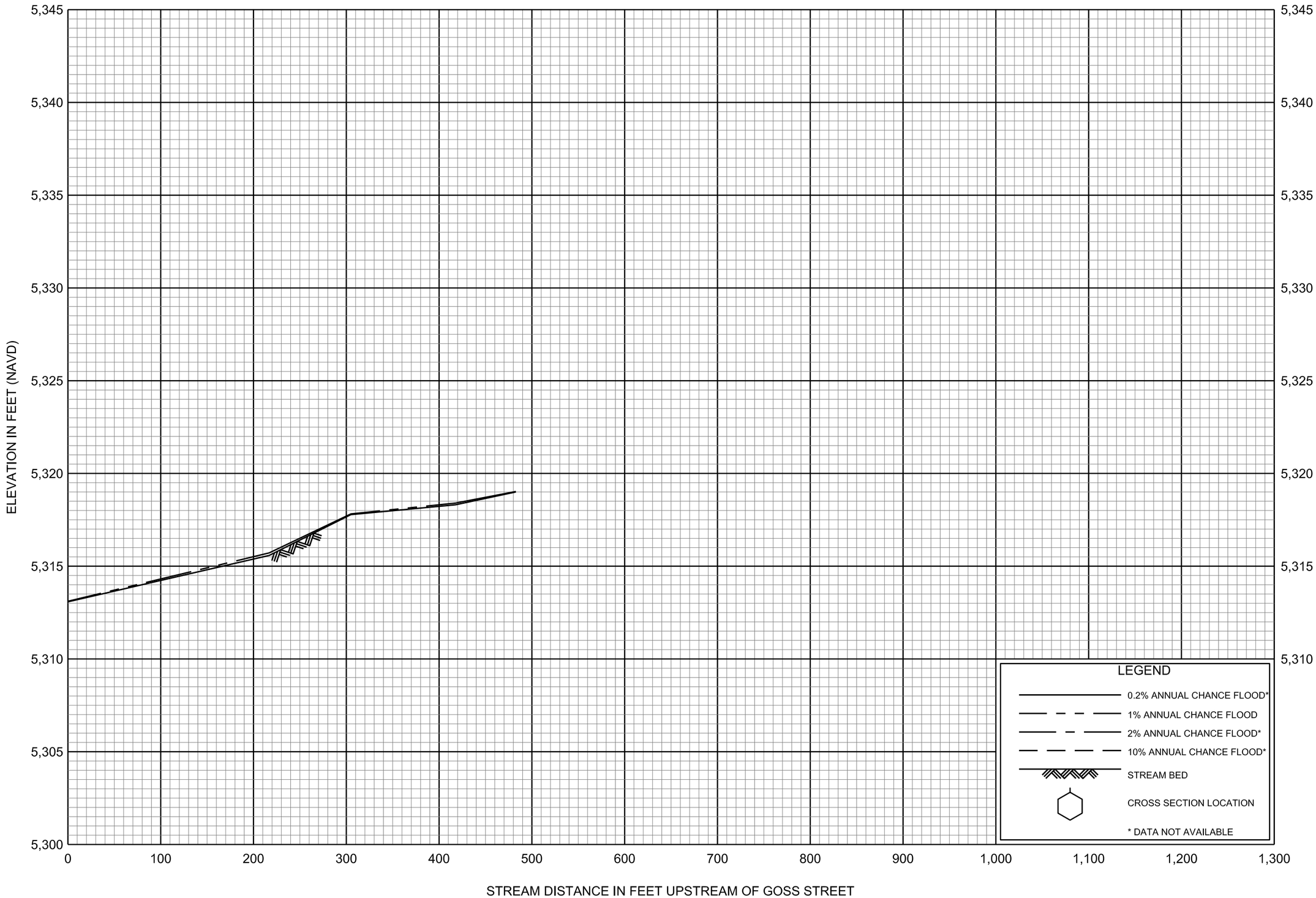
FLOOD PROFILES

BOULDER SLOUGH - 22ND STREET SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

AND INCORPORATED AREAS



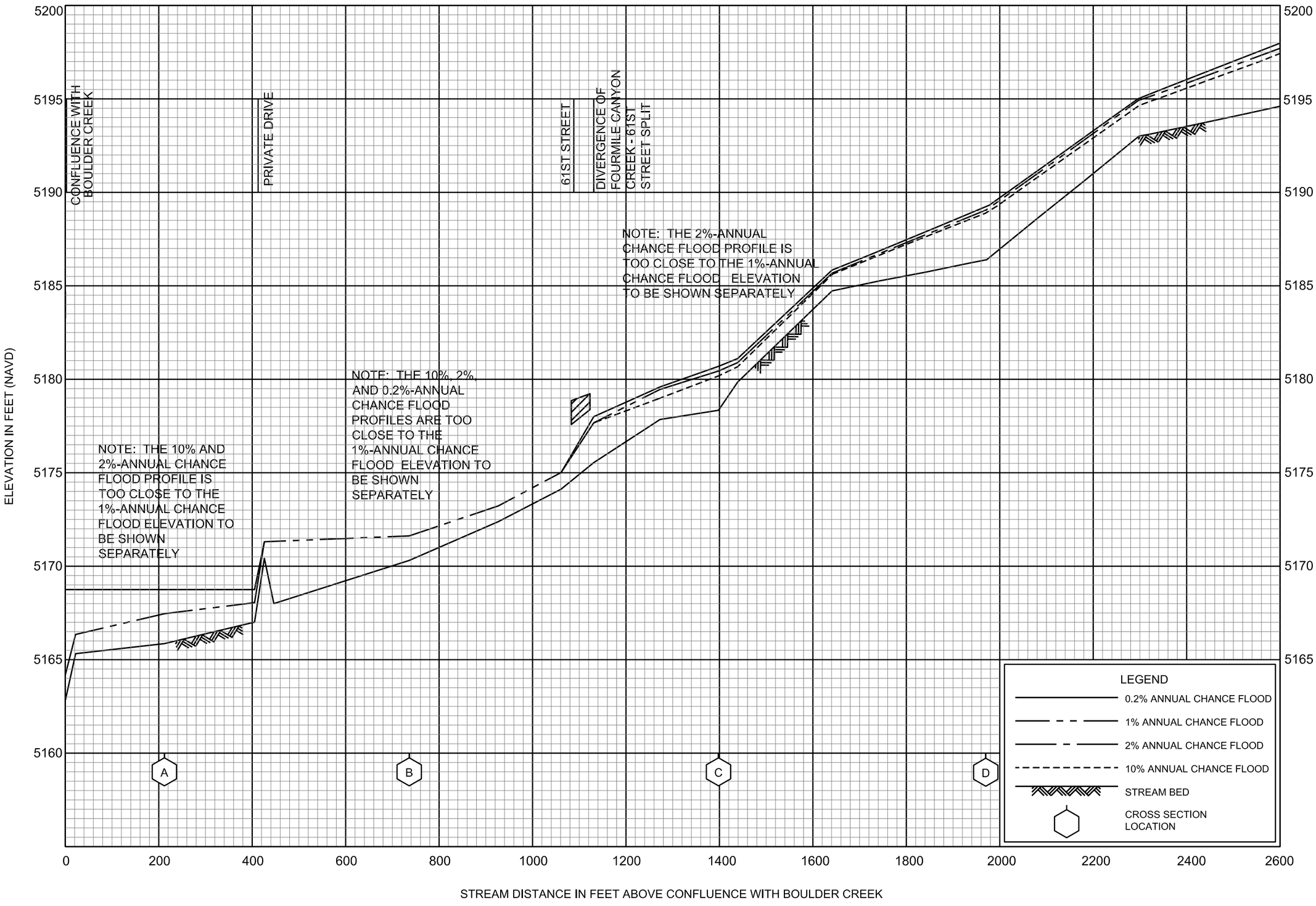
FLOOD PROFILES

BOULDER SLOUGH - GOSS ALLEY SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

AND INCORPORATED AREAS



FLOOD PROFILES

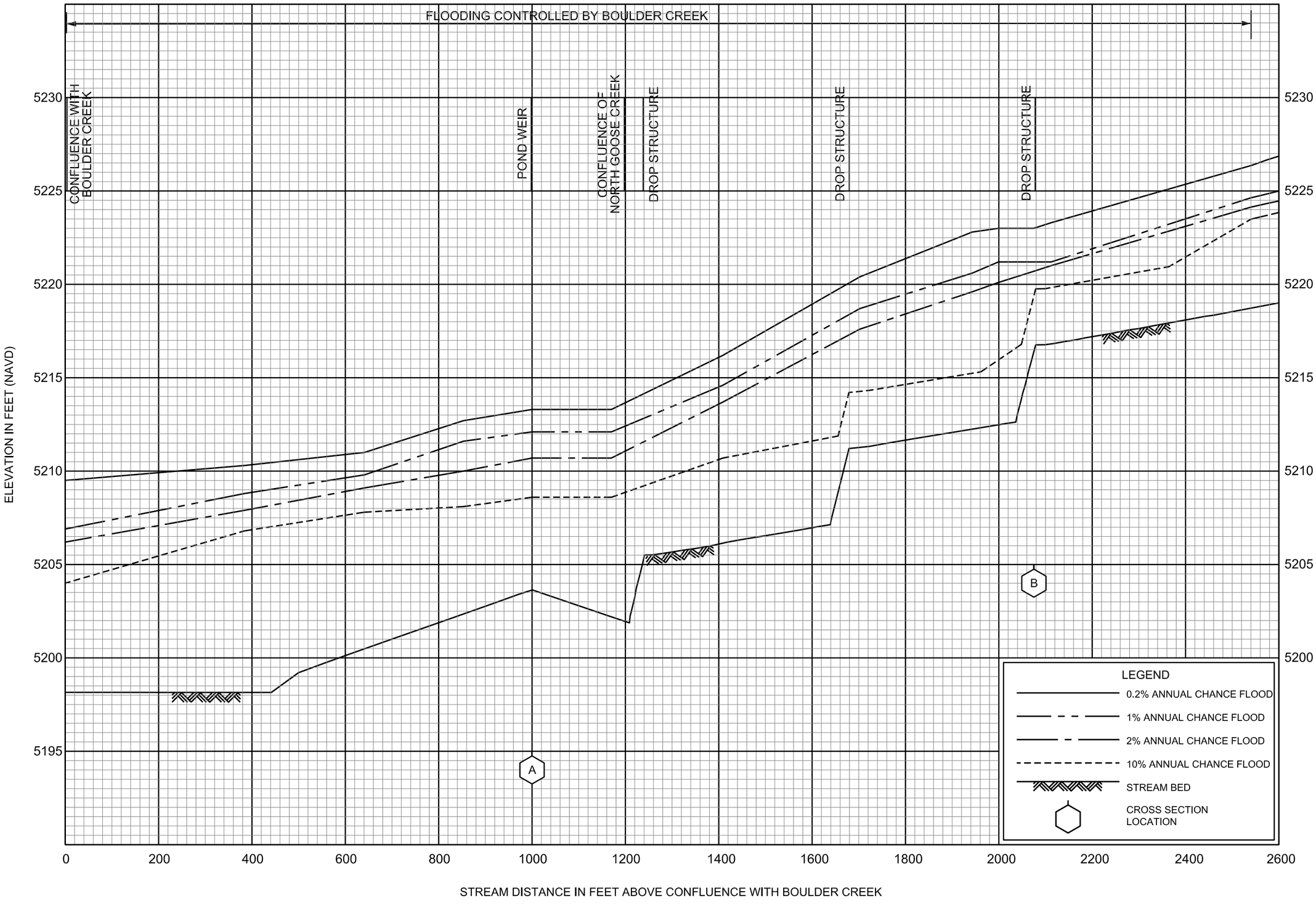
FOURMILE CANYON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

AND INCORPORATED AREAS

186P



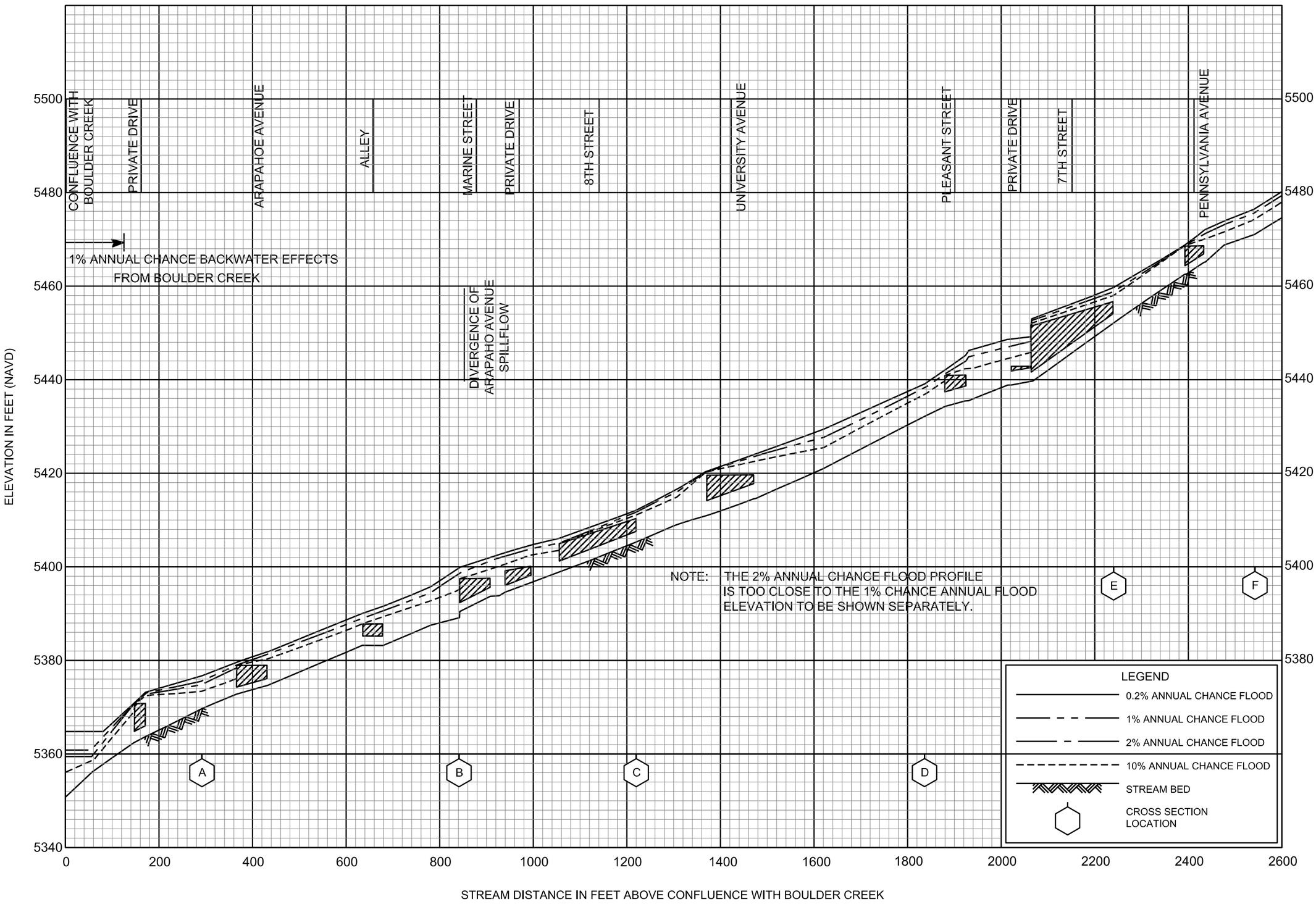
FLOOD PROFILES

GOOSE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

AND INCORPORATED AREAS



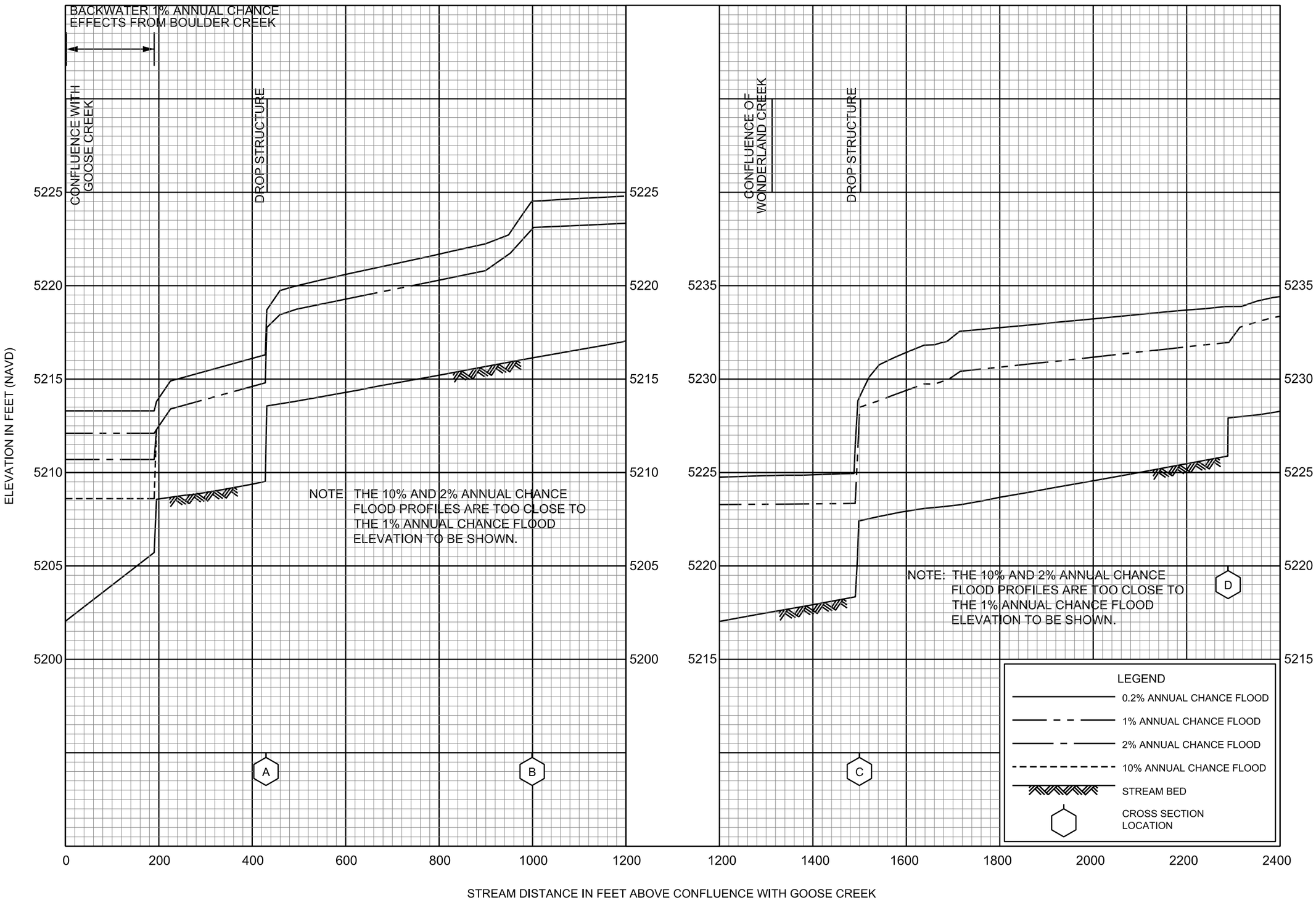
FLOOD PROFILES

GREGORY CANYON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

AND INCORPORATED AREAS



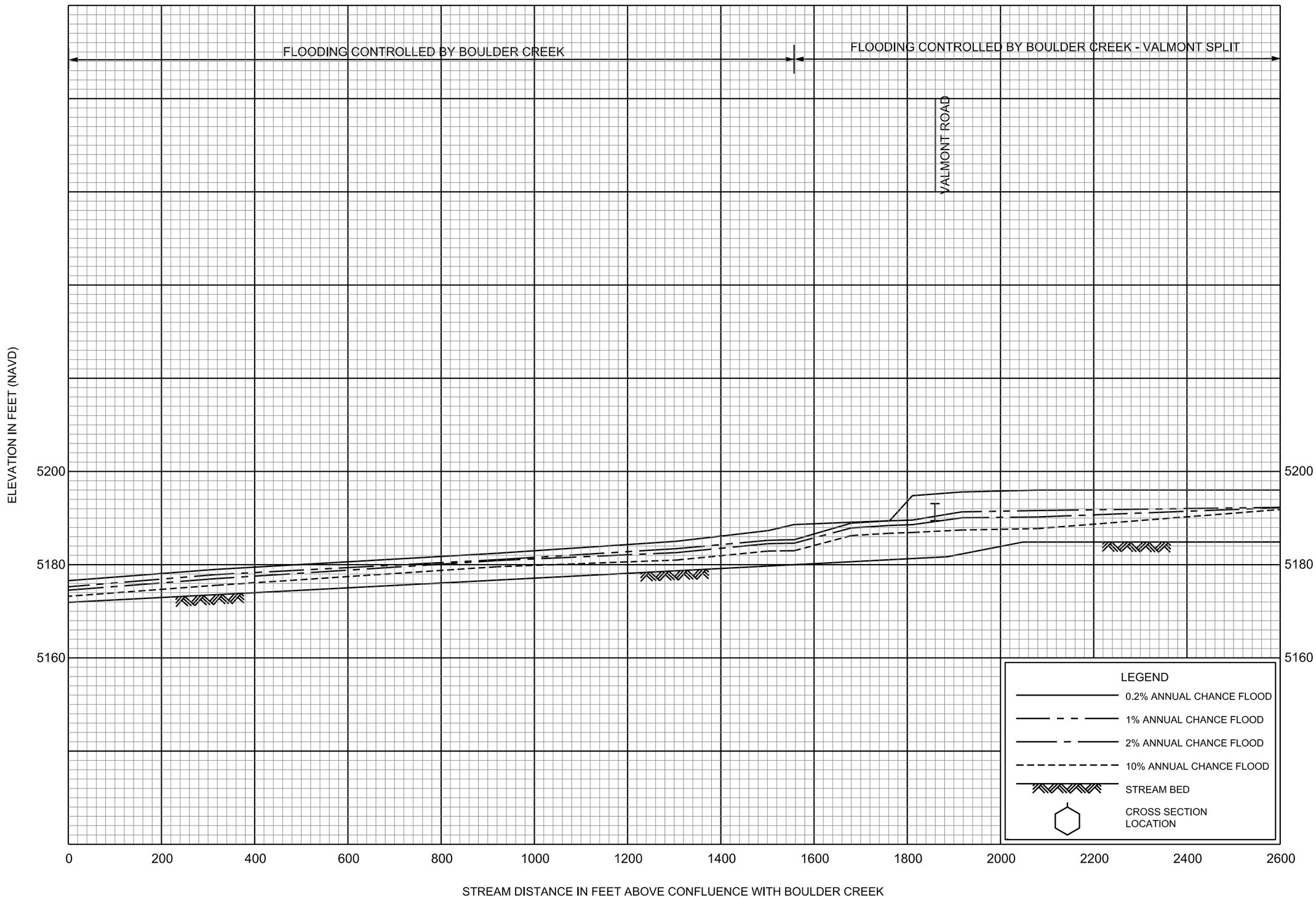
FLOOD PROFILES

NORTH GOOSE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

AND INCORPORATED AREAS



FLOOD PROFILES

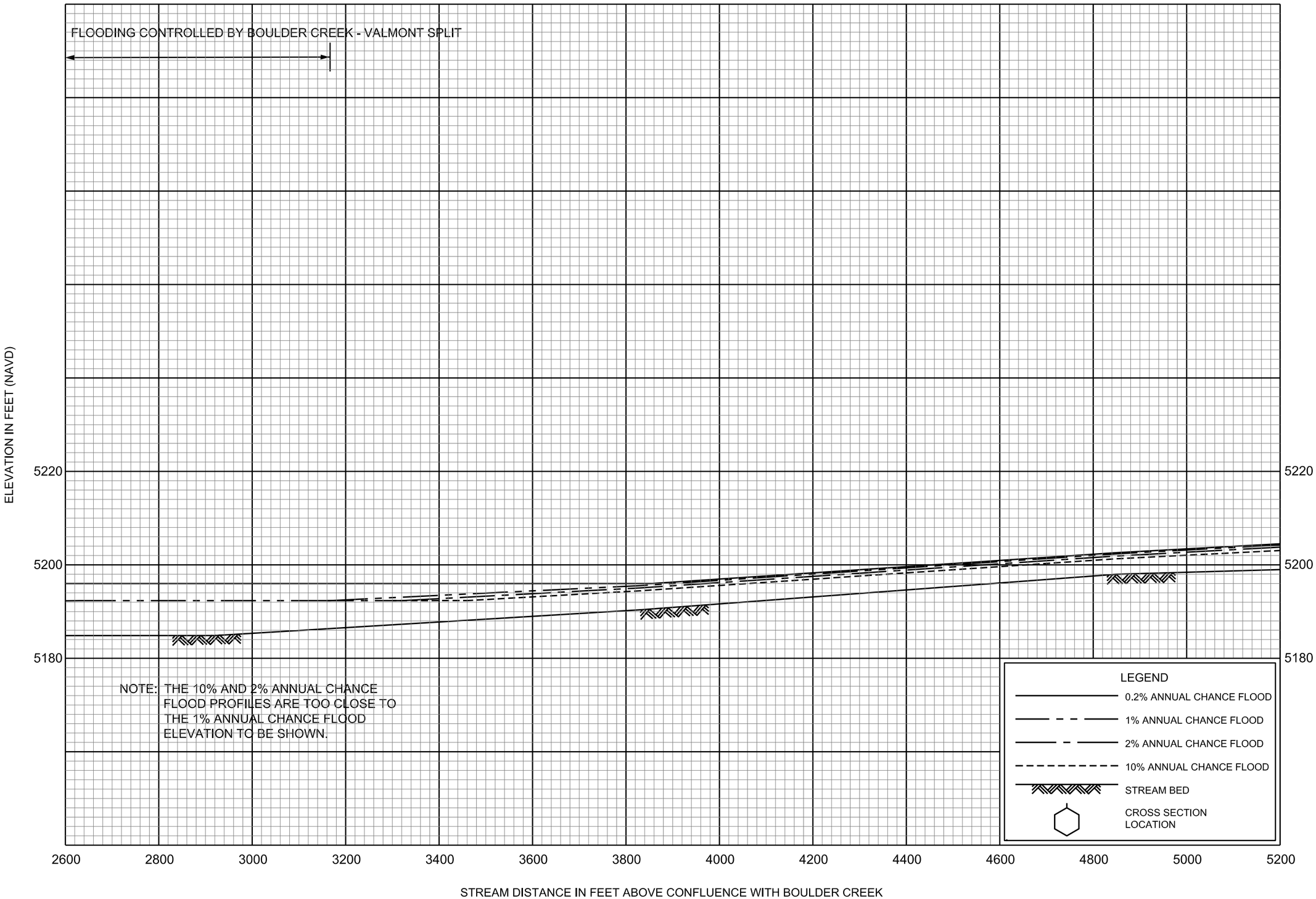
SOUTH BOULDER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

AND INCORPORATED AREAS

346P



FLOOD PROFILES

SOUTH BOULDER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOULDER COUNTY, CO

AND INCORPORATED AREAS