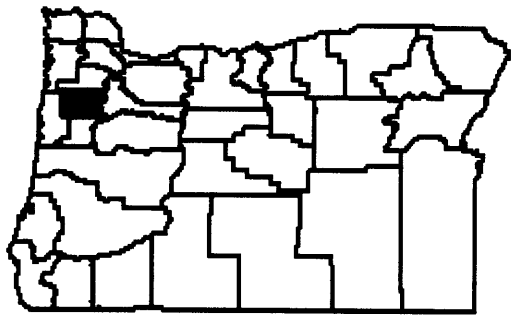
FLOOD INSURANCE STUDY

POLK COUNTY, OREGON,
AND INCORPORATED AREAS



Community Name	Community Number
DALLAS, CITY OF	410187
FALLS CITY, CITY OF	410188
INDEPENDENCE, CITY OF	410189
MONMOUTH, CITY OF	410190
POLK COUNTY	
UNINCORPORATED AREAS	410186

REVISED:
DECEMBER 19, 2006

Federal Emergency Management Agency
FLOOD INSURANCE STUDY NUMBER
41053CV000A

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 may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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

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

The profiles in this Preliminary Flood Insurance Study report are presented in a reduced scale to minimize reproduction costs. All profiles will be included and printed at full scale in the final published report.

Part or all of this Flood Insurance Study may be revised and republished at any time. In addition, part of this Flood Insurance Study may be revised by the Letter of Map Revision process, which does not involve republication or redistribution of the Flood Insurance Study. It is, therefore, the responsibility of the user to consult with community officials and to check the community repository to obtain the most current Flood Insurance Study components.

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd)

Page

FIGURES

TABLES

EXHIBITS

Exhibit 1 - Flood Profiles

Exhibit 2 - Flood Insurance Rate Map Index
Flood Insurance Rate Map

FLOOD INSURANCE STUDY
POLK COUNTY, OREGON AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study (FIS) revises and updates information on the existence and severity of flood hazards in the geographic area of Polk County, Oregon, including the Cities of Dallas, Falls City, Independence, Monmouth, and the unincorporated areas of Polk County (referred to collectively herein as Polk 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 and to assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

Please note that the City of Salem is geographically located in Polk and Marion Counties. The flood-hazard information for the City of Salem is for information purposes only. See separately published FIS report and Flood Insurance Rate Map (FIRM).

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 FIS are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for the Willamette River adjacent to the City of Salem and Marion County were performed by CH2M Hill, Inc., for the Federal Insurance Administration (FIA), under Contract No. H-3994. This work, which was completed in October 1977, was prepared for the Marion County and City of Salem FIS reports.

The hydrologic and hydraulic analyses for the Willamette River downstream of Benton County were performed by the U.S. Army Corps of Engineers (USACE), Portland District, for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. H-18-78, Project Order No. 21. This study, which was completed in December 1980, was prepared for the Benton County FIS.

The hydrologic and hydraulic analyses for portions of South Yamhill River were performed by the USACE, Portland District, for FEMA, under Inter-Agency Agreement No. H-10-77. This work, which was completed in January 1981, was prepared for the Yamhill County FIS.

The hydrologic and hydraulic analyses for Ash Creek and its tributaries were performed by the U.S. Soil Conservation Service (SCS).

Additional hydrologic and hydraulic analyses for this study were performed by Ogden Beeman and Associates, Inc., for the FEMA, under Contract No. EMW-84-C-1658. This study was completed in March 1986, and covered portions of the Willamette River, South Yamhill River and Rickreall Creek.

The hydrologic and hydraulic analyses for the remaining flooding sources in this study were performed by the SCS, Portland, Oregon, for the Federal Insurance Administration, under Inter-Agency Agreement No. IAA-H-16-72, Project Order No. 17. This work, which was completed in August 1973, covered flooding sources affecting the unincorporated areas of Polk County with the exception of streams studied by approximate methods. Approximate flood boundaries for these streams were determined in January 1976 by Dames & Moore, under contract to the FIA.

1.3 Coordination

The final coordination meeting for the previous FIS for the unincorporated areas of Polk County was held on July 23, 1976.

Initial community coordination meetings were held April 5 and 6, 1984, with representatives of Polk County; the Cities of Dallas, Independence, and Monmouth; FEMA; the SCS; and the Study Contractor (SC). The meetings were held to identify streams requiring detailed study or reanalyses, to discuss and agree upon the study, scope, and to identify available data.

Results of the hydrologic analyses for this study were coordinated with Polk County; the Cities of Dallas, Independence, and Monmouth; the Oregon Department of Water Resources; the Oregon Department of Land Conservation and Development; the U.S. Geological Survey (USGS); the SCS; and the USACE.

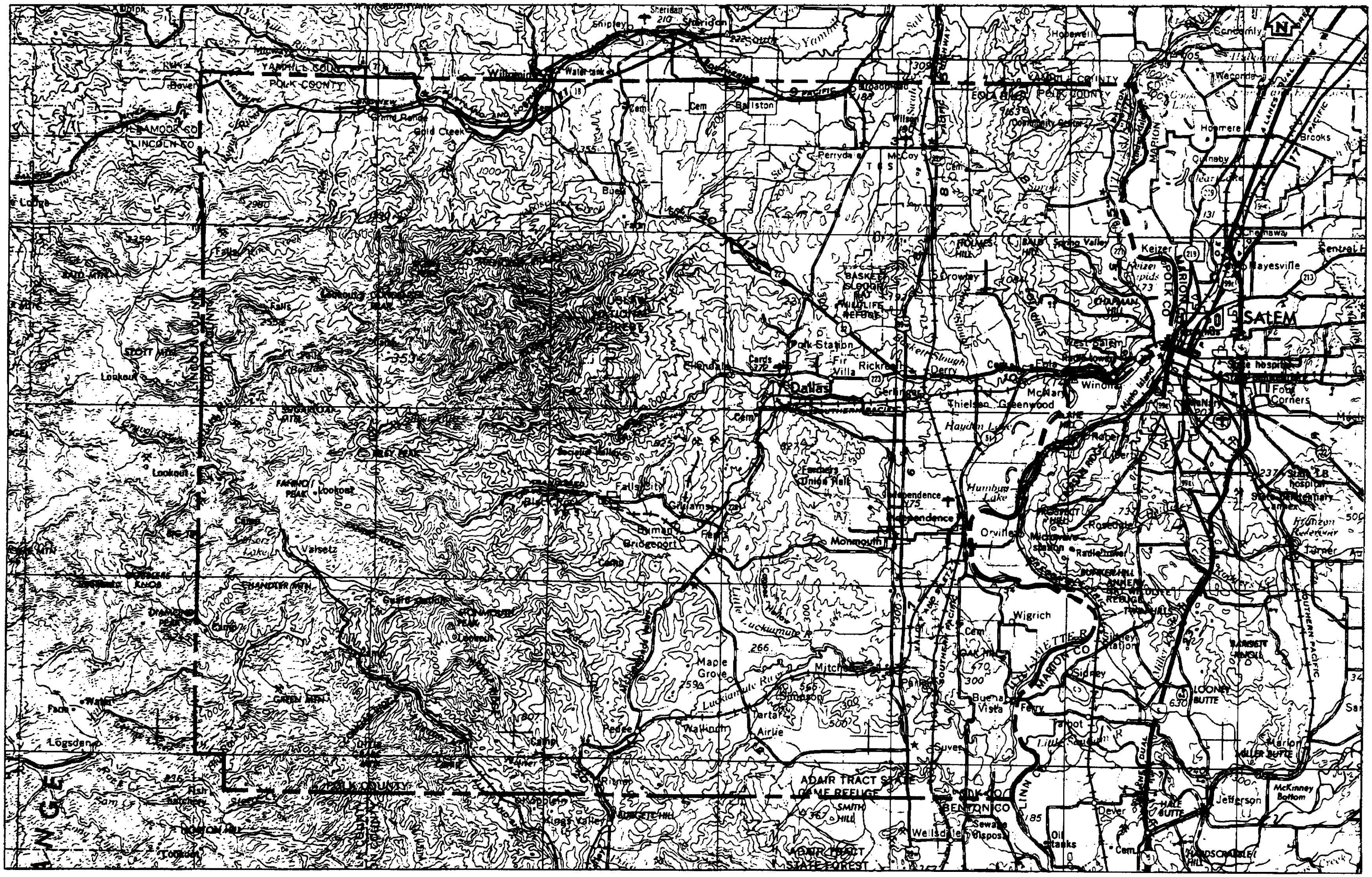
Intermediate community coordination meetings to discuss the results of the analyses were held on April 23 and 24, 1986, for Polk County and the Cities of Dallas, Independence, and Monmouth. The meetings were attended by representatives of Polk County; the Cities of Dallas, Independence, and Monmouth; FEMA; and the SC.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS covers the geographic area of Polk County, Oregon, including the incorporated communities listed in Section 1.1. The area of study is shown on the Vicinity Map (Figure 1).

The study limits for flooding sources studied by detailed methods are listed in Table 1.



FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR AND INCORPORATED AREAS

APPROXIMATE SCALE

3.2 0 3.2 6.4 9.6 MILES

VICINITY MAP

FIGURE 1

Table 1. Summary of Detailed Flooding Sources

Flooding Source	Limits of Study
Willamette River	River Mile (RM) 77.0 to RM 89.4; RM 94.7 to RM 96.7; RM 109.0 to RM 110.6 (County Boundary)
South Yamhill River	RM 43.9 to RM 56.3
Rickreall Creek	Mouth to RM 19.0
Ash Creek	Mouth to Confluence of North Fork Ash Creek and Middle Fork Ash Creek
Agency Creek	Confluence with South Yamhill River to the County Boundary
South Fork Ash Creek	Confluence with Ash Creek to RM 0.5; RM 3.4 (Hemlick Road) to RM 4.2
North Fork Ash Creek	Confluence with Ash Creek To RM 0.5 (Hoffman Road); RM 6.9 to RM 8.0 (Uglow Street); RM 8.4 (Main Street at Dallas) to Kings Valley Highway
Middle Fork Ash Creek	Confluence with Ash Creek to approximately 2,000 feet (ft.) upstream of Riddell Road
North Fork Tributary	From approximately 1,000 ft. above the confluence with North Fork Ash Creek to approximately 500 ft. upstream of Monmouth Cutoff Highway
Middle Fork Tributary	Upstream from the confluence of Middle Fork Ash Creek to a point approximately 900 ft. above the confluence
Rowell Creek	Upstream from the confluence with South Yamhill River to a point approximately 2,900 ft. above the confluence
Rock Creek	Confluence with South Yamhill River to County Road 687 Bridge

The detailed analyses for Rowell and Rock Creeks were taken from the previous FIS for the unincorporated areas of Polk County (Reference 1).

The detailed analyses of the Willamette River at the City of Independence (RM 94.7 to RM 96.7) were performed by the SC, Odgen Beeman and Associates, Inc. The Willamette River detailed study from RM 77.0 to RM 89 was taken from data used to prepare the Marion County and City of Salem FIS reports (References 2 and 3). The Willamette River detailed study from RM 109.0 to the county boundary was taken from data used to prepare the Benton County and Linn County FIS reports (References 4 and 5).

The detailed analyses of the South Yamhill River downstream of RM 44.5 and upstream of RM 51.3 were taken from data used to prepare the Yamhill County and City of Willamina FIS reports (References 6 and 7). The detailed analyses on Agency Creek were taken from the Yamhill County FIS (Reference 6).

The detailed analyses for Ash Creek, the North and Middle Forks of Ash Creek, North and Middle Fork Tributaries, and the downstream reach of South Fork Ash Creek were taken from a 1985 floodplain management study prepared by the SCS (Reference 8). This area was restudied as documented in Section 10.3.

The areas studied by detailed methods were selected with priority given to all known flood hazards and areas of projected development or proposed construction through March 1991.

2.2 Community Description

Polk County is located in the central portion of the Willamette River Basin in Northwestern Oregon. The county is bounded on the east by the Willamette River (Marion and Linn Counties), on the west generally by the Coast Range Mountains (Lincoln and Tillamook Counties), on the north by Yamhill County, and on the south by Benton County. Polk County includes the incorporated communities of the Cities of Dallas, Independence, Monmouth, Falls City, Willamina, and a portion of the City of Salem.

Polk County is approximately 33 miles (mi.) long from east to west, 24 mi. long from north to south, and has a total area of 473,600 acres. Of this total, there are 472,800 acres of land and 800 acres of water surface. The county has a range in elevation varying from 3,725 ft. on Laurel Mountain to 120 ft. along the Willamette River in the vicinity of Lincoln.

Polk County was created in 1845 by the Provisional Legislative Committee. Its county seat is at Dallas. The Willamette Valley is one of the earliest settled areas of the northwest, with large-scale immigration over the Oregon Trail by the mid-1840s.

The population of Polk County was 35,349 in 1970, 45,203 in 1980, 49,541 in 1990, and 62,380 in 2000 as reported by the U.S. Bureau of the Census. Approximately 72 percent of Polk County's population resides in the urban areas of Dallas, Falls City, Independence, a portion of the City of Salem (West Salem), and Willamina (Reference 9).

Most of the floodplain in Polk County is used for agricultural production, but residential development has encroached upon portions along the streambanks. Major industries in the county are agriculture, lumber and wood products, and manufacturing.

The City of Dallas is located in central Polk County. It is situated at the approximate middle of the Willamette River Valley, about 70 mi. southwest of Portland, Oregon, and 15 mi. west of Salem, Oregon. Settlement of the area began in the early 1840s. In 1850 the town site of Cynthian (or Cynthia Ann, by some historians) on the north side of Rickreall Creek was established as the Polk County seat. The town site was moved about a mile southward in 1856, and its name later changed to Dallas.

Dallas is the largest urban center in Polk County, with the exception of West Salem, with a 1980 population of 8,590. The population for the year 2000 was 12,451 (References 9 and 10). Dallas has a diversified economy that includes two major industries: local, State, and federal offices; and a variety of smaller manufacturing, retail, and service establishments.

Incorporated in 1874, the City of Independence is located along the west bank of the Willamette River. It is approximately 12 mi. southwest of Salem, Oregon, and 10 mi. southwest of Dallas. Independence is bordered on the east by Willamette River and is adjacent to the City of Monmouth to the west.

The lower reaches of Ash Creek Basin flow through Independence to its confluence with the Willamette River within the city. Total land area within Independence corporate limits in 1979 was 1743 acres, of which 470 acres were developed (Reference 11). Approximately 300 acres are situated in the floodplain along the Willamette River and lower reaches of Ash Creek Basin (Reference 11). Main Street parallels the Willamette River and essentially separates the related floodplain from the higher elevation within the city. A State-designated Greenway area occupies a strip of shoreline along the Willamette River for the full length of the city. The purpose of the Willamette Greenway is to protect, conserve, enhance, and maintain the natural, scenic, historical, agricultural, economic, and recreational qualities of land along the Willamette River.

The city on Monmouth is located in Eastern Polk County in the Willamette River Valley. Founded in 1881, the city's 1980 population was 5,600. The population for the year 2000 was 7,741(References 9 and 12). Monmouth is the site of Western Oregon State College.

The City of Salem is located in Western Marion and Eastern Polk Counties, along the Willamette River Valley. Marion County, the center of early missionary activity, was created by a provisional government legislative committee on July 5, 1843, 16 years before Oregon obtained statehood. The present Marion County boundary, encompassing 1,125 square miles (sq. mi.), was established in 1856. Salem was designated the county seat and later became the State capital. Salem has incorporated areas of approximately 34.5 sq. mi., which is platted on both banks of the Willamette River. In 1979, the total population of Marion and Polk Counties was 237,000. Almost 40 percent of the population, about 89,000, lived in Salem. Salem is one of the fastest growing cities in Oregon. Population in Polk County, except for West Salem, has leveled off after rapid expansion following World War II (Reference 2).

The City of Willamina is at the southern boundary of Yamhill County, in northwestern Oregon. The southern part of the city is in Polk County. The city is approximately 50 mi. southwest of Portland, Oregon, and approximately 23 mi. southwest of McMinnville, the Yamhill County seat. The area was settled in the 1850s, and the Willamina Post Office was established in May 1855. Willamina was incorporated in 1903, and its population increased from 1,193 in 1970 to 1,445 in 1978 (Reference 13). Economic activities include agriculture, lumber and plywood mills, and retail and support services. Most commercial development is along Main Street, with lumber and plywood mills on the western and eastern sides of the city (Reference 7).

The Willamette River drains a total of 11,200 sq. mi. in northwestern Oregon. The river, originating at the confluence of the Middle and Coast Forks just upstream from Eugene, meanders northward through the Willamette Valley a distance of 187 mi. before discharging into the Columbia River north of Portland. Its tributaries originate in the foothills and mountains of the Coast and Cascade Ranges.

Topographically, the county is comprised of three main divisions: stream bottoms and low alluvial areas along the Willamette River, the valley floor and related benchlands, and hilly and mountainous areas. Most of the study area lies within the Willamette Valley lowland physiographic province, geologically formed by erosion and subsequent alluvial deposits. Consequently, floodplain configurations in lower drainages, such as Rickreall Creek below the City of Dallas, tend to be widespread and somewhat oriented to the historic Willamette River floodplain.

Polk County has a moderate marine forest climate, with clear, dry, moderately warm summers and wet, generally mild winters. Precipitation is mostly in the form of rain from storms originating over the Pacific Ocean. Mean annual precipitation ranges from over 200 inches (in.) in the mountains west of Dallas to 90 in. at the base of the mountains, and as low as 40 in. along the Willamette River.

At Dallas, the mean annual precipitation is approximately 51 in., the mean daily maximum temperature is 83 degrees Fahrenheit (°F) in July, and the 0 mean daily minimum temperature is 33°F in January. The nearest climatological data station representative of Independence is located in Salem. Records there show daily mean temperatures are a high of 66.6°F in July, and a low of 38.8°F in January.

Precipitation amounts to about 41 in. annually, with about 7 in. of snowfall each year. Mean annual precipitation at Monmouth is approximately 45 in. Average annual precipitation for Willamina is 53 in., with approximately 75 percent falling from November through March (Reference 14). Average annual snowfall is 13 in., with most occurring in January (Reference 15).

2.3 Principal Flood Problems

Flood season in the Willamette River Basin extends from October through April, with most major floods occurring in December and January. Floods in the areas are normally general in extent rather than limited to a few streams. They are caused primarily by heavy rainfall, sometimes augmented by snowmelt, at a time when the soil is saturated by prior rainfall or is frozen. The Willamette River remains above bankfull stage for up to 10 days following

a major flood, while smaller tributaries recede in 4 or 5 days. Floodwaters may remain standing in the floodplain for several days after streams recede.

Damage from flooding in Polk County is mainly to farmlands, largely in terms of flooded crops and pastures and fields and bank erosion. However, there is some flooding nearly every year; this results in damage to roads and bridges necessitating increased maintenance and repair patrols during flooding.

The largest flood on record on the Willamette River occurred in 1861 with an estimated peak flow of 500,000 cubic feet per second (cfs) at Salem (Reference 16). Many large floods have occurred since then. The December 1964 flood, unregulated, would have been the largest Willamette River flood since 1861. However, operation of seven upstream flood control storage dams reduced its estimated potential 472,000 cfs flow to 309,000 cfs and its flood level by 7 ft. at Salem.

Observed stages during the 1964 flood were considerably lower at Salem because seven flood control storage dams (one on the North Santiam River and six on tributaries in the upper Willamette Basin)were operating at that time. Flood elevations on the Willametter River at Salem were still high enough to cause extensive damage. The sewage plant was inundated and downtown stores and hotels sustained damage from storm sewers backed up by high river stages. Gravel operations and golf courses were damaged by silting and erosion. Monetary loss due to sedimentation and other damages to agricultural lands resulting from the 1964 flood amounted to approximately $355,000 in Polk County.

Other recent significant Willamette River floods with crest heights approximating 1964 flood levels in the Independence area occurred in 1943, 1945, and 1955.

On the South Yamhill River in the study area, the flood of record occurred December 22, 1964, with a peak flow of 19,600 cfs at the USGS stream gage near Wallace Bridge, about 2 mi. upstream from Willamina (records since 1934). Other large floods with peak flows exceeding 15,000 cfs were recorded at this gage in 1949, 1956, 1972, and 1974. The 1972 and 1974 floods had peak discharges of 16,800 cfs and 15,200 cfs and approximated return periods of 25 and 20 years, respectively (Reference 7).

The greatest recorded flood on Rickreall Creek occurred December 22, 1964, with a peak flow of 7,160 cfs measured at USGS Gage No. 14190700, approximately 3 mi. upstream from Dallas (records 1958-1978). The next greatest peak flows at the USGS gage were 4,700 and 4,800 cfs recorded in January 1972, and December 1975. The 1964 flood washed out a stream gage located at the Town of Rickreall near RM 8.2.

The December 1964 floodflow of 7,160 cfs approximates the computed 1-percent-annual-chance flood of 7,500 cfs at the USGS Dallas gage. The city park was flooded, and a logjam at Levens Street Bridge caused Rickreall Creek to back up and flow down city streets north of the creek channel. Bank erosion and floodwaters advanced through backyards of city residences and threatened homes. The 1964 flood caused approximately $60,000 in damages to local bridges, including the park footbridge, stream bank protection, streets, and utilities in the City of Dallas (Reference 17). The January 1972 flood also inundated a portion of the city park and backyards.

During the 1964 flood, damages from flooding were high in farmlands surrounding Independence. A flood evacuation center set up at Independence City Hall provided refuge for more than 50 persons whose homes were lost or threatened. Minor flood damages occurred in the Willamette River floodway fringe east of Main Street where the city's water treatment plant was threatened and commercial aggregate operations and some basement and lower story areas were flooded. On the west side of town, Ash Creek flooding was compounded by Willamette River backwater. This caused a log-pond dike failure on Ash Creek, which resulted in property damages as logs and debris spilled through flooded city streets.

The Ash Creek Basin has experienced varying degrees of flooding from several storms in the past 30 years. Damaging floods are usually caused by winter storms associated with frontal activity that brings heavy rain on already wet soil. Major storms occurred in this area in December 1955, December 1964, January 1965, January 1972, and January 1974. Flooding occurs at some points in Ash Creek annually. The larger storms of December 1964 and January 1972 caused extensive flooding in the valley with much agricultural land and several homes damaged.

Prior to stream improvements in 1984 within the City of Monmouth, overbank flooding of South Fork Ash Creek within the study area reportedly occurred several times each year. This caused a continuing problem of overbank fill erosion and streambed and bank deterioration. A local channel improvement project was constructed in 1984 to reduce these flooding problems.

2.4 Flood Protection Measures

In 1938, Congress authorized the comprehensive Willamette River Basin Project, which initially provided for seven flood control reservoirs. With additional authorizations, 13 multipurpose dams now help regulate floodflows in approximately 42 percent of the drainage basin upstream from Salem near Independence. These projects are operated by the USACE, Portland District, to significantly reduce flooding on the Willamette River. With such regulation, the USACE estimates that the unregulated 100 year natural floodflow of 445,000 cfs for the Willamette River at Salem is reduced to 280,000 cfs (Reference 18).

There are no flood control structures on South Yamhill River or Rickreall Creek.

Comprehensive plans for Polk County and the Cities of Dallas, Independence, and Monmouth contain land use ordinances to regulate and manage development in the floodplain as a nonstructural means of providing flood protection (References 10-12).

The U.S. Weather Service Forecast Office in Portland, Oregon, provides flood warning and river forecast services to the Oregon Department of Emergency Services and others.

The City of Dallas implements policies and regulations to restrict floodplain development. Structures may be allowed if built to or above the 1-percent-annual-chance flood level described in the SCS's Polk County Flood Plain Report (Reference 19). In its Comprehensive Land Use Plan (Reference 10), the city is committed to adopt a floodplain ordinance upon participation in the NFIP. The City of Dallas performs periodic maintenance of the Rickreall Creek channel to remove debris and improve channel shape; this helps to reduce flood elevations by maintaining efficient flow capacity in the stream.

In 1984, local landowners in Monmouth, in cooperation with the SCS, constructed channel improvements in the study reach to reduce erosion resulting from frequent overbank flooding. The project consisted of excavating a uniform trapezoidal-shaped channel with smooth transitions to increase hydraulic capacity and to contain all but the larger floods within banks. An ongoing maintenance program is planned.

Willamina has established floodplain regulations intended to reduce future flood losses. The City adopted Zoning Ordinance No. 467 on October 26, 1978 (Reference 20), and a comprehensive plan in May 1979 (Reference 21) that covers proposed development in the floodplain. The community requires permits for proposed developments and reviews permit applications to assure that sites are reasonably free from flooding.

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-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-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 100-year flood (1-percent chance of annual exceedence) 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 peak discharge-frequency relationships for each flooding source studied by detailed methods affecting the community.

Peak discharge-frequency relationships for the Willamette River at Salem and Independence were based on curves developed by the USACE and utilized in previous contiguous FIS reports for the City of Salem (Reference 2) and Marion County (Reference 3). Floodflow on the Willamette River is regulated by operation of storage reservoirs in the basin headwaters, and the related peak flow reduction was determined by the USACE. The USACE has developed revised regulated flow estimates for 1982 conditions (Reference 18). However, the previous 1-percent-annual-chance floodflow is within the ninety (90) percent Confidence Interval of the new flow. Therefore, previous Willamette River floodflows are used to assure agreement with the most recent applicable FIS reports (References 2 and 3). Records were obtained from the USGS stream gaging station located on the Willamette River at Salem at RM 84.16, with a period of 84 years.

The hydrologic analyses for the upstream reach of the Willamette River adjacent to Benton and Linn Counties (RMs 109.0 to 110.6) were developed by the USACE for the Benton County and Linn County FIS reports (References 4 and 5). Stream gage records for the Willamette River were statistically analyzed utilizing the standard log-Pearson Type III distribution as outlined by the Water Resources Council (Reference 22). Natural discharge-frequency curves were developed for the USGS gages on the Willamette River at Albany (Gage No. 14174000) and Harrisburg (Gage No. 14166000) using data from 1893 to 1976. Regulated discharge-frequency curves were then prepared for each gage using flood-routing computations to take upstream storage projects into account. Between the gaging stations, Willamette River regulated discharge values were derived based upon a ratio of change in drainage area.

For South Yamhill River between RMs 44.5 and 51.3, the annual peak flows for the USGS gage at Willamina (No. 14192500) were fit to the log-Pearson Type III distribution, and a weighted regional skew was applied. Forty-nine annual peaks recorded between 1934 and 1983 were used. This analysis was in accordance with guidelines from the U.S. Water Resources Council (Reference 23).

For the downstream limit of this reach, the drainage area is increased by an additional 4.36 sq. mi. to reflect the basin increment downstream of the USGS gage. Peak discharges at this point were calculated using the equation listed below from the USGS (Reference 24):

$$Q_u = Q_g (A_u/A_g)^a$$

Where: Q_u = discharge at ungaged site

Q_g = discharge at gaged site

A_u = drainage area at ungaged site

A_g = drainage area at gaged site

a = exponent from Table 1 of Reference 18

Additional discharge-frequency relationships were similarly determined on the South Yamhill River at its confluence with Gold Creek, Klees Creek, and Cosper Creek.

Peak discharges for South Yamhill River upstream of RM 51.3 and downstream of the abandoned steel bridge at RM 44.5 were developed by the USACE and included in the FIS reports for the City of Willamina and for Yamhill County (References 6 and 7).

In 1974, stream gage records at three sites in the South Yamhill River Basin were statistically analyzed using log-Pearson Type III methods, and discharge-frequency curves were developed. The three gages analyzed were South Yamhill River near Whiteson (1941-1970), South Yamhill River near Willamina (1934 through 1971), and Willamina Creek near Willamina (1935-1972). Using the results of the statistical analysis for the three gages and a regional discharge analysis, Myers rating curves were developed to obtain peak discharges for the 10-, 2-, 1-, and 0.2-percent-annual-chance flood events for South Yamhill River.

In 1977, the three gages were analyzed using additional years of record and computed probability. Standard log-Pearson Type III analyses were used as outlined by the U.S. Water Resources Council (Reference 22). However, the 1974 discharges for South Yamhill River still fell within the 90 percent confidence band. The 1974 discharges and the related flood profiles and flood boundaries have been used in this study area.

For Rickreall Creek, stage-discharge records for two stream gages were analyzed to determine basic floodflow frequency relationships: the USGS gage near Dallas (No. 14190700, 1958 to 1978), and the Oregon Water Resources Gage at Rickreall (No. 14190800, 1965-1984). These data were correlated with stage discharge records for Luckiamute River at Suver (No. 14190500) to provide additional equivalent years of record and were fitted to a log-Pearson Type III distribution in accordance with Water Resources Council guidelines (Reference 23).

Floodflows at Ellendale Creek were determined using the USGS drainage area relationship equation (Reference 24), except that the exponent "a" was specifically derived to fit the above Rickreall Creek stream gage data.

There is a substantial ungaged tributary basin at Baskett Slough in Rickreall Creek downstream from the USGS gage at Rickreall. Floodflows for the downstream ungaged tributary areas were determined using regionalized methodology developed by the USGS and the Oregon State Highway Department (Reference 24) with the 0.2-percent-annual-chance flows extrapolated by log-curve fitting using regression analyses. Tributary flow peaks were assumed coincident with corresponding year peak flows on Rickreall Creek.

For Agency Creek, the modified SCS method for rainfall-runoff and unit hydrograph determination (Reference 25) was used because there were no available gage data. This method develops peak discharges for selected recurrence intervals based on precipitation records, drainage area, soil characteristics, and land use patterns.

There are no stream gaging stations or records for the upstream reach of South Fork Ash Creek (above Helmick Road). Discharge-frequency relationships were derived using regionalized methodology developed by the USGS and the Oregon State Highway Department (Reference 23). This method essentially relates floodflows to drainage basin area and intensity of precipitation based on regression analyses of extensive hydrologic data in western Oregon. Drainage basin area was determined from USGS topographic maps (Reference 26). The 0.2-percent-annual-chance flow was extrapolated by log-curve fitting. This is consistent with the approach and results of similar work for South Fork Ash Creek by the City of Monmouth and the SCS (References 27-30).

Peak discharges for the remaining detailed flooding sources within the Ash Creek Basin were determined in a 1985 SCS floodplain management study (Reference 8). Fourteen stream gages were investigated for use in a regional frequency analysis. Three of the gage records were dropped due to large drainage area or short gage record. The 11 stream gages used in developing the discharge-frequency relationship drain areas were between the crest of the Coast Range and the Willamette River. Discharge-frequency relationships were developed for each gage using the log-Pearson Type III statistical procedures (Reference 23). Regression equations of peak discharge-drainage area were developed for several frequencies of storm using the discharge-frequency of the 11 gages.

For the ungaged streams Rowell Creek and Rock Creek, their maximum floodplain geomorphic surface was correlated with the equivalent floodplain on gaged streams to determine the area expected to be flooded in a 1-percent-annual-chance event. Discharges for the 0.2-percent-annual-chance floods were determined by straight line extrapolation of a single-log graph of flood discharges computed for frequencies up to 100 years (Reference 1).

Peak discharge-drainage area relationships for Willamette River, South Yamhill River, Rickreall Creek, Agency Creek, and Ash Creek and its tributaries are shown in Table 2, Summary of Discharges.

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 FIRM represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles or in the Floodway Data tables in the FIS report. Flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS in conjunction with the data shown on the FIRM.

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.

Bank-to-bank cross sections, including below-water portions for the backwater analyses of Willamette River at Independence, South Yamhill River (RM 44.5 to RM 51.3), Rickreall Creek, and South Fork Ash Creek above Helmick Road, were obtained by field survey. Overbank cross sections were derived from aerial photographs, flown in November 1984, at a negative scale of 1:4,800 (References 31-34). All bridges were field surveyed to obtain structural geometry.

A completed cross section along the upstream reach of South Fork Ash Creek was assumed for a farm road culvert system under construction at the time of the field survey. Backwater analysis shows that this culvert installation, when completed, will not have adequate hydraulic capacity to pass floodwaters of the selected recurrence intervals, resulting in weir flow overtopping of the road and increased backwater elevations upstream.

The hydraulic analyses for the Willamette River from the mouth of Rickreall Creek to downstream of Salem were taken from data developed for the City of Salem and Marion County FIS reports (References 2-3). Cross sections within Salem were obtained from the USACE. Cross sections downstream and upstream of Salem, adjacent to Marion County, were compiled using field surveying methods.

Table 2. Summary of Discharges

Flooding Source and Location	Drainage Area (Sq. Mi.)	Peak Discharges (cfs) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
Willamette River					
At City of Salem	7,280.0	190,000	250,000	280,000	363,000
At USGS Albany Gage No. 14174000	4,840.0	117,000	172,000	200,000	272,000
South Yamhill River					
At Mouth	523.0	39,000	52,000	59,500	77,000
At Abandoned Steel Bridge Near City of Willamina (River Mile 44.5)	137.3	14,500	18,100	19,400	22,600
At USGS (14192500) Near Willamina (River Mile 46.6)	133.0	14,100	17,600	18,900	22,000
Downstream of Gold Creek (River Mile 48.2)	122.4	13,100	16,400	17,600	20,500
Downstream of Klees Creek (River Mile 50.2)	117.7	12,700	15,800	17,000	19,700
Downstream of Cosper Creek (River Mile 51.2)	106.9	11,600	14,500	15,600	17,900
Rickreall Creek					
At Mouth	96.9	11,700	16,600	18,800	24,100
Near Greenwood School (River Mile 4.9)	78.4	10,400	14,700	16,600	21,200
At Oregon Water Resources Department Gage No. 14190800 Near Rickreall	46.7	8,500	11,800	13,200	16,300
Downstream of Ellendale Creek	33.2	7,700	10,700	12,000	14,800
At USGS Gage No. 14190700 Near Dallas	22.4	4,900	6,800	7,500	9,400
Ash Creek					
At Mouth	—[1]	4,130	5,860	6,890	9,090
Above confluence with South Fork Ash Creek	21.31	2,320	3,280	3,860	5,100
Agency Creek	25	2,130	3,430	4,080	5,090

[1] Data Not Available

Table 2. Summary of Discharges (Cont'd)

Flooding Source and Location	Drainage Area (Sq. Mi.)	Peak Discharges (cfs) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
South Fork Ash Creek					
At Mouth	—[1]	1,470	2,080	2,450	3,230
At Helmick Road (River Mile 3.4)	6.8	720	1,060	1,210	1,540
North Fork Ash Creek					
At Monmouth	13.07	1,360	1,930	2,270	3,000
At Dallas	—[1]	490	690	810	1,070
Middle Fork Ash Creek					
At Mouth	—[1]	700	990	1,160	1,530
North Fork Tributary	—[1]	270[2]	440[2]	580[2]	770[2]
Middle Fork Tributary					
At Mouth	—[1]	60	80	100	130
Glenn Creek					
Just Downstream of Wallace Road	3.7	265	365	410	535
Just Downstream of Glenn Creek Road	2.72	210	290	325	425
Just Downstream of Confluence of Unnamed Tributary	2.15	175	245	275	355
Just Downstream of Fernwood Court Footbridge	1.79	155	215	240	260
Gibson Creek					
Just Downstream of Wallace Road	5.8	450	610	690	900
Just Upstream of Brush College Road	5.3	424	574	650	847

[1] Data Not Available
[2] Includes overflow from North Fork Ash Creek

The hydraulic analyses for South Yamhill River upstream of RM 51.3 and downstream of the abandoned steel bridge (RM 44.5) and Agency Creek were taken from data developed for the City of Willamina and Yamhill County FIS reports (References 6-7). Cross-section data were obtained from the following sources: USACE field and aerial surveys and USGS topographic information (References 35-36). All bridges, dams, and culverts were field checked to obtain elevation data and structural geometry.

Cross-section data and hydraulic analyses for Rowell Creek and Rock Creek were taken from data prepared for the previous Polk County FIS (Reference 1).

Cross sections for streams studied by detailed methods within the Ash Creek Basin, including the downstream portion of South Fork Ash Creek, were developed as part of the 1985 SCS floodplain management study (Reference 8).

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).

Flooding along the segment of Agency Creek within Polk County is controlled by backwater effects from the South Yamhill River. No profiles have been presented for this portion of Agency Creek.

The hydraulic analyses for the Willamette River reach upstream of Independence were taken from data developed for the Benton County and Linn County FIS reports (References 4-5). Water-surface profiles were determined from hydraulic rating curves. Those curves were based on crest gages established in 1964 and high-water marks recorded at the crest gages.

Water-surface profiles for Ash Creek, North and Middle Forks of Ash Creek, North Fork Tributary, Middle Fork Tributary, and the downstream reach of South Fork Ash Creek were developed using the SCS WSP2 computer program (Reference 37). Field survey data were used in this program. Roughness coefficients (Manning's "n" values) were determined by field observation and reflect the conditions in 1984.

Starting water-surface elevations (WSELs) for the mouth of Ash Creek were obtained from the USACE from prior studies of the discharge vs. elevation of the Willamette River. The elevations used from the Willamette data were of the same frequencies as the Ash Creek discharges. This assumes that both the Willamette River and Ash Creek experience the peak flow at the same time, a conservative approach. However, it is very possible that both streams would experience a given frequency flood in the same storm, although several hours or days apart. Some computations were developed using a low flood elevation for the Willamette River with the high floods on Ash Creek. These computations determined that there is no significant backwater effect from the Willamette River at Gun Club Road with an increasing backwater effect downstream to the river.

WSELs for Rowell Creek and Rock Creek were computed using the SCS WSP2 step-backwater program (Reference 37).

Starting WSELs for North, South, and Middle Forks of Ash Creek were determined from computed elevations on Ash Creek. The starting elevations for North Fork Ash Creek at Dallas were computed using normal-depth procedures. Flows over the mill dam on North Fork Ash Creek were computed by weir flow relationships and used to develop starting elevations above the dam.

For the remaining flooding sources studied by detailed methods, WSELs of floods of the selected recurrence intervals were computed using the USACE step-backwater HEC-2 computer program (Reference 38). Hydraulic roughness coefficients (Manning's "n" values) used in the hydraulic computations were chosen by engineering judgment and were based on field observations of the stream channel and overbank areas. Tabulated "n" values for the streams studied are listed in Table 3.

Starting WSELs for Willamette River were taken from the City of Salem FIS (Reference 2). Starting WSELs for South Yamhill River were taken from the Yamhill County FIS (Reference 6). Starting WSELs for Rickreall Creek and South Fork Ash Creek upstream of Helmick Road were calculated using the slope-area method.

Figures 2-12 show approximate locations of estimated Base (1-percent-annual-chance) Flood Elevations (BFEs) at bridges on the South Yamhill River, Rickreall Creek, and South Fork Ash Creek.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the 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 (NGVD). With the finalization of the North American Vertical Datum of 1988 (NAVD), many FIS reports and FIRMs are being prepared using NAVD as the referenced vertical datum.

All flood elevations shown in this FIS report and on the FIRM are referenced to NAVD. Structure and ground elevations in the community must, therefore, be referenced to NAVD. It is important to note that adjacent communities may be referenced to NGVD. This may result in differences in BFEs across the corporate limits between the communities.

Table 3. Manning's "n" Values

Flooding Source	Roughness Coefficients		
	Left Overbank	Channel	Right Overbank
Willamette River	.042 to .085	.035 to .047	.042 to .085
South Yamhill River	.06 to .50	.040 to .11	.06 to .50
Rickreall Creek	.05 to .50	.038 to .08	.05 to .50
Agency Creek	.120	.060 to .300	.120
Ash Creek	.05 to .12	.04 to .045	.05 to .12
North Fork Ash Creek	.05 to .10	.04 to .045	.05 to .10
South Fork Ash Creek	.045	.030 to 0.04	.045
Ash Creek, Overflow Channel	.05 to .10	.05 to .10	.05 to .10

FIGURE 2. South Yamhill River - 100-year elevation at Condemned Steel Bridge (at River Mile 44.51).

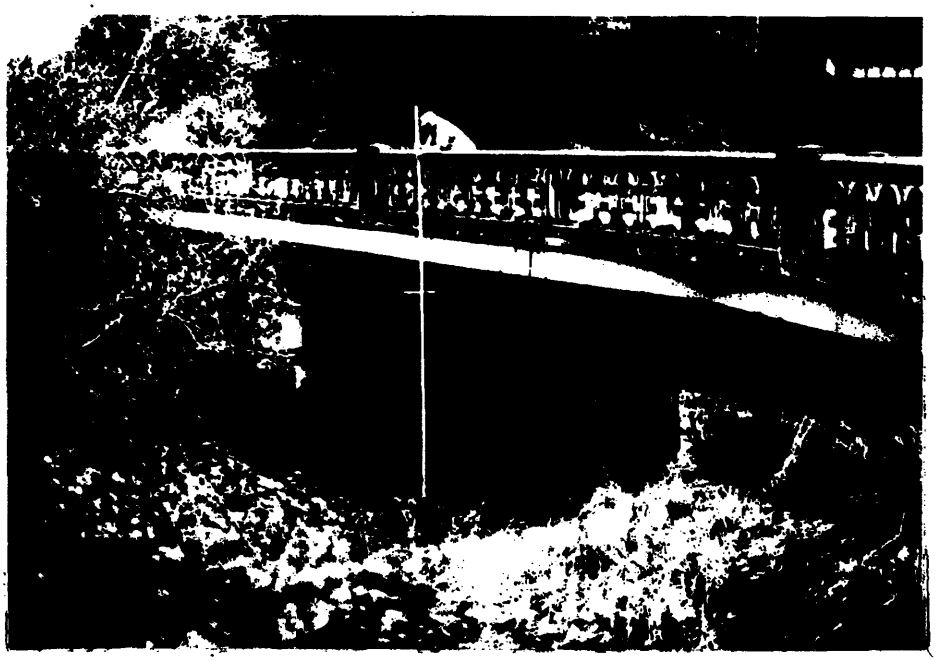


FIGURE 3. South Yamhill River - 100-year elevation at Wallace Bridge (State Highway 22), at River Mile 45.64.

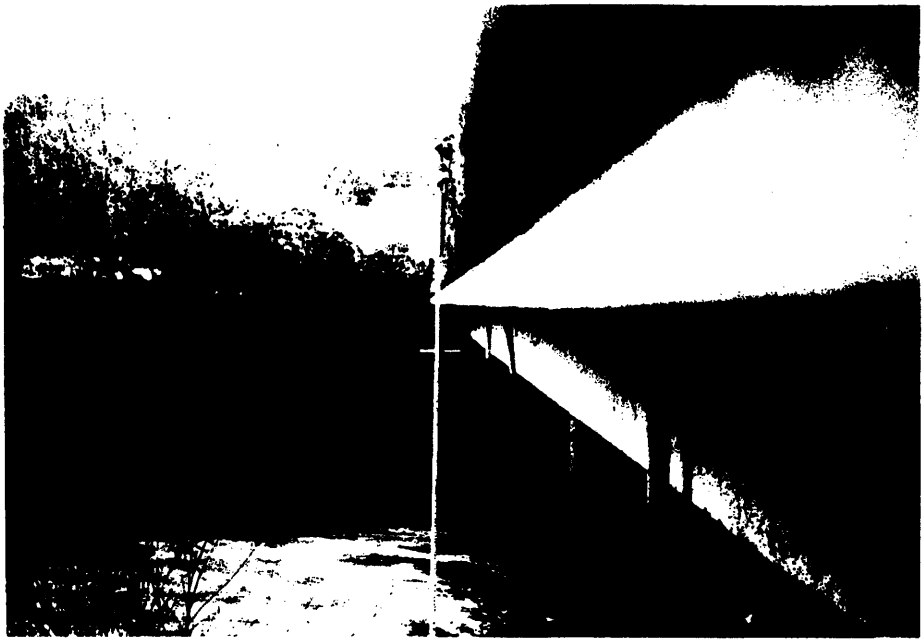


FIGURE 4. South Yamhill River - 100-year elevation at Gold Creek Road (at River Mile 48.29).

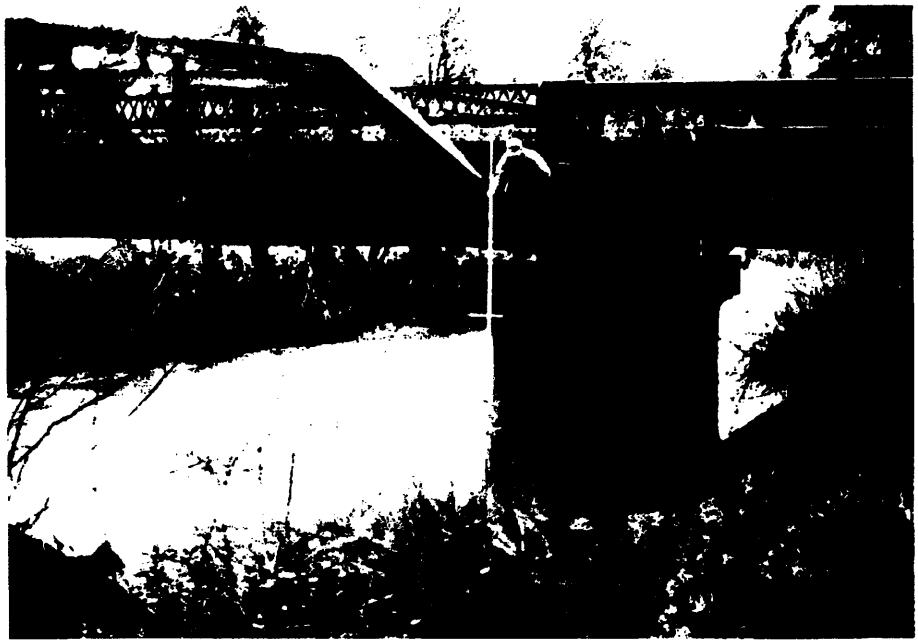


FIGURE 5. South Yamhill River - 100-year elevation at State Highways 18 and 22 (Salmon River Highway) at River Mile 51.3.

FIGURE 6. Rickreall Creek - 100-year elevation at Greenwood Road.

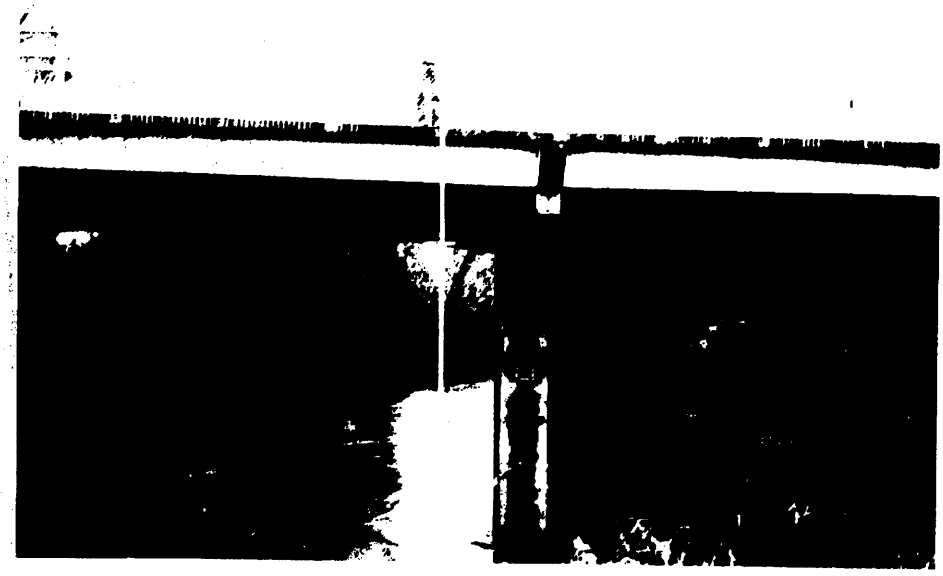


FIGURE 7. Rickreall Creek - 100-year elevation at Pacific Highway 99 West.

FIGURE 8. Rickreall Creek - 100-year elevation at Bowersville Road.

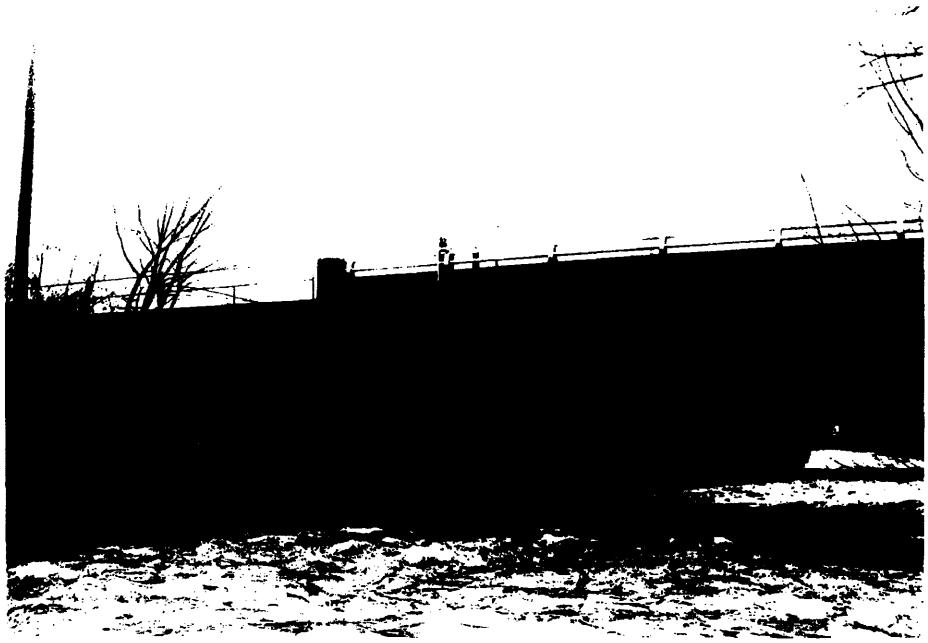


FIGURE 9. Rickreall Creek - 100-year elevation at State Highway 233 (Main Street), upstream bridge.

FIGURE 10. Rickreall Creek - 100-year elevation at Levens Street.

FIGURE 11. South Fork Ash Creek - 100-year elevation at Monmouth Highway (State Highway 51).

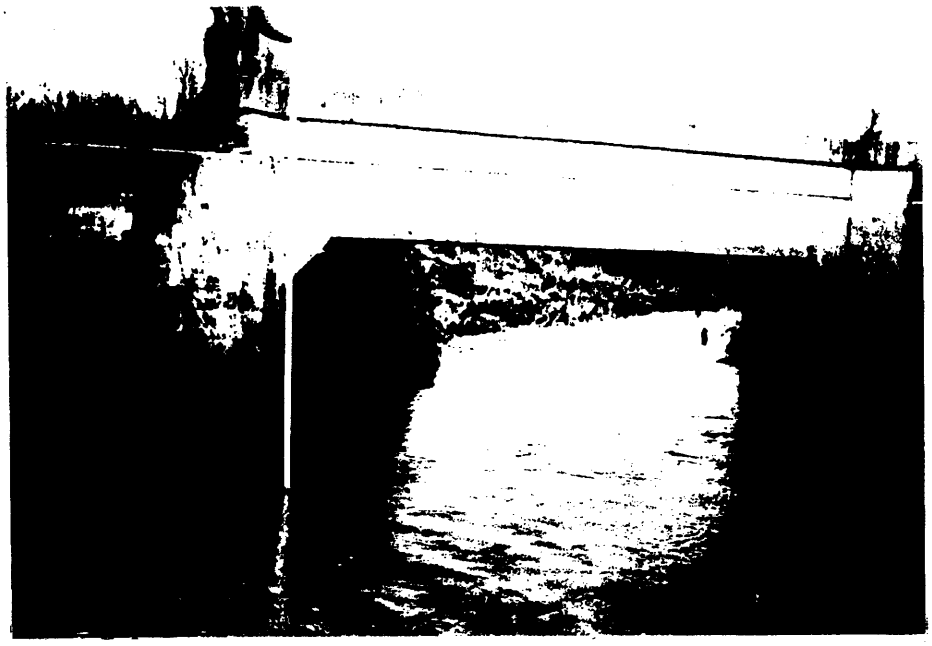


FIGURE 12. South Fork Ash Creek - 100-year elevation at Helmick Road.

For more information on NAVD, see the FEMA publication entitled Converting the National Flood Insurance Program to the NAVD (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), or contact the National Geodetic Survey at the following address:

NGS Information Services, NOAA, N/NGS12
National Geodetic Survey SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

Fax: (301) 713-4172, or
Telephone: (301) 713-3242

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

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

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

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent-annual-chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent-annual-chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied by detailed methods, the 1- and 0.2-percent-annual-chance floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using photogrammetric and topographic maps at scales of 1:4,800, 1:24,000, and 1:4,800, with contour intervals of 4, 10, and 5 ft. (References 31-36 and 39) and stereophotos at a scale of 1:12,000 (Reference 40).

Flood boundaries for Ash Creek, North and Middle Forks of Ash Creek, North Fork Tributary, Middle Fork Tributary, and the downstream reach of South Fork Ash Creek were delineated using available topographic maps as part of the 1985 SCS floodplain management study (Reference 8).

The 1- and 0.2-percent-annual-chance floodplain boundaries are shown on the FIRM (Exhibit 2). On this map, the 1-percent-annual-chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A 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.

Approximate 1-percent-annual-chance floodplain boundaries in portions of the study area were taken from the previous FIS for Polk County (Reference 1). Some of these flood boundaries were revised using aerial photographs at a scale of 1: 24,000 (Reference 41). Approximate flood boundaries at Falls City were taken from the 1981 FIRM for the City of Falls City (Reference 42).

For the streams studied by approximate methods, only the 1-percent-annual-chance floodplain boundary is shown on the FIRM (Exhibit 2).

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment. 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 ft., 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.

No floodways have been computed on North Fork Tributary, Rowell Creek, or Rock Creek. No floodways have been determined on Rickreall Creek downstream of Cross Section BH, below the City of Dallas.

The floodways presented in this study 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 are tabulated for selected cross sections (see Table 4, Floodway Data). In cases where the floodway and 1-percent-annual-chance floodplain boundaries are either close together or collinear, only the floodway boundary is shown.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET (NAVD))	WITH FLOODWAY	INCREASE
ASH CREEK								
A	2,400	277	4,568	1.5	162.4	162.4	163.4	1.0
B	3,300	128	2,428	2.8	162.7	162.7	163.7	1.0
C	3,420	208	3,297	2.1	163.0	163.0	164.0	1.0
D	4,390	224	3,067	2.3	163.4	163.4	164.4	1.0
E	5,640	218	2,725	1.4	164.1	164.1	165.1	1.0
F	7,870	206	1,634	2.4	165.8	165.8	166.8	1.0
G	8,828	325	1,919	2.0	166.3	166.3	167.3	1.0
H	9,523	470	1,945	2.0	167.1	167.1	168.0	0.9
I	9,857	235	1,254	3.1	167.6	167.6	168.4	0.8
J	10,257	200	831	4.6	168.0	168.0	168.8	0.8
K	10,727	70	626	5.5	169.4	169.4	169.9	0.5
L	11,112	70	585	5.9	170.1	170.1	170.6	0.5
M	11,412	75	543	6.3	170.6	170.6	171.1	0.5
N	11,697	84	538	6.4	171.0	171.0	172.0	1.0
O	11,872	79	906	3.8	172.3	172.3	172.9	0.6
P	12,362	70	542	6.3	172.4	172.4	173.1	0.7
Q	12,729	70	581	5.9	173.5	173.5	174.2	0.7
R	13,155	70	543	6.3	174.6	174.6	175.1	0.5
S	13,495	69	555	6.2	175.5	175.5	176.0	0.5
T	13,654	66	620	5.5	176.0	176.0	176.4	0.4

[1] Stream distance in feet above confluence with Willamette River.

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

FLOODWAY DATA

ASH CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NAVD)		
ASH CREEK OVERFLOW CHANNEL								
A	630	152	1,045	0.4	169.7	169.7	170.3	0.6
B	1,330	110	540	0.8	169.8	169.8	170.4	0.6
C	1,615	110	550	0.8	169.9	169.9	170.5	0.6
D	2,115	105	418	1.0	169.9	169.9	170.7	0.8
E	2,400	85	306	1.4	170.1	170.1	170.9	0.8
F	2,641	104	334	1.3	170.3	170.3	171.3	1.0
G	3,686	65	253	1.7	172.5	172.5	173.2	0.7
H	4,395	80	112	3.8	174.8	174.8	175.4	0.6
I	4,680	120	194	2.2	175.9	175.9	176.6	0.7
J	4,855	190	336	1.3	176.1	176.1	177.0	0.9

[1] Stream distance in feet above confluence with Ash Creek.

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

FLOODWAY DATA

ASH CREEK OVERFLOW CHANNEL

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					FEET (NAVD 88)			
Gibson Creek								
A	-0.017	40	221	3.1	139.0	139.0	140.0	1.0
B	0.020	82	734	0.9	145.8	145.8	146.0	0.2
C	0.194	78	501	1.4	146.1	146.1	146.5	0.4
D	0.350	60	309	2.2	146.9	146.9	147.8	0.9
E	0.493	100	373	1.9	150.1	150.1	151.0	0.9
F	0.664	143	893	0.7	158.8	158.8	159.7	0.9
G	0.880	99	605	1.1	159.3	159.3	160.2	0.9
H	0.971	90	190	3.4	160.7	160.7	161.2	0.5
I	1.019	140	385	1.7	161.3	161.3	162.3	1.0
J	1.099	140	301	2.2	162.8	162.8	163.8	1.0
K	1.150	58	166	3.9	164.1	164.1	164.6	0.5
L	1.235	104	258	2.5	166.9	166.9	167.9	1.0
M	1.352	104	228	2.9	169.0	169.0	169.9	0.9
N	1.443	160	454	1.4	169.5	169.5	170.4	0.9
O	1.541	100	349	1.9	171.9	171.9	172.7	0.8
P	1.628	115	210	3.1	172.3	172.3	173.2	0.9

[1] Stream distance in miles above Wallace Road.

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

FLOODWAY DATA

GIBSON CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NAVD 88)		
Glenn Creek								
A	-140	25	102	4.0	141.6	140.6[2]	141.1[2]	0.5
B	110	28	182	2.2	143.7	143.7	144.2	0.5
C	570	35	151	2.7	144.6	144.6	145.2	0.6
D	955	25	113	3.6	147.3	147.3	147.9	0.6
E	1,985	25	127	3.2	159.0	159.0	159.8	0.8
F	2,805	25	101	4.0	165.1	165.1	165.6	0.5
G	4,234	42	215	1.9	179.3	179.3	180.1	0.8
H	4,694	117	312	1.3	179.7	179.7	180.7	1.0
I	5,424	39	62	6.6	183.9	183.9	184.1	0.2
J	6,024	48	175	2.3	189.1	189.1	190.1	1.0
K	7,344	33	79	5.2	200.7	200.7	201.0	0.3
L	7,914	31	120	3.4	209.2	209.2	209.8	0.6
M	8,122	31	77	5.3	211.9	211.9	211.9	0.0
N	8,607	31	86	4.7	217.2	217.2	217.2	0.0
O	9,837	25	90	4.6	234.8	234.8	234.8	0.0
P	10,351	26	97	4.2	244.0	244.0	245.0	1.0
Q	10,921	12	31	10.6	253.2	253.2	253.2	0.0
R	11,067	27	133	2.4	255.5	255.5	255.5	0.0
S	11,247	28	75	4.3	255.9	255.9	256.5	0.6
T	11,637	21	71	4.6	261.2	261.2	261.4	0.2
U	12,135	60	100	2.7	271.4	271.4	272.4	1.0
V	12,190	30	45	6.1	273.3	273.3	273.6	0.3
W	12,760	29	82	3.3	281.8	281.8	282.0	0.2
X	12,860	27	50	5.4	288.5	288.5	288.8	0.3
Y	13,685	28	42	6.5	323.4	323.4	323.4	0.0
Z	14,054	19	44	6.3	329.6	329.6	329.6	0.0

[1] Feet above Wallace Road

[2] Elevation computed without considering backwater effect from Willamette River

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

FLOODWAY DATA

GLENN CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NAVD 88)		
Glenn Creek								
AA	14,213	4	22	12.8	337.7	337.7	337.8	0.1
AB	14,451	30	71	3.9	344.6	344.6	345.3	0.7
AC	14,727	29	40	6.8	351.2	351.2	351.2	0.0
AD	15,044	25	101	2.4	365.9	365.9	366.3	0.4
AE	15,243	23	37	6.5	371.3	371.3	371.3	0.0
AF	15,492	16	42	5.7	374.5	374.5	374.5	0.0
AG	15,650	24	54	4.4	381.9	381.9	382.9	1.0
AH	16,268	16	33	7.3	402.6	402.6	402.6	0.0
AI	16,426	19	66	3.6	409.6	409.6	410.5	0.9
AJ	18,055	24	38	6.3	467.3	467.3	467.4	0.1
AK	18,650	15	54	4.5	492.1	492.1	492.5	0.4
AL	19,303	16	39	6.2	515.1	515.1	515.5	0.4

[1] Feet above Wallace Road

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

FLOODWAY DATA

GLENN CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NAVD)		
Middle Fork Ash Creek								
A	2,100	93	533	2.2	179.6	179.6	180.6	1.0
B	3,350	176	1,131	0.9	184.5	184.5	185.5	1.0
C	5,050	131	554	1.9	186.2	186.2	187.2	1.0
D	6,310	247	959	1.1	188.4	188.4	189.4	1.0
E	6,770	105	354	2.9	189.8	189.8	190.8	1.0
Unnamed Tributary Middle Fork Ash Creek								
F	7,750	135	481	0.8	191.7	191.7	192.7	1.0
G	8,800	164	352	1.1	192.9	192.9	193.9	1.0
Middle Fork Tributary								
A	470	59	305	0.3	184.7	184.7	185.7	1.0
B	890	47	225	0.4	184.7	184.7	185.7	1.0

[1] Stream distance in feet above mouth.

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

FLOODWAY DATA

MIDDLE FORK ASH CREEK-UNNAMED TRIBUTARY MIDDLE FORK ASH CREEK-MIDDLE FORK TRIBUTARY

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NAVD)		
NORTH FORK ASH CREEK AT DALLAS								
A	36,278	59	218	3.7	276.3	276.3	277.3	1.0
B	37,290	30	135	6.0	283.9	283.9	284.9	1.0
C	38,030	33	162	5.0	287.6	287.5	288.6	1.0
D	38,294	35	181	4.5	288.9	288.9	289.9	1.0
E	39,737	37	162	5.0	294.4	294.4	295.4	1.0
F	40,525	39	166	4.9	297.5	297.5	298.5	1.0
G	41,122	35	148	5.5	300.8	300.8	301.8	1.0
H	41,438	35	244	3.3	304.5	304.5	305.5	1.0
I	41,587	205	858	0.9	304.7	304.7	305.7	1.0
J	42,101	43	193	4.2	306.2	306.2	307.2	1.0
K	42,412	51	282	2.9	308.4	308.4	309.4	1.0
L	44,195	49	245	3.3	320.0	320.0	321.0	1.0
M	44,321	60	313	2.6	321.8	321.8	322.8	1.0
N	44,850	31	192	4.2	322.1	322.1	323.1	1.0
O	45,490	28	170	4.8	322.7	322.7	323.7	1.0
P	46,520	37	178	4.6	324.6	324.6	325.6	1.0
Q	47,610	38	223	2.8	328.0	328.0	329.0	1.0
R	49,034	63	243	2.6	334.5	334.5	335.5	1.0
S	50,000	41	163	3.9	340.0	340.0	341.0	1.0
T	50,160	144	520	0.9	340.9	340.9	341.9	1.0

[1] Stream distance in feet above confluence with Ash Creek.

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

FLOODWAY DATA

NORTH FORK ASH CREEK AT DALLAS

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NAVD)		
NORTH FORK ASH CREEK AT MONMOUTH								
A	1,190	110	881	2.6	178.1	178.1	178.5	0.4
B	2,130	71	487	4.7	178.6	178.6	178.9	0.3
C	2,664	51	380	6.2	180.0	180.0	180.2	0.2

[1] Stream distance in feet above confluence with Ash Creek.

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

FLOODWAY DATA

NORTH FORK ASH CREEK AT MONMOUTH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NAVD 88)		
Rickreall Creek								
CH	79,083	578	2289	5.2	325.1	325.1	325.9	0.8
CI	80,223	114	1031	11.6	327.4	327.4	328.4	1.0
CJ	80,573	232	974	12.3	330.5	330.5	330.5	0.0
CK	81,333	404	1953	6.1	336.4	336.4	336.6	0.2
CL	82,408	368	1670	7.2	340.0	340.0	340.7	0.7
CM	83,483	335	1506	8.0	344.1	344.1	344.9	0.8
CN	84,958	478	2127	5.6	350.2	350.2	351.2	1.0
CO	86,833	139	1080	11.1	357.2	357.2	357.2	0.0
CP	87,923	279	1456	8.2	362.2	362.2	363.0	0.8
CQ	88,858	180	1370	8.8	367.2	367.2	368.1	0.9
CR	90,108	113	1049	11.4	372.8	372.8	372.8	0.0
CS	91,723	117	1087	11.0	379.7	379.7	380.0	0.3
CT	93,158	101	761	15.8	390.6	390.6	390.6	0.0
CU	93,633	99	1162	10.3	395.8	395.8	395.8	0.0
CV	93,928	97	1048	11.4	397.2	397.2	397.2	0.0
CW	94,018	66	777	11.8	397.4	397.4	397.4	0.0
CX	94,828	68	560	16.4	401.6	401.6	401.6	0.0
CY	95,878	54	573	16.1	412.0	412.0	412.0	0.0
CZ	96,878	79	661	13.9	421.6	421.6	421.6	0.0
DA	98,718	125	777	11.8	437.4	437.4	437.4	0.0
DB	99,703	190	786	11.7	452.1	452.1	452.1	0.0
DC	101,628	110	796	11.6	469.9	469.9	469.9	0.0
DD	102,828	89	681	13.5	478.3	478.3	478.4	0.1
DE	103,728	102	763	12.1	485.5	485.5	486.1	0.6

[1] Stream distance in feet above confluence with Willamette River

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

FLOODWAY DATA

RICKREALL CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY FEET (NAVD 88)	WITH FLOODWAY	INCREASE
Rickreall Creek								
BH	63,765	370	2146	5.8	260.6	260.6	261.4	0.8
BI	64,720	274	1381	9.0	263.7	263.7	263.9	0.2
BJ	65,050	140	1477	8.4	265.2	265.2	265.7	0.5
BK	65,135	186	1453	8.5	266.0	266.0	266.0	0.0
BL	66,010	308	1909	6.5	268.4	268.4	269.0	0.6
BM	66,885	189	1420	8.7	270.8	270.8	271.6	0.8
BN	67,785	259	1950	6.4	273.3	273.3	274.1	0.8
BO	68,560	209	1396	8.9	275.5	275.5	276.2	0.7
BP	69,285	221	1584	7.8	278.8	278.8	279.6	0.8
BQ	69,960	114	948	13.1	280.7	280.7	281.4	0.7
BR	70,870	186	1401	8.8	287.2	287.2	288.2	1.0
BS	71,410	376	1344	9.2	289.3	289.3	290.2	0.9
BT	72,460	158	1137	10.9	295.0	295.0	295.0	0.0
BU	73,720	86	947	12.7	300.6	300.6	300.9	0.3
BV	74,360	147	1364	8.8	304.7	304.7	304.7	0.0
BW	74,960	107	1068	11. 2	305.9	305.9	306.2	0.3
BX	75,310	80	920	13.0	307.0	307.0	307.6	0.6
BY	75,527	154	1571	7.6	314.0	314.0	314.6	0.6
BZ	75,677	417	2704	4.4	315.0	315.0	315.2	0.2
CA	76,087	189	1844	6.5	315.3	315.3	315.6	0.3
CB	76,402	127	1354	8.9	315.5	315.5	315.8	0.3
CC	76,677	105	1649	7.3	317.7	317.7	318.6	0.9
CD	76,877	119	1439	8.3	317.9	317.9	318.7	0.7
CE	77,352	501	3651	3.3	319.3	319.3	320.3	1.0
CF	77,917	525	2371	5.1	319.8	319.8	320.7	0.9
CG	78,508	626	2607	4.6	323.7	323.7	324.7	1.0

[1] Stream distance in feet above confluence with Willamette River

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

FLOODWAY DATA

RICKREALL CREEK

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NAVD)		
SOUTH FORK ASH CREEK								
A	360 [1]	71	945	2.6	164.0	164.0	165.0	1.0
B	1,240 [1]	67	855	2.9	164.6	164.6	165.6	1.0
C	1,390 [1]	137	1,427	1.7	165.0	165.0	166.0	1.0
D	2,310 [1]	50	559	4.4	167.7	167.7	168.7	1.0
E	2,440 [1]	60	798	3.1	168.5	168.5	169.4	0.9
F	11 [2]	20	165	7.3	194.5	194.5	194.9	0.4
G	301 [2]	45	283	4.3	195.5	195.5	195.9	0.4
H	746 [2]	44	260	4.7	195.7	195.7	196.1	0.4
I	1,306 [2]	30	222	5.4	197.5	197.5	197.9	0.4
J	1,666 [2]	48	256	4.7	197.9	197.9	198.4	0.5
K	3,226 [2]	80	406	3.0	198.6	198.6	199.6	1.0
L	3,976 [2]	55	253	4.8	200.5	200.5	201.5	1.0
M	4,226 [2]	39	259	4.7	201.3	201.3	201.8	0.5

[1] Stream distance in feet above confluence with Ash Creek.

[2] Stream distance in feet above Helmick Road.

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

FLOODWAY DATA

SOUTH FORK ASH CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NAVD)		
SOUTH YAMHILL RIVER								
A	32.56	4,575 [2]	19,357	1.7	159.5	159.5	159.8	0.3
B	33.28	3,870 [2]	17,373	1.9	162.1	162.1	162.5	0.4
C	33.59	3,075 [2]	11,406	2.9	163.2	163.2	163.7	0.5
D	34.06	3,858 [2]	16,601	2.0	164.9	164.9	165.4	0.5
E	34.21	3,750 [2]	17,787	1.9	165.5	165.5	166.0	0.5
F	34.26	3,715 [2]	19,178	1.7	165.6	165.6	166.1	0.5
G	34.30	3,459 [2]	15,679	2.1	165.7	165.7	166.2	0.5
H	34.75	3,090 [2]	9,245	3.6	167.5	167.5	167.8	0.3
I	35.47	1,850 [2]	10,402	3.2	171.0	171.0	171.5	0.5
J	44.23	200	3,252	6.1	229.3	229.3	229.6	0.3
K	44.29	226	2,943	6.7	229.6	229.6	229.9	0.3
L	44.42	210	2,757	7.1	231.0	231.0	231.1	0.1
M	44.55	345	5,652	3.4	233.3	233.3	234.3	1.0
N	44.57	301	4,520	4.3	233.3	233.3	234.3	1.0
O	44.78	277	2,658	7.3	234.2	234.2	235.1	0.9
P	45.07	218	2,264	8.6	239.0	239.0	239.3	0.3
Q	45.35	301	3,813	5.1	242.1	242.1	242.2	0.1
R	45.59	205	2,357	8.2	243.4	243.4	243.5	0.1
S	45.68	190	2,407	8.1	244.7	244.7	244.8	0.1
T	45.75	260	2,586	7.5	246.6	246.6	246.7	0.1
U	45.85	151	2,126	9.1	247.6	247.6	247.7	0.1
V	46.08	172	2,354	8.2	251.0	251.0	251.0	0.0
W	46.29	219	3,081	6.3	253.4	253.4	253.5	0.1
X	46.51	169	2,147	8.8	255.2	255.2	255.4	0.2
Y	46.87	174	2,483	7.6	259.7	259.7	259.8	0.1
Z	47.18	142	2,327	8.1	262.5	262.5	262.6	0.1

[1] Stream distance in miles above mouth.

[2] Located entirely outside study area.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE [1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NAVD)		
SOUTH YAMHILL RIVER								
AA	47.46	282	3,435	5.5	265.4	265.4	265.6	0.2
AB	47.66	469	2,592	7.3	266.9	266.9	267.1	0.2
AC	47.82	223	2,821	6.7	268.2	268.2	268.7	0.5
AD	48.16	310	4,621	4.1	270.2	270.2	271.0	0.8
AE	48.28	299	2,800	6.3	270.6	270.6	271.5	0.9
AF	48.33	174	2,633	6.7	271.5	271.5	272.3	0.8
AG	48.38	241	3,525	5.0	272.9	272.9	273.6	0.7
AH	48.58	172	2,741	6.4	273.5	273.5	274.3	0.8
AI	48.83	367	5,224	3.4	274.9	274.9	275.6	0.7
AJ	48.96	182	2,904	6.1	275.0	275.0	275.7	0.7
AK	49.22	319	3,809	4.6	276.5	276.5	277.3	0.8
AL	49.50	254	2,713	6.5	277.7	277.7	278.5	0.8
AM	49.71	277	3,324	5.3	279.6	279.6	280.5	0.9
AN	49.95	317	2,994	5.9	281.3	281.3	282.2	0.9
AO	50.05	244	2,823	6.2	282.4	282.4	283.4	1.0
AP	50.09	317	3,247	5.4	283.3	283.3	284.0	0.7
AQ	50.39	518	3,668	4.6	285.5	285.5	286.4	0.9
AR	50.81	625	4,260	4.0	289.2	289.2	290.1	0.9
AS	51.06	242	2,419	7.0	291.5	291.5	292.4	0.9
AT	51.20	242	2,094	8.1	293.1	293.1	294.0	0.9
AU	51.30	158	1,808	8.6	294.5	294.5	295.5	1.0
AV	53.69	215	1,829	7.1	317.0	317.0	317.4	0.4
AW	53.82	208	1,396	8.6	320.3	320.3	320.5	0.2
AX	53.84	126	1,504	8.0	322.0	322.0	322.4	0.4
AY	53.94	584	3,562	3.4	324.8	124.8	324.9	0.1
AZ	54.59	240	1,931	6.2	330.9	330.9	331.2	0.3

[1] Stream distance in miles above mouth.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE [1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NAVD)		
SOUTH YAMHILL RIVER								
BA	54.64	163	1,659	7.2	331.5	331.5	331.8	0.3
BB	55.04	149	1,959	4.2	334.9	334.9	335.3	0.4
BC	55.49	148	1,217	6.7	337.2	337.2	337.8	0.6
BD	55.54	107	1,409	5.8	338.8	338.8	339.4	0.6
BE	55.74	220	1,840	4.4	340.2	340.2	341.1	0.9

[1] Stream distance in miles above mouth.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NAVD)		
WILLAMETTE RIVER								
A	406,560	800	36,370	7.7	127.0	127.0	128.0	1.0
B	409,110	450	33,487	8.4	128.6	128.6	129.5	0.9
C	413,180	750	59,641	4.7	131.9	131.9	132.8	0.9
D	415,280	680	44,173	6.3	133.1	133.1	133.8	0.7
E	417,070	670	53,505	5.2	134.3	134.3	134.9	0.6
F	418,770	580	39,031	7.2	135.3	135.3	135.8	0.5
G	422,670	2,650	80,550	3.5	138.4	138.4	138.8	0.4
H	428,370	3,950	80,602	3.5	139.7	139.7	140.5	0.8
I	434,170	3,100	59,825	4.7	141.6	141.6	142.6	1.0
J	439,020	2,170	50,591	5.5	143.9	143.9	144.7	0.8
K	443,220	780	40,124	7.0	146.1	146.1	146.7	0.6
L	445,020	425	62,653	4.3	146.6	146.6	147.2	0.6
M	449,020	270	86,932	3.1	147.8	147.8	148.4	0.6
N	451,020	740	103,160	2.6	148.2	148.2	148.7	0.5
O	452,930	1,175	87,316	3.1	148.3	148.3	148.9	0.6
P	455,090	780	86,158	3.1	148.7	148.7	149.2	0.5
Q	456,305	580	76,469	3.5	148.9	148.9	149.4	0.5
R	457,890	300	81,487	3.3	149.2	149.2	149.7	0.5
S	459,740	650	87,854	3.1	149.5	149.5	150.2	0.7
T	461,850	320	74,102	3.4	149.9	149.9	150.6	0.7
U	463,805	530	89,237	3.0	150.3	150.3	151.2	0.9
V	468,035	4,830	101,527	2.7	151.4	151.4	152.1	0.7
W	470,055	4,520	82,965	3.2	151.7	151.7	152.4	0.7
X	472,115	3,300	80,271	3.4	152.0	152.0	152.9	0.9
Y	500,386	1,750	105,540	2.5	160.9	160.9	161.9	1.0
Z	502,920	460	104,831	2.6	161.5	161.5	162.5	1.0

[1] Stream distance in feet above mouth.

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

FLOODWAY DATA

WILLAMETTE RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH [2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NAVD)		
WILLAMETTE RIVER								
AA	507,302	9364/600	109,593	2.5	162.7	162.7	163.7	1.0
AB	508,411	8924/400	103,075	2.6	162.8	162.8	163.8	1.0

[1] Stream distance in feet above mouth.

[2] Width/width within corporate limits.

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

FLOODWAY DATA

WILLAMETTE RIVER

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 WSEL of the 1-percent-annual-chance flood more than 1 ft. at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 13.

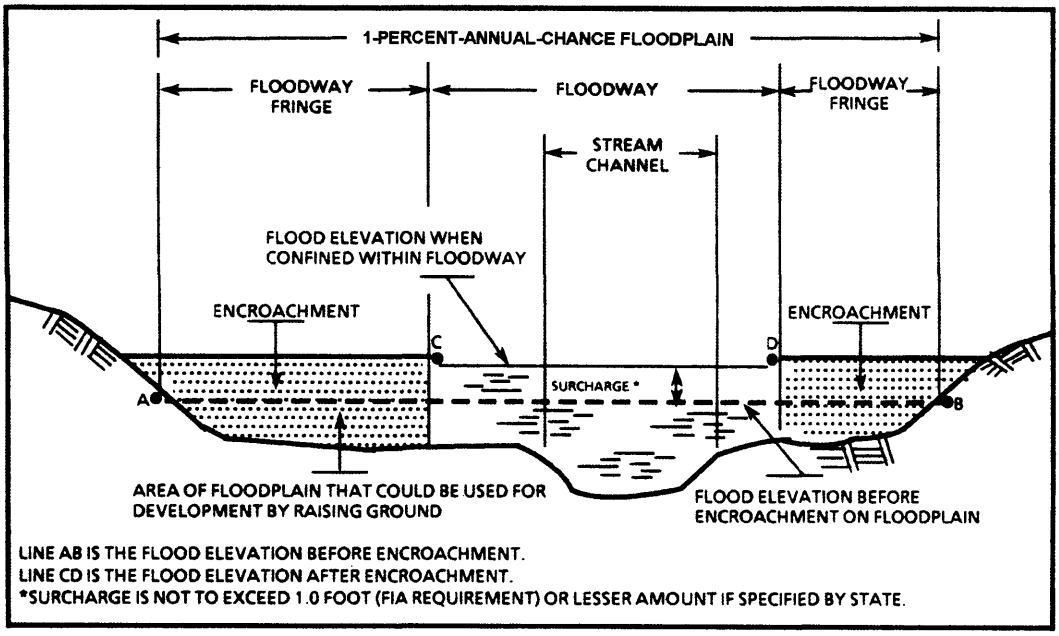

Figure 13. Floodway Schematic

5.0 INSURANCE APPLICATION

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

Zone A

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

Zone AE

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

Zone X

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

Zone D

Zone D is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

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 rate zones as described in Section 5.0 and, in the 1-percent-annual-chance floodplains that were studied by detailed methods, shows selected whole-foot 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 countywide FIRM presents flooding information for the entire geographic area of Polk County. Previously, FIRMs were prepared for each incorporated community and the unincorporated areas of the county identified as flood-prone. This countywide FIRM also includes flood-hazard information that was presented separately on Flood Boundary and Floodway Maps, where applicable. Historical data relating to the maps prepared for each community are presented in Table 5, Community Map History.

7.0 OTHER STUDIES

An FIS report was published for the unincorporated areas of Polk County in 1977 (Reference 1). Due to updated detailed analyses, this FIS supersedes the previously published Polk County FIS report.

FIS reports have been published for the Cities of Salem and Willamina (References 2 and 7). Detailed and approximate flooding in portions of these studies was used to update the Polk County FIS.

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE(S)	FLOOD INSURANCE RATE MAP EFFECTIVE DATE	FLOOD INSURANCE RATE MAP REVISION DATE(S)
Dallas, City of	November 23, 1973	July 2, 1976	April 5, 1988	April 5, 1988
Falls City, City of	May 10, 1974	December 12, 1975	July 7, 1981	
Independence, City of	December 28, 1973	May 21, 1976	April 5, 1988	
Monmouth, City of	May 24, 1974	September 22, 1981	April 5, 1988	
Polk County Unincorporated Areas	February 7, 1975		February 15, 1978	April 5, 1988

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

A FIRM has been prepared for the City of Falls City (Reference 42). Flood boundaries from this study were used to update the Polk County FIS.

Flood Hazard Boundary Maps have been prepared for the Cities of Dallas, Independence, and Monmouth (References 43-45). Due to its more detailed analyses, this FIS supersedes these previously published studies.

FIS reports have been prepared for the following adjacent counties: Yamhill, Marion, Linn, Benton, Lincoln, and Tillamook Counties, Oregon (References 3, 4, 6, 46-48). Flood boundaries along the Willamette River within Yamhill County disagree with Polk County due to differing scopes of study. Marion County and Polk County are in agreement except at the City of Independence. The Willamette River currently has detailed analyses at Independence and approximate Zone A designations in adjacent Marion County. With these exceptions, the adjacent counties are in agreement with this FIS.

A floodplain management study for Ash Creek and several of its tributaries was prepared by the SCS in 1985 (Reference 8). Detailed analyses from that report were used to update this Polk County FIS.

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

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting FEMA, Mitigation Division, Federal Regional Center, 130 228th Street, SW, Bothell, Washington 98021-9796.

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10.0 REVISION DESCRIPTIONS

This section has been added to provide information regarding significant revisions made since the original FIS was printed. Future revisions may be made that do not result in the republishing of the FIS report. To assure that any user is aware of all revisions, it is advisable to contact the community repository.

10.1 First Revision

This FIS was revised on September 30, 1993, to add flooding affecting two streams of Polk County. The streams studied by detailed methods are Glenn Creek from just upstream of Glenn Creek Road to approximately 3,000 feet upstream of Gleneden Court and Gibson Creek from just upstream of Doaks Ferry Road to approximately 1.0 mi. upstream.

The hydrologic and hydraulic analyses for this restudy were performed by the USACE, Portland District, for FEMA, under Interagency Agreement No. EMW-87-E-2509, Project Order No. 24. This restudy was completed in May 1991.

On June 13, 1986, the initial coordination meeting took place at the Marion County Planning Office in the City of Salem, Oregon. The meeting was attended by representatives of Marion County, the Cities of Salem and Keizer, FEMA, and the USACE. The final scope of work and decision to prepare this revision was made by FEMA representatives in April 1987.

The results of this study were reviewed at the final Consultation and Coordination Officer (CCO) meeting held on December 17, 1992, and attended by representatives of the City of Salem, FEMA, and the USACE. All problems raised at that meeting have been addressed in this study.

Hydrologic Analyses

The peak frequency discharges for Glenn Creek and Gibson Creek were developed from the regional analysis performed by the USGS (Reference 49). Both Glenn Creek and Gibson Creek have stream gage data. The Glenn Creek station (USGS station number 14192100) has 24 years of crest gage data from the period 1951 through 1975 (Reference 50), while the Gibson Creek station (USGS station number 14192200) has 15 years of crest gage data from the period 1952 through 1966 (Reference 51). Floodflow frequency analysis was performed for both sets of crest gage data using the log-Pearson Type III distribution in the computation of the frequency curves (Reference 52). This is in

accordance with methods outlined by the U.S. Water Resources Council in Bulletin 17B (Reference 53). A generalized skew of zero was used for both frequency analyses. This method of frequency analysis produced results somewhat lower than in the regional analysis, with the explanation that the period of record for both crest gage stations did not reflect urban development in the drainage basins for the past 15 to 25 years. Results of the hydrologic analysis are shown in Table 2, Summary of Discharges.

Hydraulic Analyses

Cross-sectional data for the backwater analyses were determined from field surveys by the USACE and orthophoto topographic maps developed by the City of Salem (Reference 54). All bridges, culverts, and weir structures were surveyed to obtain elevation data and structural geometry.

The hydraulic analysis for Glenn Creek and Gibson Creek was performed using the USACE HEC-2 step-backwater program (Reference 55). The starting WSEL was determined using the slope-area method. Channel and overbank roughness coefficients (Manning's "n") used in the hydraulic computations were chosen by engineering judgment based on field observations of the stream and floodplain areas. For Gibson Creek, the channel "n" values ranged from 0.045 to 0.085, and the overbank "n" values ranged from 0.085 to 0.140. For Glenn Creek, the channel "n" values ranged from 0.010 to 0.110, and the overbank "n" values ranged from 0.050 to 0.150. The hydraulic analysis for this study was based on unobstructed flow.

Floodplain boundaries were delineated using topographic maps at a scale of 1:2,400 with a contour interval of 2 ft. (Reference 54).

The Summary of Discharges (Table 2) and Floodway Data (Table 4) have been updated to include the results of the detailed study of Glenn Creek and Gibson Creek.

10.2 Second Revision

This FIS was revised on December 19, 1995, as the result of an investigation into the existence and severity of flood hazards in Polk County, Oregon. This study includes the restudy by detailed methods of the Willamette River from RM 77 upstream to RM 84.1.

The hydrologic and hydraulic analyses for this study were prepared by the USACE, Portland District. This work was completed in June 1993 under Inter-Agency Agreement No. EMW-91-E-3525, Project Order No. 8.

An initial CCO meeting was held on July 11, 1990, at the city hall in the City of Keizer. The meeting was attended by city officials and representatives of FEMA and the USACE, Portland District.

Another intermediate CCO meeting was held on September 12, 1993, at which work maps and profiles, showing flooded areas and flood WSELs, were presented by the SC for review by city officials.

The results of this study were reviewed at a final meeting held on October 6, 1994, and attended by representatives of FEMA, the community, and the USACE.

This restudy covers the Willamette River from RM 77 upstream to RM 84.1, upstream of the northeast county boundary.

For the revised study of the Willamette River, hydrologic analyses were carried out to establish the peak discharge-frequency relationships.

Discharges on the Willamette River were based on stream gage records obtained from the USGS gage just upstream of the Center Street bridge in Salem and three other gage sites upstream of Salem, and flood control storage and operation at the upstream reservoirs.

On the Willamette River, regulated discharge-frequency curves were developed for the gages using flood-routing computations for the upstream reservoirs to reduce expected flood discharges. The regulated and natural discharge-frequency curves at the stream gages were then used to obtain peak discharge values for the selected recurrence intervals used in this study.

Discharges were initially determined by the USACE in April 1969. These discharges were the result of an adjustment made to an analysis done in May 1965 for the Willamette River Basin using various possible combinations of discharge storage at upstream USACE Projects. Those 83 years of record were statistically analyzed using the standard log-Pearson Type III methods as outlined by the U.S. Water Resources Council (References 22-23, and 53). In February 1982, the Portland District revised those 1969 flood frequency discharges on the basis of additional hydrologic data, project operation records, and a basinwide routing study. The updated discharges for the Willamette River are shown in Table 2.

The updated discharges were used in this study in place of previously determined values because they provide the most reliable description of the hydrologic characteristics of the upstream river basin.

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevation of floods of the selected recurrence intervals.

WSELs of floods of the selected recurrence intervals on the reach of the Willamette River between RM 77 and RM 84 were computed using the USACE HEC-2 step-backwater program (Reference 57).

Channel roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and were based on field observations of the streams and floodplain areas. The roughness factors used in the restudy are listed in Table 6.

Table 6. Manning's "n" Values for Willamette River Restudy

Value	Area Used
.035	The stream channel up to the elevation of trees and brush (i.e., the sandy normal channel)
.06-.07	Upper parts of the banks covered by trees and brush
.05-.07	Flat fields adjacent to tree-covered riverbanks
.09-.12	Urbanized areas, depending on how heavily obstructed they were

.4-.5	Two small urban areas representing high obstructions to flow
.01-.03	Increase added to upper riverbank values at Cross Sections 80.12, 80.9, and 81.22 to account for additional energy loss attributed to 90-degree change in the channel

Cross-sectional information for the Willamette River was taken from USACE field surveys and topographic maps. The above-water portions of the cross sections were obtained from topographic maps developed from aerial photographs flown in the early 1960s and from USGS 7.5-minute quadrangle maps (Reference 39); the underwater portions were obtained by field measurements in the early 1960s.

For this revision, a cross section was added at RM 80.9, which is located where the extension of Cummins Lane intersects the Keizer Dike and is about 30 degrees through the 90-degree bend the river makes at the City of Keizer. The cross section was developed from City of Keizer topographic maps from aerial photographs flown in 1981 and 1985 (Reference 56). The underwater portion of the section was estimated based on adjacent cross sections. Starting WSELs for the Willamette River were calculated using the slope-area method, but they were based on the December 1964 flood high-water mark at the crest gage at RM 77 .0. Slopes comparable to the 1964 flood slope, but adjusted, were used.

The slope of the water surface at RM 79.33 for the 10- through 0.2-percent-annual-chance discharges ranges from .0013 to .0014. The water surface along the dike upstream of the contraction has considerably less slope ranging between .00024 and .00032.

Flood boundaries were delineated using City of Keizer-developed topographic maps at scales of 1:2,400 and with contour intervals of 2 ft. (Reference 56). In cases where the 1- and 0.2-percent-annual-chance floodplain boundaries are close together, only the l-percent-annual-chance floodplain boundary has been shown.

The floodways presented were computed on the basis of equal conveyance reduction from each side of the floodplain, with adjustments made to consider factors such as existing roads, sloughs, and overland flow patterns. Floodway widths were computed at cross sections. Between cross sections, the boundaries were interpolated using the topographic maps. In cases where the floodway and l-percent-annual-chance floodplain boundaries are either close together or collinear, only the flood boundary has been shown. The results of these computations are tabulated at selected cross sections (Table 4).

10.3 Third Revision

The hydrologic and hydraulic analyses for this study, North Fork Ash Creek, Ash Creek, and Ash Creek Overflow channel in the Vicinity of the City of Monmouth, were performed by Parsons Brinckerhoff Quade & Douglas, Inc, for the FEMA, under Contract No. EMS-1999-CO-0068-T02. This study was completed in March 2003.

Coordination

Contacts made to acquire historical data for the study included the Cities of Monmouth and Independence, Polk County, Natural Resource Conservation Service (NRCS, formerly the Soil Conservation Service or SCS), and FEMA archives.

Scope of Study

This FIS restudies the floodway and the 10-percent-annual-chance, 2-percent-annual-chance, 1-percent-annual-chance, and 0.2-percent-annual-chance flood profiles of a 8,065 ft. reach of Ash Creek in the Cities of Monmouth and Independence, Polk County, Oregon. The study reach for Ash Creek extends from around 700 ft. downstream of Gun Club Road to the confluence with North Fork Ash Creek (5,400 ft.). The North Fork Ash Creek was studied from its confluence with Ash Creek to Hoffman Road (2,665 ft.), and the study reach for the overflow channel of Ash Creek covered its extent from the overland flow leaving Ash Creek to the confluence with Ash Creek (over 5,200 ft).

Hydrologic Analyses

The peak discharge values utilized in the study for the 10-percent-annual-chance, 2-percent-annual-chance, 1-percent-annual-chance, and 0.2-percent-annual-chance floods are shown in Table 2. The discharges were developed by the NRCS (formerly SCS) for the currently effective FIS using regional regression equations. No stream gages are located on Ash Creek.

Hydraulic Analyses

The cross-section locations were chosen based on the location of the cross sections in the previous model of Ash Creek performed by the NRCS (formerly SCS). The location of additional cross sections reflected structures built after the NRCS study of Ash Creek and sections needed to define the overflow channel. Chase Jones & Associates, Inc. surveyed seven channel cross sections on Ash Creek, North Fork Ash Creek, and the overflow channel of Ash Creek. The Ash Creek Water Conservation District provided additional surveyed cross sections of Ash Creek and North Fork Ash Creek in addition to bridge information. The overbank geometry of the cross sections was taken from multiple sources. Spencer B. Gross provided topographic mapping with 2-ft. contour lines in addition to spot elevations. The City of Monmouth provided spot elevations and 1-ft. contours collected for the design and construction of 16th Street. The City of Monmouth data included cross sections of Ash Creek and the overflow channel in the vicinity of 16th Street. Polk County also provided GIS data for Monmouth and Independence.

The study contains five bridges on Ash Creek and North Fork Ash Creek and two culvert groups on the overflow channel. Chase Jones & Associates, Inc. surveyed one bridge and one culvert group in addition to the seven channel cross sections. Information on the remainder of the bridges and culverts was collected during site visits or provided by the Ash Creek Water Conservation District and the City of Monmouth, through their engineer for 16th Street (Westech Engineering).

The Manning's "n" values of Ash Creek were estimated based on site visits and aerial photography. The range of Manning's "n" values for the main and overflow channels of Ash Creek are shown in Table 3. A HEC-RAS hydraulic analysis was performed to provide an estimate of the WSELs due to the 10-percent-annual-chance, 2-percent-annual-chance, 1-percent-annual-chance, and 0.2-percent-annual-chance flood events along Ash Creek, North Fork Ash Creek and the overflow channel. The resulting Flood Profiles are shown in Exhibit 1. The datums of stream length on the flood profile

plots are from the mouth of Ash Creek and from the confluences with Ash Creek for the North Fork Ash Creek and overflow channel.

Floodflows are primarily contained within the channel of North Fork Ash Creek at Cross Section A for all of the modeled flood events. However, downstream of A during the 1-percent-annual-chance and .2-percent-annual-chance floods, a portion of the discharge overflows the left bank of, upstream of the sewer lagoons and near the confluence of the Middle Fork Ash Creek, and travels northeast into the overflow channel. The overflow channel rejoins Ash Creek upstream of Cross Section J.

The discharge entering the overflow channel was determined with the steady-state, one-dimensional USACE hydraulic model, HEC-RAS Version 3.1. In order to determine the discharge leaving Ash Creek and entering the overflow channel, a lateral weir was defined in HEC-RAS along the left bank where flow leaves North Fork Ash Creek during the 1-percent-annual-chance and 0.2-percent-annual-chance floods.

The downstream WSEL of Ash Creek for each of the flood profiles and the floodway case were taken from the currently effective FIS for Ash Creek.

Floodplain Boundaries

The floodplain boundaries were delineated based on the topographic maps (2-ft. contour interval) provided by Spencer B. Gross. In applicable locations, survey data from the design of 16th Street and the Ash Creek Water Conservation District were also utilized to delineate floodplain boundaries.

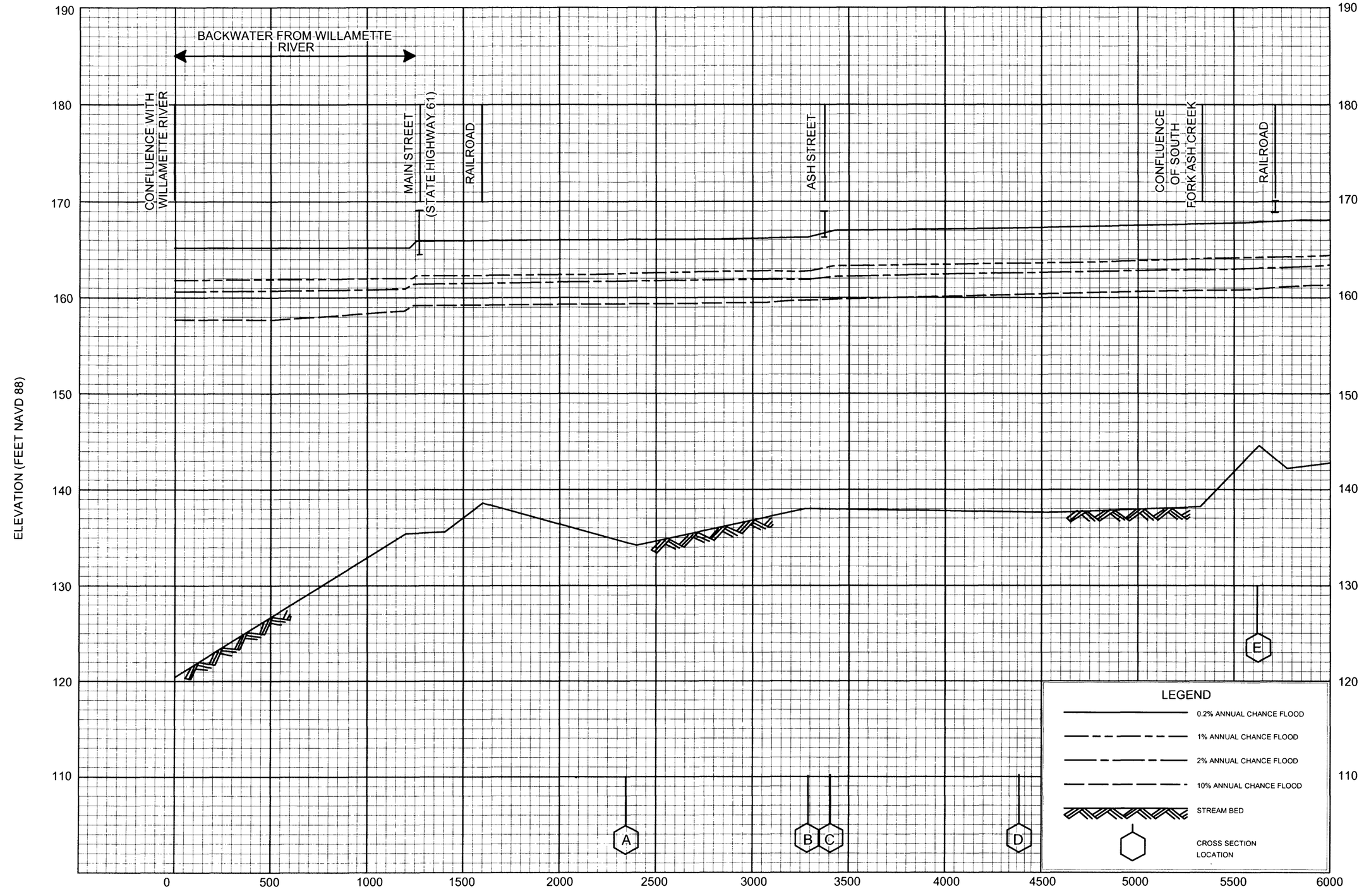
The floodway, 1-, and 0.2-percent-annual-chance floodplains are shown on the Work Map.

Floodways

The floodway was determined with the assumption that the corresponding flows in the main and overflow channels of Ash Creek would be unchanged between the l-percent-annual-chance flood and the floodway condition. While the currently effective FIS does not have a floodway designated on the overflow channel, a floodway is defined for both Ash Creek, the North Fork of Ash Creek and the overflow channel of Ash Creek to fulfill FEMA's 1-ft. rise criteria. The floodway corresponding to the l-percent-annual-chance flood was initially determined using a Method 4 encroachment analysis in HEC-RAS, with a water surface rise of 1 foot specified. The Method 4 approach was then converted to Method 1 and modified to ensure the water surface rise was less than 1 ft. in all locations.

At the downstream end of the study reach, the floodway width contained in the currently effective FIS could not be replicated. The floodway width was revised accordingly for the downstream section.

The floodway data for the study reach is provided in Table 4.



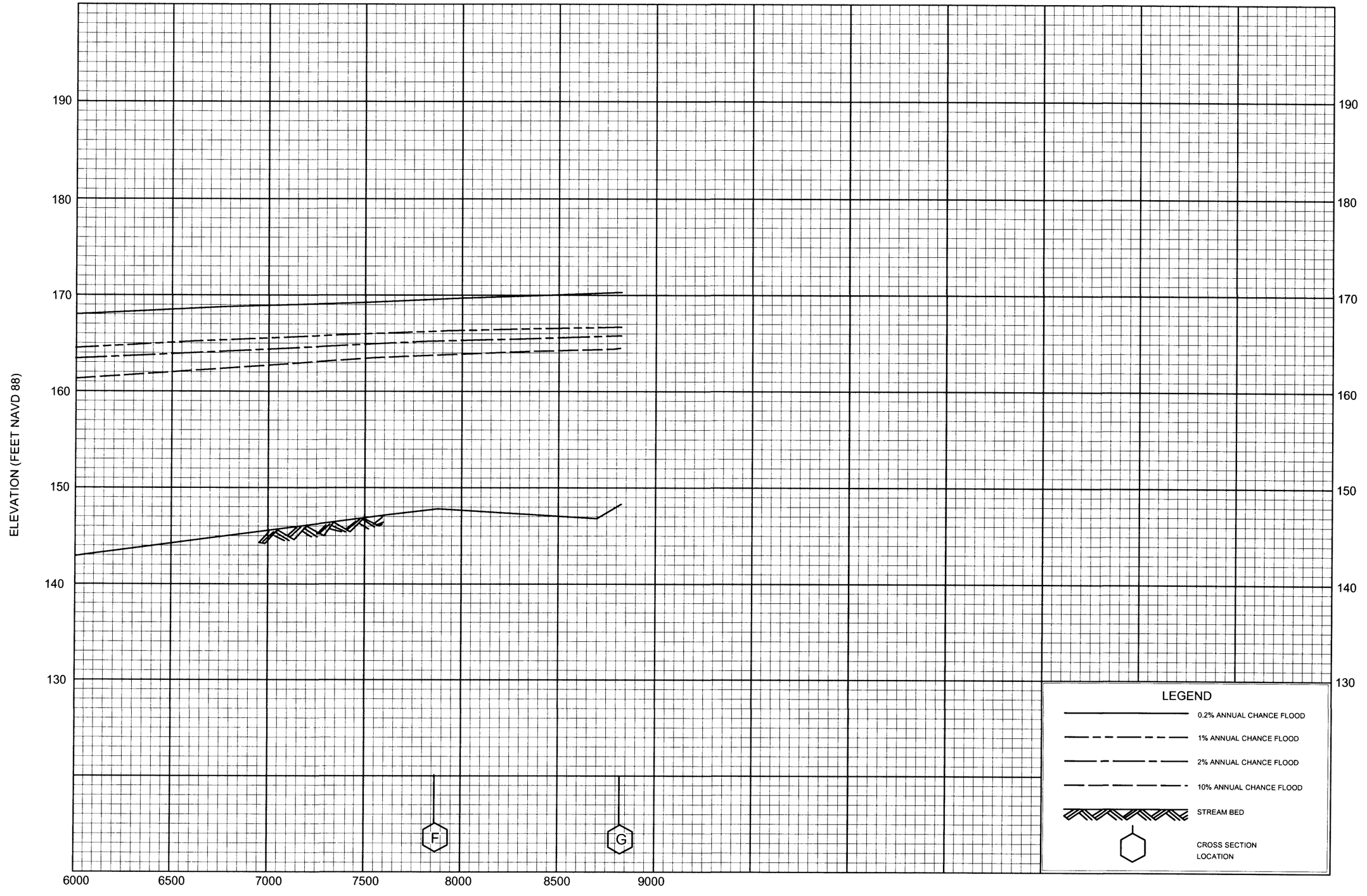
FLOOD PROFILES

ASH CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

01P



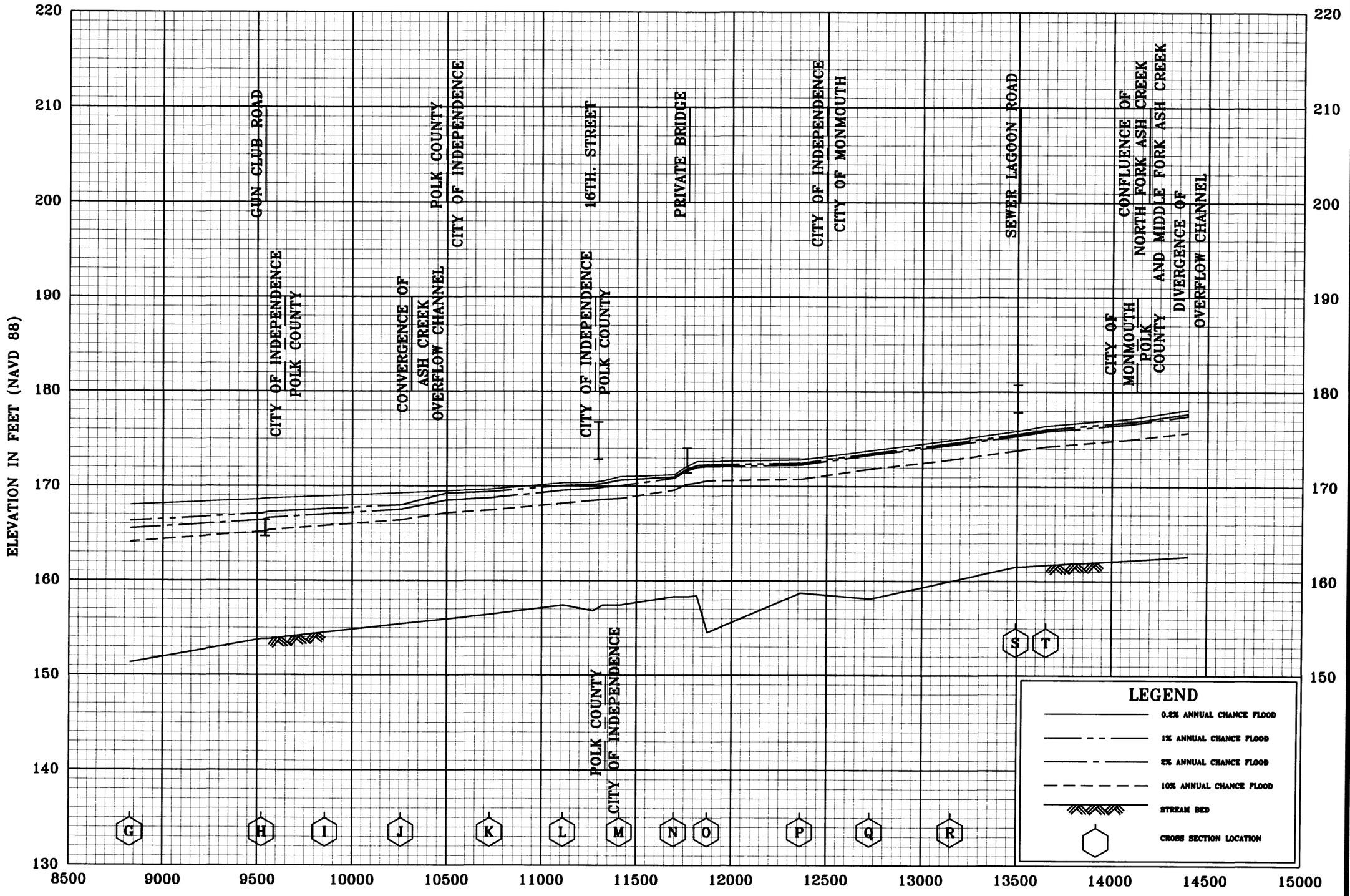
FLOOD PROFILES

ASH CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

02P



FLOOD PROFILES

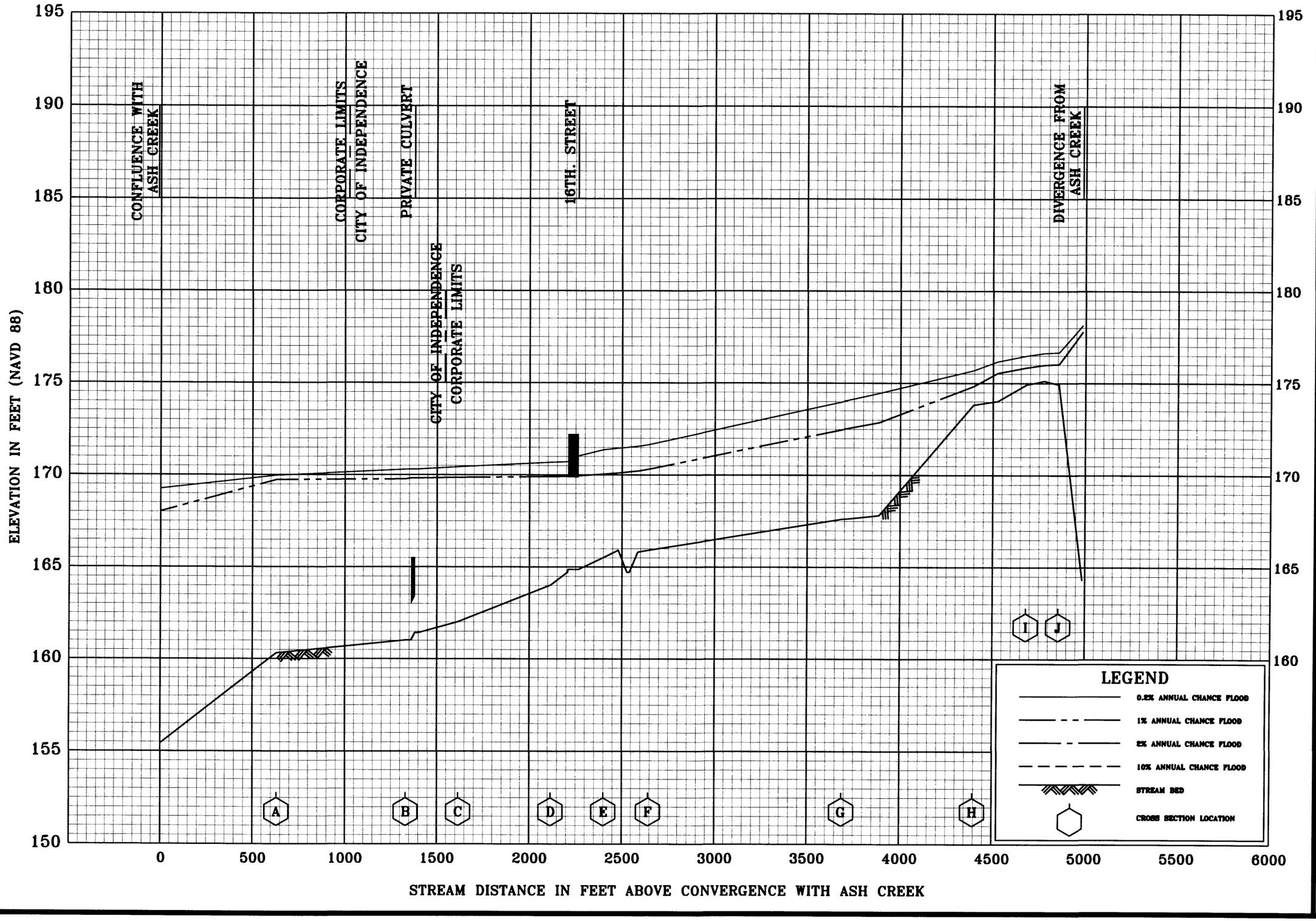
ASH CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR

AND INCORPORATED AREAS

03P



FLOOD PROFILES

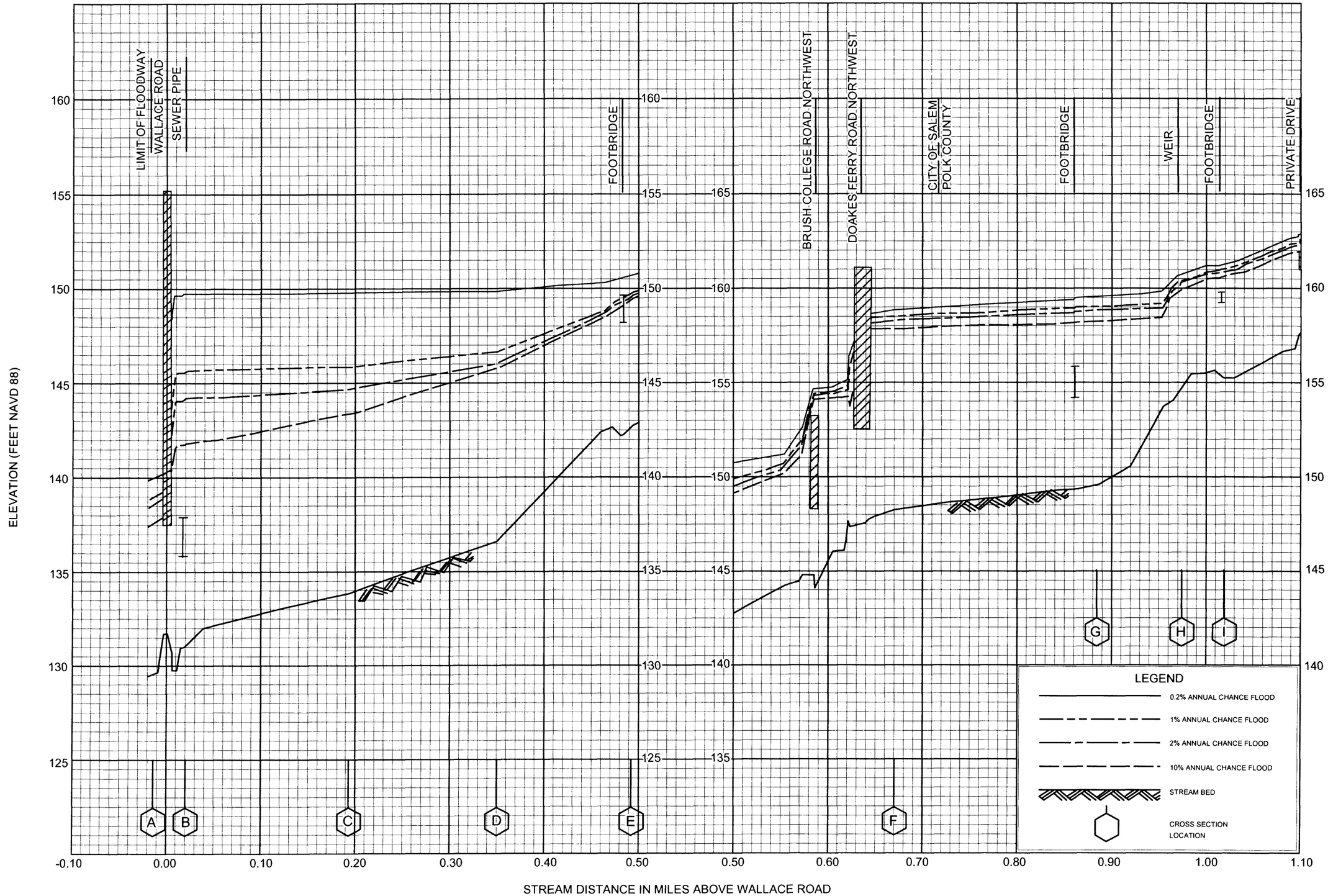
ASH CREEK OVERFLOW CHANNEL

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR

AND INCORPORATED AREAS

04P



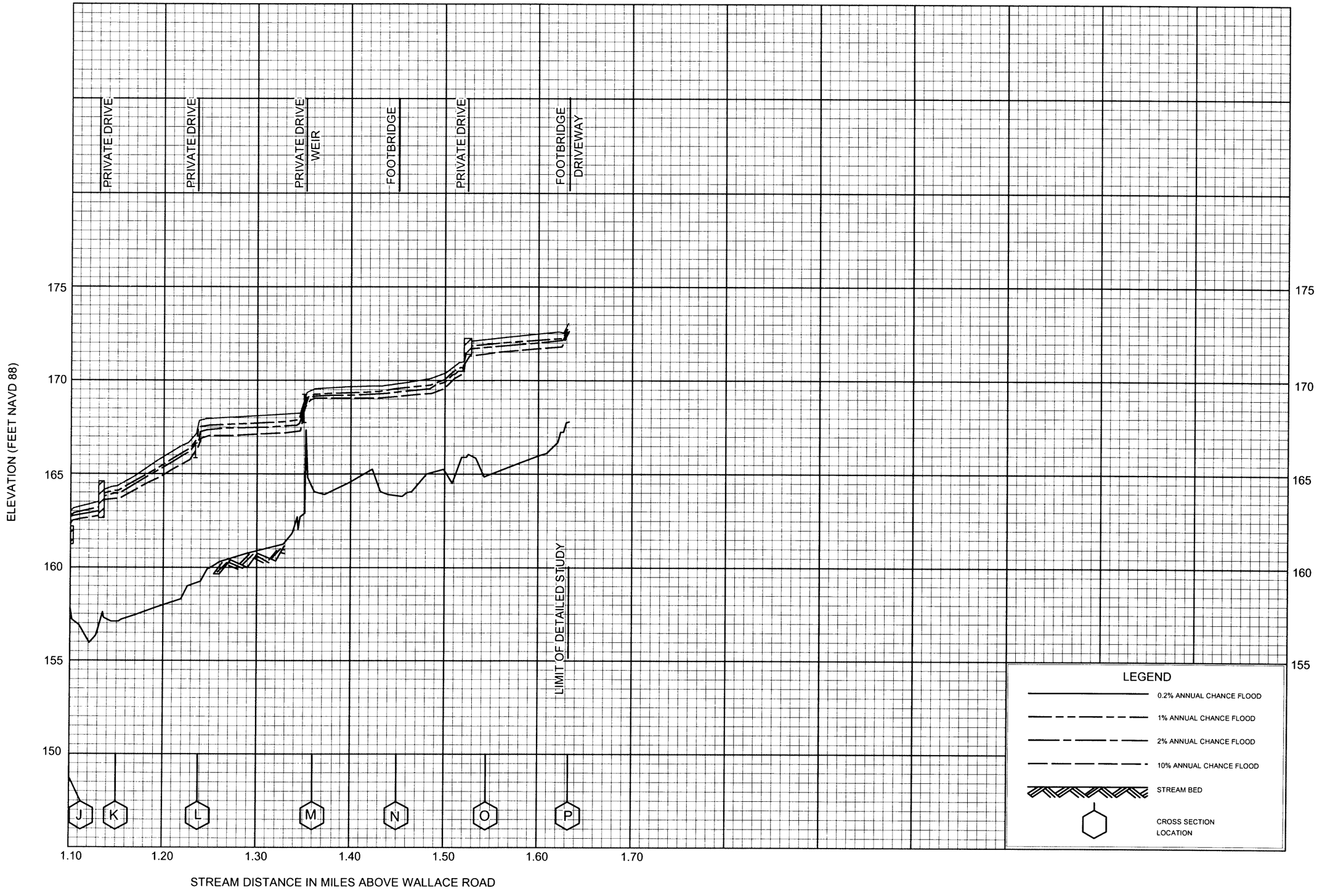
FLOOD PROFILES

GIBSON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

05P



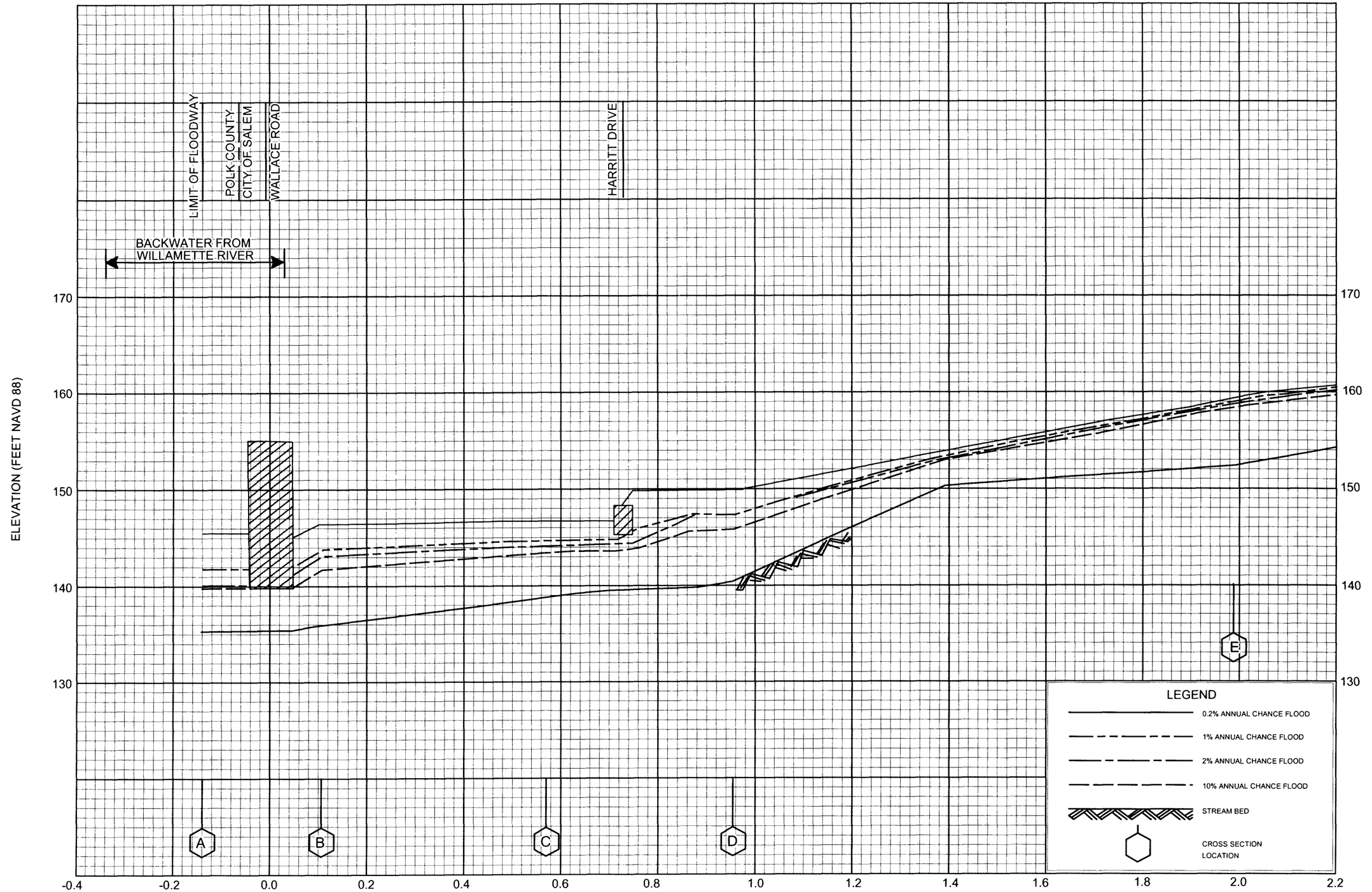
FLOOD PROFILES

GIBSON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

06P



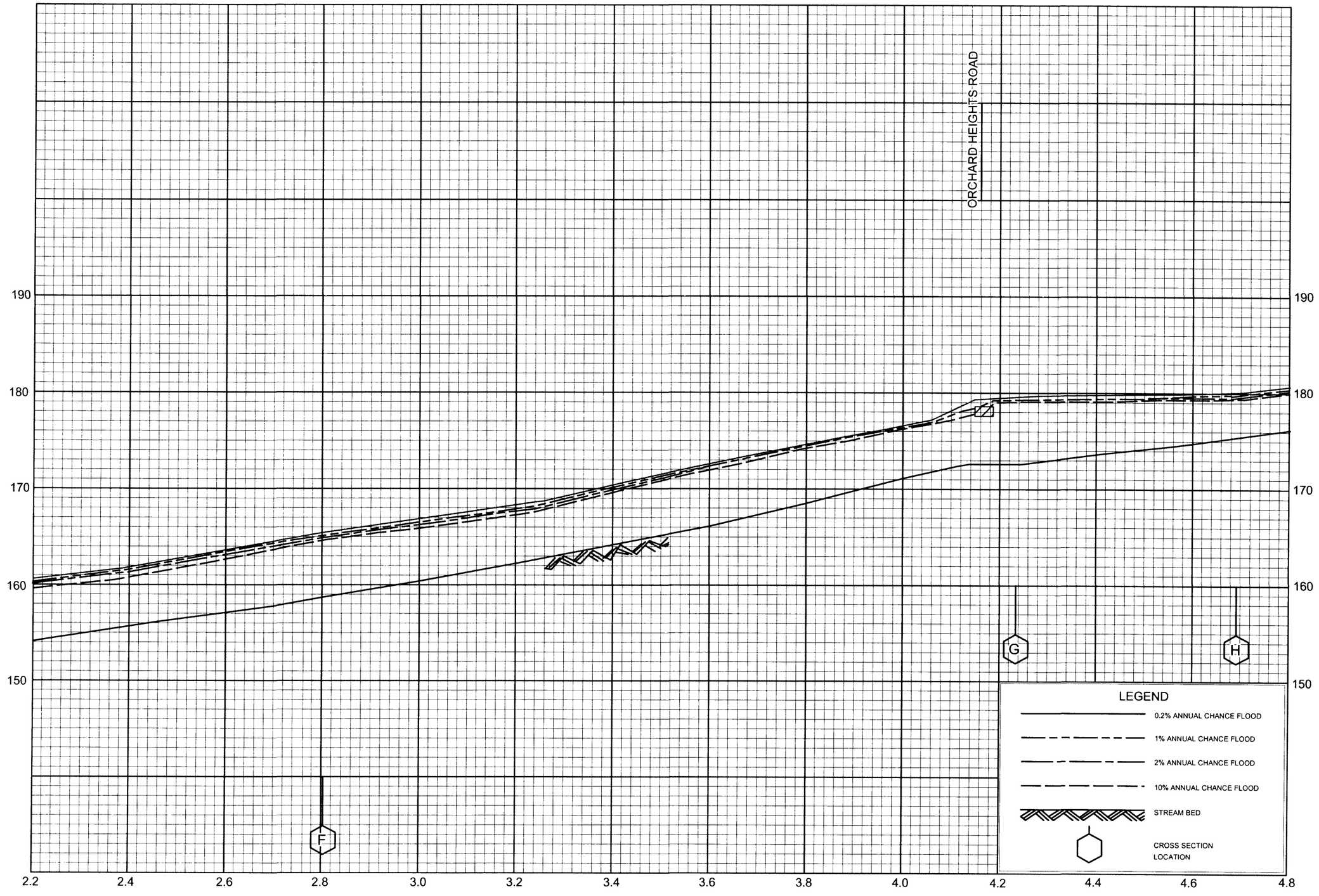
FLOOD PROFILES

GLENN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

07P



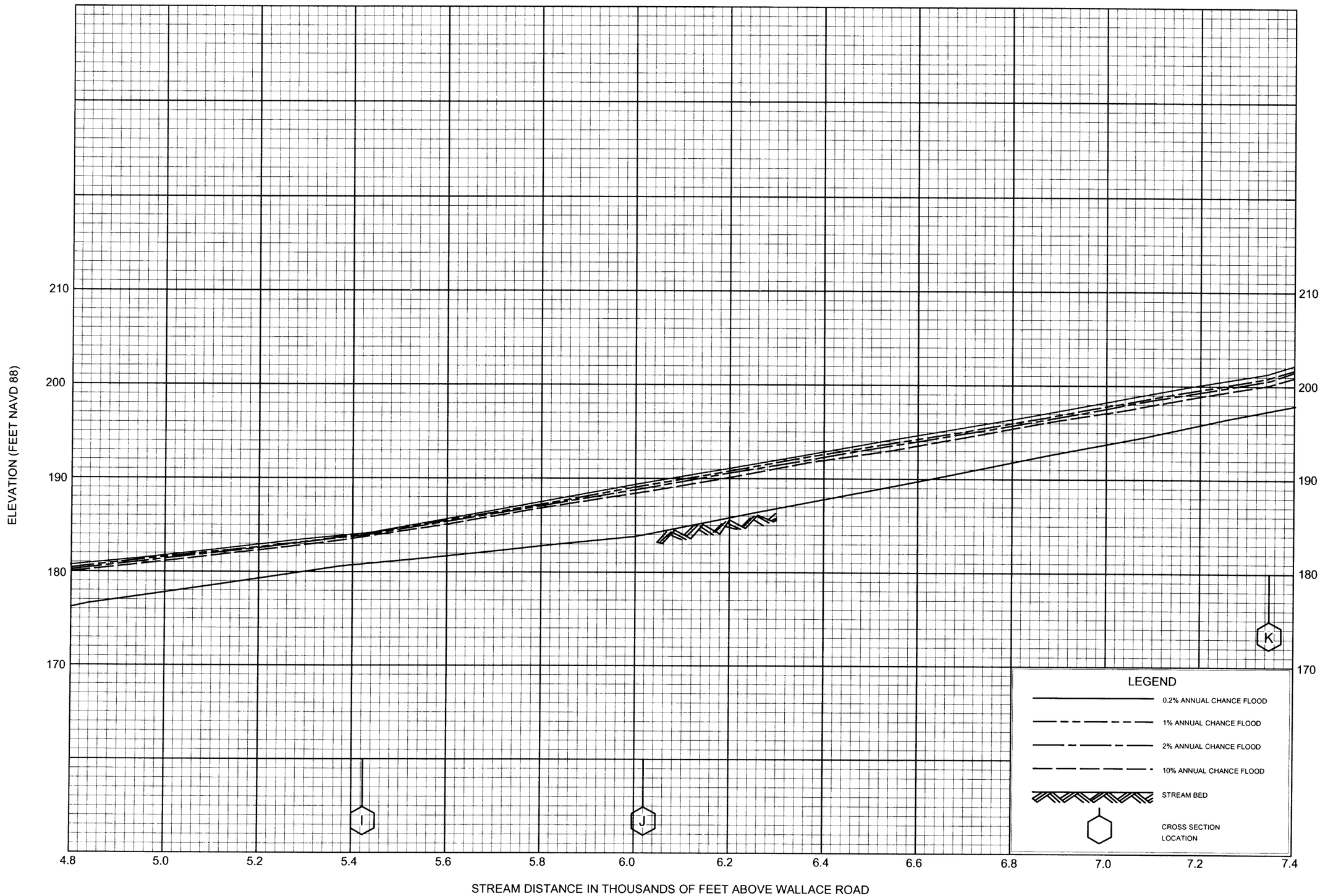
FLOOD PROFILES

GLENN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

08P



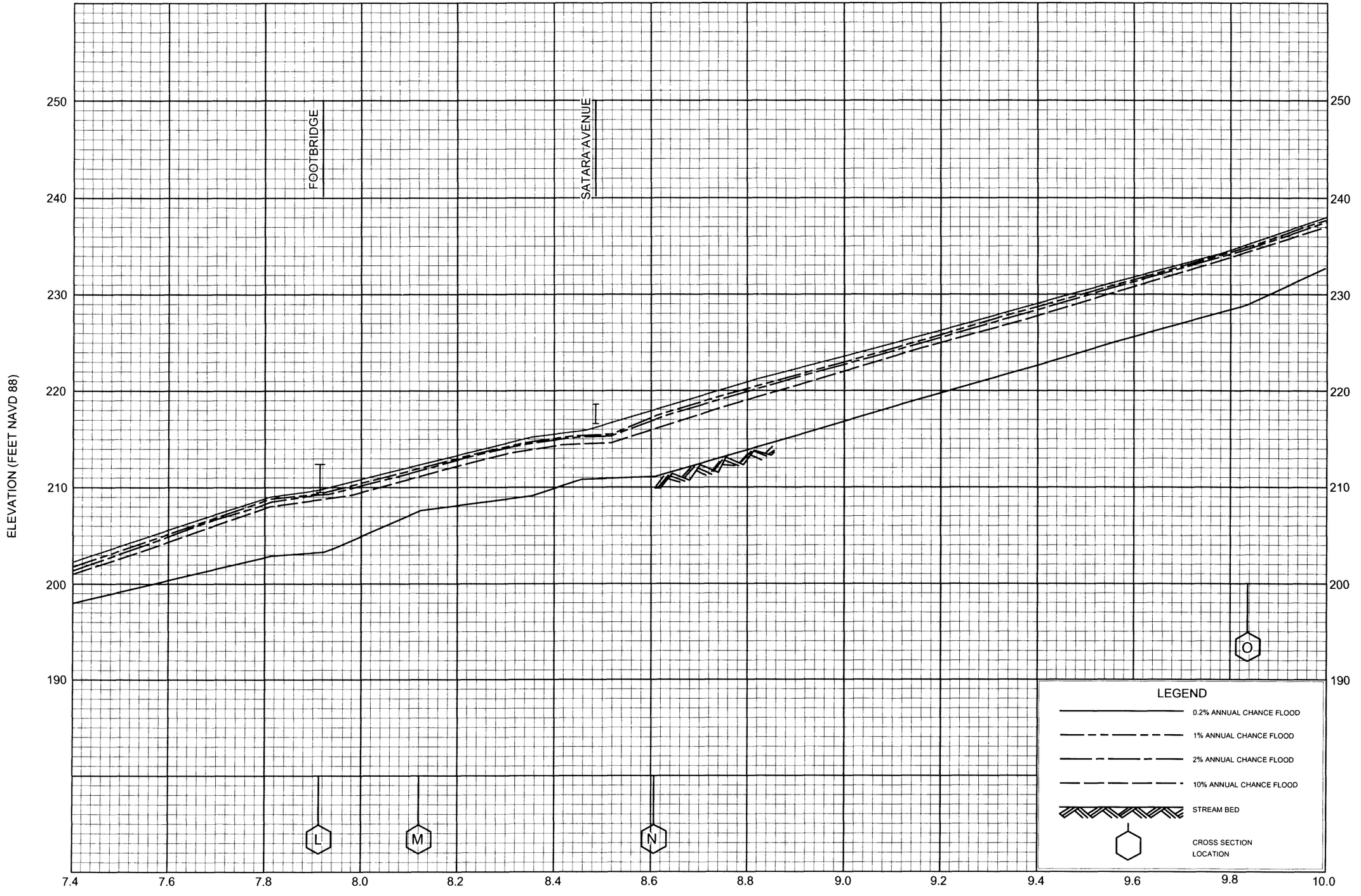
FLOOD PROFILES

GLENN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

09P



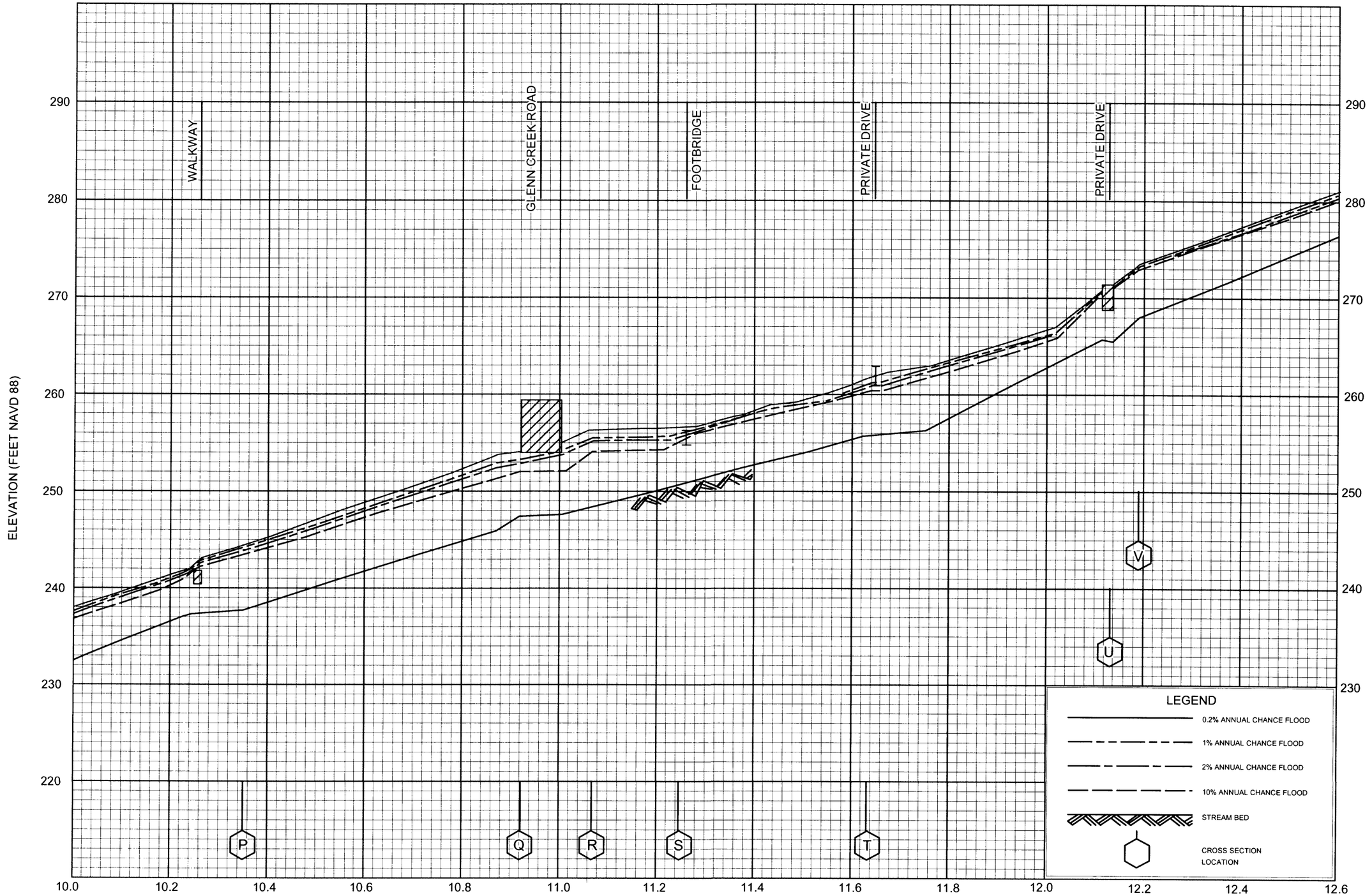
FLOOD PROFILES

GLENN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

10P



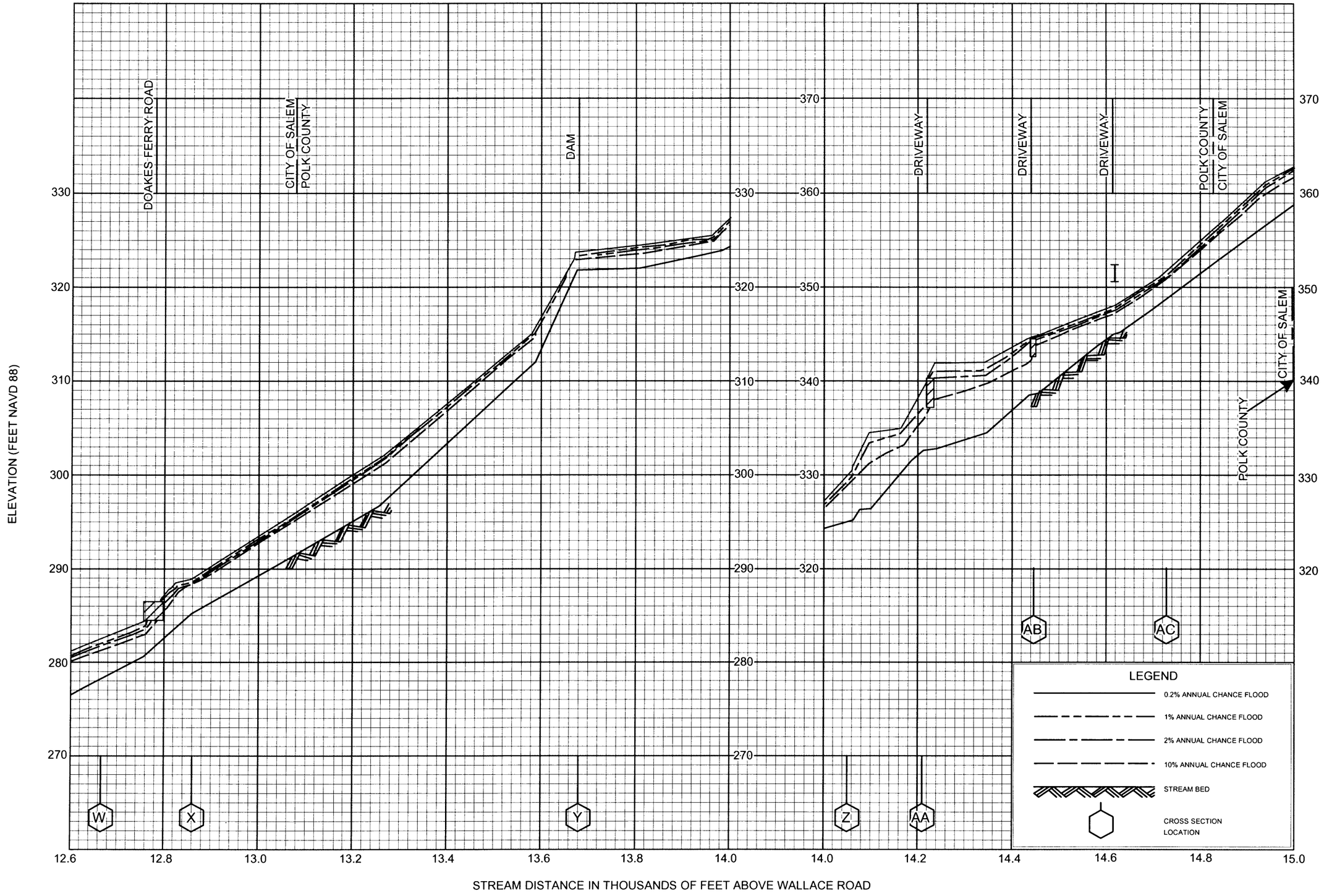
FLOOD PROFILES

GLENN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

11P



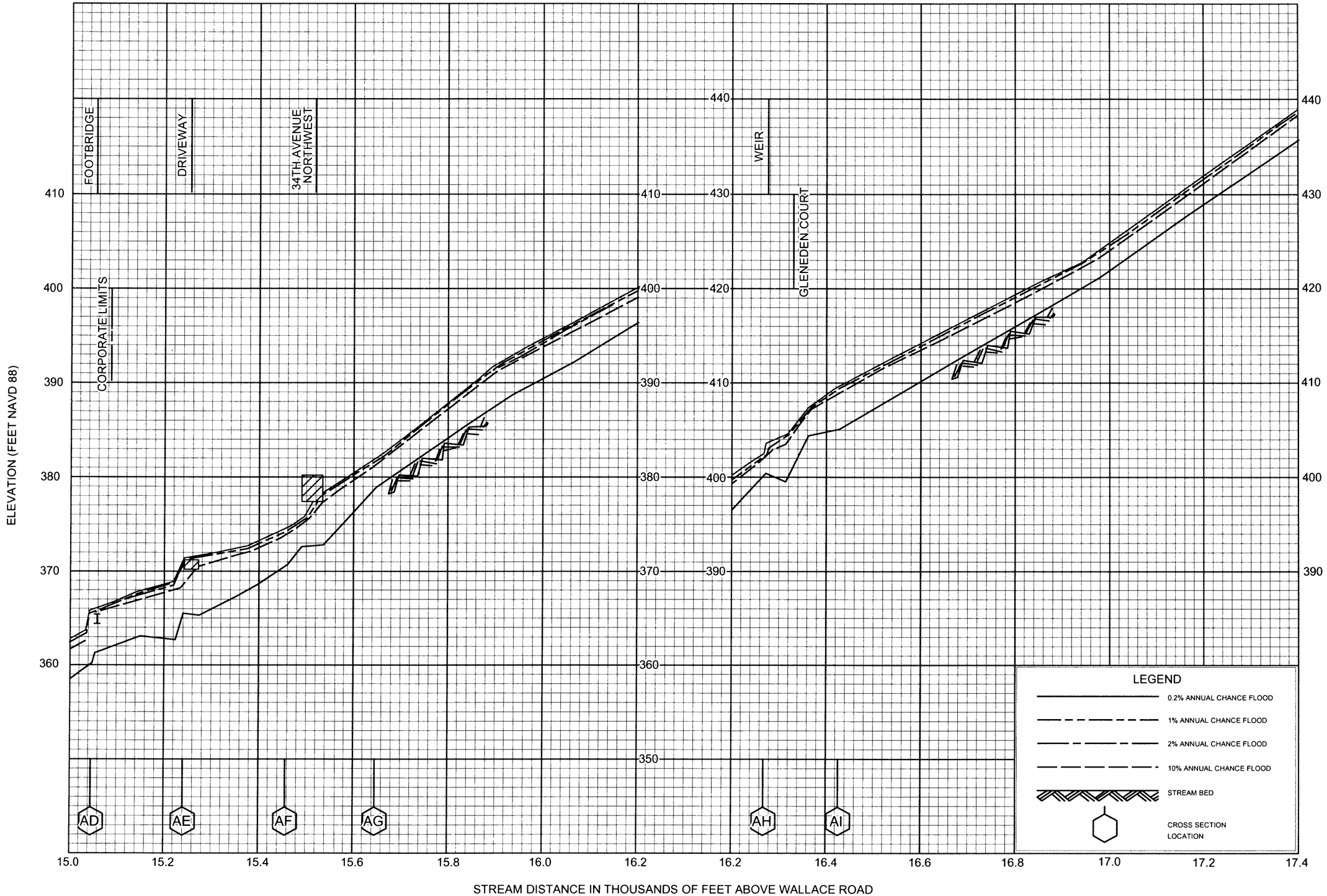
FLOOD PROFILES

GLENN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

12P



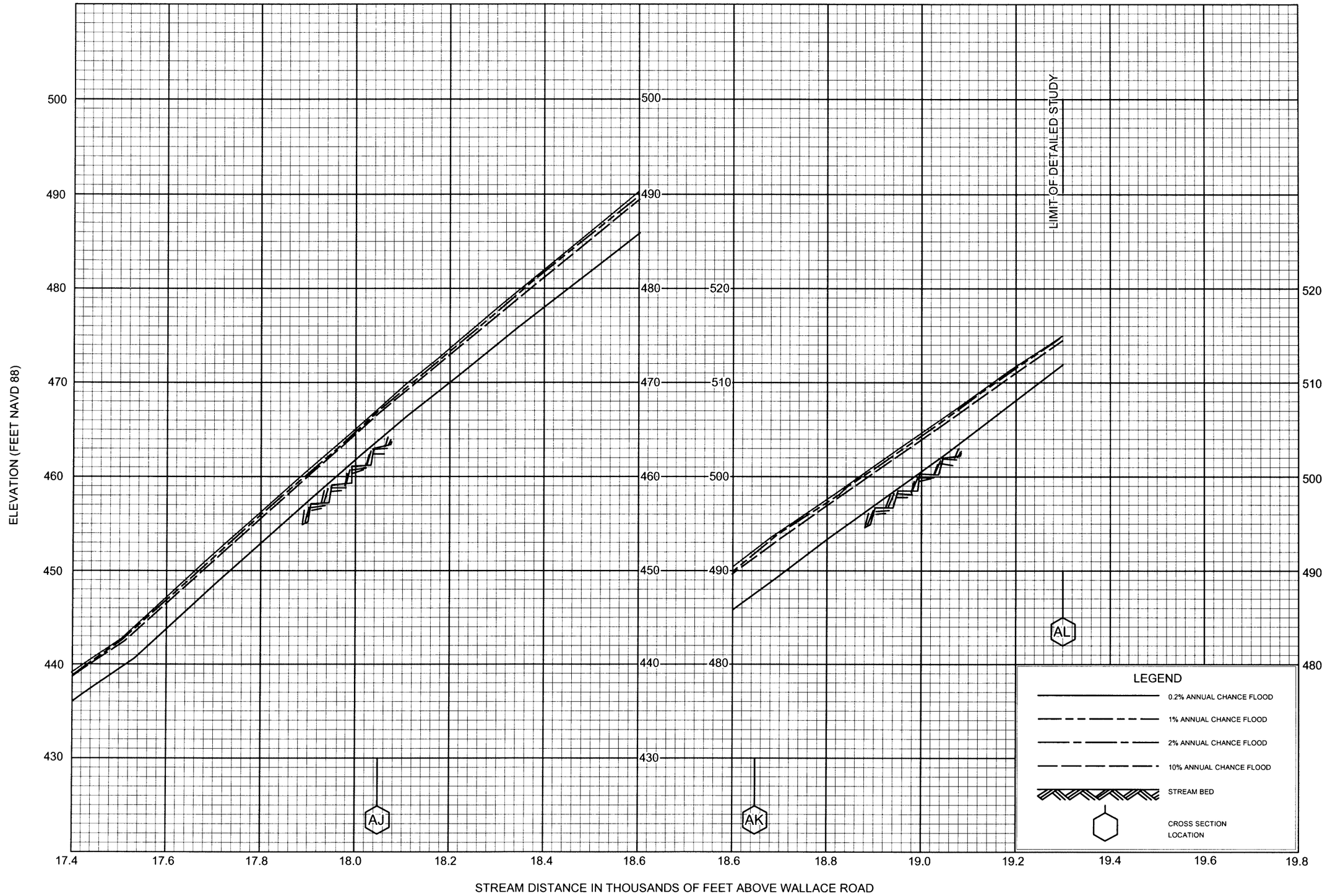
FLOOD PROFILES

GLENN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

13P

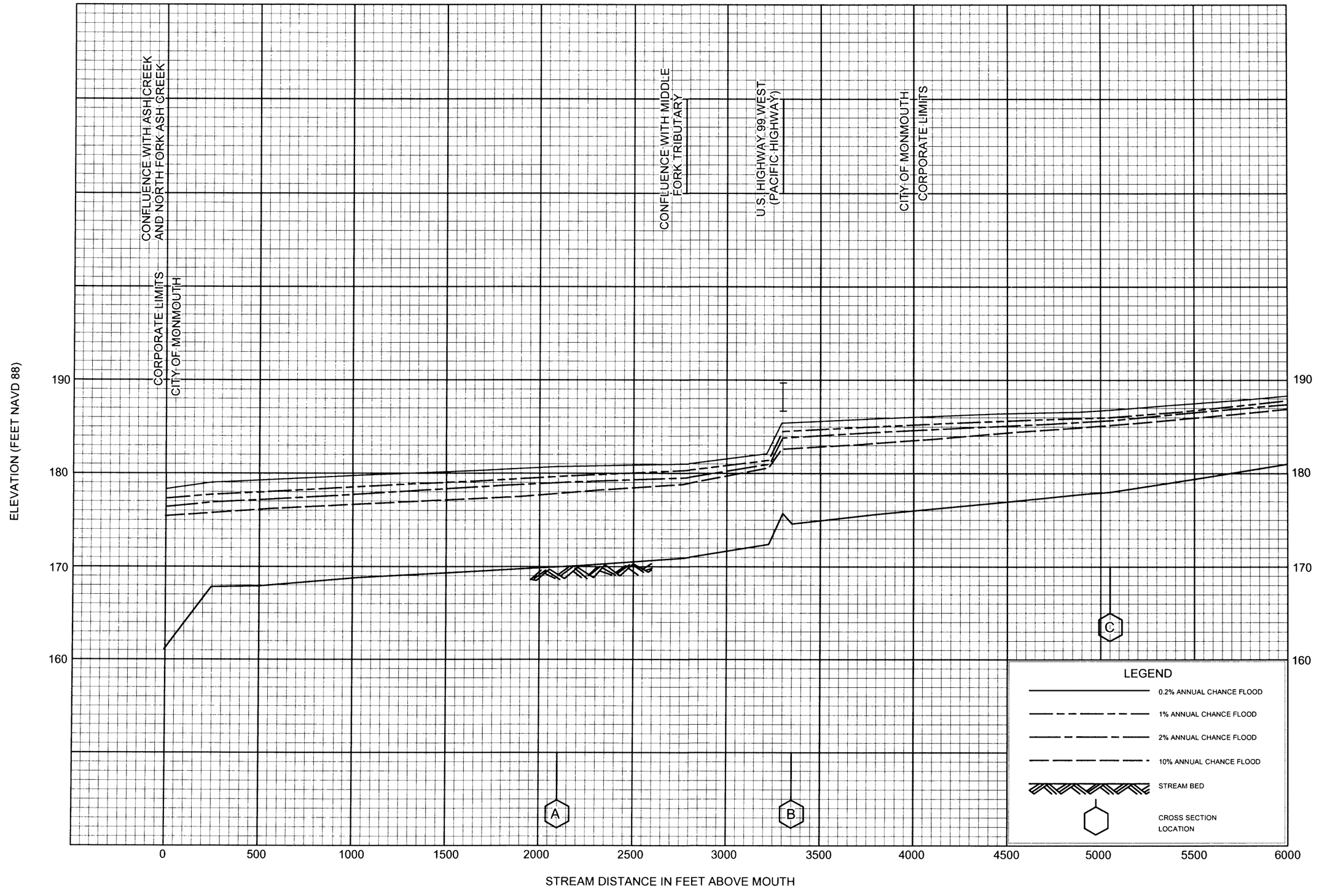


FLOOD PROFILES

GLENN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS



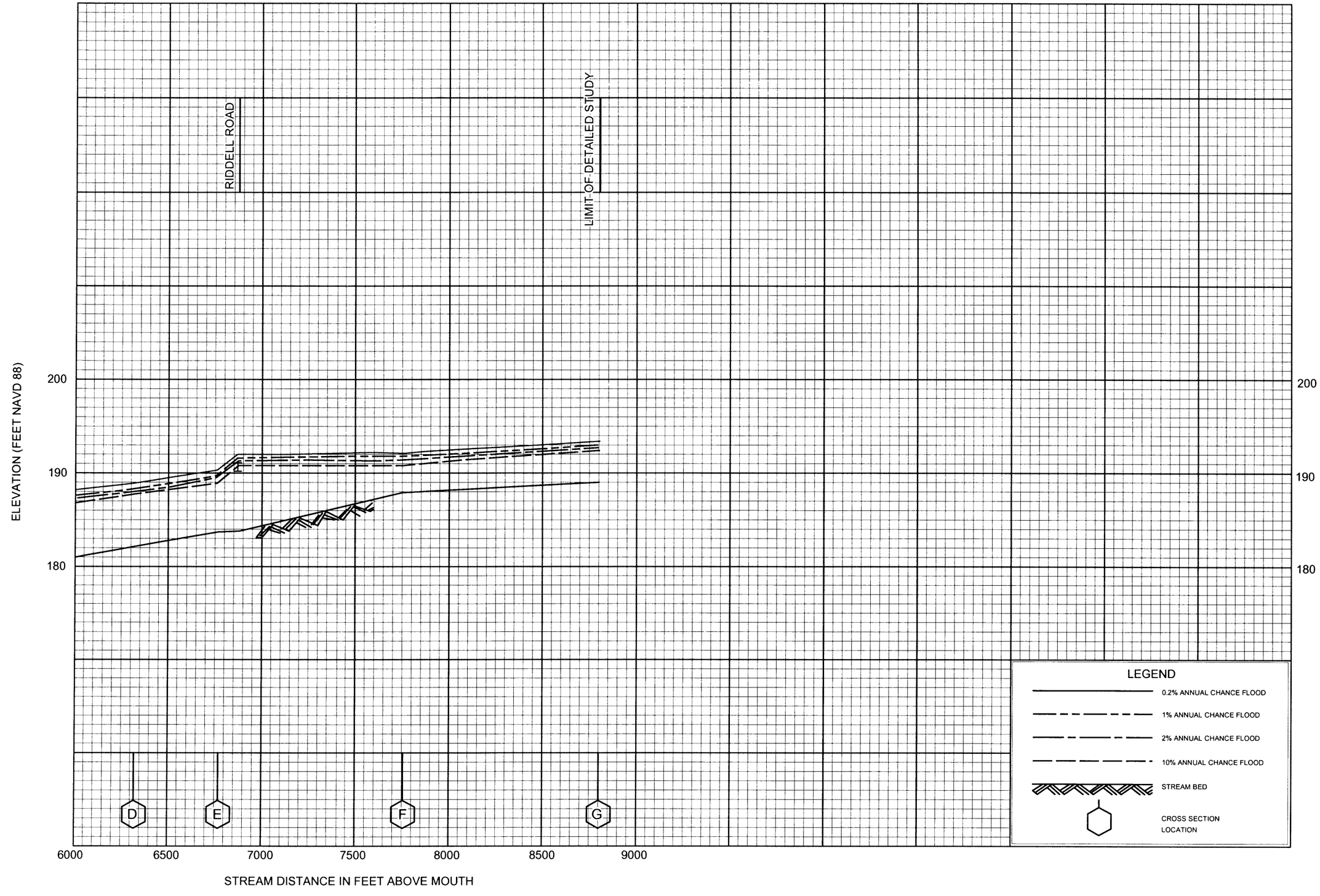
FLOOD PROFILES

MIDDLE FORK ASH CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

15P



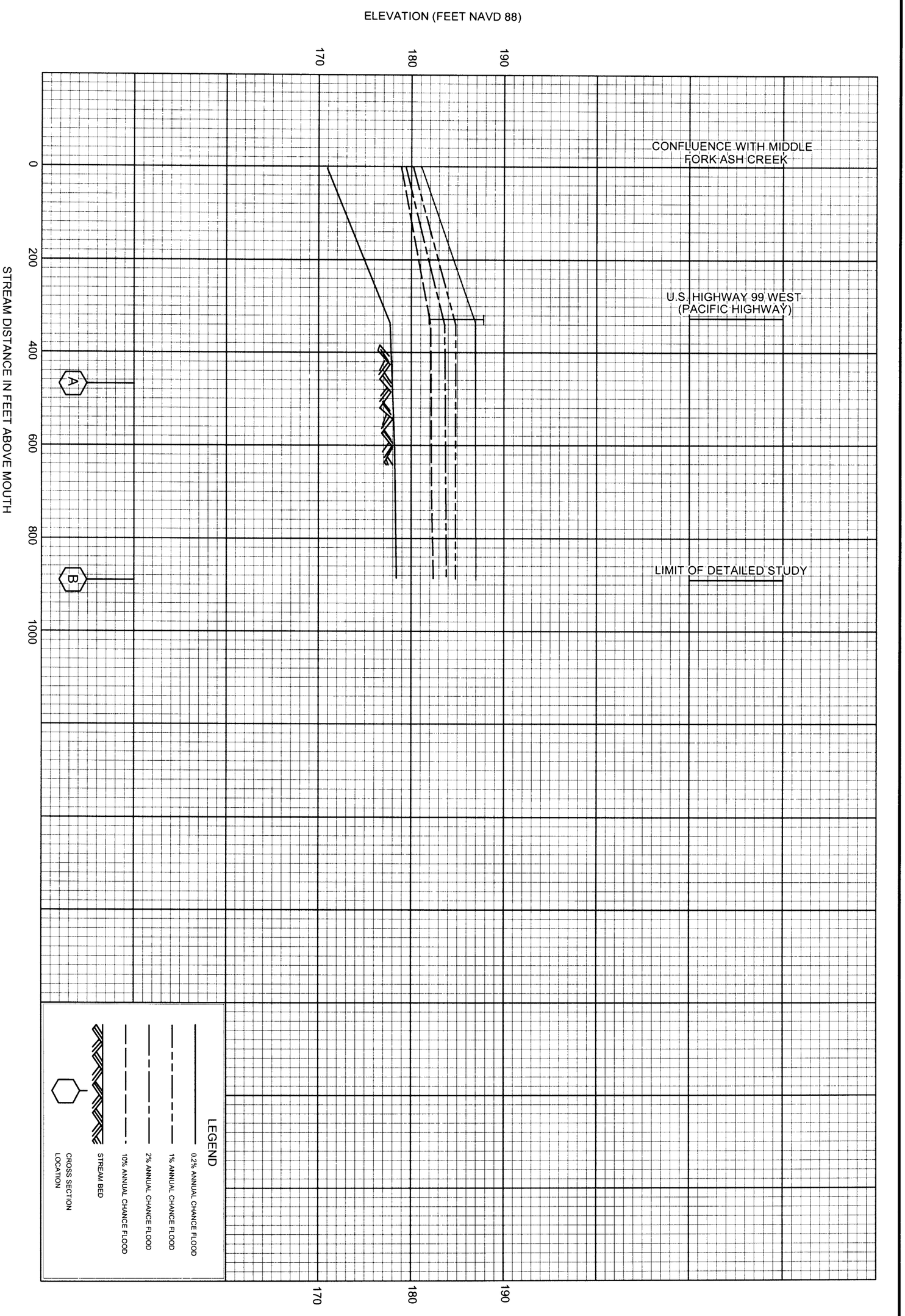
FLOOD PROFILES

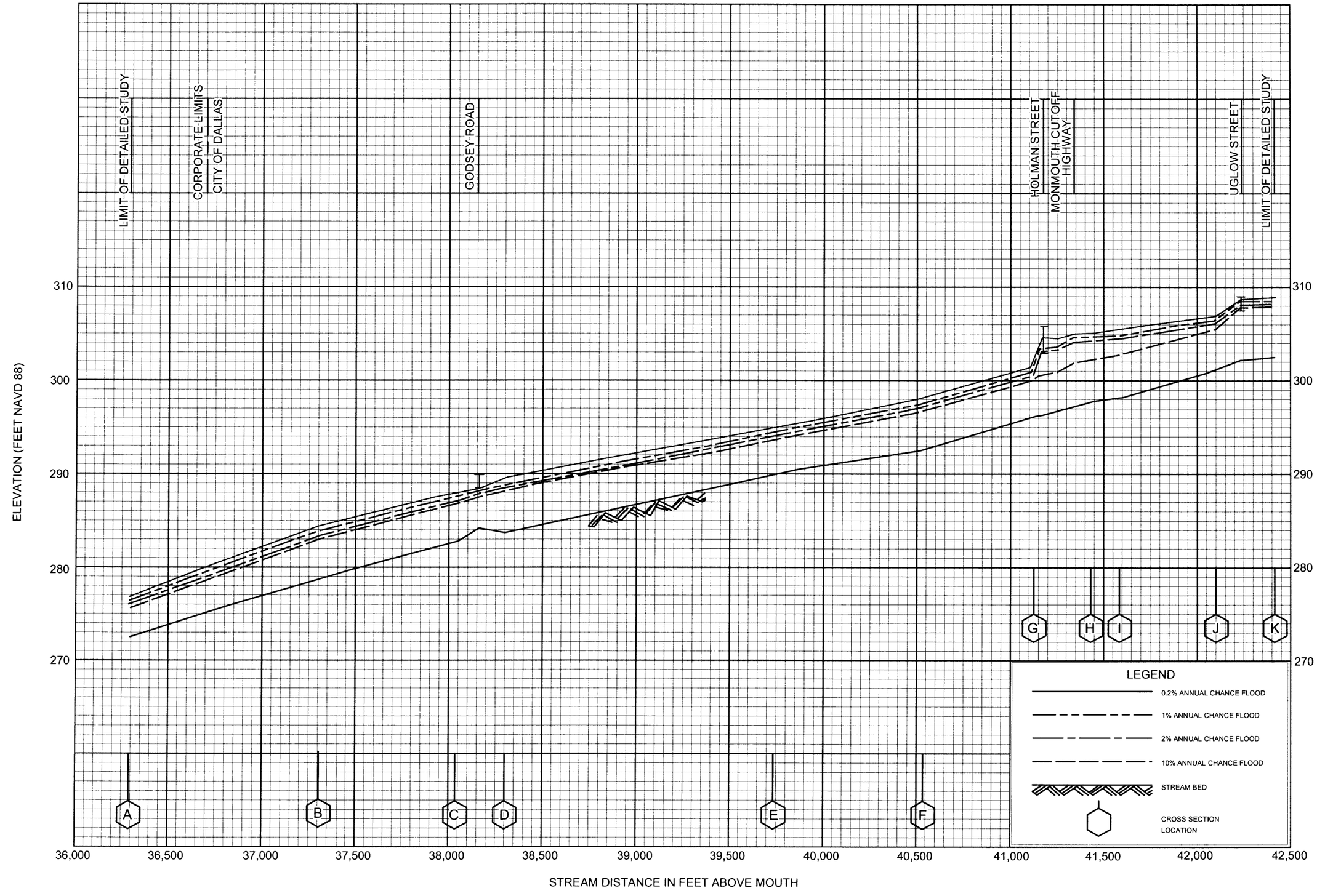
MIDDLE FORK ASH CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

16P


ELEVATION (FEET NAVD 88)
170
180
190
0
200
400
600
800
1000
STREAM DISTANCE IN FEET ABOVE MOUTH
CONFLUENCE WITH MIDDLE FORK ASH CREEK
U.S. HIGHWAY 99 WEST (PACIFIC HIGHWAY)
LIMIT OF DETAILED STUDY
A
B
LEGEND
0.2% ANNUAL CHANCE FLOOD
1% ANNUAL CHANCE FLOOD
2% ANNUAL CHANCE FLOOD
10% ANNUAL CHANCE FLOOD
STREAM BED
CROSS SECTION LOCATION



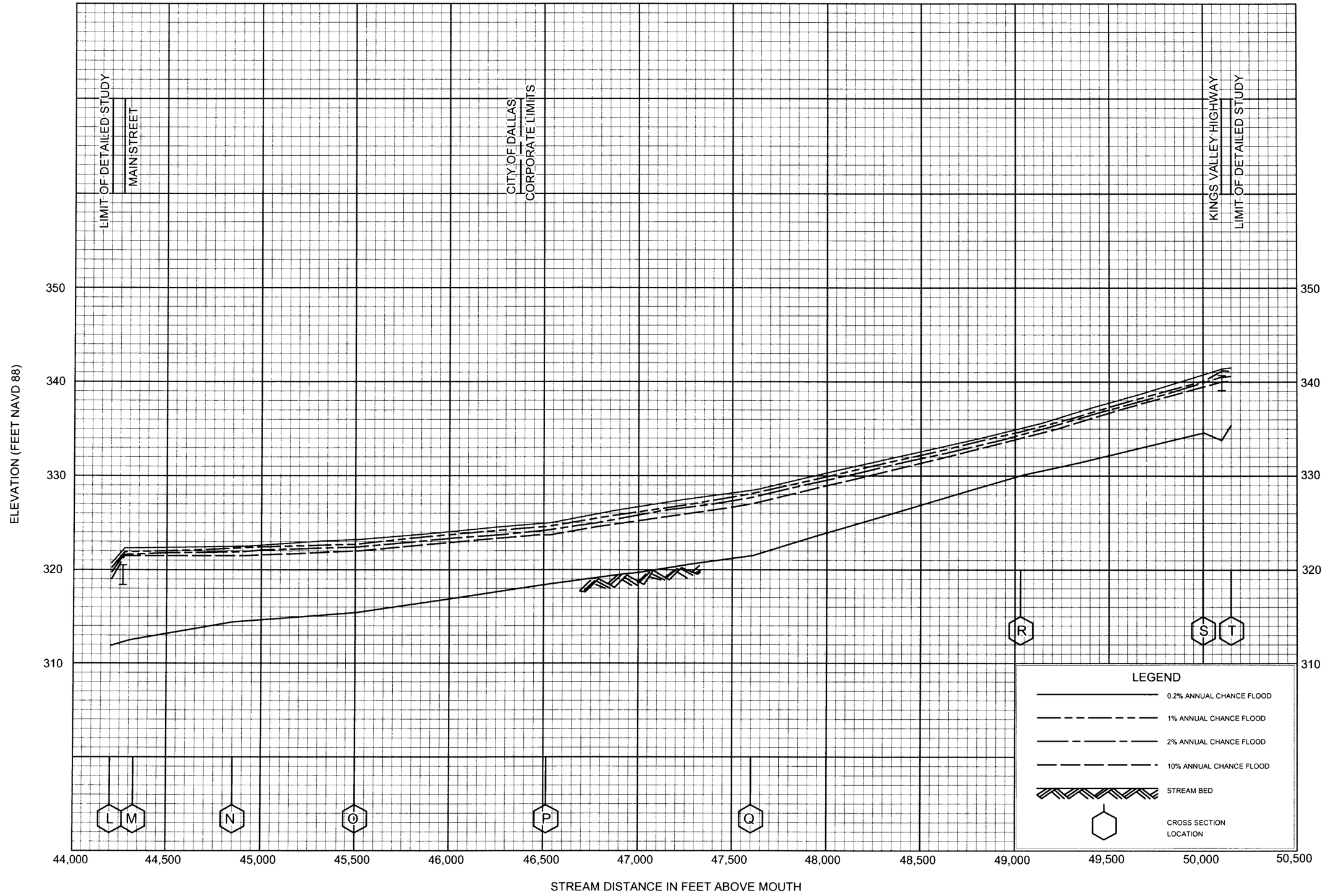
FLOOD PROFILES

NORTH FORK ASH CREEK AT DALLAS

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

18P

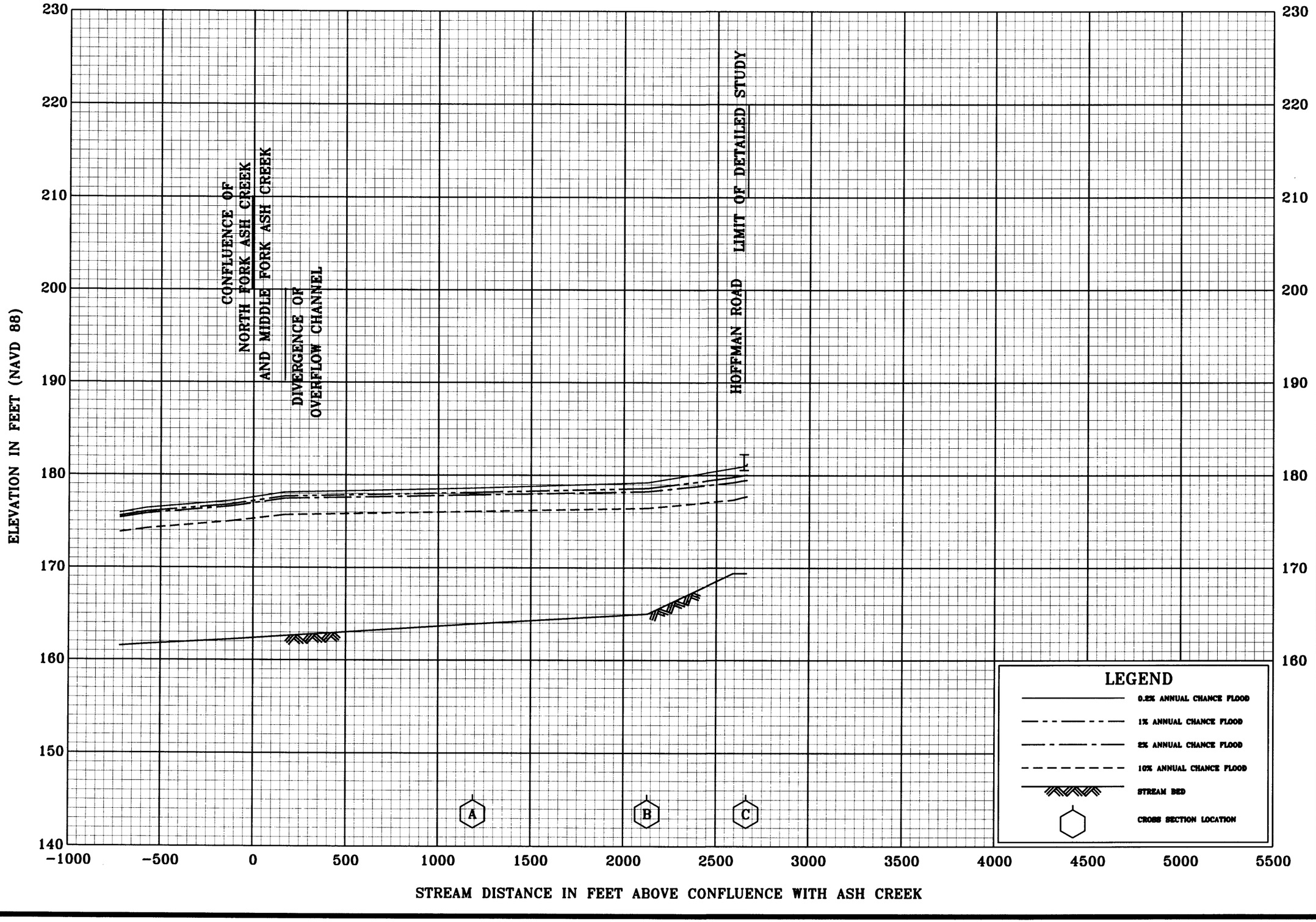


FLOOD PROFILES

NORTH FORK ASH CREEK AT DALLAS

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS



FLOOD PROFILES

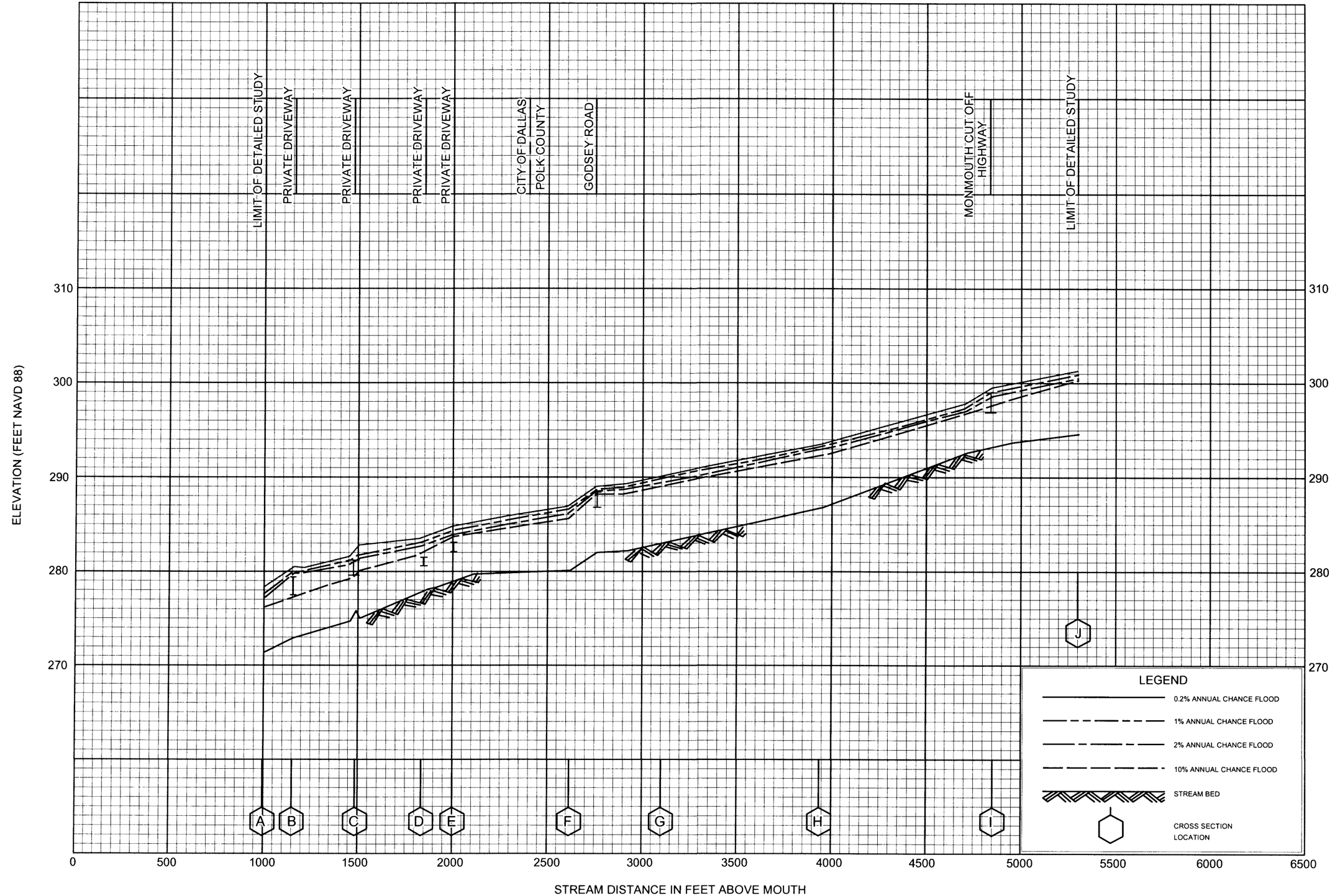
NORTH FORK ASH CREEK AT MONMOUTH

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR

AND INCORPORATED AREAS

20P

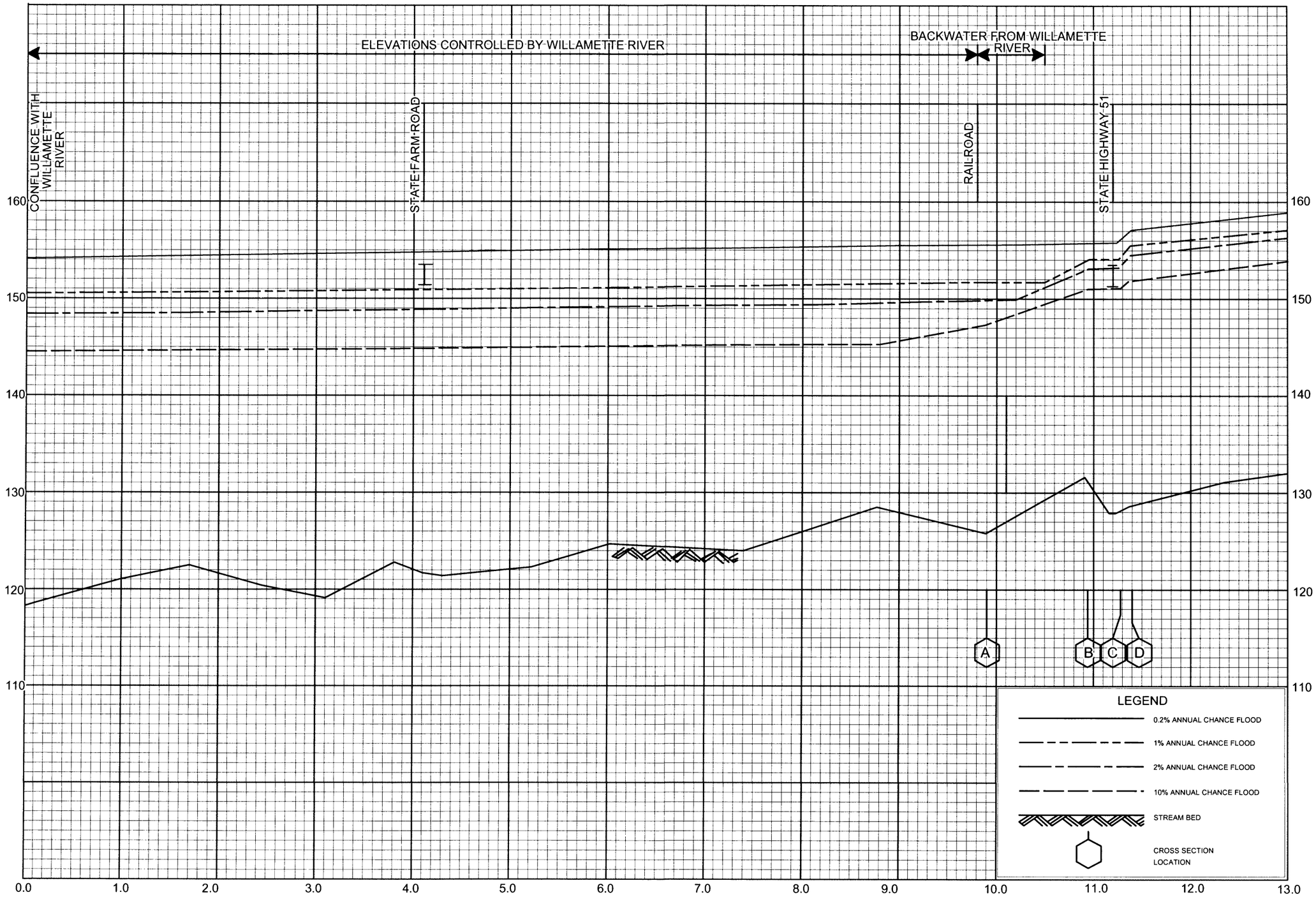


FLOOD PROFILES

NORTH FORK TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS



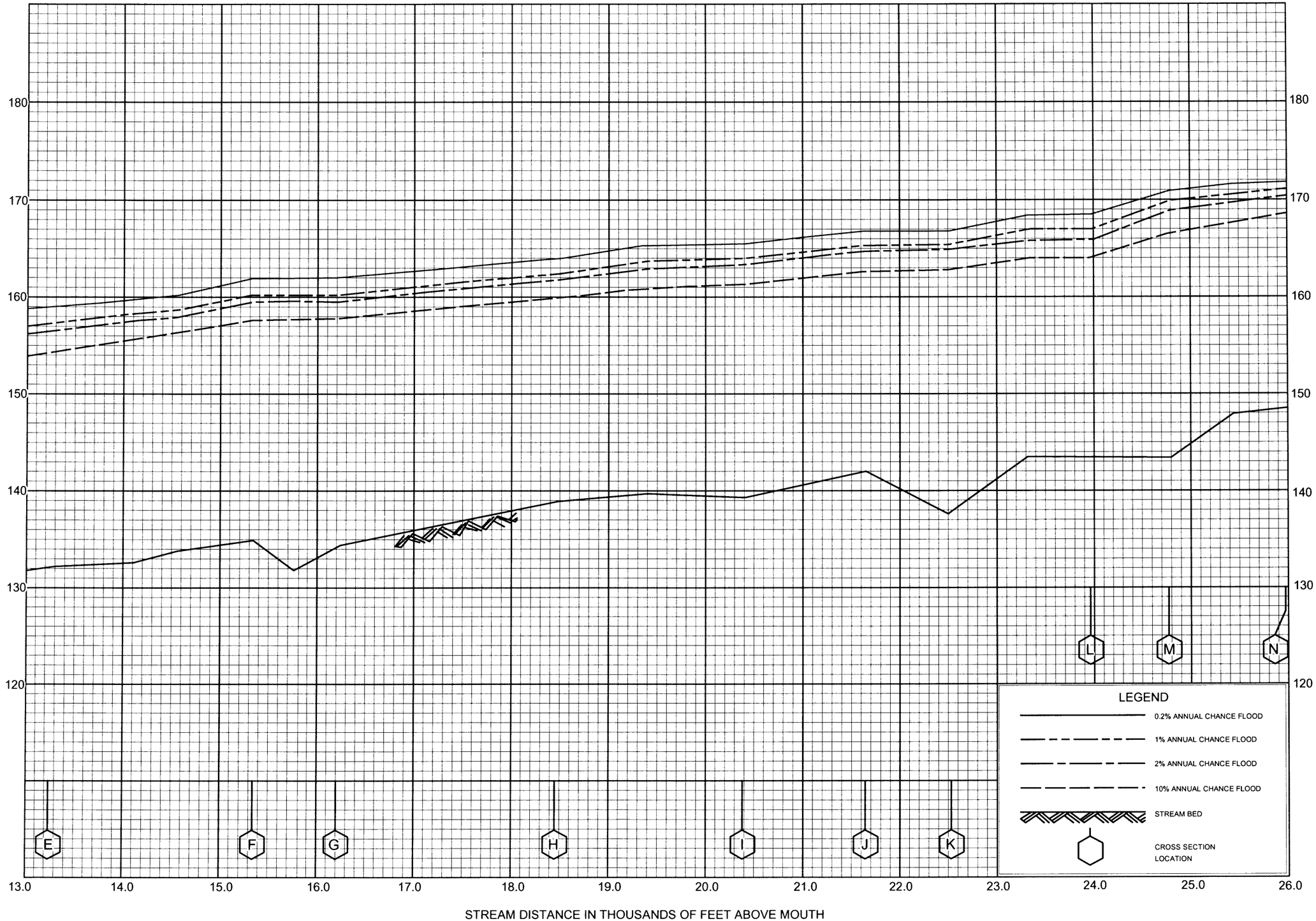
FLOOD PROFILES

RICKREALL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

22P

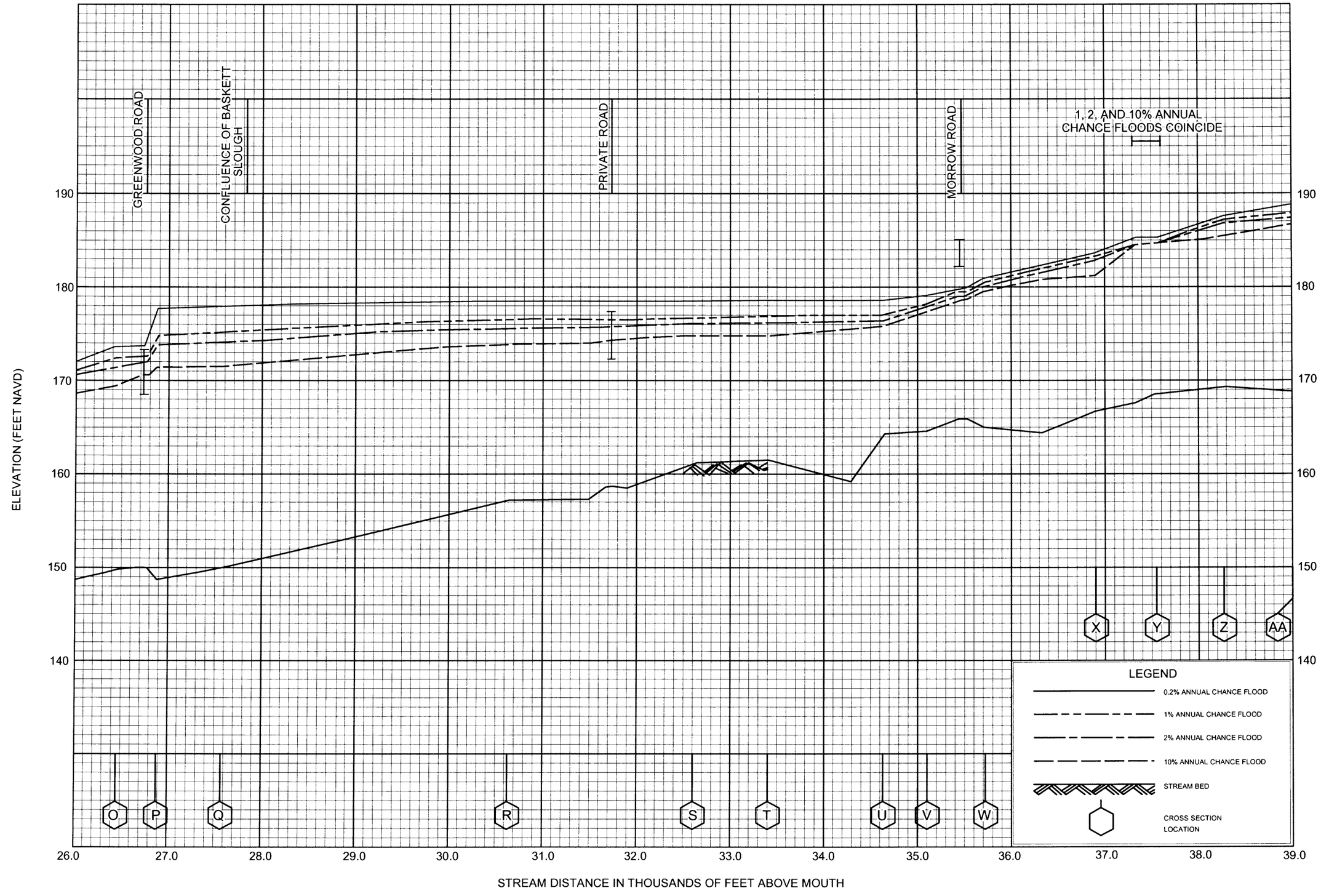


FLOOD PROFILES

RICKREALL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS



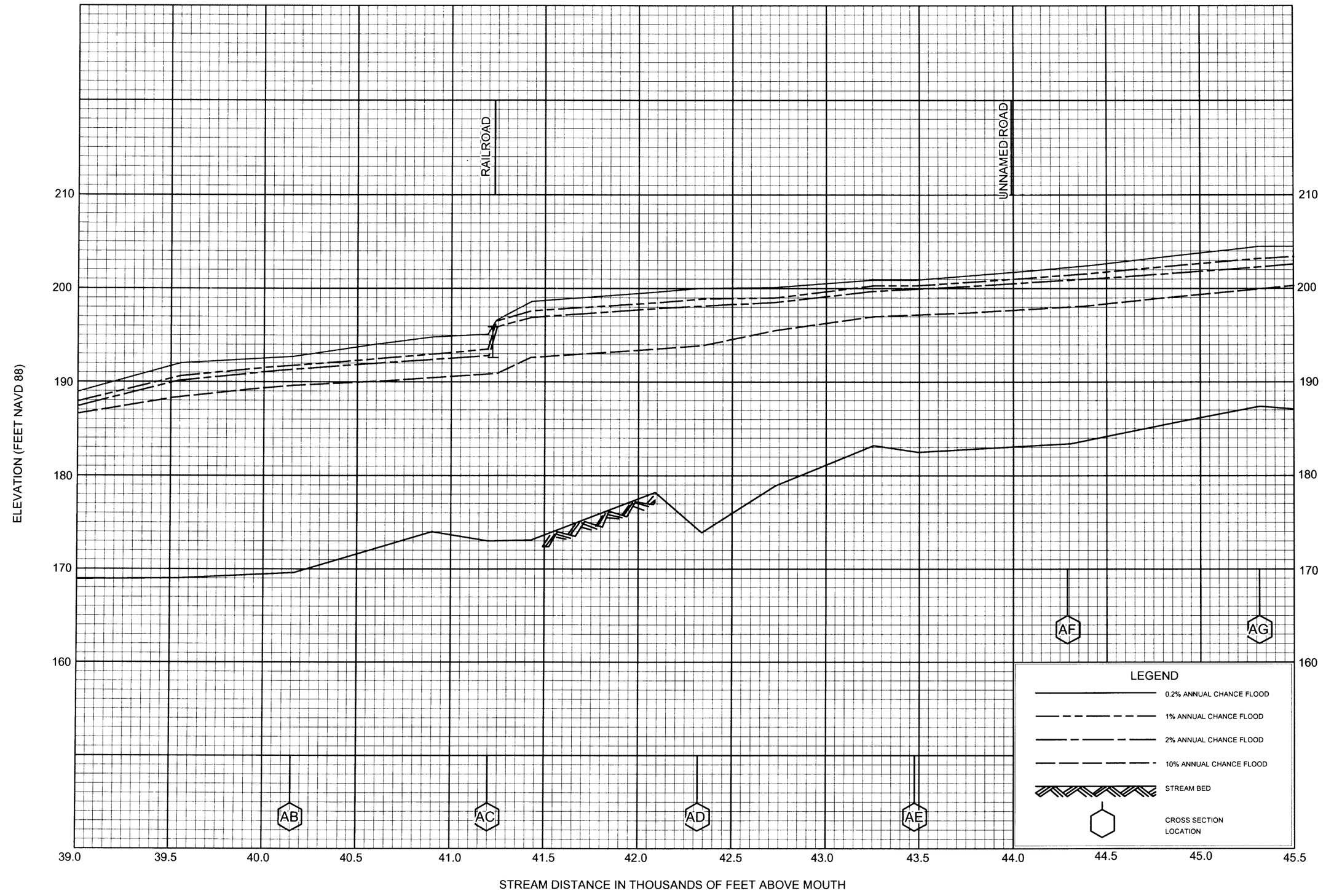
FLOOD PROFILES

RICKREALL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

24P

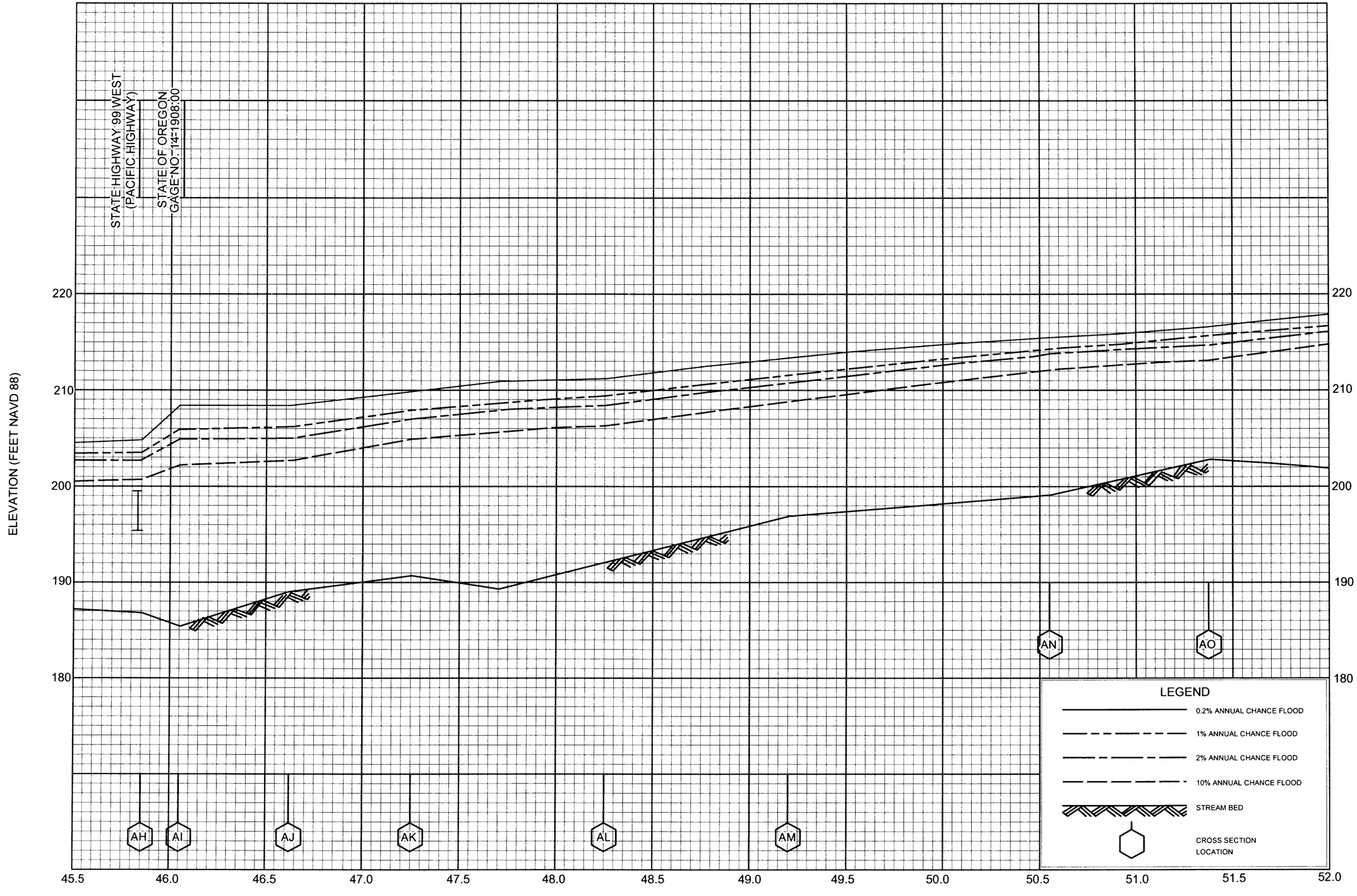


FLOOD PROFILES

RICKREALL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

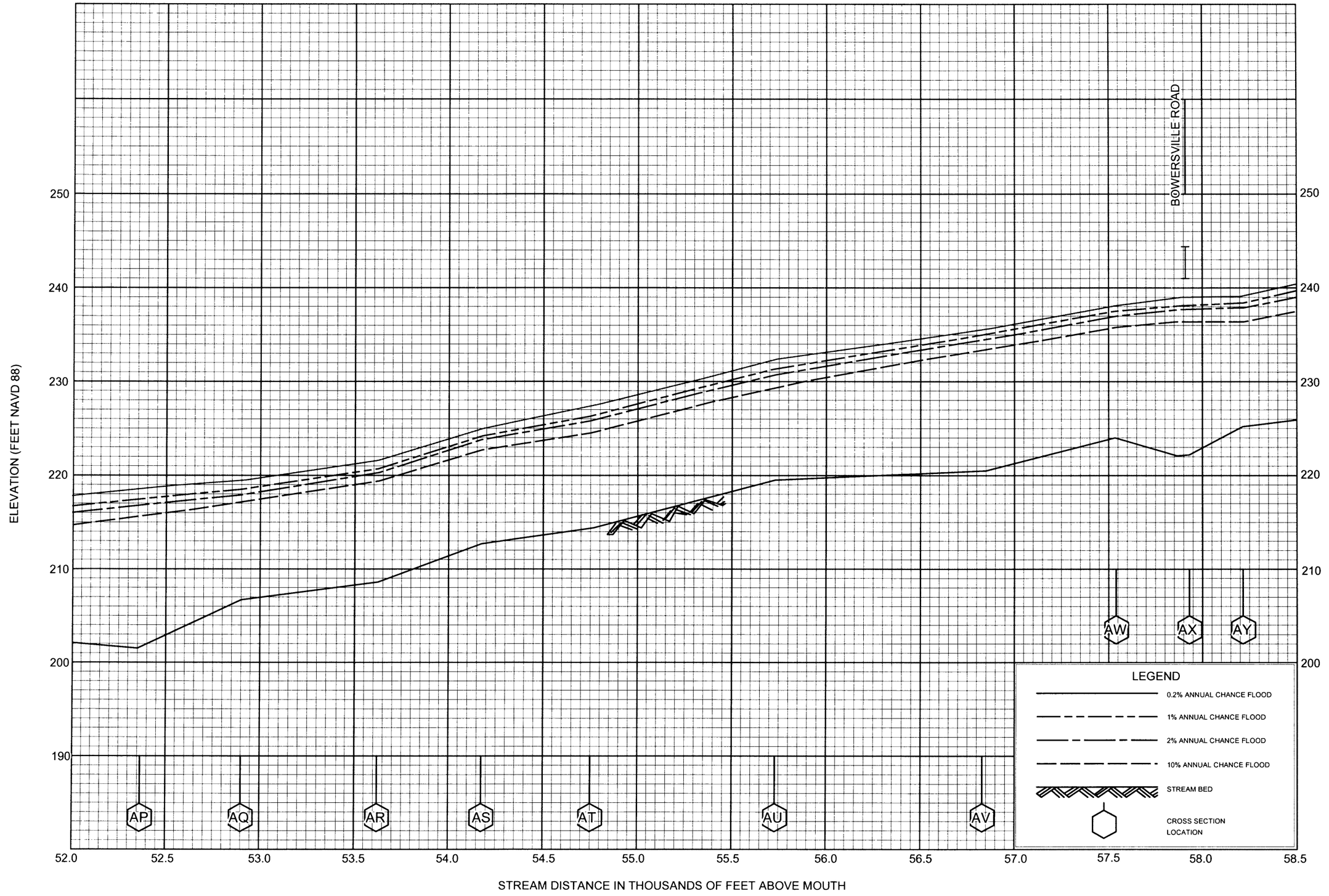


FLOOD PROFILES

RICKREALL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

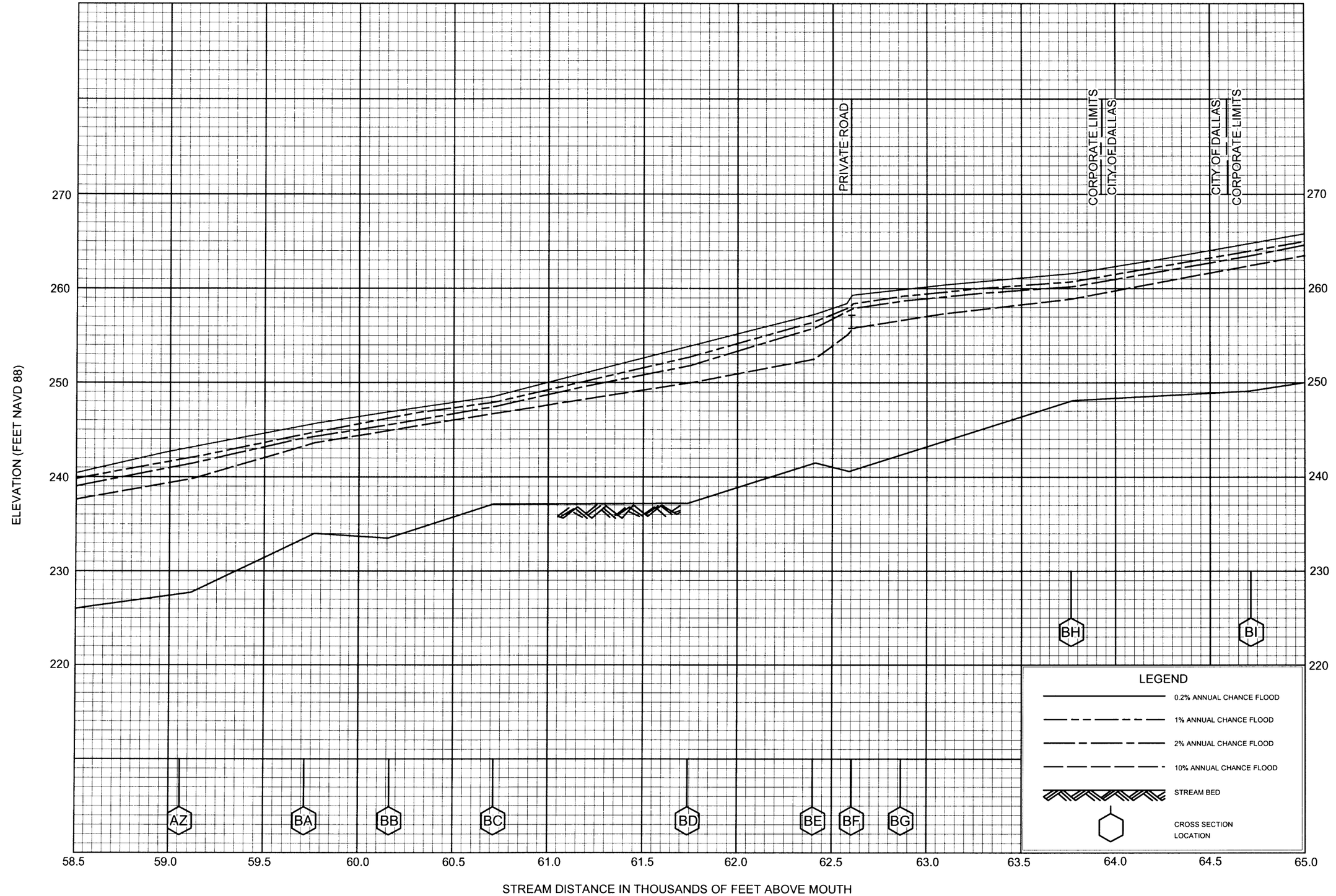


FLOOD PROFILES

RICKREALL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

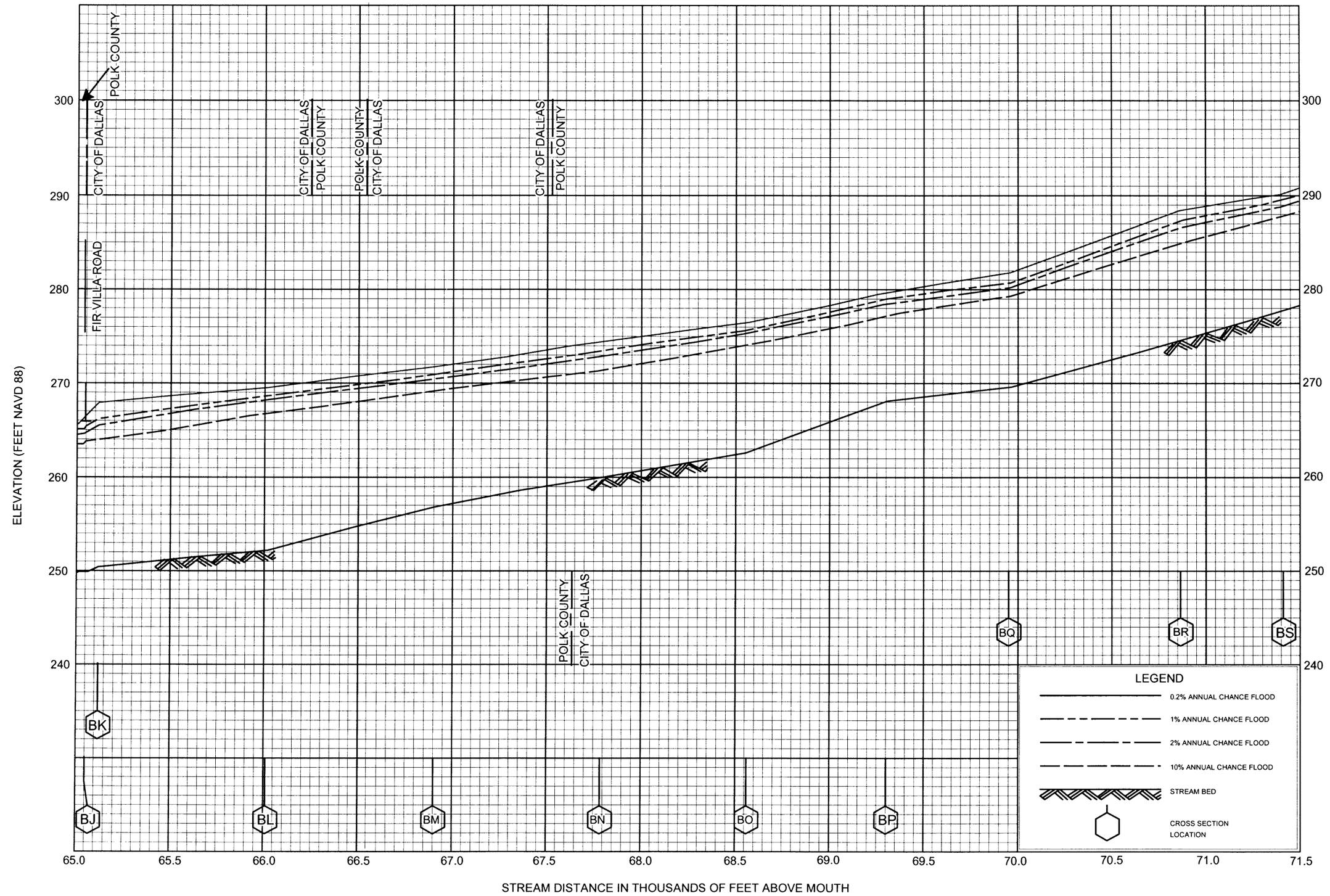


FLOOD PROFILES

RICKREALL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS



FLOOD PROFILES

RICKREALL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

ELEVATION (FEET NAVD 88)

330
320
310
300
290
280
270

JEFFERSON STREET
STATE HIGHWAY 223 (MAIN STREET)
LEVENS STREET
HAYTER STREET

BT BU BV BW BX BY BZ CA CB CC CD CE CF

LEGEND
0.2% ANNUAL CHANCE FLOOD
1% ANNUAL CHANCE FLOOD
2% ANNUAL CHANCE FLOOD
10% ANNUAL CHANCE FLOOD
STREAM BED
CROSS SECTION LOCATION

71.5 72.0 72.5 73.0 73.5 74.0 74.5 75.0 75.5 76.0 76.5 77.0 77.5 78.0

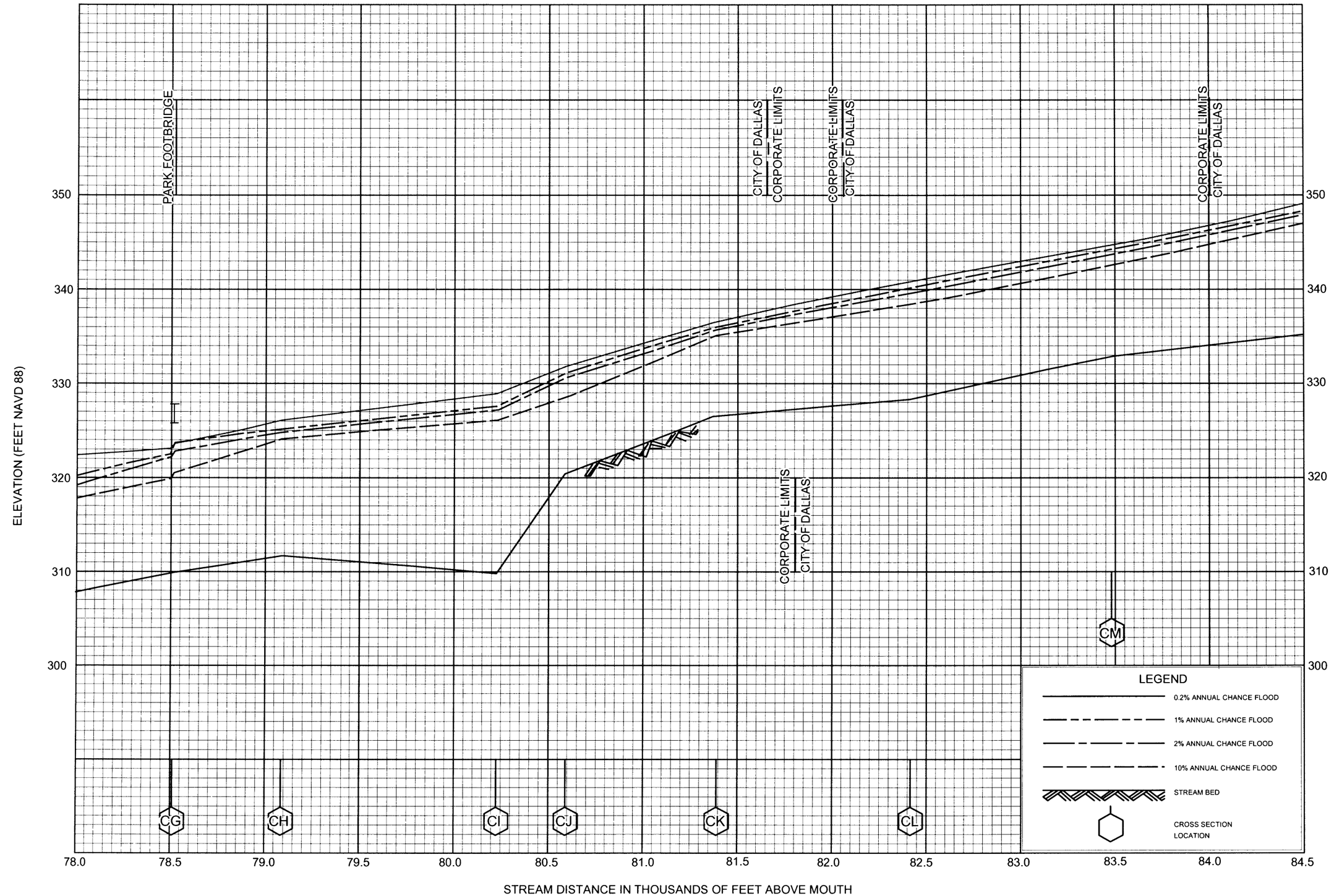
STREAM DISTANCE IN THOUSANDS OF FEET ABOVE MOUTH

FLOOD PROFILES

RICKREALL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

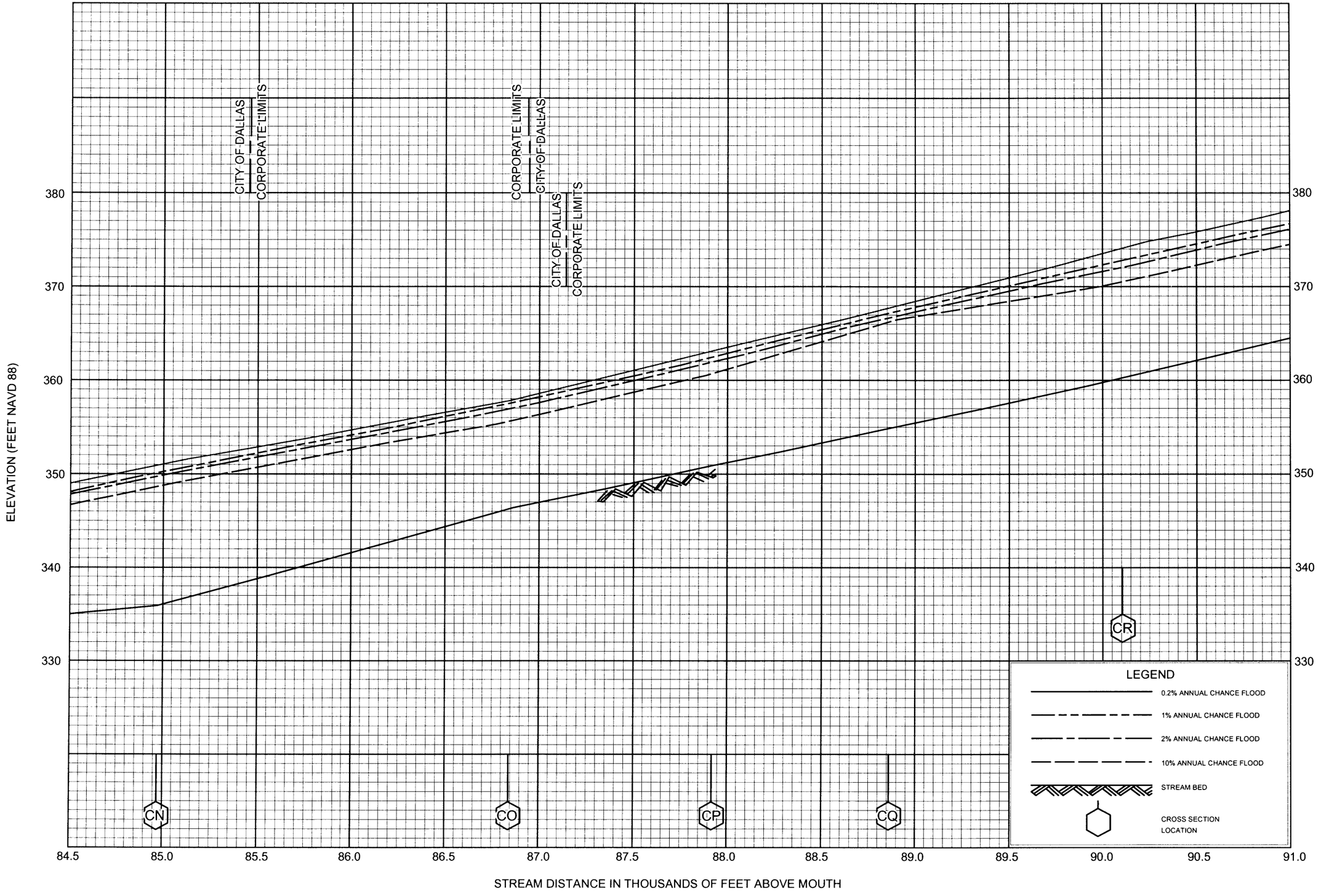


FLOOD PROFILES

RICKREALL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS



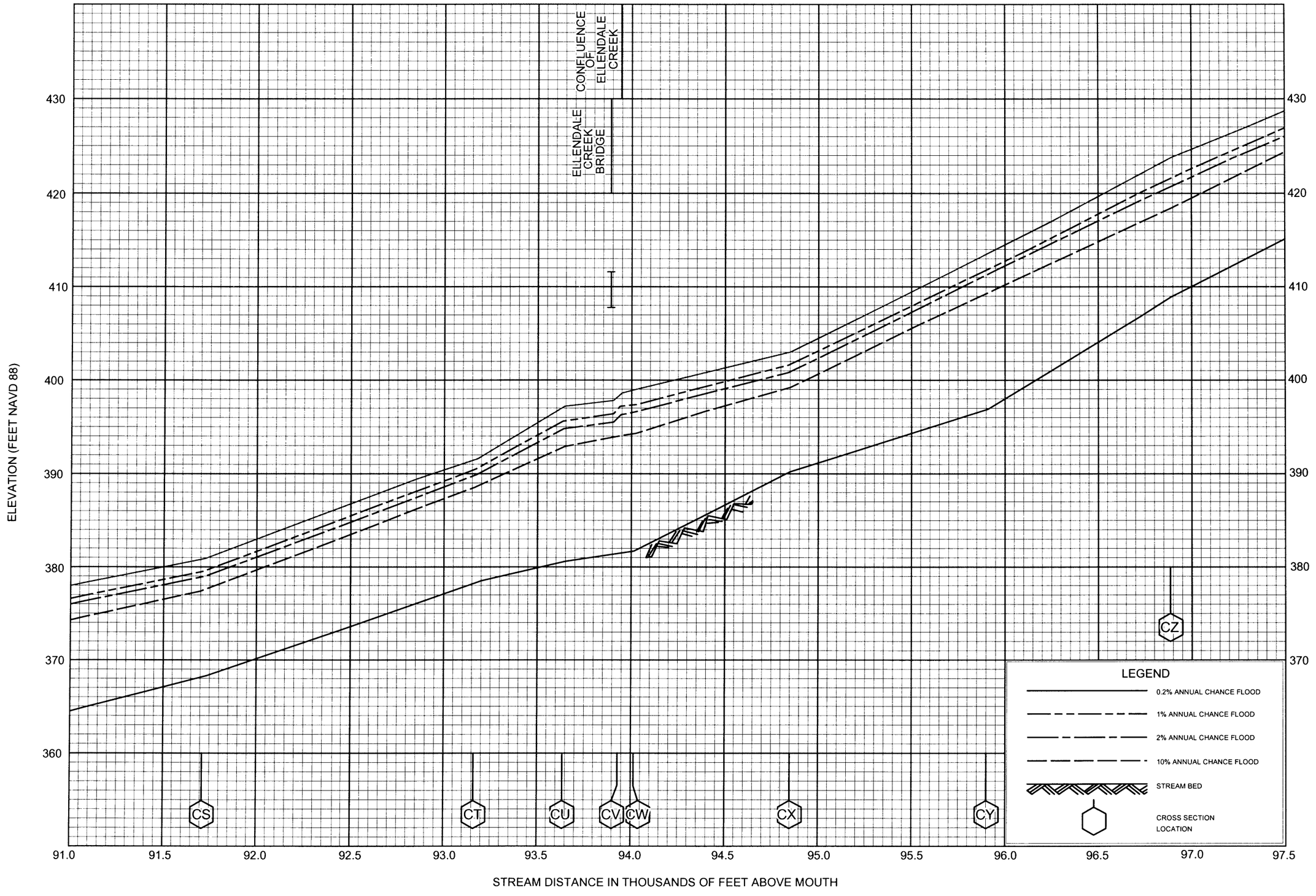
FLOOD PROFILES

RICKREALL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

32P



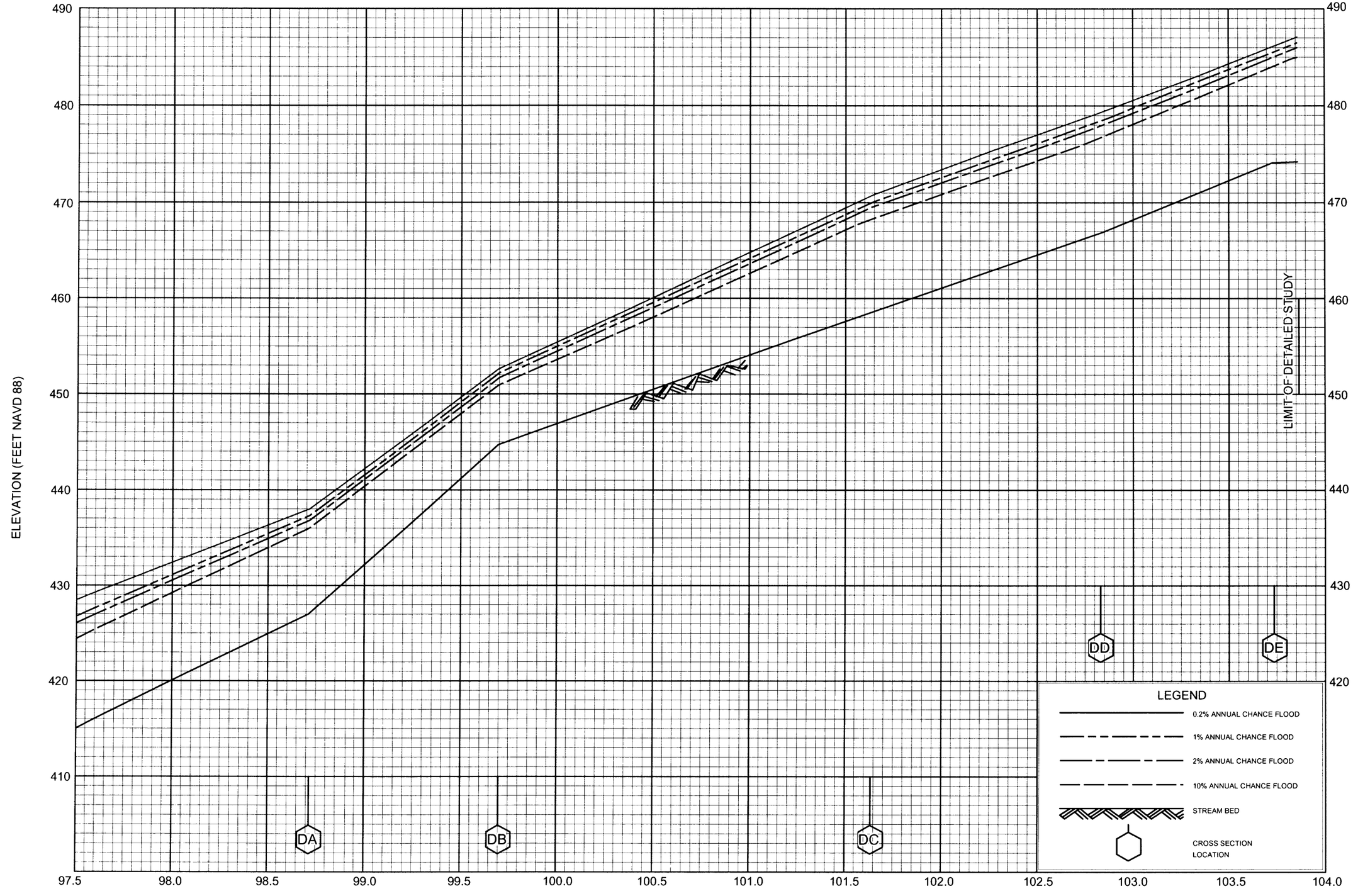
FLOOD PROFILES

RICKREALL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

33P

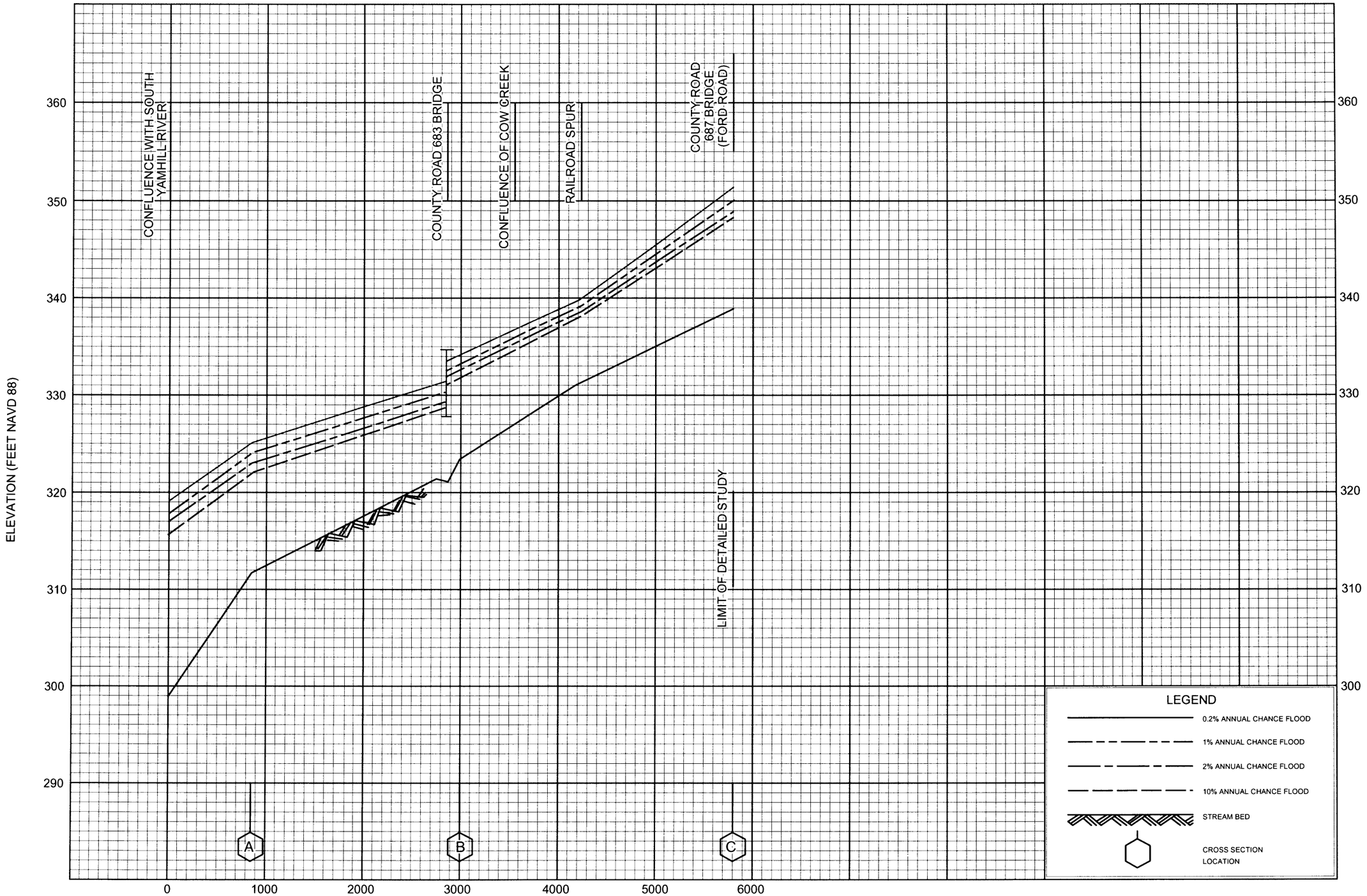


FLOOD PROFILES

RICKREALL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS



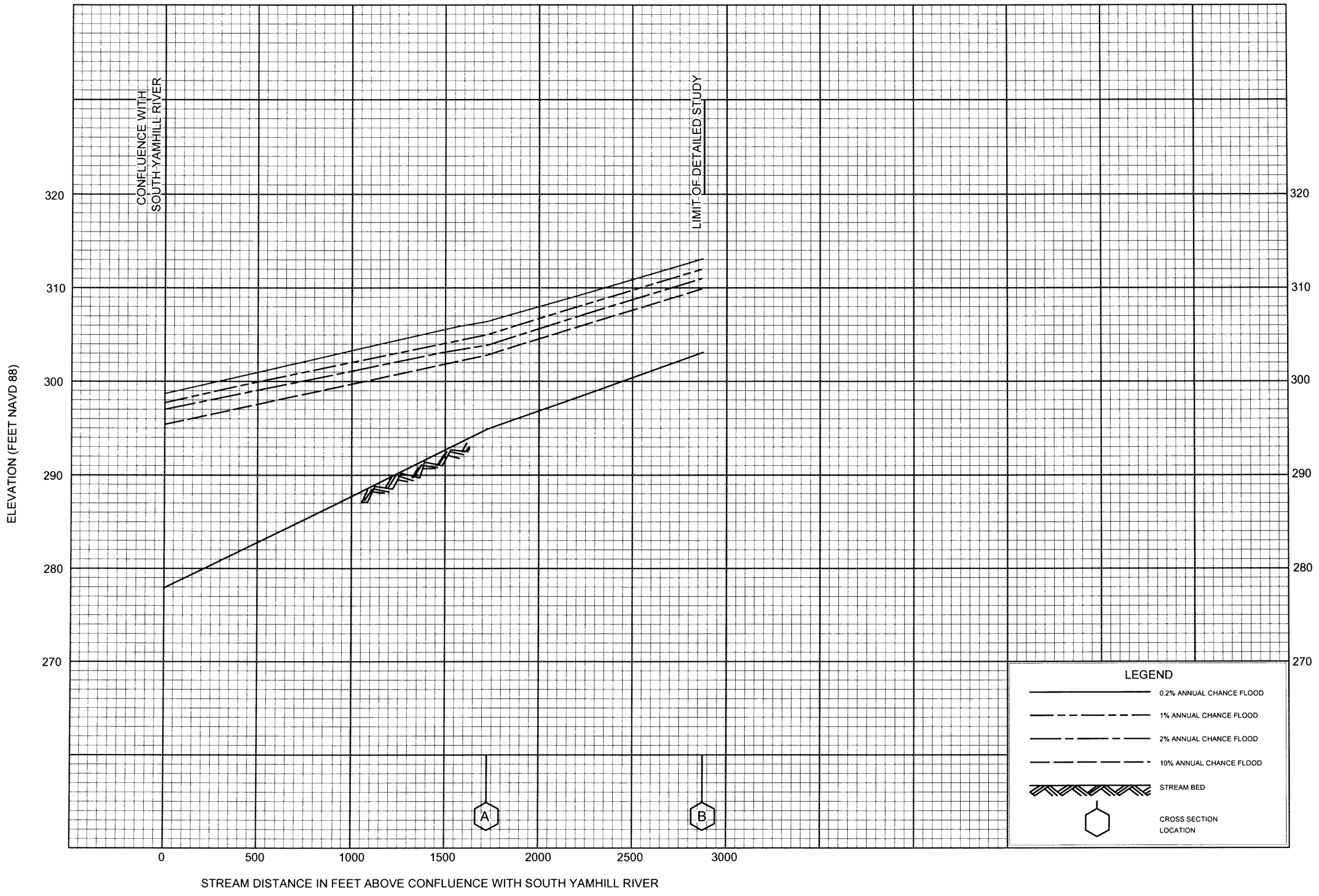
FLOOD PROFILES

ROCK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

35P

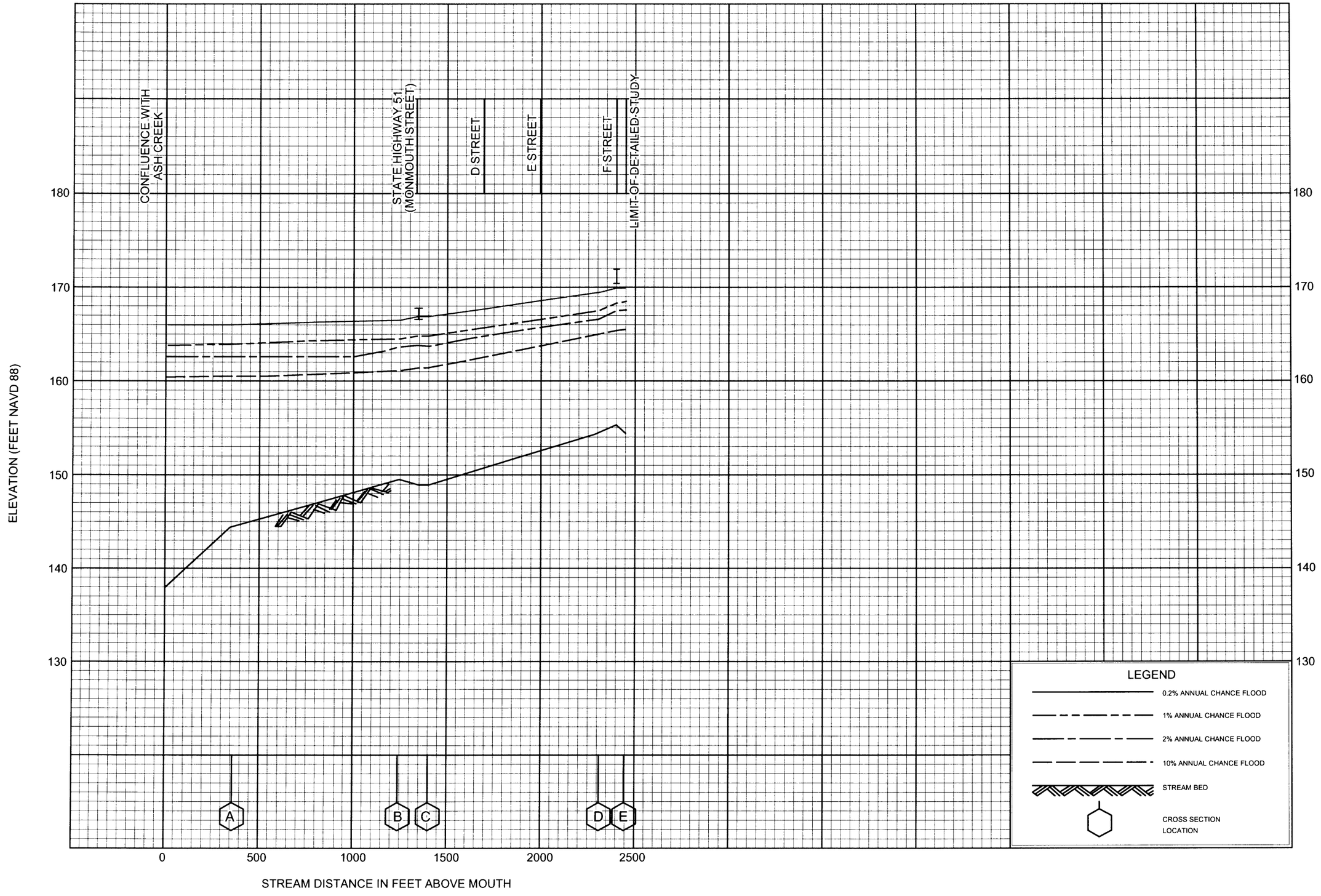


FLOOD PROFILES

ROWELL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS



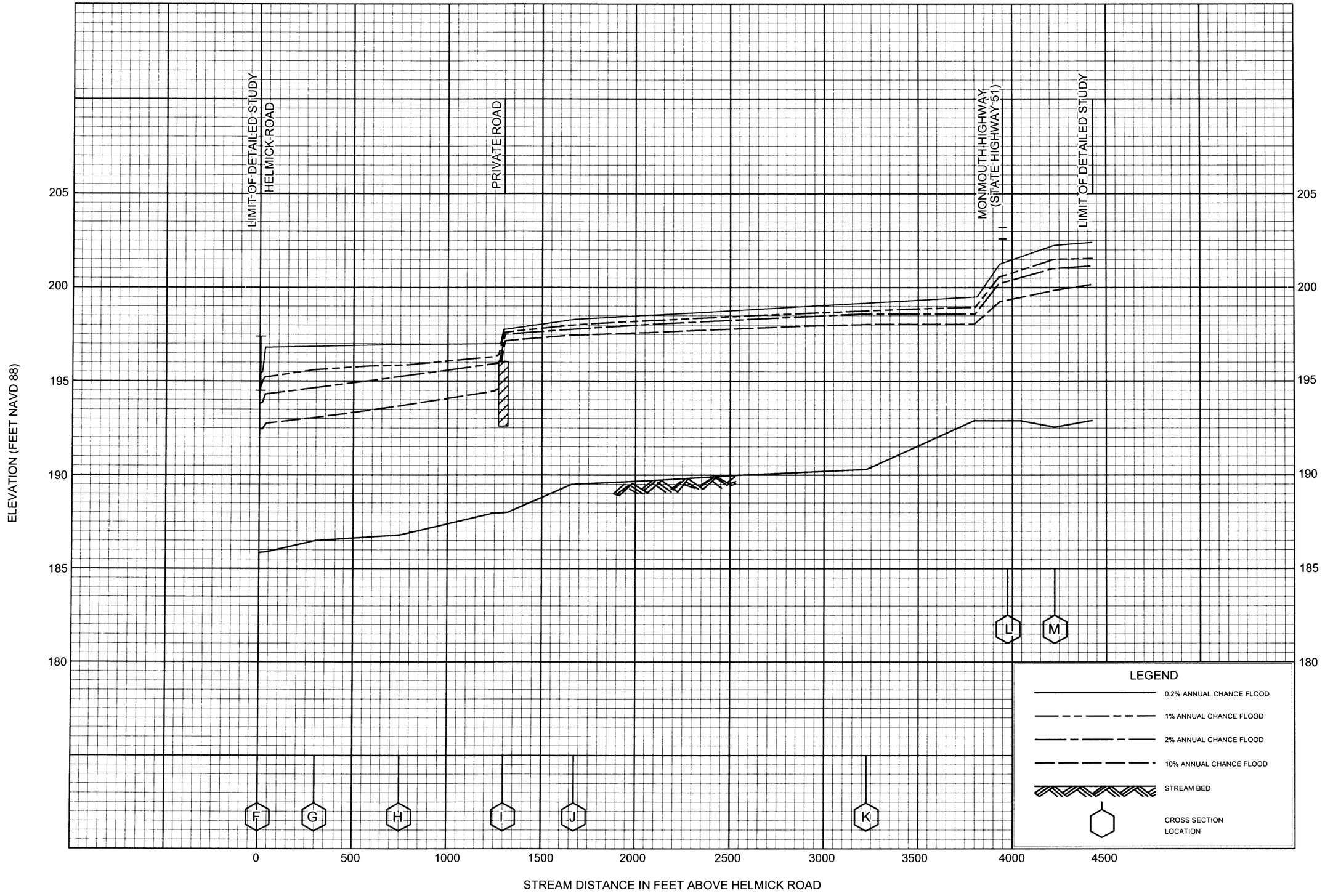
FLOOD PROFILES

SOUTH FORK ASH CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

37P



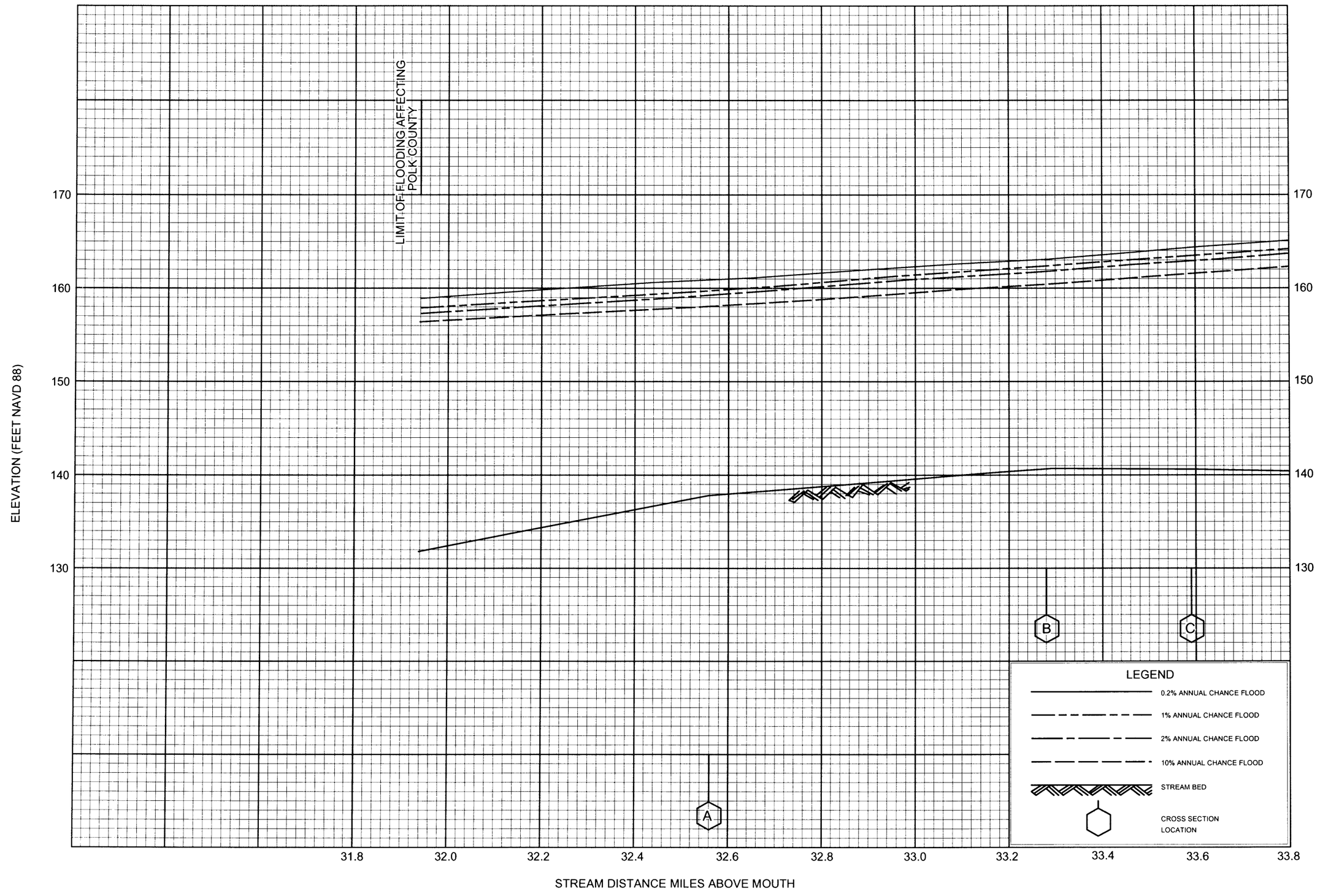
FLOOD PROFILES

SOUTH FORK ASH CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

38P

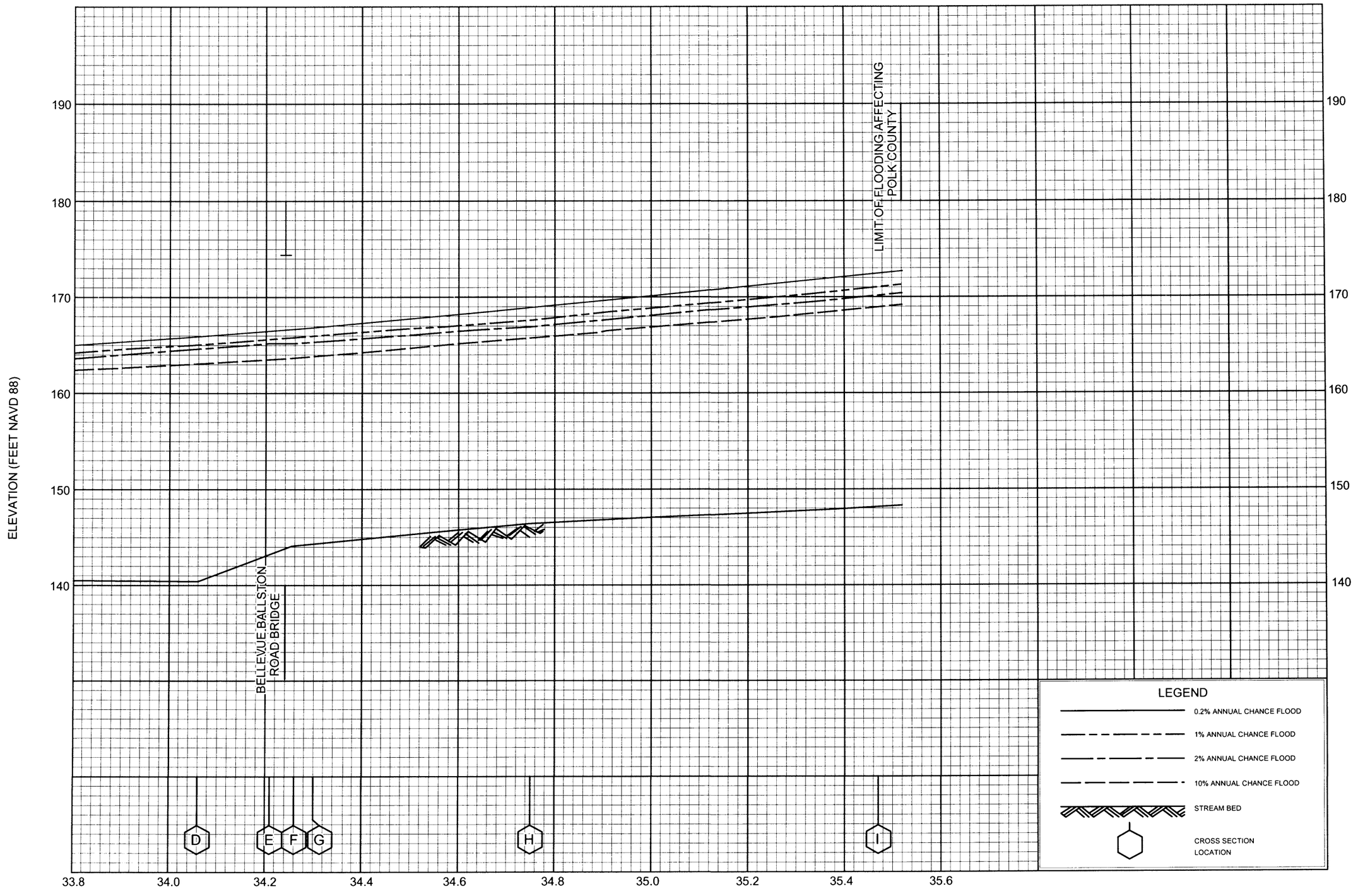


FLOOD PROFILES

SOUTH YAMHILL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

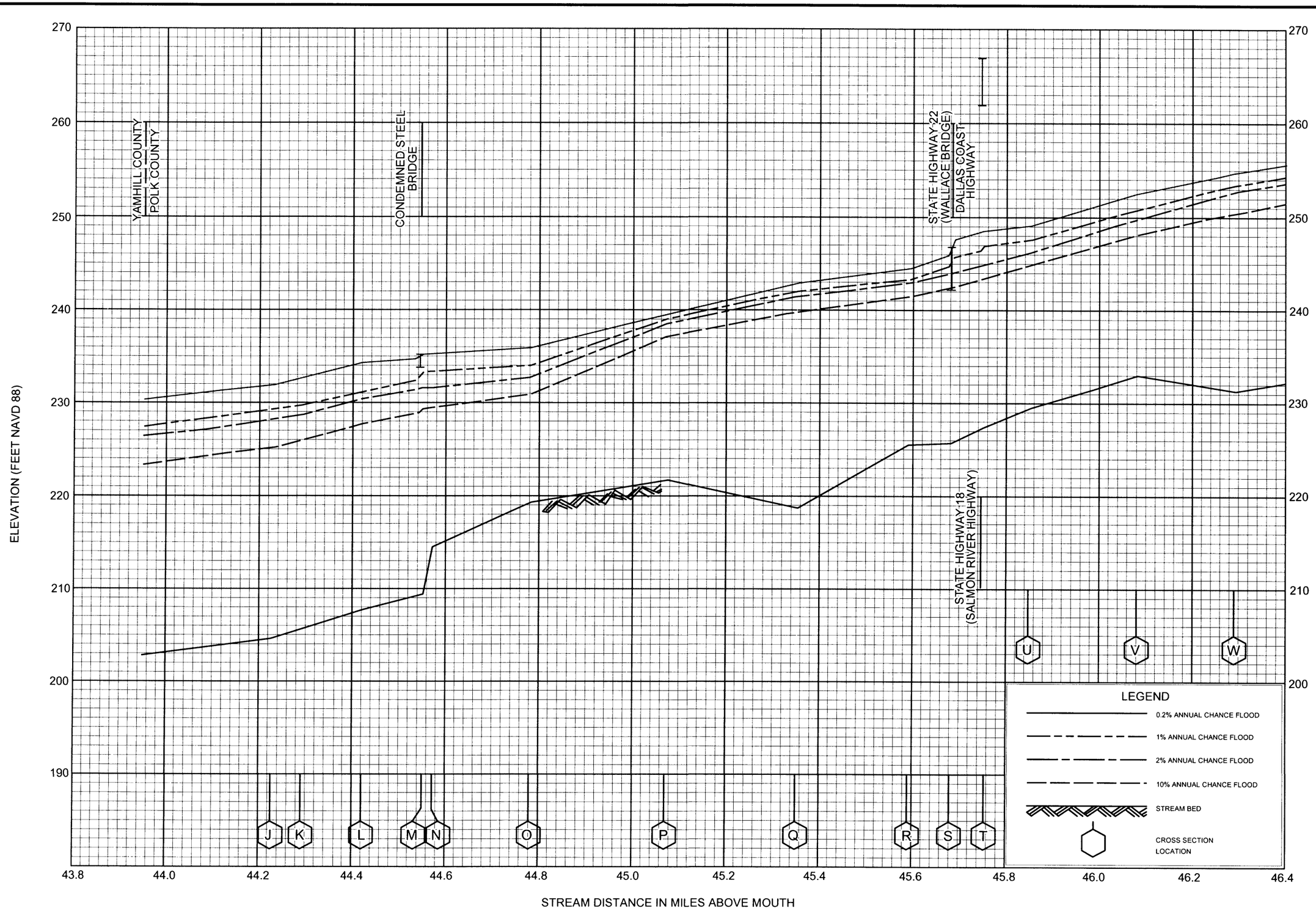


FLOOD PROFILES

SOUTH YAMHILL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS



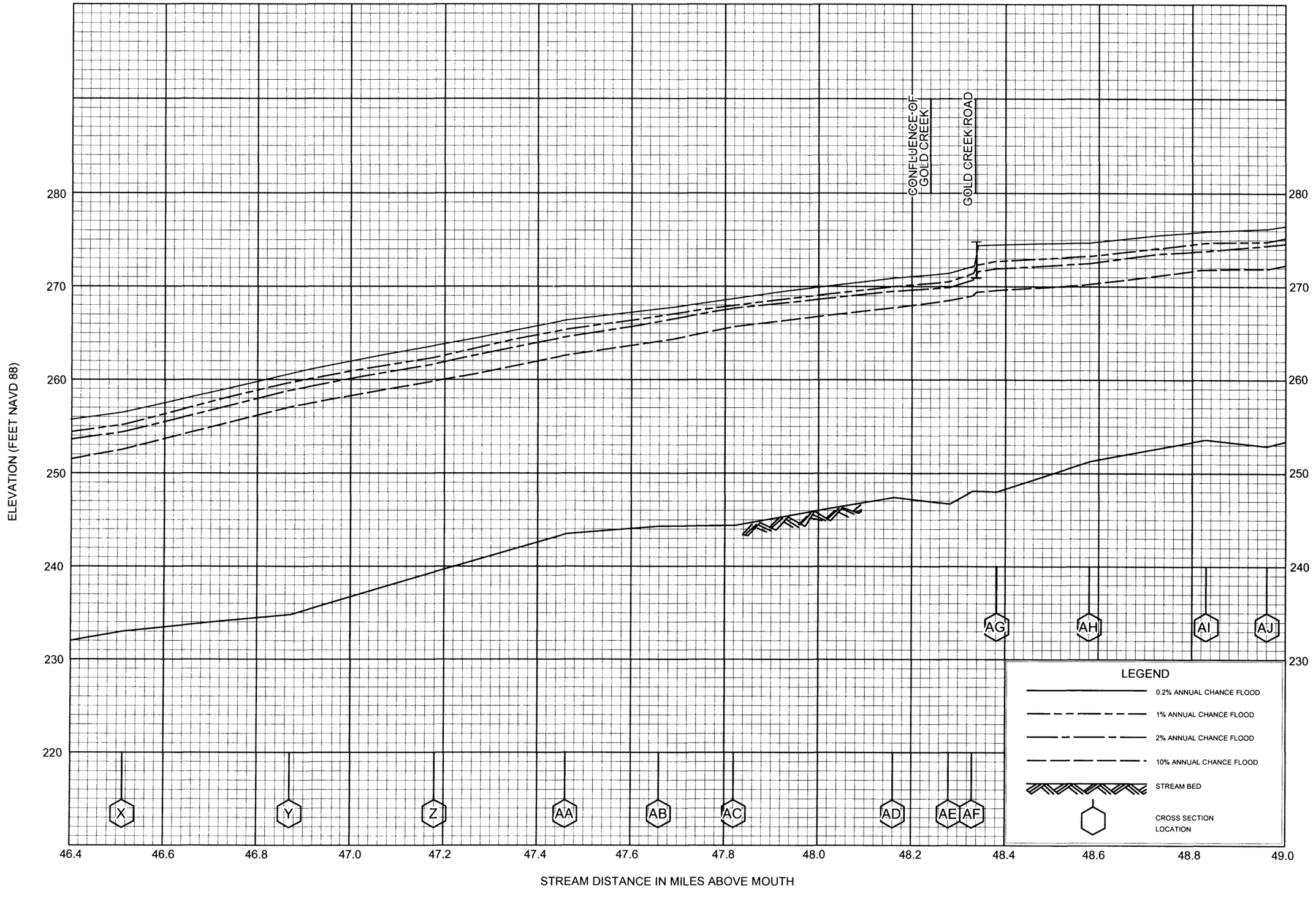
FLOOD PROFILES

SOUTH YAMHILL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

41P

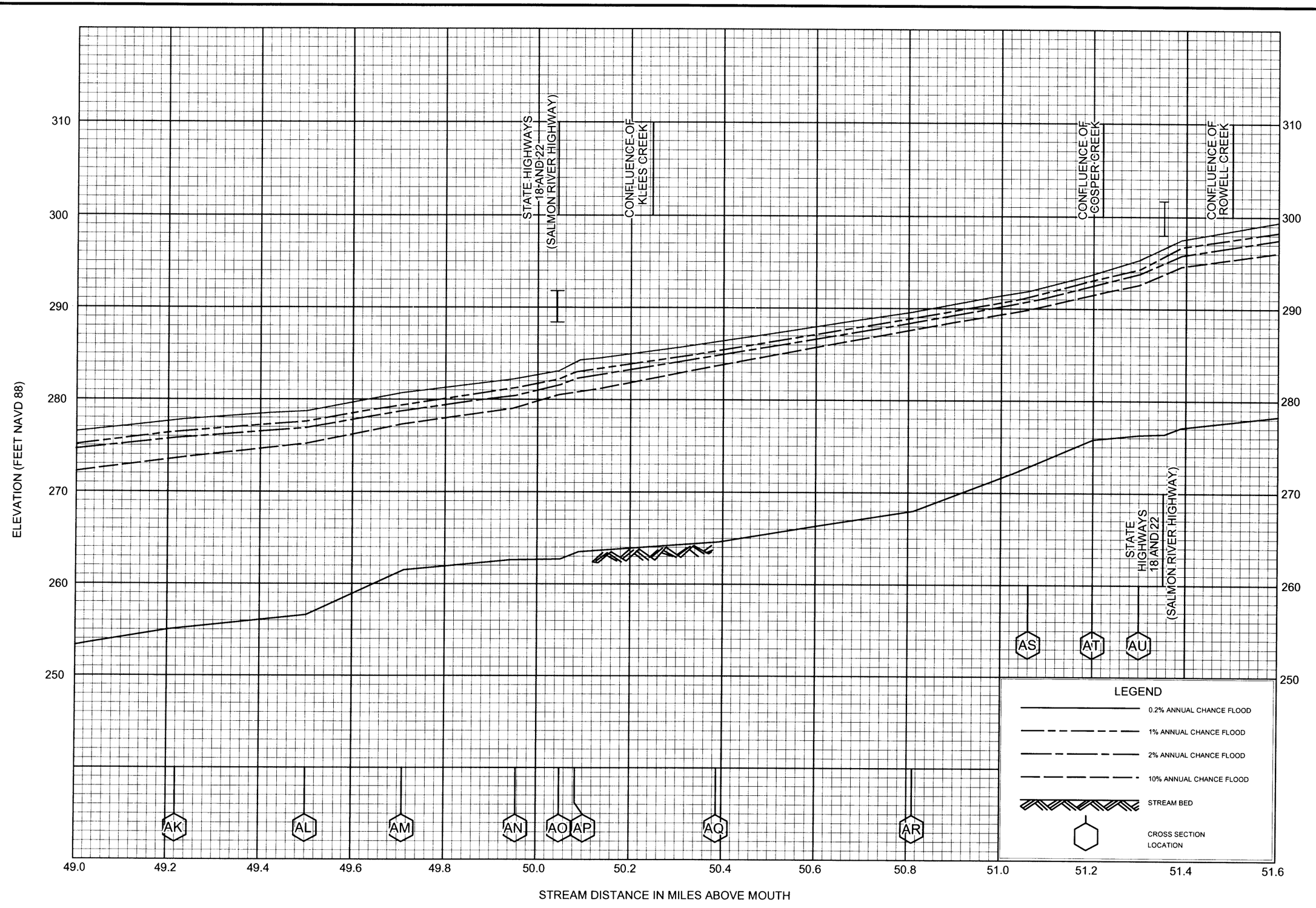


FLOOD PROFILES

SOUTH YAMHILL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

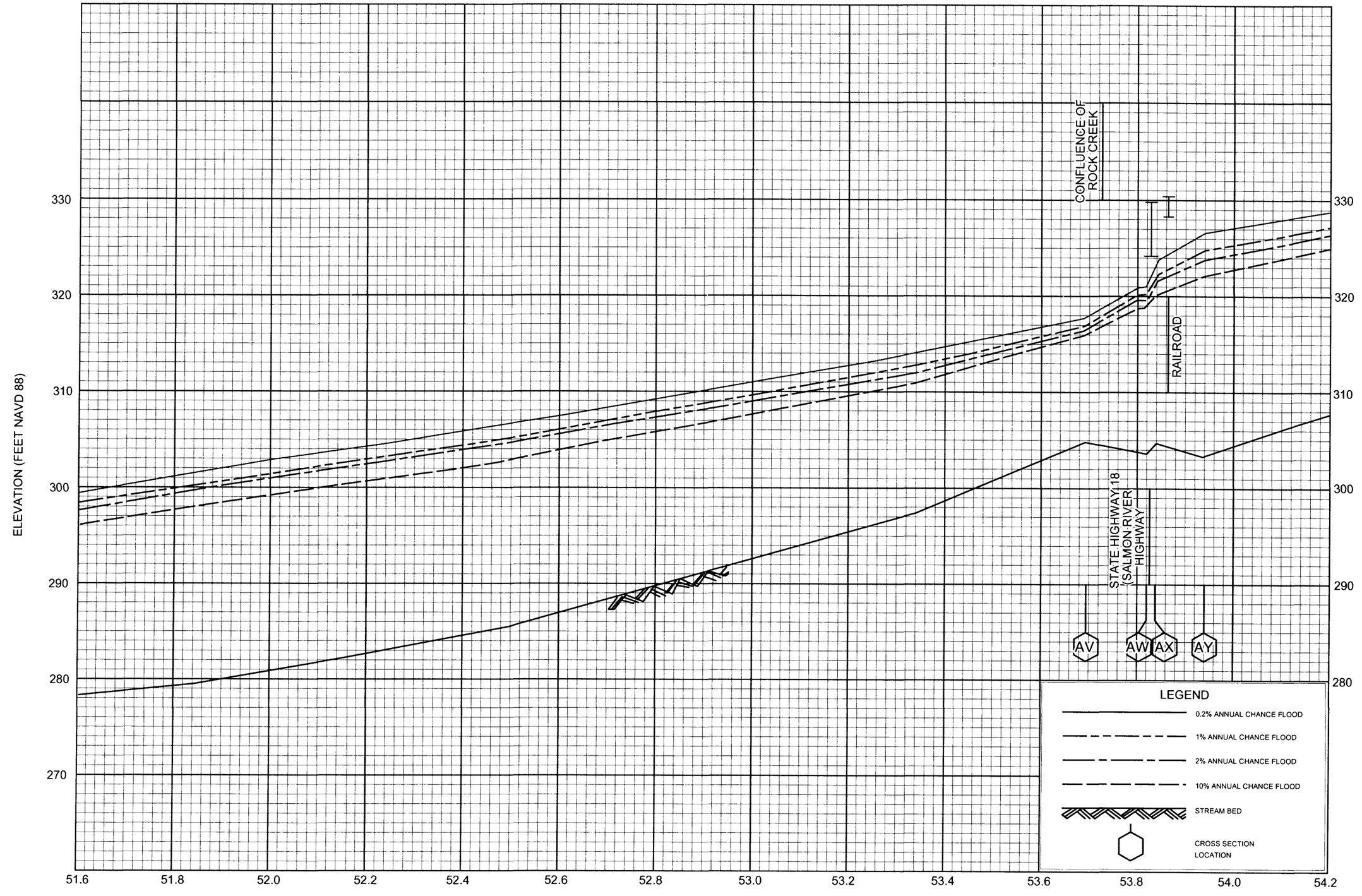


FLOOD PROFILES

SOUTH YAMHILL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS



FLOOD PROFILES

SOUTH YAMHILL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
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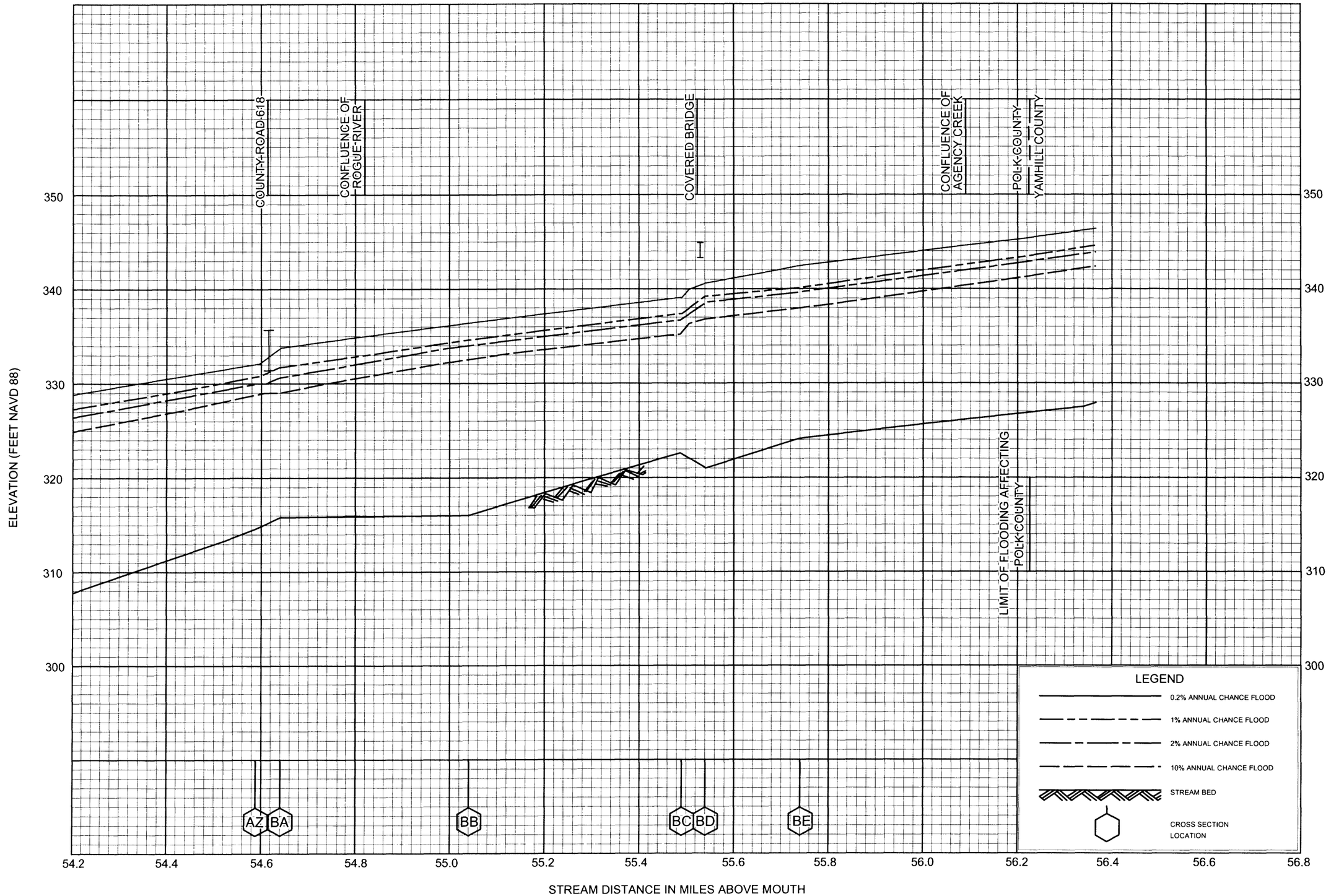

FLOOD PROFILES

SOUTH YAMHILL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
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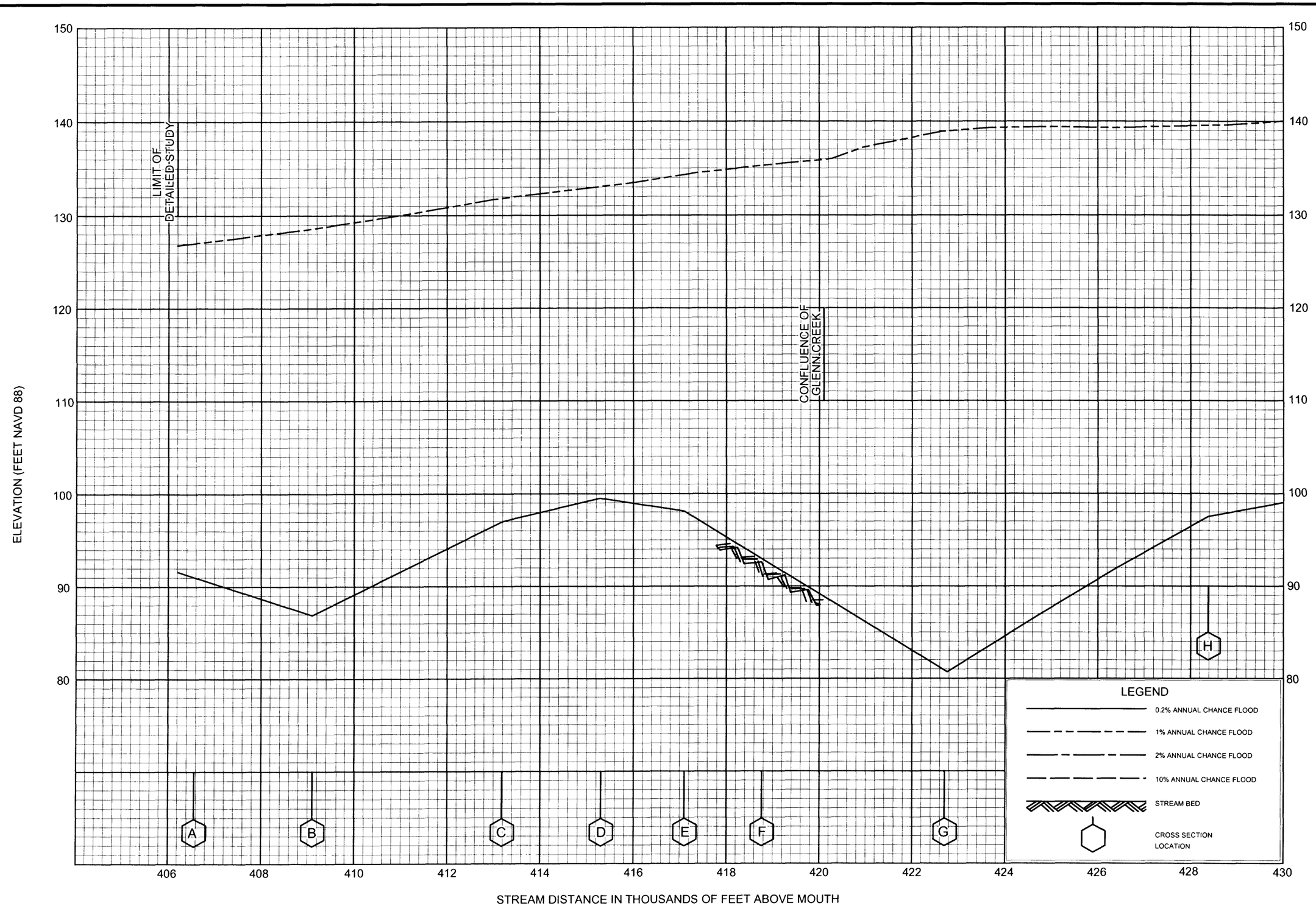
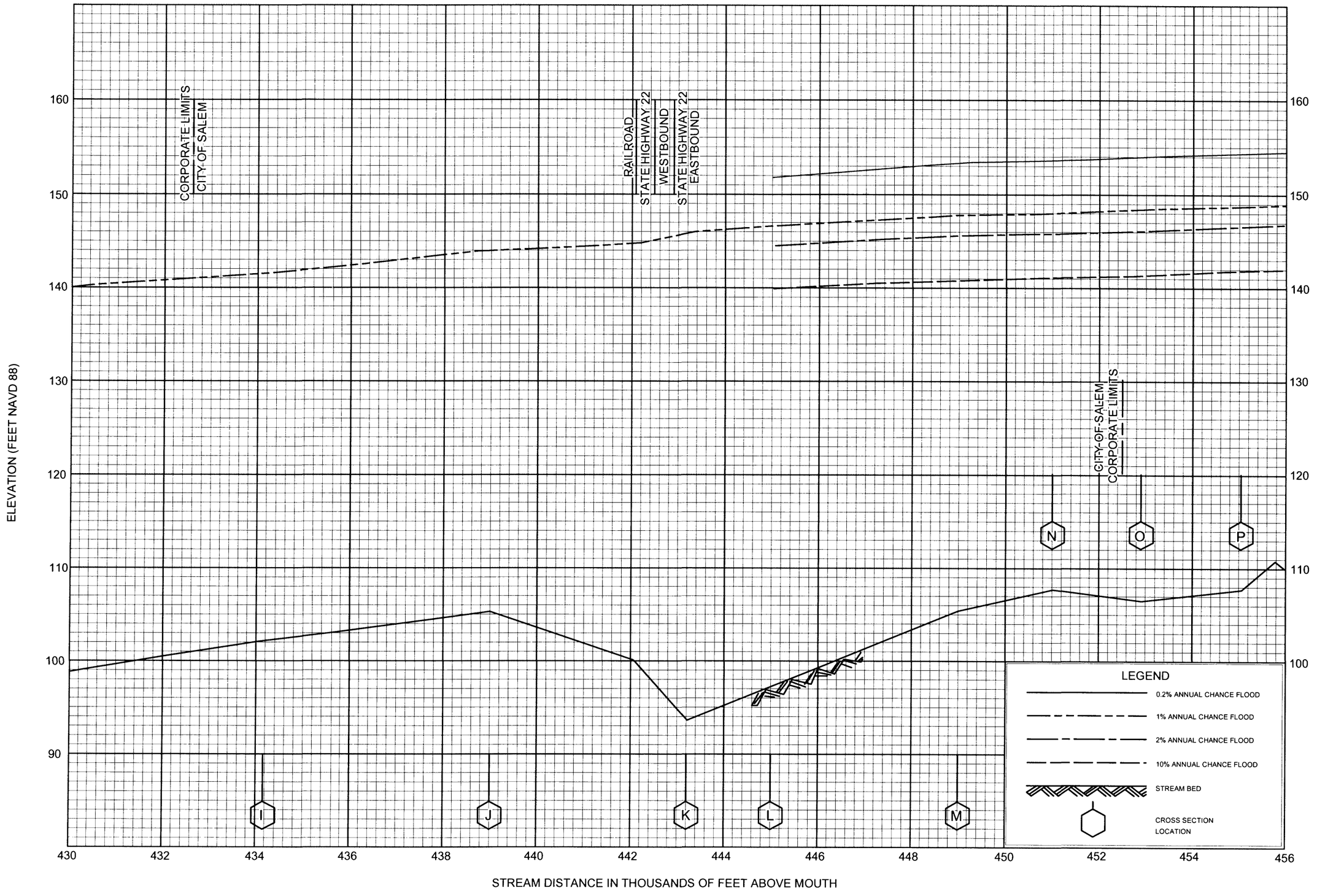


FLOOD PROFILES

WILLAMETTE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS



FLOOD PROFILES

WILLAMETTE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
AND INCORPORATED AREAS

47P

ELEVATION (FEET NAVD 88)

160
150
140
130
120
110
100

CONFLUENCE OF RICKREALL CREEK

LIMIT OF DETAILED STUDY

Q R S T U V W X

456 458 460 462 464 466 468 470 472 474 476 478 480 482

STREAM DISTANCE IN THOUSANDS OF FEET ABOVE MOUTH

LEGEND

- 0.2% ANNUAL CHANCE FLOOD
- 1% ANNUAL CHANCE FLOOD
- 2% ANNUAL CHANCE FLOOD
- 10% ANNUAL CHANCE FLOOD
- STREAM BED
- CROSS SECTION LOCATION

FLOOD PROFILES

WILLAMETTE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

POLK COUNTY, OR
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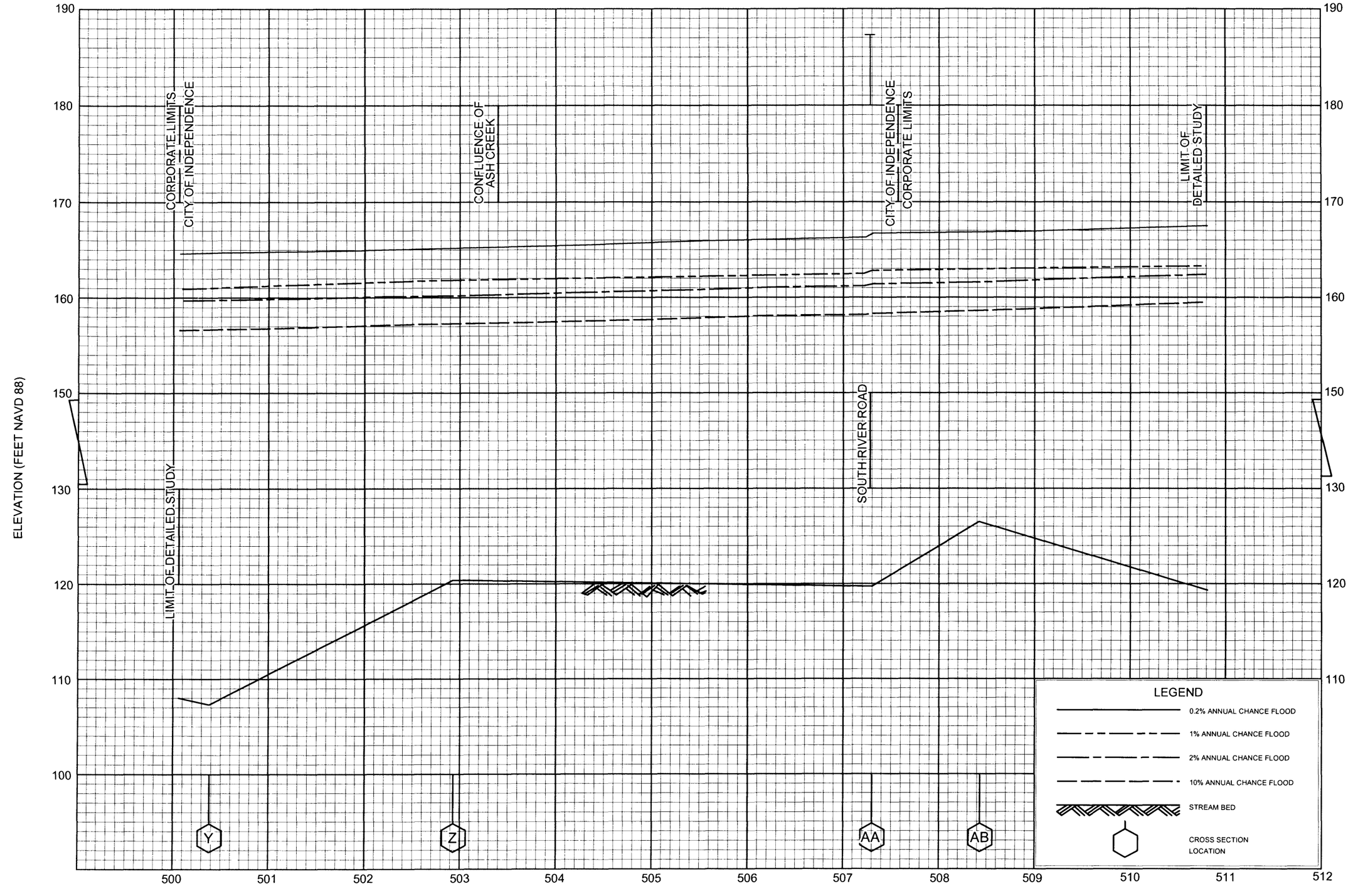

FLOOD PROFILES

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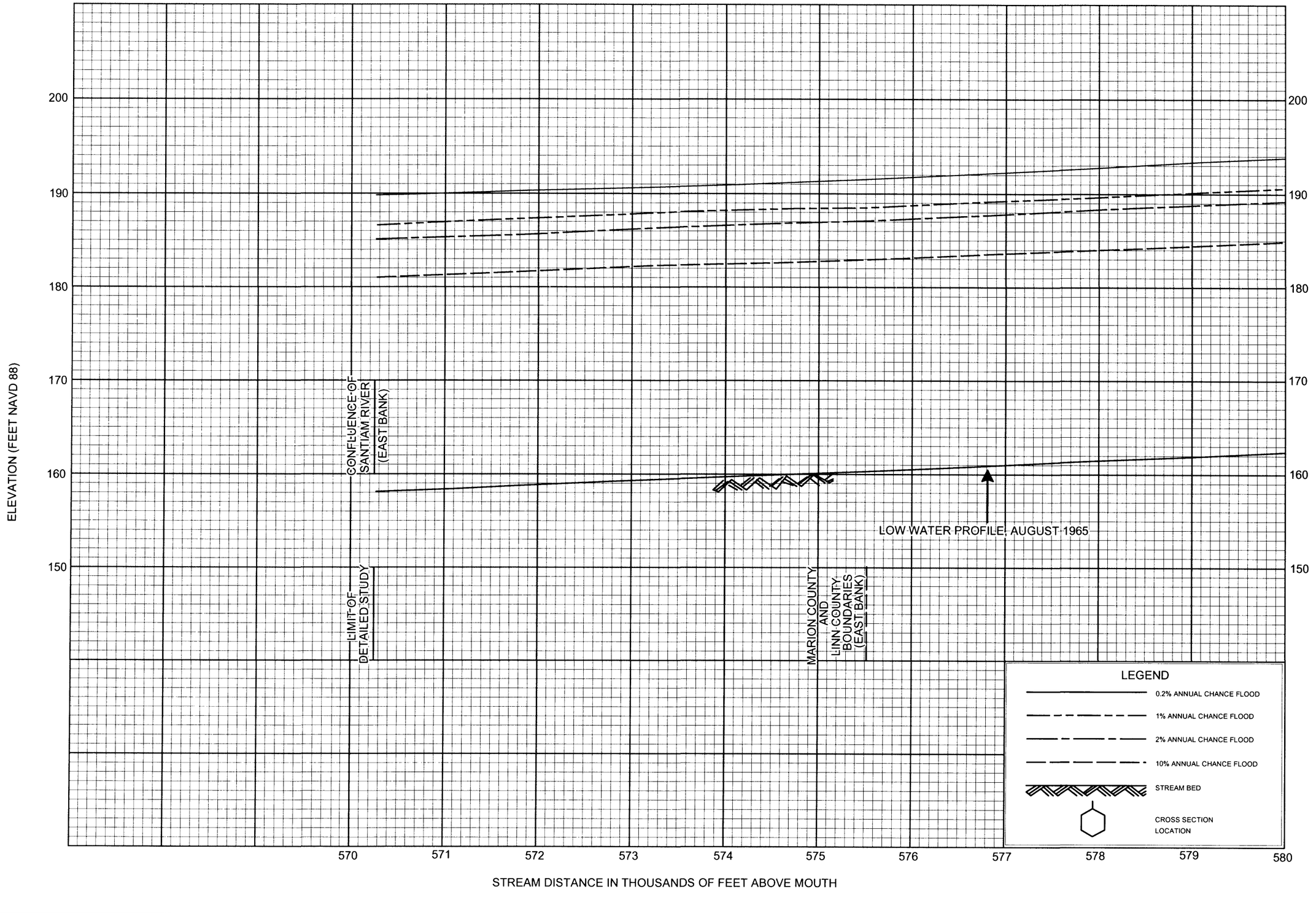

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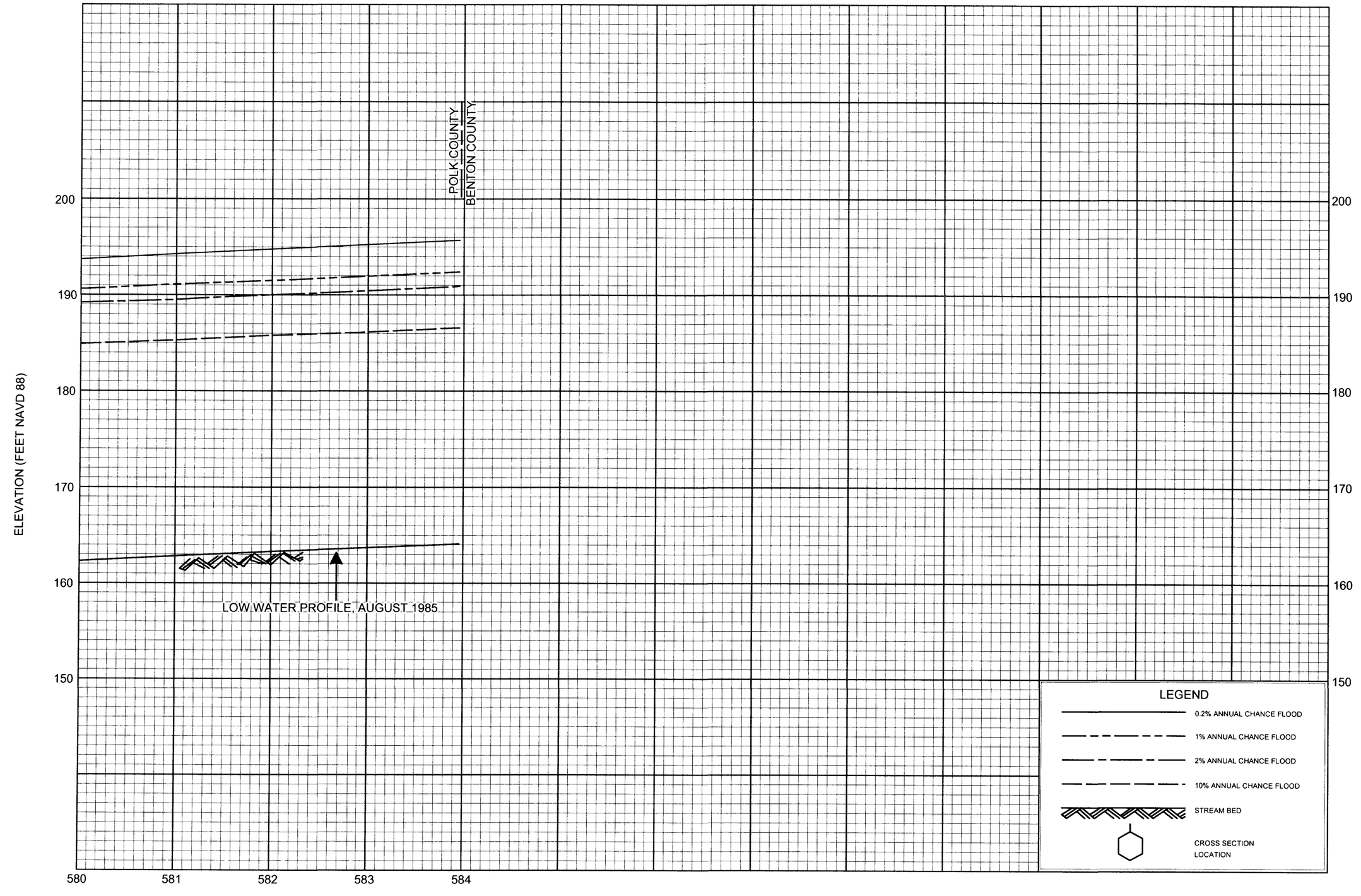

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