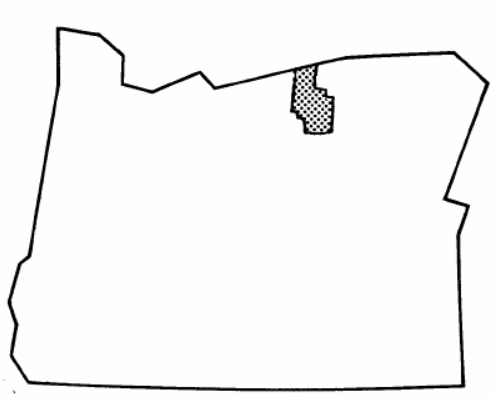
FLOOD INSURANCE STUDY

MORROW COUNTY, OREGON AND INCORPORATED AREAS



COMMUNITY NAME	COMMUNITY NUMBER
BOARDMAN, CITY OF	410174
HEPPNER, CITY OF	410175
IONE, CITY OF	410176
IRRIGON, CITY OF	410177
LEXINGTON, CITY OF	410178
MORROW COUNTY, UNINCORPORATED AREAS	410173

EFFECTIVE DATE:
DECEMBER 18, 2007

Federal Emergency Management Agency

Flood Insurance Study Number
41049CV000A

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) 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

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

Initial Countywide FIS Effective Date: December 18, 2007

Revised Countywide FIS Dates:

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PUBLISHED SEPARATELY

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Flood Insurance Rate Map

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FLOOD INSURANCE STUDY
MORROW 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 Morrow County, including the Cities of Boardman, Heppner, Ione, Irrigon, and Lexington; and the unincorporated areas of Morrow County (referred to collectively herein as Morrow 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.

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 Acknowledgements

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

The hydrologic and hydraulic analyses for this study were performed by WEST Consultants, Inc., for the Federal Emergency Management Agency (FEMA), under Contract No. EMS-2001-CO-0068. This study was completed in November 2005.

1.3 Coordination

The initial Consultation Coordination Office (CCO) meeting was held on July 1977, and attended by representatives of the study contractor, FEMA, Morrow County, and the Cities of Heppner, Ione, Irrigon, and Lexington.

The results of the study were reviewed at the final CCO meeting held on May 1, 1980, and attended by representatives of the study contractor, FEMA, Morrow County, and the Cities of Heppner, Ione, Irrigon, and

Lexington. All problems raised at that meeting have been addressed in this study.

The final CCO meeting for this countywide FIS report was held on December 4, 2006. It was attended by representatives of FEMA, Morrow County, Oregon State Department of Land Conservation and Development, WEST Consultants, Inc., and the Cities of Heppner and Lexington.

2.0 AREA STUDIED

2.1 Scope of Study

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

Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon, by FEMA and the community.

2.2 Community Description

Morrow County comprises a 2,059-square-mile area in north-central Oregon. It is bordered by Columbia River to the north, Umatilla County to the east, Grant County to the south, Wheller County to the southwest, and Gilliam County to the west.

The estimated population in 2004 was 11,681. This was an increase of 6.24% from the 2000 census (Reference 1).

The Morrow County flood plains are occupied and surrounded by commercial, industrial, residential, and public utility areas.

The topography varies from steep, forested slops and narrow canyons in the Blue Mountains of southern Morrow County to a gently sloping plateau of the Columbia River plain in the north. The watershed elevations range from less than 200 feet at the mouth of Willow Creek to 6,000 feet at Black Mountain.

The climate of Willow Creek basin, which is the chief drainage basin in the county, is semiarid. The normal-annual precipitation ranges from 8 inches at the mouth to approximately 34 inches in the headwaters of the

basin. Summers are dry, with much of the annual precipitation occurring during winter and spring. The average annual temperature is 50°F with recorded extreme temperatures above 100°F in the summer and below 0°F in the winter.

The soils are suitable for grass and forest production in the ravines and canyons of southern Morrow County, with soils suitable for cropland cultivation in central and northern Morrow County.

City of Heppner

Heppner is located in central Morrow County. It is situated along Willow Creek, approximately 40 miles south of Boardman, and Interstate Highway 80. The community is surrounded by unincorporated areas of Morrow County.

The city was incorporated in 1887 and has been the county seat since 1885. The population of Heppner in 2003 was 1,435 (Reference 1).

Heppner is in a narrow valley where Hinton Creek, Shobe Creek, and Balm Fork flow into Willow Creek. The Willow Creek basin is approximately 60 miles long and has a maximum width of 23 miles. The city is surrounded by rolling hills, and elevations range from 2,300 feet to over 5,900 feet.

The flood plains in Heppner are highly developed for both commercial and residential uses.

Soils in the area are sandy loams and support vegetation consisting of sagebrush and greasewood.

City of Lexington

Lexington is in central Morrow County and is surrounded by unincorporated areas of Morrow County.

The city was incorporated in 1903 and had a population of 273 in 2003 (Reference 1).

Lexington lies within the Willow Creek basin, an elongated, 890 square mile area. The basin is approximately 60 miles long and has a maximum width of 23 miles. At Lexington, the valley is approximately 0.5 mile wide and is surrounded by rolling hills with elevations up to 1,800 feet (Reference 2).

The flood plains in Lexington are developed primarily for residential use, but there is a small commercial area along Main Street near Blackhorse Canyon.

Soils in the area are sandy loams, and they support vegetation consisting of sagebrush and greasewood.

City of Ione

The City of Ione is located along Willow Creek, approximately 18 miles downstream from the City of Heppner and 9 miles northwest of the City of Lexington, in western Morrow County, in northern Oregon. It is surrounded by unincorporated areas of the county.

Lorraine and Rietmann Creeks flow into Willow Creek at Ione.

Ione had a population of 332 in 2003 (Reference 1). The city lies in a steeply walled valley, where the topography of the developed portion of the city on the valley floor is flat. The surrounding hillsides rise rapidly from an elevation of 1,080 feet to 1,600 feet. The ground water table in the valley floor is high in areas immediately adjacent to Willow Creek (Reference 3).

Land use in the city is primarily residential with a small commercial area along Main Street.

2.3 Principal Flood Problems

There are three types of floods common to Willow Creek basin. One type of flooding occurs when a period of annual high water develops in early spring from melting snow, occasionally augmented by rainstorms. These flows seldom exceed channel capacities. A second type is caused by winter-rain snowmelt which usually occurs from December through February. It results from above average snowfall on frozen ground followed by warm rains. However, the most damaging floods in the basin are caused by violent summer thunderstorms with intense rainfall.

Floods of significant size occurred in 1885, 1888, 1891, 1903, 1904, 1917, 1918, 1961, 1965, 1971, 1979, 1983, and 1997. The May 1971 flood was caused by a thunderstorm at Heppner which resulted in a flash flood in Shobe Canyon. Its estimated peak discharge was 6,000 cubic feet per second (cfs), with an estimated recurrence interval exceeding the 0.2-percent-annual-chance flood. A very destructive flood occurred in June 1903. The storm centered in the headwaters area of Balm Fork and Willow Creek above Heppner and caused the death of 247 persons. It was estimated to have had a peak discharge of 36,000 cfs and a 0.28-percent

annual chance flood above the confluence of Balm Fork and Willow Creek.

The rugged nature of the terrain and sparse vegetative cover of the watershed along with sudden occurrences of thunderstorms all combine to cause these destructive cloudburst floods.

2.4 Flood Protection Measures

The only flood protection structure in the Willow Creek basin is the U.S. Army of Corps of Engineers (USACE) Willow Creek Dam, constructed in 1982, and located on Willow Creek directly upstream from the City of Heppner, and just downstream from the junction of Balm Fork and Willow Creek. The gross storage capacity of the Willow Creek Lake is 13,250 acre-feet, of which 11,250 acre-feet will be exclusively flood-control space. The remaining 2,000 acre-feet are maintained for aesthetics, fish, wildlife, recreation, and sediment accumulation.

The National Weather Service provides flash-flood forecasts and warnings under its Flash Flood Alert, Watch, and Warning Program. The City of Heppner and Morrow County, in cooperation with the National Weather Service and Defense Civil Preparedness Agency, have established a Flash Flood Alarm System and Warning Plan. The inhabitants of Heppner and the industries along the streams are warned of approaching flood conditions by a siren and are advised to evacuate the area.

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 is 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 flood, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 1-percent-annual-chance flood in any 50-year period is approximately 40 percent (4 in 10); 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.

In November 2002, the City of Heppner, Oregon, requested a review of the effective flood discharges for their community. At the request of FEMA Region X, Michael Baker, Jr., Inc. reviewed the USACE 1978 hydrologic analyses (Reference 4) for streams in Heppner. By comparing to gaging data in the vicinity of Morrow County and extreme floods in eastern Oregon, it was concluded that the actual effective base flood discharges computed using the USACE approach were unreasonably high (Reference 5).

The USACE, Portland District, reviewed the original 1978 flood frequency analysis for Shobe and Hinton Creek. The USACE believed that the flood frequency discharges for thunderstorm events would be reduced and made revisions to the original study.

WEST Consultants, Inc. also reviewed the 1978 USACE hydrologic study. The 1978 study used the 1903 and 1934 floods to develop the thunderstorm frequency flows. Plotting positions of 0.007 and 0.0171 were assigned to these two floods since they were the two largest from 1875 through 1974 (a 99-year period). A thunderstorm frequency curve was developed based on these historic floods and synthetic frequency floods. However, because the exact frequency for the 1903 floods is unknown, the exact plotting point for the 1903 flood is uncertain. The Bureau of Reclamation (Reference 6) believes that the 1903 flood was overestimated and suggested that the peak discharge might be the result of a “dam break”.

Based on all the above discussions, WEST Consultants, Inc. conducted detailed hydrologic analyses to determine the 10-, 2-, 1-, and 0.2-percent annual chance discharges to be used in this FIS report. A regional regression analysis using the hybrid method was conducted to develop regression equations (Reference 7). Compared to conventionally developed regression equations, the hybrid regression equation uses all peak records at gaging stations and a number of historic thunderstorm peak discharges at miscellaneous sites throughout a region. Therefore, the hybrid regression equation is able to reflect the impact of thunderstorms on flood frequency flows, which is a very important watershed characteristic for watersheds in Morrow County.

The developed hybrid regression equations for the 10-, 2-, and 1-percent annual chance discharges were applied to the study basins for the full

range of drainage area. The 0.2-percent-annual chance discharges for the study streams were estimated by extrapolating the 10-, 2-, and 1-percent annual chance discharges, which were computed using the hybrid regression equations.

The proposed 1-percent annual chance discharges were compared to gaging data, 1-percent annual chance discharges from the flood frequency analysis for Willow Creek at Heppner and Balm Fork, discharges calculated using the Oregon Department of Transportation (ODOT) flash flood equation, and maximum observed peak discharges in the vicinity of Morrow County. Based on comparisons, the proposed discharges are considered reasonable and, therefore, recommended for use in this FIS report.

Peak discharge-drainage area relationships for Willow Creek; the Cities of Heppner, Lexington, and Ione; and Morrow County Unincorporated Areas are shown in Table 1, 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 Flood Insurance Rate Map (FIRM) represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles or in the Floodway Data 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.

A steady flow model of the system was developed by WEST Consultants, Inc. using HEC-RAS Version 3.1.3 to model the 10-, 2-, 1-, and 0.2-percent annual-chance floods (Reference 8).

Cross sections for the streams in the areas were obtained from 2 foot contours and ground surveys. The aerial flights were made September 2004 and the surveys occurred between August and October 2004, and in May 2005. All bridges and culverts were surveyed to obtain elevation data and structural geometry.

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.

Table 1. Summary of Discharges

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQUARE MILES)	PEAK DISCHARGES (CFS) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
WILLOW CREEK					
Above confluence with Shobe Creek	97.2	220[1]	370[1]	500[1]	19,066
Above confluence with Hinton Creek	104.1	296	1,334	2,516	19,538
Below confluence with Hinton Creek	146.9	1,057	3,738	6,069	22,090
Below confluence with Little Blackhorse Canyon	152.4	1,131	3,948	6,360	22,381
Above confluence with Blackhorse Canyon	178.3	1,448	4,826	7,551	23,669
Below confluence with Blackhorse Canyon	201.5	1,703	5,504	8,447	24,722
At Ione	507.8	4,116	11,254	15,565	34,369
HEPPNER, OREGON					
Shobe Creek	6.9	296	1,334	2,516	7,428
Hinton Creek	42.5	955	3,444	5,660	14,198
LEXINGTON, OREGON					
Unnamed Tributary of Blackhorse Canyon	1.3	101	558	1195	4098
Blackhorse Canyon above confluence with unnamed Canyon	21.5	616	2,413	4,177	11,137
Blackhorse Canyon below confluence with unnamed Canyon	22.9	642	2,494	4,296	11,390
IONE, OREGON					
Rietmann Canyon	3.0	173	863	1,735	5,520
Lorraine Canyon	0.3	39	260	621	2,431
MORROW COUNTY UNINCORPORATED					
Balm Fork	26.9	712	2,713	4,616	12,063
Little Blackhorse Canyon	2.7	162	817	1,656	5,316

cfs -cubic feet per second

[1]Regulated values are from Willow Creek Lake Water Control Manual 2003

Roughness factors (Manning's 'n') used in the hydraulic computations were based on field inspections during the cross-section survey and from the 2004 aerial photos. Roughness values are listed in Table 2. A sensitivity analysis was conducted to the final Manning's 'n' values by increasing the overbank and channel 'n' values by ±0.1 and noted that there were not any significant changes in the results. These analyses are included in the HEC-RAS models provided to FEMA as part of the hydraulic modeling review process. No calibration data were identified for this study.

Table 2 - Manning's 'n' Values

	Main Channel *n*	**Overbanks *n***
Willow Creek - Ione	0.045	0.040 - 0.100
Willow Creek - Lexington	0.035 - 0.055	0.040 - 0.100
Willow Creek - Heppner	0.045	0.040 - 0.150
Balm Fork	0.040	0.040
Blackhorse Canyon	0.045	0.040 - 0.100
Hinton Creek	0.045	0.040 - 0.150
Little Blackhorse Canyon	0.040 - 0.050	0.040 - 0.080
Lorraine Canyon	0.045	0.040 - 0.070
Rietmann Creek	0.045	0.040 - 0.050
Shobe Creek	0.040 - 0.045	0.040 - 0.120

Starting water-surface elevations were specified at the downstream end of each reach based on the ground slope near the downstream end of each model reach.

Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals (Exhibit 1).

Hydraulic models yielded critical depth at numerous locations even after various modifications were done to the RAS models, including varying the Manning's 'n' value and adding interpolated cross-sections. The floodway analysis was conducted based on a 1 foot increase in the energy grade line. The effective encroachment widths were also used to help define the floodway (References 9, 10, 11, and 12). The floodway tables are shown in the "Floodway Data Tables" (Table 4) later in this report. In some cases, the 1-percent-annual chance water surface was confined within the main channel and therefore typically an energy increase of zero is listed.

Elevations for floods of 1-percent-annual-chance flood for Willow Creek Lake are shown in Table 3. This table overrides the old study data on Balm Fork. The previously studied cross sections on Balm Fork are superseded by the water surface elevation of Willow Creek Lake.

Table 3. Summary of Elevations

	Elevation (Feet NAVD) % Annual Chance of Flooding			
Flooding Source	10	2	1	0.2
Willow Creek Lake	-	-	2117.0	-

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

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the Flood Profiles (Exhibit 1) are thus considered valid only if hydraulic structures remain unobstructed, 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 used for newly created or revised FIS reports and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD). With the completion of the North American Vertical Datum of 1988 (NAVD), many FIS reports and FIRMs are now prepared using NAVD as the referenced vertical datum.

Flood elevations shown in this FIS report and on the FIRM are referenced to NAVD88. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the NGVD and NAVD, visit the National Geodetic Survey website at 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, Maryland 20910-3282
(301) 713-3242
(301) 713-4172 (fax)

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 government to adopt sound floodplain management programs. To assist in this endeavor, each FIS report provides 1-percent-annual-chance floodplain data, which may include a combination of the following: 10-, 2-, 1-, and 0.2-percent-annual-chance flood elevations; delineations of the 1- and 0.2-percent-annual-chance floodplains; and a 1-percent-annual-chance floodway. This information is presented on the FIRM and in many components of the FIS report, including Flood Profiles, Floodway Data tables, and Summary of Stillwater Elevation tables. Users should reference the data presented in the FIS report as well as additional information that may be available at the local community map repository before making flood elevation and/or floodplain boundary determinations.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent-annual-chance flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent-annual-chance flood is employed to indicate additional areas of flood risk in the community. For each stream studied be detailed methods, the 1- and 0.2-percent-annual-chance floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24,000 with a contour interval of 2 feet (Reference 13).

The 1- and 0.2-percent-annual-chance floodplain boundaries are shown on the FIRM. On this map, the 1-percent-annual-chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A and AE), and the 0.2-percent-annual-chance floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 1- and 0.2-percent-annual-chance floodplain boundaries are close together, only the 1-percent-annual-chance floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above

the flood elevations, but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

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

Approximate 1-percent-annual-chance floodplain boundaries in some portions of the study area were taken directly from the Flood Hazard Boundary Map for Morrow County (Reference 14).

4.2 Floodways

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

The floodways presented in this 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.

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

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ.FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE[3] (FEET)
BLACKHORSE CANYON								
A	0	235	989	4.3	1,442.3	1,440.1[2]	1,441.1	0.9
B	222	270	772	5.6	1,444.2	1,444.0[2]	1,444.4	1.0
C	635	328	1,229	3.5	1,449.2	1,449.2	1,449.9	1.0
D	979	293	1,275	3.4	1,454.9	1,454.9	1,455.7	0.8
E	1,328	185	962	4.5	1,456.9	1,456.9	1,457.7	1.0
F	1,532	189[4]	886	4.7	1,458.0	1,458.0	1,458.9	1.0
G	1,611	175[4]	589	7.1	1,458.9	1,458.9	1,459.5	0.8
H	2,146	101	428	9.8	1,467.4	1,467.4	1,467.7	0.8
I	2,593	75	405	10.3	1,473.2	1,473.2	1,474.0	0.9
J	3,009	61	346	12.1	1,479.5	1,479.5	1,479.5	0.9

[1]Feet above confluence with Willow Creek

[2]Elevation computed without consideration of backwater effects from Willow Creek

[3]In Specific Energy

[4]Top width does not match the width shown on map

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORROW COUNTY, OR

AND INCORPORATED AREAS

FLOODWAY DATA

BLACKHORSE CANYON

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ.FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE[2] (FEET)
HINTON CREEK								
A	0	271	851	6.7	1,927.4	1,927.4	1,928.4	0.9
B	15	261	935	6.1	1,928.0	1,928.0	1,928.8	0.8
C	176	252	921	6.1	1,932.5	1,932.5	1,932.5	-0.4
D	220	200	842	6.7	1,932.6	1,932.6	1,932.8	0.9
E	352	219	1,294	4.4	1,936.1	1,936.1	1,936.8	1.0
F	436	153	851	6.7	1,936.7	1,936.7	1,937.0	0.8
G	538	166	974	5.8	1,938.2	1,938.2	1,939.0	0.9
H	910	145	972	5.8	1,948.8	1,948.8	1,949.3	0.7
I	1,315	44	356	15.9	1,953.1	1,953.1	1,953.1	0.1
J	1,637	87	673	8.4	1,961.9	1,961.9	1,962.0	0.7
K	2,320	363	1,284	4.4	1,967.1	1,967.1	1,967.9	0.9
L	2,561	370	1,366	4.1	1,970.7	1,970.7	1,971.6	0.9
M	2,945	340	1,344	4.2	1,974.8	1,974.8	1,975.5	0.8
N	3,195	225	677	8.4	1,977.3	1,977.3	1,978.0	0.9
O	4,117	74	422	13.4	1,990.2	1,990.2	1,990.2	0.0
P	5,030	41	374	15.1	2,005.0	2,005.0	2,005.1	0.1
Q	6,542	114	540	10.5	2,026.4	2,026.4	2,026.4	0.7
R	7,573	308	1,661	3.4	2,037.2	2,037.2	2,038.1	1.0
S	8,179	148	554	10.2	2,046.2	2,046.2	2,046.6	0.9

[1]Feet above confluence with Willow Creek

[2]In Specific Energy

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORROW COUNTY, OR

AND INCORPORATED AREAS

FLOODWAY DATA

HINTON CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ.FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE[2] (FEET)
LITTLE BLACKHORSE CREEK								
A	0	152	567	5.1	1,871.7	1,871.7	1,872.7	1.0
B	62	133	235	7.1	1,875.1	1,875.1	1,875.5	0.5
C	250	80	196	8.4	1,881.3	1,881.3	1,882.0	0.6
D	354	150	752	2.2	1,891.0	1,891.0	1,891.8	0.8
E	405	42	274	6.0	1,891.0	1,891.0	1,891.6	1.0
F	615	75	317	5.2	1,897.7	1,897.7	1,898.1	0.5
G	889	76	202	8.2	1,906.4	1,906.4	1,906.8	0.8
H	1,059	72	276	6.0	1,913.2	1,913.2	1,914.2	0.8
I	1,692	72	289	5.7	1,936.8	1,936.8	1,937.7	1.0
J	2,108	62	330	5.0	1,955.3	1,955.3	1,956.2	1.0
K	2,526	48	467	3.5	1,974.9	1,974.9	1,975.8	1.0
L	3,228	63	180	9.2	2,006.9	2,006.9	2,007.1	0.9
M	3,368	77	292	5.7	2,013.2	2,013.2	2,014.1	0.8
N	3,569	74	353	4.7	2,022.9	2,022.9	2,023.8	0.9
O	3,924	72	304	5.4	2,034.5	2,034.5	2,035.3	0.9
P	4,152	69	327	5.1	2,043.0	2,043.0	2,043.8	0.9
Q	4,245	68	299	5.5	2,046.3	2,046.3	2,047.3	1.0
R	4,678	53	179	9.2	2,064.0	2,064.0	2,064.0	0.1
S	4,838	63	360	4.6	2,072.7	2,072.7	2,073.6	1.0
T	5,635	80	322	5.1	2,103.2	2,103.2	2,104.0	0.9
U	5,800	58	470	3.5	2,110.9	2,110.9	2,111.9	0.9
V	6,309	41	154	10.8	2,126.2	2,126.2	2,126.3	0.9

[1]Feet above confluence with Willow Creek

[2]In Specific Energy

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ.FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE[3] (FEET)
LORRAINE CANYON								
A	0	50	148	4.2	1,092.6	1,091.1[2]	1,092.1	0.8
B	108	29	70	8.9	1,092.6	1,092.5[2]	1,092.5	0.0
C	240	84	206	3.1	1,100.7	1,100.7	1,100.7	0.1
D	354	24	66	9.4	1,107.6	1,107.6	1,107.6	0.0
E	671	24	66	9.4	1,127.8	1,127.8	1,127.8	0.0
F	977	24	65	9.6	1,160.1	1,160.1	1,160.1	0.0
RIETMANN CREEK								
A	0	186	542	3.2	1,098.6	1,098.6	1,099.6	1.0
B	131	87	247	7.0	1,099.3	1,099.3	1,100.0	0.9
C	354	58	337	5.1	1,105.5	1,105.5	1,106.0	0.7
D	430	21	157	11.0	1,105.1	1,105.1	1,105.9	0.5
E	523	24	131	13.3	1,110.1	1,110.1	1,110.1	0.1
F	686	31	198	8.8	1,112.7	1,112.7	1,113.2	0.9
G	872	30	142	12.2	1,115.8	1,115.8	1,116.3	1.0

[1]Feet above limit of detailed study

[2]Elevation computed without consideration of backwater effects from Willow Creek

[3]In Specific Energy

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORROW COUNTY, OR

AND INCORPORATED AREAS

FLOODWAY DATA

LORRAINE CANYON - RIETMANN CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ.FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE[2] (FEET)
SHOBE CREEK								
A	0	376	832	3.0	1,962.2	1,962.2	1,963.2	1.0
B	68	273[3]	608	4.1	1,964.0	1,964.0	1,964.1	0.5
C	107	423	769	3.3	1,965.4	1,965.4	1,966.0	0.7
D	168	398	966	2.6	1,967.3	1,967.3	1,968.2	1.0
E	365	223	611	4.1	1,972.0	1,972.0	1,972.7	0.4
F	441	80	256	9.8	1,974.7	1,974.7	1,974.7	0.8
G	617	38	195	12.9	1,981.4	1,981.4	1,981.4	0.1
H	785	48	316	8.0	1,986.9	1,986.9	1,986.9	-0.2
I	950	59	244	10.3	1,988.2	1,988.2	1,988.2	0.0
J	1,273	62	231	10.9	1,997.5	1,997.5	1,997.5	0.0
K	1,711	53	219	11.5	2,009.9	2,009.9	2,009.9	0.0
L	2,072	38	197	12.8	2,028.3	2,028.3	2,028.3	0.0
M	2,887	63	233	10.8	2,068.8	2,068.8	2,068.8	0.0
N	3,705	65	567	4.4	2,096.9	2,096.9	2,097.6	0.7
O	4,052	47	210	12.0	2,102.8	2,102.8	2,102.8	0.0
P	4,468	195	716	3.5	2,117.2	2,117.2	2,118.1	0.9
Q	4,717	144	541	4.7	2,117.8	2,117.8	2,118.6	1.0
R	5,202	125	445	5.6	2,129.3	2,129.3	2,130.0	0.7
S	5,453	100	270	9.3	2,132.3	2,132.3	2,132.8	1.0
T	6,593	68	238	10.6	2,162.0	2,162.0	2,162.2	0.9

[1]Feet above confluence with Willow Creek

[2]In Specific Energy

[3]Top width does not match the width shown on map

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORROW COUNTY, OR

AND INCORPORATED AREAS

FLOODWAY DATA

SHOBE CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ.FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE[2] (FEET)
WILLOW CREEK								
A	107,885	682	3,099	5.0	1,068.7	1,068.7	1,069.7	0.7
B	108,208	670	2,250	6.9	1,070.3	1,070.3	1,070.7	0.1
C	108,958	621	2,266	6.9	1,075.0	1,075.0	1,075.0	0.1
D	109,378	819	3,530	4.4	1,078.7	1,078.7	1,079.2	0.8
E	109,644	991	5,109	3.0	1,079.6	1,079.6	1,080.5	1.0
F	109,855	986	4,847	3.2	1,080.0	1,080.0	1,081.0	1.0
G	110,454	939	3,897	4.0	1,082.3	1,082.3	1,083.2	1.0
H	111,016	893	3,619	4.3	1,085.7	1,085.7	1,086.4	1.0
I	111,484	790[3]	3,038	5.1	1,088.5	1,088.5	1,089.2	0.9
J	112,222	810[3]	3,307	4.7	1,092.6	1,092.6	1,093.4	1.0
K	112,741	761[3]	2,795	5.6	1,094.9	1,094.9	1,095.6	0.7
L	113,302	770	2,756	5.6	1,097.3	1,097.3	1,098.1	1.0
M	113,862	760	2,581	6.0	1,099.5	1,099.5	1,100.3	1.0
N	114,166	744	2,365	6.6	1,101.0	1,101.0	1,101.8	0.9
O	156,858	375	1,291	6.5	1,407.8	1,407.8	1,408.8	0.9
P	157,113	395	1,641	5.1	1,410.8	1,410.8	1,411.7	0.8
Q	157,171	541	2,275	3.7	1,413.3	1,413.3	1,414.1	0.8
R	157,421	561	2,229	3.8	1,413.9	1,413.9	1,414.6	0.7
S	157,670	347	1,343	6.3	1,414.9	1,414.9	1,415.6	1.0
T	158,115	356	1,308	6.5	1,418.1	1,418.1	1,419.0	1.0
U	158,792	238	1,178	7.2	1,426.9	1,426.9	1,427.5	0.9
V	159,280	259	1,129	7.5	1,430.3	1,430.3	1,431.0	0.9
W	159,670	196	874	9.7	1,434.3	1,434.3	1,434.8	1.0
X	160,232	295	1,661	5.1	1,441.4	1,441.4	1,442.3	1.0
Y	160,390	340	1,988	3.8	1,442.3	1,442.3	1,443.1	0.9
Z	160,797	196	1,109	6.8	1,444.1	1,444.1	1,444.8	1.0

[1]Feet above county boundary

[2]In Specific Energy

[3]Top width does not match the width shown on map

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORROW COUNTY, OR

AND INCORPORATED AREAS

FLOODWAY DATA

WILLOW CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ.FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE[2] (FEET)
WILLOW CREEK								
AA	161,233	295	1,640	4.6	1,448.0	1,448.0	1,448.9	0.9
AB	161,393	277	1,753	4.3	1,451.6	1,451.6	1,452.5	1.0
AC	161,709	204	1,172	6.4	1,453.8	1,453.8	1,454.6	0.9
AD	162,019	132	978	7.7	1,456.6	1,456.6	1,457.2	0.5
AE	162,299	193	934	8.1	1,458.8	1,458.8	1,459.2	0.8
AF	181,988	452	1,562	4.1	1,792.3	1,792.3	1,793.3	1.0
AG	183,252	577	1,024	6.2	1,802.1	1,802.1	1,802.3	0.3
AH	183,524	368	1,068	6.0	1,805.5	1,805.5	1,806.1	0.8
AI	183,721	254	970	6.6	1,807.1	1,807.1	1,807.9	0.9
AJ	183,987	158	1,116	5.7	1,815.6	1,815.6	1,816.1	0.7
AK	184,680	377	2,079	3.1	1,817.2	1,817.2	1,818.0	0.9
AL	184,999	341[3]	1,173	5.4	1,818.7	1,818.7	1,819.0	0.7
AM	185,645	510	1,792	3.6	1,827.4	1,827.4	1,828.0	0.6
AN	186,093	775	1,440	4.4	1,831.6	1,831.6	1,832.6	1.0
AO	187,300	523	1,185	5.4	1,838.7	1,838.7	1,839.4	1.0
AP	187,561	340	1,190	5.3	1,842.8	1,842.8	1,843.3	0.6
AQ	188,065	194	1,407	4.5	1,848.6	1,848.6	1,848.7	0.2
AR	189,797	308	1,081	5.9	1,859.5	1,859.5	1,860.0	0.7
AS	189,901	299	1,364	4.7	1,859.8	1,859.8	1,860.6	0.7
AT	190,265	181	919	6.9	1,862.9	1,862.9	1,863.5	0.7
AU	190,383	211	1,123	5.7	1,863.8	1,863.8	1,864.5	0.6
AV	190,465	154	941	6.8	1,864.5	1,864.5	1,865.0	0.5
AW	190,700	195	843	7.5	1,868.1	1,868.1	1,868.1	0.1
AX	190,887	207[3]	968	6.3	1,868.8	1,868.8	1,869.0	0.3
AY	192,191	210	704	8.6	1,878.9	1,878.9	1,878.9	0.7
AZ	192,822	441	1,643	3.7	1,885.3	1,885.3	1,885.4	0.1

[1]Feet above county boundary

[2]In Specific Energy

[3]Top width does not match the width shown on map

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORROW COUNTY, OR

AND INCORPORATED AREAS

FLOODWAY DATA

WILLOW CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ.FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE[2] (FEET)
WILLOW CREEK								
BA	193,070	196	924	6.6	1,885.9	1,885.9	1,885.9	0.3
BB	193,501	244	1,366	4.4	1,890.7	1,890.7	1,891.7	1.0
BC	193,621	252	1,226	4.9	1,891.1	1,891.1	1,892.0	0.8
BD	193,913	275	848	7.2	1,894.3	1,894.3	1,894.6	0.9
BE	194,359	417	1,229	4.9	1,899.4	1,899.4	1,900.0	1.0
BF	194,834	391	1,150	5.3	1,903.1	1,903.1	1,903.6	0.4
BG	195,103	430	1,453	4.2	1,907.0	1,907.0	1,907.7	1.0
BH	195,247	277	1,285	4.7	1,907.6	1,907.6	1,908.4	1.0
BI	195,518	270	1,042	5.8	1,909.8	1,909.8	1,910.0	0.2
BJ	195,869	300	1,222	5.0	1,914.2	1,914.2	1,914.8	1.0
BK	196,185	337	1,085	5.6	1,917.6	1,917.6	1,918.1	1.0
BL	196,616	397	1,350	4.5	1,920.7	1,920.7	1,921.4	0.9
BM	197,166	249	920	6.6	1,926.1	1,926.1	1,926.4	1.0
BN	197,437	232[3]	1,306	4.6	1,929.9	1,929.9	1,930.7	0.9
BO	197,558	58[3]	499	5.0	1,930.6	1,930.6	1,931.3	0.9
BP	197,754	78[3]	555	4.5	1,930.8	1,930.8	1,931.8	0.9
BQ	198,044	79[3]	586	6.1	1,932.6	1,932.6	1,933.2	0.5
BR	198,260	42	252	10.0	1,933.8	1,933.8	1,934.3	0.2
BS	198,701	63	341	7.4	1,939.5	1,939.5	1,939.5	0.0
BT	199,112	57	267	9.4	1,942.9	1,942.9	1,943.0	0.5
BU	199,547	54	294	8.6	1,948.8	1,948.8	1,948.8	0.4
BV	199,958	54	336	7.5	1,953.3	1,953.3	1,953.3	0.0
BW	200,405	52[3]	248	10.2	1,957.3	1,957.3	1,957.4	0.1
BX	200,534	41[3]	240	40.5	1,959.1	1,959.1	1,959.2	0.0
BY	200,692	56[3]	409	6.1	1,961.4	1,961.4	1,961.4	0.0
BZ	200,782	50	291	1.7	1,962.1	1,962.1	1,962.1	0.0

[1]Feet above county boundary

[2]In Specific Energy

[3]Top width does not match the width shown on map

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORROW COUNTY, OR

AND INCORPORATED AREAS

FLOODWAY DATA

WILLOW CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ.FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE[2] (FEET)
WILLOW CREEK								
CA	201,156	13	76	6.6	1,962.6	1,962.6	1,962.6	0.0
CB	201,187	35	145	3.4	1,963.4	1,963.4	1,963.4	0.0
CC	201,344	33	114	4.4	1,963.8	1,963.8	1,963.8	0.0
CD	201,717	22	65	7.7	1,967.0	1,967.0	1,967.0	0.0
CE	202,127	28	81	6.2	1,972.2	1,972.2	1,972.2	0.0
CF	202,419	34	93	5.4	1,975.3	1,975.3	1,975.3	0.0
CG	202,769	23	106	4.7	1,977.1	1,977.1	1,977.1	0.0
CH	203,036	35	164	3.1	1,977.8	1,977.8	1,977.8	0.0
CI	203,075	15	78	6.4	1,977.6	1,977.6	1,977.6	0.0

[1]Feet above county boundary

[2]In Specific Energy

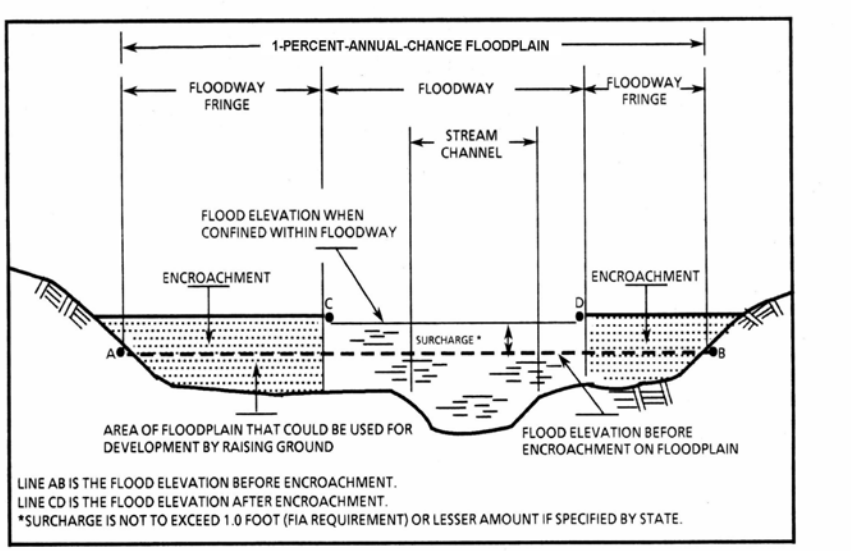

Figure 1. Floodway Schematic

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 report by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base (1-percent-annual-chance) flood elevations (BFEs) or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 1-percent-annual-chance floodplains that are determined in the FIS report by detailed methods. 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 foot, areas of 1-percent-annual-chance flooding where

the contributing drainage area is less than 1 square mile (sq. mi.), and areas protected from the base flood by levees. No BFEs or depths are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

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

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

For flood 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 Morrow 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 (FBFMs), where applicable. Historical data relating to the maps prepared for each community are presented in Table 5, "Community Map History."

7.0 OTHER STUDIES

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

8.0 LOCATION OF DATA

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

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE(S)	FLOOD INSURANCE RATE MAP EFFECTIVE DATE	FLOOD INSURANCE RATE MAP REVISION DATE(S)
Boardman, City of	December 18, 2007	None	December 18, 2007	None
Heppner, City of	November 23, 1973	December 19, 1975	April 1, 1981	February 15, 1984
Ione, City of	November 22, 1974	None	April 1, 1981	April 3, 1984
Irrigon, City of	December 18, 2007	None	December 18, 2007	None
Lexington, City of	September 6, 1974	November 26, 1976	April 1, 1981	July 5, 1984
Morrow County, Unincorporated Areas	January 24, 1975	July 19, 1977	April 1, 1981	July 5, 1984

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORROW COUNTY, OR

AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

9.0 BIBLIOGRAPHY AND REFERENCES

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2. East Central Oregon Association of Counties, Draft Technical Report, Town of Lexington, April 1978.

3. U.S. Department of the Army, Corps of Engineers, Hydrologic Report: Stream of Morrow County, Oregon, November 1978.

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5. Thomas, W, "Review of the effective base flood discharges for the City of Heppner, Oregon." Review Comments, Michael Baker Jr., Inc., June 23, 2003 (revised).

6. Levish, D. R., and Ostenaa, D. A., "Applied paleoflood hydrology in north-central Oregon." Guidebook for Field Trip 2, April 19-21, 1996, 92nd Annual Meetings of the Geological Society of America, Portland, Oregon.

7. Hjalmarson, H. W., and Thomas, B. E., "New look at regional flood-frequency relations for arid land." Journal of Hydraulic Engineering, ASCE, 118(6), 868-886, dated 1992.

8. Hydrologic Engineering Center (HEC), HEC-RAS, User's Manual, US Army Corps of Engineers, Davis, CA, November 2002.

9. Federal Emergency Management Agency, Flood Insurance Study, City of Heppner, Morrow County, Oregon, Revised February 15, 1984.

10. Federal Emergency Management Agency, Flood Insurance Study, City of Ione, Morrow County, Oregon, Revised April 3, 1984.

11. Federal Emergency Management Agency, Flood Insurance Study, Town of Lexington, Morrow County, Oregon, Revised July 5, 1984.

12. Federal Emergency Management Agency, Flood Insurance Study, Unincorporated Areas, Morrow County, Oregon, Revised July 5, 1984.

13. Spenser B. Gross, Inc., Aerial Photos, Scale 1:24,000, Flown September 2004.

14. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, Morrow County, Oregon, Scale 1:24,000, January 1975, Revised July 1977.

WEST Consultants, Inc. "Technical Support Data Notebook" prepared for FEMA Region X, dated November 2005.

10.0 REVISION DESCRIPTIONS

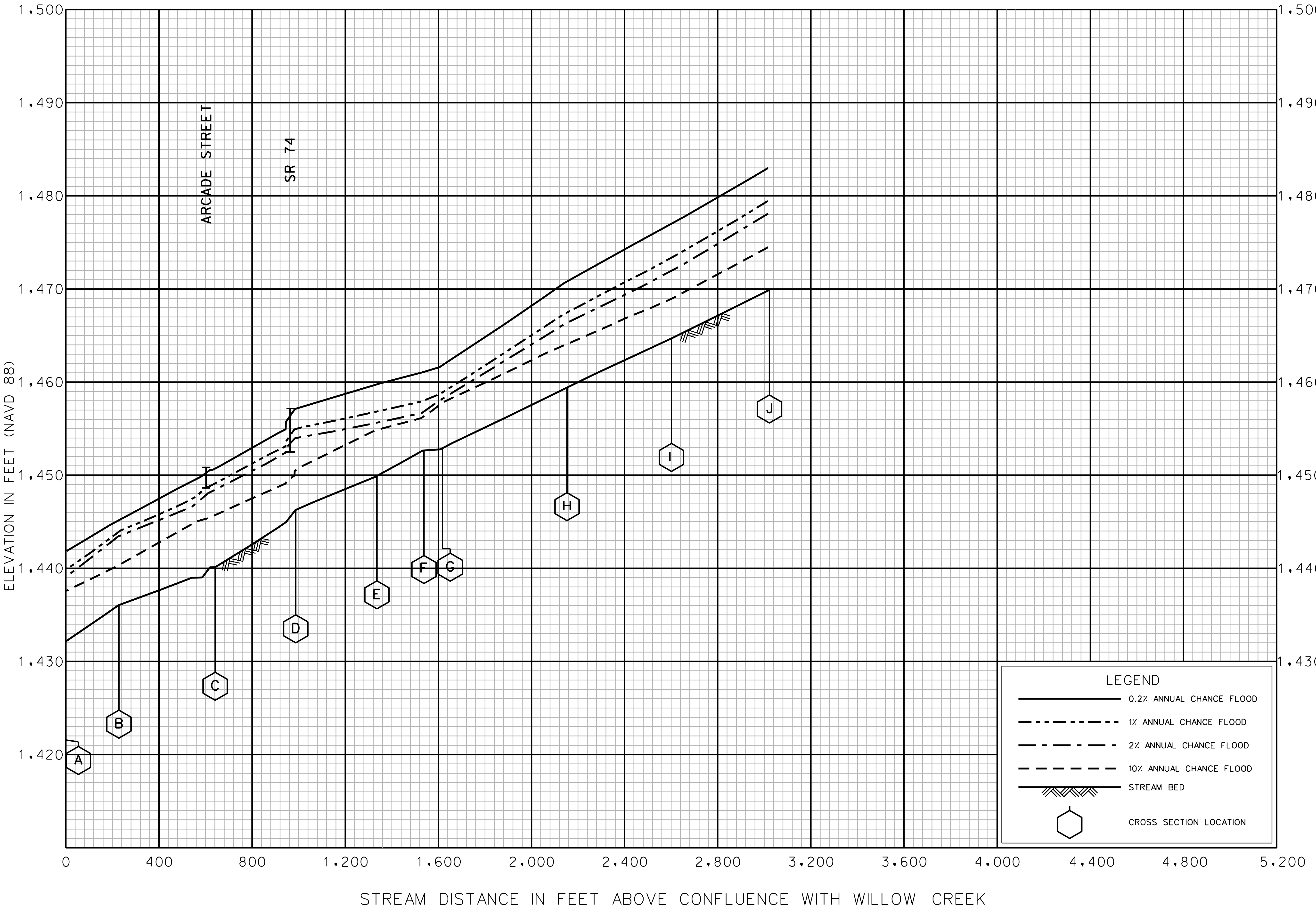
This section has been added to provide information regarding significant revisions made since the original Flood Insurance Study was printed. Future revisions may be made that do not result in the republishing of the Flood Insurance Study report. To assure that any user is aware of all revisions, it is advisable to contact the community repository of flood hazard data located at the Department of Land and Water Resources, 201 South Jackson Street, Suite 600, Seattle, Washington 98104-3855.

10.1 First Revision

The purpose of this revision is to update detailed studies for Blackhorse Canyon, Hinton Creek, Little Blackhorse Canyon, Lorraine Canyon, Rietmann Creek, Shobe Creek, and Willow Creek. Refer to section 3.0 and 4.0 for an explanation for how these streams were restudied. For flood insurance purposes, refer to the separately published Flood Insurance Rate Map.

The hydrologic and hydraulic analyses for this study were performed by WEST Consultants, Inc., for FEMA, under Contract No. EMS-2001-CO-0068. This study was completed in November 2005.

The final CCO meeting for this countywide FIS report (as mentioned in Section 1.3) was held on December 4, 2006. It was attended by representatives of FEMA, Morrow County, Oregon State Department of Land Conservation and Development, WEST Consultants, Inc., and the Cities Heppner and Lexington.



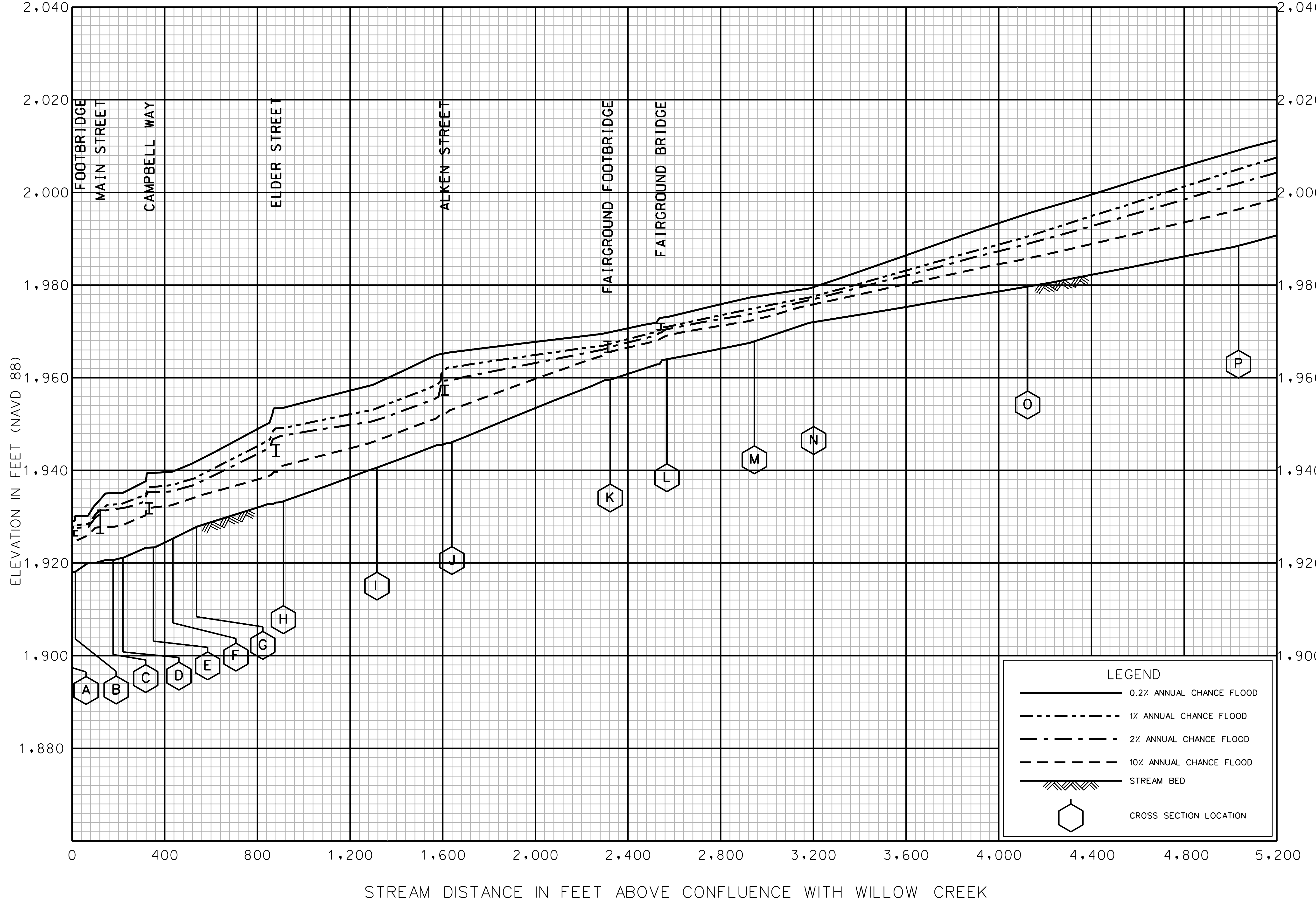
FLOOD PROFILES

BLACKHORSE CANYON

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORROW COUNTY, OREGON
AND INCORPORATED AREAS

01P



FLOOD PROFILES

HINTON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY
MORROW COUNTY, OREGON
AND INCORPORATED AREAS

02P

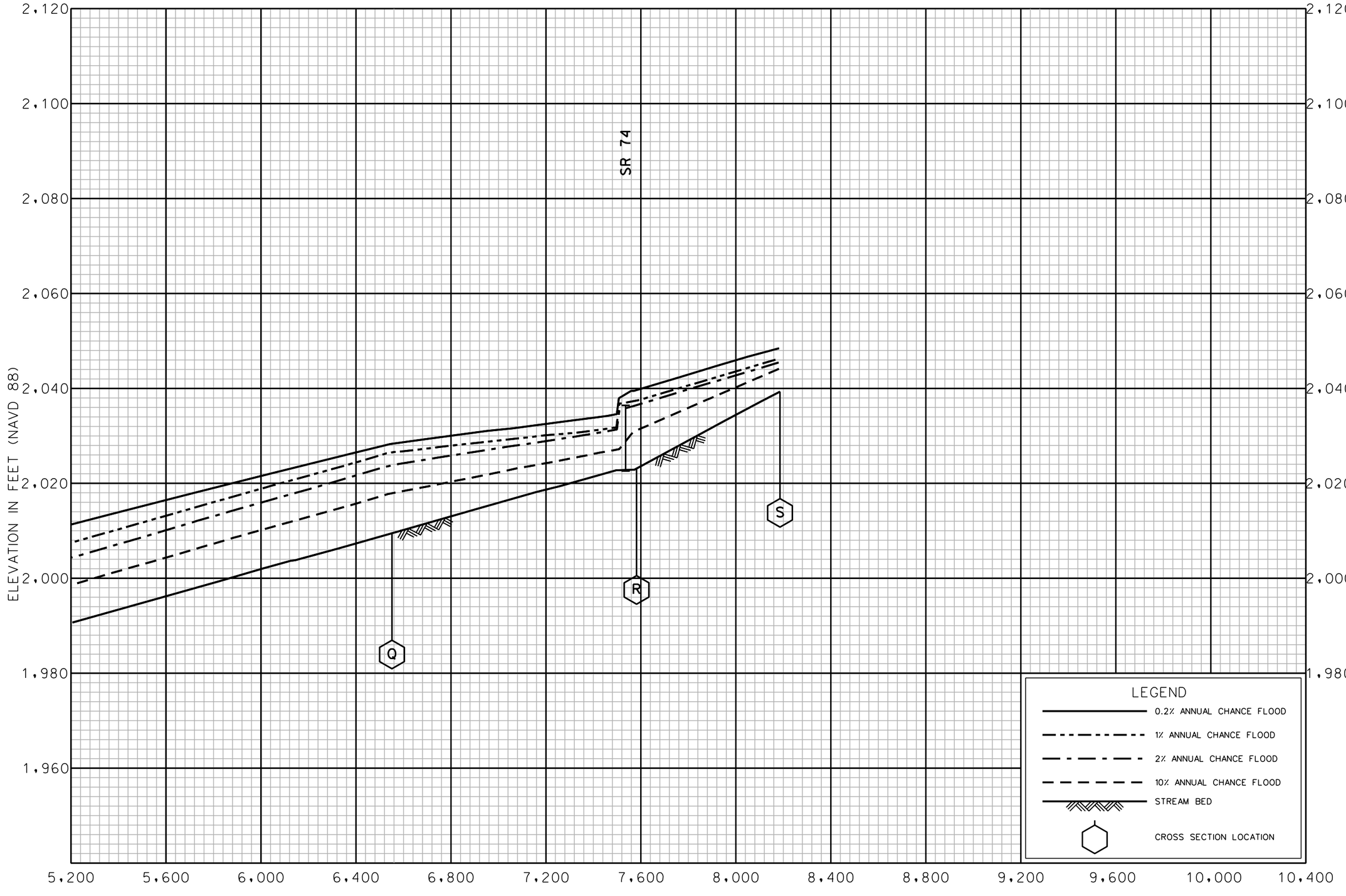
FLOOD PROFILES

HINTON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORROW COUNTY, OREGON

AND INCORPORATED AREAS



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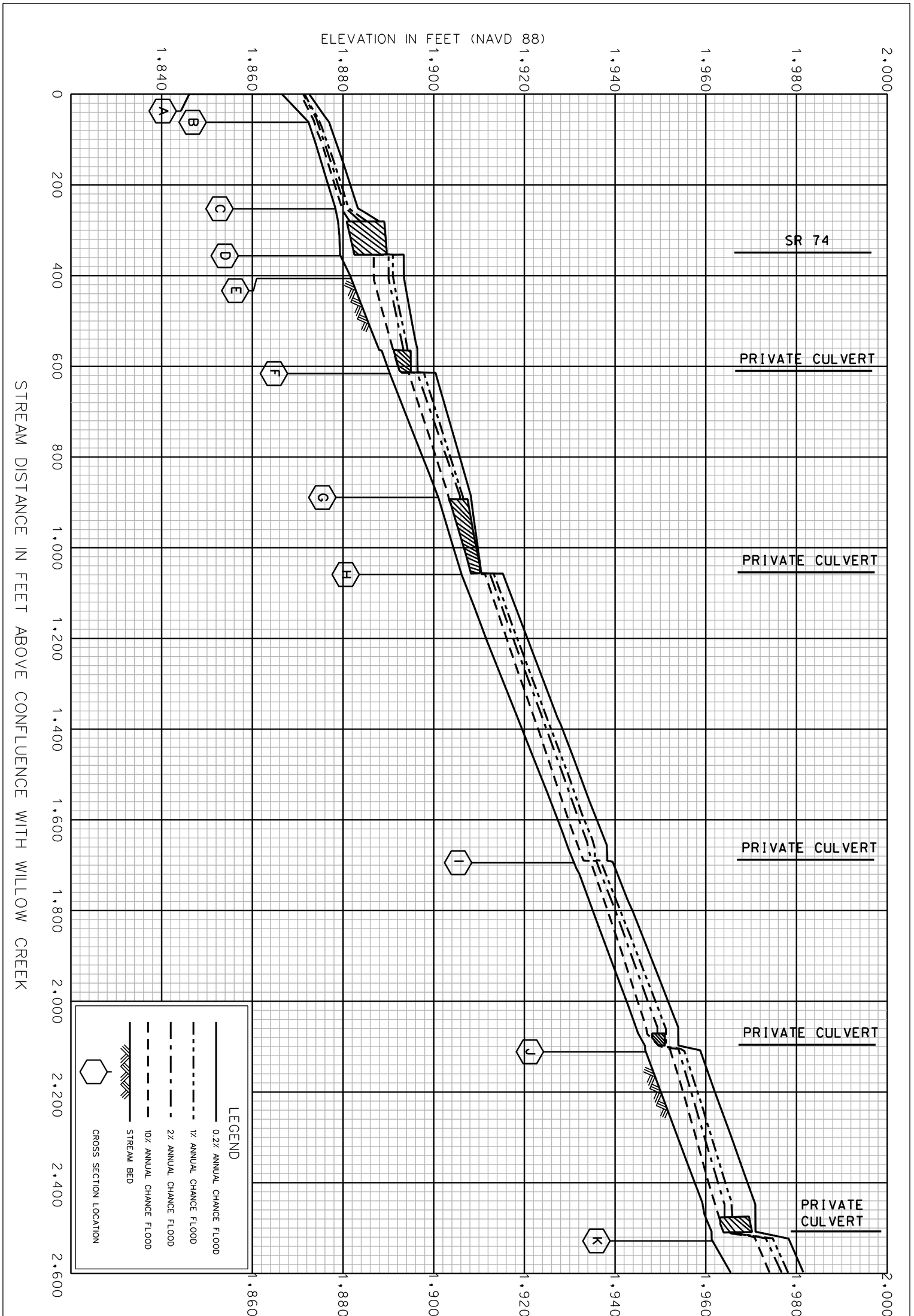


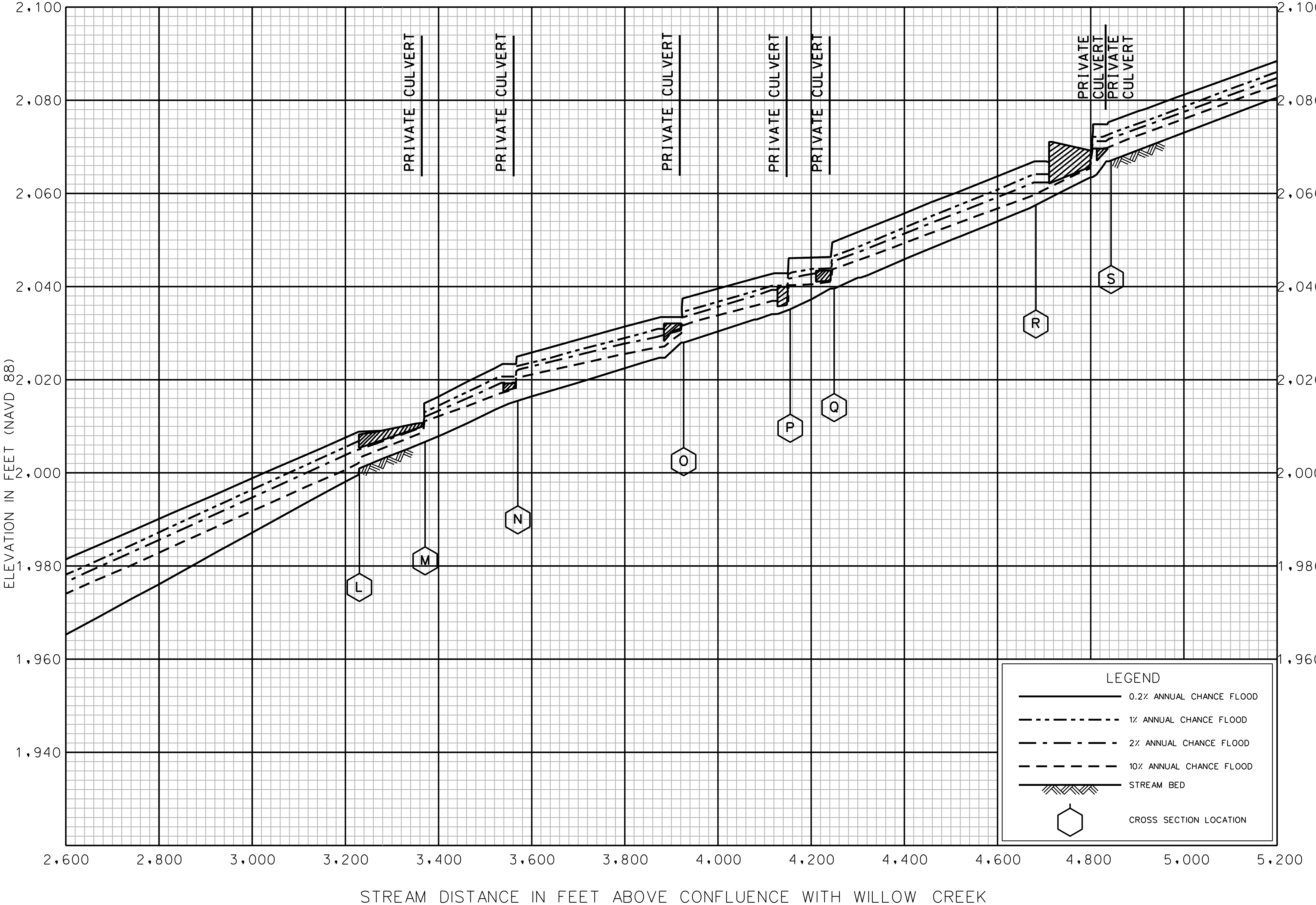
04P

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORROW COUNTY, OREGON AND INCORPORATED AREAS

FLOOD PROFILES

LITTLE BLACKHORSE CANYON



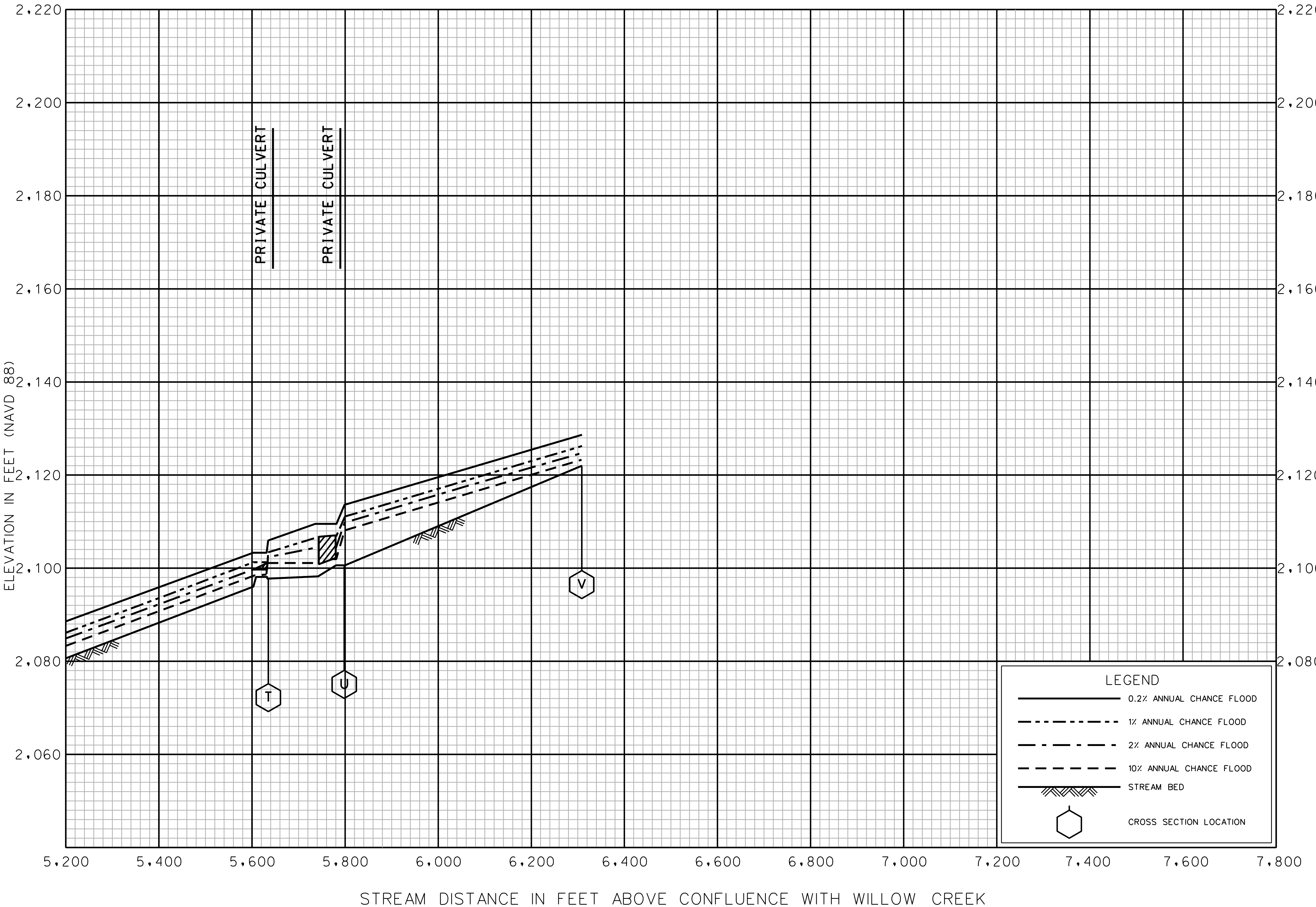
FLOOD PROFILES

LITTLE BLACKHORSE CANYON

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORROW COUNTY, OREGON AND INCORPORATED AREAS

05P



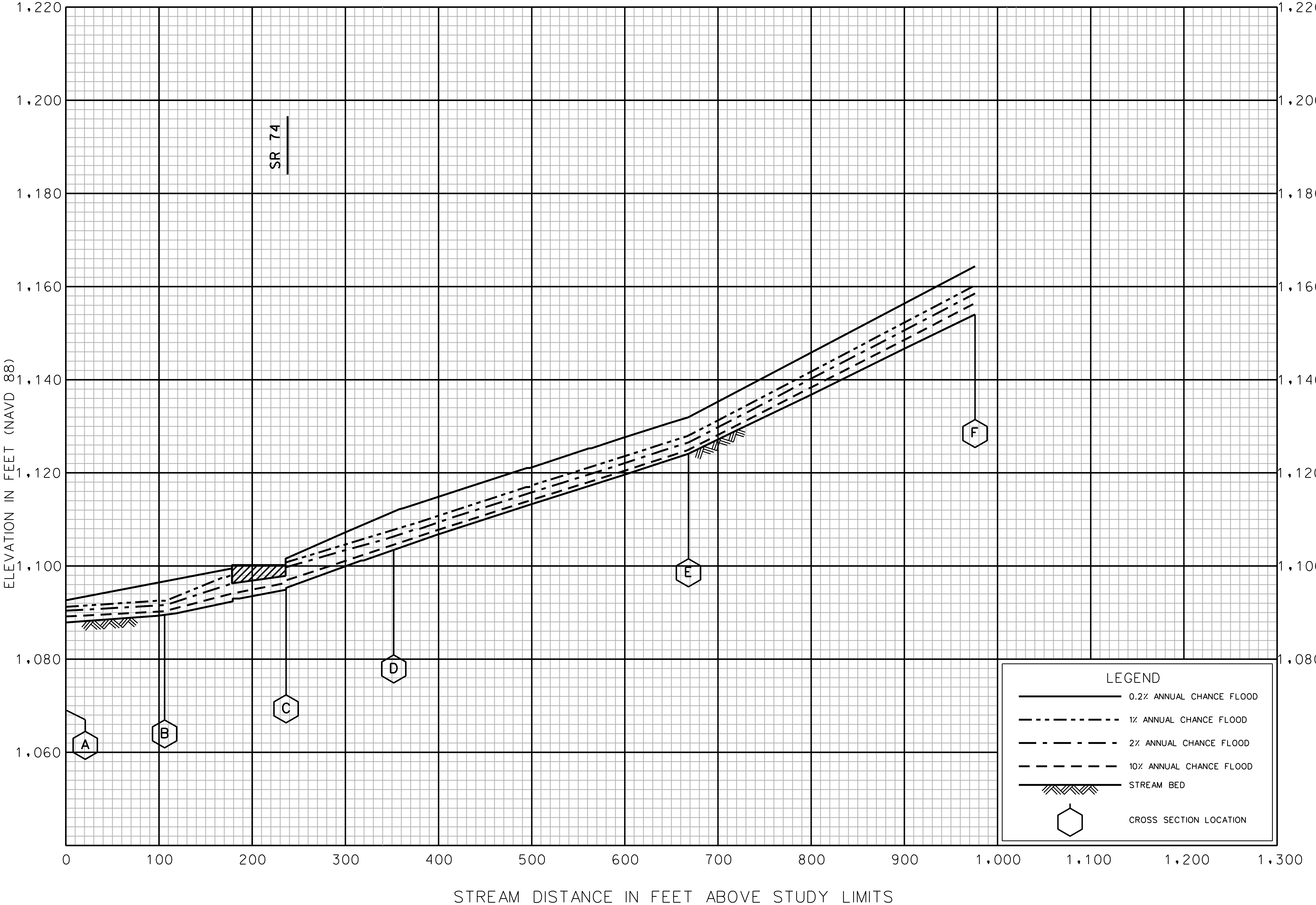
FLOOD PROFILES

LITTLE BLACKHORSE CANYON

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORROW COUNTY, OREGON AND INCORPORATED AREAS

06P



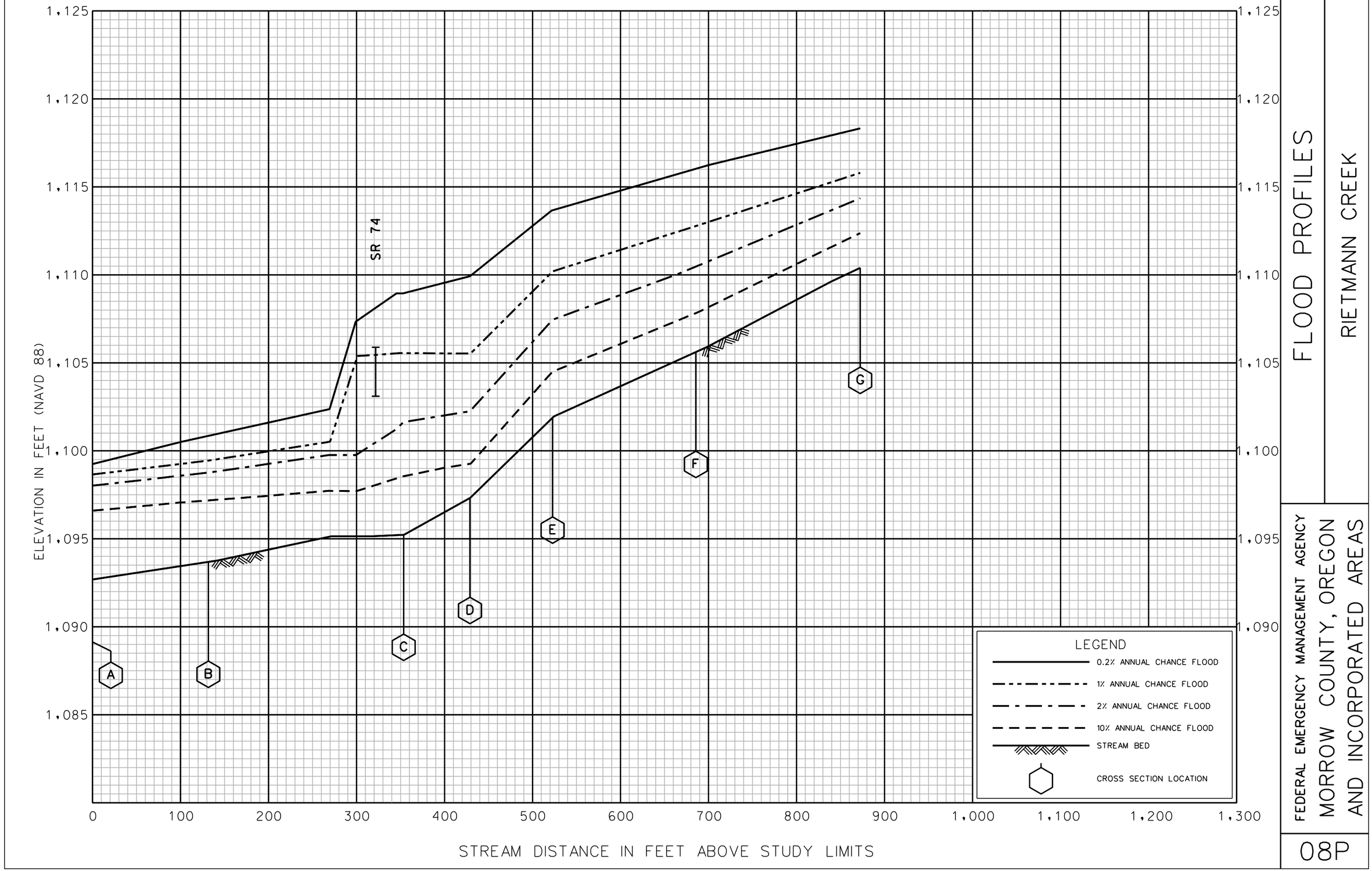
FLOOD PROFILES

LORRAINE CANYON

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORROW COUNTY, OREGON AND INCORPORATED AREAS

07P



FLOOD PROFILES

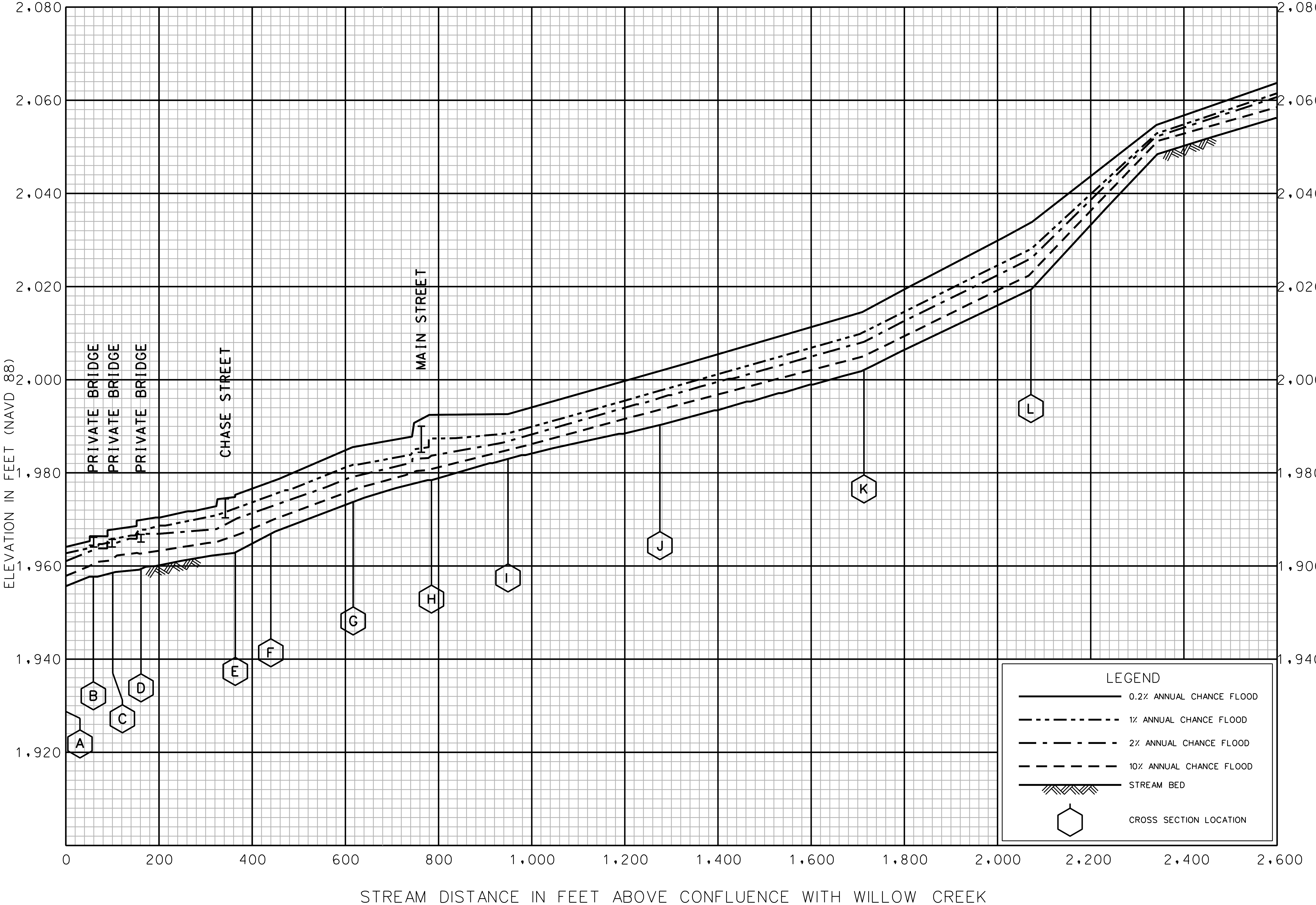
RIETMANN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORROW COUNTY, OREGON

AND INCORPORATED AREAS

08P



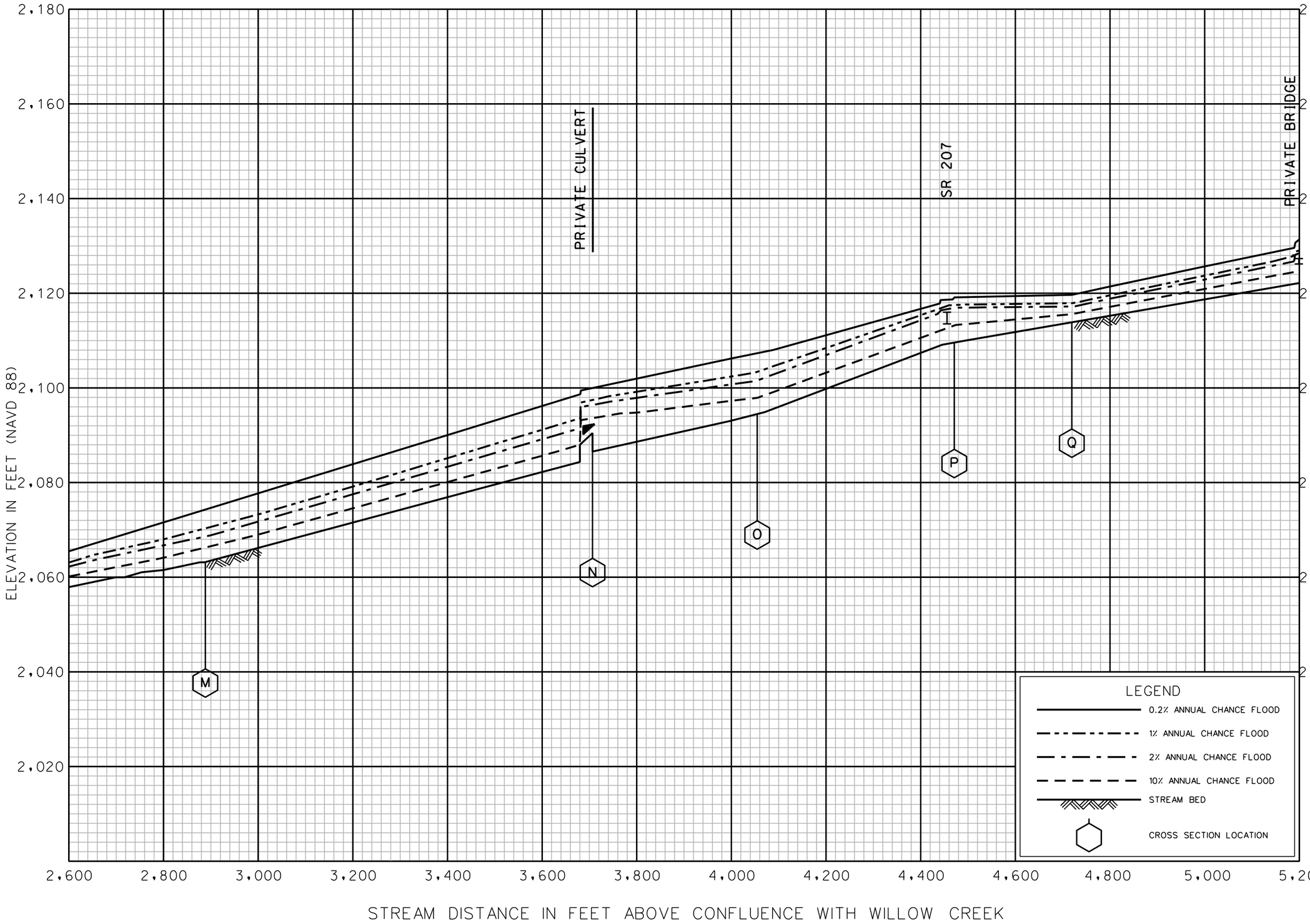
FLOOD PROFILES

SHOBE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORROW COUNTY, OREGON AND INCORPORATED AREAS

09P



FLOOD PROFILES

SHOBE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORROW COUNTY, OREGON AND INCORPORATED AREAS

10P

FLOOD PROFILES

SHOBE CREEK

ELEVATION IN FEET (NAVD 88)

2,260
2,240
2,220
2,200
2,180
2,160
2,140
2,120
2,100

R
S
T

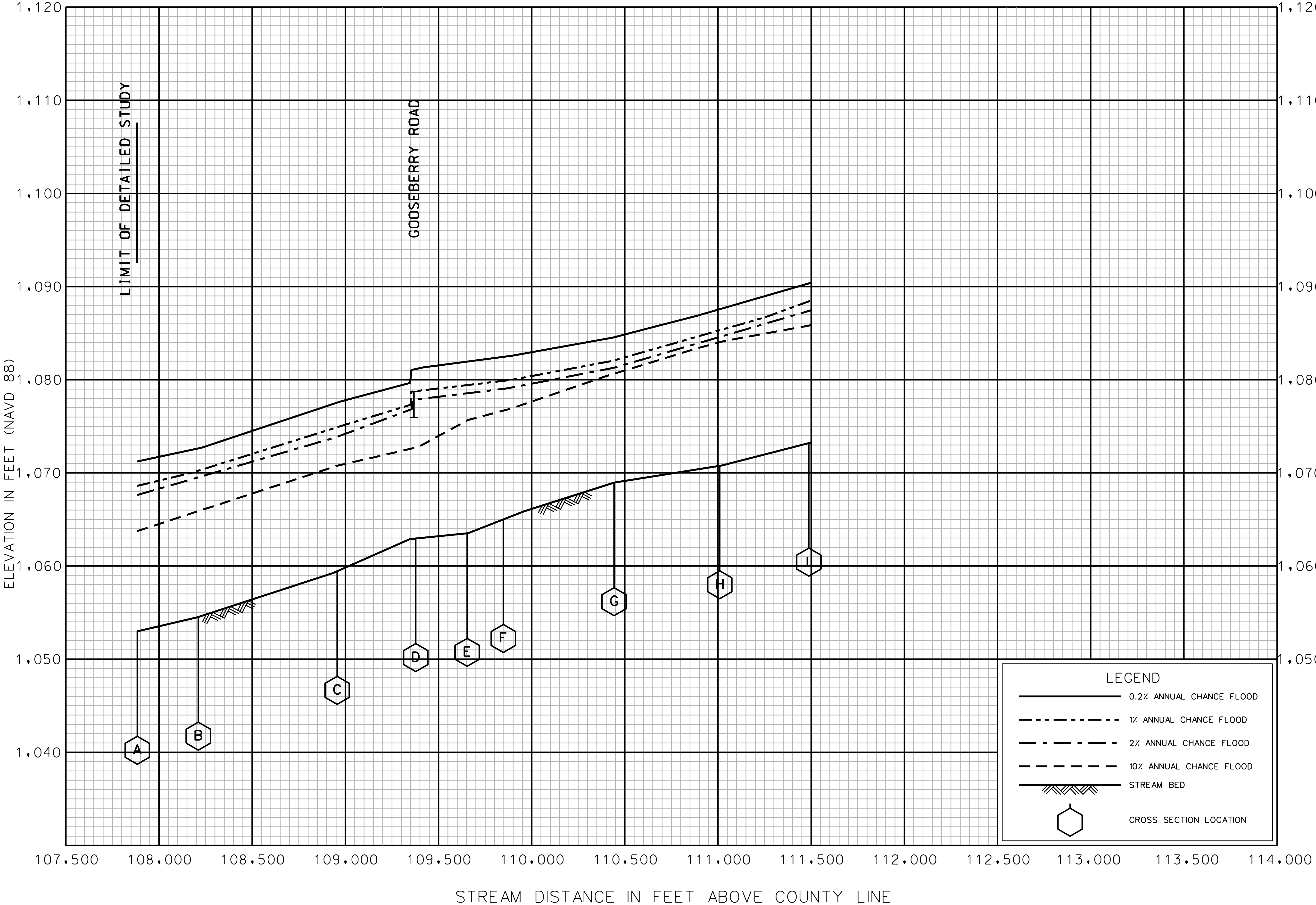
LEGEND
- 0.2% ANNUAL CHANCE FLOOD
- 1% ANNUAL CHANCE FLOOD
- 2% ANNUAL CHANCE FLOOD
- 10% ANNUAL CHANCE FLOOD
- STREAM BED
- CROSS SECTION LOCATION

5,200 5,400 5,600 5,800 6,000 6,200 6,400 6,600 6,800 7,000 7,200 7,400 7,600 7,800

STREAM DISTANCE IN FEET ABOVE CONFLUENCE WITH WILLOW CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY
MORROW COUNTY, OREGON
AND INCORPORATED AREAS

11P



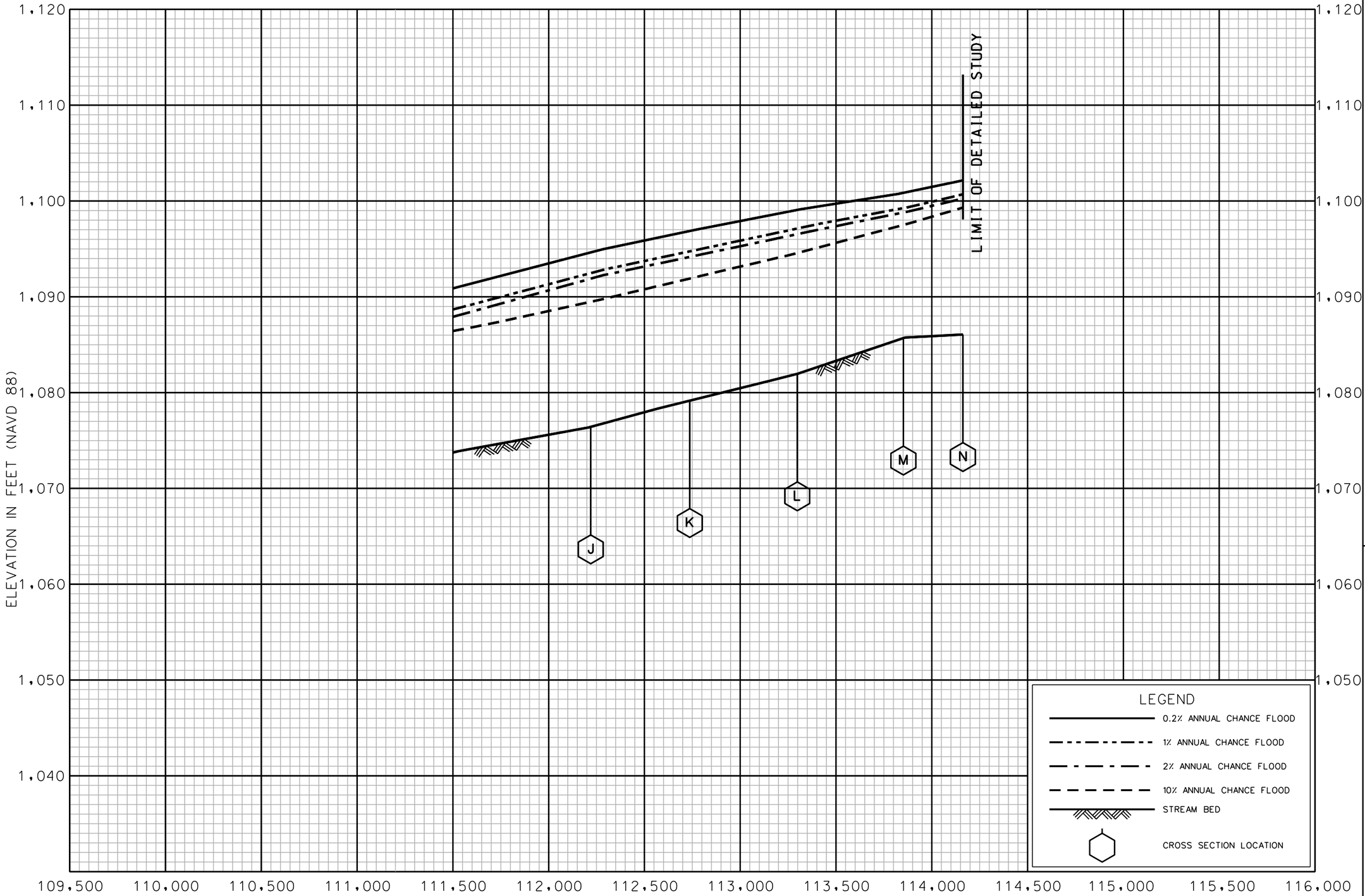
FLOOD PROFILES

WILLOW CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORROW COUNTY, OREGON AND INCORPORATED AREAS

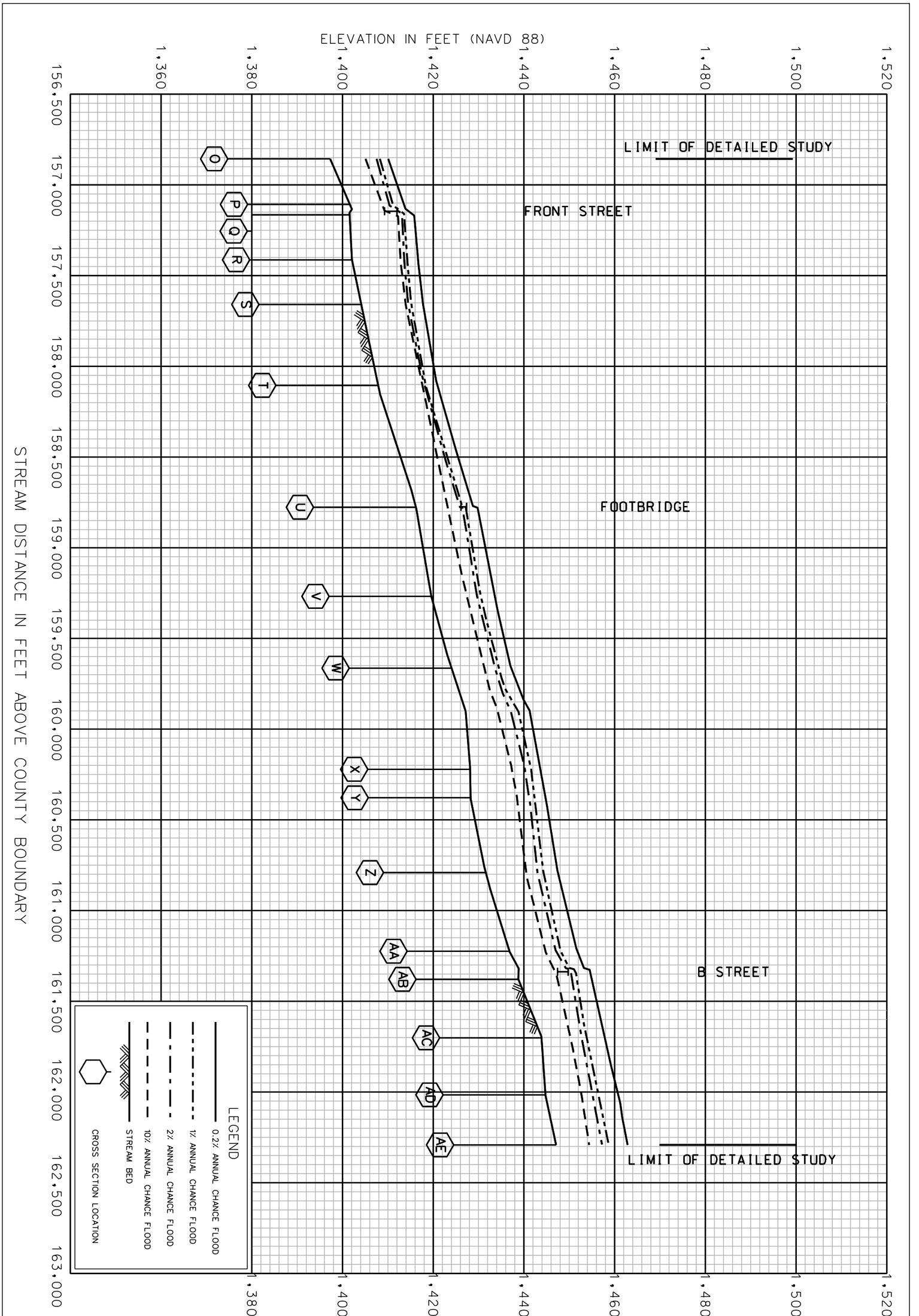
12P



FLOOD PROFILES

WILLOW CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY
MORROW COUNTY, OREGON
AND INCORPORATED AREAS



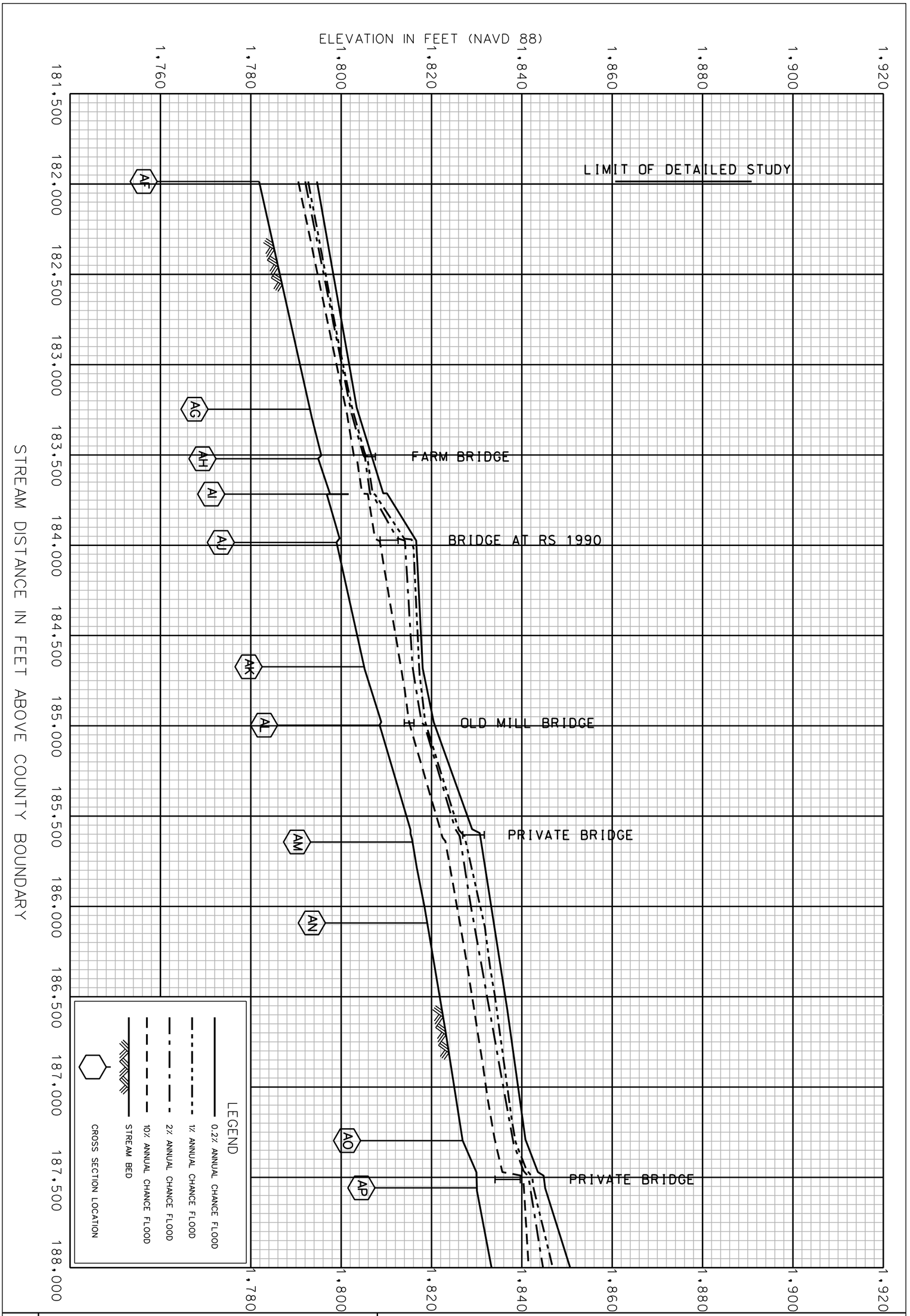
14P

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORROW COUNTY, OREGON AND INCORPORATED AREAS

FLOOD PROFILES

WILLOW CREEK



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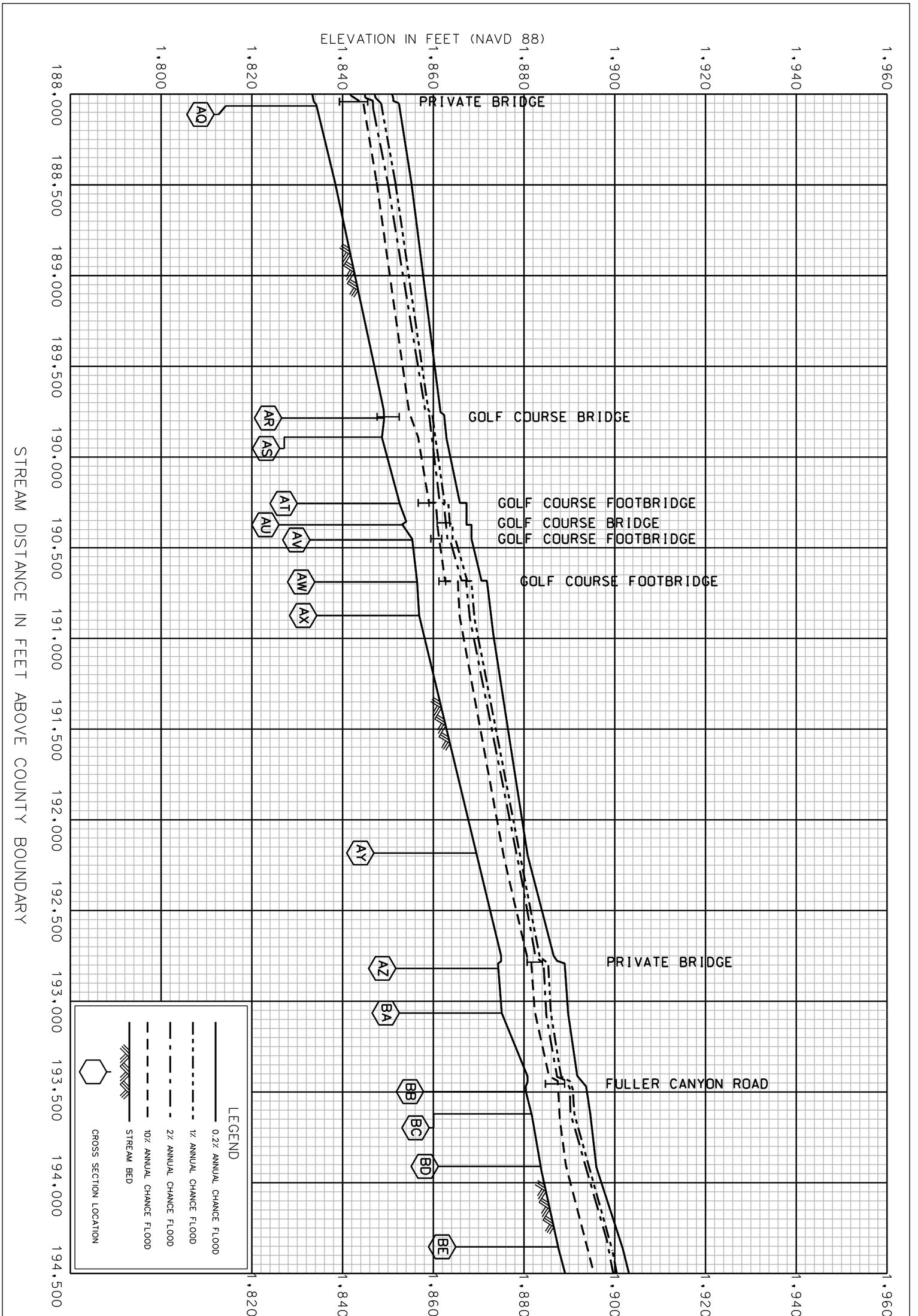
FEDERAL EMERGENCY MANAGEMENT AGENCY

MORROW COUNTY, OREGON AND INCORPORATED AREAS

FLOOD PROFILES

WILLOW CREEK



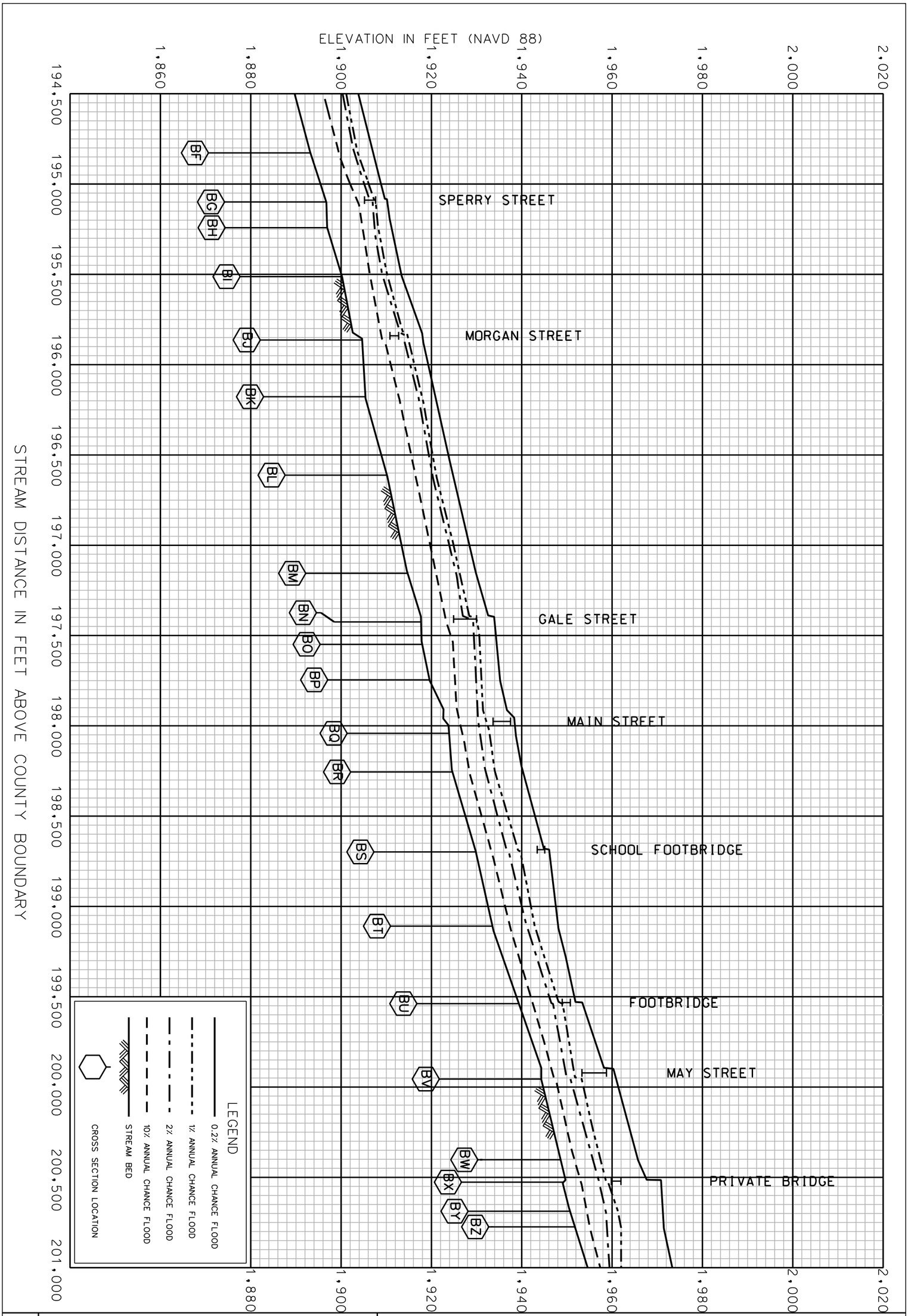
16P

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORROW COUNTY, OREGON AND INCORPORATED AREAS

FLOOD PROFILES

WILLOW CREEK



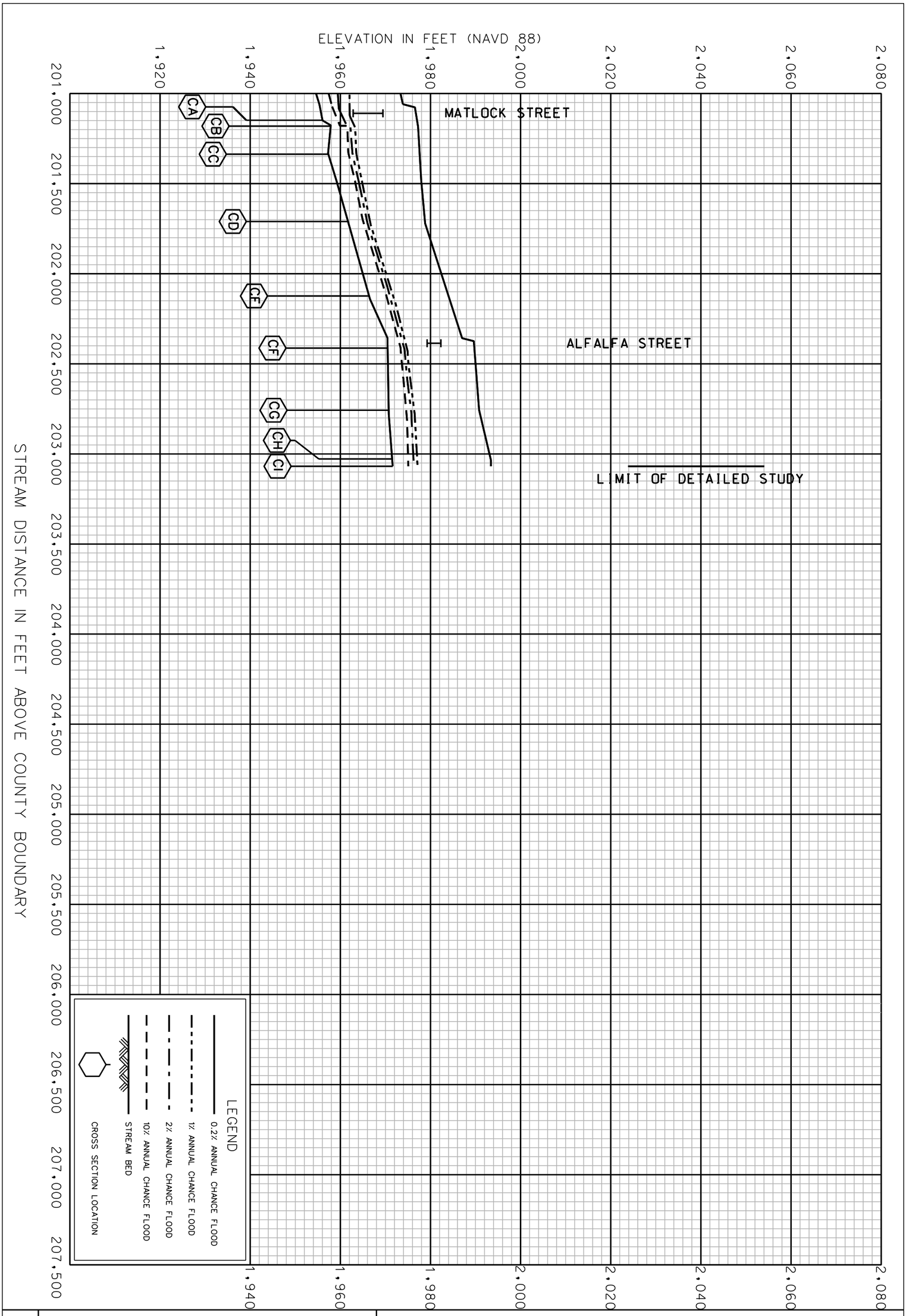
17P

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORROW COUNTY, OREGON AND INCORPORATED AREAS

FLOOD PROFILES

WILLOW CREEK



STREAM DISTANCE IN FEET ABOVE COUNTY BOUNDARY

18P

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORROW COUNTY, OREGON AND INCORPORATED AREAS

FLOOD PROFILES

WILLOW CREEK