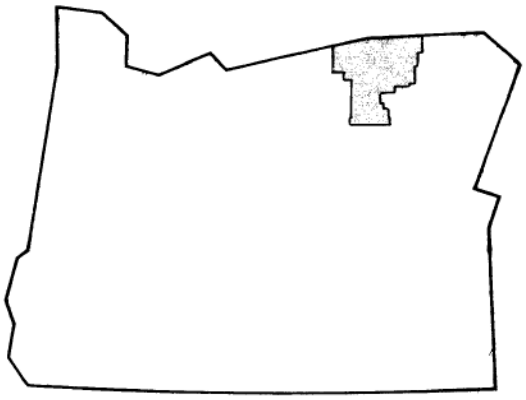
FLOOD INSURANCE STUDY

UMATILLA COUNTY, OREGON
AND INCORPORATED AREAS
VOLUME 1 OF 2



COMMUNITY NAME	COMMUNITY NUMBER
ADAMS, CITY OF	410205
ATHENA, CITY OF	410206
ECHO, CITY OF	410207
HELIX, CITY OF	410208
HERMISTON, CITY OF	410209
MILTON-FREEWATER, CITY OF	410210
PENDLETON, CITY OF	410211
PILOT ROCK, CITY OF	410212
STANFIELD, CITY OF	410213
UKIAH, CITY OF	410279
UMATILLA, CITY OF	410214
UMATILLA COUNTY	410204
UNINCORPORATED AREAS	
UMATILLA INDIAN RESERVATION	410012
WESTON, CITY OF	410215

Effective:
September 3, 2010

Federal Emergency Management Agency

Flood Insurance Study Number
41059CV001A

NOTICE TO
FLOOD INSURANCE STUDY USERS

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

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
B	X (shaded)
C	X (unshaded)

Part or all of this 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.

This FIS report was revised on September 3, 2010. User should refer to Section 10.0, Revision Descriptions, for further information. Section 10.0 is intended to present the most up-to-date information for specific portions of this FIS report. Therefore, users of this FIS report should be aware that the information presented in Section 10.0 supersedes information in Sections 1.0 through 9.0 of this FIS report.

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PUBLISHED SEPARATELY

Flood Insurance Rate Map Index

Flood Insurance Rate Map

FLOOD INSURANCE STUDY
UMATILLA COUNTY AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study revises and updates information on the existence and severity of flood hazards in the geographic area of Umatilla County, including the cities of Adams, Athena, Echo, Helix, Hermiston, Milton-Freewater, Pendleton, Pilot Rock, Stanfield, Ukiah, Umatilla, and Weston; Umatilla Indian Reservation; and the unincorporated areas of Umatilla County (referred to collectively herein as Umatilla 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 Acknowledgments

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

The hydrologic and hydraulic analyses for Birch Creek, East Fork Birch Creek, West Fork Birch Creek, Greasewood Creek, McKay Creek, Mill Creek, Nelson Creek, Patawa Creek, Pine Creek, Sand Hollow Creek, Southwest Drainage, Stage Gulch, Tutuilla Creek, Umatilla River, Walla Walla River, South Fork Walla Walla River, Waterman Gulch, and Wildhorse Creek were performed by the U.S. Army Corps of Engineers (USACE), Walla Walla District. The hydrologic and hydraulic analysis for Stage Gulch in the City of Stanfield was performed by the USACE, Portland District. These studies, completed at various times from 1973 to 1985, were performed for the Federal Emergency Management Agency (FEMA) under Contract No. IAA-H-2-19-73, Project Order Nos. 2 and 4; Contract No. IAA-H-2-19-74, Project Order No. 6; Contract No. IAA-H-3-16-75, Project Order No. 18; Contract No. EMW-E-1153, Project Order No.1, Amendment 18; and Contract No. C-0542.

The countywide update was performed by WEST Consultants, Inc. for FEMA under Contract No. EMS-20010-CO-0068. Updated aerial photography from October 2006 was used in the analysis. As part of the countywide update, the hydrologic and hydraulic analyses of the Umatilla River, Squaw Creek, and Meacham Creek in the lands of the Umatilla Indian Reservation performed by the USACE, Portland District, in 1998 were reviewed and subsequently revised for inclusion in this Flood Insurance Study. An additional hydraulic analysis of the Walla Walla River in the vicinity of the City of Milton-Freewater, as well as redelineation of the floodplain boundaries along the lower Umatilla River were also performed by WEST Consultants, Inc. The countywide update

was completed in December 2008.

1.3 Coordination

The dates of the initial, intermediate, and final CCO meetings held for the previous FIS reports for Umatilla County and the incorporated communities within its boundaries are shown in Table 1, "Initial, Intermediate, and Final CCO Meetings". They were attended by representatives of FEMA, the communities, and the study contractor.

Table 1. Initial, Intermediate, and Final CCO Meetings

Community	Initial CCO Date	Intermediate CCO Date	Final CCO Date
Adams, City of	--[1]	--[1]	December 9, 1982
Athena, City of	--[1]	--[1]	August 4, 1983
Echo, City of	--[1]	--[1]	December 10, 1982
Helix, City of	--[1]	--[1]	December 9, 1982
Hermiston, City of	--[1]	--[1]	November 22, 1985
Milton-Freewater, City of	--[1]	--[1]	--[1]
Pendleton, City of	--[1]	--[1]	November 22, 1985
Pilot Rock, City of	July, 1983	--[1]	September 3, 1987
Stanfield, City of	--[1]	April 22, 1982	August 3, 1983
Ukiah, City of	--[1]	--[1]	--[1]
Umatilla, City of	--[1]	--[1]	--[1]
Umatilla County, unincorporated areas	--[1]	--[1]	February 25, 1986
Umatilla Indian Reservation	--[1]	--[1]	--[1]
Weston, City of	July, 1983	--[1]	August 26, 1986

[1] Information not available

Countywide Update

The results of the study were reviewed at the final Consultation Coordination Officer [CCO] meetings held on April 14, 15 and 16, 2009, and attended by representatives of the cities of Adams, Athena, Weston, Echo, Hermiston, Pendleton, Pilot Rock, Stanfield, Milton-Freewater, Umatilla County, the Umatilla Indian Reservation, FEMA, WEST Consultants and the Oregon Department of Land Conservation and Development. All problems raised at that meeting have been addressed in this study.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the geographic area of Umatilla County, including the incorporated communities listed in Section 1.1.

The flooding sources studied by detailed methods in Umatilla County were selected with priority given to all known flood hazards and areas of projected development or proposed construction through June 1990.

Table 2 lists the flooding sources studied in detail and the included segments.

Table 2. Flooding Sources Studied by Detailed Methods

Flooding Source	Limits of Detailed Study
Birch Creek	From a point 0.1 miles downstream of East and West Forks Birch Creek to the confluence (0.1 miles)
East Fork Birch Creek	From the confluence of East and West Forks Birch Creek to the corporate limit of Pilot Rock (0.7 miles)
West Fork Birch Creek	From the confluence of East and West Forks Birch Creek to a point 140 feet upstream of the corporate limit of Pilot Rock (0.7 miles)
Greasewood Creek	From 0.1 miles upstream of Cemetery Road to the corporate limit of Helix (0.5 miles)
Iskuulpa Creek	From its mouth to a point 1.5 miles upstream (River Mile 0.0 to 1.5)
Iskuulpa Creek Left Overbank Split	From 0.2 miles upstream of Bingham Road to a point 0.5 miles downstream of Bingham Road (0.7 miles)
Meacham Creek	From its mouth to a point 10 feet upstream of Union Pacific Railroad (River Mile 0.0 to 1.5)
Mill Creek	From the Oregon-Washington Border to a point 0.2 miles upstream of Forest Service Road 65 (River Mile 22.2 to 25.4)
Mill Creek (Side Channel)	From 0.1 miles downstream of Straw Springs Lane to the confluence of Mill Creek (0.3 miles)
Nelson Creek	From its mouth to a point 400 feet above NW Furnish Avenue (0.5 miles)
Patawa Creek	From its mouth to Old Dump Road (River Mile 0.0 to 1.6)
Pine Creek	From the corporate limit of Weston to a point 0.3 miles upstream of Broad Street (River Mile 0.2 to 1.6)
Sand Hollow Creek	From its mouth to the corporate limit of Adams (0.2 miles)
Southwest Drainage	From its mouth to a point 100 feet above County Road 323 (0.4 miles)

Table 2. Flooding Sources Studied by Detailed Methods (continued)

Flooding Source	Limits of Detailed Study
Stage Gulch	From 250 feet downstream of Hoosier Lane to S Edwards Road (River Mile 0.5 to 1.6)
Tutuilla Creek	From its mouth to a point 0.1 miles above the southern corporate limit of Pendleton (River Mile 0.0 to 2.3)
Umatilla River	From 4.4 miles above its mouth to a point 0.5 miles above Union Pacific Railroad (River Mile 4.4 to 33.4), and from the confluence with McKay Creek to 0.1 miles downstream of Ryan Creek (River Mile 50.7 to 81.6)
Umatilla River Right Overbank	From N Cayuse Road to the confluence of the Umatilla River (0.5 miles)
Walla Walla River	From the Oregon-Washington border to Birch Creek Road (River Mile 40.0 to 41.8), and from 0.3 miles above Couse Creek Road to confluence of North and South Forks Walla Walla River (River Mile 47.1 to 50.0)
South Fork Walla Walla River	From 0.6 miles below South Fork Walla Walla River Road to 0.3 miles above South Fork Walla Walla River Road (0.9 mile)
Waterman Gulch	From its mouth to 100 feet upstream of Waterman Road (River Mile 0.0 to 1.1)
Wildhorse Creek	From its mouth to 25 feet upstream of Adams Road (River Mile 0.0 to 3.5); from 0.1 miles downstream of Main Street to the corporate limit of Adams (River Mile 6.3 to 7.0); and from 0.5 miles above Labor Camp Road to 0.1 miles above 3rd Street (River Mile 8.3 to 9.3)

Approximate analyses were used to study flooding sources in areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by representatives from FEMA, USACE, Umatilla County, and the Cities of Adams, Athena, Helix, Pendleton, and Pilot Rock. Table 3 lists the flooding sources, grouped by watershed, which were studied by approximate methods.

Table 3. Flooding Sources Studied by Approximate Methods

1. Camas Creek, Owens Creek
2. Columbia River
3. Birch Creek, East Fork Birch Creek, McKay Creek, Sand Hollow Creek, Umatilla River, Wildhorse Creek
4. Walla Walla River

2.2 Community Description

Umatilla County is located in the northeastern Oregon, approximately 180 miles east of Portland. It is bounded on the west by Morrow County, on the south by Grant County, on the east by Wallowa and Union Counties, and on the north by Walla Walla and Benton Counties in Washington State. Varying in width from 22 to 70 miles and with an approximately 70-mile length, Umatilla County comprises a 3,240-square-mile area. In 1970, the population was 45,000. The estimated population in 2006 was 72,928 (Reference 1).

The main streams draining the area in the central and northwestern portion of the county are the Umatilla River, Birch Creek, East and West Forks Birch Creek, McKay Creek, Meacham Creek, Patawa Creek, Squaw Creek, Tutuilla Creek, and Wildhorse Creek
The Umatilla River, a tributary of the Columbia River, is the major drainage basin in the county. In Umatilla County, the river flows west through the Umatilla Indian Reservation to Nolin, then northwest to Cottonwood Bend, then north to its confluence with the Columbia River. Other major streams that drain the Umatilla basin are Birch Creek, East and West Forks Birch Creek, McKay Creek, Meacham Creek, Squaw Creek, Tutuilla Creek, and Patawa Creek. These streams flow northerly and northwesterly. Wildhorse Creek, the only major northside tributary of the Umatilla River, flows southwesterly to its confluence with the Umatilla River.

The Walla Walla River is also a tributary of the Columbia River. Within the study area, the river flows northwesterly to Milton-Freewater and north to the Oregon-Washington State line. Its tributaries include North and South Forks Walla Walla River and Mill Creek.

The topography in Umatilla County ranges from mountainous terrain in the southern part to high, rolling prairies in the north.

The climate of the Umatilla River basin is characterized by light to moderate precipitation and an extreme range in temperature. In general, the climate is subject to the moderating influence of the prevailing westerly flow of maritime air from the Pacific Ocean, but occasional influxes of polar airmasses cause brief periods of extremely cold temperatures. Record extreme temperatures within the county are 119°F at Pendleton and -52°F at Meacham.

The seasonal distribution of precipitation is similar to that generally observed over the interior in the Pacific Northwest, the greater portion falling during the winter. The average annual precipitation at Pendleton is 13.6 inches. Nearly 60 percent of the recorded annual precipitation falls from November to March.

The largest portion of the Umatilla River floodplain is devoted to agricultural and related purposes. Development within the communities located partially within the floodplain is

primarily commercial and residential. Most of the floodplain along Wildhorse Creek is in open-type agricultural land, although suburban developments and farmsteads exist. Land use in the Tutuilla Creek and McKay Creek floodplains includes residential development and agricultural land use, with limited commercial development in the McKay Creek floodplain. Development in the Mill Creek floodplain is mainly residential, which includes lots for summer homes and cabins. Agricultural land use predominates in the Walla Walla River floodplain. Among other developments in Umatilla County, city streets, highways, and railroad lines cross the floodplains. Development is expected to continue within the study area, accompanied by continued pressures to intensify floodplain use.

City of Adams

The City of Adams is located in north-central Umatilla County. It is bordered completely by unincorporated areas of Umatilla County. The population of Adams was approximately 297 in 2000 (Reference 1).

After its founding in 1883, the City of Adams lost out to other nearby towns in the bid to become the premier service center for an extensive and fertile dryland wheat-farming area in eastern Umatilla County. By 1890 the town had entered into a steady decline. Today Adams is a rural residential area for nearby farms. Two-thirds of the city area is farmed, and within the built-up portions, homes are widely spaced. Horses, chickens, and large gardens are common. Much of the city is built on the floodplain adjacent to Wildhorse Creek with one residential area ascending the low hill to the west and a cluster of grain elevators towering along State Highway 11 to the east.

Two streams flow through Adams. Wildhorse Creek is a major tributary of the Umatilla River, and Sand Hollow Creek, a tributary of Wildhorse Creek, is a minor stream in the northeastern corner of the city.

City of Athena

The City of Athena is located in northeastern Umatilla County and is surrounded entirely by the unincorporated areas of Umatilla County. In 2000, the population of Athena was estimated to be 1,221 (Reference 1).

From its inception in 1878, when Athena was known as Centerville, the city had served almost exclusively as a rural service center for the wheat farmers in surrounding Umatilla County. By 1892, the population of Athena had grown to over 1,000. Because of farm mechanization and increased automobile usage, Pendleton replaced Athena as the regional service center, and by 1940 the population of Athena had dwindled to one-half its former size. However, with the establishment of the green pea industry in the area, Athena regained its original importance to the region.

Two streams run through the City of Athena. Wildhorse Creek flows through the southern part of the city. Waterman Gulch is a tributary of Wildhorse Creek. Development in the floodplains consists mostly of an industrial area in the western part of the city along Waterman Gulch and some residential areas along Wildhorse Creek.

City of Echo

The City of Echo is located in the northwest portion of Umatilla County. The population of Echo was 650 in 2000 (Reference 1).

Echo is a small, rural service center, founded in 1879 on a river terrace at the ford where the historic Oregon Trail crossed the lower Umatilla River. The adjacent "meadows" along the river provided a fertile area for the establishment of the first Euro-American settlements in this region in the 1850s, and together with its predecessors, Utilla and Fort Henrietta, Echo served as a trading post and stage stop for a wide area. From its zenith in the 1920s, the community declined for several decades until the Columbia Basin irrigation "boom" of the 1960s and 70s triggered growth in west Umatilla County. A municipal golf course was developed on the hill above the city and new homes were built, bringing the population up to 625. This growth triggered development of a new sewer system, rebuilding of the water system, and remodeling and expansion of the Echo School. Echo also serves as the social center for an extensive irrigated and dryland wheat-farming area and as a residential neighborhood for the nearby Cities of Pendleton and Hermiston.

The Umatilla River flows northwesterly along the western corporate limits of Echo.

City of Helix

The City of Helix is a small agricultural community in the wheat belt of northeast Oregon. It lies approximately 47 miles north of Pendleton and is surrounded by the unincorporated areas of Umatilla County. In 2000, the population of Helix was estimated to be 183 (Reference 1).

Helix is a wheat town serving the surrounding farms as an educational, social, and operational center. Founded in 1880 by a Scandinavian immigrant named Peter Hjelseng, Helix developed slowly until the arrival of the railroad in 1889. The 1890s and early 20th Century witnessed the growth of a considerable business community in Helix; however, increased farm mechanization and auto use signaled the decline of Helix as a retail and personal service center. Today, Helix is chiefly a residential area for people attracted by its small town atmosphere.

The two principal streams in Helix are Greasewood Creek and Southwest Drainage. Greasewood Creek flows from north to south and passes through the western part of the city. Development on the Greasewood Creek floodplain consists of a railroad yard on the west bank and residential areas to the east of the stream. Southwest Drainage flows to the northeast and is a tributary of Greasewood Creek.

The soil types within and surrounding Helix are prime for agricultural use and are rated as U.S. Soil Conservation Service Class I and II for cultivation capability.

City of Hermiston

The City of Hermiston, founded in 1907, is located in the northwestern corner of Umatilla County, approximately 35 miles northwest of Pendleton and is surrounded by the City of Umatilla to the north and the City of Stanfield to the south. It comprises an area of generally high, rolling prairies. According to the U.S. Bureau of the Census, the population of Hermiston grew from 4,893 to 9,408 from 1970 to 1980 (Reference 2). In 2000, the population of Hermiston was 13,154 (Reference 1).

The principal stream in Hermiston is the Umatilla River.

City of Milton-Freewater

The City of Milton-Freewater, founded in 1950, is situated in the northeastern portion of Umatilla County and is surrounded by the unincorporated areas of the county. It is

located approximately 5 miles south of the Oregon/Washington border. The population of Milton-Freewater increased from 5,086 in 1980 to an estimated 6,585 in 2006 (Reference 3).

The principal stream in Milton-Freewater is the Walla Walla River.

City of Pendleton

The City of Pendleton, founded in 1880, is located in the central portion of Umatilla County and is surrounded by the unincorporated areas of the county. It is located approximately 200 miles east of Portland. The total land area contained within the corporate limits is 10.1 square miles. Pendleton is situated along the Umatilla River, approximately 45 miles from its source in the Blue Mountains. According to U.S. Census Bureau figures, the population of Pendleton was 14,521 in 1980 (Reference 2). This figure increased to 16,354 in 2000 (Reference 1).

The Umatilla River flows west through the center of the community. Tutuilla Creek originates on the northeastern slopes of Emigrant and Cabbage Hills in the Blue Mountains, then flows north and west 15 miles to its confluence with the Umatilla River at Pendleton. McKay Creek originates on the northern slopes of the Blue Mountains in the southeastern part of the Umatilla River Basin, and then flows north and west 29 miles to its confluence with the Umatilla River at Pendleton.

Pendleton is a community center for an extensive irrigated and dry farming area of Umatilla County and serves as the hub of transportation facilities in northeastern Oregon. Development within Pendleton is primarily commercial and residential. Land use in the Tutuilla Creek and McKay Creek floodplains includes residential development and agricultural land use. There is limited industrial development in the McKay Creek floodplain at its northern terminus with the Umatilla River.

City of Pilot Rock

The City of Pilot Rock, founded in 1911, is located in central Umatilla County and is surrounded by the unincorporated areas of the county. The total land area contained within the corporate limits is 0.8 square miles. Pilot Rock is approximately 15 miles south of the City of Pendleton. According to U.S. Census Bureau figures, the population increased from 1,612 in 1970 to 1,630 in 1980 (Reference 2). In 2000, the population of Pilot Rock was 1,532 (Reference 1).

East and West Forks of Birch Creek originate in the northern slopes of the Blue Mountains in the southern part of Umatilla County. The streams flow northerly into Pilot Rock and meet to form Birch Creek, which continues northerly to Umatilla River. The drainage area of the two streams above Pilot Rock encompasses 219 square miles.

Approximately 50 percent of Pilot Rock has been developed, with the remainder of the land consisting of open fields. Within the floodplain studied, development includes the main business district and family residences.

City of Stanfield

The City of Stanfield, founded in 1910, is located in western Umatilla County, approximately 5 miles southeast of Hermiston and approximately 8 miles west of Nolin. Stanfield is surrounded by unincorporated areas of Umatilla County. In 2000, the population was 1,979 (Reference 1).

Stanfield was first known as Foster, named for John R. Foster, a well-known Umatilla County resident. The town name was later changed to honor Robert N. Stanfield, a nearby landowner who subsequently became a U.S. Senator.

The main portion of the City of Stanfield is in a low-lying floodplain with higher elevations to the north and south. While some development has taken place in the floodplain, the major development has occurred on the higher elevations to the north.

Agriculture and the railroad form the major economic base for the area. The region is semiarid but, since the completion of numerous irrigation projects and deep wells, the area produces wheat, potatoes, hay, watermelons, mints, and other crops was well as cattle. The soils range from U.S. Soil Conservation Service Classes I to IV.

Stage Gulch originates in the hills southeast of Stanfield near the City of Pendleton. It flows northwesterly to its confluence with the Umatilla River just outside the corporate limits of Stanfield.

City of Ukiah

The City of Ukiah, founded in 1969, is located in southern Umatilla County. It is surrounded by unincorporated areas of Umatilla County and is approximately 50 miles south of Pendleton. The population was estimated to be 260 in 2006 (Reference 3).

The principal streams in Ukiah are Camas and Owens Creeks.

City of Umatilla

The City of Umatilla, founded in 1864, is situated in northwest Umatilla County at the confluence of the Umatilla and Columbia rivers. It is located 7 miles north of Hermiston. Its population more than doubled from 3,199 inhabitants in 1980 to approximately 6,385 in 2006 (Reference 3).

The principal stream in Umatilla is the Umatilla River.

Umatilla Indian Reservation

The Umatilla Indian Reservation was established through the Treaty of 1855 and is comprised of three tribes – the Cayuse, Umatilla, and Walla Walla (Reference 4). The Reservation consists of approximately 270 square miles of land in Umatilla County. This area includes 250 square miles just east of Pendleton along the Umatilla River and 20 square miles in the McKay, Johnson, and McCoy Creek areas southeast of Pilot Rock (Reference 4). In 2000, the population of the Reservation was estimated to be 2,927 (Reference 1).

Principal streams in the Umatilla Indian Reservation include the Umatilla River, Meacham Creek, and Squaw Creek.

City of Weston

The City of Weston, founded in 1878, is located in northeast Umatilla County. The total land area contained in the corporate limits is 0.5 square miles. It is approximately 20 miles northeast of Pendleton. According to the U.S. Census Bureau figures, the population of Weston increased from 660 in 1970 to 719 in 1980 (Reference 2). In 2000, the population of Weston was 717 (Reference 1).

Pine Creek flows northerly through Weston and is the only stream that can cause any major flooding within the corporate limits. Pine Creek originates in the foothills of the Blue Mountains southeast of Weston and flows through foothill draws that are sparsely covered with trees and brushy vegetation. It then flows through the lower foothills, which are mostly dryland wheat fields.

Approximately 53 percent of Weston has been developed, with the remainder of the land being vacant side hills and open fields. Within the floodplain studied, development is mainly family residences and a small business district.

2.3 Principal Flood Problems

Flooding in Umatilla County usually lasts from March through June, although flooding may occur during the winter. Flooding is typically caused by a combination of rainfall and snowmelt. When snowmelt augments rainfall runoff, the floods have both high peaks and large volumes; however, damaging stages seldom last longer than one or two days. Floodflow stages can rise from normal flow to extreme flood peaks in a relatively short time, with high velocities in the main channel of the streams. The melting of low-elevation snow on frozen ground has also caused serious flooding in the past.

High flows on the Umatilla River and tributaries generally begin in February and last through June. The prevailing low summer flows are increased during the late fall and early winter by rainfall and melting of low-elevation snow. November, December, and January often have brief periods of high flows because of heavy rain and melting snow caused by unseasonably warm temperatures.
Damaging floods have occurred in the study areas of the Umatilla River in 1882, 1906, 1908, 1913, 1921, 1932, 1937, 1946, 1949, 1958, and 1965. Of these, the December 1882 flood was the highest of record.

Bottom lands in the study areas of McKay and Tutuilla Creeks are subject to flooding from high flows. Velocities up to 13 feet per second can be expected in the floodplains of these creeks. The February 1949 flood was among the largest known for Tutuilla Creek, with an estimated peak discharge of 2,500 cubic feet per second (cfs). The 1904 flood was the most serious, according to the U.S. Soil Conservation Service; however, no additional data are available.

Little historical flood data are available for Wildhorse Creek, Waterman Gulch, and Sand Hollow Creek. The Waterman Gulch floodplain is quite extensive given the normal size of the creek, but the drainage is subject to extreme flows during the summer cloudbursts and snow melt periods. Flooding along this gulch is usually shallow and wide due to the flat area around the creek. Wildhorse Creek is a major tributary of the Umatilla River and has a rather large watershed. The February 1949 flood is among the largest known for Wildhorse Creek, with an estimated discharge of 10,000 cfs, which is slightly higher than the 1-percent-annual-chance flood (9,600 cfs).

On McKay Creek, the April 1958 flood is the largest to have occurred below the reservoir of McKay Dam since its completion in 1926. It had a maximum release of 2,520 cfs.

Mill Creek is subject to flash floods of relatively short duration. High flows occur during the winter and spring, and may be caused by intensive rainstorms, excessive snowmelt, or a combination of rainfall and snowmelt. Flooding on Mill Creek is frequent. Flows in excess of bankfull (600 cfs) have occurred 29 times during 36 years of record. The

maximum flood of record on Mill Creek occurred in March 1931. Streamflow records were not being kept at that time; therefore, the flood discharge and stage data are not available.

The Walla Walla River experienced significant flooding in 1906, 1931, and 1965, with the two largest occurring in April 1931 and January 1965. High velocities of 14 feet per second can be expected in the floodplain.

Approximately 17,600 acres along the Umatilla River main stem and 12,000 acres along tributary streams are subject to flooding. Natural obstructions to floodflows include trees, brush, and other vegetation growing along the streambanks in floodplain areas. Manmade encroachments either on or over the streams, such as bridges, create more extensive flooding than would otherwise occur.

2.4 Flood Protection Measures

Flood prevention measures in the unincorporated areas of Umatilla County are limited to those constructed locally and by the USACE or other Federal agencies under emergency conditions. These measures consist of channel clearing and levee construction, and are not considered permanent or adequate to protect against floods of the 1-percent-annual-chance magnitude. Nonstructural measures of flood protection are also being used to aid in the prevention of future flood damage. These are in the form of land use regulations, adopted from the Code of Federal Regulations, which control building within areas that have a high risk of flooding (Reference 5).

The floodplain in Pendleton is protected from large overflows on the Umatilla River by a well developed levee system. The levees can contain the 1-percent-annual-chance flood, but not the 0.2-percent-annual-chance flood. Throughout Pendleton, the levees run along the south bank of the Umatilla River. The levees along the Umatilla River are currently undergoing accreditation. During the interim, the levees are considered to be provisionally accredited according to the agreement between FEMA and the City of Pendleton signed June 28, 2007.

There is a box culvert where Highway 395 crosses Tutuilla Creek. As long as the culvert remains unobstructed, it can carry the 1-percent-annual-chance flood. Hence, flood protection measures on Tutuilla Creek include taking proper precautions to keep the culvert free of debris during high flows. Local interests have also done some channel clearing in a few locations.

None of the several flood control measures on McKay Creek provide complete flood protection. The principal flood control project is McKay Dam and Reservoir, located upstream from the Pendleton city limits and constructed in 1926 by the U.S. Bureau of Reclamation. This project is operated for irrigation; any flood control is incidental. However, even incidental regulation has provided significant reduction in floodflows, especially for winter floods. In spring, McKay Reservoir is filled for irrigation purposes, so additional water storage capacity is small. Other flood control measures include channel enlargement and levee construction by local interests, and emergency channel work by the USACE after the 1965 floods.

Very little has been done to upgrade the capacity of the Pine Creek channel through Weston because flooding has not been a frequent serious problem. Intermittent reaches have been riprapped by local residents to protect the streambanks adjacent to their

property.

Flood forecasts are made for the Umatilla River and tributaries at Pendleton by the Office of the National Weather Service, River District, in Portland, Oregon. Forecasts are issued to the State and County Civil Defense Directors and are disseminated in the area by the office of the National Weather Service in Pendleton. Flood forecasts on Mill Creek and the Walla Walla River are issued to civil defense and other authorities through the offices of the National Weather Service in Pendleton and Walla Walla, Washington.

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.

Several gaging stations in the Walla Walla and Umatilla River basins were the principal source of data for defining frequency-discharge relationships for the streams studied in detail. To define discharge-frequency data for Umatilla River, McKay Creek, Wildhorse Creek, Walla Walla River, South Fork Walla Walla River, and Mill Creek, which are gaged streams, and for Stage Gulch, Waterman Gulch, Sand Hollow Creek, Greasewood Creek, Southwest Drainage, Birch Creek, East Fork Birch Creek, West Fork Birch Creek, Tutuilla Creek, Nelson Creek, Patawa Creek, and Pine Creek, which are ungaged streams, a regional relationship between basin characteristics and streamflow statistics (Reference 6) was the principal method used. The regional relationship of peak discharge data and drainage-area parameters was analyzed. Frequency statistics in the form of logarithm mean flood, standard deviation, and skew for gaged areas were plotted versus drainage-area parameters, such as drainage-area size, normal annual precipitation, and basin mean elevation. The frequency statistics were selected from the curves and applied using the standard log-Pearson Type III distribution as outlined by the U.S. Water Resources Council (References 7 and 8). Values of the 10-, 2-, 1-, and 0.2-percent-annual-chance peak discharges were obtained from the log-Pearson Type III distribution of annual peak-flow data (References 7 and 8).

To define the frequency-discharge data for Nelson and Patawa Creeks, the Synder Unit Hydrograph method was used. Specific frequency precipitation was derived from the

National Oceanic and Atmospheric Administration Atlas 2, "Precipitation-Frequency Atlas of the Western United States", Volume X-Oregon (Reference 9). The specific frequency precipitation was applied to the unit hydrograph which determined the specific frequency discharges. The frequency curve was derived by applying the log-Pearson Type III method to the specific frequency discharges.

Hydrology was updated on July 4, 1988 to incorporate the effects of a new hydrologic analysis of Patawa Creek on the base flood elevations (BFEs) and floodplain boundaries. This revised hydrologic analysis was based on a study by the Oregon State Department of Transportation, Highways Division, which utilized regression equations developed in the U.S. Geological Survey Report 82-4078, entitled Magnitude and Frequency of Floods in Eastern Oregon, and from the Oregon State Highways Division Hydraulics Manual.

In 1998, the USACE, Portland District, conducted a hydrologic analysis of flooding sources within the Umatilla Indian Reservation as part of a flood evaluation study (Reference 10). This study included approximately 26 miles of the Umatilla River upstream of Pendleton, Meacham Creek, and Squaw Creek. This analysis was compared to a more recent hydrologic analysis conducted by the Oregon Water Resources Department (OWRD) in 2006 (Reference 11) to determine if the addition of newer data was sufficient to significantly change the USACE 1998 peak discharge for the 1-percent-annual-chance flood.

Umatilla River discharge from the USACE study was determined using streamflow data from the Pendleton gage (gage No. 14020850), the West Reservation boundary gage (gage No. 14021000), and the gage near Gibbon (gage No. 1402000). Records from these gages were statistically analyzed utilizing the standard log-Pearson Type III distribution (References 7 and 8). The USACE analysis agreed well with the more recent hydrologic analysis conducted by the OWRD and was therefore used.

Meacham Creek discharge was determined at the Gibbon gage (gage No. 14020300). Both the USACE and OWRD studies included a flood frequency analysis for the gage (References 10 and 11). Peak discharge for the 1-percent-annual-chance flood from the USACE study was significantly higher than the discharge from the OWRD study. Because the OWRD (Reference 11) study used a longer period of record as well as computed probabilities to estimate the peak discharges, the OWRD discharges were used in the hydraulic analysis.

No gaging station exists on Squaw Creek. The 1998 USACE (Reference 10) study conducted a direct correlation analysis to establish synthetic flow records for Squaw Creek by transferring observed annual peak discharges for the Gibbon gage (gage No. 14020300). An updated hydrologic analysis was performed using the current regional flood frequency regression equations for the North-Central Region of Eastern Oregon (Reference 11). Because the USACE study used data transferred from a significantly larger drainage basin, discharges developed from the OWRD regional regression equations were used.

Peak discharge-drainage area relationships for flooding sources studied in detail in Umatilla County are shown in Table 4.

Table 4. Summary of Discharges

Flooding Source and Location	Drainage Area (square miles)	Peak Discharges (cfs) 10-percent-annual-chance	2-percent-annual-chance	1-percent-annual-chance	0.2-percent-annual-chance
Birch Creek	219	2,775	4,500	5,310	7,570
West Fork Birch Creek	125	1,730	2,860	3,430	4,960
East Fork Birch Creek	94	1,540	2,540	3,040	4,440
Greasewood Creek					
At Concord Street	5.4	--[1]	--[1]	900	--[1]
Iskuulpa Creek					
At confluence with the Umatilla River	34.8	956	1,570	1,850	2,590
Meacham Creek					
At River Mile 1.4	176	4,800	7,690	9,120	13,000
McKay Creek					
At confluence with the Umatilla River	--[1]	1,030	2,600	4,000	13,000
Mill Creek	95	3,200	4,450	6,100	11,000
Nelson Creek	2.8	109	245	325	600
Patawa Creek	38	1,000	1,800	2,200	3,500
Pine Creek					
At Weston	20.3	800	1,370	1,680	2,540

[1]Data not available

Table 4. Summary of Discharges (continued)

Flooding Source and Location	Drainage Area (square miles)	Peak Discharges (cfs) 10-percent-annual-chance	2-percent-annual-chance	1-percent-annual-chance	0.2-percent-annual-chance
Sand Hollow Creek					
At confluence with Wildhorse Creek	14.8	--[1]	--[1]	1,330	--[1]
Southwest Drainage					
At confluence with Greasewood Creek	2	--[1]	--[1]	200	--[1]
Stage Gulch					
At confluence with the Umatilla River	117	920	1,590	1,960	3,030
Tutuilla Creek					
At confluence with the Umatilla River	--[1]	1,100	2,500	3,400	6,300
At confluence with Patawa Creek	--[1]	600	1,370	1,860	3,420
Umatilla River					
At Umatilla, Oregon	2,290	10,800[2]	17,800[2]	21,600[2]	31,900[2]
At Butter Creek	2,250	14,000	22,500	28,000	43,000
At Pendleton (River Mile 55.2)	637	11,200	18,400	22,200	32,700
At West Reservation Boundary (River Mile 58.3)	441	10,700	17,300	20,600	30,000
Above Meacham Creek (River Mile 83.1)	131	3,870	6,020	7,110	10,200
Walla Walla River					
Near Touchet	170	3,000	7,550	11,000	22,700

[1]Data not available
[2]Discharge reflects a reduction in discharge by Temporary Valley Storage on the Umatilla River below the Yoakum gage.

Table 4. Summary of Discharges (continued)

Flooding Source and Location	Drainage Area (square miles)	Peak Discharges (cfs) 10-percent-annual-chance	2-percent-annual-chance	1-percent-annual-chance	0.2-percent-annual-chance
Waterman Gulch					
At confluence with Wildhorse Creek	10.1	--[1]	--[1]	1,360	--[1]
Wildhorse Creek					
Near the City of Pendleton	--[1]	2,850	6,900	9,600	19,500
Upstream of Waterman Gulch	--[1]	--[1]	--[1]	2,360	--[1]
Downstream of Waterman Gulch	--[1]	--[1]	--[1]	2,910	--[1]
Upstream of confluence with Sand Hollow Creek	76.8	--[1]	--[1]	3,570	--[1]
Downstream of confluence with Sand Hollow Creek	91.4	--[1]	--[1]	4,050	--[1]

[1]Data not available

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.

Cross sections for streams were field surveyed, determined from detailed topographic maps (Reference 12), or obtained from aerial photography (References 13, 14, and 15). Cross sections for Wildhorse Creek, Sand Hollow Creek, Greasewood Creek, and Southwest Drainage were determined photogrammetrically from aerial photographs at a scale of 1:2,400 (Reference 16). Cross sections for Waterman Gulch were determined photogrammetrically, using aerial photos at a scale of 1:4,800 (Reference 17).

Cross sections for backwater analysis of Birch Creek, East Fork Birch Creek, and West Fork Birch Creek were obtained from 2-foot contour interval maps (Reference 18) and field surveys. Cross sections for Pine Creek were obtained from aerial photographs (Reference 19) and field surveys. All bridges and culverts were surveyed to obtain elevation data and structural geometry.

Cross sections were surveyed along Wildhorse Creek upstream of its confluence with Waterman Gulch and bridge detail was gathered for the Third Street Bridge over Wildhorse Creek. These data, obtained in August 1994, were then appended to the existing hydraulic model of Wildhorse Creek, which was developed in 1989 for determining 1-percent-annual-chance flood elevations and a regulatory floodway for a portion of Wildhorse Creek immediately downstream of its confluence with Waterman Gulch.

A section of Mill Creek between Henry Canyon Bridge and the approximate boundary of the Umatilla National Forest was revised to include updated hydraulic information. Channel cross sections were obtained by studying aerial photographs and determining the appropriate spacing to represent the meanders in Mill Creek. The surveying of cross sections was performed by David Evans & Associates, Inc. Exceptions include a portion of Mill Creek farther downstream that was not resurveyed but rather repeated from the previous study. In addition, some sections were extended by the use of a USGS Big Meadows quadrangle map for Umatilla County.

Cross sections for the Umatilla River through the Umatilla Indian Reservation, Meacham Creek, and Squaw Creek were developed from a 1998 analysis conducted by the USACE, Portland District (Reference 10). Additional cross sections were determined using topographic mapping with a contour interval of 2 feet (Reference 20) and aerial photography (Reference 21).

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.

Channel roughness factors (Manning's "n") used in the hydraulic computations were

chosen by engineering judgment and based on field observations of the streams and floodplain areas. Roughness coefficients for the updated analysis of Wildhorse Creek were established based on field inspections during a site visit made in August 1994. The range of roughness values used for all floods is shown in Table 5. The acceptability of all assumed data was checked by computations that duplicated historic floodwater profiles.

Table 5. Range of Manning's Roughness Values

Flood Source	Main Channel	Floodplain
Birch Creek	0.037	0.030-0.045
East Fork Birch Creek	0.037	0.030-0.045
West Fork Birch Creek	0.037	0.030-0.045
Greasewood Creek	0.050	0.060-0.110
Iskuulpa Creek	0.050-0.060	0.080-0.130
McKay Creek	0.035-0.040	0.080-0.100
Meacham Creek	0.053	0.085-0.120
Mill Creek	0.035-0.400	0.080-1.100
Nelson Creek	0.024-0.040	0.050-0.060
Patawa Creek	0.040	0.050-0.070
Pine Creek	0.055	0.090
Sand Hollow Creek	0.070	0.050
Southwest Drainage	0.050	0.080
Stage Gulch	0.035-0.040	0.035-0.080
Tutuilla Creek	0.035-0.040	0.080-0.100
Umatilla River	0.035-0.060	0.040-0.140
Walla Walla River	0.035-0.400	0.080-1.100
South Fork Walla Walla River	0.055	0.065
Waterman Gulch	0.040-0.050	0.030-0.050
Wildhorse Creek	0.045-0.080	0.050-0.060

Water-surface elevations of floods of the selected recurrence intervals were computed through use of the USACE HEC-2 step-backwater computer program (References 22, 23, and 24). Starting water-surface elevations for Umatilla and South Fork Walla Walla Rivers, Nelson Creek, Waterman Gulch, and Pine Creek were calculated using the slope-area method. Only the 1-percent-annual-chance water-surface elevation was computed for Waterman Gulch. Starting water-surface elevations on Stage Gulch were taken from the Umatilla River. Starting water-surface elevations for Patawa Creek were taken from Tutuilla Creek. Starting water-surface elevations for Wildhorse Creek, Sand Hollow Creek, Greasewood Creek, and Southwest Drainage were determined using normal-depth calculations. Water-surface elevations for the Mill Creek restudy and for the Umatilla River, Meacham Creek, and Squaw Creek in the Umatilla Indian Reservation were computed using the USACE HEC-RAS computer program (References 25 and 26).

Maximum water-surface elevations (MAXWS) of floods of the selected recurrence intervals were computed through use of the HEC-2 step-backwater computer program for Birch Creek (Reference 23). MAXWS is defined as being the greater of either (a) the computed water surface elevation (CWSEL) or (b) the sum of the critical water surface elevation plus 0.4 times the mean velocity head (CRIWS + 0.4 HV). Starting water-surface elevations for Birch Creek were calculated using the normal-depth method. East and West Forks of Birch Creek were analyzed as continuations of Birch 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.

In the City of Milton-Freewater, shallow flooding was determined along the Walla Walla River left overbank due to decertification of the levee protecting the city (Reference 27). This flooding has a calculated average depth of one foot. The approximate without-levee analysis for the Walla Walla River was conducted in August 2007 using HEC-RAS (Reference 26).

Approximate flood elevations were determined using Leach's New Method, as described in King's Handbook of Hydraulics (Reference 28).

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 29). With the completion of the North American Vertical Datum of 1988 (NAVD 88), many FIS reports and FIRMs are now prepared using NAVD 88 as the referenced vertical datum.

To accurately convert flood elevations for the streams and rivers in Umatilla County from the current NGVD 29 datum to the newer NAVD 88 datum, the following procedure was implemented. Locations at the upstream and downstream ends of each flooding source, as well as at an intermediate location between these two end points, were evaluated using the COE CORPSCON vertical datum conversion software. At each of the three points CORPSCON calculated the difference between NGVD 29 and NAVD 88 elevations. These three conversion factors were averaged to develop an average conversion factor for each flooding source. The final NAVD 88 elevations reported herein were computed by adding the calculated average conversion factor to the existing NGVD 29 elevation data. Table 6 shows the conversion factor for each stream studied in detail.

Table 6. Vertical Datum Conversion Factors

	Conversion from NGVD 29 to NAVD 88 (feet)			
Stream Name	Minimum Conversion	Maximum Conversion	Average Conversion[1]	Maximum Offset
Mill Creek	3.60	3.70	3.65	0.05
Walla Walla River	3.05	3.41	3.20	0.21
Wildhorse Creek	3.32	3.50	3.40	0.09
Waterman Gulch	3.46	3.47	3.46	0.01
Sand Hollow Crk	3.41	3.45	3.43	0.02
Birch Creek	3.28	3.54	3.38	0.16
E Fork Birch Crk	3.40	3.48	3.44	0.04
W Fork Birch Crk	3.40	3.41	3.40	0.00
Greasewood Creek	3.38	3.44	3.41	0.03
Southwest Drainage	3.43	3.43	3.43	0.00
Stage Gulch	3.32	3.33	3.32	0.00
Pine Creek	3.49	3.52	3.51	0.02

Table 6. Vertical Datum Conversion Factors (continued)

Stream Name	Conversion from NGVD 29 to NAVD 88 (feet) Minimum Conversion	Maximum Conversion	Average Conversion[1]	Maximum Offset
Tutuilla Creek	3.28	3.30	3.29	0.00
McKay Creek	3.29	3.33	3.31	0.02
Nelson Creek	3.30	3.32	3.31	0.01
Patawa Creek	3.28	3.30	3.29	0.01
Umatilla River	3.31	3.32	3.32	0.00
S Fork Walla Walla River	3.41	3.85	3.63	0.23
N Fork Walla Walla River	3.41	3.65	3.54	0.13
Camas Creek	3.71	3.79	3.75	0.04
Owens Creek	3.71	3.95	3.83	0.12

[1] Used to convert elevation data from NGVD 29 to NAVD 88.

Flood elevations shown in this FIS report and on the FIRMs are referenced to NAVD 88. 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 the 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 the FIRMs for this community. Interested individuals may contact FEMA to access these data.

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

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. To assist in this endeavor, each FIS 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-percent-annual-chance and 0.2-percent-annual-chance floodplains; and 1-percent-annual-chance floodway. This information is presented on the FIRM and in many components of the FIS report, including Flood Profiles and Floodway Data tables. Users should reference the data presented in the FIS report as well as additional information that may be available at the local 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 (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.

Floodplain boundaries for a portion of Wildhorse Creek in the vicinity of Adams, Sand Hollow Creek, Greasewood Creek, and Southwest Drainage were developed photogrammetrically, using aerial photographs at a scale of 1:2,400 (Reference 16).

Floodplain boundaries for a portion of the Umatilla River in the vicinity of Echo and Waterman Gulch were developed photogrammetrically, using aerial photographs at a scale of 1:4,800 (Reference 17). For Wildhorse Creek in the vicinity of Athena, floodplain boundaries were delineated using U.S. Geological Survey topographic maps at a scale of 1:24,000, with a contour interval of ten feet (Reference 12), and aerial photographs at a scale of 1:4,800 (Reference 17).

Floodplain boundaries for portions of the Umatilla River in the vicinity of Hermiston and Pendleton, and portions of Tutuilla Creek, Patawa Creek, Nelson Creek, McKay Creek in the vicinity of Pendleton were developed using aerial photographs at scales of 1:3,600, 1:4,800, 1:6,000, and 1:12,000 (Reference 13) and by field inspection.

Floodplain boundaries for Birch Creek, East Fork Birch Creek, and West Fork Birch Creek were interpolated using topographic maps at a scale of 1:1,200, with a contour interval of two feet (Reference 18).

Floodplain boundaries for portions of the Umatilla River in the vicinity of Stanfield were developed photogrammetrically using aerial photographs at a scale of 1:1,200 (Reference 29), by field inspection, and using topographic mapping at a scale of 1:1,200 with a contour interval of two feet (Reference 30). Boundaries for Stage Gulch were determined using orthophoto topographic maps at a scale of 1:2,400, with a contour interval of two feet (Reference 15).

Floodplain boundaries for Pine Creek were interpolated using topographic maps at a scale of 1:2,400, with a contour interval of five feet (Reference 19).

Floodplain boundaries for portions of the Umatilla River within the Umatilla Indian Reservation, Meacham Creek, and Squaw Creek were mapped using topographic mapping with a contour interval of two feet (Reference 20).

Floodplain boundaries for remaining portions of the Umatilla River, Walla Walla River, South Fork Walla Walla River, and Mill Creek were interpolated using aerial photographs at scales of 1:3,600, 1:4,800, 1:6,000, and 1:12,000 (Reference 13); orthophoto topographic maps at a scale of 1:2,400, with a contour interval of two feet (References 14 and 15); topographic maps at a scale of 1:1,200, with a contour interval of two feet (Reference 30); and by field inspection.

For the streams studied by approximate methods, only the 1-percent-annual-chance floodplain boundary is shown on the Flood Insurance Rate Map. Floodplain boundaries

for streams studied by approximate methods were delineated using topographic maps at a scale of 1:24,000, with a contour interval of ten feet (Reference 12), aerial photographs at scales of 1:3,600, 1:4,800, 1:6,000, and 1:12,000 (Reference 13), and aerial photographs at a scale of 1:2,400 (Reference 16).

Floodplain boundaries for the area of shallow flooding in the City of Milton-Freewater were delineated using USGS topographic maps at a scale of 1:24,000 with a contour interval of twenty feet (Reference 31).

The 1- and 0.2-percent-annual-chance floodplain boundaries are shown on the Flood Insurance Rate Map. On this map, the 1-percent-annual-chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE, and AO), 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.

Countywide Update

As part of the countywide update, floodplain boundaries were digitized from the effective FIRM and Floodway panels. USGS topographic maps (Reference 31) and aerial photography (Reference 21) were used to adjust floodplain and floodway boundaries where appropriate.

Approximately 29 miles of the Umatilla River floodplain boundaries were revised using topographic mapping with a contour interval of two feet (Reference 32). The redelineated portion of the Umatilla River floodplain begins 4.4 miles above its mouth and continues to a point just upstream of the Union Pacific Railroad near RM 33.6.

In accordance with FEMA Procedure Memorandum 36 (Reference 33), profile baselines have been included in all areas of detailed study. Profile baselines are shown in the location of the original stream centerline or original profile baseline without regard to the adjusted floodplain position on the new base map. This was done to maintain the relationship of distances between cross sections along the profile baseline between the hydraulic models, flood profiles, and floodway data tables.

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 1-percent-annual-chance floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 1-percent-annual-chance flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to one 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 results of the floodway

computations at selected stream cross sections are shown on Table 7, “Floodway Data.”

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

Data were not tabulated for the floodway on the Umatilla River in the Echo and Stanfield areas. This floodway was based on hydraulic computations, as were the others, but was adjusted using engineering judgment and negotiated with the community and FEMA.

The 1-percent-annual-chance flood on the Umatilla River through Pendleton is generally confined to the channel area by the levee system. For this reason, no floodway was computed from approximately 200 feet downstream of cross section EC. The floodway limits for this part of the river were delineated coincident with the 1-percent-annual-chance flood boundary.

Floodways of Greasewood Creek and the Southwest Drainage were not included in the scope of this Flood Insurance Study.

Floodway for the portion of the Umatilla River within the Umatilla Indian Reservation, Meacham Creek and Iskuulpa Creek were calculated based on a maximum surcharge of 0.1 foot.

The area between the floodway and 1-percent-annual-chance floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 1-percent-annual-chance flood 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.

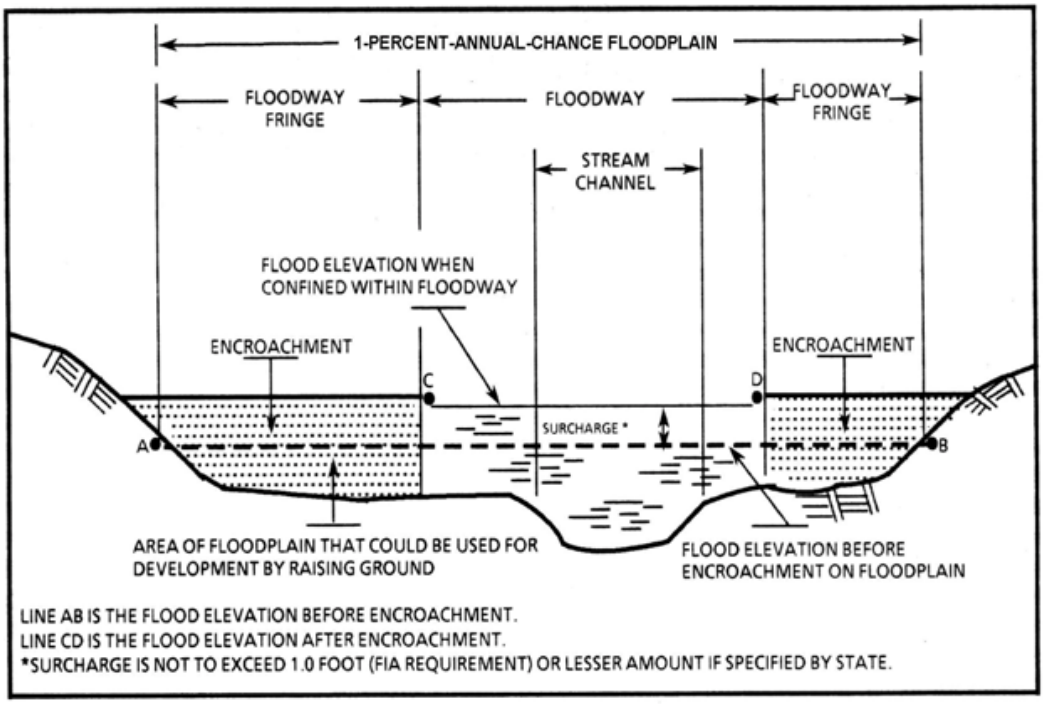

Figure 1. Floodway Schematic

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
Birch Creek								
A	-485[1]	157	598	8.9	1,622.4	1,622.4	1,623.1	0.7
B	-210[1]	105	472	11.2	1,625.1	1,625.1	1,625.9	0.8
C	0[1]	106	448	11.9	1,627.6	1,627.6	1,627.9	0.3
East Fork Birch Creek								
A	180[2]	62	304	10.0	1,629.7	1,629.7	1,629.7	0.0
B	425[2]	90	325	9.4	1,631.4	1,631.4	1,632.1	0.7
C	550[2]	102	375	8.1	1,633.3	1,633.3	1,633.4	0.1
D	678[2]	156	594	5.1	1,636.4	1,636.4	1,636.8	0.4
E	840[2]	123	325	9.4	1,637.4	1,637.4	1,638.3	0.9
F	1,035[2]	77	391	7.8	1,640.8	1,640.8	1,641.5	0.7
G	1,210[2]	132	682	4.5	1,642.5	1,642.5	1,643.2	0.7
H	1,425[2]	100	562	5.4	1,642.6	1,642.6	1,643.4	0.8
I	1,585[2]	57	276	11.0	1,643.6	1,643.6	1,643.6	0.0
J	1,730[2]	91	441	6.9	1,645.5	1,645.5	1,645.5	0.0
K	1,870[2]	112	349	8.7	1,647.1	1,647.1	1,647.6	0.5
L	2,005[2]	90	384	7.9	1,647.8	1,647.8	1,648.4	0.6
M	2,200[2]	147	580	5.2	1,650.0	1,650.0	1,650.9	0.9
N	2,375[2]	73	290	10.5	1,651.9	1,651.9	1,652.5	0.6
O	2,560[2]	55	258	11.8	1,654.7	1,654.7	1,655.1	0.4
P	3,135[2]	127	410	7.4	1,661.1	1,661.1	1,661.9	0.8
Q	3,490[2]	77	401	7.6	1,665.1	1,665.1	1,665.9	0.8

[1]Feet below confluence with East and West Forks of Birch Creek

[2]Feet above confluence with West Fork Birch Creek

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR AND INCORPORATED AREAS

FLOODWAY DATA

BIRCH CREEK, EAST FORK BIRCH 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[2] (FEET NAVD)	WITH FLOODWAY[2] (FEET NAVD)	INCREASE (FEET)
West Fork Birch Creek								
A	180	49	293	11.7	1,628.9	1,628.9	1,629.0	0.1
B	335	69	367	9.4	1,630.8	1,630.8	1,630.8	0.0
C	420	55	261	13.1	1,632.1	1,632.1	1,632.3	0.2
D	720	58	418	8.2	1,636.0	1,636.0	1,636.7	0.7
E	1,245	41	364	9.4	1,638.8	1,638.8	1,639.8	1.0
F	1,625	44	316	10.9	1,643.8	1,643.8	1,644.6	0.8
G	1,780	51	262	13.1	1,647.1	1,647.1	1,647.1	0.0
H	2,215	41	247	13.9	1,651.5	1,651.5	1,652.0	0.5
I	2,645	80	346	9.9	1,656.7	1,656.7	1,657.1	0.4
J	3,145	44	317	10.8	1,659.3	1,659.3	1,660.2	0.9
K	3,430	48	250	13.7	1,663.3	1,663.3	1,663.3	0.0

[1]Feet above confluence with East Fork Birch Creek

[2]Maximum water-surface elevations (See section 3.2)

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR AND INCORPORATED AREAS

FLOODWAY DATA

WEST FORK BIRCH CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
Iskuulpa Creek								
A	1196[2]	207	419	3.9	1698.0	1698.0	1698.0	0.0
B	1674[2]	130	618	2.6	1704.9	1704.9	1704.9	0.0
C	1763[2]	70	189	8.6	1704.8	1704.8	1704.8	0.0
D	1957[2]	210	628	2.6	1706.8	1706.8	1706.9	0.0
E	2138[2]	459	975	1.7	1707.4	1707.4	1707.4	0.0
F	2350[2]	326	435	4.3	1708.5	1708.5	1708.5	0.0
G	2593[2]	327	472	3.9	1712.1	1712.1	1712.2	0.1
H	2813[2]	192	392	4.7	1714.2	1714.2	1714.3	0.1
I	3235[2]	314	403	4.6	1719.5	1719.5	1719.5	0.0
J	3444[2]	326	390	4.8	1723.3	1723.3	1723.4	0.1
K	3786[2]	355	716	2.6	1727.2	1727.2	1727.3	0.1
L	4013[2]	390	1167	1.6	1728.1	1728.1	1728.2	0.1
M	4483[2]	221	572	3.2	1733.3	1733.3	1733.4	0.1
N	5296[2]	170	561	3.3	1744.1	1744.1	1744.2	0.1
O	5840[2]	152	346	5.4	1750.2	1750.2	1750.2	0.0
P	6807[2]	295	685	2.7	1763.2	1763.2	1763.3	0.1
Q	7424[2]	240	388	4.8	1770.4	1770.4	1770.5	0.1
R	8126[2]	165	464	4	1779.3	1779.3	1779.4	0.1

[1]Feet above confluence with Wildhorse Creek [2]Feet above confluence with Umatilla River [3]Data not available

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR AND INCORPORATED AREAS

FLOODWAY DATA

ISKUULPA 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 (FEET)
Iskuulpa Creek Left Overbank Split								
A	-2750	30	54	4.4	1681.8	1681.8	1681.9	0.1
B	-2319	215	382	0.6	1683.3	1683.3	1683.4	0.1
C	-1567	116	180	1.3	1686.4	1686.4	1686.4	0.0
D	-913	259	155	1.5	1692.4	1692.4	1692.5	0.1
E	-197	40	150	1.6	1697.4	1697.4	1697.4	0.0
F	38	119	260	0.9	1700.9	1700.9	1700.9	0.0
G	276	121	52	4.5	1701.1	1701.1	1701.2	0.1
H	622	122	169	1.4	1707.2	1707.2	1707.2	0.0

[1]Feet from River Road

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
AND INCORPORATED AREAS

FLOODWAY DATA

ISKUULPA CREEK LEFT OVERBANK SPLIT

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 (FEET)
McKay Creek								
A	1,200	109	679	5.9	1,003.5	1,003.5	1,004.5	1.0
B	1,930	456	800	5.0	1,007.1	1,007.1	1,007.1	0.0
C	2,800	222	586	6.8	1,011.5	1,011.5	1,011.5	0.0
D	3,620	117	439	9.1	1,017.7	1,017.7	1,017.7	0.0
E	4,460	103	422	9.5	1,024.7	1,024.7	1,025.0	0.3
F	5,450	139	608	6.6	1,031.8	1,031.8	1,032.3	0.5
G	6,730	844	1,266	3.2	1,035.8	1,035.8	1,036.5	0.7
H	7,460	85	347	11.5	1,041.3	1,041.3	1,041.3	0.0
I	8,250	274	1,100	3.6	1,048.2	1,048.2	1,048.2	0.0
J	8,900	108	429	9.3	1,049.0	1,049.0	1,049.5	0.5
K	9,950	110	599	6.7	1,056.5	1,056.5	1,056.5	0.0
L	11,030	143	727	5.5	1,063.1	1,063.1	1,063.1	0.0
M	11,550	79	436	9.2	1,063.4	1,063.4	1,064.3	0.9
N	11,920	78	579	6.9	1,066.4	1,066.4	1,066.4	0.0
O	12,500	123	504	7.9	1,068.9	1,068.9	1,068.9	0.0
P	13,260	99	444	9.0	1,074.3	1,074.3	1,074.7	0.4
Q	14,400	98	581	6.9	1,080.9	1,080.9	1,081.0	0.1
R	15,190	83	369	10.8	1,084.6	1,084.6	1,084.8	0.2
S	15,890	98	511	7.8	1,089.8	1,089.8	1,090.5	0.7
T	16,660	486	1,498	2.7	1,094.6	1,094.6	1,094.9	0.3
U	17,630	118	379	10.6	1,098.3	1,098.3	1,099.1	0.8
V	18,880	359	510	7.8	1,109.5	1,109.5	1,109.9	0.4
W	19,790	135	675	5.9	1,113.4	1,113.4	1,113.8	0.4
X	20,880	176	522	7.7	1,118.4	1,118.4	1,118.4	0.0
Y	22,550	249	1,021	3.9	1,130.0	1,130.0	1,130.0	0.0

[1]Feet above mouth

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR AND INCORPORATED AREAS

FLOODWAY DATA

McKAY 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 (FEET)
McKay Creek (continued)								
Z	23,960	362	526	7.6	1,133.4	1,133.4	1,133.5	0.1
AA	27,400	97	527	7.6	1,149.7	1,149.7	1,150.2	0.5
AB	29,840	59	335	11.9	1,163.2	1,163.2	1,163.8	0.6
AC	30,070	54	398	10.1	1,166.5	1,166.5	1,166.5	0.0
AD	30,510	68	611	6.5	1,168.6	1,168.6	1,168.6	0.0
AE	30,950	350	1,217	3.1	1,173.8	1,173.8	1,174.8	1.0
AF	31,750	157	1,000	4.0	1,175.3	1,175.3	1,175.6	0.3

[1]Feet above mouth

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 (FEET)
Meacham Creek								
A	700	502	1,788	5.1	1,766.2	1,766.2	1,766.3	0.1
B	1,265	345	1,159	7.9	1,770.6	1,770.6	1,770.6	0.0
C	1,441	150	924	9.9	1,773.2	1,773.2	1,773.2	0.0
D	1,565	389	2,601	3.5	1,775.3	1,775.3	1,775.3	0.0
E	2,281	367	1,311	7.0	1,777.4	1,777.4	1,777.4	0.0
F	2,554	292	1,606	5.7	1,780.5	1,780.5	1,780.5	0.0
G	3,064	522	1,892	4.8	1,784.2	1,784.2	1,784.2	0.0
H	3,659	361	1,244	7.3	1,787.6	1,787.6	1,787.6	0.0
I	4,414	431	1,992	4.6	1,793.2	1,793.2	1,793.2	0.0
J	5,059	422	1,746	5.2	1,797.1	1,797.1	1,797.2	0.1
K	5,884	416	1,636	5.6	1,804.2	1,804.2	1,804.3	0.1
L	6,734	380	1,328	6.9	1,810.2	1,810.2	1,810.2	0.0
M	7,183	480	2,233	4.1	1,812.5	1,812.5	1,812.6	0.1
N	7,815	171	749	12.2	1,815.3	1,815.3	1,815.3	0.0
O	7,958	128	973	9.4	1,819.6	1,819.6	1,819.6	0.0

[1]Feet above confluence with Umatilla River

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR AND INCORPORATED AREAS

FLOODWAY DATA

MEACHAM 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 (FEET)
Mill Creek								
A	117,000	95[2]	538	9.4	2,066.8	2,066.8	2,067.8	1.0
B	117,250	162	462	10.9	2,070.8	2,070.8	2,070.8	0.0
C	117,520	133	518	9.7	2,075.9	2,075.9	2,075.9	0.0
D	117,930	67	376	13.4	2,082.6	2,082.6	2,082.6	0.0
E	118,340	77	391	12.9	2,089.9	2,089.9	2,089.9	0.0
F	118,650	81	399	12.7	2,095.1	2,095.1	2,095.1	0.0
G	118,920	55	351	14.4	2,099.0	2,099.0	2,099.5	0.5
H	119,280	82	448	11.3	2,106.4	2,106.4	2,107.2	0.8
I	119,350	144	3,046	1.7	2,114.5	2,114.5	2,114.5	0.0
J	119,760	135	557	9.1	2,115.3	2,115.3	2,116.1	0.8
K	120,190	108	459	11.0	2,121.7	2,121.7	2,122.5	0.8
L	120,690	104	432	11.7	2,129.8	2,129.8	2,130.1	0.3
M	121,100	248	699	7.2	2,137.1	2,137.1	2,137.4	0.3
N	121,220	336	1,298	3.9	2,139.7	2,139.7	2,139.7	0.0
O	121,620	160	557	9.1	2,145.2	2,145.2	2,146.0	0.8
P	122,020	135	542	9.3	2,151.9	2,151.9	2,151.9	0.0
Q	122,450	156	519	9.7	2,159.6	2,159.6	2,159.9	0.3
R	122,840	427	949	5.3	2,163.8	2,163.8	2,164.7	0.9
S	123,280	130	432	11.7	2,171.8	2,171.8	2,171.8	0.0
T	123,740	143	591	8.5	2,177.0	2,177.0	2,177.5	0.5
U	123,980	150	490	10.3	2,182.5	2,182.5	2,182.5	0.0
V	124,240	210	734	6.9	2,186.1	2,186.1	2,186.1	0.0
W	124,520	208	526	9.6	2,190.2	2,190.2	2,190.2	0.0
X	124,790	461	1,030	4.9	2,195.1	2,195.1	2,195.1	0.0
Y	124,930	274	483	10.5	2,196.2	2,196.2	2,196.2	0.0

[1]Feet above mouth [2]Floodway lies outside County Limits

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR AND INCORPORATED AREAS

FLOODWAY DATA

MILL 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 (FEET)
Mill Creek (continued)								
Z	125,283	122	247	20.5	2,202.7	2,202.7	2,202.7	0.0
AA	125360	59	566	8.9	2,209.5	2,209.5	2,209.5	0.0
AB	126021	123	374	13.1	2,213.2	2,213.2	2,213.2	0.0
AC	126851	81	388	12.6	2,226.4	2,226.4	2,226.9	0.5
AD	127,581	141	471	10.9	2,238.3	2,238.3	2,238.3	0.0
AE	128,339	310	1,112	6.6	2,252.5	2,252.5	2,252.5	0.0
AF	129,051	70	370	13.2	2,263.5	2,263.5	2,263.5	0.0
AG	129,681	147	327	15.0	2,272.3	2,272.3	2,272.3	0.0
AH	130,149	64	648	7.6	2,286.0	2,286.0	2,286.4	0.4
AI	130,661	152	385	15.0	2,291.5	2,291.5	2,291.5	0.0
AJ	131,091	141	546	14.0	2,298.0	2,298.0	2,298.7	0.7
AK	131,771	61	312	15.7	2,310.2	2,310.2	2,310.2	0.0
AL	132,341	69	313	15.7	2,323.4	2,323.4	2,323.4	0.0
AM	133,248	88	544	9.0	2,342.3	2,342.3	2,342.3	0.0
AN	134,061	124	387	12.7	2,351.1	2,351.1	2,351.1	0.0

[1]Feet above mouth

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR AND INCORPORATED AREAS

FLOODWAY DATA

MILL 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 (FEET)
Nelson Creek								
A	820	45	42	7.7	1,054.4	1,054.4	1,054.4	0.0
B	1,480	47	40	8.2	1,077.3	1,077.3	1,077.3	0.0
C	2,480	46	213	1.5	1,107.2	1,107.2	1,107.3	0.1

[1]Feet above confluence with Umatilla River

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
AND INCORPORATED AREAS

FLOODWAY DATA

NELSON 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 (FEET)
Patawa Creek								
A	858	36	175	12.5	1,097.5	1,097.5	1,097.5	0.0
B	1,523	51	319	6.9	1,103.8	1,103.8	1,103.8	0.0
C	2,320	44	241	9.2	1,106.7	1,106.7	1,106.7	0.0
D	2,898	37	181	12.1	1,112.7	1,112.7	1,112.7	0.0
E	3,888	202	475	8.1	1,124.1	1,124.1	1,124.4	0.3
F	4,888	50	268	8.9	1,130.0	1,130.0	1,130.1	0.1
G	5,730	56	226	11.5	1,139.4	1,139.4	1,139.6	0.2
H	6,433	171	526	6.0	1,145.6	1,145.6	1,146.3	0.7
I	7,123	219	383	9.8	1,152.2	1,152.2	1,152.5	0.3
J	7,936	47	256	8.6	1,158.0	1,158.0	1,158.3	0.3
K	8,543	231	440	9.5	1,164.7	1,164.7	1,164.8	0.1

[1]Feet above confluence with Tutuilla Creek

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR AND INCORPORATED AREAS

FLOODWAY DATA

PATAWA 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 (FEET)
Pine Creek								
A	1,460	52	245	6.8	1,782.5	1,782.5	1,782.7	0.2
B	2,070	40	197	8.5	1,788.7	1,788.7	1,788.9	0.2
C	2,450	91	264	6.4	1,794.2	1,794.2	1,794.2	0.0
D	2,744	57	210	8.0	1,797.6	1,797.6	1,797.6	0.0
E	3,170	44	346	4.8	1,805.0	1,805.0	1,805.1	0.1
F	3,587	39	142	11.8	1,808.6	1,808.6	1,808.6	0.0
G	3,827	52	343	4.9	1,816.0	1,816.0	1,816.0	0.0
H	4,138	43	268	6.3	1,816.6	1,816.6	1,817.0	0.4
I	4,410	33	195	8.6	1,823.5	1,823.5	1,823.5	0.0
J	4,667	49	219	7.7	1,826.5	1,826.5	1,826.7	0.2
K	5,083	33	291	5.8	1,833.9	1,833.9	1,834.5	0.6
L	5,307	31	149	11.3	1,836.5	1,836.5	1,836.5	0.0
M	5,882	80	473	4.2	1,844.5	1,844.5	1,845.5	1.0
N	6,320	60	302	5.6	1,849.1	1,849.1	1,849.1	0.0
O	6,575	40	150	11.2	1,852.1	1,852.1	1,852.1	0.0
P	6,825	31	177	9.5	1,855.7	1,855.7	1,855.7	0.0
Q	7,010	25	133	12.6	1,859.6	1,859.6	1,859.6	0.0
R	7,404	72	332	5.0	1,866.4	1,866.4	1,866.5	0.1
S	7,920	55	156	10.8	1,871.1	1,871.1	1,871.1	0.0
T	8,470	33	149	11.2	1,881.3	1,881.3	1,881.3	0.0

[1]Feet above the Union Pacific railroad bridge

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
AND INCORPORATED AREAS

FLOODWAY DATA

PINE CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
Sand Hollow Creek								
A	870[1]	95	--[3]	--[3]	1528.1	1528.1	1529.1	1.0
Stage Gulch								
A	3,003	64	312	6.3	593.6	593.6	593.8	0.2
B	3,293	120	596	3.3	597.1	597.1	597.6	0.5
C	3,503	180	1,287	1.5	597.5	597.5	598.2	0.7
D	3,653	220	1,207	1.6	597.5	597.5	598.2	0.7
E	4,053	359	2,409	0.8	597.7	597.7	598.7	1.0
F	4,453	451	2,608	0.8	597.7	597.7	598.7	1.0
G	4,766	450	2,970	0.7	597.8	597.8	598.8	1.0
H	5,041	450	1,760	1.1	597.8	597.8	598.8	1.0
I	5,521	490	3,267	0.6	597.9	597.9	598.8	0.9
J	5,771	450	2,190	0.9	597.9	597.9	598.8	0.9
K	6,401	470	2,771	0.7	597.9	597.9	598.9	1.0
L	6,755	490	2,317	0.8	598.0	598.0	599.0	1.0
M	7,212	489	1,455	1.3	598.0	598.0	599.0	1.0
N	7,889	339	581	3.4	598.7	598.7	599.5	0.8

[1]Feet above confluence with Wildhorse Creek [2]Feet above confluence with Umatilla River [3]Data not available

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR AND INCORPORATED AREAS

FLOODWAY DATA

SAND HOLLOW CREEK, STAGE GULCH

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 (FEET)
Tutuilla Creek								
A	200	76	663	5.1	1,030.3	1,030.3	1,031.3	1.0
B	1,430	56	271	12.5	1,035.2	1,035.2	1,035.2	0.0
C	2,370	66	386	8.8	1,043.8	1,043.8	1,043.8	0.0
D	3,250	74	423	8.0	1,052.0	1,052.0	1,052.0	0.0
E	3,750	57	272	12.5	1,054.9	1,054.9	1,054.9	0.0
F	3,850	66	340	10.0	1,057.1	1,057.1	1,057.1	0.0
G	5,000	81	445	7.6	1,066.1	1,066.1	1,066.9	0.8
H	5,770	145	976	3.5	1,076.4	1,076.4	1,076.4	0.0
I	6,280	156	857	4.0	1,076.8	1,076.8	1,076.9	0.1
J	6,800	81	316	10.8	1,078.0	1,078.0	1,078.5	0.5
K	7,770	210	1,134	3.0	1,085.9	1,085.9	1,086.8	0.9
L	9,350	117	327	5.7	1,094.1	1,094.1	1,094.3	0.2
M	10,330	144	342	5.4	1,101.6	1,101.6	1,101.6	0.0
N	10,940	104	291	6.4	1,105.3	1,105.3	1,105.3	0.0
O	11,550	91	248	7.5	1,109.8	1,109.8	1,109.8	0.0
P	11,955	150	471	3.9	1,115.0	1,115.0	1,115.3	0.3
Q	12,200	160	344	5.4	1,115.8	1,115.8	1,115.9	0.1

[1]Feet above confluence with Umatilla River

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
AND INCORPORATED AREAS

FLOODWAY DATA

TUTUILLA 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 (FEET)
Umatilla River								
A	23,600	143	1,921	11.2	416.1	416.1	417.1	1.0
B	25,106	300	3,467	6.2	419.4	419.4	420.4	1.0
C	25,930	349	4,001	5.4	420.3	420.3	421.3	1.0
D	27,118	453	4,413	4.9	421.2	421.2	422.2	1.0
E	28,382	762	5,117	4.2	422.2	422.2	423.1	0.9
F	29,735	210	2,427	8.9	423.1	423.1	423.9	0.8
G	31,922	151	1,987	10.9	427.5	427.5	428.0	0.5
H	33,739	822	3,370	6.4	431.5	431.5	432.4	0.9
I	34,863	352	2,783	7.8	433.4	433.4	434.3	0.9
J	36,468	256	2,541	8.5	436.7	436.7	437.2	0.5
K	37,395	219	2,091	10.3	438.6	438.6	439.2	0.6
L	40,017	873	3,726	5.8	445.3	445.3	445.6	0.3
M	44,065	328	2,809	7.7	450.6	450.6	451.4	0.8
N	44,950	153	2,764	7.8	451.7	451.7	452.5	0.8
O	46,909	229	2,291	9.4	457.8	457.8	458.8	1.0
P	49,334	471	2,135	10.1	469.6	469.6	469.6	0.0
Q	51,311	216	2,678	10.5	476.6	476.6	476.6	0.0
R	53,289	615	4,582	6.1	485.8	485.8	486.6	0.8
S	54,749	211	2,321	12.1	488.5	488.5	489.3	0.8
T	56,230	423	3,765	7.4	492.9	492.9	493.8	0.9
U	59,894	391	3,013	9.3	503.6	503.6	504.0	0.4
V	61,891	514	3,195	8.8	510.1	510.1	510.7	0.6
W	63,297	326	2,625	10.7	513.9	513.9	514.4	0.5
X	64,698	302	3,034	9.2	517.9	517.9	518.5	0.6
Y	66,361	184	2,863	9.8	520.2	520.2	521.1	0.9

[1]Feet above confluence with Columbia River

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR AND INCORPORATED AREAS

FLOODWAY DATA

UMATILLA RIVER

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 (FEET)
Umatilla River (continued)								
Z	67,478	262	3,526	7.9	522.3	522.3	523.3	1.0
AA	70,069	340	3,326	8.4	525.5	525.5	526.4	0.9
AB	71,473	468	3,900	7.2	530.0	530.0	530.4	0.4
AC	72,543	323	2,436	11.5	531.6	531.6	531.8	0.2
AD	74,421	436	3,899	7.2	538.0	538.0	538.1	0.1
AE	76,581	453	3,414	8.2	541.5	541.5	541.7	0.2
AF	78,311	366	3,662	7.6	544.4	544.4	544.6	0.2
AG	79,955	629	5,576	5.0	546.6	546.6	547.2	0.6
AH	81,111	101	--[2]	--[2]	546.8	546.8	--[2]	--[2]
AI	82,420	461	--[2]	--[2]	551.2	551.2	--[2]	--[2]
AJ	82,576	493	--[2]	--[2]	552.4	552.4	--[2]	--[2]
AK	83,604	395	--[2]	--[2]	552.6	552.6	--[2]	--[2]
AL	84,655	354	--[2]	--[2]	552.9	552.9	--[2]	--[2]
AM	85,652	558	--[2]	--[2]	553.2	553.2	--[2]	--[2]
AN	86,552	566	--[2]	--[2]	553.5	553.5	--[2]	--[2]
AO	87,801	633	--[2]	--[2]	553.5	553.5	--[2]	--[2]
AP	88,794	937	--[2]	--[2]	553.9	553.9	--[2]	--[2]
AQ	90,034	758	--[2]	--[2]	554.3	554.3	--[2]	--[2]
AR	90,903	1062	--[2]	--[2]	554.6	554.6	--[2]	--[2]
AS	91,932	558	--[2]	--[2]	554.8	554.8	--[2]	--[2]
AT	92,998	609	--[2]	--[2]	555.6	555.6	--[2]	--[2]
AU	94,104	643	--[2]	--[2]	556.1	556.1	--[2]	--[2]
AV	95,142	636	--[2]	--[2]	556.6	556.6	--[2]	--[2]
AW	96,001	710	--[2]	--[2]	557.2	557.2	--[2]	--[2]

[1]Feet above confluence with Columbia River [2]Data not available

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR AND INCORPORATED AREAS

FLOODWAY DATA

UMATILLA RIVER

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 (FEET)
Umatilla River (continued)								
AX	97,132	674	--[2]	--[2]	558.5	558.5	--[2]	--[2]
AY	98,146	685	--[2]	--[2]	560.3	560.3	--[2]	--[2]
AZ	99,210	678	--[2]	--[2]	561.5	561.5	--[2]	--[2]
BA	100,274	577	--[2]	--[2]	562.6	562.6	--[2]	--[2]
BB	101,091	638	--[2]	--[2]	563.6	563.6	--[2]	--[2]
BC	102,224	607	--[2]	--[2]	565.8	565.8	--[2]	--[2]
BD	103,267	692	--[2]	--[2]	567.8	567.8	--[2]	--[2]
BE	104,327	620	--[2]	--[2]	568.4	568.4	--[2]	--[2]
BF	105,227	364	--[2]	--[2]	570.0	570.0	--[2]	--[2]
BG	106,296	309	--[2]	--[2]	572.1	572.1	--[2]	--[2]
BH	107,085	404	--[2]	--[2]	573.6	573.6	--[2]	--[2]
BI	108,137	238	--[2]	--[2]	574.0	574.0	--[2]	--[2]
BJ	109,119	275	--[2]	--[2]	576.1	576.1	--[2]	--[2]
BK	110,204	203	--[2]	--[2]	578.5	578.5	--[2]	--[2]
BL	111,278	183	--[2]	--[2]	580.6	580.6	--[2]	--[2]
BM	112,357	318	--[2]	--[2]	582.7	582.7	--[2]	--[2]
BN	113,359	587	--[2]	--[2]	583.9	583.9	--[2]	--[2]
BO	114,319	691	--[2]	--[2]	584.9	584.9	--[2]	--[2]
BP	115,313	791	--[2]	--[2]	586.4	586.4	--[2]	--[2]
BQ	116,390	618	--[2]	--[2]	587.6	587.6	--[2]	--[2]
BR	117,369	774	--[2]	--[2]	589.3	589.3	--[2]	--[2]
BS	118,397	985	--[2]	--[2]	590.9	590.9	--[2]	--[2]
BT	119,108	1098	--[2]	--[2]	592.1	592.1	--[2]	--[2]
BU	119,246	--[2]	--[2]	--[2]	593.0	593.0	--[2]	--[2]

[1]Feet above confluence with Columbia River [2]Data not available

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR AND INCORPORATED AREAS

FLOODWAY DATA

UMATILLA RIVER

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 (FEET)
Umatilla River (continued)								
BV	120,200	1138	--[2]	--[2]	596.0	596.0	--[2]	--[2]
BW	121,201	1121	--[2]	--[2]	596.6	596.6	--[2]	--[2]
BX	122,304	607	--[2]	--[2]	597.2	597.2	--[2]	--[2]
BY	123,204	578	--[2]	--[2]	599.4	599.4	--[2]	--[2]
BZ	124,489	166	--[2]	--[2]	602.7	602.7	--[2]	--[2]
CA	125,505	--[2]	--[2]	--[2]	606.0	606.0	--[2]	--[2]
CB	125,872	--[2]	--[2]	--[2]	607.7	607.7	--[2]	--[2]
CC	126,888	--[2]	--[2]	--[2]	607.9	607.9	--[2]	--[2]
CD	127,827	1149	--[2]	--[2]	610.2	610.2	--[2]	--[2]
CE	128,809	989	--[2]	--[2]	612.2	612.2	--[2]	--[2]
CF	129,808	1290	--[2]	--[2]	613.9	613.9	--[2]	--[2]
CG	130,810	1309	--[2]	--[2]	616.3	616.3	--[2]	--[2]
CH	131,886	1118	--[2]	--[2]	618.7	618.7	--[2]	--[2]
CI	132,881	991	--[2]	--[2]	623.3	623.3	--[2]	--[2]
CJ	133,850	1016	--[2]	--[2]	626.4	626.4	--[2]	--[2]
CK	134,994	1230	--[2]	--[2]	628.7	628.7	--[2]	--[2]
CL	135,949	1042	--[2]	--[2]	630.9	630.9	--[2]	--[2]
CM	136,869	--[2]	--[2]	--[2]	633.4	633.4	--[2]	--[2]
CN	137,032	--[2]	--[2]	--[2]	636.0	636.0	--[2]	--[2]
CO	137,993	1634	--[2]	--[2]	637.9	637.9	--[2]	--[2]
CP	139,072	930	--[2]	--[2]	639.9	639.9	--[2]	--[2]
CQ	140,110	267	--[2]	--[2]	642.0	642.0	--[2]	--[2]
CR	141,120	338	--[2]	--[2]	644.9	644.9	--[2]	--[2]
CS	142,152	365	--[2]	--[2]	648.4	648.4	--[2]	--[2]

[1]Feet above confluence with Columbia River [2]Data not available

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR AND INCORPORATED AREAS

FLOODWAY DATA

UMATILLA RIVER

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 (FEET)
Umatilla River (continued)								
CT	143,196	328	--[2]	--[2]	652.3	652.3	--[2]	--[2]
CU	144,213	264	--[2]	--[2]	655.8	655.8	--[2]	--[2]
CV	145,227	295	--[2]	--[2]	657.4	657.4	--[2]	--[2]
CW	146,372	400	--[2]	--[2]	660.2	660.2	--[2]	--[2]
CX	147,320	361	--[2]	--[2]	662.4	662.4	--[2]	--[2]
CY	148,307	201	--[2]	--[2]	666.3	666.3	--[2]	--[2]
CZ	149,169	192	--[2]	--[2]	670.4	670.4	--[2]	--[2]
DA	150,396	237	--[2]	--[2]	673.8	673.8	--[2]	--[2]
DB	151,391	396	--[2]	--[2]	676.7	676.7	--[2]	--[2]
DC	152,508	337	--[2]	--[2]	678.5	678.5	--[2]	--[2]
DD	153,390	456	--[2]	--[2]	681.6	681.6	--[2]	--[2]
DE	154,402	196	--[2]	--[2]	684.0	684.0	--[2]	--[2]
DF	155,392	318	--[2]	--[2]	687.0	687.0	--[2]	--[2]
DG	156,462	397	--[2]	--[2]	689.9	689.9	--[2]	--[2]
DH	157,443	268	--[2]	--[2]	691.6	691.6	--[2]	--[2]
DI	158,490	260	--[2]	--[2]	694.3	694.3	--[2]	--[2]
DJ	159,520	323	--[2]	--[2]	696.6	696.6	--[2]	--[2]
DK	160,550	192	--[2]	--[2]	699.5	699.5	--[2]	--[2]
DL	161,599	287	--[2]	--[2]	702.4	702.4	--[2]	--[2]
DM	162,596	210	--[2]	--[2]	704.2	704.2	--[2]	--[2]
DN	163,641	200	--[2]	--[2]	707.2	707.2	--[2]	--[2]
DO	164,655	131	--[2]	--[2]	711.6	711.6	--[2]	--[2]
DP	165,603	125	--[2]	--[2]	713.2	713.2	--[2]	--[2]
DQ	166,687	114	--[2]	--[2]	714.7	714.7	--[2]	--[2]

[1]Feet above confluence with Columbia River [2]Data not available

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR AND INCORPORATED AREAS

FLOODWAY DATA

UMATILLA RIVER

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 (FEET)
Umatilla River (continued)								
DR	167,646	194	--[2]	--[2]	718.6	718.6	--[2]	--[2]
DS	168,763	186	--[2]	--[2]	721.0	721.0	--[2]	--[2]
DT	169,719	163	--[2]	--[2]	724.7	724.7	--[2]	--[2]
DU	170,689	415	--[2]	--[2]	726.1	726.1	--[2]	--[2]
DV	171,689	510	--[2]	--[2]	726.5	726.5	--[2]	--[2]
DW	172,861	315	--[2]	--[2]	729.2	729.2	--[2]	--[2]
DX	173,753	144	--[2]	--[2]	732.6	732.6	--[2]	--[2]
DY	174,402	87	--[2]	--[2]	735.6	735.6	--[2]	--[2]
DZ	174,684	84	--[2]	--[2]	738.9	738.9	--[2]	--[2]
EA	175,710	327	--[2]	--[2]	739.05	739.05	--[2]	--[2]
EB	177,399	n/a	--[2]	--[2]	741.31	741.31	--[2]	--[2]
EC	291851	390	2270	9.1	1102.7	1102.7	1102.8	0.1
ED	292124	264	1742	11.8	1104.0	1104.0	1104.1	0.1
EE	292342	141	1416	14.6	1105.9	1105.9	1105.9	0.0
EF	292519	208	2506	8.2	1111.1	1111.1	1111.1	0.0
EG	292612	332	3085	6.7	1111.2	1111.2	1111.3	0.1
EH	292745	511	3613	5.7	1111.6	1111.6	1111.6	0.0
EI	293306	1002	6604	3.1	1113.2	1113.2	1113.3	0.1
EJ	293868	889	4449	4.6	1114.2	1114.2	1114.2	0.0
EK	294314	934	4396	4.7	1115.2	1115.2	1115.3	0.1
EL	294789	1105	4161	5.0	1116.6	1116.6	1116.6	0.0
EM	295249	1139	4098	5.0	1118.5	1118.5	1118.6	0.1
EN	295931	1403	4136	5.0	1121.9	1121.9	1122.0	0.1
EO	296570	1288	4639	4.4	1125.5	1125.5	1125.6	0.1

[1]Feet above confluence with Columbia River [2]Data not available

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR AND INCORPORATED AREAS

FLOODWAY DATA

UMATILLA RIVER

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 (FEET)
Umatilla River (continued)								
EP	297286	1404	4047	5.1	1128.7	1128.7	1128.8	0.1
EQ	298459	1770	5796	3.6	1133.2	1133.2	1133.3	0.1
ER	299519	950	3379	6.1	1137.0	1137.0	1137.0	0.0
ES	300471	961	3923	5.3	1141.3	1141.3	1141.4	0.1
ET	301205	297	2567	8.0	1143.9	1143.9	1143.9	0.0
EU	301893	453	2326	8.9	1147.1	1147.1	1147.2	0.1
EV	302356	562	2665	7.7	1150.0	1150.0	1150.1	0.1
EW	302786	669	3073	6.7	1152.8	1152.8	1152.8	0.0
EX	303211	1088	4971	4.1	1155.5	1155.5	1155.6	0.1
EY	304277	1495	6874	3.0	1159.0	1159.0	1159.1	0.1
EZ	304962	1714	4247	4.9	1161.3	1161.3	1161.4	0.1
FA	305797	2166	6118	3.3	1165.0	1165.0	1165.0	0.0
FB	306445	1342	3795	5.4	1167.3	1167.3	1167.3	0.0
FC	307039	1151	4066	5.0	1170.6	1170.6	1170.7	0.1
FD	307634	1541	3933	5.2	1173.5	1173.5	1173.6	0.1
FE	308069	881	3516	5.8	1175.6	1175.6	1175.6	0.0
FF	308561	838	2724	7.5	1178.3	1178.3	1178.4	0.1
FG	309417	1560	7453	2.7	1182.0	1182.0	1182.0	0.0
FH	310156	680	2219	9.2	1184.9	1184.9	1184.9	0.0
FI	310559	487	2359	8.6	1189.5	1189.5	1189.5	0.0
FJ	310911	549	2608	7.8	1192.1	1192.1	1192.2	0.1
FK	311806	1615	3587	5.6	1199.7	1199.7	1199.7	0.0
FL	312680	1143	4661	4.3	1204.9	1204.9	1204.9	0.0
FM	313230	791	3014	6.7	1207.3	1207.3	1207.4	0.1

[1]Feet above confluence with Columbia River

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR AND INCORPORATED AREAS

FLOODWAY DATA

UMATILLA RIVER

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 (FEET)
Umatilla River (continued)								
FN	313708	902	3127	6.4	1210.6	1210.6	1210.7	0.1
FO	314123	411	2362	8.5	1213.4	1213.4	1213.5	0.1
FP	314266	249	2135	9.4	1215.7	1215.7	1215.7	0.0
FQ	314352	355	3024	6.7	1216.5	1216.5	1216.6	0.1
FR	314451	597	4068	5.0	1217.2	1217.2	1217.3	0.1
FS	315078	820	3399	5.9	1219.0	1219.0	1219.1	0.1
FT	315755	1502	5276	3.8	1222.8	1222.8	1222.9	0.1
FU	316324	1380	3954	5.1	1225.8	1225.8	1225.8	0.0
FV	317240	1618	3611	5.6	1232.0	1232.0	1232.0	0.0
FW	318125	2103	4319	4.7	1237.8	1237.8	1237.9	0.1
FX	318730	1794	6887	2.9	1241.6	1241.6	1241.7	0.1
FY	319143	1852	6585	3.1	1243.0	1243.0	1243.1	0.1
FZ	319680	2080	7536	2.7	1244.8	1244.8	1244.9	0.1
GA	320537	1589	7213	2.8	1247.0	1247.0	1247.0	0.0
GB	321242	1562	6095	3.3	1249.4	1249.4	1249.5	0.1
GC	322491	2187	6616	3.0	1256.0	1256.0	1256.0	0.0
GD	323270	1891	6368	3.2	1259.5	1259.5	1259.5	0.0
GE	323914	1492	5808	3.5	1262.3	1262.3	1262.4	0.1
GF	325233	1461	5871	3.4	1269.3	1269.3	1269.4	0.1
GG	326432	1686	6942	2.9	1274.4	1274.4	1274.4	0.0
GH	327075	1695	5090	4.0	1279.1	1279.1	1279.2	0.1
GI	328012	1468	6260	3.2	1282.9	1282.9	1283.0	0.1
GJ	329588	1067	3803	5.3	1291.1	1291.1	1291.1	0.0
GK	331002	899	3978	5.1	1299.2	1299.2	1299.3	0.1

[1]Feet above confluence with Columbia River

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 (FEET)
Umatilla River (continued)								
GL	332205	969	3860	5.2	1304.2	1304.2	1304.2	0.0
GM	332752	1297	4948	4.1	1307.9	1307.9	1308.0	0.1
GN	333345	1723	4611	4.4	1310.4	1310.4	1310.4	0.0
GO	334196	1452	6159	3.1	1314.1	1314.1	1314.2	0.1
GP	334859	1220	4630	4.2	1317.0	1317.0	1317.1	0.1
GQ	335574	1260	5400	3.6	1321.7	1321.7	1321.7	0.0
GR	336583	1243	5240	3.7	1326.6	1326.6	1326.6	0.0
GS	337159	1365	6082	3.2	1328.8	1328.8	1328.9	0.1
GT	337735	1632	5630	3.4	1331.5	1331.5	1331.5	0.0
GU	338779	1879	6320	3.1	1337.8	1337.8	1337.8	0.0
GV	340071	945	3628	5.3	1345.9	1345.9	1346.0	0.1
GW	340506	1255	4968	3.9	1348.9	1348.9	1349.0	0.1
GX	340925	1188	4250	4.6	1350.4	1350.4	1350.5	0.1
GY	341614	1258	4097	4.7	1353.2	1353.2	1353.2	0.0
GZ	342707	1287	4285	4.5	1358.5	1358.5	1358.6	0.1
IA	358320	1087	5071	3.5	1440.1	1440.1	1440.2	0.1
IB	358891	930	3776	4.8	1441.7	1441.7	1441.8	0.1
IC	359710	671	3003	6.0	1445.5	1445.5	1445.6	0.1
ID	360364	557	2471	7.3	1449.1	1449.1	1449.2	0.1
IE	361066	750	4874	3.7	1453.3	1453.3	1453.3	0.0
IF	361759	1112	4353	4.1	1455.5	1455.5	1455.5	-0.1
IG	362557	798	3389	5.3	1459.2	1459.2	1459.3	0.1
IH	363687	1068	3890	4.6	1465.1	1465.1	1465.2	0.1
II	364589	865	3596	5.0	1469.7	1469.7	1469.7	0.0

[1]Feet above confluence with Columbia River

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 (FEET)
Umatilla River (continued)								
IJ	365519	842	4084	4.4	1473.6	1473.6	1473.7	0.1
IK	366225	674	2907	6.2	1476.7	1476.7	1476.7	0.0
IL	366677	872	4417	4.1	1480.2	1480.2	1480.3	0.1
IM	367098	719	4114	4.4	1482.2	1482.2	1482.2	0.0
IN	367645	520	2767	6.5	1484.6	1484.6	1484.7	0.1
IO	368419	657	4054	4.4	1489.4	1489.4	1489.4	0.0
IP	368914	618	2858	6.3	1492.0	1492.0	1492.0	0.0
IQ	369349	706	2540	7.1	1494.7	1494.7	1494.8	0.1
IR	370193	587	3468	5.2	1499.9	1499.9	1499.9	0.0
IS	370946	753	3028	5.8	1503.0	1503.0	1503.1	0.1
IT	371744	666	2805	6.3	1507.7	1507.7	1507.8	0.1
IU	372261	503	2512	7.0	1511.0	1511.0	1511.1	0.1
IV	372917	165	1965	9.0	1514.0	1514.0	1514.1	0.1
IW	373122	161	1907	9.3	1517.2	1517.2	1517.2	0.0
IX	373477	487	1909	9.3	1518.2	1518.2	1518.3	0.1
IY	374283	796	5581	3.2	1523.1	1523.1	1523.2	0.1
IZ	374527	937	5658	3.1	1523.7	1523.7	1523.8	0.1
JA	374739	857	4773	3.7	1524.1	1524.1	1524.2	0.1
JB	375515	615	3952	4.5	1526.2	1526.2	1526.2	0.0
JC	376843	1089	4126	4.3	1532.4	1532.4	1532.5	0.1
JD	377220	1273	5185	3.4	1535.8	1535.8	1535.9	0.1
JE	377778	1113	5362	3.2	1538.6	1538.6	1538.7	0.1
JF	378235	1212	4803	3.5	1540.7	1540.7	1540.8	0.1
JG	378897	1283	5027	3.4	1543.0	1543.0	1543.0	0.0

[1]Feet above confluence with Columbia River

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 (FEET)
Umatilla River (continued)								
JH	379829	1127	4170	4.1	1548.6	1548.6	1548.6	0.0
JI	380878	1420	5730	3.0	1554.0	1554.0	1554.1	0.1
JJ	381591	1451	4531	3.8	1557.3	1557.3	1557.3	0.0
JK	382606	796	2791	6.1	1564.4	1564.4	1564.4	0.0
JL	383574	1486	4357	3.9	1570.0	1570.0	1570.0	0.0
JM	384254	1541	3678	4.6	1573.4	1573.4	1573.4	0.0
JN	384847	1288	5318	3.2	1576.7	1576.7	1576.8	0.1
JO	385531	1204	1295	13.1	1579.3	1579.3	1579.3	0.0
JP	385676	1064	2665	6.4	1581.7	1581.7	1581.8	0.1
JQ	385795	1268	3091	5.5	1586.8	1586.8	1586.8	0.0
JR	386317	944	4955	3.4	1588.3	1588.3	1588.3	0.0
JS	387191	664	3023	5.6	1590.7	1590.7	1590.7	0.0
JT	387676	436	2382	7.1	1594.4	1594.4	1594.4	0.0
JU	388344	746	4438	3.8	1599.5	1599.5	1599.5	0.0
JV	388929	901	3072	5.5	1601.9	1601.9	1601.9	0.0
JW	389772	653	3428	5.0	1606.9	1606.9	1606.9	0.0
JX	390519	561	1910	8.8	1610.9	1610.9	1610.9	0.0
JY	391214	871	3607	4.7	1616.1	1616.1	1616.1	0.0
JZ	392026	888	3118	5.4	1620.6	1620.6	1620.7	0.1
KA	392708	865	3786	4.4	1625.2	1625.2	1625.3	0.1
KB	393203	943	3082	5.4	1628.6	1628.6	1628.6	0.0
KC	394422	1179	4410	3.8	1636.1	1636.1	1636.2	0.1
KD	395478	1073	4580	3.7	1641.0	1641.0	1641.1	0.1
KE	396290	983	3769	4.5	1645.8	1645.8	1645.8	0.0

[1]Feet above confluence with Columbia River

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 (FEET)
Umatilla River (continued)								
KF	397308	1073	3835	4.4	1651.1	1651.1	1651.2	0.1
KG	397959	1052	4564	3.7	1654.4	1654.4	1654.4	0.0
KH	398536	1002	4263	3.9	1657.0	1657.0	1657.0	0.0
KI	399093	772	3361	5.0	1660.2	1660.2	1660.3	0.1
KJ	400265	935	4267	3.9	1667.3	1667.3	1667.4	0.1
KK	400901	587	2382	7.0	1671.5	1671.5	1671.5	0.0
KL	401658	1104	3826	4.4	1676.9	1676.9	1676.9	0.0
KM	402690	1106	2959	5.7	1682.6	1682.6	1682.7	0.1
KN	403506	780	2362	7.1	1688.5	1688.5	1688.5	0.0
KO	404209	584	3035	5.0	1693.5	1693.5	1693.5	0.0
KP	404919	448	1924	7.9	1697.6	1697.6	1697.6	0.0
KQ	405200	577	2309	6.5	1700.0	1700.0	1700.1	0.1
KR	405446	722	2240	6.7	1702.0	1702.0	1702.0	0.0
KS	406305	1155	4758	3.2	1706.1	1706.1	1706.2	0.1
KT	406747	957	3299	4.6	1708.2	1708.2	1708.3	0.1
KU	407151	899	3327	4.5	1711.1	1711.1	1711.2	0.1
KV	408115	713	2882	5.2	1717.6	1717.6	1717.7	0.1
KW	408436	551	2717	5.6	1719.5	1719.5	1719.6	0.1
KX	408949	845	4624	3.3	1722.4	1722.4	1722.4	0.0
KY	409706	573	2895	5.2	1725.4	1725.4	1725.5	0.1
KZ	410584	413	2782	5.4	1732.4	1732.4	1732.4	0.0
LA	411601	545	3213	4.7	1737.6	1737.6	1737.6	0.0
LB	412150	870	3886	3.9	1739.9	1739.9	1740.0	0.1
LC	412496	960	3494	4.3	1741.8	1741.8	1741.9	0.1

[1]Feet above confluence with Columbia River

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 (FEET)
Umatilla River (continued)								
LD	413344	737	3269	4.6	1748.1	1748.1	1748.1	0.0
LE	414061	761	3202	4.7	1752.5	1752.5	1752.5	0.0
LF	414387	935	2882	5.2	1754.3	1754.3	1754.3	0.0
LG	414601	838	2761	5.4	1756.2	1756.2	1756.3	0.1
LH	414899	636	3784	4.0	1759.3	1759.3	1759.3	0.0
LI	415143	672	2834	5.3	1760.2	1760.2	1760.2	0.0
LJ	415445	770	3478	2.1	1762.5	1762.5	1762.6	0.1
LK	415779	611	1931	3.8	1762.9	1762.9	1762.9	0.0
LL	415926	571	1615	4.5	1763.5	1763.5	1763.5	0.0
LM	416449	531	1224	5.9	1769.3	1769.3	1769.4	0.1
LN	416884	441	1615	4.5	1773.8	1773.8	1773.8	0.0
LO	417203	311	1080	6.7	1776.5	1776.5	1776.5	0.0
LP	417571	346	1268	5.7	1780.6	1780.6	1780.6	0.0
LQ	418265	215	791	9.2	1789.4	1789.4	1789.4	0.0
LR	418523	289	1474	4.9	1792.9	1792.9	1793.0	0.1
LS	418805	408	1424	5.1	1794.5	1794.5	1794.6	0.1
LT	419419	460	1139	6.3	1800.5	1800.5	1800.5	0.0
LU	420053	295	1228	5.9	1806.2	1806.2	1806.3	0.1
LV	420578	130	727	9.9	1810.6	1810.6	1810.6	0.0
LW	421273	310	1140	6.3	1817.8	1817.8	1817.8	0.0
LX	421599	213	852	8.4	1820.0	1820.0	1820.0	0.0
LY	421741	116	724	9.9	1821.9	1821.9	1821.9	0.0
LZ	421863	161	934	7.7	1823.9	1823.9	1823.9	0.0
MA	422188	247	990	7.3	1825.9	1825.9	1825.9	0.0

[1]Feet above confluence with Columbia River

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 (FEET)
Umatilla River (continued)								
MB	422613	313	934	7.7	1829.7	1829.7	1829.7	0.0
MC	423151	221	875	8.2	1834.5	1834.5	1834.5	0.0
MD	423516	260	712	10.1	1838.1	1838.1	1838.1	0.0
ME	424068	240	881	8.2	1844.5	1844.5	1844.6	0.1
MF	424644	110	763	9.3	1849.7	1849.7	1849.7	0.0
MG	425169	92	699	10.2	1854.0	1854.0	1854.1	0.1
MH	425857	104	760	9.4	1860.2	1860.2	1860.2	0.0
MI	426318	347	924	7.7	1864.3	1864.3	1864.4	0.1
MJ	427127	116	928	7.7	1870.6	1870.6	1870.7	0.1
MK	427595	107	686	10.4	1873.7	1873.7	1873.7	0.0
ML	428199	216	1063	6.7	1880.3	1880.3	1880.3	0.0
MM	428802	62	496	14.3	1885.5	1885.5	1885.5	0.0
MN	429031	133	1021	7.0	1890.1	1890.1	1890.1	0.0
MO	429512	98	595	12.0	1893.6	1893.6	1893.6	0.0
MP	429946	113	772	9.2	1900.4	1900.4	1900.4	0.0
MQ	430284	215	687	10.4	1903.7	1903.7	1903.7	0.0
MR	430503	218	1099	6.5	1906.9	1906.9	1907.0	0.1
MS	430693	206	1219	5.8	1908.3	1908.3	1908.4	0.1

[1]Feet above confluence with Columbia River

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 (FEET)
Walla Walla River								
A	211,000	169[2]	1,037	10.6	780.2	780.2	781.2	1.0
B	211,800	438	1,377	8.0	786.8	786.8	787.0	0.2
C	212,900	498	2,420	4.6	792.2	792.2	793.1	0.9
D	214,250	584	1,597	6.9	800.8	800.8	800.8	0.0
E	215,350	344	1,492	7.4	807.5	807.5	808.1	0.6
F	216,125	322	1,427	7.7	811.8	811.8	812.6	0.8
G	217,125	199	901	12.2	823.3	823.3	823.8	0.5
H	218,100	336	1,693	6.5	830.9	830.9	831.6	0.7
I	220,250	255	1,239	8.9	848.3	848.3	849.1	0.8
J	220,900	156	834	13.2	855.8	855.8	855.8	0.0
K	249,550	849	1,251	6.0	1,190.1	1,190.1	1,190.1	0.0
L	250,170	841	1,557	4.8	1,196.5	1,196.5	1,197.2	0.7
M	251,150	386	1,162	6.5	1,210.0	1,210.0	1,210.7	0.7
N	252,100	159	699	10.7	1,220.5	1,220.5	1,221.1	0.6
O	253,025	128	766	9.9	1,228.4	1,228.4	1,229.2	0.8
P	253,525	219	713	10.5	1,237.4	1,237.4	1,237.4	0.0
Q	254,350	179	819	9.2	1,244.9	1,244.9	1,245.5	0.6
R	255,350	219	810	9.3	1,258.9	1,258.9	1,259.6	0.7
S	255,780	458	1,316	5.7	1,266.3	1,266.3	1,267.0	0.7
T	256,200	117	588	12.8	1,272.4	1,272.4	1,272.4	0.0
U	256,475	102	559	13.4	1,276.7	1,276.7	1,276.7	0.0
V	256,525	147	1,081	6.9	1,279.8	1,279.8	1,279.8	0.0
W	257,755	79	514	14.6	1,293.2	1,293.2	1,293.2	0.0
X	258,250	80	635	11.8	1,298.5	1,298.5	1,299.1	0.6

[1]Feet above mouth

[2]Floodway lies outside county limits

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR AND INCORPORATED AREAS

FLOODWAY DATA

WALLA WALLA RIVER

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 (FEET)
Walla Walla River (continued)								
Y	258,800	81	518	14.5	1,305.3	1,305.3	1,305.3	0.0
Z	259,550	258	1,038	7.2	1,314.1	1,314.1	1,314.4	0.3
AA	259,950	108	566	13.2	1,317.7	1,317.7	1,317.7	0.0
AB	260,700	211	1,029	7.3	1,325.9	1,325.9	1,325.9	0.0
AC	261,405	273	769	9.8	1,333.2	1,333.2	1,333.2	0.0
AD	262,150	240	851	8.8	1,343.9	1,343.9	1,343.9	0.0
AE	263,505	287	917	8.2	1,361.9	1,361.9	1,362.2	0.3
AF	263,805	288	971	7.7	1,366.1	1,366.1	1,367.0	0.9

[1]Feet above mouth

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 (FEET)
South Fork Walla Walla River								
A	0	82	408	7.9	1,924.4	1,924.4	1,925.4	1.0
B	720	103	397	8.1	1,934.9	1,934.9	1,934.9	0.0
C	1,190	83	341	9.4	1,942.8	1,942.8	1,943.0	0.2
D	1,768	73	426	7.6	1,950.2	1,950.2	1,950.4	0.2
E	2,307	49	273	11.8	1,959.1	1,959.1	1,959.1	0.0
F	2,793	101	410	7.8	1,969.9	1,969.9	1,970.2	0.3
G	3,133	145	456	7.1	1,975.3	1,975.3	1,975.3	0.0
H	4,054	65	324	10.0	1,992.3	1,992.3	1,992.4	0.1
I	4,396	78	313	10.3	1,999.4	1,999.4	1,999.4	0.0
J	4,819	113	481	6.7	2,005.1	2,005.1	2,006.0	0.9

[1]Feet above Limit of Detailed Study

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR AND INCORPORATED AREAS

FLOODWAY DATA

SOUTH FORK WALLA WALLA RIVER

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 (FEET)
Waterman Gulch								
A	490	130	--[2]	--[2]	1,710.6	1,710.6	1,710.7	0.1
B	810	147	--[2]	--[2]	1,713.6	1,713.6	1,714.1	0.5
C	1,170	272	--[2]	--[2]	1,717.1	1,717.1	1,717.9	0.8
D	1,490	155	--[2]	--[2]	1,719.0	1,719.0	1,720.0	1.0
E	2,175	378	--[2]	--[2]	1,723.4	1,723.4	1,724.0	0.6
F	2,575	300	--[2]	--[2]	1,728.0	1,728.0	1,729.0	1.0
G	2,855	200	--[2]	--[2]	1,728.0	1,728.0	1,729.0	1.0
H	3,405	403	--[2]	--[2]	1,731.8	1,731.8	1,732.8	1.0
I	3,825	80	--[2]	--[2]	1,732.4	1,732.4	1,733.0	0.6
J	3,910	160	--[2]	--[2]	1,733.0	1,733.0	1,733.9	0.9
K	5,045	95	247	5.5	1,740.7	1,740.7	1,741.7	1.0
L	5,505	150	235	5.8	1,744.1	1,744.1	1,744.5	0.4

[1]Feet above confluence with Wildhorse Creek [2]Data not available

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR AND INCORPORATED AREAS

FLOODWAY DATA

WATERMAN GULCH

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 (FEET)
Wildhorse Creek (Near Pendleton)								
A	155	225	1,309	7.3	1,099.3	1,099.3	1,099.9	0.6
B	625	450	1,903	5.0	1,102.1	1,102.1	1,102.2	0.1
C	1,100	120	847	11.3	1,103.3	1,103.3	1,104.1	0.8
D	2,100	74	814	11.8	1,114.3	1,114.3	1,114.6	0.3
E	2,750	56	582	16.5	1,117.5	1,117.5	1,117.5	0.0
F	3,380	87	962	10.0	1,122.6	1,122.6	1,123.1	0.5
G	3,855	69	650	14.8	1,123.9	1,123.9	1,124.5	0.6
H	4,650	197	1,304	7.4	1,130.0	1,130.0	1,130.9	0.9
I	5,050	138	936	10.3	1,132.2	1,132.2	1,132.2	0.0
J	5,290	90	683	14.1	1,136.1	1,136.1	1,136.1	0.0
K	5,980	120	1,011	9.5	1,139.9	1,139.9	1,139.9	0.0
L	6,600	200	1,111	8.6	1,141.7	1,141.7	1,142.4	0.7
M	7,290	170	1,300	7.4	1,145.9	1,145.9	1,145.9	0.0
N	7,950	63	561	17.1	1,147.0	1,147.0	1,147.0	0.0
O	8,610	215	1,245	7.7	1,152.2	1,152.2	1,153.1	0.9
P	9,285	190	1,101	8.7	1,155.5	1,155.5	1,156.1	0.6
Q	9,970	287	1,634	5.9	1,158.5	1,158.5	1,158.9	0.4
R	10,765	223	933	10.3	1,163.0	1,163.0	1,163.0	0.0
S	10,880	82	730	13.2	1,164.6	1,164.6	1,164.6	0.0
T	11,060	159	977	9.8	1,165.4	1,165.4	1,165.9	0.5
U	11,170	165	1,106	8.7	1,166.9	1,166.9	1,166.9	0.0
V	11,800	165	848	11.3	1,170.0	1,170.0	1,170.0	0.0
W	12,500	138	839	11.4	1,173.3	1,173.3	1,174.2	0.9
X	13,125	89	816	11.8	1,177.5	1,177.5	1,178.2	0.7

[1]Feet above mouth

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR AND INCORPORATED AREAS

FLOODWAY DATA

WILDHORSE CREEK (NEAR PENDLETON)

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 (FEET)
Wildhorse Creek (Near Pendleton) (continued)								
Y	13,800	82	853	11.3	1,181.1	1,181.1	1,181.4	0.3
Z	14,530	202	1,217	7.9	1,184.3	1,184.3	1,184.9	0.6
AA	15,150	239	1,155	8.3	1,187.9	1,187.9	1,188.1	0.2
AB	15,755	169	1,122	8.6	1,190.8	1,190.8	1,191.5	0.7
AC	16,465	193	1,513	6.3	1,194.4	1,194.4	1,195.4	1.0
AD	17,120	128	670	14.3	1,198.0	1,198.0	1,198.0	0.0
AE	17,755	500	1,546	6.2	1,203.3	1,203.3	1,203.8	0.5
AF	18,325	88	856	11.2	1,205.9	1,205.9	1,205.9	0.0

[1]Feet above mouth

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 (FEET)
Wildhorse Creek (City of Adams)								
A	0	275	--[2]	--[2]	1,511.7	1,511.7	1,512.2	0.5
B	720	390	--[2]	--[2]	1,514.0	1,514.0	1,514.4	0.4
C	1,115	390	--[2]	--[2]	1,515.9	1,515.9	1,515.9	0.0
D	1,515	445	--[2]	--[2]	1,517.6	1,517.6	1,518.3	0.7
E	1,950	185	--[2]	--[2]	1,520.2	1,520.2	1,521.2	1.0
F	2,350	250	--[2]	--[2]	1,522.8	1,522.8	1,523.7	0.9
G	2,975	85	--[2]	--[2]	1,525.7	1,525.7	1,526.7	1.0
H	3,735	80	--[2]	--[2]	1,528.0	1,528.0	1,528.9	0.9

[1]Feet above Limit of Detailed Study [2]Data not available

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR AND INCORPORATED AREAS

FLOODWAY DATA

WILDHORSE CREEK (CITY OF ADAMS)

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 (FEET)
Wildhorse Creek								
A	0	100	483	6.6	1,674.1	1,674.1	1,674.9	0.8
B	630	295	509	5.7	1,682.4	1,682.4	1,682.4	0.0
C	1,040	235	505	5.8	1,685.6	1,685.6	1,686.3	0.7
D	1,430	215	553	5.3	1,689.0	1,689.0	1,689.6	0.6
E	1,880	136	417	7.0	1,692.3	1,692.3	1,692.7	0.4
F	2,080	167	369	7.9	1,694.6	1,694.6	1,694.7	0.1
G	2,340	78	401	7.3	1,696.7	1,696.7	1,697.7	1.0
H	2,540	45	368	7.9	1,698.4	1,698.4	1,699.1	0.7
I	2,600	51	422	6.9	1,699.2	1,699.2	1,699.8	0.6
J	2,750	43	389	7.5	1,700.4	1,700.4	1,700.8	0.4
K	2,940	39	307	9.5	1,701.9	1,701.9	1,702.1	0.2
L	3,330	167	598	3.9	1,705.7	1,705.7	1,706.3	0.6
M	3,650	60	435	5.4	1,707.5	1,707.5	1,708.5	1.0
N	3,980	45	384	6.1	1,711.0	1,711.0	1,711.9	0.9
O	4,418	196	343	6.9	1,718.4	1,718.4	1,718.6	0.2
P	4,800	98	459	5.1	1,719.8	1,719.8	1,720.7	0.9
Q	5,170	80	451	5.2	1,722.8	1,722.8	1,723.8	1.0

[1]Feet above Limit of Detailed Study

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
AND INCORPORATED AREAS

FLOODWAY DATA

WILDHORSE CREEK (NEAR ATHENA)

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to the 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 Flood Insurance Study 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 Flood Insurance Study by detailed methods. Whole-foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

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

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 0.2-percent-annual-chance floodplain, areas within the 0.2-percent-annual-chance floodplain, areas of 1-percent-annual-chance flooding where average depths are less than one foot, areas of 1-percent-annual-chance flooding where the contributing drainage area is less than one square mile, 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.

Table 8 lists the flood insurance zones that each community is responsible for regulating.

Table 8. Flood Insurance Zones within Each Community

Community	Flood Zone(s)
Adams, City of	A, AE, X
Athena, City of	A, AE, X
Echo, City of	AE, X, D
Helix, City of	AE, X, D
Hermiston, City of	AE, X, D
Milton-Freewater, City of	AO, A, X
Pendelton, City of	A, AE, X
Pilot Rock, City of	A, AE, X, D
Stanfield, City of	AE, X
Ukiah, City of	A, X
Umatilla, City of	A, X, D
Umatilla County, Unincorporated Areas	A, AE, X, D
Umatilla Indian Reservation	AE, AO, X, D
Weston, City of	AE, X, D

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map 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 Flood Insurance Rate Map presents flooding information for the entire geographic area of Umatilla County. Previously, Flood Insurance Rate Maps were prepared for each incorporated community and the unincorporated areas of the County identified as flood-prone. This countywide Flood Insurance Rate Map 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 9, “Community Map History.”

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE(S)	FLOOD INSURANCE RATE MAP EFFECTIVE DATE	FLOOD INSURANCE RATE MAP REVISION DATE(S)
Umatilla County Unincorporated Areas	June 15, 1978	-----	June 15, 1978	March 4, 1987 September 8, 1999
Adams, City of	August 30, 1974	December 26, 1975 May 8, 1979 July 14, 1981	May 15, 1984	-----
Athena, City of	November 2, 1973	April 16, 1976 July 28, 1981	July 16, 1984	September 8, 1999
Echo, City of	September 13, 1974	December 26, 1975	May 15, 1984	-----
Helix, City of	December 20, 1974	August 28, 1979 August 18, 1981	June 1, 1984	-----
Hermiston, City of	October 23, 1977	-----	September 29, 1986	-----
Milton-Freewater, City of	November 16, 1973	May 28, 1976	-----	September 12, 1978

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE(S)	FLOOD INSURANCE RATE MAP EFFECTIVE DATE	FLOOD INSURANCE RATE MAP REVISION DATE(S)
Pendleton, City of	May 4, 1973	September 26, 1975	July 13, 1976	November 3, 1978 September 1, 1981 February 19, 1987 July 15, 1988
Pilot Rock, City of	November 16, 1973	December 5, 1975	August 4, 1988	-----
Stanfield, City of	November 9, 1974	January 2, 1976	August 15, 1984	September 4, 1986
Ukiah, City of	May 29, 1979	-----	September 24, 1984	-----
Umatilla, City of	November 9, 1973	June 18, 1976	September 24, 1984	-----
Umatilla Indian Reservation	-----	-----	-----	-----
Weston, City of	May 17, 1974	December 5, 1975 July 21, 1981	September 18, 1987	-----

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR
AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

7.0 OTHER STUDIES

The Federal Insurance Administration previously published Flood Insurance Rate Maps for unincorporated Umatilla County (Reference 34), the City of Adams (Reference 35), the City of Athena (Reference 36), the City of Echo (Reference 37), the City of Helix (Reference 38), the City of Hermiston (Reference 39), the City of Pendleton (Reference 40), the City of Pilot Rock (Reference 41), the City of Stanfield (Reference 42), and the City of Weston (Reference 43). The present Flood Insurance Study is more detailed and thus supersedes the earlier maps.

This study is compatible with the Flood Insurance Studies for the Cities of Umatilla and Ukiah (References 44 and 45), and Union and Grant Counties, Oregon (References 46 and 47); and Flood Hazard Boundary Map for Wallowa County, Oregon (Reference 48).

Six Floodplain Information reports were prepared by the USACE, Walla Walla District, for Umatilla County. These include reports on the Umatilla River, Echo-Stanfield, Oregon, and vicinity (Reference 49); Umatilla River, Mission-Riverside area (Reference 50); Umatilla River, Cayuse-Gibbon, Oregon (Reference 51); Umatilla River Tributaries, McKay, Tutuilla, and Wildhorse Creeks, Pendleton, Oregon, and vicinity (Reference 52); Walla Walla River, vicinity of Milton-Freewater, Oregon (Reference 53); Mill Creek, Walla Walla County, Washington, Kooskooskie and vicinity (Reference 54); and Mill Creek, Umatilla County, Oregon (Reference 55). The base flood elevations and flood profiles used in this study are basically the same as shown in these reports.

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 purposed 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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Map Name	Date	Scale	Contour Interval (Feet)
Adams	1966	1:24,000	10
Athena	1974	1:24,000	20
Barnhart	1978	1:24,000	20
Big Meadows	1983	1:24,000	40
Blalock Mountain	1983	1:24,000	40
Bowlus Hill	1976	1:24,000	20
Cayuse	1966	1:24,000	20
Echo	1968	1:24,000	20
Gibbon	1983	1:24,000	40
Helix	1966	1:24,000	10
Hermiston	1993	1:24,000	10
McKay Reservoir	1966	1:24,000	20
Milton-Freewater	1978	1:24,000	20
Mission	1974	1:24,000	10
Nolin	1968	1:24,000	20
Pendleton	1976	1:24,000	20
Pilot Rock	1967	1:24,000	20
Stanfield	1993	1:24,000	10
Table Rock	1966	1:24,000	10
Thorn Hollow	1964	1:24,000	40
Ukiah	1983	1:24,000	20
Umatilla	1993	1:24,000	10

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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 Umatilla County Planning Department, 216 Southeast 4th Street, Pendleton, Oregon 97801.

10.1 First Revision (July 4, 1988)

Flood information for Patawa Creek in the City of Pendleton and unincorporated Umatilla County was revised on July 4, 1988 to incorporate the effects of a new hydrologic analysis on the base flood elevations (BFEs) and floodplain boundaries. This revised hydrologic analysis was based on a study by the Oregon State Department of Transportation, Highways Division, which utilized regression equations developed in the U.S. Geological Survey Report 82-4078, entitled Magnitude and Frequency of Floods in Eastern Oregon, and from Oregon State Highways Division Hydraulics Manual. The result of this analysis was an increase in the discharges and BFEs along Patawa Creek and a change in the floodplain boundaries. The Summary of Discharges Table, Floodway Data Table, and profiles were revised to reflect the effects of these higher discharges.

The corporate limits of Pendleton were also changed to include the Glendale Annexation along McKay Creek. The construction of the McKay Park Footbridge did not have any effect on the water-surface elevation. However, the footbridge was added to the FIRM and profile.

10.2 Second Revision (September 8, 1999)

The study was again revised on September 8, 1999, to incorporate detailed flood-hazard information along Wildhorse Creek, prepared by the U.S. Army Corps of Engineers (USACE), Walla Walla District, for the City of Athena (Reference 56).

The 1-percent-annual-chance discharges for Wildhorse Creek were computed in 1987 as part of the Flood Insurance Study of Umatilla County, Oregon (Reference 57). To define discharge-frequency data for Wildhorse Creek, which is an ungaged stream, a regional relationship between basin characteristics and streamflow statistics (Reference 6) was the principal method used. The regional relationship of peak discharge data and drainage-area parameters was analyzed. Frequency statistics in the form of logarithm mean flood, standard deviation, and skew for gaged areas were plotted versus drainage-area parameters, such as drainage-area size, normal annual precipitation, and base mean elevation. The frequency statistics for the ungaged areas and areas remote from gaging stations were selected from curves and applied using the log-Pearson Type III method (Reference 7). Values of the 1-percent-annual-chance discharges were obtained from the log-Pearson Type III distribution of annual peak-flow data (Reference 7).

Cross sections were surveyed along Wildhorse Creek upstream of its confluence with Waterman Gulch and bridge detail was gathered for the Third Street Bridge over Wildhorse Creek. These data, obtained in August 1994, were then appended to an existing hydraulic model of Wildhorse Creek, which was developed in 1989 for determining 1-percent-annual-chance flood elevations and a regulatory floodway for a portion of Wildhorse Creek immediately downstream of its confluence with Waterman Gulch. The USACE HEC-2 computer program (Reference 24) was used to compute the 1-percent-annual-chance water-surface profiles and the regulatory floodway.

Roughness coefficients (Manning's "n" values) were established based on field inspections during a site visit made in August 1994. Channel values ranged from 0.025 to 0.090 and overbank values ranged from 0.050 to 0.060.

Several reaches along Wildhorse Creek have extensive brush overgrowth along and within the main stream channel, which may seriously impede flood flow and may aggravate flooding conditions during high-flow events.

Based on field inspections done as part of this restudy, the Third Street Bridge was noted as potentially being a significant obstruction to flood flows. On the upstream side of the bridge, a concrete weir has been constructed that reduces the effective flow area of the bridge opening by approximately 40 percent as compared to the flow area that would be available if the weir were not present.

For Wildhorse Creek, the floodway from approximately 1,100 feet downstream of Third Street to approximately 750 feet upstream of Third Street is based on a community-adopted alignment that was mutually accepted by both the City of Athena and Umatilla County. This revised floodway was provided by the USACE with their revised analysis dated March 31, 1998.

This restudy also incorporated detailed flood-hazard information along Mill Creek between Henry Canyon bridge and the approximate boundary of the Umatilla National Forest on Mill Creek. The hydrologic and hydraulic analyses were prepared for FEMA by Ogden Beeman & Associates, Inc., under Contract No. EMS-96-CO-0078-TA02.

The 1-percent-annual-chance discharges for the portion of Mill Creek restudied were taken from hydrologic analyses performed by the USACE, Walla Walla District, for the portion of Mill Creek downstream of this study. Water-surface elevations for Mill Creek were computed using the USACE HEC-RAS computer program (Reference 25).

Channel cross sections for the reach of Mill Creek were obtained by studying aerial photographs and determining the appropriate spacing to represent the meanders in Mill Creek. The surveying of cross sections was performed by David Evans & Associates, Inc. Exceptions include a portion of Mill Creek farther downstream that was not resurveyed but rather repeated from the previous study. In addition, some sections were extended by the use of a USGS Big Meadows quadrangle map for Umatilla County. Roughness coefficients (Manning's "n" values) were established based on field inspections from site visits. The channel value was 0.040 and overbank values ranged from 0.090 to 0.150.

The results of the restudy were reviewed at the final Consultation Coordination Officer meeting held on January 7, 1998, and attended by representatives of Umatilla County; the USACE, Walla Walla District; and FEMA. All problems raised at that meeting have been addressed in this restudy.

Table 10 summarizes the flooding sources updated since the original study was completed.

Table 10. Revised Study Descriptions

Flooding Source(s)	Community	Limits of Study	Date of Revision
Mill Creek	Umatilla County Unincorporated Areas	From the Henry Canyon bridge to the approximate boundary of the Umatilla National Forest on Mill Creek	September 8, 1999
Patawa Creek	City of Pendleton, and Umatilla County Unincorporated Areas	Tutuilla Creek upstream to Old Dump Road	July 4, 1988
Wildhorse Creek	City of Athena, and Umatilla County Unincorporated Areas	From just west of Waterman Gulch to approximately 750 feet upstream of Third Street in the City of Athena	September 8, 1999

10.3 Countywide Update (August 5, 2010)

The countywide update was performed in September 2008 by WEST Consultants, Inc., for FEMA under Contract No. EMS-2001-CO-0068.

This update combined the Flood Insurance Rate Maps (FIRMs) and Flood Insurance Study (FIS) reports for Umatilla County and incorporated communities into the countywide format. Under the countywide format, FIRM panels have been produced using a single layout format for the entire area within the county instead of separate layout formats for each community. The single-layout format facilitates the matching of adjacent panels and depicts the flood-hazard area within the entire panel border, even in areas beyond a community's corporate boundary line. In addition, under the countywide format this single FIS report provides all associated information and data for the entire county area.

As part of this revision, the format of the map panels has changed. Previously, flood hazard information was shown on both FIRMs and Flood Boundary and Floodway Maps (FBFMs). In the new format, all base flood elevations, zone designations, cross sections, and floodplain and floodway boundary delineations are shown on the FIRMs; the FBFM has been eliminated. Some of the flood insurance zone designations were changed to reflect the new format. Areas previously shown as numbered Zone A were revised to Zone AE. Areas previously shown as Zone B were changed to Zone X (shaded). Areas previously shown as Zone C were changed to Zone X (unshaded). In addition, all Flood Insurance Zone Data Tables were removed from the FIS report and all zone designations and reach determinations were removed from the Flood Profiles.

All flood elevations shown in this FIS report and on the FIRM panels were converted from NGVD 29 to NAVD 88. The conversion factor from NGVD to NAVD was calculated on a stream-by-stream basis and ranges from +3.20 to +3.83 feet. Conversion values for each stream are shown in Table 6.

The floodplain boundaries for most flooding sources were digitized from the effective FIRM and

Floodway panels. Aerial photography (Reference 21) and USGS topographic maps (Reference 31) were used to adjust floodplain and floodway boundaries where appropriate.

As part of the countywide update for Umatilla County, the hydrologic and hydraulic analyses of portions of the Umatilla and Walla Walla Rivers, Meacham Creek, and Squaw Creek were reviewed and updated as necessary for inclusion in this study.

In 1998, the USACE, Portland District, conducted a hydrologic analysis of flooding sources within the Umatilla Indian Reservation as part of a flood evaluation study (Reference 10). This study included approximately 26 miles of the Umatilla River upstream of Pendleton, Meacham Creek, and Squaw Creek. This analysis was compared to a more recent hydrologic analysis conducted by the Oregon Water Resources Department (OWRD) in 2006 (Reference 11) to determine if the addition of newer data was sufficient to significantly change the USACE 1998 peak discharge for the 1-percent-annual-chance flood.

Umatilla River discharge from the USACE study was determined using streamflow data from the Pendleton gage (gage No. 14020850), the West Reservation boundary gage (gage No. 14021000), and the gage near Gibbon (gage No. 1402000). Records from these gages were statistically analyzed utilizing the standard log-Pearson Type III distribution (References 7 and 8). The USACE analysis agreed well with the more recent hydrologic analysis conducted by the OWRD and was therefore used.

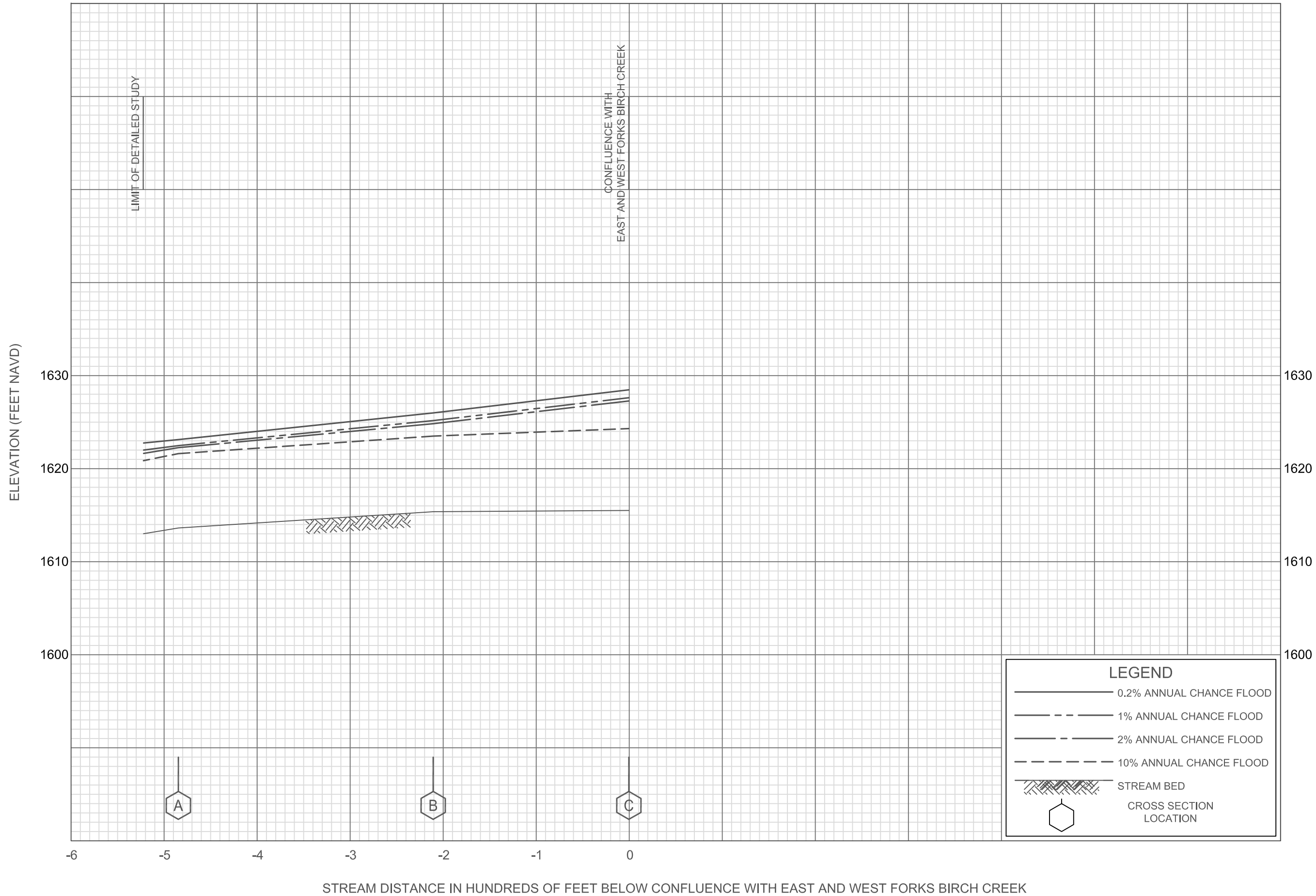
Meacham Creek discharge was determined at the Gibbon gage (gage No. 14020300). Both the USACE and OWRD studies included a flood frequency analysis for the gage (References 10 and 11). Peak discharge for the 1-percent-annual-chance flood from the USACE study was significantly higher than the discharge from the OWRD study. Because the OWRD (Reference 11) study used a longer period of record as well as computed probabilities to estimate the peak discharges, the newer discharges were used in the hydraulic analysis.

No gaging station exists on Squaw Creek. The 1998 USACE (Reference 10) study conducted a direct correlation analysis to establish synthetic flow records for Squaw Creek by transferring observed annual peak discharges for the Gibbon gage (gage No. 14020300). An updated hydrologic analysis was performed using the current regional flood frequency regression equations for the North-Central Region of Eastern Oregon (Reference 11). Because the USACE study used data transferred from a significantly larger drainage basin, discharges developed from the OWRD regional regression equations were used.

Cross sections for the Umatilla River through the Umatilla Indian Reservation, Meacham Creek, and Squaw Creek were developed from the USACE hydraulic model (Reference 10). Additional cross sections were determined using topographic mapping with a contour interval of two feet (Reference 20) and aerial photography (Reference 21). Water-surface elevations for these streams were computed using the USACE HEC-RAS computer program (Reference 26).

In the City of Milton-Freewater, shallow flooding was determined along the Walla Walla River left overbank due to decertification of the levee protecting the city (Reference 27). This flooding has a calculated average depth of one foot. The approximate without-levee analysis for the Walla Walla River was conducted in August 2007 using HEC-RAS (Reference 26).

Approximately 29 miles of the Umatilla River floodplain boundaries were revised using topographic mapping with a contour interval of two feet (Reference 32). The portion of the Umatilla River floodplain redelineation begins 4.4 miles above its mouth and continues 29 miles to a point above the Union Pacific Railroad.



FLOOD PROFILES

BIRCH CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR

AND INCORPORATED AREAS

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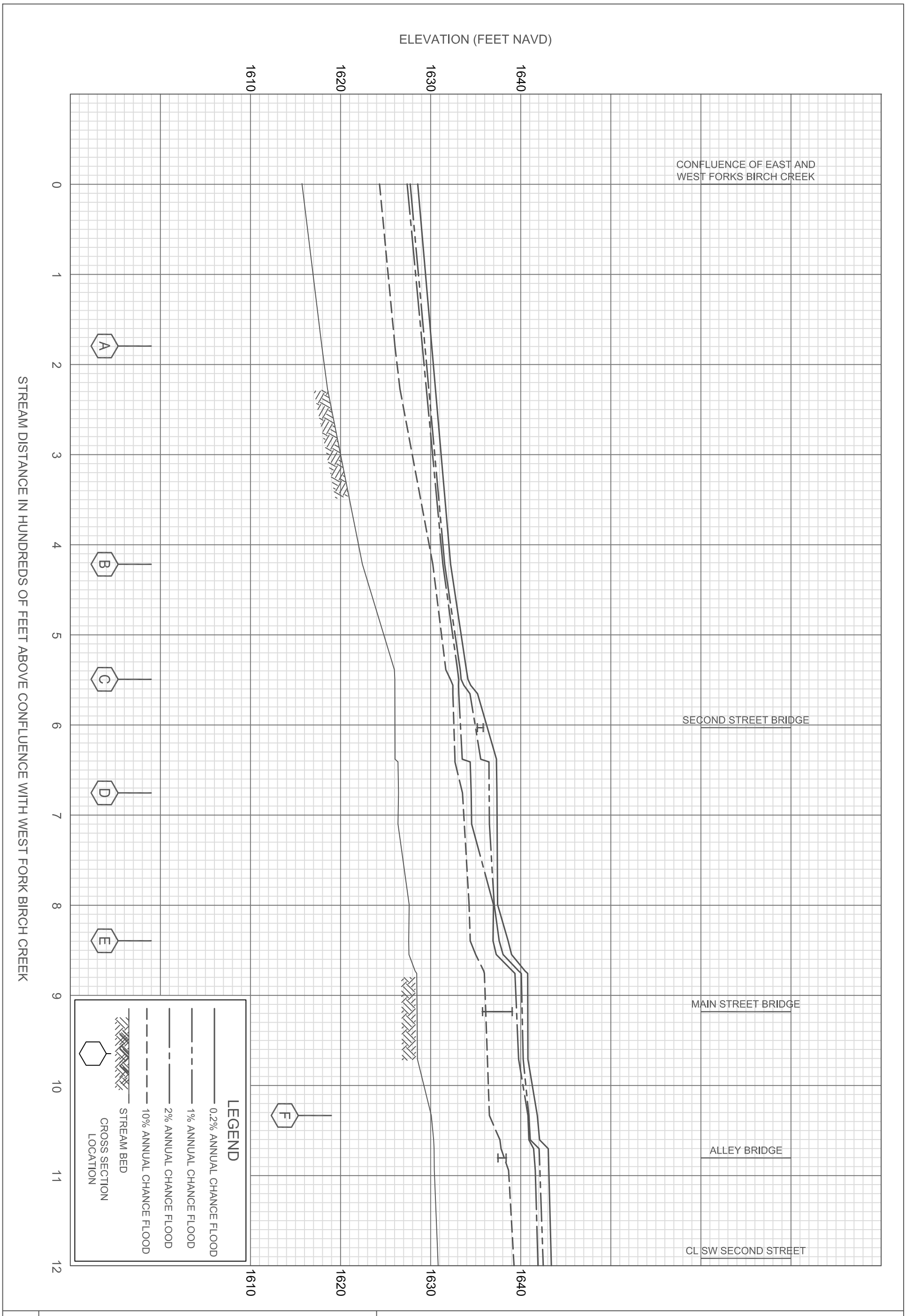

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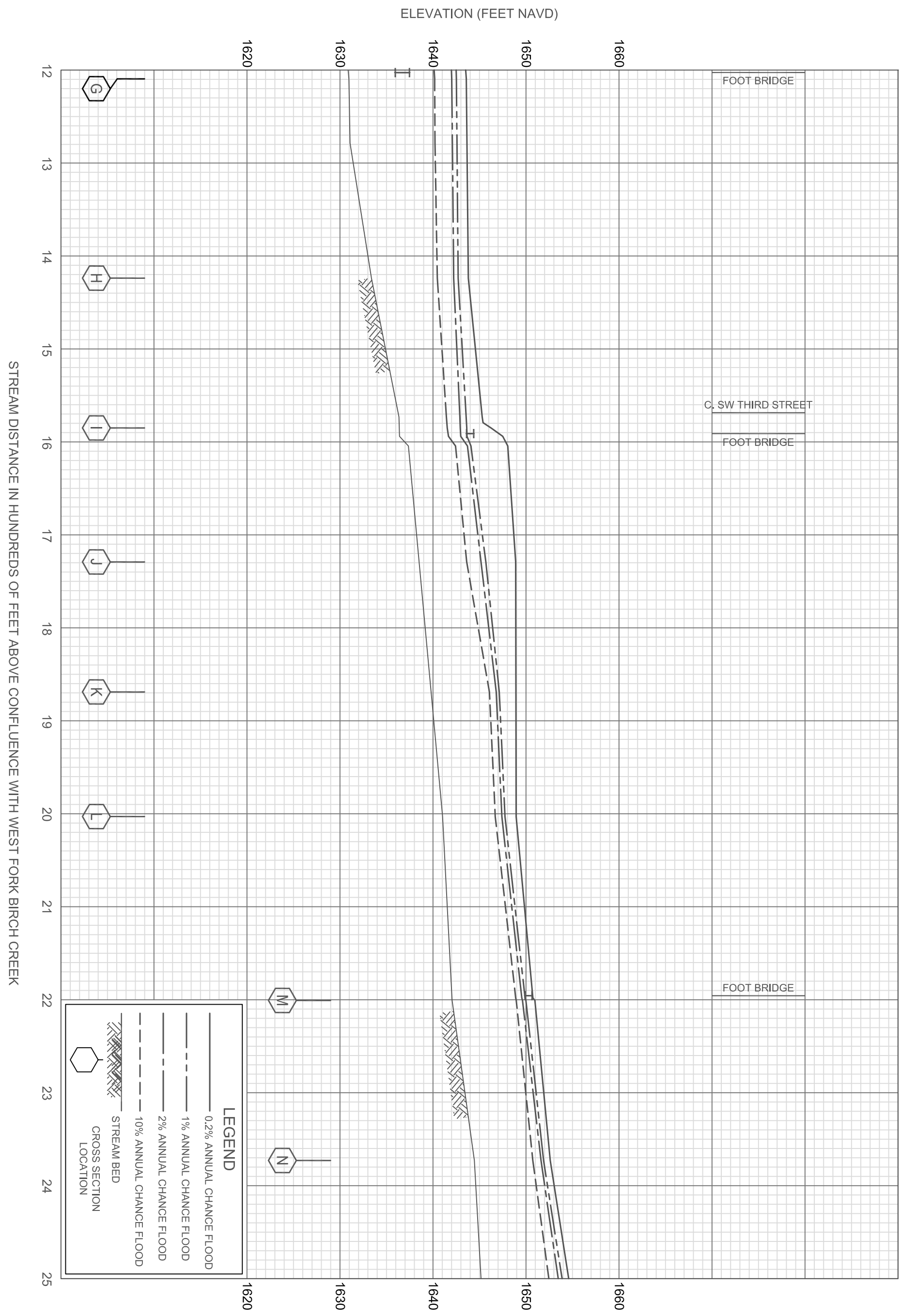
FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR

AND INCORPORATED AREAS

FLOOD PROFILES

EAST FORK BIRCH CREEK



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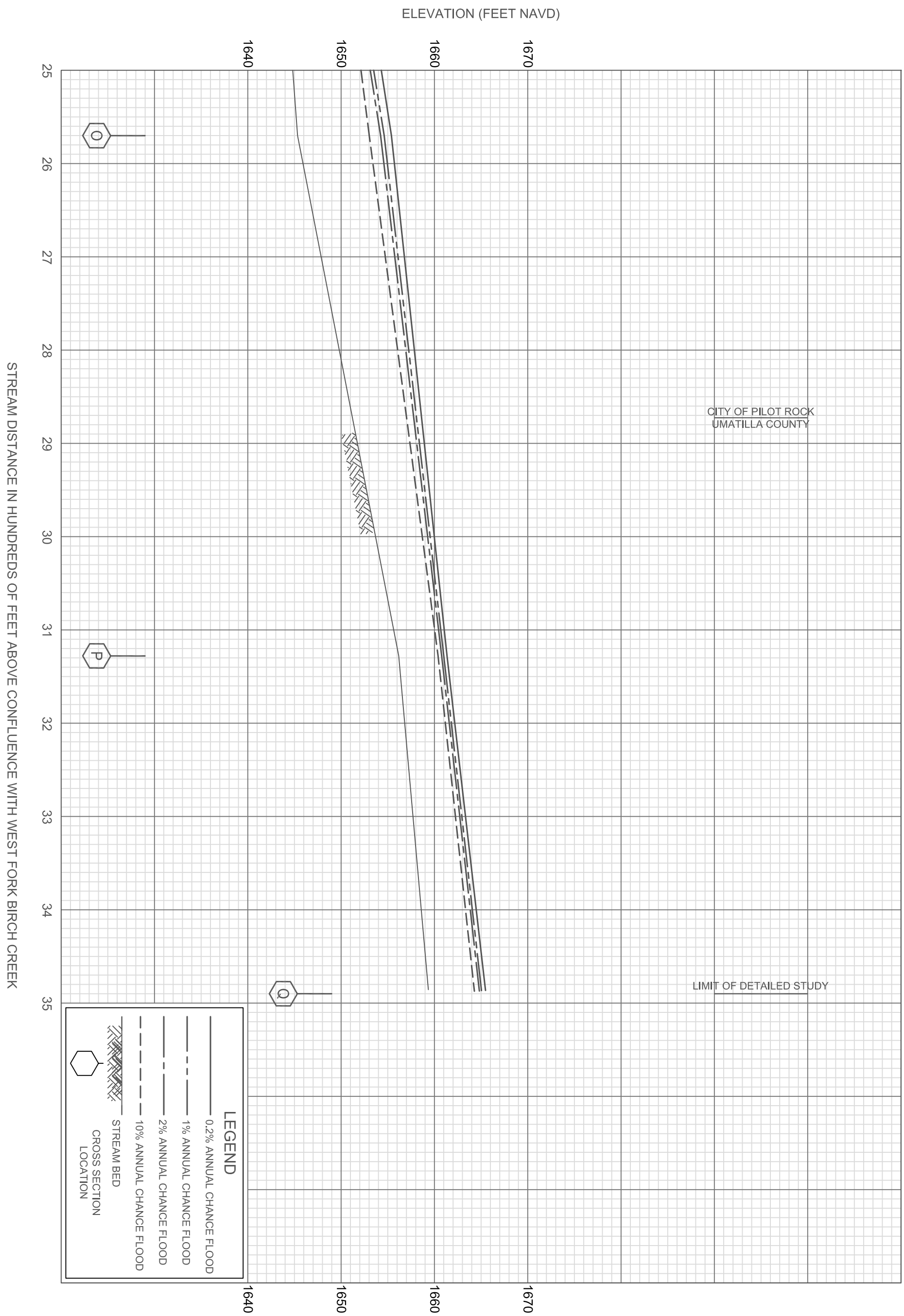
FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR

AND INCORPORATED AREAS

FLOOD PROFILES

EAST FORK BIRCH CREEK



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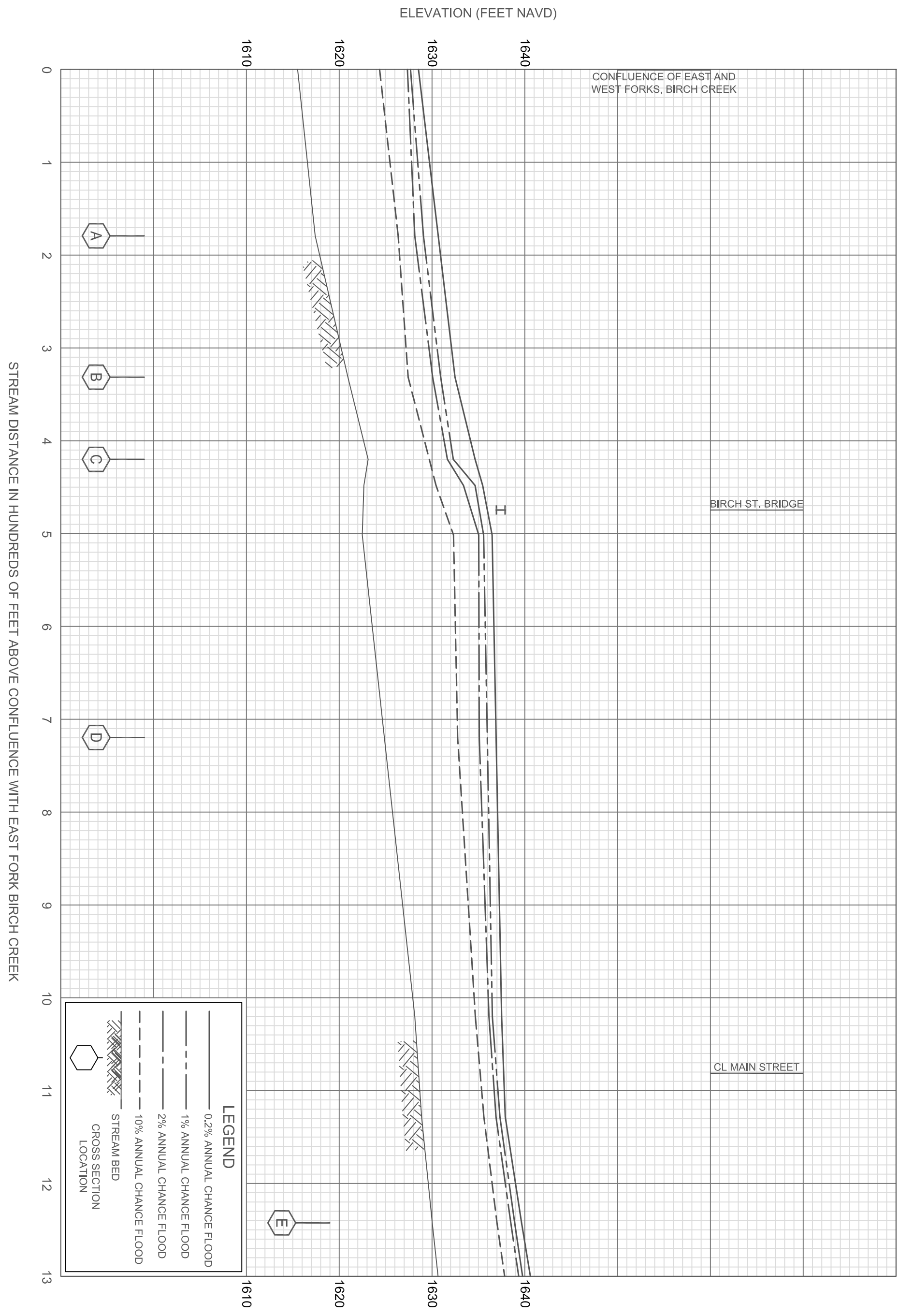
FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR

AND INCORPORATED AREAS

FLOOD PROFILES

EAST FORK BIRCH CREEK



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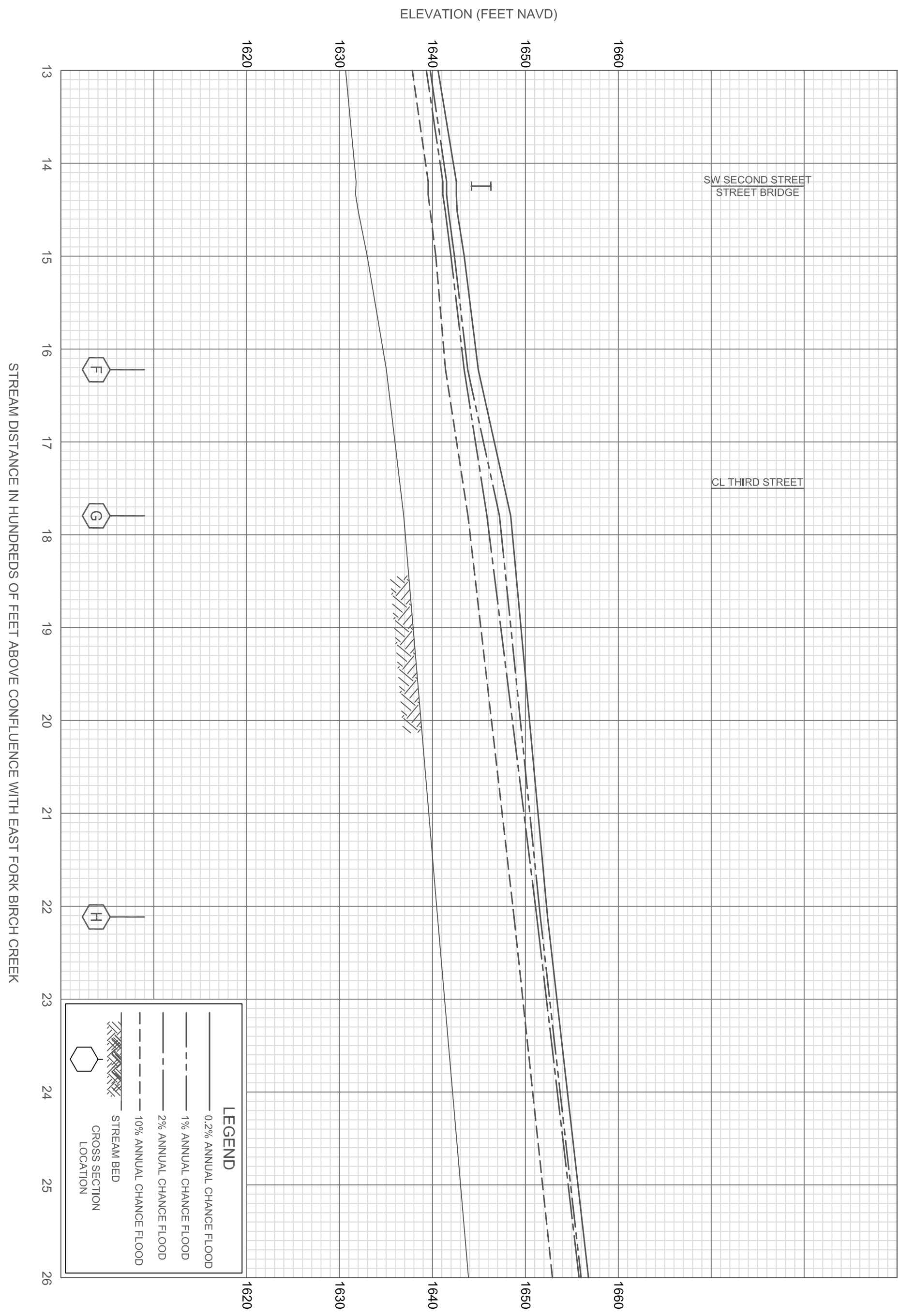
FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR

AND INCORPORATED AREAS

FLOOD PROFILES

WEST FORK BIRCH CREEK



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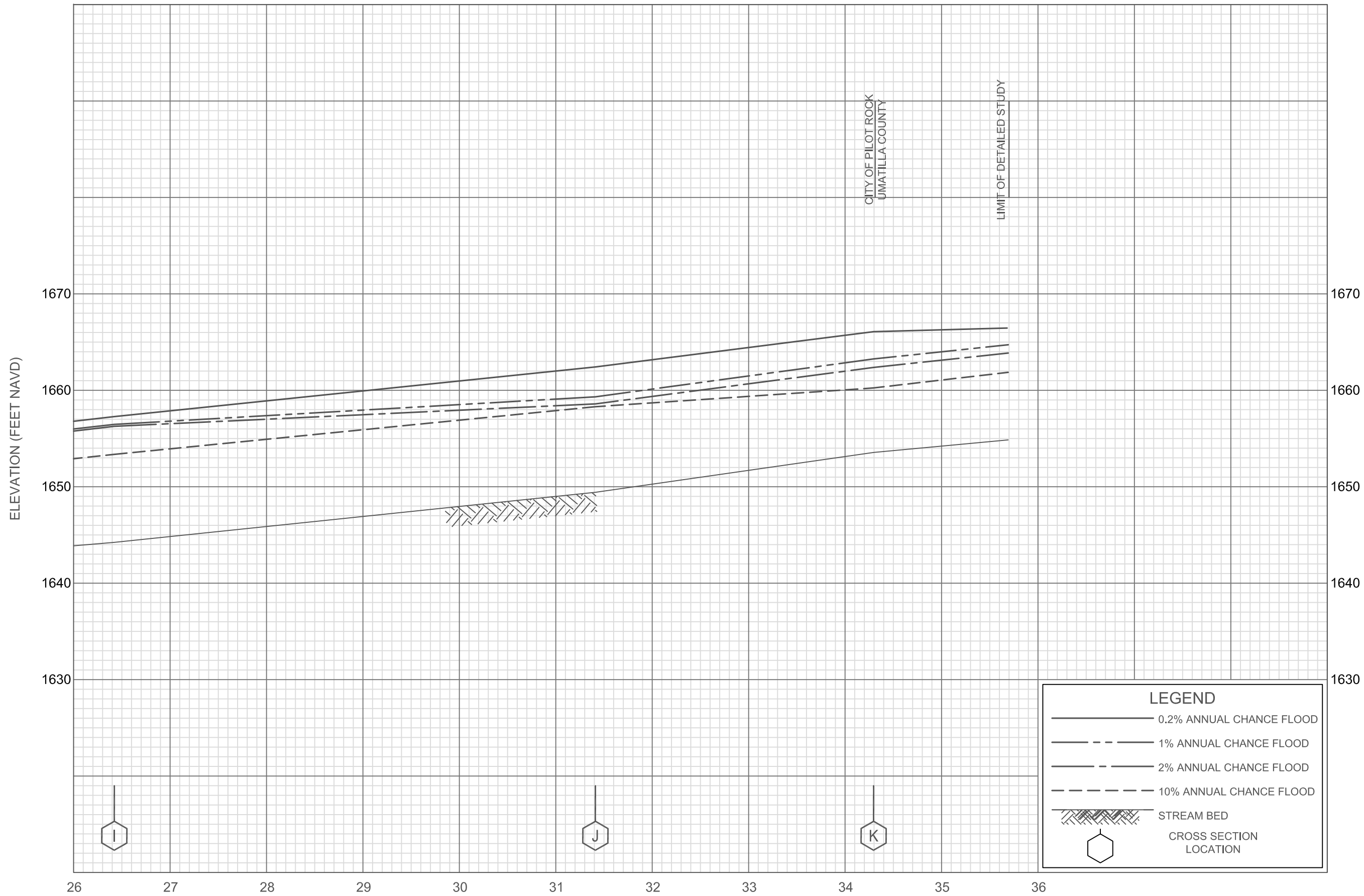
FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR

AND INCORPORATED AREAS

FLOOD PROFILES

WEST FORK BIRCH CREEK



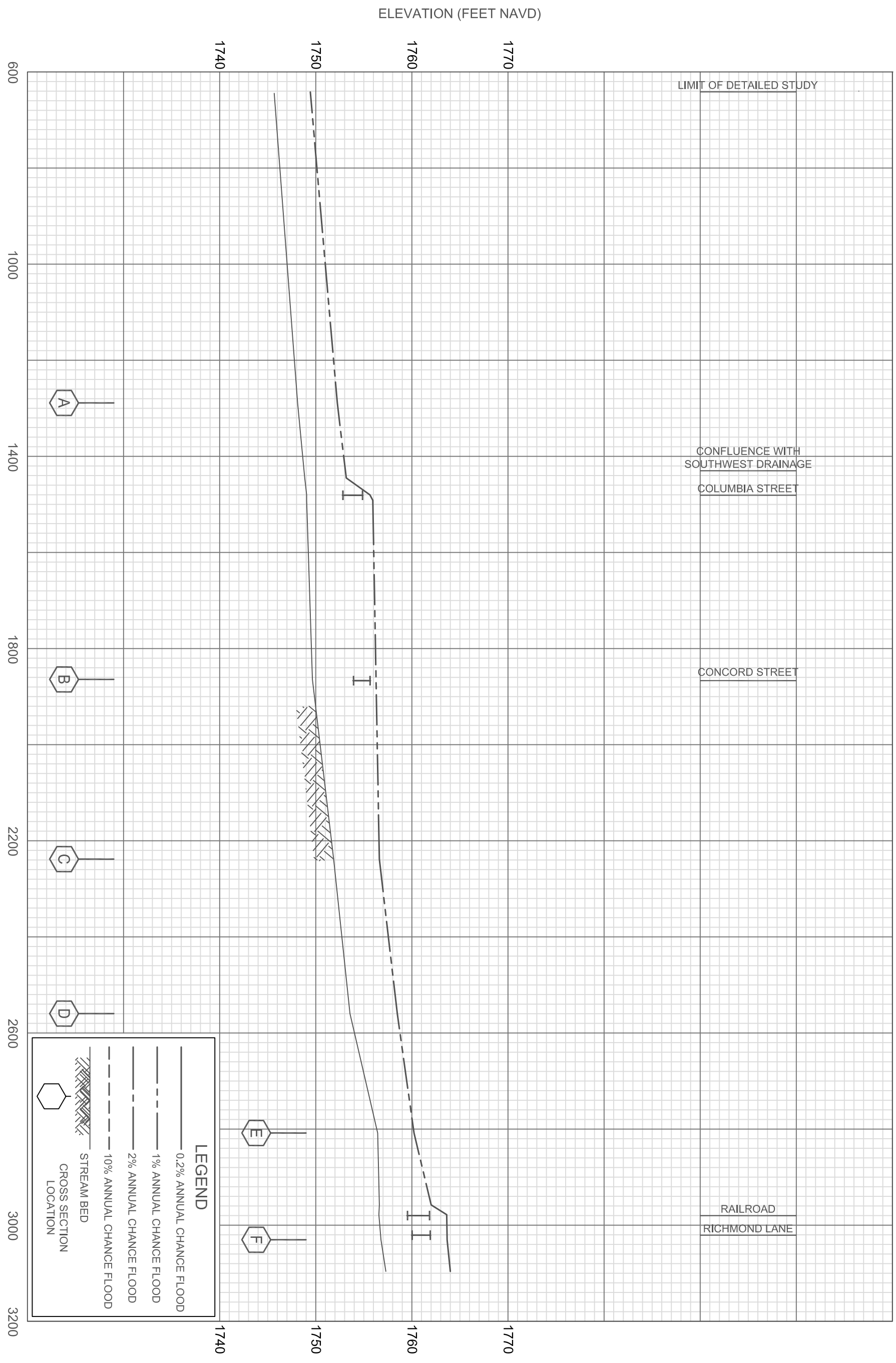
FLOOD PROFILES

WEST FORK BIRCH CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR

AND INCORPORATED AREAS



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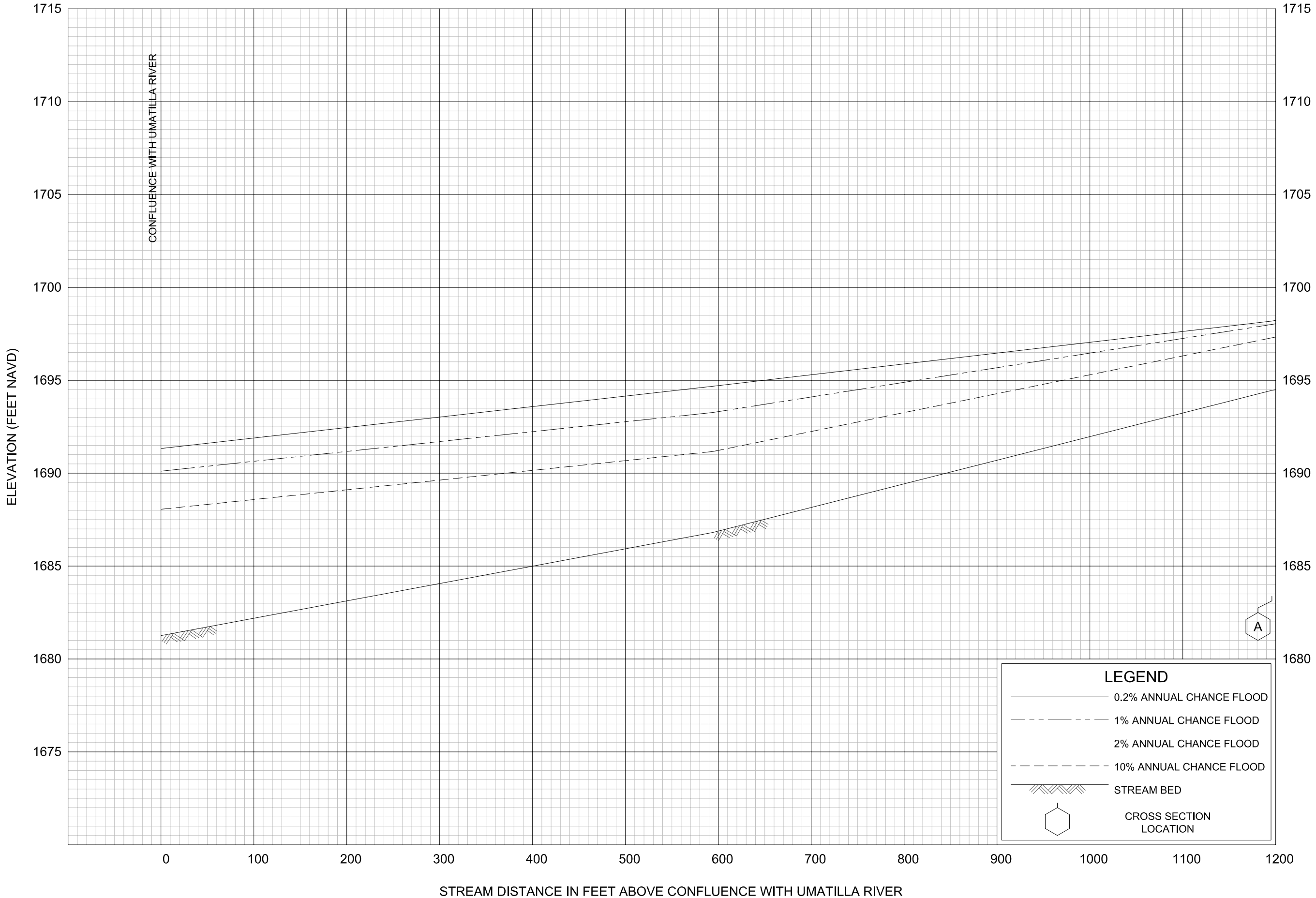
FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR

AND INCORPORATED AREAS

FLOOD PROFILES

GREASEWOOD CREEK



FLOOD PROFILES

ISKUULPA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR

AND INCORPORATED AREAS

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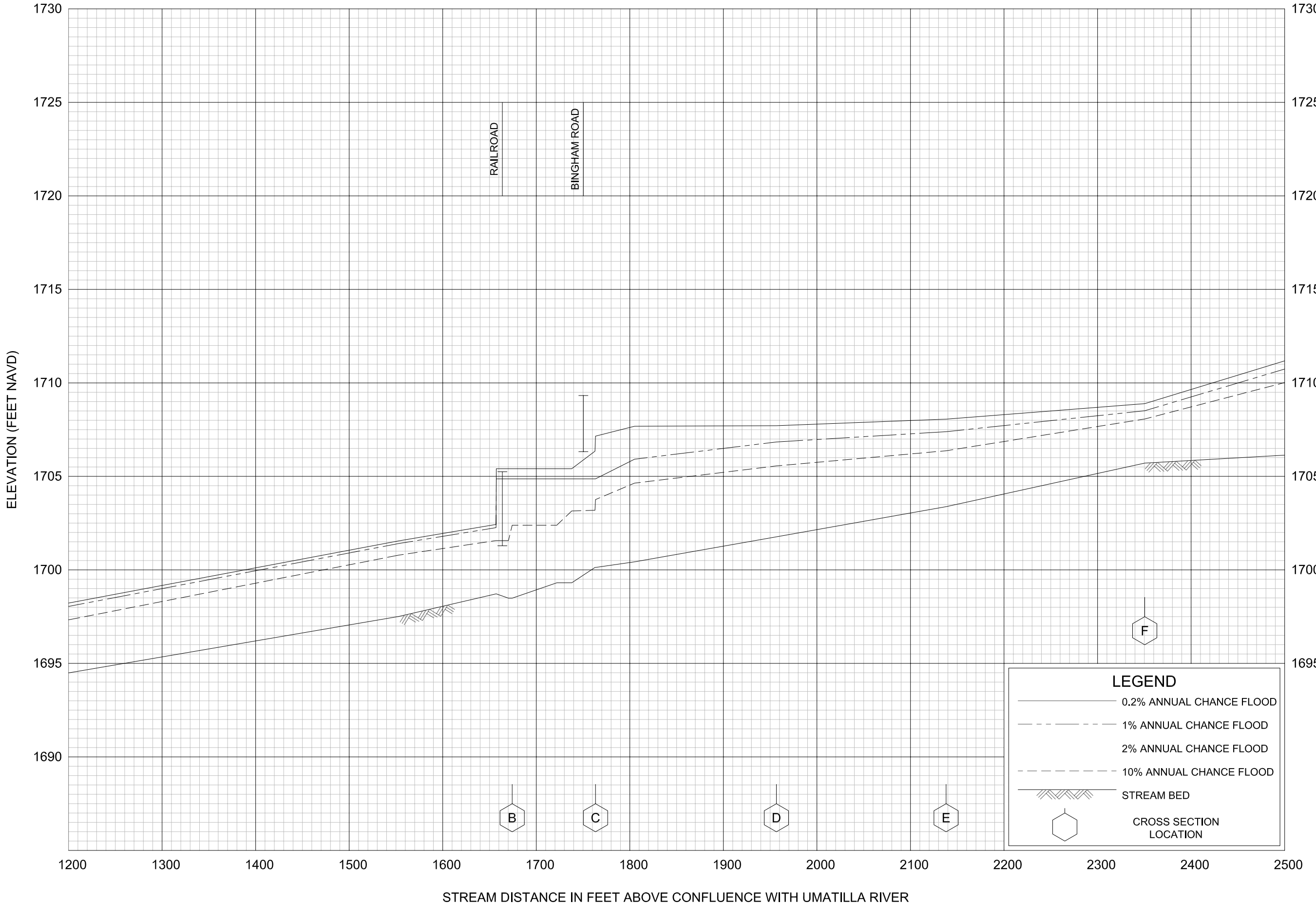


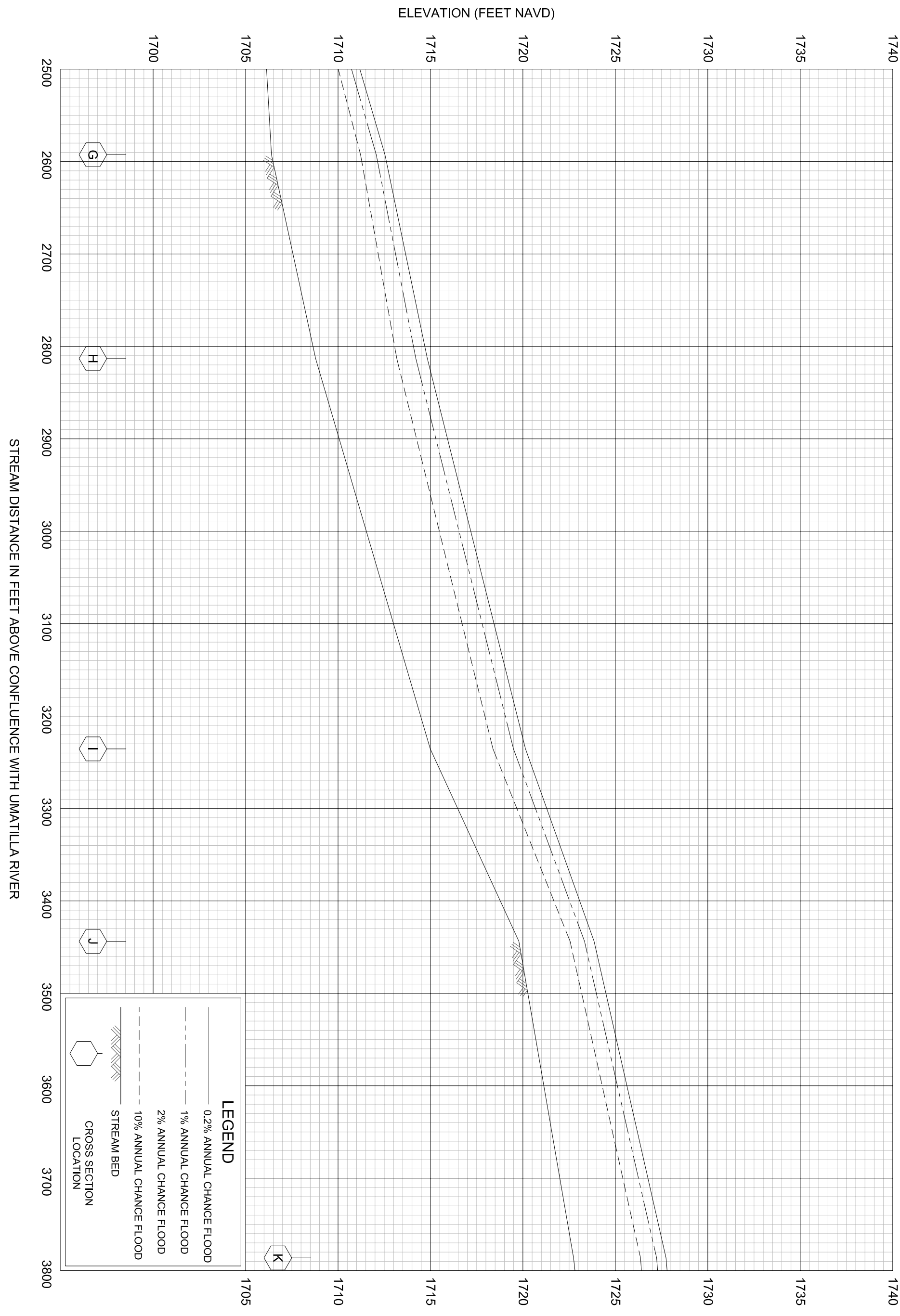
FLOOD PROFILES

ISKUULPA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR

AND INCORPORATED AREAS



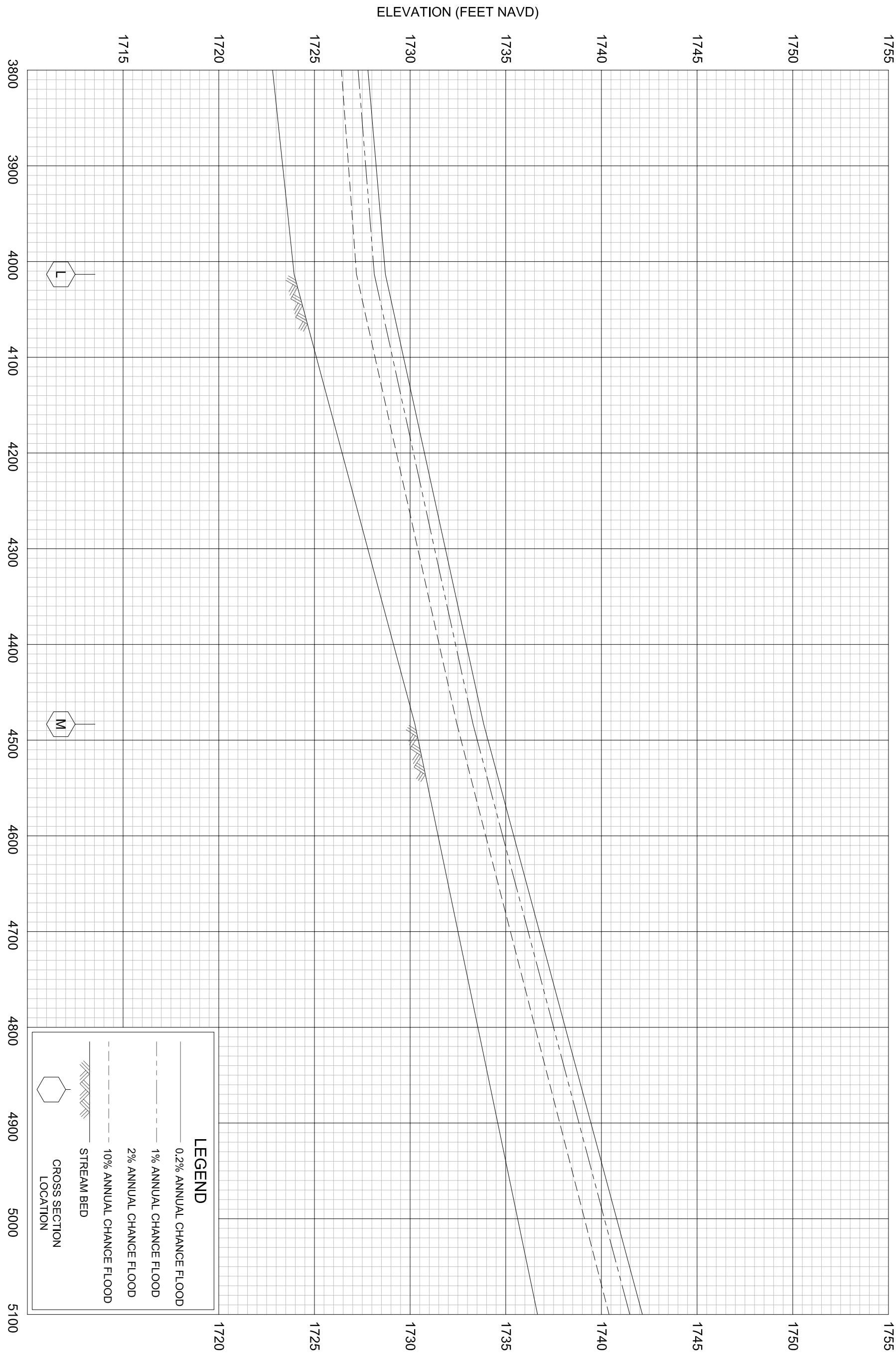
FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR

AND INCORPORATED AREAS

FLOOD PROFILES

ISKUULPA CREEK



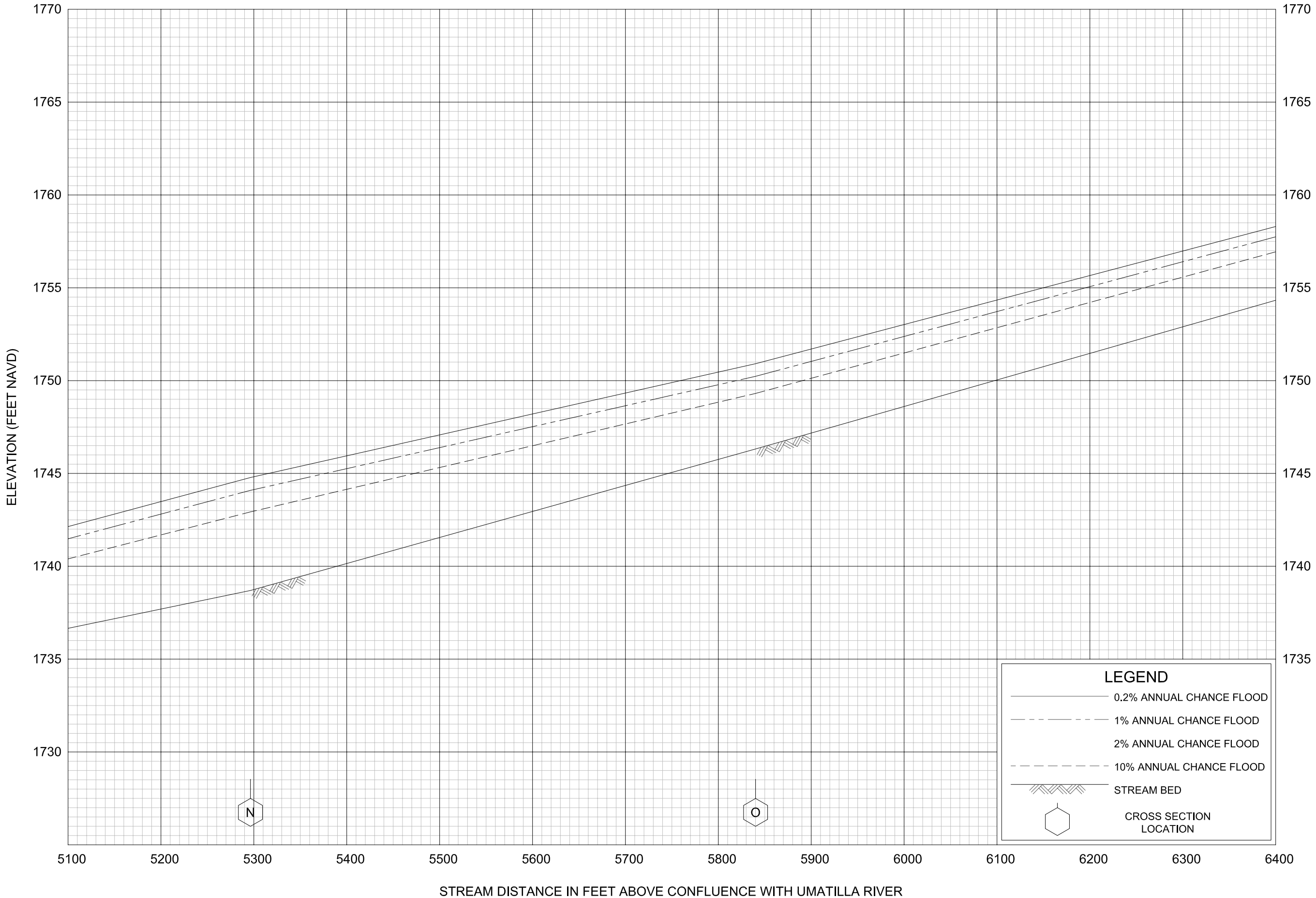
FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR

AND INCORPORATED AREAS

FLOOD PROFILES

ISKUULPA CREEK



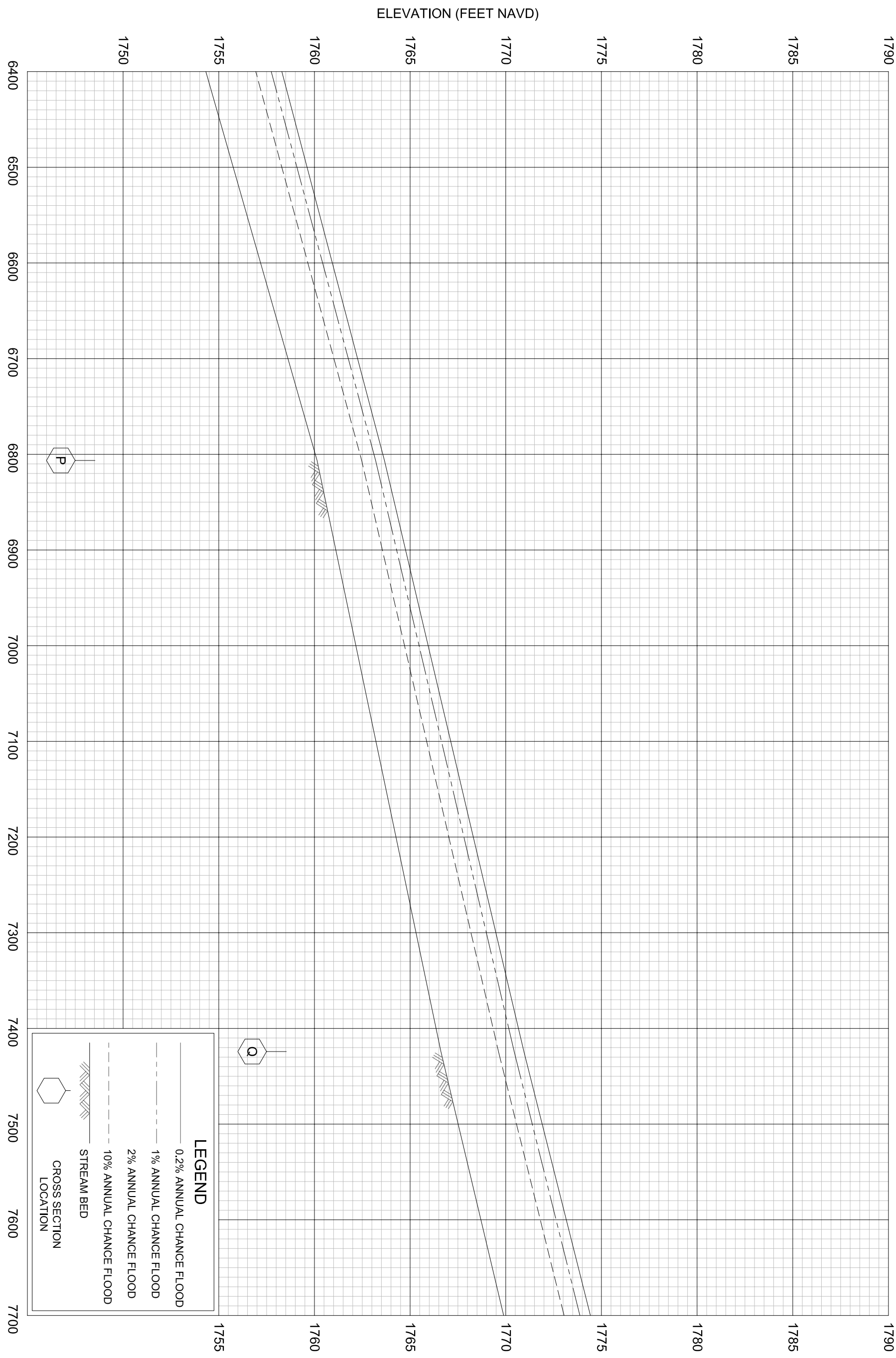
FLOOD PROFILES

ISKUULPA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR

AND INCORPORATED AREAS



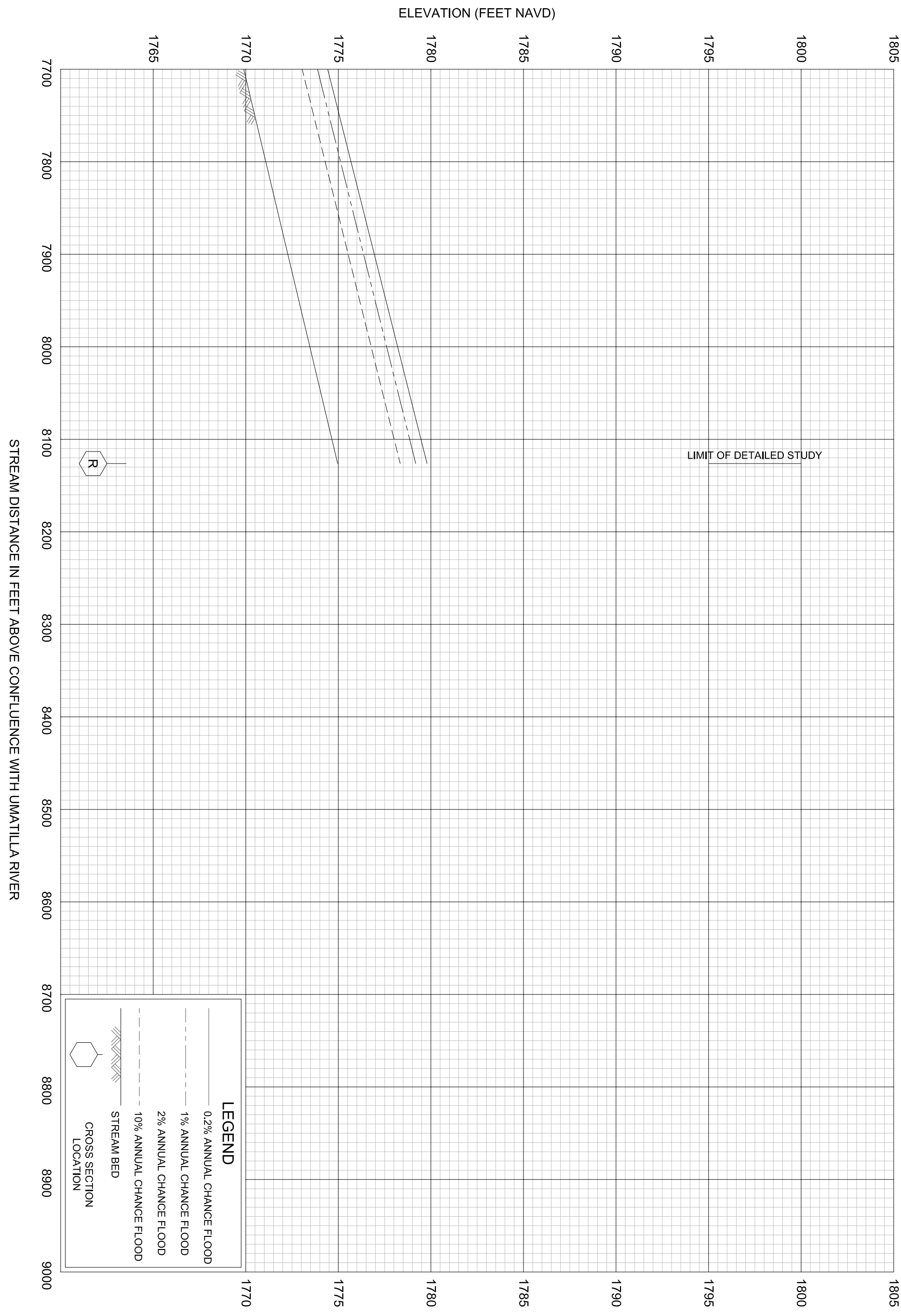
FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR

AND INCORPORATED AREAS

FLOOD PROFILES

ISKUULPA CREEK



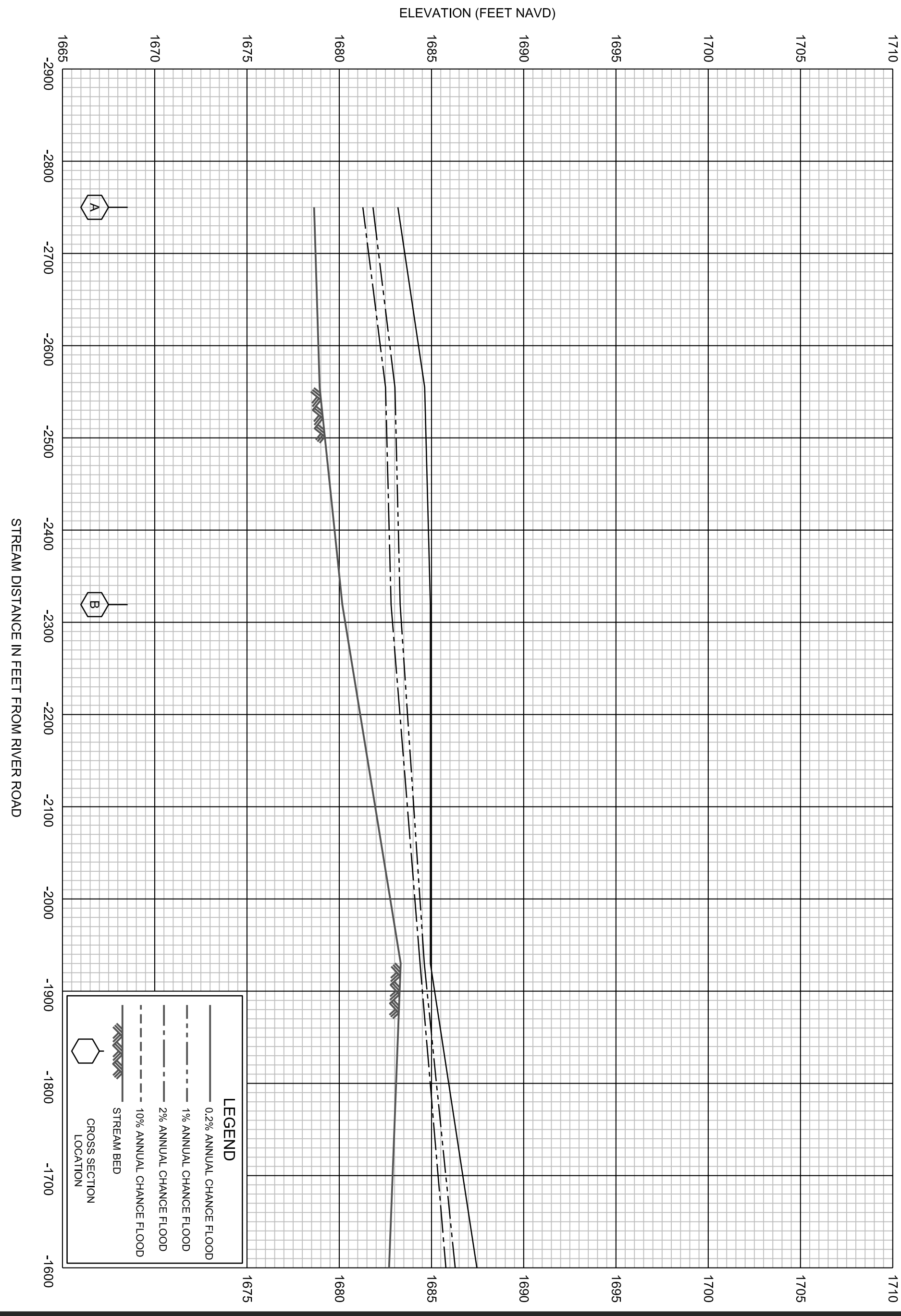
FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR

AND INCORPORATED AREAS

FLOOD PROFILES

ISKUULPA CREEK



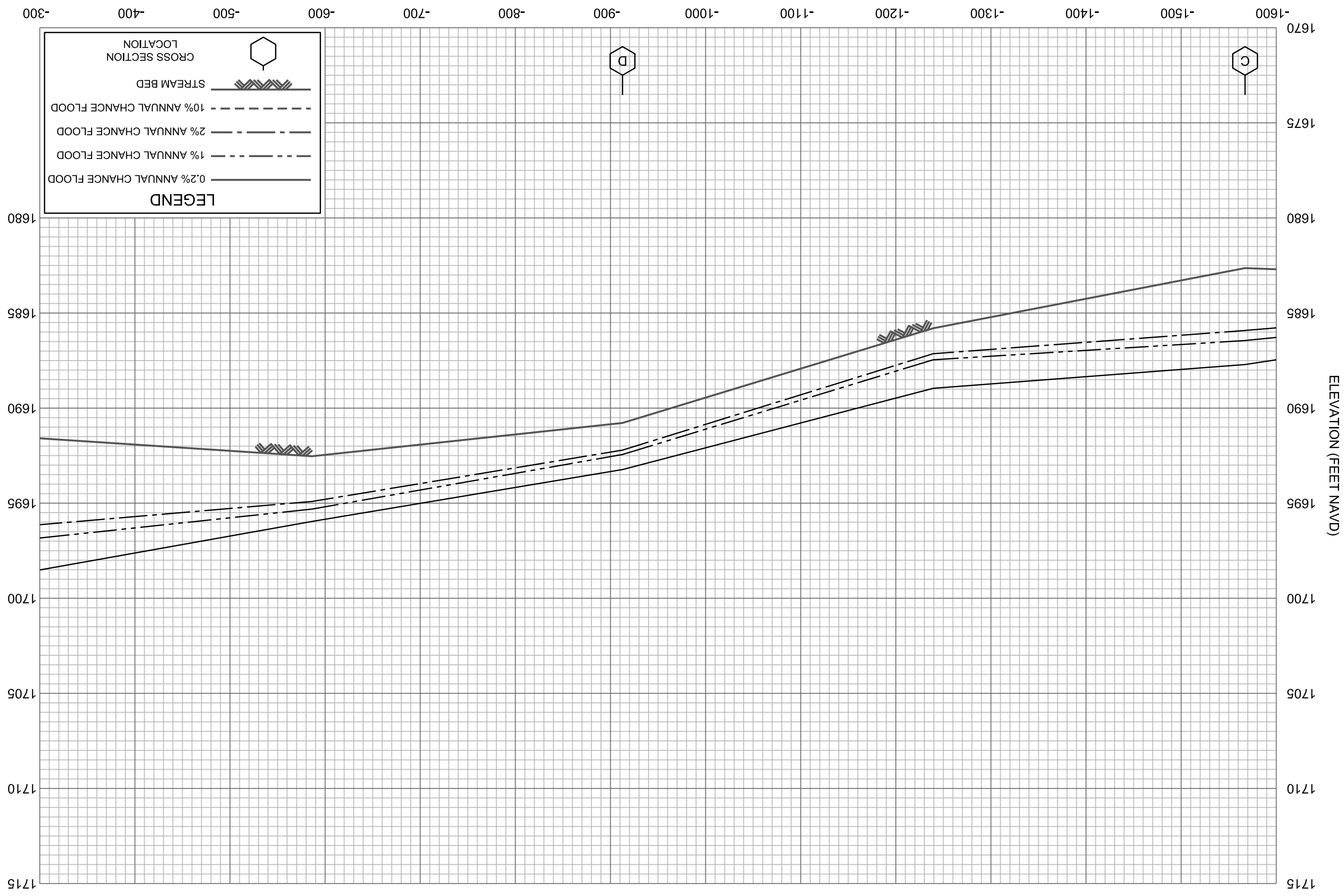
FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR

AND INCORPORATED AREAS

FLOOD PROFILES

ISKUULPA CREEK LEFT OVERBANK SPLIT



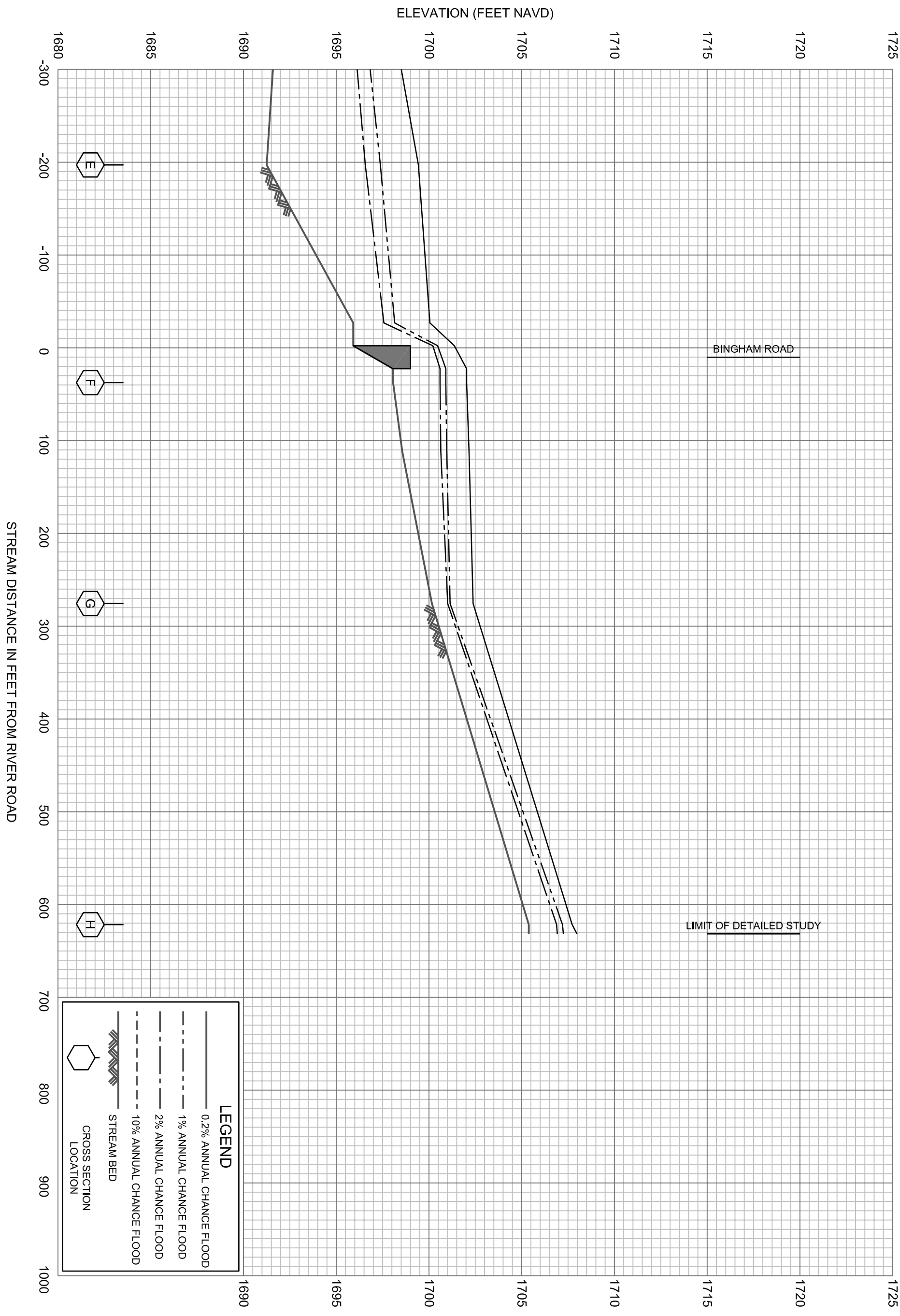
FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR

AND INCORPORATED AREAS

FLOOD PROFILES

ISKUULPA CREEK LEFT OVERBANK SPLIT



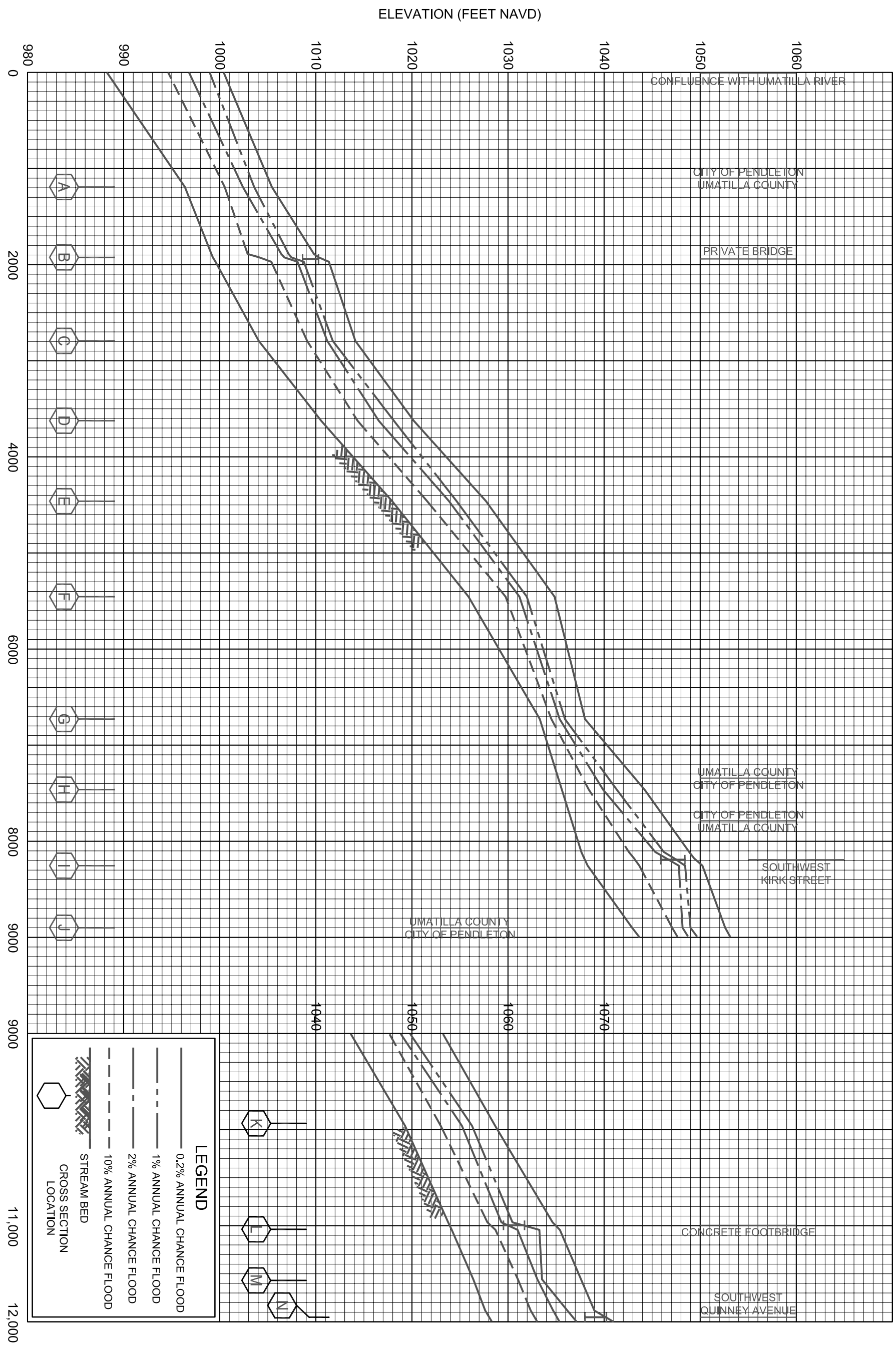
FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR

AND INCORPORATED AREAS

FLOOD PROFILES

ISKUULPA CREEK LEFT OVERBANK SPLIT



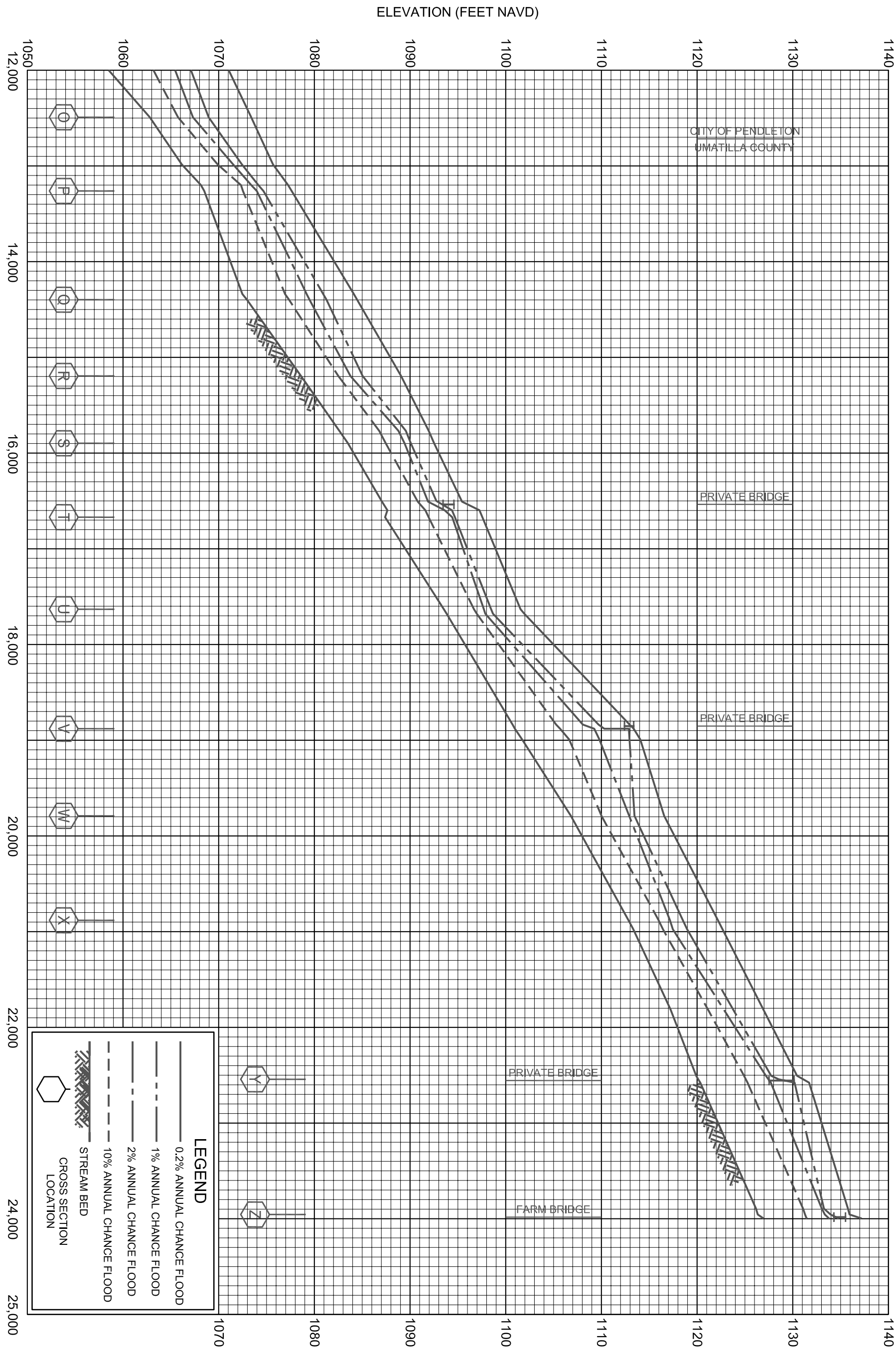
FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR

AND INCORPORATED AREAS

FLOOD PROFILES

McKAY CREEK



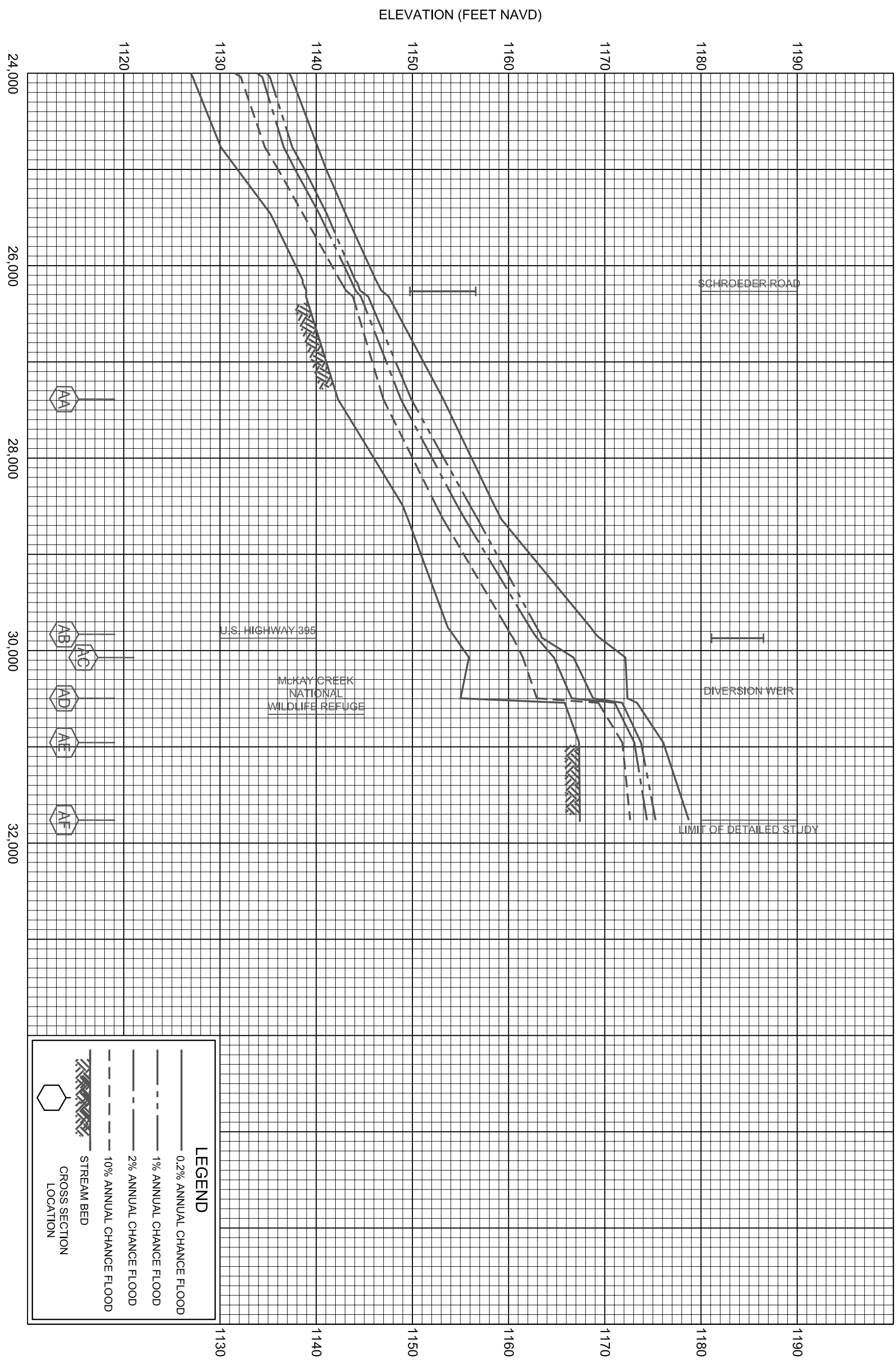
FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR

AND INCORPORATED AREAS

FLOOD PROFILES

McKAY CREEK



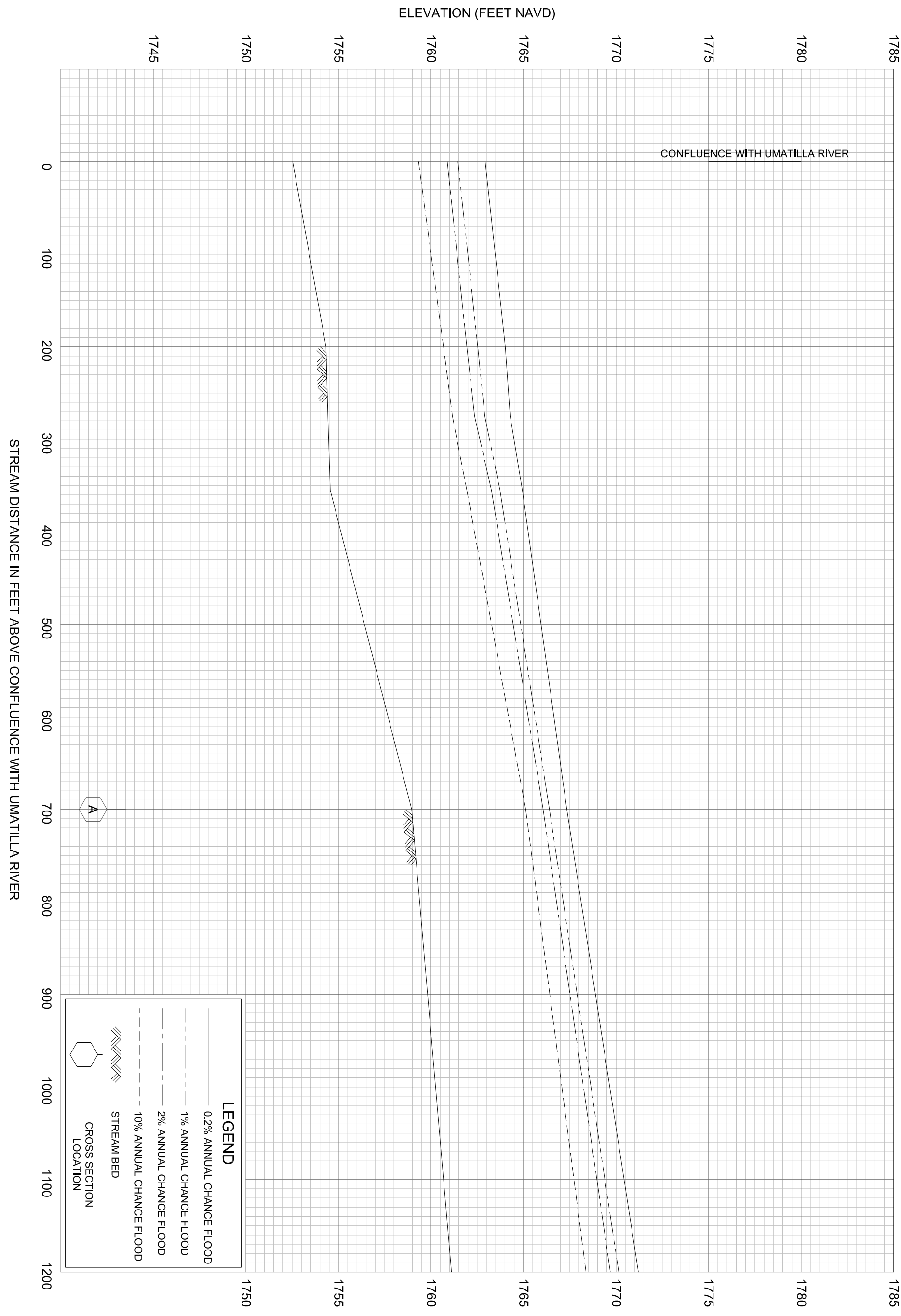
FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR

AND INCORPORATED AREAS

FLOOD PROFILES

McKAY CREEK



22P

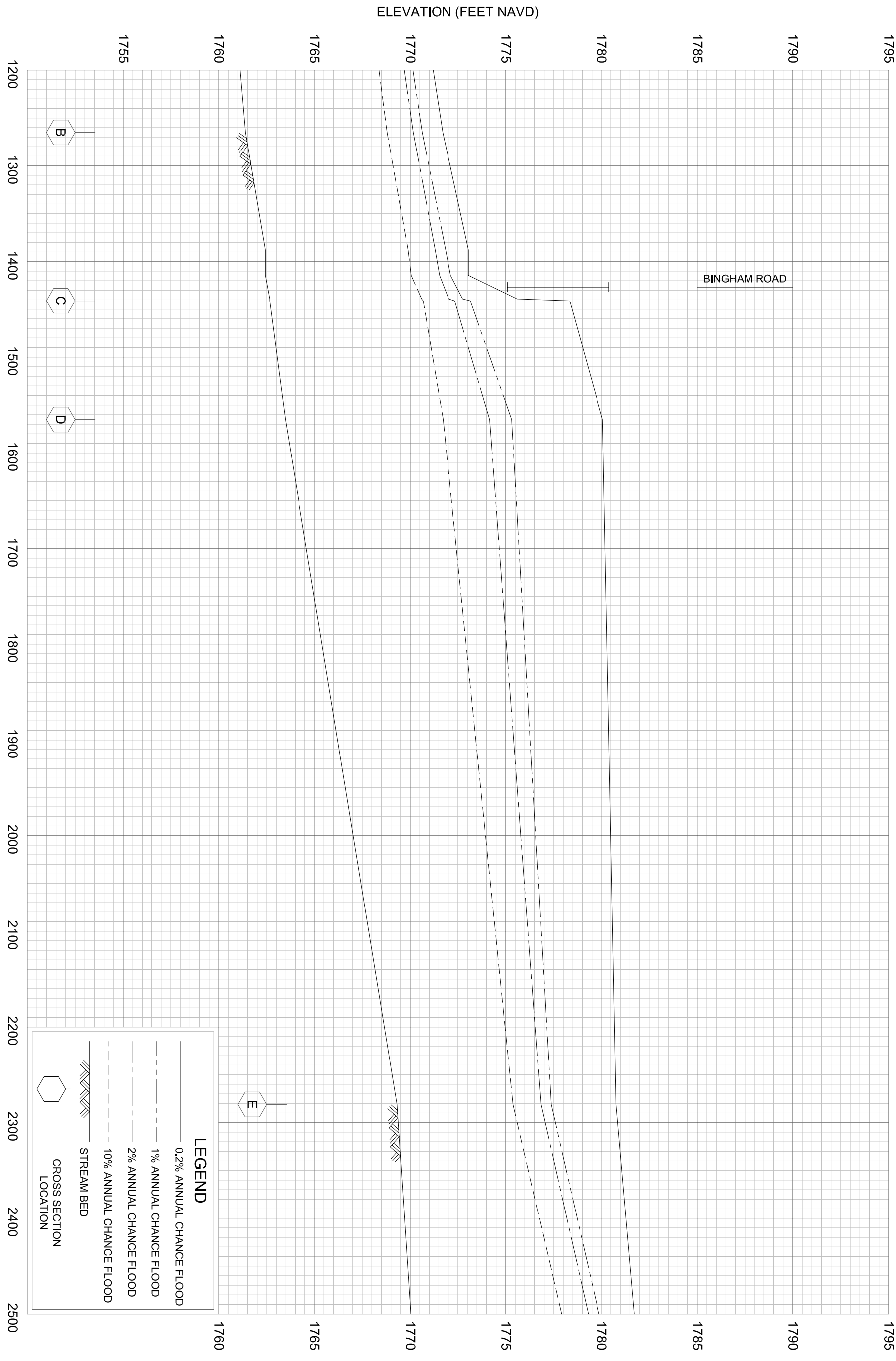
FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR

AND INCORPORATED AREAS

FLOOD PROFILES

MEACHAM CREEK



23P

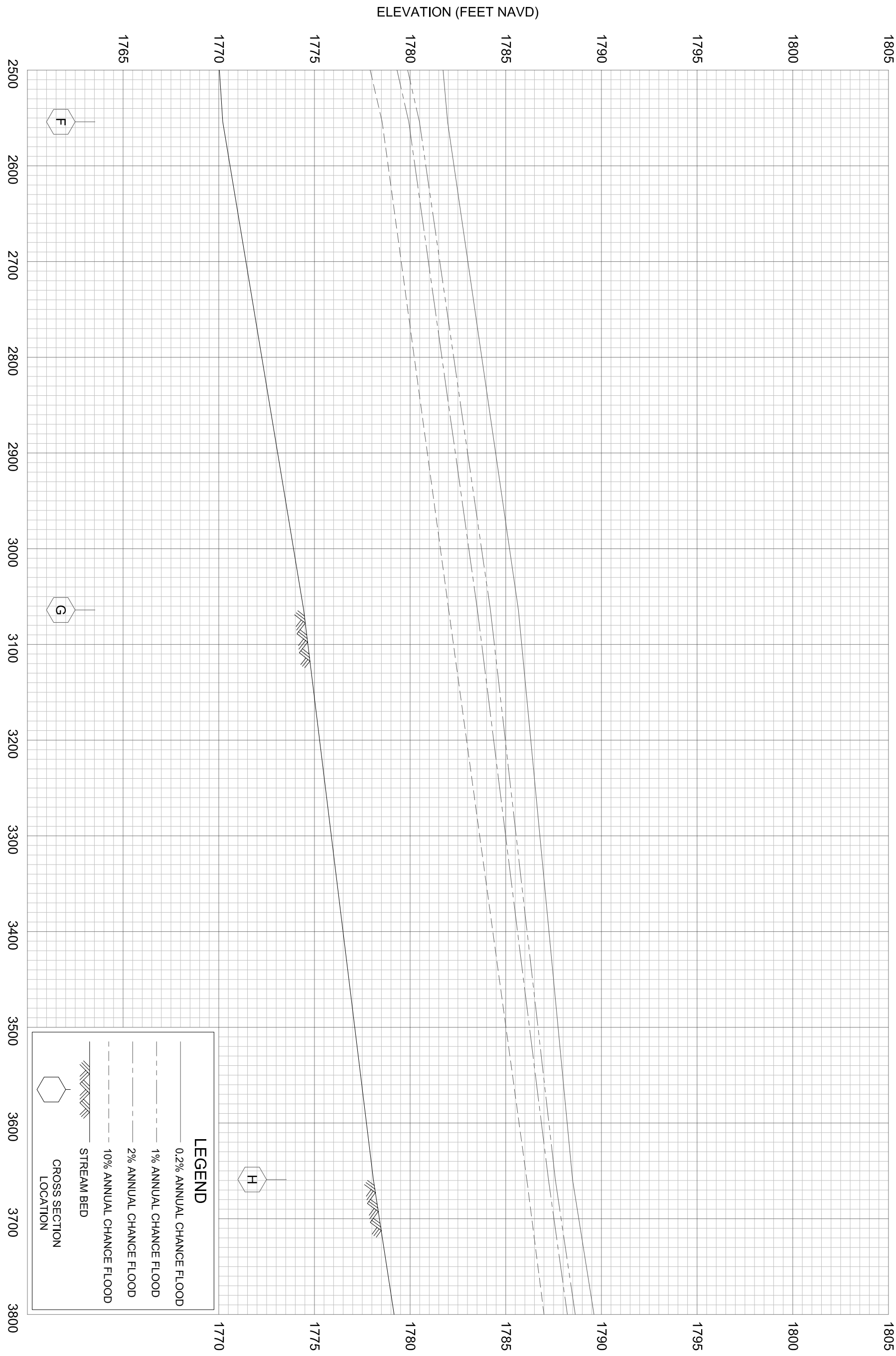
FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR

AND INCORPORATED AREAS

FLOOD PROFILES

MEACHAM CREEK



24P

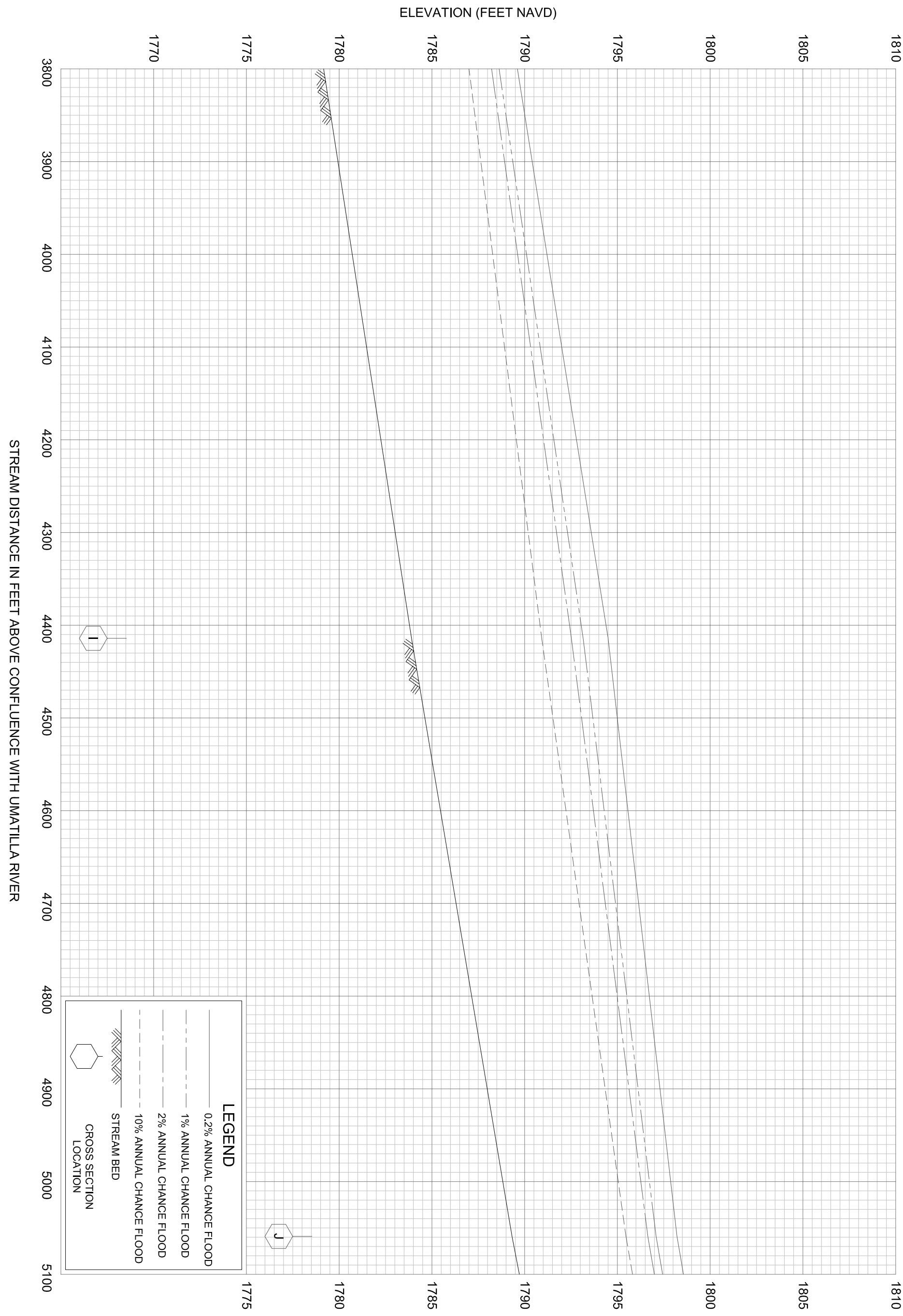
FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR

AND INCORPORATED AREAS

FLOOD PROFILES

MEACHAM CREEK



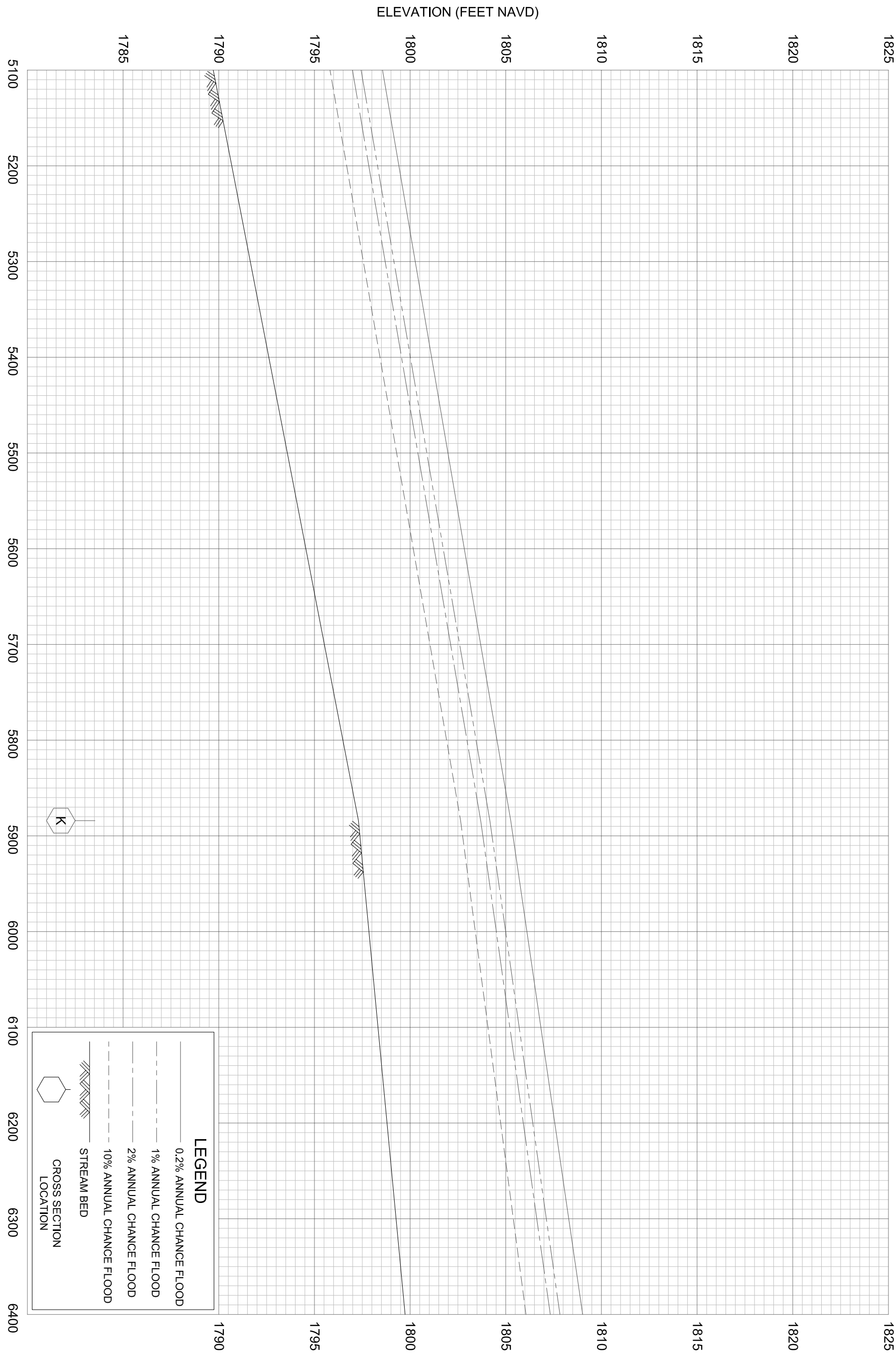
FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR

AND INCORPORATED AREAS

FLOOD PROFILES

MEACHAM CREEK



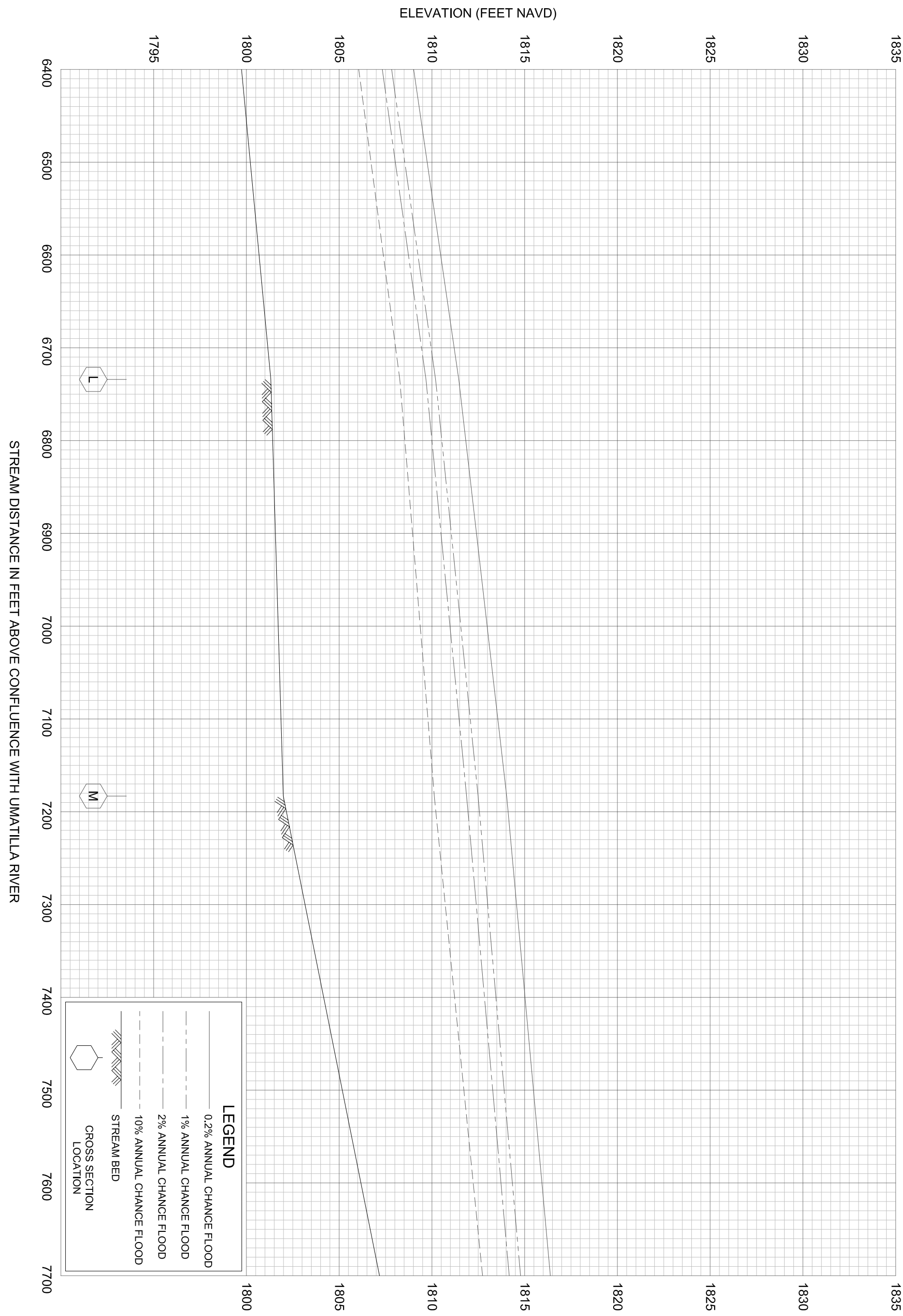
FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR

AND INCORPORATED AREAS

FLOOD PROFILES

MEACHAM CREEK



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UMATILLA COUNTY, OR

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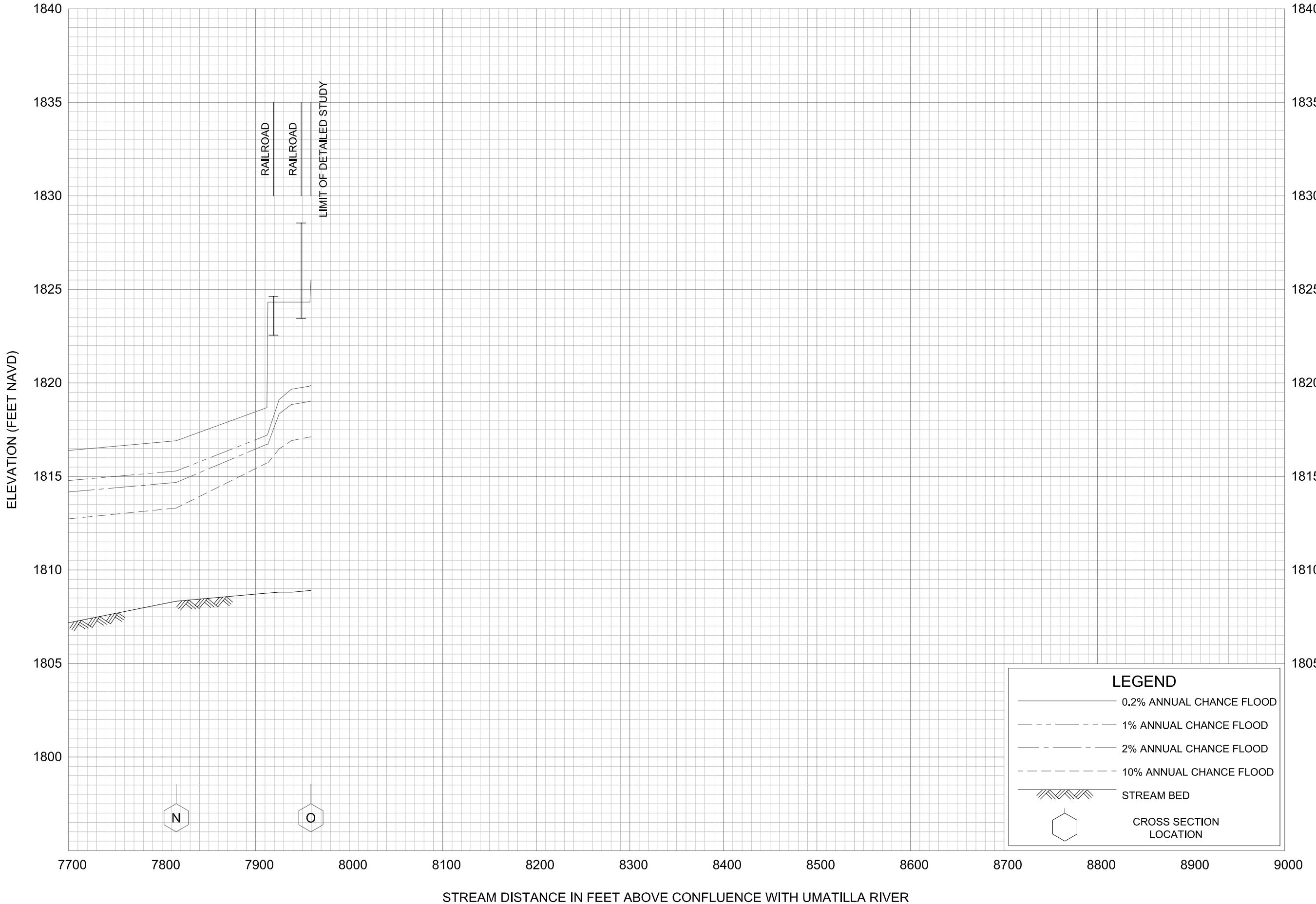
MEACHAM CREEK



FLOOD PROFILES

MEACHAM CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

UMATILLA COUNTY, OR

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