

FLOOD INSURANCE STUDY



LAWRENCE COUNTY, SOUTH DAKOTA AND INCORPORATED AREAS

Community Name	Community Number
CENTRAL CITY, CITY OF	461200
DEADWOOD, CITY OF	460045
LEAD, CITY OF	460190
SPEARFISH, CITY OF	460046
LAWRENCE COUNTY UNINCORPORATED AREAS	460094
*WHITEWOOD, CITY OF	460228

*Non Flood Prone

April 17, 2012



Federal Emergency Management Agency
FLOOD INSURANCE STUDY NUMBER
46081CV000A

NOTICE TO

FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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

Initial FIS Report Effective Date: April 17, 2012 Lawrence County
and Incorporated Areas

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

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

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FLOOD INSURANCE STUDY
LAWRENCE COUNTY and INCORPORATED AREAS, SOUTH DAKOTA

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study revises and updates a previous Flood Insurance Study/Flood Insurance Rate Map for the City of Deadwood, City of Spearfish, and Lawrence County Unincorporated Areas, South Dakota. This information will be used by Lawrence County and Incorporated Areas to update existing floodplain regulations as part of the Regular Phase of the National Flood Insurance Program (NFIP). The City of Whitewood is non-floodprone. The information will also be used by local and regional planners to further promote sound land use and floodplain development.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these federally supported studies are based. In such cases, the more restrictive criteria take precedence, and the State (or other jurisdictional agency) will be able to explain them.

This Flood Insurance Study investigates the existence and severity of flood hazards in Lawrence County and incorporated areas, South Dakota, and aids in the administration of the Nation Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study had developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the communities in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

1.2 Authority and Acknowledgements

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 base map information shown in this study was compiled from State of South Dakota Geographic Information System (GIS) data as well as community GIS resources. Information on the latest State of South Dakota GIS data can be accessed via the internet at <http://www.state.sd.us/gis/> or by telephone at 605-773-4750. The base map information updates the political boundaries and transportation lines throughout the county.

The base map information is current as of September 2006 at a scale of 1:24000. The base map data is based on NAD83 horizontal datum and projected to UTM Z14N.

The hydrologic and hydraulic analyses for the Lawrence County study were performed by Banner Associates, Inc., the Study Contractor, for the Federal Emergency Management Agency (FEMA), under Contract No. EMW-84-C-1633. This work was completed in January 1988.

The hydrologic and hydraulic analyses for the original study in the City of Deadwood were performed by Howard Needles Tammen and Bergendoff for FEMA, under Contract No. A-4548. This work, which was completed in January 1979, covered all significant flooding sources affecting the City of Deadwood, with the exception of Deadwood Creek. The hydrologic and hydraulic analyses required to complete this study were performed by Dames & Moore for FEMA, under Contract No. H-3952. The hydrologic and hydraulic analyses for the revised portion of this study were performed by Banner Associates, Inc., for FEMA under Contract No. EMW-84-C-1633. This work was completed in January 1988.

In October 2003, a hydraulic analysis was prepared for Hungry Hollow Gulch, Ice House Creek, Ice House Creek Tributary A, a portion of Spearfish Creek, and a breakout flow of Spearfish Creek in Spearfish, South Dakota. This work was done by Ellis Consultants, Inc. It was reviewed and modified for NFIP use by FEMA in November 2007.

1.3 Coordination

Community base map selection and the identification of streams requiring detailed study were performed in a meeting attended by personnel of the study contractor, the FEMA, the South Dakota Office of Emergency Management and the affected communities on September 19, 2006 and October 17, 2006 by conference call.

A final community coordination meeting for the countrywide study was held in Deadwood on April 9, 2009. The outcome of the meeting set the effective date for this study.

Lawrence County

On April 10, 1984, a community meeting was held to identify available base and contour maps, existing flood hazard reports, and areas to be studied by detailed and approximate methods in Lawrence County. The meeting was attended by Lawrence County Government officials, FEMA, and the Study Contractor.

Mapping of the extra-territorial area for the City of Spearfish was obtained from the City. Flood prone area mapping of the areas to be studied was obtained from the U.S. Geological Survey.

The final hydrologic determinations were submitted for review to Lawrence County Planning and Zoning, Omaha District of the U.S. Army Corps of Engineers (COE), South Dakota Office of Emergency and Disaster Service, and the South Dakota Department of Transportation.

A meeting was held at the office of Banner Associates, Inc., on April 3, 1987. The purpose of the meeting was to establish if there had been any changes in the corporate limits of any communities within the study area. This meeting was attended by representatives of FEMA, the City of Deadwood, Lawrence County, the City of Spearfish, and the Study Contractor. All identified boundary changes have been incorporated into this study.

On August 11, 1989, the results of the study were reviewed at a final Consultation Coordination Officer meeting attended by representatives of FEMA, the Study Contractor, and Lawrence County.

City of Deadwood

An initial community coordination meeting for the original study in the City of Deadwood was held on May 26, 1977, and attended by officials of the City of Deadwood, representatives of FEMA, and representatives of the study contractor. The selection of the city base map and the identification of streams for detailed and approximate study were completed in this meeting.

Hydrologic determinations were submitted to community officials: the South Dakota State Planning Bureau, the U.S. Soil Conservation Service, and the U.S. Geological Survey (USGS), Water Resources Division.

The final community coordination meeting was held on January 17, 1980, and attended by representatives of FEMA, the study contractor, and the city.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the unincorporated and incorporated areas of Lawrence County, South Dakota. This includes the City of Deadwood, City of Spearfish, City of Lead, and City of Central City.

There are no incorporated areas excluded from this Lawrence County

study. The City of Spearfish Extra-territorial jurisdictional limits are included in this countywide study.

The following streams were studied by detailed methods:

Deadwood Creek

For the original study dated August 3, 1981, from its confluence with Whitewood Creek to a point approximately 490 feet upstream of U.S. Highway 14A, a reach of approximately 3,765 feet.

False Bottom Creek

From a point approximately 6,110 feet downstream of the west bound lane of Interstate 90 at the north section line of Section 18 to a point approximately 320 feet upstream of U.S. Highway 14A, a reach of approximately 6,914 feet.

Higgins Gulch

The original study by detailed methods from the City of Spearfish's extra-territorial boundaries to a point approximately 420 feet upstream of a U.S. Forest Service Road, which is approximately 1.7 miles upstream of the extra-territorial boundaries of the City of Spearfish. In 2003, the previous study was revised from a point approximately 2,406 feet downstream of the county road, which is approximately 13,609 feet downstream of Interstate 90, to the extra-territorial jurisdiction limits of Spearfish, a reach of approximately 36,160 feet. An unnamed tributary was also studied.

Hungry Hollow Gulch

For the previous study dated May 15, 1984, from its confluence with Spearfish Creek to a point approximately 766 feet upstream of St. Joe Avenue, a reach of approximately 2,904 feet.

Ice House Creek

From Grant Street to just upstream of State Street has a reach total distance of approximately 2200 feet.

Ice House Creek Tributary A

From the confluence with Ice House Creek and is a distance of approximately 600 feet upstream.

Riggs Gulch

A Letter of Map Revision was incorporated into this countywide study from Highway 14 to Christensen Drive. Refer to the Summary of Map Action for more information. No floodway was computed for this reach.

Spearfish Creek

For the previous study dated May 15, 1984, from a point approximately 5,386 feet downstream of Nash Street to a point approximately 2,429 feet upstream of Canyon Street, a reach of approximately 13,094 feet. Directly upstream and downstream of this reach, an additional study has been completed which extends these limits of study. The revised reach runs

from a point approximately 1,668 feet downstream of the county road, which is approximately 14,570 feet downstream of the west bound lane of Interstate 90 to a point approximately 2,445 feet upstream of the county road off of alternate U.S. Highway 14, a distance of approximately 41,290 feet. For the 2003 study of Spearfish Creek, the study extended from just downstream of Utah Blvd and to a point approximately 1300 feet upstream of Winterville Drive. Spearfish has a reach distance of approximately 13,500 feet.

Spearfish Creek Breakout Flow

From its confluence with Spearfish Creek to the divergence from Spearfish Creek has a reach total distance of approximately 3,500 feet.

West Chipmunk Gulch

Studied from Oliver Street downstream to the Spearfish Creek confluence.

Whitewood Creek

For the original study dated August 3, 1981, from a point approximately 686 feet downstream of the confluence with Spruce Gulch to a point approximately 1,260 feet downstream of U.S. Highway 85. An additional study has been completed that extends the upstream study limit to a point approximately 360 feet upstream of U.S. Highway 85, a total reach of approximately 19,075 feet.

The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through 1992.

The following streams were studied by approximate methods:

West Strawberry Creek, from its confluence with Whitewood Creek to a point approximately 2,640 feet upstream; Whitewood Creek, from its confluence with West Strawberry Creek to a point approximately 1,320 feet upstream; and Grizzly Gulch, from its confluence with West Strawberry Creek to a point approximately 1,320 feet upstream.

City and Spring Creeks were studied by approximate methods within the corporate limits of the City of Deadwood.

Johnston Gulch was studied by approximate methods from its confluence with Higgins Gulch to a point approximately 2.25 miles upstream.

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

2.2 Community Description

Lawrence County

Lawrence County is located in the northern Black Hills region along the western border of South Dakota. The major population centers are the Cities of Deadwood (the county seat), Lead, and Spearfish.

According to the 1980 census, the population of Lawrence County was 18,339, an increase of 5 percent from its 1970 population of 17,453 (Reference 1).

Central Lawrence County is approximately 45 miles northwest of Rapid City. The recent and projected growth in Lawrence County is occurring in and adjacent to the population centers previously mentioned.

The areas being drained are a limestone plateau and domal uplift of granites that create a radial dendritic drainage pattern. The ridge and slope soils in areas of granite and metamorphic parent materials are relatively shallow, coarse textured, and porous. The more easily transported fines have been deposited on the lower slopes and valley bottoms.

The climate in the study area has more precipitation and average lower temperatures than the surrounding plains, but the extremes in precipitation and temperature are less. The average annual temperature and precipitation are approximately 46° F and 22 inches. The maximum precipitation occurs as rain in the spring and early summer. The prevailing winds are westerly, averaging 4.8 miles per hour (Reference 2).

Forest cover is the dominant vegetation with ponderosa pine trees being the dominant species; however, white spruce trees are more common in stream bottoms. Other common tree species are quaking aspen, paper birch, willow, red osier, dogwood, and water birch. Among the forested areas, there are numerous open meadows, parks, and prairies among which are found true prairie, plains, and Rocky Mountain flora. The narrow stream bottom supports herbaceous cover, with Kentucky bluegrass being a dominant species (Reference 3).

City of Deadwood

The City of Deadwood is located in Lawrence County in the northern Black Hills region along the western border of South Dakota. Deadwood, the county seat, had a 1980 population of 2,035, a decrease of 16 percent from the 1970 population of 2,409 (Reference 1).

Whitewood Creek flows northeasterly through the center of Deadwood in a fairly steep, narrow, rocky streambed. It is a tributary of Belle Fourche River. Deadwood Creek flows easterly from the western corporate limits

of Deadwood to its confluence with Whitewood Creek in the center of the city. There has been no recent floodplain development and none is foreseen because the community has zoning regulations prohibiting development in the floodplain.

Deadwood is in the central crystalline area of an ancient domal uplift of granite. The relief in the drainage basin of Whitewood Creek ranges from 5,630 feet to 4,540 feet in Deadwood. The radial dendretic drainage pattern is related to the physiographic and geologic history. The ridge and slope soils in areas of granite and metamorphic parent materials are relatively shallow, coarse textured, and porous. The more easily transported fines have been deposited on the lower slopes and valley bottoms.

Forest cover is the dominant vegetation, and ponderosa pine is the dominant species. White spruce, however, is dominant in stream bottoms. Other common tree species are quaking aspen, paper birch, willow, red osier dogwood, and water birch. Within the forested areas, numerous open meadows, parks, and "prairies" (including true prairie, plans, and Rocky Mountain floras) are found. The narrow stream bottoms support herbaceous covers, and Kentucky bluegrass is dominant (Reference 3).

Deadwood has more precipitation and lower average temperatures than the surrounding plains. The average annual temperature is approximately 46°F, and the average annual precipitation is approximately 23 inches. The maximum precipitation occurs as rain in May and June. The prevailing winds are westerly and average 4.8 miles per hour (Reference 13).

City of Spearfish

Spearfish is located in north central Lawrence County in the northern Black Hills along the western border of South Dakota. According to the 1980 census, the population of the City of Spearfish was 5,251, an increase of 12.7 percent from its 1970 population of 4,661 (Reference 26). The creeks being studied all flow in a north-to northeasterly direction. The areas being drained are a limestone plateau and domal uplift of granites that create a radial dendritic drainage pattern. The ridge and slope soils in areas of granite and metamorphic parent materials are relatively shallow, coarse textured, and porous. The more easily transported fines have been deposited on the lower slopes and valley bottoms.

The climate in Spearfish has more precipitation and average lower temperatures than the surrounding plains, but the extremes in precipitation and temperature are less. The average annual temperature and precipitation are approximately 46 degrees Fahrenheit and 22 inches, respectively. The maximum precipitation occurs as rain in the spring and

early summer. The prevailing winds are westerly, averaging 4.8 miles per hour.

Forest cover is the dominant vegetation with ponderosa pine trees being the dominant species; however, white spruce trees are more common in stream bottoms. Other common tree species are quaking aspen, paper birch, willow, redosier dogwood, and water birch.

Among the forested areas, there are numerous open meadows, parks, and prairies among which are found true prairie, plains, and Rocky Mountain flora. The narrow stream bottom supports herbaceous cover, with Kentucky bluegrass being a dominant species (Reference 3).

2.3 Principal Flood Problems

Lawrence County

Past flooding on the creeks within Lawrence County indicates that floods are caused by snowmelt in combination with heavy rainfall and by intense thunderstorm precipitation alone. Stream gage recordings show that 90 percent of the peak annual discharges occur during the months of May, June and early July.

The history of flooding and damage potential is characterized by Whitewood Creek, which flows through the City of Deadwood, and Spearfish Creek, which flows through Spearfish.

Significant floods along Whitewood Creek occurred in April 1878, May 1883, June 1890, the springs of 1909 and 1933, and the greatest flood of record, on May 14, 1965. The peak discharge on Whitewood Creek caused by the 1965 flood was 8,030 cubic feet per second (cfs), a discharge greater than the 100-year runoff discharge (Reference 4).

Significant floods along Spearfish Creek occurred on June 5, 1904; May 1933; May 15, 1965; and June 15, 1976. The flood on May 15, 1965 had an estimated discharge of 4,240 cfs, slightly less than the 50-year flood frequency, and caused damage estimated at \$1,322,000 (Reference 5).

Although no principal flood problems have been identified along the study reaches, the potential for flood problems is great if development is allowed to occur in the floodplain. Thus, the information generated by this study will enable Lawrence County and incorporated areas to control the development and prevent future flood damages.

City of Deadwood

Deadwood has a history of flooding, and records indicate that major floods have been the result of snowmelt in combination with heavy rainfall and

by intense thunderstorm precipitation. The combination of intense rainfall, rapid runoff concentration, and steep stream gradients creates the flash-flood conditions that aggravate flood damage and contribute to the probability of loss of life.

The first major flood in Deadwood was recorded in April 1878, but no one was injured. After snowmelt from a record snow pack of more than 4 feet, several buildings were demolished, several mines outside town were flooded, and some bridges were washed out by the ensuing flood (Reference 15). A much more devastating flood occurred in May 1883. Every bridge in Deadwood was washed out, and many valuable structures were undermined and engulfed as Whitewood Creek cut a wide zigzag swath through the heart of the city. This flood was caused by severe rain and late spring snows (Reference 16). In June 1890, another destructive flood, which was caused by a deluge of rain lasting more than 24 hours, occurred. Although none of the bridges in the city were completely washed out, several were very badly damaged because of the velocity of Whitewood Creek, which was estimated at nearly 15 feet per second (Reference 17).

Two major floods also occurred in the springs of 1909 and 1933. During the 1933 flood, a pole plant on the upstream side of Deadwood was flooded, and 40-foot and 60-foot poles were washed downstream. These poles formed a log jam a short distance downstream from the bridge at the intersection of Sherman and Wall streets (Reference 18).

The greatest flood of record occurred on May 14, 1965, when extremely heavy rainfall accelerated snowmelt in the mountain areas around Deadwood. A 32-inch snowfall that preceded the rain by 1 week caused extensive breaking of small trees and tree limbs, which contributed to the heavy debris deposited by floodwaters where the stream gradients flatten. Flooding on Whitewood Creek caused extensive erosion of the channel banks and privately built retaining walls. Nine commercial properties had first-floor flooding and foundation erosion. Three automobiles and a tractor-trailer were lost. Sewer lines, waterlines, a state highway garage, and a county maintenance shop sustained heavy damage. Two railroad bridges fell into the stream, and a street bridge was shifted on its piers. One trailer court was evacuated by a crew from the Homestake Mine Company. Deadwood Creek caused heavy foundation and erosion damage to two commercial properties and privately built retaining walls.

City Creek caused extensive damage to a section of canyon roadway and a bridge. This destruction in Deadwood accounted for part of the total estimated damage along Whitewood Creek of \$116,000 (Reference 5). The rainfall associated with this event measured 6.7 inches in a 24-hour period and caused a peak discharge on Whitewood Creek of 8,030 cubic

feet per second, an event with a recurrence interval of considerably more than 100 years (Reference 5).

City of Spearfish

Significant floods along Spearfish Creek occurred on June 5, 1904; May 1933; May 15, 1965; and June 15, 1976. The flood on May 15, 1965 had an estimated discharge of 4,240 cubic feet per second (cfs), slightly less than the 50-year flood frequency, and caused damages estimated at \$1,322,000 (Reference 5).

2.4 Flood Protection Measures

Lawrence County and incorporated areas currently have no flood protection structures and there are no plans to build any in the future. There are currently six non-classified dams within Lawrence County and incorporated areas but it is believed that these dams are small in size and agricultural in use.

The City of Deadwood has no flood protection structures and has no definite plans to build any in the future. The factors of localized rainfall intensities and localized flash flooding make it economically unfeasible to build structures, except as local protection projects for areas where severe damage has been concentrated.

Culverts enclose a portion of Whitewood Creek in the center of Deadwood, and Deadwood creek, from its confluence with Whitewood Creek to a point 1,000 feet upstream. Both of these culverts are equipped with trash racks at their upstream ends to prevent debris from forming obstacles within the culverts. Neither of the culverts are capable of containing 100-year flooding.

Floodplain management, in the form of zoning laws, prohibits development in the floodplains of Deadwood.

The City of Spearfish currently has no flood protection structures and there are no plans to build any in the future. Floodplain management, in the form of zoning regulations, controls development in the existing floodplain.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail 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 which 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

flood plain management and for flood insurance premium 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 one year are considered. For example, the risk of having a flood which equals or exceeds the 1% annual chance flood (1 percent chance of annual occurrence) in any 50-year period is approximately 40 percent (4 in 10), and for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

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

The flood flows for Higgins Gulch were based on the Black Hills Regional Curve developed by the COE (Reference 6).

The COE analysis was an in-house study for Rapid City, and a specific regional area study of the Black Hills. These base regional data were used in a log-Pearson Type III analysis (Reference 7) to develop specific regional flood discharge-frequency relationships.

Peak discharge-drainage area relationships for Higgins Gulch are shown in Table 1.

The discharge frequency data for Whitewood and Deadwood Creeks were developed using the results of COE hydraulic analysis for Rapid City and specific regional areas of the Black Hills around Rapid City (Reference 20). The base regional data were then used for a log-Pearson Type III analysis (Reference 7) to develop specific regional flood discharge-frequency relationships for each stream studied in detail.

Peak discharge-drainage area relationships for Whitewood and Deadwood Creeks are shown in Table 1.

The flood flows for Spearfish Creek are based on an area versus discharge curve developed from a previous Flood Insurance Study for the City of Spearfish, South Dakota, revised May 15, 1984. For that study the discharge-frequency data for Spearfish Creek were defined using the historical gage data from USGS Gage No. 06431500, Spearfish Creek at Spearfish, South Dakota. The gage is located on the right bank of the

creek in the city park in Spearfish, 500 feet downstream from the fish hatchery and 9.8 miles upstream from the mouth (Reference 26). The period of record of this gage is from October 1946 to the present. Included in the log-Pearson Type III analyses (Reference 7) to develop the specific discharge-frequency data was the use of the regional skew coefficient from the USGS gaging station to form a weighted skew coefficient.

The discharge-frequency data from Higgins Gulch, Hungry Hollow Gulch, and False Bottom Creek were defined using the results of a COE hydraulic analysis for Rapid City and a specific regional area of the Black Hills around Rapid City (Reference 27). This study was a COE in-house study (Reference 5), prepared to check the results of the original Rapid City Flood Plain Information report after the disastrous June 1972 floods. These base regional data were used in a log-Pearson Type III analysis (Reference 7) to develop specific regional flood discharge-frequency relationships.

Peak discharge-drainage area relationships for Spearfish Creek north, Higgins Gulch, False Bottom Creek, and Spearfish Creek South are shown in Table 1.

TABLE 1– SUMMARY OF DISCHARGES

<u>Flooding Source / Location</u>	<u>Drainage Area (Square Miles)</u>	<u>Peak Discharges (Cubic Feet per Second)</u>			
		<u>10-Year</u>	<u>50-Year</u>	<u>100-Year</u>	<u>500-Year</u>
Chipmunk Gulch At Confluence With Spearfish Creek	1.7	90	485	970	4,550
East Chipmunk Gulch At Confluence With West Chipmunk Gulch	0.4	35	210	445	2,300
At King Avenue	0.3	30	180	385	2,050
West Chipmunk Gulch At Confluence With East Chipmunk Gulch	1.2	70	400	820	3,930
Deadwood Creek At upstream corporate limits	8.4	240	1,325	2,475	10,800
False Bottom At Southern Section Line Section 18 T6N, R3E, B.H.M.	14.6	360	1,800	3,420	14,230
At Northern Section Line					

Flooding Source / Location	Drainage Area (Square Miles)	10-Year	Peak Discharges (Cubic Feet per Second)		
			50-Year	100-Year	500-Year
Section 18 T6N, R3E, B.H.M.	15.2	370	1,840	3,490	14,430
Higgins Gulch					
At Southern Section Line					
Section 13 T6N, R1E, B.H.M.	13.3	340	1,700	3,240	13,540
At Confluence With					
Johnson Gulch	21.5	470	2,275	4,285	17,435
At Northern Section Line					
Section 28 T7N, R2E, B.H.M.	26.5	540	2,600	4,870	19,625
Hungry Hollow Gulch					
At Confluence With					
Spearfish Creek	2.7	120	650	1,290	5,920
Ice House Creek – at confluence with Spearfish Creek					
	0.3	74	194	238	488
Spearfish Creek					
At Downstream Study Limit	172.2	1,280	4,510	7,460	22,800
At North City Limits	172.2	1,260	4,450	7,370	22,500
At Northern Section Line					
Section 28 T7N, R2E, B.H.M.	175.0	1,280	4,500	7,500	23,000
At confluence with					
Hungry Hollow Gulch	168.0	1,260	4,450	7,370	22,500
At Northwest ¼, Section 23,					
T6N, R2E, B.H.M.	154.3	1,170	4,000	7,000	21,000
At South City Limits	160.1	1,210	4,110	7,200	22,000
Near Winterville	154.3	1,170	4,000	7,000	21,000
Spring Creek					
At confluence w/ Whitewood Ck	0.5	¹ - -	¹ - -	476	¹ - -
Whitewood Creek					
Southern section Line Section					
27 T5N, R3E, B.H.M.	27.2	540	2,500	4,650	18,000
At upstream corporate limits	29.6	570	2,700	5,030	19,900
At confluence with Deadwood					
Creek	38.4	690	3,260	6,060	23,900
At confluence with City Creek	39.6	720	3,370	6,260	24,700
At confluence with Spruce					
Gulch	40.3	730	3,430	6,380	25,200
At downstream corporate					
limits	43.4	760	3,540	6,560	25,800

Footnote: ¹Data not available

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of streams in the community were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each stream studied in the community. 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.

The hydraulic analysis for this study was based on open channel conditions free of debris and ice. The flood elevations shown on the profiles are, thus, considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail. The conditions shown would be of a minimum flooding situation that could occur under these conditions. Known high-water marks were used to an accuracy of 0.5 foot in the computer analysis.

The October 2003 Ellis hydraulic analysis provided water surface profiles that were developed using HEC-RAS, version 2.2 software. As part of the November 2007 FEMA modifications, these models were updated into HEC-RAS, version 3.1.3 software. All elevations are in reference to the NAVD 88 datum.

Location 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 Flood Insurance Rate Map (FIRM) (Exhibit 2). Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals (Exhibit 1).

Water surface profiles from the original hydraulic analyses were developed using the COE HEC-2 step-backwater model (Reference 8).

Cross sections for the detailed study areas were digitized from aerial photography. Structural geometry and elevation data for all structures were obtained by field survey and supplemented with bridge design plans obtained from the South Dakota Department of Transportation (Reference 9). Cross sections were located at close intervals above and below bridges and culverts in order to compute any significant backwater effects.

Roughness factors (Manning's "n") were determined by inspection in the field at each cross section for both the channel and the floodplain. Roughness values on the streams for the main channel varied from 0.011 to 0.048, and values in the floodplain ranged from 0.011 to 0.100. Values were held constant for all floods. Roughness factors for Deadwood Creek were provided by the South Dakota Department of Transportation, Division of Highways. Manning's "n" values for Whitewood and Deadwood Creeks in the main channel ranged from 0.055 to 0.075, and values in the overbank ranged from 0.070 to 0.180.

Manning's "n" values for the revised portion of Whitewood Creek range from 0.030 to 0.080. Values were held constant for all floods.

The starting water-surface elevation for Higgins Gulch was based on a normal-depth analysis by computer.

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.

For Whitewood Creek, cross section data were obtained by field survey. Structural geometry and elevations data for all structures were obtained by field survey. Cross section data were obtained from topographic maps for Deadwood Creek (Reference 21).

Starting water-surface elevations on Whitewood Creek were based on a normal depth analysis. On Deadwood Creek, the starting water-surface elevation was determined by normal depth calculations for the 10- and 50-year floods. For the 100- and 500-year floods, a starting water-surface elevation was determined using a culvert rating to balance overland and pressure flow. The overland flow depth was determined to be critical at the culvert inlet.

The two large culverts that enclose portions of Deadwood and Whitewood Creeks (Section 2.4) are equipped with trash racks. Analyses of varying percentages of trash rack blockage were made for Whitewood Creek. The results of these analyses indicated that up to a 50-percent blockage would result in only minimal increases in 100-year elevations; therefore, the hydraulic analyses for both streams are based on unobstructed flow.

100-year shallow flooding along Deadwood Creek and Whitewood Creek near their confluence is caused by overflow from the culvert inlets. The depth of this 100-year shallow flooding was determined to be less than 1 foot.

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.

Cross sections for the detailed study areas on Spearfish Creek, Higgins Gulch, and False Bottom Creek were digitized from aerial photography. Cross sections for Hungry Hollow Gulch were obtained by field survey. Structural geometry and elevation data for all structures were obtained by field survey and supplemented with bridge design plans obtained from the South Dakota Department of Transportation (References 29 and 30). Cross Sections were located at close intervals above and below bridges and culverts in order to compute any significant backwater effects.

Cross sections for the detailed study areas on Spearfish Creek, Hungry Hollow, and Ice House Creek were digitized from aerial photography. Cross sections for the Winterville area were obtained by field survey. Structural geometry and elevation data for all structures are from the bridge design plans, obtained from the South Dakota Department of Transportation and supplemented with field survey information.

Roughness factors (Manning's "n") were determined by inspection in the field at each cross section for both the channel and the floodplain on Spearfish creek, Higgins Gulch, and False Bottom Creek. Roughness values for the main channels ranged from .012 to .048, and values in the floodplain ranged from .012 to 0.100. For Hungry Hollow Gulch, the values ranged from 0.020 to 0.075 in the main channel and 0.050 to 0.200 in the floodplain. Values were held constant for all floods.

During the 100- and 500-year floods Interstate Highway 90 causes backwater such that Higgins Gulch and Spearfish Creek floodplains combine. Due to the elevation of Spearfish Creek being lower than Higgins Gulch the overbank flows from Higgins Gulch flow to Spearfish Creek. In addition, a split flow condition occurs between Higgins Gulch and Spearfish Creek, overtopping a low spot on Interstate Highway 90.

3.3 Vertical Datum

All FISs and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum in use for newly created or revised FIS reports and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD29). With the finalization of the North American Vertical Datum of 1988 (NAVD88), many FIS reports and FIRMs are being prepared using NAVD88 as the referenced vertical datum.

All flood elevations shown in this FIS report and on the FIRM are referenced to NAVD88. It is important to note that adjacent communities may be referenced to NGVD29. This may result in differences in base flood elevations across the corporate limits between communities.

As noted above, the elevations shown in the FIS report and on the FIRM for Lawrence County and Incorporated Areas are referenced to NAVD88. Ground, structure, and flood elevations may be compared and/or referenced to NGVD29 by applying a standard conversion factor.

The conversion from NGVD29 to NAVD88 ranged between 1.6 to 2.4 feet for this county. According to Appendix B of the FEMA Guidelines and Specifications, due to the range in conversion factors, a stream by stream conversion factor was established for each flood source studied by detailed methods in the entire county. The elevations shown in the FIS report and on the FIRM were, therefore, converted to NAVD88 using a stream by stream approach in which an average conversion was established for each detailed study stream. The conversion factor for NGVD 29 to NAVD 88 used for each flooding source in the community is listed in Table 2 below:

TABLE 2 – Vertical Datum Conversion Factors – Stream by Stream

Stream	Vertical Datum Conversion Factor
Higgins Gulch	1.83
Spearfish Creek	1.81
False Bottom Creek	1.85
Hungry Hollow Gulch	1.85
Whitewood Creek	1.95
West Chipmunk	1.85
Deadwood Creek	1.97
Spring Creek	1.95
Unnamed Trib to Higgins Gulch	1.76
Riggs Gulch	1.89

The BFEs shown in the FIRM represent whole-foot rounded values. For example, a BFE of 1202.4 will appear as 1202 on the FIRM and 1202.6 will appear as 1203. Therefore, users who wish to convert the elevations in this FIS to NGVD29 should apply the stated conversion factor to elevations shown on the Flood Profiles and supporting data tables in the FIS report, which are shown at a minimum to the nearest 0.1 foot.

For more information on NAVD88, see the publication entitled, *Converting the National Flood Insurance Program to the North American Vertical Datum of 1988* (FEMA Publication FIA-20/June 1992), or contact the Vertical Network Branch, National Geodetic Survey, Coast and Geodetic Survey, National Oceanic and Atmospheric Administration, Rockville, Maryland 20910 (Internet address <http://www.ngs.noaa.gov>).

Qualifying bench marks within a given jurisdiction that are cataloged by the National Geodetic Survey (NGS) and entered into the National Spatial Reference System (NSRS) as First or Second Order Vertical and have a vertical stability classification of A, B, or C are shown and labeled on the FIRM with their 6-character NSRS Permanent Identifier.

Bench marks catalogued by the NGS and entered into the NSRS vary widely in vertical stability classification. NSRS vertical stability classifications are as follows:

- Stability A: Monuments of the most reliable nature, expected to hold position/elevation well (e.g., mounted in bedrock)
- Stability B: Monuments which generally hold their position/elevation well (e.g., concrete bridge abutments)
- Stability C: Monuments which may be affected by surface ground movements (e.g., concrete monument below frost line)
- Stability D: Mark of questionable or unknown vertical stability (e.g., concrete monument above frost line or steel witness post)

To obtain up-to-date elevation information on NGS bench marks shown on the FIRM, please contact the Information Services Branch of the NGS at (301) 713-3242, or visit their website at www.ngs.noaa.gov. Map users should seek verification of non-NGS monument elevations when using these elevations for construction or floodplain management purposes.

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 this FIS report and FIRM for this community. Interested individuals may contact FEMA to access this data.

4.0 FLOOD MANAGEMENT APPLICATIONS

The NFIP encourages state and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 1% annual chance flood elevations and delineations of the 100- and 500-year floodplain boundaries and 1% annual chance floodway to assist communities in developing sound flood plain management measures.

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 purposes of flood plain management measures. 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 in detail, the boundaries of the 100- and 500-year floods have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at scales of 1:2,400, with a contour interval of 2 feet.

The 100- and 500-year floodplain boundaries are shown on the Flood Insurance Rate Map (Exhibit 2). On this map, the 1% annual chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones AE, A, and X); and the 500-year floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100- and 500-year floodplain boundaries are close together, only the 1% 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.

The previously effective delineation of the 1% annual chance floodplain, 0.2% annual chance floodplain, and floodway boundaries in some portions of the study area were taken directly from the Flood Insurance Rate Map and Flood Hazard Boundary Map for Lawrence County, City of Deadwood, City of Spearfish, South Dakota.

On a portion of Whitewood Creek, boundaries between cross sections were interpolated at 100-foot intervals using aerial photographs.

The delineation of the 100-year approximate flood boundary was based on existing mapping for City Creek and Spring Creek (Reference 21).

Approximate 100-year floodplain boundaries in some portions of the study area were taken directly from the Flood Hazard Boundary Map (Reference 23).

For the streams studied by approximate methods, only the 100-year floodplain boundary is shown on the FIRM (Exhibit 2).

The determination of 100-year approximate flooding in Spearfish was based on the Flood Hazard Boundary Map (Reference 32) and topographic maps at a scale of 1:600 with a 1-foot contour interval (Reference 33).

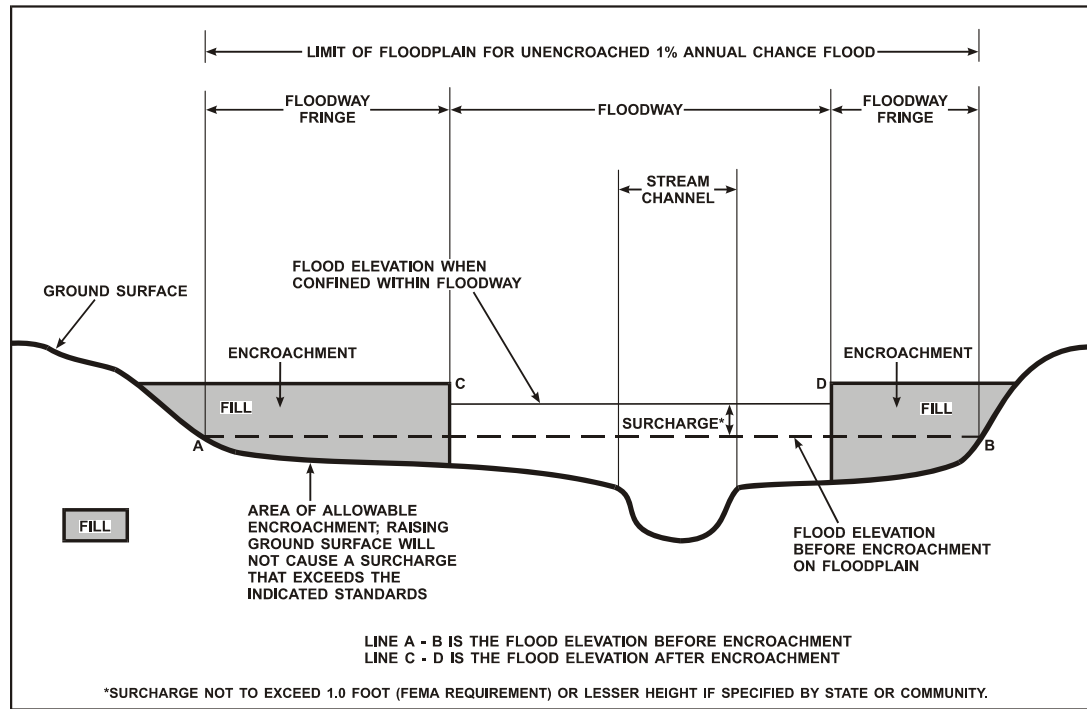
4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces the flood-carrying capacity, increases the 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% annual chance floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of the stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional studies.

The floodways presented in this study were computed for certain stream segments on the basis of equal conveyance reduction from each side of the flood plain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated at selected cross sections (Table 3). In cases where the floodway and the 1% annual chance floodplain boundaries are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and the 1% annual chance floodplain boundaries is termed the floodway fringe. The floodway fringe thus encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 1% annual chance flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 1.

Figure1 - Floodway Schematic



FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
FALSE BOTTOM CREEK								
A	0 ¹	467	776	4.5	3,849.9	3,849.9	3,849.9	0.0
B	1,930 ¹	110	345	10.1	3,868.2	3,868.2	3,868.2	0.0
C	5,440 ¹	360	736	4.6	3,921.2	3,921.2	3,921.2	0.0
D	6,085 ¹	78	438	7.8	3,935.6	3,935.6	3,935.6	0.0
E	6,222 ¹	77	373	9.2	3,936.3	3,936.3	3,936.3	0.0
F	6,604 ¹	85	388	8.8	3,942.4	3,942.4	3,942.4	0.0
G	6,634 ¹	97	578	6.6	3,943.3	3,943.3	3,943.3	0.0
H	6,914 ¹	97	331	10.5	3,946.6	3,946.6	3,947.5	0.9

¹ Feet Above North Section Line of Section 18

T A B L E 3	FEDERAL EMERGENCY MANAGEMENT AGENCY	FLOODWAY DATA
	LAWRENCE COUNTY, SD (And Incorporated Areas)	FALSE BOTTOM CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
HIGGINS GULCH								
A	100	74	232	9.6	3,390.5	3,390.5	3,390.7	0.2
B	2,506	319	1,017	2.2	3,404.3	3,404.3	3,404.7	0.4
C	2,536	154	744	3.0	3,404.3	3,404.3	3,404.6	0.3
D	4,186	52	200	11.2	3,407.7	3,407.7	3,408.3	0.6
E	11,486	1452	797	2.1	3,444.2	3,444.2	3,445.2	1.0
F	14,926	49	159	10.4	3,478.8	3,478.8	3,478.8	0.0
G	16,276	93	265	6.2	3,498.3	3,498.3	3,498.3	0.0
H	16,916	33	141	11.7	3,501.8	3,501.8	3,501.8	0.0
I	17,538	20	117	14.1	3,507.6	3,507.6	3,507.6	0.0
J	17,558	96	484	3.4	3,510.6	3,510.6	3,510.6	0.0
K	19,583	645	635	6.8	3,529.2	3,529.2	3,530.1	0.9
L	21,368	132	444	9.7	3,552.8	3,552.8	3,553.8	1.0
M	21,806	506	1,195	3.6	3,559.9	3,559.9	3,560.8	0.9
N	21,826	326	1,266	3.4	3,560.0	3,560.0	3,560.9	0.9
O	21,911	183	1,534	2.8	3,560.1	3,560.1	3,561.1	1.0
P	23,421	211	492	8.7	3,573.9	3,573.9	3,573.9	0.0
Q	24,376	273	536	8.0	3,596.3	3,596.3	3,597.2	0.9
R	27,526	191	565	7.6	3,647.9	3,647.9	3,647.9	0.0
S	27,556	337	947	4.5	3,648.8	3,648.8	3,648.8	0.0
T	28,366	475	1,331	3.2	3,652.8	3,652.8	3,653.4	0.6
U	28,416	257	545	7.9	3,654.4	3,654.4	3,655.2	0.8
V	29,876	119	433	9.9	3,683.6	3,683.6	3,683.6	0.0
W	30,202	437	1,521	2.8	3,689.1	3,689.1	3,690.1	1.0
X	30,232	160	487	8.8	3,689.5	3,689.5	3,690.5	1.0
Y	31,128	25	201	16.2	3,710.6	3,710.6	3,710.6	0.0
Z	31,158	113	455	7.1	3,714.5	3,714.5	3,714.5	0.0

¹ Feet Above North Extra-territorial Jurisdictional Limits

T A B L E 3	FEDERAL EMERGENCY MANAGEMENT AGENCY	FLOODWAY DATA
	LAWRENCE COUNTY, SD (And Incorporated Areas)	HIGGINS GULCH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
HIGGINS GULCH (cont'd)								
AA	31,453	146	409	7.9	3,717.1	3,717.1	3,718.1	1.0
AB	32,789	56	261	12.4	3,740.8	3,740.8	3,740.8	0.0
AC	35,219	65	315	10.3	3,783.9	3,783.9	3,784.5	0.6
AD	37,269	431	1,109	2.9	3,819.0	3,819.0	3,819.0	0.0
AE	37,329	220	603	5.4	3,819.0	3,819.0	3,819.0	0.0
AF	39,344	92	324	10.0	3,858.0	3,858.0	3,858.6	0.6
AG	41,904	180	463	7.0	3,908.5	3,908.5	3,909.0	0.5
AH	43,524	317	789	4.1	3,941.5	3,941.5	3,941.5	0.0
AI	43,574	250	667	4.9	3,941.5	3,941.5	3,941.5	0.0
AJ	47,604	235	1,013	3.2	4,037.4	4,037.4	4,037.4	0.0
AK	47,734	177	1,046	3.1	4,040.8	4,040.8	4,041.6	0.8
AL	48,004	70	341	9.5	4,043.5	4,043.5	4,044.5	1.0

¹ Feet Above North Extra-territorial Jurisdictional Limits

T A B L E 3	FEDERAL EMERGENCY MANAGEMENT AGENCY	FLOODWAY DATA
	LAWRENCE COUNTY, SD (And Incorporated Areas)	HIGGINS GULCH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION				
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY		WITH FLOODWAY	INCREASE
						FEET (NAVD)			
HUNGRY HOLLOW GULCH									
A	323	87	165	7.8	3,632.0	3,632.0	3,633.0	1.0	
B	875	123	214	6.0	3,652.4	3,652.4	3,653.2	0.7	
C	1,468	80	163	7.9	3,665.0	3,665.0	3,665.9	1.0	
D	1,936	75	201	6.4	3,681.8	3,681.8	3,682.5	0.7	
E	2,608	36	123	10.5	3,699.6	3,699.6	3,699.6	0.0	

¹ Stream distance in feet above confluence with Spearfish Creek

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY
**LAWRENCE COUNTY, SD
AND INCORPORATED AREAS**

FLOODWAY DATA

HUNGRY HOLLOW GULCH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	FEET (NAVD)		INCREASE
						WITHOUT FLOODWAY	WITH FLOODWAY	
ICE HOUSE CREEK								
A	274	93	54	4.4	3,659.6	3,659.6	3,659.6	0.0
B	725	69	388	0.9	3,661.3	3,661.3	3,661.8	0.5
C	1,222	35	175	1.0	3,672.3	3,672.3	3,672.4	0.1
D	1,730	49	315	0.5	3,682.0	3,682.0	3,682.2	0.1
E	2,127	60	268	0.6	3,686.3	3,686.3	3,686.4	0.1

¹ Stream distance in feet above Grant Street

TABLE 3	FEDERAL EMERGENCY MANAGEMENT AGENCY LAWRENCE COUNTY, SD AND INCORPORATED AREAS	FLOODWAY DATA
		ICE HOUSE CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	FEET (NAVD)		INCREASE
						WITHOUT FLOODWAY	WITH FLOODWAY	
ICE HOUSE CREEK TRIBUTARY A								
A	247	24	30	6.5	3,662.7	3,662.7	3,662.6	0.0
B	658	46	57	3.5	3,670.8	3,670.8	3,671.4	0.6

¹ Stream distance in feet above confluence with Ice House Creek

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY
LAWRENCE COUNTY, SD
AND INCORPORATED AREAS

FLOODWAY DATA

ICE HOUSE CREEK TRIBUTARY A

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
SPEARFISH CREEK								
A	0	420	1,137	8.8	3,387.8	3,387.8	3,387.8	0.0
B	1,668	671	1,222	8.2	3,402.4	3,402.4	3,402.9	0.5
C	1,693	654	2,153	4.6	3,403.5	3,403.5	3,403.9	0.4
D	1,913	391	1,226	8.2	3,405.1	3,405.1	3,405.8	0.7
E	6,723	844	1,309	7.6	3,444.4	3,444.4	3,444.5	0.1
F	12,233	697	4,802	2.1	3,471.4	3,471.4	3,471.4	0.0
G	15,428	852	1,350	7.4	3,483.2	3,483.2	3,483.3	0.1
H	16,058	485	1,269	7.9	3,489.6	3,489.6	3,490.3	0.7
I	16,798	83	520	14.2	3,499.8	3,499.8	3,499.8	0.0
J	17,198	341	864	8.5	3,504.4	3,504.4	3,504.5	0.1
K	17,340	177	689	10.7	3,509.5	3,509.5	3,509.5	0.0
L	17,510	85	621	11.9	3,512.2	3,512.2	3,512.2	0.0
M	17,640	333	2,728	2.7	3,514.6	3,514.6	3,514.6	0.0
N	20,105	220	763	9.7	3,530.3	3,530.3	3,531.0	0.7
O	20,535	465	1,137	6.5	3,536.6	3,536.6	3,536.7	0.1
P	22,277	270	892	8.3	3,554.1	3,554.1	3,554.1	0.0
Q	23,515	600	1,077	6.8	3,563.3	3,563.3	3,564.2	0.9
R	24,057	549	973	7.6	3,570.0	3,570.0	3,570.5	0.5
S	24,261	415	1,314	5.6	3,573.9	3,573.9	3,574.6	0.8
T	25,021	349	910	8.1	3,581.7	3,581.7	3,582.1	0.4
U	25,849	316	795	9.3	3,589.6	3,589.6	3,590.5	0.8
V	26,648	486	1,158	6.4	3,597.1	3,597.1	3,598.0	0.9
W	27,294	680	1,266	5.8	3,605.8	3,605.8	3,606.5	0.7
X	27,941	460	1,357	5.4	3,615.1	3,615.1	3,615.8	0.6
Y	28,579	423	969	7.6	3,619.4	3,619.4	3,620.3	0.9
Z	29,482	790	1,222	5.9	3,631.6	3,631.6	3,631.6	0.0

¹ Feet Above North Extraterritorial Jurisdictional Limits

T A B L E 3	FEDERAL EMERGENCY MANAGEMENT AGENCY	FLOODWAY DATA
	LAWRENCE COUNTY, SD (And Incorporated Areas)	SPEARFISH CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
SPEARFISH CREEK (cont'd)								
AA	30,061	570	976	7.4	3,638.1	3,638.1	3,638.3	0.2
AB	30,567	580	1,420	5.1	3,646.2	3,646.2	3,646.9	0.7
AC	31,604	147	637	11.3	3,659.8	3,659.8	3,660.8	1.0
AD	32,195	315	640	11.3	3,666.8	3,666.8	3,667.7	0.9
AE	33,495	550	1,022	7.1	3,680.4	3,680.4	3,680.8	0.4
AF	34,635	590	987	7.3	3,689.9	3,689.9	3,690.8	0.9
AG	35,383	329	977	7.2	3,699.1	3,699.1	3,699.4	0.3
AH	36,348	720	756	9.3	3,710.8	3,710.8	3,710.8	0.0
AI	36,683	430	1,248	5.6	3,715.3	3,715.3	3,716.3	0.9
AJ	37,608	192	660	10.6	3,726.1	3,726.1	3,726.2	0.1
AK	38,792	176	715	9.8	3,742.4	3,742.4	3,742.5	0.1

¹ Feet Above North Extraterritorial Jurisdictional Limits

T A B L E 3	FEDERAL EMERGENCY MANAGEMENT AGENCY	FLOODWAY DATA
	LAWRENCE COUNTY, SD (And Incorporated Areas)	SPEARFISH CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
WEST-CHIPMUNK GULCH								
A	630	108	139	7.0	3,576.2	3,576.2	3,576.2	0.0
B	820	41	109	8.9	3,578.5	3,578.5	3,578.5	0.0
C	1,020	45	109	8.9	3,582.4	3,582.4	3,582.4	0.0
D	1,180	45	110	8.8	3,585.2	3,585.2	3,585.2	0.0
E	1,830	53	116	8.4	3,600.3	3,600.3	3,600.3	0.0
F	2,018	71	131	7.4	3,604.6	3,604.6	3,604.6	0.0
G	2,246	163	168	5.8	3,608.9	3,608.9	3,608.9	0.0
H	2,623	46	99	8.3	3,614.4	3,614.4	3,614.6	0.2
I	2,970	160	221	3.7	3,617.0	3,617.0	3,617.5	0.5
J	3,234	166	151	5.4	3,631.0	3,631.0	3,631.0	0.0
K	3,533	89	122	6.7	3,636.1	3,636.1	3,636.1	0.0
L	4,534	30	86	9.6	3,659.2	3,659.2	3,659.2	0.0

¹ Feet Above Confluence With Spearfish Creek

T A B L E 3	FEDERAL EMERGENCY MANAGEMENT AGENCY	FLOODWAY DATA
	LAWRENCE COUNTY, SD (And Incorporated Areas)	WEST-CHIPMUNK GULCH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Whitewood Creek								
A	-0.137	148.4	582.8	11.3	4,401.4	4,401.4	4,401.4	0.0
B	-0.056	52.8	415.2	15.8	4,407.1	4,407.1	4,407.2	0.1
C	0.083	82.5	632.7	10.4	4,418.9	4,418.9	4,418.9	0.0
D	0.565	147.5	1,041.2	6.1	4,448.1	4,448.1	4,449.1	1.0
E	0.832	91.0	716.0	8.9	4,470.4	4,470.4	4,470.4	0.0
F	1.077	70.0	624.0	10.2	4,489.6	4,489.6	4,489.6	0.0
G	1.884	124.0	571.0	8.8	4,554.8	4,554.8	4,555.2	0.4
H	2.028	60.0	535.0	9.4	4,568.7	4,568.7	4,569.3	0.6
I	2.147	73.0	551.0	9.1	4,582.8	4,582.8	4,583.3	0.5
J	2.246	146.0	938.0	5.4	4,590.9	4,590.9	4,591.8	0.9
K	2.438	110.0	574.5	8.8	4,604.3	4,604.3	4,604.8	0.5
L	2.673	53.5	402.1	12.5	4,626.6	4,626.6	4,626.6	0.0
M	2.719	73.3	696.3	7.2	4,629.8	4,629.8	4,629.8	0.0
N	2.854	150.4	506.5	9.9	4,638.3	4,638.3	4,638.3	0.0
O	2.963	154.0	518.0	9.7	4,644.4	4,644.4	4,644.4	0.0
P	3.234	312.0	1,020.0	4.9	4,666.1	4,666.1	4,666.2	0.1
Q	3.634	68.0	375.0	13.4	4,701.0	4,701.0	4,701.0	0.0
R	3.744	42.0	320.0	15.7	4,721.3	4,721.3	4,721.3	0.0
S	3.824	64.0	371.0	13.5	4,728.9	4,728.9	4,729.2	0.3

¹ Miles above U.S. Highway 14A

T A B L E 3	FEDERAL EMERGENCY MANAGEMENT AGENCY	FLOODWAY DATA
	LAWRENCE COUNTY, SD (And Incorporated Areas)	WHITEWOOD CREEK

5.0 INSURANCE APPLICATION

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

Zone A

Zone A is the flood insurance rate zone that corresponds to the 1% 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 flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 1% annual chance floodplains that are determined in the Flood Insurance Study by detailed methods. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within the 500-year floodplain, areas of 1% annual chance flooding where average depth are less than 1 foot, areas of the 1% annual chance flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 1% annual chance flood by levees. No base flood elevations or depths are shown within this zone.

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% annual chance floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations 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 100- and 500-year floodplains, floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

The current FIRM presents flooding information for the entire geographic area of Lawrence County. Previously, separate FIRMS were prepared for each identified floodprone incorporated community and for the unincorporated areas of the county. Historical data relating to the maps prepared for each community are presented in Table 4.

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE(S)	FLOOD INSURANCE RATE MAP EFFECTIVE DATE	FLOOD INSURANCE RATE MAP REVISION DATE(S)
City of Central City	N/A	N/A	4/17/2012	none
City of Deadwood	7/11/1975	none	2/3/1982	4/16/1990 5/07/2001 4/17/2012
Lawrence County Unincorporated Areas	5/17/1990	none	5/17/1990	4/17/2012
City of Lead	N/A	N/A	4/17/2012	none
City of Spearfish	3/29/1974	6/4/1976	9/2/1981	5/15/1984 1/17/1990 2/5/2003 4/17/2012
*City of Whitewood	N/A	N/A	N/A	N/A

*Non Flood Prone

T A B L E 4	FEDERAL EMERGENCY MANAGEMENT AGENCY LAWRENCE COUNTY, SD And Incorporated Areas	COMMUNITY MAP HISTORY
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7.0 OTHER STUDIES

A floodplain study by the COE dated November 17, 1981, for the Lawrence County Commissioners was incorporated into this study and supplemented by new data as necessary to extend the study from the Spearfish city limits to the extra-territorial limits. The information in this Flood Insurance Study supersedes the COE study.

Staven Engineers published a hydrology study of Deadwood and Whitewood Creeks for the South Dakota Department of Transportation, Division of Highways (Reference 18). The discharges developed in this Flood Insurance Study are based on a more detailed study than those of Staven Engineers and have been accepted by the South Dakota State Highway Department.

A floodplain study by the COE dated November 17, 1981, for the Lawrence County Commissioners was incorporated into this study and supplemented by new data as necessary to extend the study from the Spearfish City limits to the extra-territorial limits. This limitation in this Flood Insurance Study supersedes the COE study.

This study is authoritative for the purposes of the Flood Insurance Program; data presented herein either superseded or are compatible with all previous determinations.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, Federal Emergency Management Agency, Denver Federal Center, Building 710, Box 25267, Denver, Colorado 80225-0267.

9.0 BIBLIOGRAPHY AND REFERENCES

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10.0 REVISION DESCRIPTIONS

This section has been added to provide information regarding significant revisions made since the 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.

10.1 First Revision

This study was revised on May 7, 2001, to incorporate detailed hydrologic and hydraulic analyses to update flood hazards for Whitewood and Deadwood Creeks, and establish a floodplain for Spring Creek within the City of Deadwood. The hydrologic and hydraulic analyses for this restudy were performed by J.F. Sato and Associates for the Federal Emergency Management Agency (FEMA) under contract number EMD-96-CO-00200 using the U.S. Army Corps of Engineers HEC-RAS computer program (Reference 24). The need for a detailed study of flood hazards was identified at a Consultation Coordination Officer (CCO) meeting attended by representatives of the study contractor, FEMA, and the City of Deadwood on January 21, 1998. The work was completed in December 1998.

The results of the study were reviewed at the final CCO meeting held April 18, 2000, and attended by representatives of FEMA and your community. All problems raised at that meeting have been addressed in this study.

The restudy revises the lower Whitewood Creek floodplain (from the corporate boundary upstream approximately 2,000 feet). The reach between Cross Section L upstream to the three bridges (U.S. Highway 85, abandoned Burlington Northern railroad, and pedestrian Bridges) at Cross Section Q, was studied in detail and revised because of a new retaining wall and fill in the vicinity of Deadwood Gulch. Discharges for Whitewood Creek were taken from the effective study for the City of Deadwood (Reference 18). Flows into the culverts were taken from the effective study.

On Deadwood Creek, the culvert was enhanced to include the reach from the confluence with Whitewood Creek upstream approximately 3,500 feet

to Highway 14-A. The reach upstream from the culvert to the corporate limits was revised by detailed methods. A floodway was not computed for Deadwood Creek because all the 100-year discharge is confined within the channel and culvert. Discharges for Deadwood Creek were taken from the effective study (Reference 18). Flows into the culvert were taken from the effective study.

The 100-year flood discharge for Spring Creek was computed using methods developed by the U.S. Geological Survey (Reference 25). No floodway was computed because the 100-year discharge is confined within the channel banks and culvert. Flows into the culverts were computed from the same rating curve used for the Deadwood Creek culvert.

Roughness coefficients (Manning's "n" values) for the restudied reaches of Whitewood and Deadwood Creeks and for Spring Creek were determined by field inspection. For Whitewood Creek, Manning's "n" values ranged between 0.050-0.075 for the main channel and 0.065-0.150 for the overbank areas. For Deadwood Creek, main channel and overbank "n" values ranged between 0.04-0.05. On Spring Creek, Manning's "n" values ranged between 0.02-0.07 for the main channel and 0.02-0.08 for the overbank areas. Starting water-surface elevations were computed according to the slope-area method using channel bed slope at the downstream ends for each stream.

"Summary of Discharges," "Floodway Data," and "Flood Profiles," were revised as a result of the restudy.

10.2 Second Revision

This study was revised on February 5, 2003, to incorporate new floodplain data for West Chipmunk Gulch in the City of Spearfish, Lawrence County, South Dakota.

The hydrologic and hydraulic analyses for this restudy were performed by J.F. Sato and Associates, for the Federal Emergency Management Agency (FEMA), under Contract No. EMD-96-CO-00200, Project No. 9774. The work was completed in March 2000.

An Initial Consultation Coordination Officer (CCO) meeting was held on July 14, 1997, and was attended by representatives from the City of Spearfish, FEMA, and J.F. Sato and Associates. The result of the meeting was the decision to include the flood hazard information for Chipmunk Gulch and updated information for a portion of Spearfish Creek in the restudy.

The results of the restudy were reviewed at the final CCO meeting held on November 9, 2001. All problems raised at that meeting have been addressed in this restudy.

This revision reflects a request from the City of Spearfish to update the Flood Insurance Rate Map (FIRM). The City has experienced growth and development since the time of the original study. Therefore, their maps do not represent actual flooding conditions due to major changes and substantial earthwork within the Spearfish Creek floodplain as well as changes documented in the new detailed study for the West Chipmunk Gulch area. The purpose of this restudy was to evaluate the existing floodplain maps and to revise and update the approximate floodplain boundaries.

The restudied tributary is an unnamed tributary located west of Spearfish Creek. As part of the revision process, the tributary has been named Chipmunk Gulch. Two sub-basins, defined as East Chipmunk Gulch and West Chipmunk Gulch, are located above the fork in the tributary. East Chipmunk Gulch originates about 1.5 miles south of the confluence with West Chipmunk Gulch and covers approximately 770 acres. Between the Spearfish Creek and the confluence of East and West Chipmunk Gulch, the study area covers approximately 70 acres.

This limited-detail restudy area covers a reach of the Chipmunk Gulch from its confluence with Spearfish Creek to approximately 2,500 feet upstream. Only the 1-percent-annual-chance flood event was analyzed.

Hydrologic Analyses

Peak discharge data were obtained from the U.S. Army Corps of Engineers (COE) hydrology analysis for Rapid City, South Dakota, and specific regional areas of the Black Hills around Rapid City. This base regional data was then incorporated in a log-Pearson Type III statistical analysis to arrive at peak discharges for Chipmunk Gulch (Reference 7).

Peak discharges for storms having 10-, 50-, 100- and 500-year recurrence intervals were determined.

For this restudy, only the 100-year flows were necessary for the floodplain boundary analysis.

Hydraulic Analysis

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the 100-year recurrence intervals. Users should be aware that flood

elevations shown on the FIRM represent rounded whole-foot elevations shown on the FIRM represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles (Exhibit 1) or in the Floodway Data Table in the FIS report. Flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS in conjunction with the data shown on the FIRM.

Cross sections for West Chipmunk Gulch were taken from the topographic mapping provided by the City of Spearfish (References 34 and 35).

Water-surface profiles for the study reach were computed using the COE steady flow computer program Hydrologic Engineering Center-River Analysis System (HEC-RAS, step-backwater model, Reference 36).

Roughness factors (Manning's "n" values) used in the step-backwater analyses were based on field observations by the COE of the channel and overbank areas using guidelines established by the U.S. Geological Survey (References 37 and 38). Manning's "n" values for West Chipmunk Gulch were approximated as 0.03 for the main channel and 0.035 for the overbank areas.

The starting water-surface elevations for flood profiles at the downstream end of the study reach were based on normal depth with a slope of 0.001 and were computed based on a sub-critical flow regime.

The floodway corresponding to the base flood was initially determined using the equal-conveyance reduction option in the HEC-RAS step-backwater model, with a maximum water surface or energy grade line rise of 1.0 foot. The equal-conveyance reduction approach was then modified to ensure the water-surface rise was less than 1.0 foot in all locations.

This study was also revised on February 3, 2003, to incorporate new floodplain data for False Bottom Creek in the City of Spearfish, Lawrence County, South Dakota.

The hydrologic and hydraulic analyses for this restudy were taken from the original study performed by Banner Associates Inc., for FEMA, under Contract No. EMW-84-C-1633. The work was completed in January 1988.

This was a Physical Map Revision Request (PMR) request, submitted by NJS Engineering, on behalf of the City of Spearfish. With the request, NJS Engineering enclosed copies of the published effective FIS report (Reference 38) and the FIRM (Reference 39) for the City of Spearfish, Lawrence County, South Dakota, both dated January 17, 1990.

The scope of the study includes the updated flood hazard information for False Bottom Creek.

This revision reflects a request from the City of Spearfish to update the flooding information for False Bottom Creek. The City has experienced growth and development since the time of the original study. The purpose of this restudy was to evaluate the existing floodplain maps and to revise and update the approximate floodplain boundaries.

Hydrologic Analysis

For this restudy, the effective hydrologic method was used. Peak discharge data were obtained from the COE hydrologic analysis for Rapid City, South Dakota, and specific regional areas of the Black Hills around Rapid City. These base regional data were then incorporated in a log-Pearson Type III statistical analysis to arrive at peak discharges for False Bottom Creek (Reference 27).

Peak discharges for storms having 10-, 50-, 100- and 500-year recurrence intervals were determined.

Hydraulic Analysis

Cross sections for False Bottom Creek were taken from the original work map digitized from aerial photography (Reference 31).

Water surface profiles for the study reach were computed using the COE HEC-2 computer step-backwater model (Reference 28).

Roughness factors (Manning's "n" values) used in the backwater analyses were based on field observations of the channel and overbank areas. Manning's "n" values for False Bottom Creek ranged from 0.012 to 0.048 for the main channel and 0.012 to 0.100 for the overbank areas.

The starting water-surface elevations for flood profiles at the downstream end of the study reach were based on a normal depth analysis.

The floodway corresponding to the base flood for False Bottom Creek was revised in this restudy to incorporate the new floodplain information based on the new topographic map submitted by NJS Engineering (Reference 40).

The Flood Profile (Exhibit 1) for False Bottom Creek was replotted using the cross section data from the revised HEC-2 model. On the profile, the

location of Cross Section D was revised to match the appropriate section in the HEC-2 Model and on the FIRM.

Table 2, "Floodway Data," was also revised to incorporate the data from the revised HEC-2 Model. The revised FIRM shows the revised floodway and 100-year floodplains. Areas downstream and upstream of Interstate Highway 90 were replaced with appropriate Base Flood Elevations (BFEs).

The backwater area just downstream of the west-bound lane of Interstate Highway 90 was revised based on the topographic map (Reference 20) submitted by NJS Engineering and based on a backwater BFE of 3925 from the downstream end of the training dike. The BFE of 3930 west of the dike was revised to 3925.

Zone AE areas upstream of the highway and the Zone X (shaded) area near the gravel pit were removed since they were not contiguous with the main channel of False Bottom Creek and were not represented in the model's cross sections.

The Flood Profiles (Exhibit 1) and the FIRM show locations of selected cross sections used in the hydraulic analyses. The Floodway Data Table and the FIRMs show the results of the floodway computations. The FIRMs also show the revised 100-year floodplains.

For this restudy, all elevations are referenced to National Geodetic Vertical Datum of 1929 (NGVD). Elevation Reference Marks (ERMs) used in this study are shown on the FIRMs along with their descriptions. ERMs from the original study are shown on the FIRM panels, with their descriptions listed in the text. ERMs shown on the FIRM represent those used during the preparation of this and previous Flood Insurance Studies. The elevations associated with each ERM were obtained and/or developed during FIS production to establish vertical control for determination of flood elevations and floodplain boundaries shown on the FIRM. Users should be aware that these ERM elevations may have changed since the publication of this FIS. To obtain up-to-date elevation information on National Geodetic Survey (NGS) ERMs shown on the map, please contact the Information Services Branch of the NGS at (301) 713-3242, or visit their website at www.ngs.noaa.gov. Map users should seek verification of non-NGS ERM monument elevations when using these elevations for construction or floodplain management purposes.

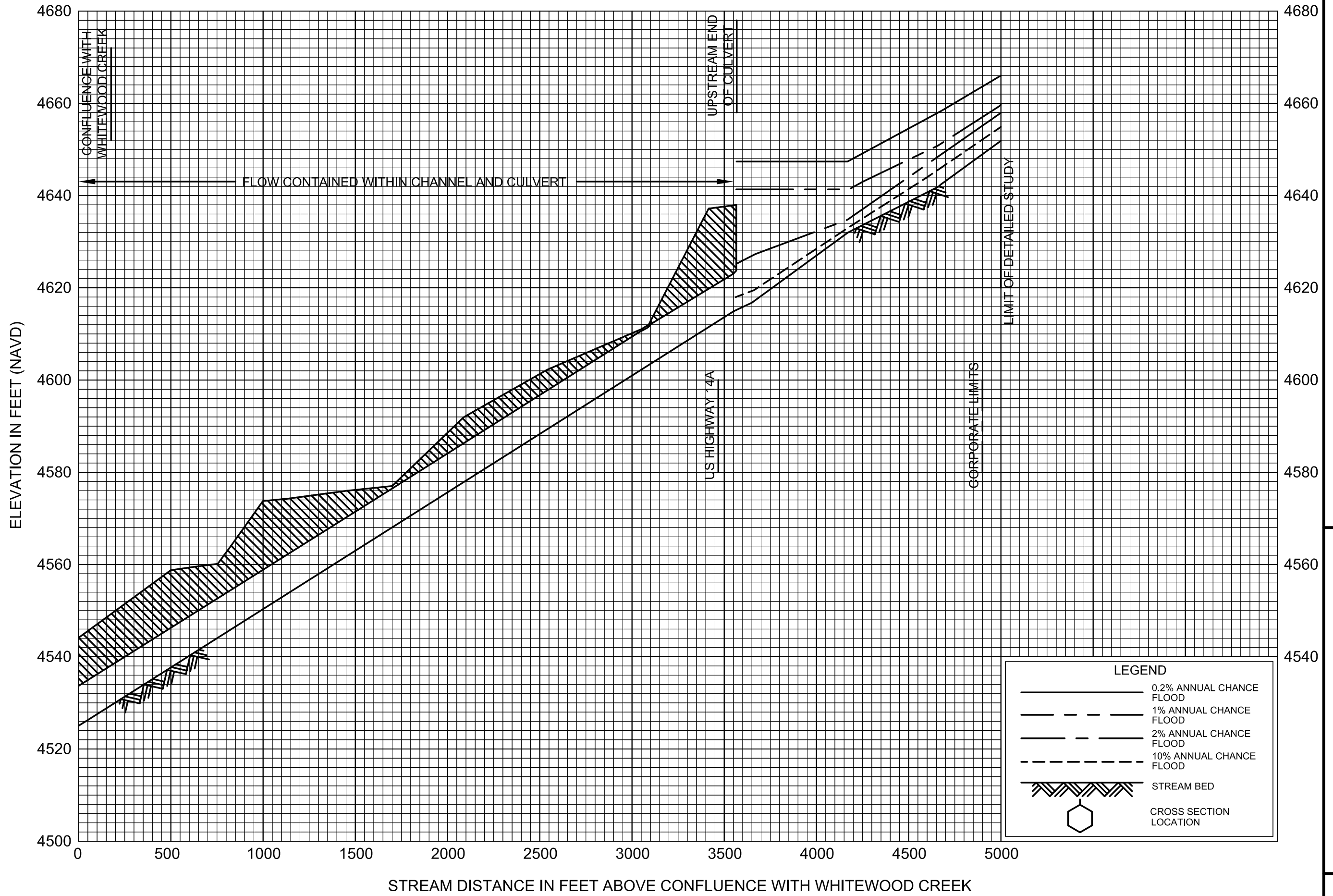
The NFIP encourages State and local governments to adopt sound floodplain management programs. To assist in this endeavor, each FIS provides 100-year floodplain data, which may include a combination of the following: 10-, 50-, 100-, and 500-year flood elevations; delineations

of the 100-year and 500-year floodplains; and 100-year floodway. This information is presented on the FIRM and in many components of the FIS, including the Flood Profiles, the Floodway Data Table and the Summary of Discharges Table. Users should reference the data presented in the FIS as well as additional information that may be available at the local community map repository before making flood elevation and/or floodplain boundary determinations.

Table 1, "Summary of Discharges," and Table 2, "Floodway Data," for Chipmunk Gulch and False Bottom Creek were revised as part of this restudy.

10.3 Third Revision

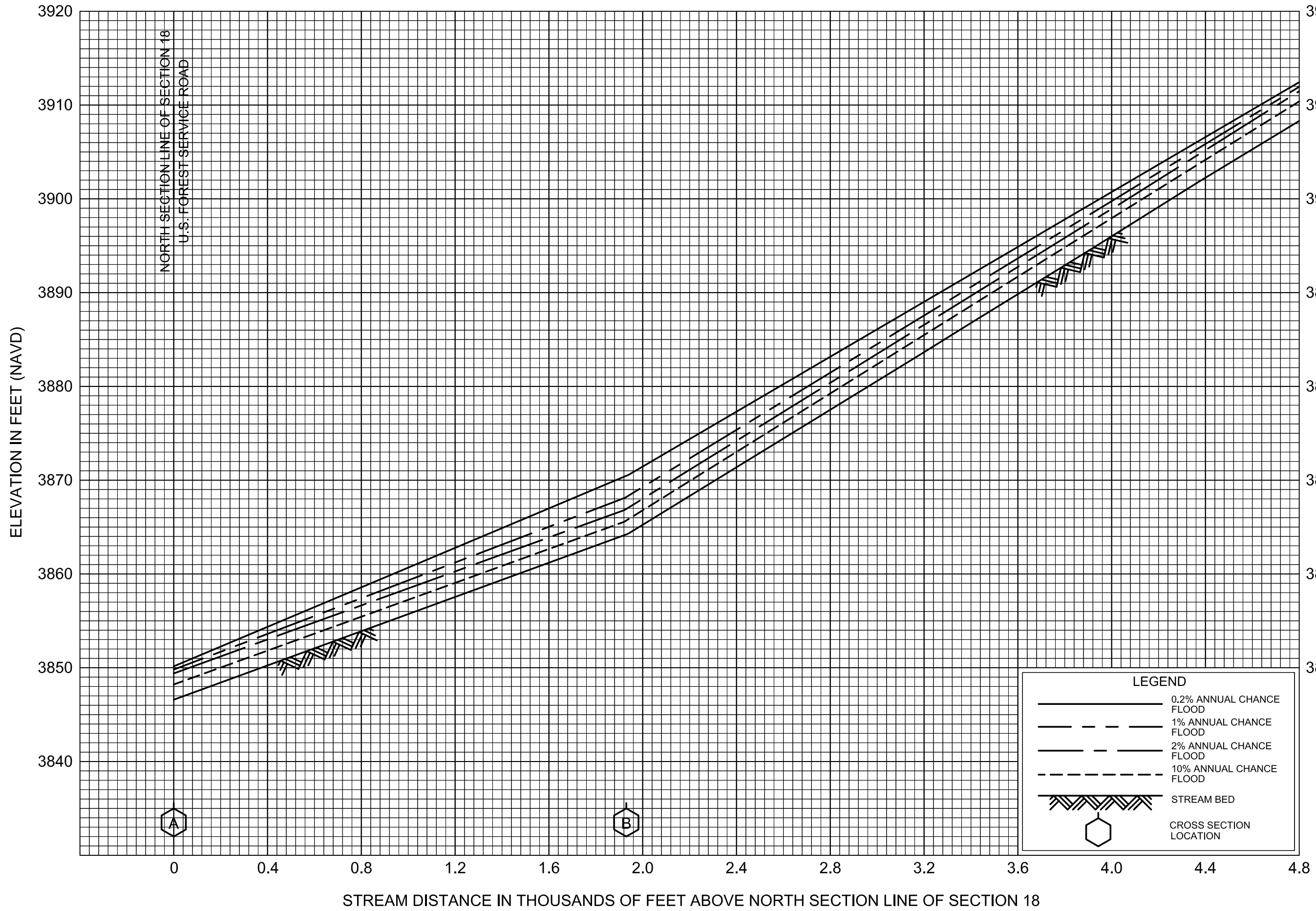
In April 2012, the individual Flood Insurance Studies for Lawrence County Unincorporated Areas, City of Deadwood, and City of Spearfish were combined into a single countywide Flood Insurance Study: Lawrence County and Incorporated Areas. This revision combined previous information into a single document and resulted in the renaming of tables and references. This work was completed by ICON Engineering, Inc. under the South Dakota Office of Emergency Management Auditor Contract #08-1431-012 as authorized by FEMA Region VIII through the Cooperating Technical Partner (CTP) program.



FLOOD PROFILES
DEADWOOD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY
LAWRENCE COUNTY, SD
AND INCORPORATED AREAS

01P

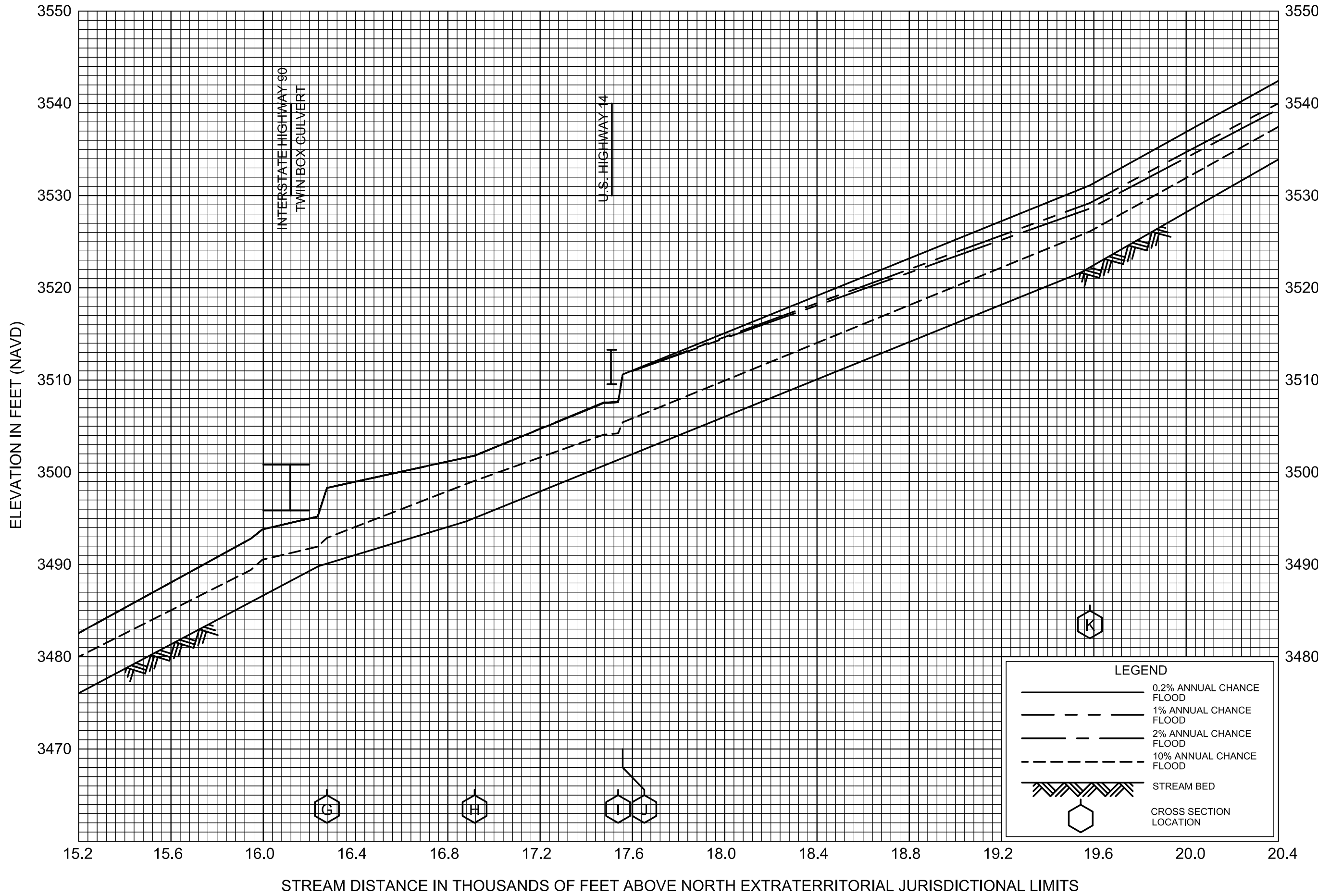


FLOOD PROFILES

FALSE BOTTOM CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

LAWRENCE COUNTY, SD
AND INCORPORATED AREAS



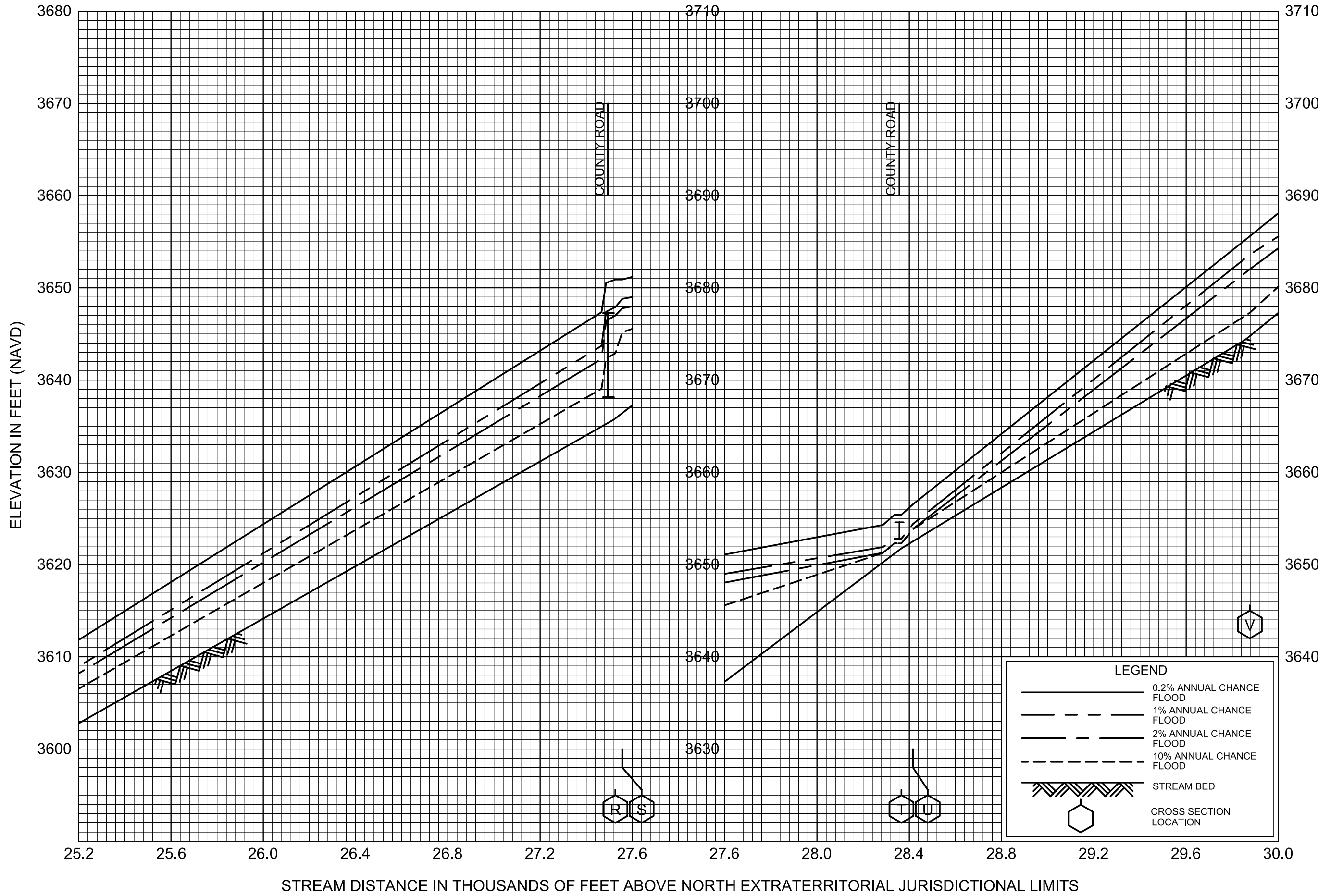
FLOOD PROFILES

HIGGINS GULCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

LAWRENCE COUNTY, SD
AND INCORPORATED AREAS

07P

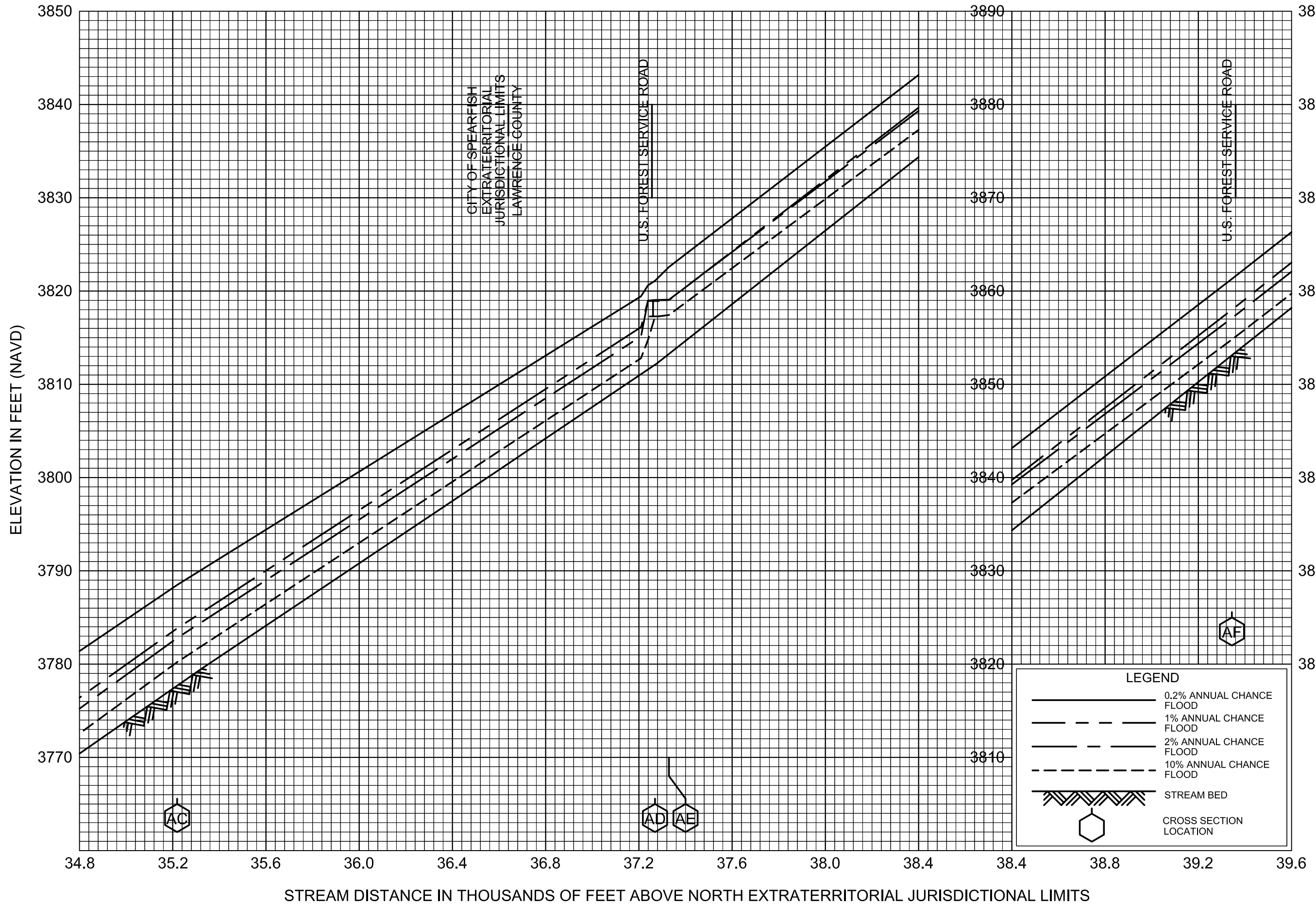


FLOOD PROFILES

HIGGINS GULCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

LAWRENCE COUNTY, SD
AND INCORPORATED AREAS

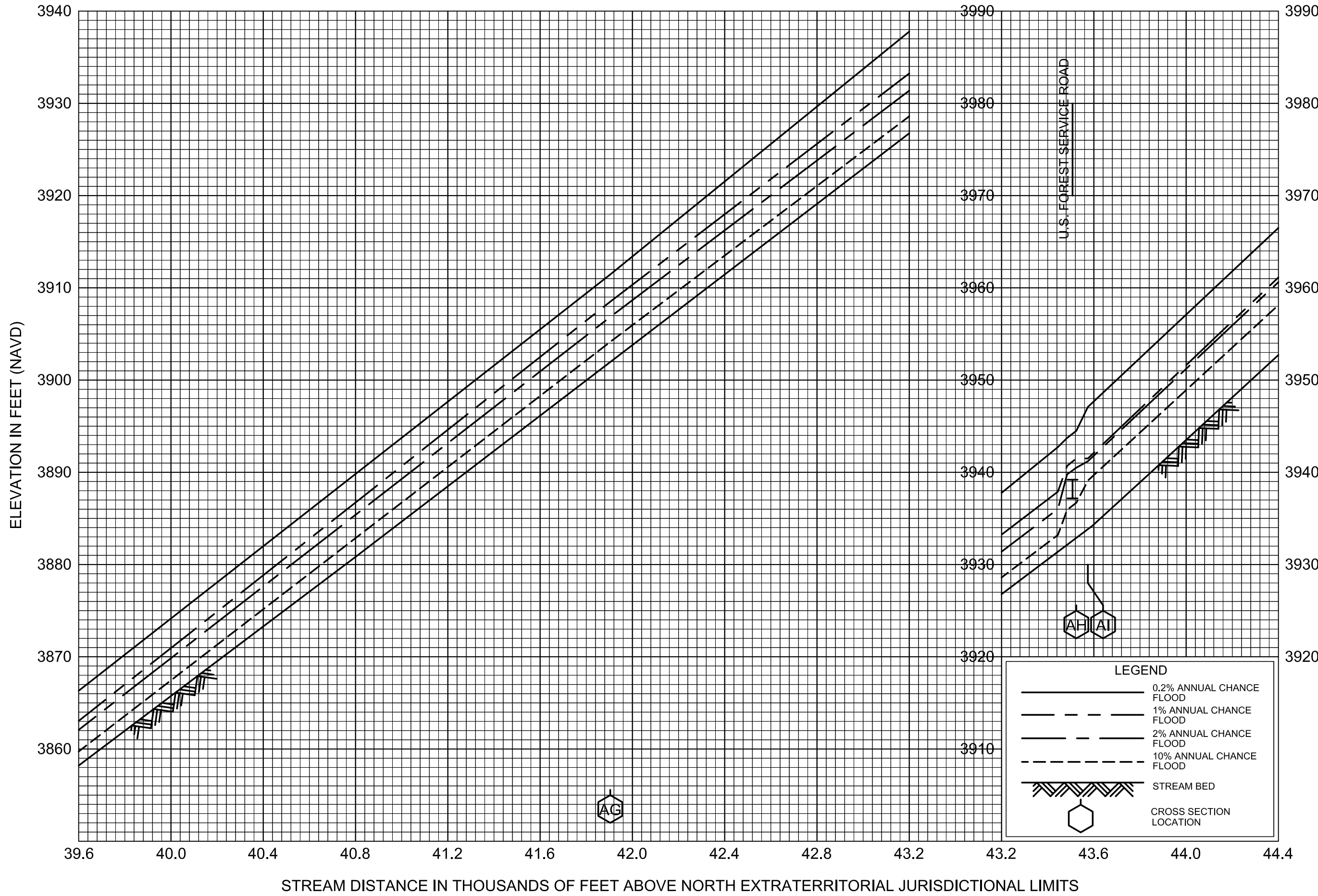


FLOOD PROFILES

HIGGINS GULCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

LAWRENCE COUNTY, SD
AND INCORPORATED AREAS

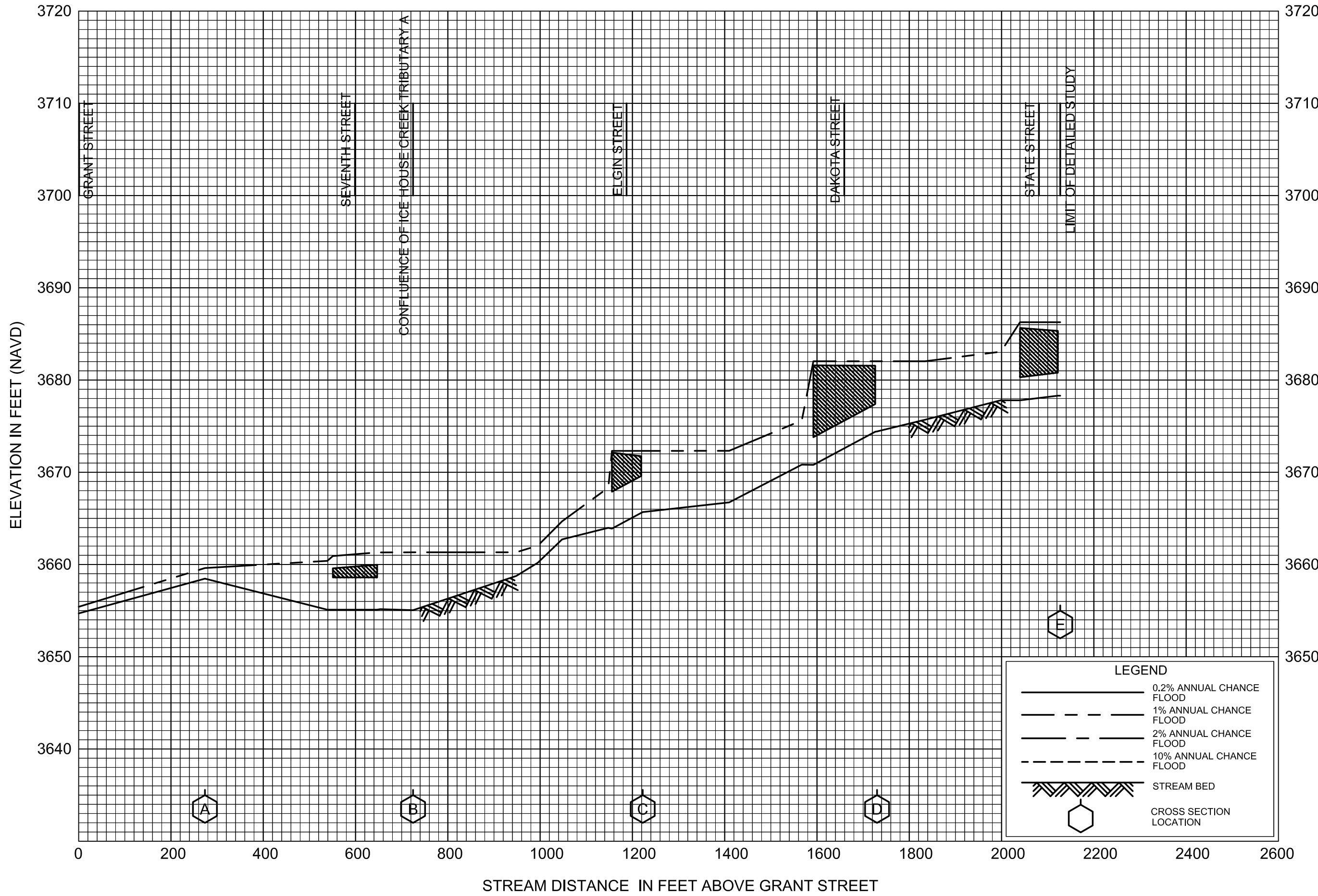


FLOOD PROFILES

HIGGINS GULCH

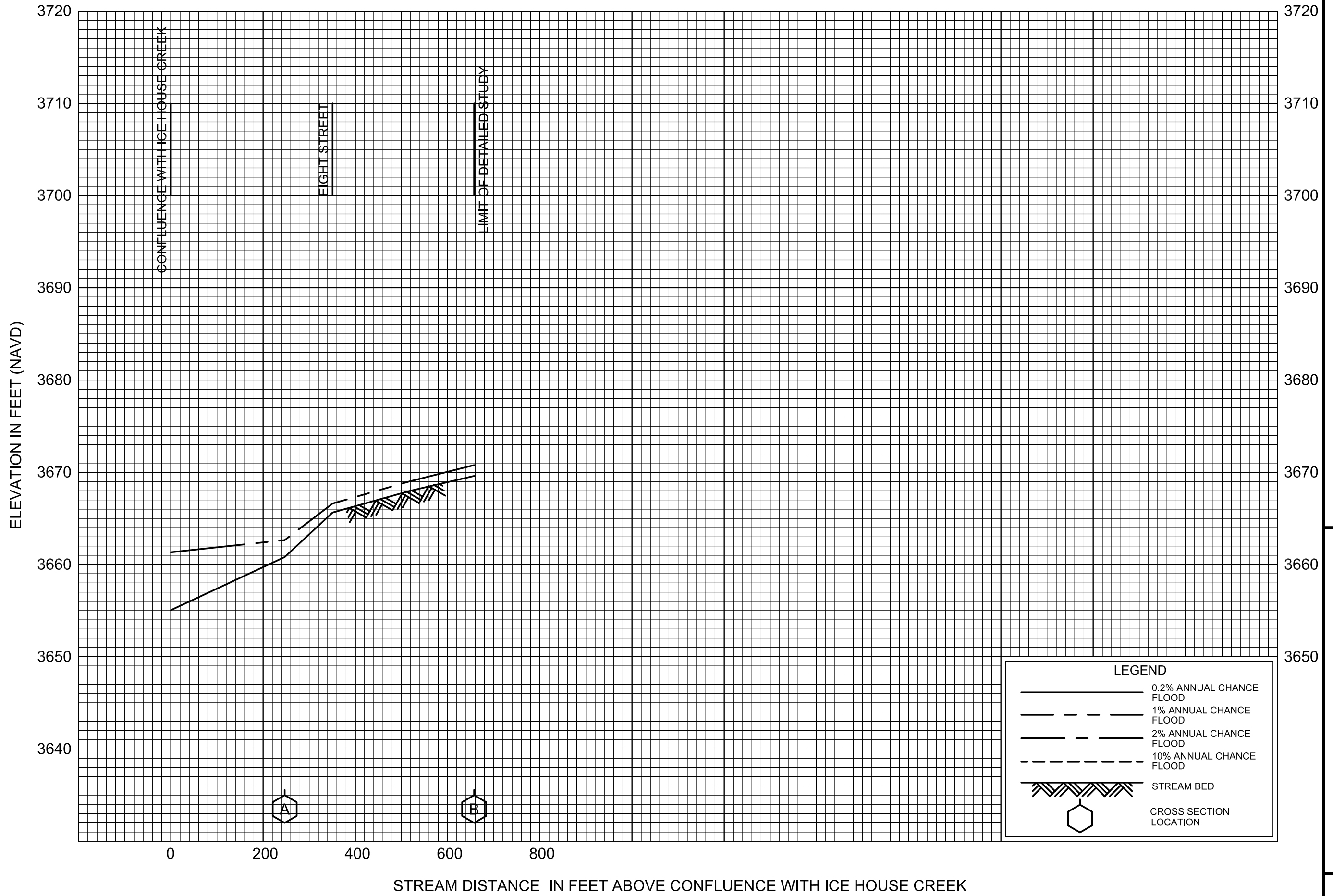
FEDERAL EMERGENCY MANAGEMENT AGENCY

LAWRENCE COUNTY, SD
AND INCORPORATED AREAS



LEGEND

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



LEGEND

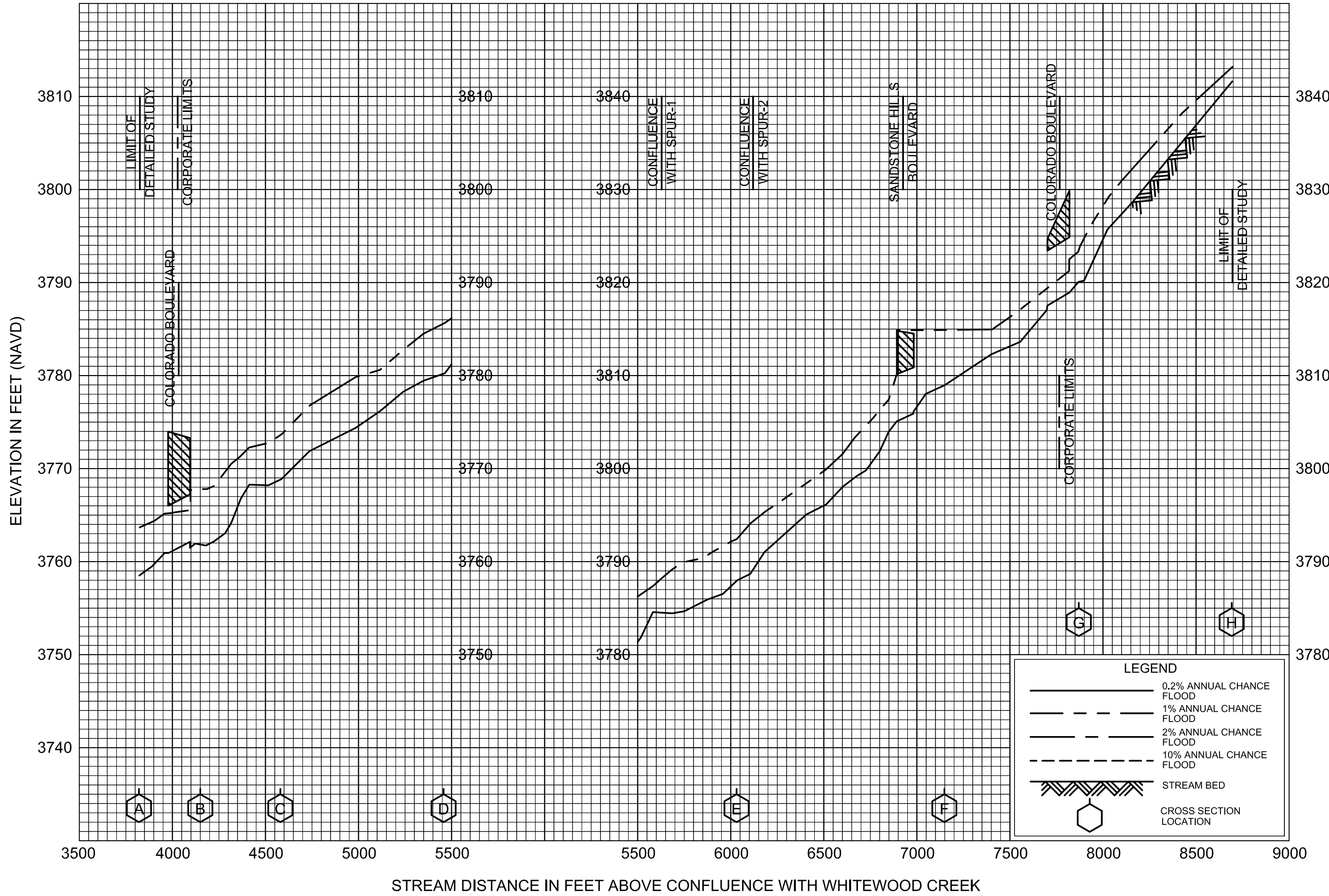
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- - - 2% ANNUAL CHANCE FLOOD
- - - 10% ANNUAL CHANCE FLOOD
- ▨ STREAM BED
- ⬡ CROSS SECTION LOCATION

FLOOD PROFILES

ICE HOUSE CREEK TRIBUTARY A

FEDERAL EMERGENCY MANAGEMENT AGENCY

LAWRENCE COUNTY, SD
AND INCORPORATED AREAS

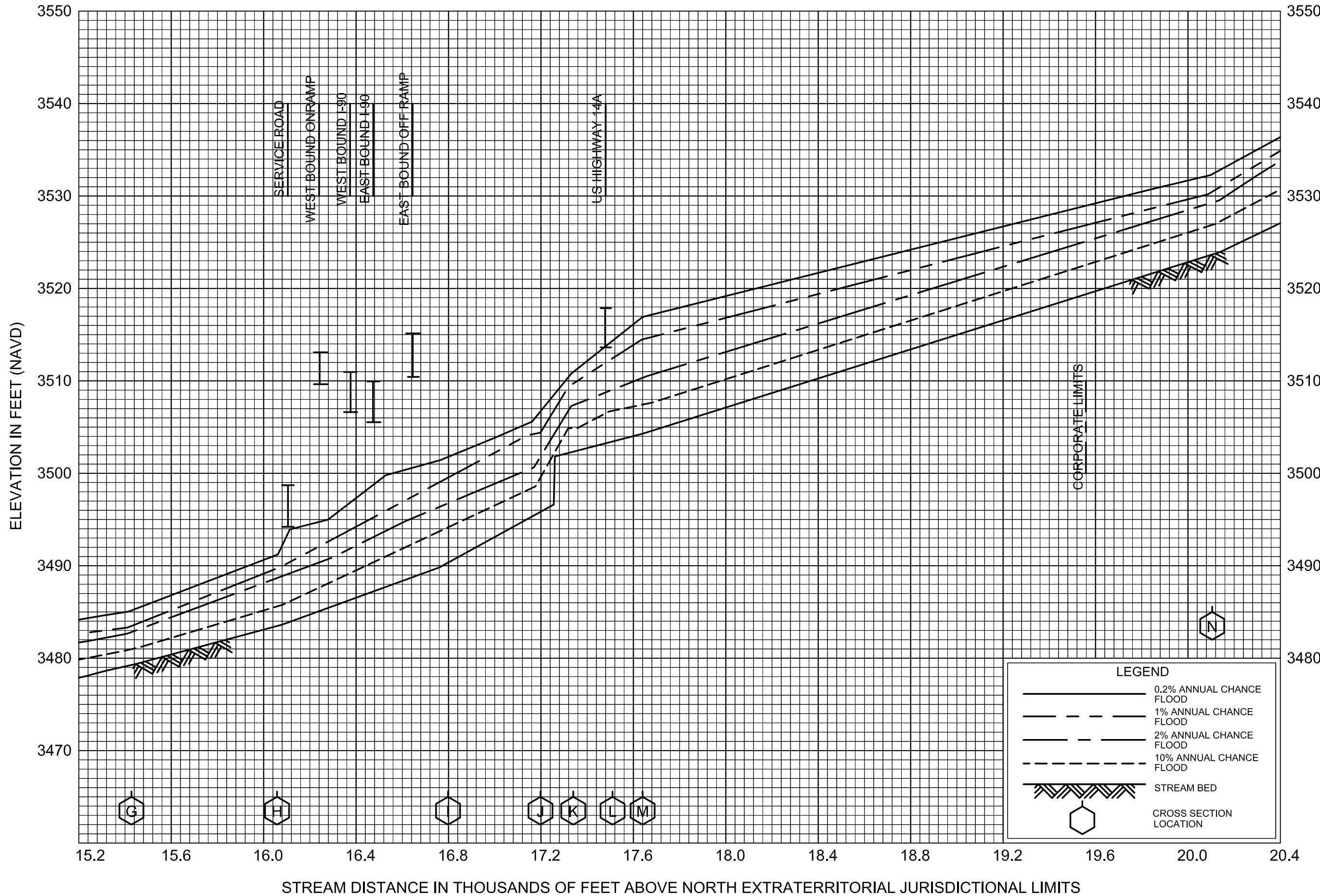


FLOOD PROFILES

RIGGS GULCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

LAWRENCE COUNTY, SD
AND INCORPORATED AREAS

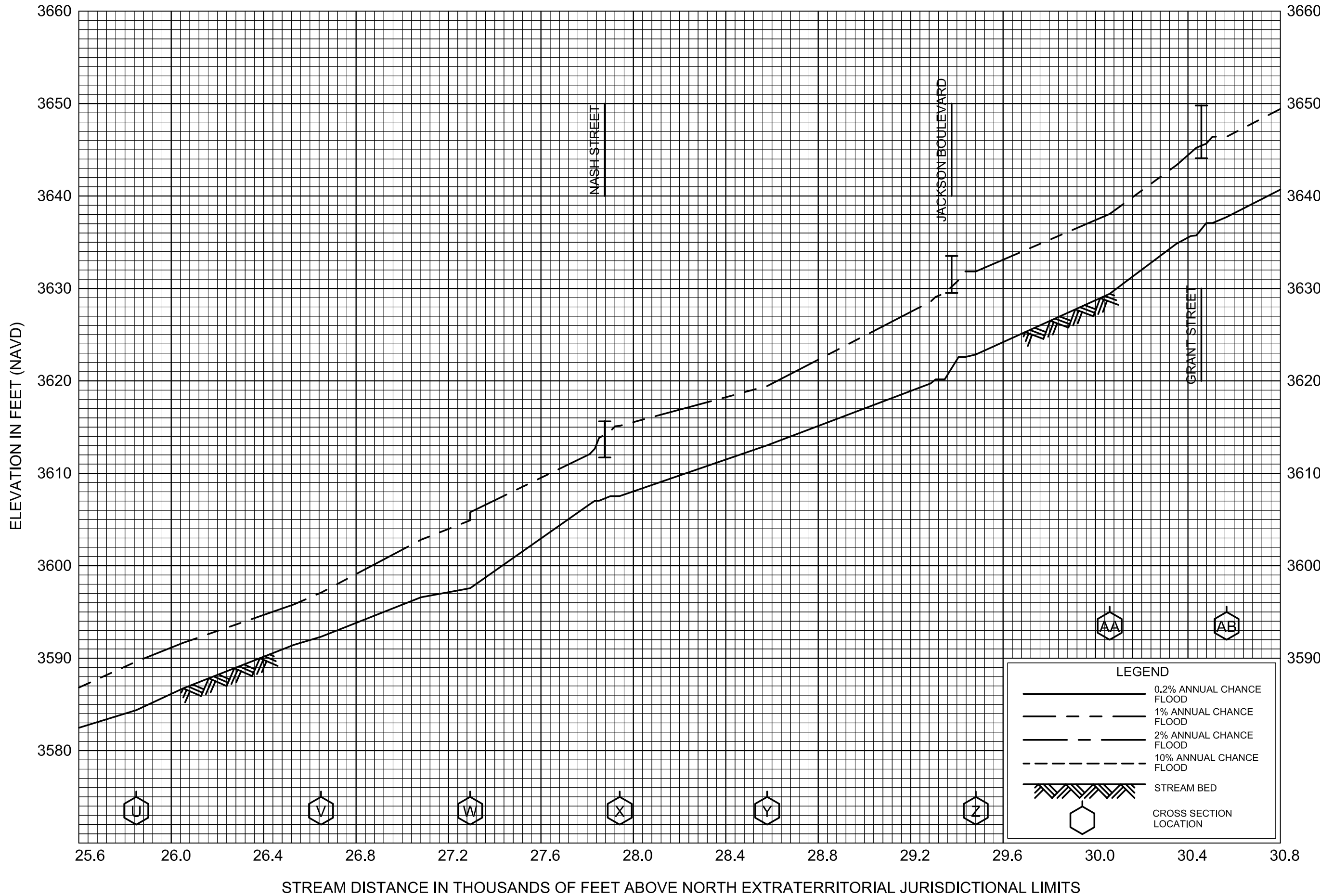


FLOOD PROFILES

SPEARFISH CREEK

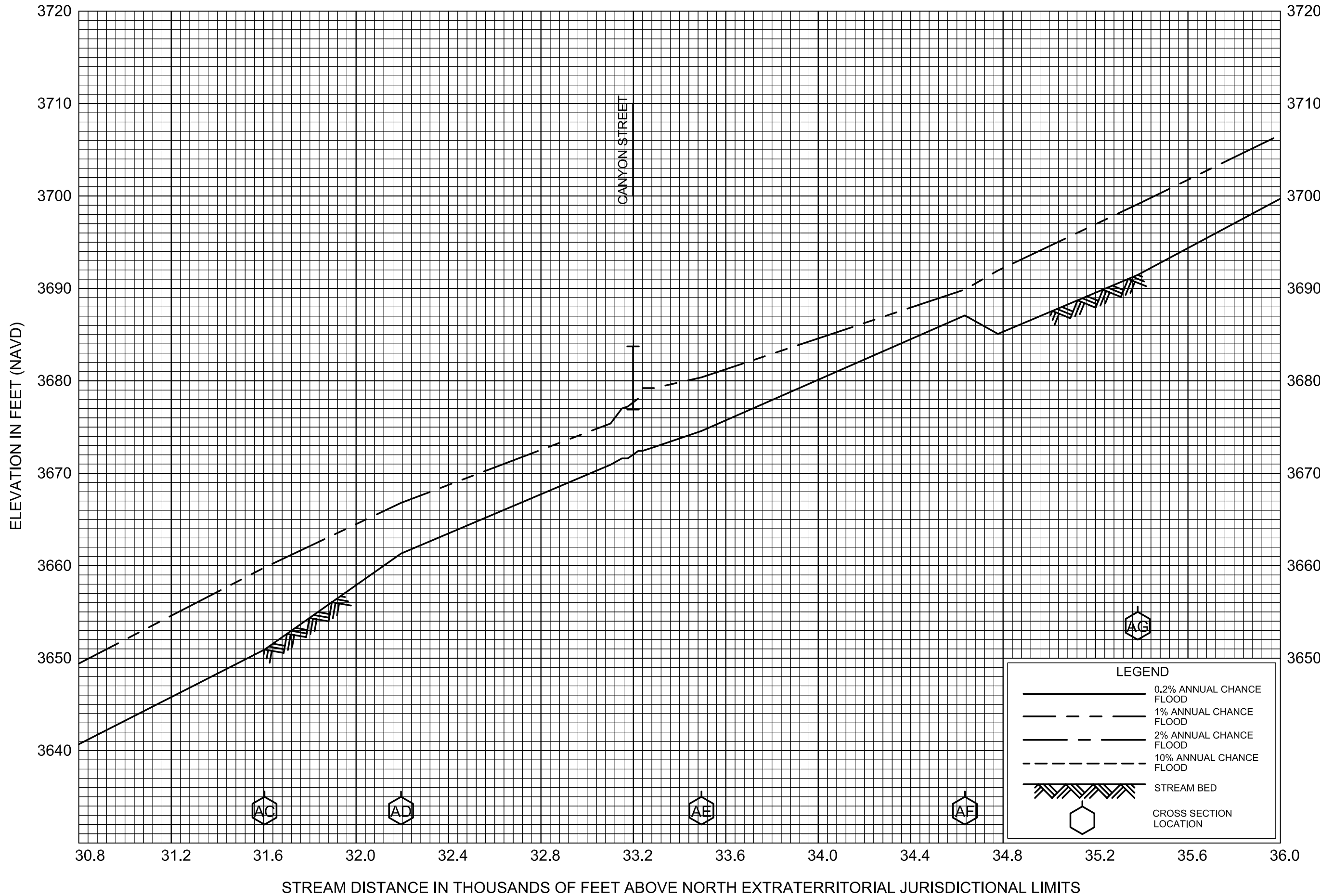
FEDERAL EMERGENCY MANAGEMENT AGENCY

LAWRENCE COUNTY, SD
AND INCORPORATED AREAS



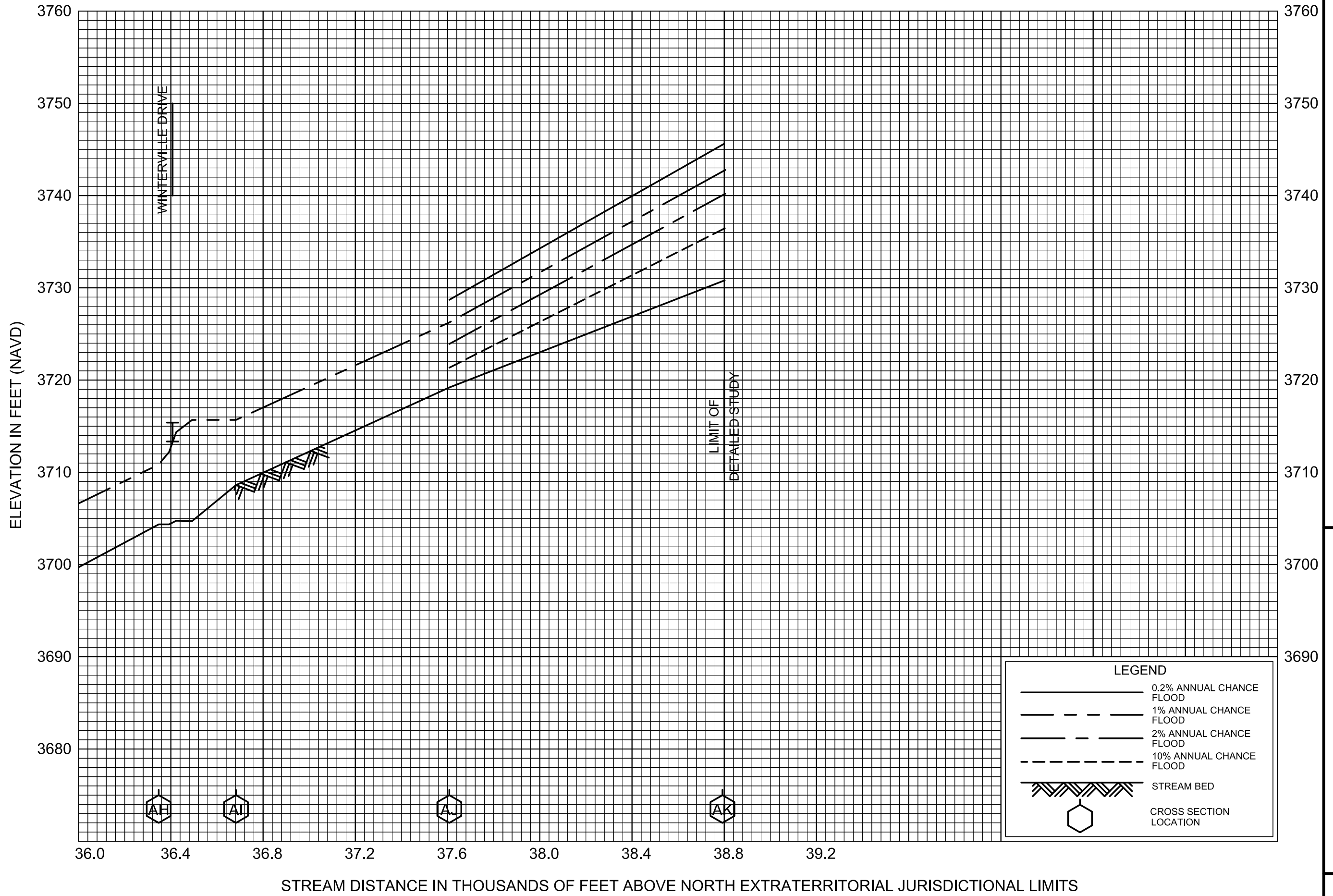
FLOOD PROFILES
SPEARFISH CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY
LAWRENCE COUNTY, SD
AND INCORPORATED AREAS



FLOOD PROFILES
SPEARFISH CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY
LAWRENCE COUNTY, SD
AND INCORPORATED AREAS

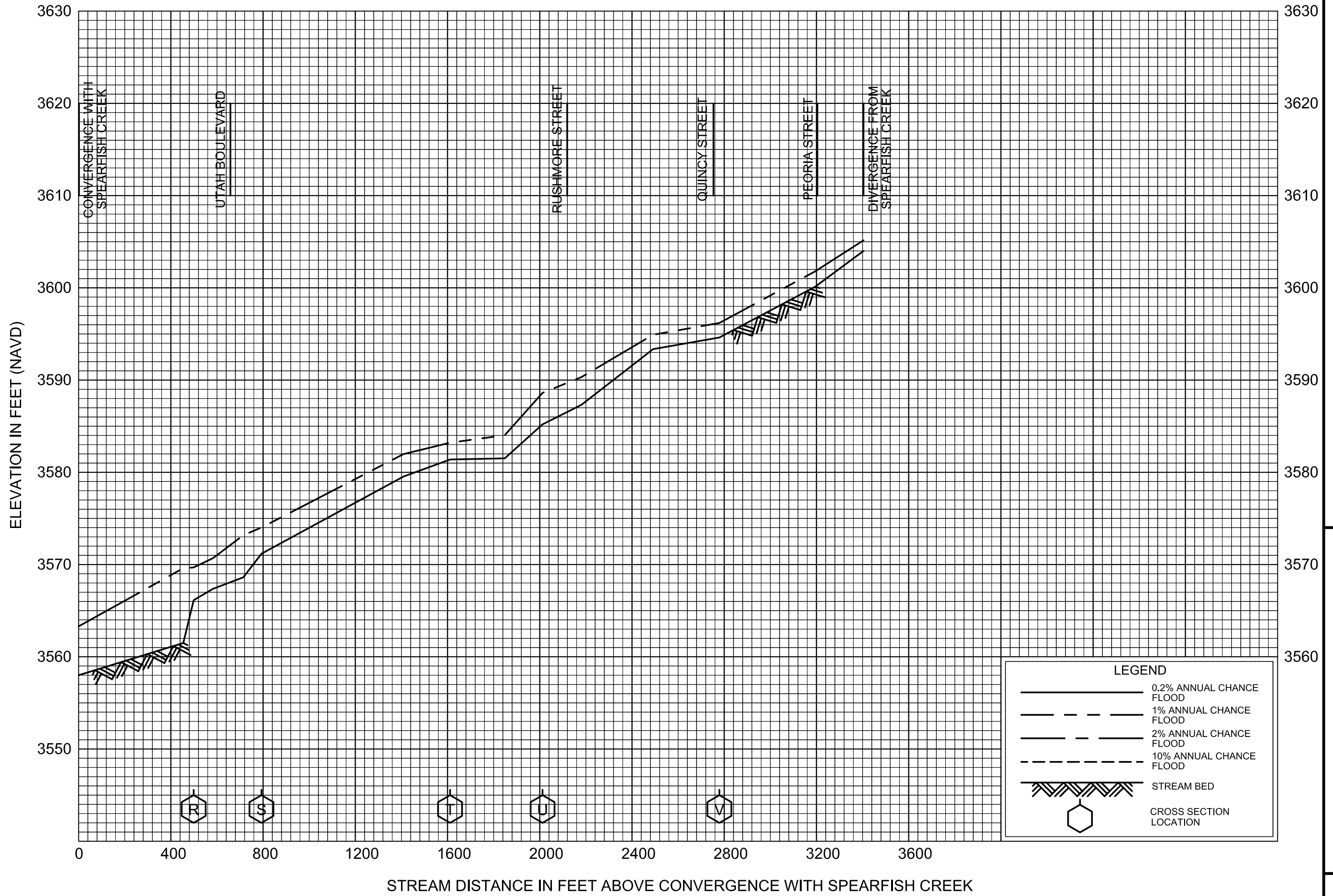


FLOOD PROFILES

SPEARFISH CREEK

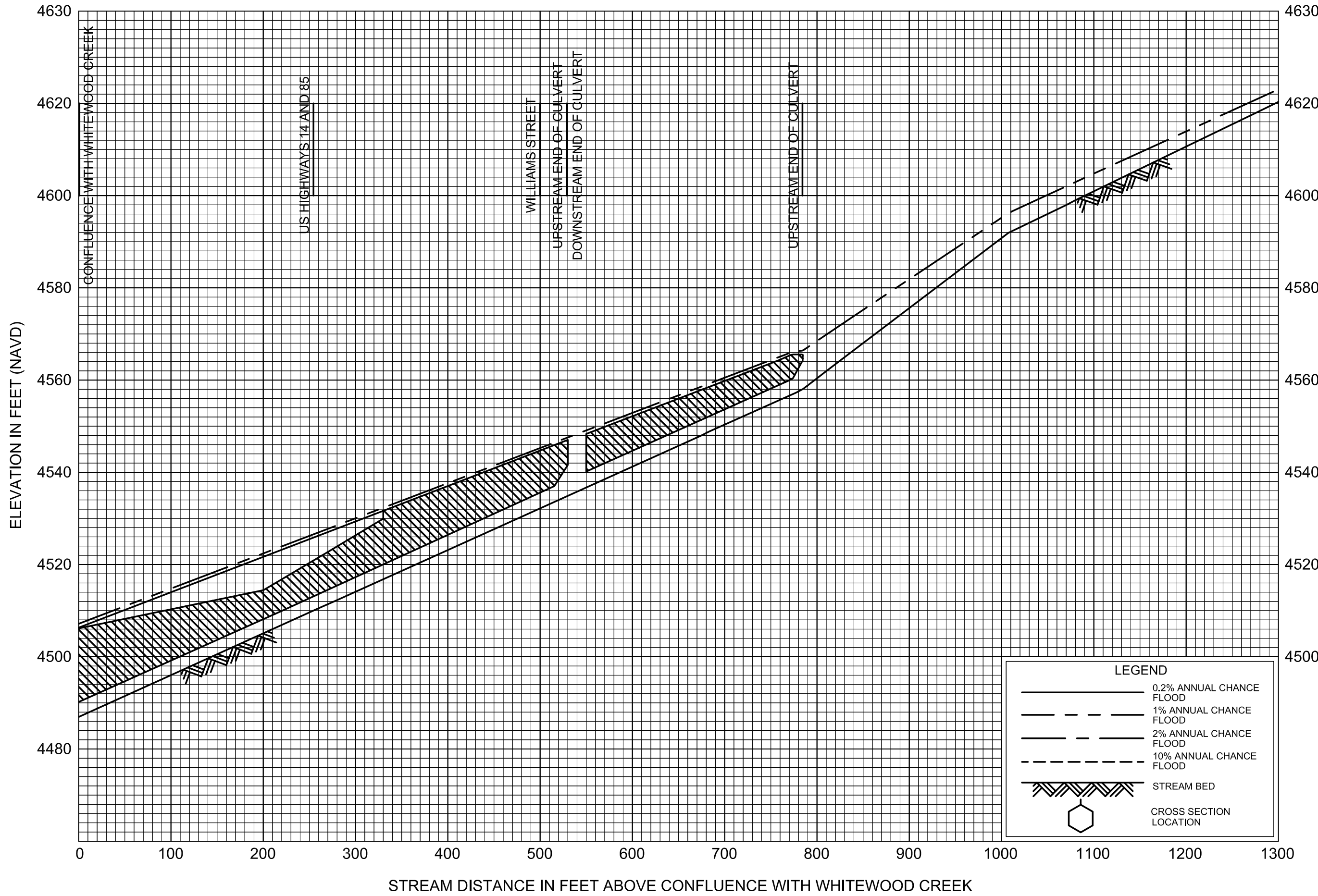
FEDERAL EMERGENCY MANAGEMENT AGENCY

LAWRENCE COUNTY, SD
AND INCORPORATED AREAS



LEGEND

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

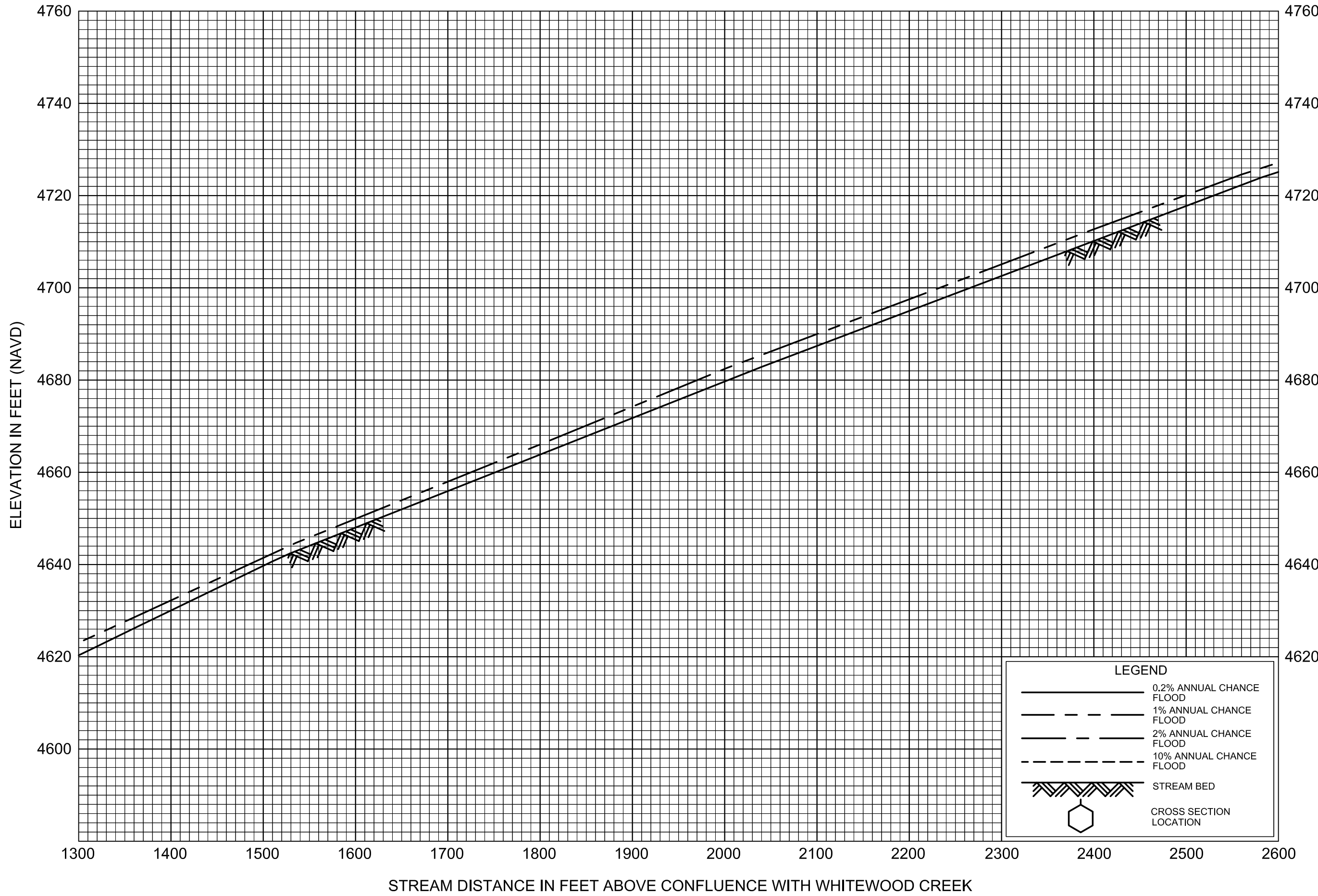


FLOOD PROFILES

SPRING CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

LAWRENCE COUNTY, SD
AND INCORPORATED AREAS

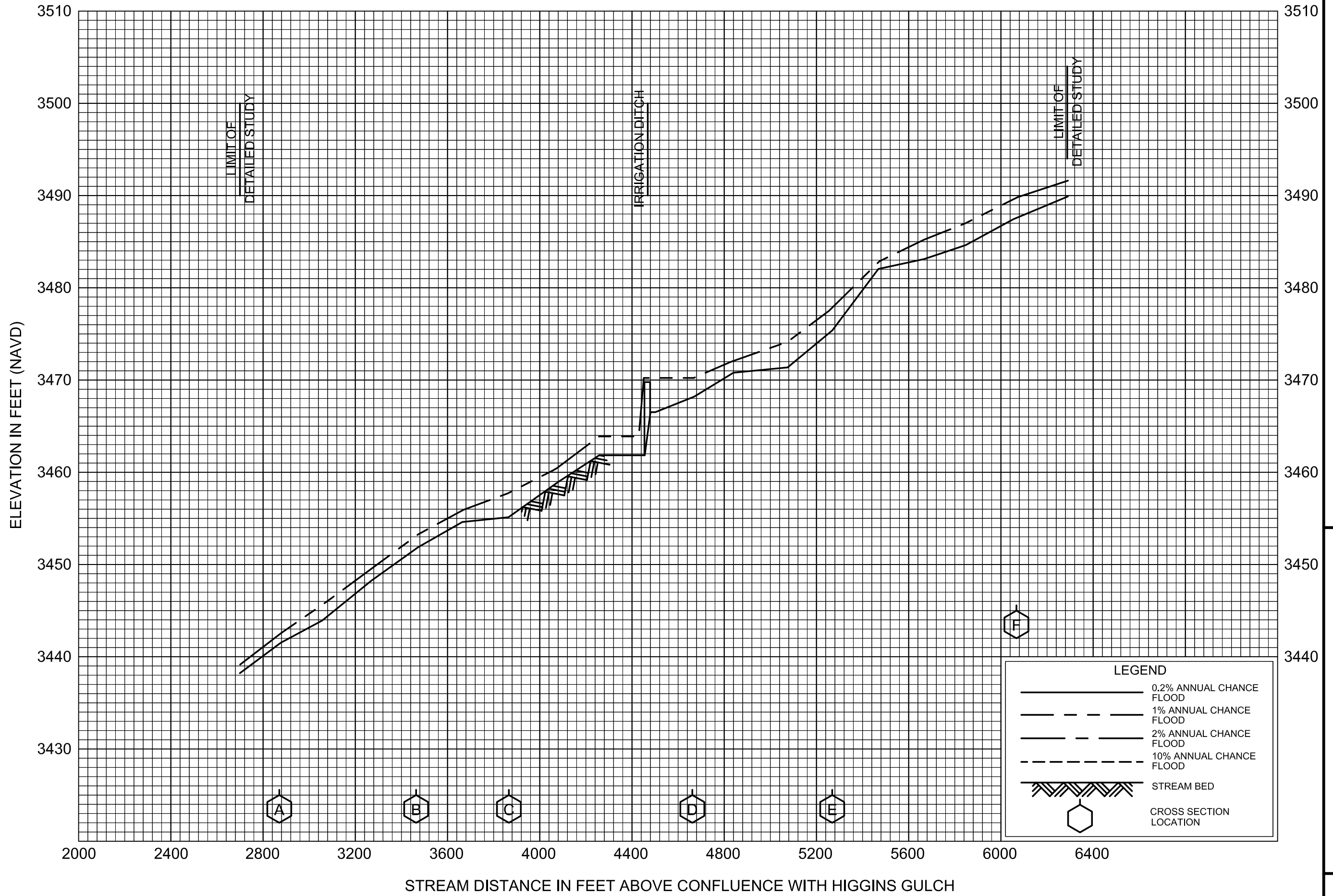


FLOOD PROFILES

SPRING CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

LAWRENCE COUNTY, SD
AND INCORPORATED AREAS

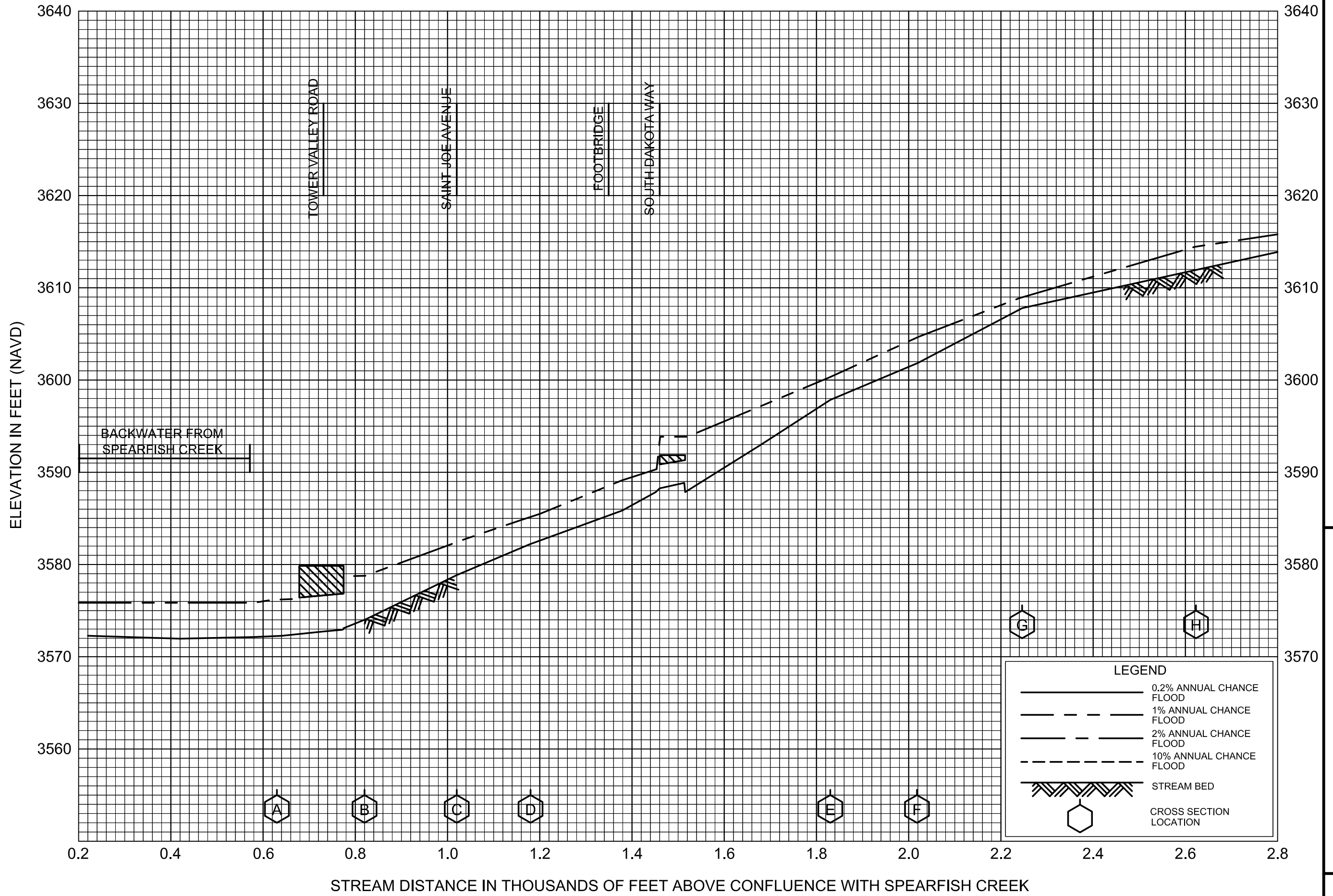


FLOOD PROFILES

UNNAMED TRIBUTARY TO HIGGINS GULCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

LAWRENCE COUNTY, SD
AND INCORPORATED AREAS

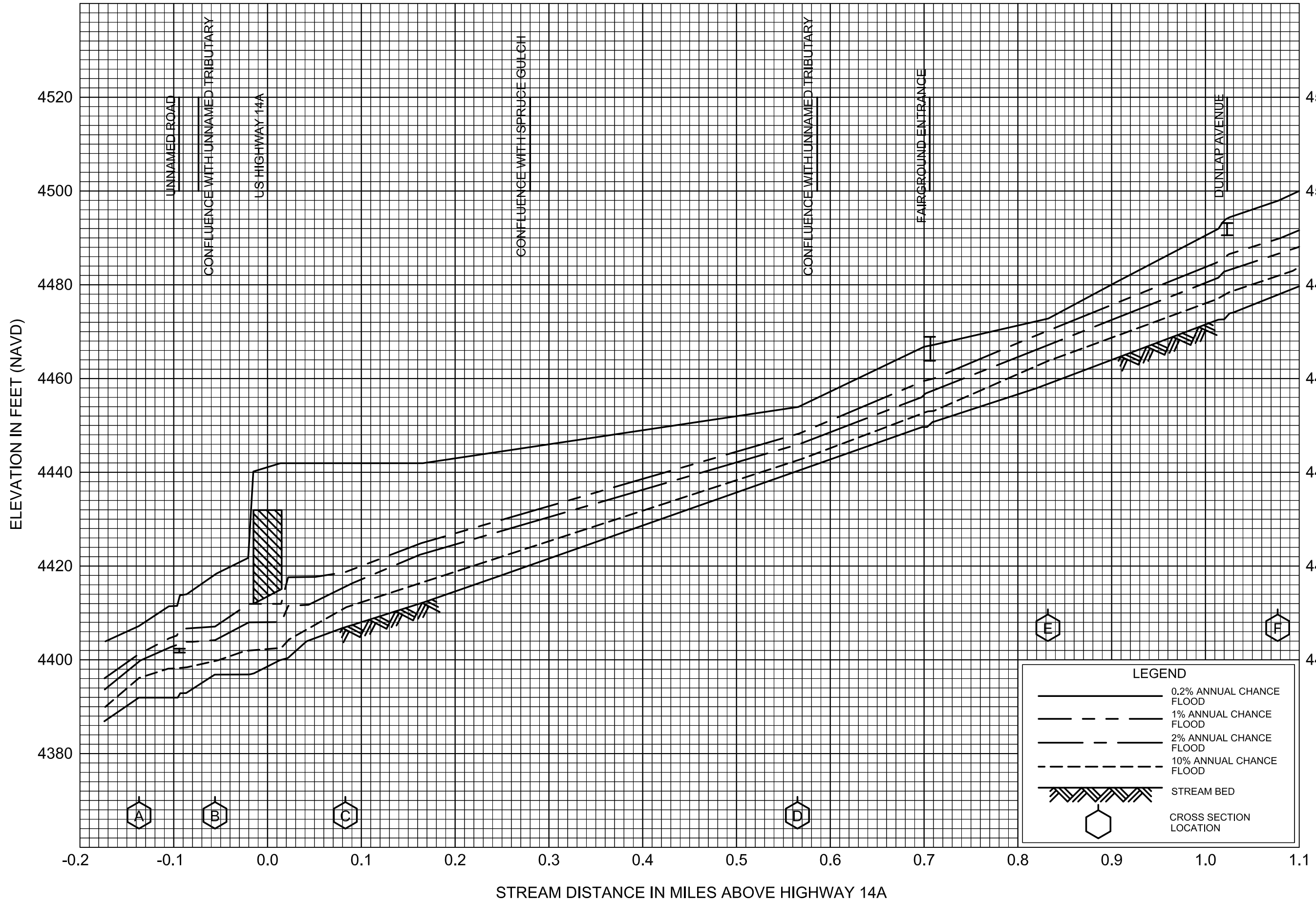


FLOOD PROFILES

WEST CHIPMUNK GULCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

LAWRENCE COUNTY, SD
AND INCORPORATED AREAS

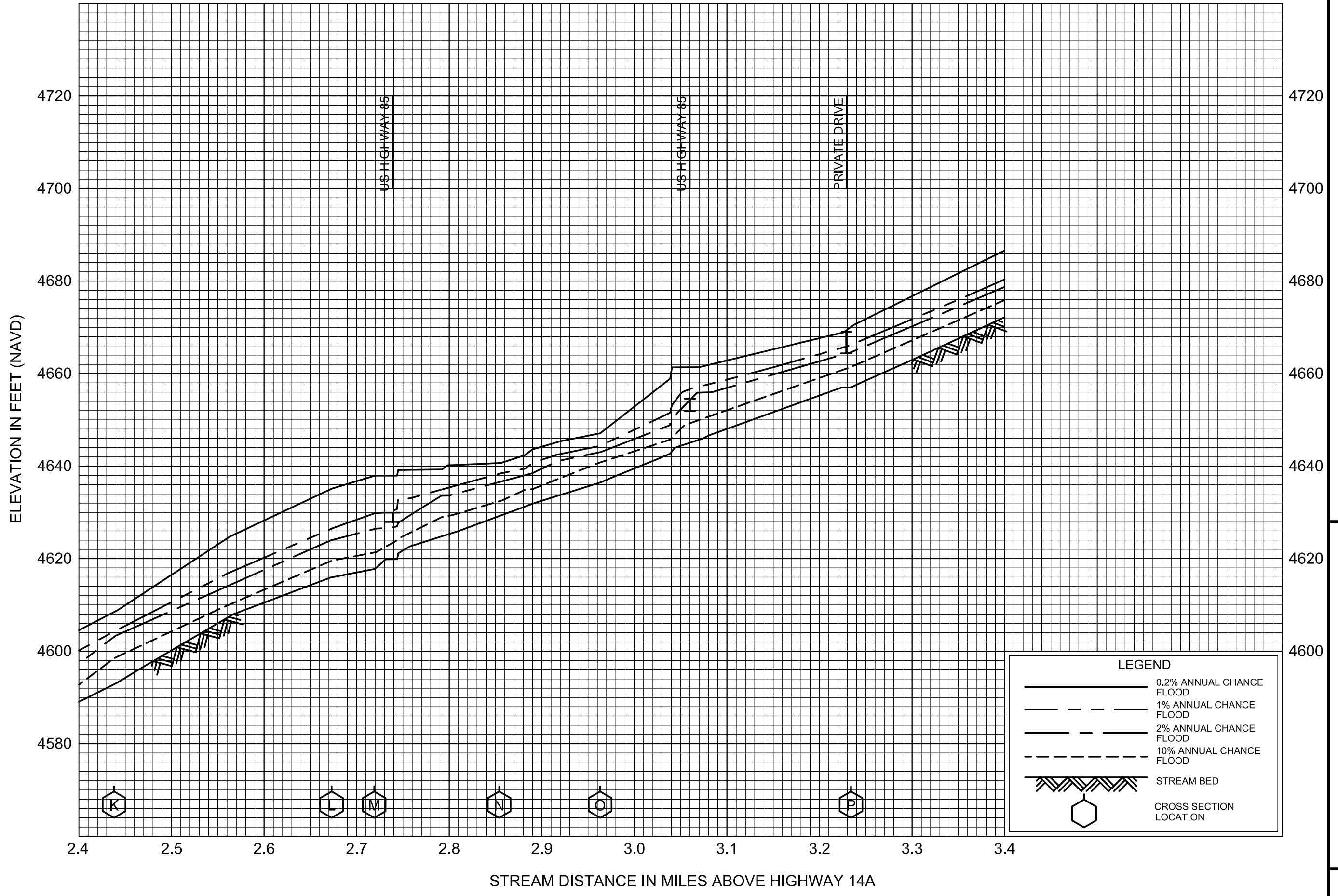


FLOOD PROFILES

WHITEWOOD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

LAWRENCE COUNTY, SD
AND INCORPORATED AREAS



LEGEND







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

FLOOD PROFILES
WHITEWOOD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY
LAWRENCE COUNTY, SD
AND INCORPORATED AREAS



LEGEND

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

FLOOD PROFILES
 WHITEWOOD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY
 LAWRENCE COUNTY, SD
 AND INCORPORATED AREAS