

# FLOOD INSURANCE STUDY

## FEDERAL EMERGENCY MANAGEMENT AGENCY

VOLUME 1 OF 3



## ROBERTSON COUNTY, TENNESSEE

### AND INCORPORATED AREAS

COMMUNITY NAME	COMMUNITY NUMBER
ADAMS, CITY OF	470159
CEDAR HILL, TOWN OF*	470464
COOPERTOWN, TOWN OF	470423
CROSS PLAINS, TOWN OF	470160
GREENBRIER, CITY OF	470161
ORLINDA, TOWN OF	470465
RIDGETOP, CITY OF	470162
ROBERTSON COUNTY, UNINCORPORATED AREAS	470158
SPRINGFIELD, CITY OF	470163

\* No Special Flood Hazard Areas Identified



# FEMA

**REVISED:**

**FEBRUARY 26, 2021**

FLOOD INSURANCE STUDY NUMBER  
47147CV001B

Version Number 2.4.3.6

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**Exhibit 1**

Flood Profiles	<u>Panel</u>
Battle Creek	01-04 P
Beaver Dam Creek	05-06 P
Bednigo Branch	07-08 P
Browns Fork	09 P
Brush Creek	10-13 P
Brush Fork	14 P
Carr Creek	15-20 P
Dickerson Branch	21 P
Frey Branch	22-24 P
Hollis Creek	25-27 P
Hollis Creek Tributary 1	28 P
Hollis Creek Tributary 2	29 P
Hollis Creek Tributary 3	30 P
Hollis Creek Tributary 4	31 P
Honey Run Creek	32 P
Long Branch	33-34 P
Millers Creek	35-38 P
North Fork Sycamore Creek	39-43 P
Pole Bridge Branch	44-45 P
Red River	46-47 P
Redding Branch	48 P
Reeves Branch	49-50 P
Savage Branch	51-53 P
South Fork Sycamore Creek	54-59 P
Sulphur Fork	60-63 P
Sycamore Creek	64-70 P
Sycamore Creek Tributary A	71 P
Unnamed Tributary of Red River	72 P
Unnamed Tributary to Millers Creek	73-74 P
Wartrace Creek	75-78 P
West Fork	79-80 P

**Published Separately**

Flood Insurance Rate Map (FIRM)

# FLOOD INSURANCE STUDY REPORT ROBERTSON COUNTY, TENNESSEE

## SECTION 1.0 – INTRODUCTION

### 1.1 The National Flood Insurance Program

The National Flood Insurance Program (NFIP) is a voluntary Federal program that enables property owners in participating communities to purchase insurance protection against losses from flooding. This insurance is designed to provide an alternative to disaster assistance to meet the escalating costs of repairing damage to buildings and their contents caused by floods.

For decades, the national response to flood disasters was generally limited to constructing flood-control works such as dams, levees, sea-walls, and the like, and providing disaster relief to flood victims. This approach did not reduce losses nor did it discourage unwise development. In some instances, it may have actually encouraged additional development. To compound the problem, the public generally could not buy flood coverage from insurance companies, and building techniques to reduce flood damage were often overlooked.

In the face of mounting flood losses and escalating costs of disaster relief to the general taxpayers, the U.S. Congress created the NFIP. The intent was to reduce future flood damage through community floodplain management ordinances, and provide protection for property owners against potential losses through an insurance mechanism that requires a premium to be paid for the protection.

The U.S. Congress established the NFIP on August 1, 1968, with the passage of the National Flood Insurance Act of 1968. The NFIP was broadened and modified with the passage of the Flood Disaster Protection Act of 1973 and other legislative measures. It was further modified by the National Flood Insurance Reform Act of 1994 and the Flood Insurance Reform Act of 2004. The NFIP is administered by the Federal Emergency Management Agency (FEMA), which is a component of the Department of Homeland Security (DHS).

Participation in the NFIP is based on an agreement between local communities and the Federal Government. If a community adopts and enforces floodplain management regulations to reduce future flood risks to new construction and substantially improved structures in Special Flood Hazard Areas (SFHAs), the Federal Government will make flood insurance available within the community as a financial protection against flood losses. The community's floodplain management regulations must meet or exceed criteria established in accordance with Title 44 Code of Federal Regulations (CFR) Part 60, *Criteria for Land Management and Use*.

SFHAs are delineated on the community's Flood Insurance Rate Maps (FIRMs). Under the NFIP, buildings that were built before the flood hazard was identified on the community's FIRMs are generally referred to as "Pre-FIRM" buildings. When the NFIP was created, the U.S. Congress recognized that insurance for Pre-FIRM buildings would be prohibitively expensive if the premiums were not subsidized by the Federal

Government. Congress also recognized that most of these floodprone buildings were built by individuals who did not have sufficient knowledge of the flood hazard to make informed decisions. The NFIP requires that full actuarial rates reflecting the complete flood risk be charged on all buildings constructed or substantially improved on or after the effective date of the initial FIRM for the community or after December 31, 1974, whichever is later. These buildings are generally referred to as “Post-FIRM” buildings.

## **1.2 Purpose of this Flood Insurance Study Report**

This Flood Insurance Study (FIS) Report revises and updates information on the existence and severity of flood hazards for the study area. The studies described in this report developed flood hazard data that will be used to establish actuarial flood insurance rates and to assist communities in efforts to implement sound floodplain management.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive than the minimum Federal requirements. Contact your State NFIP Coordinator to ensure that any higher State standards are included in the community’s regulations.

## **1.3 Jurisdictions Included in the Flood Insurance Study Project**

This FIS Report covers the entire geographic area of Robertson County, Tennessee.

The jurisdictions that are included in this project area, along with the Community Identification Number (CID) for each community and the United States Geological Survey (USGS) 8-digit Hydrologic Unit Code (HUC-8) sub-basins affecting each, are shown in Table 1. The FIRM panel numbers that affect each community are listed. If the flood hazard data for the community is not included in this FIS Report, the location of that data is identified.

The location of flood hazard data for participating communities in multiple jurisdictions is also indicated in the table.

Jurisdictions that have no identified SFHAs as of the effective date of this study are indicated in the table. Changed conditions in these communities (such as urbanization or annexation) or the availability of new scientific or technical data about flood hazards could make it necessary to determine SFHAs in these jurisdictions in the future.

**Table 1: Listing of NFIP Jurisdictions**

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
Adams, City of	470159	05130206	47147C0180C 47147C0185C	
Cedar Hill, Town of <sup>1</sup>	470464	05130206	47147C0195C 47147C0215C	
Coopertown, Town of	470423	05130202 05130206	47147C0335C 47147C0345C <sup>2</sup> 47147C0355C 47147C0360C 47147C0365D 47147C0370D 47147C0450D	
Cross Plains, Town of	470160	05130206	47147C0255C 47147C0265C 47147C0270C	
Greenbrier, City of	470161	05130202 05130206	47147C0380C 47147C0383C <sup>2</sup> 47147C0390D 47147C0395D	
Millersville, City of	470388	05130201 05130202 05130206	N/A	Sumner County FIS Report 2021
Orlinda, Town of	470465	05130206	47147C0235C 47147C0255C 47147C0260C 47147C0280C	
Portland, City of	470187	05130206	N/A	Sumner County FIS Report 2021
Ridgetop, City of	470162	05130202 05130206	47147C0395D 47147C0415C	
Robertson County, Unincorporated Areas	470158	05110002 05130201 05130202 05130205 05130206	47147C0025C <sup>2</sup> 47147C0050C 47147C0065C 47147C0075C <sup>2</sup> 47147C0090C 47147C0095C 47147C0120C 47147C0125C <sup>2</sup> 47147C0140C	

<sup>1</sup> No Special Flood Hazard Areas Identified

<sup>2</sup> Panel Not Printed

**Table 1: Listing of NFIP Jurisdictions continued**

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
Robertson County, Unincorporated Areas (continued)	470158		47147C0175C 47147C0180C 47147C0185C 47147C0190C 47147C0195C 47147C0205C 47147C0210C <sup>2</sup> 47147C0215C 47147C0218C 47147C0219C 47147C0220C <sup>2</sup> 47147C0230C <sup>2</sup> 47147C0235C 47147C0236C <sup>2</sup> 47147C0237C 47147C0238C 47147C0239C 47147C0245C	
		05110002	47147C0255C	
		05130201	47147C0260C	
		05130202	47147C0265C	
		05130205	47147C0270C	
		05130206	47147C0280C	
			47147C0300C <sup>2</sup>	
			47147C0325C <sup>2</sup>	
			47147C0330C	
			47147C0335C	
			47147C0340C	
			47147C0345C <sup>2</sup>	
			47147C0355C	
			47147C0357C	
			47147C0360C	
			47147C0365D	
			47147C0370D	
			47147C0376C	
			47147C0380C	
			47147C0381C	
			47147C0382C	
			47147C0383C <sup>2</sup>	
			47147C0384C	

<sup>2</sup> Panel Not Printed

**Table 1: Listing of NFIP Jurisdictions continued**

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
Robertson County, Unincorporated Areas (continued)	470158	05110002 05130201 05130202 05130205 05130206	47147C0390D 47147C0395D 47147C0405C 47147C0410C 47147C0415C 47147C0420C <sup>2</sup> 47147C0450D 47147C0455D 47147C0460D	
Springfield, City of	470163	05130206	47147C0215C 47147C0218C 47147C0219C 47147C0220C <sup>2</sup> 47147C0238C 47147C0239C 47147C0357C 47147C0360C 47147C0376C 47147C0380C	
White House, City of	470339	05130206	N/A	Sumner County FIS Report 2021

<sup>2</sup> Panel Not Printed

#### 1.4 Considerations for using this Flood Insurance Study Report

The NFIP encourages State and local governments to implement sound floodplain management programs. To assist in this endeavor, each FIS Report provides floodplain data, which may include a combination of the following: 10-, 4-, 2-, 1-, and 0.2-percent annual chance flood elevations (the 1% annual chance flood elevation is also referred to as the Base Flood Elevation (BFE)); delineations of the 1% annual chance and 0.2% annual chance floodplains; and 1% annual chance floodway. This information is presented on the FIRM and/or in many components of the FIS Report, including Flood Profiles, Floodway Data tables, Summary of Non-Coastal Stillwater Elevations tables, and Coastal Transect Parameters tables (not all components may be provided for a specific FIS).

This section presents important considerations for using the information contained in this FIS Report and the FIRM, including changes in format and content. Figures 1, 2, and 3 present information that applies to using the FIRM with the FIS Report.

- Part or all of this FIS Report may be revised and republished at any time. In addition, part of this FIS Report may be revised by a Letter of Map Revision (LOMR), which does not involve republication or redistribution of the FIS Report.

Refer to Section 6.5 of this FIS Report for information about the process to revise the FIS Report and/or FIRM.

It is, therefore, the responsibility of the user to consult with community officials by contacting the community repository to obtain the most current FIS Report components. Communities participating in the NFIP have established repositories of flood hazard data for floodplain management and flood insurance purposes. Community map repository addresses are provided in Table 30, "Map Repositories," within this FIS Report.

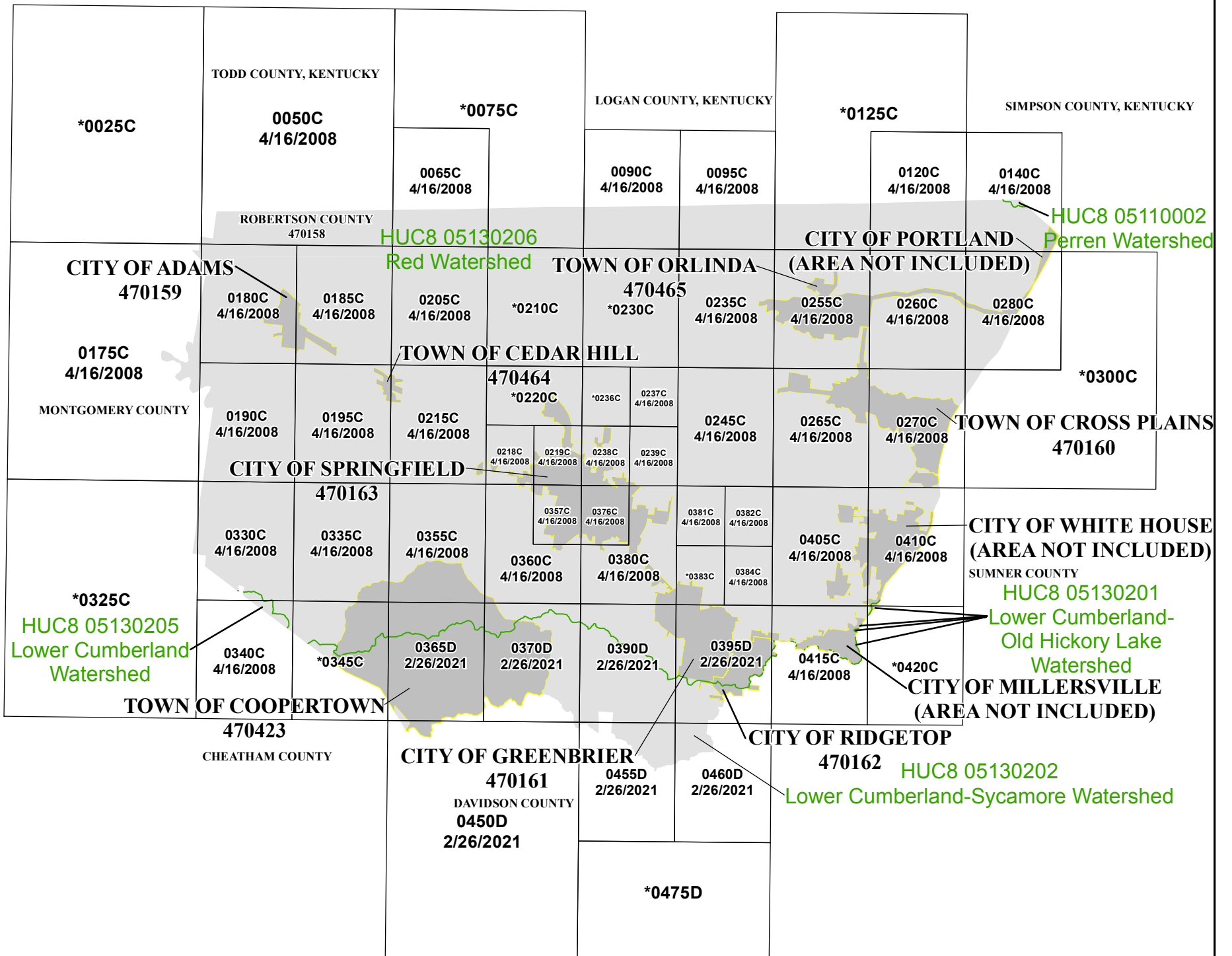
- New FIS Reports are frequently developed for multiple communities, such as entire counties. A countywide FIS Report incorporates previous FIS Reports for individual communities and the unincorporated area of the county (if not jurisdictional) into a single document and supersedes those documents for the purposes of the NFIP.

The initial Countywide FIS Report for Robertson County became effective on April 16, 2008. Refer to Table 27 for information about subsequent revisions to the FIRMs.

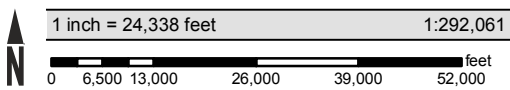
- FEMA has developed a *Guide to Flood Maps* (FEMA 258) and online tutorials to assist users in accessing the information contained on the FIRM. These include how to read panels and step-by-step instructions to obtain specific information. To obtain this guide and other assistance in using the FIRM, visit the FEMA Web site at [www.fema.gov/online-tutorials](http://www.fema.gov/online-tutorials).

The FIRM Index in Figure 1 shows the overall FIRM panel layout within Robertson County, and also displays the panel number and effective date for each FIRM panel in the county. Other information shown on the FIRM Index includes community boundaries, watershed boundaries, and USGS HUC-8 codes.

Figure 1: FIRM Index



**ATTENTION:** The corporate limits shown on this FIRM Index are based on the best information available at the time of publication. As such, they may be more current than those shown on FIRM panels issued before FEBRUARY 26, 2021.



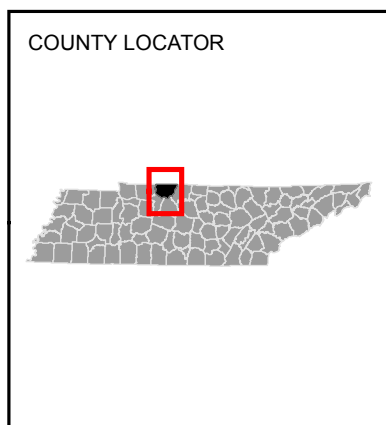
Map Projection:  
State Plane Lambert Conformal Conic,  
Tennessee Zone; North American Datum 1983;  
Western Hemisphere; Vertical Datum: NAVD 88

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

[HTTPS://MSC.FEMA.GOV](https://MSC.FEMA.GOV)

SEE FLOOD INSURANCE STUDY FOR ADDITIONAL INFORMATION

\* PANEL NOT PRINTED - NO SPECIAL FLOOD HAZARD AREAS



**NATIONAL FLOOD INSURANCE PROGRAM**

FLOOD INSURANCE RATE MAP INDEX

ROBERTSON COUNTY, TENNESSEE and Incorporated Areas

PANELS PRINTED:

0050, 0065, 0090, 0095, 0120, 0140, 0175, 0180, 0185, 0190, 0195, 0205, 0215, 0218, 0219, 0235, 0237, 0238, 0239, 0245, 0255, 0260, 0265, 0270, 0280, 0330, 0335, 0340, 0355, 0357, 0360, 0365, 0370, 0376, 0380, 0381, 0382, 0384, 0390, 0395, 0405, 0410, 0415, 0450, 0455, 0460



FEMA

MAP NUMBER  
47147CIND08

MAP REVISED  
FEBRUARY 26, 2021

Each FIRM panel may contain specific notes to the user that provide additional information regarding the flood hazard data shown on that map. However, the FIRM panel does not contain enough space to show all the notes that may be relevant in helping to better understand the information on the panel. Figure 2 contains the full list of these notes.

**Figure 2: FIRM Notes to Users**

<p style="text-align: center;"><b>NOTES TO USERS</b></p> <p>For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products, or the National Flood Insurance Program in general, please call the FEMA Mapping and Insurance eXchange at 1-877- FEMA-MAP (1-877-336-2627) or visit the FEMA Flood Map Service Center website at <a href="http://msc.fema.gov">msc.fema.gov</a>. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website. Users may determine the current map date for each FIRM panel by visiting the FEMA Flood Map Service Center website or by calling the FEMA Mapping and Insurance eXchange.</p> <p>Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Flood Map Service Center at the number listed above.</p> <p>For community and countywide map dates, refer to Table 27 in this FIS Report.</p> <p>To determine if flood insurance is available in the community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.</p>
<p>The map is for use in administering the NFIP. It may not identify all areas subject to flooding, particularly from local drainage sources of small size. Consult the community map repository to find updated or additional flood hazard information.</p> <p><b><u>BASE FLOOD ELEVATIONS:</u></b> For more detailed information in areas where Base Flood Elevations (BFEs) and/or floodways have been determined, consult the Flood Profiles and Floodway Data and/or Summary of Non-Coastal Stillwater Elevations tables within this FIS Report. Use the flood elevation data within the FIS Report in conjunction with the FIRM for construction and/or floodplain management.</p> <p><b><u>FLOODWAY INFORMATION:</u></b> Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the FIS Report for this jurisdiction.</p> <p><b><u>FLOOD CONTROL STRUCTURE INFORMATION:</u></b> Certain areas not in Special Flood Hazard Areas may be protected by flood control structures. Refer to Section 4.3 "Non-Levee Flood Protection Measures" of this FIS Report for information on flood control structures for this jurisdiction.</p>

## Figure 2: FIRM Notes to Users

**PROJECTION INFORMATION PROJECTION INFORMATION:** The projection used in the preparation of the map was State Plane Lambert Conformal Conic, Tennessee Zone. The horizontal datum was the North American Datum 1983; Western Hemisphere. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of the FIRM.

**ELEVATION DATUM:** Flood elevations on the FIRM are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at [www.ngs.noaa.gov](http://www.ngs.noaa.gov).

Local vertical monuments may have been used to create the map. To obtain current monument information, please contact the appropriate local community listed in Table 30 of this FIS Report.

**BASE MAP INFORMATION:** Base map information shown on this FIRM was provided by the State of Tennessee, Department of Finance & Administration, Strategic Technologies Solutions, GIS Services at <http://tnmap.tn.gov/>. Data was also obtained from the United States Army Corps of Engineers Nashville District, Austin Peay State University GIS Center, and the United States Department of Transportation. Ortho imagery was originally produced by the Tennessee Department of Transportation in 2013 and has a 10 inch ground sample distance. For information about base maps, refer to Section 6.2 “Base Map” in this FIS Report.

The map reflects more detailed and up-to-date stream channel configurations than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables may reflect stream channel distances that differ from what is shown on the map.

Corporate limits shown on the map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after the map was published, map users should contact appropriate community officials to verify current corporate limit locations.

### **NOTES FOR FIRM INDEX**

**REVISIONS TO INDEX:** As new studies are performed and FIRM panels are updated within Robertson County, Tennessee, corresponding revisions to the FIRM Index will be incorporated within the FIS Report to reflect the effective dates of those panels. Please refer to Table 27 of this FIS Report to determine the most recent FIRM revision date for each community. The most recent FIRM panel effective date will correspond to the most recent index date.

**ATTENTION:** The corporate limits shown on this FIRM Index are based on the best information available at the time of publication. As such, they may be more current than those shown on FIRM panels issued before February 26, 2021.

### **SPECIAL NOTES FOR SPECIFIC FIRM PANELS**

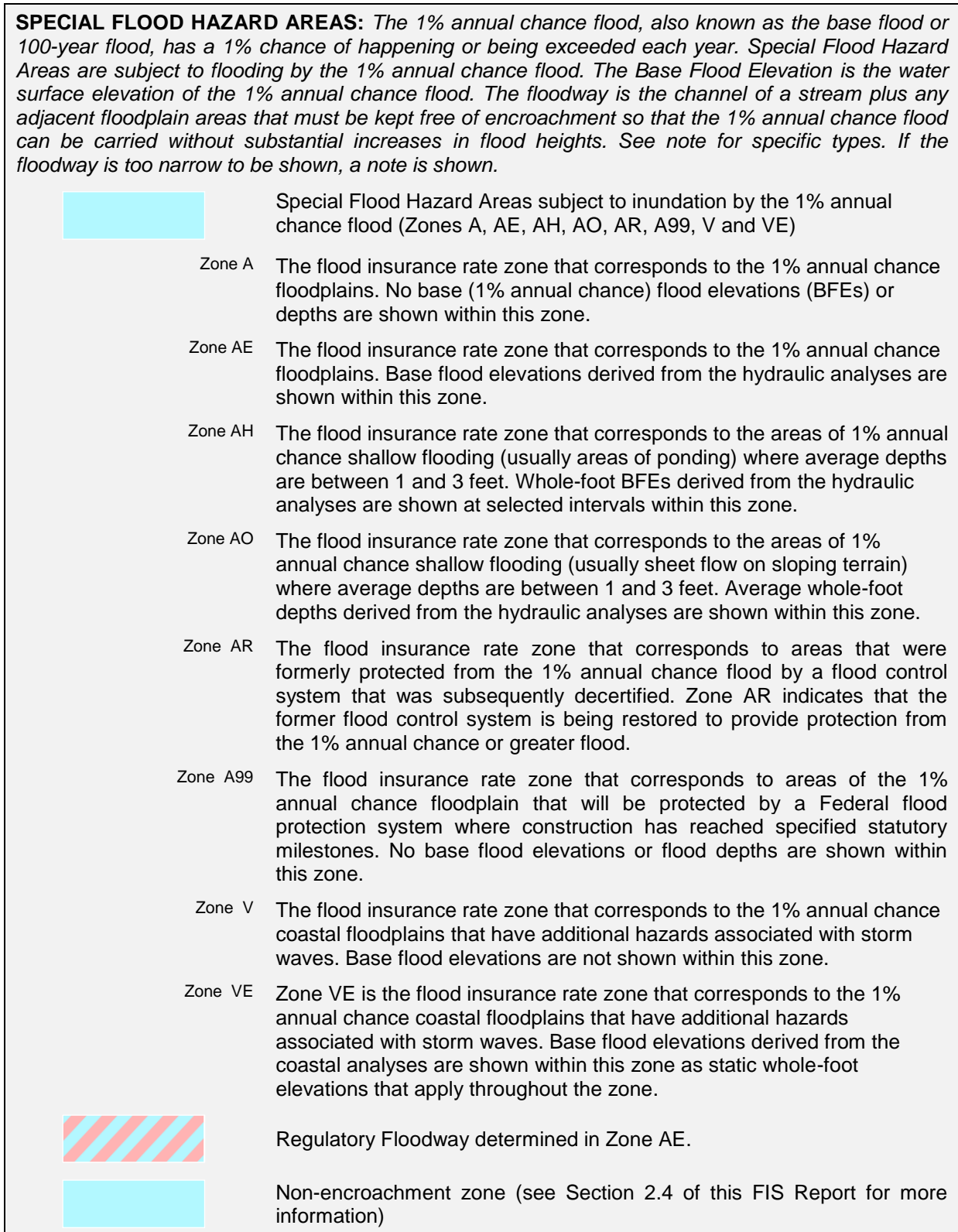
This Notes to Users section was created specifically for Robertson County, Tennessee, effective February 26, 2021.

## Figure 2: FIRM Notes to Users

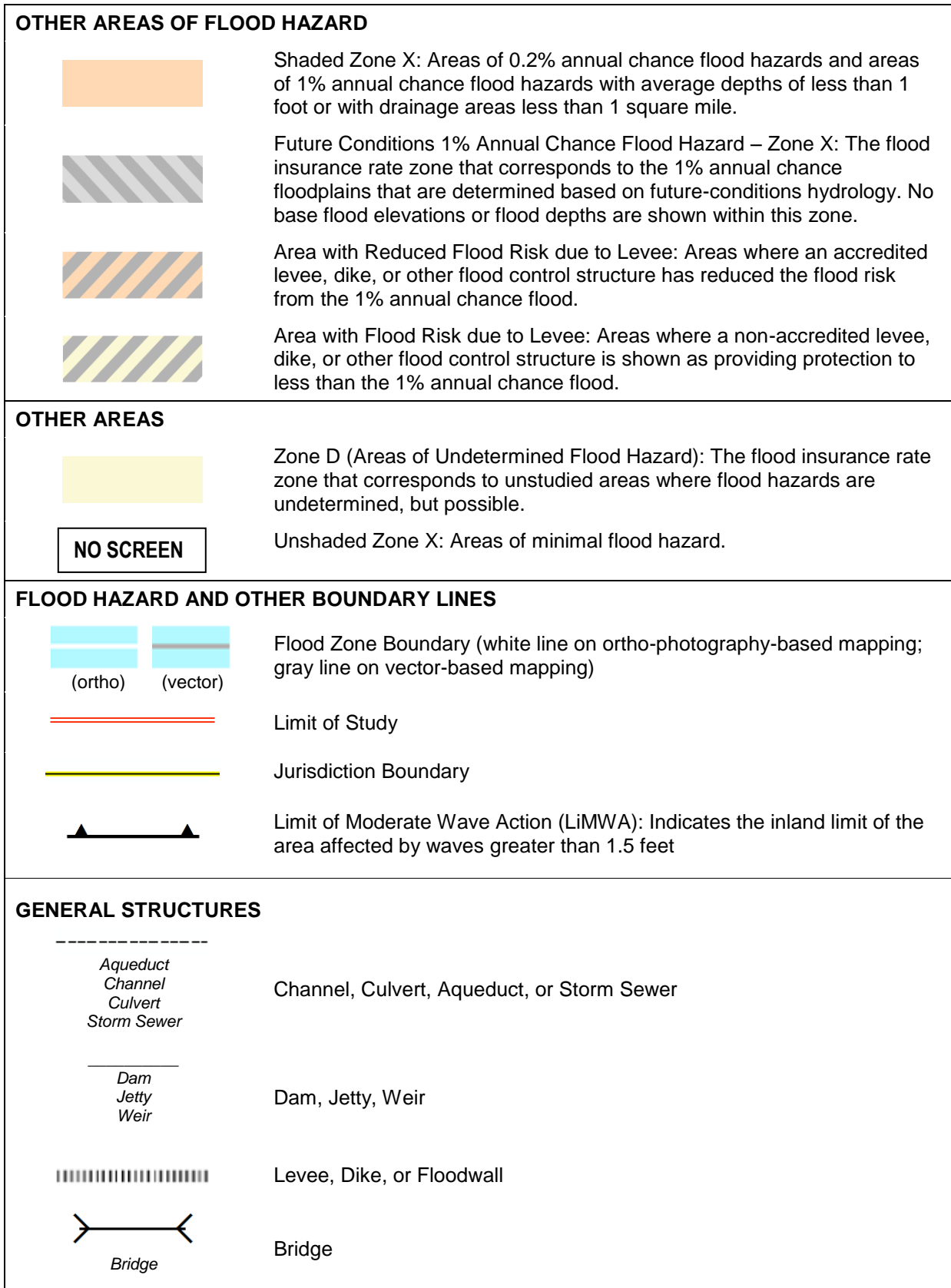
**FLOOD RISK REPORT:** A Flood Risk Report (FRR) may be available for many of the flooding sources and communities referenced in this FIS Report. The FRR is provided to increase public awareness of flood risk by helping communities identify the areas within their jurisdictions that have the greatest risks. Although non-regulatory, the information provided within the FRR can assist communities in assessing and evaluating mitigation opportunities to reduce these risks. It can also be used by communities developing or updating flood risk mitigation plans. These plans allow communities to identify and evaluate opportunities to reduce potential loss of life and property. However, the FRR is not intended to be the final authoritative source of all flood risk data for a project area; rather, it should be used with other data sources to paint a comprehensive picture of flood risk.

Each FIRM panel contains an abbreviated legend for the features shown on the maps. However, the FIRM panel does not contain enough space to show the legend for all map features. Figure 3 shows the full legend of all map features. Note that not all of these features may appear on the FIRM panels in Robertson County.


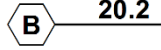
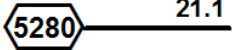
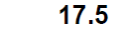




**Figure 3: Map Legend for FIRM**









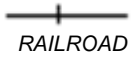






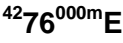


**Figure 3: Map Legend for FIRM**



**Figure 3: Map Legend for FIRM**

<b>REFERENCE MARKERS</b>	
	River mile Markers
<b>CROSS SECTION &amp; TRANSECT INFORMATION</b>	
	Lettered Cross Section with Regulatory Water Surface Elevation (BFE)
	Numbered Cross Section with Regulatory Water Surface Elevation (BFE)
	Unlettered Cross Section with Regulatory Water Surface Elevation (BFE)
	Coastal Transect
	Profile Baseline: Indicates the modeled flow path of a stream and is shown on FIRM panels for all valid studies with profiles or otherwise established base flood elevation.
	Coastal Transect Baseline: Used in the coastal flood hazard model to represent the 0.0-foot elevation contour and the starting point for the transect and the measuring point for the coastal mapping.
	Base Flood Elevation Line
<b>ZONE AE (EL 16)</b>	Static Base Flood Elevation value (shown under zone label)
<b>ZONE AO (DEPTH 2)</b>	Zone designation with Depth
<b>ZONE AO (DEPTH 2) (VEL 15 FPS)</b>	Zone designation with Depth and Velocity

**Figure 3: Map Legend for FIRM**

<b>BASE MAP FEATURES</b>	
	River, Stream or Other Hydrographic Feature
	Interstate Highway
	U.S. Highway
	State Highway
	County Highway
	Street, Road, Avenue Name, or Private Drive if shown on Flood Profile
	Railroad
	Horizontal Reference Grid Line
	Horizontal Reference Grid Ticks
	Secondary Grid Crosshairs
	Name of Land Grant
	Section Number
	Range, Township Number
	Horizontal Reference Grid Coordinates (UTM)
	Horizontal Reference Grid Coordinates (State Plane)
	Corner Coordinates (Latitude, Longitude)

## SECTION 2.0 – FLOODPLAIN MANAGEMENT APPLICATIONS

### 2.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1% annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2% annual chance (500-year) flood is employed to indicate additional areas of flood hazard in the community.

Each flooding source included in the project scope has been studied and mapped using professional engineering and mapping methodologies that were agreed upon by FEMA and Robertson County as appropriate to the risk level. Flood risk is evaluated based on factors such as known flood hazards and projected impact on the built environment. Engineering analyses were performed for each studied flooding source to calculate its 1% annual chance flood elevations; elevations corresponding to other floods (e.g. 10-, 4-, 2-, 0.2-percent annual chance, etc.) may have also been computed for certain flooding sources. Engineering models and methods are described in detail in Section 5.0 of this FIS Report. The modeled elevations at cross sections were used to delineate the floodplain boundaries on the FIRM; between cross sections, the boundaries were interpolated using elevation data from various sources. More information on specific mapping methods is provided in Section 6.0 of this FIS Report.

Depending on the accuracy of available topographic data (Table 22), study methodologies employed (Section 5.0), and flood risk, certain flooding sources may be mapped to show both the 1% and 0.2% annual chance floodplain boundaries, regulatory water surface elevations (BFEs), and/or a regulatory floodway. Similarly, other flooding sources may be mapped to show only the 1% annual chance floodplain boundary on the FIRM, without published water surface elevations. In cases where the 1% and 0.2% annual chance floodplain boundaries are close together, only the 1% annual chance floodplain boundary is shown on the FIRM. Figure 3, “Map Legend for FIRM”, describes the flood zones that are used on the FIRMs to account for the varying levels of flood risk that exist along flooding sources within the project area. Table 2 and Table 3 indicate the flood zone designations for each flooding source and each community within Robertson County, respectively.

Table 2, “Flooding Sources Included in this FIS Report,” lists each flooding source, including its study limits, affected communities, mapped zone on the FIRM, and the completion date of its engineering analysis from which the flood elevations on the FIRM and in the FIS Report were derived. Descriptions and dates for the latest hydrologic and hydraulic analyses of the flooding sources are shown in Table 12. Floodplain boundaries for these flooding sources are shown on the FIRM (published separately) using the symbology described in Figure 3. On the map, the 1% annual chance floodplain corresponds to the SFHAs. The 0.2% annual chance floodplain shows areas that, although out of the regulatory floodplain, are still subject to flood hazards.

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 procedures to remove these areas from the SFHA are described in Section 6.5 of this FIS Report.

**Table 2: Flooding Sources Included in this FIS Report**

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Battle Creek	Coopertown, Town of	Confluence with Sycamore Creek	Approximately 1.24 miles upstream of Lipscomb Lane	05130202	3.7	N	AE	10/01/2017
Beaver Dam Creek	Robertson County, Unincorporated Areas	Confluence with Sulphur Fork	Approximately 1.22 miles upstream of Louis Draughorn Road	05130206	3.7	Y	AE	05/01/1982
Beaver Dam Creek	Robertson County, Unincorporated Areas	Approximately 1.22 miles upstream of Louis Draughorn Road	Approximately 1.32 miles upstream of Louis Draughorn Road	05130206	0.1	N	A	05/01/1982
Bednigo Branch	Coopertown, Town of; Robertson County, Unincorporated Areas	Confluence with Sycamore Creek	Approximately 1,120 feet upstream of Abednego Road	05130202	1.9	N	AE	10/01/2017
Browns Fork	Robertson County, Unincorporated Areas	Confluence with Carr Creek	Approximately 3,220 feet upstream of Ammeto Larr Road	05130206	1.1	Y	AE	05/01/1982
Browns Fork	Robertson County, Unincorporated Areas	Approximately 3,220 feet upstream of Ammeto Larr Road	Approximately 4,100 feet upstream for the confluence with Brushy Creek	05130206	2.5	N	A	04/01/2008
Brush Creek	Coopertown, Town of; Robertson County, Unincorporated Areas	Confluence with Sulphur Fork	Approximately 1.35 miles upstream of Wandaland Road	05130206	1.4	Y	AE	05/01/1982
Brush Creek	Robertson County, Unincorporated Areas	Approximately 1.35 miles upstream of Wandaland Road	Approximately 850 feet upstream of Gause Road	05130206	0.2	N	A	05/01/1982
Brush Fork	Robertson County, Unincorporated Areas	Confluence with Bednigo Branch	Approximately 1,240 feet upstream of Abednego Road	05130202	0.2	N	AE	10/01/2017

**Table 2: Flooding Sources Included in this FIS Report continued**

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Buzzard Creek	Robertson County, Unincorporated Areas	Confluence with Red River	Approximately 1.38 miles upstream of Buzzard Road	05130206	3.0	N	A	04/01/2008
Calebs Creek	Robertson County, Unincorporated Areas	Confluence with Sulphur Fork	At County Highway 6277 / Old Washington Road	05130206	1.0	N	A	04/01/2008
Carr Creek	Robertson County, Unincorporated Areas	Confluence with Sulphur Fork	At Hackney Road	05130206	11.2	Y	AE	05/01/1982
Carr Creek	Robertson County, Unincorporated Areas	At Hackney Road	Approximately 1,340 feet upstream of Hackney Road	05130206	0.3	N	A	05/01/1982
Dickerson Branch	Robertson County, Unincorporated Areas	Confluence with North Fork Sycamore Creek	Approximately 1,560 feet upstream of Smiley Hollow Road	05130202	0.4	N	AE	10/01/2017
Elk Fork Creek	Robertson County, Unincorporated Areas	Confluence with Red River	At Hopper Hollow Road	05130206	4.7	N	A	04/01/2008
Frey Branch	Robertson County, Unincorporated Areas	At Pleasant Grove Road	Approximately 1.93 miles upstream of Pleasant Grove Road	05130206	1.9	Y	AE	05/01/1982
Frey Branch	Robertson County, Unincorporated Areas	Approximately 1.93 miles upstream of Pleasant Grove Road	Approximately 1.97 miles upstream of Pleasant Grove Road	05130206	0.0	N	A	05/01/1982
Hollis Creek	Coopertown, Town of; Robertson County, Unincorporated Areas	Confluence with Sycamore Creek	Approximately 2,750 feet upstream of Cooper Nicholson Road	05130202	3.6	N	AE	10/01/2017
Hollis Creek Tributary 1	Coopertown, Town of	Confluence with Hollis Creek	Approximately 1,535 feet upstream of the confluence with Hollis Creek	05130202	0.3	N	AE	10/01/2017
Hollis Creek Tributary 2	Coopertown, Town of	Confluence with Hollis Creek	Approximately 2,145 feet upstream of Cooper Nicholson Road	05130202	0.5	N	AE	10/01/2017

**Table 2: Flooding Sources Included in this FIS Report continued**

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Hollis Creek Tributary 3	Coopertown, Town of	Confluence with Hollis Creek	Approximately 860 feet upstream of the confluence with Hollis Creek	05130202	0.2	N	AE	10/01/2017
Hollis Creek Tributary 4	Coopertown, Town of	Confluence with Hollis Creek	Approximately 580 feet upstream of Cooper Nicholson Road	05130202	0.1	N	AE	10/01/2017
Honey Run	Cross Plains, Town of; Robertson County, Unincorporated Areas; White House, City of	Confluence with Sulphur Fork	Davidson County boundary	05130206	10.2	N	A	04/01/2008
Honey Run Creek	Robertson County, Unincorporated Areas	Confluence with Millers Creek	Approximately 5,120 feet upstream of James Stone Road	05130206	1.7	Y	AE	05/01/1982
Honey Run Creek	Robertson County, Unincorporated Areas	Approximately 5,120 feet upstream of James Stone Road	Approximately 5,320 feet upstream of James Stone Road	05130206	0.1	N	A	05/01/1982
Long Branch	Greenbrier, City of; Robertson County, Unincorporated Areas	Confluence with Sulphur Fork	Approximately 760 feet downstream of the confluence of Pole Bridge Branch	05130206	2.7	Y	AE	05/01/1982
Long Branch	Greenbrier, City of; Robertson County, Unincorporated Areas	Approximately 760 feet downstream of the confluence of Pole Bridge Branch	Confluence of Pole Bridge Branch	05130206	0.1	N	A	05/01/1982
Mill Branch	Robertson County, Unincorporated Areas	Confluence with Sulphur Fork	Approximately 1,200 feet upstream of New Hall Road	05130206	1.9	N	A	04/01/2008
Millers Creek	Coopertown, Town of; Robertson County, Unincorporated Areas	Confluence with Sulphur Fork	Approximately 5,095 feet upstream of Unnamed Road	05130206	7.9	Y	AE	05/01/1982

**Table 2: Flooding Sources Included in this FIS Report continued**

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Millers Creek	Coopertown, Town of	Approximately 5,020 feet upstream of Unnamed Road	Approximately 1.0 miles upstream of Unnamed Road	05130206	0.1	N	A	05/01/1982
North Fork Sycamore Creek	Robertson County, Unincorporated Areas	Confluence with Sycamore Creek / South Fork Sycamore Creek	Approximately 1,500 feet upstream of Private Drive	05130202	6.1	N	AE	10/01/2017
Pole Bridge Branch	Greenbrier, City of; Ridgetop, City of; Robertson County, Unincorporated Areas	Confluence with Long Branch	Approximately 4,171 feet upstream of Kelley Willis Road	05130206	1.7	Y	AE	05/01/1982
Pole Bridge Branch	Greenbrier, City of; Ridgetop, City of; Robertson County, Unincorporated Areas	Approximately 4,171 feet upstream of Kelley Willis Road	Approximately 4,699 feet upstream of Kelley Willis Road	05130206	0.1	N	A	05/01/1982
Red River	Adams, City of; Robertson County, Unincorporated Areas	Montgomery County boundary	Logan County, KY boundary	05130206	25.3	N	A	05/01/1982
Red River	Robertson County, Unincorporated Areas	Logan County, KY boundary	Approximately 970 feet downstream of the confluence of Unnamed Tributary to Red River	05130206	83.0	N	A	05/01/1982
Red River	Orlinda, Town of; Robertson County, Unincorporated Areas	Approximately 970 feet downstream of the confluence of Unnamed Tributary to Red River	At I-65	05130206	6.0	Y	AE	05/01/1982
Red River	Robertson County, Unincorporated Areas	At I-65	Davidson County boundary	05130206	1.0	N	A	05/01/1982
Redding Branch	Coopertown, Town of	Confluence with Sycamore Creek	Approximately 815 feet upstream of Weir	05130202	0.3	N	AE	10/01/2017

**Table 2: Flooding Sources Included in this FIS Report continued**

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Reeves Branch	Coopertown, Town of	Confluence with Sycamore Creek	Approximately 4,430 feet upstream of Martins Chapel Road	05130202	1.8	N	AE	10/01/2017
Savage Branch	Robertson County, Unincorporated Areas	Confluence with Sulphur Fork	Approximately 580 feet upstream of Private Drive	05130206	1.5	Y	AE	05/01/1982
Savage Branch	Robertson County, Unincorporated Areas	Approximately 580 feet upstream of Private Drive	Approximately 1,030 feet upstream of Private Drive	05130206	0.1	N	A	05/01/1982
South Fork Sycamore Creek	Robertson County, Unincorporated Areas	Confluence with Sycamore Creek / North Fork Sycamore Creek	Approximately 4,725 feet upstream of Greer Road	05130202	6.9	Y	AE	10/01/2017
South Red River	Cross Springs, Town of; Robertson County, Unincorporated Areas	Logan County, KY boundary	Approximately 1.0 miles upstream of East Robertson Road	05130206	17.2	N	A	04/01/2008
Spring Creek	Robertson County, Unincorporated Areas	Confluence with Sulphur Fork	Approximately 2.7 miles upstream of the confluence of Sulphur Fork	05130206	2.7	N	A	04/01/2008
Sulphur Fork	Robertson County, Unincorporated Areas	Montgomery County boundary	Approximately 2.7 miles upstream of Old Washington Road	05130206	20.6	N	A	05/01/1982
Sulphur Fork	Robertson County, Unincorporated Areas; Springfield, City of	Approximately 2.73 miles upstream of Old Washington Road	Approximately 320 feet upstream of Swift Road	05130206	24.2	Y	AE	05/01/1982
Sulphur Fork	Robertson County, Unincorporated Areas	Approximately 320 feet upstream of Swift Road	Approximately 580 feet upstream of Swift Road	05130206	0.0	N	A	05/01/1982
Summers Branch	Robertson County, Unincorporated Areas	Confluence with Red River	Approximately 3,930 feet upstream of Red River School Road	05130206	1.9	N	A	05/01/1982

**Table 2: Flooding Sources Included in this FIS Report continued**

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Summers Branch	Portland, City of; Robertson County, Unincorporated Areas	Approximately 2,700 feet downstream of I-65	Davidson County boundary	05130206	0.9	N	A	05/01/1982
Sycamore Creek	Robertson County, Unincorporated Areas	Cheatham County boundary	Approximately 3,310 feet upstream of the confluence of Sycamore Creek Tributary A	05130202	5.9	N	AE	10/01/2017
Sycamore Creek	Coopertown, Town of; Robertson County, Unincorporated Areas	Approximately 3,310 feet upstream of the confluence of Sycamore Creek Tributary A	Confluence of North Fork Sycamore Creek / South Fork Sycamore Creek	05130202	2.0	Y	AE	10/01/2017
Sycamore Creek Tributary A	Coopertown, Town of	Cheatham County boundary	Approximately 3,440 feet upstream of Cheatham County boundary	05130202	0.7	N	AE	10/01/2017
Unnamed Tributary of Red River	Robertson County, Unincorporated Areas	Confluence with Red River	Approximately 1,060 feet upstream of Durers Mill Road	05130206	1.0	Y	AE	05/01/1982
Unnamed Tributary of Red River	Robertson County, Unincorporated Areas	Approximately 1,060 feet upstream of Durers Mill Road	Approximately 2,700 feet upstream of Durers Mill Road	05130206	0.2	N	A	05/01/1982
Unnamed Tributary to Millers Creek	Robertson County, Unincorporated Areas	Confluence with Millers Creek	Approximately 2,110 feet upstream of Unnamed Road	05130206	2.0	Y	AE	05/01/1982
Unnamed Tributary to Millers Creek	Robertson County, Unincorporated Areas	Approximately 2,110 feet upstream of Unnamed Road	Approximately 2,290 feet upstream of Unnamed Road	05130206	0.0	N	A	05/01/1982
Wartrace Creek	Robertson County, Unincorporated Areas; Springfield, City of	Confluence with Sulphur Fork	At Worsham Road	05130206	4.5	Y	AE	05/01/1982

**Table 2: Flooding Sources Included in this FIS Report continued**

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Wartrace Creek	Robertson County, Unincorporated Areas	At Worsham Road	Approximately 1,900 feet upstream of Worsham Springs Road	05130206	0.4	N	A	05/01/1982
West Fork	Robertson County, Unincorporated Areas	Confluence with Brush Creek	Approximately 1,430 feet upstream of Fyke Lane	05130206	1.8	Y	AE	05/01/1982
West Fork	Robertson County, Unincorporated Areas	Approximately 1,430 feet upstream of Fyke Lane	Approximately 2,080 feet upstream of Fyke Lane	05130206	0.1	N	A	05/01/1982

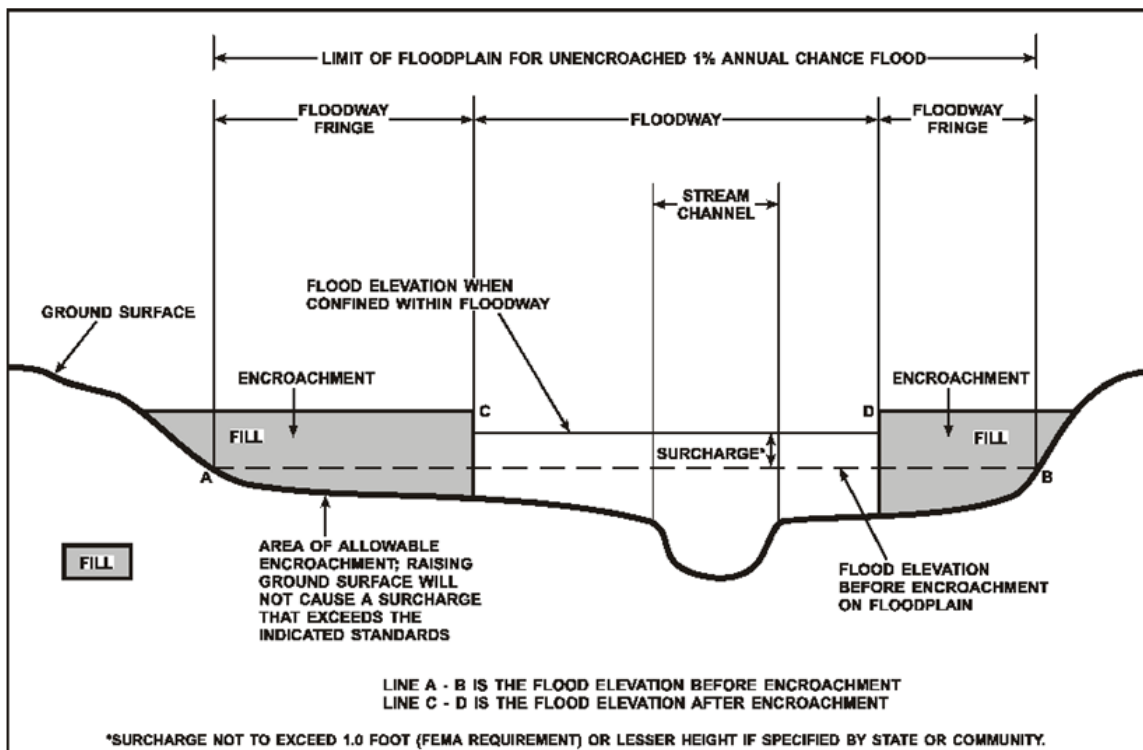
## 2.2 Floodways

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 balancing floodplain development against increasing flood hazard. With this approach, the area of the 1% annual chance floodplain on a river is divided into a floodway and a floodway fringe based on hydraulic modeling. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment in order to carry the 1% annual chance flood. The floodway fringe is the area between the floodway and the 1% annual chance floodplain boundaries where encroachment is permitted. The floodway must be wide enough so that the floodway fringe could be completely obstructed without increasing the water surface elevation of the 1% 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 4.

To participate in the NFIP, Federal regulations require communities to limit increases caused by encroachment to 1.0 foot, provided that hazardous velocities are not produced. Regulations for Tennessee require communities in Robertson County to limit increases caused by encroachment to 1.0 foot and several communities have adopted additional restrictions. The floodways in this project are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway projects.

**Figure 4: Floodway Schematic**



Floodway widths presented in this FIS Report and on the FIRM were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. For certain stream segments, floodways were adjusted so that the amount of floodwaters conveyed on each side of the floodplain would be reduced equally. The results of the floodway computations have been tabulated for selected cross sections and are shown in Table 23, "Floodway Data."

All floodways that were developed for this Flood Risk Project are shown on the FIRM using the symbology described in Figure 3. In cases where the floodway and 1% annual chance floodplain boundaries are either close together or collinear, only the floodway boundary has been shown on the FIRM. For information about the delineation of floodways on the FIRM, refer to Section 6.3.

### **2.3 Base Flood Elevations**

The hydraulic characteristics of flooding sources were analyzed to provide estimates of the elevations of floods of the selected recurrence intervals. The Base Flood Elevation (BFE) is the elevation of the 1% annual chance flood. These BFEs are most commonly rounded to the whole foot, as shown on the FIRM, but in certain circumstances or locations they may be rounded to 0.1 foot. Cross section lines shown on the FIRM may also be labeled with the BFE rounded to 0.1 foot. Whole-foot BFEs derived from engineering analyses that apply to coastal areas, areas of ponding, or other static areas with little elevation change may also be shown at selected intervals on the FIRM.

Cross sections with BFEs shown on the FIRM correspond to the cross sections shown in the Floodway Data table and Flood Profiles in this FIS Report. BFEs are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS Report in conjunction with the data shown on the FIRM.

### **2.4 Non-Encroachment Zones**

Some States and communities use non-encroachment zones to manage floodplain development. For flooding sources with medium flood risk, field surveys are often not collected and surveyed bridge and culvert geometry is not developed. Standard hydrologic and hydraulic analyses are still performed to determine BFEs in these areas. However, floodways are not typically determined, since specific channel profiles are not developed. To assist communities with managing floodplain development in these areas, a "non-encroachment zone" may be provided. While not a FEMA designated floodway, the non-encroachment zone represents that area around the stream that should be reserved to convey the 1% annual chance flood event. As with a floodway, all surcharges must fall within the acceptable range in the non-encroachment zone.

General setbacks can be used in areas of lower risk (e.g. unnumbered Zone A), but these are not considered sufficient where unnumbered Zone A is replaced by Zone AE. The NFIP requires communities to ensure that any development in a non-encroachment area causes no increase in BFEs. Communities must generally prohibit development within the area defined by the non-encroachment width to meet the NFIP requirement. Regulations for Tennessee require communities in Robertson County to limit increases

caused by encroachment to 1.0 foot and several communities have adopted additional restrictions for non-encroachment areas.

Non-encroachment determinations may be delineated where it is not possible to delineate floodways because specific channel profiles with bridge and culvert geometry were not developed. Any non-encroachment determinations for this Flood Risk Project have been tabulated for selected cross sections and are shown in Table 24, "Flood Hazard and Non-Encroachment Data for Selected Streams." Areas for which non-encroachment zones are provided show BFEs and the 1% annual chance floodplain boundaries mapped as zone AE on the FIRM but no floodways.

## **2.5 Coastal Flood Hazard Areas**

This section is not applicable to this Flood Risk Project.

### **2.5.1 Water Elevations and the Effects of Waves**

This section is not applicable to this Flood Risk Project.

#### **Figure 5: Wave Runup Transect Schematic**

[Not Applicable to this Flood Risk Project]

### **2.5.2 Floodplain Boundaries and BFEs for Coastal Areas**

This section is not applicable to this Flood Risk Project.

### **2.5.3 Coastal High Hazard Areas**

This section is not applicable to this Flood Risk Project.

#### **Figure 6: Coastal Transect Schematic**

[Not Applicable to this Flood Risk Project]

### **2.5.4 Limit of Moderate Wave Action**

This section is not applicable to this Flood Risk Project.

## **SECTION 3.0 – INSURANCE APPLICATIONS**

### **3.1 National Flood Insurance Program Insurance Zones**

For flood insurance applications, the FIRM designates flood insurance rate zones as described in Figure 3, "Map Legend for FIRM." Flood insurance zone designations are assigned to flooding sources based on the results of the hydraulic or coastal analyses. Insurance agents use the zones shown on the FIRM and depths and base flood elevations in this FIS Report in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

The 1% annual chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (e.g. Zones A, AE, V, VE, etc.), and the 0.2% annual chance floodplain boundary corresponds to the boundary of areas of additional flood hazards.

Table 3 lists the flood insurance zones in Robertson County.

**Table 3: Flood Zone Designations by Community**

Community	Flood Zone(s)
Adams, City of	A, X
Cedar Hill, Town of	X
Coopertown, Town of	AE, A, X
Cross Plains, Town of	A, X
Greenbrier, City of	A, AE, X
Orlinda, Town of	A, AE, X
Ridgetop, City of	A, AE, X
Robertson County, Unincorporated Areas	A, AE, X
Springfield, City of	AE, X

## SECTION 4.0 – AREA STUDIED

### 4.1 Basin Description

Table 4 contains a description of the characteristics of the HUC-8 sub-basins within which each community falls. The table includes the main flooding sources within each basin, a brief description of the basin, and its drainage area.

**Table 4: Basin Characteristics**

HUC-8 Sub-Basin Name	HUC-8 Sub-Basin Number	Primary Flooding Source	Description of Affected Area	Drainage Area (square miles)
Barren	05110002	Barren Lake	This watershed has virtually no presence in Robertson County. A very small portion in the northeast corner of the county is contained in this watershed.	2,265
Lower Cumberland-Old Hickory Lake	05130201	Cumberland River	This watershed has a small presence. It contains a portion of Robertson County in the southeast corner of the county.	986

**Table 4: Basin Characteristics continued**

HUC-8 Sub-Basin Name	HUC-8 Sub-Basin Number	Primary Flooding Source	Description of Affected Area	Drainage Area (square miles)
Lower Cumberland-Sycamore	05130202	Cumberland River	This watershed has the second to largest presence in the county. It contains the southern portion of Robertson County, including the Town of Coopertown and a portion to the City of Ridgetop	741
Lower Cumberland	05130205	Cumberland River	Like Barren, this watershed has virtually no presence. It contains a small portion of Robertson County in the southwest corner.	2,334
Red	05130206	Red River	This watershed has the largest presence containing a majority of Robertson County and the incorporated areas.	1,454

**4.2 Principal Flood Problems**

Table 5 contains a description of the principal flood problems that have been noted for Robertson County by flooding source.

**Table 5: Principal Flood Problems**

Flooding Source	Description of Flood Problems
All Sources	<p>Records of past flooding on Sulphur Fork show that the period of winter and early spring, December through April, is the time when the majority of floods occur. Historically, floods causing significant damage occurred in 1866, 1890, 1913, 1937, 1952, 1962, 1969, 1975 and 1978. The March 1975 flood had a recurrence interval between the 10 and 50 year flood (FIS 2008).</p> <p>There is no available information concerning principal flood problems for the other streams in the county other than high water marks from the December 1978 flood on Millers Creek and highwater marks from the 1975 flood on Red River (FIS 2008).</p>

Table 6 contains information about historic flood elevations in the communities within Robertson County.

**Table 6: Historic Flooding Elevations**

[Not Applicable to this Flood Risk Project]

### 4.3 Non-Levee Flood Protection Measures

Table 7 contains information about non-levee flood protection measures within Robertson County such as dams, jetties, and or dikes. Levees are addressed in Section 4.4 of this FIS Report.

**Table 7: Non-Levee Flood Protection Measures**

Flooding Source	Structure Name	Type of Measure	Location	Description of Measure
Wartrace Creek	N/A	Earthen Dam	At Mile 0.7 on Wartrace Creek	This dam is currently used for recreational purposes. It's unknown if this was previously built for flood protection, but its presence has little effect on the 1% annual chance flood when routed through the dam. Because it is constructed of highly erodible material. It would probably fail during 0.2% annual chance flood. Apparently a failure did occur during construction (FIS 2008).

### 4.4 Levees

This section is not applicable to this Flood Risk Project.

**Table 8: Levees**

[Not Applicable to this Flood Risk Project]

## SECTION 5.0 – ENGINEERING METHODS

For the flooding sources 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 at least once on the average during any 10-, 25-, 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-, 25-, 50-, 100-, and 500-year floods, have a 10-, 4-, 2-, 1-, and 0.2% annual chance, respectively, of being equaled or exceeded during any year.

Although the recurrence interval represents the long-term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1-percent chance of annual exceedance) during the term of a 30-year mortgage is approximately 26 percent (about 3 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.

## **5.1 Hydrologic Analyses**

Hydrologic analyses were carried out to establish the peak elevation-frequency relationships for floods of the selected recurrence intervals for each flooding source studied. Hydrologic analyses are typically performed at the watershed level. Depending on factors such as watershed size and shape, land use and urbanization, and natural or man-made storage, various models or methodologies may be applied. A summary of the hydrologic methods applied to develop the discharges used in the hydraulic analyses for each stream is provided in Table 12. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation.

A summary of the discharges is provided in Table 9.

**Table 9: Summary of Discharges**

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)				
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Battle Creek	At the confluence with Sycamore Creek	3.76	1,574	1,989	2,299	2,609	3,329
Battle Creek	Approximately 2,930 feet upstream of Martins Chapel Road	3.08	1,352	1,711	1,980	2,249	2,872
Battle Creek	Approximately 2,170 feet downstream of Martins Chapel Church Road	2.63	1,199	1,519	1,759	1,999	2,556
Battle Creek	Approximately 200 feet upstream of Libscomb Lane	2.25	1,065	1,351	1,566	1,780	2,278
Battle Creek	Approximately 2,450 feet upstream of Lipscomb Lane	1.90	936	1,189	1,379	1,568	2,009
Battle Creek	Approximately 3,800 feet upstream of Lipscomb Lane	1.66	846	1,076	1,249	1,421	1,821
Beaver Dam Creek	At mile 0.09	14.79	3,260	*	5,120	6,000	8,985
Beaver Dam Creek	At Louis Draughon Road	9.80	2,420	*	3,810	4,460	6,870
Beaver Dam Creek	At mile 3.63	7.63	2,015	*	3,170	3,720	5,820
Bednigo Branch	At the confluence with Sycamore Creek	6.53	2,395	3,012	3,473	3,935	5,004
Bednigo Branch	Approximately 1,530 feet downstream of Abednego Road	6.16	2,290	2,883	3,324	3,767	4,792
Bednigo Branch	At the confluence with Brush Fork	3.03	1,333	1,687	1,953	2,218	2,833
Browns Fork	At mile 0.23	8.40	2,200	*	3,400	4,000	6,200
Brush Creek	At mile 0.30	15.90	3,436	*	5,393	6,318	9,414
Brush Creek	At Edd Ross Road Bridge	12.40	2,870	*	4,510	5,286	8,009

\* Not calculated for this Flood Risk Project

**Table 9: Summary of Discharges continued**

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)				
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Brush Creek	At mile 4.60	6.80	1,860	*	2,930	3,434	5,420
Brush Fork	At the confluence with Bednigo Branch	2.45	1,137	1,441	1,670	1,897	2,427
Carr Creek	At mile 0.17	37.30	6,370	*	9,950	11,600	16,400
Carr Creek	At Highway 65 Bridge	19.40	3,970	*	6,220	7,300	10,700
Carr Creek	At Mile 6.60	14.20	3,170	*	4,970	5,800	8,700
Carr Creek	At Chapel Road Bridge	7.60	2,020	*	3,170	3,700	5,800
Dickerson Branch	At the confluence with North Fork Sycamore Creek	2.36	1,103	1,399	1,621	1,842	2,357
Frey Branch	At mile 0.05	2.30	850	*	1,340	1,580	2,680
Hollis Creek	At the confluence with Sycamore Creek	7.26	2,595	3,262	3,758	4,257	5,410
Hollis Creek	At the confluence of Hollis Creek Tributary 1	5.26	2,031	2,559	2,954	3,349	4,264
Hollis Creek	At the confluence of Hollis Creek Tributary 2	3.14	1,371	1,735	2,008	2,280	2,912
Hollis Creek	At the confluence of Hollis Creek Tributary 3	1.47	769	980	1,138	1,295	1,661
Hollis Creek	At the confluence of Hollis Creek Tributary 4	0.70	437	559	652	743	958
Hollis Creek Tributary 1	At the confluence with Hollis Creek	1.50	782	995	1,155	1,315	1,687
Hollis Creek Tributary 2	At the confluence with Hollis Creek	1.34	716	912	1,060	1,206	1,549
Hollis Creek Tributary 3	At the confluence with Hollis Creek	1.21	664	847	984	1,121	1,440

\* Not calculated for this Flood Risk Project

**Table 9: Summary of Discharges continued**

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)				
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Hollis Creek Tributary 4	At the confluence with Hollis Creek	0.68	428	548	639	729	939
Honey Run Creek	At mile 0.41	4.50	1,380	*	2,175	2,550	4,150
Honey Run Creek	At mile 1.00	2.80	940	*	1,590	1,740	2,900
Honey Run Creek	At mile 1.70	1.10	500	*	790	930	1,660
Long Branch	At confluence with Sulphur Fork	9.44	2,350	*	3,710	4,350	6,710
Long Branch	At mile 0.58	7.73	2,040	*	3,210	3,760	5,890
Long Branch	At mile 1.96	5.65	1,630	*	2,560	3,010	4,800
Millers Creek	At confluence with Sulphur Fork	23.00	4,487	*	7,033	8,236	11,967
North Fork Sycamore Creek	At the confluence with Sycamore Creek / South Fork Sycamore Creek	11.60	3,707	4,642	5,336	6,036	7,649
North Fork Sycamore Creek	Approximately 4,520 feet upstream of confluence with Sycamore Creek / South Fork Sycamore Creek	9.79	3,256	4,083	4,698	5,317	6,745
North Fork Sycamore Creek	Approximately 1,210 feet downstream of Edgar Dillard Road	9.06	3,072	3,855	4,436	5,022	6,373
North Fork Sycamore Creek	At the confluence of Dickerson Branch	6.06	2,261	2,846	3,282	3,720	4,732
North Fork Sycamore Creek	Approximately 330 feet upstream of Private Drive	5.63	2,138	2,693	3,107	3,522	4,483
North Fork Sycamore Creek	Approximately 4,450 feet upstream of Private Drive	4.95	1,937	2,443	2,820	3,198	4,073

\* Not calculated for this Flood Risk Project

**Table 9: Summary of Discharges continued**

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)				
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
North Fork Sycamore Creek	Approximately 200 feet downstream of Private Drive	3.64	1,536	1,941	2,244	2,547	3,250
North Fork Sycamore Creek	Approximately 1,640 feet upstream of Private Drive	2.44	1,130	1,433	1,661	1,887	2,414
North Fork Sycamore Creek	Approximately 2,100 feet downstream of Private Drive	1.69	857	1,090	1,265	1,439	1,845
North Fork Sycamore Creek	Approximately 315 feet upstream of Private Drive	1.08	609	778	905	1,031	1,325
Pole Bridge Branch	At confluence with Long Branch	5.13	1,520	*	2,390	2,800	4,510
Pole Bridge Branch	At mile 0.17	4.32	1,280	*	2,020	2,370	3,880
Pole Bridge Branch	At mile 0.40	3.40	1,130	*	1,780	2,090	3,450
Pole Bridge Branch	At mile 1.09	1.60	650	*	1,030	1,220	2,120
Red River	Just above Summers Branch	49.10	7,760	*	12,130	14,200	19,590
Red River	At mile 84.8	39.20	6,600	*	10,320	12,080	16,920
Red River	At mile 87.0	29.20	5,330	*	8,350	9,780	13,970
Redding Branch	At the confluence with Sycamore Creek	0.53	352	452	528	603	778
Reeves Branch	At the confluence with Sycamore Creek	1.73	872	1,109	1,287	1,464	1,877
Reeves Branch	Approximately 490 feet downstream of Martins Chapel Road	1.19	657	838	974	1,110	1,425
Savage Branch	At mile 0.11	2.20	822	*	1,301	1,527	2,603
Sulphur Fork	At mile 4.85	210.00	17,559	*	27,591	32,127	47,048
Sulphur Fork	At mile 10.82	186.00	14,800	*	23,400	27,200	43,074

\* Not calculated for this Flood Risk Project

**Table 9: Summary of Discharges continued**

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)				
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Sulphur Fork	At mile 18.12	136.60	13,212	*	20,767	24,202	35,766
Sulphur Fork	At mile 23.60	87.20	11,624	*	18,133	21,203	28,457
Sulphur Fork	At mile 30.70	73.10	10,353	*	16,152	18,893	25,374
Sulphur Fork	At 5 <sup>th</sup> Avenue Bridge	65.60	9,574	*	14,942	17,481	23,650
Sulphur Fork	At mil 32.93	49.10	7,764	*	12,132	14,198	19,591
Sulphur Fork	At mile 38.08	34.90	6,066	*	9,492	11,111	15,692
Sulphur Fork	At Distillery Road Bridge	28.70	5,256	*	8,052	9,656	13,819
Sulphur Fork	At mile 40.08	19.10	3,923	*	6,153	7,208	10,605
Sulphur Fork	At mile 40.36	12.30	2,854	*	4,484	5,255	7,967
Sulphur Fork	At Hall Road Bridge	7.30	1,957	*	3,082	3,613	5,676
Sulphur Fork	At Swift Ridge Road	2.20	822	*	1,301	1,527	2,603
South Fork Sycamore Creek	At the confluence with Sycamore Creek / North Fork Sycamore Creek	14.18	7,760	10,100	11,855	13,325	16,605
South Fork Sycamore Creek	Approximately 2,640 feet upstream of Riley Adcock Road	12.01	7,490	9,575	11,165	12,390	15,020
South Fork Sycamore Creek	At the confluence of Sulfur Branch	8.37	5,350	7,025	7,960	8,970	10,845
South Fork Sycamore Creek	Approximately 4,750 upstream of the confluence of Sulfur Branch	4.78	3,470	4,180	4,705	5,210	6,430
South Fork Sycamore Creek	At the confluence of South Fork Sycamore Creek Tributary	2.54	1,845	2,220	2,495	2,765	3,415

\* Not calculated for this Flood Risk Project

**Table 9: Summary of Discharges continued**

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)				
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Sycamore Creek	Just upstream of the confluence of Hollis Creek	67.90	20,790	28,460	34,067	40,796	53,858
Sycamore Creek	Just upstream of the confluence of Battle Creek	56.35	20,076	27,392	32,432	37,626	47,843
Sycamore Creek	At the confluence of Long Creek	46.74	17,935	22,910	27,295	32,965	41,625
Sycamore Creek	Just upstream of I-65	33.98	13,880	17,495	21,080	24,585	31,810
Sycamore Creek	Approximately 2,640 feet upstream of I-65 <sup>1</sup>	27.26	11,520	14,505	17,135	20,120	25,795
Sycamore Creek Tributary A	At the confluence with Sycamore Creek	2.53	1,163	1,474	1,707	1,940	2,481
Sycamore Creek Tributary A	Approximately 1,960 feet upstream of the confluence with Sycamore Creek	2.31	1,086	1,378	1,597	1,815	2,322
Unnamed Tributary of Red River	At mile 0.18	5.10	1,510	*	2,400	2,700	4,500
Unnamed Tributary to Millers Creek	At mile 0.18	3.80	1,510	*	2,400	2,700	4,500
Wartrace Creek	At mile 1.03	6.92	1,883	*	2,965	3,477	5,482
Wartrace Creek	At mile 2.08	4.94	1,476	*	2,327	2,730	4,403
Wartrace Creek	At mile 3.00	3.30	1,102	*	1,741	2,043	3,388
West Fork	At confluence with Brush Creek	4.10	1,300	*	2,050	2,400	3,900

<sup>1</sup> Located in Davidson County

\* Not calculated for this Flood Risk Project

**Figure 7: Frequency Discharge-Drainage Area Curves**

[Not Applicable to this Flood Risk Project]

**Table 10: Summary of Non-Coastal Stillwater Elevations**

[Not Applicable to this Flood Risk Project]

**Table 11: Stream Gage Information used to Determine Discharges**

[Not Applicable to this Flood Risk Project]

**5.2 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. Base flood elevations on the FIRM represent the elevations shown on the Flood Profiles and in the Floodway Data tables in the FIS Report. Rounded whole-foot elevations may be shown on the FIRM in coastal areas, areas of ponding, and other areas with static base flood elevations. These whole-foot elevations may not exactly reflect the elevations derived from the hydraulic analyses. Flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS Report in conjunction with the data shown on the FIRM. The hydraulic analyses for this FIS 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 streams for which hydraulic analyses were based on cross sections, locations of selected cross sections are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 6.3), selected cross sections are also listed in Table 23, "Floodway Data."

A summary of the methods used in hydraulic analyses performed for this project is provided in Table 12. Roughness coefficients are provided in Table 13. Roughness coefficients are values representing the frictional resistance water experiences when passing overland or through a channel. They are used in the calculations to determine water surface elevations. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation.

**Table 12: Summary of Hydrologic and Hydraulic Analyses**

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Battle Creek	Confluence with Sycamore Creek	Approximately 1.24 miles upstream of Lipscomb Lane	Regression Equations (USGS 2000)	HEC-RAS 4.1.0 (USACE 2010)	10/01/2017	AE	
Beaver Dam Creek	Confluence with Sulphur Fork	Approximately 1.22 miles upstream of Louis Draughorn Road	Regression Equations (USGS 1976)	HEC-2 (USACE 1976)	05/01/1982	AE w/ Floodway	
Beaver Dam Creek	Approximately 1.22 miles upstream of Louis Draughorn Road	Approximately 1.32 miles upstream of Louis Draughorn Road	Other	Other	05/01/1982	A	A depth-area relationship, also developed by the USGS, was used for approximate method streams to estimate the depth of the 100-year flow at the locations unaffected by backwater from bridge obstructions. Estimates of backwater effects from such obstructions were made by field inspection (FIS 1983 Dec).
Bednigo Branch	Confluence with Sycamore Creek	Approximately 1,120 feet upstream of Abednego Road	Regression Equations (USGS 2000)	HEC-RAS 4.1.0 (USACE 2010)	10/01/2017	AE	
Browns Fork	Confluence with Carr Creek	Approximately 3,220 feet upstream of Ammeto Larr Road	Regression Equations (USGS 1976)	HEC-2 (USACE 1976)	05/01/1982	AE w/ Floodway	
Browns Fork	Approximately 3,220 feet upstream of Ammeto Larr Road	Approximately 4,100 feet upstream for the confluence with Brushy Creek	Regression Equations (USGS 2000)	HEC-RAS 3.1.2 (USACE 2004)	04/01/2008	A	
Brush Creek	Confluence with Sulphur Fork	Approximately 1.35 miles upstream of Wandaland Road	Regression Equations (USGS 1976)	HEC-2 (USACE 1976)	05/01/1982	AE w/ Floodway	

**Table 12: Summary of Hydrologic and Hydraulic Analyses continued**

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Brush Creek	Approximately 1.35 miles upstream of Wandaland Road	Approximately 850 feet upstream of Gause Road	Other	Other	05/01/1982	A	A depth-area relationship, also developed by the USGS, was used for approximate method streams to estimate the depth of the 100-year flow at the locations unaffected by backwater from bridge obstructions. Estimates of backwater effects from such obstructions were made by field inspection (FIS 1983 Dec).
Brush Fork	Confluence with Bednigo Branch	Approximately 1,240 feet upstream of Abednego Road	Regression Equations (USGS 2000)	HEC-RAS 4.1.0 (USACE 2010)	10/01/2017	AE	
Buzzard Creek	Confluence with Red River	Approximately 1.38 miles upstream of Buzzard Road	Regression Equations (USGS 2000)	HEC-RAS 3.1.2 (USACE 2004)	04/01/2008	A	
Calebs Creek	Confluence with Sulphur Fork	At County Highway 6277 / Old Washington Road	Regression Equations (USGS 2000)	HEC-RAS 3.1.2 (USACE 2004)	04/01/2008	A	
Carr Creek	Confluence with Sulphur Fork	At Hackney Road	Regression Equations (USGS 1976)	HEC-2 (USACE 1976)	05/01/1982	AE w/ Floodway	
Carr Creek	At Hackney Road	Approximately 1,340 feet upstream of Hackney Road	Other	Other	05/01/1982	A	A depth-area relationship, also developed by the USGS, was used for approximate method streams to estimate the depth of the 100-year flow at the locations unaffected by backwater from bridge obstructions. Estimates of backwater effects from such obstructions were made by field inspection (FIS 1983 Dec).
Dickerson Branch	Confluence with North Fork Sycamore Creek	Approximately 1,560 feet upstream of Smiley Hollow Road	Regression Equations (USGS 2000)	HEC-RAS 4.1.0 (USACE 2010)	10/01/2017	AE	

**Table 12: Summary of Hydrologic and Hydraulic Analyses continued**

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Elk Fork Creek	Confluence with Red River	At Hopper Hollow Road	Regression Equations (USGS 2000)	HEC-RAS 3.1.2 (USACE 2004)	04/01/2008	A	
Frey Branch	At Pleasant Grove Road	Approximately 1.93 miles upstream of Pleasant Grove Road	Regression Equations (USGS 1976)	HEC-2 (USACE 1976)	05/01/1982	AE w/ Floodway	
Frey Branch	Approximately 1.93 miles upstream of Pleasant Grove Road	Approximately 1.97 miles upstream of Pleasant Grove Road	Other	Other	05/01/1982	A	A depth-area relationship, also developed by the USGS, was used for approximate method streams to estimate the depth of the 100-year flow at the locations unaffected by backwater from bridge obstructions. Estimates of backwater effects from such obstructions were made by field inspection (FIS 1983 Dec).
Hollis Creek	Confluence with Sycamore Creek	Approximately 2,750 feet upstream of Cooper Nicholson Road	Regression Equations (USGS 2000)	HEC-RAS 4.1.0 (USACE 2010)	10/01/2017	AE	
Hollis Creek Tributary 1	Confluence with Hollis Creek	Approximately 1,535 feet upstream of the confluence with Hollis Creek	Regression Equations (USGS 2000)	HEC-RAS 4.1.0 (USACE 2010)	10/01/2017	AE	
Hollis Creek Tributary 2	Confluence with Hollis Creek	Approximately 2,145 feet upstream of Cooper Nicholson Road	Regression Equations (USGS 2000)	HEC-RAS 4.1.0 (USACE 2010)	10/01/2017	AE	
Hollis Creek Tributary 3	Confluence with Hollis Creek	Approximately 860 feet upstream of the confluence with Hollis Creek	Regression Equations (USGS 2000)	HEC-RAS 4.1.0 (USACE 2010)	10/01/2017	AE	
Hollis Creek Tributary 4	Confluence with Hollis Creek	Approximately 580 feet upstream of Cooper Nicholson Road	Regression Equations (USGS 2000)	HEC-RAS 4.1.0 (USACE 2010)	10/01/2017	AE	

**Table 12: Summary of Hydrologic and Hydraulic Analyses continued**

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Honey Run	Confluence with Sulphur Fork	Davidson County boundary	Regression Equations (USGS 2000)	HEC-RAS 3.1.2 (USACE 2004)	04/01/2008	A	
Honey Run Creek	Confluence with Millers Creek	Approximately 5,120 feet upstream of James Stone Road	Regression Equations (USGS 1976)	HEC-2 (USACE 1976)	05/01/1982	AE w/ Floodway	
Honey Run Creek	Approximately 5,120 feet upstream of James Stone Road	Approximately 5,320 feet upstream of James Stone Road	Other	Other	05/01/1982	A	A depth-area relationship, also developed by the USGS, was used for approximate method streams to estimate the depth of the 100-year flow at the locations unaffected by backwater from bridge obstructions. Estimates of backwater effects from such obstructions were made by field inspection (FIS 1983 Dec).
Long Branch	Confluence with Sulphur Fork	Approximately 760 feet downstream of the confluence of Pole Bridge Branch	Regression Equations (USGS 1976)	HEC-2 (USACE 1976)	05/01/1982	AE w/ Floodway	
Long Branch	Approximately 760 feet downstream of the confluence of Pole Bridge Branch	Confluence of Pole Bridge Branch	Other	Other	05/01/1982	A	A depth-area relationship, also developed by the USGS, was used for approximate method streams to estimate the depth of the 100-year flow at the locations unaffected by backwater from bridge obstructions. Estimates of backwater effects from such obstructions were made by field inspection (FIS 1983 Dec).
Mill Branch	Confluence with Sulphur Fork	Approximately 1,200 feet upstream of New Hall Road	Regression Equations (USGS 2000)	HEC-RAS 3.1.2 (USACE 2004)	04/01/2008	A	
Millers Creek	Approximately 5,020 feet upstream of Unnamed Road	Approximately 1.0 miles upstream of Unnamed Road	Regression Equations (USGS 1976)	HEC-2 (USACE 1976)	05/01/1982	AE w/ Floodway	

**Table 12: Summary of Hydrologic and Hydraulic Analyses continued**

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Millers Creek	Confluence with Sycamore Creek / South Fork Sycamore Creek	Approximately 1,500 feet upstream of Private Drive	Other	Other	05/01/1982	A	A depth-area relationship, also developed by the USGS, was used for approximate method streams to estimate the depth of the 100-year flow at the locations unaffected by backwater from bridge obstructions. Estimates of backwater effects from such obstructions were made by field inspection (FIS 1983 Dec).
North Fork Sycamore Creek	Confluence with Long Branch	Approximately 4,171 feet upstream of Kelley Willis Road	Regression Equations (USGS 2000)	HEC-RAS 4.1.0 (USACE 2010)	10/01/2017	AE	
Pole Bridge Branch	Approximately 4,171 feet upstream of Kelley Willis Road	Approximately 4,699 feet upstream of Kelley Willis Road	Regression Equations (USGS 1976)	HEC-2 (USACE 1976)	05/01/1982	AE w/ Floodway	
Pole Bridge Branch	Approximately 3,750 feet upstream of Kelley Willis Road	Approximately 4,060 feet upstream of Kelley Willis Road	Other	Other	05/01/1982	A	A depth-area relationship, also developed by the USGS, was used for approximate method streams to estimate the depth of the 100-year flow at the locations unaffected by backwater from bridge obstructions. Estimates of backwater effects from such obstructions were made by field inspection (FIS 1983 Dec).
Red River	Montgomery County boundary	Logan County, KY boundary	Other	Other	05/01/1982	A	A depth-area relationship, also developed by the USGS, was used for approximate method streams to estimate the depth of the 100-year flow at the locations unaffected by backwater from bridge obstructions. Estimates of backwater effects from such obstructions were made by field inspection (FIS 1983 Dec).

**Table 12: Summary of Hydrologic and Hydraulic Analyses continued**

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Red River	Logan County, KY boundary	Approximately 970 feet downstream of the confluence of Unnamed Tributary to Red River	Other	Other	05/01/1982	A	A depth-area relationship, also developed by the USGS, was used for approximate method streams to estimate the depth of the 100-year flow at the locations unaffected by backwater from bridge obstructions. Estimates of backwater effects from such obstructions were made by field inspection (FIS 1983 Dec).
Red River	Approximately 970 feet downstream of the confluence of Unnamed Tributary to Red River	At I-65	Regression Equations (USGS 1976)	HEC-2 (USACE 1976)	05/01/1982	AE w/ Floodway	
Red River	At I-65	Davidson County boundary	Other	Other	05/01/1982	A	A depth-area relationship, also developed by the USGS, was used for approximate method streams to estimate the depth of the 100-year flow at the locations unaffected by backwater from bridge obstructions. Estimates of backwater effects from such obstructions were made by field inspection (FIS 1983 Dec).
Redding Branch	Confluence with Sycamore Creek	Approximately 815 feet upstream of Weir	Regression Equations (USGS 2000)	HEC-RAS 4.1.0 (USACE 2010)	10/01/2017	AE	
Reeves Branch	Confluence with Sycamore Creek	Approximately 4,430 feet upstream of Martins Chapel Road	Regression Equations (USGS 2000)	HEC-RAS 4.1.0 (USACE 2010)	10/01/2017	AE	
Savage Branch	Confluence with Sulphur Fork	Approximately 580 feet upstream of Private Drive	Regression Equations (USGS 1976)	HEC-2 (USACE 1976)	05/01/1982	AE w/ Floodway	

**Table 12: Summary of Hydrologic and Hydraulic Analyses continued**

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Savage Branch	Approximately 580 feet upstream of Private Drive	Approximately 1,030 feet upstream of Private Drive	Other	Other	05/01/1982	A	A depth-area relationship, also developed by the USGS, was used for approximate method streams to estimate the depth of the 100-year flow at the locations unaffected by backwater from bridge obstructions. Estimates of backwater effects from such obstructions were made by field inspection (FIS 1983 Dec).
South Fork Sycamore Creek	Confluence with Sycamore Creek / North Fork Sycamore Creek	Approximately 4,725 feet upstream of Greer Road	HEC-HMS 4.0 (USACE 2013)	HEC-RAS 4.1.0 (USACE 2010)	10/01/2017	AE w/ Floodway	The hydrology and hydraulics were performed by USACE. Additional information can be found in "Nashville Metro Flood Preparedness Phase 4D, Metro Nashville PAS - Phase 4D Flood Insurance Update" (USACE 2016 Phase 4D).
South Red River	Logan County, KY boundary	Approximately 1.0 miles upstream of East Robertson Road	Regression Equations (USGS 2000)	HEC-RAS 3.1.2 (USACE 2004)	04/01/2008	A	
Spring Creek	Confluence with Sulphur Fork	Approximately 2.7 miles upstream of the confluence of Sulphur Fork	Regression Equations (USGS 2000)	HEC-RAS 3.1.2 (USACE 2004)	04/01/2008	A	
Sulphur Fork	Montgomery County boundary	Approximately 2.7 miles upstream of Old Washington Road	Other	Other	05/01/1982	A	A depth-area relationship, also developed by the USGS, was used for approximate method streams to estimate the depth of the 100-year flow at the locations unaffected by backwater from bridge obstructions. Estimates of backwater effects from such obstructions were made by field inspection (FIS 1983 Dec).
Sulphur Fork	Approximately 2.73 miles upstream of Old Washington Road	Approximately 320 feet upstream of Swift Road	Regression Equations (USGS 1976)	HEC-2 (USACE 1976)	05/01/1982	AE w/ Floodway	

**Table 12: Summary of Hydrologic and Hydraulic Analyses continued**

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Sulphur Fork	Approximately 320 feet upstream of Swift Road	Approximately 580 feet upstream of Swift Road	Other	Other	05/01/1982	A	A depth-area relationship, also developed by the USGS, was used for approximate method streams to estimate the depth of the 100-year flow at the locations unaffected by backwater from bridge obstructions. Estimates of backwater effects from such obstructions were made by field inspection (FIS 1983 Dec).
Summers Branch	Confluence with Red River	Approximately 3,930 feet upstream of Red River School Road	Other	Other	05/01/1982	A	A depth-area relationship, also developed by the USGS, was used for approximate method streams to estimate the depth of the 100-year flow at the locations unaffected by backwater from bridge obstructions. Estimates of backwater effects from such obstructions were made by field inspection (FIS 1983 Dec).
Summers Branch	Approximately 2,700 feet downstream of I-65	Davidson County boundary	Other	Other	05/01/1982	A	A depth-area relationship, also developed by the USGS, was used for approximate method streams to estimate the depth of the 100-year flow at the locations unaffected by backwater from bridge obstructions. Estimates of backwater effects from such obstructions were made by field inspection (FIS 1983 Dec).
Sycamore Creek	Cheatham County boundary	Approximately 3,310 feet upstream of the confluence of Sycamore Creek Tributary A	HEC-HMS 4.0 (USACE 2013)	HEC-RAS 4.1.0 (USACE 2010)	10/01/2017	AE	The hydrology was performed by USACE. Additional information can be found in "Nashville Metro Flood Preparedness Phase 4D, Metro Nashville PAS - Phase 4D Flood Insurance Update" (USACE 2016 Phase 4D).

**Table 12: Summary of Hydrologic and Hydraulic Analyses continued**

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Sycamore Creek	Approximately 3,310 feet upstream of the confluence of Sycamore Creek Tributary A	Confluence of North Fork Sycamore Creek / South Fork Sycamore Creek	HEC-HMS 4.0 (USACE 2013)	HEC-RAS 4.1.0 (USACE 2010)	10/01/2017	AE w/ Floodway	The hydrology and hydraulics were performed by USACE. Additional information can be found in "Nashville Metro Flood Preparedness Phase 4D, Metro Nashville PAS - Phase 4D Flood Insurance Update" (USACE 2016 Phase 4D).
Sycamore Creek Tributary A	Cheatham County boundary	Approximately 3,440 feet upstream of Cheatham County boundary	Regression Equations (USGS 2000)	HEC-RAS 4.1.0 (USACE 2010)	10/01/2017	AE	
Unnamed Tributary of Red River	Confluence with Red River	Approximately 1,060 feet upstream of Durers Mill Road	Regression Equations (USGS 1976)	HEC-2 (USACE 1976)	05/01/1982	AE w/ Floodway	
Unnamed Tributary of Red River	Approximately 1,060 feet upstream of Durers Mill Road	Approximately 2,700 feet upstream of Durers Mill Road	Other	Other	05/01/1982	A	A depth-area relationship, also developed by the USGS, was used for approximate method streams to estimate the depth of the 100-year flow at the locations unaffected by backwater from bridge obstructions. Estimates of backwater effects from such obstructions were made by field inspection (FIS 1983 Dec).
Unnamed Tributary to Millers Creek	Confluence with Millers Creek	Approximately 2,110 feet upstream of Unnamed Road	Regression Equations (USGS 1976)	HEC-2 (USACE 1976)	05/01/1982	AE w/ Floodway	
Unnamed Tributary to Millers Creek	Approximately 2,110 feet upstream of Unnamed Road	Approximately 2,290 feet upstream of Unnamed Road	Other	Other	05/01/1982	A	A depth-area relationship, also developed by the USGS, was used for approximate method streams to estimate the depth of the 100-year flow at the locations unaffected by backwater from bridge obstructions. Estimates of backwater effects from such obstructions were made by field inspection (FIS 1983 Dec).

**Table 12: Summary of Hydrologic and Hydraulic Analyses continued**

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Wartrace Creek	Confluence with Sulphur Fork	At Worsham Road	Regression Equations (USGS 1976)	HEC-2 (USACE 1976)	05/01/1982	AE w/ Floodway	
Wartrace Creek	At Worsham Road	Approximately 1,900 feet upstream of Worsham Springs Road	Other	Other	05/01/1982	A	A depth-area relationship, also developed by the USGS, was used for approximate method streams to estimate the depth of the 100-year flow at the locations unaffected by backwater from bridge obstructions. Estimates of backwater effects from such obstructions were made by field inspection (FIS 1983 Dec).
West Fork	Confluence with Brush Creek	Approximately 1,430 feet upstream of Fyke Lane	Regression Equations (USGS 1976)	HEC-2 (USACE 1976)	05/01/1982	AE w/ Floodway	
West Fork	Approximately 1,430 feet upstream of Fyke Lane	Approximately 2,080 feet upstream of Fyke Lane	Other	Other	05/01/1982	A	A depth-area relationship, also developed by the USGS, was used for approximate method streams to estimate the depth of the 100-year flow at the locations unaffected by backwater from bridge obstructions. Estimates of backwater effects from such obstructions were made by field inspection (FIS 1983 Dec).

**Table 13: Roughness Coefficients**

Flooding Source	Channel “n”	Overbank “n”
Battle Creek	0.045	0.070-0.150
Beaver Dam Creek	0.050	0.100
Beaver Dam Creek	N/A	N/A
Bednigo Branch	0.045	0.070-0.150
Browns Fork	0.045	0.090
Browns Fork	0.050	0.150
Brush Creek	0.055	0.120
Brush Creek	N/A	N/A
Brush Fork	0.045	0.070-0.130
Buzzard Creek	0.050	0.150
Calebs Creek	0.050	0.150
Carr Creek	0.050	0.090
Carr Creek	N/A	N/A
Dickerson Branch	0.045-0.050	0.060-0.070
Elk Fork Creek	0.050	0.150
Frey Branch	0.050	0.100
Frey Branch	N/A	N/A
Hollis Creek	0.045	0.070-0.150
Hollis Creek Tributary 1	0.045	0.130
Hollis Creek Tributary 2	0.045	0.130
Hollis Creek Tributary 3	0.045	0.130
Hollis Creek Tributary 4	0.045	0.130
Honey Run	0.050	0.150
Honey Run Creek	0.055	0.120
Honey Run Creek	N/A	N/A
Long Branch	0.045	0.100
Long Branch	N/A	N/A
Mill Branch	0.050	0.150
Millers Creek	0.055	0.120
Millers Creek	N/A	N/A
North Fork Sycamore Creek	0.040-0.050	0.060-0.120
Pole Bridge Branch	0.045	0.100
Pole Bridge Branch	N/A	N/A

**Table 13: Roughness Coefficients continued**

Flooding Source	Channel “n”	Overbank “n”
Red River	N/A	N/A
Red River	N/A	N/A
Red River	0.050	0.100
Red River	N/A	N/A
Redding Branch	0.045	0.050-0.130
Reeves Branch	0.045	0.130
Savage Branch	0.060	0.090
Savage Branch	N/A	N/A
South Fork Sycamore Creek	0.030-0.045	0.065-0.120
South Red River	0.050	0.150
Spring Creek	0.050	0.150
Sulphur Fork	N/A	N/A
Sulphur Fork	0.054	0.090
Sulphur Fork	N/A	N/A
Summers Branch	N/A	N/A
Summers Branch	N/A	N/A
Sycamore Creek	0.040-0.050	0.060-0.120
Sycamore Creek	0.035-0.055	0.080-0.120
Sycamore Creek Tributary A	0.045	0.130
Unnamed Tributary of Red River	0.055	0.090
Unnamed Tributary of Red River	N/A	N/A
Unnamed Tributary to Millers Creek	0.055	0.120
Unnamed Tributary to Millers Creek	N/A	N/A
Wartrace Creek	0.030-0.045	0.100
Wartrace Creek	N/A	N/A
West Fork	0.045	0.090
West Fork	N/A	N/A

### 5.3 Coastal Analyses

This section is not applicable to this Flood Risk Project.

#### **Table 14: Summary of Coastal Analyses**

[Not Applicable to this Flood Risk Project]

#### 5.3.1 Total Stillwater Elevations

This section is not applicable to this Flood Risk Project.

#### **Figure 8: 1% Annual Chance Total Stillwater Elevations for Coastal Areas**

[Not Applicable to this Flood Risk Project]

#### **Table 15: Tide Gage Analysis Specifics**

[Not Applicable to this Flood Risk Project]

#### 5.3.2 Waves

This section is not applicable to this Flood Risk Project.

#### 5.3.3 Coastal Erosion

This section is not applicable to this Flood Risk Project.

#### 5.3.4 Wave Hazard Analyses

This section is not applicable to this Flood Risk Project.

#### **Table 16: Coastal Transect Parameters**

[Not Applicable to this Flood Risk Project]

#### **Figure 9: Transect Location Map**

[Not applicable to this Flood Risk Project]

### 5.4 Alluvial Fan Analyses

This section is not applicable to this Flood Risk Project.

#### **Table 17: Summary of Alluvial Fan Analyses**

[Not Applicable to this Flood Risk Project]

#### **Table 18: Results of Alluvial Fan Analyses**

[Not Applicable to this Flood Risk Project]

## SECTION 6.0 – MAPPING METHODS

### 6.1 Vertical and Horizontal Control

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 (NGVD29). With the completion of the North American Vertical Datum of 1988 (NAVD88), many FIS Reports and FIRMs are now prepared using NAVD88 as the referenced vertical datum.

Flood elevations shown in this FIS Report and on the FIRMs are referenced to NAVD88. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between NGVD29 and NAVD88 or other datum conversion, visit the National Geodetic Survey website at [www.ngs.noaa.gov](http://www.ngs.noaa.gov).

Temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, they may be found in the archived project documentation 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 in the area, please visit the NGS website at [www.ngs.noaa.gov](http://www.ngs.noaa.gov).

The datum conversion locations and values that were calculated for Robertson County are provided in Table 19.

**Table 19: Countywide Vertical Datum Conversion**

Quadrangle Name	Quadrangle Corner	Latitude	Longitude	Conversion from NGVD29 to NAVD88 (feet)
Average Conversion from NGVD29 to NAVD88 = -0.230 feet				

**Table 20: Stream-Based Vertical Datum Conversion**

[Not Applicable to this Flood Risk Project]

### 6.2 Base Map

The FIRMs and FIS Report for this project have been produced in a digital format. The flood hazard information was converted to a Geographic Information System (GIS) format that meets FEMA's FIRM Database specifications and geographic information standards. This information is provided in a digital format so that it can be incorporated into a local GIS and be accessed more easily by the community. The FIRM Database includes most of the tabular information contained in the FIS Report in such a way that the data can be associated with pertinent spatial features. For example, the information

contained in the Floodway Data table and Flood Profiles can be linked to the cross sections that are shown on the FIRMs. Additional information about the FIRM Database and its contents can be found in FEMA's *Guidelines and Standards for Flood Risk Analysis and Mapping*, [www.fema.gov/guidelines-and-standards-flood-risk-analysis-and-mapping](http://www.fema.gov/guidelines-and-standards-flood-risk-analysis-and-mapping).

Base map information shown on the FIRM was derived from the sources described in Table 21.

**Table 21: Base Map Sources**

Data Type	Data Provider	Data Date	Data Scale	Data Description
County Boundary	State of Tennessee Department of Finance and Administration, GIS Department	07/03/2012	N/A	S_Pol_Ar. County Boundary.
Digital Orthophoto	Tennessee Department of Transportation, Office of Aerial Surveys	08/28/2013	N/A	S_Base_Index Orthophotography. S_Base_Index table contains information about the raster data used as a base map for Robertson County, Tennessee.
Political boundaries	Austin Peay State University, GIS Center	07/20/2017	N/A	S_Pol_Ar. Incorporated areas boundaries.
Surface Water Features	State of Tennessee Department of Finance and Administration, GIS Department	09/12/2017	1:5,000	S_Wtr_Ln. Waterlines.
Transportation Features	State of Tennessee Department of Finance and Administration, GIS Department	07/18/2017	N/A	S_Trnsprt_Ln. Road Features.
Transportation Features	USDOT BTS	05/19/2017	1:24,000	S_Trnsport_Ln. Rail Features.

### 6.3 Floodplain and Floodway Delineation

The FIRM shows tints, screens, and symbols to indicate floodplains and floodways as well as the locations of selected cross sections used in the hydraulic analyses and floodway computations.

For riverine flooding sources, the mapped floodplain boundaries shown on the FIRM have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using the topographic elevation data described in Table 22.

In cases where the 1% and 0.2% annual chance 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 floodway widths presented in this FIS Report and on the FIRM were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. Table 2 indicates the flooding sources for which floodways have been determined. The results of the floodway computations for those flooding sources have been tabulated for selected cross sections and are shown in Table 23, "Floodway Data."

Certain flooding sources may have been studied that do not have published BFEs on the FIRMs, or for which there is a need to report the 1% annual chance flood elevations at selected cross sections because a published Flood Profile does not exist in this FIS Report. These streams may have also been studied using methods to determine non-encroachment zones rather than floodways. For these flooding sources, the 1% annual chance floodplain boundaries have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using the topographic elevation data described in Table 22. All topographic data used for modeling or mapping has been converted as necessary to NAVD88. The 1% annual chance elevations for selected cross sections along these flooding sources, along with their non-encroachment widths, if calculated, are shown in Table 24, "Flood Hazard and Non-Encroachment Data for Selected Streams."

**Table 22: Summary of Topographic Elevation Data used in Mapping**

Community	Flooding Source	Source for Topographic Elevation Data			
		Description	Vertical Accuracy	Horizontal Accuracy	Citation
Coopertown, Town of; Greenbrier, City of; Ridgetop, City of; Robertson County, Unincorporated Areas	All within HUC-8 05130202 05130205	Light Detection and Ranging data (LiDAR)	2 ft	24.5 cm	TDOT 2013
Adams, City of; Cedar Hill, Town of; Coopertown, Town of; Cross Plains, Town of; Greenbrier, City of; Orlinda, Town of; Ridgetop, City of; Robertson County, Unincorporated Areas; Springfield, City of	All within HUC-8 05130204 06040002 06040003	7.5-Minute Series Topographic	N/A	N/A	USGS 2006

BFEs shown at cross sections on the FIRM represent the 1% annual chance water surface elevations shown on the Flood Profiles and in the Floodway Data tables in the FIS Report.