

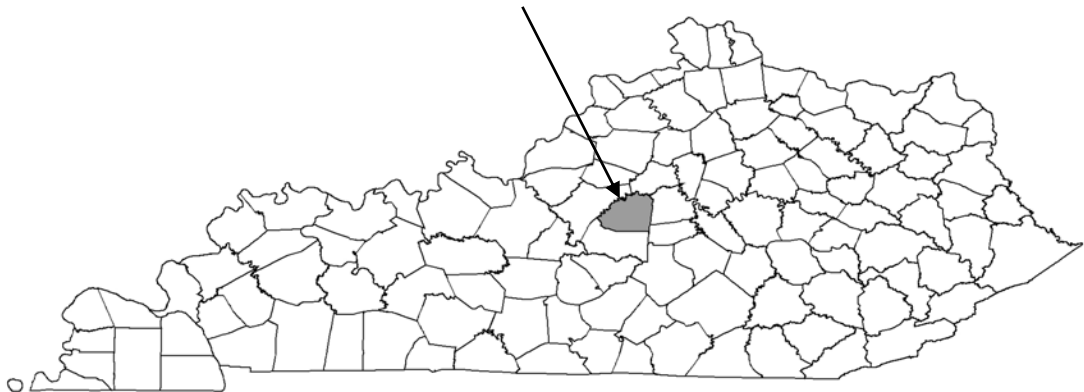
# FLOOD INSURANCE STUDY



## WASHINGTON COUNTY, KENTUCKY AND INCORPORATED AREAS

COMMUNITY NAME	COMMUNITY NUMBER
*MACKVILLE, CITY OF	210475
SPRINGFIELD, CITY OF	210220
WASHINGTON COUNTY (UNINCORPORATED AREAS)	210365
*WILLISBURG, CITY OF	210476
*NON-FLOODPRONE COMMUNITY	

Washington County



February 17, 2010

Federal Emergency Management Agency



FLOOD INSURANCE STUDY NUMBER

21229CV000A

**NOTICE TO  
FLOOD INSURANCE STUDY USERS**

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

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

Initial Countywide FIS Effective Date: February 17, 2010

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FLOOD INSURANCE STUDY  
WASHINGTON COUNTY, KENTUCKY AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study (FIS) revises and updates information on the existence and severity of flood hazards in the geographic area of Washington County, Kentucky; including the City of Mackville, the City of Springfield, the City of Willisburg, and the unincorporated areas of Washington County (referred to collectively herein as Washington County), and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood-risk data for various areas of the community that will be used to establish actuarial flood insurance rates and to assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

Please note that the Cities of Mackville and Willisburg are non-floodprone.

In some States or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence, and the State (or other jurisdictional agency) will be able to explain them.

The Digital Flood Insurance Rate Map (DFIRM) and FIS Report for this countywide study have been produced in digital format. Flood hazard information was converted to meet the FEMA DFIRM database specifications and Geographic Information System (GIS) format requirements. The flood hazard information was created and is provided in a digital format so that it can be incorporated into a local GIS and be accessed more easily by the community.

1.2 Authority and Acknowledgments

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

This FIS was prepared to include the incorporated communities within Washington County in a countywide format. The authority and acknowledgements for the unincorporated areas of Washington County, the City of Mackville, the City of Springfield, the City of Willisburg is not available since FIS reports have never been published for these communities.

For this countywide FIS, new hydrologic and hydraulic analyses were prepared for FEMA by AMEC Earth & Environmental, Inc. under Contract No. EMA-2007-

CA-5772 and this work was completed in September 2008. The extents of these analyses are listed in Section 2.0 of this report. Topographic information consisted of 10 meter Digital Elevation Models produced by the U.S. Geological Survey (USGS).

Planimetric base map information shown on all FIRM panels was derived from multiple sources. Road centerlines, stream centerlines and political boundary files were provided by the Kentucky Geographic Network and additional stream centerlines and areas were downloaded from the National Hydrography Dataset provided by the U.S. Geological Survey. Orthophoto base mapping were produced by Photo Science, Inc. for Kentucky Division of Geographic Information (KY DGI), covering the State of Kentucky.

Users of this FIRM should be aware that minor adjustments may have been made to specific base map features.

The coordinate system used for the production of this FIRM is State Plane, Lambert Conformal Conic, Kentucky Single Zone 1600, North American Datum of 1983 (NAD 83), GRS 80 spheroid. Corner coordinates shown on the FIRM are in latitude and longitude referenced to the UTM projection, NAD 83. Differences in the datum and spheroid used in the production of FIRMs for adjacent counties may result in slight positional differences in map features at the county boundaries. These differences do not affect the accuracy of information shown on the FIRM.

### 1.3 Coordination

An initial scoping meeting is held with representatives of the communities, FEMA, and the study contractors to explain the nature and purpose of the FIS, and to identify the streams to be studied by detailed methods. After preliminary issuance of the maps a PDCC (Preliminary DFIRM Community Coordination) meeting is held with representatives of the communities, FEMA, and the study contractors to review the results of the study.

For this countywide FIS, the scoping meeting was held on November 15, 2007, and the PDCC meeting was held on January 20, 2009. The scoping meeting was attended by representatives of Washington County, City of Springfield, FMSM Engineers, and Kentucky Division of Water (KDOW). The PDCC meeting was attended by representatives of Washington County, City of Springfield, AMEC Earth and Environmental, and Kentucky Division of Water (KDOW).

## 2.0 AREA STUDIED

### 2.1 Scope of Study

This FIS report covers the geographic area of Washington County, Kentucky, including the incorporated communities listed in Section 1.1. The areas studied

were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through June 2007.

No new detailed studies have been performed as part of this countywide study.

Approximate analyses were used to study those areas having a low development potential or minimal flood hazards.

The scope and methods of study were proposed to, and agreed upon, by representatives of Washington County, City of Springfield, FMSM Engineers, and Kentucky Division of Water (KDOW).

## 2.2 Community Description

Washington County and its county seat, Springfield, are located in the west-central portion of Kentucky. Located in the central portion of Washington County, Springfield is also the largest city in the county. The county is bounded on the east by Boyle and Mercer County, Kentucky, on the west by Nelson County, Kentucky, on the north by Anderson County, Kentucky, and on the south by Marion County, Kentucky.

The population of Washington County in 2008 was 11,615, according to the Kentucky Cabinet for Economic Development. The city of Springfield's population in 2007 was 2,863, also reported in data cited by the Kentucky Cabinet for Economic Development (Reference 1).

The climate in Washington County is temperate with moderately cold winters and warm, humid summers, resulting in an average annual temperature of 55.2 degrees (normal 30-year record) as measured by the National Weather Service. The average annual rainfall (normal 30-year record) for Washington County is 45.91 inches (Reference 1).

## 2.3 Principal Flood Problems

There is no information on record regarding flooding problems in the community.

## 2.4 Flood Protection Measures

There are no flood protection measures within the study area which could significantly affect the 1-percent-annual-chance flood.

## 3.0 ENGINEERING METHODS

For the flooding sources studied by detailed methods in the community, standard hydrologic and hydraulic study methods were used to determine the flood-hazard data required for this study. Flood events of a magnitude that is expected to be

equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 1-percent-annual-chance flood in any 50-year period is approximately 40 percent (4 in 10); for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

### 3.1 Hydrologic Analyses

Discharges for Zone A studies were developed using Regression Equations contained in the USGS report Estimating the Magnitude of Peak Flows for Streams in Kentucky for Selected Recurrence Intervals (Reference 2). Drainage areas along streams were determined using a flow accumulation grid developed from the USGS 10 meter digital elevation models and corrected National Hydrologic Data (NHD) stream coverage. Flow points along stream centerlines were calculated using the regression equations in conjunction with accumulated area for every 10 percent increase in flow along a particular stream.

### 3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals. Flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS in conjunction with the data shown on the FIRM.

Approximate (Zone A) hydraulic modeling for Washington County was performed using HEC-RAS, version 3.1.2, from the U.S. Army Corps of Engineers, Hydrologic Engineering Center (HEC) (Reference 3). AMEC's program, Automated Floodplain Generator (AFG), was used to assist in the development of the geometries and resulting floodplains throughout the county. AFG employs methodologies of HEC-GeoRAS, a Geographic Information Systems (GIS) interface developed by HEC for the preparation of hydraulic models. In a GIS environment, the engineer places stream centerline and cross-section cutlines. The banklines and flow path lines are automatically placed, buffering the stream based on user-specified spacing. The AFG then extracts the vertical elevation from the



background topography and creates the input geometry file for the HEC-RAS model. Next, cross-section locations are evaluated in reference to the floodplain boundary and are manually adjusted as necessary. The bank stations, Manning's n values, and ineffective flow areas are prescribed in the HEC-RAS model. Subsequently, the water surface elevation is extracted from the HEC-RAS model output and a water surface Triangulated Irregular Network (TIN) is created. The floodplain boundary is delineated based on the difference between the water surface TIN and ground surface TIN.

Floodplains were delineated using automated GIS methods. Floodplains were mapped to include backwater effects that govern each flooding source near its downstream extent.

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

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

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

In addition to NSRS benchmarks, the FIRM may also show vertical control monuments established by a local jurisdiction; these monuments will be shown on the FIRM with the appropriate designations. Local monuments will only be placed on the FIRM if the community has requested that they be included, and if the monuments meet the aforementioned NSRS inclusion criteria.

To obtain current elevation, description, and/or location information for benchmarks shown on the FIRM for this jurisdiction, please contact the Information Services Branch of the NGS at (301) 713-3242, or visit their Web site at [www.ngs.noaa.gov](http://www.ngs.noaa.gov).

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

### 3.3 Vertical Datum

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

All flood elevations shown in this FIS report and on the FIRM are now referenced to NAVD 88. In order to perform this conversion, effective NGVD 29 elevation values were adjusted downward by 0.48 foot. Structure and ground elevations in the community must, therefore, be referenced to NAVD 88. It is important to note that adjacent communities may be referenced to NGVD 29. This may result in differences in base flood elevations across the corporate limits between the communities.

For more information on NAVD 88, see *Converting the National Flood Insurance Program to the North American Vertical Datum of 1988*, FEMA Publication FIA-20/June 1992, or contact the National Geodetic Survey at the following address:

Spatial Reference System Division  
National Geodetic Survey, NOAA  
Silver Spring Metro Center 3  
1315 East-West Highway  
Silver Spring, Maryland 20910  
(301) 713-3242  
<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 Technical Support Data Notebook associated with the FIS report and FIRM for this community. Interested individuals may contact FEMA to access these data.

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

## 4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

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

### 4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent-annual-chance flood has been adopted by FEMA as the base flood for floodplain management purposes. Between cross-sections, the boundaries were interpolated using 10 meter Digital Elevation Models produced by the U.S. Geological Survey (USGS) (Reference 4).

The 1- and 0.2-percent-annual-chance floodplain boundaries are shown on the FIRM. On this map, the 1-percent-annual-chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zone A). In cases where the 1- and 0.2-percent-annual-chance floodplain boundaries are close together, only the 1-percent-annual-chance floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations, but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

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

### 4.2 Floodways

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

minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

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

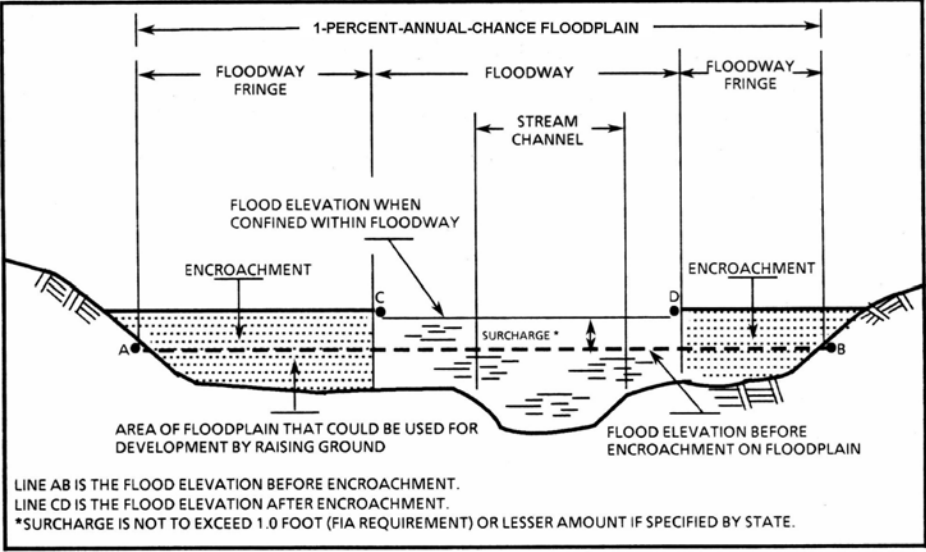


Figure 1: Floodway Schematic

Near the mouths of streams studied in detail, floodway computations are made without regard to flood elevations on the receiving water body.

Encroachment into areas subject to inundation by floodwaters having hazardous velocities aggravates the risk of flood damage, and heightens potential flood hazards by further increasing velocities. In order to reduce the risk of property damage in areas where the stream velocities are high, the community may wish to restrict development in areas outside the floodway.

No floodways were computed in Washington County.

5.0 INSURANCE APPLICATION

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

## Zone A

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

## Zone X

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

## 6.0 FLOOD INSURANCE RATE MAP

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

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

For floodplain management applications, the map shows by tints, screens, and symbols, the 1- and 0.2-percent-annual-chance floodplains, floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

The countywide FIRM presents flooding information for the entire geographic area of Washington County. Previously, FIRMs were prepared for each incorporated community and the unincorporated areas of the County identified as flood-prone. This countywide FIRM also includes flood-hazard information that was presented separately on Flood Boundary and Floodway Maps (FBFMs), where applicable. Historical data relating to the maps prepared for each community are presented in Table 1, "Community Map History."

## 7.0 OTHER STUDIES

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

## 8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting Federal Insurance and Mitigation Division, FEMA Region IV, Koger-Center — Rutgers Building, 3003 Chamblee Tucker Road, Atlanta, GA 30341.

Future revisions may be made that do not result in the republishing of the Flood Insurance Study report. To ensure that any user is aware of all revisions, it is advisable to contact the map repository of flood hazard data located in the community.

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	FIRM EFFECTIVE DATE	FIRM REVISIONS DATE
* Mackville, City of	None	None	None	None
Springfield, City of	May 31, 1974	July 9, 1976	July 17, 1986	None
Washington County (Unincorporated Areas)	February 17, 2010	None	February 17, 2010	None
* Willisburg, City of	None	None	None	None

\*Non-Floodprone Community

TABLE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

**WASHINGTON COUNTY, KY  
AND INCORPORATED AREAS**

**COMMUNITY MAP HISTORY**

## 9.0 BIBLIOGRAPHY AND REFERENCES

1. Cabinet for Economic Development, Kentucky Quick Facts. <http://www.thinkkentucky.com>. Last updated March 16, 2007.
2. U.S. Geological Survey, Technique for Estimating Magnitude and Frequency of Floods in Kentucky, Water Resources Investigations 76-62, Nov. 1976.
3. U.S. Army Corps of Engineers, Hydrologic Engineering Center, "River Analysis System," HEC-RAS, Version 3.1.2 Computer Program, revised April 2004.
4. U. S. Geological Survey, 7.5 Minute Series (Topographic) Maps, Scale: 1:24,000. The National Elevation Dataset (NED) 1/3 Arc Second is a raster product assembled by the U.S. Geological Survey (USGS). NED 1/3 Arc Second is designed to provide National elevation data in a seamless form with a consistent datum, elevation unit, and projection. Data corrections are made in the NED 1/3 Arc Second assembly process to minimize, but not eliminate, artifacts, perform edge matching, and fill sliver areas of missing data. NED 1/3 Arc Second has a resolution of 1/3 arc-second (approximately 10 meters). Projection is geographic, horizontal datum is NAD83 and vertical datum is NAVD88. 2004