Floodplain Management Plan

Prepared for
The City of Huntsville, Alabama
2010 - 2011

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List of Abbreviations

ADECA	Alabama Department of Economic and Community Affairs
ADID	Advanced Identification
AI	Action Item
BCEGS	Building Code Effectiveness Grading Schedule
BFE	Base Flood Elevation
BFE+1	Base Flood Elevation plus 1 foot
BMPs	Best Management Practices
CFS	cubic feet per second
CIP	Capital Improvements Program
City	City of Huntsville
COE	United States Army Corps of Engineers
CRS	Community Rating System
CWA	Clean Water Act
CTP	Cooperating Technical Partner
EMA	Huntsville-Madison County Emergency Management Agency
EMWIN	Emergency Managers Weather Information Network
EOP	Emergency Operations Plan
EPA	United States Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FMP	Floodplain Management Plan
FMPC	Floodplain Management Plan Committee
GIS	geographic information system
GSA	Geological Survey of Alabama
NCDC	National Climate Data Center
NFIP	National Flood Insurance Program
NGVD	National Geodetic Vertical Datum
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRCS	National Resource Conservation Service
NWS	National Weather Service
OWR	Office of Water Resources
SFHA	Special Flood Hazard Area
SOP	Standard Operating Procedures
SRCC	Southeast Regional Climate Center
TAC	Technical Advisory Committee
TVA	Tennessee Valley Authority
USFWS	United States Fish and Wildlife Service
WFO	Weather Forecast Office

Introduction

The Floodplain Management Plan (FMP) for the City of Huntsville (City), Alabama updates and replaces the Flood Mitigation Plan. (Huntsville 2001) Both plans provide a framework which involves the public, City officials and other agencies in assessing flood hazards and making short- and long-term plans to address these hazards.

Description of the Community

The city of Huntsville is centrally located in northern Alabama. It is located primarily in Madison (County) but extends west into neighboring Limestone County. Huntsville currently covers over 210 square miles. Based on population it is the fourth-largest city in Alabama. According to the 2000 census Huntsville's population was 158,216, and in 2010, based on data obtain by the Huntsville GIS department the population grew to 180,105. (Amy Kenum, personal communication, March 15, 2011)

Huntsville has a temperate climate. Summers are characterized by warm and humid weather, with rather frequent thunderstorms. Winters are usually very cool, but vary considerably from one year to the next. The average annual precipitation is 55 inches, based on data collected at the airport weather station from January 1959 through July, 2010. (SRCC 2011)

Huntsville is almost completely surrounded by the foothills of the Appalachian Mountains. The Tennessee River winds its way westward south of the City, and the broad, fertile Tennessee River Valley, with flat to gently rolling terrain, extends to the west. (NCDC 2011) All the watersheds in the City eventually drain south to the Tennessee River.

Program Background

Huntsville has extensive floodplains that affect roughly 10,000 properties (based on Preliminary mapping which is described in more detail in section 4). Damaging floods occurred in 1949, 1963, 1973, 1988, 1990, 1999, and 2003. Following floods in 1963 and 1973, many of the existing streams and channels that experienced flooding were straightened, widened, and concrete-lined (entirely or in some cases just the banks) to increase the capacity of the channel and reduce the potential for flooding.

In the 1990s, the City made substantial improvements to Huntsville Spring Branch, the City's main drainage course. Today, the City continues to focus on improving its drainage infrastructure (with purely City funds) to eliminate flooding problems and reduce flooding potential. Huntsville has also implemented other strategies besides stormwater structural projects to reduce the likelihood of flooding and protect people from financial losses due to flooding. These include:

- In 1978, the City joined the National Flood Insurance Program (NFIP) so that citizens could purchase flood insurance to protect their properties from losses due to flooding.
- In 1990, the City adopted its first comprehensive regulations on stormwater management. And in 1991, it also adopted the Stormwater Management Manual to set standards for design of storm drainage facilities.
- In the late 1990s, the City began developing/updating hydrologic and hydraulic computer models for each watershed to more accurately understand flooding potential.
- In 2001, the City developed the Flood Mitigation Plan (which this document updates).

- In the early 2000s, the City purchased 34 homes along Aldridge Creek which were demolished or relocated and implemented channel and bridge improvements. When the updated mapping was developed, over 700 homes were removed from the floodplain and roughly 40 from the floodway.
- In September 2010, Federal Emergency Management Agency (FEMA) and the Alabama Department of Economic and Community Affairs (ADECA) Office of Water Resources (OWR) released Preliminary floodplain mapping for Madison County and the entirety of the City of Huntsville. This mapping is projected to become Effective in April/May 2012 (possibly later).
- Over the past several years the City has developed conceptual plans for improvements along Dallas Branch, Pinhook Creek and Huntsville Spring Branch and has applied to FEMA for grants to assist in the implementation of these projects.

All the City's efforts to improve drainage facilities and implement better plans to manage development have helped, but they have by no means eliminated all potential flooding damage. An example of this can be seen by the flood damage that resulted from a severe rainfall and flood event downtown in May 2003. (Huntsville 2001)

Community Rating System Summary

The City of Huntsville participates in the Federal Emergency Management Agency's (FEMA) NFIP and its Community Rating System (CRS). Under the CRS, flood insurance premiums for properties in the City are reduced to reflect the flood protection activities that are being implemented.

A community receives a CRS classification based upon the credit points it receives for its activities. It can undertake any mix of activities that do things such as reduce flood losses through better mapping, regulations, public information, flood damage reduction and/or flood warning and preparedness programs. There are ten CRS classes: Class 1 requires the most credit points and gives the largest premium reduction; Class 10 receives no premium reduction (Table IN-1). A community that does not apply to the CRS for credit points or that does not obtain the minimum number of credit points is a Class 10 community. The application of the insurance premium reduction to a policy is based on whether a property is in or out of the Special Flood Hazard Area (SFHA), which is designated on the community's Flood Insurance Rate Map (FIRM). Huntsville is currently going through review by the CRS program but is projected to be a Class 8 community.

Table IN-1. CRS Class and Insurance Premium Reduction

Credit Points	CRS Class	Premium Reduction SFHA *	Premium Reduction Non-SFHA **
4,500 +	1	45%	10%
4,000 – 4,499	2	40%	10%
3,500 – 3,999	3	35%	10%
3,000 – 3,499	4	30%	10%
2,500 – 2,999	5	25%	10%
2,000 – 2,499	6	20%	10%
1,500 – 1,999	7	15%	5%
1,000 – 1,499	8	10%	5%
500-999	9	5%	5%
0-500	10	0%	0%

Huntsville is projected to be a Class 8 community.

(Source: FEMA 2011)

**Special Flood Hazard Area*

***Preferred Risk Policies are available only in B, C, and X Zones for properties that are shown to have a minimal risk of flood damage. The Preferred Risk Policy does not receive premium rate credits under the CRS because it already has a lower premium than other policies. The CRS credit for AR and A99 Zones are based on non-Special Flood Hazard Areas (non-SFHAs) (B, C, and X Zones). Credits are: classes 1-6, 10% and classes 7-9, 5%. Premium reductions are subject to change.*

Table IN-2 lists all of the activities credited by the CRS and the maximum points that may be obtained for each activity. In addition the table includes other statistics for each activity such as the average points awarded, the maximum points awarded and the percentage of participating communities that are credited for that activity. More detail about each of these items can be found in the CRS Coordinator's Manual (FEMA 2007), commonly referred to as "the Manual" throughout this document. As an example, the original Flood Mitigation Plan was credited under Activity 510 Floodplain Management Planning. However, in order to maintain that credit the plan must be evaluated and updated on a regular basis, hence this FMP effort.

Table IN-2. Credit Points Awarded for CRS Activities				
Activity	Maximum Possible Points[1]	Average Points Awarded[2]	Maximum Points Awarded[3]	Percentage Communities Credited[4]
300 Public Information Activities				
310 Elevation Certificates	162	69	142	100%
320 Map Information Service	140	138	140	95%
330 Outreach Projects	380	90	290	86%
340 Hazard Disclosure	81	19	81	61%
350 Flood Protection Information	102	24	66	87%
360 Flood Protection Assistance	71	53	71	48%
400 Mapping & Regulatory Activities				
410 Additional Flood Data	1,346	86	521	29%
420 Open Space Preservation	900	191	734	83%
430 Higher Regulatory Standards	2,740	166	1,041	85%
440 Flood Data Maintenance	239	79	218	68%
450 Storm Water Management	670	98	490	74%
500 Flood Damage Reduction Activities				
510 Floodplain Management Planning	**359**	**115**	**270**	**20%**
520 Acquisition and Relocation	3,200	213	2,084	13%
530 Flood Protection	2,800	93	813	6%
540 Drainage System Maintenance	330	232	330	69%
600 Flood Preparedness Activities				
610 Flood Warning Program	255	93	200	30%
620 Levee Safety	900	198	198	1%
630 Dam Safety	175	66	87	81%

[1] Maximum possible points are based on the 2006 CRS Coordinator's Manual

[2] Based on community scores as of May 1, 2005

[3] Based on the highest scores from a community as of May 1, 2005. In some cases, many communities have attained the maximum amount.

[4] The percentage of communities credited as of May 1, 2005

(Source: FEMA 2007)

The Planning Process

CRS credit is provided for preparing, adopting, implementing, evaluating and updating a comprehensive floodplain management plan. The CRS does not specify what must be in the plan, but it only credits plans that have been prepared and kept updated according to the standard 10-step process shown on Figure IN-1. (FEMA 2007)

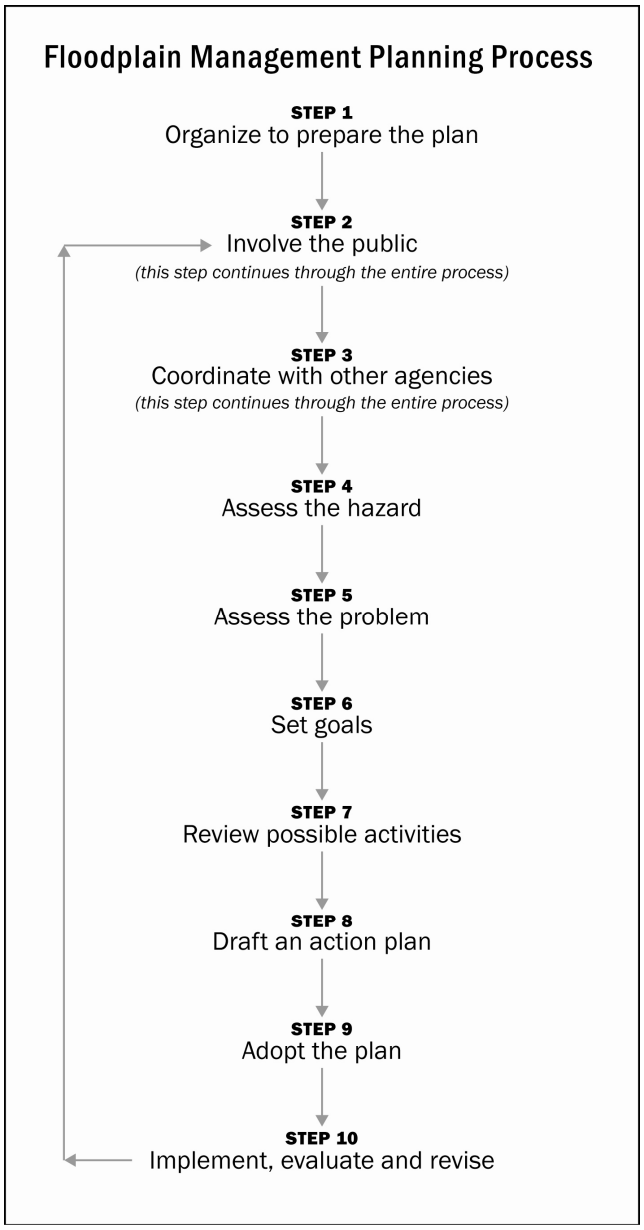


Figure IN-1. 10-Step Planning Process

For ease, this report is set up to follow the 10 steps outlined on Figure IN-1 with each section corresponding to the appropriate step. For example, Section 1 covers the items in Step 1. The CRS cross walk (Appendix A) outlines the points obtained under each of these 10 steps. To ease review of this document the crosswalk numbering is included after the applicable item in the report. For example, the area of the report that addresses item 1.a in the cross walk will be followed by "(**1a**)". In addition some items are not included in the cross walk but are required by Activity 510 of the Manual. These items are followed by 'required' and the page number from the Manual where the requirement is located; for example "(**required p. 510-5**)". Some items are included in the cross walk and are minimum requirements. These items are noted with the cross walk number and the word required; for example, "(**3a required**)". The three previous descriptions address items that were requirements for the original plan. For many of these items the text from the original plan was used and only updated as applicable. However, some items are required for both the original and the update and will be noted accordingly, for

example "(**1b, 2a, required for update p. 510-32**)". If required by the update but there is no corresponding crosswalk item then it will be noted by page number from the Manual; for example, "(**required for update p. 510-32**)".

Section 1

Organize to Prepare the Plan

A floodplain management plan is the product of a rational thought process that reviews alternatives and selects and designs those alternatives that will work best for the community. Key to the update of this plan is the involvement of a FMP Committee (Committee or FMPC) that guides the planning process (**1b, 2a, required for update p. 510-32**).

1.1 FMP Committee

As required in the CRS Manual, this subsection describes who was involved in the planning process **(required p. 510-5)**.

Resolution number 00-712 was passed on August 23, 2000 by the City Council that formally recognized the planning process and created the FMP Committee (**1c**). The original name of the committee was the Flood Mitigation Planning Committee. In 2003, the committee name was changed to Surface Water Management Committee. As a part of this plan update, the committee name was changed to Floodplain Management Plan Committee to better correspond with the CRS language. Also as a part of the plan update effort, the committee was reduced in size for efficiency and most of the original committee members were replaced for very innocuous reasons. The committee includes a mix of City staff (**1b**), Huntsville residents and 100-year Floodplain property owners. On a side note, the 100-year Floodplain is also referred to as the one percent Annual Chance or Base Floodplain; also it is generally what someone is referring to when they simply say "floodplain". The current committee members are listed in the table below. Ben Ferrill, who is a planner in the City's Planning department, is the committee chair (**1a**).

Table 1-1. Floodplain Management Plan Committee Members

Name	Affiliation
Dr. Ben Ferrill, Chair	City of Huntsville Planner III; City Floodplain Resident
Marc Beasley	Local Contractor and Developer; City 100-year Floodplain Property Owner
Jared Cassidy	Huntsville-Madison County EMA Emergency Plans coordinator, City Resident
Gary Gleason	City of Huntsville Hydrologist, City Resident
Jeff Parker	Parker Real Estate; Local Developer, City 100-year Floodplain Property Owner
Christi Robinson	Civil Engineer; City 100-year Floodplain Resident
Susan Smith	City 100-year Floodplain Resident
Andy Somers	Croy Engineering; City Floodplain Resident

Although not a requirement of the CRS planning process, to support the planning effort a technical advisory committee (TAC) was also formed in 2000. Like the FMP Committee, as a part of the plan update effort, this committee was reduced in size for efficiency and most of the original committee members were replaced for innocuous reasons. The current TAC members are listed in Table 1-2.

Table 1-2. Technical Advisory Committee Members

Name	Affiliation
Michelle Amin	General Forecaster, National Weather Service (NWS)
Marty Calvert	City of Huntsville Stormwater Drainage System Manager
Dr. John Christy	State Climatologist
Meredith Ivey	Environmental Engineer, Brown and Caldwell(consulting firm for plan development)
Lori Visone	Water Resources Engineer, Brown and Caldwell(consulting firm for plan development)

1.2 "How it Was Prepared"

As required in the Manual, this subsection describes how the plan was prepared (**required p. 510-5**).

Three meetings of the FMP Committee were held over the course of several months (October – December, 2010). The previous Goals and AIs (AIs) were reviewed, revised and updated as needed. Gary Gleason facilitated discussions regarding the hazards, risks, and mitigation opportunities. Lori Visone reviewed the six floodplain management categories and the corresponding activities (which are discussed in more detail in Section 7). An additional committee meeting was held March 1, 2011 to discuss draft FMP.

Based on the committee's input an updated "Action Plan", as discussed in the Manual, was developed that specifies recommended projects, and who is responsible for implementing them. The Action Plan is included in Section 8 of this FMP. It should be noted that this plan recommends floodplain management measures that would be beneficial. Adoption of this plan by the City Council is required by the CRS (**required for update p. 510-32**), Implementation of these recommendations depends on the cooperation and support of the offices designated as responsible for each AI and most importantly – funding.

Section 2

Involve the Public

As required in the Manual, this section details public involvement during the planning process **(required p. 510-5)**.

During the development of the original 2001 plan and as a part of the plan update the public was involved in the planning process. The following section details the public outreach.

2.1 FMP Committee

As described in the previous section, the Committee was established to guide and assist with the development of the FMP. The members of the committee represent a range of communities and interests in the City of Huntsville. Of the eight members on the committee, four own property located in the floodplain (**2a**).

2.2 Public Meetings

During the development of the original plan two public open house meetings were held to solicit input from the public on the FMP. The first meeting was held at Huntsville High School on October 30, 2000. Over 140 people attended. The planning process was explained and the FMP committee members introduced. A dozen agencies had displays that explained the various aspects of mitigation (**2b required**). During July, 2001 the FMP committee presented the draft FMP plan at a second public open house to obtain input from the public on the proposed plan (**2c required**). (Huntsville 2001)

As a result of this update process, another public meeting is proposed to be held in March 9, 2011. The draft updated FMP will be presented at this meeting and comments from the public will be obtained (**2c required for update p. 510-32**). A newspaper article announcing this meeting is included in Appendix B.

2.3 Questionnaires and other Outreach

During the development of the 2001 FMP, a one-page questionnaire was sent to all properties in the floodplain, distributed at the October open house, and posted on one television channel's website. The questionnaire asked about the respondents' flood history, what steps they had taken to protect themselves from flooding, and what suggestions they had for the City's program. Of the 10,000 distributed, there were over 1,500 responses (**2d**).

Several news releases were issued during the planning process. The *Huntsville Times* followed the FMP committee's work closely and covered the October open house. It published several supportive editorials. Three television stations went to the October open house and interviewed participants (**2f**).

During the development of the 2001 FMP, committee members and City staff spoke at and received input from several neighborhood association and organizations' meetings (**2e**). (Huntsville 2001)

Section 3

Agency Coordination

Many agencies at the local, state and federal level are involved in the mitigation of hazards. In addition, plans that are not specifically floodplain related such as open space plans or zoning plans may have an impact on floodplain management. As a result, review of existing plans and studies and coordination with relevant agencies is important in the development of a floodplain management plan.

3.1 Review of Existing Information

As a part of the update of the FMP existing studies, reports, plans and geographic information system (GIS) data were gathered and reviewed (**3a required, also required for update p. 510-32**). This includes reports and plans developed by the city of Huntsville and other agencies that are applicable or may affect floodplain management. The items reviewed include:

- City of Huntsville Flood Mitigation Plan, 2001
- FMP Annual Evaluation Reports (2002 – 2009)
- City of Huntsville GIS data (floodplain, aerial photography, city boundary and other base mapping)
- City records and information
  - Known flooding areas (not necessarily in the floodplain)
  - Drainage Standard Operating Procedure (SOP)
  - Listing of Repetitive Loss Structures
- Madison County Natural Hazards Mitigation Plan, 2009
- NWS - Storm Surveys and Significant Weather Events
- Flood Insurance Study (FIS) Madison County Alabama (May 20, 2010)
- Floodplain management plans developed by Roseville, CA; Birmingham, AL; Calumet City, IL; North Myrtle Beach , SC; and St. Tammany Parish, LA (FEMA example plans)
- NCDC Storm Events Database
- Flood Insurance Claims Data
- State Hazard Mitigation Plan (September 2010).

3.2 Coordination

During the development of the 2001 FMP the following agencies (Table 3-1) were contacted to determine how their programs affect or could support the City's floodplain management efforts (**3b required, 3c, 3d**). In some cases, agency and organization representatives were/are a part of the FMP committee or the TAC. This allowed these agencies to be a part of the discussion and development of mitigation strategies (**3e**).

Table 3-1. Agencies and Organizations Contacted as a Part of the FMP

City of Huntsville	Regional Agencies
Community Development	Madison County
Emergency Management	City of Madison
Engineering	TARCOG
Inspection	
Landscape Management	**State Agencies**
Natural Resources	Alabama Emergency Management Agency
Planning	Alabama Department of Environmental Management (ADEM)
Public Information	State Climatologist
Public Works – Drainage Maintenance	Geological Survey of Alabama (GSA)
Private Organizations	**Federal Agencies**
American Red Cross	Federal Emergency Management Agency (FEMA)
Chamber of Commerce	National Weather Service (NWS)
Flint River Conversation Association	Natural Resource Conservation Service (NRCS)
Huntsville Historical Society	Redstone Arsenal
Huntsville Madison County Builders Association	Tennessee Valley Authority (TVA)
Sierra Club	U.S. Army Corps of Engineers (COE)
Spring City Cycling Club	U.S. Department of Agriculture Extension Service
	U.S. Fish and Wildlife Service (USFWS)
	U.S. Geological Survey (USGS)
	Wheeler Wildlife Refuge

At the end of the 2001 planning process, each of these agencies was sent a copy of the draft FMP and asked to comment in time for the July, 2001 public meeting (**3f**). (Huntsville 2001)

Section 4
Assess the Hazard

4.1 Flood Hazards

Flooding is an environmentally beneficial occurrence in nature. Floods result when a channel receives too much water and the excess flows over the banks into the adjacent areas. Past floods are indications of what can happen in the future, but flood studies and management plans are based on the risk of future flooding. Flood studies use historical records and standardized engineering practices to estimate the potential that storms and floods of certain magnitude will recur.

Such events are measured by their "recurrence interval"; for example, a 10-year storm or a 50-year flood. The recurrence interval is the probability of occurrence; for example, a 50-year storm event has a two percent chance of happening in any given year (1/50 = 0.02 or 2 percent). These terms are often misconstrued. People commonly interpret the 50-year flood definition to mean "once every 50 years", which is not correct. A 50-year flood could occur two times in the same year, two years in a row, or four times over the course of 50 years. It is also possible to not have a 50-year flood over the course of 100 years.

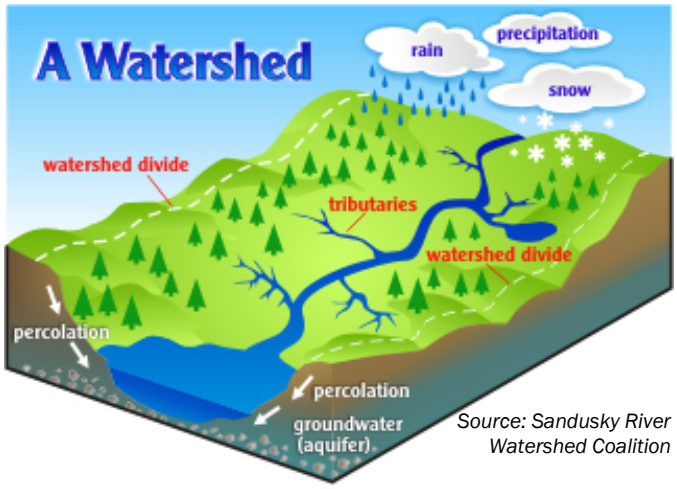
The following section includes a discussion and maps of known flood hazards and a historical account of flooding in the city. This section includes information made available since the initial FMP was developed (**4a required for update p. 510-32**).

4.1.1 Map of Known Flood Hazards

The city of Huntsville experiences two primary types of flooding: **riverine** and **localized**. Riverine flooding is associated with water overflowing the stream banks onto adjacent areas, while localized flooding is often due to the capacity of the storm sewer system. Generally, riverine flooding is more widespread while as the name indicates localized flooding is contained to a smaller area. Due to its geographic location in the watershed, Huntsville usually experiences the type of riverine flooding referred to as a flash flood. The NWS has specific parameters for the definition of a flash flood; however these events are generally characterized by a rapid rise in water, high velocities and large amounts of debris. (Wright 2008)

Two primary factors influence the extent of flooding: rainfall and the condition of the watershed. Rainfall can be widespread and slow moving such as large systems that result from hurricanes or smaller intense systems often seen as a result of convective summer storms. Flood-producing rains in Alabama are associated with two types of storms: frontal systems and tropical storms. The former occur every year, usually between November and April, and produce steady rainfall over large areas. Tropical storms, which generally occur between July and November, are less frequent but commonly produce torrential rains when movement is inland from the Gulf of Mexico. (USGS 1989) Regardless, large amounts of precipitation received over relatively short periods of time result in fast rising waters. An example of this is the 1999 flood on Aldridge Creek when seven inches of rain fell over a six-hour period (refer to subsection 4.1.2 for more information on this event).

A watershed is an area that drains into a lake, stream or other body of water. Figure 4-1 shows a watershed and some of the key terms. The boundary of a watershed is called a ridge or divide. The condition of the watershed affects what happens to the rainfall. For example, more water will run off if the terrain is steep, if the ground is already saturated from previous rains or if the watershed is covered with impervious cover such as roadways, buildings and parking lots.



Source: Sandusky River Watershed Coalition

Figure 4-1. Definition of a Watershed

As shown on Figure 4-2, all the watersheds that drain the City of Huntsville eventually flow south into the Tennessee River. Figure 4-2 shows areas of known flood hazards and includes the Effective 100-year floodplain, areas of localized flooding and Repetitive Loss Areas (defined later in this document) (**4a(1)**).

The risk of flooding is often associated with the 100-year Floodplain. FEMA through the NFIP and the development of FIRMs delineates the 100-year Floodplain for communities participating in the NFIP. The 100-Year Floodplain is the area of land that would be inundated by the flood having a 1 percent chance of being equaled or exceeded in any given year. It is used by FEMA as the basis for administering their floodplain management programs, primarily through regulatory requirements as well as requirements for the purchase of flood insurance.

The City of Huntsville Engineering Division is often contacted by homeowners about flooding and drainage issues that are confined to specific areas. These issues are the result of storm sewer capacity or local conditions that are not related to wide spread flood events. Based on his knowledge of this information and his 30-years of experience with the City, Marty Calvert, City Stormwater Drainage System Manager, determined and documented the areas noted as localized flooding on Figure 4-2.

In addition, Figure 4-2 shows Repetitive Loss Areas. FEMA defines a Repetitive Loss Structure as a structure that has received two or more claim payments of more than $1,000 from the NFIP within any rolling 10-year period. For each Repetitive Loss Structure the City does its best to identify the cause of the flooding as well as other structures in the area that may be similarly susceptible to that flooding; these locations establish the Repetitive Loss Area. There are currently nine structures and one parcel in the City that are classified as Repetitive Loss Structures. Four of these properties are being requested to be noted as mitigated since channel improvements have been made to Aldridge Creek and a Physical Map Revision (PMR) has been published demonstrating as such. Three of the remaining 5 structures have also had drainage improvements made to try and mitigate further loss or damage to property. One parcel has been purchased by the city and the structure on the property demolished. As a result, a Repetitive Loss Area has not been defined for it.

As with many communities nationwide, the floodplain mapping for the City is in the process of being updated as a part of FEMA's Map Maintenance program. The Preliminary Mapping was released in September 2010 and is shown on Figure 4-3. This mapping was initially proposed to become Effective in September 2011; however, at a public meeting presentation on December 9, 2010 the Alabama

Department of Economic and Community Affairs (ADECA) Office of Water Resources (OWR), a FEMA Cooperating Technical Partner (CTP) managing the effort for FEMA, indicated that the Effective Date for the mapping is now projected to be April or May of 2012. Further communication with OWR indicated that it may be even further off than that.

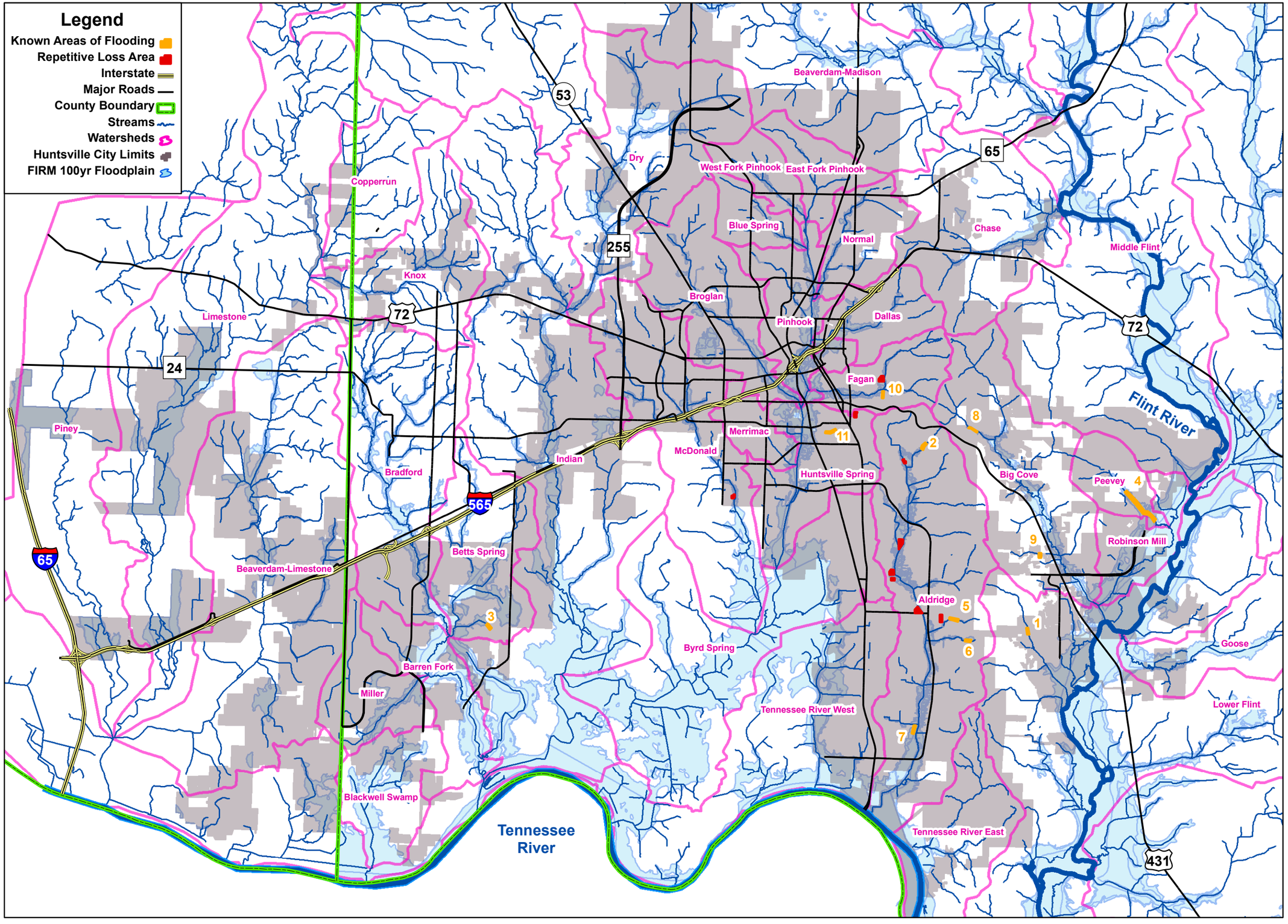


Figure 4.2
Known Flood Hazards
Huntsville Floodplain Management Plan

Brown AND Caldwell

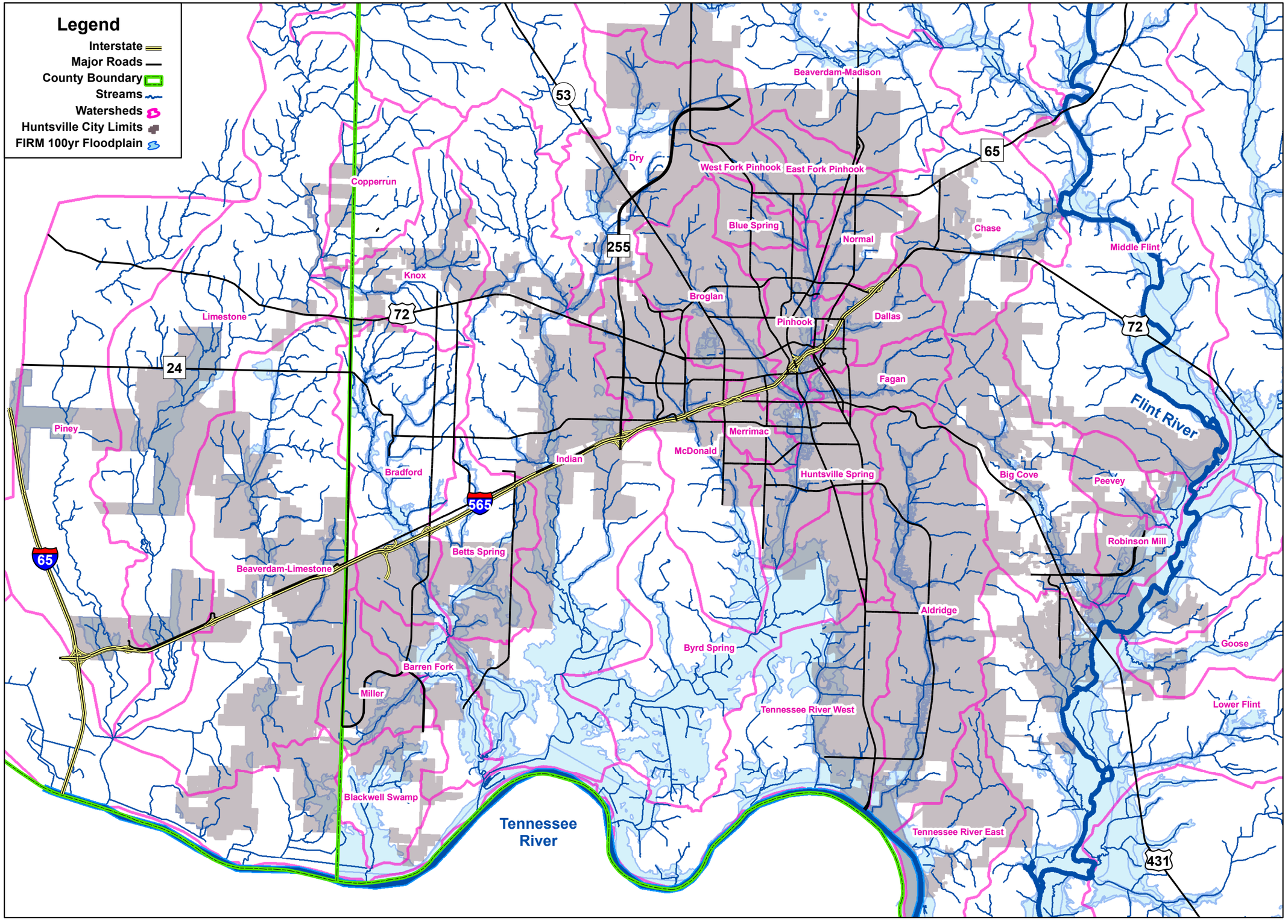


Figure 4.3
Preliminary 2010 FEMA Floodplain
Huntsville Floodplain Management Plan

Brown AND Caldwell

4.1.2 Description of Flood Hazards

This subsection includes the more detailed description, generally as documented by Marty Calvert (reference subsection 4.1.1 above), of the known flooding locations shown as localized flooding on Figure 4-2 (**4a(2)**). The numbers labeling these locations on the figure correspond to the following numbering. In the context of this section warning time means the time from when a significant rainfall transpires to the time when flooding actually occurs.

1. Over bank flooding along Unnamed Tributary to Flint River in the Hampton Ridge Subdivision
   a. Flooding Source: Watershed runoff from (mostly undeveloped) mountain slopes and farm land headwater area.
   b. Depth of flooding and velocity: Approximately two feet deep at top of bank reaching houses on the east side of the creek. Approximately six inches deep into living space of houses and garages. Velocity of water two to four feet per second.
   c. Warning Time: 15 to 20 minutes
2. Over bank flooding along Tributary 17 to Aldridge Creek , between Granada Drive and Kenyon Avenue
   a. Flooding Source: Watershed runoff from (mostly developed) mountain slopes headwater area.
   b. Depth of flooding and velocity: Approximately three feet deep at top of bank. Homes experience flooding only when rainfall and runoff is extreme. Velocities during extreme conditions eight to ten feet per second.
   c. Warning Time: 10 to 20 minutes
3. Residential Flooding at Lake Forest
   a. Flooding Source: Watershed runoff from (mostly developed) dense residential area.
   b. Depth of flooding and velocity: Approximately three feet deep above upstream pipe headwall, overflowing existing underground drainage pipes creating overflow across yards and streets. Velocities four to six feet per second.
   c. Warning Time: 15 to 20 minutes
4. Peevey Creek
   a. Flooding Source: Watershed runoff from (mostly undeveloped) steep mountain slopes, farmland, timber and large residential lots headwater area.
   b. Depth of flooding and velocity: two to three feet deep in streets, flooding houses on the downstream side of Little Cove Road. Approximately 6 inches deep into living space of houses and garages. Velocity of water five to seven feet per second.
   c. Warning Time: 20 to 30 minutes
5. Over Bank Flooding along Tributary 9 to Aldridge Creek (Vista /Monteview Drives)
   a. Flooding Source: Watershed runoff from (mostly undeveloped but some low density residential) steep mountain slopes headwater area.
   b. Depth of flooding and velocity: Approximately two feet deep at top of bank, flooding one house frequently and causing damage to yards. Velocity of water four to six feet per second.
   c. Warning Time: 15 to 20 minutes
6. Out of Bank Flooding along Tributary 8 to Aldridge Creek (Box Canyon Road/Bucks Canyon Area)

a. Flooding Source: Watershed runoff from (mostly undeveloped but some low density residential) steep mountain slopes headwater area.
b. Depth of flooding and velocity: Approximately two feet deep at top of bank, flooding one house frequently and causing damage to yards. Velocity of water four to six feet per second.
c. Warning Time: 15 to 20 minutes

7. Aldridge Creek at Oakhurst Subdivision
   a. Flooding Source: Watershed runoff from upstream.
   b. Depth of flooding and velocity: Approximately two feet deep over top of bank. Approximately 6 inches deep into living space of houses and garage. Velocity of water two to four feet per second.
   c. Warning Time: 30 to 40 minutes
8. Big Cove Creek at Preston Ridge Drive
   a. Flooding Source: Watershed runoff from (mostly undeveloped) very steep mountain slopes headwater area.
   b. Depth of flooding and velocity: Approximately four feet deep at top of bank reaching houses on the west side of creek. Approximately three feet deep into garage. Velocity of water six to eight feet per second.
   c. Warning Time: 15 to 20 minutes
9. Drainage Channel crossing James Road near intersection with Plainview Road
   a. Flooding Source: Watershed runoff from (mostly undeveloped but some large residential lots) mountain slopes headwater area.
   b. Depth of flooding and velocity: Approximately two feet deep across roadway, flooding houses on the east side of James Road. Approximately six inches deep into living space of houses and garage. Velocity of water four to six feet per second.
   c. Warning Time: 15 to 20 minutes
10. Tributary to Fagan Creek near intersection of Sun Valley Drive and Glennwood Drive
    a. Flooding Source: Watershed runoff from urban residential lots and City streets.
    b. Depth of flooding and velocity: Approximately two feet deep at top of bank, overflowing drainage ditch into streets. Approximately six inches deep into living space of houses and garages. Velocity of water four to six feet per second.
    c. Warning Time: 10 to 15 minutes
11. Underground Drainage Outfall System on North Side of Thornton Avenue
    a. Flooding Source: Watershed runoff from urban commercial and residential lots and city streets.
    b. Depth of flooding and velocity: Approximately three feet deep in back yards from overflowing drainage system. Velocity of water four to six feet per second.
    c. Warning Time: 10 to 15 minutes

4.1.3 Historical Floods

The City has seen damaging floods on a regular basis through out its recorded history. More quantitative data is available for the more recent floods. However, descriptions are often available for the more historic floods. The following section includes a description of key historical floods affecting the City (**4a(3)**).

Table 4-1, taken from the Madison County Flood Insurance Study (FIS), shows the relationship between peak discharge and recurrence interval for selected floods. (FEMA 2010)

Table 4-1. Peak Discharge Relationships and Recurrence Interval for Select Floods

Flooding Source and Location	Flood Date	Flowrate (cfs)	Exceedance Probability (%)	Recurrence Interval (years)
Huntsville Spring Branch				
At Johnson Road	March 1973	11,000	10	10
Below Broglan Branch	January 1949	5,400	N/A	N/A
Pinhook Creek				
At Clinton Avenue	March 1973	9,400	4	25
	January 1949	6,700	12	8
Broglan Branch				
At Holmes Avenue	March 1973	4,240	7	14
	January 1949	2,000	30	3
Fagan Creek				
At Gallatin Street	March 1973	3,030	3	30
	January 1949	2,500	6	17
Dallas Branch				
At Andrew Jackson Way	July 1963	2,200	8.5	12
At Maysville Road	March 1973	1,400	6	17
Mc Donald Creek				
500 feet above Centaur Boulevard	March 1973	3,340	7	14
At Technology Drive	March 1973	600	20	5
Indian Creek				
At Highway 20	March 1973	16,500	0.3	330
	December 1967	8,650	5	20
Aldridge Creek				
At Green Mountain Road	March 1973	5,250	2	50

March 27, 1886

The third highest known flood (as of 1964) occurred along the Tennessee River in March of 1886. One high water mark found by Tennessee Valley Authority (TVA) engineers in 1934 on the right bank of Huntsville Spring Brach just downstream of Johnson Road indicated that flooding also occurred on that stream in the vicinity of Huntsville. This high water mark was two feet higher than the 1949 flood at that location. (TVA 1964)

March 23, 1897

A large flood occurred along the Tennessee River and its backwater reached within one quarter mile of the City limits (at that time). In addition, the rain resulted in much over bank flooding on Pinhook Creek and Huntsville Spring Branch. The following day, the *Weekly Mercury* reported:

> *From all portions of the county come reports of unprecedented high waters. Every stream is out of its banks and bridges by the dozens have been washed away…Backwater from the Tennessee River has creeped up to the spoke and handle factory in the Spring Branch bottom, only a*

quarter mile form the city. Water is several feet deep in the factory building. The Spring City Flouring Mills, on the west side of Pinhook Creek, has several feet of water in its basement. On the western approach of Clinton Street Bridge over Pinhook Creek, the water is three feet deep. There is a strong current here and the road will be badly cut up. All foot bridges over Pinhook Creek and Huntsville Spring Branch have been floated away. (TVA 1957)

July 1, 1900

An intense 2-hour storm in July of 1900 resulted in the flooding described below by the *Daily Mercury* on July 3rd, 1900:

…the damage was probably the largest ever known here. Nearly every street and sidewalk in the city was a solid mass of water… The southwestern portion of the city, down of the Spring Branch, was a lake of water, and the residents were compelled to vacate their premises the best way they could. Some swam out others were rescued from the roofs of houses. Considerable damage was down in the western part of the city, fences and bridges were washed away and cattle of all descriptions were drowned. Sheeps, hogs and chickens were hurled away with the waters… (TVA 1957)

January 22, 1906

The *Morning Mercury* on January 23, 1906 gave the following description for the flooding that occurred in 1906:

As a result of the terrific downpour of rain early yesterday morning, a large area of the city in the northern and western portions was flooded yesterday. Pinhook Creek was out of its banks within a few minutes and water flowed through dozens of small houses within its territory. Many people were hemmed up at home with water a foot or two deep covering the floors. The Spring Branch was backed up over the bottom lands and water was said to be seven inches higher than in 1901 when it was higher than ever before in memory. For a time the water was above the foot bridge crossing at Gallatin Street and a few inches over the dam. It was within a few inches of the rails at the railroad culvert. The railroad yards were flooded to a depth that prevented the passage of engines and cotton standing in the cotton yard on Jefferson Street was floated down to the street crossing. On west Clinton Street the water was so high the electric cars could not pass and passengers had to be transferred across the bridge on carriages. No houses were washed away from their foundations but the damage caused by the high water is said to be considerable.

On the following day an editorial stated:

A time is near at hand when a movement will be put on foot for straightening, cleaning, and deepening the channel of the Big Spring to the Tennessee River… (TVA 1957)

September 22, 1912

After this 1912 event *The Daily Times* described it as follows:

The heaviest rain and flood that ever visited this section came last night and this morning at 3 o'clock. All the lowlands in north and west Huntsville are overflowed. The power house and gas plants are closed; probably will be no electric light or car service until tomorrow, certainly not until late tonight. Property damage will reach into the thousands of dollars. Meridian Street and the Southern Railway from that point on to Pinhook Bridge are under water. From the old brick yard in north Huntsville on the south Holmes and Clinton Streets is flooded, families being driven from their homes, which stand half buried in water. Rescue parties formed and saved the lives of more than 100 people. The flood is the heaviest known in 30 years. (TVA 1957)

April 1, 1920

The Daily Times listed many details of the flood that occurred on April 1, 1920. It was estimated that the property damage within the Huntsville City limits was $25,000. As a result of this flooding, *The Daily Times* sent a telegram to a member of Congress, E. B. Almon to request that government experts assess the situation and make recommendations to address flooding. Louis A. Jones, an expert drainage engineer, visited Huntsville on April 4. Two weeks later, a story in *The Daily Times* stated that Mr. Jones recommended a channel 50 feet wide from Huntsville to the Tennessee River with the channel gradually widening so that at the river the width is 95 to100 feet. The cost of the project was estimated at $7,500 for 12 miles for dredging. In addition the paper noted that N.C. & St. L. Railway would do what it could to relieve floodwaters caused by congestion at the trestle across Pinhook Creek southwest of the City. (TVA 1957)

May 11, 1922

On the afternoon of May 11, what was described by *The Daily Times* as a one-hour cloud burst which within half an hour resulted in flooding along Pinhook Creek. The bridges at West Holmes and West Clinton were over topped. The depth of water was noted as 'axel deep' at the Texas Company located on West Holmes Street. The water at the spring canal on Gallatin Street was level with the park and shut off access to the ice factory. (TVA 1957)

May 27, 1924

The *Huntsville Daily Times* estimated that over three inches of rain fell during the night of May 26, 1924. Extensive damage to roads, fences, bridges and stock were reported in northern and northwestern parts of Madison County. In addition, the floodwaters on Pinhook Creek reached the Rison home on West Holmes and the Huntsville Ice Cream Company on West Clinton. The levee on the City side of Pinhook Creek overtopped and many lawns were flooded. (TVA 1957)

December 28, 1926

The *Huntsville Daily Times* noted that this was the worst flood since 1912. Once again Pinhook Creek flowed out of its banks:

> *Residents in practically every section were forced to leave their homes; but not until after rescue parties were present and rendered aid. Cattle of all kind were being carried to safety. No lives were reported lost, but the reports are that not only in the parts of the city but in every precinct of the county livestock were drowned.* (TVA 1957)

September 13, 1929

The following description of this flood event was noted in the *Huntsville Daily Times*:

> *The official figures of Thomas W. Carter, cooperative weather observer at Madison, show that at that place a total of 6.25 inches fell in the 12 hours. However, there are those here who stated that the fall was 11 inches measured in containers with straight sides. Water was standing four to five feet deep in some homes. It was reported that one of the piers on the West Clinton Street Bridge had given way.* (TVA 1957)

January 5, 1949

In 1931 many channel improvements were made. As a result, many years pass until the next report of significant flooding. However, during January 3–4 approximately four inches of rain were reported. Then during the night of the 4th an additional three inches of rain fell in Huntsville and it was estimated that five to six inches fell in the headwaters of Pinhook (outside the City limits).

The floodwaters crested around 9 AM January 5 and the width of floodwaters varied from 800 to 2,200 feet along Pinhook Creek and Huntsville Spring Branch with depth up to five feet reported. Broglan Branch, Dallas Creek and Fagan Creek also experienced overbank flooding. However, the waters receded quickly and water flow was back within the channels by noon with the exception of one area, the Binford Courts housing project. Homes in this area were flooded up to a reported depth of four feet (Figure 4-4). The water here didn't drain away due to fill along Fifth Avenue and spoil piles nearby along two streams. A hole was blasted in the spoil bank along Broglan Branch to drain the water. Two hundred families were evacuated as a result of the flooding with three-quarters of those being from Binford Court.

(Source: TVA 1964)

Figure 4-4. January 5, 1949 - Flooding at Binford Court

(Located between Broglan and Huntsville Spring Branches)

An investigation by TVA engineers estimated $18,500 in damages which included 3 industries, 7 businesses, 1 church and 190 homes. In addition, the concrete bridge across Pinhook Creek at Oakwood Avenue collapsed due to a wooden bridge from upstream and other debris being lodged in it. (TVA 1964)

(Source: TVA 1964)

Figure 4-5. January 5, 1949 - Collapsed Bridge – Oakwood Avenue over Pinhook Creek

March 11, 1963

Through the reaches of Huntsville Spring Branch, Pinhook Creek, and Broglan Branch where the channel had been improved there was little flooding; however, overbank flooding occurred along the upper reaches of Pinhook Creek and Broglan Branch. Dallas Branch, Fagan Creek and Aldridge Creek also experienced over bank flooding at several locations. The only appreciable damage in Huntsville occurred in the northern part of the City along Pinhook Creek upstream from Memorial Parkway. Floodwaters in the Whiteway Trailer Ranch reached a depth of up to two feet. Several families were evacuated and one trailer was swept downstream. One-half mile upstream water surrounded homes in a new subdivision and the Glen Park apartments were flooded (Figure 4-6). The apartments are located on the right bank of Pinhook Creek just downstream of Mastin Lake Road. Water was reported at a depth of 14 inches in the apartment building. (TVA 1964)

(Source: TVA 1964)

Figure 4-6. March 11, 1963 – Flooding at Glen Park Apartments

Photo taken near flood crest, which occurred at 8 PM

July 18, 1963

An intense afternoon storm, dropped 4.5 inches of rain in a one-hour time period on July 18, 1963. As a result, flash flooding occurred throughout the City. Huntsville Spring Branch, Pinhook Creek, Broglan Branch and Fagan Creek were reported to have reached a flood stage similar to that seen in the March 1963 flooding. However, the flood stage on Dallas Branch was reported to have exceeded the January 1949 flood (the highest known flood at that time). The water that left the stream channeled upstream of the Southern Railway Bridge and flowed down Dallas Street with depth up to fee feet (Figure 4-7). (TVA 1964)

(Source: TVA 1964)

Figure 4-7. July 18, 1963 - Flooding on Dallas Street

The view is south on Dallas Street from above McCullough Avenue

July 24, 1963

Late on the evening of July 23, 1963 intense thunderstorms occurred at several localities in northern Alabama. At the Huntsville airport 1.8 inches of rain fell in a one-hour period but in Hartselle, Alabama (25 miles southwest of the airport) over nine inches of rain fell in a 90-minute period. However, there was no flooding on Huntsville Spring Branch or its tributaries. Heavier rain apparently fell over the Aldridge Creek watershed, as that stream rose to a crest at 1 AM on the 24th, which was just 0.23 feet lower than the March 1963 flood crest and subsequently the second highest flood on the creek since the stage (water height) gauge was installed in 1960. (TVA 1964)

The July 1963 flood hit the eastern watersheds the hardest and was rated a 100-year flood on the Flint River. After the 1963 flood, the Huntsville City Planning Commission prepared a report, "Toward a Flood Damage Prevention Program" (a copy of this report could not be located for review for this FMP update). The report called for a "Flood Study Committee" that would study flooding conditions and recommend both corrective (flood control, flood proofing, etc.) and preventive measures (regulations, public information, etc.). No further records were found regarding the committee.

Another product of the 1963 flood was a series of flood control projects. With assistance from the COE, the City undertook some extensive channel modifications. The most urbanized streams, Fagan Creek, Pinhook Creek, Dallas Branch, and Huntsville Spring Branch, were deepened, straightened and lined with concrete walls to increase their carrying capacity. (Huntsville 2001)

March 16, 1973

The largest flood in recent history occurred in March 1973. The extent and severity of this flood is described in the following quote from the 1975 report by the Geological Survey of Alabama:

> *Unusually heavy rains moved from southwest to northeast across a large part of the Tennessee River basin on March 14-18, 1973. On March 15-16, seven to nine inches of rain fell at Huntsville during a 22-hour period, causing major flooding in the city…*
>
> *The most severe general flooding occurred on Pinhook Creek downstream from Mastin Lake Road and on Huntsville Spring Branch and Broglan Branch downstream from Southern Railroad. Parts of floodplains, inundated as much as five feet in depth, were occupied by housing developments, trailer parks, apartment buildings, commercial and industrial buildings, streets, and so forth….*
>
> *The flood on Pinhook Creek at Clinton Avenue crested at four feet above the January 1949 flood, which was the previous highest known flood, and eight feet above the March 1963 flood. According to flood history investigations made by the Tennessee Valley Authority (1964), this flood is the highest known on Pinhook Creek in the past 88 years. Channel improvements, such as deepening, widening, straightening, lining with concrete, and increasing bridge and culvert openings, reduced flood crests on other channel reaches in the Huntsville Spring Branch basin to about the same elevation of the 1949 flood and from 0 to 3.5 feet higher than the 1963 March and July floods. On Aldridge Creek, the flood crest occurred three feet below the maximum stage of record that occurred in July 1963. Peak discharges ranged up to twice those of previously known recorded floods.*
>
> *The Tennessee River crested three days later…. Backwater from the Tennessee River caused a greater extent of flooding, in depth and time, on the lower reaches of Aldridge Creek, Huntsville Spring Branch, and McDonald Creek than the floods that occurred on March 16. (*GSA 1975*)*

While Huntsville Spring Branch went well out of its banks (Figure 4-8), much damage upstream was prevented along those streams that had channel improvements. Flooding on Dallas Branch was reduced below levels of the smaller 1963 flood. Most of the March 1973 flood damage that occurred on Fagan Creek was to the channel itself. The creek had been rechanneled and lined, but floodwaters undermined the concrete lining and eroded the banks, causing approximately $50,000 in damage. To the east, Aldridge Creek channel improvements kept the 1973 flood to a non-damaging stage.

(Source: NWS 2011)

Figure 4-8. March 16, 1973 – Flooding from Huntsville Spring Branch

The largest known flood on the Flint River occurred on March 16, 1973. The flood reached an elevation of 582.2 feet National Geodetic Vertical Datum of 1929 (NGVD29), and had a recurrence interval of approximately 230 years, at river mile 8.5 (river mile is a measure of distance in miles along a river or stream from its mouth). The Flint River valley, which is primarily in agricultural use, sustained only minor crop damage because most of the 1972 crop had been harvested. Fields, fences, and many roads in the area suffered considerable damage. (FEMA 2010)

On the Tennessee River, the 1973 flood was estimated to be a 100-year flood. However, because of the installation of Tennessee Valley Authority dams, the river was kept to a maximum elevation of 575 feet, seven feet lower than the 1867 flood of record. (TVA 1974)

January 19, 1988

A large flood occurred on Fagan Creek on January 19, 1988. This flood reached an elevation of 701.82 feet NGVD29 at river mile 2.98, and had a recurrence interval of approximately 100 years. (FEMA 2010)

December 22, 1990

Numerous high-water marks were available resulting from the December 1990 flood on the Flint River. The 1990 flood was the second largest flood of record and reached an elevation of 669.10 feet NGVD29 at the USGS gauging station No. 3575000, at river mile 35.93 near Chase, Alabama. It was determined that this flood had a recurrence interval of 80 to 90 years at the gauging station.

In addition this flood was the largest flood on Brier Fork Flint River for which data is available. The flood reached an elevation of 701.85 feet NGVD29 upstream of the Meridianville Highway Bridge at river mile 5.11, and had a recurrence interval of approximately 40 years.

On Beaverdam Creek 1 floodwaters reached an elevation of 738.40 feet NGVD29 at the Monroe Road Bridge, river mile 5.77. It had a recurrence interval of approximately 10 years.

This was the second largest flood to occur on Indian Creek during the period of record. This flood reached an elevation of 613.08 feet NGVD29 at the USGS stream gauge No. 03575830 at river mile 5.8, and had a recurrence interval of approximately 40 years.

The flood also impacted Dry Creek 2 which is a tributary to Indian Creek. This flood reached an elevation of 704.1 feet NGVD29 at river mile 1.32, and had a recurrence interval of approximately 25 years. (FEMA 2010)

June 28, 1999

In June 1999, a very heavy local storm caused a flash flood on Aldridge Creek. Floodwaters rose very fast and reached 100-year flood levels. At Toney Drive, the creek had already risen five feet before NWS issued a flash flood warning. Problems were complicated by the fact that the flood occurred in the middle of the night, when people were sleeping and staff of the broadcast media were minimal. The National Climate Data Center (NCDC) storm event database placed the property damage at $1.5 million (however flood insurance claims totaled more that $3.7 million) and described the flood as follows:

> *Heavy rainfall of four to seven inches, most of which occurred in just less than two hours, flooded the Huntsville area. According to newspaper reports, one woman was killed when her car stalled on a flooded bridge on Vermont Road. As she exited the car, she was swept away in the water. A television cameraman was injured when he was swept away by high water while filming. He was rescued by the Huntsville Fire Department. Several other motorists were stranded in high water and were rescued by the fire department. Numerous roads in the area were flooded and subsequently closed. Many local streams and creeks were out of their banks, sending several feet of water into approximately 300 homes and businesses. Several residents were rescued from their homes. Several thousand area customers were without power through the early morning hours due to lightning strikes. A mudslide occurred in Monte Sano State Park covering part of the park road. (*NCDC 2011a)

May 6, 2003

With 10.43 inches of precipitation, May 2003 still stands as the second wettest May on record. The all-time record for May is 11.88 inches set in 1983 (SRCC 2011). Heavy rain fell during May 5 – 6, 2003 resulting in the worst general flooding Huntsville has experienced since 1973. The flooding was covered under Presidential declaration 1466-DR-AL and the damage was estimated at $1.5 million. (NCDC 2011a)

One automated precipitation station in Northeast Huntsville reported 0.96 inch of rain in just five minutes—and over four inches in an hour. (NWS 2011a) Figure 4-9, provided by Dr. John Christy of the University of Alabama at Huntsville (UAH), shows radar estimates of rainfall for northern Alabama and southern Tennessee (the Alabama counties are outlined in black).

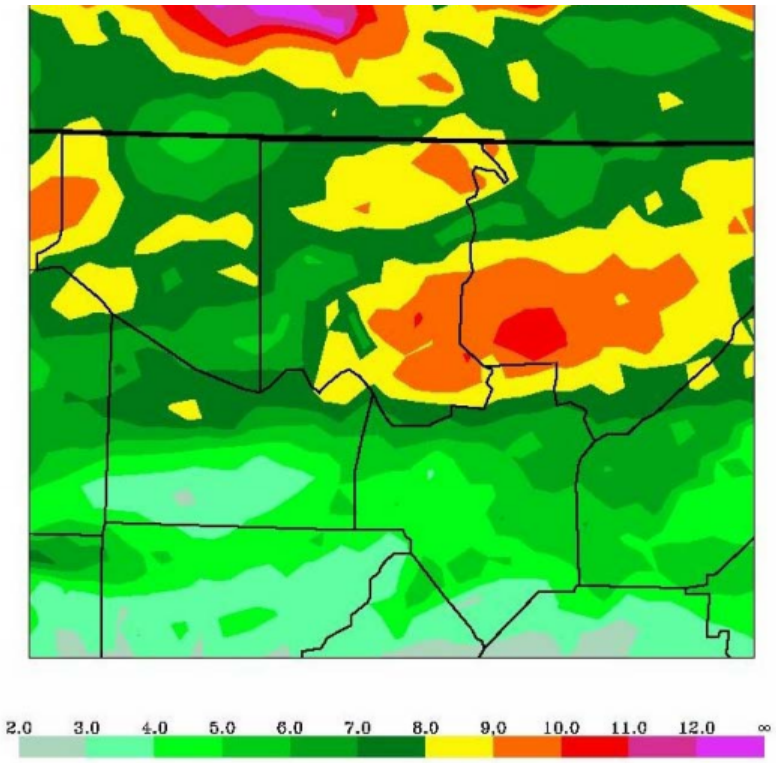


Figure 4-9. Radar Estimates of Total Rainfall from May 4 – 8, 2003

The rain with heavy thunderstorms caused flooding in most of Huntsville's watersheds and several tornados were spawned in the surrounding areas. Determining the severity of the flooding, from gauge data and recurrence interval standpoint, was not possible in many areas because most of the stream gauges have not been operating and recording data long enough for that extrapolation. The two exceptions were the Flint River gauge on Winchester Road (TVA gauge) with 62 years of data and the Indian Creek gauge on Highway 20 with a 44 year record. Calculations indicate that the flood on the Flint had a recurrence interval of only 5.5 years and on Indian Creek of 28 years. Generally, it appears that the smaller, more mountainous watersheds such as Fagan Creek and Big Cove Creek had more intense floods that may have approached the 100-year flood.

Fagan Creek water levels were surveyed and USGS estimated flow rates. Its preliminary estimate of peak flow at the Adams Street gauge was 6,810 cubic feet per second (cfs). The watershed at this point covers an area of 3.44 square miles, while at the confluence with Pinhook Creek the basin comprises 4.36 square miles. According to the Effective FIS, the 100-year flow at the mouth is 4,400 cfs. In other words, the estimated flow a mile upstream was 50 percent greater than the 100-year flow at the mouth.

Damage was widespread as a result of the May 2003 flood. Figure 4-10 shows the impending overtopping of the Holmes Avenue Bridge at Pinhook Creek shortly before the flood peak. Where high-velocity flow crested over bridges, asphalt was ripped from the roadway (Figure 4-11). Some of the worst damage occurred along Broglan Branch at the Northwoods Housing Project (Figure 4-12). Twenty-five to thirty-five units flooded at Northwoods and several homes in the adjacent Love Subdivision also flooded. Besides home flooding, fences along Broglan Branch were ripped down. The rock retaining wall on the west bank of Broglan Branch just above University Drive was also severely damaged. Approximately 2,000 feet of slope paving on Fagan Creek and Dallas Branch were damaged or destroyed in the flood.

Other areas with flood damage included the following:

1. Headwaters of Aldridge Creek along Barcody Road and Imperial Drive
2. Several businesses near the Meridian Street culvert at Dallas Branch (Figure 4-13)
3. Homes and businesses in the Orchard Street – Darryl Avenue area
4. Businesses on the southwest corner of the intersection of Jordan Lane and Holmes Avenue
5. Homes in the McDonald Creek area (Figure 4-14)
6. Culvert damage on McDonald Creek at Technology Drive
7. Handrail and pipe damage at culvert under Blue Spring Road just north of Max Luther Drive (Figure 4-15)
8. Homes in the Monarch Drive area
9. Homes in the Big Cove Creek area at Broad Armstrong Drive and in the Cheval Subdivision
10. Willowick Trail homes along Peevey Creek
11. The Little Cove Road culvert at Peevey Creek
12. Homes along Wakefield Drive near Dallas Branch
13. Homes and junction box damage along Chambers Drive near Oakwood Avenue
14. Home flooding on Wellman Avenue near the intersection with Tollgate Road
15. Homes in the Mount Vernon area of northwest Huntsville
16. Asphalt and erosion damage along Farrow Road and the Indian Creek Greenway in west Huntsville
17. Homes on Whitesburg Drive and Surrey Road
18. Four feet of water in the Von Braun Center parking garage and one foot in the VBC Arena
19. The historic Council School
20. Severe street and yard flooding in many areas such as Linde Street in northwest Huntsville, Cumberland Drive, Lily Flagg Road, and Mira Vista Drive in southeast Huntsville and Austin Avenue by UAH
21. Several businesses in the Market Square shopping center
22. Businesses around the Hall Avenue bridge over Broglan Branch

(Source: Huntsville 2003)

Figure 4-10. May 6, 2003 – Pinhook Creek at Holmes Avenue Shortly before Flood Peak

(Source: Huntsville 2003)

Figure 4-11. May 6, 2003 Flooding – Fagan Creek at Townsend Avenue Bridge

(Source: Huntsville 2003)

Figure 4-12. May 6, 2003 Flooding – Northwoods Housing Project Debris Mark on Car Antenna

(Source: Huntsville 2003)

Figure 4-13. May 6, 2003 – Business Flooding on Meridian Street

(Source: Huntsville 2003)

Figure 4-14. May 6, 2003 Flooding – Home Flooding in McDonald Creek Watershed

(Source: Huntsville 2003)

Figure 4-15. May 6, 2003 Flooding – Blue Spring Road Culvert North of Max Luther Drive

The above areas flooded on May 6, but heavy rains over the Tennessee River basin also caused flooding in south Huntsville several days later. Apartment buildings and businesses were flooded along Fisher Street, Memorial Parkway and Hobbs Island Road. In the Ashmont Boulevard area, street flooding occurred, but no homes were flooded.

The May 2003 flood provided several lessons. Many of the homes and businesses that experienced flooding were outside FEMA floodplains (Figure 4-16), illustrating that a flood's impact is not limited to the delineated floodplain.

(Source: Huntsville 2003)

Figure 4-16. May 6, 2003 – Retaining Wall Flood Damage outside the FEMA Floodplain

August 29, 2007

An intense thunderstorm developed over the central and southern portions of Huntsville dumping excessive rainfall in a very short period of time. Rainfall amounts over three inches were reported via a fairly dense network of automated and manual rain gauges in this area. Peak rainfall rates of up to six inches per hour were observed during a 20-minute time span. This led to quick runoff and flash flooding in low lying areas of south Huntsville which impacted several residences and streets.

In addition to flooding in nearby yards and streets, water was knee deep in two homes in a residential community along Auburn Avenue and Stanford Street. A section of Balmoral Drive near Airport Road was blocked off and flooding was reported on Meridian Street, Whitesburg Drive, South Memorial Parkway, University Drive, and streets in the Jones Valley Drive area near Chadwell Road. There was also flooding near Mayfair Park in the back yards of houses on Thornton Avenue. The estimated property damage was $21,000. (NCDC 2011a and Huntsville 2007)

December 10, 2008

A warm front pushed northeast from Mississippi into northern Alabama producing widespread rainfall during the afternoon on December 9, 2010. Between three and six inches of rain fell in these areas in less than 12 hours, resulting in widespread river and local flash flooding.

Floodwaters were most prevalent in Harvest, Toney, Madison, and central and northern portions of Huntsville. Flood reports began at 11:45 PM on the 9th, lasting into the morning rush hour. Roads that

experienced significant flash flooding included: Old Railroad Bed road, Ford Chapel Road, Production Road at Huntsville International Airport, Wall Triana Highway, County Line Road, Pulaski Pike, Moores Mill Road near Winchester Road, the intersection of Kelly Springs Road and Bob Wade Lane, and Martin Luther King Jr. Highway. Floodwaters forced the evacuation of a trailer park at the intersection of Trademark Drive and James Record Road in Huntsville around 4:25 AM on the 10th. Several cars were underwater at this location. The estimated property damage was $120,000. (NCDC 2011a)

December 9, 2009

A strong southwesterly flow from the Gulf of Mexico and a deepening low pressure system moving out of the southern plains and into the Ohio Valley December 8-9, 2009 resulted in flooding, specially in the southern and eastern portion of the City. NWS reported 24-hour rainfall totals that ranged from 3.65 inches at UAH (NWS gage station UAHA1) to 6.07 at Big Cove Creek (DUGA1). The Flint River peaked at a stage of 20.83, which is a little more than a foot less than the major flood stage level of 22.0 feet. Significant flooding occurred in the Hampton Cove area as a result of the rising Flint River. Several roads were also closed including Little Cove road and Cherry Tree Lane. (NWS 2011c)

(Source: NWS 2011c)

Figure 4-17. December 9, 2009 – Flooding on Little Cove Road

The Huntsville Times reported the following on their website:

> *Huntsville Police closed Cecil Ashburn Dr. over Huntsville Mountain due to a rock slide and water gushing across the road at Donagal that officers said was strong enough to move a vehicle off the road.*
>
> *High water was also reported at Highway 431 and Miller Lane and several other roads in the Hampton Cove area were flooded.*
>
> *A vehicle was stranded in high water on Lily Flagg at Willowbrook near the golf course. Police closed Lily Flagg and also Garth Road near the schools where an estimated two feet of water depth is cascading over the road.*

EMA reported two to three foot of water over the road on University Drive at Timberlane which is just west of Pulaski Pike.

Flood waters are reported seeping into homes on Wynterberry Way in Hampton Cove. At least two houses reportedly have water in them. Water is also reported over the bridge on Lilly Flagg Road at the creek. A house on Green Cove near Memorial Parkway also is reported with water inside and a man driving a Corvette reportedly is on top of the car to escape flood waters on Bailey Cove Road near Grissom High School.

Huntsville firefighters had to search for a car that is reportedly submerged in flood waters over Taylor Road behind the Wal-Mart Supercenter in Hampton Cove. A caller to the 911 Center said they were inside their car and the water was over the windshield. Another call to 911 from a driver on Sutton Road said her car was stalled in water up to the doors and she was unable to get out of her car. (Huntsville Times 2009)

In addition the NCDC reported that a car was partially submerged when attempting to drive through high water on Cook Avenue between Memorial Parkway and Church Street. (NCDC 2011a)

4.2 Other Hazards

Although this particular plan is focused on flooding hazards, other natural hazards threaten the City of Huntsville. Those hazards include: severe thunderstorm, high wind or tornadoes, hurricanes, winter storms, earthquakes, wild fires, and landslides. The Madison County Natural Hazard Mitigation Plan, latest update 2009 (Madison County 2009), reviews each of these hazards in detail and is summarized below, with a minor amount of additional information from NWS, for the purposes of this document.

A copy of the plan may be downloaded at http://www.madisoncountyema.com/mplan.html or contact Huntsville-Madison County Emergency Management Agency at 256-427-5130. It should be noted that most figures and statistics in the following section are not specific to Huntsville but include all of Madison County (**4b**).

4.2.1 Severe Thunderstorms

Hazard Description

A severe thunderstorm is a storm containing damaging winds of 58 miles per hour or more, or hail that measures an inch in diameter or greater. All severe thunderstorms contain lightning. Another by-product of severe thunderstorms is straight-line or downburst winds. These winds can be strong and concentrated. Falling rain and sinking air create the strong winds. Winds can reach speeds of 125 miles per hour.

Hazard Profile

The NCDC Storm Events Database contains 364 reports of damage from severe thunderstorms in Madison County since 1956. These have caused 14 deaths, 23 injuries, and $109.703 million in property damage and $10.018 million in crop damage.

Community Impacts

Since 1975 Madison County has experienced over 200 severe thunderstorms. Large hail, though very rare, can cause injury or loss of life. Normally it only causes damage to automobiles, trees and crops. Both lightning and high winds frequently cause loss of life and considerable property damage. The power of lightning's electrical charge and intense heat can electrocute on contact, split trees, ignite fires, and cause electrical failures.

Probability of Future Occurrences

The probability of a severe thunderstorm occurring depends on certain atmospheric and climatic conditions. Although the threat may be low, the potential for severe thunderstorms is great. The residents of Madison County can expect to experience annual damages of approximately $280,000 from severe thunderstorms. The damages include the sum of annual damages resulting from high wind, hail and lightning. The probability of annual occurrence, based on historical averages, is 2.8 events per year. Although we can extract data and probability of occurrence from historical information, the risk of a thunderstorm occurring and the location and amount of damage appear to be a random event.

4.2.2 Tornadoes and High Wind Events

Hazard Description

A tornado is a violent windstorm characterized by a twisting, funnel-shaped cloud. It is spawned by a thunderstorm (or hurricane) and produced when cool air overrides a layer of warm air, forcing the warm air to rise rapidly. Tornado season is generally March through May with a secondary peak in November (April generally having the highest number of tornados for any given year), although tornadoes can occur at any time of year. They tend to occur in the afternoons and evenings. Over 80 percent of all tornadoes strike between noon and midnight.

Hazard Profile

The damage from a tornado is a result of the high wind velocity and wind-blown debris. Tornado winds can approach speeds as high as 250 miles per hour, travel distances over 100 miles and reach heights over 60,000 feet above the ground. The potential damage resulting from a tornado is directly correlated to the strength of the particular tornado and is quantified utilizing the Fujita Tornado Scale, or the Enhanced Fujita Scale (EF). A comparison between the original Fujita Scale and the Enhanced Fujita Scale is shown in Table 4-2.

Table 4-2. Fujita F-Scale and EF-Scale

F-Scale	Wind Speed (mph)	EF-Scale	Wind Speed (mph)
F0	45-78	EF0	65-85
F1	79-117	EF1	86-109
F2	118-161	EF2	110-137
F3	162-209	EF3	138-167
F4	210-261	EF4	168-199
F5	262-317	EF5	200-234

Community Impacts

According to Storm Events database, a total of 13 tornadoes have resulted in 38 deaths and 790 injuries in the County (as of 2009). The cumulative number of tornadoes has caused approximately $524.6 million dollars in property damage. The County has suffered two major damage-causing incidents by tornadoes. In April of 1974 two consecutive F5 tornadoes touched down causing a total of 220 injuries and 14 deaths. On November 15, 1989, a similar situation occurred when two consecutive F4 tornadoes touched down in the County.

Probability of Future Occurrences

Based on historical averages, Madison County has experienced $3.6 million in damages over a 52-year period or $70,000 per year with 0.8 events annually. A death or injury causing tornado has occurred on

average once every 15 and 6 years, respectively. Historical data cannot predict the paths and severity of future tornadic activity. Consequently, all areas should be regarded as equally at risk for tornadoes.

4.2.3 Hurricanes

Hazard Description

A "tropical cyclone" is a generic term for a cyclonic, low-pressure system over tropical or sub-tropical waters. Tropical cyclones progress through three stages with increasing wind speeds: depression, storm, and hurricane. Tropical cyclones with maximum sustained winds of less than 39 miles per hour are called tropical depressions. A tropical storm is a tropical cyclone with maximum sustained winds greater than 39 miles per hour but less than 74 miles per hour and a tropical storm that progresses to winds that have reached a constant speed of 74 miles per hour or more become a hurricane.

Hazard Profile

Since 1994, 18 significant hurricanes/tropical storms have affected the state of Alabama. Although not all had an impact on Madison County, it is difficult to estimate how many severe thunderstorms and tornadoes may have been caused by tropical storms or hurricanes. All of the tropical systems were well below tropical storm strength when they affected Madison County. The strongest of these storms in recent history was Hurricane Ivan in 2004. Table 4-3 lists the significant hurricane events of the past 15 years.

Table 4-3. Most Significant Hurricanes (1995-2009)

Event	Deaths	Injuries	Statewide Property Damage	Statewide Crop Damage
Hurricane Katrina - 08/29/2005	0	0	$1 billion	0
Hurricane Dennis - 07/10/2005	0	0	$120 million	$100,000
Hurricane Ivan - 09/16/2004	0	0	$2.5 billion	$25 million
Hurricane Georges - 09/28/1998	1	0	$174.2 million	$5 million
Hurricane Opal - 10/4/1995	2	0	$100 million	$10 million

Source: NOAA; http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms

Community Impacts

Madison County is susceptible to the effects of coastal storms. Since Madison County is inland, the primary risk is the impact of high winds, the formation of tornados, and flooding. Ten percent (10%) of deaths in the United States that are associated with hurricanes are due to tornadoes.

Probability of Future Occurrences

Based on limited historical information from the NCDC Storm Events Database, a hurricane or tropical storm impacts the County every couple of years and usually indirectly. Average annual damages for Madison County can not be computed due to the fact that county-by-county damage estimates are not available. Although one can extract data and probability of occurrence from historical information, the risk of a hurricane or tropical storm and the location and amount of damage are random.

4.2.4 Winter Storms

Hazard Description

Winter storms and blizzards originate as mid-latitude depressions or cyclonic weather systems, sometimes following the meandering path of the jet stream. A blizzard combines heavy snowfall, high

winds, extreme cold, and ice storms. There are multiple origins of the weather patterns that cause severe winter storms in the continental United States; however winter storms in the southeast region are usually a result of Canadian and Arctic cold fronts from the north and mid-western states combining with tropical cyclonic weather systems in the Gulf of Mexico.

Hazard Profile

Madison County frequently experiences winter storms and extreme cold. The greatest single 24 hour event on record occurred in December 31, 1963 with a total of 15.7 inches of snow. The greatest 7 day period of snow occurred in that same time frame from December 25, 1963 to January 1, 1964 with a total of 17.1 inches (which all actually fell on December 31, 1963 and January 1, 1964). The largest event in recent times occurred March 13, 1993 with a total of 7.3 inches in Huntsville alone. (Dates and amounts in this paragraph provided by Michelle Amin and David Nadler of NWS)

Community Impacts

Risks associated with winter storms are a direct correlation to the strength of the storm and the region's ability to handle a storm. The risks include loss of life due to cold, disruption of transportation routes, loss of electricity for extended periods, and the impact on agriculture.

Probability of Future Occurrence

Madison County does have a considerable risk of a winter storm occurring which has damaging affects on the area. This is a direct result of the terrain of the County as well as to the area's ability to handle a severe winter storm.

4.2.5 Earthquakes

Hazard Description

An earthquake is a sudden, rapid shaking of the Earth caused by the breaking and shifting of rock beneath the Earth's surface.

Hazard Profile

Numerous earthquakes have been recorded in the State of Alabama. A number of the recorded tremors have occurred in north Alabama near Madison County. Table 4-4 identifies the Earthquakes recorded in Madison County since 1916.

Table 4-4. Earthquakes Affecting Madison County (1916-2009)

Date	County	Epicenter Area
6/24/1939	Madison	Huntsville
4/23/1957	Madison	Farley
8/09/1984	Madison	Huntsville
8/24/1984	Madison	Huntsville
2/20/1989	Madison	Huntsville

Community Impact

The USGS has developed a methodology for identifying an area's vulnerability to the occurrence of an earthquake. Areas are identified by their relative seismic risk. Madison County is located in an area with

a "probability of exceedance" (probability that a ground motion is exceeded for an individual earthquake) between 5 percent and 6 percent in 50 years. This is an area of slight to moderate risk as defined by FEMA. In accordance with FEMA guidelines, an area with 3 percent or greater probability of exceedance in 50 years should be further assessed for vulnerability.

Probability of Future Occurrences

The risks associated with earthquakes in Madison County are slight to moderate.

4.2.6 Wild Fires

Hazard Description

There are four categories of wildfires that are experienced throughout the United States:

- wild land fires and brush fires
- interface or intermix fires
- firestorms
- prescribed fires and prescribed natural fires.

The two primary categories experienced in Madison County are wild land fires and interface or intermix fires. Wild land fires are fueled exclusively by natural vegetation. Interface or intermix fires are fueled by both vegetation and the built up environment. The three factors which have a direct impact on wildfire formation are topography, fuel, and weather. Topography (especially slopes, canyons, and gulches) can have a powerful influence on wildfire behavior by greatly increasing the rate of spread.

Hazard Profile

Madison County averaged 30 wildfires resulting in damage of 150 acres per year from 1995 to 2003. The Alabama Forestry Commission was unable to provide data from 2003 to present.

Community Impacts

Wildfires can cause considerable damage and loss of life especially in areas where there is an interface between wild land and urban development.

Possibility of Future Occurrences

Wildfires do not have a significant impact on the communities in Madison County. When a wildfire does encroach upon a community, the impact can be loss of life, injury, and property destruction.

4.2.7 Landslides

Hazard Description

A landslide is the downward and outward movement of slope-forming materials acting under the force of gravity. The term covers a broad category of events including mudflows, mudslides, debris flows, rock falls, rockslides, debris avalanches, debris slides, and earth flows. Landslides may consist of natural rock, soil, artificial fill, or combinations of these materials. Landslides are classified by type of movement, including: slides, flows, lateral spreads, falls, and topples.

Hazard Profile

Several landslide events occurred during the 1990s. One such event was on June 28, 1999. The landslide occurred in Monte Sano State Park covering part of the park's road.

Community Impacts

The effects of landslides are often misrepresented as being the result of the landslide's trigger event, such as a flood, earthquake, volcanic eruption, hurricane, or coastal storm. The impacts from a

landslide can include loss of life, damage to buildings, lost productivity, disruption in utilities and transportation systems, and reduced property values.

Probability of Future Occurrences

The topography and geology of Madison County is susceptible to the effects of landslides, especially in the eastern areas of the County where colluvial soils are present. Development in areas with colluvial soils increases the likelihood of landslides having an impact on Madison County.

Section 5

Assess the Problem

The previous section assessed the flood hazards facing the city of Huntsville. This section focuses on assessing the impact of those hazards. For example, a flood hazard area may or may not have flood problems. Flooding is viewed as a natural and even beneficial occurrence. A floodplain is only a problem if human development gets in the way of, or exacerbates, the natural flooding. (FEMA 2007)

Once again, the focus of this document is flooding; for more information on assessing and addressing the other hazards (beyond the summary in the previous section) refer to the Madison County Natural Hazard Mitigation Plan. (Madison County 2009)

This section includes information made available since the initial FMP was developed (**required for update p. 510-32**).

5.1 Overview of Vulnerability and Impact on Community

Just over 30 square miles or 14 percent of the City land area is in the floodplain and additional areas are impacted by localized flooding (Figure 4-1). This represents a reduction from the analysis performed for the 2001 FMP which stated that 17 percent of the City's land area consists of floodplains. This change is likely the result of annexation.

As seen by the entries in the historical flooding section of this report (Section 4.1.3), the City of Huntsville was and continues to be vulnerable to flooding. The primary areas of impact are the older part of the City which includes Huntsville Spring Branch and its tributaries, Aldridge Creek watershed and more recently the Flint River watersheds in the Hampton Cove area (Figure 5-1). Much of the Huntsville Spring Branch watershed was developed prior to any floodplain regulations. As a result, many structures are in the floodplain. The City has embarked on many projects to address flooding issues starting with channel improvements as early as 1931. (TVA 1964) (**5a required**) This section evaluates the potential impact of flooding in Huntsville with respect to:

- Impact of Flood Hazard
  - Life, Safety and Health
  - Critical Facilities and Infrastructure
  - Economy and Tax Base
- Buildings Subject to the Flood Hazard
- Insurance Claims Review
- Natural and Beneficial Functions
- Development, Redevelopment, and Population Trends.

5.2 Impact of Flood Hazard

Floods may have a significant impact on the community. Concerns of the impact include the health and safety of the community, critical facilities that provide assistance during an emergency, and how the economy may be affected as a result of a flood. This subsection reviews the impact of the flood hazard on each of these concerns.

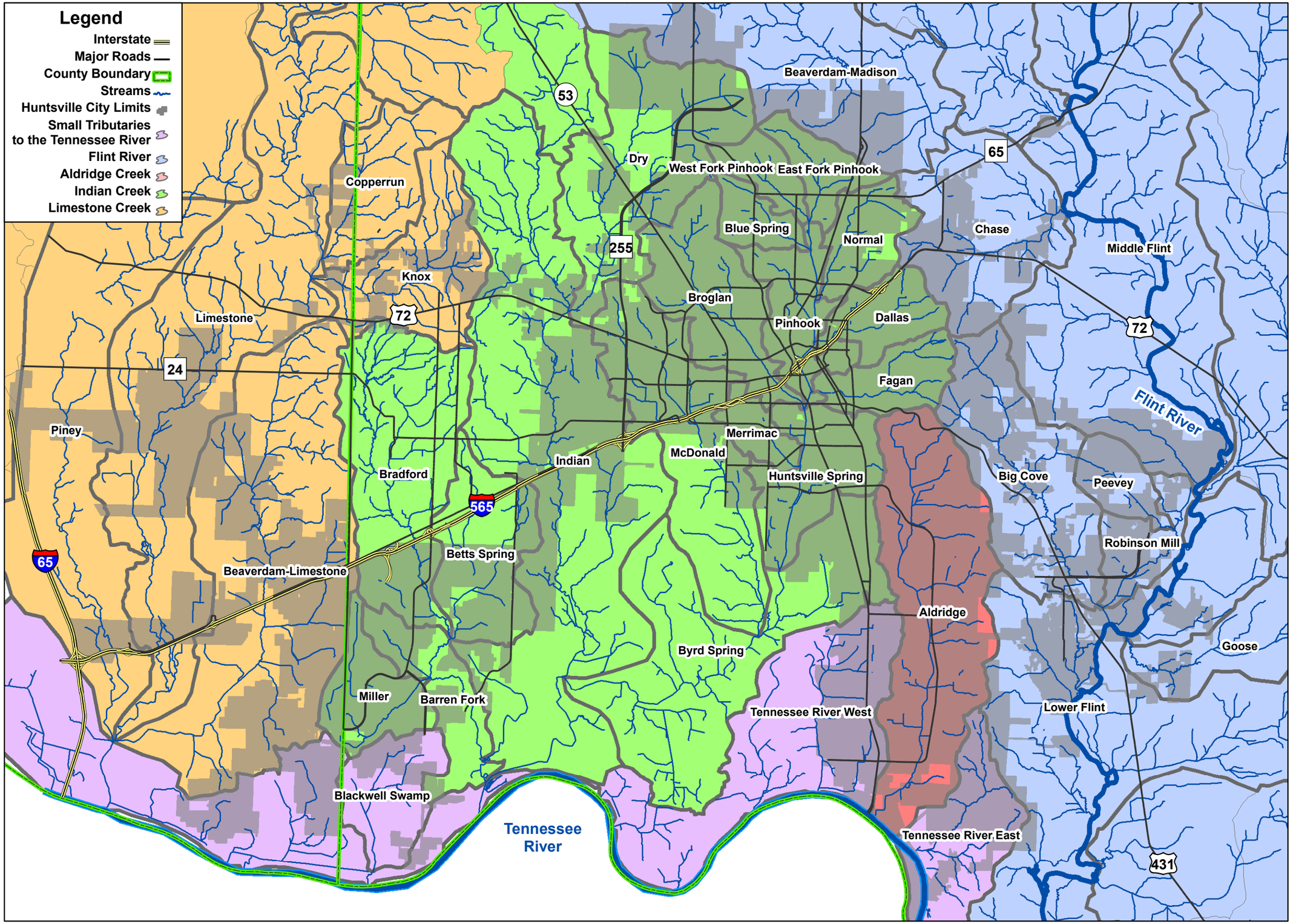


Figure 5.1
Major Watersheds
Huntsville Floodplain Management Plan

Brown AND Caldwell

5.2.1 Impact on Life, Safety and Health

The following subsection describes the warning systems in place and the impact of flooding on life, safety and health (**5b(1)**).

Hazard Warning

In January 2003, NWS opened a Weather Forecast Office (WFO) in Huntsville. This office provides hydrologic products and services to 11 counties in northern Alabama. For small streams such as Aldridge Creek, Pinhook Creek, and Indian Creek in Madison County, flash flood watches and warnings are issued to inform the public when flash flooding is possible or imminent. (Huntsville 2003)

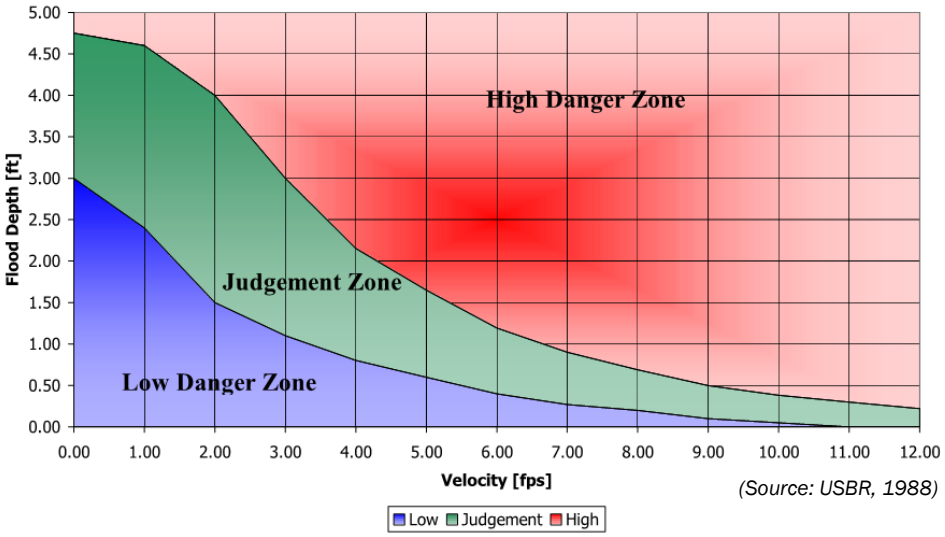
Life

Based on a 30-year record, flooding is the leading cause of weather related deaths in the United States. (NWS 2011d) However, throughout the many flooding events that have affected Huntsville over the years there is only one known fatality that has been reported due to flooding. This occurred during the 1999 flood of Aldridge Creek when car was driven across a flooded roadway. The driver emerged from the car and attempted to walk to safety, but drowned in the attempt.

Safety

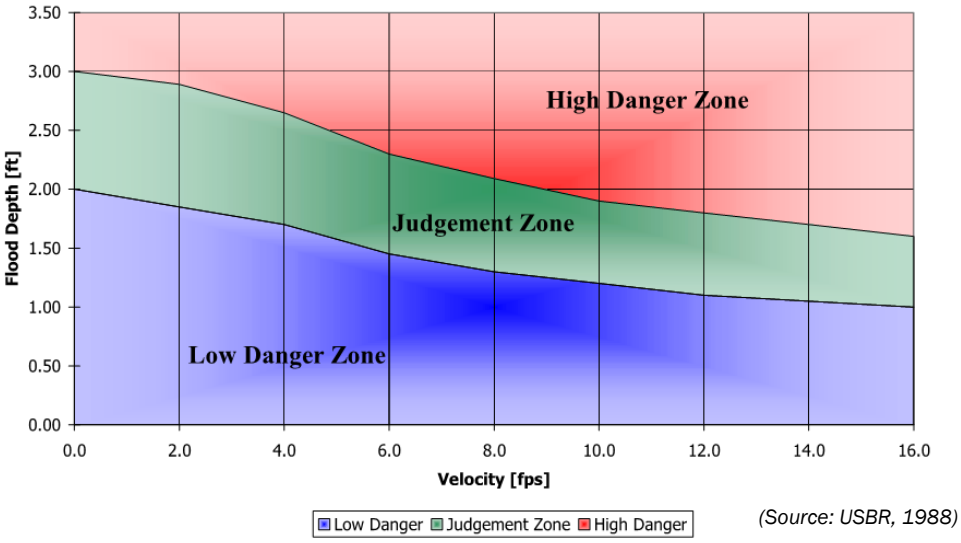
Floods bring a host of safety concerns; the primary concerns are directly a result of the floodwaters while others are secondary and result from the damage caused by the flooding. Some key primary safety concerns for Huntsville include: people being trapping in homes, on roofs or cars, and cars entering floodwaters that have overtopped roadways and being swept downstream. Secondary concerns include downed power lines and damage to bridges and roadways.

Since the one fatality experienced in Huntsville was caused by drowning in swiftly moving water this aspect of flooding safety is of particular concern. No areas with moving floodwater can be considered safe and pedestrians and vehicles should exercise extreme caution and not enter moving waters. As shown on Figure 5-2, an adult would have a difficult time wading through waters moving faster than 4 feet per second at a depth of only 2 feet. Figure 5-3 outlines the combination of water velocity and depth of water needed to endanger a car.



(Source: USBR, 1988)

Figure 5-2. Depth – Velocity Flood Danger Relationship for Adults



(Source: USBR, 1988)

Figure 5-3. Depth – Velocity Danger Relationship for Passenger Vehicles

Electrocution is the second most frequent cause of flood deaths, claiming lives in flooded areas that carry a live current created when electrical components short out or power lines are damaged. Floods also can damage utilities, roadways, and buildings creating secondary hazards such as gas leaks, unsafe structures, and fires, which are particularly damaging in areas made inaccessible to fire-fighting equipment by high water or flood related road or bridge damage. (Huntsville 2001)

Health

There is no available data on health problems caused by floods in Huntsville. While such things are not reported, three general types of health problems accompany floods.

The first comes from the water itself. Floodwaters carry whatever was on the ground that the upstream runoff picked up, including industrial chemicals, dirt, oil, animal waste, and any chemicals applied to lawns or used on farms. Pastures and areas where cattle and hogs are kept can contribute polluted waters to the flood flow. In addition, the ground becomes saturated which leads to infiltration into sanitary sewer lines which places additional strain on wastewater treatment plants. When wastewater treatment plants are flooded or overloaded, there is nowhere for the sewage to flow and it may result in sewer lines backing up into low lying areas and homes. Even though diluted by floodwaters, raw sewage can be a breeding ground for bacteria and other disease causing agents.

The second type of health problem comes after the water is gone. Stagnant pools become breeding grounds for mosquitoes, and wet areas of a building that have not been cleaned breed mold and mildew. A building that is not thoroughly and properly cleaned becomes a health hazard, especially for small children and the elderly. Another health hazard occurs when heating ducts in a forced-air system are not properly cleaned after inundation. When the furnace or air conditioner is turned on, the sediments left in the ducts are circulated throughout the building and breathed in by the occupants.

The third problem is the long-term psychological impact of having been through a flood and seeing one's home damaged and irreplaceable keepsakes destroyed. The cost and labor needed to repair a flood damaged home puts a severe strain on people, especially the unprepared and uninsured. There is also a long-term worry for those who know that their homes can be flooded again. (Huntsville 2001)

5.2.2 Impact on Critical Facilities and Infrastructure

FEMA provides the following definition and description of critical facilities:

> *For some activities and facilities, even a slight chance of flooding is too great a threat. Typical critical facilities include hospitals, fire stations, police stations, storage of critical records, and similar facilities. These facilities should be given special consideration when formulating regulatory alternatives and floodplain management plans. A critical facility should not be located in a floodplain if at all possible. If a critical facility must be located in a floodplain it should be provided a higher level of protection so that it can continue to function and provide services after the flood. Communities should develop emergency plans to continue to provide these services during the flood.*
>
> *Under Executive Order 11988, Floodplain Management, Federal agencies funding and/or permitting critical facilities are required to avoid the 0.2% (500-year) floodplain or protect the facilities to the 0.2% chance flood level. (FEMA 2011a)*

Huntsville GIS data was used to determine the critical facilities located in the floodplain. The GIS analysis method involved the point data for critical facilities, building footprints and the floodplain boundary. For all emergency response and care facilities, colleges, waste water treatment plants and senior faculties each point was zoomed to and examined to determine if the facility was located in the floodplain. Due to the numerous childcare facilities, pump stations, and schools a more automated spatial analysis techniques was applied for these facilities. The number of each type of facility is included in Table 5-1 **(5b(2))**.

Table 5-1. Critical Facilities Located in the Floodplain

Facility Type	Total Number	Number in Floodplain
Emergency Response and Care		
Fire Stations	17	2
HEMSI (ambulance) Stations	7	0
Hospitals	4	0
Police Stations	4	2
At Risk Populations		
Childcare Facilities	145	11
Schools (Elementary – High School)	73	3
Colleges	9	3
Senior Facilities	20	2
Infrastructure		
Wastewater Treatment Plants	5	3
Pump Stations	43	16

5.2.3 Impact on Economy and Tax Base

Floods can result in significant financial impact to a community as a result of damaged property and infrastructure. In addition, floods cause other problems that are not as easy to quantify. Businesses that are disrupted by floods often have to be closed. They lose their inventories, customers cannot reach them, and employees are often busy protecting or cleaning up their flooded homes. In addition to lost income, there are costs for finding temporary housing and cleaning up. (Huntsville 2001) Also, the

City expends a great deal of emergency services resources to rescue, evacuate, and patrol the flooded areas.

The City does not keep track of these financial numbers and associated City expenditures with flood occurrences (nor could any community realistically and accurately capture this data). As a result, it is difficult to quantitatively determine the economic impacts of flooding. Table 5-2 was developed using a range of available data sources to document known costs for historical flood events and annual insurance claims; however, it can safely be assumed that this under estimates the actual costs as previously eluded to and because 1) there are gaps in the data and 2) claims are not filed for all damages, 3) total losses are not always repaired and 4) indirect losses may be difficult to quantify (**5b(3)**).

Table 5-2. Economic Impact of Flooding

Date	Dollar Amount (at time of flooding)	2010 Dollars[6]
April 1, 1920	$25,000[1]	$272,570
January 5, 1949	$18,500[2]	$169,497
March 16, 1973	$4,576,882[3]	$22,477,851
1977	$972[4]	$3,498
1979	$336,355[4]	$1,010,251
1980	$28,221[4]	$74,682
1982	$969[4]	$2,190
1983	$111,293[4]	$245,035
1989	$943[4]	$1,658
1990	$181,285[4]	$302,451
1994	$2,250[4]	$3,311
1995	$4,326[4]	$6,190
1996	$3,971[4]	$5,519
1997	$3,670[4]	$4,998
1998	$56,391[4]	$75,438
1999	$3,715,723[4]	$4,863,360
2000	$12,483[4]	$15,807
2003	$1,030,116[4]	$1,220,777
2004	$53,536[4]	$61,799
2005	$6,073[4]	$6,740
2007	$114,282[4]	$120,187
December 10,2008	$120,000[5]	$121,534
2009	$186,932[4]	$189,998
	$10,590,173	**$31,255,340**

[1]TVA 1957, [2]TVA 1964, [3]GSA 1975, [4]Annual Total of NFIP Flood Insurance Claims, [5]NCDC Storm Events Database, [6]Calculated using the CPI

5.3 Buildings Subject to the Flood Hazard

Based on the Effective 100-year floodplain and the City's building footprint coverage (GIS data), there are 5,079 structures that are wholly or partially in the floodplain (**5c**). It is important to note that this analysis is based on the Effective not Preliminary mapping. When the Preliminary mapping becomes Effective the number of structures in the floodplain will rise significantly.

This analysis was performed using GIS software to overlay the delineated floodplain and the building footprint polygons. Then the City's watersheds (Figure 5-1) were used to determine the number of structures in the Effective floodplain and floodway. As expected, the older portions of the City have the majority of structure located in the floodplain.

Table 5-3. Structures in the Floodplain

Watershed	Number of Structures in the Floodplain	Number of Structures in the Floodway
Aldridge	424	5
Barren Fork	1	0
Beaverdam - Limestone	7	0
Beaverdam – Madison	0	0
Betts Spring	54	1
Big Cove	130	4
Blackwell Swamp	2	0
Blue Spring	91	33
Bradford	30	1
Broglan	1,043	216
Byrd Spring	152	0
Chase	9	0
Copperun	0	0
Dallas	189	84
Dry	31	3
East Fork Pinhook	19	16
Fagan	255	26
Goose	0	0
Huntsville Spring	529	172
Indian	118	15
Knox	47	0
Limestone	5	0
Lower Flint	45	3
McDonald	253	65
Merrimac	9	1
Middle Flint	0	0
Miller	6	1
Normal	2	0
Peevey	4	0
Piney	7	1
Pinhook	1,015	129
Robinson's Mill	110	3
Tennessee River East	76	6
Tennessee River West	416	1
West Fork Pinhook	0	0
Total	**5,079**	**786**

5.4 Insurance Claims Review

A review of available data on Flood Insurance Claims was performed (**5d**). The City obtained insurance claims data from the NFIP State Coordinator. The claims data covers a time period from November 1977 to February 2010. During this time there have been 415 claims made on flood insurance policies. Of those 415 claims, 344 actually resulted in a payment being made. Table 5-4 details the annual and overall statistics on the insurance claim amounts.

Table 5-4. Insurance Claims Statistics November 1977 - February 2010

Year	Sum of Claims	Average Claim Value	Median Claim Value
1977	$972	$324	$378
1978	$0	$0	$0
1979	$336,355	$10,193	$3,936
1980	$28,221	$5,644	$1,734
1981	$0	$0	$0
1982	$969	$242	$0
1983	$111,293	$9,274	$1,107
1984	$0	$0	$0
1985	$0	$0	$0
1986	$0	$0	$0
1987	$0	$0	$0
1988	$0	$0	$0
1989	$943	$472	$472
1990	$181,285	$18,129	$6,154
1991	$0	$0	$0
1992	$0	$0	$0
1993	$0	$0	$0
1994	$2,250	$2,250	$2,250
1995	$4,326	$4,326	$4,326
1996	$3,971	$3,971	$3,971
1997	$3,670	$1,835	$1,835
1998	$56,391	$14,098	$0
1999	$3,715,723	$16,737	$10,510
2000	$12,483	$1,783	$0
2001	$0	$0	$0
2002	$0	$0	$0
2003	$1,030,116	$17,460	$7,531
2004	$53,536	$4,118	$1,504
2005	$6,073	$1,215	$0
2006	$0	$0	$0
2007	$114,282	$38,094	$13,308
2008	$7,435	$3,718	$3,718
2009	$186,932	$13,352	$3,661
2010	$0	$0	$0
Overall Statistics	**$5,859,822**	**$17,034**	**$9,494**

As shown in the table, many years had no claim but the year with the largest total dollar amount of claims ($3.7 million) was 1999, when significant flooding occurred along Aldridge Creek. The second largest total occurred in 2003 which saw claims just over $1 million after widespread flooding affected the City. Both of these events are detailed in Section 4.1.3 of this report.

5.5 Natural and Beneficial Functions

Floodplain areas and adjacent waters combine to form a complex and dynamic physical and biological system found nowhere else. When portions of floodplains are preserved in their natural state, or restored to it, they provide many benefits to natural as well as human systems. The following section describes areas present in the floodplain that provide natural and beneficial functions (5e). The numerical values in this section were developed by intersecting GIS data of wetlands, greenways and parks with the City limits and then with the effective floodplain boundary. All GIS data was obtained from the City GIS department.

Wetlands

Historically wetlands were often seen as a nuisance and were drained or filled for farming or development. However, the beneficial functions of wetlands are now recognized and these areas are protected under Section 404 of the Clean Water Act. The location of floodplains and wetlands often coincide giving communities a dual incentive to protect these areas. The City of Huntsville has approximately 7,200 acres of wetlands, based on the USFWS National Wetlands Inventory (NWI). Figure 5-4 shows the USFWS NWI as downloaded from the USFWS website. Take note that just because that inventory does not show wetlands in a particular area does not mean there are not wetlands in that area; a qualified environmental specialist can determine if wetlands exist on a site. Five thousand seven hundred (5,700) acres or 79 percent of the wetlands coincide with the 100-year floodplain.

Greenways

Starting in the early 1990s, the City recognized the need to protect open space along natural features such as streams or ridges, or along man-made features such as abandoned railroad corridors or scenic highways. This recognition led to the development of the *City of Huntsville Greenways Plan*. The purpose of the plan is to develop an interconnected system of greenway corridors throughout the City (Huntsville 2006). The existing and proposed greenways are also shown on Figure 5-4. Almost 60 miles of these greenways coincide with the floodplain. However, as noted on the figure, many of the greenways are proposed. The implementation of this greenway plan provides a dual incentive for the City and its citizens in that the greenways provides recreational and aesthetic benefits to the community while also protecting the floodplain.

Parks and Nature Preserves

Within the City limits, there are currently 78 parks and land preserves ranging in size from less than 1 acre to over 2,000 acres; all of these areas are shown as “Parks” in Figure 5-4. This includes Huntsville City Parks, State Parks, and Land Trust property. Of the over 7,000 acres of parks and preserves, 1,600 acres are located in the floodplain. Once again these areas provide the beneficial function of recreational opportunities while also protecting the floodplain.

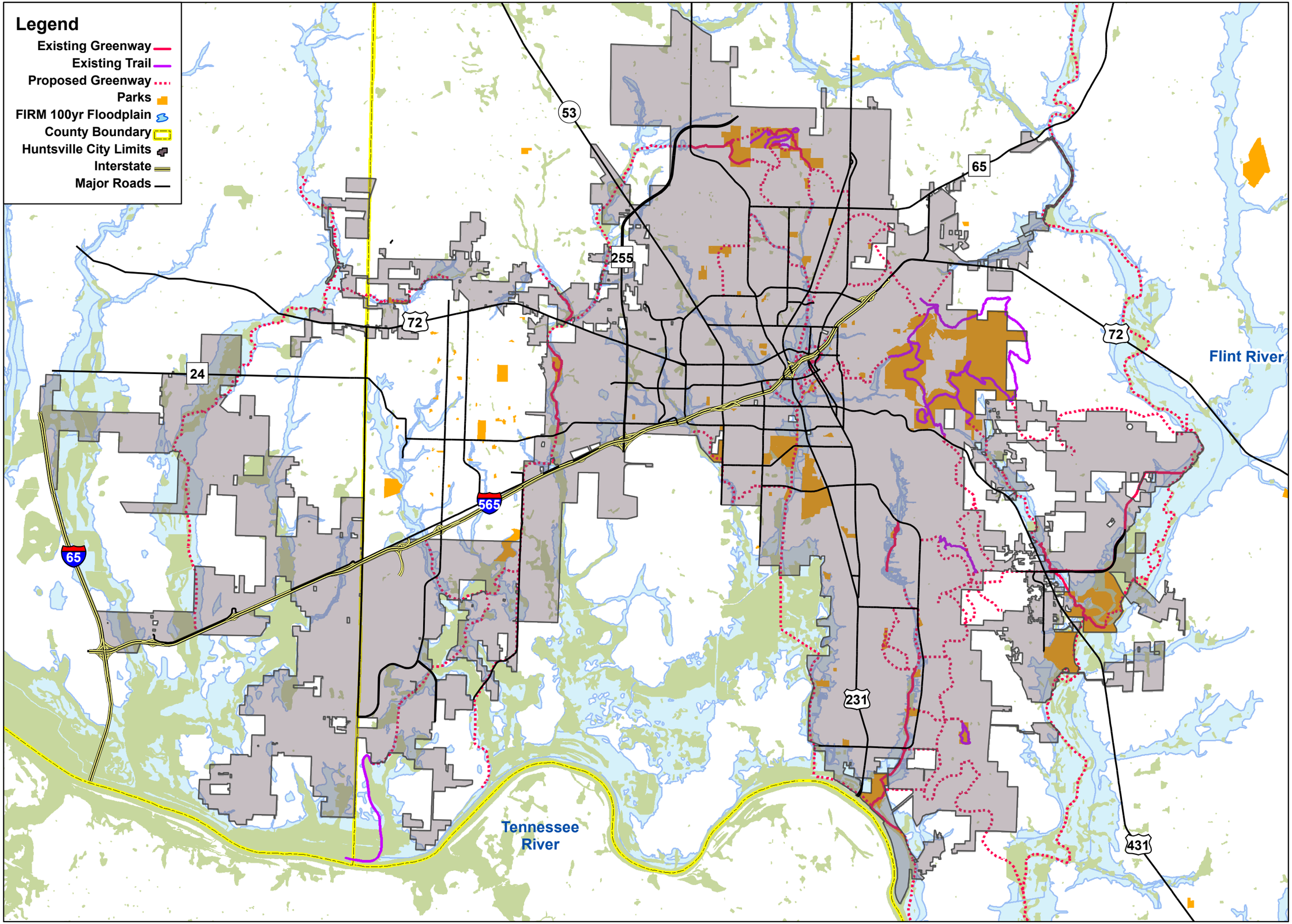


Figure 5.4
Natural & Beneficial Functions
Huntsville Floodplain Management Plan

Brown AND Caldwell

5.6 Development, Redevelopment, and Population Trends

The City continues to grow both in population and land area through annexation and relocation. The U.S Census Bureau listed the population in 2000 as 158,635 and in 2010, based on data obtain by the Huntsville GIS department the population grew to 180,105. (Amy Kenum, personal communication, March 15, 2011)

The City of Huntsville Planning Division estimated a population of 181,441 as of July 1, 2010. The following table represents watersheds in the city of Huntsville with the largest amount of housing and population growth, which is expected to continue through 2015. Refer to Figure 5-1 for the location of the watersheds.

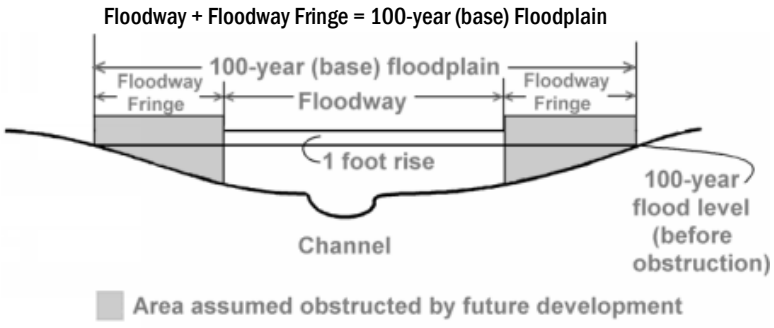
Table 5-5. Population and Housing Growth (2000 – 2015)

Watersheds	Households Added 2000 – 2010	Households Added per Year 2000 – 2010	Estimated Households Added 2000 – 2015	Estimated Population Added 2000 – 2015
Lower Flint	2,866	287	4,299	9,845
Knox	1,563	157	2,345	5,369
Dry	1,548	155	2,322	5,317
Indian	1,410	141	2,115	4,843
Betts Spring	838	84	1,258	2,879
Barren Fork	676	67	1,014	2,322
Tenn. River West	381	38	572	1,309
Total	9,282	929	13,925	31,884

Source: U.S. Census Bureau and the City of Huntsville Planning Division

As expected, the areas with the largest amount of growth are away from the City core. Many of these areas were previously farm land that has now been converted to residential development. The concern with the conversion of land from one use to another is preserving the floodplain so that it may function as needed during large storm events and thus avoid flooding that impacts the residents of Huntsville.

One key way the City preserves floodplain function, thus lessening the impact of development, is through floodplain development permitting. These permits are required for any land disturbance activity or development activity that occurs in the Flood Hazard District. This permitting process is established as a part of the City Zoning Ordinance, in particular Article 62 entitled Flood Hazard District Regulations, and allows development in the floodplain with limitations and requirements to help reduce the general impact on flooding. It should be noted that development in the floodway portion of the floodplain is more restrictive than in the flood fringe (refer to Figure 5-5 for definitions). The floodway is a more dangerous area than the fringe as it generally has deeper and faster moving water during flooding conditions.



Floodway - the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without a cumulative increase in the water surface elevation more than a designated height (general 1 foot).

Floodway Fringe – the area between the floodway and the boundary of the 100-year floodplain.

Figure 5-5. Floodway and Floodway Fringe Definitions

While the current process lessens the impact of development on the floodplain, it does not account for increases in the 100-year discharge that result from development in the upstream watershed (**5f**).

Section 6

Set Goals

It should be noted that goals are long range targets that the City's floodplain management program should aim for. They are kept in mind when the current and needed mitigation measures are reviewed and when specific recommendations and AI are drafted by the Floodplain Management Plan Committee. Available resources (primarily funding), staffing levels, and statutory authority limit the City's ability to attain all desired goals.

With the above considerations in mind, in 2001 the Flood Mitigation Planning Committee (now the Floodplain Management Committee) set five overall goals for the floodplain management planning effort, each with more detailed objectives (**6**). As a part of the FMP update the committee reviewed the original goals. The overall consensus was that the 2001 goals still accurately capture the City's objectives; however, some minor modifications were made to the goals. The following list shows the revised goals that the committee developed:

1. **Protect life and health from flooding:**
   a. Provide flood hazard information to all inquirers.
   b. Advise citizens and businesses of flood safety and health precautions.
   c. Improve the detection and advance warning of flooding.

2. **Mitigate the effects of flooding on existing development:**
   a. Mitigate flood damage.
   b. Design new developments in the watershed to minimize the increase of stormwater runoff on downstream properties, and minimize obstruction, diversion or increase of flood flows onto other properties.
   c. Minimize the loss of use of roads and infrastructure during the base flood and facilitate a quicker recovery of the use of these services.
   d. Prioritize flood protection projects, starting with those areas facing the greatest historic threat to life and property.
   e. Maintain stream channels, storage basins, and flood protection structures.

3. **Protect new development from damage by the base flood:**
   a. Protect new buildings and improvements to buildings from damage by the base flood.
   b. Facilitate the passage of emergency vehicles during the base flood.
   c. Ensure that standards for new construction will not be so restrictive that they effectively prohibit all new development.

4. **Improve the quality of life in the City:**
   a. Incorporate opportunities for sustainable development, economic development, housing improvement, recreation, environmental, and other multiple uses of flood prone lands into flood mitigation projects.
   b. Expand the greenway corridors to preserve floodplain open space, provide recreation opportunities, protect habitat, reduce erosion, and filter runoff.
   c. Preserve wetlands and other sensitive areas so they may store floodwaters, improve water quality, and provide their other natural and beneficial functions.
   d. Improve the habitat and water quality in streams and riparian areas.

5. **Secure the resources needed to implement the Flood Mitigation Plan:**
   a. Develop the GIS data base, watershed models, and maps needed to identify and regulate floodplains.
   b. Encourage the cooperation and participation of the people who are directly affected by flood protection measures.
   c. Use County, State, and Federal programs to the fullest extent possible.
   d. Fund flood mitigation programs and projects through fees assessed on users of the City's drainage system and possibly the beneficiaries of flood protection projects.

Section 7

Review Possible Activities

FEMA CRS program classifies floodplain management activities into six categories:

1. Preventive Activities
2. Property Protection Activities
3. Natural Resource Protection Activities
4. Emergency Services Activities
5. Structural Projects
6. Public Information Activities

Preventive measures, public information, and property protection attempt to reduce the risk through altering the way we manage and build in the floodplain. Natural resource protection and structural projects tend to manage the hazard – where it will flood, how frequently it will flood, and to what extent. Finally, emergency services mitigation activities change the way we respond to flooding in order to reduce risk.

All of the techniques should be considered and incorporated into a floodplain management program since no one technique addresses all of the concerns – risk, hazard, and response. In fact, it is desirable to have multiple lines of defense to protect life and property. The following section further explains the activities for each of the floodplain management categories and their application, as well as discusses the activities that were considered by the FMP Committee in 2001 (**required p. 510-16, 7a, 7b, 7c, 7d, 7e and 7f**). This section pulls from the original FMP and updates and modifies it to reflect current conditions.

7.1 Preventive Activities

Preventive measures are designed to keep the problem from occurring or getting worse. Their objective is to prevent future development from increasing flood damage. Preventive measures are usually administered by building, zoning, planning, and/or code enforcement offices. They include the following:

1. Planning
2. Open Space Preservation
3. Zoning
4. Subdivision Regulations
5. Building Codes
6. Floodplain Development Regulations
7. Stormwater Management

The first three measures, planning, zoning and open space preservation, work to keep damage-prone development out of the hazardous or sensitive areas. The next three measures, subdivision regulations, building codes, and floodplain development regulations, impose construction standards on what is allowed to be built in the floodplain. They protect buildings, roads, and other projects from flood damage and prevent development from aggravating the flood problem. The last measure, stormwater management, addresses the runoff of stormwater from new developments onto other properties and

into floodplains. The following section reviews each of these preventative measures and discusses the effectiveness of current regulatory and preventative standards and programs (**7a**).

7.1.1 Planning

Comprehensive planning defines how a community should be developed and where development should not occur. Use of the land can be tailored to match the land's hazards, in this case typically by reserving flood hazard areas for parks, greenways, golf courses, backyards, wildlife refuges, natural areas, or similar compatible uses. Generally, a plan has limited authority. It reflects what the community would like to see happen. Its utility is that it guides other local measures, such as capital improvement programs, zoning ordinances, and subdivision regulations. A community's capital improvement plan states where major public expenditures will be made over the next 5 to 20 years. Capital expenditures may include acquisition of land for public uses, such as parks, and extension or improvement of roads, utilities, streams, and drainage channels and structures.

The City of Huntsville does not have a comprehensive plan in a single document. However, the City has a number of adopted master plans which are specific in nature, such as the Major Street Plan, Downtown Master Plan, Land Use Plans, Recreation Plan, and Greenways Plan. That being said, some of these plans need to be evaluated and/or updated (possibly in some cases recreated). The Recreation Plan only addresses active recreation facilities, with no focus on passive recreation alternatives. The City has an annual Capital Improvements Program (CIP) budget that includes funding needed for, among other things, greenways and drainage projects. The budget is tied to the implementation of various officially adopted plans, such as the 2025 Transportation Plan, Greenways Plan, and Recreation Plan.

7.1.2 Open Space Preservation

Keeping the floodplain free from development is the best approach to preventing flood damage. Open space preservation should not be limited to floodplains, as some sites in the watershed may be key to controlling runoff that adds to the flood problem. Comprehensive and capital improvement plans should identify areas to be preserved by acquisition and other means, such as purchasing an easement. With an easement, the owner is free to develop and use private property, but property taxes are reduced or a payment is made to the owner if the owner agrees not to build on the flood prone part or the part set aside in the easement. That being said, there are some Federal programs that can help acquire or reserve open lands such that they do not have to be purchased. Developers can be encouraged to dedicate park land and required to dedicate easements for drainage and maintenance purposes. These are usually linear parcels along property lines or channels. Maintenance easements can also be donated by streamside property owners in return for a community channel maintenance program.

Within the last 10 years, Huntsville has increased the number of City parks from 52 to 60 with two more in the planning stages. The acreage of parks has increased from 1,900 acres to over 3,000 acres (Huntsville 2011). Additionally, Monte Sano State Park, Wheeler National Wildlife Refuge, Huntsville/Madison County Ditto Landing Marina, and several properties preserved through the Land Trust of Huntsville and North Alabama are, in whole or in part, located within the City. Together, these now comprise approximately 23 percent of the area in the mapped floodplains.

The City has plans for an extensive greenway system. As noted on Figure 5-4, there is a substantial overlap between the proposed greenways and flood prone streams. When completed, the system will have over 130 miles of interconnected trails. The Greenways Plan sets priorities for acquisition and development of land for the completed system. They favor sites with significant natural resources (e.g., floodplains and wetlands), connections to public facilities, development potential, and multi-use opportunities. Funds to implement the plan are budgeted in each year's Capital Improvement Program.

The Land Trust of Huntsville and North Alabama (Land Trust)is a non-profit organization which was incorporated in 1987 with the support and encouragement of the City. Its mission statement is to

preserve land for public use to enhance recreation, education, conservation, and prosperity in the North Alabama region. The Land Trust has been successful during its existence and receives continuing support from the City, in both land and monetary contributions. This protected land is largely composed of wetlands and mountainside.

7.1.3 Zoning

A zoning ordinance regulates development by dividing a community into zones or districts and setting development criteria for each. The floodplain can be designated as one or more separate zoning districts created to permit only those uses or activities that are not as susceptible to damage by flooding, such as conservation areas and agricultural development. Another approach is to designate the floodplain as an overlay district in order to prevent development that would contribute to or cause increased flood damage, regardless of the use in the underlying zone.

Article 62 of the City's Zoning Ordinance creates a Flood Hazard District and sets the standards for new construction in that district. This is an overlay zone which does not specify land uses, but does set flood protection construction standards (Section 62.5). In other words, the overlay zone applies whether or not the floodplain will be developed for residential or commercial use, as long as the project is in compliance with the Flood Hazard District regulations.

In addition, the Zoning Ordinance also has Article 65, Slope Development District Regulations. This is another overlay district that covers steeper hillsides (15 percent or greater slopes). The Article requires a geotechnical analysis before construction to determine the potential slope hazards, such as landslides, and specifies setbacks, lot coverage, construction, landscaping, and other development standards to minimize disruption of natural features. The amount of disruption permitted in the Slope Development District is designed to minimize stormwater runoff and maximize slope stability.

7.1.4 Subdivision Regulations

Subdivision regulations govern how land will be subdivided into individual lots, and sets the construction and location standards for the infrastructure the developer must provide to serve those lots, including roads, sidewalks, utility lines, storm sewers, and drainage ways. For example, some communities require that every subdivision in a floodplain provide a building site above the flood level for every lot and/or require streets to be at or no more than one foot below the base flood elevation. Another approach is clustering of a subdivision. The clustering of building sites within a subdivision (e.g., on high ground, above flood levels) is actually controlled through the zoning ordinance. Zoning criteria and density controls, such as lot sizes, setbacks and lot coverage requirements, determine the ability to implement the clustering concept.

Huntsville's Subdivision Regulations require standard information from the developer, including a Site Assessment Map and a Site Assessment Report that must describe the area's soils, sinkholes, landslide history, wetlands, springs and seeps, vegetation, and endangered or threatened species. The Site Assessment Report must include "Recommendations for mitigating all located and described on-site hazards and sensitive environmental features". (Huntsville May 2007) If there has been previous disturbance of the ground (e.g., a dump site) or there is potential for a landslide, a geotechnical investigation is required. The final plat must show all restricted use and flood hazard areas and note whether a geotechnical investigation was conducted. In flood hazard areas, the minimum finished floor elevations must be noted to be one foot above the base flood elevation (BFE).

Easements are required along watercourses. They must be large enough for both the drainage way and maintenance access. A minimum 15 foot buffer of natural vegetation is required next to sensitive lands "as designated by the Planning Commission." "Lands within a floodway shall not be subdivided or developed except that certain minimal grading and construction may be allowed to provide for public utility service and/or roadways to cross said floodway." (Huntsville May 2007) Just as important as the

regulatory standards are the procedures that must be followed. Applicants are advised to meet with the Planning Division staff before they prepare their layout. An application for approval of the layout (with the Site Assessment Map and Site Assessment Report) must be submitted to staff and then to the Subdivision Committee of the Planning Commission. After approval of the layout, the preliminary plat is reviewed and presented at a public hearing and then the final plat is approved by the Planning Commission. These are thorough procedures that allow for detailed review of potential problems from flooding and other hazards. It is up to the Planning Commission to ensure that those problems are addressed and that there are no variations from the subdivision and construction standards.

7.1.5 Building Codes

Flood protection standards for all new and improved or repaired buildings can be incorporated into the local building code. These standards should include criteria to ensure that the foundation will withstand flood forces and that all portions of the building subject to damage are above flood levels or otherwise protected from flooding. The Building Code Effectiveness Grading Schedule (BCEGS) is used by the insurance industry to determine how well new construction is protected from wind, earthquake and other non-flood hazards. It is similar to the CRS and the fire insurance rating scheme: community programs are reviewed and scored, a class 1 community is the best, and a class 10 community has little or no program.

Huntsville Inspection Department currently administers the 2003 International Building Code, 2003 International Residential Building Code, 2003 Existing Building Code, 2003 International Plumbing Code, 2003 International Fuel Gas Code, 2003 International Mechanical Code and the 2002 National Electrical Code.

7.1.6 Floodplain Development Regulations

As a condition of making flood insurance available, the NFIP sets minimum requirements for regulating new development in the floodplain that must be implemented by participating communities. CRS has identified numerous regulatory provisions that exceed these minimums and provides an insurance premium reduction as an incentive for communities to adopt them.

As previously mention Huntsville is a member of the NFIP and because the building code and other regulations did not include all the necessary NFIP language, a separate section (Article 62), also previously discussed, was included in the Zoning Ordinance to meet the requirements specified by the NFIP. Article 62 has one important provision that exceeds the NFIP minimums. All new buildings and substantial improvements must be protected to a level at least 1 foot above the base flood elevation. This receives credit under CRS, which would also credit many other types of higher regulatory standards as listed in its Manual.

7.1.7 Stormwater Management

Development outside a floodplain can contribute significantly to flooding problems. Runoff is increased when natural ground cover is replaced by urban development. To prevent stormwater from flooding roads and buildings, storm sewers and drainage ways are constructed to carry the water away more efficiently. This combination of increased runoff and more efficient stormwater removal leads to increases in downstream peak flows and changes in the timing of when storm flows peak move downstream. Unconstrained watershed development often will aggravate downstream flooding and overload a community's drainage system. A second concern with stormwater is its impact on water quality. Runoff from developed and agricultural areas picks up pollutants on the ground, such as road oil and landscape/agricultural chemicals, and carries them to the receiving streams.

Generally, stormwater management regulations require the construction of detention basins to minimize the increases in runoff caused by impervious surfaces and new drainage systems. A standard detention

requirement is that each development must not let stormwater leave at a rate higher than that under pre-development conditions for certain storm levels. The City requires that there be no more than 2.5 cfs increase in discharge for the 10-year event and that there be a controlled release (via an emergency spillway) of the 100-year event; in other words for the later, the detention pond cannot just spill out all around its banks. Additionally, many communities are now also adding volume and duration considerations to stormwater management requirements.

Huntsville's subdivision regulations require a drainage plan prepared in compliance with the City of Huntsville Stormwater Management Manual. The drainage plan focuses on the drainage area related to the development, not the entire watershed. In addition, the City has no authority to regulate development outside of its corporate limits and large portions of the watersheds that drain into the City are in the unincorporated areas of Madison and Limestone Counties. The detention requirements for Madison County are very similar to the City's requirements, while Limestone County does not require detention. (Madison County 2010 and Limestone County) As a result of development in the upstream communities, the increased runoff will likely increase flood heights downstream in the City.

7.1.8 Preventative Activities Considered

After reviewing the preventative measures activities the 2001 committee developed the following recommendations for consideration as AI:

1. The City should develop an open space plan coupled with appropriate funding for acquisition through the CIP. The result would be the acquisition of lands for permanently protected open space that would provide flood protection, recreation, and greenway benefits. The open space plan could be used to encourage the dedication of identified sensitive lands and/or the conveyance of conservation easements to public or open space use.
2. The City should review the Zoning Ordinance's flood protection standards to ensure appropriate protection is afforded floodplain properties.
3. The higher regulatory standards credited by CRS should be used as a checklist to determine where the floodplain regulations could be strengthened. The following are recommended for review: standards to protect floodplain fill from erosion and scour, prohibiting critical facilities from all or parts of the floodplain, prohibition of health hazards in the floodplain, buffers adjacent to streams, restrictions on the use of enclosures below elevated buildings, and drainage plans for all buildings, including those not in the floodplain.
4. The City's procedures for administering the building and floodplain development ordinances should be revised as soon as possible to ensure that all of the NFIP and CRS requirements are met for all development in the floodplain.
5. The City should proceed to prepare stormwater management master plans on all watersheds subject to future development. Those plans should set appropriate standards for new developments.
6. Until a master plan is prepared for a watershed, development will be regulated by the Subdivision Regulations. The standards and procedures in the Subdivision Regulations and the Stormwater Management Manual should be reviewed to determine whether they adequately protect downstream development and whether the City should assume responsibility for ensuring that new detention facilities are properly maintained.
7. Madison and Limestone Counties should be encouraged to adopt stormwater management regulations that protect existing and future downstream development from increased flows due to stormwater runoff.

8. When stormwater management plans are prepared for watersheds with substantial areas outside the City limits, the flood modeling should be based on the assumption that the watersheds are fully developed without detention.

7.2 Property Protection Activities

Property protection measures are used to modify buildings subject to flood damage rather than to keep floodwaters away. A community may find these to be relatively inexpensive measures because often they are implemented by or cost-shared with property owners. Many of the measures do not affect the appearance or use of a building, which makes them particularly appropriate for historical sites and landmarks. These measures include the following:

1. Relocation
2. Acquisition
3. Building Elevation
4. Local Barriers
5. Dry flood proofing
6. Wet flood proofing
7. Sewer Backup Protection
8. Insurance

7.2.1 Relocation

Relocating a structure out of a SFHA preserves the building and removes it from harms way. Relocation has the added benefit of allowing a portion of the floodplain to return to its natural condition. Relocation can be more expensive than elevation (discussed below in subsection 7.2.3); however, it can provide an additional level of protection not offered by elevation techniques.

7.2.2 Acquisition

Acquisition projects are initiated and paid for by government agencies such that the property can be converted to public use and remain free of structures. Acquisition projects, like relocation projects, are able to return the natural function of the floodplain to the property. It should be noted that the displacement of communities is a potential social issue associated with large scale acquisition projects.

7.2.3 Building Elevation

Raising a building above the flood level is the best on-site property protection method. Water flows under the building, causing little or no damage to the structure or its contents. Alternatives are to elevate on continuous foundation walls (creating an enclosed space below the building such as a crawlspace or lower level) or piers, or elevation on compacted earthen fill. If enclosed on all or all but one side and a residential structure, the enclosed area can be wet flood proofed (i.e. meet venting requirements to allow floodwater to equalize in and outside the enclosure); non-residential structures can be dry flood proofed. Both concepts of flood proofing are discussed further in subsections 7.2.6 and 7.2.5 below, respectively. Areas below the elevation requirement can be used for storage (excluding equipment) and parking.

New residential buildings have been required to be elevated in Huntsville's floodplains since 1973. The City requires that new residential structures be built at a minimum elevation of the BFE plus one foot (BFE+1).

7.2.4 Local Barriers

Barriers keep surface floodwaters from reaching a building. A barrier can be built of soil ("berm") or concrete or steel ("floodwall"). A typical design for earthen berms is three horizontal feet for each vertical foot (3:1 slope). As a result, an area 6 feet wide is the minimum needed for each foot in height. Floodwalls need less room, but are more expensive. Barriers must be placed so as not to create flooding or drainage problems on neighboring properties. Also they can not be constructed in the floodway. Depending on how porous the ground is, if floodwaters stay up for more than an hour or two, a barrier needs to handle leaks, seepage of water beneath, and rainwater that falls inside its perimeter; this is usually done with a sump and/or drain to collect the internal groundwater and surface water.

7.2.5 Dry Flood proofing

This term covers several techniques for sealing up a building to ensure that floodwaters cannot get inside it. All areas below the flood protection level are made watertight. Walls are coated with waterproofing compounds or plastic sheeting. Openings (doors, windows, and vents) are closed, either permanently, with removable shields, or with sandbags. Many dry flood proofed buildings do not look any different from those that have not been modified. Dry flood proofing is only appropriate for buildings on concrete slab floors (without basements) and with no cracks. To ensure that the slab is watertight and sound, an engineering analysis is recommended. Generally, the maximum flood protection level for dry flood proofing is about two feet above the slab. Deeper water will put pressure on the walls and slab floor such that they would need to be engineered/designed and constructed to withstand such forces.

7.2.6 Wet Flood proofing

Wet flood proofing means letting the water in and, with an impeding flood, removing everything that could be damaged by water. There are several ways to modify a building so that floodwaters are allowed inside, with only minimal damage being done to the building and its contents. These techniques range from moving a few valuable items to remodeling the flood prone portion of the structure. In the latter case, structural components below the flood protection level are replaced with materials that are not subject to water damage. For example, concrete block walls are used instead of wooden studs and gypsum wallboard, and the furnace, water heater, and laundry facilities get permanently relocated to a higher floor (where the flooding is not deep, these appliances can be raised on blocks or platforms).

Wet flood proofing is generally not feasible for one-story houses because the flooded areas are the living areas. However, many people wet flood proof their basements, crawlspaces, garages, and accessory buildings simply by relocating items that are difficult to move such as the furnace, heavy furniture and electrical outlets. Light or moveable items, like lawn furniture and bicycles, can be moved if there is enough warning. Fuse and electric breaker boxes should be located high and near a door in order to safely turn the power off to the circuits serving flood prone portions of a structure. Wet flood proofing has one advantage over the other approaches: no matter how little is done, flood damage is reduced. Thousands of dollars in damage can be prevented by simply moving furniture and electrical appliances out of a basement.

7.2.7 Sewer Backup Protection

Cross connections between sanitary and storm sewer systems (generally not in issue in the Huntsville area) and infiltration and inflow can overload the sanitary sewers during a storm. Buildings that have downspouts, footing drain tile, and/or a sump pump connected to the storm sewer service may be flooded inside during heavy local rains. Eliminating such connections and directing/allowing rain and surface water out onto the ground where it will flow away from the building should be considered. Four other approaches may be used to protect a structure against sewer backup: plugs, stand-pipes, overhead sewers, and backflow protection valves. The first two devices keep water from flowing out of

floor drains or some other lowest opening in a building. They are inexpensive solutions; however, if water becomes deep enough in the sewer system, it can flow out of the next lowest opening, such as a toilet or tub, or it can overwhelm a plug via hydrostatic pressure. The other two measures are more secure, but more expensive. An overhead sewer keeps water in the sewer line during a backup. A backflow protection valve prevents backups from flowing into the building.

7.2.8 Insurance

Flood insurance has the advantage that, as long as the policy is in force, the property is protected and no human intervention is needed for the measure to work. Although most homeowner's insurance policies do not cover a property for damage from rising water, an owner can insure a building for such damage through the NFIP. Flood insurance coverage is provided for insurable buildings and their contents damaged by a "general condition of surface flooding" in the area. (FEMA 2005) Building coverage is for the structure; this includes all things that typically stay with the building when it changes ownership. A detached garage can be included under a residential flood insurance policy if: (1) it is used only for parking of vehicles and limited storage and (2) the value does not exceed 10% of the value of the primary structure. However, a garage that does not meet these conditions or another type of accessory building would require a separate policy for flood insurance coverage. (STCRPDB 2011) Contents coverage is for the removable items inside an insurable building. A renter can take out a policy with contents coverage, even if there is no structural coverage. Certain items are not insurable.

7.2.9 Property Protection Activities Considered

After reviewing the property protection activities the 2001 committee developed the following recommendations for consideration as AIs:

1. When flood protection alternatives are considered for any particular site, property protection measures should be considered along with the traditional flood control alternatives.
2. Property owners should be advised of the property protection measures that can help them reduce flood losses.
3. The City should pursue the following activities to encourage and support measures taken by property owners:
    a. Public information,
    b. Outside funding sources that can assist property owners in funding property protection measures, especially after a disaster declaration.
4. The City should work with property owners to identify other activities the City should undertake to encourage and support property protection measures, including:
    a. Site-specific technical assistance to individual property owners,
    b. Rebates or other low levels of financial assistance,
    c. Awards or other non-financial incentives that recognize good practices.
5. The City should publicize projects that have been implemented by property owners in the past.

7.3 Natural Resource Protection Activities

Natural resource protection activities are generally aimed at preserving or in some cases restoring natural areas. In so doing, these activities enable the naturally beneficial functions of floodplains and watersheds to be better realized. The activities reviewed in this section include: wetland protection, erosion prevention and sedimentation control, stream restoration, best management practices, and dumping regulations.

7.3.1 Wetland Protection

Wetlands are often found in floodplains and depressional areas of a watershed. Many wetlands receive and store floodwaters, thus slowing and reducing downstream flows. They also serve as a natural filter, which helps to improve water quality, and provide habitat for many species of fish, wildlife, and plants. Wetlands are regulated by the COE and the U.S. Environmental Protection Agency (EPA) under Section 404 of the 1977 Clean Water Act (CWA). Before a "404 Permit" is issued, the plans are reviewed by several agencies, including COE and USFWS. Each of these agencies must sign off on individual permits. There are also nationwide permits that allow small projects that meet certain criteria to proceed without individual permits.

Generally, these agencies want to protect wetlands by preventing development that will adversely affect them. If a permit is issued, the impact of the development is typically required to be mitigated. Wetland mitigation can include creation, restoration, enhancement, or preservation of wetlands. The appropriate type of mitigation is addressed in each permit.

In 1994, City Planning and EPA staff conducted an Advanced Identification (ADID) project. The objective of ADID is to identify and assess the functions of local wetlands. The ADID results do not have any regulatory authority but do/did provide valuable information for both public and private development planning. According to Susan "Soos" Weber (a consultant working for the City at the time), it was a multi year project that took a look at every wetland in Madison and parts of Limestone County, assessed their functionality, and map them. Also, according to Ben Ferrill in City Planning, although a draft report was finished it was never published through the EPA for various reasons; however, information from the study effort is still utilized and was key in protecting some high valued mountain perched wetlands which were identified as part of the study. (Susan Weber and Ben Ferrill, personal communication, March 16-17, 2011)

7.3.2 Erosion Prevention and Sedimentation Control

Farmlands and construction sites typically contain large areas of bare exposed soil. Surface water runoff can erode soil from these sites, sending sediment into downstream waterways. Sediment tends to settle where flowing water slows down and loses power, such as when it enters a lake or a wetland. Sedimentation will gradually fill in channels and lakes, reducing their ability to carry or store floodwaters. When channels are constricted and flooding cannot deposit sediment in the bottomlands, even more is left in the channels. The result is either clogged streams or increased dredging costs (if dredging can be permitted). Not only are the drainage channels less able to do their job, but the sediment in the water reduces light, oxygen, and water quality and often brings chemicals, heavy metals and other pollutants. Sediment has been identified as the nation's number one nonpoint source pollutant for aquatic life. Practices to reduce erosion and sedimentation have two principal components: 1) minimize erosion with vegetation and 2) capture sediment before it leaves the site.

Slowing surface water runoff on the way to a drainage channel increases infiltration into the soil and reduces the volume of soil eroded from the site. Runoff can be slowed down by measures such as terraces, contour strip farming, no-till farm practices, sediment fences, hay or straw bales, constructed wetlands, and impoundments such as sediment basins and farm ponds. Erosion and sedimentation control regulations mandate that these types of practices be incorporated into construction plans. They are usually oriented toward construction sites rather than farms. The most common approach is to require an erosion and sediment control plan as a part of construction project plans being reviewed for approval. This allows the applicant and the permitting official to determine together the best practices for the project site. One often used approach is to have the contractor install sedimentation basins that are used as detention basins after construction. These basins are built first, so they detain runoff during construction.

7.3.3 Stream Restoration

Over the past decade stream restoration has become an established practice across the country. The objective is to return streams, stream banks and adjacent land to a more natural condition, including the natural stream geomorphology, riparian vegetation, and eventually the reestablishment or enhancement of aquatic and riparian ecology. Key components of these efforts include natural channel design and the use of appropriate native plantings along the banks that resist erosion. This may involve "retrofitting" the shoreline with willow cuttings, wetland plants, and/or rolls of landscape material covered with a natural fabric that decomposes after the banks are stabilized with plant roots. Studies have shown that after establishing the right vegetation, long-term maintenance costs are lower than if the banks were concrete. The NRCS estimates that over a 10 year period, the combined costs of installation and maintenance of a natural landscape may be a fifth of the cost for conventional landscape maintenance (mowing turf grass etc.).

7.3.4 Best Management Practices

Point source pollutants come from pipes, such as the outfall of a municipal wastewater treatment plant, and are regulated by the ADEM. Nonpoint source pollutants come from non-specific locations and are harder to regulate. Examples of nonpoint source pollutants are lawn fertilizers, pesticides, and other farm chemicals, animal wastes, oils from street surfaces, and sediment from agriculture, construction, mining and forestry. These pollutants are washed off the ground surface by stormwater and flushed into receiving storm sewers, ditches, and streams. Best management practices (BMPs) are measures that reduce nonpoint source pollutants that enter the waterways. BMPs can be implemented during construction and as part of project design to permanently address nonpoint source pollutants. There are three general categories of BMPs:

1. Avoidance: setting construction projects back from the stream.
2. Reduction: Preventing runoff that conveys sediment and other waterborne pollutants, such as planting proper vegetation and conservation tillage.
3. Cleanse: Stopping pollutants after they are en route to a stream, such as using grass drainage ways that filter the water or retention and detention basins that let pollutants settle to the bottom before they are drained.

In addition to improving water quality, BMPs can have flood related benefits. By managing runoff, they can attenuate flows and reduce the peak flows after a storm. Combining water quality and water quantity measures can result in more efficient multipurpose stormwater facilities. Because of the need to clean up our rivers and lakes, there are several laws mandating the use of BMPs for new developments and various land uses. EPA's National Pollutant Discharge Elimination System (NPDES) permit program for stormwater is the primary regulatory mechanism for addressing nonpoint source runoff.

7.3.5 Dumping Regulations

Dumping regulations address solid matter, such as shopping carts, appliances, and landscape waste that can be accidentally or intentionally thrown into catch basins, waterways, or wetlands. Such materials can pollute the water, obstruct low flow events, and reduce the conveyance systems ability to move and treat stormwater. Many cities have nuisance ordinances that prohibit dumping garbage or other objectionable waste on public or private property. Waterway dumping regulations need to also apply to less objectionable materials, such as grass clippings or tree branches which can kill ground cover, cause obstructions in channels, and increase nutrient loadings.

Many people do not realize the consequences of their actions. They may, for example, fill in the ditch in their front yard not realizing that it is needed to drain street runoff. They may not understand how re-

grading their yard, filling a wetland, or discarding leaves or branches in a watercourse can cause a problem to themselves and others. Therefore, a dumping enforcement program should include public information materials that explain the reasons for the rules as well as the penalties. Regular inspections to catch violations should also be scheduled. Finding dumped materials is easy; locating the source of the refuse is hard.

Ordinance 88-419, Section 20-264 states: "It shall be unlawful for any person to throw, dump or otherwise deposit in or around the public drainage ditches, storm sewers or sanitary sewer of the City any Solid Waste or any other article or material that would tend to impede flow of water or that would tend to clog such ditches, storm sewers, or sanitary sewers." (Huntsville 1988) Code enforcement officers respond to dumping complaints and can cite violators. The City is receiving CRS credit for this regulation.

7.3.6 Natural Resource Protection Activities Considered

After reviewing the natural resource protection activities the 2001 committee developed the following recommendations for consideration as AIs:

1. The City should incorporate stream restoration-type approaches in plans for channel improvements and maintenance.
2. Standards for BMPs for stormwater management facilities should be reviewed to see if they should be expanded to include all types of developments, not just industrial.
3. City procedures should be reviewed to close any gaps in enforcement of existing ordinances.

7.4 Emergency Services Activities

Emergency services measures protect people during and after a flood. Locally, these measures are coordinated by the Huntsville-Madison County Emergency Management Agency (EMA). The EMA's main guidance for implementing population protection measures is the Emergency Operations Plan (EOP). Emergency services measures include the following:

1. Flood Detection
2. Flood Warning
3. Flood Response
4. Critical Facilities Protection
5. Post-Disaster Recovery and Mitigation

7.4.1 Flood Detection

The first step in responding to a flood is knowing that one is coming; hence, detection is key. Without a proper and timely flood threat detection system, adequate warnings by NWS cannot be disseminated. A flood threat detection system provides early warning to emergency managers. A good system will predict the time and height of the flood crest. Most flood warning systems consist of three components: (1) data collection (gauges); (2) data processing (computers and software); and (3) information dissemination. (NSW 2010) However, these systems can be quite costly to develop and maintain.

The NWS, a division of the National Oceanic and Atmospheric Administration (NOAA), is the primary agency responsible for the flood detection. Flood threat predictions are disseminated on the Emergency Managers Weather Information Network (EMWIN) or NOAA Weather Radio. NOAA Weather Radio is considered by the federal government as the official source for weather information. NWS issues notices to the public, using two levels of notification:

- Flood watch: conditions are right for flooding

- Flood warning: a flood has started or is expected to occur

NWS may issue a "flash flood watch." This means the amount of rain expected will cause ponding and other flooding on small streams. These events are so localized and so rapid that a "flash flood warning" may seldom be issued, especially if no remote detection equipment is available. On smaller rivers, locally established rainfall and river gauges are needed to establish a flood threat detection system.

7.4.2 Flood Warning

After the flood threat detection system tells the emergency management coordinator that a flood is coming, the next step is to notify the public and staff of other agencies and critical facilities that a flood is imminent. The earlier and the more specific the warning is, the greater the number of people who can implement protection measures. A flood warning may be disseminated in a variety of ways. Multiple or redundant systems are most effective: if people do not hear one warning, they may still get the message from another part of the system.

7.4.3 Flood Response

The protection of life and property is the foremost important task of emergency responders. Concurrent with detection and issuing flood warnings by NWS, the community responds with actions that can prevent or reduce injuries and damages. A flood response or emergency action plan ensures that all bases are covered and that the response activities are appropriate for the expected flood threat.

Planning is best done with adequate data. One of the best tools is a flood stage forecast map that shows what areas would be under water at various flood stages as determined by NWS Flash Flood Guidance. Emergency management staff can identify which properties may flood, which roads will potentially be under water, which critical facilities will possibly be affected, etc. With this information, an advance plan can be prepared that shows problem sites and determines what resources will be needed. The plan would be ready to use when ground reports verify flood heights.

Required drills and exercises should occur between floods to test functional capabilities for handling most emergency and disaster situations. This also ensures that key participants understand their duties. These coordinated efforts are implemented by emergency management and emergency response groups who have experience working together so that available resources can be used more efficiently.

7.4.4 Critical Facilities Protection

Protecting critical facilities during a flood is the responsibility of the facility owner or operator. However, if they are not prepared for a flood, the rest of the community could be impacted. If a critical facility is flooded, workers and resources may be unnecessarily drawn away from other flood response efforts. If such a facility is adequately prepared by the owner or operator, it will be better able to support the community's flood response efforts.

Under Activity 610, CRS gives the same number of points for critical facility planning as it does for the community's flood response plan (note that a flood response plan is required to get credit for critical facilities planning). CRS credit focuses on coordinating the community's efforts with the facilities and helping the facilities develop their own flood-specific emergency plans.

7.4.5 Post-Disaster Recovery and Mitigation

After a disaster, communities should undertake activities to protect public health and safety, and facilitate recovery. Recovery actions include patrolling evacuated areas to prevent looting, providing safe drinking water, monitoring for diseases, vaccinating residents for tetanus, instructing owners of flooded property in safe and healthy cleaning methods, clearing streets, cleaning up debris and garbage, and

regulating reconstruction to ensure that it meets all code requirements, including the NFIP's regulations. In addition mitigation actions include conducting a public information effort to advise residents about mitigation measures they can incorporate into their reconstruction work, evaluating damaged public facilities to identify mitigation measures that can be included during repairs, acquiring substantially or repeatedly damaged properties from willing sellers, planning for long-term mitigation activities, and applying for post-disaster mitigation funds.

Requiring permits, conducting inspections, and enforcing the NFIP substantial regulations can be very difficult for local, understaffed, and overworked offices after a disaster. If these activities are not carried out properly, not only does the municipality miss a tremendous opportunity to redevelop or clear out a hazardous area, it may be violating its obligations under the NFIP.

7.4.6 Emergency Services Activities Considered

After reviewing the possible emergency services activities the 2001 committee developed the following recommendations for consideration as AIs:

1. The "state-of-the-science severe weather detection and warning system" proposed by the State Climatologist should be pursued. The results would be immediately useful to Huntsville, but also would have national benefits as a pilot project.
2. Flood stage forecast maps should be prepared whenever a watershed is modeled and mapped.
3. When alternative approaches to flood protection are reviewed for a watershed, the planning should include an analysis of the costs and benefits of installing gauges needed to detect and predict downstream flooding.
4. A pilot flood stage forecast map and watershed-specific flood response plan should be prepared. The plan would include:
    a. Procedures that clarify when and how flood threats are detected
    b. How flood warnings are issued
    c. What critical facilities are affected
    d. What support is needed by the critical facilities
    e. A specific list of flood response activities
    f. Resource needs
5. Upon completion of the pilot map and plan, staff should determine the utility of financing improvements to the stream gauges and preparing similar plans for other areas.
6. Inspections Division staff should review other communities' post-flood mitigation procedures to determine if the current guidance should be modified or expanded.
7. If enough items are completed in regards to a flood warning program to warrant a change in CRS class, a modification in the program should be requested.

7.5 Structural Projects

Structural projects have traditionally been used by cities to control flows and water surface elevations. Structural projects keep floodwaters away from an area. They are usually designed by engineers and managed or maintained by public works staff. Five types of structural projects are reviewed in the subsection: (1) reservoirs, (2) levees and floodwalls, (3) channel modifications, (4) dredging, and (5) drainage system maintenance.

7.5.1 Reservoirs

Reservoirs control flooding by holding high flows behind dams or in storage basins. After a flood peaks, water is released or pumped out slowly at a rate that the river can accommodate downstream. The lake created may provide recreational benefits. Reservoirs are suitable for protecting existing development downstream from the project site. Unlike levees and channel modifications, they do not have be built close to or disrupt the area to be protected. Reservoirs are most efficient in deeper valleys where there is more room to store water, or on smaller rivers where there is less water to store. Building a reservoir in flat areas and on large rivers may not be cost-effective, because large areas of land have to be purchased.

The best known reservoir upstream of Huntsville is Guntersville Lake on the Tennessee River. The TVA reports that the lake, when combined with upstream reservoirs and floodplains, provides "a measurable amount of flood control benefit for downstream locations… But all in all, it is a small amount of flood storage compared to the size of floods which come down the river." (no specific reference available in original 2001 report) Within the City there are several small reservoirs: Sherwood Branch flooding is reduced with the help of two City owned basins in Research Park West and McDonald Creek is helped by another on Oakwood College.

7.5.2 Levees and Floodwalls

Probably the best known structural flood control measure is a barrier of earth known as a levee, or steel or concrete, referred to as a floodwall that is erected between the watercourse and the properties to be protected. Levees occupy more space than floodwalls. Therefore, when adequate space for a levee is not available, floodwalls are used, although they are usually more expensive than levees.

Levees and floodwalls have not been used very much in Huntsville. There is one small floodwall that protects a few properties on South Memorial Parkway. It is fitted with several one-way rubber valves that keep high water from backing up the drains and into the protected area.

7.5.3 Channel Modifications

By increasing the conveyance of a stream channel or drainage ditch, more water is carried away. While this benefits those adjacent to the improvement, often, the extra water will cause increased flooding downstream.

Channel Improvements

These include making a channel wider, deeper, smoother, or straighter. Some channels can be lined with concrete ("slope paving"); smaller channels can even be put in underground pipes. Modifications that result in faster moving water may also increase bank erosion which can lead to undercutting of properties and downstream sedimentation. These types of improvements were the primary approach to Huntsville's flooding problems in the 1960s and 1970s. Most of the streams in the central portion of the City have been modified by straightening and widening and, in many cases, slope paving to make them smoother and easier to maintain.

Bridge and Culvert Improvements

Bridge and culvert improvements include the replacement, enlargement, or removal of existing bridge decks and culverts at road, railroad, and other crossings over streams. There are three situations where such projects can produce flood control benefits: (1) the original opening was too small to handle floodwaters, (2) upstream development results in an increased peak flow such that the existing structure is no longer adequate, and (3) debris easily blocks the opening. Enlarging the openings, lowering the roadway or approaches, and removing bridges or culverts at abandoned crossings can reduce flood heights in that location, but such projects can also transfer the problem downstream.

Diversions

A diversion is a new channel that sends floodwaters to a different location, thereby reducing flooding along an existing watercourse. Diversions can be surface channels or underground pipes/culverts. During normal flows, the water stays in the old channel; then during flood flows, the floodwaters spill over to the diversion, which carries the excess water to a receiving lake or waterway. Diversions are limited by topography and will not work in some areas. Unless the receiving water body is relatively close to the flood prone stream and the land in between is low and vacant, the cost of creating a diversion can be prohibitive.

7.5.4 Dredging

Dredging removes sediment from the bottom of the stream channel. While it may appear that by making the channel deeper, it will carry more floodwaters, given a large volume of water that comes downstream during a flood, removing a foot or two from the bottom of the channel will have little effect on flood heights. Dredging is often cost prohibitive because the dredged material must be disposed of somewhere and the stream will usually fill back in with sediment in a few years. If the channel has not been disturbed for many years, dredging will destroy the habitat that has developed; to protect the natural values of the stream, federal law requires a COE permit before dredging can proceed. Permitting can be a lengthy process that requires much advance planning and many safeguards to protect habitat. Because of its shortcomings, dredging is usually undertaken on larger rivers only to maintain a navigable waterway.

The City has periodically dredged channels that have been clogged by sediment. In April 1997, the COE approved a dredging project for Aldridge Creek. It had to be done in 9 segments that were between 200 and 1,300 feet in length. While those were relatively short sections of the Creek, an estimated 57,000 cubic yards of sediment was removed. The COE required a small berm be constructed to channelize low flows for habitat maintenance.

7.5.5 Drainage System Maintenance

Trash, debris and vegetative growth can obstruct a channel or the inlet or outfall to a detention basin. Such obstructions can convert low flows to flooding situations. Channel and detention basin maintenance is an ongoing program to clean out such blockages. This work is usually done by a public works or drainage district crew. These activities normally do not affect the shape of the channel or basin, but they do affect how well they can perform. Sometimes it is a very fine line that separates debris that needs removal and natural material that helps form habitat.

7.5.6 Structural Project Activities Considered

After reviewing the types of structural projects the 2001 committee developed the following recommendations for consideration as AIs:

1. The City should continue to construct flood control projects where they are shown to be the most cost-effective flood mitigation approach.
2. Future flood control projects should incorporate appearance, long-term maintenance, water quality and habitat protection. Design of new projects should be coordinated with parks and landscaping staff.
3. The City's policies and procedures for dredging and channel maintenance should be reviewed in light of the concerns raised in this section. Participation in the review process by representatives of streamside residents is recommended.

4. A secured source of funding would help consolidate the City's flood control and maintenance activities and ensure that today's policies and objectives can be implemented over future years.

7.6 Public Information Activities

A successful floodplain management program involves both the public and private sectors. Public information activities advise property owners, renters, businesses, and local officials about flood hazards and ways to protect people and property from these hazards. These activities can motivate people to take flood protection steps and protect the natural and beneficial functions of floodplains and watersheds. This section covers six general public information activities: (1) Map Information, (2) Library, (3) Outreach Projects, (4) Technical Assistance, (5) Real Estate Disclosure, and (6) Educational Programs. In addition, the CRS provides special credit for a "public information program strategy." This document qualifies as the City's public information program strategy.

7.6.1 Map Information

Many benefits stem from providing map information to inquirers. Residents and businesses who are aware of the potential flood hazards can take steps to avoid problems and/or reduce their exposure to flooding. Real estate agents and house hunters can find out if a property is flood prone and whether flood insurance may be required. Flood maps have a wealth of information about past and potential flood hazards. However, they can be hard to obtain and many people have trouble reading maps. Therefore, communities that provide map information from the FIRMs perform a valuable public information service. Communities may also assist residents in submitting requests for map amendments and revisions when they are needed to show that a building is outside the mapped floodplain.

Communities can often supplement what is shown on the FIRM with maps that complement and clarify the FIRM and information on additional hazards, flooding outside mapped areas, topography, etc. When the information is provided, community staff could also explain flood insurance, property protection measures and mitigation options that are available to property owners. Users and inquirers need to remember that maps are not perfect. They display only the larger flood prone areas that have been studied. Some maps are based on data that are more than 30 years old. In some areas, watershed development makes even recent maps outdated. A map information service needs to remind inquirers that being outside the mapped floodplain is no guarantee that a property will never get flooded.

The City's Engineering Division provides a map information service. Publicity materials (including an annual mail-out to Real Estate, Lending/Mortgage, and Insurance Agents with business licenses in the City) advise people to call 256-427-5300 or visit http://maps.hsvcity.com to find out if a property is in the floodplain as shown on the FIRMs. At the website the City's interactive GIS mapping allows anyone to view the FIRM mapping along with other city data.

7.6.2 Library

The community library and local web sites are obvious places for residents to seek information on flooding, flood protection, and protecting natural resources. Historically, libraries have been the first place people turn when they want to research a topic. Interested property owners can read or check out handbooks or other publications that cover their situation. Libraries also have their own public information campaigns with displays, lectures, and other projects, which can augment the activities of the local government.

The Huntsville Madison County Public Library has a collection of flood related and flood protection documents in the Information and Periodicals Department. The material cannot be checked out, but can

be read during regular library hours and copied on available copying machines. The Library's collection includes: Madison and Limestone County FIRMs, documents on flood insurance, FEMA and COE publications on property protection, the City's Stormwater Management Manual, a directory of sources of assistance, etc.

7.6.3 Outreach Projects

Mapping, library materials, websites, etc. are of little or no use if no one knows they exist. An outreach project can remedy this. Sending notices to flood prone property owners can help introduce the idea of property protection and identify sources of assistance. Outreach projects can be the first step in the process of orienting property owners to property protection and assisting them in designing and implementing a project. They are designed to encourage people to seek out more information and take steps to protect themselves and their properties. The City does annual mail-outs to property owners in the floodplain as well as has information in the phone book regarding flooding and related topics,

7.6.4 Technical Assistance

While general information helps, most property owners do not feel ready to retrofit their buildings without help or guidance. Local building department staff are experts in construction. They can provide free advice, not necessarily to design a flood protection measure, but to steer the owner onto the right track. Some building department or public works staff visit properties and offer suggestions. Most can recommend or identify qualified or licensed companies, an activity that is especially appreciated by owners who are unsure of the project scope or the contractor.

Technical assistance can be provided in one-on-one sessions with property owners or can be provided through seminars. For instance, seminars or "flood proofing open houses" can be provided on retrofitting flood prone structures, selecting qualified contractors, and carrying out flood preparedness activities. Another effective technique is called a flood audit. A property protection expert visits a flood prone site, locates past and potential flood depths on the property, and discusses alternative protection measures with the owner. The owner is given a written report with recommendations and a photograph of the property showing flood depths.

The City Engineering Division has 2 staff members available who have taken FEMA's E279 - Retrofitting Flood-Prone Residential Buildings 4 day training course and can discuss options for flood proofing structures.

7.6.5 Real Estate Disclosure

Many times after a flood or other natural disaster, people say they would have taken steps to protect themselves if only they had known they had purchased a flood prone property. Federally regulated lending institutions must advise applicants for a mortgage or other secured loan for a building that the property is in a floodplain as shown on the FIRM and that they are required to purchase flood insurance as a condition of the mortgage/loan. However, because this requirement has to be met only before closing, often the applicant is already committed to purchasing the property when he or she first learns of the flood hazard. According to the *Truth in Lending Act*, it can be as few as 10 days before the closing date that a buyer would see on their Good Faith Estimate from the lender that they are required to have flood insurance. (FDIC 2011) State laws and practices by local real estate boards can overcome this deficiency and advise newcomers about the hazard earlier. They may also require disclosure of past flooding or sewer problems, regardless of whether the property is in a mapped floodplain.

To the City's knowledge, there is not State law require notification to a buyer that a property is in the floodplain; however, anecdotally it seems that real estate agents and people in that area of the business do tend to notify potential buyers at an earlier stage than when the mortgage companies require flood insurance be in place before closing.

7.6.6 Educational Programs

A community's most important asset is its children, the future generations who will inherit the resources, infrastructure and development left to them. They will be facing the same natural forces that cause periodic flooding. The watersheds and floodplains will be theirs to farm, build on, and care for. Environmental education programs can teach children about flooding, the forces that cause it, the factors that cause flood problems, and the significance of protecting the natural and beneficial functions of watersheds and floodplains. These programs can be undertaken by schools, parks and recreation departments, conservation associations, and youth organizations. An activity can be as involved as course curriculum development or as simple as an explanatory sign near a river.

Educational programs do not have to be limited to children. Often adults learn about innovative concepts or new ideas from their children. If the children come home with an assignment for their new water quality monitoring project, the parents become interested in finding out about water quality monitoring. There are many programs that provide support and curriculum materials for school and other educational programs.

7.6.7 Public Information Activities Considered

After reviewing the public information activities the 2001 committee developed the following recommendations for consideration as AIs:

1. The City should implement and publicize the following services that will inform and assist property owners who want to protect themselves from flooding:
    a. Providing map and flood hazard data to inquirers. The City should pursue making this readily available to anyone via the City's web site.
    b. Making site visits to review problems and providing advice to the owner.
    c. Providing the library and other offices with a list of appropriate flood protection references, government publications, Internet web sites and maps.
2. The following projects should be implemented to disseminate the messages on flood hazard mitigation and City services:
    a. News releases and news articles on flood protection measures and the progress of implementing this FMP should be prepared for the local media.
    b. A flood protection page should be developed for the City's web site, including links to other sites that would help Huntsville residents.
    c. Flood related videos and news tapes should be regularly shown on the public access cable TV channel and be available for loan to interested organizations.
    d. A homeowner's flood protection manual should be prepared, made available for interested residents and businesses and given to media that want to cover flood protection.
    e. A mailing should be sent to floodplain property owners and tenants each year, to remind them of the hazard, identify City flood services, and review ways they can protect themselves and their property.
    f. Staff should make presentations at meetings of neighborhood associations.
    g. Staff should make presentations at meetings of interested groups, such as contractors and teachers.
    h. Staff should investigate other means of disclosing flood hazards and meet with the Huntsville Board of Realtors® to discuss possible approaches.
3. Public information activities should cover the following topics:

a. What the City is doing about flooding, stormwater, and water quality
b. The City's map information and technical assistance services
c. Where residents can get help with flooding issues
d. The City's flood hazard
e. Flood safety
f. Flood insurance
g. Property protection measures that property owners can take on their own
h. The natural and beneficial functions of Huntsville's floodplains
i. The City's flood warning system and signals
j. Permit requirements
k. The Substantial improvement/damage
l. Drainage maintenance responsibilities of property owners

4. The City should develop sinkhole and landslide risk maps, make people aware of the risks, and publicize the availability of insurance for homes and businesses.

Section 8
Action Plan

Using the knowledge gained by assessing the flood hazard, the established goals and the recommendations as a result of reviewing the possible activities the 2001 committee developed an Action Plan that contained 16 items. As a part of this update, the action plan was revised to account for the projects that have been completed, dropped, or changed, and for changes in the hazard problem assessments (**required for update p. 510-32**). For each AI the following subsections identify "who does what" followed by a subsection discussing all AIs in regards to "when it will be done and how it will be financed" (i.e. prioritization and funding) (**required p. 510-18**). Finally, there is a subsection on project oversight.

8.1 Action Items

During the fall of 2010, the Committee met three times to review and update the FMP. The following section describes the changes made to the AIs.

8.1.1 Action Item(s) Completed

A comprehensive Open Space Plan (originally AI 6) has been created by the Planning Department. This plan combined information from the Major Street Plan, Downtown Master Plan, Land Use Plans, Recreation Plan, and Greenways Plan. As a result of this new Open Space Plan, two planned and brand new greenways, Big Cove Greenway and the Flint River Greenway, have been constructed since 2001.

8.1.2 Action Items Modified

The AIs that were removed, combined, or replaced are described as follows:

1. Since the 'Floodplain Regulations' (originally AI 4) are a subset of the 'Zoning Ordinance' (original AI 5), these two AIs were combined as AI 4.
2. 'Adopt the Plan' (originally AI 13) was removed as an AI since it is actually an official step in the 10-step planning process (Figure IN-1), rather than a true AI developed by the FMPC. It is covered in Section 10 of this report.
3. 'Program Oversight' (originally AI 14) was removed as an AI because it did not seem to fit within one of the FEMA CRS program floodplain management activities six categories. However, as previously mentioned, a description of the FMP Committee roles for program oversight is included later in this section.
4. Similar to item 3 above 'The Community Rating System' (originally AI 16) was removed as an AI and is now included in the Program Oversight section.

8.1.3 Updated Action Items

The following is the listing of the 11 AIs as updated and modified by the FMP Committee. Each Item is followed by the City department/division that is responsible for the item implementation.

1. **Floodplain Mapping** – Engineering Division

Hydrologic and hydraulic models and mapping including existing and future (full build out) conditions for significant stream channels for the following uses:

   a. Submit existing conditions to FEMA for map revisions.
   b. Evaluate flood protection measures.

c. Flood stage forecast mapping.

2. **Watershed Plans** – Engineering Division

With input from the Planning and Natural Resources Divisions, prepare master flood protection plans using the models and mapping developed pursuant to the previous AI. Each plan should include the following:

a. An inventory of the flood prone buildings, critical facilities and infrastructure to help determine the threat to life, safety and health in the area.

b. An evaluation of structural and property protection measures (and combinations of those measures) that will protect lives, safety, health and existing development. The evaluation would compare the effectiveness of feasible alternatives including regional retention basins, channel modifications, acquisition, relocation and floodproofing. The evaluations should examine:

   i. The benefits and costs of the alternatives.

   ii. Their impact on wetlands and streams, natural or other sensitive areas, habitat and water quality.

   iii. How they can support other objectives of the community, such as expansion of open space, greenways, stream restoration, and economic development.

   iv. Incorporation of aesthetic and long-term maintenance needs.

c. Recommendations for projects:

   i. Priority should be given to properties in the floodway.

   ii. Priority should be given to cost effective projects.

d. Determination of the best approach to managing stormwater runoff (primarily for the 100-year event) from new development in the watershed (existing versus future conditions), including location for regional detention facilities.

e. An analysis of the costs and benefits of installing gauges needed to detect and predict flooding.

3. **Stormwater Management Regulations** – Engineering Division

With the Natural Resources, Inspection, Planning and Legal Divisions, review and revise the standards and procedures in the Subdivision Regulations Manual and the Stormwater Management Manual for new development. The review should include engineers and technical advisors who are familiar with stormwater management practices in Huntsville and in other communities. The review should consider the following concerns:

a. Appropriate standards to ensure that post-development flows leaving a development will not cause increased damage to downstream properties.

b. City inspections to ensure maintenance of new stormwater management facilities that will be located on private property.

c. Best management practices that protect water quality and other provisions to meet upcoming NPDES requirements.

d. Replacement of the regulatory standards with watershed specific criteria when watershed plans are completed and adopted (AI 2).

e. The impact of different standards and procedures on the cost of development and the long-term costs of flooding and facility maintenance.

4. **Floodplain and Zoning Regulations** – Engineering Division and Planning Department
    a. Ensure that the City meets all regulatory provisions required by the NFIP and meets or exceeds requirements for current level of participation in the CRS.
    b. With the Inspection, Natural Resources and Legal Divisions, review and revise the applicable portions of the zoning ordinance in regards to item a. above and floodplain development in general. The following additions are recommended by the Committee and are credited under the CRS:
        i. Consider increasing freeboard requirement (430a).
        ii. Standards to protect building foundations constructed on fill in the floodplain from erosion and scour (430b).
        iii. Prohibiting and/or protecting critical facilities in the 500-year floodplain (430e).
        iv. Buffers adjacent to streams or natural areas (430g).
        v. Restrictions on use of enclosures below elevated buildings (430h).
        vi. Drainage plans for all buildings, including those not in the floodplain (450c).
        vii. Consider regulating to the future conditions floodplain (reference AI 1) (450i).
    c. Once the new watershed models and floodplain maps are available, a procedure should be adopted to evaluate the flood impact caused by zoning changes to ensure that they do not have detrimental impacts on flooding and drainage.
5. **Regulatory Procedures** – Engineering Division and Inspection Department
    a. With the Planning/Zoning, Inspection, Natural Resources, and Legal Departments, review the City's procedures for development plan review, permit issuance and inspections to ensure that all the floodplain and stormwater regulations that are dependent on more than one office are properly and fully enforced.
    b. With all appropriate divisions, conduct an annual review of the procedures to identify whether any further changes are needed.
    c. With the Planning (including Zoning) Department and EMA review the procedures to be followed after a flood to ensure that all repairs and reconstruction will meet the requirements of the NFIP. The procedures should account for potential disaster assistance and other sources of funding for mitigation opportunities.
    d. Strive to maintain a Building Code Effectiveness Grading Schedule (BCEGS) class of 6 or better to aid in a CRS ranking of 7 or better.
6. **Drainage Maintenance Program** – Public Works

    In cooperation with the Engineering, Natural Resources, and Landscape Management Divisions and Operation Green Team, review and revise drainage system maintenance procedures.
    a. Include streamside residents and interested organizations in the preparation of the procedures.
    b. Account for the requirements of relevant agencies and programs, including ADEM, COE, NPDES, and CRS.
    c. Incorporate cooperative efforts by streamside residents and the general public.
    d. Incorporate maintenance standards and procedures that will protect sensitive areas and habitat.

e. Review the long-term costs and benefits of dredging and alternative ways to reduce sedimentation.

7. **Pilot Flood Response Plan** – Emergency Management Agency
    a. In conjunction with law enforcement, fire and medical response agencies, prepare a pilot flood response plan for one floodplain area.
    b. Use a flood stage forecast map prepared pursuant to AI 1 Floodplain Mapping.
    c. Evaluate the costs and benefits of the plan, with and without rain and stream gauges that would provide early flood detection.
    d. Evaluate the costs and benefits of a flood warning system for the City (any new detection or warning system is contingent on the development and implementation of a new countywide radio system).
8. **Critical Facilities Plan** – Emergency Management Agency

    Identify the critical facilities that are affected by flooding. Work with their managers to determine any special flood warning and response support they may need from the City and encourage them to prepare their own flood response plans.
9. **Ongoing Public Information** – Engineering Division

    In cooperation with the Committee, implement ongoing information and technical assistance activities:
    a. Providing map and flood hazard information to inquirers.
    b. Providing one-on-one advice and assistance on flood protection measures.
    c. Providing reference materials to the public library.
    d. Issuing news releases and news articles.
    e. Making presentations at meetings of home owners associations and other interested groups.
    f. Conducting an annual mailing to property owners in the floodplain.
    g. Coordinating with the Huntsville Board of Realtors® to discuss City support of disclosure of flood hazards.
10. **New Public Information Projects** – Engineering Division

    In cooperation with the Committee, design and initiate new activities:
    a. Publicity of property protection projects that have been constructed by Huntsville homeowners.
    b. Incorporating/updating a flood protection web page on the City's web site.
    c. Providing a library of additional flood-related videos to the public access cable television channel.
    d. Preparing a homeowner's flood protection manual.
    e. Preparation of sinkhole and landslide hazard maps and public information materials to explain them and insurance options.
11. **Storm Water User Fee** – Engineering Division/Floodplain Management Committee/Consulting Engineering Firm

Determine the appropriate mechanisms and rates for establishing a stormwater user fee. This method of financing flood protection and stormwater management activities, such as those discussed in other AIs, is being used by an increasing number of communities around the country. It has proven to be stable, adequate, flexible and equitable. It deserves special attention as the recommended funding mechanism for this plan. Recommended (sub-) AIs:

a. Obtain permissive State legislation.

b. Prepare a description of the benefits, costs, and operational aspects of a stormwater user fee.

c. Prepare an estimate of the annual stormwater management and flood protection financing needs of Huntsville.

d. Develop a budget that shows how the income will be used.

e. Develop rates that are fair to all users of the stormwater system.

f. Keep the public informed.

g. Review other sources of income, such as a charge for reviewing new development's stormwater plans and/or flood protection measures (currently the City does not charge for this permit review).

h. Any other items as needed.

The above AIs cover all six of the floodplain management categories detailed in Section 7 (**8d**). Table 8-1 lists each AI and the applicable floodplain management categories.

Table 8-1. AIs and Floodplain Management Activity Categories

AIs		Preventive	Property Protection	Natural Resource Protection	Emergency Services	Structural Projects	Public Information
1	Floodplain Mapping	X			X		
2	Watershed Plans	X	X	X	X	X	
3	Stormwater Management Regulations	X					
4	Floodplain and other Zoning Regulations	X		X			
5	Regulatory Procedures	X		X	X		
6	Drainage Maintenance Program			X		X	
7	Pilot Flood Response Plan				X		
8	Critical Facilities Plan				X		
9	Ongoing public information		X				X
10	New public information projects		X				X
11	Stormwater User Fee Funding Mechanism					X	

8.2 Action Item Prioritization and Funding

In considering prioritization, the Committee first looked at the need for (not amount of) funding, staffing, public support and dependence on other AIs. Needs were ranked on a scale of 1-10, with 10 requiring the greatest amount of the resources in question and 1 the least (reference Table 8-2).

Table 8-2. AI Prioritization Matrix

	AIs	Funding	Staffing	Public Support	Dependant on Action Item
1	Floodplain Mapping	9	1	1	11
2	Watershed Plans	10	1	1	1, 11
3	Stormwater Management Regulations	8	5	7	11
4	Floodplain and other Zoning Regulations	1	9	7	
5	Regulatory Procedures	2	10	1	
6	Drainage Maintenance Program	5	5	3	11
7	Pilot Flood Response Plan	5	5	1	1, 11
8	Critical Facilities Plan	2	7	1	
9	Ongoing public information	1	2	1	
10	New public information projects	1	4	1	
11	Stormwater User Fee	8	4	10	

In general, it became evident that most items had a strong need for funding, staffing, or a combination of both. Unfortunately because necessary additional funding and staffing are not available for the foreseeable future, only a couple of these AIs appear possible to achieve without the additional resources. Of course, additional funding would directly and could indirectly solve both of these needs; hence AI 11 – Stormwater User Fee funding mechanism appears to be a top priority.

The Stormwater User Fee concept is a sensitive topic receiving a 10 ranking in need for Public Support. Significant effort will be required to educate the public on its workings and need to ensure that misinformation does not taint the process. Obtaining permissive legislation through the Alabama Legislature is one of the first steps that must be taken. It appears that the next regular Legislative Session in which such legislation might be introduced will be in 2013.

As AI 1, Floodplain Mapping, is needed for two additional AIs, thus it is of a high priority. Once AI 1 becomes reasonably satisfied, moving on to AI 2, Watershed Plans, would be the next logical course of action.

AIs 3, 4, 5, and 6 - Stormwater Management Regulations, Floodplain and other Zoning Regulations, Regulatory Procedures, and Drainage Maintenance Program Regulations, respectively – all have some element in place already. Consequently, they are of a lower priority.

AI 7, Pilot Flood Response Plan, is dependent on the availability of real-time monitoring, which is beyond the current scope of the EMA's services. This is pursuant to the development of real-time monitoring gauges. In lieu of this capability, the EMA has developed a generic flood response Standard Operating Procedure (SOP) in conjunction with the Huntsville Police and Huntsville Fire and Rescue departments and the amateur radio group. The EMA is awaiting USGS development of new stream gauge technology, but this effort is underfunded. Also, it was intended that this effort be incorporated into the City's Intelligent Traffic System, which has not yet been developed.

For AI 8, Critical Facilities Plans, is of moderate priority with a key limiting factor being staff resources to complete the task.

AI 9, Ongoing Public Information, is of an even lower priority as it is generally being met. As there is already significant outreach to owners of property in the floodplain with the City's annual direct mailing. AI 10, New Public Information Projects, is of the lowest priority.

As previously mentioned, all but the two lowest prioritized AIs require a level of funding and/or staffing that is not currently available; hence, scheduling of work on these AIs is difficult. As funding and staff levels to work on these AIs become available, they will be pursed as prioritized.

8.3 Program Oversight

The FMPC plays a vital role in the planning process, as well as in the continued evaluation of the plan, and monitoring its implementation. The Committee's roles and responsibilities include the following:

a. Prepare an Annual Evaluation Report per CRS guidelines and report on progress and recommended changes to the Mayor and City Council.
b. As the FMP nears full implementation, the Committee should address other possible AIs, including but not limited to encouraging coordination of City watershed mapping, plans and regulation with Madison County and the City of Madison.
c. Submit a modification to the CRS, after sufficient AIs are implemented to warrant additional credit and a change in classification.

Section 9

Adopt the Plan

On September 27, 2001, by a unanimous vote the Huntsville City Council passed Resolution 01-830 (included in Appendix C) adopting the 2001 Flood Mitigation Plan (**9 required p. 510-21**). The updated FMP was adopted as Resolution 11-230 by the City Council on March 24, 2011 (included in Appendix C as well) (**required p. 510-32**).

Section 10

Implement, Evaluate, and Revise

In order to keep the FMP creditable under the CRS program and up-to-date in general the process of implementation must be monitored and the plan revised on an annual basis. The following items are proposed for this process:

1. An annual evaluation report will be developed which monitors the implementation of the AIs and recommends revisions to the plan. The evaluation report will be submitted to the CRS and State NFIP Coordinator, the City Council, and made public via the City's website (**10a required**).

2. The FMP Committee will be responsible for developing the annual evaluation report (**10b**).

3. An update of the FMP will be developed every 5 years (**required p. 510-22**).

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Appendix A: CRS Activity Worksheet (Cross Walk)

OMB No 1660-0022
Expires August 31, 2010

Community: Huntsville, AL

510 FLOODPLAIN MANAGEMENT PLANNING

511.a Floodplain Management Planning (FMP)

Credit Points: *Enter the section or page number in the plan where each credited item can be found.*

CRS Step	Section/Page	Item Score	Step Total
1. Organize to prepare the plan.			
a. Supervision or direction of a professional planner (2)	Section 1 / Page 1-1		
b. Planning committee of department staff (6)	Section 1 / Page 1-1		
c. Process formally created by the community's governing board (2)	Section 1 / Page 1-1		
2. Involve the public.			
a. Planning process conducted through a planning committee (40)	Section 2 / Page 2-1		
b. Public meetings held at the beginning of the planning process (15)	Section 2 / Page 2-1		
c. Public meeting held on draft plan (15)	Section 2 / Page 2-1		
d. Questionnaires ask the public for information (5)	Section 2 / Page 2-1		
e. Recommendations are solicited from advisory groups, etc. (5)	Section 2 / Page 2-1		
f . Other public information activities to encourage input (5)	Section 2 / Page 2-1		
3. Coordinate with other agencies.			
a. Review of existing studies and plans (required) (3)	Section 3 / Page 3-1		
b. Invited neighboring communities and other agencies (required) (1)	Section 3 / Pages 3-1 thru 3-2		
c. Contacted communities and NFIP and EM agencies (4)	Section 3 / Pages 3-1 thru 3-2		
d. NWS, ARC and others are asked how they can help community (4)	Section 3 / Pages 3-1 thru 3-2		
e. Meetings are held with agencies on mitigation strategies (10)	Section 3 / Page 3-1		
f. Draft action plan sent to agencies for comments (3)	Section 3 / Page 3-2		
4. Assess the hazard.			
a. Plan includes an assessment of the flood hazard (REQUIRED) with:	Section 4.1 / Pages 4-1 thru 4-22		
(1) A map of known flood hazards (5)	Section 4 / Page 4-4		
(2) A description of known flood hazard (5)	Section 4.1.2 / Pages 4-6 thru 4-7		
(3) A discussion of past floods (5)	Section 4.1.3 / Pages 4-7 thru 4-22		
b. The plan describes other natural hazards (REQUIRED FOR DMA) (5)	Section 4.2 / Pages 4-22 thru 4-27		

Community: Huntsville, AL

CRS Step	Section/Page	Score	Total
5. Assess the problem.			
a. Summary of each hazard identified in the hazard assessment and their community impact (REQUIRED) (2)	Section 5 / Page 5-1		
b. Description of the impact of the hazards on:			
(1) Life, safety, health, procedures for warning and evacuation (5)	Section 5.2.1 / Pages 5-3 thru 5-4		
(2) Critical facilities and infrastructure (5)	Section 5.2.2 / Page 5-5		
(3) The community's economy and tax base (5)	Section 5.2.3 / Page 5-5		
c. Number and types of buildings subject to the hazards (5)	Section 5.3 / Pages 5-6 thru 5-7		
d. Review of all flood insurance claims (4)	Section 5.4 / Pages 5-8 thru 5-9		
e. Natural and beneficial functions (4)	Section 5.5 / Pages 5-9 thru 5-10		
f. Development, redevelopment, and population trends (5)	Section 5.6 / Pages 5-11 thru 5-12		
6. Set goals. (required) (2)	Section 6 / Pages 6-1 thru 6-2		
7. Review possible activities.	Section 7		
a. Preventive activities (5)	Section 7.1 / Pages 7-1 thru 7-6		
b. Property protection activities (5)	Section 7.2 / Pages 7-6 thru 7-8		
c. Natural resource protection activities (5)	Section 7.3 / Pages 7-8 thru 7-11		
d. Emergency services activities (5)	Section 7.4 / Pages 7-11 thru 7-13		
e. Structural projects (5)	Section 7.5 / Pages 7-13 thru 7-16		
f . Public information activities (5)	Section 7.6 / Pages 7-16 thru 7-19		
8. Draft an action plan.			
Actions must be prioritized (required)			
a. Recommendations for activities from two of the six categories (10)			
b. Recommendations for activities from three of the six categories (20)			
c. Recommendations for activities from four of the six categories (30)			
d. Recommendations for activities from five of the six categories (45)	Section 8.1.3 / Pages 8-1 thru 8-5		
e. Post-disaster mitigation policies and procedures (10)			
f . Recommendations from Habitat Conservation Plan (10)			
g. Action items for mitigation of other hazards (5)			

Community: Huntsville, AL

CRS Step	Section/Page	Score	Total
9. Adopt the plan. (2)	Section 9 and Appendix C		
10. Implement, evaluate and revise.			
a. Procedures to monitor and recommend revisions (required) (2)	Section 10 / Page 10-1		
b. Same planning committee or successor committee that qualifies under Section 511.a.2 (a) does the evaluation (13)	Section 10 / Page 10-1		

Add the totals for steps 1 through 10 above: FMP= _____

514 Credit Documentation:

_____ a. FMP: The completed CRS activity worksheet (AW-510-1−510-3) or the mitigation plan review crosswalk.

_____ b. A copy of the floodplain management plan, hazard mitigation plan, repetitive loss area analysis, and/or Habitat Conservation Plan.

_____ c. Documentation showing how the public was involved in preparing or reviewing the plan, including a copy of the notice(s) advising residents about the public meeting(s) held pursuant to steps 2(b) and (c), and a record of the meeting(s).

_____ d. Copies of correspondence, meeting notes, or other materials that document the coordination with other municipalities, agencies, and organizations credited under sections 511.a.3(b) - (f).

_____ e. Documentation showing that the plan was adopted by the community's governing board.

The following will be needed at the annual recertification:

_____ f. An annual report on evaluating progress toward implementing the action plan's objectives.

The following will be needed at least every five years:

_____ g. An update to the floodplain management or hazard mitigation plan.

Appendix B: Public Meeting Notice

ATTENTION FLOODPLAIN RESIDENTS:

there will be an informal public comment meeting regarding the update of the City of Huntsville Floodplain Management Plan (FMP) on Wednesday March 9th from 5 to 7 pm at the Public Services Building-320 Fountain Circle in the Urban Development Conference Room (first floor). The Plan was developed as a part of the City's participation in FEMA's Community Rating System (CRS) program, and aids the City in earning points in the program which translate into a discount for citizens on their flood insurance. Every five years the City is required to update the plan following a ten step process: organize to prepare the plan, involve the public (citizens on planning committee), coordinate with other agencies, assess the hazard, assess the problem, set goals, review possible activities, draft an action plan, adopt the plan, and finally implement, evaluate and revise the plan. The original plan can be viewed at huntsvilleal.gov/OriginalFMP and the updated draft can be viewed at huntsvilleal.gov/UpdatedDraftFMP . The updated draft goes into good detail on generally all of the process steps. During the two hour period a member of the City staff will be available to answer specific questions about the plan and collect written comments from attendees. If you are unable to attend the meeting but would still like to comment on the plan please e-mail comments to floodplain@huntsvilleal.gov.

Appendix C: Plan Adoption Resolution

09/27/01

Resolution No. 01-830

Whereas the City of Huntsville has been faced with overbank flooding and drainage problems over the years that have flooded buildings, closed businesses, disrupted traffic, and presented a general public health and safety hazard; and

Whereas the City's Flood Mitigation Planning Committee has prepared a recommended *Flood Mitigation Plan* that reviews the City's options to reduce damage from flooding and stormwater problems; and

Whereas the recommended *Flood Mitigation Plan* has been widely circulated for review by the City's residents, neighborhood groups, and federal, state and regional agencies and has been supported by those reviewers;

Now, therefore, be it resolved that:

1. The *Flood Mitigation Plan* is hereby adopted as an official plan of the City of Huntsville.

2. The Mitigation Committee is hereby established as a permanent advisory body.

   a. The Committee members and its Chair shall be appointed by the Mayor, subject to the approval of the City Council.

   b. Resident Committee members shall serve two year terms with one-half of the members' terms expiring each year.

   c. The schedule of Committee meetings shall be posted in appropriate places. All meetings of the Committee shall be open to the public.

3. The Committee shall meet as often as necessary to prepare or review mitigation activities and progress toward implementing the *Flood Mitigation Plan*. It shall meet at least once each year to review the status of ongoing projects.

4. By September 1 each year, the Committee shall prepare an annual evaluation report to the Mayor and City Council on the *Mitigation Plan*. The report will cover the following points:

   - A review of the original plan.

   - A review of any floods that occurred during the previous calendar year.

- A review of the action items in the original plan, including how much was accomplished during the previous year.
- A discussion of why any action items were not completed or why implementation is behind schedule.

- Recommendations for new projects or revised action items. Such recommendations shall be subject to approval by this Council as amendments to the adopted plan.

5. The Committee should not restrict itself to only flood hazard mitigation. As time and interests become available, it should also investigate mitigation measures appropriate for tornadoes, landslides, sinkholes, and other hazards facing Huntsville and Madison County.

6. The City Engineer is charged with supervising the implementation of the plan's recommendations within the funding limitations provided by the City Council or other sources. The Engineer shall give priority attention to those action items recommended by the *Flood Mitigation Plan* with the earliest deadlines.

7. The City Engineer shall name a staff member as Community Rating System (CRS) Coordinator for the City. The CRS Coordinator shall be the main point of contact for all matters relating to the CRS. He or she is responsible for submittal of all documentation needed for the application, verification and annual recertification.

ADOPTED this the **27th** day of **September**, 2001

Sandra Moon
President of the City
Council of
The City of Huntsville,
Alabama

APPROVED this the **27th** day of **September**, 2001

Loretta Spencer
Mayor of the City of
Huntsville,
Alabama

Adopted 3/24/11

RESOLUTION NO. 11-230

BE IT RESOLVED by the City Council of the City of Huntsville, Alabama, that the Mayor be, and he is hereby authorized, in Huntsville, Alabama, on behalf of the City of Huntsville, a municipal corporation in the State of Alabama to adopt the Existing Flood Mitigation Plan Update, as adopted and approved on the 27th day of September, 2001, by the City Council of the City of Huntsville, Alabama by Resolution No. 01-830, as attached hereto and identified as "Update to the Flood Mitigation Plan, as adopted by Resolution No. 01-830 of September 27, 2001" consisting of a total of one hundred four (104) pages, and the date of March 24, 2011 appearing on the margin of the first page, together with the signature of the President or President Pro Tem of the City Council, and an executed copy of said document being permanently kept on file in the Office of the City Clerk of the City of Huntsville, Alabama.

ADOPTED this the 24th day of March, 2011.

President of the City Council of the City of Huntsville, Alabama

APPROVED this the 24th day of March, 2010.

Mayor of the City of Huntsville,

Appendix D: Electronic Files