Discovery Report

Grand Lake O' the Cherokees Watershed, HUC 8 – 11070206

Benton County, Arkansas
Cherokee and Labette Counties, Kansas
McDonald and Newton Counties, Missouri
Craig, Delaware, Mayes, and Ottawa Counties, Oklahoma

January 20, 2012

FEMA

Project Area Community List

Community Name	CID
Benton County, AR, Communities	
Benton County Unincorporated Areas	050419
Cherokee County, KS, Communities	
Cherokee County Unincorporated Areas	200044
City of Treece	200368
Craig County, OK, Communities	
Craig County Unincorporated Areas	400540
Town of Ketchum	400292
Delaware County, OK, Communities	
Delaware County Unincorporated Areas	400502
Town of Bernice	400559
City of Grove	400385
Town of Jay	400057
Labette County, KS, Communities	
Labette County Unincorporated Areas	200590
Mayes County, OK, Communities	
Mayes County Unincorporated Areas	400458
Town of Disney	400554
Town of Grand Lake Towne	400555
Town of Langley	400296
McDonald County, MO, Communities	
McDonald County Unincorporated Areas	290817
City of Southwest City	290528
Newton County, MO, Communities	
Newton County Unincorporated Areas	290820
City of Neosho	290265
City of Seneca	290269
Ottawa County, OK, Communities	
Ottawa County Unincorporated Areas	400154
Town of Afton	400155
City of Commerce	400156
Town of Fairland	400377
City of Miami	400157
Town of North Miami	400426
City of Picher	400159
Town of Quapaw	400436
Town of Wyandotte	400161

Table of Contents

I. Discovery Overview 1
- i. Watershed Selection 2
  - A. General 2
  - B. Land Use 4
  - C. Risk Analysis 5

II. Discovery Efforts 14
- i. Engagement Plan 14
- ii. Pre-Discovery Efforts 15
- iii. Discovery Meeting 17
- iv. Data Gathering Overview 18

III. Watershed Findings 28
- i. Engineering Review of Community Comments 28
- ii. Post-Discovery Hydrology 30
- iii. Frequency Analysis 31
- iv. Post-Discovery CNMS Analysis 34
- v. Post-Discovery Hydraulics and Floodplain Analysis 39

IV. Watershed Options 40

Figures

Figure 1: Grand Lake O' the Cherokees Watershed and Communities 3
Figure 2: 10-Year View of Urban Change within the Watershed 7
Figure 3: Risk Factors and Topographic Data Availability for the Watershed 13
Figure 4: USGS Gage Locations 32

Tables

Table 1: Land Use in the Watershed 4
Table 2: Effective Flood Insurance Rate Map Dates 5
Table 3: Stream Miles in the Watershed 6
Table 4: NVUE Approximate Stream Mileage in the Watershed 8
Table 5: Disaster Declarations in the Watershed 8
Table 6: Mitigation Plan Status 9
Table 7: NFIP Insurance Claims by County and Community in the Watershed 10
Table 8: Repetitive and Severe Repetitive Losses in the Watershed 11
Table 9: Watershed Risk Factor Rankings 12
Table 10: Regional Project Team 14
Table 11: Project Discovery Meeting Times and Locations 17

Table 12: Data Collection Summary – Pre-Discovery Meeting 19
Table 13: Summary of Data Collected During the Discovery Meeting and Post-Meeting 21
Table 14: Comparison of 1-Percent-Annual-Chance Peak Flows of Gage Frequency Analysis and Effective Discharges 33
Table 15: CNMS Validation Status for Detailed Streams 34
Table 16: Failed Elements for Streams 35
Table 17: Hydrologic and Hydraulic Information for Enhanced Streams 38
Table 18: Potential Watershed Needs and Actions 40
Table 19: Metrics and Rankings of Needs 44

Acronyms and Abbreviations

BFE	Base Flood Elevation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfs	cubic feet per second
CID	Community Identification number
CNMS	Coordinated Needs Management Strategy
CRS	Community Rating System
DCS	Data Capture Standards
DEM	Digital Elevation Model
DFIRM	Digital Flood Insurance Rate Map
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FPA	Floodplain Administrator
GIS	Geographic Information System
GRDA	Grand River Dam Authority
HEC-1	Hydrologic Engineering Center – Hydrologic model program
HEC-2	Hydrologic Engineering Center – Hydraulic model program
HEC-RAS	Hydrologic Engineering Center – River Analysis System
HUC	Hydrologic Unit Code
LIDAR	Light Detection and Ranging
LOMA	Letter of Map Amendment
LOMC	Letter of Map Change
LOMR	Letter of Map Revision
MIP	Mapping Information Platform
NFIP	National Flood Insurance Program
NHD	National Hydrologic Dataset
NVUE	New Validated or Updated Engineering
OTSA	Oklahoma Tribal Statistical Area
OWRB	Oklahoma Water Resources Board
RAMPP	Risk Assessment, Mapping, and Planning Partners
RCRA	Resource Conservation and Recovery Act
Risk MAP	Risk Mapping, Assessment, and Planning
RL/SRL	Repetitive Loss / Severe Repetitive Loss
SCS	Soil Conservation Service

SFHA	Special Flood Hazard Area
STARR	Strategic Alliance for Risk Recovery
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
WSEL	water surface elevation

I. Discovery Overview

The Federal Emergency Management Agency (FEMA) is currently implementing the Risk Mapping, Assessment, and Planning (Risk MAP) program across the Nation. The purpose of Risk MAP is the continued improvement of flood hazard information for the National Flood Insurance Program (NFIP), the promotion of increased national awareness and understanding of flood risk, and the support of Federal, State, and local mitigation actions to reduce risk.

The vision and intent of the Risk MAP program is to collaborate with State and local entities to increase public awareness of flood risk and develop mitigation solutions that reduce risk to life and property. To achieve its vision, FEMA has transformed traditional flood identification and mapping efforts into an integrated process that more accurately identifies, assesses, communicates, plans, and mitigates flood risks. Risk MAP addresses gaps in flood hazard data to form a solid foundation for risk assessment and floodplain management, and provides State and local entities with the information needed to mitigate flood-related risks.

The FEMA Region VI office, in partnership with the State of Oklahoma Water Resources Board (OWRB) began the Discovery process in the Grand Lake O' the Cherokees Watershed in February 2011. The purpose of Discovery is to gather local information and readily available data for determining project viability and the need for Risk MAP products. The new data will help communities become more resilient. FEMA and its contractor, RAMPP (Risk Analysis, Mapping, and Planning Partners), and OWRB partnered throughout the Discovery process to facilitate communications, meetings, identification of risks, and final reporting and documentation. The Regional Project Team coordinated with FEMA Region VII, which contains the States of Kansas and Missouri, throughout the Discovery process.

Throughout the Discovery process, FEMA determines which areas of the Hydrologic Unit should be examined for further flood risk identification. The areas are assessed in collaboration with local communities, taking into consideration the information collected from local communities during this process. Discovery initiates open lines of communication and relies on local involvement for productive discussions about flood risk. The process facilitates a watershed-wide effort to understand how the applicable watershed community's flood risks are related to flood risk throughout the watershed. In Risk MAP, projects are analyzed on a watershed basis; therefore, Discovery meetings target numerous stakeholders from throughout the watershed on local, regional, State, and Federal levels.

In September 2011, FEMA and OWRB held a series of four Discovery meetings in this watershed. During Discovery, FEMA and the State reached out to local communities to:

- Gather information about local flood risk and flood hazards
- Review current and historic mitigation plans to understand local mitigation capabilities, hazard risk assessments, and current or future mitigation activities
- Include multidisciplinary staff from within their communities to participate and assist in the development of a watershed vision

The results of the Discovery process are presented in this Discovery Report, a watershed-scale Discovery Map, and the digital data gathered or developed during this process under FEMA Indefinite Delivery Indefinite Quantity Contract HSFEHQ-09-D-0369, Task Order HSFE06-10-J-0002. The digital data submitted (on DVD) with this report contain correspondence, exhibits used at the Discovery meetings, geographic information system (GIS) data, mapping documents (PDFs, spatial files, and personal geodatabases), or other supplemental digital information. Any graphics shown in this report are available as a larger format graphics file for printing and as GIS data that can be printed and used at any map scale.

i. Watershed Selection

The Grand Lake O' the Cherokees Watershed, Hydrologic Unit Code (HUC) 11070206, was selected for Discovery for a number of factors, described below.

A. General

The watershed is located in four States: Arkansas, Kansas, Missouri, and Oklahoma, and in nine counties in those four States. Twenty incorporated communities (cities and towns) and 12 other census-designated places are located in or partly in the watershed. In addition, 10 Native American Tribes also have lands in the watershed. The Tribes are:

- Cherokee Nation
- Eastern Shawnee Tribe of Oklahoma
- Miami Tribe of Oklahoma
- Modoc Tribe of Oklahoma
- Ottawa Tribe of Oklahoma
- Peoria Tribe of Oklahoma
- Quapaw Tribe of Oklahoma
- Seneca-Cayuga Tribe of Oklahoma
- Shawnee Tribe
- Wyandotte Nation

The population for the Grand Lake O' the Cherokees Watershed is approximately 63,700 based on the 2010 Census. The area of the watershed is 909.4 square miles. The watershed also spans two FEMA regions. Arkansas and Oklahoma are in FEMA Region VI, and Missouri and Kansas are in FEMA Region VII. A map of the watershed is shown in Figure 1.

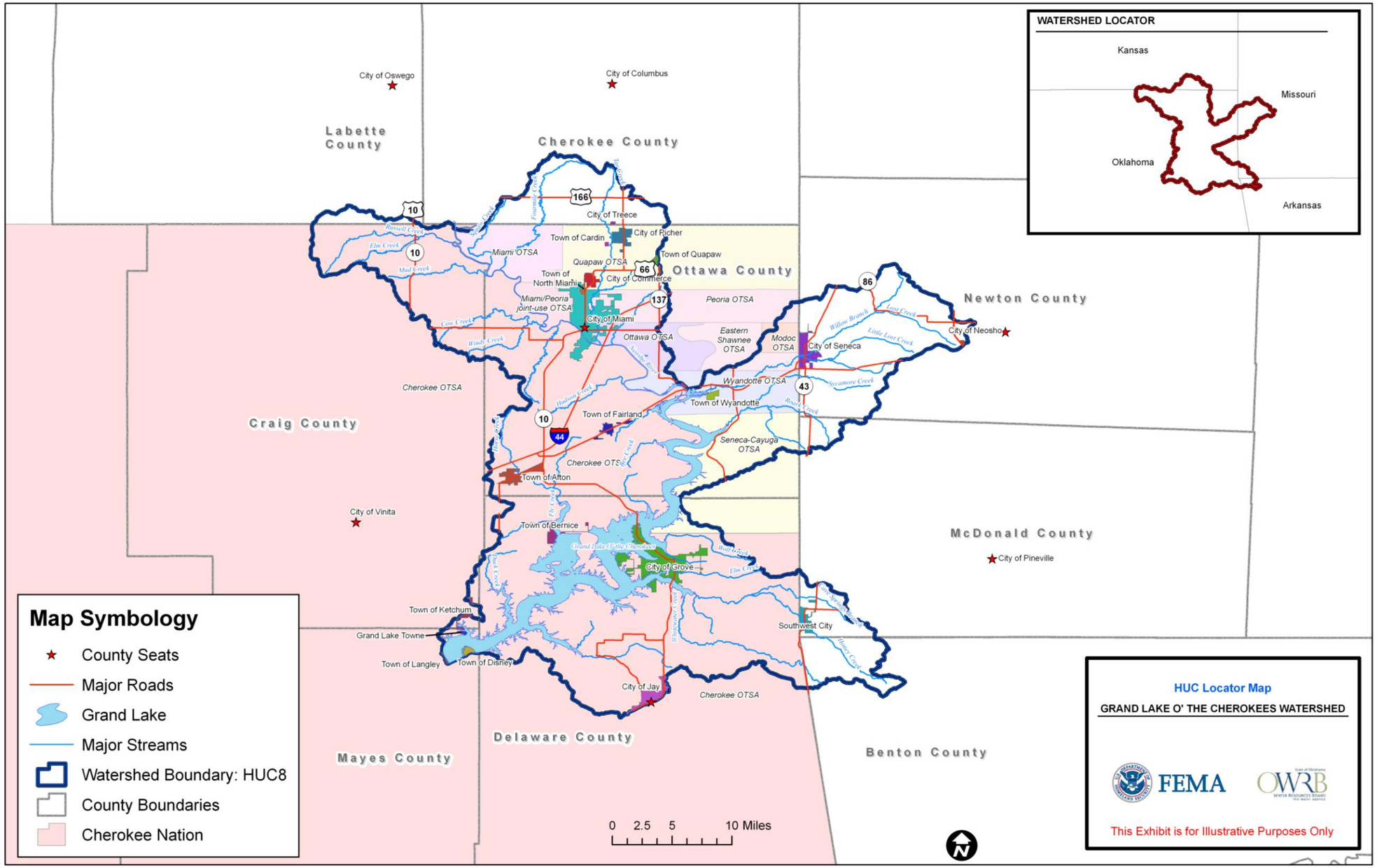

Figure 1: Grand Lake O' the Cherokees Watershed and Communities

The watershed is located in the foothills of the Ozark Mountains, mostly in the State of Oklahoma, in Delaware and Ottawa Counties. The primary river in the watershed, the Neosho River, enters the watershed in northern Oklahoma between Craig and Ottawa Counties. Below the confluence with the Spring River at Twin Bridges State Park in Ottawa County near the town of Wyandotte, the Neosho River is alternately known as the Grand River. Other significant flood sources in the watershed include Tar Creek, Elm Creek, Sycamore Creek, Lost Creek, Fourmile Creek, Honey Creek, and Whitewater Creek.

The Grand Lake O' the Cherokees (or Grand Lake, as it is often abbreviated) is formed by the Pensacola Dam near the Town of Disney, OK. The dam was completed in 1940 and is administered by the Grand River Dam Authority (GRDA). The GRDA was created in 1935 as a conservation and reclamation district for the waters of the Grand River. It operates the Grand Lake Reservoir and the hydroelectric facilities in the Pensacola Dam.

The mean elevation of Grand Lake is 742 feet above sea level. At this elevation, the lake has a 1,300-mile shoreline and a surface area of 72.7 square miles.

B. Land Use

Another factor to consider for watershed selection is land use, such as populated areas and areas with potential for future development. The watershed has populated areas as well as State parks and forests. There are no national forests or parks, or military facilities, in the watershed. Areas that may be excluded from flood risk consideration if they have include large cemeteries, U.S. Environmental Protection Agency (EPA) remediation sites (i.e., Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Resource Conservation and Recovery Act (RCRA) sites), prison areas, and water quality or flowage easement areas. These areas contribute to the overall square mileage of the watershed, but are not places where communities plan for population growth and development. Table 1 shows the land use in the watershed.

The Tar Creek Superfund Site is located in the watershed and includes the communities of Cardin, Commerce, North Miami, Picher, and Quapaw, OK. Mining in the area has been destructive to the land and water. Areas in the Superfund site, especially in Cardin and Picher, have been bought out and future development at the site will be largely related to remediation. The City of Picher and Town of Cardin have been bought out and are now ghost towns. The City of Treece is also in the process of being bought out.

Table 1: Land Use in the Watershed

Land Use	Approximate Square Miles
Incorporated Communities	35.5
Unincorporated Counties	873.9
Native American Lands	725.4
Grand Lake O' the Cherokees	72.7

Of the total 909.4 square miles for the Grand Lake O' the Cherokees Watershed, it is estimated that all areas, aside from the Grand Lake (72.7 square miles), are available to be developed or have development and population currently in place.

C. Risk Analysis

Flood risk analysis is a major factor in watershed selection. The majority of the Grand Lake O' the Cherokees Watershed has been mapped for flood hazards in the past. The effective dates for the current countywide Flood Insurance Rate Maps (FIRMs) are shown in Table 2.

Table 2: Effective Flood Insurance Rate Map Dates

County	Status	Effective Date
Benton	Effective	September 28, 2007
Cherokee	Effective	November 19, 2008
Craig	Effective	April 17, 1996
Delaware	Effective	August 5, 2010
Labette	Effective	January 2, 2009
Mayes	Effective	September 16, 2011
McDonald	Effective	May 3, 2010
Newton	Effective	November 26, 2010
Ottawa	Effective	August 5, 2010

Most communities participate in the NFIP. The Cities of Jay, OK and Treece, KS, and Towns of Disney, Ketchum, Langley, North Miami, Quapaw, and Grand Lake Towne, OK are not participating; however, the Town of Disney is in the process of joining. None of the Native American jurisdictions in the watershed participate in the NFIP, although many have expressed interest in joining in the future.

Availability of topographic data is one of the factors in the selection and analysis of the watersheds, and digital, updated topographic data will be available for much of the area in the Grand Lake O' the Cherokees Watershed. Recent Light Detection and Ranging (LIDAR) data are available for Benton, Delaware, Mayes, and Ottawa Counties. Representatives from Cherokee County also said that LIDAR is being flown by the State of Kansas and will be available in the near future.

As for streams within the watershed, the U.S. Geological Survey (USGS) provides the National Hydrologic Dataset (NHD), consisting of hydrologic spatial files that can be used to identify stream locations. The NHD stream mileage was used to approximate the total potential stream miles for a watershed. Artificial flow paths were removed from the count,

and only natural flow paths were counted. Based on the NHD, there are approximately 937 miles of streams in the Grand Lake O' the Cherokees Watershed.

FEMA maintains a Coordinated Needs Management Strategy (CNMS) Inventory of the status and attributes of currently studied streams in FEMA's floodplain study inventory. In general, the stream mileage shown in CNMS reflects streams that have effective Special Flood Hazard Areas (SFHAs) designated for them. Table 3 compares the NHD data to the CNMS data in the Grand Lake O' the Cherokees Watershed. It summarizes the status and attributes of studies in FEMA's floodplain study inventory.

Table 3: Stream Miles in the Watershed

Source	Stream Miles
NHD streams	1,683
CNMS streams (streams with effective SFHAs)	746
NHD stream miles not accounted for in CNMS	937

NHD = National Hydrologic Dataset
CNMS = Coordinated Needs Management Strategy
SFHA = Special Flood Hazard Area

In addition to listing the number of miles of studied stream within a watershed, CNMS documents certain physiological, climatological, or engineering methodological factors that may have changed since the date of the effective flood studies. The stream miles shown in CNMS are attributed with a Validation Status and Status Type that allows an evaluation of the condition of a given study or group of studies. Studies considered Valid in CNMS are the only ones that contribute to the New Validated or Updated Engineering NVUE) metric.

Figure 2 shows areas of relatively higher urban change within the watershed that can be used to help determine if streams are Valid. Streams are Valid if they meet NVUE Criteria. See Section III.iv, "Post-Discovery CNMS Analysis", for more information.

The NVUE metric is an indicator of the status of studies for the FEMA mapped SFHA inventory. The categorization of these studies as "Unverified" typically means that there has been some factor of change since the SFHA became effective, or the effective SFHA may have a deficiency, such as areas with more than five new or removed hydraulic structures (bridge/culvert) in the SFHA or hot spots of Repetitive Loss/Severe Repetitive Loss (RL/SRL), warranting restudy. CNMS stream mileage categorized as 'Requires Assessment' requires more input to determine their validity, often because they represent paper inventory or non-modernized studies. CNMS aids in identifying areas to be considered for study during the Discovery process by highlighting needs on a map, quantifying them (by mileage), and providing further categorization of these needs.

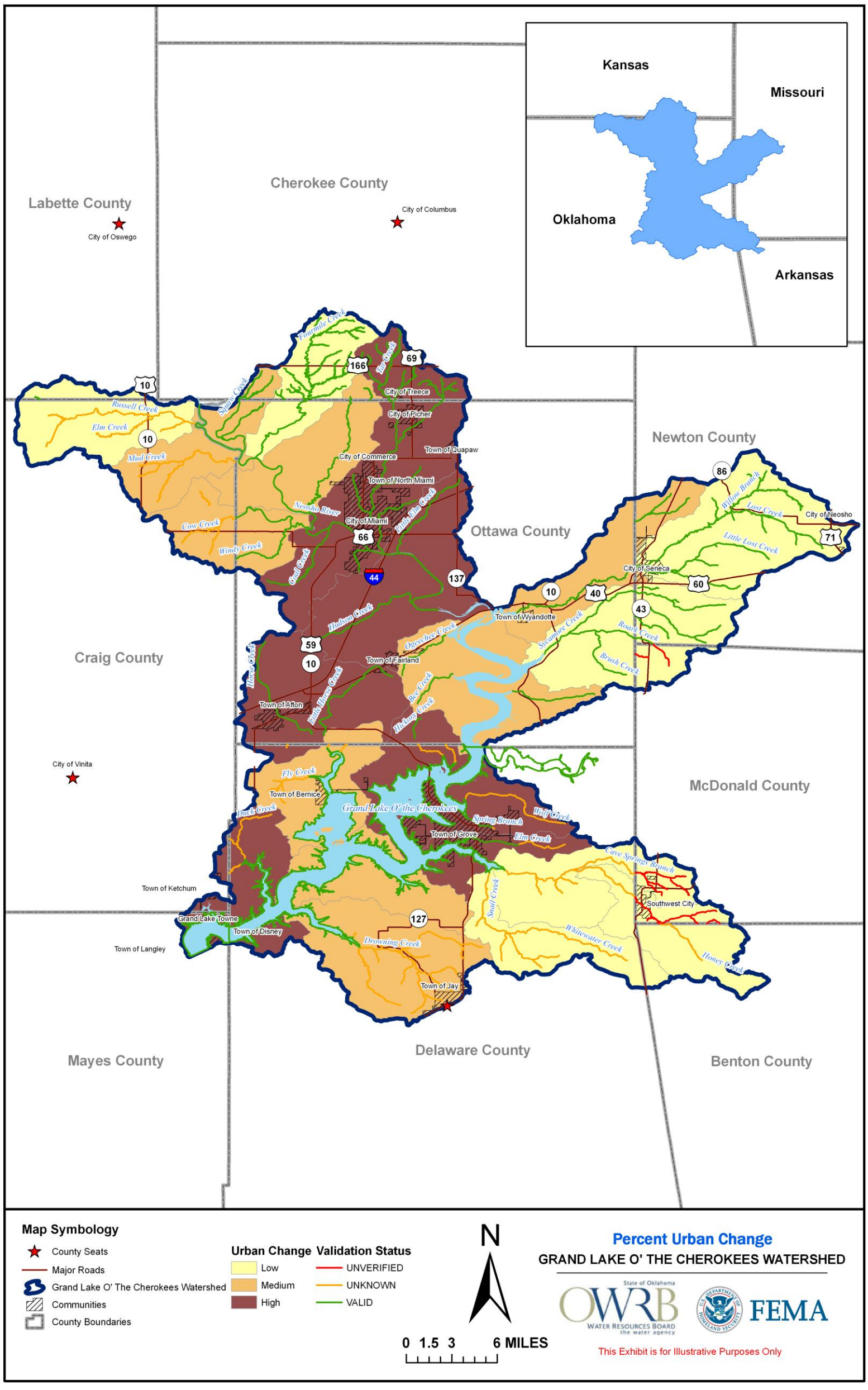

Figure 2: 10-Year View of Urban Change within the Watershed

In the Grand Lake Watershed, approximately 451 miles of streams studied by basic Zone A methods were identified as being Invalid or Unknown. The Zone A streams were identified as Invalid because the streams were modeled using an invalid Digital Elevation Model (DEM). The Invalid streams were in McDonald County and included the Cave Springs Branch, Roark Creek, and Honey Creek. The Unknown streams were in Benton, Craig, and Delaware Counties. Streams were given Unknown status if they were not submitted to FEMA with accompanying hydraulic and hydrologic models. Unknown status Zone A streams include segments of Fly Creek, Honey Creek, Mud Creek, Neosho River, Russell Creek, and Whitewater Creek. All Zone AE streams in the watershed are CNMS Valid. Table 4 summarizes the NVUE stream mileage from CNMS.

Table 4: NVUE Approximate Stream Mileage in the Watershed

NVUE Validation Status	Stream Miles
CNMS Valid Zone AE	294.2
CNMS Valid Zone A	80.3
CNMS Unknown Zone A	45.4
CNMS Unverified Zone A	19.7

NVUE = New Validated or Updated Engineering
CNMS = Coordinated Needs Management Strategy

Table 5 lists recent disaster declarations in the Grand Lake O' the Cherokees Watershed. The most recent flood events in May 2011 resulted in disaster declarations for many of the counties within the watershed.

Table 5: Disaster Declarations in the Watershed

Date of Declaration	Watershed Counties Declared	Hazard Type
5/13/2011	Craig, Mayes, and Ottawa	Severe Winter Storm and Snowstorm
5/9/2011	Newton	Severe Storms, Tornadoes, and Flooding
5/2/2011	Benton	Severe Storms, Tornadoes, and Associated Flooding
3/23/2011	McDonald and Newton	Severe Winter Storm and Snowstorm
2/3/2011	McDonald and Newton	Severe Winter Storm
2/2/2011	Craig, Delaware, Mayes, and Ottawa	Severe Winter Storm
3/9/2010	Cherokee and Labette	Severe Winter Storm and Snowstorm
3/5/2010	Craig, Delaware, Mayes, and Ottawa	Severe Winter Storm

Table 5: Disaster Declarations in the Watershed

Date of Declaration	Watershed Counties Declared	Hazard Type
6/19/2009	Newton	Severe Storms, Tornadoes, and Flooding
2/6/2009	Benton	Severe Winter Storm
3/19/2008	McDonald	Severe Storms and Flooding

Table 6 shows the status of all the mitigation plans within the watershed. The Discovery process is a good opportunity for FEMA and State officials to touch base with local officials on the status of their mitigation plans. More information about mitigation plans for communities within the watershed is found in the Discovery Engagement Plan. The approved dates and expiration dates are not known for many of the county mitigation plans.

Table 6: Mitigation Plan Status

Organization and Plan	Date Approved by FEMA	Expires	Comments
State of Arkansas Hazard Mitigation Plan	9/13/2010	9/13/2013	
State of Kansas Hazard Mitigation Plan	11/1/2007	11/1/2012	
State of Missouri Hazard Mitigation Plan	4/19/2010	4/19/2015	
State of Oklahoma Hazard Mitigation Plan	3/23/2007	3/23/2012	Adopted 3/20/2008
Benton County, AR Comprehensive Natural Hazard Mitigation Plan	Unknown	Unknown	
Cherokee County, KS Hazard Mitigation Plan	Unknown	Unknown	
Cherokee Nation Hazard Mitigation Plan	Unknown	Unknown	Adopted 2/14/2011
Labette County, KS Multi-Hazard Mitigation Plan	Unknown	Unknown	Adopted 3/2/2009
McDonald County, MO Multi-Hazard Mitigation Plan	Unknown	Unknown	Adopted 1/23/2006
Newton County, MO Multi-Hazard Mitigation Plan	Unknown	Unknown	Adopted 3/24/2005
Craig County, OK Multi-Hazard Mitigation Plan	1/22/2010	10/22/2015	
Delaware County, OK Hazard Mitigation Plan	11/28/2007	11/28/2012	
Mayes County, OK Hazard Mitigation Plan	Unknown	Unknown	

Table 6: Mitigation Plan Status

Organization and Plan	Date Approved by FEMA	Expires	Comments
Ottawa County, OK Hazard Mitigation Plan	Unknown	Unknown	

Table 7 shows NFIP insurance claims by communities and counties in the watershed. Claims for each community are for the whole community, including areas outside of the watershed. The majority of claims are for the City of Miami and the surrounding area in Ottawa County.

Table 7: NFIP Insurance Claims by County and Community in the Watershed

Community	Claims
Afton, Town of	0
Benton County, Unincorporated Areas	8
Bernice, Town of	0
Cardin, Town of	0
Cherokee County, Unincorporated Areas	37
Commerce, City of	0
Craig County, Unincorporated Areas	0
Delaware County, Unincorporated Areas	34
Disney, Town of	0
Fairland, Town of	1
Grand Lake Towne, Town of	0
Grove, City of	2
Jay, Town of	0
Ketchum, Town of	0
Labette County, Unincorporated Areas	17
Langley, Town of	0
Mayes County, Unincorporated Areas	29
McDonald County, Unincorporated Areas	16
Miami, City of	736
Neosho, City of	20
Newton County, Unincorporated Areas	13
North Miami, Town of	0
Ottawa County, Unincorporated Areas	219
Picher, City of	0
Seneca, City of	3
Quapaw, Town of	0
Southwest City, City of	2
Treece, City of	0
Wyandotte, Town of	3

In addition to NFIP claims, there are several RL/SRL properties in the Grand Lake O' the Cherokees Watershed. Most of these are in the Miami area. Table 8 summarizes these claims by county and community within the watershed. Most of the RL/SRL properties are in and around the Cities of Miami and Grove and around Grand Lake. RL data includes mitigated and non-mitigated structures. Additionally, the county totals include both the county and its incorporated communities. Communities not shown in Table 8 do not have RL/SRL properties.

Table 8: Repetitive and Severe Repetitive Losses in the Watershed

By County			
County	**Number of Properties**	**Total Claims**	**Average Number of Claims per Property**
Benton, AR	8	20	2.5
Cherokee, KS	5	17	3.4
Labette, KS	7	18	2.6
McDonald, MO	14	34	2.4
Newton, MO	9	23	2.6
Craig, OK	0	0	0.0
Delaware, OK	6	20	2.6
Mayes, OK	7	22	3.1
Ottawa, OK	132	537	4.1

By Community*			
Community	**Number of Properties**	**Total Claims**	**Average Claim Per Property**
Town of Afton, OK	2	6	3
Town of Cardin, OK	1	2	2
City of Grove, OK	1	2	2
City of Miami, OK	129	903	7
City of Neosho, MO	1	4	4
Town of Wyandotte, OK	2	6	3

*Communities not shown do not have RL/SRL properties.

During the Discovery process, watersheds are selected and analyzed at the HUC-8 level and evaluated using three major factors: population, topographic data availability, and risk decile. Risk decile is ranked 1 to 10, with 1 being the highest and 10 being the lowest. Risk decile is calculated using nine parameters:

- Population density
- Historical population growth

- Predicted population growth
- Number of housing units
- Number of flood policies
- Number of single claims
- Number of repetitive losses
- Number of repetitive loss properties
- Number of declared disasters

Table 9 shows the overall rankings of the Grand Lake O' the Cherokees Watershed compared to other HUC-8 watersheds nationally and regionally. Figure 3 shows risk factors and topographic data availability for the watershed. This information, along with rankings of smaller HUC-12 sub-watersheds, helps identify stream segments and locations where risk evaluation can be targeted. The combination of factors was important in the selection of this watershed for a Discovery project. All background information in this report for population data, historical flooding, and community information was obtained from the Engagement Plan for this watershed provided by CNMS, effective Flood Insurance Study (FIS) reports, and State and local hazard mitigation plans on file with FEMA Region VI.

Table 9: Watershed Risk Factor Rankings

Grand Lake O' the Cherokees Watershed Selection Rankings
National Risk Factor Rank: 487 National Risk Decile: 3 Average Annualized Loss: $16,143,300 National Average Annualized Loss Rank: 474 National Overall Rank: 646
Region 6 Risk Factor Rank: 76 Region 6 Risk Decile: 5 Average Annualized Loss: $16,143,300 Region 6 Average Annualized Loss Rank: 67 Region 6 Overall Rank: 153

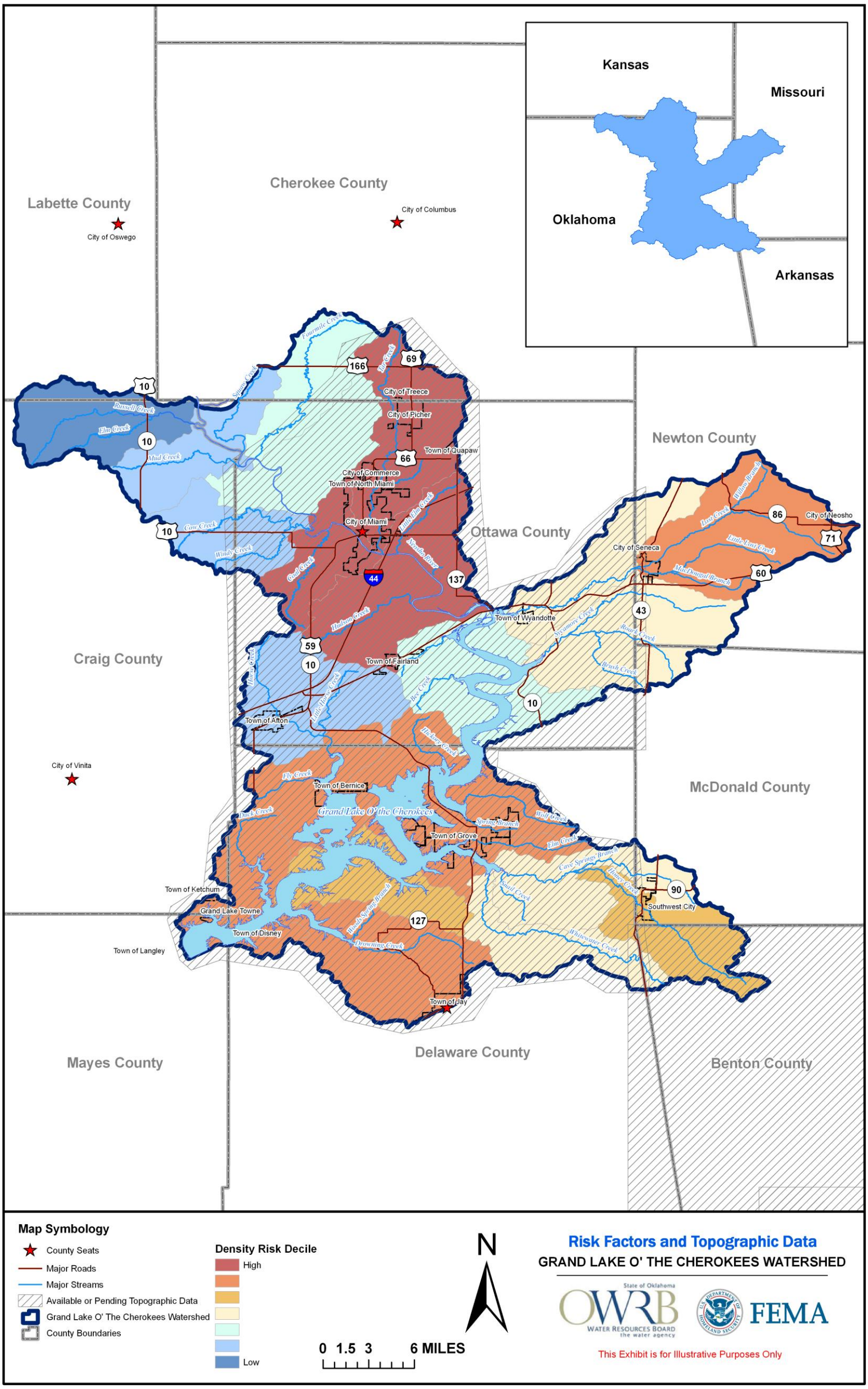

Figure 3: Risk Factors and Topographic Data Availability for the Watershed

II. Discovery Efforts

i. Engagement Plan

The Grand Lake O' the Cherokees Watershed Engagement Plan was prepared during Pre-Discovery by the Regional Project Team. The Regional Project Team was made up staff shown in Table 10.

Table 10: Regional Project Team

Name	Organization	Project Role
James Orwat	FEMA Region VI	Project Monitor - Engineering and Mapping Lead
Ron Wanhanen	FEMA Region VI	Deputy Project Monitor
Shanene Thomas	FEMA Region VI	Mitigation Planner
Roberto Ramirez	FEMA Region VI	Natural Hazards Program Specialist
Don Davis	FEMA Region VI	Grants Specialist
Jennifer Huxley	FEMA Region VI	GIS Specialist
Diane Howe	FEMA Region VI	Outreach Specialist
Linda Delamare	FEMA Region VI	Insurance Specialist
Bob Franke	FEMA Region VII	Project Monitor – Engineering and Mapping
Joe Chandler	FEMA Region VII	Mitigation Planner
Connie Wisiniewski	FEMA Region VII	Compliance Specialist
Julie Grauer	FEMA Region VII	Compliance Specialist
Monique Pilch	FEMA Region VII	Insurance Specialist
Laura Josephson	FEMA Region VII	Grants Specialist
Joe Remondini	USACE	Flood Risk Engineer
Peggy McGehee	Rep. Boren	Field Representative
Sabrina Parker	Sen. Inhofe	FEMA Caseworker
Gavin Brady	OWRB	State Coordinator
Kent Wilkins	OWRB	Field Services Representative
Matthew Rollins	OWRB	Field Service Representative

Table 10: Regional Project Team

Name	Organization	Project Role
Janet Meshek	Meshek & Assoc.	Engineer
Eric Nemeth	RAMPP	Study Manager
Rhonda Hurst	RAMPP	FEMA Regional Service Center Engineer
Luke Smith	RAMPP	Engineer

FEMA = Federal Emergency Management Agency
USACE = U.S. Army Corps of Engineers
OWRB = Oklahoma Water Resources Board
RAMPP = Risk Assessment, Mapping, and Planning Partners

The Engagement Plan is a tool that allows Regional Project Team members to understand the history of the watershed and highlights recent engagements with the FEMA Region VI Mitigation Division. In addition to contact information for key stakeholders and organizations in the watershed, the Engagement Plan captures media outlet information, the location and summary of recent articles or news releases, a strategy for keeping Congressional liaisons involved in the Discovery process, and a history of communications. The various team members can use the Engagement Plan to strategize communications to the various groups within the watershed to deliver the Discovery meeting messages and vision, and to track hot topics or points of interest.

The Engagement Plan served as the initial repository for summary information about the watershed. These data were discussed in the previous section of the report as background for the selection process for the Grand Lake O' the Cherokees Watershed to proceed through the Discovery process. This plan served as a clearinghouse for information about mitigation planning, active and closed grants, insurance policy information, socioeconomic overviews of the communities, and a review of the recent mapping initiatives in the watershed. From this collective review of the watershed, the project team can identify how communities within a project area should be engaged and selects from a high, medium, or low engagement strategy based on the risk, need, and political will of the communities. The complete Engagement Plan is included with the supplemental digital data that accompanies this report.

ii. Pre-Discovery Efforts

FEMA and the project team contacted watershed stakeholders via letters, telephone calls, and e-mails before the Discovery meeting to request local participation and identify key people who should be included in the Discovery process. Stakeholders were also asked to provide any data that could assist in risk identification in the watershed.

In preparation for the Discovery meeting, the Regional Project Team:

- Gathered information about local flood risk and flood hazards
- Reviewed mitigation plans to understand local mitigation capabilities, hazard risk assessments, and current or future mitigation activities
- Encouraged communities in the watershed to develop a vision for the watershed's future
- Used all information gathered to determine which areas of the watershed may require further study through a Risk MAP project

The Regional Project Team then began outreach efforts to the local governments in the watershed, along with Congressional and public officials, USACE, State departments in the four States, GRDA, and local Chambers of Commerce to inform them of the Discovery process and invite them to participate and contribute relevant information. The following key steps were taken before the Discovery meetings were held:

- Initial coordination meeting with FEMA and the State of Oklahoma NFIP Coordinator were held to set the stage for co-participation and sharing of duties for the Discovery process, as well as to establish potential meeting times and locations for the watershed Discovery meetings.
- RAMPP organized the meeting dates, locations, and facilities.
- Information letters were mailed to the communities, Tribes, and interested groups such as the Chambers of Commerce, the University of Arkansas Water Resource Center, and the GRDA.
- FEMA and RAMPP made initial calls to Chief Executive Officers; Floodplain Administrators (FPAs); Tribal chairpersons; Federal, State, and local officials; and other project stakeholders to inform them of the meetings and request data.
- Invitation letters were mailed.
- FEMA followed up with e-mails with meeting information.
- FEMA and RAMPP followed up with telephone calls to personally invite key stakeholders and representatives from the communities and to remind them of the meeting details and logistics.
- FEMA invited USACE to participate as an active member of the project team.
- A Congressional briefing was held before the meeting.
- A media briefing was held before the meeting.

Copies of key correspondence associated with Discovery are included with the supplemental digital data that accompanies this report.

iii. Discovery Meeting

Four Discovery meetings were held for the Grand Lake O' the Cherokees Watershed. The meeting times and locations are shown in Table 11. Meetings were held in the Cities of Miami and Grove and the Town of Afton. A fourth meeting, also held in Miami, focused on engagement with the Tribes in the watershed. Three hours were allotted for each meeting.

Table 11: Project Discovery Meeting Times and Locations

Meeting	Date and Time	Location
1	September 13, 2011 1:00 PM – 4:00 PM	Miami Civic Center 129 5th Avenue NW Miami, OK 74354
2	September 14, 2011 9:00 AM – 12:00 PM	Afton Community Center 201 SW 1st Street Afton, OK 74331
3	September 14, 2011 2:30 PM – 5:30 PM	Grove Community Center 104 W 3rd Street Grove, OK 74344
4	September 15, 2011 9:00 AM – 12:00 PM	Miami Civic Center 129 5th Avenue NW Miami, OK 74354

Attendees visited four Discovery stations that focused on Grants, Planning, Compliance and Mitigation, and Mapping. Each station had a series of large-format watershed maps with an aerial photograph of the watershed displayed along with community boundaries and road names. Additionally, each station had several 11x17-inch laminated maps for the watershed with topical information related to the watershed. These maps are included in the supplemental digital data that accompanies this report. The maps include:

- Floodplain-related grant activity
- Current Letters of Map Change (LOMCs)
- Current Percent Urban Cover
- Claims activity
- Risk, need, and available topographic data
- RL/SRL claims
- Urban change since 1992
- Urban change in the past 5 years

The four stations also had the following:

- *Grants Station:* Community Benefits and Grant Opportunities – maps of current floodplain-related grants; risk, needs, and topographic availability; RL/SRL;

LOMCs; urban changes over the last 5 years; and single claims. The station also had handouts on various FEMA grant programs.

- *Planning Station:* Mitigation Planning and Mitigation Activities – handouts on mitigation plans, understanding Risk MAP, and determining risk. The USACE assisted at the Planning station and provided information related to USACE activities in the watershed.
- *Compliance and Mitigation Station:* NFIP Community Actions – effective FIRMs, FISs, and LOMCs; maps of RL/SRL properties, single claims, and urban changes over the last 5 years.
- *Mapping Station:* Risk Identification and Communication – maps of risk, need, and topographic availability; LOMCs; population density and urban change in the watershed; high water marks; and low water crossings.

At each station, attendees were asked to contribute information about concerns in the watershed by indicating on the large watershed map the locations of their concerns, and then provide a short write-up on a comment form. Concerns related to effective FIRMs were marked on the FIRM panels with numbered stickers. The sticker number was written on the comment form to correlate the comment to the map location. Staff members from the Regional Project Team were at each station to answer questions and collect information and concerns. After visiting a station, attendees rotated to the next station, and each attendee was encouraged to stop at all four stations. If attendees had valuable information that they didn't bring to the meeting, they were encouraged to send it to the Project Team afterward.

Information sheets were collected at each station, and the Discovery watershed maps were marked to identify the locations relevant to the information sheets. These information sheets are included in the supplemental digital data that accompanies this report.

iv. Data Gathering Overview

All four Discovery meetings were attended by local participants. A full list of attendees is provided in the sign-in sheets in the digital data that accompanies this report. The meetings were well attended with most local communities represented. Attendees included:

- Local community elected officials and councilpersons
- Local floodplain managers, emergency management staff, community planners, public works staff
- Local Chamber of Commerce representatives
- General public/local engineering consultants

The meetings afforded personal, interactive communication with attendees at each station. The Project Team interviewed attendees and listened to discussions of positive mitigation and areas of continuing concern for the watershed as a whole. As attendees interacted at

each station, they not only discussed their own local concerns but listened to the concerns of others in the watershed.

Feedback from the attendees indicated that they felt this was an opportunity to express their concerns about the watershed and that they preferred the interactive stations rather than a lengthy presentation. Many attendees were appreciative of the chance to speak with the Project Team members from both FEMA and the State of Oklahoma. Some information that was collected was:

- Areas with local drainage or surface water flooding issues
- Places where bridges or roads are regularly closed due to flooding
- Places where structures flood and there is no current SFHA defined
- Places where the effective FIRM and FIS products were believed to not reflect actual conditions
- Areas that have been mitigated through buy-out or elevation of structures
- Areas of high urban change and planned growth
- Studies being conducted by other agencies that may be of use in future mapping and mitigation activities

The information from the comment forms and the locations of the concerns were compiled into a spatial data set after the meetings. This spatial set is included in the digital data accompanying this report.

Data collected from the attendees in the Discovery meetings is summarized in Table 12.

Table 12: Data Collection Summary – Pre-Discovery Meeting

Data Location	Data Custodian	Data Set Description
Watershed-wide	FEMA	Effective FIRM and FIS and backup information available on the MIP
Watershed-wide	FEMA	LOMC locations
Watershed-wide	FEMA	Locations of RL/SRL
Watershed-wide	FEMA	Location of grants being funded
Watershed-wide	FEMA	Currently accepted Hazard Mitigation Plan
Watershed-wide	FEMA	Participation in the NFIP, CRS ratings

Table 12: Data Collection Summary – Pre-Discovery Meeting

Data Location	Data Custodian	Data Set Description
Watershed-wide	FEMA	Disaster declarations
Watershed-wide	FEMA	CNMS information
Watershed-wide	FEMA, USGS, USDA	Locations of available and planned areas of LiDAR and other topographic data
Watershed-wide	U.S. Census Bureau	Populated place and population characteristics, spatial data for political boundaries
Watershed-wide	U.S. Representative Dan Boren	Case Information and Privacy Release Form Authorizations throughout Delaware and Ottawa Counties requesting assistance with concerns with FEMA
Benton County	Benton County and the State of Kansas	New Countywide LiDAR
City of Grove	City of Grove	Municipal boundary and roads spatial data, and hard copy of city map
City of Miami	City of Miami	Municipal boundary and roads spatial data, and hard copy of city map
Grand Lake	GRDA, USACE	Stage-storage and dam structure elevation information , flood-frequency curves, inundation maps
McDonald and Newton Counties	McDonald and Newton Counties	High water marks from 2007, 2011 floods
McDonald County	McDonald County	Historical flood data back to 1941, locations of flood-prone areas
Peoria Tribe	Peoria Tribe	Tribal boundaries spatial data
Quapaw OTSA and surrounding area, northern Ottawa County	EPA	Ongoing study of ground and surface water for Tar Creek and surrounding area
Town of Afton	USACE	Study of flooding sources

LIDAR data was acquired in 2010 for areas in FEMA Region VI. Areas included in the LIDAR collection were the entirety of Benton County, and the areas of Delaware, Mayes, and Ottawa Counties that are located in the watershed. The State of Kansas is currently collecting LIDAR for many areas in the State, including Cherokee County. Quality

topographic data like new LIDAR is crucial to producing enhanced studies that reflect the true topography of the area.

Table 13 summarizes the comments and concerns that were collected at the four stations during the four Discovery meetings. Scans of comment forms are included in the digital deliverables. Locations of concerns and other comments were recorded in an ESRI spatial file, also included in the digital deliverables. Many areas of concern identified at the meetings were later determined to be outside of the watershed. The concerns outside the watershed are noted in the table.

Peggy McGehee, a field representative for U.S. Representative Dan Boren Representative Dan Boren from Oklahoma's 2nd District, provided correspondence from constituents to the RAMPP Team. This correspondence expressed concerns about the effective FIRMs. Recurring concerns were that the floodplains did not reflect the topography of the areas and that those non-flood-prone areas were erroneously added to the SFHAs.

Table 13: Summary of Data Collected During the Discovery Meeting and Post-Meeting

Issues and Concerns Collected During the Discovery Meeting			
Item	**Flooding Source**	**Information Provided By**	**Discovery Meeting Comment Summary**
C1	Grand Lake Watershed, Craig County	City of Vinita	The City of Vinita, which is outside of the Grand Lake Watershed, reported that flooding in Vinita was partly due to flooding sources from the Grand Lake Watershed exiting upstream of the watershed's output at Pensacola Dam and flowing to Vinita from the north.
C2, P6	Stogdon Creek, McDonald County	McDonald County	Stockton Hollow Road along Stogdon Creek is easily flooded. This flooding source is not located in the watershed.
C3	Little Elm Creek, Ottawa County	Peoria Tribe	A housing addition is being built adjacent to the flood boundary. The Peoria Tribe has a spatial file with Tribal boundaries available for future NFIP actions.
C4	All flooding sources, Town of Disney Mayes County	Town of Disney	The Town of Disney is in the process of joining the NFIP. Lots of development is taking place in the town, and a copy of changes since the last FIRM is requested.
C5	N/A	Labette County	Labette County stated that there are no issues to investigate in the Grand Lake Watershed.
C6	Butler Creek, Benton County	Benton County	Debris removal and erosion control projects are ongoing in Benton County. This flooding source is not located in the watershed. The county has 2-foot contours from 2009 available for future NFIP actions.

Table 13: Summary of Data Collected During the Discovery Meeting and Post-Meeting

Issues and Concerns Collected During the Discovery Meeting			
Item	**Flooding Source**	**Information Provided By**	**Discovery Meeting Comment Summary**
C7	Lost Creek, Ottawa County	Wyandotte Tribe	Approximately 200 acres of property has been purchased by the Tribe with the intent of building a new industrial park and road.
C8	Spring Creek, Ottawa County	Wyandotte Tribe	Land has been purchased near Spring Creek. The Tribe has requested an NFIP Package. The Tribe has GIS data available for use, including Tribal boundaries.
C9	Sycamore Creek	Eastern Shawnee Tribe	Flood events occur in this area. The Eastern Shawnee Tribe requests an NFIP Package. A Hazard Mitigation Plan has been submitted.
C10	N/A	Modoc Tribe	The Modoc Tribe requests NFIP information, and to use Tribal First as an insurance provider.
C11	Unnamed Streams	Peoria Tribe	A housing development of the Tribe east of the City of Miami is shown in the SFHA and should not be. The Peoria Tribe requests an NFIP Package and grant information. The Tribe has Tribal boundaries spatial data.
G1	N/A	Peoria Tribe	The area identified as the Miami OTSA should be labeled "Miami/Peoria Joint-Use OTSA."
G2	Neosho River	Ottawa County	At 1115 Larson Lane, owner requests buyout. Surrounding properties have been bought out.
M1	Neosho River and Tar Creek	City of Miami	The City of Miami's wastewater treatment plant is located in Zone AE at the confluence of Tar Creek and Neosho River. It is regularly inundated.
M1a	Elk River	McDonald County	The base floods shown on the Elk River are 2 feet off compared to topographic data. This flood source is outside of the watershed.
M1b	N/A	Cherokee County	The State of Kansas is collecting new LIDAR for Cherokee County.
M2	Neosho River	City of Miami	The Williams Lift Station is in Zone AE and is regularly inundated by flood waters.
M2a	Unnamed Flow path	City of Miami	The floodplain is incorrectly mapped, and houses that have sufficient elevation are shown as inundated.
M3	Neosho River, Tar Creek, Belmont Run, Fairgrounds Branch	City of Miami	Flooding along these flow paths enter manholes.

Table 13: Summary of Data Collected During the Discovery Meeting and Post-Meeting

Issues and Concerns Collected During the Discovery Meeting			
Item	**Flooding Source**	**Information Provided By**	**Discovery Meeting Comment Summary**
M3a	Elk River	McDonald County	The Elk River, which is not in the Grand Lake Watershed, is a tributary to Grand Lake, and its water level is dependent on the Pensacola Dam.
M4	N/A	McDonald County	McDonald County has high water marks available.
M4a	Tar Creek	City of Miami	The flood zone extends too close to Poner and 16th Streets. Homes with sufficient elevation are incorrectly shown in the SFHA.
M5	Neosho River and Little Elm Creek	Ottawa County	At the confluence of the two flow paths, the floodplain does not reflect the actual flood locations.
M5a	Tar Creek	City of Miami	Storm drain at 3rd Avenue and D Street NE backs up from Tar Creek floods, causing flooded streets.
M5b	Lost Creek	Newton County	Casinos in Ottawa County near the Missouri/Oklahoma State line are causing flooding across the State line in Missouri.
M6	Tar Creek	Ottawa County	There are several high-elevation areas in the floodplain that are above the base flood and should be removed from the SFHA.
M6a	Neosho River and Tar Creek	City of Miami	The floodwaters back up through the storm drains, flooding into streets and causing street closures.
M7	Spring River	Ottawa County	The SFHA at this location is split into two parallel floodplains at this location. The County believes this location has been incorrectly mapped and does not reflect the actual split location. This location is not in the floodplain.
M7a	Neosho River and Tar Creek	City of Miami	There are several properties in the Tar Creek and Neosho River SFHAs that the City of Miami has bought out because of repeat flooding.
M8	Hudson Creek	Ottawa County	The 2010 FIRM updates have a wider floodplain than the previous effective FIRMs. Several non-flood-prone houses have been erroneously added to the flood zones.
M8a	Neosho River	City of Miami	Wooden trestles carry the sewer line across the Neosho River.

Table 13: Summary of Data Collected During the Discovery Meeting and Post-Meeting

Issues and Concerns Collected During the Discovery Meeting			
Item	**Flooding Source**	**Information Provided By**	**Discovery Meeting Comment Summary**
M10	Warren Branch	Ottawa County	The mapped SFHAs are too extensive and cover areas that should not be shown in the flood zone. This flow path is not in the watershed.
M12	Tar Creek	City of Miami	A Letter of Map Amendment (LOMA) has been received for this area.
M13	Unnamed Flow paths	Ottawa County	There are several high points that should be removed from the SFHAs.
M15	Fourmile Creek, Slow Creek, Squaw Creek	Ottawa County	The northwest section of Ottawa County is poorly studied and would benefit from enhanced restudy. Many areas are in the mapped floodplain that should not be.
M17	Little Elm Creek	Ottawa County	There has been development that will affect the flooding.
M18	Unnamed Tributary to Spring River	Ottawa County	The flood zone extends too far in this area and is shown in areas with high elevation. This area is outside of the floodplain.
M20	Big Cabin Creek	Craig County	The Big Cabin Creek is incorrectly shown on the effective FIRMs and the floodplain is inaccurate. This area is outside of the floodplain.
M21	Jones Creek and Little Cabin Creek	Craig County	The floodplain at the confluence of these two creeks shows flooding more than 10 feet vertically from what should be shown. This area is outside of the floodplain.
M22	Unnamed Flow path	Ottawa County	The backwater at the confluence of two flow paths in two southwest tributaries in Ottawa County is too extensive and extends into high areas.
M22a	Spring Branch	City of Grove	A LOMA has been reviewed that removes locations from the SFHA.
M30	Unnamed Flow path	Town of Afton	The flood zone through Afton is too wide and should be re-analyzed with good topographic data. USACE is conducting a new study that may be of use in future mapping efforts.
M31, M32	Horse Creek	Town of Afton	Two addresses (3 NW 3rd and 3 NE 3rd) are not flood-prone and are shown in the flood zone. Residents believe that effects of street drainage should be considered.

Table 13: Summary of Data Collected During the Discovery Meeting and Post-Meeting

Issues and Concerns Collected During the Discovery Meeting			
Item	**Flooding Source**	**Information Provided By**	**Discovery Meeting Comment Summary**
M33	Grand Lake	Delaware County	The aerial photographs used on the Delaware County Effective FIRMs are out of date. Mapped flood zones do not reflect actual locations, and maps that had been printed at 1”=500’ have been changed to 1”=1000’ scale.
M34	Horse Creek	Delaware County	The flood zone in the 2010 effective FIRMs shows properties on the south side of the road in the flood zone even though they should not be.
M35	Elm Creek	City of Grove	The mapped flood zone does not reflect the elevation in the area and should be revised.
M40	Spring River	Quapaw Tribe	The Quapaw Tribes Powwow grounds are near the river. The Spring River is not in the floodplain.
M41, M50	Tar Creek	Quapaw Tribe	When the Tar Creek floods, contaminants are re-introduced into the floodplain. Plans are in place to dam the creek. Removal of mining waste is ongoing. There are ongoing EPA and CH2M Hill studies that could be of use in future mapping efforts.
M42	Wyandotte Ditch	Wyandotte Tribe	The ditch is only studied to Wyandotte’s town limits. It should be studied farther east since there is more development outside of the town.
M43	Spring River	Wyandotte Tribe	The Tribe requests a restudy of Spring River. This flow path is outside of the watershed.
M44	Beaver Creek	Quapaw Tribe	New development is taking place along Beaver Creek. The Tribe requests enhanced study. This location is not in the watershed.
M45	Garrett Creek and Tar Creek	Quapaw Tribe	A water treatment plant in Commerce is near the SFHA. Lagoons along Garrett Creek have been filled, and new mapping efforts should reflect this change.
M46	Neosho River	Ottawa County	Levees have been proposed along the Neosho River where it forms the boundary between Craig and Ottawa Counties.
M47	Watershed-wide	U.S. Representative Dan Boren	The Congressman’s office provided the RAMPP Team with much correspondence from individuals throughout the watershed Counties in Oklahoma stating strong concerns and issues with the floodplain mapping shown on the current effective maps.

Table 13: Summary of Data Collected During the Discovery Meeting and Post-Meeting

Issues and Concerns Collected During the Discovery Meeting			
Item	**Flooding Source**	**Information Provided By**	**Discovery Meeting Comment Summary**
P1	Quail Creek	City of Miami	The creek overflows into Elm NE and 16th Streets when it rains.
P2	Tar Creek	City of Miami	Sky Harbor Drive floods when it rains.
P3	N/A	City of Miami	There are 28 mitigated houses.
P4	Neosho River	City of Miami	On Highway 125, flooding enters the road and forces closures.
P5	Elk River	McDonald County	The Elk River overflows onto Highway 43. The river is not in the watershed.
P7	Elk River	McDonald County	The Elk River overflows onto Beaman Hollow and Gordon Hollow Roads. The 2010 FIRMs contain errors and do not reflect actual conditions. These locations are not in the watershed.
P8	Elm Creek	Ottawa Tribe	On Elm Creek, water backs up from the Grand Lake, sometimes up to 10 feet vertically. Floods extend to Highway 10.
P9	Tar Creek	Ottawa Tribe	Tar Creek floods when Grand Lake is too high.

All supporting information, data, and files collected for this report are included in the supplemental digital data submitted with this report. The following is a directory listing of the files and folders included and which data are found under each sub-folder. If a submittal is not applicable for the Grand Lake O' the Cherokees Watershed, a Readme Text file is included in its place noting that it was not included.

11070206\Discovery

- Project_Discovery_Initiation
  - Regional Project Team
  - Lake O' Cherokees Table M.2-1 (Community Contact List)
  - GIS
    - DCS_S_POL_AR (Political Areas)
    - DCS_S_TRNSPORT_LN (Transportation Lines)
    - DCS_S_HUC (HUC Boundaries)
- Discovery_Meeting
  - Meeting Attendance Record
  - Meeting Agenda
  - Meeting Minutes
  - Presentation
  - Exhibits

    - Correspondence
        - Initial Contact Letters
        - Invitation Letters
        - Thank You Letters
- Post_Discovery
    - Discovery Maps
    - Discovery Report
    - Data Capture Standards (DCS) Information
    - Scope of Work and Mapping Activity Statement
    - Geospatial Data Summary
- Supplemental_Data
    - Engagement Plan
    - USGS Gage Data
    - GIS (Personal geodatabase files used to create exhibits and Discovery Map)
    - Metadata
    - Hazard Mitigation Plan
    - Outreach Newsletters

III. Watershed Findings

After the Discovery meetings, an additional engineering overview analysis was performed to more clearly identify key areas flagged as concerns for future projects in the watershed. The analysis targeted areas within the watershed that had been identified as having mitigation action plans for the future. The details in this section supplement the documentation supporting the need for further mitigation actions or studies in particular streams, reaches, or communities in the watershed.

This section describes the riverine floodplain analysis as either basic or enhanced. The basic analysis will produce a model-backed Zone A floodplain delineation. The enhanced analysis will produce a model-backed Zone AE floodplain delineation. These analysis types are discussed in more detail below as part of the evaluation of needs.

i. Engineering Review of Community Comments

All engineering-related comments provided by communities during the Discovery meetings were investigated. Comments were checked in terms of hydrologic and hydraulic issues in the watershed and with any general floodplain or Base Flood Elevation (BFE)-related comments.

Several communities in the watershed have experienced growth and development near flood sources. Neosho River, Tar Creek, Elm Creek, Quail Creek, Hudson Creek, and Little Elm Creek are streams identified in community comments as being near ongoing or planned development. Development is also ongoing along the Grand Lake.

- The Neosho River enters the watershed at the northwest corner of Ottawa County and is a mapped Zone A until it reaches the City of Miami. It was studied by enhanced methods for approximately 5 miles as it flows through the City of Miami. From that point forward, it was studied by approximate methods to its confluence with Council Hollow, after which the study was enhanced. The Neosho River transitions into the Grand Lake near the Town of Wyandotte at its confluence with the Spring River. For the last enhanced study of the Neosho River per the 2010 effective FIS for Ottawa County, gage data from USGS Gage 07185000 near Commerce, OK, was used to determine the flow rates. Ortho-derived topographic data from 1984 were used for hydrologic and hydraulic analyses. The HEC-2 software was used to calculate the water surface elevations (WSELs). The 2010 publication date of the FIS indicates that the study should have been conducted using recent base data, but the large number of community comments and the publication of new LIDAR suggest an enhanced restudy is warranted.
- The effective DFIRMs for Grand Lake utilize a Static BFE from USACE which is based on the Pensacola Dam elevation. Restudy for the Grand Lake should be done contiguously with the Neosho River to have a smoother transition and better show the flood elevations in the upstream parts of the lake.
- Tar Creek was studied by basic methods through Cherokee County into Ottawa County south to just north of the City of Commerce. It was studied by enhanced methods from

that point to the confluence with the Neosho River in the City of Miami. The enhanced study was published in 2010 Ottawa County FIS. The hydrologic model for Tar Creek was published by the Soil Conservation Service in 1983. The HEC-2 software was used to calculate the WSELs. Ortho-derived topographic data from 1984 were used for hydrologic and hydraulic analyses. The large number of community comments and the publication of new LIDAR suggest an enhanced restudy is warranted. The areas around Tar Creek north of Miami are experiencing a sharp decline in population, so restudy of these areas is not warranted, but the new development in Miami merits new study. The age of the hydrologic analyses suggests that new hydrology should be calculated.

- Elm Creek is in Delaware County. It was studied by basic methods in its upstream extents and by enhanced methods through the City of Grove to its confluence with Grand Lake. The hydrology for the river was calculated in the 2010 FIRM and FIS revisions using the HEC-1 software. Topographic data derived from 1999 aerial photographs were used in modeling. HEC-RAS was used for new hydraulic modeling. The number of community comments and the existence of new LIDAR in this area justify restudy.
- Quail Creek is primarily in the City of Miami and was studied by approximate studies. Ortho-derived topographic data from 1984 were used for hydrologic and hydraulic analyses. Given that it flows through urban areas for its whole extent, enhanced restudy is recommended.
- Hudson Creek is a large creek in southwest Ottawa County. It was studied by basic methods. Although the site had one community comment, it is located in a very rural area and does not warrant study by enhanced methods. The Zone A streams in Ottawa County are NVUE Valid, so restudy may not be needed, even with the new LIDAR now available in Ottawa County.
- Little Elm Creek is in Ottawa County. It was studied by basic methods in its upstream extents and by enhanced methods in its lower extents. All community comments are regarding the enhanced segment. The hydrology for Little Elm Creek was calculated in HEC-1, and the hydraulics were calculated in HEC-2. Topographic data derived from 1984 aerial photographs were used. The age of the base data used in the models and the high number of community comments indicates restudy should be performed for this creek.
- The Town of Afton's flooding sources are all studied by basic methods, mapped as Zone A. The town has requested enhanced restudy of the flood sources. There have been catastrophic floods in Afton in recent years, and restudy of the Afton flood sources is recommended.

Several communities expressed dissatisfaction with the base data used on the effective FIRMs. Common issues were that street files, municipal boundaries, and aerial photographs in the effective maps were not updated in the last studies. A comparison between 2010 effective FIRMs and historic FIRMs indicates that the base map data was not updated between the studies. All panels printed as part of new flood studies should use updated base map data.

Many communities also expressed concern that the floodplain extents on the effective FIRMs did not reflect actual flood locations. The topographic data used to produce the effective FIRMs for Ottawa County are dated 1984. The effective FIRMs for Mayes County were produced using topographic data from the early 1970s. The effective FIRMs for Delaware County were produced using topographic data dated 1999. USGS topographic data were used in McDonald and Newton Counties. The topographic data source was not specified in Benton County. New LIDAR is available for several areas in the watershed, so revisions based on new topographic data should be used wherever available.

ii. Post-Discovery Hydrology

Limited reviews of the hydrologic information were performed for post-Discovery analyses in the Grand Lake O' the Cherokees Watershed. These reviews focused on:

- Peak discharges in the watershed
- Limited gage analyses in the watershed

The 1-percent-annual-chance peak discharges were reviewed for all streams across community and county boundaries. Areas with Letters of Map Revision (LOMRs) were specifically checked because LOMRs may indicate that there are larger issues. Information obtained from USGS gages was checked against the effective FIS for consistency. This analysis could potentially flag anomalies that would indicate that the hydrology is out of date, too high, or too low for the watershed.

Peak discharges in the watershed were reviewed based on effective FIS reports, flow gages, and available LOMRs. Areas of special interest were county boundaries and locations of LOMRs and gages. Hydrologic models were not provided for areas studied by basic methods, so only enhanced models were reviewed.

The floodplain boundaries in the Grand Lake O' the Cherokees Watershed were checked for continuity between the flood zones in different counties. It is important for flood zones to be consistent throughout the study areas, so locations where the flood zones were different across county lines or where a study was not continued were recorded. The boundary between Ottawa and Newton Counties was the only place with discrepancies. Here, two Zone A SFHAs do not continue across the county line, and none of the floodplains were continuous.

An important check is to compare the discharges of a stream studied by enhanced methods across a county boundary. The only Zone AE SFHA that crosses a county line, besides Grand Lake, is Lost Creek which flows from Newton County to Ottawa County. In Newton County, the downstream-most flow rate at the county boundary is 17,635 cubic feet per second (cfs), while the Ottawa County effective FIS shows a flow rate of 19,310 cfs at a location 5,000 feet upstream of Grand Lake. The flow rates for both were calculated using HEC-1, and no restudy based on hydrology is recommended.

Grand Lake crosses into Mayes, Delaware, and Ottawa Counties. The static BFE is 755 feet in Ottawa County and 757 feet in Mayes and Delaware Counties. All three counties

cite USACE as the source of the water elevation. Applying a single static BFE to the entire lake does not accurately represent the flood elevation of the upstream parts of the lake and the restudy of the Neosho River should extend all the way to the Pensacola Dam for a more accurate calculation of the flood extents.

LOMRs within the Grand Lake Watershed that have an impact on hydrology were reviewed. There was only one new LOMR (FEMA Case Number 10-06-3154P) located in Ottawa County's unincorporated area on Grand Lake. Grand Lake should be remapped based on a consistent BFE and the new LIDAR data in Oklahoma. This LOMR should also be incorporated into the FIRMs.

iii. Frequency Analysis

Frequency analyses were performed for all gages in the Grand Lake O' the Cherokees Watershed having more than 10 peaks. Frequency analyses were performed using the USGS PeakFQWin program. There are 11 locations in the Grand Lake O' the Cherokees Watershed with USGS gages. Of these, seven have more than 10 years of record, making them suitable for analysis. Two are located on the Neosho River, one on Tar Creek, one on Lost Creek, one on Cave Springs Branch, and two on Horse Creek. A map of the gage sites is shown in Figure 4. USGS gages having 10 or more years of unbroken records were analyzed using the USGS PeakFQWin 5.2 program to determine the 1-percent-annual-chance discharges. These discharges were compared to the flow rates from effective studies. The comparisons are shown below in Table 14. Only Tar Creek has a flow rate in an effective FIS because the other streams were studied by basic methods only and do not have reported flow rates. The calculated flow rates for Tar Creek were very close to those calculated in the effective study, and no changes should be necessary in future studies.

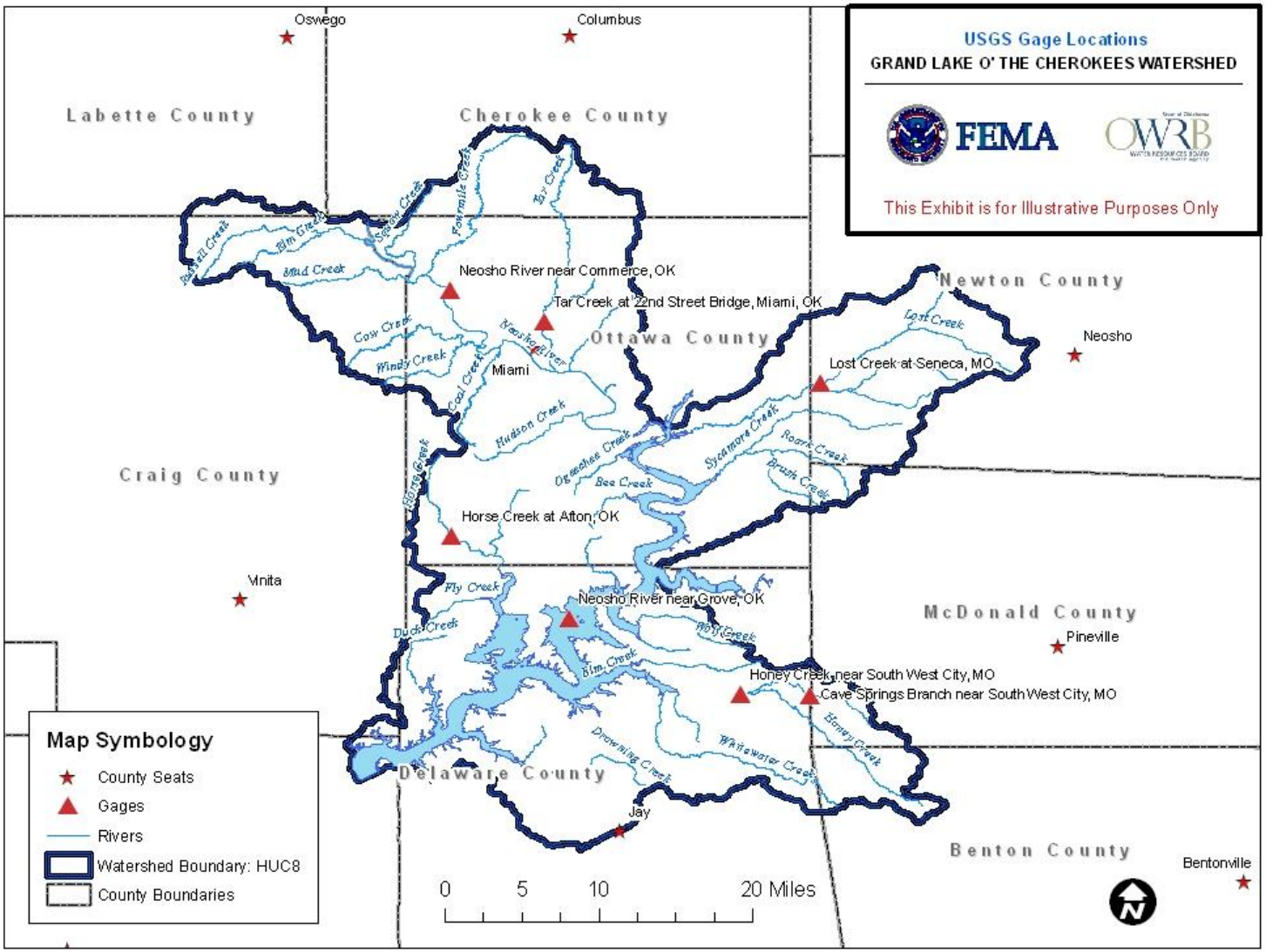

Figure 4: USGS Gage Locations

Table 14: Comparison of 1-Percent-Annual-Chance Peak Flows of Gage Frequency Analysis and Effective Discharges

Stream Name and Location	USGS Gage	Drainage Area from USGS Gage (square miles)	Effective Discharges Source	Effective 1% Annual-Chance Discharge (cfs)	95% Confidence Limits Lower (cfs) (Gage)	1% Annual-Chance Discharge from PeakFQWin (Gage)	95% Confidence Limits Upper (cfs) (Gage)	Number of Peaks on Record
Cave Springs Branch near Southwest City	07189540	7.9	N/A*	N/A*	1,844	2,968	7,052	13
Honey Creek near Southwest City	07189542	48.2	N/A*	N/A*	7,421	16,230	67,860	13
Horse Creek at Afton	07189700	21.9	N/A*	N/A*	2,653	3,204	4,305	20
Lost Creek at Seneca	07188500	42.0	N/A*	N/A*	32,430	14,570	107,200	29
Neosho River near Commerce	07185000	5,876	N/A*	N/A*	134,200	165,700	216,900	71
Neosho River near Grove	07189500	9,969	N/A**	N/A**	140,000	202,500	380,400	15
Tar Creek at 22nd Street Bridge at Miami	07185095	44.7	SCS Study	13,920	9,017	13,710	28,170	16

* Approximate Study. No effective discharge is available.
** Location is in the Grand Lake. No Discharge is calculated and a static Base Flood Elevation is used on the Flood Insurance Rate Map.

USGS = U.S. Geological Survey
cfs = cubic feet per second
SCS = Soil Conservation Service

iv. Post-Discovery CNMS Analysis

Benton, Delaware, Mayes, and Ottawa Counties were part of the RAMPP detailed CNMS Phase 3 processed. Labette, McDonald, and Newton were processed by Strategic Alliance for Risk Recovery (STARR). Table 15 below shows the detailed study streams in the Lake O' the Cherokees Watershed evaluated during the CNMS stream reach-level validation process. All validation was conducted per the CNMS Database User's Guide Version 4.2. The CNMS validation elements attempt to identify changes in the physical environment, climate, and engineering methodologies since the date of the effective analysis (different from the effective issuance date). According to the CNMS validation process, the studied reach is considered Invalid or is assigned an 'Unverified' status, if one of 7 critical elements fails, or if 4 or more of the 10 secondary elements fail during stream reach level validation. Table 14 provides a description of the validation elements that failed as identified in the CNMS database, and Table 16 defines those elements.

Table 15: CNMS Validation Status for Detailed Streams

Stream Name	County	Validation Status	Failed CNMS Elements
Elm Creek	Delaware, OK	VALID	None
Grand Lake O' the Cherokees	Delaware, OK	VALID	None
North Tributary to Spring Branch (downstream)	Delaware, OK	VALID	None
North Tributary to Spring Branch (upstream)	Delaware, OK	VALID	None
Spring Branch	Delaware, OK	VALID	S10
Grand Lake O' the Cherokees	Mayes, OK	VALID	None
Little Lost Creek (County)	Newton, MO	VALID	S4, S5
Little Lost Creek (Seneca)	Newton, MO	VALID	S4
Lost Creek (County)	Newton, MO	VALID	S4
Lost Creek (Seneca)	Newton, MO	VALID	S4, S5
MacDougal Branch	Newton, MO	VALID	S4, S5, S10
Belmont Run	Ottawa, OK	VALID	S4, S5, S10
Fairgrounds Branch	Ottawa, OK	INVALID	C5, S10
Grand Lake	Ottawa, OK	VALID	S2
Little Elm Creek	Ottawa, OK	VALID	None
Lost Creek (Lower Reach)	Ottawa, OK	VALID	None
Lost Creek (Upper Reach)	Ottawa, OK	VALID	None
Neosho River	Ottawa, OK	VALID	S2
Quail Creek	Ottawa, OK	VALID	S4, S5, S10
Tar Creek	Ottawa, OK	VALID	S4

Table 15: CNMS Validation Status for Detailed Streams

Stream Name	County	Validation Status	Failed CNMS Elements
Wyandotte Ditch	Ottawa, OK	VALID	None

Table 16: Failed Elements for Streams

Element Name	Issue Being Identified by the Element	Element Description
C5	*Channel reconfiguration outside the SFHA*	This element compares digital SFHA boundaries to current aerial imagery to determine whether the flood source channel has been reconfigured outside of the SFHA since the date of effective study.
S2	*Repetitive losses outside the SFHA*	This element fails when repetitive loses have been noted outside of the SFHA. Repetitive loses determined to be from an unmapped source or due to local drainage issues are not considered.
S4	*More than 1 and less than 5 new or removed hydraulic structures (bridge/culvert) impacting BFEs*	This element identifies addition or removal of more than 1 but less than 5 hydraulic structures along the studied streams since the date of the effective study. Please note, pursuant to guidance from FEMA, all structures identified using aerial imagery were to be counted for this element, including footbridges.
S5	*Channel Improvements / Shoreline Changes*	Failure of this element indicates that channel improvements such as straightening/channelization or armoring have occurred since the date of effective analysis.
S10	*New regression equations available*	Failure of this element indicates updates to regression equations since the date of study for studies that used a regression analysis for hydrology.

Benton County, AR

Benton County was included in CNMS Phase 3. The only Benton County stream that falls within the watershed is a 3.9-mile basic study of Honey Creek that is not CNMS valid because it is not model-backed in the FEMA Library.

Cherokee County, KS

The 74.8 miles of Cherokee County Streams that fall within the watershed are all model-backed basic studies, and therefore, valid. Among the flooding sources studied by approximate methods are Fourmile Creek, Squaw Creek, Tar Creek, and multiple unnamed tributaries.

Labette County, KS

The only Labette County stream that falls within the watershed is a 0.4-mile model-backed basic study of an unnamed tributary.

McDonald County, MO

The 19.6 miles of McDonald County streams that fall within the watershed are all basic studies, which have been determined by Region VII to be Unverified due to their creation using an invalid DEM. These studies include Cave Springs Branch, Honey Creek, Roark Creek, and tributaries to those three streams.

Newton County, MO

The Newton County streams that fall within the watershed include 62.9 miles of model-backed basic studies and 5.4 miles of Valid enhanced studies. Among the enhanced Studies, MacDougal Branch, two sections of Lost Creek, and two sections of Little Lost Creek failed Secondary Element S4, indicating that 4 or less hydraulic structures have been added or removed since the date of effective analysis, as identified by aerial imagery. MacDougal Branch, one section of Lost Creek, and one section of Little Lost Creek failed Secondary Element S5, indicating the identification of significant channel improvements since the date of effective analysis. MacDougal Branch also failed Secondary Element S10, indicating that this study used regression methods and that new regression equations have been published for this geographic area since the date of effective analysis.

Basic studies included sections of Little Lost Creek, Lost Creek, MacDougal Branch, Roark Creek, Sycamore Creek, Willow Branch, and multiple unnamed flooding sources.

Craig County, OK

Craig County was not included in the CNMS Phase 3 effort, as its maps are entirely non-digital and outdated. The only Craig County streams that fall within the watershed (approximately 45 miles) are all non-model-backed basic studies. These studies include Cow Creek, Mud Creek, the Neosho River, Russell Creek, and multiple unnamed flooding sources.

Delaware County, OK

Delaware County was included in the CNMS Phase 3 effort. The Delaware County streams that fall within the watershed include 98.3 miles of non-model backed basic studies, as well as 125.2 miles of Valid detailed studies.

Among the detailed studies, Elm Creek, a section of the Grand Lake O' the Cherokees, and two sections of North Tributary to Spring Branch did not fail a single Element. Spring Branch failed Secondary Element S10, indicating that this study used regression methods

and that new regression equations have been published for this geographic area since the date of effective analysis.

The date of effective analysis for the Grand Lake O' the Cherokees is June 1, 2001. The date of effective analysis for Spring Branch and the upstream section of North Tributary to Spring Branch is February 2, 1979. The date of effective analysis for Elm Creek and the downstream section of North Tributary to Spring Branch is November 1, 2000.

Basic studies included Cave Springs Branch, Drowning Creek, Duck Creek, Elm Creek, Fly Creek, Hickory Creek, Honey Creek, Horse Creek, Neosho River, North Tributary to Spring Branch, Spring Branch, Whitewater Creek, Wolf Creek, Wood Springs Branch, and multiple unnamed flooding sources.

Mayes County, OK

Mayes County was included in the CNMS Phase 3 effort. The Mayes County streams that fall within the Grand Lake O' the Cherokees Watershed include a 0.8-mile non-model-backed basic study, as well as a 9.5-mile Valid detailed study.

The enhanced study, a portion of the Grand Lake O' the Cherokees, did not fail any elements. The date of effective analysis for this study was June 1, 2001.

The basic study is for an unnamed stream.

Ottawa County, OK

Ottawa County was included in the CNMS Phase 3 effort. The Ottawa County streams that fall within the Grand Lake O' the Cherokees Watershed include 33.3 miles of model-backed basic studies, as well as 370.5 miles of Valid and 1.7 miles of Unverified enhanced studies.

Among the enhanced studies, Little Elm Creek, both sections of Lost Creek, and the Wyandotte Ditch did not fail any elements. Fairgrounds Branch failed Critical Element C5, indicating that the flooding source channel has been reconfigured outside of the SFHA since the date of effective analysis. Grand Lake and the Neosho River failed Secondary Element S2, indicating that repetitive loss (attributable to this flood source) outside the SFHA has been identified. Belmont Run, Quail Creek, and Tar Creek failed Secondary Element S4, indicating that four or fewer hydraulic structures have been added or removed since the date of effective analysis, as identified by aerial imagery. Belmont Run and Quail Creek failed Secondary Element S5, indicating the identification of significant channel improvements since the date of effective analysis. Belmont Run, Fairgrounds Branch, and Quail Creek failed Secondary Element S10, indicating that this study used regression methods and that new regression equations have been published for this geographic area since the date of effective analysis.

The date of effective analysis for Wyandotte Ditch is February 11, 1997. The date of effective analysis for all other enhanced studies in Ottawa County that fall within the watershed is November 1, 1986.

The basic studies include Bee Creek, Belmont Run, Brush Creek, Coal Creek, Council Hollow, Cow Creek, Elm Creek, Fairgrounds Branch, Fourmile Creek, Garret Creek,

Hickory Creek, Horse Creek, Hudson Creek, Little Elm Creek, Little Horse Creek, Lost Creek, Lytle Creek, the Neosho River, Ogeechee Creek, Quail Creek, Roark Creek, Slow Creek, Spring River, Squaw Creek, Sycamore Creek, Tar Creek, Winds Creek, Wyandotte Ditch, and multiple unnamed flooding sources.

Table 17 shows the study methodologies for Zone AE streams studied by enhanced methods and their validation status.

Table 17: Hydrologic and Hydraulic Information for Enhanced Streams

Stream Name	County	Validation Status	Date of Effective Analysis	Hydrology Model	Hydraulic Model
Elm Creek	Delaware, OK	VALID	11/1/2000	Other	HEC-RAS
Grand Lake O' the Cherokees	Delaware, OK	VALID	6/1/2001	Other	Other
North Tributary to Spring Branch (downstream)	Delaware, OK	VALID	11/1/2000	Other	HEC-RAS
North Tributary to Spring Branch (upstream)	Delaware, OK	VALID	2/1/1979	Other	HEC-2
Spring Branch	Delaware, OK	VALID	2/1/1979	Regression Equations	HEC-2
Grand Lake O' the Cherokees	Mayes, OK	VALID	6/1/2001	Other	HEC-RAS
Little Lost Creek (County)	Newton, MO	VALID	12/1/1980	HEC-1	HEC-2
Little Lost Creek (Seneca)	Newton, MO	VALID	9/1/1999	TR-20 (February 1992)	HEC-RAS 3.0.1
Lost Creek (County)	Newton, MO	VALID	12/1/1980	HEC-1	HEC-2
Lost Creek (Seneca)	Newton, MO	VALID	9/1/1999	TR-20 (February 1992)	HEC-RAS 3.0.1
MacDougal Branch	Newton, MO	VALID	12/1/1980	Regression Equations	HEC-2
Belmont Run	Ottawa, OK	VALID	9/1/1986	Regression Equations	HEC-2
Fairgrounds Branch	Ottawa, OK	UNVERIFIED	9/1/1986	Regression Equations	HEC-2
Grand Lake	Ottawa, OK	VALID	9/1/1986	OTHER	OTHER
Little Elm Creek	Ottawa, OK	VALID	9/1/1986	HEC-1	HEC-2
Lost Creek (Lower Reach)	Ottawa, OK	VALID	9/1/1986	HEC-1	HEC-2
Lost Creek (Upper Reach)	Ottawa, OK	VALID	9/1/1986	HEC-1	HEC-2

Table 17: Hydrologic and Hydraulic Information for Enhanced Streams

Stream Name	County	Validation Status	Date of Effective Analysis	Hydrology Model	Hydraulic Model
Neosho River	Ottawa, OK	VALID	9/1/1986	Other	HEC-2
Quail Creek	Ottawa, OK	VALID	9/1/1986	Regression Equations	HEC-2
Tar Creek	Ottawa, OK	VALID	9/1/1986	Other	HEC-2
Wyandotte Ditch	Ottawa, OK	VALID	2/11/1997	HEC-1	HEC-2

v. Post-Discovery Hydraulics and Floodplain Analysis

Hydraulics and floodplain mapping tasks were reviewed based on project deliverables, including the FIS reports, hydraulic models, FIRMs, and other submittals. Hydraulic modeling was not available for most basic study steams. Although CNMS had a Validated status for the Zone A streams' analysis mileage for Cherokee, Newton, and Ottawa Counties, the hydraulic models for the streams were not available on the MIP. There were no disconnects between basic and approximate study streams at county lines.

Several streams in Delaware and Newton Counties were redelineated in the most recent flood hazard studies, in which previously calculated profiles are mapped onto new topographic data. Lost Creek, Little Lost Creek, and McDougal Branch, all in Newton County, were all mapped on the effective FIRMs using redelineation, and are all NVUE Valid. The redelineated Zone A streams in Delaware County have all been assigned unknown validation status, having not yet been assessed as of December 30, 2011.

The BFEs of Lost Creek were checked on both sides of the Newton/Ottawa County line for consistency. The downstream-most BFE in Newton County is 847 feet and the uppermost BFE in Ottawa County is 848 feet. The profiles in the effective FIS reports confirm this slight difference in flood elevation. Lost Creek was studied in Newton County using HEC-RAS, and in Ottawa County using HEC-2. The flow rates were consistent, and the methodologies are both acceptable. The high water mark used as a starting elevation in the Ottawa County segment is the probable cause for the elevation dip. The hydraulics for Lost Creek should be studied continuously in a future mapping effort to remove the lag. Lost Creek has a floodway, and the floodway widths on both sides of the county line are consistent.

IV. Watershed Options

In conjunction with the assessment of risk, need, and the availability of topographic data, as well as the input of stakeholders in this watershed, flood hazard delineation projects should be initiated in the Grand Lake O' the Cherokees Watershed. Table 18 lists some potential needs in the watershed and actions that could be taken under each of the four areas discussed during the Discovery meetings, which are:

- Risk identification and communication, including traditional flood studies and data updates
- NFIP community actions, including insurance-related mitigation or information
- Mitigation planning and mitigation actions, including items related to planning updates
- Community benefits and grant opportunities, which relate to outreach and disaster preparedness as well as non-flooding hazards like safe room information

Table 18: Potential Watershed Needs and Actions

Risk Identification and Communication
• The Peoria Tribe has a spatial file with Tribal boundaries available for future updates. This file should be used in future mapping. • Benton County has 2-foot contours from 2009 available for future NFIP actions. • The Wyandotte Tribe has GIS data available for use, including Tribal boundaries. • A housing development of the Peoria Tribe east of the City of Miami is incorrectly shown in the SFHA. Base map information must be updated. • The area identified as the Miami OTSA on the effective FIRM should be labeled "Miami/Peoria Joint-Use OTSA." • The State of Kansas is collecting new LIDAR for Cherokee County that may be available for future mapping studies. • Unnamed streams' floodplains in City of Miami are incorrectly mapped, and houses that have sufficient elevation are shown as inundated. • McDonald County has high water marks available for future analyses. • The flood zone for Tar Creek in the City of Miami extends too far near Poner and 16th Streets. Homes with sufficient elevation are incorrectly shown in the SFHA. There are several high-elevation areas in the floodplain that are above the BFE and should be removed from the SFHA. A LOMA has been received for this area. • Along the Neosho River and Tar Creek, the floodwaters back up through the storm drains, flooding into streets and causing street closures. There are several locations in the Tar Creek and Neosho River SFHAs that the City of Miami has bought out because of repeat flooding. • At the confluence of the Neosho River and Little Elm Creek, the floodplain does not reflect the actual flood locations. • A split flood is mapped at the Spring River incorrectly and it does not reflect the actual split location.

Risk Identification and Communication
• On the Hudson Creek, the 2010 FIRM updates have a wider floodplain than the previous effective FIRMs. Several non-flood-prone houses have been erroneously added into the flood zones. • On the Warren Branch, the mapped SFHAs are too far and cover areas that should not be shown in the flood zone. • On unnamed flow paths in north Ottawa County, there are several high points that should be removed from the SFHAs. The northwest section of Ottawa County is poorly studied and would benefit from detailed restudy. Many areas are in the mapped floodplain that should not be. • The flood zone through Afton is too wide and should be re-analyzed with good topographic data. A new study is being conducted by USACE that may be of use in future mapping efforts. • The aerial photographs used in the Delaware Count Effective FIRMs are out of date. Mapped flood zones do not reflect actual locations, and maps that had been printed at 1”=500’ have been changed to 1”=1,000’ scale. • The mapped flood zone on Elm Creek in the City of Grove does not reflect the elevation in the area and should be revised. • When Tar Creek floods, contaminants are re-introduced into the floodplain. Plans are in place to dam the creek. Removal of mining debris is ongoing. There are ongoing EPA and CH2M Hill studies that could be used in future mapping efforts.

NFIP Community Actions
• The Peoria Tribe is building a housing addition adjacent to the flood boundary of the Little Elm Creek. A LOMR should be submitted for any changes. • The Wyandotte Tribe has purchased property with the intent of building a new industrial park and road near Spring Creek and Lost Creek. A LOMR should be submitted for any changes. • The Eastern Shawnee Tribe requests an NFIP Package. • The Modoc Tribe requests NFIP information, and to use Tribal First as an insurance provider. • The Peoria Tribe requests an NFIP Package and grant information. • There has been development that will affect the flooding along Little Elm Creek. A LOMR should be submitted for any changes. • On some locations in Ottawa County, flood extents are too broad and are shown in areas with high elevation. These areas are outside of the floodplain. LOMRs will be submitted to remove these areas. • A LOMA has been reviewed that removes locations from the SFHA of Spring Branch. • The flood zone in the 2010 effective FIRMs shows properties on the south side of the road in the flood zone even though they should not be. A LOMR will resolve this issue. • The Wyandotte Ditch is only studied to the Wyandotte town limits. It should be studied farther east because there is more development outside of the town. • A water treatment plant in the City of Commerce is near the SFHA. Lagoons along Garrett Creek have been filled and new mapping efforts should reflect the change.

Mitigation Planning and Mitigation Actions
• The Town of Disney is in the process of joining the NFIP. Much development is taking place in the town, and a copy of Changes since Last FIRM is requested. • Repeated floods occur along Sycamore Creek in the Eastern Shawnee Tribe's areas. Plans should account for the known floods. The Tribe has submitted a hazard mitigation plan. • At 1115 Larson Lane, owner requests a buyout. Surrounding properties have been bought out. • The City of Miami's wastewater treatment plant is located in Zone AE at the confluence of Tar Creek and the Neosho River. It is regularly inundated. The city must act to mitigate flooding of the facility. • The Williams Lift Station in the City of Miami is in Zone AE and is regularly inundated by flood waters. The city must act to mitigate flooding of the facility. • Storm drain at 3rd Avenue and D Street NE backs up when Tar Creek floods, causing flooded streets. The City of Miami must act to mitigate flooding. • Casinos in Ottawa County near the Missouri/Oklahoma State line are causing flooding across the State line in Missouri. An inter-agency agreement must be made to alleviate the flooding into neighboring communities. • Quail Creek overflows into Elm NE and 16th Streets when it rains. The city must act to mitigate the floods. • There are many locations along the Neosho River and Tar Creek where floods back up through the storm drains into the streets. Community actions are needed to mitigate floods. • On Elm and Tar Creeks, there is backwater from Grand Lake, sometimes up to 10 feet vertically. Floods extend to Highway 10. Mitigation will have to involve regulation of Grand Lake stillwater elevations to alleviate flooding in upstream communities.

Community Benefits and Grant Opportunities
• The Peoria Tribe has requested grant information. • Coordination with other counties and communities is needed to provide grant assistance, if warranted. • Provide grants to assist in the accomplishment of other mitigations actions identified previously. • Provide grants to assist in the continued acquisition of RL and SRL properties within the SFHA.

To further detail the list of needs captured during the Discovery meeting and in any follow-up correspondence, Table 19 provides a specific evaluation of streams or areas that could benefit from additional study. FEMA-based metrics are noted that would be met if the need or issue was addressed and if any current FEMA map actions would impact the activity. A comment or concern raised by a stakeholder during the Discovery process that could be correlated to one of the Needs or Actions for the watershed is also noted. There are some needs and actions listed that were not noted by any particular community but were

improvements that could be made in the Grand Lake O' the Cherokees Watershed to meet general FEMA Regional goals.

Needs are identified as being on the critical path as high, medium or low priority or as something that a State or local community could be tasked with completing. These definitions are also included in Table 19.

- **High** – Local community would immediately benefit from the action, and FEMA's metrics would also be met.
- **Medium** – Local community would benefit over the longer term from the action, and a portion of FEMA's metrics may be met.
- **Low** – Local community activities can continue without this revision, and FEMA's metrics are not impacted.
- **Community Action** – Activity would be more appropriate as a community-led action rather than a FEMA-led action.

Table 19: Metrics and Rankings of Needs

Item	Description of Need Evaluation Guide **Community Action** – Activity would be more appropriate as a community-led action **Low** – Local community activities can continue without this revision, and FEMA's metrics are not impacted **Medium** – Local community would benefit over the longer term from the action, and a portion of FEMA's metrics may be met **High** – Local community would immediately benefit from the action, and FEMA's metrics would also be met		Impacts from Any Current Map Actions	FEMA Metric or Community Benefit	Evaluation	Relates to Community Comment Number
	Location of Need/Project	Details				
A	All flood sources, Town of Disney, Mayes County	• The Town of Disney is in the process of joining the NFIP. • Development is taking place in the town.	• No Current Map Actions • Mayes County Effective Date: September 16, 2011	• Grant application for assistance • Useful for county zoning and planning • Update mitigation plan	Community Action	C4
B	All flood sources, City of Miami, Ottawa County	• Several homes in the city have been bought out. • Many of the streams that flood often backup through storm sewers into streets. • LOMAs are coming in for flood areas added on the 2010 effective FIRMs. • Several areas were identified that have repetitive losses.	• No Current Map Actions • Ottawa County Effective Date: August 5, 2010	• Mitigate local flooding concerns • Grant application for assistance • Update mitigation plan • Follow the LOMR process if any map changes result	Community Action	C11, M1, M2, M2A, M3, M4A, M5A, M6A, M7A, M8A, M47
C	Garrett and Tar Creeks, Ottawa County	• Former treatment lagoons along Garrett Creek have been decommissioned and filled with earth. A potential loss of storage due to the removal of lagoons will have impacts on Garrett and Tar Creeks below the confluence.	• No Current Map Actions • Ottawa County Effective Date: August 5, 2010	• Mitigate local flooding concerns • Grant application for assistance • Update mitigation plan • Follow the LOMR process if any map changes result	Community Action	M45
D	Two Unnamed Flowpaths, Ottawa County, Basic Analysis	• The backwater at the confluence of two unnamed flowpaths in Ottawa County (Ottawa DFIRM WTR_LN_ID 374 and 375) was identified by Ottawa County as incorrectly inundating high, non-flood-prone areas. • Restudy the streams by basic methods using updated methods, base map data, and terrain. • The streams are studied by basic methods in Ottawa County. • New LIDAR is available in Ottawa County. • The extents are not NVUE Valid.	• No Current Map Actions • Ottawa County Effective Date: August 5, 2010	• Validate 0.5 mile of Zone A in NVUE as Verified streams • Useful for zoning and planning for several communities • Consistent methodology and floodplain mapping across political boundaries • Update base map information	Low	M13, M47

Table 19: Metrics and Rankings of Needs

Item	Description of Need Evaluation Guide **Community Action** – Activity would be more appropriate as a community-led action **Low** – Local community activities can continue without this revision, and FEMA's metrics are not impacted **Medium** – Local community would benefit over the longer term from the action, and a portion of FEMA's metrics may be met **High** – Local community would immediately benefit from the action, and FEMA's metrics would also be met		Impacts from Any Current Map Actions	FEMA Metric or Community Benefit	Evaluation	Relates to Community Comment Number
	Location of Need/Project	Details				
E	North Tributary Branch to Spring Creek, Delaware County, Enhanced Study	• Restudy the stream by enhanced methods using updated methods, base map data, and terrain. • The river is studied by basic methods in Delaware County. • New LIDAR is available in Delaware County. • All extents are NVUE Valid.	• No Current Map Actions • Delaware County Effective Date: August 5, 2010	• Validate 1.2 miles of Zone AE in NVUE as Verified streams • Useful for zoning and planning for several communities • Consistent methodology and floodplain mapping across political boundaries • Update base map information	Low	N/A

F	Zone A Streams, Cherokee, Labette, Newton, and Ottawa Counties, Basic Study	• Restudy the streams by basic methods using updated methods, base map data, and terrain.
		• 284 miles of Zone A streams are currently NVUE Valid.
		• New LIDAR is available in Cherokee and Ottawa Counties
		• All extents are NVUE Valid.
		• Community concerns were voiced from throughout the watershed expressing dissatisfaction with the effective floodplain maps.
			• No Current Map Actions
			• County Effective Dates:
			  ○ Cherokee: November 19, 2008
			  ○ Labette: January 2, 2009
			  ○ Newton: November 26, 2010
			  ○ Ottawa: August 5, 2010
				• Re-validate 284 miles of Zone A in NVUE as Verified streams
				• Useful for zoning and planning for several communities
				• Consistent methodology and floodplain mapping across political boundaries
				• Update base map information
					Low	C5, C6, C9, C10, C11, G1, M1b, M2a, M4, M13, M15, M20, M21, M47

G	Unnamed Flow Path, Newton and Ottawa Counties, Basic Study	• An unnamed flow path (Ottawa County DFIRM WTR_LN_ID 407) is mapped in Ottawa County and not in Newton County.
		• A tie-in should be developed for continuity in the watershed.
		• New LIDAR is available in Ottawa County.
			• No Current Map Actions
			• County Effective Dates:
			  ○ Newton: November 26, 2010
			  ○ Ottawa: August 5, 2010
				• Add 1.2 miles of Zone A in NVUE as Verified streams
				• Useful for zoning and planning for several communities
				• Consistent methodology and floodplain mapping across political boundaries
				• Update base map information
					Low	N/A

H	Spring Branch, Delaware County, Enhanced and Basic Analysis	• Spring Branch was studied by enhanced methods inside the City of Grove and by basic methods outside the city. • A LOMA has removed properties from the mapped Zone AE in the City of Grove. • New LIDAR is available in Delaware County. • The Zone AE is NVUE Valid, but the Zone A is Status Unknown.	• No Current Map Actions • Delaware County Effective Date: August 5, 2010	• Re-validate 1.5 miles of Zone AE • Validate 0.2 mile of Zone A in NVUE as Verified streams • Useful for zoning and planning for several communities • Consistent methodology and floodplain mapping across political boundaries • Update base map information	Medium	M22a, M47

Table 19: Metrics and Rankings of Needs

Item	Description of Need Evaluation Guide **Community Action** – Activity would be more appropriate as a community-led action **Low** – Local community activities can continue without this revision, and FEMA's metrics are not impacted **Medium** – Local community would benefit over the longer term from the action, and a portion of FEMA's metrics may be met **High** – Local community would immediately benefit from the action, and FEMA's metrics would also be met		Impacts from Any Current Map Actions	FEMA Metric or Community Benefit	Evaluation	Relates to Community Comment Number
	Location of Need/Project	Details				
I	Sycamore Creek, Ottawa County, Basic Analysis	• Restudy the stream by basic methods using updated methods, base map data, and terrain. • There have been multiple floods from the Sycamore Creek. • The floodplain is in Zone A. • New LIDAR is available in Ottawa County. • Zone A is NVUE Valid.	• No Current Map Actions • Ottawa County Effective Date: August 5, 2010	• Re-validate 12.6 miles of Zone A in NVUE as Verified streams • Useful for zoning and planning for several communities • Consistent methodology and floodplain mapping across political boundaries • Update base map information	Medium	C8
J	Hudson Creek, Ottawa County, Basic Analysis	• Restudy the stream by basic methods using updated methods, base map data, and terrain. • The river was studied by basic methods in Ottawa County. • New LIDAR is available in Ottawa County. • All extents are NVUE Valid. • Several community comments are concerned with the quality of the floodplain mapping in the county and with the age of the base map data.	• No Current Map Actions • Ottawa County Effective Date: August 5, 2010	• Re-validate 7.6 miles of basic analyses as Verified streams • Useful for zoning and planning for several communities • Consistent methodology and floodplain mapping across political boundaries • Update base map information	Medium	M8, M47
K	Two Unnamed Flowpaths, Ottawa County, Basic Analysis	• Two unnamed flowpaths in Ottawa County (Ottawa DFIRM WTR_LN_ID 218 and 229) have been identified as having elevated areas in the Zone A SFHAs that should not be part of the floodplain. • Restudy the stream by basic methods using updated methods, base map data, and terrain. • The streams were studied by basic methods in Ottawa County. • New LIDAR is available in both counties. • The extents are not NVUE Valid.	• No Current Map Actions • Ottawa County Effective Date: August 5, 2010	• Validate 0.5 mile of Zone A in NVUE as Verified streams • Useful for zoning and planning for several communities • Consistent methodology and floodplain mapping across political boundaries • Update base map information	Medium	M13, M47

L	Fourmile Creek, Cherokee and Ottawa Counties, Basic Analysis	• Restudy the stream by basic methods using updated methods, base map data, and terrain.
		• The river is studied by basic methods in Cherokee and Ottawa Counties.
		• New LIDAR is available in both counties.
		• All extents are NVUE Valid.
		• Ottawa County is concerned with the quality of the floodplain mapping in the county and with the age of the base map data.
			• No Current Map Actions
			• County Effective Dates:
			  ○ Cherokee: November 19, 2008
			  ○ Ottawa: August 5, 2010
				• Validate 16.6 miles of Zone A in NVUE as Verified streams
				• Useful for zoning and planning for several communities
				• Consistent methodology and floodplain mapping across political boundaries
				• Update base map information
					Medium	M15, M47

Table 19: Metrics and Rankings of Needs

Item	Description of Need Evaluation Guide **Community Action** – Activity would be more appropriate as a community-led action **Low** – Local community activities can continue without this revision, and FEMA's metrics are not impacted **Medium** – Local community would benefit over the longer term from the action, and a portion of FEMA's metrics may be met **High** – Local community would immediately benefit from the action, and FEMA's metrics would also be met		Impacts from Any Current Map Actions	FEMA Metric or Community Benefit	Evaluation	Relates to Community Comment Number
	Location of Need/Project	Details				
M	Slow Creek, Ottawa County, Basic Analysis	• Restudy the stream by basic methods using updated methods, base map data, and terrain. • The river was studied by basic methods in Ottawa County. • New LIDAR is available in Ottawa County. • All extents are NVUE Valid. • Ottawa County is concerned with the quality of the floodplain mapping in the county and with the age of the base map data.	• No Current Map Actions • Ottawa County Effective Date: August 5, 2010	• Validate 3.9 miles of Zone A in NVUE as Verified streams • Useful for zoning and planning for several communities • Consistent methodology and floodplain mapping across political boundaries • Update base map information	Medium	M15, M47

N	Squaw Creek, Cherokee and Ottawa Counties, Basic Analysis	• Restudy the stream by basic methods using updated methods, base map data, and terrain.
		• The river was studied by basic methods in both counties.
		• New LIDAR is available in both counties.
		• All extents are NVUE Valid.
		• Ottawa County is concerned with the quality of the floodplain mapping in the county and with the age of the base map data.
			• No Current Map Actions
			• County Effective Dates:
			  ○ Cherokee: November 19, 2008
			  ○ Ottawa: August 5, 2010
				• Validate 8.6 miles of Zone A in NVUE as Verified streams
				• Useful for zoning and planning for several communities
				• Consistent methodology and floodplain mapping across political boundaries
				• Update base map information
					Medium	M30, M47

O	Quail Creek, Ottawa County, Enhanced Study (Single Profile)	• Restudy the stream by enhanced methods using updated methods, base map data, and terrain. • The river is studied by basic methods in Ottawa County. • New LIDAR is available in Ottawa County. • All extents are NVUE Valid. • The City of Miami is concerned with the quality of the floodplain mapping in the county and with the age of the base map data.	• No Current Map Actions • Ottawa County Effective Date: August 5, 2010	• Validate 2.3 miles of Zone AE in NVUE as Verified streams • Useful for zoning and planning for several communities • Consistent methodology and floodplain mapping across political boundaries • Update base map information	Medium	M47, P1
P	Belmont Run, Ottawa County, Enhanced Study	• Restudy the stream by enhanced methods using updated methods, base map data, and terrain. • The river is studied by basic methods in Ottawa County. • New LIDAR is available in counties. • All extents are NVUE Valid. • Flooding from Belmont Run enters storm sewers and overflows into roads through manholes.	• No Current Map Actions • Ottawa County Effective Date: August 5, 2010	• Validate 2.9 miles of Zone AE in NVUE as Verified streams • Useful for zoning and planning for several communities • Consistent methodology and floodplain mapping across political boundaries • Update base map information	Medium	M3

Table 19: Metrics and Rankings of Needs

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	Location of Need/Project	Details				
Q	Fairgrounds Branch Ottawa County Enhanced Study	• Restudy the stream by enhanced methods using updated methods, base map data, and terrain. • The river is studied by basic methods in Ottawa County. • New LIDAR is available in Ottawa County. • All extents are NVUE Valid. • Flooding from Fairgrounds Branch enters storm sewers and overflows into roads through manholes.	• No Current Map Actions • Ottawa County Effective Date: August 5, 2010	• Validate 1.7 miles of Zone AE in NVUE as Verified streams • Useful for zoning and planning for several communities • Consistent methodology and floodplain mapping across political boundaries • Update base map information	Medium	M3

R	Zone A Streams, Benton, Craig, Delaware, McDonald, and Ottawa Counties, Basic Study	• Restudy the streams by basic methods using updated methods, base map data, and terrain.
		• 167 miles of Zone A streams are currently NVUE Invalid or Unverified.
		• New LIDAR is available in Benton, Delaware, and Ottawa Counties.
		• All extents are NVUE Valid.
		• Community concerns were voiced from throughout the watershed expressing dissatisfaction with the effective floodplain maps.
			• No Current Map Actions
			• County Effective Dates:
			  ○ Benton: September 28, 2007
			  ○ Craig: November 19, 2008
			  ○ Delaware: August 5, 2010
			  ○ McDonald: May 3, 2010
			  ○ Ottawa: August 5, 2010
				• Validate 167 miles of Zone A in NVUE as Verified streams
				• Useful for zoning and planning for several communities
				• Consistent methodology and floodplain mapping across political boundaries
				• Update base map information
					Medium	C8, C9, C10, C11, G1, M2a, M13, M22, M30, M47, P3

S	Unnamed Flow Path, Newton and Ottawa Counties, Basic Study	• An unnamed flow path north of Sycamore Creek is mapped in Newton County and not in Ottawa County.
		• A tie-in should be developed for continuity in the watershed.
		• New LIDAR is available in Ottawa County.
			• No Current Map Actions
			• County Effective Dates:
			  ○ Newton: November 26, 2010
			  ○ Ottawa: August 5, 2010
				• Add 0.3 mile of Zone A in NVUE as Verified streams
				• Useful for zoning and planning for several communities
				• Consistent methodology and floodplain mapping across political boundaries
				• Update base map information
					Medium	N/A

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	Location of Need/Project	**Details**				

T	Grand Lake O' the Cherokees, Delaware, Mayes, and Ottawa Counties, Enhanced Analysis (Single Profile)	• The lake is currently mapped using statistic BFEs or mapped as Zone A.
		• The entire lake should be studied by enhanced methods.
		• The mapped extents and elevations are not consistent in effective FIRMs showing the lake.
		• Grand Lake is NVUE Valid in Delaware and Mayes Counties but not Ottawa County.
		• New LIDAR is available for entire study area.
			• LOMR 10-06-3154P
			• County Effective Dates:
			  ○ Delaware: August 5, 2010
			  ○ Mayes: January 26, 2003
			  ○ Ottawa: August 5, 2010
				• Re-validate 259 miles of lake perimeter in NVUE as Verified streams
				• Add 217 new miles of lake perimeter in NVUE as Verified streams
				• Useful for zoning and planning for several communities
				• Consistent methodology and floodplain mapping across political boundaries
				• Update base map information
					High	C4, M3a, M33, M47, P8, P9

U	Little Elm Creek, Ottawa County, Basic and Enhanced Analyses	• Restudy the stream using updated methods, base map data, and terrain. • The creek is studied by basic methods outside of the City of Miami and enhanced methods in the city. • New LIDAR is available in Ottawa County. • All extents are NVUE Valid. • Development is taking place along the creek. • Community comments indicate mapping and base data are erroneous and out of date.	• No Current Map Actions • Ottawa County Effective Date: August 5, 2010	• Re-validate 3.5 miles of Zone A and 3.5 miles of Zone AE in NVUE as Verified streams • Useful for zoning and planning for several communities • Consistent methodology and floodplain mapping across political boundaries • Update base map information	High	C3, M5, M17, M47
V	Horse Creek and Unnamed Flow Paths, Town of Afton, Ottawa County, Enhanced Analysis (Single Profile)	• Restudy Horse Creek by enhanced methods using updated methods, base map data, and terrain. • Restudy the streams in the Town of Afton by enhanced methods using updated methods, base map data, and terrain. • The rivers were studied by basic methods in Ottawa County. • New LIDAR is available in Ottawa County. • Segments of Horse Creek are NVUE Valid; other flow paths are unverified. • The town is concerned with the quality of the floodplain mapping in the county, with the hydrologic analyses, and with the age of the base map data.	• No Current Map Actions • Upcoming USACE study may be of use in future mapping efforts • Ottawa County Effective Date: August 5, 2010	• Validate 11.5 miles of Zone AE in NVUE as Verified streams • Useful for zoning and planning for several communities • Consistent methodology and floodplain mapping across political boundaries • Update base map information	High	M30, M31, M32, M34, M47

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	Location of Need/Project	Details				
W	Elm Creek, Delaware County, Enhanced and Basic Analyses	• The river is studied by enhanced methods in the City of Grove and by basic methods outside of the City. • Restudy Elm Creek by enhanced methods using updated methods, base map data, and terrain inside the City of Grove. • Restudy Elm Creek by basic methods outside of the City of Grove to validate in NVUE. • New LIDAR is available in Delaware County. • Zone AE is NVUE Valid; Zone A is Unverified. • The City is concerned with the quality of the floodplain mapping in the county, with the hydrologic analyses, and with the age of the base map data.	• No Current Map Actions • Delaware County Effective Date: August 5, 2010	• Validate 2.9 miles of Zone AE in NVUE as Verified streams • Add 2.8 miles of Zone A NVUE Valid streams • Useful for zoning and planning for several communities • Consistent methodology and floodplain mapping across political boundaries • Update base map information	High	M35, M47, P8
X	Wyandotte Ditch, Ottawa County, Basic Analysis	• Study Wyandotte Ditch by basic methods east of the Town of Wyandotte. • The ditch is only studied to Wyandotte's town limits. Wyandotte Tribe requests study east of town since there is more development outside of the Town. • The ditch is studied by enhanced methods in the Town of Wyandotte, by basic methods west of the town, and is not studied east of the town. • New LIDAR is available in Ottawa County. • Zone AE is NVUE Valid; Zone A is Unverified.	• No Current Map Actions • Ottawa County Effective Date: August 5, 2010	• Validate 0.9 mile of new Zone A in NVUE as Verified streams • Useful for zoning and planning for several communities • Consistent methodology and floodplain mapping across political boundaries • Update base map information	High	M42

Y	Lost Creek, McDonald and Ottawa Counties, Basic and Enhanced Analyses	• Restudy the stream using updated methods, base map data, and terrain.
		• The creek is studied by enhanced methods in the City of Seneca and Town of Wyandotte, and by basic methods elsewhere.
		• Flood profiles in the two counties are in disagreement.
		• New LIDAR is available in Ottawa County.
		• High water marks and historical data are available in McDonald County.
		• Development is taking place near the creek.
		• All extents are NVUE Valid.
			• No Current Map Actions
			• County Effective Dates:
			  ○ McDonald: May 3, 2010
			  ○ Ottawa: August 5, 2010
				• Re-validate 3.5 miles of Zone A and 3.5 miles of Zone AE in NVUE as Verified streams
				• Useful for zoning and planning for several communities
				• Consistent methodology and floodplain mapping across political boundaries
				• Update base map information
					High	C7, M5b

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	Location of Need/Project	Details				

Z	Neosho River, Craig and Ottawa Counties, Basic and Enhanced Analyses	• Restudy the stream using updated methods, base map data, and terrain.
		• The river was studied by basic methods in Craig and Ottawa Counties, and by enhanced methods in the City of Miami.
		• New LIDAR is available in both counties.
		• Development is taking place along the river.
		• All extents are NVUE Valid.
		• Several community comments are concerned with the quality of the floodplain mapping in the county and with the age of the base map data.
			• No Current Map Actions
			• County Effective Dates:
			  ○ Craig: April 17, 1996
			  ○ Ottawa: August 5, 2010
				• Re-validate 29 miles of Zone A and 4.9 miles of Zone AE in NVUE as Verified streams
				• Useful for zoning and planning for several communities
				• Consistent methodology and floodplain mapping across political boundaries
				• Update base map information
					High	G2, M1, M2, M3, M5, M6a, M7a, M8a, M46,M47, P4

AA	Tar Creek, Cherokee and Ottawa Counties, Basic and Enhanced Analyses	• Restudy the stream using updated methods, base map data, and terrain.
		• The creek was studied by basic methods through Cherokee County and Ottawa County until just north of the City of Commerce and by enhanced methods south to the confluence with the Neosho River in the City of Miami.
		• New LIDAR is available in both counties.
		• Development is taking place near the creek.
		• All extents are NVUE Valid.
		• Several community comments are concerned with the quality of the floodplain mapping in the county and with the age of the base map data.
			• No Current Map Actions
			• Studies by EPA and CH2M Hill may be of use in new mapping efforts
			• County Effective Dates:
			  ○ Cherokee: November 19, 2008
			  ○ Ottawa: August 5, 2010
				• Re-validate 11.1 miles of Zone A and 7.5 miles of Zone AE in NVUE as Verified streams
				• Useful for zoning and planning for several communities
				• Consistent methodology and floodplain mapping across political boundaries
				• Update base map information
					High	M1, M1b, M3, M3a, M4a, M5a, M6, M6a, M7a, M12, M18, M41, M45, M47, M50, P2, P9

AB	Craig County, countywide, Basic and Enhanced Analyses	• The last countywide FIRM of Craig County was published in 1996. • None of the SFHAs in the county are NVUE-compliant. • All SFHAs need to be digitized or restudied. • Best available topographic data are USGS National Elevation Dataset 1/3-arc-second raster files.	• No Current Map Actions • Craig County Effective Date: April 17, 1996	• All streams in Craig County added to NVUE as Verified streams • Useful for zoning and planning for several communities • Consistent methodology and floodplain mapping across political boundaries • Update base map information	High	C1, M20, M21, M46