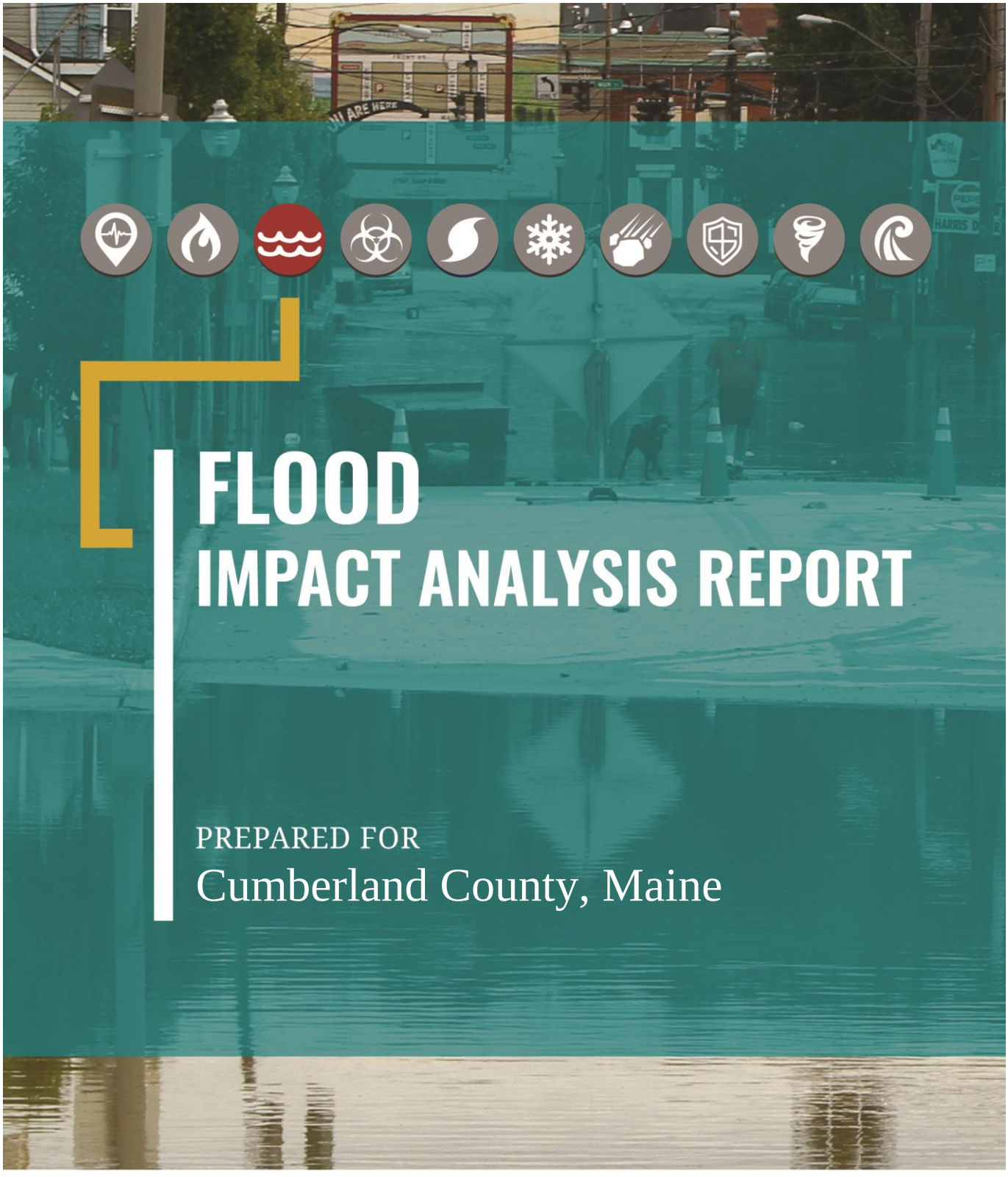


FLOOD
IMPACT ANALYSIS REPORT

PREPARED FOR

Cumberland County, Maine

THIS REPORT DEVELOPED BY

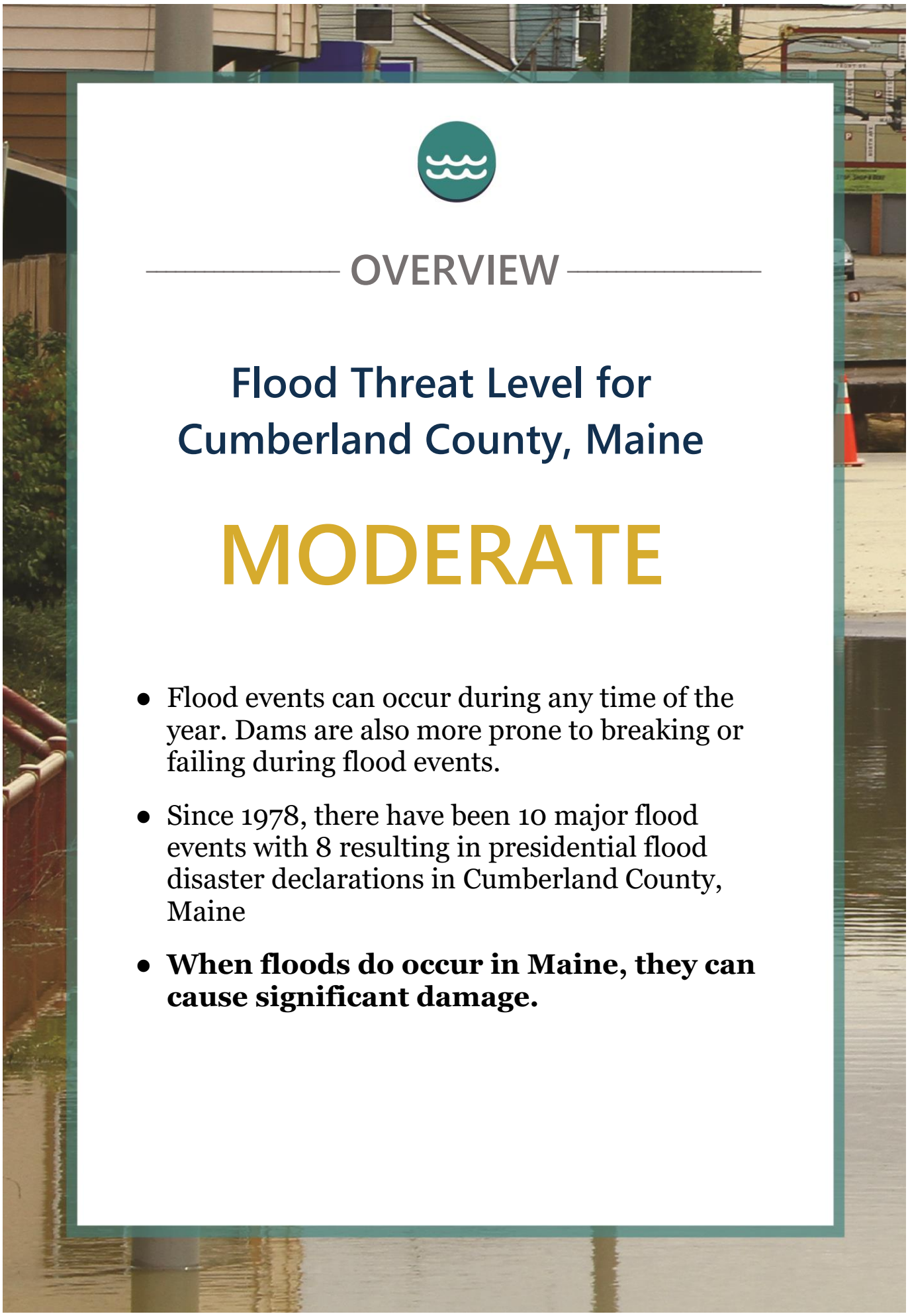
The Northeast States Emergency Consortium

1 WEST WATER STREET, SUITE 205
WAKEFIELD, MA 01880
(781) 224-9876
WWW.NESEC.ORG

UTILIZING FEMA'S

HAZUS MH
EARTHQUAKE • WIND • FLOOD

PROGRAM



OVERVIEW

Flood Threat Level for Cumberland County, Maine

MODERATE

- Flood events can occur during any time of the year. Dams are also more prone to breaking or failing during flood events.
- Since 1978, there have been 10 major flood events with 8 resulting in presidential flood disaster declarations in Cumberland County, Maine
- **When floods do occur in Maine, they can cause significant damage.**

CONTENTS

I. INTRODUCTION

The first step in preparing for and mitigating any disaster is to estimate its potential impact on an area or region. The purpose of this study is to provide emergency managers and other government decision makers with an estimate of the potential impact of a moderate to large size flood affecting Cumberland County, Maine.

METHODOLOGY The methodology used to produce the results contained in this report is called HAZUS-MH (referred to as HAZUS) which was developed by the Federal Emergency Management Agency (FEMA) in cooperation with the National Institute of Building Sciences (NIBS). HAZUS uses Geographic Information System (GIS) software to calculate, map and display flood loss data. HAZUS uses mathematical formulas and information about building stock, digital elevation models (DEMs), potential floods, economic data and other information to estimate potential losses.

DATA COMPILATION This report utilizes default data contained in the HAZUS software compiled from available national databases. This data has been augmented using available state and county data. These default databases describe in general terms the building inventory and economic and social structure of Cumberland County, Maine. The default data provide a preliminary estimate of flood losses and impacts. More accurate estimates require detailed information about local hydrology, buildings, utilities and other specific information. This data is usually available from local and state agencies and departments and typically can be added to the HAZUS data base by local and state emergency personnel. In some cases, however, technical assistance from hydrologists, engineers and GIS experts may be required.

ESTIMATION It is imperative to point out that this HAZUS impact analysis is not a precise prediction, but rather a rough estimate of potential damage, human and economic impacts that may result from a future hypothetical flood affecting Cumberland County, Maine. While this estimate is based on current scientific and engineering knowledge, there are large uncertainties in the results, especially for essential facilities. Moreover, the study results are area-wide and tend to be less accurate for individual sites or facilities. More accurate site-specific results typically require detailed hydrologic studies and site-specific examinations beyond the scope and intent of HAZUS.

DISCLAIMER ***The estimates of social and economic impacts contained in this report are based on Hazus-MH Version 4.2 that utilizes 2010 census data and current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific flood.***

II. EXECUTIVE SUMMARY OF IMPACT

The following is an Executive Summary of the estimated potential impact of a 500-year flood occurring on the major rivers of Cumberland County, Maine.

Estimated Direct Losses

Calculated by estimating the damage to buildings by wind and surge effects from the storm.

General Building Stock	$430,637,000
Lifeline Utilities	$0
Total Direct Losses	$430,675,450

Essential Facilities

By averaging probabilities, we have calculated how many essential public facilities would be non-functional as a result of this event.

Emergency Operations Centers (EOC's)	0
Police Stations	0
Fire Stations	0
Hospitals and Medical Care Facilities	0
Schools	0

Estimated Debris

By averaging probabilities, we have calculated how the functionality of essential public facilities will be impacted.

Generated (Tons)	23,515

Estimated Social Impact

By averaging probabilities, we have calculated how individuals and households will be affected.

Displaced Households	3,351
People Requiring Shelter	100

III. THE FLOOD HISTORY OF Cumberland County, Maine

Flood History

Historically, Cumberland County has suffered repeatedly from flood hazard events, both riverine and coastal. These events have resulted in significant damage to property, economic disruption, reduced access for emergency vehicles, injury and death of persons. These events are primarily associated with spring runoff events and coastal storms.

Widespread flooding occurs regularly in the spring and fall. Localized flooding occurs during the summer as a result of short high-intensity rainfall from thunderstorms. At least once in every decade, Cumberland County can expect a major flood event resulting in damage, primarily to roads.

The Study Flood

The scenario flood used for this study is based on the 500-year flood and occurs on all major rivers in Cumberland County, Maine. Figure 1 illustrates the location of the study flood event.

It is important to note that this event does not necessarily represent the greatest impact a flood could have on Cumberland County, Maine. Flood events can occur during any time of the year, from torrential summer rains, excessive spring rains combining with snowmelt runoff, to ice jams in the winter. Dams are also more prone to breaking or failing during flood events.

The Study Area

The area chosen for this study was Cumberland County, Maine with a land area of approximately 919.53 square miles and a 2010 US Census population of 281,674. The study area includes 66 census blocks which are the basic units of analysis for the HAZUS Methodology.

Figure 1 illustrates the location of the study region.

IV. DIRECT ECONOMIC IMPACT

General Building Stock

HAZUS estimates losses to the general building stock using default national inventories. This report was compiled based on HAZUS default data and has been augmented using available state and county data. Damage to the general building stock is not evaluated on a building by building basis. Rather, the methodology estimates losses based on the general character of the building stock (e.g. occupancy class, age, first floor elevation, foundation type and depth of flooding) in each census block. Damage estimates are then converted into dollar losses. The direct losses to the general building stock were estimated to be $430,637,000. HAZUS estimates the total value of the building stock exposure for Cumberland County, Maine to be $38,909,008,000. Therefore, these losses represent approximately 1.11 percent of the total value of the building stock. These total losses include direct building damage (structural, non-structural, contents and inventory) and income losses (relocation, income, wages and rental). Direct losses are $246,573,000 or 57.26 percent of the total losses with income losses of $184,064,000 accounting for the remaining 42.74 percent. Table 1 contains additional information on direct economic losses for buildings. Figure 2 is a map of Economic Losses to Buildings by census tracts.

Lifeline Utilities

The HAZUS methodology estimates losses for selected types of lifeline utilities. Lifeline utilities are vital to the function of a community or state. Damage to these systems can be devastating in terms of the health and safety of the citizens. Total direct losses to lifeline utilities facilities were estimated at $0.

The direct losses and number of non-functional facilities by type of utility were estimated to be as follows:

TYPE	LOSS	NUMBER OF NON-FUNCTIONING FACILITIES
Waste Water	$0	N/A
Electric Power	$0	N/A
Water	$0	N/A
Oil	$0	N/A
Natural Gas	$0	N/A
Communications	$0	N/A

Essential Facilities

The HAZUS methodology estimates losses for selected types of essential facilities. These include hospitals, police stations, fire stations, emergency operating centers and schools. Schools are included because of the critical role they often play as emergency shelters. Estimated losses to essential facilities are expressed in terms of their ability to function immediately following the flood. The number of non-functional essential facilities was estimated as follows:

FACILITY	NUMBER OF NON-FUNCTIONING FACILITIES
Emergency Operations Centers (EOC's)	0
Police Stations	0
Fire Stations	0
Hospitals and Medical Care Facilities	0
Schools	0

Tables for essential facilities are not included because the HAZUS Flood Model only generates results for facilities situated in the floodplain.

HIGH POTENTIAL LOSS FACILITIES HAZUS defines high potential loss facilities as dams, levees, nuclear power plant facilities and military installations. High potential loss facilities tend to be unique and complex facilities that require in-depth analysis by structural and geotechnical engineers to assess their vulnerability to all types of hazards. For this reason HAZUS is limited to providing information about the location of the study area's high potential loss facilities. The default HAZUS database does not include any of these facilities.

Dams were imported into HAZUS using available state data. Figure 3 is a map of all dams in Cumberland County, Maine in relation to the major rivers of the county. This map can serve as a first step to identify which dams could be impacted by the scenario flood.

Direct Social Impact

DISPLACED HOUSEHOLDS AND SHELTERING NEEDS Floods can cause loss of habitability of buildings which contain housing units. Loss of habitability is calculated directly from damage to residential occupancy inventory and loss of electric power and water.

The HAZUS methodology estimates the number of displaced households and the number of those households expected to seek shelter based on the number of non-functioning or

inhabitable units. HAZUS estimated that 3,351 displaced households would result in approximately 100 people requiring emergency shelter. Individuals whose housing becomes uninhabitable will likely seek alternative shelter. Many will stay with friends and relatives. Others will stay in hotels. Some will stay in public shelters. In addition, observations from past disasters show that approximately 80% of the pre-disaster homeless population will seek public shelter in time of disaster.

Table 2 contains a summary of estimated displaced households and shelter needs.

Induced Physical Damage

HAZARDOUS SUBSTANCES HAZUS defines hazardous substances as chemicals, reagents, or substances which exhibit physical or health hazards, whether the materials are in a usable or waste state.

The default database was developed using the EPA Toxic Release Inventory (TRI) Database of hazardous material sites. The HAZUS default database contains only those substances that are considered highly toxic, flammable or explosive. In addition, it is limited to those facilities where large quantities are stored. Estimating flood losses related to the release of hazardous substances would require an in-depth analysis by hydrologists, geotechnical engineers, health physicists, and chemical experts to assess their vulnerability to floods. For this reason, HAZUS is limited to providing geographic information about the location of the study area's hazardous substances and estimated flood loss. There are no hazardous materials facilities in the HAZUS default database for Cumberland County. It is recommended that this section is updated using available county data.

DEBRIS HAZUS include a model that estimates three types of debris caused by floods. The first type of debris is foundation debris, which is generally reinforced concrete and steel that tend to fall in large pieces. These large pieces of debris will need to be broken down into smaller pieces before they can be disposed of. It is likely that cranes and other heavy equipment would be required to remove this type of debris. It is estimated that 7,078 tons of foundation debris will be generated from the flood.

The other two types of debris are structural debris, which include brick, wood, and glass, and finish debris, which includes plaster walls, insulation, furniture, equipment and other materials that are smaller in size and more easily removed with a bulldozer or handheld tools. It is estimated that the flood will generate 9.26 tons of structural debris and 7,180 tons of finish debris. The combined total debris is estimated to be 23,515 tons. This amount of debris would require an estimated 940.6 twenty-five ton truck loads to remove.

Table 3 contains a summary of the debris generated by the flood broken down by type of debris.

VI. FIGURES, TABLES, AND APPENDICES

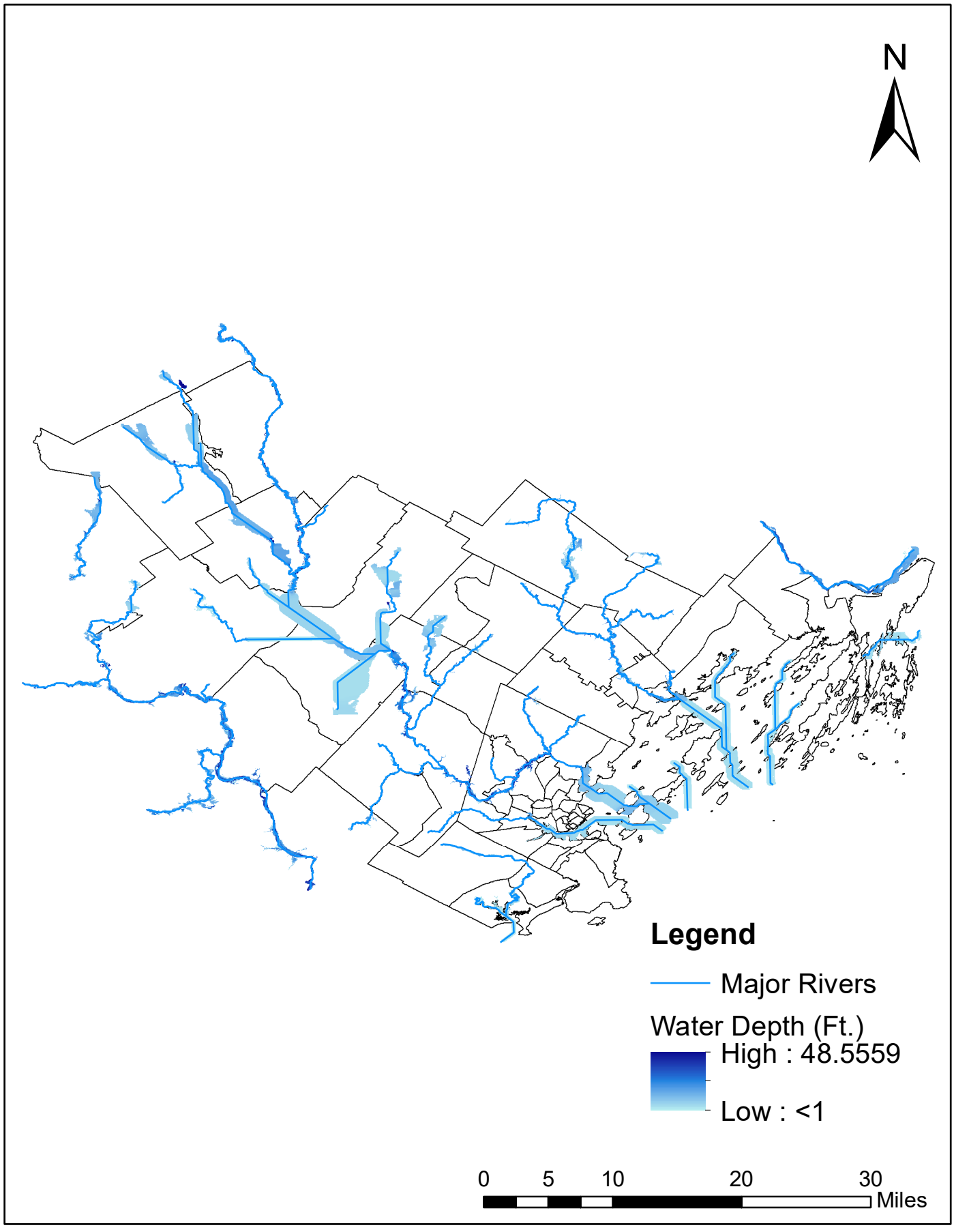
FIGURES

TABLES

APPENDICES

Figure 1

500-Year Flood Event
Cumberland County, Maine



Economic Losses for Buildings
Cumberland County, Maine

Figure 2

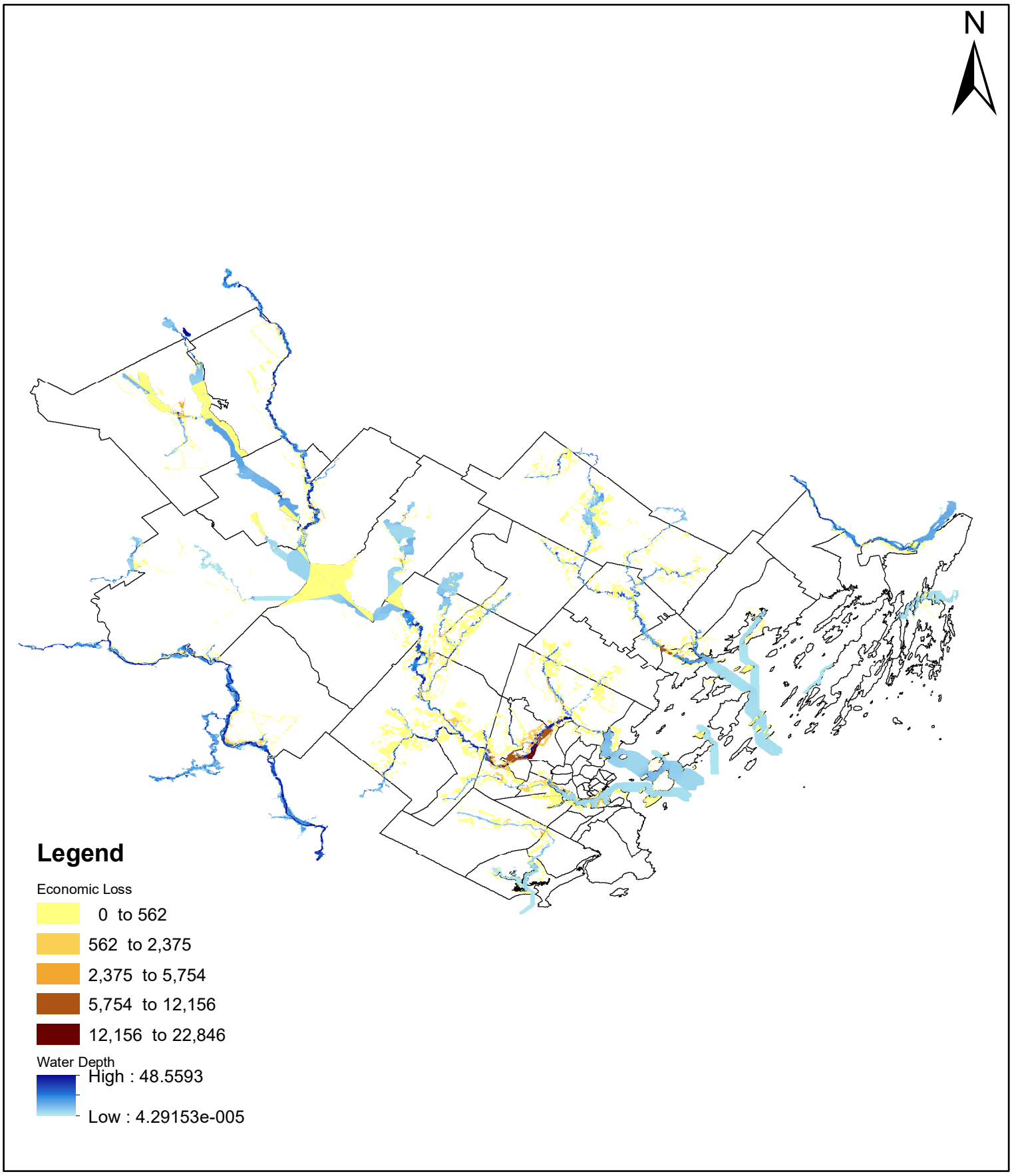


Figure 3

Dams of Cumberland County, Maine
500- Year Flood Event

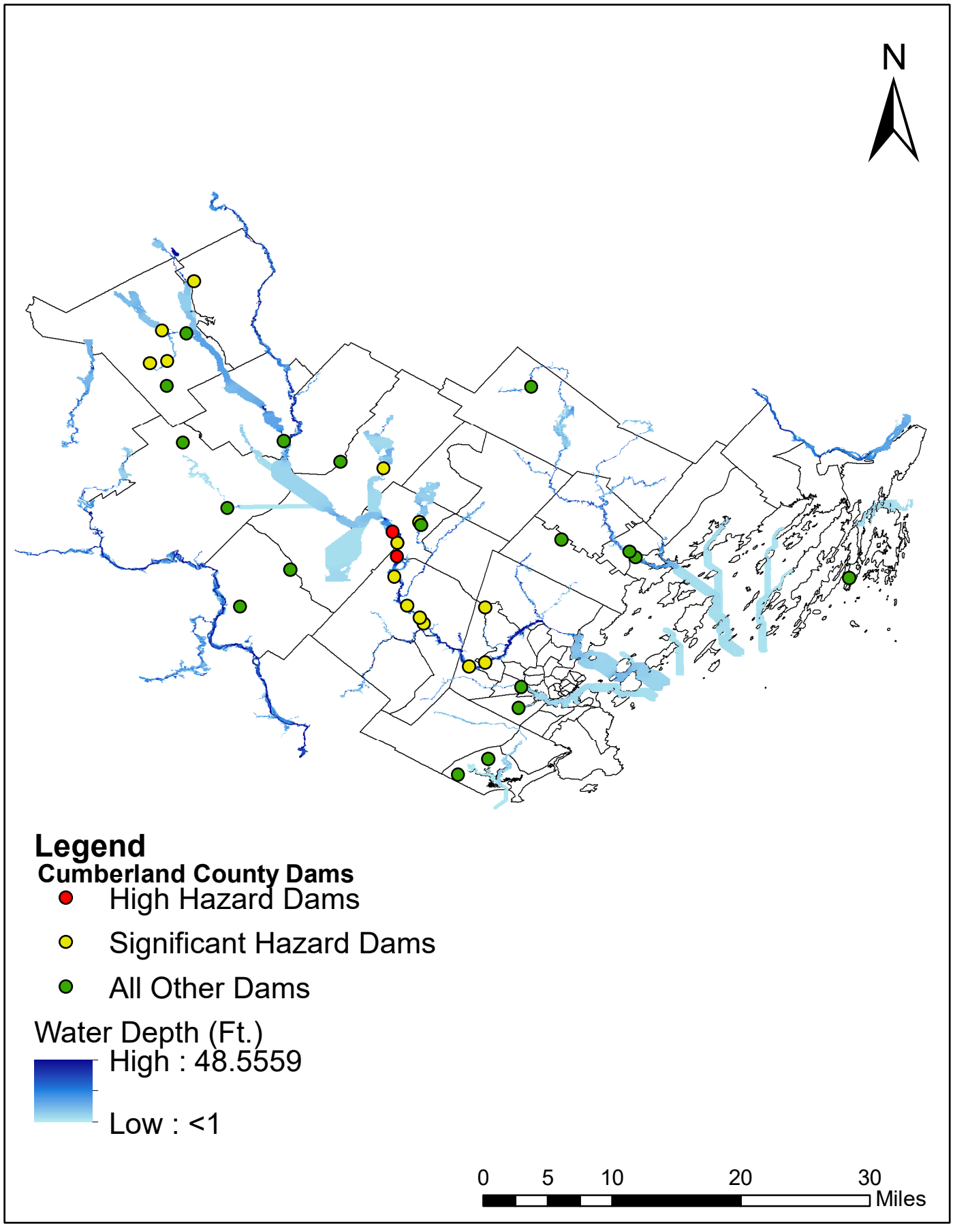


Table 1

Direct Economic Losses for Buildings

September 10, 2020

All values are in thousands of dollars

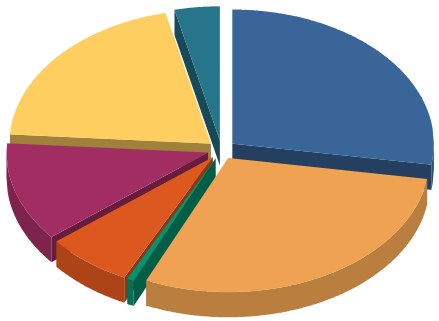
	Capital Stock Losses				Income Losses				
	Building Loss	Contents Loss	Inventory Loss	Building Loss Ratio %	Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	Total Loss
Maine									
Cumberland	118,803	124,705	3,065	2.00	29,985	50,942	87,185	15,952	430,637
Total	**118,803**	**124,705**	**3,065**	**2.00**	**29,985**	**50,942**	**87,185**	**15,952**	**430,637**
Scenario Total	**118,803**	**124,705**	**3,065**	**2.00**	**29,985**	**50,942**	**87,185**	**15,952**	**430,637**

Direct Economic Losses for Buildings

September 10, 2020

All values are in thousands of dollars

Total Direct Economic Losses for Buildings ($K)



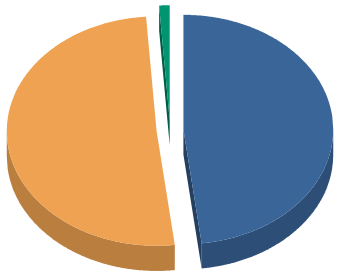
Structural Damage	$118,803
Contents Damage	$124,705
Inventory Loss	$3,065
Relocation Loss	$29,985
Capital related Loss	$50,942
Wage Loss	$87,185
Rental Income Loss	$15,952
Total:	$430,637

Direct Economic Losses for Buildings

September 10, 2020

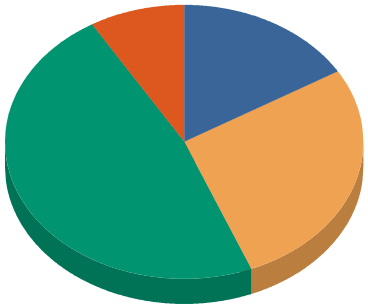
All values are in thousands of dollars

Loss by Capital Stock Categories ($K)



Structural Damage	$118,803
Contents Damage	$124,705
Inventory Loss	$3,065
Total:	$246,573

Income Losses by Categories ($K)



Relocation Loss	$29,985
Capital Related Loss	$50,942
Wage Loss	$87,185
Rental Income Loss	$15,952
Total:	$184,064

Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

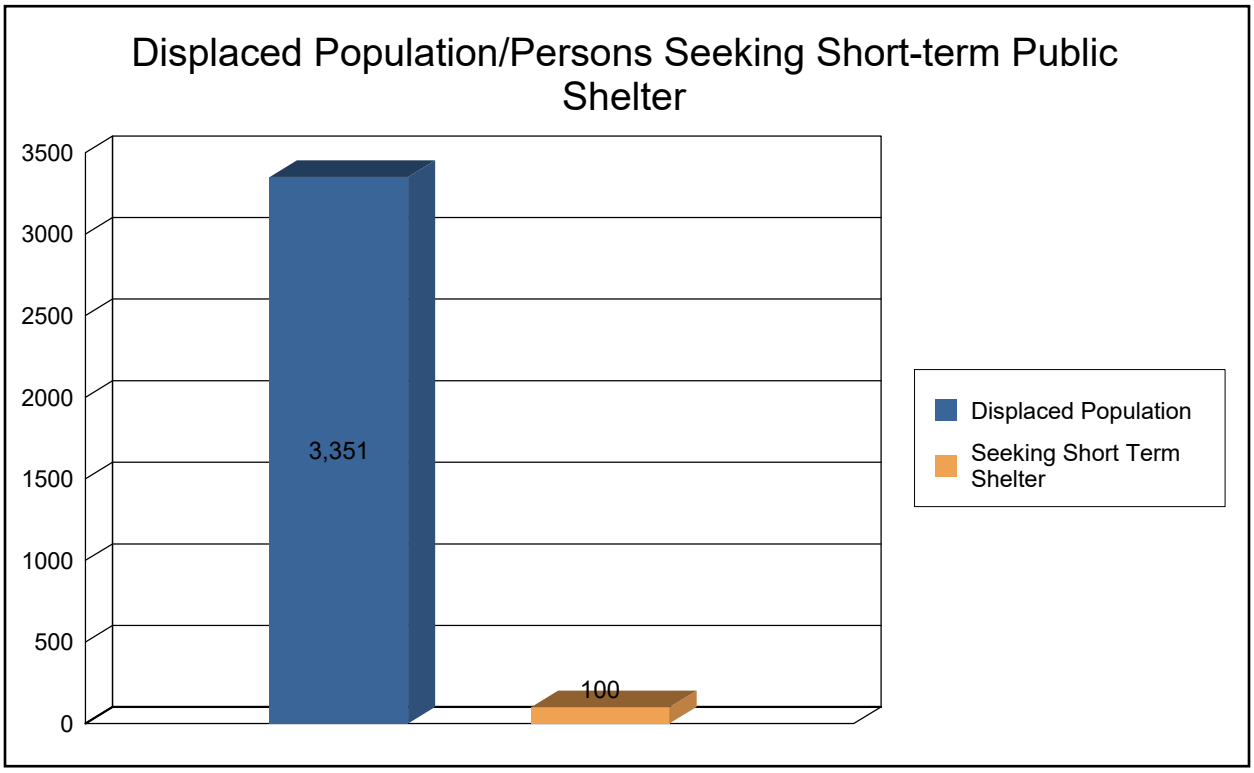
Study Region: cumberlandriverine
Scenario: 500yrflood
Return Period: 500

Table 2

Shelter Summary Report

September 10, 2020

	# of Displaced People	# of People Needing Short Term Shelter
Maine		
Cumberland	3,351	100
Total	**3,351**	**100**
Scenario Total	**3,351**	**100**



Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Study Region: cumberlandriverine
Scenario: 500yrflood
Return Period: 500

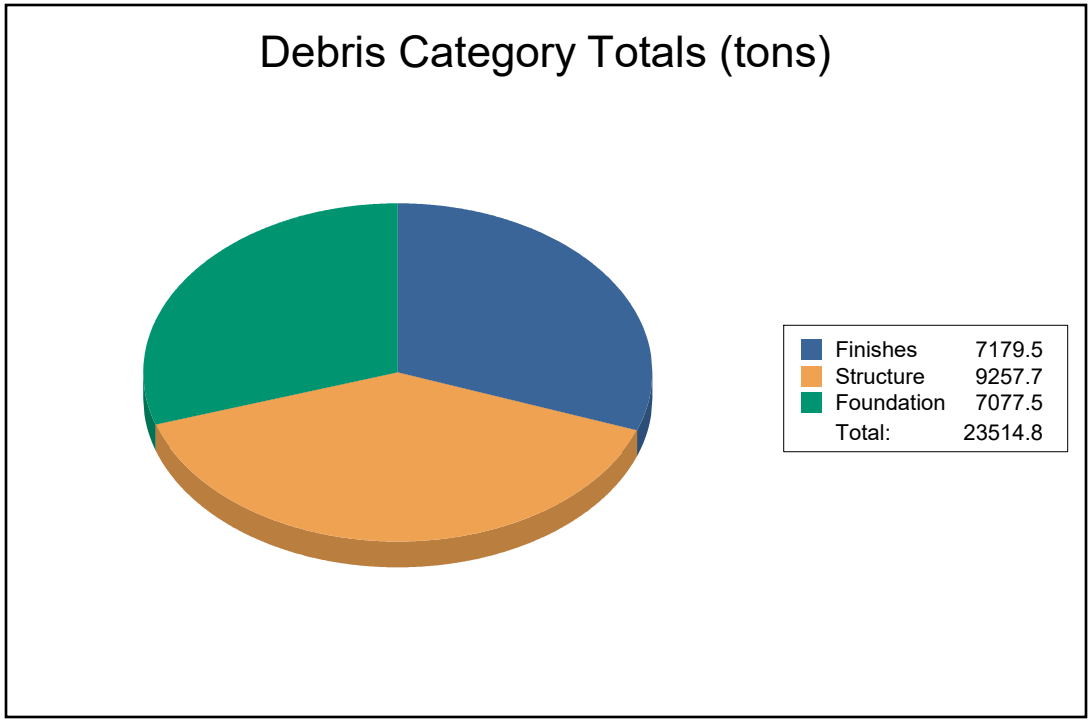
Debris Summary Report

September 10, 2020

All values are in tons.

	Finishes	Structures	Foundations	Total
Maine				
Cumberland	7,180	9,258	7,078	23,515
Total	**7,180**	**9,258**	**7,078**	**23,515**
Scenario Total	**7,180**	**9,258**	**7,078**	**23,515**

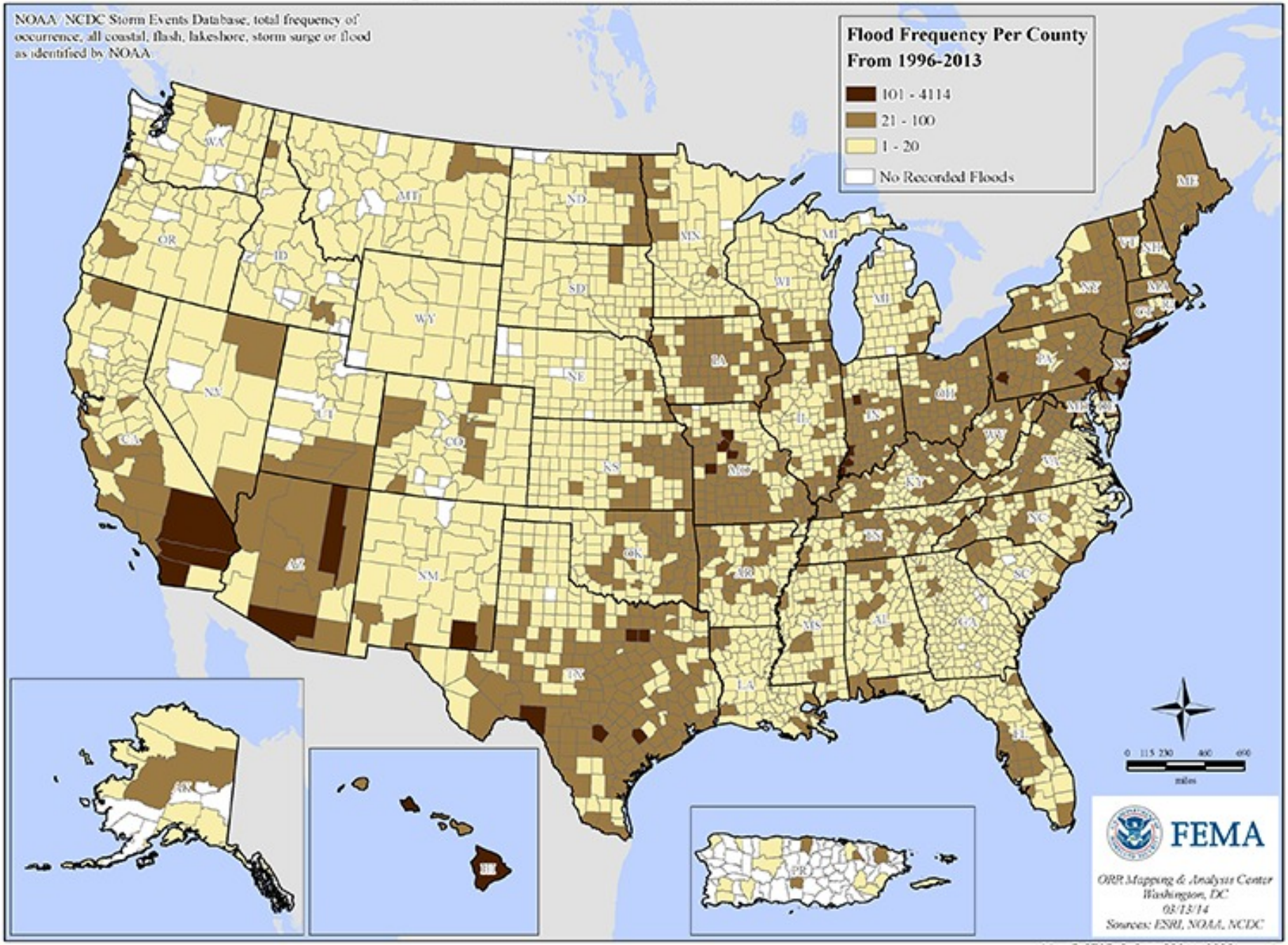
Debris Summary Report



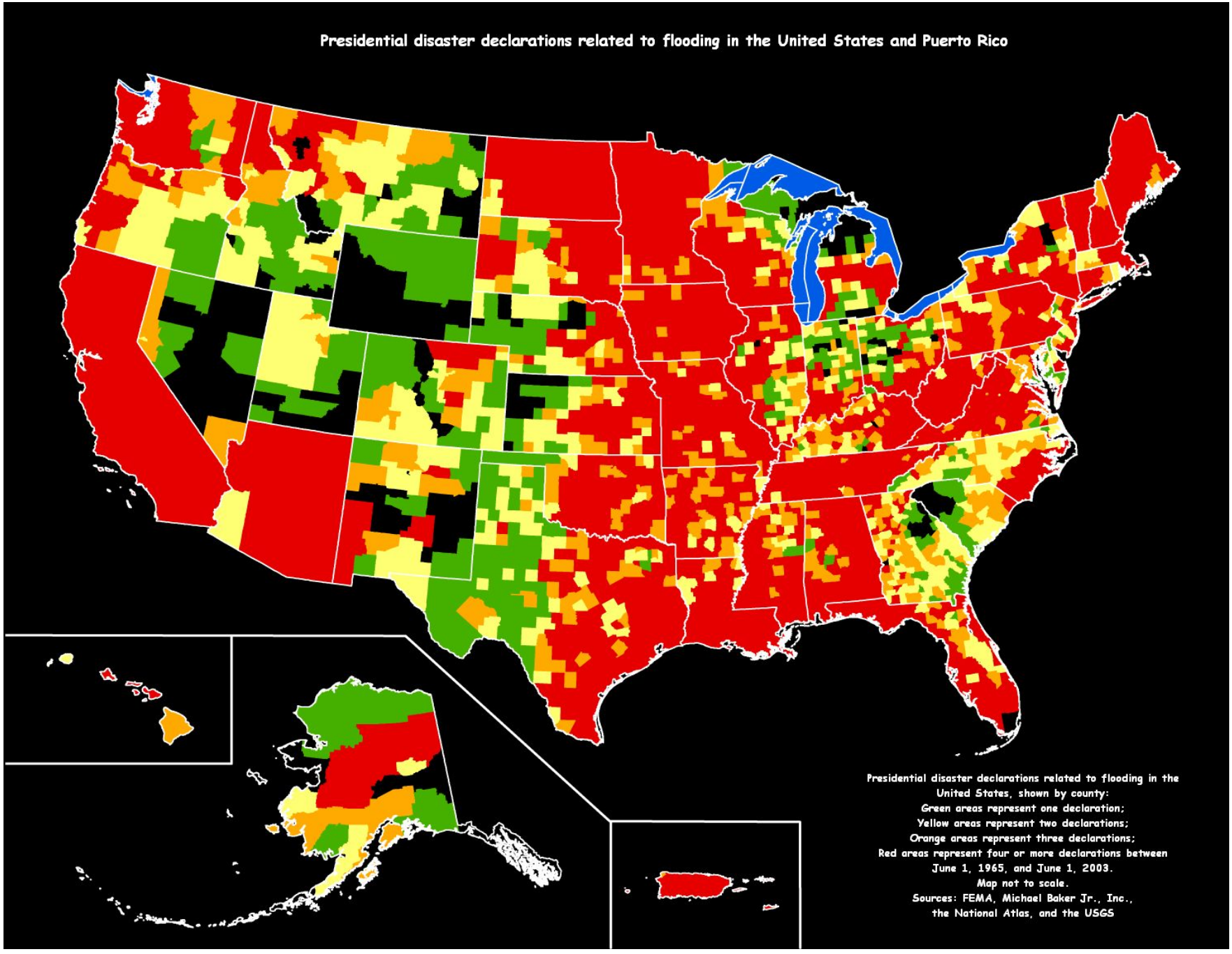
Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.

Appendix A

Frequency of Flood Events by County: 1996-2013



Appendix B


Presidential disaster declarations related to flooding in the United States and Puerto Rico
Presidential disaster declarations related to flooding in the United States, shown by county:
Green areas represent one declaration;
Yellow areas represent two declarations;
Orange areas represent three declarations;
Red areas represent four or more declarations between June 1, 1965, and June 1, 2003.
Map not to scale.
Sources: FEMA, Michael Baker Jr., Inc., the National Atlas, and the USGS