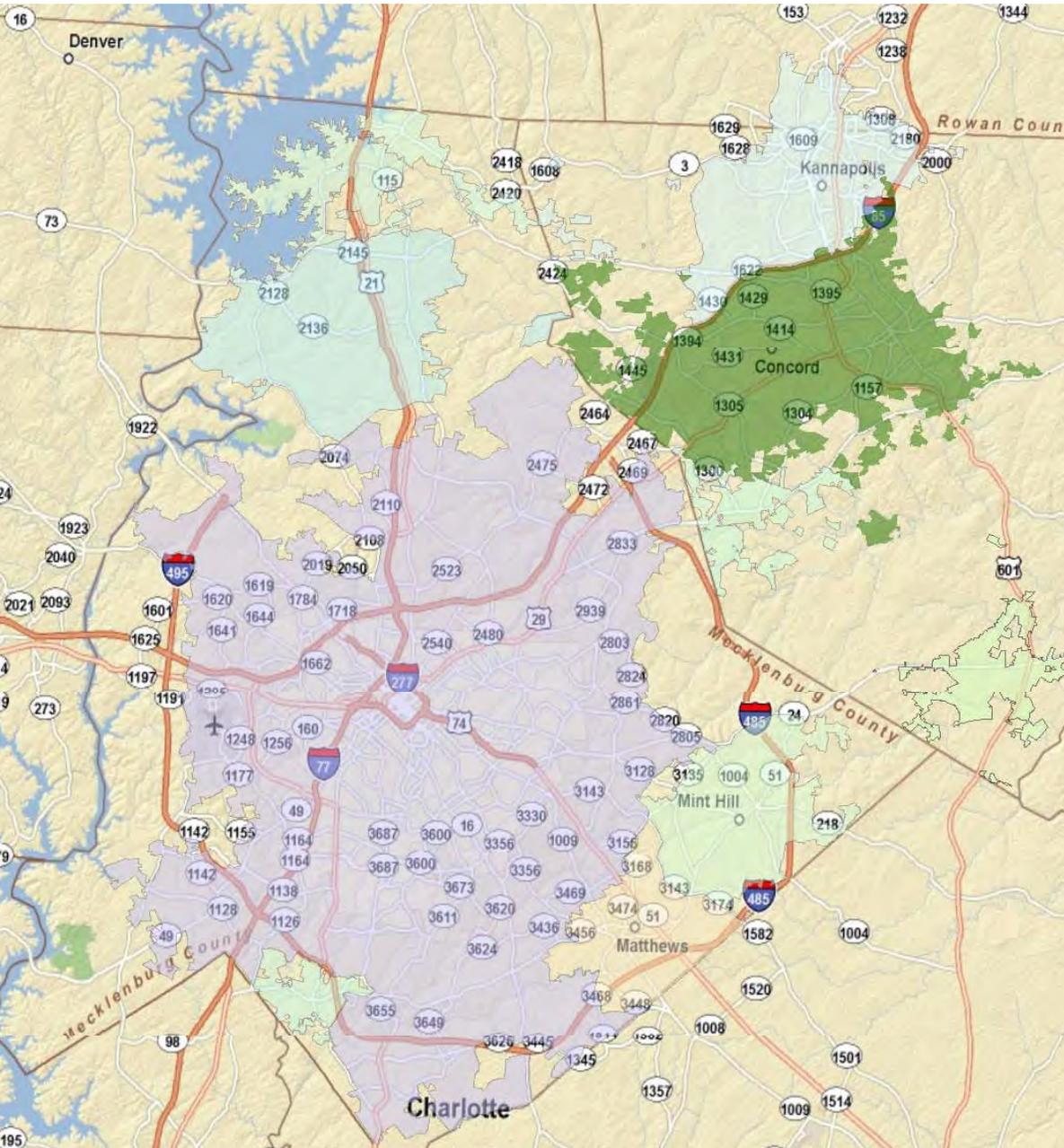


Concord

NORTH CAROLINA



NATURAL HAZARD MITIGATION PLAN

September 2010



Prepared for:

CITY OF CONCORD
P.O. Box 308
Concord, NC 28026-0308

Prepared by:

CONCORD FIRE AND LIFE SAFETY, DIVISION OF EMERGENCY
MANAGEMENT

&

CONCORD EMERGENCY PLANNING COMMITTEE

P.O. Box 308
Concord, NC 28026-0308

RECORD OF CHANGES

Change #	Date of Change	Reason	Made by
1	February 2004	Initial review by NCEM	Emergency Management
2	August 2004	Second review by NCEM	CEPC
3	September 3004	Approval by NCEM	Emergency Management
4	October 29, 2004	Change to Adoption Resolution	Legal Department
5	November 11, 2004	Resolution adoption	Emergency Management
6	March 8, 2005	FEMA Adoption	Emergency Management
7	January 15, 2006	Added Natural Hazards Center as Reference	Emergency Management
8	March 15, 2006	Annual link update	Emergency Management
9	March 4, 2007	Annual link update	Emergency Management
10	December 2, 2008	Updates from NFPI	Business and Neighborhoods
11	March 23, 2008	Annual link update	Emergency Management
12	March 19, 2009	Annual link update	Emergency Management
13	September 2009	Update from August Flooding	Emergency Management
14	September 21, 2009	Completed weather detour interactive web site	Transportation/Streets
15	November 2010	Complete Revision	CEPC
16	December 2010	Adopted Resolution for 2010 Revision	Emergency Management

Executive Summary

Concord's Natural Hazard Mitigation Plan (NHMP) Update focuses on information, actions to assist the community, public and private sector organizations, and others interested in reducing the impact of natural disasters on the community. The NHMP includes activities that may assist the City of Concord in reducing risk and preventing loss from future natural hazard events.

The Disaster Mitigation Act of 2000, Public Law 106-390 was passed by Congress on October 30, 2000. The act required local jurisdictions to have a disaster mitigation plan in order to obtain either Pre-Disaster Mitigation (PDM) or Hazard Mitigation Grant Program (HMPG) funds.

The initial Concord Natural Hazard Mitigation plan was a compilation several years of work by the Concord Division of Emergency Management and the Concord Emergency Planning Committee. That plan reflected the commitment of those whose energy created it and is a testament to the City's commitment to make Concord a more enjoyable place to work, live and play.

A natural hazard mitigation plan addresses hazards that are considered part of the natural environment of Concord. It does not include manmade hazards such as hazardous materials incident except for dam failure and wildland/urban interface fires which can have natural or manmade triggers.

Traditionally many of the hazards were considered independently. For the purposes of this Plan some consolidation was done. For example, snowstorms and ice storms were considered as winter weather and tornadoes, windstorms, and severe thunderstorms were all combined into a single category, severe weather. Several hazards were ruled out due to no local potential such as volcano, coastal storms, and tsunami. Due to the extensive research that has been conducted the past few years into the effects of climate change the decision was made to provisionally include it in the Plan, but without attempting to address mitigation measures related to it. As more is understood about the consequences for the local jurisdiction mitigation measures may be included in future editions of the Plan.

Since the adoption of the 2004 mitigation plan, some but not all of the hazards have had some level of impact on the city, either from a minor earthquake which occurred in October 2009 or the flood of August 2008 which resulted in a State Disaster Declaration. The 2009 revision includes information taken from recent studies, research and historical data. The plan is a result of reviewing existing plans, public input, and survey results to develop strategies to minimize the potential impact of hazards in Concord.

Concord has implemented multiple programs and policies which have been effective in minimizing the impacts of hazards including:

- Developing outreach activities such as the Community Emergency Response Team program, Ready Kids, and public education to enable Concord residents, businesses and visitors to survive in-place for more than three days.
- Ensuring continuation of governmental operations and provision of vital services following a hazard event, such as generators at critical facilities, departmental Continuation of Operations Planning, Work from home options and Disaster Employee Child Care.
- The documentation of natural hazard to identify venerable structures and infrastructure in order to evaluate retrofitting or other mechanisms to reduce impact.
- To mitigate against the loss of major transportation facilities in and around the City, Redmond will invest resources in building more resilient transportation networks.
- To mitigate impacts from expected increases in incidences of urban flooding, Concord implemented a Storm Water management system and continues to explore educational an warning methods.

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SECTION 1 INTRODUCTION

Introduction

This plan is an update of the 2004 City of Concord's Natural Hazard Mitigation Plan (NHMP). Although it is an update, this document has been redesigned so that it looks, feels, and reads differently than the original. This is due to several factors: new hazard information has become available that drives new definitions of risk, the City has matured and new capabilities are now available, and the new format will allow readers to more easily understand the content. In addition, the 2004 HMP included several action items that have been completed, creating an opportunity for developing new mitigation strategies.

There is a variety of hazards that pose risks to people and property in Concord. Hazards which are within the capabilities of the city to respond are considered emergencies. An event becomes a disaster if vulnerabilities are high and capabilities insufficient. The extent of destruction resulting from an event is determined by the degree to which vulnerabilities cannot be protected. Concord is at risk of both natural hazards, such as floods, and human caused events, such as a hazardous material spill. In both cases, damages can be exacerbated by alterations to the natural environment.

This HMP focuses on long-term improvement and protection of the built and natural environments, infrastructure, communication and the livelihood of the community. This plan strives to reduce the financial impacts and make the community more resilient to inevitable hazards.

This HMP identifies the hazards that pose the greatest risk to the City of Concord. The risk assessment section examines the four factors of risk: location, timing and duration, severity, and frequency. The results of this risk assessment serve as a basis to determine which hazards demand the most attention in this plan. Hazard specific vulnerabilities are addressed in Part 3, Risk Assessments.

This plan includes several hazards-related scenarios to help readers conceptualize a hazards event. The scenarios include probable secondary hazards. Through critical analyses and public input, this plan concludes with a set of long-term strategies and action items that call for more immediate attention.

Overview

The concept of Emergency Management is composed of four phases; each is interdependent on the other as part of a continuous process by which communities manage hazards. Mitigation can be considered the cornerstone of the process. Mitigation is the community's prevention methodology to reduce the impact of disaster. The mitigation plan services as the community's code book for actions it will take to accomplish its mitigation goal. When, where and to what extent of the next disaster that will impact the City of Concord is impossible to



predict. Through implantation of mitigation strategies, joint planning among departments, stakeholders, and citizens, the impact of the disaster can be reduced.

In 2004, the Emergency Management Division of the Department of Fire and Life Safety led the development of the Concord Hazard Mitigation Plan. That plan assessed the natural hazard vulnerabilities, identified mitigation efforts and funding for the benefit of the City. The document represented a cooperative effort between Elected Officials, city departments, external governmental agencies and authorities. The plan utilized input from the private sector, businesses, community organization and citizens. The plan was submitted and approved to have met all the requirements under the Stafford Act. Since the initial plan was written, it has continued to grow and change and the summary of this change is contained in this new document, a result of the five year update.

Disaster Mitigation Act of 2000 (DMA 2000) amended the Stafford Act and provided for a new and revitalized approach to mitigation planning. All disaster start at the local level and the act recognized the significance in Section 322. This section modified the requirements for the national post-disaster Hazard Mitigation Grant Program (HMGP) by basing funding eligibility on having an approved mitigation plan. An effective mitigation strategy requires coordination beginning at the local up to the Federal level to promote effective mitigation planning.¹

A mitigation plan is the development and implementation of activities designed to reduce or eliminate losses resulting from natural hazards. Increase in damage costs has resulted in methods to identify an implement means of reducing the City's vulnerability. Communities cannot prevent the occurrence of natural disasters. Communities can reduce or mitigate the effects of the hazard on life and property by identifying resources, information and strategies for risk reduction. The document will guide and coordinate mitigation activities throughout the City.

This plan contains the information necessary to provide a background on the natural disasters that can affect the City of Concord. It also contains goals and objectives to reduce the risk from these hazards through education, outreach programs, partnerships, and preventative items such as flood plain management or storm water programs.

Benefits of Mitigation Planning

Development of effective natural hazard mitigation plans necessitates that a community identify their vulnerabilities and develop strategies to lessen or eliminate the effects of the hazard. In addition the City of Concord realized the following benefits:

- **Prioritizing of Hazards:** Prioritizing of hazards provided an effective means for implementation of funding for risk reduction projects, development of regulatory standards and policies to address the hazards, and articulate the community's needs to other level of government when funding becomes available. An approved natural hazard mitigation plan is required to receive funds for HMGP projects.

- **Increased public awareness of natural hazards:** Mitigation planning serves to help residents better understand the threat to public health, safety, and welfare, economic vitality, and the operational capability of critical infrastructure. It expands understanding of potential risk reduction measures to include structural and regulatory tools, where available, such as ordinances and building codes. Through implementation of local floodplain ordinances, it is estimated that \$1.1 billion in flood damages are prevented annually.
- **Reduction of impact:** Hazard mitigation can reduce the impacts of these natural disasters in Concord. Torrential rains and tornadoes from occurring though, planning for natural hazards and implementing mitigation measures can reduce the *impact* of such events. Personal injury, loss of life, and monetary losses can be reduced. The economic and social impact on the community as a whole will be lessened.
- **Builds Partnerships:** Mitigation planning helps to build partnerships with diverse stakeholders increasing opportunities to leverage data and resources in reducing workloads as well as achieving shared community objectives. For example, managing floodplain development may decrease flood losses but also protect water quality by restoring natural functions.
- **Assures compliance:** This Plan ensures that the City is compliant with the Federal Disaster Mitigation Act of 2000 (DMA 2000) and eligible to compete nationwide for Pre-Disaster Mitigation project funds.

Planning Phases

Planning was conducted in a four-phase process as recommend by FEMA and illustrated in the diagram below:



In the first phase involved a review of the original plan and coordinating with internal departments to review and update the status of their hazard mitigation planning efforts.

External stakeholders were then integrated into the planning process through neighborhood groups meetings and other outreach programs.

In the second phase we reviewed the risks identified in the 2005 plan to identify if changes had occurred in the vulnerabilities and estimating potential impacts. This allowed the community to evaluate a change in risk and relationships to community growth and programs.

The third stage of the process involved revising old goals and objectives and developing new ones as needed. A capability assessment was conducted to identify and analyze mitigation actions and documenting the process. Not only does the City of Concord have a robust source of internal capabilities, it also has many external capabilities offered through regional planning and coordination.

Finally the plan is adopted, implemented and monitored during the interim period to ensure that the plan's goals and objectives are met.

Plan Organization

The Concord NHMP represents the City's approach to mitigating the adverse impacts of natural disasters. The plan is organized into the following sections:

Section 1: Introduction and Adoption

The Introduction provides a brief history of the Concord NHMP and its purpose. This section also establishes that the City of Concord will adopt the Plan by Executive Order. This ensures comprehensive mitigation planning citywide, strong management, and a citywide commitment to mitigation planning.

Section 2: Planning Process

This Section outlines the methodology used by the City of Concord during the creation of this plan. This includes a listing of the departments involved in the process, how they were involved, and the methods of public participation that were used.

Section 3: Natural Hazards Risk Assessment

Risk Assessment provides information on the process used by the City of Concord to identify and analyze the hazards which are considered to pose a threat. The Risk Assessment section provides a scientific and technical basis to guide the Mitigation Strategy.

Section 4: Mitigation Strategy

The Mitigation Strategy section describes how the City of Concord intends to reduce losses identified in the Risk Assessment. It includes goals and objectives to guide the selection of activities to mitigate and reduce potential losses. The section contains a prioritized list of cost-effective, environmentally sound, and

technically feasible mitigation actions. It identifies current and potential sources of funding and other resources needed to implement the mitigation actions.

Section 5: Plan Maintenance

The Plan Maintenance discusses how the City of Concord will continually monitor, evaluate, and update its mitigation plan. It establishes the review process for meeting the FEMA 5 year update.

Section 6: Appendices

This section contains the maps for the plan and a glossary of the terms used.

How to use the Plan

The Federal Emergency Management Agency defines mitigation as “the effort to reduce loss of life and property by lessening the impact of disasters.” This includes a variety of solutions such as codes which prohibit development in the floodplain, public disaster education, the Greenway Program are examples of methods the City uses to mitigate its hazards. This plan is the guide which outlines the strategies the city will employ to address its identified hazards. Implementation of the plan will improve the quality of life in Concord by increasing public safety and minimizing recovery the cost of recovery.

The Mitigation Plan represents only one portion of the City’s Emergency Management Program. Other portions include response, recovery, and preparedness which are addressed in other interoperable plans and policies such as the City’s Emergency Operations Plan.

This update is built upon the foundation laid forth in the 2004 Mitigation Plan. The NHMP provides guidance for emergency management planning and programming at the municipal level. The community can use this plan to develop similar documents, research local hazards, and coordinate disaster mitigation efforts. Internally, departments can use the portions of the plan relevant to their departments to establish goals, objectives and mitigation strategies. This plan provides the building blocks toward making the City of Concord more resilient to natural disasters.

Supporting documentation, maps, tables and charts are included throughout the document and/or in the appendices.

Concord Emergency Planning Committee

The City of Concord Natural Hazard Mitigation Plan is the result of a collaborative effort of the Departments of the City of Concord, its Citizens, public agencies, non-profit organizations, the private sector, and regional and State Organizations. It was developed in support of the Cabarrus County Hazard Mitigation Plan that coordinated the planning efforts of other local towns. The Project Committee was a component of the Concord Emergency Planning Committee that meets monthly. Plan contents were presented to the local community at two public meetings and the City receives monthly comments on its activities through the neighborhood liaison program.

Members of the Project Team consisted of:

- Allen Scott – Concord Solid Waste Director
- Jeff Corely – Concord Storm Water Department
- Christina Putnam – Concord Water Resources/Storm Water Director
- Terry Gross – Concord Water Resources Department
- Joe Wilson – Transportation Department Director
- Lex Patterson – Transportation Department Director
- Bob Pate – Electrical Utilities Director
- Larry Bradley – Electric Utilities
- Mark Fowler – Water Systems Director
- David Whitley – GIS Manager in Business & Neighborhood Services Department
- George Daniels – Business & Neighborhood Services Department
- Jeff Young – Director, Business and Neighborhood Services Department
- Lisa Eudy – Finance Department
- Margaret Pearson – Developmental Services Department
- David Rathford – Buildings and Grounds Department
- Concord Citizen Corps Council

Project Manager - Jim Sells, Emergency Management Coordinator

¹ DMA 2000, State and Local Plan Criteria: Mitigation Planning Workshop for Local Governments, <http://www.fema.gov/fima/planning_toc4.shtm>

Adoption

The following requirement(s) are met in this section:

Part 201.6(c)(5): The plan shall include documentation that the plan has been formally adopted by the local governing body of the jurisdiction requesting approval of the plan. For multi-jurisdictional plans, each jurisdiction requesting approval of the plan must document that it has been formally adopted.

Formal Adoption Process

The City manager will facilitate the adoption of the Hazard Mitigation Plan. As the Chief Executive of the City of Concord, the City Manager will request that the Mayor and Council of the City of Concord adopt the Plan on behalf of the City. This adoption assures that the City of Concord will comply with all its contents and actions of the plan. In addition, the City and its officials will comply with all applicable Federal Statutes and regulations in effect with respect to the periods which it receives grant funding in compliance with 44 CFR 13.11(c). The City of Concord will amend its plan whenever necessary to reflect changes in its mitigation strategy or changes in State of Federal laws and statutes as required in 44 CFR 13.11(d). All Departments have participated in the planning update process.

The adoption resolution is provided at the end of this section. Upon adopting the plan, the City of Concord will resolve to comply with the actions of the plan and to maintain and update the plan in keeping with the processes outlined in the plan.

Authorities and References

The Concord Natural Hazard Mitigation Plan has been adopted by the City of Concord in accordance with the authorities granted to cities as defined by the State of North Carolina (NCGS 160A). A copy of the resolution to adopt the plan is included in Section 6 Plan Adoption.

This plan was developed in accordance with current state and federal rules and regulations governing local hazard mitigation plans. The Plan shall be monitored and updated on a routine basis to maintain compliance with the following legislation:

- Section 322, Mitigation Planning, of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as enacted by Section 104 of the Disaster Mitigation Act of 2000 (P.L. 106-390) and by FEMA's Interim Final Rule published in the Federal Register on February 26, 2002, at 44 CFR Part 201.
- North Carolina General Statutes, Chapter 166A: North Carolina Emergency Management Act, as amended by Senate Bill 300: An Act to Amend the Laws

Regarding Emergency Management as Recommended by the Legislative Disaster Response and Recovery Commission (2001).

Additional authorities and references include:

Local and State:

- Cabarrus County Hazard Mitigation Plan
- Cabarrus County Emergency Operations Plan
- Concord Emergency Operations Plan
- Concord Municipal Ordinance – Chapter 26, Article II Emergency Preparedness.
- North Carolina General Statutes, Chapter 166A: North Carolina Emergency Management Act, as amended by Senate Bill 300: An Act to Amend the Laws Regarding Emergency Management as Recommended by the Legislative Disaster Response and Recovery Commission.
- State of North Carolina Natural Hazard Mitigation Plan – October 2007 Update

Federal

- Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law 93-288, as amended by Public Law 100-707
- Disaster Relief Act of 1970 (PL. 91-606)
- Title 24, Chapter XIII, Part 2205, and other relevant parts of the Code of Federal Regulations
- FEMA Regulations 44 CFR, Part 201
- FEMA Regulations 44 CFR, Part 206, Subparts M & N
- Single Audit Act of 1984
- FEMA Regulations 44 CFR, Part 13, Uniform Administrative Requirements for Grants and Cooperative Agreements to State And Local Governments, and Part 14, Administration of Grants: Audits of State and Local Governments
- Presidential Executive Order 12148, dated July 20, 1979, as amended, Federal Emergency Management
- Presidential Executive Order 12656, dated November 18, 1988, Assignment of Emergency Preparedness Responsibilities
- Federal Civil Defense Act of 1950, as amended (PL 81-920)
- Executive Orders 11988, 11990 and 12612 (Floodplain Management, Wetlands Protection and Federalism)
- Executive Order 12699 (Seismic Safety of Federal and Federally Assisted or Regulated New Building Construction)
- The National Earthquake Hazards Reduction Act of 1977, Public Law 95-124
- National Earthquake Hazard Reduction Program (NEHRP)
- National Flood Insurance Program (NFIP)
- Flood Control Act of 1968 (Public Law 90-448)
- Flood Disaster Protection Act of 1973 (PL. 93-234)
- National Flood Insurance Reform Act of 1994 (PL. 103-325)

- Federal Hurricane Preparedness Program (HPP)
- Dam Safety Act of 1986, as amended.

References:

North Carolina General Statutes 143-215.56. Delineation of flood hazard areas and 100-year floodplains; powers of Department; powers of local governments and of the Department.

143-215.56. Delineation of flood hazard areas and 100-year floodplains; powers of Department; powers of local governments and of the Department.

- (a) For the purpose of delineating a flood hazard area and evaluating the possibility of flood damages, a local government may:
 - (1) Request technical assistance from the competent State and federal agencies, including the Army Corps of Engineers, the Natural Resources Conservation Service, the Tennessee Valley Authority, the Federal Emergency Management Agency, the North Carolina Department of Crime Control and Public Safety, the North Carolina Geodetic Survey, the North Carolina Geological Survey, and the U.S. Geological Survey, or successor agencies.
 - (2) Utilize the reports and data supplied by federal and State agencies as the basis for the exercise by local ordinance or resolution of the powers and responsibilities conferred on responsible local governments by this Part.

- (b) The Department shall provide advice and assistance to any local government having responsibilities under this Part. In exercising this function the Department may furnish manuals, suggested standards, plans, and other technical data; conduct training programs; give advice and assistance with respect to delineation of flood hazard areas and the development of appropriate ordinances; and provide any other advice and assistance that the Department deems appropriate. The Department shall send a copy of every rule adopted to implement this Part to the governing body of each local government in the State.

- (c) A local government may delineate any flood hazard area subject to its regulation by showing it on a map or drawing, by a written description, or any combination thereof, to be designated appropriately and filed permanently with the clerk of superior court and with the register of deeds in the county where the land lies. A local government may also delineate a flood hazard area by reference to a map prepared pursuant to the National Flood Insurance Program. Alterations in the lines delineated shall be indicated by appropriate entries upon or addition to the appropriate map, drawing, or description. Entries or additions shall be made by or under the direction of the clerk of superior court. Photographic, typed or other copies of the map, drawing, or description, certified by the clerk of superior court, shall be admitted in evidence in all courts and shall have the same force and effect as would the original map or description. A local government may

- provide for the redrawing of any map. A redrawn map shall supersede for all purposes the earlier map or maps that it is designated to replace upon the filing and approval thereof as designated and provided above.
- (d) The Department may prepare a floodplain map that identifies the 100-year floodplain and base flood elevations for an area for the purposes of this Part if all of the following conditions apply:
 - (1) The 100-year floodplain and base flood elevations for the area are not identified on a floodplain map prepared pursuant to the National Flood Insurance Program within the previous five years.
 - (2) The Department determines that the 100-year floodplain and the base flood elevations for the area need to be identified and the use of the area regulated in accordance with the requirements of this Part in order to prevent damage from flooding.
 - (3) The Department prepares the floodplain map in accordance with the federal standards required for maps to be accepted for use in administering the National Flood Insurance Program.
 - (e) Prior to preparing a floodplain map pursuant to subsection (d) of this section, the Department shall advise each local government whose jurisdiction includes a portion of the area to be mapped.
 - (f) Upon completing a floodplain map pursuant to subsection (d) of this section, the Department shall both:
 - (1) Provide copies of the floodplain map to every local government whose jurisdiction includes a portion of the 100-year floodplain identified on the floodplain map.
 - (2) Submit the floodplain map to the Federal Emergency Management Agency for approval for use in administering the National Flood Insurance Program.
 - (g) Upon approval of a floodplain map prepared pursuant to subsection (d) of this section by the Federal Emergency Management Agency for use in administering the National Flood Insurance Program, it shall be the responsibility of each local government whose jurisdiction includes a portion of the 100-year floodplain identified in the floodplain map to incorporate the revised map into its floodplain ordinance. (1971, c. 1167, s. 3; 1973, c. 621, ss. 6, 7; c. 1262, s. 23; 1977, c. 374, s. 2; c. 771, s. 4; 1987, c. 827, ss. 154, 184; 2000-150, s. 1; 2002-165, s. 1.6.)

Section 322 Mitigation Planning, of the Robert T. Stafford Disaster Relief and Emergency Act of 2000 (PL 106-390):

MITIGATION PLANNING. {Sec. 322}

Requirement of Mitigation Plan.--As a condition of receipt of an increased Federal share for hazard mitigation measures under subsection (e), a State, local, or tribal government shall develop

and submit for approval to the President a mitigation plan that outlines processes for identifying the natural hazards, risks, and vulnerabilities of the area under the jurisdiction of the government.

Local and Tribal Plans.--Each mitigation plan developed by a local or tribal government shall describe actions to mitigate hazards, risks, and vulnerabilities identified under the plan; and establish a strategy to implement those actions.

State Plans.--The State process of development of a mitigation plan under this section shall identify the natural hazards, risks, and vulnerabilities of areas in the State; support development of local mitigation plans; provide for technical assistance to local and tribal governments for mitigation planning; and identify and prioritize mitigation actions that the State will support, as resources become available.

Funding:

In general.--Federal contributions under section 404 may be used to fund the development and updating of mitigation plans under this section.

Maximum federal contribution.--With respect to any mitigation plan, a State, local, or tribal government may use an amount of Federal contributions under section 404 not to exceed 7 percent of the amount of such contributions available to the government as of a date determined by the government.

Increased Federal Share for Hazard Mitigation Measures:

In general.--If, at the time of the declaration of a major disaster, a State has in effect an approved mitigation plan under this section, the President may increase to 20 percent, with respect to the major disaster, the maximum percentage specified in the last sentence of section 404(a).

Factors for consideration.--In determining whether to increase the maximum percentage under paragraph (1), the President shall consider whether the State has established-eligibility criteria for property acquisition and other types of mitigation measures; requirements for cost effectiveness that are related to the eligibility criteria; a system of priorities that is related to the eligibility criteria; and a process by which an assessment of the effectiveness of a mitigation action may be carried out after the mitigation action is complete.

(P.L. 106-390, § 104(a), 114 Stat. 1558).

City of Concord Resolution

A Resolution to Adopt the City of Concord Hazard Mitigation Plan

WHEREAS, each year the citizens and property within the City of Concord have the potential to suffer loss from the effects of natural and man-made hazards and with the knowledge of the risk and vulnerabilities of the community to these hazards; and

WHEREAS, the City of Concord recognizes that mitigation is a key component to reduce the impact of these hazards; and

WHEREAS, NCGS 143-215.56, 160A-174 to 160A-205 inclusive, and 160A-360 to 160A-459 inclusive; authorizes local governmental units to adopt regulations designed to promote the public health, safety, and general welfare of its citizenry; and

WHEREAS, it is the intent of the City Council that this hazard mitigation plan meet all requirements of NCGS 166A-6.01 and be approved pursuant to the Stafford Act; and

WHEREAS, Section 322 Mitigation Planning, of the Robert T. Stafford Disaster Relief and Emergency Act of 2000 (PL 106-390) requires local government agencies to develop and submit an Hazard Mitigation Plan in order to receive future Hazard Mitigation Program Funds; and

WHEREAS, it is the intent of the Council of the City of Concord to fulfill this obligation in order that the City will be eligible for federal and state assistance in the event that a state of disaster is declared for a hazard event effecting the City;

NOW, THEREFORE, be it resolved the Council of the City of Concord hereby adopts the Concord Hazard Mitigation Plan update and vests the City Manager with the responsibility and authority to:

1. Inform all interested and concerned parties of this action.
2. Cooperate with Federal, State and local agencies and private firms which undertake to study, survey, map, and identify floodplain or flood-related erosion areas, and cooperate with neighboring communities with respect to the management of adjoining floodplain and/or floor-related erosion areas in order to prevent aggravation of existing hazards.
3. Whenever an annexation or extraterritorial expansion results in a change to the City's boundaries cause all adopted floodplain management regulations to be enforced and will notify all concerned and interested parties. Whenever the City's boundaries are modified, provide notification of boundary revisions along with a map suitable for reproduction, clearly delineating municipal limits and extraterritorial jurisdiction boundaries, in order that all Flood Hazard Boundary Maps (FHBMS) and Flood Insurance Rate Maps (FIRMs) accurately represent the City's planning and other jurisdictional boundaries. .

4. Review the Hazard Mitigation Plan annually and conduct a comprehensive review once every 5 (five) years to assure that the Plan is in compliance with all State and Federal regulations and that any needed revisions or amendments to the Plan are developed and presented to the Council of the City of Concord for consideration.
5. Take such other official action as may be reasonably necessary to carry out the objectives of the Hazard Mitigation Plan.

Adopted by the Council of the City of Concord on this the 9th Day of December 2010.

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SECTION 2 PLANNING PROCESS

FEMA Requirements

The following requirements are met in this section:

- **Requirement §201.6(b):** In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:
 - An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;
 - An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and
 - Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.
- **Requirement §201.6(c)(1):** The plan shall document the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.
- **Part 201.6(b)(2):** The planning process shall include an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process.

Overview

The City of Concord maintains an active Emergency Planning Committee comprised of City Management and representatives from each department. The structure of this committee allows mitigation to be developed with input from the various professions involved in all four phases of community emergency preparedness. Since the development of the 2004 HMP, the City has incorporated a Storm Water department which has been influential in addressing mitigation strategies. The Concord Emergency Planning Committee meets monthly and is concurrently developing a Debris Management Plan, Airport Response Plan Review, Environment Emergency Response and recovery from the State Declared flood which occurred on August 28, 2008.

Each meeting involves data on current emergency management activities including data on potential hazards or reviews of recent response. The Emergency Management Division within the Department of Fire and Life Safety coordinates the review of the plan and conducts historical research for the assessment of the City's risk. Individual departments are concurrently assigned portions of the plan for review based on their experience and local knowledge. This narrowed the scope of the research based on the relevance of the associated department. Department review includes ranking of the particular hazards to evaluate changes in the risk analysis which has occurred since the original plan in 2004.

Each department is individually required to provide ranked assessments of Concord's potential hazards. Information from the Emergency Management Division's historical research enables members to make informed decisions about selecting hazards for mitigation. Feedback is provided to the Concord Emergency Planning Committee which provides direction for development of, worst-case hazard scenarios. Scenarios are either created or based on historical facts. These are then presented to the group as part of a participation exercise to encourage feedback on strategies to mitigate the effects of the scenario.

Recommendations for strategies are then incorporated into the draft HMP prior to presentation to the public for review and comment and the final strategies are used in the Hazards Mitigation Plan Update.

Mitigation Planning offers many benefits, including:

- saving lives and property;
- saving money;
- speeding recovery following disasters;
- reducing future vulnerability through wise development and post-disaster recovery and
- reconstruction;
- enhancing coordination within and across participating jurisdictions;
- expediting the receipt of pre-disaster and post-disaster grant funding; and
- demonstrating a firm commitment to improving community health and safety.

The City of Concord incorporates mitigation planning as a means to produce long-term and recurring benefits designed at reducing repetitious disaster losses. These investments reduce the impact on the community and thereby reduce the demand for post-disaster assistance. Finally, disaster mitigation provides a tool for residents, businesses and industries to recover from the effects of a disaster and restore service interruption and economic restoration.

The local hazard mitigation planning process began with organizing departmental mitigation activities and gathering information to assess hazard risks and determine how best to minimize or manage these risks. Each department has responsibility to ensure the functionality of each mitigation action. Departments evaluated the 2004 plan and provided updates to specific portions of the plan. The project began with a kick-off meeting of the emergency planning committee. Each department was requested to conduct a vulnerability assessment and risk assessment from the prospective of the individual departments.

The individual departmental assessments were evaluated to determine the overall mitigation strategy for the City. Simultaneously, we began the process to incorporate public comment into the plan design. This process is detailed in the following Section "Public Process". Comments received from the public were providing to the planning team to be incorporated into the mitigation plan concurrently with developing the

procedure for plan maintenance. A draft plan was developed and presented to each department for review while additional methods of public outreach was utilized such as Concord 101 and Public Safety Academy.

The final draft copy of the plan was then completed and forwarded to North Carolina Emergency Management for review. Comments and changes from the State review will be incorporated into the plan prior to submittal to FEMA. Final adoption/approval will be sought upon FEMA's review and addressing of any corrections.

2009 Mitigation Survey

Your community is currently engaged in a planning process to become less vulnerable to disasters caused by natural hazards, and your participation is important to us!

Municipal Departments are working together to update the City's Hazard Mitigation Plan. The purpose of this Plan is to identify and assess our community's natural hazard risks (such as flooding, winter storms, tornadoes and wildfires) and determine how to best minimize or manage those risks. Upon completion, the Plan will become presented to council for adoption and then submitted to the North Carolina Division of Emergency Management and Federal Emergency Management Agency for review and approval.

This survey questionnaire provides an opportunity for you to share your opinions and participate in the mitigation planning process. The information you provide will help us better understand your hazard concerns and can lead to mitigation activities that should help lessen the impact of future hazard events.

The information from the questionnaires and meetings was to gather "common person" information about the mitigation efforts and natural hazard risks. The intent was to also gather information from the public regarding their knowledge of the educational efforts available to them. At public events, information was made available that was useful in personal preparedness activities.

Copies of "Concord's Natural Hazard Mitigation Program" are available upon request.

Following the presentations on the mitigation planning process, the Emergency Management Davison addressed any questions and concerns raised by the committee. These were primarily related to the hazards to be addressed in the planning process and the methods and data requirements for completing the risk and capability assessments. The committee also briefly discussed the need to expand committee membership or at least invite additional stakeholders to future meetings of the Concord Emergency Planning Committee.

Public Process

It is widely known that disasters begin at the local level and this begins with the individual or family. To improve the effectiveness of the HMP, public input was a key

element of the planning process. This began with a survey to gather ideas and feedback from residents. This survey provided planners with information about the community's disaster preparedness knowledge and their perception of the threats to the City. The survey was sent through the community newsletter, posted on the city web-site, and distributed during public events.

Involving Stakeholders

The preparation of the Concord Mitigation Plan involved community surveys, public meetings and public programs as opportunities for neighboring communities, agencies, businesses, academia, non-profits and other interested parties to be involved in the planning process. The Concord Emergency Planning Committees provided an opportunity for other interested parties to participate in the development of the Hazard Mitigation Plan as were Concord Citizen Corps meetings. Attendance was encouraged through notifications and invitations. Media advertisements and survey instruments also provided local officials, residents and businesses with an opportunity to be involved and offer input throughout the mitigation planning process.

Meeting attendance

“One of the social realities to be faced in disaster planning is that the general attitude toward disaster is characterized by apathy.¹ During the development of the original plan, public turnout was poor, despite public outreach efforts, low percentages of surveys were returned and public meetings were sparsely attended. Two individual public meetings were held on April 8, 2010 and April 15, 2010 with a total attendance of 3 people (Margie Smith, Betty Crump, Roe Thompson). Economic constraints coupled with the tendency for not taking disasters seriously until after they happen, one of the many reasons for public apathy, also affects the interest in mitigation planning. Choosing where to live is not driven by risk but most often associated with careers or job availability. The risk of losing one's home is often overridden by aesthetic reasons such as the risk of storm surge is often overridden by the view from beach front property. Interest in disaster has also been found to be proportional to the frequency and magnitude of the last disaster.

Upon completion of the final draft plan, the document will be posted in the City of Concord public Website for citizen review and comment. The plan will be available at the municipal offices.

Ad Content Proof Actual Size

THE CITY OF CONCORD DIVISION OF EMERGENCY MANAGEMENT will hold two public meetings in April 2010 to receive comments on the proposed City of Concord Natural Hazard Mitigation Plan. The meetings will be held on Thursday April 8, 2010 at Concord Fire Station #9 (1020 Ivy Cline Road) and on April 15, 2010 at Concord Fire Station #8 (1485 Old Charlotte Road) beginning at 7:00 pm. The Natural Hazard Mitigation Plan is a municipal planning document and addresses the types, location, severity and probability of various natural hazards that may impact the infrastructure, environment, and citizens of the City. Citizens are invited to provide comments and information that be incorporated into the plan. For more information call Jim Sells with Concord Department of Fire and Life Safety, Division of Emergency Management at (704)920-5528 or email at sellsj@ci.concord.nc.us.

Publish: March 28, 2010.

Public Survey

A survey was also used to gather public input. This survey was sent out through the Recongized Neighborhood Program, during Concord 101, and Concord Public Safety Academy and on the City’s web page. Questions regarding the survey and opportunities to participate in the development of the Natural Hazard Migitation Plan were directed to the Emergency Management Division.

Public Survey Findings

The public response gathered indicated a concern with hurricanes, flooding, winter storms, severe thunderstorms and tornadoes. It was interesting to note that members of the public considered the affects of tropical systems versus the individual impact as associated with the remains of Hurricane Faye cause significant damage in August 2008.

Fifty percent of those who responded to the survey had experienced or had been impacted by the affects of a disaster. This could either be a local occurrence or from another local. The majority of the responses indicated that the public was somewhat concerned (75%) about the possibility of a being impacted by a disaster. The remainders were either not concerned (15%) or extremely concerned (10%).

The community selected tornado/wind storm (26%) as the one hazard that is the greatest threat to their neighborhood. This was followed closely by severe winter storm severe winter storm (24%), drought (20%), and flooding (12%). The table below compares the public perception of specific disaster impacts to the Risk Rating.

Disaster	Response	Percentage	Assessment Ranking
Tornado	33	26	6
Severe Winter Storm	24	19	1
Drought	20	16	2
Flood	15	12	3
Severe Storms	14	11	4
Major Urban Fire	7	5	N/A
Hurricane	6	5	8
Landslide	4	1	11
Hazardous Materials	2	2	N/A
Extreme Heat/Cold	2	2	7
Terrorism	1	1	N/A
Earthquake	0	0	5
Dam Failure/Levee Failure	0	0	9
Pandemic	0	0	10
Tsunamis	0	0	0
Volcano	0	0	0

Major urban fire, hazardous materials and terrorism were not considered natural hazards.

Other Outreach Programs

Concord 101

Concord also utilized two public outreach programs to gather additional information. Concord 101 is a program designed to give citizens a first hand look at their local government. This 13 week class voluntarily learned about the City of Concord, its employees, mission and organizational structure. The emergency management portion of the class was used to educate the attendees on the City's Emergency Management function and illicit input on the City's Mitigation Strategy.

Public Safety Academy

The second program is the Citizen's Public Safety Academy. This is a ten week "academy" to allow citizens to learn about the functions of Concord's Public Safety Departments, meet staff, and help us evaluate the services we provide. Emergency Management is presented during the initial class meeting. A in-depth presentation of the City's Emergency Management Program, history of disaster response and feedback on the mission and goals of the City's mitigation efforts are included in this class.

Community Preparedness Day

Community Preparedness day opportunity was at a community preparedness day hosted by a local organization and open to the public.

Additional input was provided to the public through a public meeting held at Concord Fire Station #8 and #9. These public meetings provided more information about community knowledge and the existing vulnerabilities and capabilities. Finally after updates were complete, the document updated the current document on the City's web site.

Public meetings are scheduled for April and April. The first meeting was held at Concord Fire Station #3 and the second, across town at Concord Fire Station #9. Hazard specific information was provided at each meeting (including maps where appropriate) to assist residents to identify the risks of the community. A PowerPoint presentation details the natural hazard history of Concord, a brief summary of the hazards data, the relative risk rankings and the importance of mitigation planning. One of the three scenarios used in the mitigation plan is presented and attendees were asked to discuss impacts, mitigation strategies and how preparedness can reduce the risk.

Review of existing documents

The Planning Team members reviewed various plans, studies and guides to begin developing the NHMP. These plans included hazard mitigation plans from surrounding jurisdictions and other cities, FEMA guidance documents, emergency-services documents, contingency plans, community plans, federal, state, and local regulations and ordinances, and other similar documents. The following table provides examples of the documents used in the development of our plan,:

Existing Plans and Studies

Plans/Studies/Guides	Author
North Carolina Natural Hazards Mitigation Plan	State of North Carolina
Cabarrus County Multi-Jurisdictional Hazard Mitigation Plan	Cabarrus, County NC
Concord Natural Hazard Mitigation Plan 2004	Concord, NC
Concord Emergency Operations Plan	Concord, NC
Concord Continuity of Operations Plan	Concord, NC
Wake County Hazard Mitigation Plan	Wake County
Natural Hazard Observer	Natural Hazards Center, University of Colorado at Boulder
Best Practices in Natural Hazards Planning and Mitigation	Colorado Department of Local Affairs
Billion Dollar Climate and Weather Disasters 1980 – 2005	United States Department of Commerce
Climate Change and North Carolina Inland Flooding from Coastal Storms – Lessons Learned in North Carolina	United States EPA North Carolina Department of Crime Control and Public Safety – Div. of Emergency Management
Death by Degrees The Health Threats of Climate Change in North Carolina	Physicians for Social Responsibility
A Climatology of Extreme Weather and Climate Events and other documents	National Climatic Data Center
Winter Storms	The Northeast States Emergency Consortium
Earthquake Informational Bulletin	Carl A. von Hake
Earthquakes: Frequently Asked Questions.	US Geological Survey
The Hurricane and Its Impact.	Simpson, R. and Reihl
North Carolina Center for Geographical Information and Analysis	North Carolina
Historical Hurricane Track	National Oceanic Atmospheric and Coastal Services Center
National Flood Insurance Program	FEMA
NFIP Community Rating System	FEMA
Natures Most Violent Storms	National Severe Storms Laboratory
FEMA’s How-to-Guide(Series 386-1, 2, 3, 4, and 5)	FEMA
Protection from Extreme Winds	Texas Tech University Wind Science and Engineering Research Center
2000 Census	U.S. Census Bureau
Pandemic Flu and You	State of North Carolina Department of Health and Human Services, Division of Public Health

Review Process

The Emergency Planning Team began the detailed review of the 2004 Natural Hazard Mitigation Plan in October 2008 and completed the process in December 2009. During this timeframe departments participated in internal review meetings and development meetings. Discussions indicated a major revision to the plan was warranted. The Emergency Management Division conducted one-to-one meetings with individual departments and CEPC members to devise and implement the revision strategy. Community involvement strategy was also discussed and a community survey was determined to be the best strategy.

The Emergency Management Division began with notes from the sectional review of the existing plan and drafted the new sections. Departments were then allowed to review and comment on these changes. Updates were provided at emergency planning committee meetings and at various functional team meeting conducted by the Administration Division of the City. Numerous other meetings were held such as with the Debris Management Team, Environmental Team and individual conferences with departments as needed for specific planning purposes.

Revisions to the Plan

The plan will be revised every five years and more frequently based on the annual review. The Advisory Committee will be responsible for making recommendations to the Concord Emergency Planning Committee for presentation to the City Manager. The City Manager will review the recommendations and present these recommendations to the City Council. Approved revisions will be forwarded to the North Carolina Emergency Management State Mitigation Officer for review and approval in accordance with Hazard Mitigation legislation.

Updates to the Plan

Each update to the plan will be recorded in the plan revision table after they are adopted by the City Council. Updates to the plan will be presented at the appropriate City Council meeting that is open to the public. Following the presentation of the updated plan and receipt of any public comment, the City Council has the authority to formally adopt the updated plan.

¹ Drabek, TE, Human Responses to Disaster, an Inventory of Sociological findings, New York, 1986, Springer-Verlag.

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SECTION 3 NATURAL HAZARD RISK ASSESSMENT

FEMA Requirements:

The following FEMA requirements are addressed in this section:

- **Requirement §201.6(c)(2)(i):** [The risk assessment *shall* include a] description of the type... of all natural hazards that can affect the jurisdiction.
The risk assessment shall include a] description of the ... location and extent of all natural hazards that can affect the jurisdiction. The plan *shall* include information on previous occurrences of hazard events and the probability of future hazard events.
- **Requirement §201.6(c)(2)(ii):** [The risk assessment *shall* include a] description of the jurisdictions vulnerability to the hazards described in paragraph §201.6(c)(2)(i). This description *shall* include an overall summary of each hazard and its impact on the community.
The risk assessment] *must* also address National Flood Insurance Program (NFIP) insured structures that have been repetitively damaged by floods.
- **Requirement §201.6(c)(2)(ii)(A):** [The plan *should* describe vulnerability in terms of types and numbers of] existing and future buildings, infrastructure, and critical facilities located in the identified hazard area....
- **Requirement §201.6(c)(2)(ii)(B):** [The plan *should* describe vulnerability in terms of types and numbers of an] estimate of the potential dollar losses to vulnerable structures identified in §201.6(c)(2)(ii)(A) of this description the methodology used to prepare the estimate....
- **Requirement §201.6(c)(2)(ii)(C):** [The plan *should* describe vulnerability in terms of types and numbers of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions

Risk assessment approach

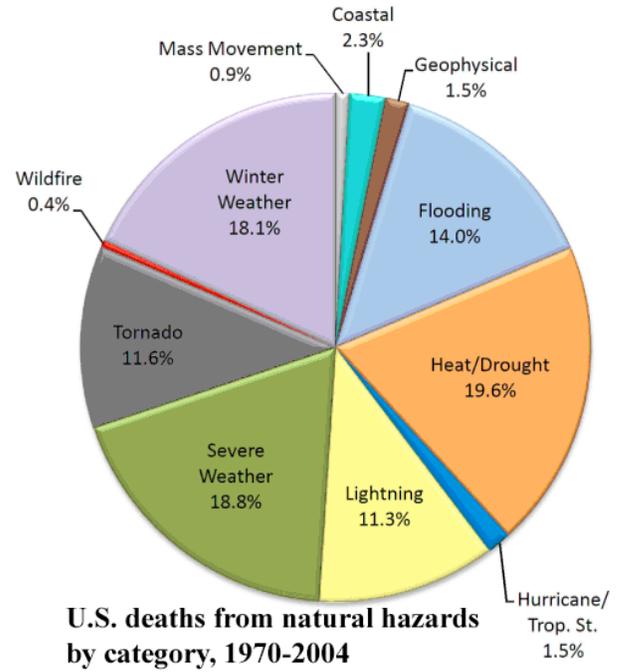
What would happen if a natural hazard occurs in Concord? This is the basic question that fuels the need for a risk assessment. In section 201.6(c) (2), FEMA requires “a description of the type, location, and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.” The intent is to help communities identify and prioritize mitigation activities that will reduce loss from identified hazards.

It is critical that risk assessment, mitigation and preparedness efforts are founded on accurate information. This section of the plan assesses the potential threats to the City of Concord – earthquakes, severe storms, flooding, wildfires, landslides, pandemics, extreme temperatures, droughts and hazardous materials spills – and the corresponding vulnerabilities. The risks have been identified based on historical events and available information about changing conditions. Changes in land use and climate change were researched in order to provide a valuable assessment of how these risks may vary from the historical patterns.

The City of Concord GIS databases were used to determine the potential impact of each hazard on the critical infrastructure and city services. Historical data and climate change

predictions were used to identify the likelihood that the identified hazards would affect Concord in the future.

Hurricanes, earthquakes, and tornadoes get the attention-grabbing headlines when a natural disaster kills people in the U.S.¹ Yet heat waves, cold winter weather, severe thunderstorm winds, and flooding all killed more people in the U.S. between 1970 and 2004, according to a December 2008 article published by Kevin Borden and Susan Cutter of the University of South Carolina. Tornadoes and lightning were tied for fifth place, and Hurricanes and earthquakes tied for eighth place. However, had this study extended one more year into 2005, the roughly 1800 hurricane deaths from Hurricane Katrina would have vaulted hurricane deaths into third place, behind heat wave deaths and cold weather deaths. The study also showed that people living in rural areas were most likely to die from a natural disaster than those living in cities.²



Hazard Identification

The first round of screening looked at a wide variety of hazards that are probable in the United States, then narrowing these down to the State Level and finally to the local level. Through this screening, the project team identified the significant risks for Concord.

Hazards in North Carolina

After looking at the wide range of national hazards, these were narrowed down by using the hazards identified in the North Carolina Multi-Hazard Mitigation Plan. These were evaluated based on historic data on the local community to produce the list of hazards included in the Concord Hazard Mitigation Plan.

NORTH CAROLINA NATURAL HAZARDS		
Hazard	Description	North Carolina Greater Hazard ³
Dam Failure	An uncontrolled release of impounded water resulting in downstream flooding.	No
Drought	A prolonged period with no rain. Limited winter precipitation accompanied by moderately dry periods during the spring and summer months can also lead to drought conditions.	No
Earthquakes	Earthquake is a term used to describe both sudden slip on a fault and the resulting ground shaking and radiated seismic energy caused by the slip, or by volcanic or magmatic activity, or other sudden stress changes in the earth.	Yes
Flooding	A flood is an overflow or accumulation of an expanse of water that submerges land.	Yes
Heat Wave	Heat waves occur when temperatures hover 10 degrees or more above the average high temperature for the region and last for several weeks	No
Hurricanes	Hurricanes are severe tropical storms that form in the southern Atlantic Ocean, Caribbean Sea, Gulf of Mexico, and in the eastern Pacific Ocean. Hurricanes develop when a tropical storm's wind speed reaches 74 miles per hour.	Yes
Infectious Disease	Infectious diseases are any diseases that can be transmitted between persons or species.	No
Landslides	Landslides occur when masses of rock, earth, or debris move down a slope. Landslides may be very small or very large, and can move at slow to very high speeds.	No
Severe Winter Storms	Severe storms are atmospheric disturbances sometimes characterized by snow, ice, sleet, and below freezing temperatures.	Yes
Thunderstorm	According to the National Weather Service, a severe thunderstorm is a	No

NORTH CAROLINA NATURAL HAZARDS		
Hazard	Description	North Carolina Greater Hazard³
and Tornadoes	thunderstorm which produces tornadoes, hail 0.75 inches or more in diameter, or winds of 50 knots (58 mph) or more. Structural wind damage may imply the occurrence of a severe thunderstorm.	
Tsunamis	A tsunamis is a series of waves of extremely long wave length and long period generated in a body of water by an impulsive disturbance that displaces the water.	No
Volcanoes	A volcano is an opening, or rupture, in a planet's surface or crust, which allows hot magma, ash and gases to escape from below the surface.	No
Wildfire	A wildfire is an uncontrolled burning of grasslands, brush or woodlands. The potential for wildfire depends upon surface fuel characteristics, recent climate conditions, current meteorological conditions and fire behavior. Hot, dry summers and dry vegetation increase susceptibility to fire in the fall, a particularly dangerous time of year for wildfire.	No

Hazard selection process

Content of existing plans and procedures were first evaluated for content regarding response to natural hazards. The North Carolina Division of Emergency Management’s Plans and Cabarrus County Plans were also referenced for procedures regarding natural’s hazards. Appendix A of the 2004 North Carolina State Hazard Mitigation Plans, Statewide Risk Assessment for Natural Hazards provided descriptions and an assessment of the natural hazards that impact North Carolina. The topography and climate of North Carolina changes dramatically from the coast to the mountains which results in varied risk levels across the regional of State for specific disasters.

Hazard Selection Worksheet

To further localize the hazard identification process each department was requested to complete a hazard selection worksheet. This sheet ranked the impact of a natural based on how it would affect the departments, operations, policies or physical infrastructure. An explanation was also requested for each hazard selected.

Historic Research

Each hazard was then researched further to support a decision to include these in the plan. Additional information was collected and analyzed from the National Oceanic and Atmospheric Administration, National Weather Service, North Carolina Department of Environment and Natural Resources, FEMA and local records.

Eliminated Hazards

The results of research the Emergency Planning Team eliminated tsunami and volcano as a local hazard risk. These are discussed briefly in the plan.

The Risk Assessment Model (described below) was used to determine the relative risk of each hazard based on the location, frequency and vulnerabilities. Three likely scenarios were written in order to illustrate the probable sequence of events. In order to understand the likely risks, each hazard was profiled considering the location, timing/duration, severity, frequency, vulnerabilities and future planned development.

Final list of City of Concord Hazards

The City of Concord is exposed to a number of natural hazards that vary in potential intensity and impact on the City. This plan addresses 6 hazards that pose a significant threat and five that pose limited or low threats.

Hazards were included in the plan based on the likelihood of occurrence and the potential impact on the City. Vulnerabilities considered include people, buildings, systems, the local economy, and the natural environment. Although heat related hazards do not currently present a significant hazard in Concord’s mild climate, climate change predictions indicate that these hazards may be more significant in the future. In addition to considering the hazards independently, the plan addresses the likelihood that one event may trigger secondary hazards or exacerbate existing conditions.

The hazards included in this plan were identified through academic research and community input. The MIC (Mitigation Implementation Committee) provided local expertise and historical knowledge to the Project Team, which subsequently conducted extensive research. The list of hazards includes all those that pose a potential risk to the City of Concord

FINAL HAZARD LISTING FOR THE CITY OF CONCORD		
Hazard	Risk	Why/Why not
Dam Failure	Low	5 of the 18 dams located within the municipal limits or with an impact potential are considered to have a High Hazard Class. Only 2 of these have EAP’s. Risk may improve upon completion, exercise of EAP’s and installation of warning systems.
Drought	Moderate	Multiple(30) historical incidents of drought with four of these being considered significant, local susceptibility to drought, economic impact.
Earthquake	Moderate	Concord is located in two different intensity zones for earthquakes, light and moderate. This relates to no potential for damage to very light damage potential. Historically only light damage has occurred.
Extreme Heat/Cold	Low	Risk may increase with climate change
Flood	Moderate	Floods occur frequently, especially localized urban flooding. Climate change and development can lead to an increase in flooding.

FINAL HAZARD LISTING FOR THE CITY OF CONCORD		
Hazard	Risk	Why/Why not
Hazardous Materials Spill	N/A	Not considered a natural hazard.
Hurricane	Low	Inland hurricane impact is mainly confined to wind and rain which are discussed in separate hazards. Actual impact from a categorized hurricane in an infrequent occurrence but can impact a large area.
Landslide	Low	Landslides in Concord are generally related to human activity and most often occurs as the result of a failed retaining structure. Old mining tunnels have been reported to exist under the down town area but these have not been evaluated for potential collapse risk.
Pandemic	Low	The individual characteristics of a pandemic can determine the impact on the community. Pandemics happen infrequently with limited affects on the natural environment, infrastructure systems or the build environment.
Severe Storm	Moderate	Severe thunderstorms bring a triple threat to the community with flooding, wind damage and fire. The threat is considered moderate. Severe Storms are combined with the discussion of tornados in this plan.
Tornado	Moderate	Tornados happen primarily in the spring and are mainly classified as weak(71%). During the last 5 year period the area has been impacted by two tornados and funnel clouds.
Tsunami	None	Concord is located approximately 153 miles from the nearest coast line(SC) and is not considered at risk from Tsunami.
Valcano	None	Does not affect the City
Wildfire	Low	Urbanization has reduced the potential for wildfire int eh area. Concord continues to have brush/wood fires but not at the magnitude of those in other areas of the state.
Winter Storm	High	It is hard to forecast winter events locally. Snow storms bring a disruption to traffic and closes schools, while ice storms seriously disrupt the transportation system, can cause large scale outages and impact business.

Hazard Vulnerability Analysis

In order to comprehensively assess the relative risk posed by hazards, the Project Team evaluated several models. The majority of the models evaluated considered the risk based on the frequency of the hazard multiplied by the vulnerability factor. Vulnerabilities were based on the impact of hazard on the build environment, systems, and population. The model deals with hazards and risks in a relative manner and the risk

rankings are to be considered within this context. Frequency and vulnerability were given equal weighting. Specifically, the model uses the following simplified equation:

$$\text{Risk} = \text{Frequency} \times \text{Vulnerability Factor}$$

Frequency

The hazard frequency was classified by evaluation of historic occurrences and rated on a scale of 0 – 3 as follows:

Frequency	
0	Hazard is unlikely to ever occur in Concord
1	Hazard may occur once in 50 to 100 years
2	Hazard may occur every ten to fifty years
3	Hazard will occur with some regularity

Vulnerability Factor

A vulnerability factor was used to address the various vulnerabilities based on the severity of a hazard allowing for the community’s mitigation efforts (preparedness, initial response and external response). The possibility of death or injury (human impact), physical losses and damages (property impact) and interruption of services (business impact) are each assigned a zero to three value. In order to equally weight the potential impact of a hazard, the community’s mitigation efforts were deducted from the severity. The vulnerability ratings used the following equation:

$$\text{Vulnerability Factor} = (\text{Human} + \text{Built} + \text{Natural} + \text{Severity})/5$$

The vulnerability factor was then classified on a 0-3 scale)

Vulnerability Factor	
0	The vulnerable population or system will not be affected
1	Event causes some mild disturbances to some systems, buildings, natural environment or populations
2	Event causes some mild disturbances to all systems, buildings, natural environment or populations OR event causes severe disturbance to some systems, buildings, natural environment or populations
3	The entire City is significantly affected by the event

Based on the information provided about each of the hazards, the assessment used the following equation to complete the Hazard Rating Chart:

$$\text{Risk} = \text{Frequency} \times ((\text{Human} + \text{Built} + \text{Natural} + \text{Systems} + \text{Severity})/5)$$

Due to the variability inherent in each of the hazards and the rating system, the risks were divided into categories of low, moderate and high-risk hazards. The relative ranking

established by this model provided a framework for the risks and strategies addressed in the Hazards Mitigation Plan.

Concord Risk Assessment Model

Event	Frequency	Vulnerability					Vulnerability Factor	Risk Rating	Risk Level
		Built	Natural	Systems	Population	Severity			
Possible Rankings	0 – 3	0 – 3	0 – 3	0 – 3	0 – 3	0 – 3	0 – 3	0 – 9	Low – High
Dam/Levee Failure	1	1.27	1.55	1.45	1.55	1.45	1.45	1.5	Low
Drought	3	1	2.64	1.73	2.64	2	2.0	6.0	Moderate
Earthquake	2	2.27	1.55	2.27	2.18	2.09	2.0	4.0	Moderate
Extreme Heat/Cold	2	1	1.73	1.55	2.09	1.61	1.6	3.2	Low
Flooding	3	2.25	1.91	2.0	1.91	2	2.0	6.0	Moderate
Hurricanes	1	2.09	2.09	2.36	2.45	2.25	2.3	2.3	Low
Tornado	2	2	1.82	1.73	2	1.91	1.9	3.8	Moderate
Severe Storms	3	1.55	1.82	1.82	1.91	1.77	1.8	5.4	Moderate
Tsunamis	0	0	0	0	0	0	0	0	0
Volcano	0	0	0	0	0	0	0	0	0
Landslide	1	1.09	1.18	1.09	1.09	1.11	1.1	1.1	Low
Winter Storm	3	1.73	2.18	2.45	2.73	2.3	2.3	6.9	High
Pandemic	1	0.82	0.36	1.36	2.64	1.32	1.3	1.3	Low

Note: Hurricane is an event in which the system is still a tropical storm or hurricane when it affects Concord. Indirect affects are included under the specific event class such as floods.

Mitigation efforts

- Preparedness activities included based on:
- the state of current plans,
- frequency of drills,
- training status,
- budgeting, and
- availability of alternate sources for critical supplies/services

Internal resources are considered based on the:

- Types of supplies on hand/will they meet need?
- Volume of supplies on hand/will they meet need?
- Staff availability
- Coordination with MOB's
- Availability of back-up systems
- Internal resources ability to withstand disasters/survivability

Considerations for external resources included, but were not limited to:

- Types of agreements with community agencies/drills?
- Coordination with local and state agencies
- Coordination with proximal health care facilities
- Coordination with treatment specific facilities
- Community resources

Concord's Hazard Environment

Since the original City of Concord Hazard Mitigation Plan in 2004, the community has continued to feel the impacts of natural disasters mentally, physically, and economically. In August 2008, the remnants of Tropical Storm Faye caused extensive flooding and resulted in a State Disaster Declaration. Damage to the City's infrastructure was over \$1.3 million and included washed out roadways, limited evacuations, damaged culverts, and damage to facilities. Since 2004 the City has grown and new hazard information has become available. The City has also matured with new capabilities and resources. Several items in the 2004 HMP have been completed and opportunities have arisen to create opportunities for developing new strategies.

The community has continued to partner with the City of Concord update the HMP and addresses developing concerns regarding the impacts of natural hazards.

The Natural Environment

Geography

Concord is located in the Southern Piedmont area of North Carolina. This is within Area 12 of the Western Branch, North Carolina Division of Emergency Management and Region IV of the Federal Emergency Management Agency. Concord is also the governmental seat of Cabarrus County. The City of Kannapolis is located to the north, the Town of Mt. Pleasant to the east, Midland to the south and the Town of Harrisburg to the west.

The City of Concord receives raw water and sewer outfall lines from the Water & Sewer Authority of Cabarrus County. The raw water is then treated and distributed to residents. The system is connected to the Charlotte Mecklenburg water system to the west and Kannapolis water system to the north.

Concord's topography is common to the southern piedmont of North Carolina with gently rolling hills. The Piedmont is a transitional region of the state located between mountains to the west and coastal plains to the east. The extremes in elevation include a low of 500 feet to a height of 750 feet. Rocky River is the largest source of water in the area with tributaries of Coddle Creek, Irish Buffalo Creek, Thee Mile Branch and Dutch Buffalo Creek all sources for Rocky River.

Concord's inland location often allows protection from the violence of Atlantic Hurricanes or Gulf Coast Hurricanes. These often provide relief from the hot summer dry periods and are commonly associated with flooding. Each year, thunderstorms can cause damage from high winds, hail, localized flooding and tornados.

During winter months, Concord can be impacted by winter storms. These usually result in traffic problems; power outages and damage to property from ice or snow build up. While major accumulations are not common, the area has been impacted by significant

damage during winter storms in 1980, 1989, 2000 and 2002. This includes at least one presidential declaration.

Flooding in the area is usually localized which results in stranded motorists and limited evacuations. The area received a State Disaster Declaration for a major flood which occurred on August 26, 2008. During this event the local community had over \$1.3 million in damages.

Climate

The City of Concord has a mild climate characterized by cool winters and warm summers. Temperatures reach the freezing point slightly more than half of the winter days. Winter weather can be described as changeable with occasional cold periods, but extreme cold periods are rare. Snow is infrequent and can occur as early as November or December. Heavy snowfalls have occurred, but do not tend to remain accumulated on the ground for more than a day or two. On the average, temperatures have reached freezing in early April in the spring and early November in the fall.

Summers are long and described as warm and humid. Afternoon temperatures are often in the low 90's, but 100's are not common. Rainfall is generally evenly distributed throughout the year, with the driest weather usually in the fall. Summer rain is usually provided by thunderstorms and occasional dry periods of one to three weeks can occur.

Topography

Concord is located in the Piedmont topographic region of North Carolina. The Piedmont is the middle region of the state, located between the Coastal Plain and the Mountain regions. Piedmont is a French word meaning "foot of the mountain." The elevations of this region range from about 300 feet in the western Coastal Plain to about 1,500 feet near the mountains. The boundary between the Coastal Plain and the Piedmont is called the fall line or fall zone. Along this are, rivers flow from the older, harder rocks of the Piedmont to the softer rocks of the coastal Plain. Along the fall line, rivers form shoals, low waterfalls, and rapids. Below the fall line, streams are usually sluggish and smooth-flowing. Above the fall line, the streams are rocky and shallow, making boating difficult. The land of the Piedmont is called a plateau because it is high and mostly flat.. This plateau of rolling hills is composed of red clay and increases in elevation from east to west rising from 300 to over 600 feet.

The Social Environment

Demographics

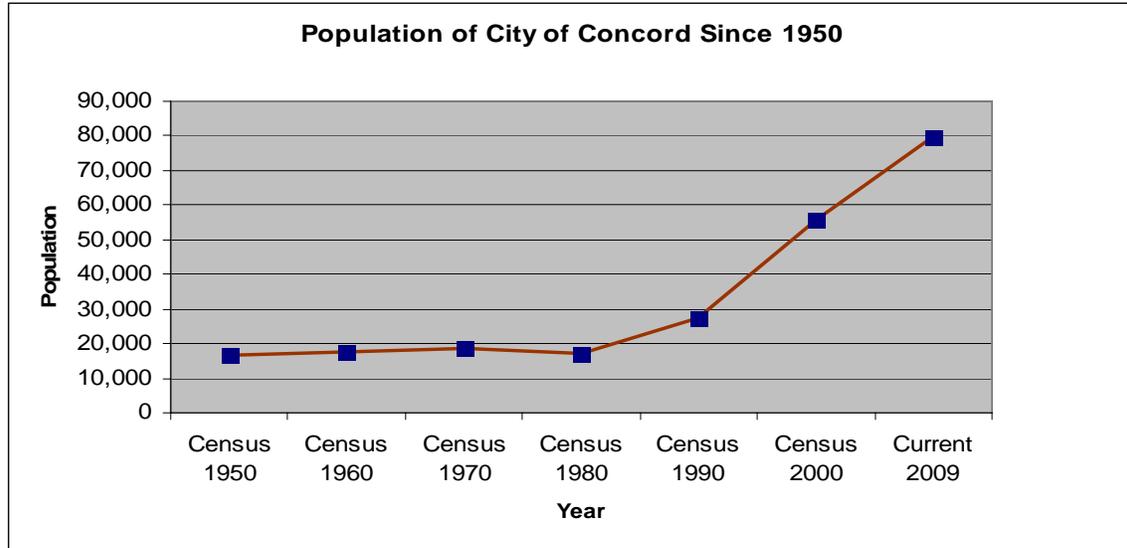
The population of Concord has grown substantially since the 1990 Census and is now the 14th largest city in North Carolina. The total population has nearly tripled during the 19-year period between 1990 and 2009. This is due largely to the fact that the city limits of Concord has grown from 23 square miles in 1990 to 60 square miles in 2009, a 260% increase in size. The population growth is also due to the general trend of growth in the Charlotte metropolitan area of which Concord is a part. The median age in Concord is 34.1 years old and 73.6% of the population is 18 years old or older.

CONCORD DEMOGRAPHICS⁴		
Age	Population	Percentage
Under 5 years	5,740	8.7%
5 to 9 years	4,002	6.0%
10 to 14 years	4,732	7.1%
15 to 19 years	4,680	7.1%
20 to 24 years	4,554	6.9%
25 to 34 years	10,208	15.4%
35 to 44 years	10,263	15.5%
45 to 54 years	8,839	13.3%
55 to 59 years	3,926	5.9%
60 to 64 years	2,557	3.9%
65 to 74 years	3,592	5.4%
75 to 84 years	2,230	3.4%
85 years and over	960	1.4%
Median age (years)	34.1	
18 years and over	48,767	73.6%
21 years and over	45,923	69.3%
62 years and over	8,133	12.3%
65 years and over	6,782	10.2%
18 years and over	48,767	100%
Male	23,847	36.0%
Female	24,920	37.6%
65 years and over	6,782	100%
Male	2,680	4.0%
Female	4,102	6.2%

The Black or African American population in the city has increased from 5607 in 1990 to an estimated 10,088 in 2007, and represents 15.2% of the city's total population. The

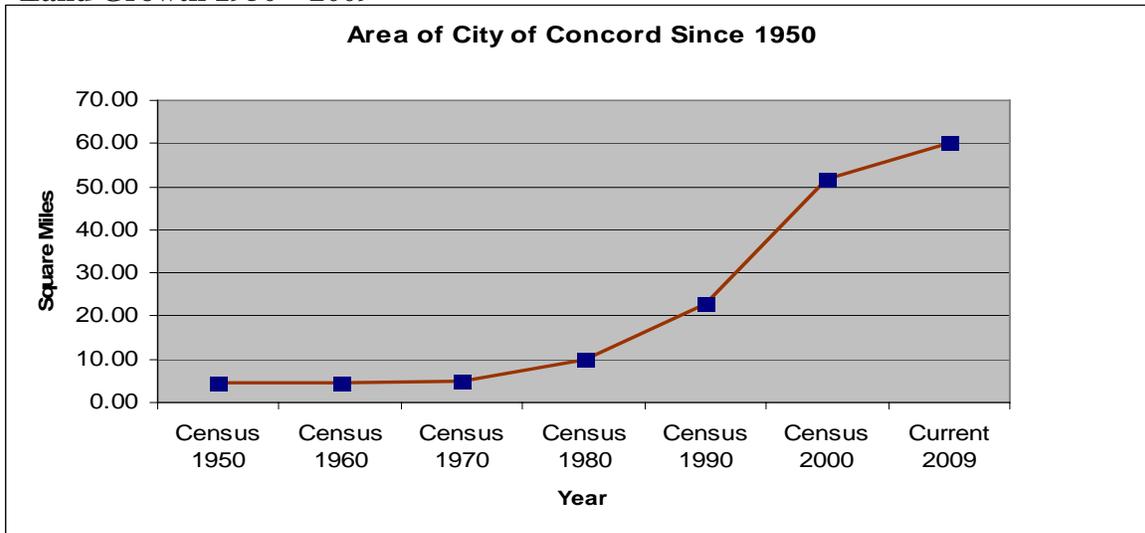
White or Caucasian Race comprises 78.7%, while the Hispanic population is approximately 10%.

Population Growth 1950 – 2009



CITY OF CONCORD POPULATION AND LAND AREA DATA ⁵				
Year	Square Miles	Land Area % Increase from Prior Decade	City Population	Population % Increase from Prior Decade
1950	4.5		16,486	
1960	4.50	0	17,799	8
1970	5.00	11	18,464	4
1980	10.00	100	16,942	-8
1990	22.85	129	27,347	61
2000	51.64	126	55,977	105
2009	60.042	16	79,673	42

Land Growth 1950 – 2009



Census Data

CITY OF CONCORD CENSUS DATA⁶				
Year	Sq. Miles	Sq. Miles % Increase	City Population	Population % Increase
1950	4.5		16,486	
1960	4.50	0	17,799	7
1970	5.00	10	18,464	4
1980	10.00	50	16,942	-9
1990	22.85	56	27,347	38
2000	51.64	56	55,977	51
2004	54.23	5	59,791	6

Neighborhoods

Concord is composed of 320 neighborhoods of which 39 participate in the City's Recognized Neighborhood Program. Every neighborhood plays an integral part in the vitality of the City of Concord. The City implemented the neighborhood program, Partnerships For Stronger Neighborhoods, in 2000 to build relationships with the City's neighborhoods in an effort to enhance the quality of life in the City and stimulate activity within neighborhoods and in City events. Through the program, neighborhoods are partnered with a City staff member who serves as their liaison and will attend the neighborhood meetings and assist residents in identifying solutions to problems. Based upon these relationships, City staff is better able to deliver services tailored to the needs of individual neighborhoods and obtain feedback on proposed public improvement projects within neighborhoods.

The Economic Environment

Major Employers

Concord, the largest city in the county and the county seat, has experienced an 11.8% population increase between 2000 and 2009. During 2009, Philip Morris, USA, closed their operations Plant in Concord. This was, until that time, the largest employer in the community. The Cabarrus County area has a workforce of 82,822 as of March 2009 with 73,428 employed. Recent economic conditions have resulted in 9,394 unemployed for a 11.3% unemployment rate for March 2009, .5 percent above the state average. Recent job growth is negative and jobs have decreased by 6.3%. The City has rapidly become a leader in the tourist industry of North Carolina. The City is home to Lowe's Motor Speedway including many race teams and the current #1 tourist attraction in the State, Concord Mills Mall. The following table lists the major employers of the city and the number of employees.

Top Employers in Concord⁷	
Employer	Employees
Carolinas Medical Center – Northeast	4,300
Cabarrus County Schools	3,398
Connections	950
City of Concord	925
Cabarrus County Government	828
Shoe Show	650
S & D Coffee	500
Hendrick Motorsports	500
Perdue Products, Inc	480
Pass & Seymour Inc.	475
Motorsports Authentics	400
Roush Fenway Racing	400
First Assembly	350
Wayne Brothers, Inc.	350
Sysco Food Services	300

Household Income and Education

The median income for a household in the city was \$50,728 in 2007 up from 46,094 in 2000 and above the North Carolina Average of 44,670. Males had a median income of \$37,030 versus \$26,044 for females. The per capita income for the city was \$25,053.

About 5.8% of families and 8.2% of the population were below the poverty line, including 10.0% of those under age 18 and 12.7% of those ages 65 or over.

Seventy-nine percent of Concord's population has received a high school diploma or higher, which is 1% above the state average. Twenty-two percent of the population hold a Bachelors degree or higher.

Economic Trends⁸

Concord is a diverse business community with a significant economic base in the motorsports industry. During the national economic crisis, Concord lost one of its primary manufacturers, Philip Morris USA. This facility included 3.5 million square feet of industrial space located on 2,023 acres in the western portion of the City. Excluding the final two months of 2009, the community has experienced a -\$27,264,226.00 difference in permitted new development and a -806 decrease in projected new jobs.

Cabarrus New Business Development⁹				
Month	Permitted New Investment		Projected New Jobs	
	2008	2009	2008	2009
January	\$30,486,013	\$11,083,752	61	48
February	\$5,624,134	\$16,953,583	147	33
March	\$1,853,306	\$6,014,870	11	25
April	\$14,164,494	\$4,163,090	261	20
May	\$6,531,869	\$24,072,550	133	37
June	\$13,761,536	\$5,830,650	347	32
July	\$7,621,843	\$17,537,632	20	35
August	\$9,132,349	\$4,076,672	27	30
September	\$13,605,371	\$6,421,020	62	20
October	\$47,272,179	\$3,551,307	187	29
November	\$13,417,640	N/A	77	N/A
December	\$9,246,102	N/A	46	N/A
TOTALS	\$150,053,094	\$99,705,126	1,256	309

During this period employment numbers dropped 6.63% while the State employment numbers dropped only by 4.96%. Unemployment increased drastically during this period. The community averaged a 4.75% unemployment rate during the first quarter of 2008, below both the State and National levels. Unemployment rates then rose steadily during 2008 until January of 2009 when rates increased by 1.6%. As economic uncertainty swept the nation the local unemployment rate increased to 11.7% reflected by a rate change of 74.63% over the same period last year.

Local government budgets has been strained during this period as the taxable sales revenue dropped 7.75 percent and new housing fell by 43.48%. Concord has been able to maintain .42 tax rate, the lowest of the three primary communities in the county without a sacrifice in municipal services.

The Built Environment

The City of Concord growth timeline can be seen in the diverse architecture within in the limits. The historic downtown section is rich with late 19th and early 20th century architecture contained in its three historic districts. An area built on the industrial and economic growth of the rail service, local gold rush and the textile industry. To the east the community gives way to traditional agricultural area of Cabarrus County while toward the west is a more modern and urbanized area adjacent reflective of the growth associated with the Charlotte metro area.

As Concord expanded with almost exponential growth in the late 80’s to the turn of the century, tens of thousands of people begin to migrate daily between their homes and the metro Charlotte work environment. With this growth in the built environment, Concord has identified certain assets that are vital to its security, public health and safety, economy and the way of life the community has chosen. These assets are vital to Concord during a major natural disaster in order to assure at least a base line level of governmental service and sustained daily activity for its residents.

Roadway Transportation

Concord is the largest city within Cabarrus County. As discussed above, the city has experienced a rapid growth in population and development. There is an estimated 3% yearly average increase in vehicles using our transportation system. From 2004 to the present, the transportation system in the City of Concord has expanded to currently cover 59.19 sq. miles from 50.75 sq. miles. The local street system from 291-miles of City maintained streets in 2004 to 321-miles(1330 streets) in 2009 to meet the needs of the growing region. In addition, the 455-total miles of road system also includes 89-miles of state maintained streets, 144 miles of private streets, 199 miles of side walk, 414 miles of curb and gutter, 18.5 of interstate highway and 16 publicly maintained bridges.

Local road network – State and US Routes ¹⁰			
Street Name	Maintenance Agency	Roadway Surface	Roadway mileage
AKINS DR.	STATE	HARD	0.37
ARMENTROUT DR.	STATE	HARD	0.49
BEDLINGTON DR., NW	STATE	HARD	0.28
BRANCHVIEW DR., NE	STATE	HARD	2.30

Local road network – State and US Routes¹⁰			
Street Name	Maintenance Agency	Roadway Surface	Roadway mileage
BRANCHVIEW DR., SE	STATE	HARD	0.61
BRANCHVIEW DR., SE	STATE	HARD	1.17
CABARRUS AVE., E	STATE	HARD	0.69
BRIARCREST DR. (SR 2925)	STATE	HARD	0.24
BRUTON SMITH BLVD.	STATE	HARD	1.95
CABARRUS AVE., W	STATE	HARD	2.13
CAROLINA LILY LN.	STATE	HARD	0.28
CASELTON CT. (SR 2932)	STATE	HARD	0.03
CENTERGROVE RD.	STATE	HARD	0.21
CENTRAL CABARRUS DR., SW	STATE	HARD	0.63
CENTRAL HEIGHTS DR.	STATE	HARD	0.89
CHRISTENBURY PKWY. (SR 1447)	STATE	HARD	0.55
CHRISTENBURY RD. (SR 1447)	STATE	HARD	0.03
CHURCH ST., N	STATE	HARD	2.15
CHURCH ST., S	STATE	HARD	0.17
CLARKE CREEK PKWY. (SR 2930)	STATE	HARD	0.87
COCHRAN RD.	STATE	HARD	1.23
COLFAX DR.	STATE	HARD	0.05
COMMERCE DR. (SR2841)	STATE	HARD	0.14
CONCORD FARMS RD.	STATE	HARD	1.44
CONCORD LAKE RD.	STATE	HARD	0.39
CONCORD MILLS BLVD.	STATE	HARD	1.26
CONCORD PARKWAY	STATE	HARD	
CORBAN AVE., SE	STATE	HARD	1.47
CORBAN AVE., SW	STATE	HARD	0.08
COX MILL RD.	STATE	HARD	0.41
CRESTFIELD CT. (SR 2933)	STATE	HARD	0.03
CRESTMONT DR.	STATE	HARD	0.40
DALE EARNHARDT BLVD.	STATE	HARD	0.07
DARTMOUTH CT. (SR 2927)	STATE	HARD	0.03

Local road network – State and US Routes¹⁰			
Street Name	Maintenance Agency	Roadway Surface	Roadway mileage
DAVIDSON DR., NW	STATE	HARD	0.24
DAVIDSON HWY.	STATE	HARD	2.76
DERITA RD.	STATE	HARD	0.91
DUNBLANE CT., NW	STATE	HARD	0.04
ELLENWOOD RD.	STATE	HARD	0.12
GARDEN TERRACE	STATE	HARD	0.01
GEORGE W. LILES PARKWAY	STATE	HARD	1.69
GOODMAN RD.	STATE	HARD	0.66
HADDINGTON DR. (SR 2931)	STATE	HARD	0.57
HARRIS RD.	STATE	HARD	0.15
HEDGEMORE CT.	STATE	SGS	0.60
HEGLAR RD.	STATE	HARD	0.15
HESS RD.	STATE	HARD	0.00
INTERNATIONAL DR.	STATE	HARD	1.38
IVEY CLINE RD.	STATE	HARD	0.38
JW CLINE RD.	STATE	SGS	0.19
KIRKMONT DR. (SR 2928)	STATE	HARD	0.27
KISER WOODS DR.	STATE	HARD	0.09
LAKE CONCORD RD., NE	STATE	HARD	0.21
MARLBORO DR.	STATE	HARD	0.35
MILLSTREAM RIDGE DR.	STATE	HARD	0.54
MONTROSE DR., NW	STATE	HARD	0.64
MOREHEAD RD.	STATE	HARD	0.04
N.C. 3	STATE	HARD	
N.C. 3 INTERCHANGES	STATE	HARD	0.03
N.C. 49	STATE	HARD	4.07
N.C. 73 E.	STATE	HARD	0.31
N.C. 73 W.	STATE	HARD	
NEWBARY CT. (SR 2935)	STATE	HARD	0.02
ODELL SCHOOL RD.	STATE	HARD	0.57
OLD AIRPORT RD.	STATE	HARD	0.94

Local road network – State and US Routes¹⁰			
Street Name	Maintenance Agency	Roadway Surface	Roadway mileage
OLD CHARLOTTE RD.	STATE	HARD	1.95
OLD FARM RD.	STATE	HARD	0.40
OLD HOLLAND RD.	STATE	HARD	0.38
OLD SALISBURY RD.	STATE	HARD	0.60
PITTS SCHOOL RD., NW	STATE	HARD	3.10
PITTS SCHOOL RD., SW	STATE	HARD	2.53
POPLAR TENT RD.	STATE	HARD	6.38
QUAY RD	STATE	HARD	0.31
ROBERTA RD.	STATE	HARD	3.35
ROBERTA CHURCH RD.	STATE	HARD	1.67
ROCK HILL CHURCH RD.	STATE	HARD	1.91
ROCKY RIVER RD.	STATE	HARD	0.54
SHADOWCREST DR., SW	STATE	HARD	0.21
S. MAIN ST.	STATE	HARD	
S. RIDGE AVE.	STATE	HARD	0.37
STOUGH RD.	STATE	HARD	1.37
STOWE LANE	STATE	HARD	0.15
SUMMERCREST DR. (SR 2926)	STATE	HARD	0.03
TANGLEY CT. (SR 2929)	STATE	HARD	0.03
TRIANGLE DR. NW	STATE	HARD	0.08
UNION ST., S	STATE	HARD	0.33
U.S. 29 (CONCORD PARKWAY)	STATE	HARD	4.94
U.S. 29/601 (CONCORD PKWY)	STATE	HARD	3.88
U.S. 29/601 INTERCHANGES	STATE	HARD	0.06
U.S. 29A	STATE	HARD	0.79
U.S. 601 SOUTH	STATE	HARD	0.19
SR 1007 (WAS U.S. 601)	STATE	HARD	
U.S. 601(WARREN COLEMAN)	STATE	HARD	3.94
U.S. 601 INTERCHANGES	STATE	HARD	0.45
U.S. I-85	STATE	HARD	11.82
U.S. I-85 INTERCHANGES	STATE	HARD	6.73

Local road network – State and US Routes ¹⁰			
Street Name	Maintenance Agency	Roadway Surface	Roadway mileage
WARREN COLEMAN BLVD.	STATE	HARD	
WEBB RD. (SR 1155)	STATE	HARD	0.40
WEDDINGTON RD.	STATE	HARD	3.94
WILSHIRE AVE.	STATE	HARD	2.30
WINECOFF SCHOOL RD.	STATE	HARD	1.15
WINGHAVEN CT. (SR 2934)	STATE	HARD	0.02
ZION CHURCH RD.	STATE	HARD	0.00
ZION CHURCH RD. (SR 1155)	STATE	HARD	0.15
ZION CHURCH RD. EAST	STATE	HARD	0.28

Vehicles traveling over city or state maintained roadways are the primary transportation choices. The road system performs two basic functions: (1) providing general mobility for the residents and (2) accommodating transportation of goods and services between communities.

The city's growth and the resultant increase in traffic volume can be attributed to I-85, which is a major link between the middle Atlantic and southeast sections of the United States. . Many of North Carolina's biggest cities can be found along the I-85 Corridor. Historically, I-85 has been affected by winter storms and flooding. Natural hazards such as these can disrupt automobile traffic and shut down local transit systems.

The population growth that the city of Concord has experienced in the last decade creates more community exposure to hazards and disasters and changes how agencies prepare for and respond these events.. For example, more people living on the fringe of flood prone areas have an increased chance risk of flooding. Uncontrolled or poorly planned development can increase a community's flood potential due to the reduction of natural measures that prevent storm-water run-off.

Increased development density can also affect risk. Streets designed and constructed to minimum widths and alignment are more difficult for emergency service vehicles to navigate, the high ratio of residents to emergency responders affects response times, and homes located closer together increase the chances of fires spreading.

Natural hazards do not discriminate, but the effects in terms of vulnerability and the ability to recover vary greatly among the population. FEMA's Preparedness, Training, and Exercise Directorate, indicates that 80% of the disaster burden falls on the public, and within that number, a disproportionate burden is placed upon special needs groups.

Bus Service

CK Rider operates a nine bus system with seven routes connecti the Cities of Concord and Kannapolis. The routes serve many of the local neighborhoods, business areas and attractions. An estimated 25,000 local residents utilize the system monthly.

Rail

Freight and passenger trains cross the City of 24-hours a day, seven days a week, serving commerce and personal needs. The rail corridor bisects the City North/South necessitating 16 grade and elevated crossings for highways and waterways. The service is part of the North Carolina Railroad company which operates a 317 mile corridor in the State. Norfolk Southern and CSX both operate Class I large freight service through the city. Amtrac operates two passenger trains, the Piedmont and Carolina. The Carolinian travels daily between Charlotte and New York City and the Piedmont between Raleigh and Charlotte.

Air Transportation

Concord Regional Airport on 677 acres along I-85 South about 15 minutes northeast Charlotte, North Carolina. The airport provides continuous operations 365 days a year with a manned Air Traffic Control Tower from 7:00 am until 11:00 pm. Annual departures and arrivals average 65,000 via a asphalt surface 7400 x 100 ft runway.

Emergency Services

Concord's emergency services include the Police Department and Department of Fire and Life Safety. The emergency management for the City is provided by a division of the Department of Fire and Life Safety. The Stations serve as community rooms and pre-storm Safe Havens due to their strategic locations. Cabarrus County provides paramedic level emergency care which is supplemented by the fire department's first responder program. Other municipal services provide emergency response functions including the Water Resources, Electric Utilities, Transportation, and Storm Water Departments

Hospital and Health Care

Hospital and Health Care Natural hazards such as earthquakes, tornadoes, and winter storms often result in victims who need emergency care. Carolina's Medical Center - Northeast, a Level III Trauma Center, is the community's primary source of emergency medical care with a 31,000 square foot emergency care center. CMC-NorthEast is an active community partner and recognizes its importance during disaster and also its vulnerability and potential to become a victim itself. Hospital staff have completed national incident management system training, has a fully functional emergency operations center, emergency preparedness coordinator, and actively participates in internal and community disaster exercises. The medical center also is connected to the community's emergency management video conferencing network

Federal law requires that Medicare and Medicaid certified facilities have written plans and procedures to meet all potential emergencies and provide training to employees in emergency procedures. Nursing home administrators use a variety of factors to influence their decision to evacuate or shelter in place. Mandatory evacuations orders must take into consideration factors such as the health of residents, risks of transporting, effective emergency planning and availability of host facilities.

The following table list local facilities were the residents are under the 24-hour care of licensed or registered staff – skilled nursing facility or registered nursing assistants – intermediate care facility.

Name	Address	Occupancy	Type	Sq. Ft.	ID	Pre-plan
Brian Center Health and Retirement	250 Bishop Lane	87	24hr NH	32,997	125292	N
Brian Center Health and Retirement	250 Bishop Lane	87	24hr NH	32,997	125292	N
Universal Hearth Care and Rehab	430 Brookwood Avenue, NE	101	24hr NH		125393	N
St. Andrews Living Center	246 Cabarrus Avenue, W.	56	24hr NH	8,000	125542	N
Avante at Concord	515 Lake Concord Road	116	24hr NH	33,090	126948	N
Morningside of Concord	500 Penny Lane		24hr NH		127314	N
Concord Place	2452 Rock Hill Church Road	112	24hr NH		127513	Y
Claire Bridge Nursing Home	2460 Rock Hill Church Road	N/A	24hr NH		127514	N
Gardens of Taylor Glenn	3700 Taylor Glen Lane	N/A	Residential board and care	375,000	127628	Floor plans but no PP
First Assembly Living Nursing Home	160 Warren C. Coleman Blvd.	N/A	24hr NH	34,022	127907	N
Five Oaks Nursing Center	413 Winecoff School Road	152	24hr NH	144,000	128891	N
Horizon Bay	1501 Zion	N/A	24hr NH		128902	Y

Name	Address	Occupancy	Type	Sq. Ft.	ID	Pre-plan
Assisted Living Memory Care	Church Road					

In addition, neighborhood services such as schools, churches, childcare facilities, the library, and community centers are considered critical facilities. Lastly, systems that provide services to residents and businesses in the City of Concord are another set of critical facilities. This last set includes links and facilities in the transportation network that connect the City of Concord to neighboring cities (e.g. NC 73, US 29, NC 3 and I-85, and 164th Avenue NE) (see **Map 7, City of Concord Community Facilities**).

Education

The City of Concord is served by the Cabarrus County School District. The public schools in the City of Concord consist of 10 elementary schools, 4 middle schools and 4 high schools. The population for the system during 2008 was 27,747.¹¹ Eight private schools offer secondary education: Covenant Classical, Canon School, First Assembly Christian School, New Life Christian Academy, Piedmont Primary, Concord Christian Center and Goddard School. Rowan Community College has a satellite campus in the City.

Cultural facilities

Concord is composed of three historic districts, (North Union, South Union, and Edgewood). The area has one of the largest and most intact collections of late nineteenth and early twentieth century homes in the State of North Carolina. Many of the mansions were built for the founders of the textile industry, the primary industry for the community for many years.

Energy

Concord is one of more than 70 communities in North Carolina which provide public power and serve over 25,000 customers. Electric supply is purchased from Duke Power and provided to customers through the municipal owned infrastructure. Duke Power and Union Electric also provide electric infrastructure within the city limits.

Two large refined petroleum product interstate pipelines pass through the city limits. Plantation Pipe Line Company and Colonial Pipe Line are part of the system which originates in Louisiana and delivers over 600,000 barrels of petroleum products daily.

Telecommunications

Telecommunication networks are vitally important component of the communities basic infrastructure and essential to public safety. Multiple companies provide, voice, data, and video services using a variety of technologies. The local system is generally reliable but is vulnerable to the effects of a disaster.

The primary fixed telephone provides in Concord is Windstream Communications, although a number of other companies provide this service to residential and business customers.

Major wireless carriers that serve the City of Concord include:

- Sprint/Nextel
- AT&T
- Verison Wireless

Cable service is provided by Time Warner Cable.

Concord Communications Center is one of the three primary answering points from the local 911 system along with Cabarrus County and the City of Kannapolis. Each agency is responsible for emergency dispatch for public safety agencies within their jurisdiction. These three PSAP's provide a redundant service and serve as back-up in the event of a individual system's failure. Three communication's towers are located within the community to ensure adequate coverage. The City of Concord owns and provides service for the public safety communications infrastructure.

Non-emergency dispatch for utility service (water, storm water, waste water and electric) and other municipal service functions is provided by the Customer Care Center, which is essentially a 311 type service. The center is staffed from 0700 – 1800 and manages an average of 12,578 calls for service monthly. During serve weather the center supports the Concord Communications Center. The Center also provides the municipal Joint Information Center function during Emergency Operations Center activation.

Water Supply and Waste Water Treatment

The City of Concord receives its raw water from three primary sources, Lake Don T. Howell, Lake Fisher, and Lake Concord. Lake Don T. Howell, a 1300-acre impoundment, and Lake Concord, a 100 acre lake impoundment of Coddle Creek is owned by Cabarrus County and operated by the Water and Sewer Authority of Cabarrus County. Lake Fisher is a 534 acre lake owned by the City of Concord. Concord provides raw water treatment from two facilities, Coddle Creek Water Plan Plant and the Hillgrove Water Treatment Plant. The plants switched to sodium hypochlorite in place of gaseous chlorine to eliminate the risk posed from this extremely hazardous chemical.

The city of Concord maintains a waster water collection system which consists of over 528 miles of sewer pipeline, approximately 12,974 manholes, and 25 wastewater pump

stations. The system came into existence in the early 1900's and continued to be upgraded and extended to meet the community's needs. Currently the system serves approximately 30,423 customer connections. A Global Positioning System is used to provide accurate locations of the various components of the system which allows for more timely responses. A flow monitoring program has been put in place to assist the department in identifying instances and sources of inflow caused by heavy rains or flood events.

WSACC operates the Rocky River Regional Wastewater Treatment Plant(RRWWTP), a 24MGD wastewater treatment facility that treats the sewage received from the City's waste water system. The facility uses a 95% pure-oxygen activated sludge biological process and sodium hypochlorite for disinfection.

Critical Facilities

A variety of critical facilities are found in the City of Concord. Within the context of the Hazards Mitigation Plan, critical facilities are defined as a building or infrastructure that is central in supporting the provision of services to and by the City of Concord. FEMA provides a definition of critical facilities by listing examples including hospitals, fire stations, police stations, storage of critical records, and similar facilities.

Structural vulnerability to natural hazards

Structures throughout the county are subject to a wide variety of natural hazards such as windstorms, floods, earthquakes and other hazards and structures in Concord or no exception. For example, buildings and infrastructure located within the floodplain or with inadequate drainage are susceptible to flooding. The majority of the older sections of the city are composed of unreinforced masonry buildings or wood structures that are at a higher risk to earthquake damage and wind damage than buildings made from sturdier materials, or buildings that are reinforced. Retrofitting of these structures based on frequency of earthquakes to current building codes is not economically feasible. Therefore the number of buildings at risk, especially in the downtown area remains high.

Extreme temperatures can cause pavement to buckle and damage overhead electric and telephone lines. Windstorms can cause trees and power lines to fall and debris to fly in the air. High-wind events, such as coastal storms or tornadoes, can cause less robustly built structures to suffer roof failures and building collapses. Winter weather can cause surface degradation to buildings and roadways, and disrupt movement on the roadway. Overall, a structure's geographic and physical attributes generally affect its susceptibility to certain hazards.

North Carolina Building Code

Building codes have been around in some form for thousands of years. These codes are often the result of some tragedy such as the Iroquois Theatre Fire instead of progressive prevention. A minimum building and fire code is imposed throughout the State. In 1973, North Carolina adopted the Southern Building Code Congress (SBCC) Standard Building Code insulating standards and further

supplemented this in 1978 with the adoption of the Standard Building Code with North Carolina Amendments. Building code enforcement is performed by the Cabarrus County Building Inspection Department. The City has chosen to enforce the Fire Prevention Code through the Department of Fire and Life Safety. Fire Codes are maintenance type codes and require periodic reviews of a structure after it is complete. Local buildings are constructed to meet these minimum codes to better withstand the impacts of natural disaster. Local government has the authority to adopt codes that are more restrictive than the State code.

Many of the new code provisions address natural hazard mitigation, including new standards to protect buildings from drought, earthquakes, extreme temperatures, flooding, wind, and winter weather.

Community Profile resources:

- City of Concord website: <http://www.ci.concord.nc.us>
- Cabarrus county website: <http://www.co.cabarrus.nc.us>
- United States Census Bureau: <http://www.census.gov>
- North Carolina State Demographics: <http://demog.state.nc.us>
- Federal Emergency Management Agency: <http://www.fema.gov>
- U.S. Geological Survey website: <http://usgs.gov>
- North Carolina Hazards Workshops
- City of Concord Land Use Plan

Hazard Analysis

Dam Failure

Hazard Description

Loss of life and damage to structures, roads, utilities and crops may result from dam failure. Economic losses can also result from a lowered tax base and lack of utility profits. Reduction in the amount of available water supply would also impact the area until repairs can be made to the dam involved. These effects would certainly accompany the failure of one of the three dams near the City of Concord. Because dam failure can have severe consequences FEMA requires that all dam owners develop Emergency Action Plans for (EAP) for warning, evacuation, and post-flood actions. Although there may be coordination with County Officials in the development with the EAP, the responsibility of developing potential flood inundation maps and facilitation of emergency response is the responsibility of the dam owner.

Dams within the City of Concord¹²

Dam Name	EAP	River/Stream	Year Constructed	Hazard Class
Lake Concord	N	Cold Water Creek Tributary	1926	High
Lake Fisher	N	Cold Water Creek	1948	High
Twin Oaks Farm Lake Dam	NR	Little Cold Water Creek	1950	Low
Lake Lynn Dam	N	Cold Water Creek Tributary	1950	High
Buffal Ranch Lake Dam	N	Cold Water Creek Tributary	1956	High
Frank Liske Park Dam	Y	Wolf Meadow Branch Tributary	1950	High
Cook Lake Dam	NR	Little Cold Water Creek	N/A	Low
Mills Pond Dam	NR	Adams Creek	N/A	Low
Traton Woods Lake Dam #1	NR	Cold Water Creek	1975	Low
Traton Woods Lake Dam #2	NR	Cold Water Creek	N/A	Low
Calloway Lake Dam	NR	Cold Water Creek	N/A	Low
Clemons Dam	NR	Cold Water Creek Tributary	N/A	Low
Beaver Dam	N	Lake Fisher Tributary	N/A	Low
Cabarrus Landfill Dam	NR	Cold Water Creek Tributary	N/A	Low

Dam Name	EAP	River/Stream	Year Constructed	Hazard Class
Helms Dam	NR	Cold Water Creek Tributary	N/A	Low
Lake Daffodil Dam	N	Irish Buffalo Creek	1993	High
Faggart Dam	N	Cold Water Creek	N/A	High
Pioneer Mill Dam	N	Caldwell Creek Tributary	N/A	Intermediate
Concord Mills East Detention Pond Dam	N	Rocky River Tributary	1998	Low
Norma Drive Dam	N	N/A	N/A	Low
Cabarrus County Schools Bus Maintenance Dam	N	N/A	N/A	Low
Lake Don T. Howell	Y	Coddle creek	1993	High

Over 26,000 of the 80,000 dams in the United States pose a “high” or “significant” hazard to life and property in the event of a failure. The hazard potential of dams are classified as low, significant and high, each building on the other. Regardless of the classification, the failure of any dam or water retaining structure will present a danger to life and property downstream. The following are definitions for dam hazard classifications:

LOW HAZARD POTENTIAL

Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner’s property.

SIGNIFICANT HAZARD POTENTIAL

Dams assigned the significant hazard potential classification are those dams where failure or mis-operation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

HIGH HAZARD POTENTIAL

Dams assigned the high hazard potential classification are those where failure or mis-operation will probably cause loss of human life.

Dam Hazard Classification Table¹³

Hazard Classification	Description	Quantitative Guidelines
Low	Interruption of road service, low volume roads	Less than 25 vehicles per day

Hazard Classification	Description	Quantitative Guidelines
	Economic damage	Less than \$30,000
Intermediate	Damage to highways, Interruption of service	25 to less than 250 vehicles per day
	Economic damage	\$30,000 to less than \$200,000
High	Loss of human life*	Probable loss of 1 or more human lives
	Economic damage	More than \$200,000
	*Probable loss of human life due to breached roadway or bridge on or below the dam.	250 or more vehicles per day

The Dam Safety Law of 1967 provides for the certification and inspection of dams to reduce the risk of dam failure, prevent injuries to persons, damage to downstream property and loss of reservoir storage.¹⁴

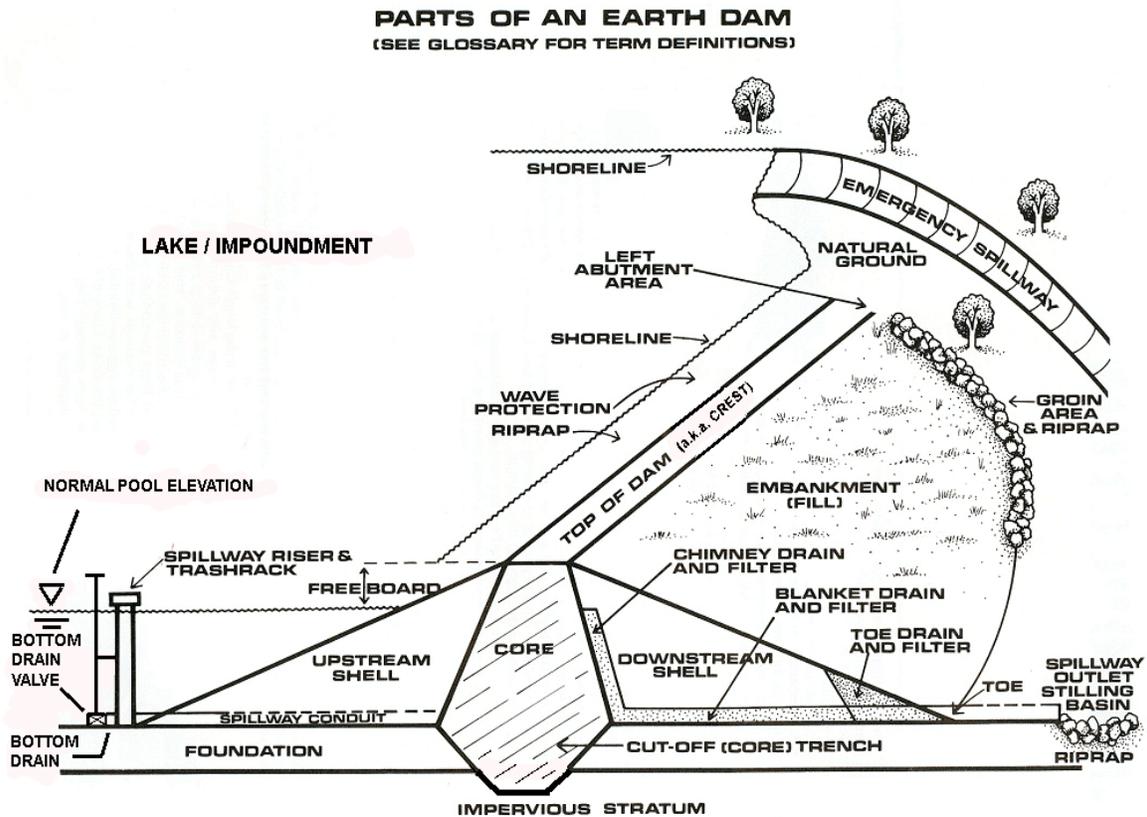
Terminology

- **Dam:** An artificial barrier that has the ability to impound water, wastewater, or any liquid-borne material, for the purpose of storage or control of water.
- **Dam failure:** Catastrophic type of failure characterized by the sudden, rapid, and uncontrolled release of impounded water or the likelihood of such an uncontrolled release
- **Dam safety:** Dam safety is the art and science of ensuring the integrity and viability of dams such that they do not present unacceptable risks to the public, property, and the environment.
- **Dam safety program purposes:** The purposes of a dam safety program are to protect life, property, and the environment by ensuring that all dams are designed, constructed, operated, and maintained as safely and as effectively as is reasonably possible.
- **Emergency Action Plan (EAP):** A plan of action to be taken to reduce the potential for property damage and loss of life in an area affected by a dam failure or large flood.
- **Gate:** A movable water barrier for the control of water.
- **Hazard:** A situation that creates the potential for adverse consequences such as loss of life, property damage, or other adverse impacts.
- **Hazard potential:** The possible adverse incremental consequences that result from the release of water or stored contents due to failure of the dam or misoperation of the dam or appurtenances.
- **Reservoir:** A body of water impounded by a dam and in which water can be stored.
- **Spillway:** A structure over or through which flow is discharged from a reservoir. If the rate of flow is controlled by mechanical means, such as gates, it is considered a

controlled spillway. If the geometry of the spillway is the only control, it is considered an uncontrolled spillway.

Severity

Loss of life and damage to structures, roads, utilities and crops may result from dam failure. Economic losses can also result from a lowered tax base and lack of utility profits. Reduction in the amount of available water supply would also impact the area until repairs can be made to the dam involved. These effects would certainly accompany the failure of one of the three dams near the City of Concord. Because dam failure can



have severe consequences FEMA requires that all dam owners develop Emergency Action Plans for (EAP) for warning, evacuation, and post-flood actions. Although there may be coordination with County Officials in the development with the EAP, the responsibility of developing potential flood inundation maps and facilitation of emergency response is the responsibility of the dam owner.

A failure of any of the dams within Concord will have an impact on the community. Areas along the affected watercourse can expect flooding with limited warning times. The impacts will be similar to that of flooding. This includes damage to homes, industrial and commercial building, transportation infrastructure and interruption of utility service. Economic loss must also consider the lost of business from water damage

and interruption of transportation. Loss of a dam will also impact the water supply of the community. Limited injuries can be expected including potential loss of life.

As an example, Lake Howell is considered a high hazard under the North Carolina Dam Safety Law based on the land use down stream. The Lake Howell dam protects a 1,300-acre reservoir, impounding approximately 5 billion gallons of water. The height of the dam is over 49 feet. A failure of the reservoir would pose a threat to communities down stream. To illustrate this, a “Sunny Day Breach” of the dam was considered. The effects of the breach are illustrated in the following tables. Depth of Flooding, considers the impact on the locale transportation system while the second indicates when flood waters would reach the selected locations and the time the road would be flooded.

Sunny Day Breach of the Lake Don T. Howell Dam – Depth of Flooding¹⁵

Road/Street Name	Distance below dam	Elevation of roadway	Approximate max. flood elevation	Approximate depth of water over road
Roberta Road	9.19	566.8	576.4	9.6
NC 49	12.18	554.3	556.1	1.8
Southern Railway	12.42	563.5	555.3	--
Rocky River Road	15.03	543.1	540.8	---
Flowes Store Road	18.28	526*	528.3	2.3
U.S. Hwy 601	22.55	534.2	505.4	--

Sunny Day Breach of Lake Don T. Howell Dam – Time of Flooding

Road/Street Name	Distance below dam	Arrive time of flood wave(hours)	Time of road inundation	Time of peak flooding elevation (hrs)
NC 73	0.15 miles	0.4	0.7	3.3
I-85	2.49	1.8	2.8	5.0
Poplar Tent Road	2.94	2.6	3.0	6.0
Weddington Road	4.37	3.3	4.0	7.7
Highway 29	6.15	5.3	6.3	10.6
Roberta Road	9.19	7.4	10.8	15.8
NC 49	12.18	9.4	17.9	20.0
Southern Railway	12.42	9.6	-	20.0
Rocky River Road	15.03	10.0	-	26.7
Flowes Store Road	18.28	11.1	27.8	32.8
U.S. Hwy 601	22.55	12.8	-	44.5

Probability

Of the 22 dams identified within the City limits, 8 are classified as high risk, 1 intermediate risk and thirteen low risks. Only 2 of the high risk dams have a plan on file. No recorded information could be found on a failure of a dam within the City limits. The Lake Howell Dam had a mechanical failure of one gate which caused limited flooding along Coddle Creek, but no damage therefore the hazard frequency would be considered.

A complete failure of any of the dams is unlikely. Damaged spillways, overtopping or other problems are the most likely scenario. The most common reasons (nationally) of dam failure are:

OVERTOPPING – 34% of all failures (nationally)

- Inadequate Spillway Design
- Debris Blockage of Spillway
- Settlement of Dam Crest

FOUNDATION DEFECTS – 30% of all failures

- Differential Settlement
- Sliding and Slope Instability
- High Uplift Pressures
- Uncontrolled Foundation Seepage

PIPING AND SEEPAGE – 20%

- Internal Erosion Through Dam Caused by Seepage- “Piping”
- Seepage and Erosion Along Hydraulic Structures Such as
- Outlet
- Conduits or Spillways, or Leakage Through Animal Burrows
- Cracks in Dam

CONDUITS AND VALVES – 10%

- Piping of Embankment Material Into Conduit Through Joints or Cracks

Location

Concord contains 22 public or private dams scattered across the city. This includes three dams which are part of the community water supply systems. Loss of dams at the three major water impounds would have immediate and prolonged affects. Areas along the affected watercourse can expect flooding with limited warning times. The impacts will be similar to that of flooding. Economic loss must also consider the lost of business from water damage and interruption of transportation. Loss of a dam will also impact the water supply of the community. Limited injuries can be expected.

Historic occurrence of dam failure in Concord

No recorded data indicates historical failure of a dam within the city limits. An incident in 2002 where one floodgate was stuck in the down position resulted in minor flooding

along Coddle Creek. Recent heavy rains that caused river flooding compounded this incident.

Vulnerability Assessment

The catastrophic potential of a down failure can not be addressed by traditional flood-damage analysis. The potential exists down stream for impact on the built, natural, infrastructure systems and the population. The tables above provided an estimate of a breach of the Lake Howell dam and the area down stream which would be impacted. The severity would be limited to the area below the dam often which has flood potential.

The most likely event would be an overtopping of the dam or equipment failure. Most local dams have a low height which limits the impact of any release to the number of acre feet stored behind the dam when the failure occurs.

Structural Vulnerability

The flood hazards are for a dam failure often exceeds the area of the waterway's associated 100 year flood plain. Structural damaged can be expected in this area including damages to roadways, bridges, and utility infrastructure. Depending on the cause of the incident the community could also be faced with an impact to the water system and the flood control capability's of the dam. Environmentally, disruption of wildlife can be expected and erosion of the stream or river banks with the resulting loss of land.

Potential Loss Estimates

Losses to the built environment, utility systems, and natural system were briefly discussed above. Additional risks are posed to the population. A failure of the Lake Don T. Howell will impact 10 local roadways including Interstate 85.

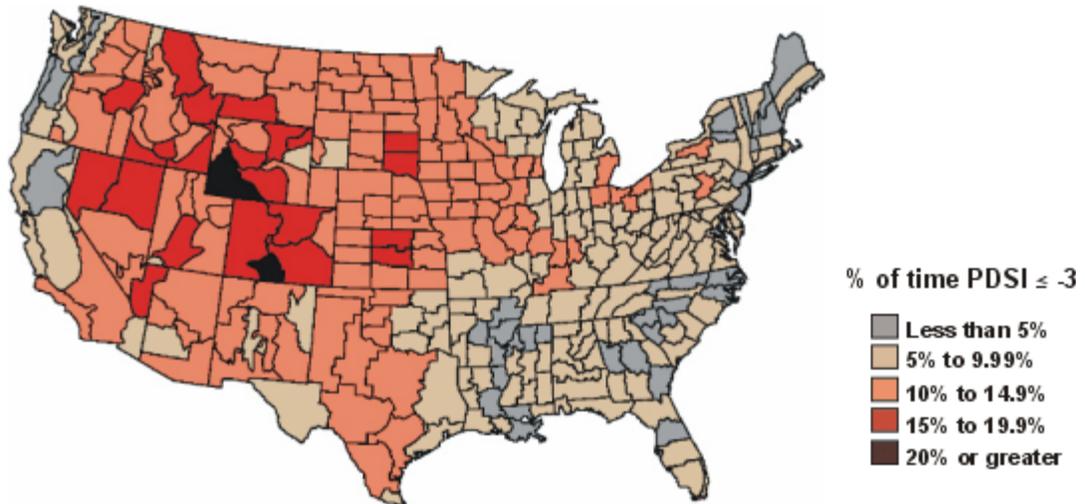
Based on the research conducted the likelihood of occurrence of a dam failure is considered to be **possible** or between 1 and 10% probability in the next year, or at least one chance in the next 100 years. The intensity of a dam failure is considered to be **moderate**, since a limited portion of the population will be impacted, though economic impacts could affect the whole community. The potential for impact is **limited** due to consideration of the area affected limited injuries and limited amount of shutdown of critical facilities due a failure. The committee concluded that a dam poses a low risk though included actions in the goals and objectives to update local plans.

Drought

Hazard Description

Drought is a normal, recurrent feature of climate, although many erroneously consider it a rare and random event. It occurs in virtually all-climatic zones, but its characteristics vary significantly from one region to another. Drought is a temporary aberration; it differs from aridity, which is restricted to low rainfall regions and is a permanent feature of climate. A number of climatic indicators are available for monitoring appropriate stages of drought response. Drought indicators are used to identify the onset of deteriorating water supply conditions. Possible indicators include precipitation, stream flow, ground water levels, and reservoir storage levels.

1895 – 1995 Percent of time in severe and extreme drought¹⁷



Though the public becomes concerned about drought as the direct result of a correlation between the natural event (lack of rain) and how much water people require. water vapor condenses only if air rises into the colder regions of the atmosphere. If the air doesn't rise, then no rain will form. When there is high air pressure, air falls instead of rising. With the air pressing down in a high-pressure zone, no currents of water vapor are carried upward. As a result, no condensation occurs, and little rain falls to earth. In addition, high-pressure areas push clouds and air currents downward and away, resulting in sunny, cloudless weather. Low-pressure systems see cloudier, stormy weather.

Usually, we experience both high- and low-pressure systems. It is normal for a high-pressure system to pass over an area and move on, being replaced by a low-pressure system. However, when a high-pressure system is stalled, the sunny weather can drag on for days. If it keeps on going, the result is a drought. This condition is commonly caused by the term "Bermuda High" by local meteorologists.

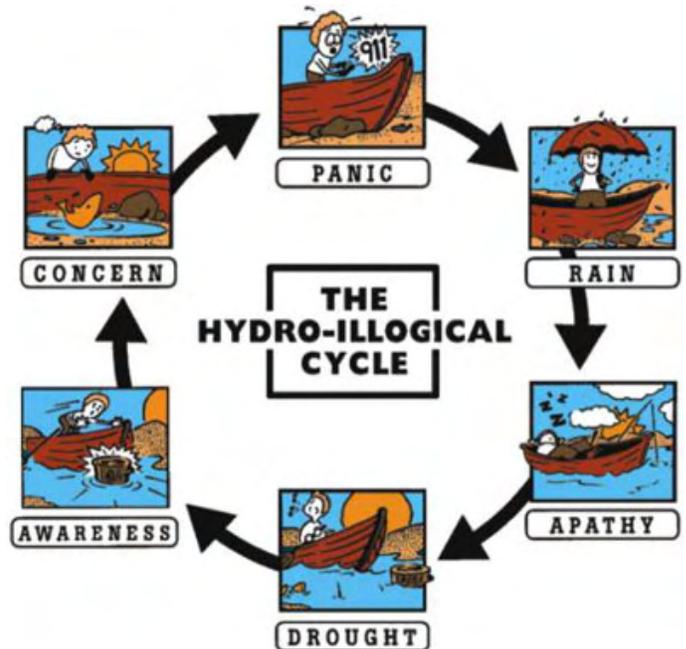
Two additional weather phenomena can affect drought, El Nino: a warm water current which can bring drought relief in the form of hurricanes or La Nina a cold water current which can bring drought. Both these conditions occur in the Pacific Ocean, but can affect our conditions here.

Another natural condition that can cause drought is Concord's location in relation to the mountains. Mountains can prevent wind from blowing moisture to needed regions. As air is moving past a mountain range, it is forced to rise in order to pass over the peaks. However, as the air rises, it becomes colder and the vapor condenses into rain or snow. The rain then falls on that side of the mountain, known as the windward side (the side that is turned toward the wind). When the air mass finally makes it over the mountain, it has lost much of its vapor. This is another reason why many deserts are found on the side of a mountain facing away from the wind. This phenomenon is known as the rain shadow effect. This also protects us from many winter weather events.

These are natural conditions for which a community does not have control. A community can control other factors which effect is susceptibility to drought. Communities can address its ability to control growth where population need (consumption and industrial use) results in a water shortage for some activity, group, or environmental sector. Lawn irrigation is often touted as the biggest water waster, and perhaps rightly so.¹⁸ Fescue, a popular lawn and pasture grass in North Carolina due to its relative drought tolerance, can survive on approximately half an inch of water per week, but many residents use three or four times that much. In-ground sprinkler systems, which indiscriminately water grass and pavement, are now standard in at least 25 per cent of new homes, according to estimates from the North Carolina Irrigation Association. Some municipalities, such as Concord, require sprinkler systems to have rain gauges to prevent them from irrigating during rainfall. In addition, municipalities may penalize irrigators who water driveways and sidewalks with fines.

Man made contributions to drought could result from uncontrolled growth when development exceeds the community's available water supply. Uncontrollable acts of terrorism can also cause lack of available potable water by damaging critical infrastructure, such as water plants, raw water intakes and man made dams. This could result in raw water deficiencies.

The diagram right provides a concept of the public's reaction to drought. This can be addressed through evaluation of available resources and the community's requirements.¹⁹



In 2008, North Carolina suffered from the worst drought in recorded history. The **Drought Management Act** (NCGS 143.355.1) was signed into law in July 2008(House Bill 2499). The law expands the ability of the governor and local communities to respond when drought conditions worsen and encourages greater planning, conservation and cooperation.²⁰ The Act required local governments that provides public water service to develop and implement water conservation measures to respond to drought or other water shortage conditions. Each plan is required to:

- Include tiered levels of water conservation measures and actions based on the severity of water shortage conditions;
- Each level of conservation measures shall be based on increasing drought or water shortage severity incrementally increasing water conservation measures.

The Act also allows the governor, with a recommendation from the Department of Environment and Natural Resources, to declare a local water emergency. Previously, a gubernatorial declaration could only be implemented if a community’s health and safety was threatened.

Chapter 62 of the City of Concord Code of Ordinances provides the authority for the City Manager to enact the provisions of the city’s Water Shortage Response Plan. The plan outlines trigger conditions and delegation of authority in the absence of the City Manager. The plan establishes levels of response and reduction goals for water use.

Drought Management Levels City of Concord Water Shortage Response Plan		
Level	Level Name	Reduction Goal
0	Drought Planning	Conservation
1	Drought Watch	Voluntary 3 to 5% reduction (or more)
2	Drought Warning	Mandatory 5 to 10% reduction (or more)
3	Drought Emergency Level I	Mandatory 10 to 20% reduction (or more)

4	Drought Emergency Level II	Mandatory 20 to 30% (or more)
Note: These levels would also apply in any water shortage situation		

The City of Concord is located within the Yadkin-Pee Dee River Basin of North Carolina. This basin serves 21 Counties and 93 municipalities with a 2000 population of 1,463,535.



Lake Howell, operated by WSACC, represents 74 percent of the total useable storage for the combined reservoir system for the Cities of Concord and Kannapolis and has been selected as the reservoir that provides the indication of the hydrologic condition of the County’s water supply watersheds within the Rocky River sub basin.²¹ The Water and Sewer Authority of Cabarrus County has established a 5 trigger point Drought Operations Plan based on the useable volume available in the reservoir and the current reservoir inflow. The plan also recognizes the NC Drought Management Advisory Council’s trigger mechanism.

WSACC Regional Drought Operation Plan Drought Response Trigger Points City of Concord Water Shortage Response Plan²²			
Stage	Lake Howell Useable Volume		Percent of Historical Mean Reservoir Inflow (cfs)
1	>70%	and	>75%
2	>70%	but	<75%
3	=70%		----

4	40% to 60%		----
5	30% to 50%		----
Note: cfs = cubic feet per second			

Storage is also available from the following sources:

- Lake Fisher has a usable volume of 749.6 million gallons and represents about 11% of the usable volume of the system.
- Lake Concord has a usable volume of 179.2 million gallons and represents about 2% of the usable volume of the system.
- Storage of finished water is: 4 (two million gallon clear wells) and 13.75 million gallons stored in 6 elevated storage tanks.

Concord has two water treatment plants: Hillgrove located on Palaside Drive and Coddle Creek located approximately 6 miles east of the city on Davidson Highway. Both plants have a treatment capacity of 12 million gallons per day each.

Concord has an 8 inch connection and a 24 inch connection with the City of Kannapolis which we can purchase approximately 2 million gallons per day and two 12 inch connections and a 16 inch connection with the City of Charlotte which we can purchase approximately 8 million gallons per day.

Residential ground water wells are still used in Concord primarily for irrigation purposes. These wells depend on rain water and are often not affected by short term drought. They can rapidly deplete during long term drought and take longer to recover than stream-flow, reservoirs and lake systems.

Terminology

Drought can be defined in four technical terms:

- Hydrological Drought: Hydrological drought refers to deficiencies in surface and subsurface water supplies. It is measured as stream flow, and as lake, reservoir, and ground water levels. There is a time lag between lack of rain or snow and less water in streams, rivers, lakes, and reservoirs, so hydrological measurements are not the earliest indicators of drought. When precipitation is reduced or deficient for a long time, this storage is reflected in declining surface and subsurface water levels.
- Agricultural Drought: Agricultural drought occurs when there isn't enough soil moisture to meet the needs of a particular crop at a particular time. Agricultural drought is typically evident after meteorological drought but before a hydrological drought.

- Meteorological Drought: Meteorological drought is usually based on precipitation's departure from normal over some period of time. These definitions are usually region-specific, and presumably based on a thorough understanding of regional climatology. Normally, meteorological measurements are the first indicators of drought.
- Socioeconomic Drought: When water shortage conditions begin to affect people.

Severity

Concord has sufficient water reservoirs and emergency connections to other utilities to manage many drought situations. We also monitor inflow and discharge from each reservoir. The real problem becomes back-to-back dry seasons, similar to what occurred during the period 1998-2002.

A short-term drought can last from a few weeks to a couple of months while a long-term drought can last from several months to several years. Concord has experience both types of droughts, historically in the summer months. Concord residents will long remember the drought of 2008, the driest year in over a century. If the epicenter for droughts remains shifted to the south-east, the area will continue to see more intense and long-term drought. It is important to know in light of the preceding statement that droughts are an indication of climate change. Population changes are also a consideration for demand on water supply just as the affects of reduced periods of rain.

A drought must also be considered outside of the context of a natural event. A community can place a demand on its water supply when uncontrolled growth exceeds its capability to produce potable water. Therefore growth must be considered to meet available supply.

One must consider more than “no rainfall” when defining a drought. Periods of no rain are part of a normal climate pattern. It is when less rain is received than expected for an extended period of time. The severity of the 1998-2002 droughts’ impact was a combined result of the much reduced precipitation, high water demand, and municipalities’ slow response to dwindling supplies. In 2002, drought-induced losses totaling \$398 million was incurred by the agricultural sector (Hayes et al. 2004). The multiplier effects of those impacts amounted to an additional \$233 million; 4,337 North Carolina jobs were also affected by the drought (direct and indirect) (RESI 2008).

Probability

Here in the southern United States, dry summer weeks without rain are not uncommon and drought is part of the local climate. However, when the weeks turn to months and months turn to years, serious problems can arise across a wide area. Because of the fact that much of our drinking water comes from streams, a drought can have serious implications in terms of how much water is available. Unlike other natural disaster, the onset and termination is hard to define.

Thirty Drought events were reported in Cabarrus County between 01/01/1959 and 02/28/2009. The following provide a summary of the more severe drought events.

Based on historical data, drought will continue to impact the Concord area. The severity of the drought is dependant on the degree of moisture deficiency, the duration of the drought, and the size of the affected.

Location

A drought can affect large regions at once and can last from weeks to years. The major components of the City's water system are shown in the community profile of this plan. Lacking a major river, the city's location within the Piedmont makes it vulnerable to internal and external weather conditions.

Although Concord is located in the Rocky River sub-basin of the Yadkin, the state considers the city to be between the Yadkin Basin and the Catawba Basin to its west. This means that withdrawal from either river is subject to inter-basin transfer limitations. In part because of these limits, Concord only had an emergency connection to the Charlotte-Mecklenburg system, which takes its water from the Catawba River. Until late 2002, Concord could withdraw up to 1.5 million gallons of water per day on an emergency basis. The city recently completed an expansion of that connection, which will allow Concord to withdraw up to 5 million gallons of water per day.

Concord relies on shared water sources and therefore the whole City will be affected by a drought. Past droughts have resulted in varying levels of water restrictions and usage fees. Water Shortages impacted the ability of businesses as well as residents to adequately maintain landscaping.

History of Drought in Concord

In the 1930s, the drought that created the Dust Bowl in the western plains also dried up North Carolina agriculture and water supplies, with major economic impacts. Then again in the 1950s and 1980s, drought struck North Carolina. The longest recent drought periods begin 1998 until August 2002. In 2001, Cabarrus County was included as part of 48 North Carolina Counties available for disaster assistance due to the drought. Concord experienced significant rainfall reductions during this period. A significant drought again impacted the area in 2007/2008.

Surface water supplies are mostly concentrated in use by the thermoelectric plants in the Piedmont regions (Moreau 2008). During the 2007 drought, 340 public water systems (53 percent of total) called for water use restrictions affecting a population of about five million (North Carolina Department of Environmental and Natural Resources 2007). Increased severity of droughts in the future from unmitigated climate change could put an even greater strain on the already stressed water supply systems in North Carolina.

1986 Drought

From winter through mid-summer of this year, drought conditions caused approximately \$330 million in agricultural losses in North Carolina. Drought conditions this year in

North Carolina reduced yields of several crop varieties. The overall yield of the state's most prevalent small grain-- wheat-- dropped in production to 14.5 million bushels in 1986 from 26.7 million bushels in 1985. As well, corn production dropped 27% below 1985 production levels, hay production dropped 21%, and tobacco production levels were down nearly 25%.²³

Due to sustained drought conditions, the following North Carolina communities currently have in place mandatory water use restrictions and/or water use bans: Atlantic Beach, Durham, Charlotte, Hillsborough, Stovall, Concord, Liberty, Bessemer City, and Cherryville.²⁴

1998 – 2002

From 1998-2002, sustained drought impaired hydroelectric power production at the J.H. Kerr Reservoir. As a result, North Carolina energy companies paid \$1.3 million to purchase replacement power from more expensive sources

According to the U.S. Geological Survey, the North Carolina agriculture industry lost \$398 million in 2002 due to continued drought.

During August, 2002, the North Carolina governor announced a ban on all "non essential" water use by state agencies.

During September, approximately 250 North Carolina municipalities currently are operating under voluntary, mandatory, or emergency water conservation plans because of sustained drought conditions and accompanying water usage increases.

According to the National Interagency Fire Center, severe drought conditions and the presence of dry, fallen leaves have contributed to increased wildland fire activity in the following Eastern states: Georgia, Kentucky, Maryland, North Carolina, Pennsylvania, South Carolina, Virginia, West Virginia and Tennessee.

2005 - 2006 Drought

The maximum number of water systems calling for mandatory water use restrictions was 14 from October 2005 to February 2006 according to the North Carolina Division of Water Resources and the Public Water Supply Section. These 14 systems provide water services to 600,000 people. Also during that time, 92 systems, serving about 1.9 million people, requested voluntary water use restrictions due to dry conditions.

2007 Drought

Gov. Mike Easley has directed all state agencies in North Carolina to stop non-essential water use because of drought conditions. He has also asked all citizens to cut water usage by 20%. As of Aug. 23, 59 public water systems had voluntary restrictions and 21 systems had mandatory restrictions. In all, 130 systems serving 52% of the state's population have implemented water restrictions because of the drought or seasonal programs, or for other reasons.

Seventy-two water systems have mandatory water restrictions in North Carolina, while 67 systems have voluntary water conservation orders as the people of North Carolina heed the governor's order to conserve water. Two counties are in moderate drought, while the remaining 98 counties are in worse drought categories. State agencies are to end all non-essential water use. All citizens who aren't under any water restrictions, including those who use private wells, are asked to reduce their water use by 20 %.

Vulnerability Assessment

Concord depends on three surface water collection Lakes; Howell, Fisher, and Concord. These lakes are predominately filled by rainfall so when the rain stops, Concord can rapidly find its self in trouble. The community's vulnerability is both physical and social and both must be considered to determine the vulnerability.

Concord has the ability to produce 22 million gallons of water per day for public consumption. Currently an average of 10 million gallons of water are consumed per day. The City of Concord has sufficient water reservoirs and emergency connections to other utilities along with a drought management plan, adopted by City Council, to minimize the vulnerability to the affects of a drought.

The City constantly monitors rainfall, climate data and lake levels which has led to early implantation of water restrictions to mitigate the effects of pending drought, sometime as much as a year prior to other municipalities taking the same action. Drought mitigation efforts also include education, increasing rates, and limiting residential growth. Working with local businesses to find the best ways to conserve water, the community found innovative ways to manage water use. As an example, Philip Morris, reduced its water usage (1.5 million gallons/day) by 30% using modified hardware to be more water efficient. Growth was controlled by limiting new connections to the water supply resulting in a 4% growth versus the normal 6 – 10% growth.

A severe drought will result in loss of revenue as water usage is curtailed to meet the demands of a thirsty community. Business dependant on water for income may have to suspend operations as a City attempts to preserve its drinking water. Considerations such as cost, public opinion, fairness, and the ability of the water system must all be considered. As an example, it may cost up to \$5000K/day to haul water into an impacted area and would impact the whole community while loss of water for golf course maintenance would cost \$10,000K/day but would only impact the golf course.

Structural vulnerability

The effects of a drought are not commonly associated with structural damage and does not affect infrastructure except in the event of soil shrinkage. This displacement of soil volume can impact the foundation on which the infrastructure is built resulting in collapse. Rare instances of this were observed as a result of the severe drought around the turn of the century.

Potential loss estimates.

A drought is a regional issue and would impact the whole community and therefore the entire population of Concord. Concord does not contain a significant amount of land used for agricultural purposes. Economic loss must also consider the lost of business from water. During the last drought, the City of Concord last and estimated \$3M in revenue or 6% of its total revenue due to drought restrictions necessary to conserve water. A drought also impacts Wastewater Revenue which during this period was estimated to be down \$1.4M or 3%.

Therefore future events will continue to pose a risk of economic loss to business and governmental revenue from water restrictions. A drought will have no significant impact on man-made structures, though landscaping of homes, golf courses and other human-manipulated landscapes are vulnerable. Reduce stream flow will have an impact on aquatic life and the natural ecosystem. Lack of moisture coupled with other natural conditions such as high wind will increase the likelihood of wildfires.

Water supply and electrical systems are vulnerable. Reduction of available water supplies intensifies the regional discussion of water allocation from natural systems. Water is also necessary for the production of hydroelectric and nuclear power. Local businesses that require large quantities of water to operate their business will be vulnerable if they have not developed prior mitigation strategies to withstand water shortages.

Based on the research conducted the likelihood of occurrence of a drought is considered to be **likely** or hazard will occur with some regularity. The intensity of a drought is considered to be **severe**, since a drought will affect the entire population. The potential for impact is **limited** due to consideration of the area affected, limited injuries (note: heat, discussed below was considered), effective drought planning, education, controlled growth and limited amount of shutdown of critical facilities due to the drought. The committee concluded that a drought poses a **moderate risk** to the City of Concord and is address in the plan.

Earthquake

Hazard Description

An earthquake is the violent shaking of the Earth's surface caused by the individual plates moving against each other. These plates make up the outermost shell of the Earth's crust and move relative to each other and to the Earth's interior. The intensity of an earthquake is measured by the Richter scale where a earthquake of a magnitude of 2.5 represents a mild tremor and little to no damage while an earthquake of a magnitude of 7.0 or greater represents a major tremor where changes to the Earth's surface occur and vast damage is expected.

North Carolina itself has no active fault zones. The western portion of the State has the most frequent seismic activity. Generally though, earthquakes in North Carolina are occur periodically, infrequently and are still considered a geological hazard. The North Carolina Geological Society has noted 4 seismic zones which have resulted in earthquakes felt or caused damage in North Carolina:

- Giles County, Virginia Seismic Zone
- Charleston, South Carolina Seismic Zone
- Eastern Tennessee Seismic Zone
- New Madrid Seismic Zone

Terminology

- Crustal Fault Earthquakes: Most common earthquakes and can occur at relatively shallow depths of 6 – 12 miles below the surface. These are often of a magnitude of <4 and create little
- or no damage, though they can cause quakes of a magnitude 7 with extensive damage.
- Deep intraplate Earthquakes: These occur at a depth of 25 – 40 miles below the surface in the sub ducting oceanic crust. They can reach magnitudes of 7.5.
- Subduction Zone Earthquakes: Caused by a sudden release of slowly accumulated stress and can produce earthquakes of magnitude 8.0 or larger.
- Ground shaking: The motion felt on the earth's surface caused by seismic waves generated by the earthquake. This is the primary cause of earthquake damage. The strength of the earthquake depends on the magnitude of the earthquake, the type of fault and the distance from the epicenter. Buildings on poorly consolidated and thick soils will typically see more damage than buildings on consolidated and bedrock.
- Liquefaction: When ground-shaking causes wet granular soils to change from a solid state to a liquid state. This results in the loss of soil strength and the soils ability to support weight. Buildings and their occupants are at risk when the ground can no longer support these buildings and structures.

- **Amplification:** Soils and soft sedimentary rocks near the earth's surface can modify ground shaking caused by earthquakes. One of these modifications is amplification. This increases the magnitude of the seismic waves generated by the earthquake. The amount of amplification is influenced by the thickness of geologic materials and their physical properties. Buildings and structures built on soft and unconsolidated soils can face greater risk. Amplification can also occur in areas with deep sediment filled basins and on ridge tops.
- **Epicenter:** Where the earthquake originates.
- Mercalli Intensity
- Magnitude
- Richter Scale.

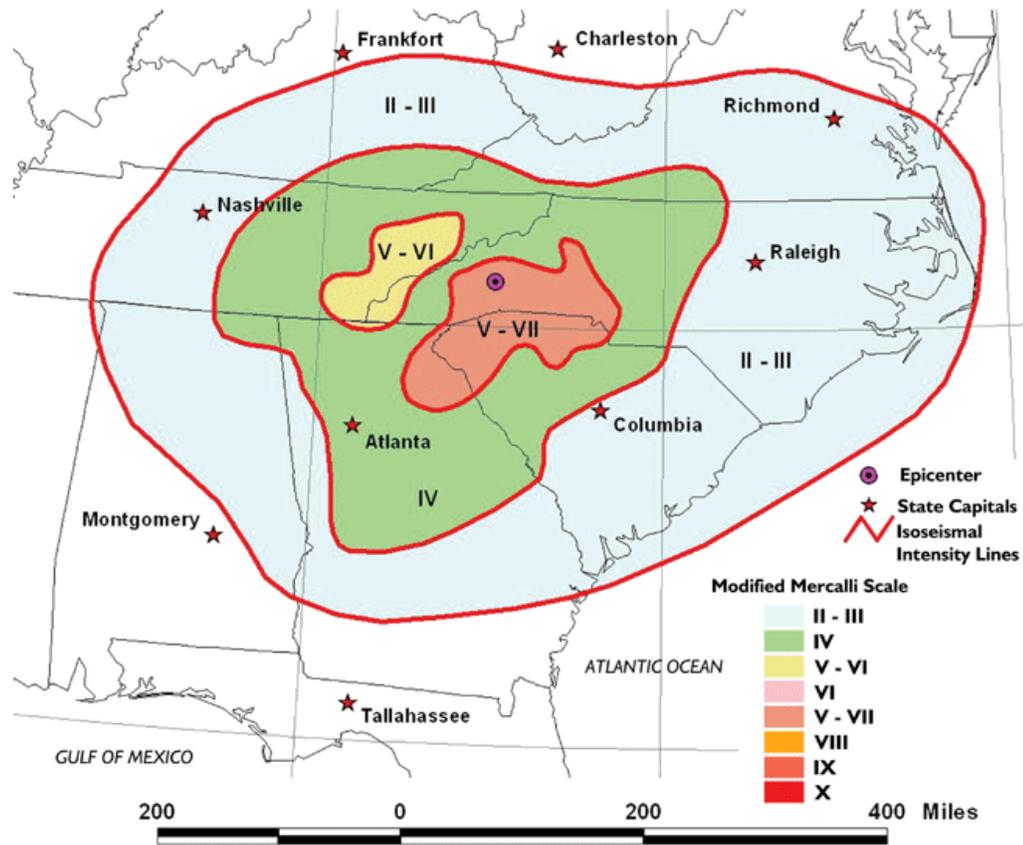
Severity

The Richter scale and the Modified Mercalli Intensity (MMI) are both terms used to describe the severity of an earthquake. All earthquakes release energy which radiates out from the epicenter (or center). Distance and soil can have a direct impact on the severity of an earthquake. The Richter scale measures the total amount of energy released while the effects, damage to buildings, the ability of people to feel the earthquake, etc... are expressed in terms of the MMI scale.

The diagram below provides a comparison between the MMI and the Richter Scale

MODIFIED MERCALLI SCALE		RICHTER SCALE	
I.	Felt by almost no one.	2.5	Generally not felt, but recorded on seismometers.
II.	Felt by very few people.	3.5	Felt by many people.
III.	Tremor noticed by many, but they often do not realize it is an earthquake.		
IV.	Felt indoors by many. Feels like a truck has struck the building.		
V.	Felt by nearly everyone; many people awakened. Swaying trees and poles may be observed.		
VI.	Felt by all; many people run outdoors. Furniture moved, slight damage occurs.	4.5	Some local damage may occur.
VII.	Everyone runs outdoors. Poorly built structures considerably damaged; slight damage elsewhere.		
VIII.	Specially designed structures damaged slightly, others collapse.	6.0	A destructive earthquake.
IX.	All buildings considerably damaged, many shift off foundations, Noticeable cracks in ground.		
X.	Many structures destroyed. Ground is badly cracked.	7.0	A major earthquake.
XI.	Almost all structures fall. Very wide cracks in ground.	8.0 and up	Great earthquakes.
XII.	Total destruction. Waves seen on ground surfaces, objects are tumbled and tossed.		

The magnitude 5.2 earthquake (Mercalli Intensity VII) which occurred 1916 near Skyland, North Carolina is used in the diagram below to illustrate the distance the effects of an earthquake can be felt.



Probability

Earthquake data before 1886 is sparse. Seismic instruments were installed in the region in the late 1920's. Prior to that time earthquake data are based on historical records. The distribution of seismograph stations did not allow for location of earthquakes with magnitudes <4 until 1962-1963. Micro-earthquake networks began operating in the region in the mid-1970s.

The most recent earthquake in was a magnitude 2.5 which occurred on October 03, 2009 20 miles south of Asheville.

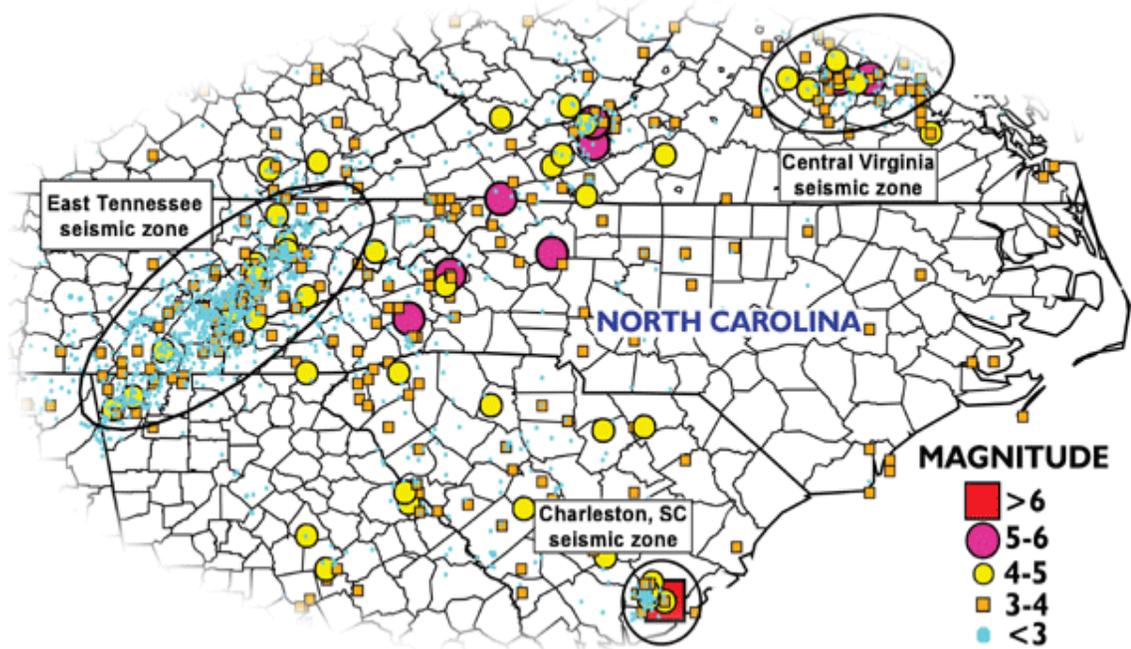
Location

Concord is located between three seismic zones, the East Tennessee seismic zone, Central Virginia seismic zone and Charleston, South Carolina seismic zone. Concord is located in an area of North Carolina that is at a low risk for the effects of an earthquake. Concord residents have experienced tremors and in the case of the Charleston earthquake in the 1800, some minor damage. Therefore the area is at some risk.

Historic Occurrence

Concord has been spared the effects of strong earthquakes. The earliest recorded earthquake in North Carolina on March 8, 1735 was felt in Concord and a second incident on February 21, 1774 shook the area again. The State has experienced 21 earthquakes which have caused damage in the state since 1735.²⁶ On June 5, 1998 at 02:31, an earthquake, magnitude 2.4 was centered 13.5 miles from the City.

The following chart of earthquake epicenters recorded in North Carolina and portions of adjacent states between 1698 and 2002. Major geologic provinces and known major faults exposed at the surface are shown for North Carolina. Faults identified to date in North Carolina are ancient and inactive. The lack of correspondence between the locations of earthquake epicenters and these faults indicates they are not responsible for earthquakes in North Carolina within historical times. The faults beneath the surface that generate earthquakes have yet to be positively identified.



As the map indicates, Concord is located between three seismic zones, East Tennessee, Central Virginia and Charleston, SC. In contrast to California which has active fault zones, North Carolina has not active zones. Earthquake activity is random, infrequent and small with the most frequent earthquake area being the East Tennessee zone. Three earthquakes which can be considered significant have occurred in 1861, 1916 and 1926. The table below summarizes damaging earthquakes in North Carolina from 1598 to 1989.²⁷

Year	Epicenter	Magnitude	Mercalli Intensity
1861	Near Wilkesboro, Wilkes County	5.0	VI

Year	Epicenter	Magnitude	Mercalli Intensity
1916	Near Skyland, Buncombe County	5.2	VII
1926	Southern Mitchell County	5.5	VII
1957	Near Woodlawn, McDowell County	4.0	VI
1957	Buncombe County	3.7	VI
1957	Northwest Jackson County	3.9	VI
1981	Near Hendersonville, Henderson County	3.5	VI

The great earthquakes of 1811 -1812 centered in the Mississippi Valley near New Madrid, Missouri, were felt throughout North Carolina. Intensity VI effects were observed in the western part of the State. The relatively small amount of damage caused by the New Madrid earthquakes is attributable to the low population density.

Among the most interesting events in North Carolina's earthquake history was a series of explosive shocks in the McDowell County area in 1874. There were at least 75 earthquakes between February 10 and April 17. The shocks were felt over an area about 40 kilometers in diameter. Although the tremors caused stout log buildings to shake violently at times, no damage was noted (intensity V).

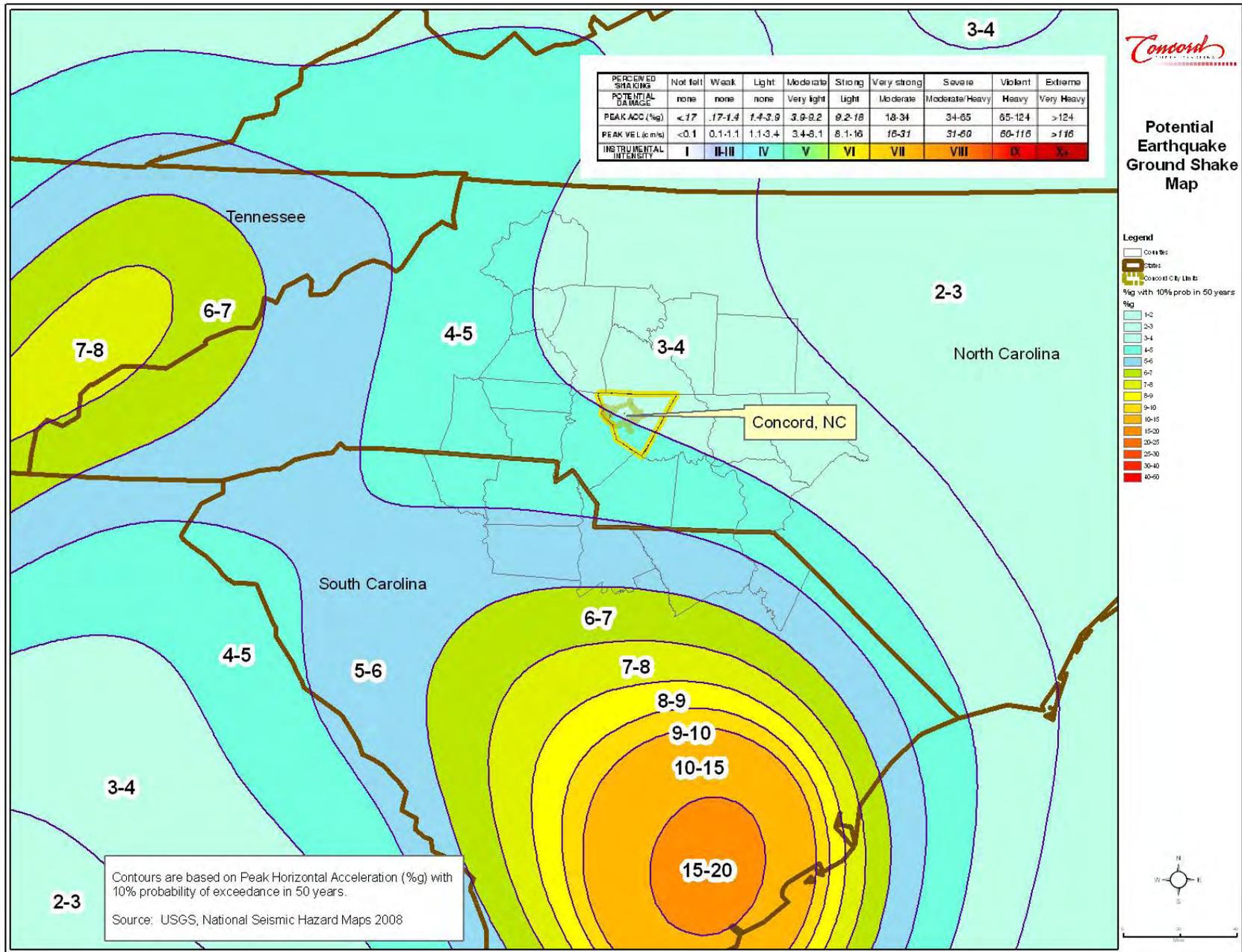
A minor earthquake on December 13, 1879, awakened persons in Charlotte, Pineville, Providence, and Sharon (intensity V). The tremor was preceded by a light foreshock the previous day. An earthquake shook houses in Wilmington on January 18, 1884. In addition, crockery was thrown from shelves (intensity V). On August 6, 1885, houses rocked violently and dishes rattled near Blowing Rock. A noise like thunder was reported at Boone (intensity IV - V).

Vulnerability Assessment

Concord's vulnerability to an earthquake is based on multiple factors. Concord is physically located within proximity to three seismic zones. The majority of earthquakes which occur in the State of North Carolina on average are a magnitude 4.4. Concord's vulnerability is based on the location, age and conditions of manmade structures. The movement from a sparse rural population to a denser urban environment has increased the risk to life. Should a major earth occur, the affects would be disastrous.

Risk of an earthquake reduces from west to east in the State of North Carolina. Concord's location near the middle of the state reflects its risk to the affects of an earthquake and considered a moderate risk to the City.

Ground shake Map²⁸



Extreme Temperatures

Hazard Description - Heat

“The most important single influence contributing to the variability of North Carolina climate is altitude. In all seasons of the year, the average temperature varies more than 20° Fahrenheit from the lower coast to the highest elevations. The average annual temperature at Southport on the lower coast is nearly as high as that of interior northern Florida, while the average on the summit of Mount Mitchell is lower than that of Buffalo, NY.²⁹ With its nearly 7,000-foot range in elevation and 300-mile range from the ocean, North Carolina has one of the most varied climates of any eastern state.”

Residents of the Piedmont area of North Carolina are presumed to be use to hot weather and high humidity. It is not uncommon during the summer months to see headlines stating, “It was another day of hot temperatures and high humidity across the Carolinas...”³⁰ Yet, these conditions can pose problems for those not accustomed to the climate or who are outside for prolonged periods of time. Extreme heat is defined as temperatures that hover 10 degrees or more above the high average temperature for a particular region and last for several weeks. Humid or muggy conditions, which add to the discomfort of high temperatures, occur when a “dome” of high atmospheric pressure traps hazy, damp air near the ground.

In 1900, A.T. Burrows defined a heat wave as three or more consecutive days where the maximum shade temperature reached or exceeded 90 F. Heat kills by taxing the human body beyond its abilities. In a normal year, about 175 Americans succumb to the demands of summer heat. Among the large continental family of natural hazards, only the cold of winter - not lightning, hurricanes, tornadoes, floods, or earthquakes - takes a greater toll. In the 40-year period from 1936 through 1975, nearly 20,000 people were killed in the United States by the effects of heat and solar radiation. In the disastrous heat wave of 1980, more than 1,250 people died. North Carolina experienced 161 heat related deaths from the period 1976 until 2002.³¹

Higher temperatures and increased frequency of heat waves may increase the number of heat-related deaths and the incident of heat-related illnesses. A warming increase of 3F during a typical summer is estimated to increase heat related deaths by nearly 70%. Also a warmer and wetter climate can increase the potential for an increased mosquito population, increasing the risk for West Nile Virus and other associated diseases.

This could also impact water quality (a reason heat is included with drought) since rising temperatures increase water demand especially for growing communities such as Concord. Lower stream flows and higher water temperatures also allow concentration of pollution and reduce the assimilation of wastes. This could affect rivers that not only supply water but also receives wastewater from many municipalities and industries.

Terminology

- **Heat wave:** Prolonged period of excessive heat and humidity. The National Weather Service steps up its procedures to alert the public during these periods of excessive heat and humidity.
- **Heat index:** A number in degrees Fahrenheit (F) that tells how hot it really feels when relative humidity is added to the actual air temperature. Exposure to full sunshine can increase the heat index by 15 degrees F.
- **Heat cramps:** Heat cramps are muscular pains and spasms due to heavy exertion. Although heat cramps are the least severe, they are an early signal that the body is having trouble with the heat.
- **Heat exhaustion:** Heat exhaustion typically occurs when people exercise heavily or work in a hot, humid place where body fluids are lost through heavy sweating. Blood flow to the skin increases, causing blood flow to decrease to the vital organs. This results in a form of mild shock. If not treated, the victim may suffer heat stroke.
- **Heat stroke:** Heat stroke is life threatening. The victim's temperature control system, which produces sweating to cool the body, stops working. The body temperature can rise so high that brain damage and death may result if the body is not cooled quickly.
- **Sunstroke:** Another term for heat stroke.
- **Excessive Heat Watch**—Conditions are favorable for an excessive heat event to meet or exceed local Excessive Heat Warning criteria in the next 24 to 72 hours.
- **Excessive Heat Warning**—Heat Index values are forecast to meet or exceed locally defined warning criteria for at least 2 days (daytime highs=105-110° Fahrenheit).
- **Heat Advisory**—Heat Index values are forecast to meet locally defined advisory criteria for 1 to 2 days (daytime highs=100-105° Fahrenheit).

Timing and Duration

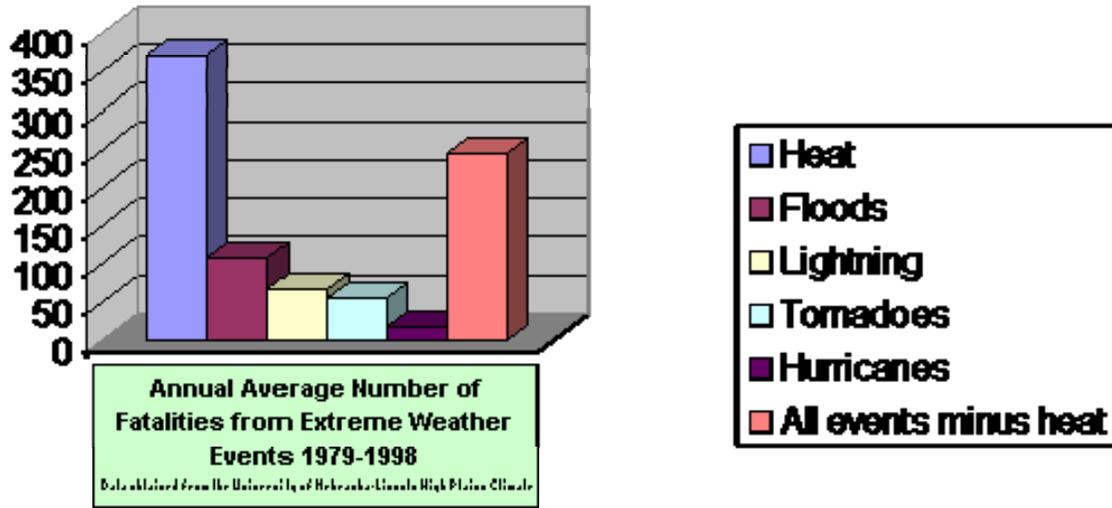
The most common time for a heat wave is usually from late July through August and often are accompanied by a varying of drought.

Heat is not listed as an identified hazard in the State Mitigation Plan.

Severity

Heat is not often considered in the same risk categories as other forms of severe weather, though from 1979 to 1998 heat related deaths were greater than those caused by other forms of severe weather. A extreme heat wave does not have to be present to cause heat related deaths. National Weather Service figures indicate an average of 175 people annually succumb to the affects of heat.

Damage estimates from heat are also more commonly associated with the effects of drought.

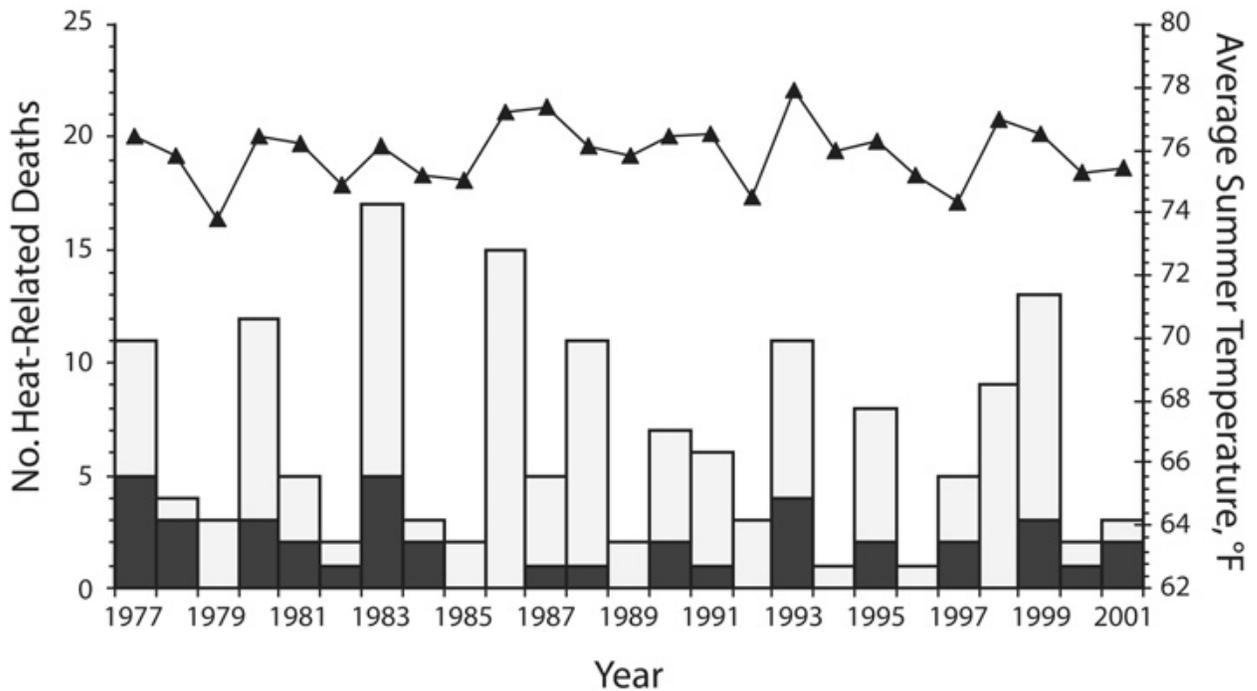


Probability

Records have been sketchy regarding heat related incidents in the Concord area. Climate changes have been widely discussed in many scientific circles. Average temperature increases have been recorded around the globe. During the last century the average temperature in parts of North Carolina has increased 1.2F. Projections from the Intergovernmental Panel on Climate change indicates that by 2100 temperatures in North Carolina could increase by 3F in all seasons, though other models show different results. North Carolina is exposed to regular, intense heat during a typical summer and populations will continue to be sensitive to heat waves.

The American Journal of Public Health study for the 24 year period January 1, 1977 to December 31, 2001 found the average fatality rate to be 0.11/100,000/year during this period. The study provided a definite relationship between the average summer temperatures and numbers of heat-related deaths. Heat related death rates increased at 5% for additional day of temperatures at 90F or higher.

The chart below was taken from this study and shows the incidents of occupational heat related fatalities (black bars) and non-occupational (white bars) in relation to the average annual summer temperatures in North Carolina.



Vulnerability

Anyone not taking proper precautions during periods of extreme heat is at risk. Certain portions of the population though are more at risk than others. This includes the poor, children, elderly and immune-compromised compromised individuals. Heat waves can affect the human body in a variety of ways as seen in the following figure:

Heat effects

HI	Possible Heat Disorder:
80°F – 90°F	Fatigue possible with prolonged exposure and physical activity.
90°F - 105°F	Sunstroke, heat cramps and heat exhaustion possible.
105°F - 130°F	Sunstroke, heat cramps, and heat exhaustion likely, and heat stroke possible.
130°F or greater	Heat stroke highly likely with continued exposure.

The **Heat Index (HI)** is the temperature the body feels when heat and humidity are combined. The chart below shows the HI that corresponds to the actual air temperature and relative humidity. (This chart is based upon shady, light wind conditions. **Exposure to direct sunlight can increase the HI by up to 15°F.**) (Due to the nature of the heat index calculation, the values in the tables below have an error +/- 1.3F.)

		Relative Humidity (%) versus Temperature															
		8	8	84	86	88	90	92	94	96	98	100	10	104	10	10	11
RH(%)/ T		0	2									2	6	8	0		
40%	8	8	83	85	88	91	94	97	10	10	109	11	119	12	13	13	
	0	1							1	5		4	4	0	6		
45%	8	8	84	87	89	93	96	100	10	10	114	11	124	13	13		
	0	2							4	9		9	0	7			
50%	8	8	85	88	91	95	99	103	10	11	118	12	131	13			
	1	3							8	3		4	7				

55%	81	84	86	89	93	97	101	106	112	117	124	130	137				
60%	82	84	88	91	95	100	105	110	116	123	129	137					
65%	82	85	89	93	98	103	108	114	121	128	136						
70%	83	86	90	95	100	105	112	119	126	133							
75%	84	88	92	97	103	109	116	124	132								
80%	84	89	94	100	106	113	121	129									
85%	85	90	96	102	110	117	126	135									
90%	86	91	98	105	113	122	131										
95%	86	93	100	108	117	127											
100%	87	95	103	111	121	132											

Caution
Extreme Caution
Danger
Extreme Danger

Temperature (Down) versus Dew point (across)							
°F	55	60	65	70	75	80	85
80	80	80	81	83	84	87	
85		84	86	89	93	99	107
90			91	95	100	107	117
95				101	106	114	125
100					113	121	131
105						127	138
110						134	145

Vulnerability Profile

Heat is often seen in direct relationship to drought. Heat can increase water usage and evaporation, but is not a prime reason for drought conditions. Heat waves can pose a threat to the community and cause increase utility usage. Heat will affect the entire jurisdiction, though the impact to critical facilities is negligible. Heat was considered with drought due to Federal recommendations though discussed separately due to its impact on the population. Based on age, 30.1 percent of the population of Concord would be at risk during a heat wave.

Heat is not considered to be a risk to built structures. The natural environment can be impacted through a negative impact depending when the heat event occurs during a plant's growth cycle. This is further impacted if extreme heat is accompanied by a drought. Dry conditions, lack of humidity and high wind can increase the risk of

wildfire. During periods of extreme heat, an increase can be expected in water and electrical usage as people attempt to stay cool. As discussed above, high heat taxes the bodies ability to remain cool. Multiple health related problems can occur during exposure and those working outside are especially vulnerable. Those without home air conditioning or the ability to seek cool areas are also vulnerable. The elderly, those with compromised immune systems are at an increased risk.

As development continues, reduction of natural surfaces by paving will increase the local surface temperatures. This can create localized areas of heating.

Vulnerability Assessment

Based on historical data and climatologic information it is likely that Concord will continue to periodically feel the effects of a heat wave in the future. Heat affects large geographical areas, though the effects coincide with a person’s ability to cope with the heat, (due to age or capacity to cool down). Therefore the magnitude or intensity of damage is classified as **moderate** and taken separate from drought.

Impact to critical facilities is not expected to be significant, though heat will result in an increased demand for electrical service and water usage. Agricultural impact has a potential to be significant, tough agricultural area only accounts for .06% of the City’s Area. Therefore the impact is considered to be **limited**.

The risk associated with a heat related event is considered to be **low**; mitigation efforts are only briefly addressed in this plan. Concord’s approach to mitigating heat related injuries include internal departmental policies for employees, public education and public safety announcements release in conjunction with National Weather Service Statements and a local program that provides fans for the elderly. The risk from heat was considered in conjunction with drought.

Hazard Description – Extreme Cold

Extreme cold often accompanies a winter storm or can occur on it’s on. Winter weather can have a negative impact on the community beside the most visual effects of ice or snow. Extreme cold can cause freezing of pipes and physical danger to humans. The danger to humans is compounded when the wind blows. This results in a wind chill or what the temperature feels, similar to a heat index. Infants and elderly people are most susceptible. The National Weather Service will can issue wind warnings or advisories. Cold weather also increases the risk of home heating fires and injuries from carbon monoxide poisoning. In addition, pipes may freeze and burst in homes that are poorly insulated or without heat. The following chart explains the cooling effect the body can experience from a combination of wind and temperatures.

Wind Speed(MPH)/Temperature (°F)																		
W/T	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45

5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-89	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

 Caution
 Frostbite in 30 min
 Frost bite in 10 min
 Frostbite in 5 min

Terminology

- Wind Chill Watch – Conditions are favorable for wind chill temperatures to fall to 20 below zero in the mountains, or 15 below zero in the foothills and piedmont, within the next 48 hours.
- Wind Chill Warning – Wind chill temperatures reaching or exceeding minus 20 in the mountains, or minus 15 outside of the mountains.
- Wind Chill Advisory – Wind chill temperatures reaching or exceeding minus 5 in the mountains, or zero outside of the mountains.

Severity

Extreme cold temperatures can pose a variety of direct and indirect health problems. Physical impacts include hypothermia, frost bite, cardiac-related deaths and indirect affects such as fire injuries and carbon monoxide poisoning.

Probability

Extreme cold events usually have historically occurred in December and January. Since these events are not dependant on the presence of moisture, they are considered separately from winter storms. Extreme cold temperatures can last for a single day to weeks. Normally the community deals with extreme cold temperatures by wearing the appropriate clothing, staying indoors with a heat source. Wind speed coupled with low temperatures create a “wind chill” which relates to the fact that wind increases the body’s rate of heat loss making it seem colder than it actually is.

Extreme Cold – 5 Events, \$500,000 Damages³²

Event #	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1	01/15/1994	0000	Extreme Cold	N/A	3	0	500K	0
2	01/19/1994	0000	Extreme Cold	N/A	6	0	0	0
3	04/01/1997	12:00 AM	Cold	N/A	0	0	0	0
4	12/01/2000	12:00 AM	Extreme Cold	N/A	0	0	0	0
5	3/27/2004		Frost/Freeze	B.A	0	0	0	0

Vulnerability Assessment

When exposed to cold temperatures, your body begins to lose heat faster than it can be produced. Prolonged exposure to cold will eventually use up the body's stored energy. This can cause hypothermia, or abnormally low body temperature. Normally the community deals with extreme cold temperatures by wearing the appropriate clothing, staying indoors with a heat source. Wind speed coupled with low temperatures create a "wind chill" which relates to the fact that wind increases the body's rate of heat loss making it seem colder than it actually is. The use of wind chill is show the effective temperature at a particular wind speed. For instance in calm conditions at -29°C a well clothed person is in little danger, a light wind of 10mph gives the same effect as a temperature of -44°C when exposed flesh can freeze in a minute or so. A breeze of 25mph gives an equivalent of -66°C with severe danger to exposed flesh within seconds rather than minutes. This is one of the reasons why Antarctica is such an extreme environment, it is often both very cold and very windy.

The following are examples of vulnerabilities to cold temperatures:

1. Three people died of hypothermia, one in Robeson County and two in Wayne County , in the coldest outbreak since December 1989. Record breaking low temperatures dipped below zero in the mountains and ranged to 10 to 15 degrees at the coast. Daytime temperatures remained below freezing over most of the state on the 16th and 17th. Water pipes burst in many places especially in beach cottages at the coast.
2. Another round of record low temperatures hit the state with minimum temperatures ranging from below zero over the mountains to the teens along the coast. Daytime temperatures remained below freezing on the 20th. Six people died of hypothermia, one in Rockingham County, two in Caswell County , two in Guilford County , and one in Robeson County.

3. Several cold snaps following the relatively warm late winter caused temperatures to dip well into the 20s at times yielding substantial damage to the apple crop and perhaps other crops.
4. December, 2000 will long be remembered for the brutal hold that cold weather had on the region. Temperatures ran 6 to 8 degrees below normal for the entire month. At Charlotte, it was the coldest month in 83 years.
5. A late freeze caused considerable damage to some of the fruit crop across the piedmont and the foothills. Some orchards suffered up to a 50% loss.

When a cold snap hits a normally warm city, the effects can be significantly than the same temperature at a colder city. Concord has a normally mild winter. When a cold snap occurs, people begin to take measures to stay warm. Extreme cold temperatures have a direct impact on the population, especially the homeless, aged and very young. The built environment can be affected as water line rupture resulting in structural damage from water and damage to the transportation system if waterlines are impacted.

Communities across the county witness an increase in fires as people seek alternate means of staying warm. Loss of life and structural damage are a direct result. Carbon monoxide poisoning also increases during these periods and can results in deaths even in milder cold weather conditions such as the deaths of two campers during an October race event at Lowes' Motor Speedway.

Demand for fossil fuel increase during the winter months due to the use of home heating oil and other fossil fuels. In the year 2000 prices rose sharply when oil supplies plummeted. Extreme cold can also impact the ability of people to cope with the effects of a winter storm. The need for sheltering is often reduced during warm weather events unless an individual home is directly impacted. Loss of power often results in the inability of people to remain at home due to an inability to remain warm. Those that do often use alternate heat sources with bad results.

Cold temperatures doe not have to be extreme to have a negative impact on the community. The timing of the cold temperatures can impact the local economy. Cold temperatures can damage crops throughout the area.

Extreme cold temperatures will affect the community as a hole and the effects are multiplied when coupled with other forms of severe weather. An event can occur at any time but on average occur every ten to fifty years.

Impact to critical facilities can occur in the event of loss of heat resulting in rupture of water lines but damage is not expected to be significant. Annually the community is impacted as the natural result of normal cold weather with the increase of home heating fires. The transportation system can be impacted by potholes and washout resulting from water line ruptures. Abnormally low temperatures do not have to be extreme to have an

impact. Frost, occurring at the wrong time can seriously damage local crop production which accounts for .06% of the City's area.

The risk associated with a extreme cold weather event in itself is considered to be low; mitigation efforts are only briefly addressed in this plan. An aggressive fire prevention and disaster preparedness program is an effective means of addressing the public risk to the effects of cold weather. This includes internal departmental policies for employees, public education and public safety announcements release in conjunction with National Weather Service Statements. The risk from extreme cold is further considered in the winter weather portion of this plan..

Though extreme temperatures can happen with some regularity, the impact on the built, natural, and infrastructure systems are rather. These events pose a moderate risk to the population with the low income and frail elderly at the greatest risk. Extreme cold presents an increased risk to fire which is addressed through an effective Life Safety Education program within the fire department.

Flooding

Hazard Description

Flooding is a natural and recurring event for a river or stream. Statistically, streams will equal or exceed the mean annual flood once every 2.33 years (Leopold *et al.*, 1964). Flooding is a result of heavy or continuous rainfall exceeding the absorptive capacity of soil and the flow capacity of rivers, streams, and coastal areas. This causes a watercourse to overflow its banks onto adjacent lands. Floodplains are, in general, those lands most subject to recurring floods, situated adjacent to rivers and streams. Floodplains are therefore "flood-prone" and are hazardous to development activities if the vulnerability of those activities exceeds an acceptable level.



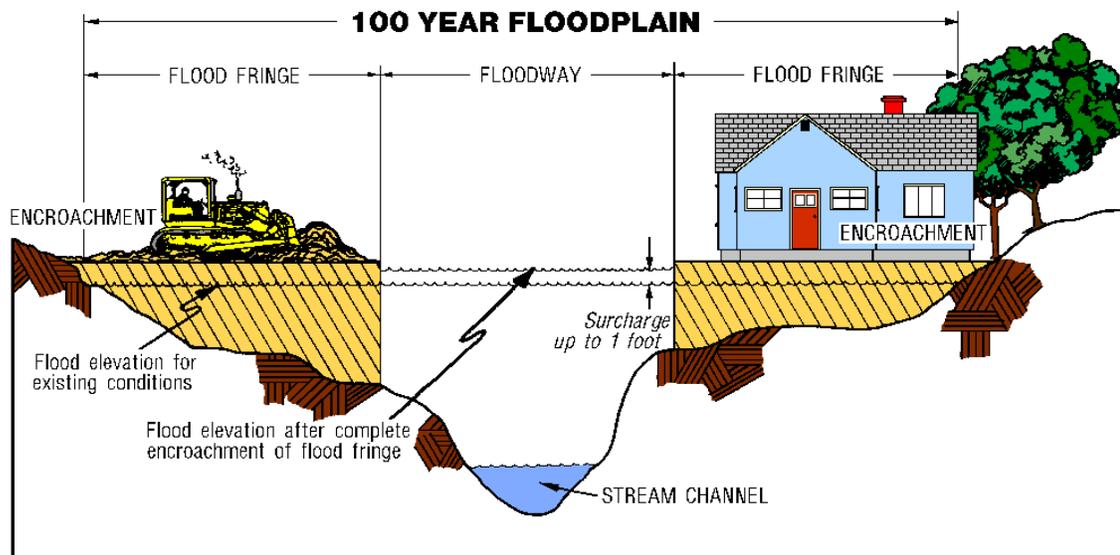
Floods can have a slow onset and usually lasts for a longer period of time than rapid onset flooding (flash flooding) which is more dangerous and poses a greater risk to life and property due to less time to take preventive actions. Of the four different categories of flooding; costal, arroyos, river and urban, Concord is only affected by river and urban flooding.

Terminology

- **Costal Floods:** Coastal Floods usually occur along coastal areas. When there are hurricanes and tropical storms which will produce heavy rains, or giant tidal waves created by volcanoes or earthquakes, ocean water may be driven onto the coastal areas and cause coastal floods.
- **Arroyos Floods:** A arroyo is river which is normally dry. When there are storms approaching these areas, fast-moving river will normally form along the gully and cause damages.
- **River Floods:** River flooding is caused when rivers and streams overflow their banks. Flooding from large rivers usually results from large-scale weather systems that generate prolonged rainfall over wide areas. These same weather systems may cause flooding of smaller basins that drain to major rivers. Small rivers and streams

are susceptible to flooding from more localized weather systems that cause intense rainfall over small areas. According to the Concord Flood Insurance Study, while overbank flooding of rivers and streams is the most common type of flood event in North Carolina, this type of flooding is less frequent and severe in Concord than rapid flooding.

- **Urban Floods:** In most of the urban area, roads are usually paved. With heavy rain, the large amount of rain water cannot be absorbed into the ground and leads to urban floods. Densely populated areas have a high risk for flash floods. The construction of buildings, highways, driveways, and parking lots increases runoff by reducing the amount of rain absorbed by the ground. During periods of heavy rainfall, storm drains may become overwhelmed and flood roads and buildings. Low spots, such as underpasses, underground parking garages, and basements are especially vulnerable to flash floods.



- **Floodplain:** Land area adjacent to a river, stream, lake, estuary or other body of water that is subject to flooding. This area, if left undisturbed, acts to store excess floodwater. The floodplain is made up of two sections: the floodway and the flood fringe.
- **100-Year Flood:** The 100-year flooding event is the flood having a one percent chance of being equaled or exceeded in magnitude in any given year. Contrary to popular belief, it is not a flood occurring every 100 years. The 100-year floodplain is the area adjoining a river, stream or watercourse covered by water in the event of a 100-year flood.
- **Floodway:** The floodway is one of two main sections that make up the flood plain. Floodways are defined for regulatory purposes. Unlike floodplains, floodways do not reflect a recognizable geologic feature. For NFIP purposes, floodways are defined as the channel of a river or stream, and the over bank areas adjacent to the channel. The floodway carries the bulk of the floodwater downstream and is usually the area where water velocities and forces are the greatest. NFIP regulations require that the floodway be kept open and free from development or other structures that would obstruct or divert flood flows onto other properties. City of Concord regulations prohibit all development in the

floodway. The NFIP definition is “the channel of a river or other watercourse and adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot. Floodways are not mapped for all rivers and streams but are generally mapped in developed areas.

- **Flood Fringe:** The flood fringe refers to the outer portions of the floodplain, beginning at the edge of the floodway and continuing outward. This is area where development is likely to occur, and where precautions to protect life and property need to be taken.
- **Development:** Development is defined broadly in the Unified Development Ordinance to mean:
 - Change in Use, Construction, filling, excavating, grading, paving, dredging, mining, drilling, or otherwise significantly disturbing the soil of a site;
 - Building, installing, enlarging, replacing or substantially restoring a structure, impervious surface, or central water system, and including the long term storage of materials...”
- **Base Flood Elevation (BFE):** The term “Base Flood Elevation” refers to the elevation (normally) measured in feet above sea level) that the base flood is expected to reach. Base flood elevations can be set at levels other than the 100-year flood. Some communities choose to use higher frequency flood events as their base flood elevations for certain activities, while using lower frequencies for others. The regulations of the NFIP focus on development in the 100-year floodplain.

Severity

The NWS characterizes flood severity to more effectively communicate the impact of flooding as outlined in the table below:

NWS FLOOD CATEGORIES ³³	
Category	Description
<i>Major</i>	Extensive inundation and property damage Often involves the evacuation of people and the closure of both primary and secondary roads
<i>Moderate</i>	Inundation of secondary roads Transfer to higher elevation necessary to save property Some evacuation may be required
<i>Minor</i>	Minimal or no property damage Possibly some public inconvenience

Probability

The impact of floods varies locally as river levels increase above flood stage increasing severity occurs in the community. This type of flooding is most often seen throughout

the community as local streams, creeks and rivers overflow their banks. FEMA's Flood Insurance Rate Maps delineate

Location

The City Concord is located in the Yadkin River Basin and is bisected by a river (Rocky River) and four major creeks and streams which all flow in a southeasterly direction. The major creeks are: Coddle Creek, Irish Buffalo Creek, Three Mile Branch and Cold Water Creek. In addition to these creeks there are several smaller creeks and bodies of water that feed into them. The four major creeks converge into Rocky River, south of the city limits.

The floodways and floodplains in Concord are all adjacent to these major streams. Concord contains 5.576 square miles of 100-year floodplain, which is 9.28% of the total city area of 60.042 square miles. Of this floodplain area, 2.053 square miles is in the floodway, which leaves only 3.523 square miles (5.86% of the total city's area) in the remaining 100-year floodplain. The City of Concord's zoning ordinance does not allow development in the floodway, and buildings may not be constructed within the 100-year floodplain area. Only very limited activities, such as recreational usage, is permitted within the 100-year floodplain area.

National Flood Insurance Program

The National Flood Insurance Program (NFIP) was developed in 1968, in response to the rising cost of taxpayer funded disaster relief for flood victims and the increasing amount of damage caused by floods. Concord (Community ID 370037) has participated in the National Flood Insurance Program since 03/04/80 and maps are current as of 11/5/2008. Cabarrus County joined the program in 1981. Currently, there are 89 flood insurance policies in force in the City of Concord, with a total amount of insurance of \$24,505,200. As of 4/30/2009, nine losses have been reported since Concord joined the program in 1980 for a total payment amount of \$43,852.00. Concord's mitigation efforts allowed its Community Rating System (CRS) to improve from a Class 9 to Class 8. This is a completely voluntary program and demonstrates Concord dedication to community disaster preparedness. Improving the rating from Class 9 to Class 8 is equivalent to a 10% premium discount to policyholders. The Insurance Service Office (ISO) recently completed an updated CRS study and determined that the City's rating will remain a Class 8 and become effective on May 1, 2010. However, the City could potentially qualify for a Class 7 or better if Cabarrus County's Building Code Effectiveness Grading Schedule (BCEGS) was improved to a Class 6 or better.

Flood events are usually described according to their probability of occurrence. Historical data has been used to determine the rainfall depth and intensity that signify storms of different return periods: 2-year, 10-year, 25-year, 50-year, 100-year, and 500-year. A 100-year flood is a flood that has a 1% chance of occurring in any given year. The 100-year flood plain is used as a basis for floodplain mapping in

Cabarrus County and is based on the 100-year flood. The following table provides a description of flood plain areas as categorized on the Flood Insurance Rate Maps:

Description of Flood Plain Areas by Zone³⁴	
Zones	100-year of base floodplain type "A" zones
A	The base floodplain mapped by approximate methods, i.e., Base Flood Elevations (BFEs) are not determined. This is often called an un-numbered zone or approximates A zone.
AE	The base floodplain where the base flood elevations are provided.
AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths are determined. For areas of alluvial fan flooding, velocities are also determined.
AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations are determined.
A99	Area to be protected from 1% annual chance of flood by a Federal protection system under construction. BFEs are not determined.
AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection form the 1% annual chance or greater flood.
Zone VE	The flood zone with velocity hazard (wave action). BFEs are provided on the FIRM.
Zone X	Areas of 0.2% annual chance of flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood. Zone X also includes areas outside the 0.2% annual chance floodplain, as well as areas outside future conditions 1% annual chance floodplain.
Zone D	Areas in which flood hazards are undetermined, but possible.

Flood maps and Flood Insurance studies are often used to identify flood-prone areas. Hurricane Floyd (1999) revealed data and flood map limitations in North Carolina. In the normal FEMA program, on average, North Carolina received only one updated Flood Study for one county per year. To speed up the rate of remapping, the State entered into a Technical Partnership Program with FEMA and established the new North Carolina Floodplain Mapping Program. The mapping techniques used by this program are part of the latest technological advances such as LIDAR and GIS. In general, the City of Concord considers the new flood maps to be of very high quality. More detailed descriptions of the mapping procedures are available at the programs website (<http://www.ncfloodmaps.com>).

The NFIP was established in 1968 as a means of providing low-cost flood insurance to the nations flood-prone community. The NFIP also reduces flood losses through

regulations that focus on building codes and “sound flood plain management”. In Concord, 89 policies are in force with nine losses since 1980 for a total payment amount of \$43,852.00.

Flood Insurance Maps (FIRM) and Flood Insurance

Floodplain maps are the basis for implementing floodplain regulations and for delineating flood insurance purchase requirements. A Flood Insurance Rate Map (FIRM) is the official map produced by FEMA, which delineates SHHA in communities where NFIP regulations apply. FIRMS are also used by insurance agents and mortgage lenders to determine if flood insurance is required and what insurance rates should apply.

Water surface elevations are combined with topographic data to develop FIRMs. FIRMs illustrate areas that would be inundated during a 100-year flood, floodway areas, and elevations marking the 100-year flood level. In some cases they also include base flood elevations (BFE’s) and areas located within the 500-year floodplain.

Flood Insurance Studies and FIRMs produced for the NFIP provide assessments of the probability of flooding at a given location. FEMA conducted many Flood Insurance Studies in the late 1970s and early 1980s. These studies and maps represent flood risk at the point in time when FEMA completed the studies. It is important to note that FEMA has not mapped all 100-year and 500-year flood plains.

Flood maps are also not entirely accurate. These studies and maps represent flood risk at the point in time when FEMA completed the studies and does not incorporate planning for floodplain changes in the future due to new development. However, the business plan established by the North Carolina Floodplain Mapping Program implements a system for regularly updating map panels that qualify for remapping.

Flood Mapping Methods and Techniques

The use of GIS (Geographic Information System) is becoming an important tool for flood hazard mapping. FIRM maps can be imported directly into GIS, which allows GIS analysis of flood hazard areas. Communities find it particularly useful to overlay flood hazard areas on tax assessment parcel maps. This allows a community to evaluate the flood hazard risk for a specific parcel during review of a development request.

Historic Occurrences

Local Flood History 1993 to Present			
Date	Notes	Type	Damage
03/23/93 @ 1200	A slow-moving low pressure system moving east from the nation's midsection, brought moisture-laden air from the Gulf region into	Flash	N/A

Local Flood History 1993 to Present			
Date	Notes	Type	Damage
	western North Carolina. Widespread heavy rain and embedded thunderstorms produced two to four inches of rainfall over a large portion of the area, atop grounds saturated by previous rainfall and snowmelt. Rapid flooding resulted on the already-swollen streams and rivers. No significant property damage was reported, but several roads and bridges were flooded and a few evacuations from homes occurred.		
07/06/95 @ 1745	Several secondary roads were reported to be flooded.	Flash	N/A
08/27/95 @ 03:00	The remnants of Hurricane Jerry dropped eight to nine inches of rain producing serious flooding. A mobile home park and a nursing home were evacuated. Many homes and 30 roads sustained flood damage. Three miles of Interstate 85 were closed due to flooding from the Rocky River.	Flood	\$1.5M
10/04/95 @ 1530	Numerous roads were underwater due to very heavy rains. The Little Creek came out of its banks flooding several locations including the Stallings Bridge Road in Harrisburg and Pharr Mill Road at Little Creek.	Flash	N/A
07/23/97 @ 0140 ¹	A cluster of thunderstorms producing very heavy rain sank south in the Charlotte metro area shortly before midnight of the 23rd and continued to redevelop over the area through mid-morning. Severe flash flooding resulted as nearly 10 inches of rain fell in some spots. Mecklenburg county officials requested that people not try to go to work or drive around. Numerous roads and bridges were washed out or damaged. A railroad trestle collapsed, dropping a locomotive 100 feet into a raging creek. Two women died after their vehicles became trapped in floodwaters around 2 AM EST. A young girl perished around 9 AM EST when she went to play in the waters and was swept away. In Cabarrus County, 3 of the 4 injuries occurred when a plant roof collapsed due to the weight of the rainwater. The fourth injury occurred in Mount Pleasant when a person drove into a washout.	Flash	\$3.0M property damage \$2.0 M crops Injuries 4
01/16/98 @ 1630	Heavy rain falling during the day on still saturated ground caused several roads and bridges to be flooded as area creeks and streams rose out of their banks.	Flood	N/A
02/03/98 0800-1800	Local stream flooding, Coddle Creek Reservoir over the spillway and gates are partially lowered to attempt and reduce lake level before storm hits. Rocky River at Concord Parkway south is out of its banks, other area streams are up, though not overflowing. One building damaged due to urban flooding.	Flood	N/A
04/09/98, 0400	Heavy rain and thunderstorms persisted over the Charlotte metro area during the early morning and resulted in several flooded roads. A park was flooded in Monroe and people were stranded in their van. Bridges were covered by the floodwaters in the southern portion of Cabarrus County with one vehicle stuck in the water. Apartments and cars in the Briar Creek area of south Charlotte were flooded and some evacuations took place.	Flood	N/A

Local Flood History 1993 to Present			
Date	Notes	Type	Damage
10/11/99 @ 0500	A weak boundary and a favorable shear profile were sufficient to produce 3 super cell thunderstorms in a row, which tracked east-northeast across the Charlotte metro area and through Cabarrus County. Funnel clouds were observed with 2 of the storms across extreme eastern Cabarrus County. About 4 miles north of where one of the funnel clouds was seen, the severe thunderstorm produced damaging wind that blew down a half dozen trees. Flash flooding developed in the same areas of eastern Cabarrus County due to the repeat thunderstorms. Some roads were washed out and several major intersections were flooded.	Flash	N/A
10/11/99 @ 0500	Tropical moisture streaming north along a slow moving frontal boundary resulted in persistent heavy rain across the piedmont of North Carolina overnight. Up to 12 roads in the county became closed due to flooding.	Flood	N/A
09/01/00 @ 0500	Heavy rain from slow-moving thunderstorms caused a considerable amount of standing water and minor flooding on secondary roads.	Urban	NA
07/05/01 @ 16:00	Flooding in residential neighborhood.	Flash	N/A
09/24/01	Responded to the above address to check a report of businesses flooding. Upon arrival found several building along this street with flooding from a small creek to the rear. Recent heavy rain had cause sufficient runoff to overcome the capacity of the small creek.	Flash	N/A
01/23/02 @ 0100	Persistent overnight and morning rainfall resulted in the flooding of a couple of roads. One was northeast of Concord, and another southeast of Mt. Pleasant.	Flood	N/A
07/22/02 @ 1545	A few streets were flooded	Urban	N/A
03/20/03 @ 0900	Heavy rainfall resulted in rapid rises and flooding along numerous small streams across the county. Numerous roads were flooded and remained closed for several hours.	Flash	N/A
03/20/03 @ 1200	After morning flash flooding, moderating rainfall contributed to slower rises, but continued and additional flooding along numerous creeks and streams into the evening hours. Flooding was quite severe from Kannapolis to Concord, as well as across southern and eastern sections of the county. A nursing home and a school had to be evacuated due to rising water. At least 10 roads were closed across the county.	Flood	\$1.0M property
04/10/03 @ 0700	After a night of moderate to heavy rainfall, flooding developed during the morning along some creeks and streams between Kannapolis and Concord, causing several roads to be closed. Water levels on the Rocky River increased to 20 feet above normal. Significant flooding also occurred along the Irish Buffalo Creek. In some areas, boats were required to ferry people to and from work.	Flood	\$ 200.0K property
04/18/03 @ 0430	Persistent heavy rainfall resulted in slow rises and eventual flooding in the southern part of the county. Several fields were	Flood	N/A

Local Flood History 1993 to Present			
Date	Notes	Type	Damage
	flooded, and 12 roads were closed.		
05/22/03 @ 0700	Persistent heavy rainfall resulted in slow rises along creeks and streams, which culminated in flooding that lasted for much of the day. Flooding began during the morning near Harrisburg, where a bridge and a road were flooded. Flooding slowly worsened through the afternoon and expanded to areas from Harrisburg to Midland, and from Kannapolis to Concord.	Flood	N/A
05/25/03 @ 1800	Slow rises along creeks and streams culminated in a few flooded roads in the Harrisburg and Mt Pleasant areas.	Flood	N/A
06/07/03 @ 2300	Severe urban flooding developed, as several roads across the Harrisburg area became completely covered in water. Several streams also overflowed their banks.	Flash	N/A
06/08/03 @ 22:00	For the second night in a row, slow moving thunderstorms caused flash flooding in the Harrisburg area. The Rocky River and some of its tributaries flooded around the city. A couple of subdivisions were flooded, and some people required rescue from their homes.	Flash	\$ 10.0K property
06/16/03 @ 1730	Urban flooding was widespread throughout the city. Some residents required evacuation on McClain Rd. A bridge was damaged by the high water and required closing for at least a 7-month period.	Urban	\$10.0K property
06/16/03 @ 1738	Some roads were flooded near the Charlotte Motor Speedway.	Flash	N/A
06/16/03 @ 2030	A motorist required rescue after his vehicle was swept into creek. Another motorist required rescue from his vehicle. Several trees were also washed away due to the heavy rainfall.	Flash	\$10.K property
06/18/03 @ 1715	Several streams overflowed their banks in and around the city.	Flash	N/A
07/18/03 @ 2334	Local street flooding and urban flooding due to thunderstorm including removal of 6000 gallons of water from 150 Concord Commons.(072-03)	Flash Flood	N/A
07/21/03 @ 21:05	Flooding from a thunderstorm, which flooded streets and a department store(150 Concord Commons)(073-03)	Flash	N/A
06/14/04 @ 1715	A tributary of the Rocky River overflowed its banks near the Charlotte Motor Speedway, flooding Morehead Rd. The loading dock area of a large store(Walmart) was also flooded	Flash	N/A
09/08/2004 @ 0530	After an extended period of moderate to heavy rainfall, a period of intense rainfall rates led to flash flooding during the mid-morning. The Rocky River and several of its tributaries were the main streams affected. Some evacuations were required, and some parks and roads were closed.	Flash	N/A
09/08/2004 @ 0900	After earlier flash flooding, general flooding continued through the early afternoon. The Rocky River continued to be the main stream affected, but gradual rises eventually culminated in flooding along additional streams as well.	Flood	N/A

Local Flood History 1993 to Present			
Date	Notes	Type	Damage
09/28/2004 @ 0100	Flash flooding developed across the county shortly after midnight in response to an intense tropical rain band. Roads were damaged and water entered homes and businesses, particularly in the Harrisburg area.	Flash	\$700K
09/28/2004 @ 0300	Although moderating rainfall rates resulted in more gradual rises along creeks and streams, flooding expanded and became widespread later in the morning. By mid-morning, numerous roads were closed. A school in Cabarrus County was evacuated when it was threatened by rising water. In Rowan County, several motorists had to be rescued after driving their vehicles through flood water.	Flood	\$20K
06/02/2005 @ 0815	Flooding first began along several creeks in the Midland area, including Clear, Muddy, and Little Meadow, as well as some small tributaries of the Rocky River. Later in the morning, the Rocky River flooded in the northwest part of the county, near Poplar Tent Rd. Several roads were closed due to high water, including Hopewell Church Rd, where several homes were surrounded by high water.	Flood	N/A
06/07/2005 @ 1630	A severe thunderstorm produced extremely heavy rainfall across northern portions of Cabarrus County. A spotter reported several roads under as much as a foot of water, including portions of Sisk-Carter Rd and Shuping Mill Rd.	Flash	N/A
06/09/2005 @ 1740	Flooding of Poplar Tent and Odell Schools roads west and southwest of Kannapolis.	Flash	N/A
07/04/2005 @ 1700	Heavy rain falling over Rowan County produced flooding along Irish Buffalo Creek near Kannapolis. This required evacuation of around 70 people from a nursing home and a mobile home park.	Flood	N/A
12/15/2005 @ 1700	Flooding developed after an extended period of moderate to heavy rain. Approximately 7 roads were closed due to high water conditions.	Flood	N/A
08/15/2006 @ 2015	A campground flooded near Lowes Motor Speedway, apparently due to a combination of poor drainage and flooding along a small tributary of Irish Buffalo Creek. Several roads were flooded, including Concord Parkway near Speedway Bvd and Concord Parkway at Goodman Circle. Several campers were evacuated from the campground and at least 1 vehicle was flooded.	Flash	\$5K
08/30/2006 @ 1700	Flooding of quite a few streets and highways developed in the Concord area, with several roads closed. Although most of the flooding was due to poor drainage, Coddle Creek did overflow its banks and flood highway 49, causing a section of the road to be closed.	Flash	N/A
11/22/2006 @ 0500	Flooding developed along portions of the Rocky River, some of its tributaries, and along other streams, including Back Creek when 4 to 5 inches of rain fell in about an 18 hour period. Several roads were closed, including Mt Pleasant Rd, Pharr Mill Rd, and Stallings Rd, and highway 200 in Harrisburg. EPISODE NARRATIVE: A prolonged period of moderate rain lead to stream flooding in parts	Flood	N/A

Local Flood History 1993 to Present			
Date	Notes	Type	Damage
	of the western North Carolina piedmont.		
07/09/07 @ 1900	The intersection of Christenbury Rd and Derita Rd was closed due to flooding along a branch of the Rock River. Flooding was also reported on Speedway Bvd at I-85. EPISODE NARRATIVE: Slow moving thunderstorms developed over the Charlotte metro area during the early evening hours, dropping several inches of rain in short period of time, causing significant urban and stream flooding.	Flash	N/A
04/26/08 @ 2000	Numerous roads were closed due to high water in and around the city of Concord, due to a combination of poor drainage and at least two small streams leaving their banks. Portions of Weddington Rd were closed. Highway 29 and George Lyles Rd were closed at their intersection with Rock Hill Church Rd. Cabarrus Ave was flooded between Old Charlotte Rd and highway 601. Samual Adams Circle and Hanover Dr were flooded by small streams. EPISODE NARRATIVE: Scattered severe storms affected western North Carolina during the afternoon and evening hours.	Flash	N/A
06/22/08 @ 1915	Flash flooding developed in and around Concord after thunderstorms produced several inches of rain across the area in a few hours. The southbound lane of highway 29 was closed near its intersection with highway 601 after 2 cars became stranded in high water. A section of Stough Rd was closed when Coddle Creek overflowed its banks. Water entered several houses on Melrose Dr due to flooding along Irish Buffalo Creek. Also, Flowes Store Rd was closed near the intersection of highway 601 for a while. Thunderstorms produced very heavy rain over the Concord area, resulting in flash flooding.	Flash	\$50K
08/27/08 @ 0345	Numerous streets and roads were closed in and around Kannapolis, due to flooding streams and poor drainage. Evacuations were necessary at a rest home on Pine St. Closed roads included Sloop Rd, Trinity Church Rd, Dogwood Bvd, Dakota St, Lane St, Oakwood Ave, South Little Texas Rd, Mallard Point Rd, and East 1st St. At least 14 swift water rescues were necessary. Approximately 70 buildings were damaged by floodwater across Cabarrus County. The remnants of Tropical Storm Fay stalled just west of the Appalachian mountains, resulting in a prolonged, moist south to southeasterly flow over western North Carolina. During the early morning hours of Wed, August 27th, rainfall became especially heavy over the western North Carolina Piedmont as the southerly winds were lifted over a weak stationary front. Storm total rainfall in this area averaged 8 to 10 inches, with locally higher amounts, resulting in significant urban and stream flooding.	Flash	\$6.5M
06/05/09 @ 11:30	Wolf Meadow Branch flooded the bridges on Stough Rd, Roberta Rd and Wolfmeadow Dr. Also, three children had to be rescued when water rose rapidly on an unnamed creek in the same area. Green Dr, Fleetwood Dr and Saddlewood Cir were all flooded, as were other isolated roads located throughout the city. EPISODE NARRATIVE: A mesoscale convective vortex brought heavy rain to the Charlotte metro area, producing flash flooding on the	Flash	0

Local Flood History 1993 to Present			
Date	Notes	Type	Damage
	northeast side of town. Later in the day, an area of thunderstorms developed to the southwest of Concord, producing more flooding.		
07/22/09 @ 21:15	Numerous roads were flooded in Concord, mainly due to poor drainage on the north side of town. Several swift water rescues were required. Water entered a home on Spring St NW and a business on Branchview Dr at highway 73. Urban flooding also developed in Kannapolis, along Jackson St, where additional rescues were required. EPISODE NARRATIVE: Severe storms developed along and east of Interstate 77 over the western North Carolina Piedmont during the late evening hours. The slow moving storms produced severe urban flooding along with damaging winds and large hail.	Flash	\$50K
07/22/09 @ 22:00	A small creek flooded a portion of Bethel School Rd in Midland, and another creek flooded a portion of Stough Rd. EPISODE NARRATIVE: Severe storms developed along and east of Interstate 77 over the western North Carolina Piedmont during the late evening hours. The slow moving storms produced severe urban flooding along with damaging winds and large hail.	Flash	0
07/22/09 @ 23:30	Although heavy rain ended, water levels remained high from the city limits of Concord southwest to Stough Rd for several hours during the early morning. EPISODE NARRATIVE: Severe storms developed along and east of Interstate 77 over the western North Carolina Piedmont during the late evening hours. The slow moving storms produced severe urban flooding along with damaging winds and large hail.	Flood	0
07/27/09 @ 21:45	A second severe flash flood affected the county in less than a week. Highway 601, Miami Church Rd, and Mount Pleasant Rd were closed by flooded streams. Highway 200 was closed due to flooding from Dutch Buffalo Creek. Some water rescues were required there. Also, severe urban flooding occurred in the town of Midland, with water sweeping some cars off roads, and water entering at least one home. EPISODE NARRATIVE: Scattered thunderstorms developed over western North Carolina ahead of a weak cold front. Some of the storms produced large hail and damaging winds. During the late evening, severe urban flooding developed over the western Piedmont for the second time in less than a week.	Flash	\$50K

¹Only incident with flood related injuries reported.

Vulnerability Assessment

Concord has one large river, associated tributaries and smaller streams within the incorporated area. Flooding has impacted the local populace since recorded history. Since 1993, 43 flood events were recorded with 4 injuries, \$13.5M property damage and \$2M Crop damage. Flash flooding is the most predominate of the local flood events, has

the highest associated damage and only related injuries. Flooding accounts for one of the three emergency declarations above the local level.

The City of Concord is located in the Yadkin River Basin and is bisected by a river (Rocky River) and four major creeks and streams that all flow in a southeasterly direction. The major creeks are: Coddle Creek, Irish Buffalo Creek, Three Mile Branch and Cold Water Creek. In addition to these creeks there are several smaller creeks and bodies of water that feed into them. The four major creeks converge into Rocky River, south of the city limits.

The floodways and floodplains in Concord are all adjacent to these major streams. Concord contains 5.576 square miles of floodplain, which is 9.28% of the total city area of 60.042 square miles. Of this floodplain area, 2.053 square miles is in the unbuildable floodway, which leaves only 3.523 square miles (5.86% of the total city’s area) in the remaining floodplain.

Based on the City’s FEMA Floodplain Biennial Report of 2009, 33 structures are located inside flood hazard areas, of which 13 are single-family up to four-family structures (i.e. 1-4 family structures). The population of these 13 structures is estimated to be 34. In total, the City contains 22986 1-4 family structures, so approximately 0.05% of 1-4 family structures are located in flood hazard areas. The City of Concord’s Development Services Department implements the ordinances and regulations of the floodway and flood plain.

Flooding can present a serious threat to properties located in and along the flood hazard areas. Flood incidents generally affect road crossings that are subject to high water levels, and occasionally some structures are affected. According to FEMA records, Concord does not have any repetitive loss structures. The Insurance Service Office (ISO) has given Concord a rating of 8.

Structural Vulnerability

The table below identifies the amount of floodway and flood hazard areas(100-year floodplain in Concord:

Floodway and Flood Hazard Areas					
Flood Hazard	Square Miles in City	Percent of City Limits	Number of Structures inside	of	Notes
Floodway	2.053	3.42%		0	By ordinance, is unbuildable
100-year Floodplain	5.576	9.28%		29	By ordinance, is

Floodway and Flood Hazard Areas				
Flood Hazard	Square Miles in City	Percent of City Limits	Number of Structures inside	Notes
Including Floodway				unbuildable
100-year Floodplain Outside of Floodway	3.523	5.86%	29	By ordinance, is unbuildable

As the table above indicates, the City of Concord contains several square miles of flood hazard area. However, it is important to note that the City’s development ordinances have protected the area and restricted development. The structures that are in the 100-year floodplain area fall into one of three possible categories:

- They are old buildings which were constructed prior to the flood ordinance,
- Were developed under the county’s zoning ordinance and later annexed into the City of Concord, or
- Were not identified to be in the 100-year floodplain area when built using the available FIRM maps at that point in time, but are now identified to actually be in the 100-year floodplain due to a technological improvement in mapping techniques.

There are currently 29 structures that are located inside flood hazard areas, of which 2 are single-family, 5 are mobile homes, 8 are commercial, 1 is a church, 2 are industrial buildings, and 11 are accessory structures. The population of the 7 residential structures is estimated to be 18. In total, the City contains 22,986 1-4 family structures, so approximately 0.03% of 1-4 family structures are located in flood hazard areas. The City of Concord’s Development Services Department implements the ordinances and regulations concerning the floodway and floodplain.

Flooding can present a serious threat to properties located in and along the flood hazard areas. Flood incidents generally affect road crossings that are subject to high water levels, and occasionally some structures are affected. According to FEMA records, Concord does not have any repetitive loss structures.

When structures or fill are placed in the floodway or floodplain, water is displaced. Development raises the river levels by forcing the river to compensate for the flow space obstructed by the inserted structures and/or fill. When structures are materials are added to the floodway or the floodplain and no fill is removed to compensate, serious problems can arise. Floodwaters may be forced away from historic floodplain areas. As a result, other existing floodplain areas may experience floodwaters that rise above historic levels.

Local government must require engineer certification to ensure that proposed developments will no adversely affect the flood carrying capacity of the Special Flood

Hazard Area (SFHA). Displacement of only a few inches of water can mean the difference between no structural damage occurring in a given flood event, and the inundation of many homes, businesses, and other facilities. Careful attention should be given to development that occurs within the floodway to ensure that structures are prepared to withstand base flood events.

In highly urbanized areas, increased paving can lead to an increase in volume and velocity runoff after a rainfall event, exacerbating the potential flood hazards. Care should be taken in the development and implementation of storm water management systems to ensure that these runoff waters are dealt with effectively.

Potential Loss Estimates

The City is acquiring the HAZUS-MH software to evaluate the potential impact of flooding and other hazards. This will include an evaluation of the impact of a 100-year flood in the city. Currently, 9.28% of the city limits is prone to flooding. Flooding, similar to the August 2008 event will continue to have an impact on the local transportation system and limit access to transportation systems for other services. The topographic make-up of the community prevents significant susceptibility to large scale flooding. Flooding will also continue to be the significant potential of impact from tropical systems after they have made landfall and unlike other natural hazards, flooding is a hazard regardless of the season.

System Vulnerability

Historical data of flooding and the presence of structures, roadway, infrastructure, the natural environment and people indicate that flooding is a risk in Concord. Since the inception of the Flood insurance program, nine flood insurance claims have been filed related to flooding in the community. Concord also witnessed growth in the floodplain during the last assessment. Building which were originally outside of the floodplain was found now to be within the new boundaries. These buildings and those of the fringe of the flood plain or along unmapped streams will continue to have a risk. The table below is based on FIRM maps, response documentation and tax date to identify properties at risk in the flood plain.

Properties as Risk in the Flood Plain					
Location	Structure Type	# of Structures	Acres in the floodplain	Population	Building value
109 Shamrock St NE	Single-family residential	1	0.322	2.6062	\$85,930
115 Shamrock St NE	Single-family residential	1	0.356	2.6062	\$81,660
4312 Pebblebrook Cir SW	Accessory	1			\$253
4312 Pebblebrook Cir SW	Accessory	1			\$821
4316 Pebblebrook Cir SW	Mobile Home, Accessory	2		2.6062	\$29,960
4410 Pebblebrook Cir SW	Mobile Home, Accessory	2		2.6062	\$33,670
4420 Pebblebrook Cir SW	Mobile Home	1		2.6062	\$36,780

Properties as Risk in the Flood Plain					
Location	Structure Type	# of Structures	Acres in the floodplain	Population	Building value
4440 Pebblebrook Cir SW	Mobile Home	1	5.44	2.6062	\$78,310
4450 Pebblebrook Cir SW	Mobile Home	1	3.71	2.6062	\$62,680
235 Branchview Dr NE	Commercial	1	0.74		\$232,620
231 Branchview Dr NE	Commercial	1	0.8		\$226,100
227 Branchview Dr NE	Commercial	1	0.55		\$101,740
215,217,219 Branchview Dr NE	Commercial	1	1.22		\$668,010
209 Branchview Dr NE	Commercial	1	1.22		\$323,420
205 Branchview Dr NE	Commercial	1	2.19		\$519,600
274 Huneycutt Dr SE	Church	1	0.8		\$393,440
535, 545 Huneycutt Dr SE	Commercial	1	0.39		\$57,030
7295, 7275 West Winds Blvd NW	Industrial	2	7.95		\$6,046,770
5700 Poplar Tent Rd	Accessory	4	23.06		\$93,150
2600 Armentrout Dr SW	Commercial	1	19		\$21,360
219 Corban Ave SE	Accessory	2	5.72		Unknown
3101 Davidson Hwy	Accessory	1	11.32		Unknown
	Total:	29	84.79	18	\$9,093,304

Until recently three Sewer Pump Stations were located inside the 100-year floodplain. Although these pump stations were built at elevations above the base flood level, three were at potential risk for failure in the occurrence of a flood. In the event that a pump station was flooded to the extent that it was disabled it would have resulted in a potential spillage of sewage into the surrounded area and stream. The resulting damage to the pump stations would have cost approximately \$20,000 each.

The City of Concord has however remedied this risk by extending gravity sewer into this area and eliminated two of the stations and work is currently underway to eliminate the third. Recently the 100-year floodplain was remapped in Cabarrus County. With this

change, some of the areas additional sanitary sewer pump stations are now within the 100-year floodplain. The facilities impacted by the increased floodplain are located on the following parcels: PIN 4598-71-6435, PIN 5519-22-2774.

There are approximately 145 miles of sewer line outfalls in our service area that are not within a road right of way that requires maintenance. Other communities that have had flooding and high winds have had substantial debris removal cost in sewer right-of-ways following a storm. The City of Concord maintains a full time crew to maintain the right of ways and keep vegetation at manageable levels. It is hoped that this routine maintenance would help to minimize the cost of clean up in the event of a flood or heavy storm.

Impact to the natural environment will includes channel alteration affecting wetlands and wildlife habitats in frequently flooded areas. Urban flooding, often the result of development and the increased amount of impervious surfaces will continue to occur. Increased current flow from storm water run-off also has the potential to remove riparian vegetation and introduce natural and manmade debris into local streams. Concord’s Storm Water program will continue to identify and address these issues.

During the August 2008 event, portions of all the local manmade systems (transportation, water, and sewer) were found vulnerable to the affects of flooding. Several streets were washed out or closed for repairs as the result of this event. Flooding from the remnants of Hurricane Jerry even resulted in the closure of I-85 in 1995.

The public transportation infrastructure contains 24 areas of concern. These have been identified as potential problems during flood events. Each of the locations have been identified and mapped. Traffic control devices needed to mitigate these locations are available for deployment when severe weather threatens. The locations are identified in the following tables.

Roads & Parks Subject to Flooding					
Road #	Road Name	Location of Problem	Barricades	Temp Signs	36’ Cones
SR-1309	Stough Rd. (NCDOT)	Wolf Meadow Creek between Frank Liske Park and Roberta Road	3 x Type III	0	6
N/A	Honeycutt Cir., SE	Honeycutt Cir., SE, East leg, .11 miles north of NC 73	4 x Type III	2	12
N/A	Georgia St., SW	Lincoln St., SW, Fairview Ave., SW and Cozart Ave., SW	2 x Type III	2	0
SR-2635	Old Airport Road (NCDOT)	Cold Water Creek	4 x Type III	4	0
SR-2635	Old Airport Road (NCDOT)	Little Cold Water	4 x Type III	4	0

Roads & Parks Subject to Flooding					
Road #	Road Name	Location of Problem	Barricades	Temp Signs	36" Cones
		Creek			
SR-2635	Old Airport Road (NCDOT)	Between Lemming Dr., SE and Red Bird Cir., SE	0	0	0
NC-73	Davidson Hwy (NCDOT)	Stricker Branch	4 x Type III	2	6
SR-1394	Poplar Tent Rd. (NCDOT)	Cox Mill Rd. at Bridge	0	0	0
N/A	Barnhardt Ave., NW	Between Groff St., NW and US 29	2 x Type III		6
N/A	Brown St., NW	Between Cabarrus Ave., W and Bost St., NW	6 x Type III	4	Not Known
N/A	Brookwood Ave., NE	at Three Mile Branch	4 x Type III	2	6
N/A	Burrage Rd., NE	at Three Mile Branch – slope issue at approach to the west side of bridge.	6 x Type III	2	6
ID'ed Not Mapped	Groff St., NW	Between Helen Dr., NW and Montford Ave., NW	2 x Type III		6
ID'ed Not Mapped	Montford Ave., NW	Between Groff St., NW and US 29	2 x Type III		6
ID'ed Not Mapped	Chelwood Dr., NW	Between Kendall Ave., NW and Chadbourne Ave., NW	4 x Type III	2	6
ID'ed Not Mapped	Miramar St., NE	at Three Mile Branch	4 x Type III	2	6
ID'ed Not Mapped	Branchview Dr.	Near Crestside Dr., SE and Lawndale Ave., SE	Not Known	Not Known	Not Known
ID'ed Not Mapped	Branchview Dr.	Near Miramar St., NW	Not Known	Not Known	Not Known
N/A	Melrose Dr., SW	Caldwell Park	2 x Type III	1	0
SR-1394	Poplar Tent Road	Dorton Park	2 x Type III	3	0
N/A	Miramar Street, NE	Beverly Hills Park	0	1	0
N/A	Corban Ave., SE	McGee Park	1 x Type III	0	0
N/A	Branchview Dr., SE	McEachern Greenway	2 x Type II	3	0
N/A	Academy Ave., NW	Village Greenway	1 x Type II	2	0

All residents are vulnerable to the direct or indirect affects of flooding. Closed roadways can cause detours or isolation of structures including homes or schools. Evacuations or self evacuation are often a necessity as the result of local flooding. People continue to heed warnings and drive through flooded water waterways.

Flooding is considered one of the “greater hazards” which can impact North Carolina. Historical data indicates that flooding will occur in Concord with some regularity. Concord threat is predominately from flash flood events and do not impact the City as a whole at one time.

An active flood plain management program and Unified Development Ordinance have limited development within the floodplain, and this limits losses due to flooding. Flooding has impacted Interstate, primary and secondary roads sometime resulting in extended closure. Local detour routes and hazard warning signs assist in lessening the impact.

Flooding not only affects property, but also can affect lives. Several incidents have occurred in Concord during periods of flooding which have resulted in injuries. Educational programs are an affective method of addressing this issue along with proper marking of flooded roadways.

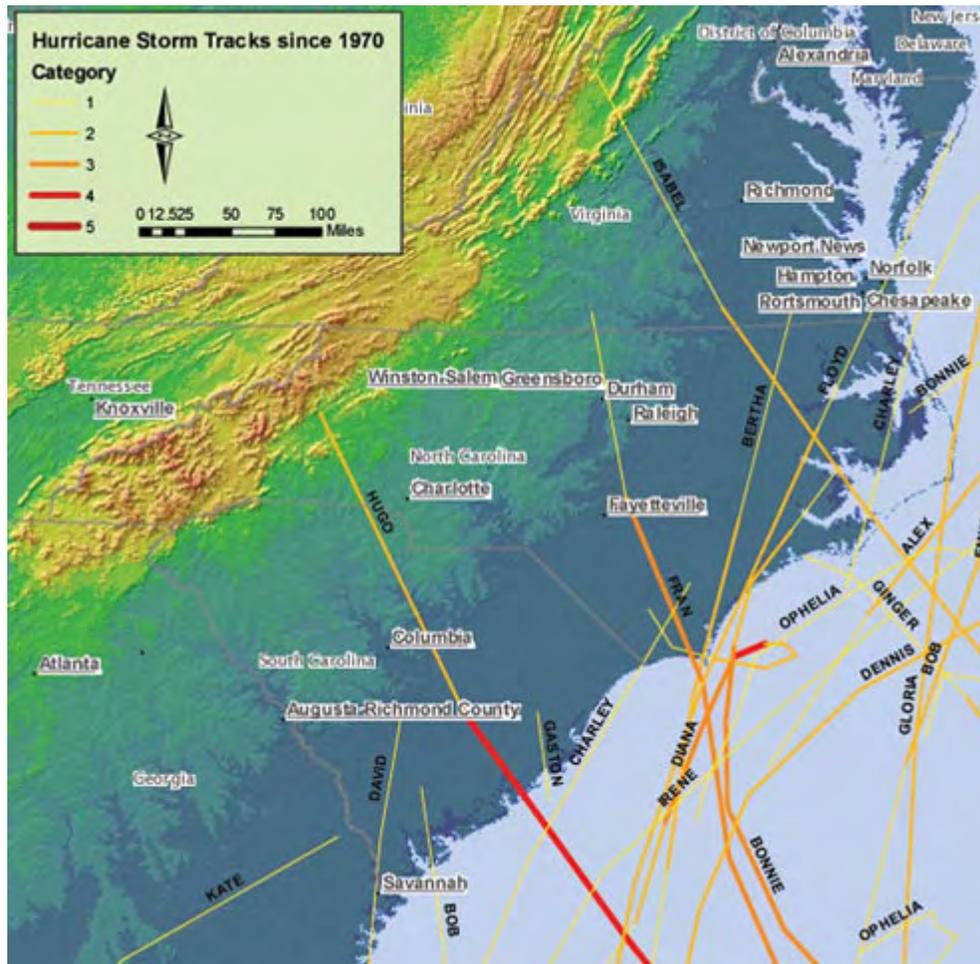
Flooding has resulted in some damages as evident through the Flood Insurance Program. Flooding is occurs with regularity within the city. It has impacted all systems, though only portions of the population. Damage to property has been limited and the level of intensity is categorized as **moderate**.

Hurricane

Hazard Description

Hurricanes are commonly thought of as a natural hazard that impacts a coastal area. They originate in the tropical ocean and can impact North Carolina from the Atlantic Ocean and indirectly from the Gulf of Mexico. Hurricane season is between June 1 and November 30 with a peak generally in September.

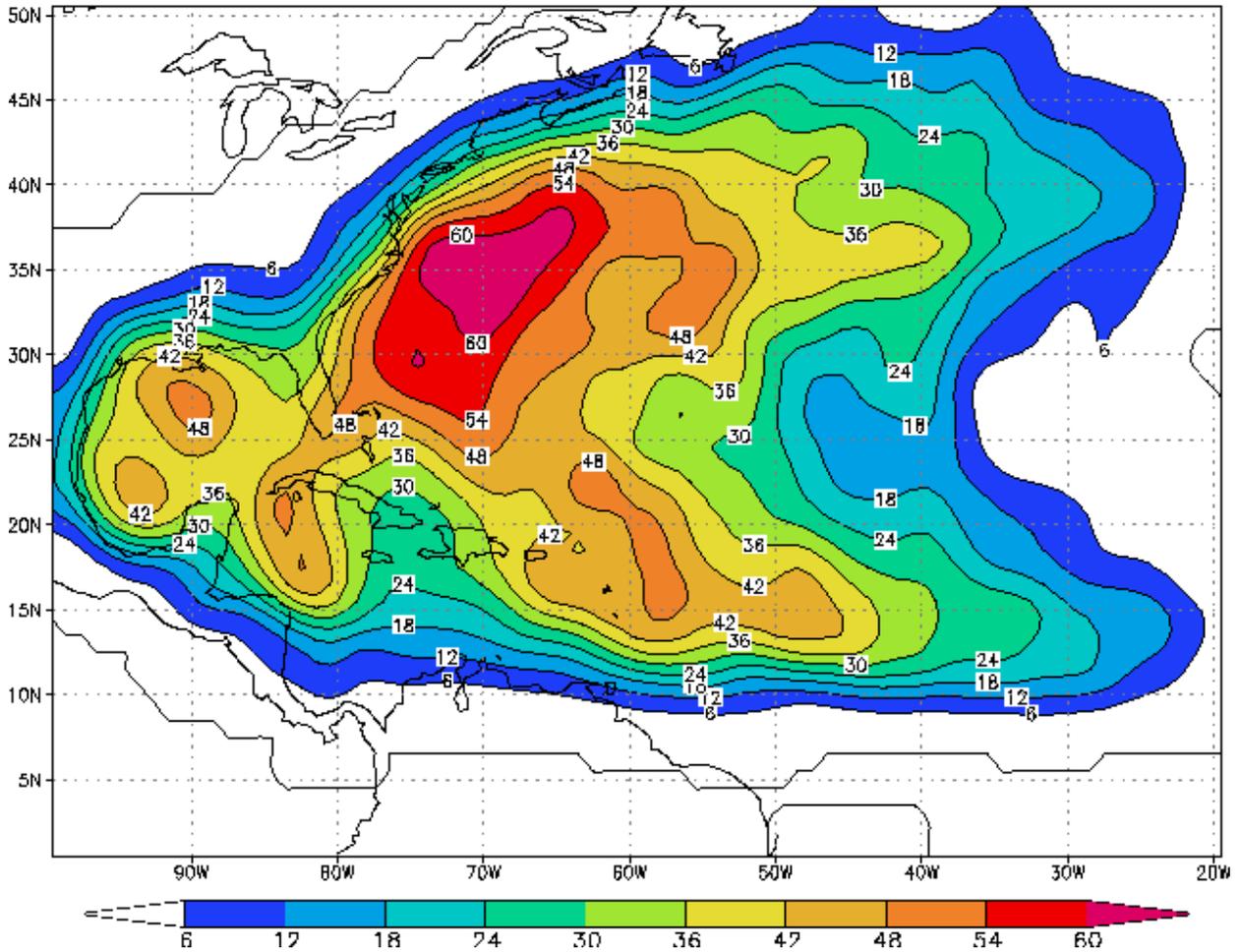
North Carolina Hurricane Storm Tracks Since 1970³⁵



Inland areas are often affected by flooding and can be issued a hurricane specific weather warning call an Inland high wind watch for hurricane force winds. This is an announcement for inland areas that sustained winds of 74 mph or greater associated with a hurricane are anticipated beyond the coastal areas though the actual occurrence, timing and location are still uncertain.

Rather it is storm surge at the coast, inland winds, or flooding from heavy rains, hurricanes present a serious threat to North Carolina. Historically, hurricanes cost people their homes, their possessions, and their lives. Hurricane Hugo in 1989 proved that not only is flooding an inland threat, but high winds can cause a critical impact on a community's infrastructure. Concord suffered significant damage during this hurricane due to wind gusts of nearly 100 mph. Areas of the community were without power for up to two weeks, schools closed, and the transportation system was interrupted. This storm was outside of the norm.

Probability graphic of named storm development³⁶



Hurricane Faye, in 2008, reemphasized the local impact flooding from hurricanes can cause. Flooding from this system caused severe damage to the local infrastructure, resulted in evacuations, and multiple water rescues. This resulted in a State emergency declaration with nearly \$3 million dollars in local damage.

Rain continues to be the predominate threat to inland areas. Rain amounts can easily exceed 6 inches causing widespread flooding. Since Hurricane Hugo, Tropical Storm Jerry and Hurricane Danny caused severe flooding from heavy rains. These significant rain amounts are addressed under flooding.

Commonly hurricane winds drop off significantly once over land and it is cut off from the sustaining forces of heat and moisture. Wind gusts may actually increase because of the greater turbulence due to land features. Winds of 74 mph can destroy poorly constructed buildings and mobile homes. Debris picked up by the storm causes additional damage.

Since Hurricane Hugo, 27 hurricanes ranging in intensity from tropical storm strength to Category 4 have affected North Carolina. sixty-seven deaths in North Carolina were attributed to the effects of hurricanes. Of these deaths, 57 were inland, 10 coastal, and 1 from storm surge. During the period 1886 to 1997, 20+ hurricanes have passed within 75 miles of the Charlotte metro area.

Terminology

Hurricanes progress through a defined growth cycle as defined by NOAA. NOAA defines these three phases as:

- **Tropical depression:** A tropical system in which the maximum sustained surface wind is 33 knots (38 mph) or less. Though the wind speeds are significantly less than those in a hurricane, tropical depressions are capable of producing tremendous rainfall amounts. During the week of July 3rd through the 7th in 1994, tropical storm Alberto moved inland and weakened to a depression. It then moved into Georgia and produced up to 28 inches of rainfall causing catastrophic river and small stream flooding.
- **Tropical storm:** A tropical system in which the maximum sustained surface wind ranges from 34 to 63 knots (39 to 73 mph). These systems are also intense rainfall producers, but often cause enough wind and waves to cause some beach erosion and minor boat damage. Hurricane Hugo was classified as a tropical as it moved through Concord in September 1989, causing widespread damage.
- **Hurricane:** A tropical system which has maximum sustained surface winds are 64 knots (74 mph) or greater. This is the worst and strongest of all tropical systems.

Severity

Since 1975 the National Weather Service has used the Saffir-Simpson Hurricane as depicted below. This system used expected wind speeds, barometric pressure and storm surge to categorize the intensity of a hurricane.

Saffir-Simpson Hurricane Scale				
Category	Barometric Pressure	Wind Speed	Storm Surge	Damage Potential

1 (weak)	28.94 in Hg or more (980.2 mb or more)	65 - 82 knots (75 - 95 mph)	4 - 5 feet (1.2 - 1.5 meters)	Minimal damage to vegetation
2 (moderate)	28.5 - 28.93 in Hg (965.12 - 979.68 mb)	83 - 95 knots (96 - 110 mph)	6 - 8 feet (1.8 - 2.4 meters)	Moderate damage to houses
3 (strong)	27.91 - 28.49 in Hg (945.14 - 964.78 mb)	96 - 113 knots (111 - 130 mph)	9 - 12 feet 2.7 - 3.7 meters	Extensive damage to small buildings
4 (very strong)	27.17 - 27.9 in Hg (920.08 - 944.8 mb)	114 - 135 knots (131 - 155 mph)	13 - 18 feet (3.9 - 5.5 meters)	Extreme structural damage
5 (devastating)	< 27.17 in Hg (< 920.08 mb)	> 135 knots (> 155 mph)	> 18 feet (> 5.5 meters)	Catastrophic building failures possible

For the 2009 season a revised was published, experientially that simplified the system and is know at the Saffir-Simpson Hurricane Wind Scale. This scale uses only peak winds and associated damage:

Saffir-Simpson Hurricane Wind Scale (Experimental)			
Category	Wind Speed	Damage Potential	Examples of Damage
1	Sustained winds 74-95 mph	Damaging winds are expected.	Some damage to building structures could occur, primarily to unanchored mobile homes (mainly pre-1994 construction). Some damage is likely to poorly constructed signs. Loose outdoor items will become projectiles, causing additional damage. Persons struck by windborne debris risk injury and possible death. Numerous large branches of healthy trees will snap. Some trees will be uprooted, especially where the ground is saturated. Many areas will experience power outages with some downed power poles.
2	Sustained winds 96-110 mph	<i>Very strong winds will produce widespread damage.</i>	Some roofing material, door, and window damage of buildings will occur. Considerable damage to mobile homes (mainly pre-

Saffir-Simpson Hurricane Wind Scale (Experimental)			
Category	Wind Speed	Damage Potential	Examples of Damage
			1994 construction) and poorly constructed signs is likely. A number of glass windows in high rise buildings will be dislodged and become airborne. Loose outdoor items will become projectiles, causing additional damage. Persons struck by windborne debris risk injury and possible death.. Numerous large branches will break. Many trees will be uprooted or snapped. Extensive damage to power lines and poles will likely result in widespread power outages that could last a few to several days.
3	Sustained winds 111-130 mph	<i>winds will cause extensive damage.</i>	Some structural damage to houses and buildings will occur with a minor amount of wall failures. Mobile homes (mainly pre-1994 construction) and poorly constructed signs are destroyed. Many windows in high rise buildings will be dislodged and become airborne. Persons struck by windborne debris risk injury and possible death. Many trees will be snapped or uprooted and block numerous roads. Near total power loss is expected with outages that could last from several days to weeks.
4	Sustained winds 131-155 mph	<i>Extremely dangerous winds causing devastating damage are expected.</i>	Some wall failures with some complete roof structure failures on houses will occur. All signs are blown down. Complete destruction of mobile homes (primarily pre-1994 construction). Extensive damage to doors and windows is likely. Numerous windows in high rise buildings will be dislodged and become airborne. Windborne debris will cause extensive damage and persons struck by the wind-blown debris will be injured or killed. Most trees will be snapped or uprooted. Fallen trees could cut off residential areas for days to

Saffir-Simpson Hurricane Wind Scale (Experimental)			
Category	Wind Speed	Damage Potential	Examples of Damage
			weeks. Electricity will be unavailable for weeks after the hurricane passes.
5	Sustained winds greater than 155 mph	<i>Catastrophic damage is expected.</i>	Complete roof failure on many residences and industrial buildings will occur. Some complete building failures with small buildings blown over or away are likely. All signs blown down. Complete destruction of mobile homes (built in any year). Severe and extensive window and door damage will occur. Nearly all windows in high rise buildings will be dislodged and become airborne. Severe injury or death is likely for persons struck by wind-blown debris. Nearly all trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months.

Probability

There have been 951 tropical cyclones that have been recorded in the Atlantic Ocean and the Gulf of Mexico. Approximately 166 or 17.5% of those tropical cyclones passed within 300 miles of North Carolina. The coast of North Carolina can expect to receive a tropical storm or a hurricane once every four years, while a tropical cyclone affects the state every 1.3 years.³⁷

North Carolina Tropical Cyclone Statistics (1886 - 1996)		
Stastic	Number of tropical cyclones making landfall in NC	Number of tropical cyclones that passed through North Carolina
Number of Storms	28	82
Percentage of Storms	2.9	8.6
Average number of years between storms	4	1.3
Average number of Storms per year	.25	.75

Historic Occurrence

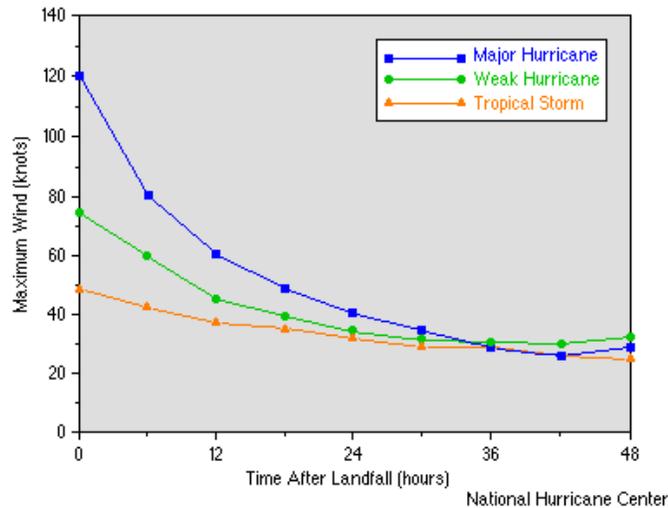
Historic hurricane activity tends to have real active periods followed by a lull. Prior to the 1900 records indicate 139 storms. The list below shows then number of tropical system which has some impact to North Carolina. During the 1950, statistics indicate we have entered another active period with continues to the present.

1900 – 1910	14
1910 – 1920	17
1920 – 1930	12
1930 – 1940	15
1940 – 1950	17
1950 – 1960	24
1960 – 1970	23
1970 – 1980	32
1980 – 1990	32
1990 – 2000	36
2000 – present	40

Vulnerability Assessment

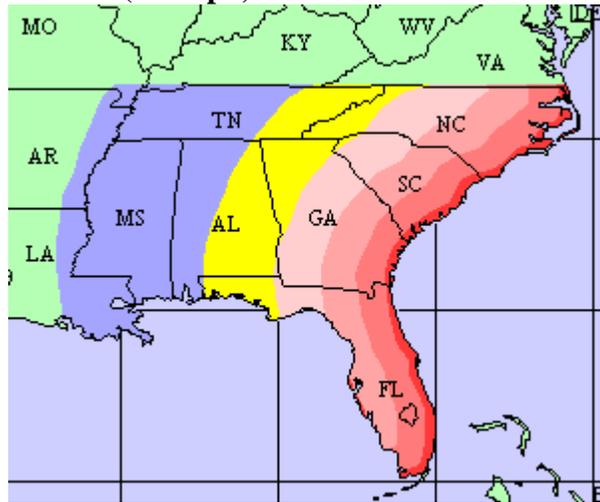
Concord’s distance from the coast has a direct relationship to the degree and type of damage that can be expected. Concord is located closer to the South Carolina coast and therefore is more vulnerable to a hurricane making landfall along the South Carolina coast and moving northwestward similar to Hugo in 1989. Interesting, Hurricane Hugo resulted in more people sheltered inland than at coastal locations(2700).

Based on the Inland Wind Model for a Category 4 Hurricane with sustained wind speeds and a forward speed of 25 mph at landfall (expected 1/50 years) the city of concord can expect 64-74 mph sustained winds with expected peak gusts of 81-95 mph. A lesser storm with 55 – 70 mph peak wind gusts would cause extensive tree damage and tree uprooting. Collateral damage can be expected to structures and the electric system infrastructure with outages in the order of 50 – 74%. Fortunately, wind speeds decrease significantly in the 12 hours after landfall.



The following graphs provide the maximum extent of winds for hurricanes based on the category of storm and forward speed. This is a combination of multiple storm tracks for mitigation and planning purposes, one storm alone will not produce the following winds.³⁸

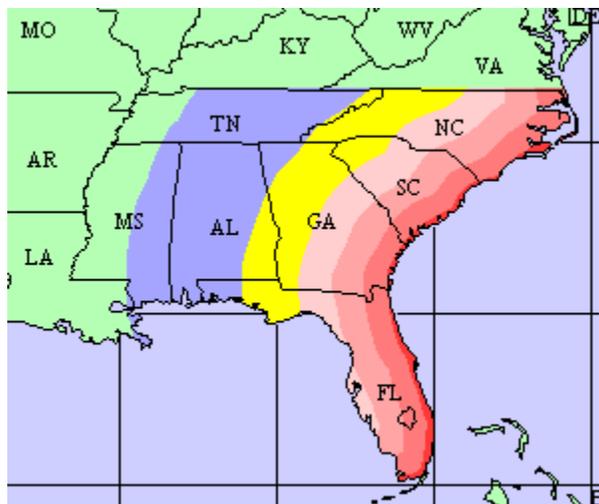
CAT 4 HURRICANE (144mph) FORWARD SPEED: 25mph



EXTENT OF INLAND WINDS

■ >34Kt(39mph)
 ■ >50Kt(58mph)
 ■ >64kt(74mph)
 ■ >80Kt(92mph)
 ■ >95Kt(109mph)
 ■ >110kt(127mph)

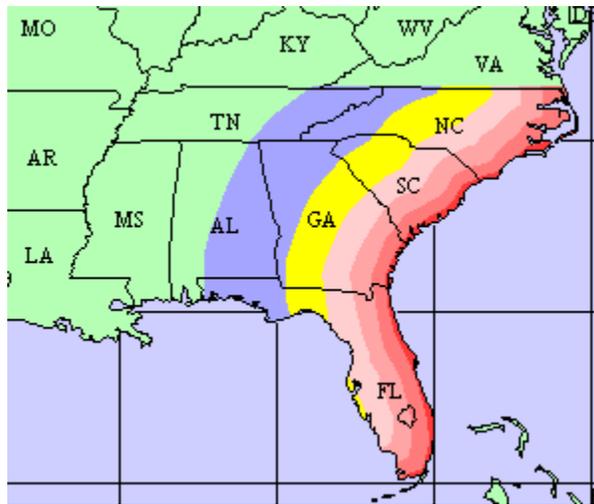
CAT 4 HURRICANE (144mph) FORWARD SPEED: 20mph



EXTENT OF INLAND WINDS

■ >34Kt(39mph)
 ■ >50Kt(58mph)
 ■ >64kt(74mph)
 ■ >80Kt(92mph)
 ■ >95Kt(109mph)
 ■ >110kt(127mph)

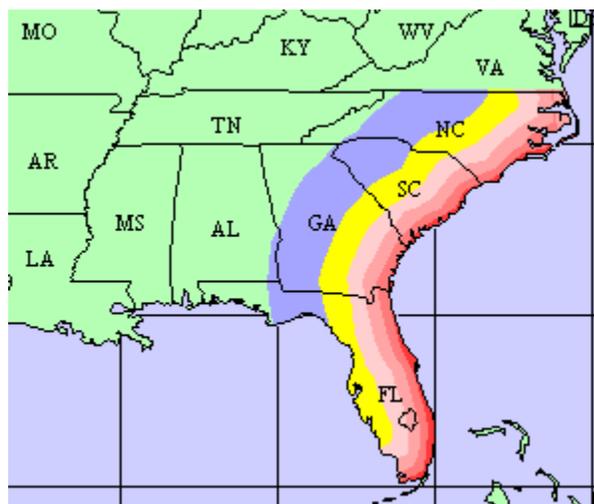
CAT 4 HURRICANE (144mph) FORWARD SPEED: 14mph



EXTENT OF INLAND WINDS

■ >34Kt(39mph)
 ■ >50Kt(58mph)
 ■ >64kt(74mph)
 ■ >80Kt(92mph)
 ■ >95Kt(109mph)
 ■ >110kt(127mph)

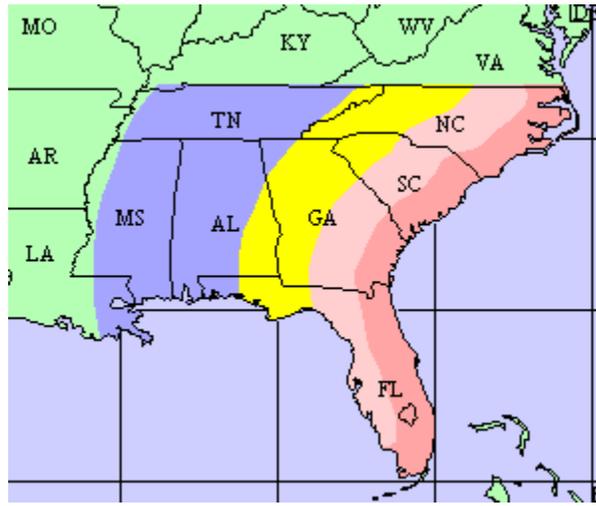
CAT 4 HURRICANE (144mph) FORWARD SPEED: 9mph



EXTENT OF INLAND WINDS

■ >34Kt(39mph)
 ■ >50Kt(58mph)
 ■ >64kt(74mph)
 ■ >80Kt(92mph)
 ■ >95Kt(109mph)
 ■ >110kt(127mph)

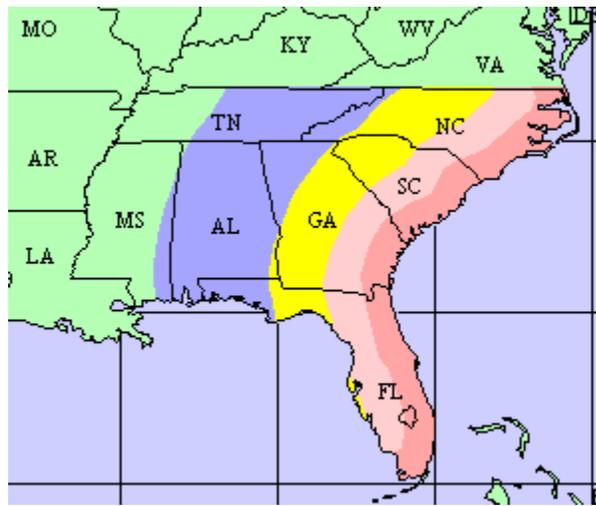
CAT 3 HURRICANE (121mph) FORWARD SPEED: 25mph



EXTENT OF INLAND WINDS

■ >34Kt(39mph)
 ■ >50Kt(58mph)
 ■ >64kt(74mph)
 ■ >80Kt(92mph)
 ■ >95Kt(109mph)
 ■ >110kt(127mph)

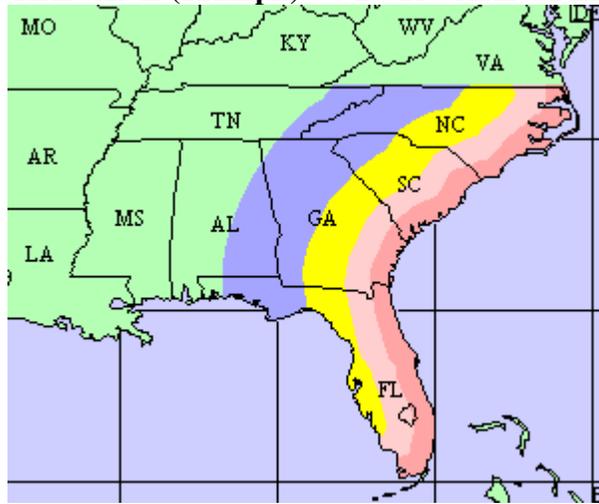
CAT 3 HURRICANE (121mph) FORWARD SPEED: 20mph



EXTENT OF INLAND WINDS

■ >34Kt(39mph)
 ■ >50Kt(58mph)
 ■ >64kt(74mph)
 ■ >80Kt(92mph)
 ■ >95Kt(109mph)
 ■ >110kt(127mph)

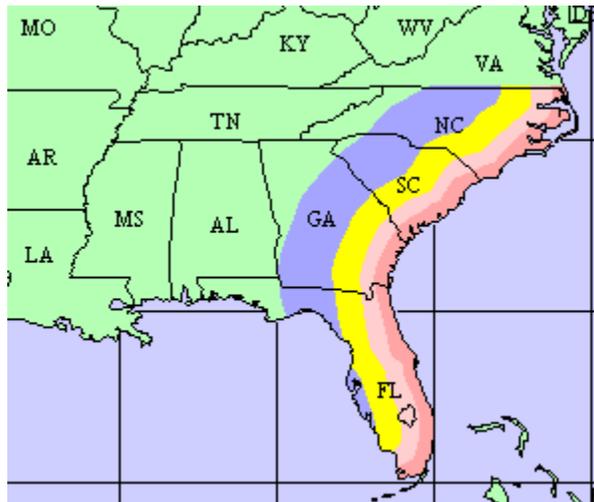
CAT 3 HURRICANE (121mph) FORWARD SPEED: 14mph



EXTENT OF INLAND WINDS

■ >34Kt(39mph)
 ■ >50Kt(58mph)
 ■ >64kt(74mph)
 ■ >80Kt(92mph)
 ■ >95Kt(109mph)
 ■ >110kt(127mph)

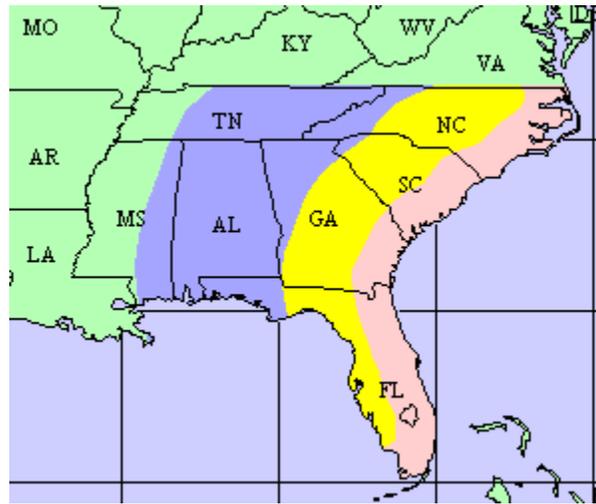
CAT 3 HURRICANE (121mph) FORWARD SPEED: 9mph



EXTENT OF INLAND WINDS

■ >34Kt(39mph)
 ■ >50Kt(58mph)
 ■ >64kt(74mph)
 ■ >80Kt(92mph)
 ■ >95Kt(109mph)
 ■ >110kt(127mph)

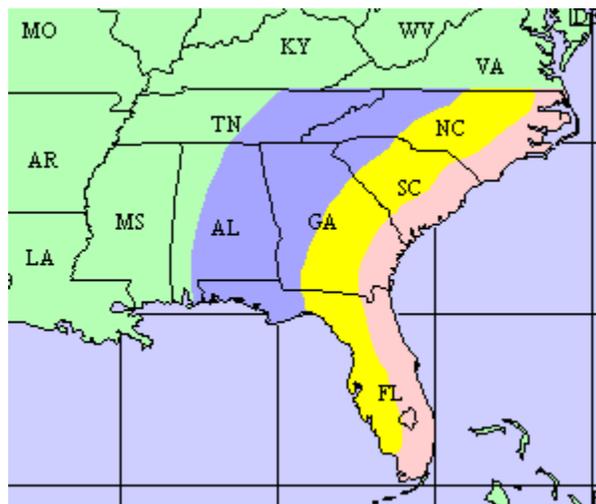
CAT 2 HURRICANE (98mph) FORWARD SPEED: 25mph



EXTENT OF INLAND WINDS

■ >34Kt(39mph)
 ■ >50Kt(58mph)
 ■ >64kt(74mph)
 ■ >80Kt(92mph)
 ■ >95Kt(109mph)
 ■ >110kt(127mph)

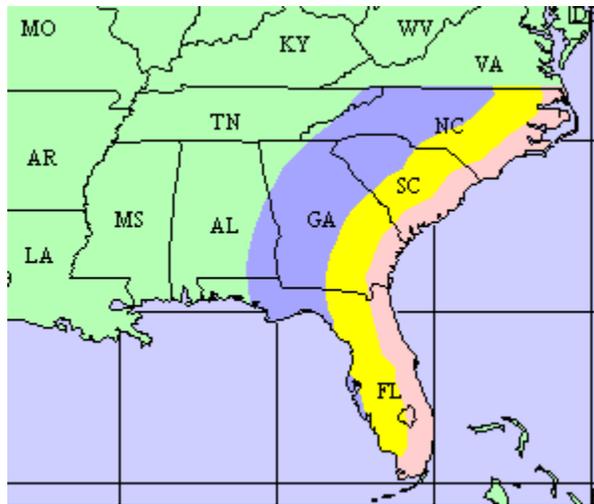
CAT 2 HURRICANE (98mph) FORWARD SPEED: 20mph



EXTENT OF INLAND WINDS

■ >34Kt(39mph)
 ■ >50Kt(58mph)
 ■ >64kt(74mph)
 ■ >80Kt(92mph)
 ■ >95Kt(109mph)
 ■ >110kt(127mph)

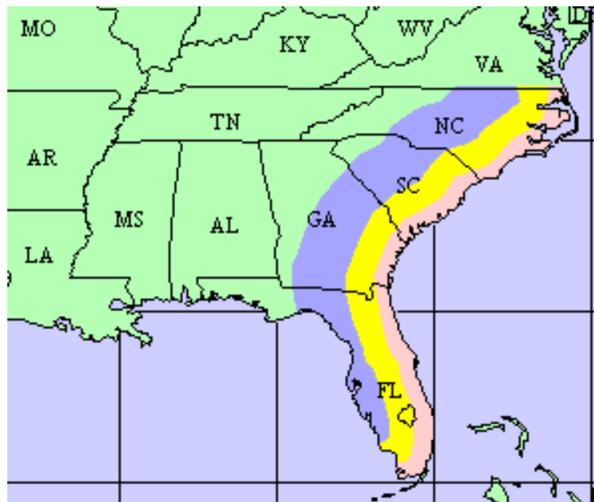
CAT 2 HURRICANE (98mph) FORWARD SPEED: 14mph



EXTENT OF INLAND WINDS

■ >34Kt(39mph)
 ■ >50Kt(58mph)
 ■ >64kt(74mph)
 ■ >80Kt(92mph)
 ■ >95Kt(109mph)
 ■ >110kt(127mph)

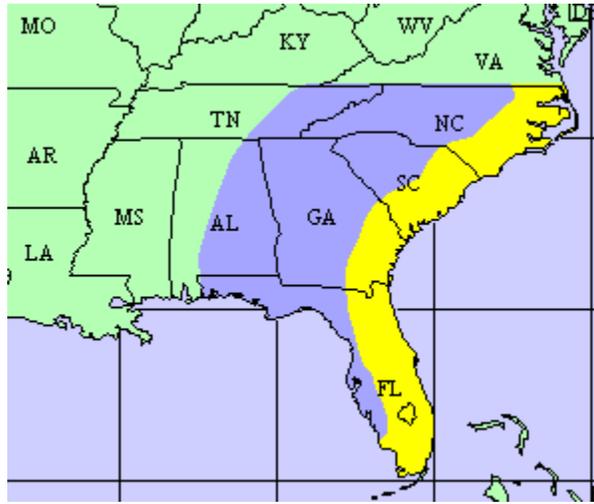
CAT 2 HURRICANE (98mph) FORWARD SPEED: 9mph



EXTENT OF INLAND WINDS

■ >34Kt(39mph)
 ■ >50Kt(58mph)
 ■ >64kt(74mph)
 ■ >80Kt(92mph)
 ■ >95Kt(109mph)
 ■ >110kt(127mph)

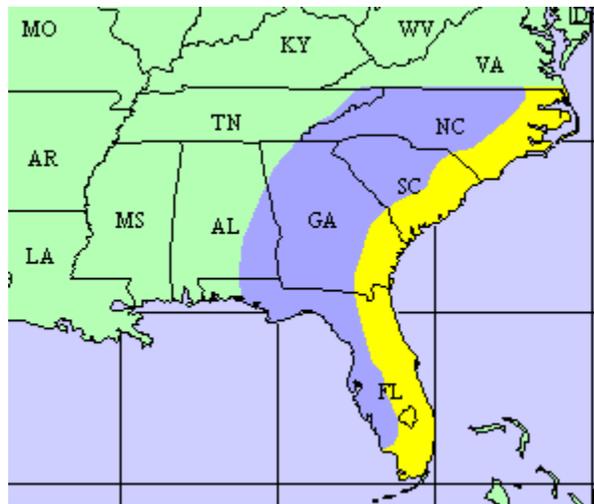
CAT 1 HURRICANE (75mph) FORWARD SPEED: 25mph



EXTENT OF INLAND WINDS

■ >34Kt(39mph)
 ■ >50Kt(58mph)
 ■ >64kt(74mph)
 ■ >80Kt(92mph)
 ■ >95Kt(109mph)
 ■ >110kt(127mph)

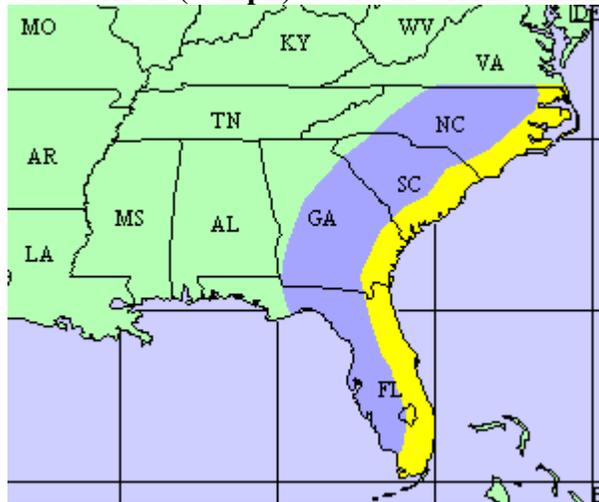
CAT 1 HURRICANE (75mph) FORWARD SPEED: 20mph



EXTENT OF INLAND WINDS

■ >34Kt(39mph)
 ■ >50Kt(58mph)
 ■ >64kt(74mph)
 ■ >80Kt(92mph)
 ■ >95Kt(109mph)
 ■ >110kt(127mph)

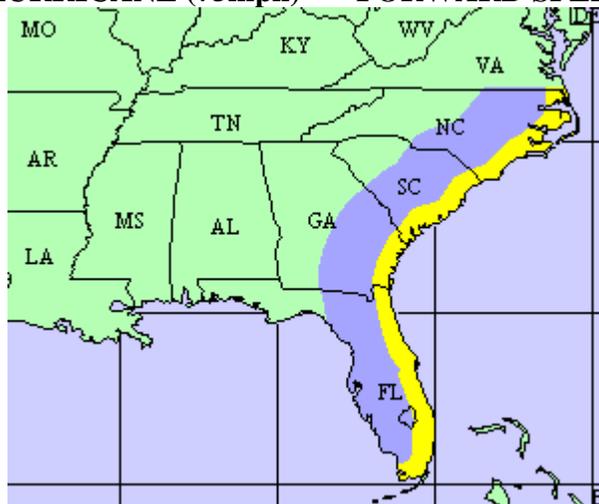
CAT 1 HURRICANE (75mph) FORWARD SPEED: 14mph



EXTENT OF INLAND WINDS

■ >34Kt(39mph)
 ■ >50Kt(58mph)
 ■ >64kt(74mph)
 ■ >80Kt(92mph)
 ■ >95Kt(109mph)
 ■ >110kt(127mph)

CAT 1 HURRICANE (75mph) FORWARD SPEED: 9mph

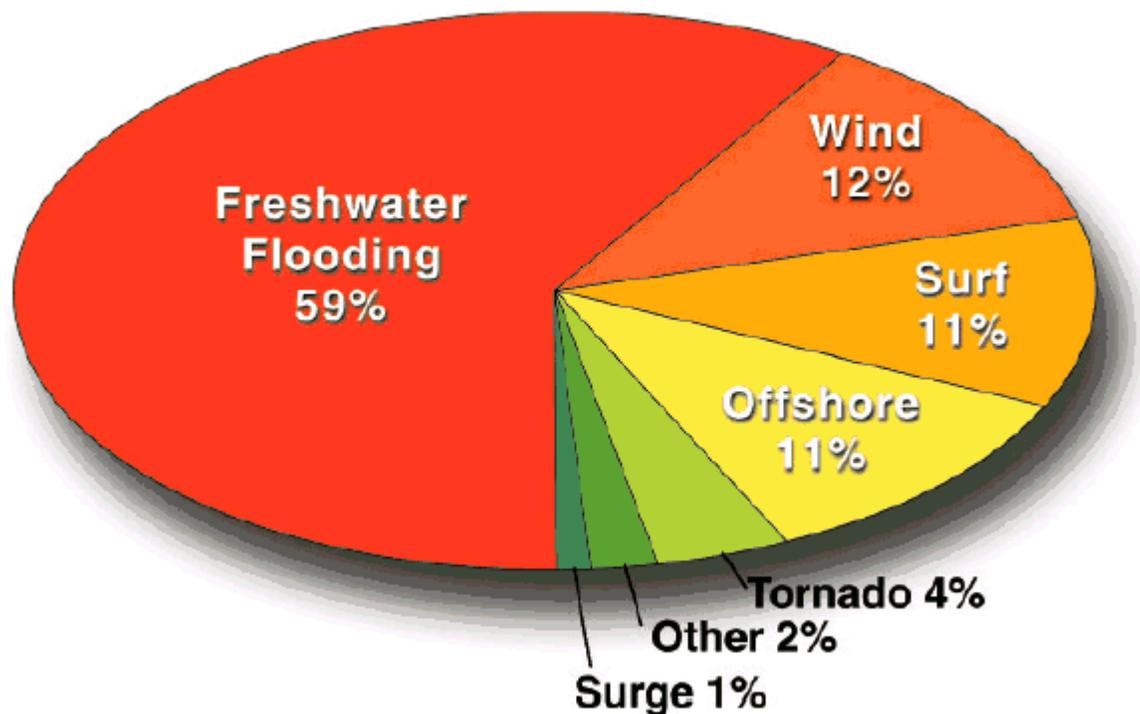


EXTENT OF INLAND WINDS

■ >34Kt(39mph)
 ■ >50Kt(58mph)
 ■ >64kt(74mph)
 ■ >80Kt(92mph)
 ■ >95Kt(109mph)
 ■ >110kt(127mph)

In addition to inland risk from straight line and tornado winds, hurricanes also produce flooding. Hurricane Floyd in 1999 brought record rain and flooding to North Carolina in addition to 50 deaths due to inland flooding. More people have died from inland flooding from 1970 up to 2000 than any other tropical cyclone affect and flooding has produced the greatest damage.³⁹

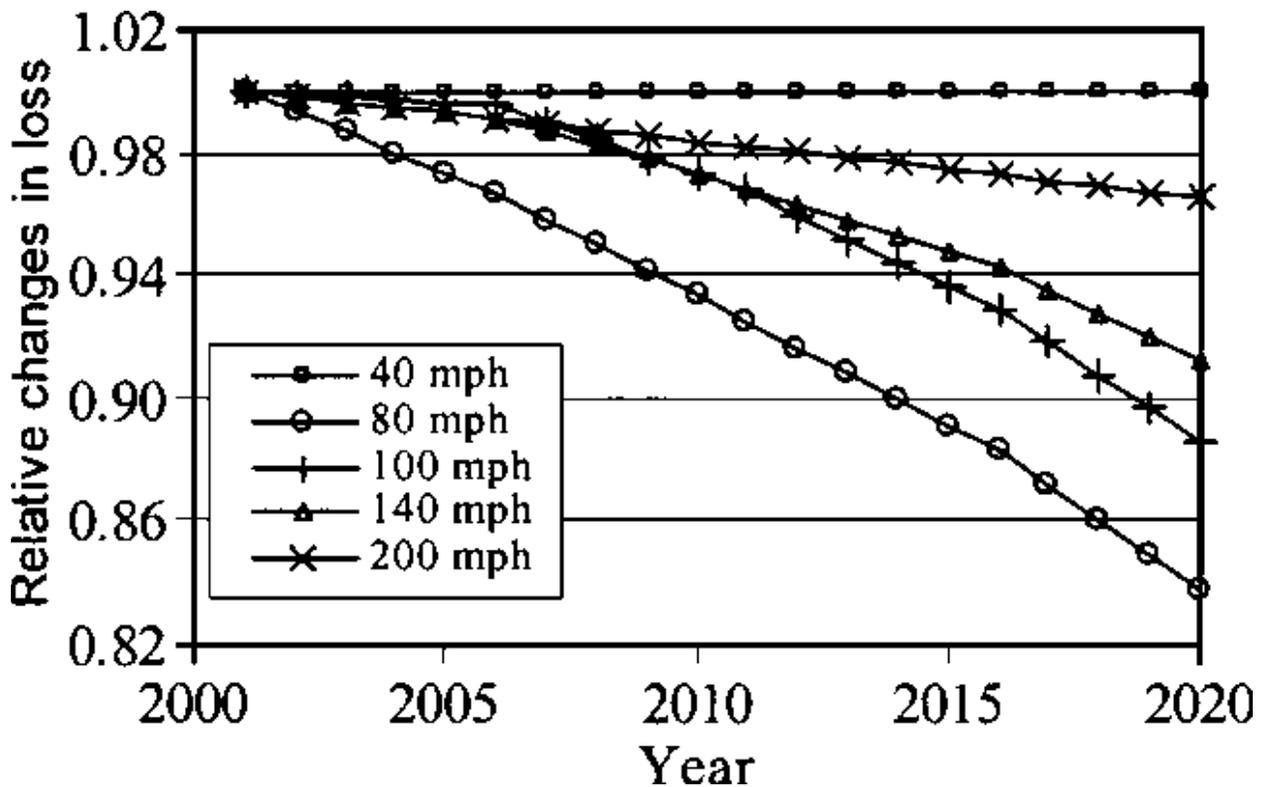
Leading Causes of Tropical Cyclone Deaths in the U.S 1970-1999



Source: Edward Rappaport—Chief, Technical Support Branch, Tropical Prediction Center

Unlike the affects from windspeed, the distance from the coast and forward speed does not play a factor. With the exception of Hurricane Hugo, flooding has been the most common risk in Concord. Weaker, slow moving storms, such as Tropical Storm Jerry and Faye, that drift or stall over an area has created the most flooding. Tropical Storm Jerry in 1995 caused flooding which closed an area of I-85 due to run-off from over 5 inches of rain and the remnants of Tropical Storm Faye in August 2008, resulted in a \$1.3 million in damage to local utility infrastructure (Transportation and Storm Water System).

A recent published study found that building code improvements are usually sufficient to increase a buildings resistance to intermediate wind speeds. Strict building codes have a positive The North Carolina State Building Code was developed in the mid-1960 in response to damage from coastal storms in the 1950's. The Code uses a design wind speed for residential design considerations for new construction. The chart below examines relative changes in loss from 2001 losses due to building code change.⁴⁰



Inland structures are frequently more protected from the effects of wind than structures on the coast. The more irregular terrain in inland areas and the surface friction caused by the ground features not only reduce the wind speed but generally change the effects of the storm from damage by direct impact of the wind on the structure to collateral damage to structures caused by trees and power lines pushed over or broken by the wind.

In areas of open terrain (e.g., areas near most airports, large fields), wind can move closer to the ground surface, where it can increase in speed and cause greater structural, roof, and exterior cladding damage to exposed buildings. In these areas, there is also a greater likelihood of debris becoming airborne and 4-15 causing collateral damage by penetrating building envelopes. An additional problem at airports is that many buildings (e.g., hangars) are higher than 30 feet to 40 feet and are therefore more vulnerable to wind damage.

Sustained winds of 50mph can even pull sheeting off mobile homes. The overall damage level is approximately 50% higher for mobile homes than for single-family dwellings in the same geographic area.

Potential Loss Estimate

Power loss is normally the result of wind damage during these events. Limbs and trees will break off and fall across power lines and even break power distribution poles. This has a domino affect on other utility systems such as water and waste water distribution

and handling systems. An estimated 70% of the local electrical system can expect to be impacted if sustained wind speeds reach event the lowest level hurricane force.

Heavy rain is the most likely cause of damage from tropical cyclone events. Hurricane induced rainfall can also be beneficial, mitigating the effects of a summer time drought. Even the time of year when a hurricane hits can produce different flooding potential. An early season storm while the leaves are still green may increase the potential for wind damage, fallen leaves can also increase the potential for urban flooding during late season storms.

Tropical systems have the potential of producing record rainfall totals. On August 28, 2009, tropical moisture from Hurricane Fran created localized intense heavy rainfall. The intense rain created flash floods in the Concord area that washed out roads damaged in-ground utility systems and bridges. Damage totals were estimated at \$5.5 million.

A hurricane can produce heavy rains that lead to flooding, high winds and severe storms. Concord is vulnerable to each of these natural hazards, (addressed in individual sections of this plan). These individual components of a hurricane can topple trees; disrupt transportation and essential utility service to the community. As a result, the magnitude or intensity of damage is categorized as **severe** with a **critical** level of impact.

A hurricane can impact a large portion of the City resulting in injuries, property damage and disruption of critical services most often as the result of flooding. Hurricane Hugo, emphasized that Concord's distance from the South Carolina coast necessitates the need for consideration of a major wind event in addition to the flooding. During Hurricane Hugo, disruption of utility service lasted for over a week, though this was primarily the electrical utilities.

The best mitigation strategy for high winds continues to be adoption of a building code supported by an active enforcement and plans review program. Some protection for power outages is provided by maintenance of right-of-ways and tree trimming. Burial of electric and telephone lines in new developments provide a measure of protection but to retroactively bury above ground utility cables is not economically feasible.

The North Carolina Emergency Mitigation Plan states: "All areas of the state are vulnerable to hurricane hazards". Inland areas are only spared the affects of the storm surge. Multiple storms have passed within 75 miles of the Concord area, though without the damage of Hugo, the area has experienced associated flooding and damage from thunderstorms. A storm the category of Hurricane Hugo impacting the area will cause widespread damage, mainly from flooding, limbs/trees on structures/vehicles, and long-term interruption of public utilities.

Concord experiences the impact from tropical systems on a regular intervals, though damage from a system such as Hugo can be expected only once in a generation. Commonly, events caused by a tropical system results in mild disturbances to all systems or severe disturbance to some systems and isolated areas of the community. Mitigation

measures associated with severe storms and flooding are successful at reducing the most common effects on hurricanes inland.

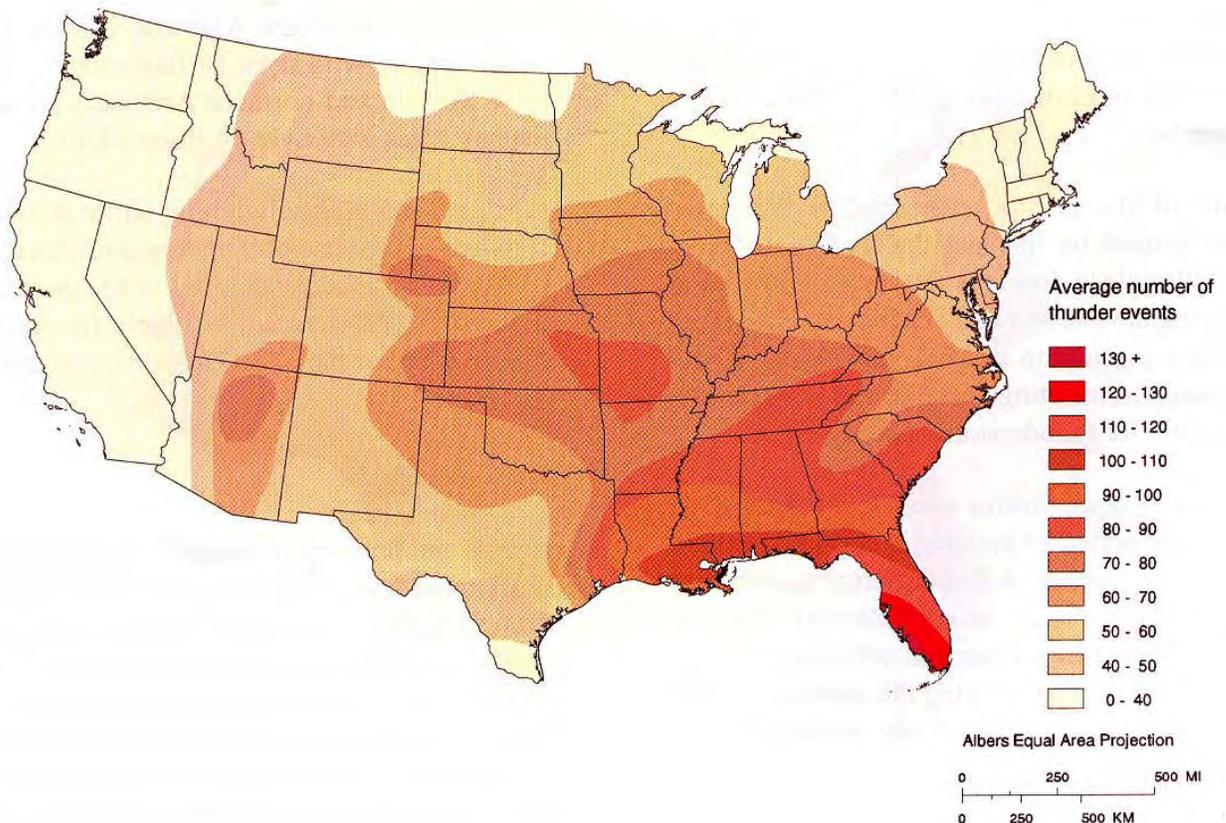
The greatest damage potential from all the affects of a hurricane occurs at the coast. Therefore the City of Concord considers the associated affects of hurricanes as a **low** hazard and addresses this in the plan.

Severe Storms and Tornadoes

Hazard Description

At any given moment, approximately 2,000 thunderstorms are occurring worldwide. Fortunately, only a small proportion of these are classified as severe, which according to the U.S. National Weather Service (NWS) are thunderstorms that produce at least one tornado, winds of at least 50 knots (58 mph), and/or hail at least 0.75 inches in diameter. Severe storms can leave behind a trail of destruction when they strike a community. Trees are uprooted onto utility lines, cars, other trees and people. Power outages can be wide spread and a large amount of resources are needed to restore service. Severe storms can also cause hail damage, fires from lightning strikes, and flooding. Two types of thunderstorm occur in our community, “air mass thunderstorms” and thunderstorms associated with mid-latitude cyclone cold fronts or dry lines. The air mass thunderstorm is the most common and happens during the summer in the late evening hours due to surface heating. These storms often contain heavy rain, lightning, thunder and produce wind gusts at the surface lasting about 1 hour. We average around 30 – 50 days with thunderstorms per year.

Annual number of Thunderstorms⁴¹



Despite their small size, all thunderstorms are dangerous. Every thunderstorm produces lightning, which kills more people each year than tornadoes. Heavy rain from

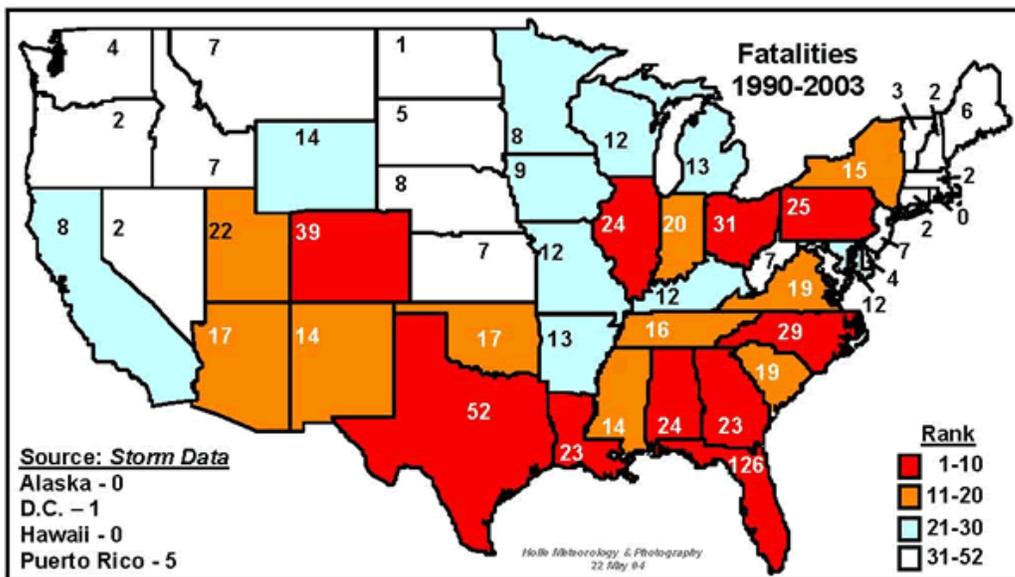
thunderstorms can lead to flash flooding. Strong winds, hail, and tornadoes are also dangers associated with some thunderstorms. Thunderstorms affect relatively small areas when compared with hurricanes and winter storms. The typical thunderstorm is 15 miles in diameter and lasts an average of 20 to 30 minutes. Of the estimated 100,000 thunderstorms that occur each year in the United States, only about 10 percent are classified as severe. The National Weather Service (NWS) considers a thunderstorm severe if it produces hail at least three-quarters of an inch in diameter, has winds of 58 miles per hour or higher, or produces a tornado.

Severe thunders are defined by the National Weather Service as those with 58 mile per hour winds and ¾ inch hail. These storms are more prevalent in the spring and early summer moving roughly from west to east. If the air has a high enough humidity in the path of the storm it can enhance uplift supplying the thunder storm with moisture and energy. This can change air mass thunderstorms into severe thunderstorms lasting for hours. These can also produce a gust front with winds exceeding 100 kilometer/hour.

Severe thunderstorms can develop a strong vertical updraft or mesocyclone. These are usually are found in the southwest portion of the storm and most often produces tornadoes (at least ½ of all mesocyclones produce a tornado). Since tornadoes are associated with severe thunderstorms these are discussed together in this risk assessment.

Lightning

Lightning is an electric discharged accompanied by thunder. It can also occur in dust storms and volcanic eruptions. In our area, summer is the peak season for lightning associated with severe storms. In 2009, lightning has killed 34 people up from 28 people in 2008. Hundreds of others were permanently injured. Of the injured/killed, 100% were outside. Lightning is also responsible for forest fires and dwelling fires each year. Though lightning is a serious danger, community wide the impact is low and mitigation is address through Life Safety Education Programs and mitigation efforts during outdoor events. North Carolina ranks 19 in the number of lightning deaths/million people.⁴²

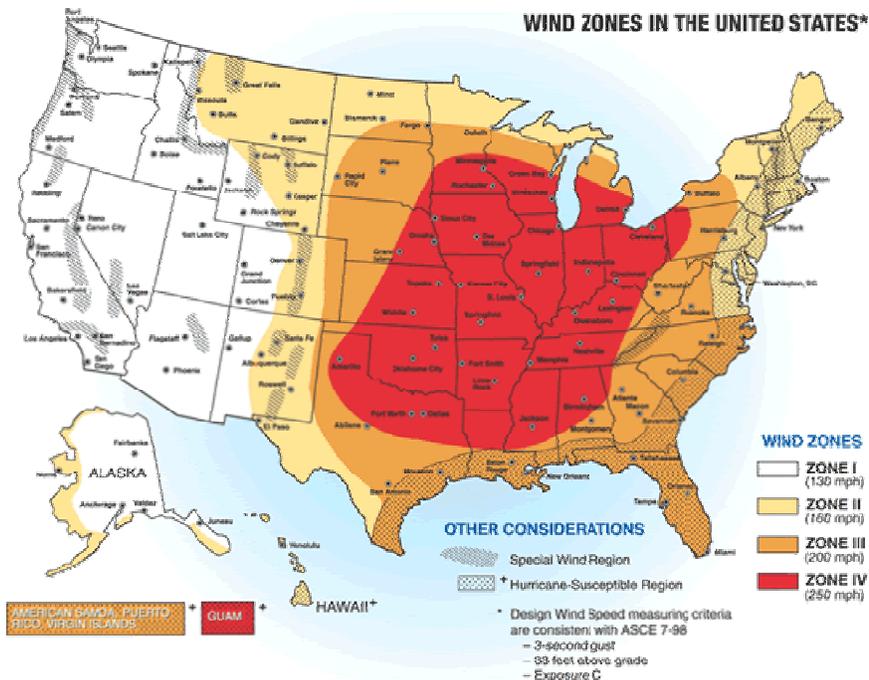


Hail

Hail is balls or irregular clumps of frozen precipitation most often produced by thunderstorm activity. Water droplets freeze within a storm and are held within the storm by its updraft. Hail size continues to grow until the weight of the hail exceeds the capacity of the updraft winds to support them. It takes approximately 100 mile per hour winds to support 4 inch hailstone. Penny size or $\frac{3}{4}$ inch hail is one of the criteria of severe thunderstorms.

Windstorms

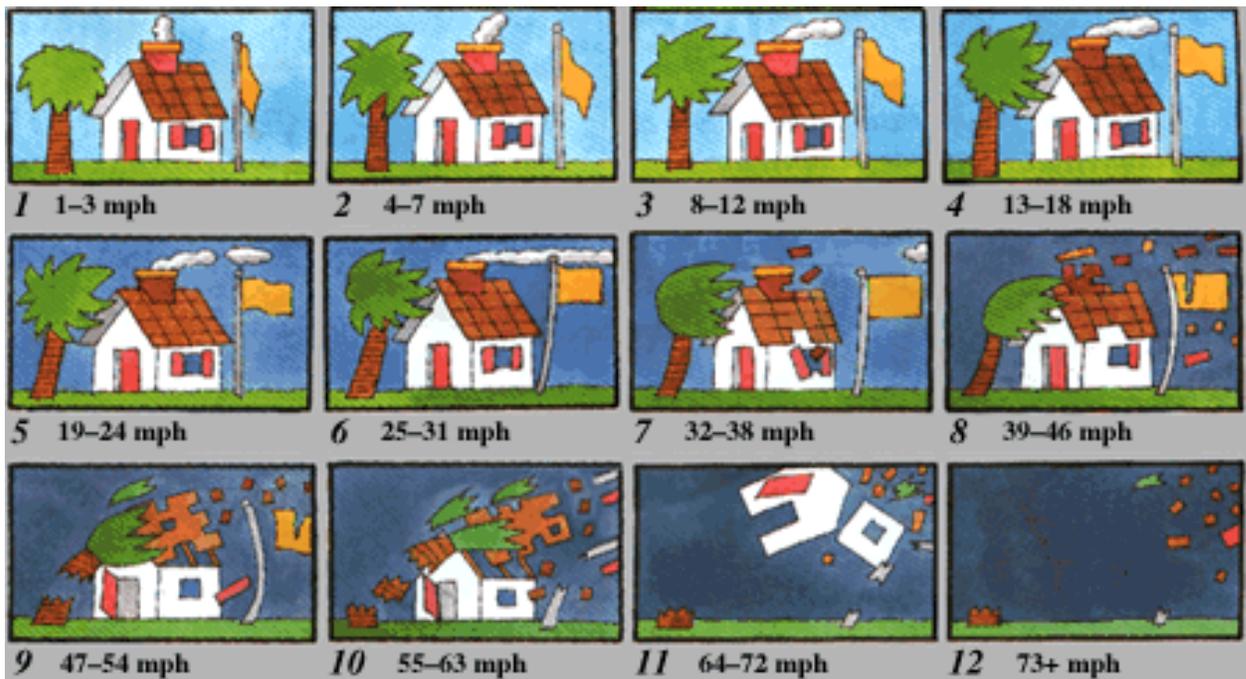
Windstorms are often associated with other storms, such as hurricanes or thunderstorms, but may occur independently. High winds can cause downed trees and power lines, flying debris, and building collapses, all of which may lead to power outages, transportation disruptions, damage to buildings and vehicles, and injury or death. Flying debris is the primary cause of damage during a windstorm. While a building may be generally structurally sound, broken glass from windows can cause injuries inside and outside the building and extensive damage to building content.⁴³



FEMA created the map above to demonstrate the frequency and strengths of windstorms in the United States based on historical data. In the graphic, two special wind zones are located in the State, the hurricane susceptible region along the eastern 1/3 of the State and a special wind hazard region located in the mountains along the Tennessee/North Carolina border.

Building codes designate wind zones that require special consideration for building construction. This also includes the design and construction of manufactured homes. The HUD Code stipulates, at §3280.305(c)(1) and §3280.305(c)(2), that the home shall be designed and constructed to conform to one of three wind load zones. The appropriate wind zone used in design is dependent on where the home will be initially installed. Homes designed and constructed to a higher Wind Zone can be installed in a lower Wind Zone (a Wind Zone III home can be installed in a Wind Zone I or II location). However, a Wind Zone I home cannot be installed in either a Wind Zone II or III area.⁴⁴

The graphic below was developed to provide a visual representation of the effects of winds at various speeds.

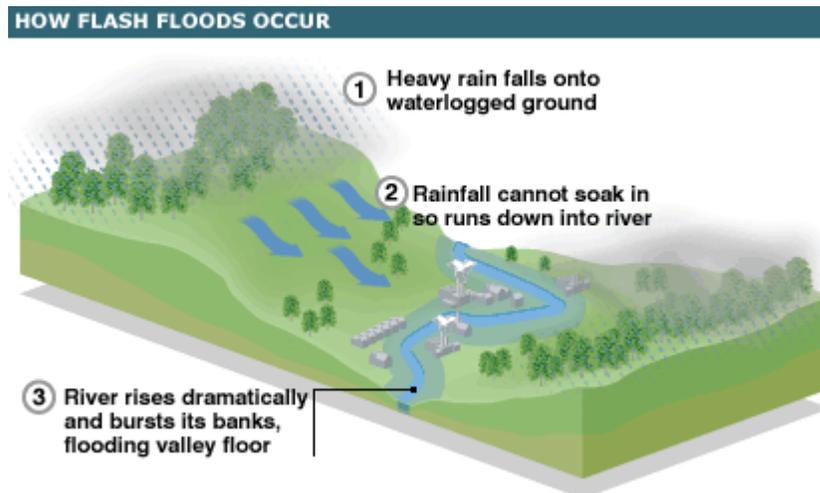


Tornado

A tornado is a violent storm with winds up to 300 miles per hour. It appears as a rotating funnel-shaped cloud, gray to black in color, extending toward the ground from the base of a thundercloud. The average tornado moves southwest to northeast at a forward speed of 30 miles per hour, but tornadoes can move in any direction and may vary from stationary to 70 miles per hour. Tornadoes are most frequent during spring and summer months between the hours of 3 PM and 9 PM. Tornadoes may also accompany hurricanes. Tornadoes can uproot trees and buildings and turn harmless objects into deadly missiles in a matter of seconds. Tornadoes are especially dangerous because they appear transparent until they begin to pick up debris and dust. These short-lived storms are the most violent of all atmospheric phenomena and, over a small area, are the most destructive. Approximately 800 tornadoes occur across the nation each year, resulting in nearly 80 deaths and 1,500 injuries. Damage paths can exceed one mile wide and 50 miles long.

Flooding

Flooding is another risk associated with severe storms. This is most commonly a flash flood or rapid flooding of low-lying areas. It is caused by the torrential rain associated with severe storms and can occur when a severe storm stalls over an area. Flash floods move at very fast speeds, can flood roadways, destroy buildings, and wash out bridges and culverts. Due to the impacts and risk associated with flooding, it is discussed independently of severe storms.⁴⁵



Terminology

- **Downburst:** A strong downdraft that induces an outburst of damaging winds on or near the ground.”
- **Funnel cloud:** A rotating column of air not in contact with the ground, extending from a towering cumulus or cumulonimbus base. Funnel clouds are found at the rear of the storm, usually from a wall cloud.
- **Severe Thunderstorm:** Thunderstorms which contain one or more of the following features: winds over 50 knots (58 miles per hour), 3/4 inch or larger hail, funnel clouds, or tornadoes.
- **Tornado:** A violently rotating column of air, in contact with the ground, usually found in the southwest quadrant of the storm. Tornadoes usually are pendant from wall clouds or directly from the thunderstorm base, within a few miles to the southwest of the precipitation shaft. Tornadoes are still called tornadoes even after they lift off the ground. The MAJORITY of tornadoes are found at the REAR of the storm.
- **Warning:** A warning is issued by the local Weather Service Office when severe weather has developed in the area. They are statements of imminent danger and are for relatively small areas. Warnings are issued for severe thunderstorms, tornadoes, or flash floods. The MSP Weather Service also issues "Very Severe Thunderstorm Warnings" when they expect winds in excess of 75 miles per hour (hurricane force winds).
- **Watch:** An area in which the National Severe Storms Forecast Center in Kansas City feels conditions are favorable for the development of severe weather. They

usually include an area 140 miles wide by 200 miles long and are issued for the potential of severe thunderstorms, tornadoes, or flash floods. A Watch means be aware of the potential for severe weather.

Severity

In 2009, severe weather losses in the United States were dominated by those from severe thunderstorms. Losses from severe thunderstorms exceeded more the \$9 billion in 2009 or 30% higher than the average loss from 2000 to 2008, even though activity was down during 2009.

Hail

The size and velocity of hail can injury people, damage property and ruin crops. Damages have been reported to reach as high as \$2 billion. The following chart provides a comparison of hail sizes with common objects.

Hail Size and Common Comparisons	
Reporting Terms	Wind Speed (mph)
BB size	0.10 inch
Pea	0.25 inch
Mothball, small marble, peanut M&M	0.50 inch
Penny or Dime, large marble,	0.75 inch
Quarter or Gold Dollar	1.00 inch
Kennedy Half-Dollar	1.25 inches
Ping Pong ball	1.50 inches
Golfball	1.75 inches
Hen Egg	2.00 inches
Tennis ball	2.50 inches
Baseball or Orange	2.75 inches
Grapefruit	4.00 inches
Softball or larger	4.50 inches

Research failed find property damage totals from hail damage for Cabarrus County. Damage totals for 4 of the five contiguous counties to Cabarrus for the period of 1958 to 2004 were:

Mecklenburg 1M
 Union: N/A
 Stanly: 200,000

Rowan: 75,000
 Iredell: 12,000

Wind

Significant damage from wind is most often related a tornado or hurricane. Strong straight line winds often associated with a squall line and where the updraft and downdrafts are strong. These can produce winds exceeding 80 miles per hour causing damage across a wide area. Damage assessments after storms can differentiate between straight line wind damage and damage from a tornado. The main difference between the two is the rotating column of air that makes a tornado.

Wind Speed Effects		
Reporting Terms	Wind Speed (mph)	Wind Effects
Calm	Calm	Calm wind. Smoke rises vertically with little if any drift.
Light Air	1 to 3 mph	Direction of wind shown by smoke drift, not by wind vanes. Little if any movement with flags. Wind barely moves tree leaves.
Light Breeze	4 to 7 mph	Wind felt on face. Leaves rustle and small twigs move. Ordinary wind vanes move.
Gentle Breeze	8 to 12 mph	Leaves and small twigs in constant motion. Wind blows up dry leaves from the ground. Flags are extended out.
Moderate Breeze	13 to 18 mph	Wind moves small branches. Wind raises dust and loose paper from the ground and drives them along.
Fresh Breeze	19 to 24 mph	Large branches and small trees in leaf begin to sway. Crested wavelets form on inland lakes and large rivers.
Strong Breeze	25 to 31 mph	Large branches in continuous motion. Whistling sounds heard in overhead or nearby power and telephone lines. Umbrellas used with difficulty.
Near Gale	32 to 38 mph	Whole trees in motion. Inconvenience felt when walking against the wind.
Gale	39 to 46 mph	Wind breaks twigs and small branches. Wind generally impedes walking.
Strong Gale	47 to 54 mph	Structural damage occurs, such as chimney covers, roofing tiles blown off, and

Wind Speed Effects		
Reporting Terms	Wind Speed (mph)	Wind Effects
		television antennas damaged. Ground is littered with many small twigs and broken branches.
Whole Gale	55 to 63 mph	Considerable structural damage occurs, especially on roofs. Small trees may be blown over and uprooted.
Storm Force	64 to 75 mph	Widespread damage occurs. Larger trees blown over and uprooted.
Hurricane Force	Over 75 mph	Severe and extensive damage. Roofs can be peeled off. Windows broken. Trees uprooted. RVs and small mobile homes overturned. Moving automobiles can be pushed off the roadways.

Tornadoes

The National Weather Service defines a tornado as a violently rotating column of air in contact with the ground and extending from the base of a thunderstorm. A condensation funnel *does not need to reach to the ground* for a tornado to be present; a debris cloud beneath a thunderstorm is all that is needed to confirm the presence of a tornado, even without a condensation funnel.

The intensity, path length and width of tornadoes are rated according to a scale developed by T. Theodore Fujita and Allen D. Pearson. This scale measured the strength of a tornado or its intensity. This scale was widely used until February 2007 when it was replaced by the Enhanced Fujita scale. This new scale was developed since the original scale was found to be more subjective. The Enhanced Fujita Scale was expanded to include more diverse and better described indicators. The table below provides a comparison with the original Fujita Scale and the new Enhanced Fujita Scale.

Fujita Tornado Damage Scale		
ORIGINAL FUJITA SCALE	ENHANCED FUJITA SCALE	TYPICAL DAMAGE
F5 261 – 318 mph	EF5: +200 mph	Incredible damage. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters (109 yds); trees debarked; incredible phenomena will occur.
F4 207-260 mph	EF4: 166-200 mph	Devastating damage. Well-constructed houses leveled; structures

Fujita Tornado Damage Scale		
ORIGINAL FUJITA SCALE	ENHANCED FUJITA SCALE	TYPICAL DAMAGE
		with weak foundations blown away some distance; cars thrown and large missiles generated.
F3 158-206 mph	EF3: 136-265 mph	Severe damage. Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown.
F2 113-157 mph	EF2: 111-135 mph	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
F1 73-112 mph	EF1: 86-110 mph	Moderate damage. Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads.
F0 <73 mph	EF0: 65-85 mph	Light damage. Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; signboards damaged.

IMPORTANT NOTE ABOUT F-SCALE WINDS: Do not use F-scale winds literally. These precise wind speed numbers are actually guesses and have never been scientifically verified. Different wind speeds may cause similar-looking damage from place to place -- even from building to building. *Without a thorough engineering analysis of tornado damage in any event, the actual wind speeds needed to cause that damage are unknown.* Source: NOAA, Historical Tornado, Severe Storm Events. (Table developed in 1971 by T. Theodore Fujita of the University of Chicago)

Damage Examples

F-0



F-1



F-2



F-3



F-4



F-5



Probability

Thunderstorms are a common occurrence in Concord during severe weather seasons. These can produce downbursts, hail, flooding and tornadoes. Concord is in a high-risk area of North Carolina that indicates a tornado of significant magnitude once every 50 years. Concord has been affected by several tornados in the period 1950 to 2002, one of which did \$2.5 million damage. No tornados during this period were listed above F1 on the fajita scale.

North Carolina in 1970 had a population of 5,084,411 and between 1950 and 1995 had 618 tornadoes. This ranks the State number 22 in tornadoes by State. The population in 1970 divided by the number of tornadoes equals 8,227 This ranks North Carolina number 26 in the ratio of tornadoes to population. North Carolina had 82 fatalities between 1950 and 1995. Compared to other states it ranked 20 The risk of death in any one year is 1 in 2,790,226 This ranks North Carolina as number 24 for the risk of death by tornado. Between 1950 and 1995 the state had 1,952 injuries involving tornadoes. This ranks the state number 17 among the States for injury. The risk of injury in any one year is one in 117,212 When we divide the population by the number of injuries, the State ranks number 24 The total cost of tornadoes between 1950 and 1995 was \$377,554,944.00 This ranks the state number 21 The cost per person for tornadoes, in the state per year, is \$ 1.65 This ranks the State number 24 In costs for tornadoes per person.

In North Carolina, F1 tornadoes account for 74% of all tornadoes. Only 1.6% of this state’s tornadoes had a F4 classification; tornadoes classified as F4 cause 44.6% of the injuries and 45.8% of the fatalities in North Carolina. Manufactured home communities are specifically vulnerable to the affects of high straight-line winds and tornado winds. The total number of manufactured homes within the City of Concord is 1400.

Thunderstorm Winds: 129 events, 1 death, 3 injuries, \$2.04 million damages

Thunderstorm winds						
Date	Time	Type	Mag	Dth	Inj	PrD
07/05/1957	1400	Tstm	0 kts.	0	0	0

Thunderstorm winds						
Date	Time	Type	Mag	Dth	Inj	PrD
		Wind				
06/02/1959	1400	Tstm Wind	0 kts.	0	0	0
04/12/1966	1900	Tstm Wind	0 kts.	0	0	0
06/16/1971	1715	Tstm Wind	0 kts.	0	0	0
06/28/1977	1500	Tstm Wind	0 kts.	0	0	0
06/19/1979	1320	Tstm Wind	65 kts.	0	0	0
08/15/1980	1845	Tstm Wind	0 kts.	0	0	0
01/04/1982	0515	Tstm Wind	0 kts.	0	0	0
05/16/1982	1700	Tstm Wind	0 kts.	0	0	0
08/23/1983	1715	Tstm Wind	0 kts.	0	0	0
08/24/1983	0200	Tstm Wind	0 kts.	0	0	0
10/13/1983	1335	Tstm Wind	0 kts.	0	0	0
10/13/1983	1350	Tstm Wind	0 kts.	0	0	0
04/14/1984	1430	Tstm Wind	0 kts.	0	0	0
07/10/1984	1640	Tstm Wind	0 kts.	0	0	0
07/15/1984	2000	Tstm Wind	0 kts.	0	0	0
02/12/1985	0025	Tstm Wind	0 kts.	0	0	0
02/12/1985	0030	Tstm	0 kts.	0	0	0

Thunderstorm winds						
Date	Time	Type	Mag	Dth	Inj	PrD
		Wind				
06/04/1985	2000	Tstm Wind	0 kts.	0	0	0
06/04/1985	2030	Tstm Wind	0 kts.	0	0	0
06/04/1985	2130	Tstm Wind	0 kts.	0	0	0
06/05/1985	1745	Tstm Wind	0 kts.	0	0	0
06/10/1985	1530	Tstm Wind	0 kts.	0	0	0
06/24/1985	1700	Tstm Wind	0 kts.	0	0	0
07/10/1985	2030	Tstm Wind	0 kts.	0	0	0
07/09/1986	1915	Tstm Wind	61 kts.	0	0	0
07/11/1986	1800	Tstm Wind	0 kts.	0	0	0
04/15/1987	1430	Tstm Wind	0 kts.	0	0	0
06/25/1987	0505	Tstm Wind	0 kts.	0	0	0
07/23/1987	1520	Tstm Wind	0 kts.	0	0	0
09/11/1987	1800	Tstm Wind	0 kts.	0	0	0
05/17/1988	1415	Tstm Wind	0 kts.	0	0	0
06/09/1988	1345	Tstm Wind	0 kts.	0	0	0
06/09/1988	1401	Tstm Wind	0 kts.	0	0	0
05/05/1989	1820	Tstm	0 kts.	0	0	0

Thunderstorm winds						
Date	Time	Type	Mag	Dth	Inj	PrD
		Wind				
05/06/1989	1115	Tstm Wind	0 kts.	0	0	0
03/01/1991	2245	Tstm Wind	0 kts.	0	0	0
04/29/1991	1930	Tstm Wind	0 kts.	0	0	0
07/02/1991	1855	Tstm Wind	0 kts.	0	0	0
03/19/1992	1345	Tstm Wind	0 kts.	0	0	0
04/24/1992	2008	Tstm Wind	55 kts.	0	0	0
04/24/1992	2058	Tstm Wind	0 kts.	0	0	0
07/18/1992	1445	Tstm Wind	0 kts.	0	0	0
07/06/1995	1450	Tstm Winds	0 kts.	0	0	0
07/06/1995	1530	Tstm Winds	0 kts.	0	0	0
07/06/1995	1700	Tstm Winds	0 kts.	0	0	0
07/06/1995	1800	Tstm Winds	0 kts.	0	0	0
01/18/1996	08:00 PM	High Wind	0 kts.	0	0	75K
04/30/1996	12:40 AM	Tstm Wind	50 kts.	0	0	0
05/11/1996	01:55 PM	Tstm Wind	50 kts.	0	0	60K
05/11/1996	02:15 PM	Tstm Wind	50 kts.	0	0	0
05/28/1996	12:00 AM	Tstm	50 kts.	0	0	0

Thunderstorm winds						
Date	Time	Type	Mag	Dth	Inj	PrD
		Wind				
06/20/1996	07:25 PM	Tstm Wind	50 kts.	0	0	30K
07/15/1996	02:33 PM	Tstm Wind	50 kts.	0	0	0
08/03/1996	08:20 PM	Tstm Wind	50 kts.	0	0	0
09/06/1996	01:00 AM	High Wind	0 kts.	0	0	0
02/24/1998	09:00 AM	High Wind	50 kts.	0	0	20K
04/19/1998	03:20 PM	Tstm Wind	50 kts.	0	0	1K
05/08/1998	02:45 PM	Tstm Wind	50 kts.	0	0	0
07/20/1998	07:00 PM	Tstm Wind	50 kts.	0	0	0
07/20/1998	07:15 PM	Tstm Wind	50 kts.	0	0	0
07/20/1998	07:30 PM	Tstm Wind	50 kts.	0	0	0
07/20/1998	07:45 PM	Tstm Wind	50 kts.	0	0	0
07/20/1998	08:00 PM	Tstm Wind	50 kts.	0	0	0
07/20/1998	08:00 PM	Tstm Wind	50 kts.	0	0	0
09/08/1998	11:50 AM	Tstm Wind	60 kts.	0	0	25K
03/03/1999	11:00 AM	High Wind	60 kts.	0	0	700K
04/27/1999	09:03 PM	Tstm Wind	50 kts.	0	0	0
07/24/1999	03:10 PM	Tstm	60 kts.	0	0	0

Thunderstorm winds						
Date	Time	Type	Mag	Dth	Inj	PrD
		Wind				
07/31/1999	01:15 AM	Tstm Wind	60 kts.	0	0	15K
07/31/1999	12:55 AM	Tstm Wind	50 kts.	0	0	0
09/09/1999	04:40 PM	Tstm Wind	60 kts.	0	0	30K
09/29/1999	06:10 PM	Tstm Wind	50 kts.	0	0	0
03/11/2000	04:40 PM	Tstm Wind	50 kts.	0	0	0
03/28/2000	12:00 PM	High Wind	50 kts.	0	1	0
05/13/2000	07:25 PM	Tstm Wind	60 kts.	0	0	0
05/13/2000	07:45 PM	Tstm Wind	52 kts.	0	0	0
07/28/2000	05:55 PM	Tstm Wind	50 kts.	0	0	0
08/10/2000	02:00 AM	Tstm Wind	55 kts.	0	0	0
08/10/2000	02:20 AM	Tstm Wind	50 kts.	0	0	0
08/18/2000	04:50 PM	Tstm Wind	65 kts.	0	0	0
11/09/2000	12:00 PM	Gusty Winds	N/A	0	0	0
02/16/2001	10:00 PM	High Wind	55 kts.	0	0	0
05/19/2001	08:01 PM	Tstm Wind	50 kts.	0	0	0
08/18/2001	04:10 PM	Tstm Wind	50 kts.	0	0	0
02/04/2002	12:00 PM	High	50 kts.	0	0	0

Thunderstorm winds						
Date	Time	Type	Mag	Dth	Inj	PrD
		Wind				
05/13/2002	04:55 PM	Tstm Wind	50 kts.	0	0	1K
05/13/2002	05:10 PM	Tstm Wind	55 kts.	0	0	25K
06/01/2002	06:03 PM	Tstm Wind	60 kts.	0	0	5K
07/22/2002	03:45 PM	Tstm Wind	65 kts.	0	0	50K
08/24/2002	05:45 PM	Tstm Wind	60 kts.	0	0	3K
02/22/2003	10:40 AM	Tstm Wind	50 kts.	0	0	0
05/02/2003	04:35 PM	Tstm Wind	50 kts.	0	0	25K
05/03/2003	06:18 PM	Tstm Wind	55 kts.	0	0	25K
05/31/2003	02:57 PM	Tstm Wind	55 kts.	0	0	0
06/03/2003	02:40 PM	Tstm Wind	55 kts.	0	0	25K
06/16/2003	05:15 PM	Tstm Wind	50 kts.	0	0	0
07/11/2003	04:10 PM	Tstm Wind	52 kts.	0	0	1K
07/19/2003	05:58 PM	Tstm Wind	50 kts.	0	0	0
07/21/2003	07:10 PM	Tstm Wind	50 kts.	0	0	0
07/29/2003	07:00 PM	Tstm Wind	50 kts.	0	0	1K
11/19/2003	08:23 AM	Tstm Wind	60 kts.	0	0	3K
03/07/2004	06:45 PM	High	65 kts.	1	2	385K

Thunderstorm winds						
Date	Time	Type	Mag	Dth	Inj	PrD
		Wind				
05/23/2004	05:40 PM	Tstm Wind	60 kts.	0	0	10K
07/04/2004	06:21 PM	Tstm Wind	55 kts.	0	0	1K
07/05/2004	06:05 PM	Tstm Wind	50 kts.	0	0	0
09/08/2004	05:50 AM	Tstm Wind	50 kts.	0	0	2K
03/08/2005	07:42 AM	Tstm Wind	55 kts.	0	0	0
03/08/2005	07:58 AM	Tstm Wind	60 kts.	0	0	20K
07/28/2005	06:20 PM	Tstm Wind	50 kts.	0	0	0
04/22/2006	04:25 PM	Tstm Wind	50 kts.	0	0	0
06/10/2006	09:24 PM	Tstm Wind	55 kts.	0	0	0
06/12/2006	06:05 PM	Tstm Wind	65 kts.	0	0	0
06/12/2006	06:40 PM	Tstm Wind	50 kts.	0	0	0
07/22/2006	09:05 PM	Tstm Wind	50 kts.	0	0	0
04/16/2007	09:00 AM	High Wind	60 kts.	0	0	500K
06/26/2007	18:36 PM	Tstm Wind	55 kts.	0	0	0K
07/09/2007	17:50 PM	Tstm Wind	50 kts.	0	0	0K
08/21/2007	16:20 PM	Tstm Wind	55 kts.	0	0	0K
08/25/2007	16:42 PM	Tstm	50 kts.	0	0	0K

Thunderstorm winds						
Date	Time	Type	Mag	Dth	Inj	PrD
		Wind				
02/10/2008	13:00 PM	High Wind	55 kts.	0	0	0K
03/04/2008	20:30 PM	Tstm Wind	50 kts.	0	0	0K
06/22/2008	18:39 PM	Tstm Wind	50 kts.	0	0	0K
06/22/2008	19:00 PM	Tstm Wind	50 kts.	0	0	0K
06/28/2008	18:00 PM	Tstm Wind	55 kts.	0	0	0K
07/08/2008	16:40 PM	Tstm Wind	55 kts.	0	0	0K
07/08/2008	16:45 PM	Tstm Wind	50 kts.	0	0	0K
07/22/2008	16:45 PM	Tstm Wind	50 kts.	0	0	0K
02/11/2009	20:45 PM	Tstm Wind	50 kts.	0	0	0K

Hail – 76 events

Hail						
Date	Time	Type	Mag	Dth	Inj	PrD
04/28/1959	1655	1.25 in.	0	0	0	0
04/13/1970	2115	1.75 in.	0	0	0	0
06/21/1970	0700	2.00 in.	0	0	0	0
05/16/1982	1700	1.00 in.	0	0	0	0
03/08/1983	1438	1.25 in.	0	0	0	0
04/14/1984	1430	1.75 in.	0	0	0	0
06/04/1985	2000	1.75 in.	0	0	0	0
06/05/1985	1745	4.50 in.	0	0	0	0
06/05/1985	1845	1.00 in.	0	0	0	0

Hail						
Date	Time	Type	Mag	Dth	Inj	PrD
06/05/1985	1900	0.75 in.	0	0	0	0
06/05/1985	1945	1.00 in.	0	0	0	0
04/24/1987	1100	1.00 in.	0	0	0	0
08/29/1987	2050	0.75 in.	0	0	0	0
07/08/1990	1738	1.00 in.	0	0	0	0
08/07/1991	1647	0.88 in.	0	0	0	0
04/30/1992	1630	1.75 in.	0	0	0	0
05/19/1993	0815	0.75 in.	0	0	0	0
05/01/1995	2111	0.88 in.	0	0	0	0
07/06/1995	1300	1.00 in.	0	0	0	0
08/28/1997	1509	1.00 in.	0	0	0	0
03/20/1998	1500	1.00 in.	0	0	0	0
04/03/1998	2100	1.75 in.	0	0	0	0
05/07/1998	1904	2.75 in.	0	0	0	0
05/07/1998	1910	1.75 in.	0	0	0	0
05/08/1998	1445	0.75 in.	0	0	0	0
05/27/1998	1643	0.75 in.	0	0	0	0
05/02/2000	1828	0.75 in.	0	0	0	0
05/13/2000	1925	1.00 in.	0	0	0	0
04/01/2001	1105	0.75 in.	0	0	0	0
07/05/2001	1900	1.25 in.	0	0	0	0
07/03/2002	1715	1.00 in.	0	0	0	0
07/04/2002	1320	0.88 in.	0	0	0	0
07/22/2002	1610	0.75 in.	0	0	0	0
05/03/2003	06:18 PM	1.00 in.	0	0	0	0
05/03/2003	06:24 PM	0.88 in.	0	0	0	0
05/03/2003	08:25 PM	0.75 in.	0	0	0	0
06/07/2005	04:48 PM	1.00 in.	0	0	0	0

Hail						
Date	Time	Type	Mag	Dth	Inj	PrD
04/22/2006	04:25 PM	0.75 in.	0	0	0	0
05/14/2006	01:20 PM	1.75 in.	0	0	0	0
05/14/2006	01:30 PM	1.75 in.	0	0	0	0
05/14/2006	01:40 PM	1.75 in.	0	0	0	0
05/18/2006	04:45 PM	1.00 in.	0	0	0	0
05/18/2006	04:50 PM	0.75 in.	0	0	0	0
05/18/2006	04:50 PM	1.00 in.	0	0	0	0
06/10/2006	09:24 PM	1.75 in.	0	0	0	0
06/10/2006	09:38 PM	1.00 in.	0	0	0	0
06/12/2006	06:40 PM	0.75 in.	0	0	0	0
08/07/2006	02:18 PM	0.75 in.	0	0	0	0
04/15/2007	15:40 PM	1.00 in.	0	0	OK	OK
05/12/2007	13:37 PM	0.75 in.	0	0	OK	OK
06/24/2007	18:22 PM	0.75 in.	0	0	OK	OK
06/25/2007	18:48 PM	0.88 in.	0	0	OK	OK
06/26/2007	18:36 PM	0.75 in.	0	0	OK	OK
04/20/2008	12:20 PM	0.75 in.	0	0	OK	OK
04/26/2008	17:55 PM	0.75 in.	0	0	OK	OK
04/26/2008	18:00 PM	0.88 in.	0	0	OK	OK
05/09/2008	18:25 PM	1.00 in.	0	0	OK	OK
05/11/2008	17:00 PM	1.00 in.	0	0	OK	OK
05/11/2008	17:10 PM	2.75 in.	0	0	OK	OK
05/11/2008	17:14 PM	1.75 in.	0	0	OK	OK
05/11/2008	17:15 PM	0.88 in.	0	0	OK	OK
05/11/2008	17:15 PM	1.00 in.	0	0	OK	OK
05/11/2008	17:18 PM	1.00 in.	0	0	OK	OK
05/11/2008	17:33 PM	1.75 in.	0	0	OK	OK
05/20/2008	14:50 PM	0.88 in.	0	0	OK	OK

Hail						
Date	Time	Type	Mag	Dth	Inj	PrD
05/20/2008	14:57 PM	0.75 in.	0	0	0K	0K
05/20/2008	15:00 PM	1.00 in.	0	0	0K	0K
05/20/2008	16:25 PM	0.75 in.	0	0	0K	0K
05/20/2008	16:30 PM	0.75 in.	0	0	0K	0K
05/20/2008	16:30 PM	0.75 in.	0	0	0K	0K
06/11/2008	17:23 PM	0.88 in.	0	0	0K	0K
06/22/2008	18:27 PM	1.00 in.	0	0	0K	0K
06/22/2008	18:55 PM	1.00 in.	0	0	0K	0K
06/22/2008	19:20 PM	0.88 in.	0	0	0K	0K
04/10/2009	15:05 PM	1.00 in.	0	0	0K	0K
04/10/2009	15:40 PM	1.25 in.	0	0	0K	0K

No crop damage totals were available and only 1 injury in the State for the same period.

Tornado – 11 events, 0 injuries, \$2.636 Million

Tornado						
Date	Time	Type	Mag	Dth	Inj	PrD
07/27/1950	1620	F1	0	0	3K	0
11/28/1954	2230	F1	0	0	25K	0
07/25/1965	1530	F1	0	0	25K	0
05/28/1973	0500	F0	0	0	25K	0
05/28/1973	1800	F0	0	0	25K	0
06/06/1975	1800	F0	0	0	3K	0
08/23/1983	1710	F1	0	0	2.5M	0
03/10/1992	2155	F1	0	3	25K	0
05/14/2006	1349	F1	0	0	5K	0
05/11/2008	1719	F0	0	0	0K	0K
12/11/2008	1550	F1	0	0	0K	0K

Note: Two funnel clouds were reported on 09/29/1999 at 1700 and 1814 within the county but never became tornados.

Vulnerability Assessment

Severe storm related events are often of short duration and limited area. Damage is often reported where trees and the built up environment are in close proximity, and from lightning or hail. Above ground utilities are especially susceptible to the affects of tornadoes and severe storms. Lightning strikes are common during severe storms and depend on the intensity of the given storm system. Historically local tornado events have been F1 or less, resulting in limited damage. Severe thunderstorms can impact the community on a broader scale then direct damage through system wide outages.

Severe storms have a more frequent occurrence, tough the reported damage has not bee as significant as tornadoes. Unfortunately we could not find statistics for hail damage which would increase the severe storm damage total. One hundred and twenty-nine thunderstorm wind events accounted for \$2.04 million while only 11 tornados accounted for \$2.64 million in damages. These incidents can impact the built and natural environment, infrastructure systems and population equally.

Based on frequency per square mile and frequency of events, North Carolina ranks in the middle portion of all States, with a slightly lower ranking in injuries and deaths when compared other states. Because of this ranking and the limited amount of manufactured homes, the area would be considered to be at a moderate risk for this type of damage.

There are many issues related to what is in danger within the community. Severe storms disrupt utility service and transportation, cause accidents, significant property damage and pose a moderate risk for injuries and loss of life. Sheltering is and care for individuals displaced by the storm is a significant issue. Unlike a winter storm which can impact a wide area, the impact level of a severe storm is categorized as limited. Based on the assessment, the City is considered at a moderate risk level for severe storms and tornados.

Tsunami

Tsunamis are large water waves, typically generated by seismic activity, that have historically caused significant damage to coastal communities throughout the world. Since North Carolina is a coastal state, a potential for tsunamis exists, though historically damage in the United States has been confined to the Pacific Ocean. Concord's height above sea level 500+ feet and distance from the coast 200+ miles, places it far beyond areas considered at greatest risk (50 feet above sea level and within one mile of the shoreline). Therefore the occurrence of tsunamis is **unlikely**, intensity considered **mild**, and its hazard ranking is categorized as **low** and not addressed in this plan.

Volcano

A volcano is any vent in the crust of the Earth or other planet or satellite (e.g., Jupiter's Io), from which molten rock, pyroclastic debris, and/or steam issue. Although volcanic activity ended hundreds of millions of years ago, rocks that formed from these ancient volcanoes are still visible. This is true within Concord. Large volcanic rocks are visible in the Jackson Park Community and around Lowe's Motor Speedway. Many kinds of volcanic activity can endanger the lives of people and property both close to and far away from a volcano. Most of the activity involves the explosive ejection or flowage of rock fragments and molten rock in various combinations of hot or cold, wet or dry, and fast or slow. Some hazards are more severe than others depending on the size and extent of the event taking place and whether people or property is in the way. And although most volcano hazards are triggered directly by an eruption, some occur when a volcano is quiet.

Volcanoes in North Carolina are an ancient natural hazard and occurrence can be classified as unlikely, therefore volcanoes are not addressed in this plan.

Landslide

A landslide is described as a downward movement of a slope and materials under the force of gravity. The term landslide includes a wide range of ground movement, such as rock falls, deep failure of slopes, and shallow debris flows. Landslides are influenced by human activity (mining and construction of buildings, railroads, and highways, and natural factors (geology, precipitation and topography).

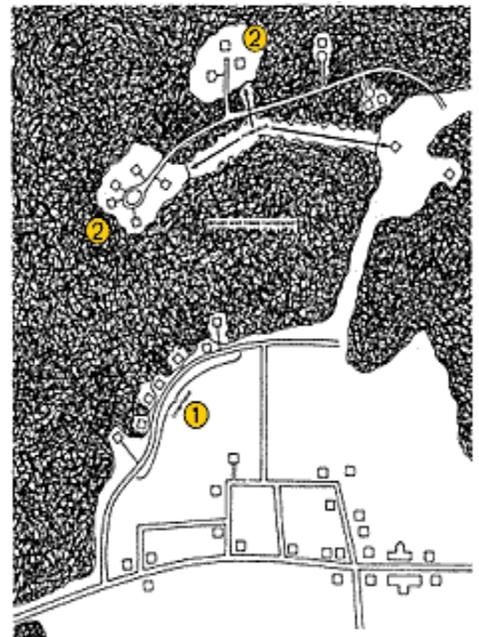
Concord had experienced small scale “landslides” usually caused by heavy rains that were also responsible washouts of roadways and flooding. North Carolina Emergency Management and local planners do not consider landslide a serious risk in Cabarrus County and Concord due to the local topography. Landslides in North Carolina have primarily been confined to the mountainous regions.

Concord has experience failure of earthen walls associated with poor landscaping, small sinkholes, and collapse of riverbanks due to erosion. Landslides are considered a possibility. A landslide in Concord would impact a minor area of the City with limited damages and the intensity rating is considered mild with a limited impact potential. Therefore, landslides are not addressed further in the Hazard Mitigation Plan.

Wildfire

Wildfire is an uncontrolled burning of grasslands, brush or woodlands. Areas commonly susceptible to wildfire are located within the wild land urban interface. The Urban Fire Protection Program originally used the term "interface" in a generic way to describe any area where potentially dangerous combustible wild land fuels were found adjacent to combustible homes and other structures.

The National Fire Protection Association Standard 299 defines wild land/urban interface as “an area where development and wild land fuels meet at well-defined boundaries.” If not clear definition of the boundaries is available the area is defined as a wild land/urban intermix. This can be better illustrated in the diagram at the right. The diagram shown here from NFPA 299 illustrates both terms, showing an interface area “1” as the first wave of structures adjacent to dense wild land vegetation. The intermix areas “2” show as individual homes or pockets of structures completely surrounded by wild land fuels. Each type of wild land/urban area has unique fire protection considerations, but both represent a single trend of people wanting to live in scenic and less densely populated surroundings.



North Carolina Emergency Management classifies the wildfire potential for Cabarrus County as a low risk from wildfire.

Concord Fire and Life Safety annually respond to minor grass and/or brush fires. These numbers have decreased since the implementation of a “no burning ordinance” within the City Limits. This restricts open burning to that used for cooking and or ceremonial events.

Historically, wildfire is a possibility within the jurisdiction and therefore categorized as **possible**. A wildfire in Concord would likely result in damage to a very limited area of the City and the magnitude or intensity of damage is categorized as **mild**. This would impact a small percentage of the City and loss of critical services is not expected resulting in a **negligible** level of impact.

Based on the probability of occurrence, magnitude, and level of impact, wildfires are considered a very low risk and not addressed in the hazard mitigation plan.

Winter Storms

Hazard Description

A Winter Storm is generally a prolonged event involving snow and ice. Winter storms affect the entire jurisdiction and are a common occurrence in the community. The national weather service monitors developing winter storm events and provides public watches and warning as they happen.

North Carolina can have a unique variety of winter weather. East of the Mississippi River, North Carolina holds the record for the length (503 miles) and for the range of altitude (from sea level at the coast to the summit of Mt. Mitchell at 6,684 feet). The warm current off the coast is often offset by the cold Labrador Current with passes between the Gulf Stream and the coast. During the winter months, Concord is partially protected by the mountain ranges to the west from frequent cold air moving southeastward across the United States. The Atlantic Ocean also helps to raise the average winter weather.

Winter in the Piedmont of North Carolina is usually classified as mild in comparison to other areas of the country. Concord has an average seasonal snowfall from 6 – 9 inches. Winter storms that impact the Concord area often form in the Gulf of Mexico or off the Atlantic Coast.

Terminology

- **Extreme Cold:** Extreme cold often accompanies a winter storm or is left in its wake. Prolonged exposure to the cold can cause frostbite or hypothermia and become life threatening. Infants and elderly people are most susceptible. What constitutes extreme cold and its effect varies across different areas of the United States. In areas unaccustomed to winter weather, near freezing temperatures are considered "extreme cold." Freezing temperatures can cause severe damage to citrus fruit crops and other vegetation. Pipes may freeze and burst in homes that are poorly insulated or without heat. In the north, below zero temperatures may be considered as "extreme cold." Long cold spells can cause rivers to freeze, disrupting shipping. Ice jams may form and lead to flooding.
- **Ice Storms:** Heavy accumulations of ice can bring down trees, electrical wires, telephone poles and lines, and communication towers. Communications and power can be disrupted for days while utility companies work to repair the extensive damage. Even small accumulations of ice may cause extreme hazards to motorists and pedestrians.
- **Heavy Snow Storms:** Heavy snow can immobilize a region and paralyze a city, stranding commuters, stopping the flow of supplies, and disrupting emergency and medical services. Accumulations of snow can collapse buildings and knock down trees and power lines. In rural areas, homes and farms may be isolated for days, and unprotected livestock may be lost. In the mountains, heavy snow can

lead to avalanches. The cost of snow removal, repairing damages, and loss of business can have large economic impacts on cities and towns.

Severity

Winter storms can impact a community in a variety of ways including:

- Automobile or other transportation accidents: This is the leading cause of death during winter storms.
- Exhaustion and heart attacks: Caused by overexertion, these are the two most likely causes of winter storm-related deaths.
- Hypothermia and asphyxiation: Elderly people account for the largest percentage of hypothermia victims. Many older Americans literally freeze to death in their own homes after being exposed to dangerously cold indoor temperatures, or they are asphyxiated because of improper use of fuels such as charcoal briquettes, which produce carbon monoxide.
- House fires: These occur more frequently in the winter because of the lack of proper safety precautions when using alternate heating sources (unattended fires, disposal of ashes too soon, improperly placed space heaters, etc.) Fire during winter storms presents a great danger because water supplies may freeze, and it may be difficult for firefighting equipment to get to the fire.
- Disruption of Utility Service: Accumulations of snow can cause roofs to collapse and knock down trees and power lines. Homes and farms may be isolated for days, and unprotected livestock may be lost. The cost of removing snow and repairing damage, and the resulting loss of business can have severe economic impacts on cities and towns.

Concord is often located in the transition zone between frozen precipitation and rain. Many factors influence the form our precipitation will take, and atmospheric temperatures are influential as well as ground conditions. Sometimes, near the rain/snow interface a region of sleet or freezing rain will occur. It is difficult to predict what form this precipitation will take, and it may alternate between rain and snow. Therefore, weather forecasters just predict a "wintry mix". Usually, this type of precipitation occurs at temperatures between -2 °C and 2 °C (28 °F and 36 °F).

Research indicates that the relationship between the mountains and the piedmont area result in a regular occurrence of freezing precipitation events (sleet and freezing rain). Cold air damming, another factor which can influence our weather, occurs when the cold, dry air mass became entrenched along the Appalachian mountain chain. This was a major factor in the winter storm of December 4-5, 2002. Cold air funneled by a shallow arctic air mass through its northeast flow caused very dry to come into the mid-Atlantic region. During this event, Gulf moisture streaming northward caused warm moist air to flow over the entrenched, very cold layer of air near the surface in the piedmont area resulting in one of the historically significant ice storms in the community's history and a Presidential Disaster declaration. During this event, Concord experience electrical service outages and transportation problems. Due to the limited impact, Concord was

able to send pre-staged mutual aide to other areas. Locally, the City's Safe Haven Program was utilized to take several residents in support of County Shelters that had shut down. This storm was followed by a series of lesser winter storm events. The storm cost the state \$97.2 million in response and recovery. Forty-two counties were eligible for disaster assistance in the wake of the storm.

Similar events have lead to other significant storms including a storm occurring on January 25, 2000 and a snow event in January 2010.

Local snow storms usually do not have the impact on system as ice storms. The often create hazardous road conditions which can last for several. The primary costs associated with these events are preventative measures and snow removal. Snow amounts of around 2 inches usually create serious disruption to traffic and the school system. Snow has occurred as early as November and as late as March.

Probability

Winter Storm 35 Snow and Ice Events (10 injures, 2 deaths, \$162.130 million damage)

Wx Type	Date	Damage	Dth	Inj	Notes
Winter Storm	03/12/93	50.0M	2	10	From March 12 to March 15 1993, a massive storm stretched from Eastern Canada, down through the eastern United States to Cuba and Central America. This super storm brought record low temperatures, strong winds, blizzards, tornadoes and storm surges. Also known as the Blizzard of 93
Ice Storm	02/10/94	0	0	0	A strong cold front brought a surge of arctic air into North Carolina on the 10th and plunged temperatures 40 to 50 degrees from readings the previous day to below freezing. Low pressure developed along the front causing widespread sleet and freezing rain across northern and western sections. The greatest ice accumulation of one to two inches and associated damages to trees and power lines occurred in the northern Piedmont and North Foothills regions. Elsewhere in northern interior and western sections, ice accumulations ranged from one-quarter to one1 inch. Numerous motor vehicle accidents were also reported.
Winter Storm	01/06/96	0	0	0	Rain gradually changed to freezing rain and then snow and sleet across the southern Piedmont. The precipitation continued well into the next day. The layer of ice under the 1 to 2 inches of snow (3 to 4 inches in Gaston county) caused serious traffic problems. The ice accumulation was enough to cause widespread power outages

Wx Type	Date	Damage	Dth	Inj	Notes
					around the Charlotte Metro area. All across western and central North Carolina, numerous traffic accidents and sledding accidents were reported. There were numerous indirect injuries and a few fatalities associated with the storm. Most injuries and deaths were traffic related. In Alexander, a man was crushed when an outbuilding collapsed from the weight of the snow.
Winter Storm	01/11/96	0	0	0	The second snowstorm within a week caused more excitement in North Carolina. Up to a foot of snow was reported in some of the mountains with most mountain and foothill locations receiving 3 to 6 inches. In the piedmont, there was more of a mixture of ice with minimal ice storm conditions reported in and around the Charlotte area. There were some power outages and numerous traffic accidents.
Ice Storm	02/02/96	10.0M	0	0	Rain began to freeze in the southern foothills and most of the piedmont. Bridges and overpasses quickly became icy with numerous problems reported on highways and streets. Rain was falling so heavily that not much was accumulating as ice. However, by about noon, ice storm conditions began to develop quickly with numerous power outages reported. Areas west and north of Charlotte were hardest hit. Damage estimates for this major ice storm are a broad estimate and not reliable. Road repair/cleanup costs in North Carolina exceeded \$20 million. Numerous traffic accidents caused many injuries and some indirect fatalities.
Snow	02/03/96	0	0	0	Light snow accumulated to 1 to 3 inches on top of the ice. Travel problems worsened in some places.
Snow	02/16/96	0	0	0	Snow fell and accumulated to several inches with heavier amounts in the northern mountains.
Snow	12/29/97	0	0	0	Snow moved north across the foothills and piedmont during the morning and became heavy north and west of the Charlotte area before ending in the middle of the afternoon. Snowfall ranged between 1 and 4 inches across the southern foothills and southern piedmont, to 4-8 inches across the northern foothills and northwest piedmont. In addition, Macon county in the southern mountains received up to 5 inches of snow before the middle of the morning. There were hundreds of traffic accidents and a few thousand people in the foothills were without power for a while.

Wx Type	Date	Damage	Dth	Inj	Notes
Snow	01/19/98	0	0	0	A wet snow fell at a pretty good rate early in the morning across the southern piedmont, including the Charlotte metro area. Despite temperatures hovering just above freezing, the snow accumulated between 1 and 3 inches.
Freezing Rain/sleet	12/23/98	0	0	0	Freezing rain and sleet developed early Wednesday morning and persisted through the morning of Christmas Eve. These areas would receive enough glaze by Christmas Eve morning to cause damage.
Ice Storm	12/24/98	0	0	0	Freezing rain accumulated to damaging levels around midnight and by morning there were numerous power outages reported due to downed trees and power lines. Road problems were mostly limited to bridges and overpasses.
Snow	02/19/99	0	0	0	A surface low moving across central Georgia and South Carolina combined with a strong upper level system to produce light snow across much of western North Carolina during the afternoon. Most accumulations were between 1 and 2 inches. Although there was a band of 3 inch accumulations stretching from the northern mountains, southeast through Morganton and to Shelby. Also, some isolated accumulations of around 8 inches were reported from the very highest peaks in the northern mountains.
Snow And Sleet	03/09/99	0	0	0	Light snow and sleet fell during the morning, associated with a strong low-pressure area moving north through the Mississippi River Valley. Accumulations by noon ranged between 1 and 3 inches. Some light freezing rain mixed in from time to time as well.
Snow	01/18/00	0	0	0	Low pressure moved east across Tennessee and weakened as it ran into a surface high-pressure ridge along the East Coast. Nevertheless, enough moisture was available to cause heavy snow to fall from Avery county, east across the northern foothills and northwest piedmont. Precipitation began as light rain in the mid-evening hours on the 17th, but quickly turned to snow as the atmosphere cooled to below freezing. Snowfall ranged between 3 and 6 inches across the area by noon on the 18th, with a narrow band of 1 to 3 inch accumulation of snow and sleet to the immediate south.
Heavy Snow	01/22/00	0	0	0	A cold dome of arctic high pressure centered over the Mid-Atlantic States provided very cold and dry air to western North Carolina. Meanwhile, weak low pressure moved east along

Wx Type	Date	Damage	Dth	Inj	Notes
					<p>a frontal boundary stalled across the Gulf Coast States to the Georgia coast. Abundant moisture flowed north into the sub-freezing air over western North Carolina, resulting in light snow as early as the afternoon on the 22nd. Snow became heavy by mid-afternoon across the mountains and by evening across the foothills and piedmont. A general 4 to 7 inch snowfall occurred in the mountains with as much as 10 inches reported in Jackson county. Generally 4 to 6 inches of snow fell across the foothills and piedmont, with a local maximum of 7 inches in western Lincoln county. Rowan county failed to meet heavy snow criteria with accumulations of up to 3 inches. Freezing rain and sleet mixed with the snow for a short time before the precipitation ended, and for the most part, caused little additional problems. The one exception was across southern Union county where freezing rain lasted all night and through much of the morning on the 23rd. Ice accumulations reached damaging levels there around 3 am, causing a large number of trees and power lines to fall throughout the morning. This in turn, resulted in widespread power outages.</p>
Heavy Snow	01/24/00	0	0	0	<p>Low pressure rapidly deepened near the Carolina coast, wrapping abundant moisture back across the piedmont of the Carolinas. Snow fell all day and into the night, heavy at times south and east of Interstate 85. By the time snow ended, accumulations ranged from a trace to 4 inches to the immediate north and west of Interstate 85, to 4 to 8 inches from eastern Rowan county to Charlotte and Gastonia, and 10 to 14 inches across southeastern Mecklenburg county and all of Union county. Utility damage in Union county alone was above \$4 million, with damage in Monroe at more than \$1 million. This storm followed no more than 36 hours after the area received several inches of snow and ice from a previous storm over the weekend.</p>
Ice Storm	01/29/00	0	0	0	<p>Weakening low pressure in the Ohio River Valley, developing low pressure along the Gulf Coast and cold, arctic air in place across the Carolinas resulted in a wintry mess across western North Carolina. This was the last in a series of 5 winter storms that wreaked havoc on western North Carolina in an 11-day span. The ice storm in the mountains consisted mainly of a couple inches of sleet. However, the combined accumulation of the mixture of sleet and snow was generally 2 to 3 inches. Some freezing rain</p>

Wx Type	Date	Damage	Dth	Inj	Notes
					mixed in during the morning of the 30th. Across the foothills and piedmont, precipitation that briefly began as some light sleet and snow, turned quickly to freezing rain. The freezing rain was heavy enough across the southern piedmont, including the Charlotte area, to result in a 1/4 to 1/2 inch glaze. Scattered power outages resulted, with Gaston county reporting 2500 people without power. The entire Duke Power system reported 77,000 people without power.
Snow	11/19/00	0	0	0	Light to moderate snow started in the mountains and spread southeast, lasting through the day. Generally 1 to 3 inches of snow fell, but some higher elevations of the central and southern mountains reported more than 4 inches.
Heavy Snow	01/03/02	0	0	0	Flurries and light snow began in the early evening and became moderate to heavy by late evening on the 2nd. Heavy snowfall accumulations were reached across this portion of the foothills and piedmont overnight on the 3rd, with 4 to 6 inches observed by noon.
Ice Storm	12/04/02	99.0M	0	0	Freezing rain began over the extreme southern mountains of North Carolina during the early afternoon on the 4th, and had spread into the southwest piedmont by mid afternoon. Resultant damage due to ice accumulation began during the mid-to-late afternoon. The intensity of the freezing rain increased after midnight, and by sunrise on the 5th, devastating ice accumulations of 1/2 to 1 1/2 inches were observed. The hardest hit area was Charlotte metro. Hundreds of thousands lost power, and the outages lasted for as long as 2 weeks in some areas.
Winter Weather/mix	01/16/03	0	0	0	Light snow fell during the evening across portions of the foothills and piedmont of North Carolina, and accumulated to 1 to 2 inches. Numerous traffic accidents ensued.
Heavy Snow	01/23/03	0	0	0	Light snow began around midnight in the southwest piedmont of North Carolina. A burst of heavy snow during the pre-dawn hours resulted in total accumulations of 3 to 8 inches by mid morning.
Sleet Storm	02/16/03	0	0	0	A light freezing rain developed over the piedmont and foothills of North Carolina during the early morning hours. By mid-morning, the precipitation began to intensify, and a transition to sleet occurred. The sleet accumulated rapidly to a depth of 1 inch in most locations, while periods of afternoon, evening, and overnight

Wx Type	Date	Damage	Dth	Inj	Notes
					sleet increased total accumulations to around 2 inches in most areas. Numerous traffic accidents and road closures resulted.
Winter Weather/mix	02/27/03	0	0	0	A light freezing rain developed during the overnight hours in areas from the blue ridge eastward to the I-77 corridor. Light ice accumulations were mainly confined trees, bushes, and automobiles. However, some slick spots did develop on bridges and overpasses, especially in the piedmont.
Winter Weather/mix	01/09/04	0	0	0	Light snow developed across much of western North Carolina during the early morning hours of the 9th. By mid morning, 1 to 2 inches had accumulated across much of the area. There were some isolated 3-inch amounts in the higher terrain along the Tennessee border. Many roads became slick and hazardous.
Sleet Storm	01/25/04	0	0	0	During the early afternoon, snow began to mix with sleet across the foothills and northern piedmont, before becoming all sleet later in the evening. In the southern piedmont, precipitation fell almost exclusively as sleet. Total sleet accumulations were generally between 1 and 2 inches across the area. A light freezing rain developed during the evening, which resulted in a thin glaze of ice on top of the layer of sleet. Very slick roads were responsible for hundreds of traffic accidents, some of which involved injuries and fatalities. Numerous injuries also occurred due to falls.
Winter Weather/mix	01/27/04	0	0	0	Light freezing rain developed during the early morning hours of the 27th across the southern foothills and southwest piedmont. This added an additional layer of glaze to the mixture of sleet and ice that was already present. The layer of ice was as thick as 2 inches in some areas. Hundreds of traffic accidents occurred overnight and into the morning rush hour. Many of the accidents involved injuries and some fatalities. The ice was slow to melt, and traffic accidents continued for another 2 days.
Heavy Snow	02/26/04	3.1M			Heavy snow began to fall across the foothills, piedmont, and northern mountains of North Carolina during the late morning. Although snowfall intensity decreased dramatically during the early-to-middle portion of the afternoon, heavy snow redeveloped during the late afternoon, and continued into the evening and overnight hours. Scattered thunderstorms contributed to intense snowfall rates of 2 to 3

Wx Type	Date	Damage	Dth	Inj	Notes
					<p>inches per hour from time to time, especially in the piedmont, where total snowfall of 12-22 inches occurred. The heaviest amounts occurred in the southwest piedmont, particularly in southern portions of Charlotte metro. Thousands of people were stranded on I-77 during the early afternoon, and some required rescue. The weight of the snowfall caused damage to numerous roofs, while some roofs completely collapsed. Across the foothills and northern mountains, accumulations were considerably lighter, generally in the 4-8 inch range, although amounts of 10-16 inches fell along the Blue Ridge north of I-40.</p>
Winter Weather/mix	01/29/05	0	0	0	<p>A mixture of light sleet and snow developed around dawn across portions of the North Carolina piedmont, and continued through the morning hours, before changing to sleet and freezing rain during the afternoon. Up to 2 inches of snow fell during the morning, with up to 1/4 inch of sleet and ice accumulating on top of the snow during the afternoon. This resulted in slick roads and quite a few traffic accidents.</p>
Winter Weather	12/15/05	0	0	0	<p>Light freezing rain developed across the piedmont during the early morning hours, and continued into the afternoon. Ice accretion ranged from trace across far southern portions of the area, to just under one quarter inch north of I-85. Sporadic damage to trees and power lines occurred, with isolated power outages.</p>
Winter Weather	01/18/07	0	0	0	<p>Widespread light precipitation, mainly in the form of freezing rain, produced light ice accretion, mainly across the foothills and piedmont during the morning hours. Accretion was mainly confined to elevated surfaces, although some slick spots developed on bridges and overpasses. Quite a few traffic accidents occurred, especially in the Charlotte metro area and in the northern North Carolina foothills. A few sporadic power outages were reported. In some areas, mainly across the northwest piedmont, precipitation started out as a combination of sleet and snow, resulting in some light accumulations.</p>
Winter Weather	02/01/07	0	0	0	<p>Precipitation began as light snow during mid-morning across portions of the North Carolina piedmont. The snow began to mix with and eventually changed over to sleet and freezing rain by late morning. Up to 2 inches of snow, along with light accumulations of sleet and ice occurred before a transition to rain in the early</p>

Wx Type	Date	Damage	Dth	Inj	Notes
					afternoon. Slick roads resulted in quite a few traffic accidents, especially along the I-40 corridor.
Winter Weather	01/16/08	0	0	0	Light snow developed across the Piedmont during mid-evening, and continued through much of the overnight hours. By mid-morning on the 17th, total accumulations ranged from around an inch south of I-85, to 3 inches or so along the I-40 corridor. Sleet and freezing rain mixed in with the snow before the event ended.
Winter Weather	01/22/08	0	0	0	Freezing drizzle and light freezing rain developed across the western Piedmont around sunrise. Roads became very slick and hazardous, and there were numerous traffic accidents during the morning commute.
Heavy Snow	01/20/09	0	0	0	Snow developed during the pre-dawn hours across the Piedmont. As snow continued to fall across the Piedmont, heavy snowfall amounts were reached across Cabarrus and Union Counties shortly before the snow completely tapered off. Accumulations ranged from 2-4 inches across the area, although a few higher amounts were reported in eastern portions of these counties.
Winter Weather	02/03/09	0	0	0	A small area of snow developed across the piedmont during the evening, with some areas picking up a quick 2 inches before the snow tapered off.
Heavy Snow	03/01/09	0	0	0	Rain changed to snow during the early evening across portions of the foothills and the western Piedmont of North Carolina. Snow became heavy at times throughout the evening, and up to 4 inches had accumulated across the area by 10 pm. Snow, heavy at times and accompanied by occasional lightning, continued into the late evening and early overnight hours. By the time the snow tapered off, accumulations of 3-6 inches were common across the area. However, localized amounts of up to 9 inches were reported, especially along a corridor extending from Shelby to Hickory. The heavy wet snow caused quite a few trees and power lines to fall, resulting in numerous power outages. Some structures received minor to moderate roof damage due to the weight of the snow. Some customers were without power for several days. A tree fell on the library in Belmont, NC, causing damage to the roof. Numerous traffic accidents also occurred.

Vulnerability Assessment

North Carolina classifies Severe Winter Weather into a “Greater Hazard” or that that have the most potential impact on the state of North Carolina in the past and in the anticipated future. Summary table 17 (a) of Appendix A: Statewide (North Carolina) Risk Assessment for Natural Hazards ranks Cabarrus County as being at a moderate risk for severe winter weather. Historically the greatest impact has been from ice storms. (12/2002 – DR1448, 01/2000 – DR1312, 02/96 - DR-1087). Ice storms can cause major impact on the electrical service and clean up associated with downed trees.⁴⁶

Based frequency, winter storms are expected to continue to impact the Concord area and are considered a regular occurrence. Historic data supports that impact from the storm will involve a large portion of the city some injuries resulting in a wide area of impact. The magnitude is considered to be High.

Pandemic

Hazard Description

On June 11, 2009, the World Health Organization raised the worldwide pandemic alert level to Phase 6 in response to the ongoing global spread of the novel influenza A (H1N1) virus. A Phase 6 designation indicates that a global pandemic is underway. The pandemic level means that the H1N1 virus has reached more parts of the world and indicates how easily the virus spreads from person to person.

Pandemics spread quickly through communities, nationally or even globally. Generally, the elderly, young children, and people with pre-existing illnesses are most vulnerable to a pandemic. However, some pandemics such as the H1N1 Influenza outbreak of 2009 and the Influenza Outbreak of 1918-1919 have defied this pattern by primarily affecting otherwise healthy individual.⁴⁷ According to the World Health Organization (WHO), a pandemic can start when three conditions have been met:

- emergence of a disease new to a population;
- agents infect humans, causing serious illness; and
- agents spread easily and sustainably among humans.

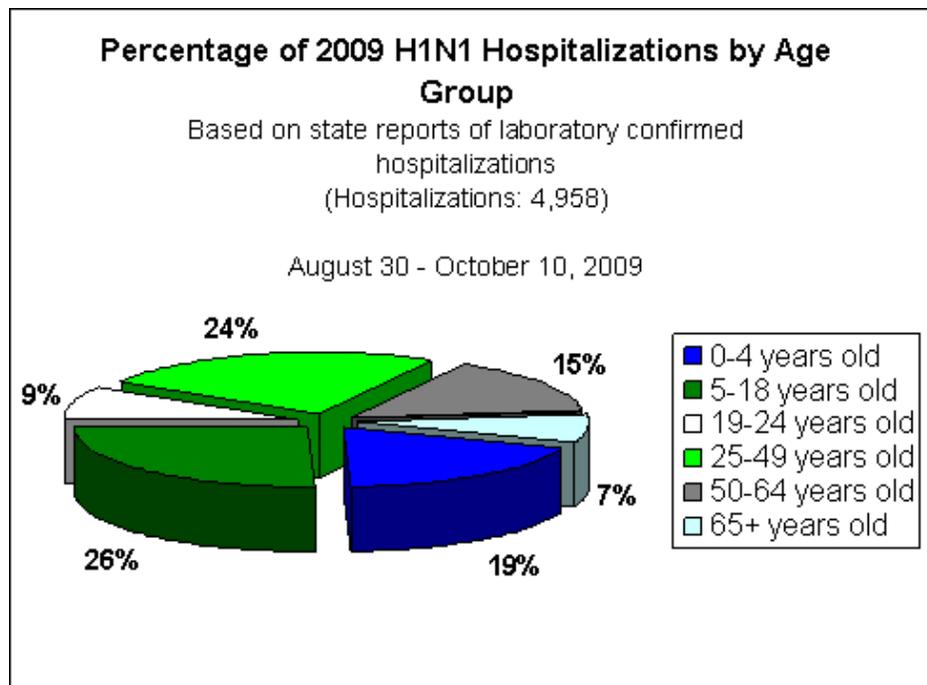
Since 1918 four pandemics have occurred as indicated in the chart below.

Historic Pandemics 1918		
YEAR	STRAIN	Summary
1918	"Spanish flu" H1N1	<i>The most devastating flu pandemic in recent history, killing more than 500,000 people in the United States, and 20 million to 50 million people worldwide.</i>
1957-1958	"Asian flu" H2N2	<i>First identified in China; this virus caused roughly 70,000 deaths in the United States during the 1957-58 season. Because this strain has not circulated in humans since 1968, no one under 30 years old has immunity to this strain.</i>
1968-1969	"Hong Kong flu" H3N2	<i>First detected in Hong Kong, this virus caused roughly 34,000 deaths in the United States during the 1968-69 season. H3N2 viruses still circulate today.</i>

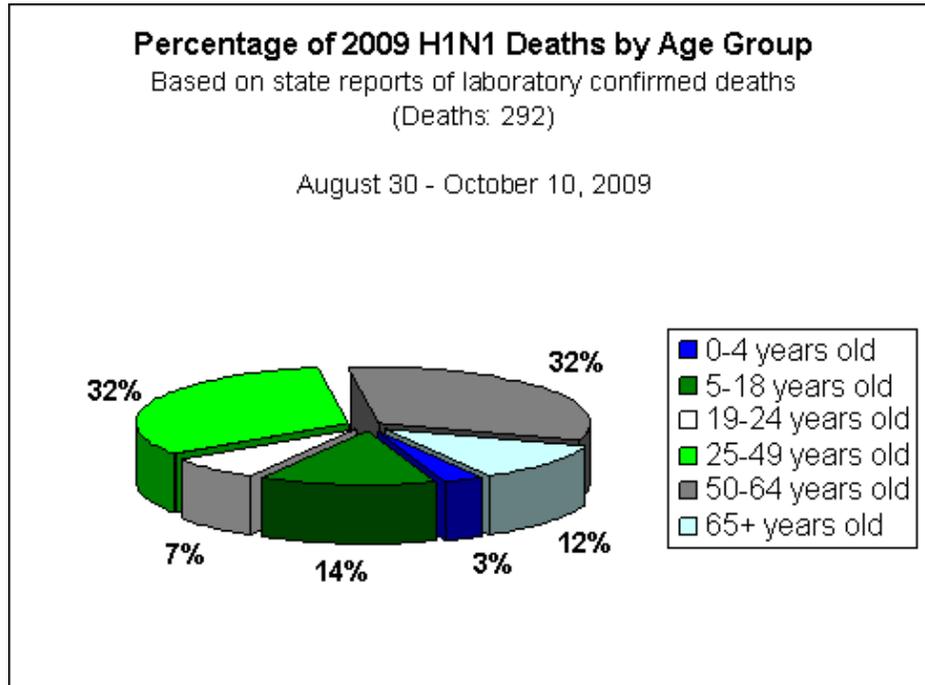
Current 2009	“Swine flu” A (H1N1)	First detected in Mexico in February 2009, and declared a pandemic by the World Health Organization on June 11, 2009. On April 26, 2009, the United States Government declared a public health emergency. This pandemic is expected to continue its global spread, with the potential for morphing into an even deadlier strain in the Fall.
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The flu is a common occurrence in the around the world and the question is not as much if there will be another pandemic, but when the next occur. As can be seen in the chart above the previously occurring pandemics were somewhat mild. As of the writing, the nation is embarking on a mass immunization campaign and the flu is widespread in 46 states. The elderly, young children and people with pre-existing illness are usually most susceptible to the affects of flu.⁴⁸

However with two pandemics, specifically the 1918 pandemic and H1N1, these flues have affected healthy people. What is not serious from some people is severe and even fatal to others.⁴⁹



The percentage for deaths also varies by age group. Statistics from August 30, 2009 through October 10, 2009 report 292 confirmed deaths. While 25 – 49 year olds are have the most number of confirmed cases and deaths, the 50 – 64 year olds have a lesser confirmed hospitalization but share in the percentage of deaths. The recent H1N1 was first detected in the United States in April 2009 and by June 11, 2009 the World Health Organization had classified it as a pandemic.⁵⁰



Globally the vulnerability to a pandemic has increased as the world has “shrunk” due to mass transit. Crossing the Atlantic in 1918 took weeks compared to hours in 2009. Mass transit also allows more people to interact than were able to in 1918. Prior to the outbreak of H1N1 the common concern for the next pandemic was the Avian Flu and planning for this flu was already in place. In response to the potential for an worldwide outbreak, the WHO created a 6 phase alert system as shown below:

World Health Organization Pandemic Alert System Phases	
Phase 1	<i>No viruses circulating among animals have been reported to cause infections in humans.</i>
Phase 2	<i>An animal influenza virus circulating among domesticated or wild animals is known to have caused infection in humans, and is therefore considered a potential pandemic threat.</i>
Phase 3	<i>An animal or human-animal influenza virus has caused sporadic cases or small clusters of disease in people, but has not resulted in human-to-human transmission sufficient to sustain community-level outbreaks.</i>
Phase 4	Verified human-to-human transmission of an animal or human-animal

World Health Organization Pandemic Alert System Phases	
	influenza virus able to cause “community-level outbreaks.” The ability to cause sustained disease outbreaks in a community marks a significant upwards shift in the risk for a pandemic.
Phase 5	Human-to-human spread of the virus into at least two countries in one WHO region. While most countries will not be affected at this stage, the declaration of Phase 5 is a strong signal that a pandemic is imminent and that the time to finalize the organization, communication, and implementation of the planned mitigation measures is short.
Phase 6	This Pandemic phase is characterized by community level outbreaks in at least one other country in a different WHO region in addition to the criteria defined in Phase 5. Designation of this phase will indicate that a global pandemic is under way.
Post-Peak Period	Pandemic disease levels in most countries with adequate surveillance will have dropped below peak observed levels. The post-peak period signifies that pandemic activity appears to be decreasing; however, it is uncertain if additional waves will occur and countries will need to be prepared for a second wave.
Post-Pandemic Period	Influenza disease activity will have returned to levels normally seen for seasonal influenza. It is expected that the pandemic virus will behave as a seasonal Influenza A virus.

Any community throughout the world is vulnerable to a pandemic. High human contact in our community’s day to day activities increase the likelihood of transmission. Concord has () residential population but is host to several significant major events and other public gathering places where a disease could spread rapidly. Large hotels, sports related business, one of the States largest tourist attractions add to the increased risk for the City during an transmittable disease outbreak.

Terminology

- **Influenza** (commonly called the “Flu”) is a contagious respiratory illness caused by influenza viruses.
- **Seasonal (or common) Flu** is a respiratory illness that can be transmitted person to person. Most people have some immunity, and a vaccine is available.
- **Avian (for bird) Flu** is caused by influenza viruses that occur naturally among wild birds. The H5N1 variant is deadly to domestic fowl and can be transmitted from birds to humans. There is no human immunity and no vaccine is available.
- **Pandemic Flu** is virulent human flu that causes a global outbreak, or pandemic, of serious illness. Because there is little natural immunity, the disease can spread easily from person to person. Currently, there is no pandemic flu.

Severity

Pandemic severity is measured by the number of cases of severe illness and number of deaths. These numbers do not have to be high for a pandemic to cause disruption in a community. An outbreak in remotes areas of the globe can illicit a different response than an outbreak which occurs in one’s community, state or region. The health community’s stresses the importance of preventive measures such as immunization and common hygiene practices which can reduce the impact.

Severe Pandemic Projection (US)⁵¹	
<i>90 million will fall ill (30% of total population)</i>	
<i>2 million will die (2.5% of those who fall ill)</i>	
Economic Impact	
Economic growth will stop	
GDP will fall by 5%	
Workforce effects	
30% of the workforce will be affected	
For surviving ill, average time away from work will be 3 weeks	
1 million workers will die(0.75% permanent reduction of the workforce)	

During planning for the potential Avian Flu, estimates were that as much as 25% to 50% of the population could become affected. An estimate of workplace absenteeism in a pandemic will range between 30–50 per cent. This includes absenteeism due to illness; the need to stay at home to care for someone who is ill; the need to stay at home to look after children in the event of school closures; fears about being infected at work as well as due to some people fulfilling other roles in the community (volunteering). Governmental agencies and local businesses would see increased absenteeism as staff stay home provide care to family members. The deadly 1918-1919 pandemic resulted in the death of 650,000 Americans and over 50 Million worldwide. The following chart shows the estimated impacted of pandemic at the County, Municipal and Municipal Staffing Levels.

	City of Concord (80,000)	Cabarrus County (168,740)	Employees (933)
30% of population will become ill with the flu	24,000	50,622	280
15% of population will require outside patient visits	12,000	25,311	140

0.3% of population will require hospitalization	240	506	3
Up to 0.1% of population will die of flu related cases	80	168	1

A community's response to the affects of a pandemic can also make a difference on the impact. During the 1918/1919 Spanish flu, communities which used proactive intervention measures such as social distancing, actually reduced the peak incident within the community by as much as 50% and a reduction in actual cases by 20%. Philadelphia failed to implement actions and even held a citywide parade of which 200,000 attended. The city had the highest mortality rate of any other US City.⁵² Reactions from denial to mistrust lead to panic and impacted this pandemic across the nation.⁵³ The flu claimed 13,000 lives Public Health Services did not require Influenza to be reported until Sept. 27, when the pandemic had already become widespread, so the reported numbers of the outbreak were probably low.

Probability

The local community is currently in the midst of a pandemic outbreak. Based on historic occurrence, a pandemic can be expected to occur every ten to fifty years. When the current pandemic will end and then next begin is difficult to predict with any accuracy. Similarly the scale of the illness, death rates and the number who will experience severe illness is also uncertain. The affect of a pandemic may also be dependant on the availability and effectiveness of antiviral drugs and vaccines. Study of past pandemics indicated that when a new virus occurs it will probably affect a community in waves with separation between waves lasting from weeks to month and subsequent waves becoming worse than the first as the virus mutates. The 1918 pandemic occurred in 3 distinct waves, the Spring and Fall of 1918 and the winter of 1919. In this instance the second wave was the most deadly. Again, as with other characteristics of a pandemic, the 1957/59 pandemic's second wave was smaller than the first.⁵⁴

Vulnerability Assessment

A pandemic just by the nature of the disease will affect the global population. Generally a new virus will appear in humans, cause serious illness and then spread from person to person world wide. A mid-level pandemic occurring in the United States has been predicted to cause the following:

- 89,000 to 207,000 deaths
- 314,000 to 734,000 hospitalizations
- 18 to 42 million outpatient visits
- 20 to 47 million people becoming sick
- An economic impact ranging between \$71.3 and \$166.5 billion⁵⁵

Until vaccines or drugs are developed to combat the disease, everyone would be susceptible.

Impact to the built environment would not be expected. Some impact to the natural environment may result from a disease that spreads from animals to humans such as the Avian Flu but otherwise the natural environment is not expected to be impacted.

If a new and severe strain of flu began spreading across the globe the local community would not be spared the affects. Due to the unpredictability of effects of a pandemic exactly what will occur cannot be done until pandemic emerges. A very virulent strain of virus would result in an overwhelmed health care system, which include our local hospital. One must also remember that what we are experiencing locally, other communities across the nation would also be experiencing. As medical staffs are impacted, a negative result in the availability of care. Eventually, the regional medical and emergency services would be overwhelmed.

As the population is impacted the local economy would suffer from loss of productivity. Since a large portion of Concord's economy is recreational based, social distancing could result in cancellation of major events and other public gatherings resulting in loss of significant revenue.

Risk analysis

The internationally accessibility of the world due to the modern transportation and along with population growth, has increased the risk to global spread of a disease. Therefore it will be impossible to stop the spread of a global pandemic but mitigation efforts can reduce its impacts. Nationally, stockpiles of antiviral and other medications and guidance for local disbursement have been established. Annual/seasonal flu vaccinations can assist in controlling the common flu which commonly occurs from November through April. A pandemic can occur anytime during the year and since it is new a vaccine would not exist.

Even if large numbers of people do not die, millions of people sick at the same time will also have a negative impact.

Community Capabilities

The capability of the community is a report on the existing policies and programs that are in place by the City that have an impact on mitigation of hazards. Some programs may help mitigate the treats posed by natural hazards while others may exacerbate such threats. This inventory of programs also contains a brief summarization of existing City of Concord programs, policies, practices and operational responsibilities. The strengths and weaknesses of some programs are provided to help determine the overall effectiveness of the community's capabilities in mitigating hazards through these programs.

Existing Mitigation Programs

Existing mitigation programs and resources in the City of Concord have been tested as a result of local natural disasters. These mitigation programs can be organized into three classifications:

- Local Programs
- State Programs
- Federal Programs

Local Programs

Municipal Government

Concord maintains professional staff with the technical skills necessary to enforce policies, programs, and ordinances that deal with mitigating the damages caused by natural hazards. Concord's Emergency Planning Committee while reviewing current policies and procedures was able to identify strengths and weaknesses that need to be addressed. This review, the hazard identification and vulnerability assessments provided the basis for formulating goals and objectives.

City of Concord Local Government Structure

In Concord, the Mayor and City Council serve part-time and are elected on a non-partisan basis. Under the council-manager form of government, the City Council acts as the legislative body in establishing policy and law and the City Manager handles the day-to-day management of the City organization. The Mayor is elected at-large (city-wide) for a four-year term and serves as the presiding officer at city council meetings and as the official head of the city for ceremonial purposes. The seven City Council Members are elected at-large from districts for staggered four-year terms. The City Council appoints a professional City Manager, who serves as the Council's chief advisor, and the City Manager appoints the employees of the City.

The City Manager is the CEO of the City government and is in charge of the dayto-day operations of the City. When the City Council makes a decision on an ordinance, law, or policy, the City Manager is responsible for implementing those policies. A Deputy City

Manager and Assistant City Manager assist him. The Manager coordinates the operations of all City departments and is responsible for the preparation of a proposed operating budget and its presentation to the City Council. This annual budget as adopted by Council provides funding, staffing, and general guidance to the City departments for the fiscal year.

The City is composed of 22 departments, which provide daily and emergency services to the community. Departments with mitigation planning responsibilities are listed below and a brief summary of their functions.

Administrative Capability

The City Council can adopt regulatory standards and other measures in times of emergency. For example, curfews can be enacted to assist the community in recovering from emergency conditions.

Several Chapters of the Code of the City of Concord address natural hazards. The City's Emergency Management Operations are codified and responsibilities detailed. A Departmental Emergency Operations Handbook is part of the emergency operations plan that is based upon an incident command system. This promotes standardized emergency management throughout the city.

City staff and elected officials have completed National Incident Management Training and the incident management system is used to manage emergencies at all levels.

Political Climate

In Concord, the Mayor and City Council serve part-time and are elected on a non-partisan basis. Under the council-manager form of government, the City Council acts as the legislative body in establishing policy and law and the City Manager handles the day-to-day management of the City organization. The Mayor is elected at-large (City-wide) for a four-year term and serves as the presiding officer at city council meetings and as the official head of the city for ceremonial purposes. The seven City Council Members are elected at-large from districts for staggered four-year terms. The City Council appoints a professional City Manager, who serves as the Council's chief advisor, and the City Manager appoints the employees of the City.

Elected officials, staff, businesses and residents are dedicated to comprehensive community emergency preparedness through an emergency management program and community development. The City has received recognition for its community programs such as Storm Ready Community recognition.

Through community programs such as the State's first Community Emergency Program, Citizen Corps Council, Recognized Neighborhood program, the City seeks support and community involvement to develop a sustainable community. The local governing body has supported such mitigation initiatives as emergency power for all municipal buildings, Safe Havens, emergency planning, a Unified Development Ordinance, drought

management, greenways, and other proactive mitigation programs. The City also actively participates in the Statewide Mutual Aid and Assistance Program, ElectriCities, and other similar type programs to promote Statewide mitigation efforts through the sharing of resources.

Concord is one of the few North Carolina Cities that supports an emergency management program through internal funding to coordinate the emergency response, preparedness and recovery efforts. All departments at all levels support this program through an active Community Emergency Planning Committee.

The local mitigation effort will continue to develop and grow with the community to meet its changing needs into the future.

Regulatory Authority

The City Council can adopt regulatory standards and other measures in times of emergency. For example, curfews can be enacted to assist the community in recovering from emergency conditions.

Several Chapters of the Code of the City of Concord address natural hazards. The City's Emergency Management Operations are codified and responsibilities detailed. A Departmental Emergency Operations Handbook is part of the emergency operations plan that is based upon an incident command system. This promotes standardized emergency management throughout the city.

The city's floodplain ordinance specifically addresses development within the floodplains and delineates areas to be protected. Local laws provide avenues to address hazards in times of disasters.

Floodplain Management

Flooding represents the greatest and most common natural hazard facing the nation. At the same time, the tools available to reduce the impacts associated with flooding are among the most developed when compared to other hazard-specific mitigation techniques. In addition to approaches that cut across hazards, such as education, outreach, and the training of local officials, the *National Flood Insurance Program* (NFIP) contains specific regulatory measures that enable government officials to determine where and how growth occurs relative to flood hazards. Participation in the NFIP is voluntary, but is promoted by FEMA as a crucial means to implement and sustain an effective hazard mitigation program.

The Concord adopted a local flood damage prevention ordinance that establishes minimum building standards in the floodplain. These standards require all new buildings and substantial improvements to existing buildings to be protected from damage by the 100-year flood, and that new floodplain development will not aggravate existing flood problems or increase damage to their properties.

The City of Concord's is rated as an "8" by the Community Rating System (CRS). This rating allows citizens to purchase flood insurance at discounted rates. The City is able to achieve this rating by imposing stricter floodplain requirements than the FEMA standard, and by undertaking outreach and education projects. Life Safety Educators within the Emergency Management Division provide annual flood safety and prevention education. The Division also responds to and documents flood events for consideration in planning and other mitigation actions. In order to maintain good standing in the NFIP, the City is subject to periodic monitoring visits. Biennial performance reports are also required to insure compliance.

In 2008, the City updated its flood prevention regulations to incorporate requirements stricter than the FEMA minimum. These requirements include prohibiting the development of new structures within the 100 year floodplain.

Concord has a Certified Floodplain Manager (CFM) that administers these regulations, and the Development Services staff insures that new construction is compliant. Each permit application is reviewed for compliance with the flood prevention regulations.

Another key service provided by the NFIP is the mapping of the identified flood hazard areas. The City's G.I.S. includes the most recent Flood Insurance Rate Map (FIRM) layer within the system, which assists the staff in determining the flood zones on individual properties during the issuance of each permit. FIRMS are an important source of information to educate the residents, government officials and the private sector about the likelihood of flooding in Concord.

Legal Capability

Municipalities are granted the authority to implement natural hazard mitigation programs in Section 160A of the General Statutes of North Carolina. This includes the authority to regulate, acquire, taxation and spend funds. Powers to authorize to implement hazard mitigation programs include:

- General Police Power: The authority to enforce ordinances and define and abate nuisances in order to protect the public health, safety and general welfare.
- Building Codes and Inspection: A minimum building and fire code is imposed throughout the State. Building code enforcement is performed by the Cabarrus County Building Inspection Department. The City has chosen to enforce the Fire Prevention Code through the Department of Fire and Life Safety. Fire Codes are maintenance type codes and require periodic reviews of a structure after it is complete. Local buildings are constructed to meet these minimum codes to better withstand the impacts of natural disaster. Local government has the authority to adopt codes that are more restrictive than the State code.

- Land Use: Local government is also allowed to control the amount, timing, density, quality and location of new development through zoning ordinances, floodplain regulation, and subdivision regulation.
- Acquisition: The acquisition of hazard-prone properties is an effective means of mitigation natural disaster hazards. This capability allows local government to acquire land in hazard prone areas such as the floodplain, and eliminate the possibility of development of these properties.
- Taxation: Taxation rates based on the suitability of development can discourage development in hazard-prone areas.
- Spending: Spending allows local government to use public money in the interest of their residents. A capital improvement program can determine the rate of development within a municipality by providing services at a schedule set by the government rather than letting developers decide when to install expensive critical infrastructure. This can discourage development, thereby mitigating hazards

Fiscal Capability Potential Sources of Hazard Mitigation Funds

Local Government is responsible for mitigating hazards within its community; therefore the first source should include available local resources that may include:

- Donations
- Capital Improvement Projects
- Economic Development Funds
- School Bonds
- Public/private land swaps
- Insurance
- Public Private partnerships

A limited amount of funding is available to implement mitigation strategies other than revisions to and implementation of regulatory policies. Storm water funds are allocated for maintenance and restoration of streams, administrating the National Flood Insurance Program and planning activities.

The City of Concord's total budget for fiscal year 2010 is \$191,546,876. The breakdown of the budget is as follows:

- General Fund - \$65,402,191
- Special Revenue Fund - \$1,252,640
- Electric Fund - \$67,960,984
- Water Fund - \$18,609,500
- Wastewater Fund - \$13,910,725
- Aviation Fund - \$8,909,766
- Stormwater Fund- \$3,476,180

- Golf Course Fund - \$2,550,339
- Transportation Improvement Fund - \$2,398,761
- Transit Fund - \$2,505,798
- Public Housing Fund - \$1,067,500
- Housing Assistance Fund - \$3,502,492

Two Federal Grant Programs are currently available through FEMA, the Hazard Mitigation Grant Program (HMGP) and the Flood Mitigation Program (FMAP). Each of these programs is administered through the North Carolina Division of Emergency Management. Historically, North Carolina does not have a permanent funding source to support hazard mitigation projects. In the aftermath of Hurricanes Bertha and Fran in 1996, the State did provide funds to make up for non-federal cost share. No guarantee of these funds exists in for future disasters. Funds have not been forthcoming from the State Declaration in the aftermath of the August 27, 2009 flood event.

NIMS National Incident Management System Training.

To enhance the ability of the City of Concord to manage domestic incidents, the National Incident Management System (NIMS) was adopted by resolution in December 2004. City staff attended classes and received certification based on their job classification and assigned roles should an emergency occur. Plans to train all city staff in NIMS continue and are now part of required training for all new and existing city employees and elected officials. Advanced training(NIMS 300/400) was provided to all department heads, and staff in key positions.

Mutual Aide Assistance

Mutual aid programs are designed to mitigate the impact of a natural hazard by identifying resource shortfalls and addressing alternate means of accessing resources during times of need. Concord participates in a variety of mutual aid assistance programs. During disasters the City can request emergency mutual aid assistance through the Electri-Cities Emergency Preparedness Program and the North Carolina Mutual Aid Assistance Program. Request for State assistance is coordinated through Cabarrus County.

Emergency Response Capability

Concord Police Department is currently staffed with 157 sworn men and women, complimented by 19 civilian coworkers, and 7 code enforcement officers. CPD practices a Community Based Policing philosophy and responds to all calls for service as well as developing community partnerships designed to facilitate a formal problem solving process. This approach is recognized throughout the international police profession as the preferred way to police. Housing code enforcement comes under the responsibility of the Police Department of the City of Concord. Inspections are performed by a Code

Enforcement Officer whenever a complaint has been received about the condition and safety of a property or the officer identifies a possible Minimum Housing Code Violation. Working with citizens and property owners, the Division administers the City's zoning, housing and general nuisance codes.

The Concord Fire & Life Safety is a team-oriented organization with a diverse group of individuals, who strive to make a difference in the lives of others. The Department is currently working on a comprehensive 20-year plan that will explore the potential redeployment of current resources and the maximum utilization of additional future resources to meet the ever expanding role of the Department. Fire protection is provided through 9 stations strategically located throughout the jurisdiction providing First Responder, Suppression, Search and Rescue and Hazardous Materials Response. Through automatic aid agreements, Concord apparatus and personnel routinely provide additional resources to the City of Kannapolis, Town of Harrisburg, as well as various Cabarrus County rural fire districts. The Department also provides Emergency Management, Inspection, Public Safety Education, and a Customer Care Center.

Currently there are nine engine companies, one operated from each fire station. The department operates two ladder companies, which are located at Fire Station No. 3 & Fire Station No.9. The department's redeployment plan calls for additional ladder companies in the future. Currently, there is one rescue squad assigned to Fire Station 7. A rescue squad consists of a piece of apparatus, which is not equipped with a fire pump. The department provides the following specialized operations:

- Aircraft Rescue Firefighting
- Hazardous Materials Response Team
- Structural Collapse Team
- Confined Space / Trench Rescue
- High Angle Rescue

The goal of the fire department is to have an average response time of less than four minutes to 85 % of the emergency calls in the city. Response time is the time from dispatch of an incident to the first fire unit arriving on scene. For fiscal year 2009, the average response time was 04:12 minutes.

Emergency Management

In the aftermath of Hurricane Hugo and several local emergencies, the City of Concord established an office of emergency management pursuant the authority provided by NCGS 166A in 1995. The office is part of the organizational structure of the Department of Fire and Life Safety. Emergency operations are coordinated through an emergency operations center and departmental operational centers to Cabarrus County EOC. A Customer Care Center is staffed during weekdays and will function as the municipality's Joint Information Center. This has significantly decreased the time needed to respond to citizen inquiries during a disaster.

Emergency Operations Plan

The Concord Emergency Operation Plan was designed to coordinate services, equipment, facilities and personnel of all departments and agencies to their fullest. The emergency operations plan is based on the incident command system and establishes this system as the standard management system for disasters. The plan is composed of standard operational procedures developed by the various departments. Four response levels are designated in the plan, which are monitoring, initial response, extended operations and recovery.

Safe Haven Program

Municipal fire stations are established community "Safe Havens" which allow citizens to find shelter until American Red Cross permanent shelters can be set up and staffed. This program has proved invaluable several times during winter storms. It also provides a cache of disaster shelter supplies (including cots) to be established throughout the city. This program supports countywide sheltering procedures.

Public Disaster Education

Life Safety education is provided to the Community through the Office of Emergency Management. Currently, the emergency management division has two Life Safety Educators.

They provide a variety of programs, brochures, and information to the public in order to prepare the community for disaster response. This includes the "Master of Disasters" program for elementary schools.

Ready Kids Camp

This camp is a joint effort between local public safety departments and the Cabarrus County Chapter of the American Red Cross. The camp is conducted during the summer months and provides a day camp where children can learn home disaster preparedness.

Annual Severe Weather Poster Contest

This annual program conducted in March promotes competition between Fourth Grade Students in public and private schools. A poster severe weather theme is designated and students must craft an educational poster on how to prepare for the disaster.

Community Emergency Response Teams

Concord was field the first Community Emergency Response Team. The CERT program supports preparing the community to be self-sufficient during the period immediately after a disaster until emergency responders can arrive. CAN HELP (Concord Area Neighbors Helping Everyone Learn Preparedness) is Concord's acronym to its community wide approach. A prepared community is an essential ingredient to mitigation of natural disasters. As part of this program a Disaster Animal Response Team was established to address the issue of care for pets when a disaster strikes.

Disaster Animal Rescue Team

Concord worked with local veterinarians and volunteers to establish a Disaster Animal Rescue Team. This team can provide pet food, vaccinations, and emergency sheltering during a disaster.

Once established, the program was handed off to Cabarrus County and operates under the Animal Control Division of the Sheriff's Department.

Storm Ready Community

Concord received the National Weather Services Storm Ready Community Certification. This program identifies communities that have met a basic criterion. As part of this program Concord has provided, through municipal funds, National Weather Service Radios in city facilities, identified and posted safe areas within these buildings, and trained police, fire, and other departmental field crews as severe weather spotters. The City has also purchased lightning detectors for use by field crews and at sporting events at city parks.

Customer Care Center

The Customer Care Center provides a central coordination point for requests for customer service. The center also serves as the municipal joint information center. Common request for service which relates to mitigation includes illegal dumping, blocked storm drains, sink holes, flooding, etc.... During a disaster such as the Winter Storm of December 2002, the center transitions to the Joint Information Center. The center operated over 143 hours, (24 hour days, 12 hour extended shifts) while answering over 22,525 requests for service during the storm event.

The single number, (704)920-5528, allows residents a single reporting contact for all City Government functions such as illicit dumping, flooding, and problems with infrastructure systems

Eyes and Ears Program

The City of Concord strives to preserve, protect, and enhance the quality of life for its citizens. In 2002 a new program was introduced aimed at engaging the City of Concord co-workers in taking an active role in keeping the community safe and clean. The "Eyes and Ears" program encourages City of Concord employees to take pride in our community by being observant and reporting any instances that are considered detrimental to our citizens and environment. This program promotes reporting of issues such as flooding, blocked storm drains, traffic light malfunctions, etc.... among municipal departments. Employees report any problem or needed service to the City of Concord's Customer Care Center at 704-920-5555.

Development and Growth

Business & Neighborhood Services Department

The Business & Neighborhood Services Department is responsible for preparing and administering plans and programs that reflect the City of Concord's interest in business development, quality of life, strong neighborhoods, sustainability of the environment, efficient public facilities and services, diverse housing opportunities of high quality, and effective utilization of the area's land resources.

The Department is comprised of five primary operational divisions:

- Community Development
- Neighborhood Program
- Geographic Information Systems
- Urban Design
- Business Development

Each division is dedicated to providing the citizens and communities of Concord with responsive, compassionate, fair, and efficient service.

The Community Development Division continues to find new and innovative ways to meet its objectives: revitalizing communities, encouraging homeownership, increasing the supply of affordable housing, preserving Concord's cultural heritage, and providing outstanding customer service.

CDBG and HOME Programs

The multiple programs under this umbrella are designed to promote affordable homeownership, repair deteriorated housing and enhance the viability of neighborhoods.

Center City Plan

The [Center City Plan](#) is a ten year plan that has been developed to establish a set of strategies for the future redevelopment and sustainability of the existing neighborhoods that surround the City's downtown. City Council adopted the plan in December 2003. Center City is defined as the area bounded by Interstate I-85, US Highway 3 (Branchview Drive), US Highway 601 (Warren C. Coleman Blvd.), and US Highway 29 (Concord Parkway). In order to evaluate these neighborhoods more closely, Center City was broken down into fourteen (14) neighborhoods.

The plan includes: Neighborhood Improvement Strategies, Neighborhood Logos, Future Land Use Map, Multi-Modal Connections Map, Corridor Improvement Strategies, and Development Incentives.

Land Use Plan

The Land Use Plan portrays the City's vision for the use of land in the future. Sustainability is a key element of this guide for development. Public involvement was a cornerstone in the preparation of the Land Use Plan.

Small Area Plans

Through the use of drawings and written standards, Small Area Plans suggest specific recommendations for the physical development of defined areas, particularly mixed-use districts identified on the Land Use Plan. SAP's serve as guidelines and suggested master plans for development. Partnerships with stakeholders who will, or may, invest in these locations are keys to their successful implementation.

Neighborhood Programs Division strives to assist neighborhoods with service, needs and resources. Every neighborhood plays an integral part in the vitality of the City of Concord. The City implemented the neighborhood program, Partnerships For Stronger Neighborhoods, in 2000 to build relationships with the City's neighborhoods in an effort to enhance the quality of life in the City and stimulate activity within neighborhoods and in City events.

Through the program, neighborhoods are partnered with a City staff member who serves as their liaison and will attend the neighborhood meetings and assist residents in identifying solutions to problems. Based upon these relationships, City staff is better able to deliver services tailored to the needs of individual neighborhoods and obtain feedback on proposed public improvement projects within neighborhoods.

Currently, there are 39 neighborhood organizations through the City formally recognized and participating in the City's Neighborhood Program. Representatives of the neighborhood comprise a portion of the community's Citizen Corps Council.

The *Geographic Information Services Division* supports numerous programs of the Department and the City through the application of geographic information systems (GIS) technology. This technology allows any type of spatially referenced information to be stored, analyzed and reproduced. It is the goal of the Division to provide quality map and other presentation products, perform spatial analysis, develop GIS applications, and support city departments and the citizens of Concord in their use of GIS.

The GIS Division creates and maintains geographic-related data and technology. The majority of their work internally supports the operations of other City departments and divisions, thereby enhancing the efficiency, productivity, and accuracy of various City services. For example, GIS is used to help route, organize, and schedule solid waste collection in the City. The division also maintains software and data to support implementation of the zoning ordinance, and implementation of the City's economic

development initiatives. The GIS also plays a significant role in supporting emergency management services for the City.

The GIS Division records, tracks, and distributes City statistical data such as population estimates, annexation records, subdivision plats, zoning maps, city limits, and Census data. Cities typically receive Federal and State funds to help provide services to the public. These funds are distributed to the cities based on statistics such as population and area. The GIS Division maintains accurate records for these statistics to help ensure that Concord receives its fair share of Federal and State distributed funds. In addition, utility providers such as cable television and natural gas pay franchise taxes to the City. The amount paid to the City is based on GIS-maintained data such as city limits and population.

There are some instances when the public may need to contact the GIS Division directly. These services include E-911 Addressing, Flood Insurance Rate Maps, Census information, or other mapping data pertaining to economic development in the City.

The *Urban Design Division* is concerned with the arrangement, appearance and functionality of the city, and in particular the shaping and uses of urban public space. It has traditionally been regarded as a disciplinary subset of urban planning, landscape architecture or architecture and in more recent times has been linked to emergent disciplines such as landscape urbanism. However, with its increasing prominence in the activities of these disciplines, it is better conceptualized as a design practice that operates at the intersection of all three, and requires a good understanding of a range of others besides, such as urban economics, political economy and social theory.

The program extends the City's efforts to prepare for the future by preparing and updating land use plans and the small area plans that provide details on the City's vision for its future physical development. The division collaborates with other departments toward the compilation of the City's comprehensive plan.

Urban design theory deals primarily with the design and management of public space (i.e. the 'public environment', 'public realm' or 'public domain'), and the way public places are experienced and used. Public space includes the totality of spaces used freely on a day-to-day basis by the general public, such as streets, plazas, parks and public infrastructure. Some aspects of privately owned spaces, such as building facades or domestic gardens, also contribute to public space and are therefore also considered by Urban Design theory.

Urban Design considers:

- **URBAN STRUCTURE** – How a place is put together and how its parts relate to each other
- **URBAN TYPOLOGY, DENSITY** and **SUSTAINABILITY** - spatial types and morphologies related to intensity of use, consumption of resources and production and maintenance of viable communities

- **ACCESSIBILITY** – Providing for ease, safety and choice when moving to and through places
- **LEGIBILITY AND WAYFINDING** – Helping people to find their way around and understand how a place works
- **ANIMATION** – Designing places to stimulate public activity
- **FUNCTION AND FIT** – Shaping places to support their varied intended uses
- **COMPLEMENTARY MIXED USES** – Locating activities to allow constructive interaction between them
- **CHARACTER AND MEANING** – Recognizing and valuing the differences between one place and another
- **ORDER AND INCIDENT**– Balancing consistency and variety in the urban environment in the interests of appreciating both
- **CONTINUITY AND CHANGE** – Locating people in time and place, including respect for heritage and support for contemporary culture
- **CIVIL SOCIETY** – Making places where people are free to encounter each other as civic equals, an important component in building social capital

The Business Development Division assist existing businesses with expansion, relocation to other facilities in Concord, contacts for training, emergency preparedness and other needs. In addition this team focuses on business development, job creation and tax base growth in partnership with property owners, investors and economic development agencies.

Growth Planning

Concord's growth is coordinated through the implementation of several plans and ordinances. The City's Land Use Plan serves as a planning tool to guide development of land within the City's jurisdiction. It focuses on land use planning within the municipal limits, as well as growth areas surrounding the City. The City's growth area boundaries tend to coincide with utility service areas, which have been collaboratively identified by the local governments in the county. The City also has adopted a Center City Plan, a Downtown Master Plan, and several small area plans. Although land use plans are not mandated by North Carolina law, the City has recognized the importance of coordinating and directing growth in an effort to provide a quality economic base for the community, continuously improves the quality of living, and provides adequate public services for its citizens. In addition, the City's zoning ordinance, referred to as the Concord Development Ordinance, is a comprehensive document designed to implement a set of development standards throughout the city. The ordinance is constantly being revised and amended to strengthen it and make it more applicable to today's environment.

On May 10, 2007 the Concord City Council approved several revisions to the 2004 Land Use Plan. The Land Use plan serves as a planning tool to guide the development of land within the City. Unlike planning laws in some states of the nation, the development of a Land Use Plan is not mandated by the State of North Carolina. However, the City Council recognizes the important connection between planning and wise utilization of

resources with organized growth. Additionally, the plan serves to protect the assets of the City by promoting good land development regulations.

The City experiences an average annual growth in population of 3 percent, and an average growth in land area of 2 percent per year. Being located within the Charlotte Metropolitan Region, Concord is one of many local communities that are experiencing a fast rate of growth. Problems such as urban sprawl challenge the city and the community in areas of transportation, congestion, utility service, education, environmental protection, public safety, and crime control. The Land Use Plan and the Development Ordinance are crucial tools in dealing with the continued urbanization and the inherent demands of a growing population.

The City also recognizes the need to participate in coordinated growth and land use planning among all the local governments in the region. The newly adopted Cabarrus County Central Area Plan is an example of such cooperation and coordination. It is Concord's goal to work with adjoining local governments to maintain the adopted land use plans, and coordinate updates on a regular basis. It is also a goal to constantly seek out and pursue new planning initiatives in the city, the county, and the region as a whole.

The Land Use Plan is advisory in nature. Although not a binding document, it shall be used as a tool to help decision makers guide development. The plan is based around existing and planned infrastructure and depicts what will make the best economical sense for the taxpayers of the City of Concord.

Although designed as a 10-year plan, the Land Use Plan is subject to change at any time since it is not a regulatory controlling document. As land is developed and the needs of the community evolve over time for the general population of Concord and City Council, periodic updates will be necessary to keep the plan current.

There are eight (8) general goals identified in this plan. These goals are identified below:

- 1) Balance of Land Uses
- 2) Vehicular and Pedestrian Connectivity
- 3) Sustainable Community
- 4) Preservation of Unique Character
- 5) Compatible Land Uses
- 6) Adequate Infrastructure
- 7) Farmland, Natural Resource and Open Space Preservation
- 8) Linking Plans and Strategies

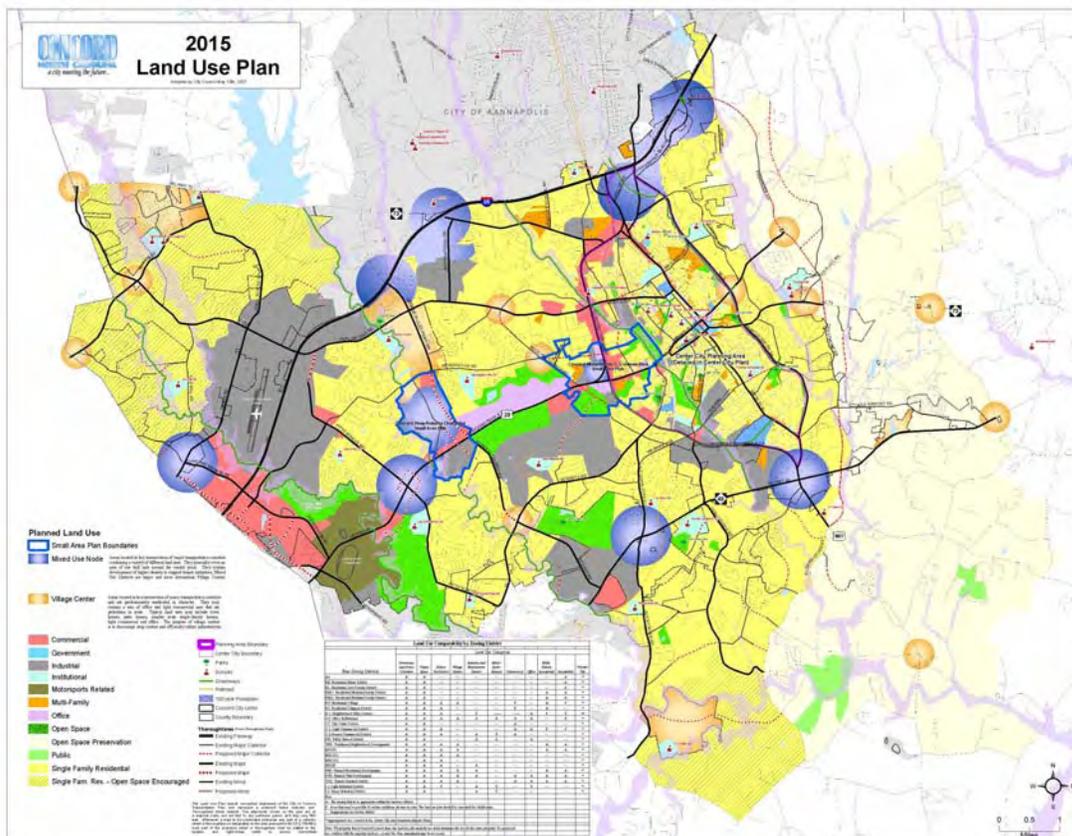
Concord will pursue two options to ensure quality orderly growth:

- 1) Seek extraterritorial jurisdiction. This would allow the City's zoning and development standards to be extended in those areas just beyond the City's limits. This jurisdiction must be approved by Cabarrus County.

- 2) If extraterritorial jurisdiction is not possible, then the City may use the extension of water and sewer lines as much as possible to leverage responsible development standards.
- 3) Concord will focus on updating current growth management tools while investigating new tools to ensure a regional development that is acceptable and provided at a minimum of cost with continual input from the public.

Through a cooperative program with the United States Census Bureau, Concord's GIS Division has already completed a large portion of the preparatory work needed for the upcoming Census for 2010. A complete list of addresses was carefully reviewed and submitted to the Census for their analysis. The Census Bureau will mail out questionnaires to residents the first part of 2010. The questionnaires should be returned to the Census Bureau by April 1, 2010. If a questionnaire is not returned, a Census Bureau employee will need to personally visit the residence. Following the complete count, the Census Bureau will deliver their population results to the President on December 31, 2010.

Continued land use planning will provide immediate and long-term guidance. In recent months master plans for parks, transportation, water, sewer and downtown development have been completed. This is the next step. This updated plan will give Concord the tools it needs to make the appropriate comprehensive land use decisions and then use infrastructure investments or noninvestment to support it.



Brownfield's Project

A Brownfield is defined as abandoned, idled or under-used real property where expansion or redevelopment is complicated by the presence or potential presence of environmental contamination. Contamination is defined as waste or products that are improperly handled. Contamination can be found in:

Water



Soil



Air



The mission of the EPA's Brownfield Initiative is to empower States, communities and their stakeholders that are engaged in Economic Development to work together in a timely manner to prevent, assess, safely clean up and reuse Brownfield sites. The program awards up to \$200,000 for Brownfield assessment activities, up to \$1,000,000.00 per eligible entity for a Revolving Loan Fund, and up to \$400,000 for clean up.

Program Goals

The City of Concord's Brownfield Program has identified the following goals:

- Identification and characterization of all private properties with environmental issues
- Prioritize sites based on clearly defined objectives and ranking criteria
- Identify strategies for providing liability protection to aid in redevelopment.
- Create a community involvement forum.

Development Services Department

The Development Services Department is designed to improve service to the real estate and development industries as well as the general public who are seeking to obtain permits or other development requirements and information. It is designed to help streamline the process by cutting through the red tape and helping developers and citizens quickly obtain the services they need within a one-stop location. Whether a citizen is looking to build a deck addition to his home or a developer is looking to build a multi-million dollar facility, the Development Services Department is the place to visit.

Key functions of the Department include:

- Providing a one-stop location to receive most any type of City permit (zoning, certificate of compliance, fire permits, flood plain development permits), plan reviews, engineering and planning inquiries, and mapping needs
- Improving customer service to developers and their agents
- Arranging preliminary development conferences
- Providing a central point of contact for the developer through the review process to ensure that schedules are maintained, interdepartmental issues are coordinated, problems are solved and the project is expedited in a timely manner
- Establishing and maintaining regular communication with the development community and the general public

The Development Services Department was created to provide citizens and developers a centralized location in which they could obtain information related to all aspects of development. Some of the services provided by this department are, plan review, permitting, and technical and planning assistance to citizens, public officials, and government agencies. The department is also responsible for support and recommendations to the Planning and Zoning Commission as well as the Board of Adjustments and Historic Preservation Commission. Since the creation of the department, the process of plan review and permitting has been drastically streamlined.

Planning Services

The Planning Services Department is responsible for the City's physical and socioeconomic planning, including land use and environmental review; preparation of plans and policies; and provision of technical assistance and planning information to government agencies, public officials, and community boards.

The Department is responsible for land use analysis in support of the Planning Commission's review of proposals for zoning map and text amendments; special permits under the Zoning Resolution; changes in the City map; the acquisition and disposition of City-owned property; the acquisition of office space for City use; site selection for public facilities; urban renewal plans and amendments; landmark and historic district designations; and community-initiated plans.

Plans Review - Building, Fire and Flood Plain Standards

Concord uses the North Carolina Building Code Volume V Fire Prevention as the basis of its fire prevention program. The code is based on the International Fire Code. In turn this code references the National Fire Protection Associations Codes. One document, which coordinates the various codes as they relate to disaster mitigation, will be NFPA 5000. This standard references a wide array of additional standards and guidelines, the predominate one being the American Society of Engineers (ASCE) Standard, (Minimum Design Loads for Buildings and Other Structures). This operates on the philosophy that you have a specific environment within an area and you must design buildings to fit into it.

As part of this program detailed maps are used to track where wind, seismic, or snow might occur and the probable severity of that event. Buildings will be designed with these design perils in mind. In order to monitor construction and coordinate the efforts of the local building code requirements, Concord has designed a Plans Review Center. This center is composed of personnel with certificates in the fire, building, zoning and flood plain management standards. Personnel are located within the same building to facilitate easily coordination of the plans review effort, before a building is constructed.

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Development Restrictions in Floodplains

The City of Concord has an adopted document for governing development, the Concord Development Ordinance (CDO). The CDO addresses the issue of development in and around floodplains in Article 4, Section 4.7 entitled “Floodplain Life and Property Protection”. The purpose of this ordinance is to promote public health, safety and general welfare and to minimize public and private losses due to flood conditions within flood prone areas by implementing provisions that are designed to:

- Restrict and prohibit uses, which are dangerous to the health, safety, and property due to water or erosion hazards or that result in damaging increases in erosion, flood heights or velocities;
- Require that uses vulnerable to floods, including facilities that serve such uses, be protected against flood damage at the time of construction;
- Control the alteration of natural floodplains, stream channels, and natural protective barriers, which are involved in the accommodation of floodwaters;

- Control filling, grading, dredging, and all other development that may increase erosion or flood damage; and
- Prevent or regulate the construction of flood barriers that will unnaturally divert flood waters or which may increase flood hazards to other lands.

The ordinance applies to all Special Flood Hazard Areas within the City's jurisdiction. Special Flood Hazard Areas are defined by the Federal Emergency Management Agency in its most recent Flood Insurance Study of Cabarrus County, which became effective November 5, 2008.

In order to develop in Special Flood Hazard Areas a Floodplain Development Permit must first be obtained. To obtain the permit the applicant must submit a Flood Prevention Plan as set forth in Section 4.7.6(B) of the ordinance. This will include a drawing to scale showing the location, dimensions and elevations of the area in question including all structures existing and proposed, fill, storage of material, drainage facilities, and the location of the foregoing.

In Section 4.7.7 (B), the ordinance states that all new residential construction shall have the lowest floor (including basement) elevate no lower than two feet above the base flood elevation. Should solid foundation perimeter walls be used to elevate a structure, opening sufficient to facilitate the unimpeded movement of floodwaters shall be provided. The base flood is defined as the peak discharge of a 100-year flood event. The base flood has a one percent probability of being equaled or exceeded in any given year.

Nonresidential Construction shall also have the lowest floor elevation at least two feet above the base flood elevation or may be flood proofed in lieu of being elevated so long as other specific requirements are met.

To maintain that any filling of land to allow for development does not affect the capacity of the floodplain, Section 4.7.7 (A, 17) states that all fill material must be derived from adjacent floodway fringe from the same deeded parcel as the land filled. Fill material may be taken from another parcel if it can be certified by a professional engineer that no net loss to storage capacity has occurred as a result of fill activity.

Development in the floodway is primarily limited to uses that do not increase the flood levels during the occurrence of a base flood. These uses include general farming, ground level parking areas, lawns and gardens, and selected recreational uses such as golf courses, tennis courts, parks, etc.

In addition to the development restriction outlined in the ordinance, the CDO (in Article 4, Section 4.3.1) also contains a River /Stream Overlay District (RSOD). The RSOD is designed to preserve the natural vegetated state of the land surrounding streams and rivers to minimize soil erosion, and to reduce the velocity of overland storm water flow. The RSOD further restricts development by establishing a buffer around perennial streams as defined by the U.S.G.S. and indicated as solid blue lines on the 1:24,000 (7.5 minute) scale topographic maps.

The buffer shall be 50 feet plus four times the average percent of slope of an area adjacent to the stream. This slope is calculated by measuring the distance of 250 feet from the center of the stream, the percent of slope for this distance shall serve as the determining factor. However the maximum distance shall not exceed 120 feet. In addition to his buffer, there is a vegetative setback which shall be 20 feet of non-built upon area adjacent to the RSOD buffer.

These restrictions on development in and around the floodplains are a proactive measure which the City of Concord uses to minimize flood hazard risk to its citizens and the buildings. It helps to protect the public safety, general welfare, and helps to minimize public and private losses due to flood conditions. As a result, the ordinance meets the following objectives:

- Protect human life, safety, and health;
- Minimize expenditure of public money for costly flood control projects;
- Minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public;
- Minimize prolonged business losses and interruptions;
- Minimize damage to public facilities and utilities that are located in flood prone areas;
- Help maintain a stable tax base by providing for the sound use and development of flood prone areas; and
- Ensure that potential buyers are aware that property is in a Special Flood Hazard Area.

Flood Plain Development

Restrict new development in floodplains shown on FEMA's Flood Insurance Rate Maps.

Technical Capability

Modern technology is an essential resource for the development and maintenance of Concord's Mitigation Plan.

Geographic Information Systems (GIS): The Geographic Information Systems supports the City of Concord through the application of geographic information systems (GIS) technology. This technology allows any type of spatially referenced information to be stored, analyzed and reproduced.

It is the goal of the GIS to provide quality map and other presentation products, perform spatial analysis, develop GIS applications, and support city departments in their use of GIS.

Internet Capabilities: The Internet is a valuable tool for research, monitoring developing weather information, and exchange of information through electronic media. The City maintains both an Intranet and Internet web site. Through the Internet, citizens can learn

about City programs, history, government and services. The city's intranet is an internal website where departments can share information.

Communications: The City maintains the public safety communication system for Cabarrus County, Concord, and the City of Kannapolis. Severe weather information is sent internally to departments via email, radio system or electronic text paging. Cellular telephone and radio service is also available to support the 800 MHz system.

Utility Operations

City Electric Utility Operations

Since Concord has its own electrical distribution system, resources are immediately dispatched to address failure to the system, especially during natural disasters. Electric Utilities has a tree-trimming program designed to reduce the potential of down power lines from falling tree limbs. To support local resources and promote communities helping communities, Concord also participates in the Electri-cities Emergency Preparedness Program.

Concord is one of eighty-four public power utilities have earned Reliable Public Power Provider (RP3) recognition from APPA for providing consumers with the highest degree of reliable and safe electric service.

The RP3 program recognizes public power utilities that demonstrate proficiency in four key disciplines: reliability, safety, training and system improvement. Criteria within each category are based on sound business practices and represent a utility-wide commitment to safe and reliable delivery of electricity. This is the third year the RP3 designation has been offered.

Critical Facilities Emergency Power

Concord implemented an aggressive program to provide emergency power to critical facilities in the early 1990's. Emergency generators were provided all fire stations (includes the EOC and Communications Center), police department, water treatment plants, the Alfred Brown Operations Center (The Fleet Services, Water Resources, Environmental and Electrical Operations' Building and back-up EOC), and Concord Regional Airport. Generators are part of each new City Critical Facility.

The Wastewater System maintains four portable generators to provide emergency power for sewer pump stations along with three portable auxiliary pumps in the event of station pump failure or damage to controls. These seven units are part of a rotation plan that is in part based on the service area along with the time it takes to complete a route before starting over. We have also augmented our portable capabilities by installing five stationary generators at our most remote and highest priority pump stations.

Water Resources

There are no new sources for water in Cabarrus County. Concord must rely on its neighbors to obtain additional sources of water. Concord has successfully investigated and implemented redundant sources to secure its water supply in the event of a disaster that would impact the primary water basin. During the recent drought a significant amount of water use reduction was achieved through public education and information programs. As well Concord has signed an agreement with Mecklenburg County as part of its process to secure long-term sources of water. Draft agreements have been drafted and are in the review process. These are expected to be finalized in 2010.

The Department also implemented a tiered rate system which was put into effect in 2007. Reduced irrigation was made permanent (3 days/week) in 2009. This reduced the average residential customer usage from 6400 gallons to 4700 gallons per month.

Drought Mitigation Program

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The Department also implemented a tiered rate system which was put into effect in 2007. Reduced irrigation was made permanent (3 days/week) in 2009. This reduced the average residential customer usage from 6400 gallons to 4700 gallons per month.

The City will also explore alternate water supply sources and programs to address community susceptibility to drought and to expand public awareness programs. This will include pursuing connection to alternate sources of major sources of water from the Yadkin Basin and Catawba Basin.

Concord will continue to educate the public on proper water conservation techniques.

Storm Water

The clearing of land combined with development of commercial and residential areas can lead to wide spread flooding and reduced groundwater discharge. Water runoff is predictably accelerated by human activity. Additions of impermeable surfaces (roofs, roads, concrete, and other “hard” surfaces), increase the potential for urban flooding. In () the City of Concord implemented a Storm Water Utility Service. The Department has many programs that are an asset to disaster mitigation. The programs include:

- Maintain all drainage ditches and storm water pipes within City ROW.
- Respond to service requests to evaluate drainage problems.

- Use street sweepers on all streets with curb and gutter to help capture pollutants before they enter streams.
- Map drainage features (ditches, pipes, streams) throughout the City with GPS.
- Clean pipes using jet vac equipment to eliminate blockages and maintain flows.
- Inspect pipes and enclosed drainage features with camera truck equipment to identify blockages and deteriorated pipes.
- Engineering Plan Review of drainage systems for new development to ensure compliance with City standards and storm water Phase 2 requirements.
- BMP inspection to ensure proper operation and ongoing maintenance.
- Review as-built plans for storm water infrastructure and BMPs, (Best Management Practices), to ensure standards are met.
- Monitor storm water BMPs on at least a yearly basis to ensure compliance with Phase 2 requirements.
- Conduct educational sessions for school groups, civic organizations, neighborhood groups, and other interested citizens on storm water pollution.
- Monitor City operations for compliance with storm water standards.

Mitigation Recommendations

Mitigation falls into broad categories: programmatic and projects. Programmatic actions may deal with future development, both buildings and infrastructure, and may include such measures as changing regulatory standards. Project actions are generally undertaken to solve a specific problem at a specific location. Concord and other local agencies have undertaken a number of measures to promote mitigation throughout the area. A significant step is participation in the Flood Plain Program. An abstract of a new process the City will incorporate to evaluate mitigation projects is included in the Cost Benefits portion of this plan.

Greenway Program

A Greenway program identifies stream corridors that are under consideration for inclusion in the Greenway system. Greenway Programs can help mitigation objectives by protection of existing open space from future development. Areas acquired in the Greenway Program may also be attractive additions to lands owned and managed by Parks & Recreation. Close coordination between appropriate agencies will help insure that priority flood prone areas are considered.

City of Concord is in the process of expanding the current Greenway system by constructing a new trail located in the downtown area. City staff presented to City Council an update on a more pedestrian friendly community and open space preservation project, which council approved. Council heard an update on the downtown connector designed to connect McEachern Greenway and the center town area. Funding has been designated in the City's Capital Project budget for these items.

Project funds are provided by PARTF grant monies dedicated to enhancing the recreation and parks programs statewide. The Parks and Recreation Trust Fund (PARTF) provides dollar-for-dollar matching grants to local governments for parks and recreational projects

to serve the public. NCDOT grants are also designated for this project with the City of Concord matching funds.

Watershed Specific Programs

A key step in any comprehensive mitigation program are flood hazard mitigation plans based on a watershed basis. Concord is currently taking measures that will lead to the development of a local water shed plan. These plans will consider alternative methods and actions to reduce flood hazard potential. This will include actively pursuing funding sources to facilitate implementation of feasible and cost effective actions.

In addition, Concord will continue analysis of drainage basins, zoning and soil types. This information will be analyzed using a computer model to identify areas subject to flooding. When this portion of the program is complete, Concord will begin Watershed Specific Flood Mitigation Programs and determination of appropriate Capital Improvement Programs. Several areas of analysis are already underway in this phase.

Disaster Debris Removal

Natural disasters generate large amounts of debris that cause considerable disposal challenges for public safety officials. During Hurricane Hugo, 2 million cubic yards of organic yard waste was created in Mecklenburg County, North Carolina. Burial or burning of debris is not the answer to managing disaster debris. Uncontrolled burial or burning of debris can cause drinking water and soil contamination.

Concord is in the process of development of a disaster debris removal plan. The Solid Waste Coordinator will be designated as the Debris Operations Manager. This plan is in the development phase and being coordinated by the Emergency Management Division. The committee is composed of the following Departments/Divisions:

- Development Services
- Engineering
- Emergency Management
- Parks and Recreation
- Airport
- Solid waste
- Storm Water
- Transportation

A disaster debris removal plan will provide an effective mitigation method of handling disaster debris. The City has conducted research and is developing the debris management program. This program will designate steps the community can take to prepare for dealing with disaster waste and speed recovery. An effective debris management plan will reduce the burden on the municipal waste management systems in the event of a natural disaster.

Emergency Public Information

Alerts and warnings are an essential part of mitigating the affects of natural hazards. Concord has achieved NOAA Storm Ready Certification but will continue to investigate alternate methods and improved methods of public alerts and warnings.

Connect CTY

Concord implemented the Connect CTY Service in 2008. This system allows time-sensitive, day-to-day events, and other public notifications to be disseminated to the public via voice, text, and email. The program allows the City to reach stakeholders quickly and reliably in minutes.

Environment Committee

The Environmental Committee was formed in 2007 as a subcommittee of the Concord Emergency Planning Committee (CEPC) in order to address and respond to the various concerns related to spills involving City equipment or City personnel while performing work duties. The Committee is made up of members from various departments that have a stake in handling spills on an unexpected or emergency basis. It is our goal to discuss and/or recommend improvements in procedures or with the follow-up of incidents to the CEPC and/or the Deputy City Manager while following current City policies, and local, State, and Federal rules and guidelines. This committee meets on the third Monday of every other month.

Sustainability Committee

The City of Concord's Sustainability Committee works within the City to promote 'green' policies and procedures within our municipal operations. We recently submitted our Green Challenge Tally to the North Carolina League of Municipalities in response to their 'Green Challenge'. In October 2009, the League recognized Concord's efforts by designating it as a Green Challenge Intermediate Level municipality.

State Programs

When local resources are inadequate, seek additional assistance from the State. The following State organizations may have access to programs that can assist local mitigation efforts.

- State Hazard Mitigation Office
- Universities and Research institutes
- Flood hazard management
- Dam Safety
- Natural resources
- Environmental protection
- Housing and community development
- Public Safety
- Building regulations and standards
- Transportation

North Division of Emergency Management

The North Carolina Division of Emergency Management is designated by the Governor to coordinate hazard mitigation programs. FEMA provides funding through a number of grant programs, most significant is the Hazard Mitigation Grant Program (HMGP). Funding becomes available only after a presidential disaster declaration is made. The Flood Mitigation Program is not linked to a disaster declaration and provides planning funds, which supports programs that are in the best interest of the National Flood Insurance Program. The focus of this program is insured buildings that have a history of repetitive flood losses.

As of 1998, the State does not have a permanent funding source to support hazard mitigation projects. In the aftermath of Hurricanes Bertha and Fran in 1996, the State provided funds to fulfill the non-federal cost share required by FEMA's HMGP. This action does not mean that State funds will be forthcoming in the future.

North Carolina Clean Water Management Trust Fund

Designed to provide funding to local jurisdictions, the Clean Water Trust Fund supports projects to improve surface waters, eliminate pollution, and protect and conserve unpolluted surface waters. Grants may support hazard mitigation objectives, for example acquisition of structures along stream corridors will help establish riparian buffers, create opportunities for wetland creation or reforestation, which will help improve water quality.

North Carolina Department of Transportation

NC DOT is responsible for a number of roads in the City of Concord. As transportation-flooding problems are identified along State Roads, and as mitigation alternatives are explored, coordination with this agency may lead to opportunities to meet multiple goals with one project.

For example a bridge is scheduled for upgrade due to increased traffic flow, then redesign of bridges and culverts may be considered in order to relieve and mitigate flood problems.

Local government's can enter into an agreement with NCDOT in regards to debris removal on public roads. This agreement allows the local government entity to apply for funding for debris clearing on State Roadways.

Federal Programs

A number of federal provide funding, both pre- and post-disaster, to support implementation of sound mitigation measures. A June 1998 report entitled, "Federal Programs Offering Non-Structural Flood Recovery and Floodplain Management Alternatives," issued as a Federal Interagency Publication of the Executive Office of the President. Mitigation assistance programs may be described in three categories:

1. Pre-disaster

Pre-disaster programs exist without a disaster declaration and support pre-disaster mitigation activity.

2. Post-disaster

Post-disaster programs generally require a Presidential disaster declaration to become applicable.

3. Disaster Applicable

Disaster applicable programs exist pre-disaster for non-emergency purposes but may be re-directed for non-emergency purposes after a disaster declaration.

The following is a brief summary of some of the federal programs:

Agency	Program	Structural	Non-Structural
HUD	Community Development Block Grant (CDBG) Entitlement Communities Program Acquisition of real property, relocation assistance....		x
FEMA	Flood Mitigation Assistance Acquisition, elevation, or relocation of insured structures in a flood plain		x
FEMA	Hazard Mitigation Grant Program (HMGP) Structural and non-structural mitigation activities to protect public and private property.	x	x
USACE	Floodplain Management Services (Section 206) - Planning and technical assistance to communities to support effective floodplain management.		x
HUD	Disaster Recovery Initiative Acquisition, relocation or repair of eligible homes affected by Presidential declared disasters		x
SBA	Small Business Administration Physical Disaster Loans and Economic Injury Disaster Loans Loan Programs to assist with uninsured damage to private property following a disaster. Funds 14 can be used to repair damaged property and mitigate against future damage.		x

Pre-Disaster Flood Insurance Programs

National Flood Insurance Program (NFIP)

The intent of the NFIP is to reduce disaster losses from flooding by providing flood insurance to property owners for structures that otherwise would be uninsurable because of their susceptibility to flooding. Flood insurance underwritten by NFIP is available only in communities that participate in the NFIP. To participate, communities adopt and enforce floodplain management ordinances.

Contact: State NFIP coordinator or FEMA Region IV office.

Community Rating System

The NFIP's Community Rating System (CRS) provides incentive for communities to do more than just regulate construction of new buildings to minimum NFIP Standards. Under the CRS, flood insurance premiums are reduced when the community accomplishes the following:

- Reduces flood damages to existing buildings
- Manages development in areas not mapped by the NFIP
- Protects new buildings beyond the minimum NFIP protection level
- Helps insurance agents obtain flood data
- Helps people obtain flood insurance

Contact: State NFIP coordinator or the FEMA Regional IV Office

Flood Mitigation Assistance Program (FMA)

This program is designed to reduce the flood hazard to structures that are insurable under the National Flood Insurance Program. Grants may be awarded for planning assistance, implementation of mitigation strategies and projects.

Contact: State NFIP coordinator or FEMA Region IV Office.

Performance Partnership Agreements (PPAs)

PPAs are the mechanism by which FEMA provides funding to States to develop and maintain emergency management programs. The following Federal programs provide annual funding to States through the PPA/CA process and have mitigation elements:

State Hazard Mitigation Program

The purpose of the State Hazard Mitigation Grant Program (SHMP) is to help States Develop a comprehensive mitigation program.

Contact: State Hazard Mitigation Officer at NCEM or the Mitigation Program Manager at the FEMA Region IV Office.

Community Assistance Program – State Support Service Element (CAP)

The CAP provides funding to meet negotiated objectives for reducing flood hazards in NFIP communities. The program intends to identify prevent and resolve floodplain management issues in participating communities before they require compliance action by FEMA. Funding is 75/25.

Contact: CAP coordinator at the NCEM or the FEMA Region IV Office.

Disaster Preparedness Improvement Grant (DPIG)

The DPIG funds assist States in developing and improving State and Local plans, programs and capabilities for disaster preparedness and mitigation.

Contact: DPIG Program manager at the State emergency management agency or the FEMA Region IV Office.

Post Disaster Programs

Stafford Act Programs

Following a Presidential disaster declaration, several mitigation programs become available to “declared” communities under the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act).

Contact: NCDEM Hazard Mitigation Section or FEMA Region IV for any of the Post Disaster Programs.

Hazard Mitigation Grant Program (HMGP)

Designed to reduce the risk of future damage, hardship, loss, or suffering as a result of - major disasters by providing substantial financial support to implement cost-effective, post-disaster State and local mitigation measures.

Infrastructure Support (Public Assistance)

This program deals with repair, restoration and replacement of damaged public facilities and damaged private non-profit facilities.

Human Services

Grant awards are available to repair disaster-damaged dwellings.

Individual and Family Grant Programs

The Stafford Act provides for grants to cover serious, unmet, disaster-related real property losses. IFG funds can be used to cover disaster-related mitigation measures up to an indexed grant amount.

Special Programs

Other programs may be available for a more limited mitigation-funding source. Congress has developed such programs through post-disaster supplemental appropriations.

Community Development Block Grants

The Department of Housing and Urban Development (HUD) sponsors this program. Its objective is to develop viable urban communities by providing decent housing and suitable living environment and by expanding economic opportunities, principally for low to moderate-income people. Disaster-related assistance is eligible under this program; and mitigation activities can be funded.

Contact: NC CDBG Office.

Conservation Fund Grants, Land and Water

This program is administrated by the National Park Service (NPS) component of DOI. Its objective is to acquire and develop outdoor recreation areas and facilities for the general public, to meet current and future needs.

Contact: Local Park Service Office

Farm Ownership Loans

This Department of Agriculture (USDA), Farm Service Agency (FSA), program is intended to assist farmers to develop, construct, or repair farm homes, farms and service buildings; to drill wells, and otherwise improve farm water supplies; and make other necessary improvements.

Contact: The Farmer Programs Loans-making Division at the FSA, USDA, Washington, D.C.

Soil and Water Loans

The USDA, FSA, administers this program. Its objective is to develop wells, improve water supplies, and build dikes, terraces, waterways, and other erosion Control projects.

Contact: The Farmer Programs Loans-making Division at the FSA, USDA, Washington, D.C.

Other Sources

Other sources of financial and technical assistance are available and may be applicable for funding the implementation of mitigation strategies.

A comprehensive listing available from the North Carolina Division of Emergency Management Hazards Mitigation Office is maintained in the Emergency Management Office.

Mitigation Funding Options

Currently a local mitigation-funding program is not available to support implementation of mitigation measures that reduce or eliminate damage to existing structures. Storm water funds are allocated for maintenance and restoration of streams, administrating the National Flood Insurance Program and planning activities.

Two Federal Grant Programs are currently available through FEMA are the Hazard Mitigation Grant Program (HMGP) and the Flood Mitigation Program (FMAP). Each of these programs is administered through the North Carolina Division of Emergency Management. Historically, North Carolina does not have a permanent funding source to support hazard mitigation projects. In the aftermath of Hurricanes Bertha and Fran in 1996, the State did provide funds to make up for non-federal cost share. No guarantee of these funds exists in for future disasters.

Storm Water Utility Fee

Storm Water Utility's Fees can provide a significant level of funding for capital improvement projects along non-FEMA regulated portions of the flood plains. These funds can be used to fund such projects as neighborhood storm drainage improvements and replacement of culverts. Examples of projects include:

- **Maintain & Install Infrastructure**
Hundreds of miles of piping and other system components make up the storm drainage system that protects Concord from flooding. Stormwater Services maintains system components inside the street right-of-way.
- **Educate**
The best way to protect storm water quality and stop pollution is to educate our citizens. We make changes in our behaviors when we learn about the negative consequences they create. Our environmental educator attends civic group & neighborhood meetings, visits school groups, develops literature and maintains an informational website to teach the importance of keeping our storm water clean, because it NEVER receives treatment before it enters a body of water!
- **Protect the Environment**
Development and other human interactions with the environment increase the amount of storm water runoff which is easily contaminated and carries pollutants into our surface waters. Storm water Services continues to work to reduce stormwater pollution, stop illegal dumping, clean up our watershed and restore local streams.
- **Street Sweep**
This program removes tons of debris from Concord streets each business day. This prevents system blockages and protects our waters from silt and sediment pollution and reduces the potential for Urban Flooding.
- **Review Plans**
Storm water Services reviews plans for all new development within the City limits, making sure projects comply with state & federal regulations and contribute as little as possible to storm water pollution.
- **Map the System**

In order to effectively maintain the storm drainage system, our GIS technician is working to map all of Concord's outfalls, drains, ditches, pipes & other system components while monitoring for illicit discharges.

- 1 Spatial Patterns of Natural Hazards Mortality in the United States, Kevin A. Borden and Susan L. Cutter, International Journal of Health Geographics, 2008.
- 2 U.S. deaths due to natural hazards between 1970 and 2004 showed that weather associated with extremes of hot and cold weather, along with severe thunderstorm winds (the "Severe Weather" category), killed the most people. Image credit: [Spatial patterns of natural hazards mortality in the United States](#), International Journal of Health Geographic. Authors: Kevin Borden and Susan Cutter of the University of South Carolina.
- 3 The Greater Hazards are those identified as having the most potential impact on the state of North Carolina in the past and in the future. The Lesser Hazards are still hazards of significant concern, but have not had as large of an impact on the entire state in the past, or in the anticipated future.
- 4 U.S. Census Bureau – American Community Survey: 2005-2007 Data Set
- 5 City of Concord Business & Neighborhood Services Department
- 6 City of Concord GIS Department
- 7 Economic Development Corporation, Concord, NC, <http://www.cabarrusedc.com>.
- 8 Ibid
- 9 Ibid
- 10 City of Concord Transportation Department
- 11 Cabarrus County Schools Accountability services
<http://www.ncpublicschools.org/docs/fbs/accounting/data/grs09.xls>
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Section 4 Mitigation Strategy

FEMA Requirement

Requirement §201.6(c)(3):

(c) Plan content. The plan shall include the following:

- (3) A mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools. This section shall include:
 1. A description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.
 2. A section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.
 3. An action plan describing how the actions identified in paragraph (c)(2)(ii) of this section will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

Part 201.6(c)(3)(iii):

The mitigation strategy shall include an action plan describing how the actions identified in paragraph (c)(2)(ii) of this section will be prioritized, implemented, and administered by the local jurisdiction.

Overview

This section provides information on the process used to develop goals and mitigation strategies that pertain to the natural hazards addressed in the mitigation plan.

Strategic Mission

The Strategic Mission of the City of Concord Hazards Mitigation Plan is to promote sound public policy designed to protect citizens, critical facilities, infrastructure, private property, and the environment from natural hazards. This can be achieved by public awareness, documenting the resources for risk reduction and loss-prevention, and identifying activities to guide the City toward building a safer, more sustainable community.

Goals

The plan describes the community's overall direction that it can take to reduce the impacts of natural hazards. The goals listed below define the broad direction of the mission statement into more specific recommendations to address the natural hazards.

Hazard Cost Benefit Analysis

A cost/benefit analysis is essential to an effective mitigation plan and is used by the State and Federal agencies to evaluate hazard mitigation projects as required by the Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law 93-288.

This plan does not provide nor is it intended to provide a detailed analysis or description of economic analysis methods that can be used to evaluate local projects. The intent is to raise benefit/cost analysis as an important for departments to consider when evaluating current and future efforts and to provide background on how economic analysis can be used to evaluate projects.

Importance of Cost Benefit Analysis

Mitigation activities are intended to reduce the cost of disaster by minimizing property damage, injuries, and the potential for loss of life, and by reducing emergency response costs, which would otherwise been incurred. The risk and vulnerability analysis provides information which can be as a guidance for the need for mitigation projects. An evaluation of these projects will allow decision makers to understand the potential benefits and costs of an activity and a method of comparison to alternate projects.

Evaluation of natural hazard mitigation projects is not an easy task and can be influenced by many variables. Disasters often produce community wide effects not just physically, but in costs from loss of business, response and recovery. Some of these costs are indirect and hard to measure and often not in financial terms (dollar loss).

Cost benefit analysis of mitigation efforts is not easily accomplished, but is a valuable from the public perspective, in assessing the positive and negative impacts from mitigation activities, and obtaining a benefit-cost comparison. The goal is to develop a method to evaluate projects for implementation with an objective understanding a benefit or non-benefit to the community.

Since hazard mitigation is aimed at reducing or eliminating future damages costs should not be associated with repair of damages from a disaster. The focus should be on affirmative actions that enhance the built community to withstand the damaging effects of future disasters. The City of Concord also considers public-education programs as part of their cost analysis since such programs

increase the public awareness and understanding of mitigation efforts, thus promoting public support.

Concord will use a systematic approach to evaluate mitigation projects and their effectiveness. Due to the complexity of estimating the benefits and costs of a hazard mitigation program, employing the services of a specialist may be necessary.

The Hazard Mitigation Sub-committee will evaluate alternatives received from departments to determine the applicability of the project. This will include the following criteria.

- Determine the project cost
- Estimate the Benefits
- Consider costs and benefits to society and the environment.
- Compare with other alternatives and rank based on evaluation.

An economic analysis will assist decision makers in choosing the appropriate strategy for the community to reduce risks and prevent loss from natural hazards. It can also assist in identifying inappropriate or unfeasible projects. The city will also consider projects that can be combined which can be integrated with storm water programs, watersheds, economic and community planning as an example. This will increase the viability of project implementation.

Each process considered for inclusion in the mitigation strategies were prioritized by the advisory committee based on the following criteria:

- 1) Cost Benefit Review
- 2) Results of the Hazard Identification and Analysis
- 3) Results of the Vulnerability Assessment
- 4) Results of The Community Capability Assessment and
- 5) The effectiveness of the project in meeting hazard mitigation goals and comprehensive plan goals.

Emphasis was given to each of the items in addition to a cost-benefit review, in light of its possible use in environmental reviews for HMGP, FMA and other federal hazard mitigation projects.

Resources for the cost benefit analysis include:

- Federal Emergency Management Agency, Benefit/Cost Analysis of Hazard Mitigation Projects, Riverine Flood, Version 1.05, Hazard Mitigation Economics, Inc., 1996

- Federal Emergency Management Agency Report on Costs and Benefits of Natural Hazard Mitigation, Publication 331, 1996.

Multi Hazard Goals

Multi-hazard goals are those that pertain to all natural hazards addressed in the plan. These include:

Generalized Goals

- Identify and implement hazard mitigation projects designed to reduce the impact of future hazard events.
- Conduct education and outreach activities intended to better inform people about natural hazards and the individual steps they can take to reduce their impact.
- Conduct training and exercises intended to better prepare government officials for all phases of emergency management (response, preparation, mitigation, and recovery).
- Seek ways to improve their ability to warn people of impending hazards and disasters.
- Enact planning and policy measures to reduce the impacts of identified hazards.
- Implement traffic control measures to reduce injuries and the loss of life before, during and after emergencies and disasters.

The Disaster Mitigation Act of 2000 has a goal of improving the coordination of risk reduction measures between state and local government authorities. The key to this is linking local and state mitigation planning goals. The development of the City of Concord's Natural Hazard Mitigation plan is consistent with the State of North Carolina's current mitigation planning goals as identified in the State Mitigation Plan.

Mitigation Techniques

Multiple techniques were considered to achieve the City's goals and the specific hazard concerns of each department. The activities considered during the City's planning process were:

Prevention

Preventative activities are intended to reduce the impact of future hazard events, and are typically administered through government programs or regulatory actions that influence the way land is developed and buildings are constructed. They are particularly effective in reducing a community's future vulnerability, especially in areas where development has not occurred or capital improvements have not been substantial. Examples of preventative activities include:

- Planning and zoning

- Building codes
- Open space preservation
- Floodplain regulations
- Storm Water management regulations
- Drainage system maintenance
- Capital improvements programming

Property Protection

Property protection measures involve the modification of existing buildings and structures or the removal of the structures from hazardous locations. Examples include:

- Acquisition
- Relocation
- Building elevation
- Critical facilities protection
- Retrofitting (i.e., wind proofing, flood proofing, seismic design techniques, etc.)
- Safe rooms, shutters, shatter-resistant glass
- Insurance

Natural Resource Protection

Natural resource protection activities reduce the impact of natural hazards by preserving or restoring natural areas and their protective functions. Generally speaking, natural areas may include floodplains, wetlands, steep slopes, barrier islands and sand dunes. Parks, recreation or conservation agencies and organizations often implement these measures.

Examples include:

- Land acquisition
- Floodplain protection
- Watershed management
- Beach and dune preservation
- Riparian buffers
- Forest and vegetation management (i.e., fire resistant landscaping, fuel breaks, etc.)
- Erosion and sediment control
- Wetland preservation and restoration
- Habitat preservation
- Slope stabilization
- Historic properties and archaeological site preservation

Structural Projects

Structural mitigation projects are intended to lessen the impact of a hazard by modifying the environment using a number of construction techniques. They are usually designed by engineers and managed or maintained by public works staff. Examples include:

- Reservoirs
- Dams/levees/dikes/floodwalls
- Diversions/detention/retention
- Channel modification
- Storm sewers

Emergency Services

Although not typically considered a “mitigation” technique, emergency services reduce the impacts of a hazard event on people and property. These actions are often taken prior to, during, or in response to an emergency or disaster. Examples include:

- Warning systems
- Evacuation planning and management
- Emergency response training and exercises
- Sandbagging for flood protection
- Installing temporary shutters for wind protection

Public Education and Awareness

Public education and awareness activities are used to advise residents, elected officials, business owners, potential property buyers, and visitors about hazards, hazardous areas, and mitigation techniques they can use to protect themselves and their property. Examples of measures used to educate and inform the public include:

- Outreach projects
- Community Emergency Response Teams
- Speaker series/demonstration events
- Hazard mapping
- Real estate disclosure
- Library materials
- School children educational programs
- Hazard expositions
- Inter-governmental coordination

Mitigation Action Plans

The Mitigation Planning Committee reviewed the individual departmental techniques and considered the results of the Capability Assessment and Risk Assessment in order to establish the most appropriate mitigation techniques for the City of Concord. The effect on the over risk reduction, its ease of implementation, the degree of political and community support and its general cost-effectiveness and funding.¹

FEMA guidance for meeting the planning requirements of the Disaster Mitigation Act of 2000 also specifies that local government should prioritize their mitigation efforts based on the level of risk a hazard poses to the lives and property of a given jurisdiction.

A matrix was developed to allow the committee with the opportunity to cross-reference each of the priority hazards (as determined in the Risk Assessment) with the comprehensive range of available mitigation techniques, including prevention, property protection, natural resource protection, structural project, emergency services and public education and awareness.

Mitigation Technique Matrix							
Mitigation Technique	High Priority			Moderate Priority			
	Winter Storm	Flood	Drought	Severe Thunder Storm	Tornado	Earthquake	Hurricane
Prevention	X	X	X	X	X	X	X
Property Protection		X			X		
Natural resource protection		X					
Structural Projects	X	X	X	X	X	X	X
Emergency Services	X	X	X	X	X	X	X
Public Education and Awareness	X	X	X	X	X	X	X

The mitigation plans proposed by various departments are listed below. Each mitigation action plan has been designed to address goals of this Natural Hazard Mitigation Plan. Many of the Action Plans identified in the 2004 plan are not continuations.

Integrate the goals and actions items from the City of Concord Natural Hazard Mitigation Plan into existing regulatory documents and programs where appropriate.

Category	Planning and Policy
Hazard Addressed	Multi-hazards
Priority:	Moderate
Estimated Cost	Staff time and resources
Potential Funding Sources	N/A
Lead Agency/Department Responsible	Business and Neighborhoods

**Implementation Schedule
Methodology**

Ongoing
Use the natural hazard mitigation plan to help the Concord Unified Development Ordinance address issues to protect life and property from natural hazards through planning strategies that restrict development in areas of known hazards.
Integrate the City’s mitigation plan into current capital improvement plans to ensure that development does not encroach on known hazard areas.
Partner with other organizations and agencies with similar goals to promote codes that are more disaster resistant at the local and State level.

Continue the role of the City of Concord Emergency Planning Committee in monitoring the process for implementing, monitoring and evaluating citywide mitigation activities.

Category Planning and Policy
Hazard Addressed Multi-hazards
Priority: Moderate
Estimated Cost Staff time and resources
Potential Funding Sources N/A
Lead Agency/Department Responsible Business and Neighborhoods
Implementation Schedule Ongoing
Methodology Continue review of NHMP.
Conduct a full review of the Natural Hazard’s Mitigation Plan every 5 years by evaluating mitigation successes, failures, and areas that were not addressed;
Provide training for Committee members to remain current on developing issues in the natural hazard loss reduction field.

Identify, improve, and sustain collaborative programs focusing on disaster education for public and private sector organizations, and individuals to avoid activity that increases risk to natural hazards.

Category Education and Outreach
Hazard Addressed All
Priority: High
Estimated Cost Staff time and resources
Potential Funding Sources N/A
Lead Agency/Department Responsible Department of Fire and Life safety – Emergency Management

**Implementation Schedule
Methodology**

Ongoing
Continue educational outreach about flood, fire, earthquake, and other forms of natural hazards to property owners in areas identified to be at risk through hazard mapping;
Develop additional senior citizen educational programs

Develop public and private partnerships to foster natural hazard mitigation program and collaboration in the City of Concord.

Category Planning and Policy
Hazard Addressed All
Priority: Moderate
Estimated Cost Staff time and resources
Potential Funding Sources N/A
Lead Agency/Department Responsible Concord Department of Fire and Life Safety Division of Emergency Management

**Implementation Schedule
Methodology**

Ongoing
Continue partnerships that foster natural hazard mitigation in the community such as the Ready Kids Program with the American Red Cross
Continue communication between NCDOT and the Transportation Department and develop strategies to prioritize strategies to deal with transportation system issues;
Establish protocol for communication between City Utility services and the Transportation Department to assure rapid restoration of services

Develop inventories of at-risk buildings and infrastructure and prioritize mitigation projects.

Category Mitigation Project
Hazard Addressed All
Priority: High
Estimated Cost Staff time and resources
Potential Funding Sources N/A
Lead Agency/Department Responsible Buildings and Grounds
Implementation Schedule Ongoing

Methodology

Identify critical facilities at risk from natural hazard events;
Develop strategies to mitigate risks to the facilities, or to utilize alternative facilities should natural hazard events cause to the facilities in question.
Maintain annual review of bridges at risk from flood or earthquake hazards, identify enhancements, and implement projects needed to reduce risks.

Conduct annual risk assessment of critical facilities

Category Mitigation Project
Hazard Addressed All
Priority: High
Estimated Cost Staff time and resources
Potential Funding Sources N/A
Lead Agency/Department Responsible EM/Police
Implementation Schedule Ongoing
Methodology Identify critical facilities at risk from natural hazard events;
Conduct annual risk assessment of buildings.
Maintain annual report and documentation of risk assessments.
Identify enhancements, and implement projects needed to reduce risks.

Implement spring public information campaign aimed at tornado, flood and severe weather awareness to include information on safe rooms.

Category Education and Outreach
Hazard Addressed Tornado, flooding, severe weather
Priority: High
Estimated Cost \$1500.00
Potential Funding Sources Storm Water Services budget, Emergency Management Budget, Business and Neighborhoods budget.
FEMA and ARC materials are free of charge
Lead Agency/Department Responsible Concord Department of Fire and Life Safety Division of Emergency Management
Implementation Schedule Annual
Methodology Educate private property owners on limitation of bridges and dangers

Implement spring public information campaign aimed at tornado, flood and severe weather awareness to include information on safe rooms.

associated with them;
 Develop a process to encourage private property owners to upgrade their bridges to support the weight of fire trucks and emergency vehicles;
 Encourage individual and family preparedness through public education projects such as safety fairs;
 Coordinate the maintenance of emergency transportation routes through communications between the Transportation Department, Police Department, Fire Department and neighboring jurisdictions.
 Continue to promote and implement new private and public Community Emergency Response Teams;
 Familiarize public officials of requirements regarding public assistance for disaster response.
 Continue to develop mutual aide and assistance programs to address local resource shortfalls;

Develop mapping of non-designated floodplains into GIS and display on the internet

Category	Mitigation Project
Hazard Addressed	Flood
Priority:	High
Estimated Cost	Staff time and resources
Potential Funding Sources	Storm Water Services budget, Business and Neighborhoods Flood Mitigation Assistance (FMA) program (technical assistance), Hazard Mitigation Grant Program (HMGP), Flood Recovery Mapping (post-disaster)
Lead Agency/Department Responsible	Business and Neighborhoods
Implementation Schedule	24 Months
Methodology	Identify areas outside the mapped flood plain; Develop mapping of identified areas; Post mapping to the City Internet page. Conduct annual review of flood events and

Develop mapping of non-designated floodplains into GIS and display on the internet

update mapping.

Develop a plan to identify and address cleaning of problematic street drainage sites, including the creation of an emergency response team.

Category	Planning and Policy
Hazard Addressed	Flood
Priority:	Moderate
Estimated Cost	Staff time and resources
Potential Funding Sources	Storm Water Services budget,
Lead Agency/Department Responsible	Storm Water Utilities
Implementation Schedule	12 Months
Methodology	Identify problem storm water drainage sites Evaluate development of an emergency storm water response team Implement event related documentation of problem areas and annual review

Complete storm sewer system and outfall mapping project

Category	Planning and Policy
Hazard Addressed	Flooding
Priority:	High
Estimated Cost	Staff time
Potential Funding Sources	Internal, Storm Water Fees
Lead Agency/Department Responsible	Storm Water
Implementation Schedule	2012
Methodology	Target remaining sub-basins based on available funding.

Drainage basin master planning to establish system capacities, flood vulnerability and establish CIP needs

Category	Planning and Policy
Hazard Addressed	Flooding
Priority:	High
Estimated Cost	Cost estimation is part of project
Potential Funding Sources	Internal, Storm Water Fees
Lead Agency/Department Responsible	Storm Water
Implementation Schedule	2011
Methodology	Target remaining sub-basins based on available funding.

Incorporate internal flood study into FEMA mapping system.

Category	Planning and Policy
Hazard Addressed	Flooding

Incorporate internal flood study into FEMA mapping system.

Priority:	High
Estimated Cost	Staff time and resources
Potential Funding Sources	Internal, Storm Water Fees
Lead Agency/Department Responsible	Storm Water/Business and Neighborhoods
Implementation Schedule	2011
Methodology	Successful incorporation into recognized flood plain mapping system

Identify structures in new flood plain area and initiate mitigation efforts for repetitive loss.

Category	Prevention
Hazard Addressed	Flooding
Priority:	High
Estimated Cost	Staff time and resources
Potential Funding Sources	Internal funding
Lead Agency/Department Responsible	Storm water
Implementation Schedule	2011
Methodology	Dependant on incorporation of internal flood study mapping

Evaluate “Turn Around Don’t Drown” Warning Program

Category	Mitigation Project
Hazard Addressed	Flood
Priority:	High
Estimated Cost	Staff time and resources
Potential Funding Sources	Signs Transportation Department Budget
Lead Agency/Department Responsible	Transportation department
Implementation Schedule	12 Months
Methodology	Evaluate the “Turn Around Don’t Drown” Program,

Strengthen emergency services preparedness and response by linking emergency services with hazard mitigation programs, enhancing public education on a citywide scale

Category	Public Education Outreach
Hazard Addressed	All
Priority:	Moderate
Estimated Cost	Staff time and resources
Potential Funding Sources	Storm Water Services budget, Business and Neighborhoods Flood Mitigation Assistance (FMA)

Lead Agency/Department Responsible	program (technical assistance), Hazard Mitigation Grant Program (HMGP), Flood Recovery Mapping (post-disaster) Concord Department of Fire and Life Safety
Implementation Schedule	Continuation
Methodology	Identify areas outside the mapped flood plain; Develop mapping of identified areas; Post mapping to the City Internet page. Conduct annual review of flood events and update mapping.

Continue to provide and maintain NIMS training for all departments and key government officials.

Category	Training and Exercises
Hazard Addressed	All
Priority:	Moderate
Estimated Cost	\$3,000.00
Potential Funding Sources	DHS – Citizen Corps, Emergency Management Institute, Local Community Colleges.
Lead Agency/Department Responsible	Concord Fire Department
Implementation Schedule	Continuation
Methodology	Continue annual NIMS classes and refresher training Incorporate NIMS into event planning and day to day operations.

Clearly mark detours during events and recovery operations that cause obstructed roadways.

Category	Traffic Control
Hazard Addressed	All
Priority:	Moderate
Estimated Cost	Staff time and resources
Potential Funding Sources	Transportation Department
Lead Agency/Department Responsible	Transportation Department
Implementation Schedule	Continuation
Methodology	Continue update of transportation road closure web site Rapid deployment of Transportation’s emergency response trailer Review and evaluation of I-85 detours

Maintain resources to adequately control traffic such as barricades, barriers, cones and signs.

Category	Traffic Control
Hazard Addressed	All
Priority:	Moderate
Estimated Cost	Staff time and resources
Potential Funding Sources	Transportation Department Concord Police Concord Fire and Life Safety
Lead Agency/Department Responsible	Business and Neighborhoods
Implementation Schedule	Continuation
Methodology	Continue to fund traffic control measures.

Develop Emergency Operation Plans for Dams

Category	Planning and Policy
Hazard Addressed	Dam Failure
Priority:	High
Estimated Cost	Staff time and resources
Potential Funding Sources	Water Resources budget, Partnership with WSAAC
Lead Agency/Department Responsible	Water Resources
Implementation Schedule	12 Months
Methodology	Identify contractor to develop emergency operations plan for dams Review and approve plan Resolve any deficiencies identified in the plan Develop plan maintenance and exercise schedule. Lake Fisher completed 05/2010

Develop public information and alerting system for dam failure based on plan.

Category	Warning
Hazard Addressed	Dam Failure
Priority:	High
Estimated Cost	Staff time and resources
Potential Funding Sources	Water Resources budget, Partnership with WSAAC
Lead Agency/Department Responsible	Water Resources
Implementation Schedule	12 Months
Methodology	Review and approve warning methodology in dam failure plan. Resolve any deficiencies identified in the plan

Develop public information and alerting system for dam failure based on plan.

Develop plan maintenance and exercise schedule to test system.

Promote better communications and coordination between floodplain management division of Business and Neighborhoods and Emergency Management

Category Planning and Policy
Hazard Addressed Flood
Priority: Moderate
Estimated Cost Staff time and resources
Potential Funding Sources N/A
Lead Agency/Department Responsible Business and Neighborhoods
Emergency Management
Implementation Schedule 24 Months
Methodology Continue interagency coordinate developed during the CRS project.
Promote joint public outreach and education

Develop evacuation and detour routes

Category Mitigation Project
Hazard Addressed Flood
Priority: High
Estimated Cost Staff time and resources
Potential Funding Sources Storm Water Services budget, Business and Neighborhoods Flood Mitigation Assistance (FMA) program (technical assistance), Hazard Mitigation Grant Program (HMGP), Flood Recovery Mapping (post-disaster)
Lead Agency/Department Responsible Business and Neighborhoods
Implementation Schedule 24 Months
Methodology Identify areas outside the mapped flood plain;
Develop mapping of identified areas;
Post mapping to the City Internet page.
Conduct annual review of flood events and update mapping.

Review all development codes and ordinances to ensure that they include appropriate flood and natural hazard mitigation strategies.

Category Planning and Policy
Hazard Addressed Flood, all
Priority: Moderate
Estimated Cost Staff time and resources
Potential Funding Sources N/A

Lead Agency/Department Responsible	Business and Neighborhoods Concord Police Department (Code enforcement)
Implementation Schedule	24 Months
Methodology	Review of current policies and procedures; Evaluate codes and ordinances with content of mitigation plan.

Continue emergency notification system (Connect CTY) to notify citizens of hazards and emergencies.

Category	Warning
Hazard Addressed	All
Priority:	Moderate
Estimated Cost	\$61,000.00
Potential Funding Sources	City Administration Budget
Lead Agency/Department Responsible	City Administration
Implementation Schedule	Continuation
Methodology	Continuation of Connect CTY as an supplemental notification system.

Burial of new power lines in sub-divisions and evaluation of burial of existing power lines.

Category	Mitigation Project
Hazard Addressed	Ice Storms, tornadoes, hurricane, severe thunderstorms
Priority:	Moderate
Estimated Cost	Coast based on amount and type of burial
Potential Funding Sources	Hazard Mitigation Grant (HMPG), Public Assistance (406 Mitigation), Economic Development
Lead Agency/Department Responsible	Electric Utilities
Implementation Schedule	Continuation
Methodology	Evaluation of feasibility of burial of existing power lines in problematic areas Continuation of burial of new power lines in sub divisions.

Equip Concord Fire and Life Safety for flood emergencies including swift water rescue

Category	Mitigation Project
Hazard Addressed	Flood
Priority:	Moderate
Estimated Cost	\$15,000.00
Potential Funding Sources	Hazard Mitigation Grant Program Assistance to Fire Fighters Grant Program
Lead Agency/Department Responsible	Department of Fire and Life Safety

Equip Concord Fire and Life Safety for flood emergencies including swift water rescue

Implementation Schedule Continuation
Methodology Conduct a capability assessment of current resources
Supplement identified needs.

Provide disaster preparedness training for city employees

Category Training and Exercises
Hazard Addressed All
Priority: Moderate
Estimated Cost \$2,000.00
Potential Funding Sources Department of Fire and Life Safety
Emergency Management Division Budget
Department of Justice, FEMA, Department of Homeland Security- Citizen Corps and CERT
Lead Agency/Department Responsible Department of Fire and Life Safety
Police Department
Implementation Schedule 24 Months
Methodology Continue disaster preparedness training program and risk assessments.

Conduct Emergency and Disasters Drills and Exercises for Departments

Category Training and Exercises
Hazard Addressed All
Priority: Moderate
Estimated Cost \$2000.00
Potential Funding Sources Staff time and resources
Department of Justice—State and Local Domestic
Preparedness Exercise Support,
Department of Justice—
State and Local Domestic Preparedness Training Program,
FEMA—First Responder Counter-Terrorism Training assistance, Department of Homeland Security—Citizen Corps/CERT
Lead Agency/Department Responsible Fire and Life Safety
Police
Implementation Schedule 24 Months
Methodology Continue exercise and drill schedule.

Develop automated flood warning system to include forecasting and warning.

Category	Warning
Hazard Addressed	Flood, severe storms
Priority:	High
Estimated Cost	NWS has 2 gages earmarked for project System components and installation
Potential Funding Sources	Storm Water Services budget, Department of Commerce (NOAA) Automated Flood Warning System, Flood Mitigation Assistance Hazard Mitigation Grant Program, Pre- Disaster Mitigation (PDM) program
Lead Agency/Department Responsible	Transportation, Emergency Management, Storm Water
Implementation Schedule	24 Months
Methodology	Continue to seek NCDOT permission for installation of devices.

Improve the dissemination of hazard information, including maps, broadcasts, web-site and blogs

Category	Education and Outreach
Hazard Addressed	All
Priority:	Moderate
Estimated Cost	Staff time and resources
Potential Funding Sources	FEMA and ARC materials are free of charge, Concord 101 and Public Safety Academy
Lead Agency/Department Responsible	Public Relations Manager Emergency Management
Implementation Schedule	24 Months
Methodology	Make the City of Concord Natural Hazard Mitigation Plan available to the public by publishing the plan electronically on the City Website. Develop and complete a baseline survey to gather perceptions of private citizens and the business community regarding natural hazard risks and mitigation needs. Repeat the survey in 5 years to monitor successes and failures of natural hazard mitigation programs. Develop outreach programs for businesses that must prepare for flood events. Develop adult and child educational programs to be used by local radio and cable stations.

Improve the dissemination of hazard information, including maps, broadcasts, website and blogs

Use local radio and cable stations as a conduit for advertising public forums. Conduct workshops for public and private sector organizations to raise awareness of mitigation activities and programs. Develop outreach materials for mitigation, preparedness, response and recovery.

Use technical knowledge of natural hazards and events to link natural resource management and land use organizations to mitigation activities and technical assistance.

Category	Mitigation Project
Hazard Addressed	All
Priority:	Moderate
Estimated Cost	Staff Time and Resources
Potential Funding Sources	Business and Neighborhoods budget, Department of Commerce (NOAA) Automated Flood Warning System, Flood Mitigation Assistance Hazard Mitigation Grant Program, Pre-Disaster Mitigation (PDM) program
Lead Agency/Department Responsible	Developmental Services/Storm Water
Implementation Schedule	Ongoing
Methodology	Review ordinances that protect natural systems and resources to mitigate natural hazards for possible enhancements. Pursue vegetation and restoration practices that assist in enhancing and restoring the natural and beneficial functions of the watershed. Develop educational and outreach programs that focus on protecting natural systems as mitigation activity.

Evaluate the feasibility of acquisition or elevation of flood-prone structures

Category	Mitigation Project
Hazard Addressed	Flood
Priority:	High
Estimated Cost	Staff Time and Resources Cost based on the number and type of structures
Potential Funding Sources	Pre-Disaster Mitigation (PDM) program, Hazard Mitigation

Evaluate the feasibility of acquisition or elevation of flood-prone structures

	Grant Program (HMGP), Flood Mitigation Assistance (FMA) program, Community Development Block Grant (CDBG) program, National Flood Insurance Program—Increased Cost of Compliance (ICC) Storm Water Utilities Emergency management
Lead Agency/Department Responsible	
Implementation Schedule	Ongoing
Methodology	Identify flood prone and repetitive loss structures Consider mitigation strategies

Improve the dissemination of hazard information, including maps, broadcasts, Internet Web site(s) and list serves.

Category	Public Education Outreach
Hazard Addressed	All
Priority:	Moderate
Estimated Cost	Staff time and resources
Potential Funding Sources	Internal budgets
Lead Agency/Department Responsible	Emergency Management Division
Implementation Schedule	18 months

Conduct NFIP Educational Programs

Category	Education and Outreach
Hazard Addressed	Flood
Priority:	High
Estimated Cost	Staff time and resources, (NFIP materials free of charge from FEMA)
Potential Funding Sources	N/A
Lead Agency/Department Responsible	Business and Neighborhoods
Implementation Schedule	12 months

Encourage residents to keep storm drains clear of debris during storms

Category	Education and Outreach
Hazard Addressed	Flood
Priority:	High
Estimated Cost	Staff time and resources, (NFIP materials free of charge from FEMA)
Potential Funding Sources	N/A
Lead Agency/Department Responsible	Storm Water
Implementation Schedule	12 months

2004 Goals and Objectives

In 2004 the City of Concord developed its first Natural Hazard mitigation plan. The following table provides an update to the goals and objectives identified in that plan.

Goal/Objective	Action Item	Status since 2004 Plan	Responsible Party	Notes
Multi Hazards				
Hazard Mitigation Plan	Review Plan	Completed	Department Directors	Plan was reviewed and submitted for approval.
	Revise Hazard Mitigation Plan	Continuation	CEPC Committee	Continue to make revision of the plan based on periodic review.
	Adopt plan revisions	New	City Council	Adopt plan upon completion of State and Federal Review.
	Prepare Plan Maintenance Report	Deleted	Planning and Zoning	Considered as part of plan review process
	Post updated plan	New	Emergency Management	Update copies of plan internally and at public access points
	Evaluate emergency response routes and response plans.	Continuation	Fire, Police, Transportation	Reviews of primary, secondary and tertiary routes or conducted and updated annually
	Acquire HAZUS	Continuation	Emergency Management	Awaiting complete program from FEMA
Maintain critical facilities and infrastructure	Maintain trees adjacent to power lines and critical facilities	Continuation	Transportation, Electric, Waste Water, Bldg/Grounds	Annual maintenance program.
	Maintain Water supply system	Continuation	Water Resources Building and Grounds	Determine that quality meets requirements, generators are operational
	Maintain Sewer Lift Stations	Continuation	Waster Water Systems	Verify that lift stations function as designed, generators are operational
	Install generators as needed at lift stations	Continuation	Waste Water Systems	Additional generators are acquired as needed based on available funding.
	Complete new vulnerability study of water system infrastructure	Complete	Water Resources, Water Resources	Vulnerability program complete.
	Develop methods to address the deficiencies identified in the water system vulnerability assessment	Quarterly program developed - deferred	Water Resources	Developed quarterly evaluation of listed improvements.
Improve Emergency Response	Implement Disaster Notification Policy	Complete	EM/Communications	Implemented Connect CTY as an supplemental public notification system.
	Continue Community Safe Haven Program	Complete	EM/Fire	Safe Haven program is established. New Safe Havens are included in new fire station

Goal/Objective	Action Item	Status since 2004 Plan	Responsible Party	Notes
				design as needed.
	Identify and designate primary transportation corridors and primary response routes	Complete	Transportation, EM, Fire and Police	Routes are identified and updated annually. New streets are considered as completed.
	Disseminate natural hazard watch/warning information to internal departments	Complete	Communications/EM	Program established. Emergency Management provides internal weather warning via email to departments and staff.
Reduce impacts to utility lines and structures	Maintain trees adjacent to electrical utility lines and critical facilities	Continuation	Transportation, Electric Systems, Duke Power, Building and Grounds	This is an annual maintenance program of the electrical department. Lines are trimmed and dead trees considered at risk are removed.
	Require burial of power lines for new developments	Continuation	Planning	Verify that underground power is installed in new developments
	Require new constructions to comply with wind section, snow load of building code	Complete	Cabarrus County Building Inspection Department/Plans Review Center	Required as part of the NC Building Code. Plans are reviewed by Cabarrus County Building Inspection Department and Concord plan review Center.
Dam/Levee Failure				
Improve dam/levee failure planning	Develop a dam/levee failure plan.	Phase 1 complete	EM, Water Resources, Water Resource and Sewer	Lake Fisher completed 2010.
	Identify dam locations, at risk property and conditions of dams.	Phase 1 complete	EM, Water Resources,	Down stream properties at risk have been identified for Lake Fisher. Lake Concord pending completion of plan.
Drought				
Expand water resources	Explore alternate water supply resources	Continual	Water Resources	Continue to identify and implement alternate water supplies sources
	Implement tiered rate structure to discourage excessive use	Completed	Water Resources, Customer Service	Reduction of customer use Tiered rate system was put into effect in 2007. Reduced irrigation was made permanent (3 days per week) in 2009. Average residential customer use had decreased from 6400 to 4700 gallons per month.
Flood Plain Risk				
Identify changes in flood plain risk	Document reported flooding.	Completed	Emergency Management, Storm Water	Program established. Events are documented by Storm water and Emergency management.
	Map documented flood events	Complete	GIS, Planning, Emergency	Each year flood events are documented by Emergency

Goal/Objective	Action Item	Status since 2004 Plan	Responsible Party	Notes
			Management Storm Water	Management and Storm water and information provided to GIS for mapping.
Aggressive review of new development	Include flood prevention compliance review for all plan review cases.	Continuation	Plans Review Center	Implementation of sign-off sheet as part of plans review.
	Review all development permits for compliance with the flood prevention requirements, including prohibiting the development of new structures within the ASFH (100 year floodplain).	Continual	Plans Review Center	Monthly reporting on the number of development permits denied, and the reason for denial
Annual flood prevention public outreach/education	Provide annual public outreach and education.	Continual	Emergency Management – Business and Neighborhoods	Annual flood prevention through ReadyKids Camps, Concord 101, Public Safety Academy, and other community based outreach programs.
Minimize the Impacts of Flooding	Use GIS to identify all structures within the Area of Special Flood hazard based on revised ASFH.	Complete	GIS	Development of map identifying at risk structures
	Certify new and permit new construction above the ASFH	Continuation	Plans Review Center	Verify that structures are constructed according to plans review.
	Install automated rain and stream gauges on major streams not currently monitored	Continuation	Storm water	Working with NWS to establish. Lack of response from NCDOT may jeopardize funding.
	Preserve stream buffers along perennial and intermittent streams	Complete	Development Services; Storm water	New construction plans are now monitored for stream buffer protection.
	Identify and map roads that flood during severe weather events based on response and new ASFH	Complete	GIS/Transportation/EM	Sites were verified. Additional reviews of sites are based on individual incidents. A new ASFH is scheduled after 2011.
	Determine cause of identified roadway flooding (debris leading to blockage and overflow, overwhelmed storm drain, road in ASFH)	Complete	Transportation, Storm Water, EM	See note above

Goal/Objective	Action Item	Status since 2004 Plan	Responsible Party	Notes
	Identify potential mitigation activities for the above, based on damage assessment, and prioritize locations for mitigation	Complete	Transportation, Storm Water, EM	Strategies to mitigate the source of road flooding is considered based on incident.
	Development of Greenway Program	Complete	Parks and Recreation	The city has implemented a successful Greenway program with 2 operational greenways.
	Greenway expansion project	New	Parks and Recreation	Successful expansion of the current Greenway System
	Prepare detour signs and have them ready for placement in the event of forecast flood events.	Complete	Transportation, Police/EM	Transportation developed and implemented response trailer which has been successfully deployed in several flood events and other situations.
	Install a telemetry system to monitor wet well levels and identification due to power failures.	Complete	Waste Water	Verify installation of system.
	Evaluate the National Weather Services, Turn-Around-Don't-Drown Program	New	Transportation/EM	Evaluate and secure funding for the turn-around-don't-drown program.
Heat Wave				
Increase public awareness about heat wave risks	Provide seasonal PSA's and public education regarding heat waves.	Complete	EM, PIO	PSA's are provided via various media outlets and as conditions warrant.
Hurricane				
Increase municipal preparedness for hurricanes	Provide Hurricane tracking charts and information to municipal departments.	Complete	EM	Charts are provide and posted on the internal web page at the beginning of each hurricane season.
Tornado/High Winds				
Evaluate school system preparedness	Monitor annual tornado drills in public and private schools system	Continuation	EM/Fire Prevention	Annual report on results of tornado drill
	Review school additions and new construction for tornado safety	Continuation	Fire Prevention/Plans Review Center	Verify during annual tornado drill that safe areas in schools are maintained.
Evaluate public facilities preparedness	Review additions and new construction for tornado safety	Deferred	Fire Prevention/Plans Review Center	Program deferred to Cabarrus County Building Inspection Department.
Winter Storms				
Evaluate	Addressed in multi-hazards Annual Drill	Complete	Transportation	Each October the transportation

Goal/Objective	Action Item	Status since 2004 Plan	Responsible Party	Notes
transportation infrastructure response			Department	conducts a drill to evaluate winter weather and snow removal policies.
Pandemic Preparedness	Implement infection control measures	New	Human Resources	Completion and implementation
Continuation of Government/Operations	Develop and implement COG/COOP plan	New	Emergency Management	Approval and implementation of plan.
Public Education and outreach				
Inform Citizens about Natural hazards	Provide municipal buildings with adequate methods of receiving alerts and warnings	Complete	EM/Communications	Verify that all municipal public buildings have methods of receiving weather alerts and warnings
	Continue annual NWS spotter program	Complete	EM	Bi-annual classes are provided with assistance from the National Weather Service
	Develop an emergency management website	New	IT/EM	Verify that the website is operational.
	Develop a school system and municipal building Emergency Response Team	Complete	EM	Custodial staff and nurses from school system have completed CERT training.
	Provide materials to support School and municipal buildings Emergency Response Teams	Complete	EM	School staff completing CERT training were supplied with CERT kits.
	Post multi-hazard information on the website.	Complete	EM/IT/ PIO	Periodic information is posted on the municipal web site including emergency information in advance of forecast threat
	Develop a community preparedness survey to determine what the community identifies as their mitigation and preparedness needs	Complete	EM/Citizen Corps Council	Surveys are developed and sent periodically to the public via email and/or internal programs.
	Develop program and educational opportunities based on the results of the survey	Complete	EM/Citizens Corps Council	Surveys results are compiled and evaluated for consideration of new programs.
	Implement an annual severe weather poster contest in local elementary schools	Complete	EM	Program is complete and in its third year.
	Annual severe	Complete	EM	See note above.

Goal/Objective	Action Item	Status since 2004 Plan	Responsible Party	Notes
	weather poster contest			
	Implement web-page with interactive street closures	Complete	Streets/Transportation	Web sites are complete
	Implement a Ready Kids Summer Camp	Complete.	EM, Fire, ARC, Cabarrus County EM, Kannapolis Fire	Program is now in the third year and supported through Citizen Corps Funding.

Benefit Cost Analysis²

Economic Analysis Approaches for Evaluating Mitigation Strategies

The approaches used to identify the costs and benefits associated with natural hazard mitigation strategies, measures, or projects fall into three general categories: benefit/cost analysis, cost-effectiveness analysis and the STAPLE/E approach. The distinction between the three methods are outlined below:

A. Benefit/Cost Analysis

Benefit/cost analysis is a key mechanism used by the North Carolina Division of Emergency Management, the Federal Emergency Management Agency, and other state and federal agencies in evaluating hazard mitigation projects, and is required by the Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law 93-288, as amended.

Benefit/cost analysis is used in natural hazards mitigation to show if the benefits to life and property protected through mitigation efforts exceed the cost of the mitigation activity. Conducting benefit/cost analysis for a mitigation activity can assist communities in determining whether a project is worth undertaking now, in order to avoid disaster related damages later. Benefit/cost analysis is based on calculating the frequency and severity of a hazard, avoided future damages, and risk. In benefit/cost analysis, all costs and benefits are evaluated in terms of dollars, and a net benefit/cost ratio is computed to determine whether a project should be implemented. A project must have a benefit/cost ratio greater than 1 (i.e., the net benefits will exceed the net costs) to be eligible for FEMA funding.

B. Cost-Effective Analysis

Cost-effectiveness analysis evaluates how best to spend a given amount of money to achieve a specific goal. This type of analysis, however, does not necessarily measure costs and benefits in terms of dollars. Determining the economic feasibility of mitigating natural hazards can also be organized according to the perspective of those with an economic interest in the outcome. Hence, economic analysis approaches are covered for both public and private sectors as follows.

Investing in public sector mitigation activities

Evaluating mitigation strategies in the public sector is complicated because it involves estimating all of the economic benefits and costs regardless of who realizes them, and potentially to a large number of people and economic entities. Some benefits cannot be evaluated monetarily, but still affect the public in profound ways. Economists have developed methods to evaluate the economic feasibility of public decisions which involve a diverse set of beneficiaries and non-market benefits.

Investing in private sector mitigation activities

Private sector mitigation projects may occur on the basis of one of two approaches:

- it may be mandated by a regulation or standard, or
- it may be economically justified on its own merits.

A building or landowner, whether a private entity or a public agency, required to conform to a mandated standard may consider the following options:

- 1) Request cost sharing from public agencies;
- 2) Dispose of the building or land either by sale or demolition;
- 3) Change the designated use of the building or land and change the hazard mitigation compliance requirement; or
- 4) Evaluate the most feasible alternatives and initiate the most cost effective hazard mitigation alternative.

The sale of a building or land triggers another set of concerns. For example, real estate disclosure laws can be developed which require sellers of real property to disclose known defects and deficiencies in the property, including earthquake weaknesses and hazards to prospective purchasers. Correcting deficiencies can be expensive and time consuming, but their existence can prevent the sale of the building. Conditions of a sale regarding the deficiencies and the price of the building can be negotiated between a buyer and seller.

C. STAPLE/E Approach

Conducting detailed benefit/cost or cost-effectiveness analysis for every possible mitigation activity could be very time consuming and may not be practical. There are some alternate approaches for conducting a quick evaluation of the proposed mitigation activities which could be used to identify those mitigation activities that merit more detailed assessment. One of these methods is the STAPLE/E Approach.

Using STAPLE/E criteria, mitigation activities can be evaluated quickly by steering committees in a systematic fashion. This criteria requires the committee to assess the mitigation activities based on the Social, Technical, Administrative, Political, Legal, Economic, and Environmental (STAPLE/E) constraints and opportunities of implementing the particular mitigation item in your community. The second chapter in FEMA's How-To Guide "Developing the Mitigation Plan – Identifying Mitigation Actions and Implementation Strategies" outlines some specific considerations in analyzing each aspect. The following are suggestions for how to examine each aspect of the STAPLE/E Approach:

Social

Community development staff, local non-profit organizations, or a local planning board can help answer these questions.

- Is the proposed action socially acceptable to the community?

- Are there equity issues involved that would mean that one segment of the community is treated unfairly?
- Will the action cause social disruption?

Technical

The City Departments with traditional public works functions, and engineering department staff can help answer these questions.

- Will the proposed action work?
- Will it create more problems than it solves?
- Does it solve a problem or only a symptom?
- Is it the most useful action in light of other community goals?

Administrative:

Elected officials or the city managers can help answer these questions.

- Can the community implement the action?
- Is there someone to coordinate and lead the effort?
- Is there sufficient funding, staff, and technical support available?
- Are there ongoing administrative requirements that need to be met?

Political

Consult the mayor, city council or planning commission, city administrator, and local planning Committee to help answer these questions.

- Is the action politically acceptable?
- Is there public support both to implement and to maintain the project?

Legal

Include legal counsel, land use planners, risk managers, and city council or planning commission members, among others, in this discussion.

- Is the community authorized to implement the proposed action?
- Is there a clear legal basis or precedent for this activity?
- Are there legal side effects? Could the activity be construed as a taking?
- Is the proposed action allowed by the comprehensive plan, or must the comprehensive plan be amended to allow the proposed action?
- Will the community be liable for action or lack of action?
- Will the activity be challenged?

Economic

Community economic development staff, civil engineers, zoning department staff, and the assessor's office can help answer these questions.

- What are the costs and benefits of this action?

- Do the benefits exceed the costs?
- Are initial, maintenance, and administrative costs taken into account?
- Has funding been secured for the proposed action? If not, what are the potential funding sources (public, non-profit, and private)?
- How will this action affect the fiscal capability of the community?
- What burden will this action place on the tax base or local economy?
- What are the budget and revenue effects of this activity?
- Does the action contribute to other community goals, such as capital improvements or economic development?
- What benefits will the action provide? (This can include dollar amount of damages prevented, number of homes protected, credit under the CRS, potential for funding under the HMGP or the FMA program, etc.)

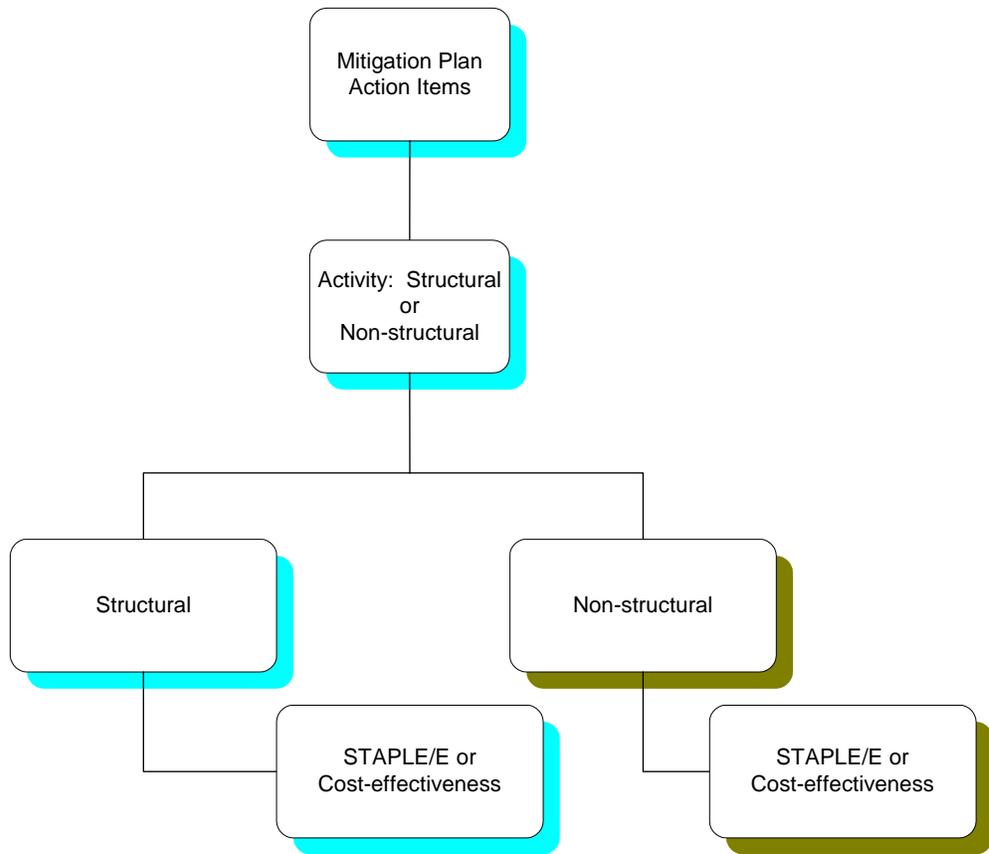
Environmental

Watershed councils, environmental groups, land use planners and natural resource managers can help answer these questions.

- How will the action impact the environment?
- Will the action need environmental regulatory approvals?
- Will it meet local and state regulatory requirements?
- Are endangered or threatened species likely to be affected?

The STAPLE/E approach is helpful for doing a quick analysis of mitigation projects. Most projects that seek federal funding and others often require more detailed Benefit/Cost Analyses.

Depending on the potential funding source the City will apply one of the methods above to determine the economic feasibility as indicted in the following flow chart.



Choosing a Approach

Concord’s initial step in developing a mitigation strategy was to establish goals and objectives that aim to reduce or eliminate the jurisdictions long-term vulnerability to natural hazard events. Goals are generalizations explaining what the City wants to achieve in terms of hazard and loss prevention. Objectives are specific measurable strategies or implementation steps used to achieve the identified goals.

The strategies to achieve the hazard mitigation goals of Concord’s Hazard Mitigation Plan were developed by analyzing the most probable scenarios based on the risk assessment. City staff was consulted to assist with the prioritization of hazards based on their frequency, severity and impact. Departments were requested to submit strategies which were analyzed using input from the public meetings, questionnaires results, input from outreach projects and consideration of projects from the 2004 plan to develop strategies.

Implementation Methodology

Future methodology for prioritizing the City’s mitigation actions will include the STAPLEE Criteria and implementation categories presented above. This process will

assign a numerical value to each action based on 10 criteria (STAPLEE, number of objectives, project cost and project time frame).

Additional Considerations

Conducting an economic analysis for potential mitigation activities can assist decision-makers in choosing the most appropriate strategy for their community to reduce risk and prevent loss from natural hazards. Economic analysis can also save time and resources from being spent on inappropriate or unfeasible projects. Several resources and models are listed on the following page that can assist in conducting an economic analysis for natural hazard mitigation activities.

Benefit/cost analysis is complicated, and the numbers may divert attention from other important issues. It is important to consider the qualitative factors of a project associated with mitigation that cannot be evaluated economically. There are alternative approaches to implementing mitigation projects. Many communities are looking towards developing multi-objective projects. With this in mind, opportunity rises to develop strategies that integrate natural hazard mitigation with projects related to watersheds, environmental planning, community economic development, and small business development, among others. Incorporating natural hazard mitigation with other community projects can increase the viability of project implementation.

After identifying the appropriate strategies, an priority will be assigned to the project of high, medium, or low for benefit and cost. This financial analysis will contribute to the decision of which action items to implement.

To approximate benefit, the savings in future expected damage considered the following:

- Frequency of the hazardous event
- Longevity of the benefit
- Discounted present value of future benefits

Per FEMA requirements, the estimation of benefits did not include the value of human lives or cultural values. However, these items were considered when selecting final action items to include in the implement.

¹ Mitigation actions may or may not require external funding to accomplish. For example, the modification of a given policy to better address identified hazard concerns may require staff time and internal resources, whereas the large scale acquisition of flood-prone properties may necessitate seeking state or federal funding assistance

² Goettel & Horner Inc., Cost/Benefit Analysis of Hazard Mitigation Projects, Prepared for FEMA's Hazard's Mitigation Branch, 10/25/1995

Horner, Gerald, Benefit/Cost Methodologies for use in Evaluating Cost Effectiveness of Proposed Hazard Mitigation Measures, Robert Olson Associates, July 1999

Federal Emergency Management Agency, *Benefit/Cost Analysis of Hazard Mitigation Projects*, Riverine Flood, Version 1.05, Hazard Mitigation Economics Inc., 1996.

Federal Emergency Management Agency *Report on Costs and Benefits of Natural Hazard Mitigation*. Publication 331, 1996.

Oregon Natural Hazards Workgroup

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Section 5 Plan Maintenance

FEMA Requirements

Part 201.6(c) (4) (i) The plan shall include a plan maintenance process that includes a section describing the method and schedule of monitoring, evaluating and updating the mitigation plan within a five-year cycle.

Part 201.6(c)(4)(ii): The plan maintenance process shall include a process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.

Part 201.6(c)(4)(ii): The plan maintenance process shall include a process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.

Part 201.6(c)(5): The plan shall include documentation that the plan has been formally adopted by the local governing body of the jurisdiction requesting approval of the plan. For multi- jurisdictional plans, each jurisdiction requesting approval of the plan must document that it has been formally adopted.

This section consists of the following three subsections:

- 1) Overview
- 2) Amendments
- 3) Continued Public Involvement

Overview

The Division of Emergency Management will monitor and coordinate the implementation of mitigation actions identified in the plan. The Planning Department will be the lead agency for plan development, update and review.

As part of the monitoring process, the DEM will work at a minimum to:

- Provide a summary of any hazard events that occurred during the prior year and the impact on the community.
- Review successful mitigation strategies identified in the HMP.
- Explain why any strategies have not been implemented.
- Review the action items to determine if the project timelines need to be amended and there are changes in funding or grant opportunities.
- Work with departments to create new mitigation projects.
- Provide a report on impacts of any other planning programs or initiatives within the City that involve hazards mitigation.
- Assess the current version of the plan and determine the necessary improvement for the 5-year update.
- Conduct site visits to obtain reports of completed or initiated mitigation strategies to incorporate in the plan update as needed.

- Research and document new disaster information pertaining to Concord during the five-year HMP update cycle.
- Develop and organize a Mitigation Advisory Committee to discuss relevant hazard mitigation issues, provide status updates, and discuss available grant opportunities.
- Convene a meeting of the MIC following a natural disaster or when funding is announced to prioritize and submit potential mitigation actions for funding.

Section 201.6.(d)(3) of Title 44 of the CFR requires that the HMP be reviewed, revised if appropriate, and resubmitted to FEMA for approval in order to remain eligible for funding given out by FEMA under the Disaster Mitigation Act. The HMP will be updated every five years to reflect the results of the annual reports and ongoing plan monitoring and evaluation by the DEM, Zoning and MIC. The DEM and MIC will assess and incorporate recommended comments expressed by FEMA in the initial review to the plan revision. At the end of the planning cycle, the DEM will submit the updated Plan to the North Carolina DEM for review and preliminary approval. The State will then submit the Plan to FEAM for Final Review. After the State and FEMA have approved the HMP, the City will formally adopt the Plan by a Council vote.

As part of this process, some minimum requirements will need to be met, including:

- The hazard risk assessments will be revised and updated using best available information and technologies on an annual basis. This effort shall include new analysis of Concord's Hazard Inventory Assessment using new data available to the City.
- Critical Structures will be evaluated and mapping will be updated.
- The action items will be reviewed and revised to account for any actions completed, dropped, or changed, and to account for any changes in the risk assessment or new City policies identified under other planning mechanism as appropriate.
- The draft HMP update will be sent to appropriate departments for comment.
- The public will be given an opportunity to comment prior to adoption.
- The City Council will adopt the updated plan, as approved by FEMA.

Five-Year Plan Review

The Plan will be reviewed at a minimum on a 5-year cycle by the Concord Emergency Planning Committee to determine if any major changes have occurred that necessitate changes to the types of mitigation actions outline herein. Such items as new developments in hazard areas, increased exposures to hazards, the local capability to address the identified hazards and changes to federal or state legislation and the results of post incident assessments are examples that may require change.

A review of the plan allows the community an opportunity to evaluate strategies that have been successful and the opportunity to document potential losses avoided due to the

various strategies. It also allows unsuccessful goals to be addressed and changed or removed.

The committee has adopted the following questions which should be answered during the five-year plan review process:

- Do the goals and actions address current and expected conditions?
- Has the nature or magnitude of hazard risk changed?
- Are current resources adequate to implement the Plan?
- Should additional local resources be committed to address identified hazard threats?
- Are there any issues that have limited the current implementation schedule?
- Have the implementation of identified mitigation actions resulted in expected outcomes?
- Has the Mitigation Planning Committee measured the effectiveness of completed hazard mitigation projects in terms of specific dollar losses avoided?
- Did the jurisdictions, agencies and other partners participate in the plan implementation process as proposed?

Amendments

If changes are warranted by reviews, the information will be disseminated to all departments and the community to seek input on the proposed amendments', allowing a 45 day review and comment period. Any comments received during this period will be forwarded to the Emergency Planning Committee for final consideration. The committee will review the amendment along with any comments received and if acceptable, the committee will submit a recommendation for the approval and adoption of changes to the Plan to each departments within 45 days.

Each of the following factors will be considered for amendments to the plan:

- There are errors, inaccuracies or omissions made in the identification of issues/needs in the Plan;
- New issues/needs have been identified which are not adequately addressed in the Plan;
- There has been a change in data or assumptions from those upon which the Plan is based.

Prior to adoption of the Plan, a public hearing will be held. This will allow community partners to review the recommendations and actively participate in comments. Any written or oral comments will be reviewed and after that a review one of the following actions will be taken:

- Adopt the proposed amendments as presented;
- Adopt the proposed amendments with modifications;

- Refer the amendments request back to the Emergency Planning Committee for further revision; or
- Defer the amendment request back to the Emergency Planning Committee for further consideration and/or additional hearings.

Upon completion of the review and update/amendment process, the City of Concord Hazard Mitigation Plan will be submitted to the North Carolina Division of Emergency Management State Hazard Mitigation Officer for review and approval. The State Hazard Mitigation Officer will submit the Plan amendments to the Federal Emergency Management Agency for final review as required by the Disaster Mitigation Act of 2000.

Disaster Declaration

Following a state or federal disaster declaration, the Concord Emergency Planning will convene and the Plan will be revised as necessary to reflect lessons learned or to address specific circumstances arising from the event. In some circumstances it may be necessary for the committee to convene following localized emergencies and disasters in order to determine if changes in the Plan are warranted. It will be the responsibility of Division of Emergency Management to reconvene the Emergency Planning Committee and ensure that the appropriate stakeholders are invited to participate in the plan revision and update process.

Incorporation into Existing Planning Mechanisms

Through adoption, the City Council will coordinate the HMP recommendations with the recommendations of additional planning documents, particularly as they pertain to achieving the goals of plans such as the Center City Plan, Downtown Master Plan and other land use plans. Although many of these plans do not explicitly mention coordination with the HMP, many of the HMP strategies support the goals of these plans.

When updating other planning documents and the HMP, the City should coordinate between these planning elements. Utility plans which provide utilities such as water, electricity, sewer and waster removal, gas supply and other household utilities. The HMP encourages programs which improves the disaster resiliency of utility systems through mitigation programs and retrofitting of utility supply equipment.

Transportation plans which encourage multi-modal transportation including vehicular, pedestrian and bicycle access within the City, can incorporate improvements which will improve the transportation network such that supplies and people can be moved within, into and out of Concord in the event of a hazard.

Land use planning allows the City to manage growth. This can be used to mitigate the effects of drought by requiring the extension of water and sewer lines prior to annexation to leverage responsible development standards. Recently, master plans for parks, transportation, water and sewer and downtown development which incorporate mitigation methodologies.

The Developmental Services Department provides a central point of contact for developers through the review process which coordinates the various reviews of departments. This assures that problems are solved and the various concerns, including mitigation goals, are addressed.

Though not a planning mechanism, public awareness through education is a proven method of disaster mitigation. The City provides staffing in various departments to provide education to the public. These agencies often coordinate activities which incorporate mitigation activities and are included as action items within the plan.

Throughout the plan maintenance cycle, the City will work to integrate hazard mitigation goals and actions into the general operations of its agencies. The Emergency Planning Committee will work with agencies to identify opportunities as outlined below:

- Update work plans, policies, or procedures to include hazard mitigation concepts.
- Establish mitigation funding within capital and operational budgets.
- Issue plans, policies, executive orders, regulations, or other directives to carry out mitigation actions.
- Add hazard mitigation elements to redevelopment plans.

Continued Public Involvement

Public involvement is essential to the continual review and updates of the plan. Copies of the plan will be catalogued and kept at the local public library. The existence and location of copies of the plan will be publicized in the Citi-Line and quarterly City Newsletter. In addition any proposed changes will be posted on the City's website. The site will also contain an email address and phone number to which people can direct their comments and concerns.

The Community's Recognized Neighborhood Program will be the primary means of outreach to the community. The Emergency Management Division will seek community input through this program. Other efforts will include:

- Concord 101,
- Public Safety Academy
- Concord Citizen Corps Council and
- Utilization of media to update the public of any maintenance or periodic review activities taking place.

Emerging Trends

Concord's population continues to grow. Population growth and further development in hazard prone areas can increase the vulnerability to natural hazards. Concord has incorporated many goals and objectives into its planning mechanisms and other

community efforts. This is reflected in the Core Values which state: We are concerned about our natural, historic, economic and aesthetic resources and endeavor to enhance their sustainability for future generations and We use education, prevention and enforcement methods to protect life and property in our businesses and residential neighborhoods, and maintain our infrastructure and facilities to provide a safe environment in which to live, work, shop and play”.

Examples of incorporation of existing mitigation items into plans and programs include:

- The Emergency Management Division and Storm Water Department document and investigate reports of flooding and coordinate with GIS to identify problem areas. This information is incorporated into planning documents and reviews. One ongoing effort of this project has been to identify the cause of residential flooding in the Old South Community in an area outside of the mapped flood plain. An internal study, based on national standards, has identified this unmapped area as being within the floodplain of a perennial stream. Efforts are currently being undertaken to extend the mapped area and incorporate measures which will improve storm water drainage.
- Roads prone to flooding are identified and departments work to determine the cause to incorporate into planning mechanism such as Flood Plain Management, Storm Water Utilities and Transportation Planning.
- New construction plans are now monitored for stream buffer protection for preservation along perennial and intermittent streams.
- Mitigation strategies to mitigate flooding were incorporated into land use planning through the development of a successful greenway program with two operational greenways and additional ones planned.
- Waste Water utility planning incorporated a telemetry system to monitor wet well levels.
- Transportation and emergency management have evaluated the Turn-Around-Don't-Drown program to provide site specific warning for roadways identified to be flood prone and are seeking funding sources.
- Planning for new school construction includes identification of safe areas within the school.
- Development Permits are reviewed for compliance with flood prevention mitigation.
- Water resources planning reduced customer use through a tiered rate system and reduction of allowable irrigation days. This successfully reduced consumption from 6400 to 4700 gallons per month.

- Community development planning requires the burial of power lines.

Further planning and program development is expected to continue to address the frequency and severity of natural hazards. The future for funding of mitigation efforts remains optimistic. As with other governmental services, mitigation efforts will continue to face financial funding hurdles and other hurdles if workforce reductions become necessary. The STAPLEE program, which will be used as evaluation of future programs will assist in prioritization.

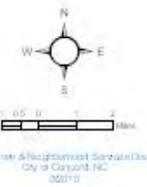
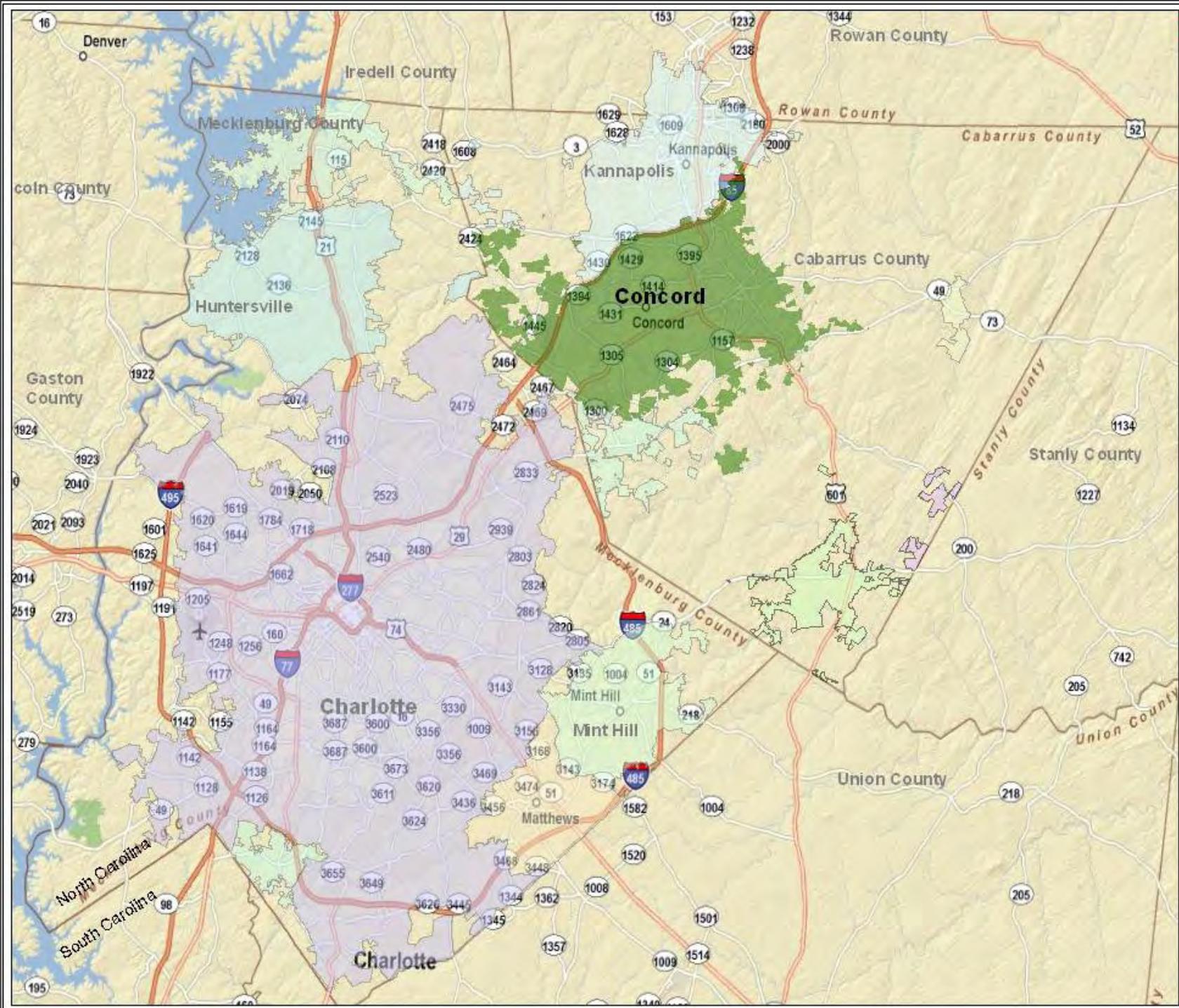
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APPENDIX A MAPS

- Regional Map
- Topographic Map
- Zoning Map
- Current Land Use
- Commercial and Residential Buildings
- Population Density
- Main Transportation Arteries
- Motorized Transportation Network
- Critical Facilities
- Community Facilities
- Fire Districts
- Police Zones
- Sub-divisions
- Recognized Neighborhoods
- Manufactured Homes
- Existing and Proposed Greenways
- Streams and Lakes
- Dams
- Existing and Potential Floodplains
- Population Density and 100 year Floodplain
- Zoning and 100 year Floodplain



Regional Map

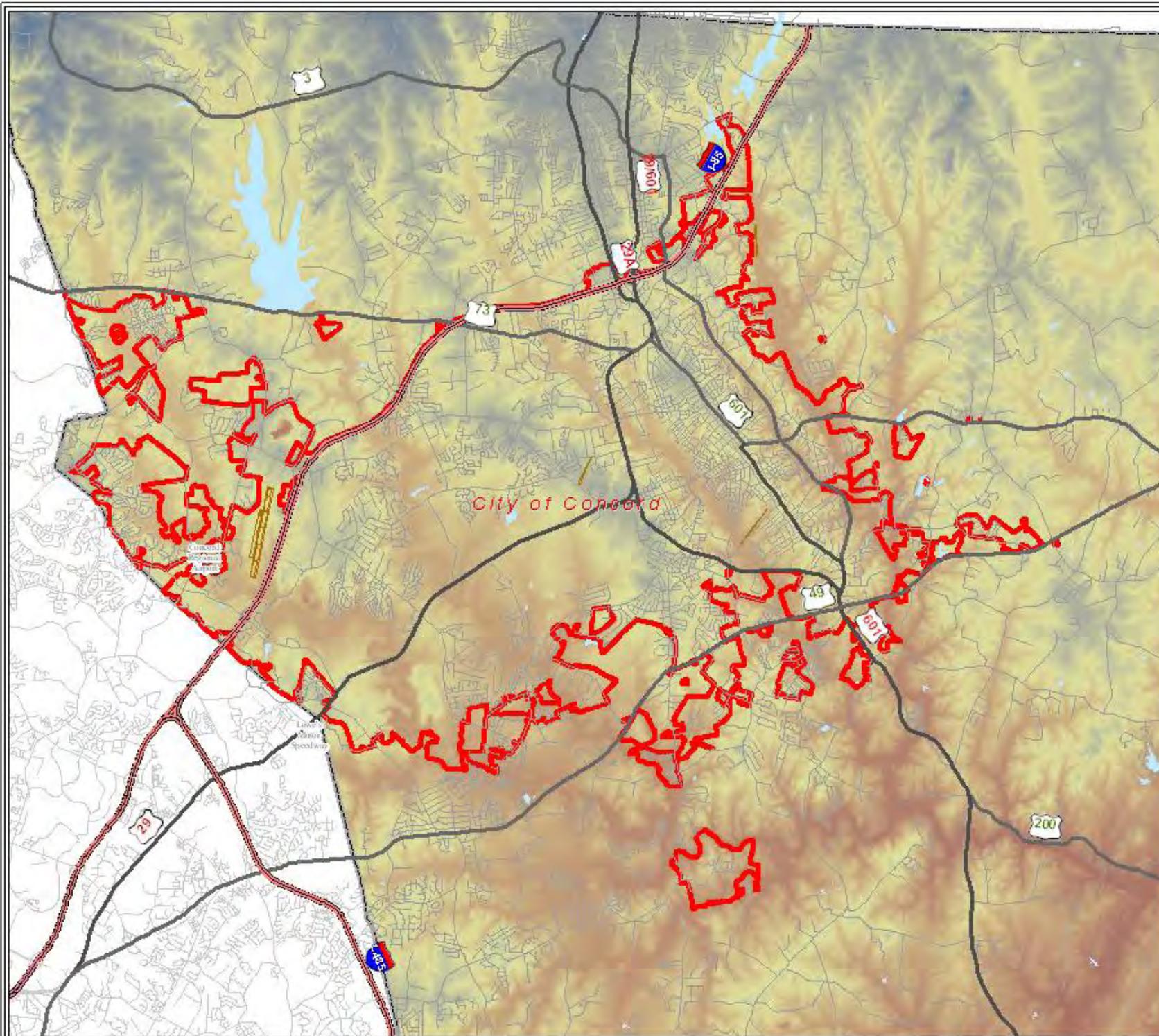


Source: & Neighborhood Services Div.
City of Concord, NC
2020

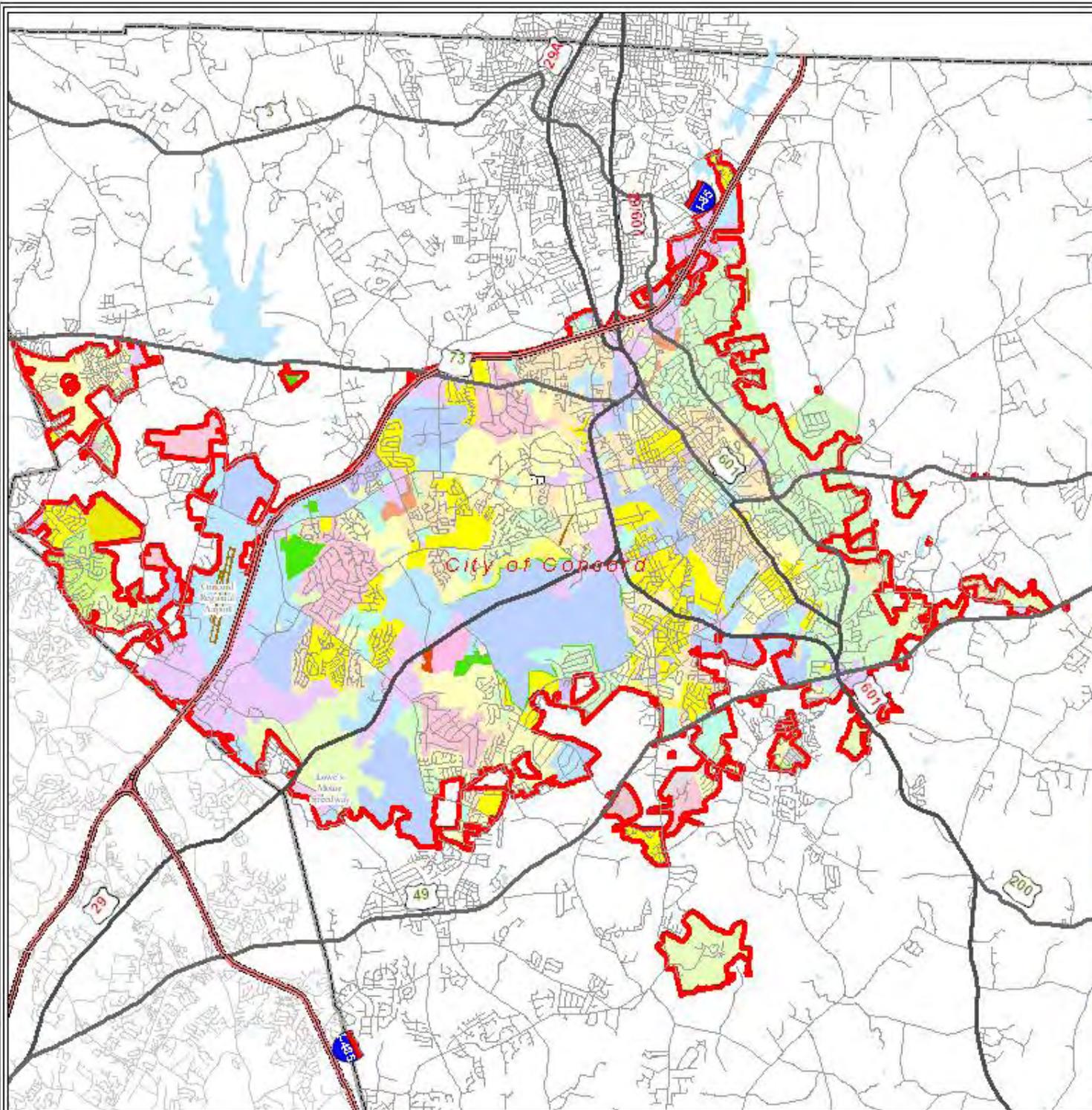
Topographic Map

Legend

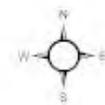
- Airport
- Streets
- Lakes & Ponds
- City of Concord
- Cabarrus Co.
- Topography**
 - High
 - Low



Zoning Map

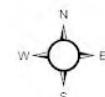
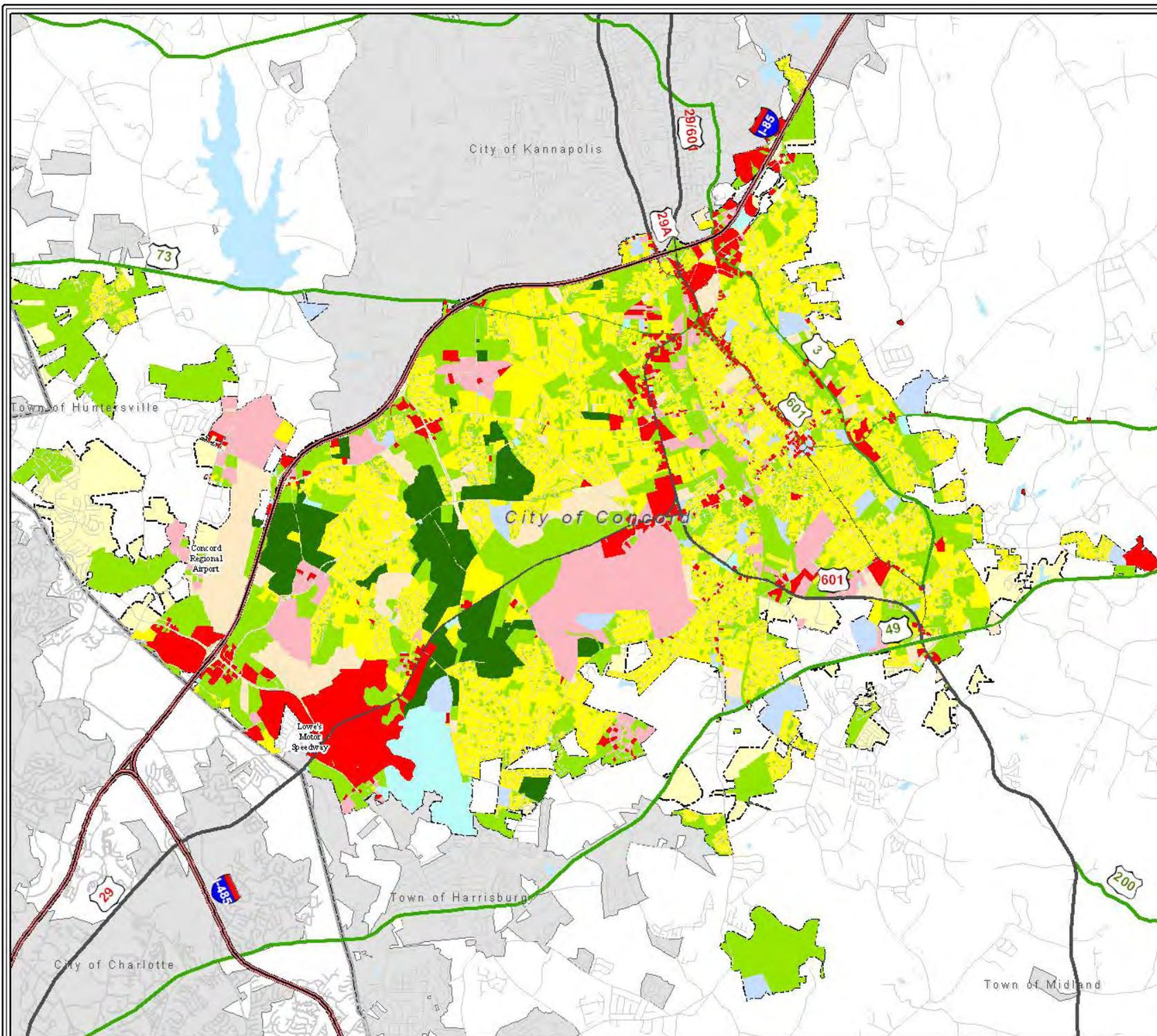


- Legend**
- Airport
 - Streets
 - Lakes & Ponds
 - City of Concord
- Zoning**
- ZONINGCODE
- AG
 - B-1
 - C-1
 - C-2
 - CC
 - CC/TC
 - CD
 - CUB-1
 - CUC-1
 - CUC-2
 - CUI-1
 - CUI-2
 - CUO-1
 - CURC
 - CURE
 - CURM-2
 - CURV
 - I-1
 - I-2
 - MHP
 - MX-CC1
 - O-1
 - PID
 - PRD
 - PUD
 - R-CO
 - RC
 - RE
 - RL
 - RM-1
 - RM-1-CD
 - RM-2
 - RV
 - TND
 - county
 - not-yet-zoned
 - Cabarrus Co.



Current Land Use

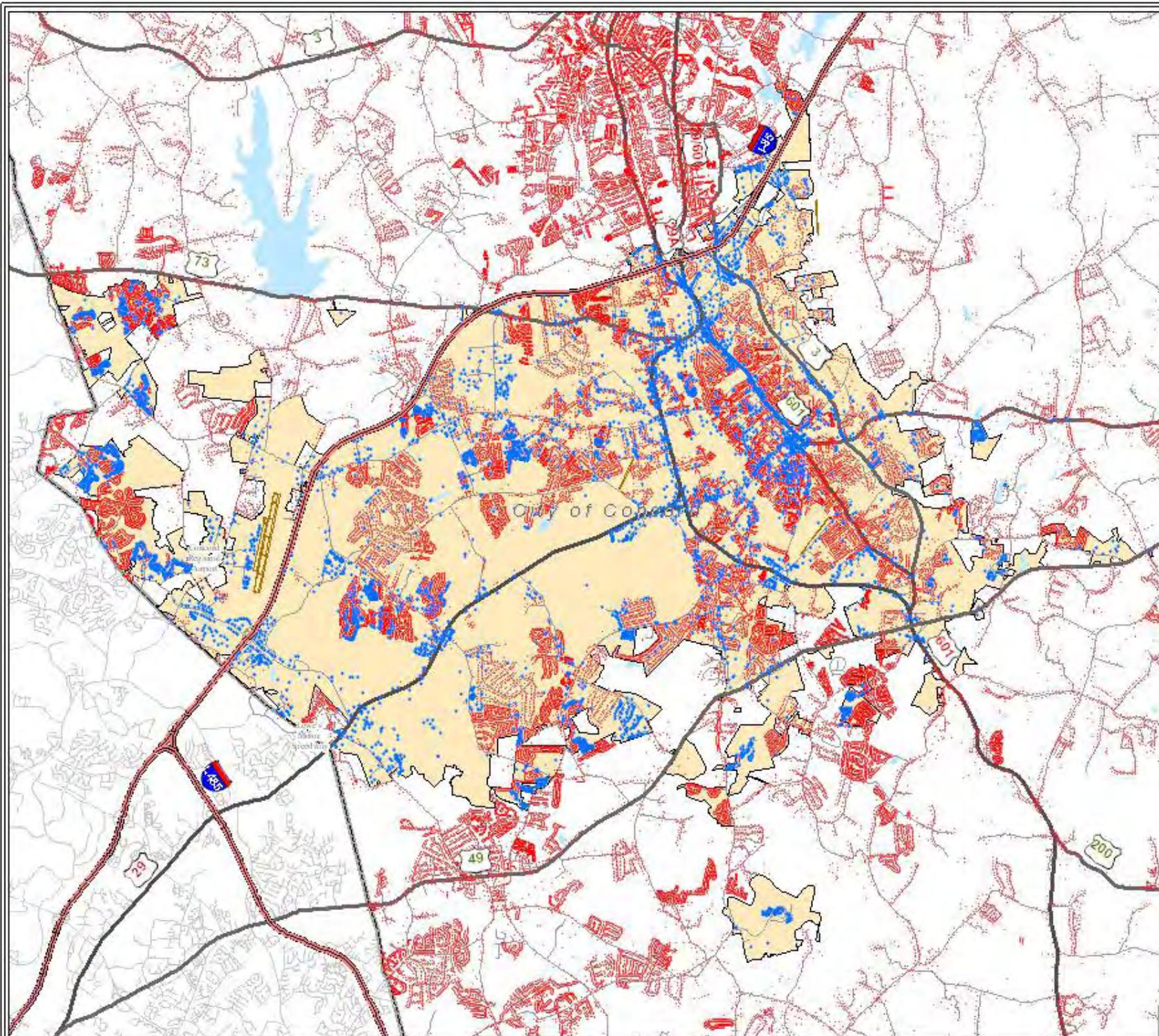
- Legend**
- Land Use CATEGORY**
- Agricultural
 - Commercial
 - Government
 - Industrial
 - Institutional
 - Miscellaneous
 - Residential
 - Vacant
 - Streets
 - Lakes & Ponds
 - Cabarrus Co.
 - City of Concord
 - Other Cities



Commercial and Residential Buildings

Legend

- Commercial Buildings
- Residential Buildings
- Airport
- Streets
- Lakes & Ponds
- City of Concord
- Cabarus Co.

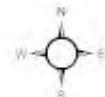
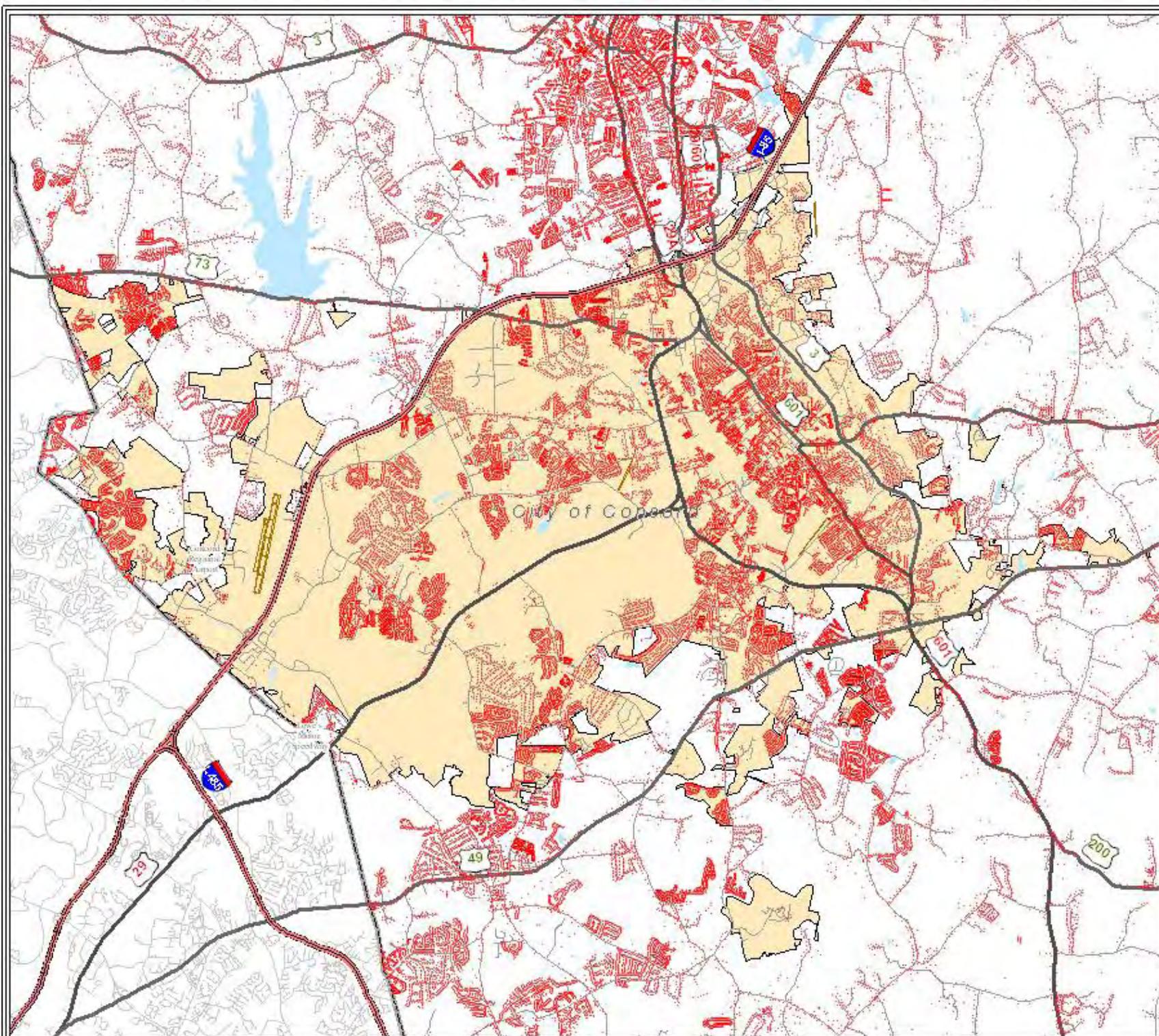


Population Density

(Signified by red areas)

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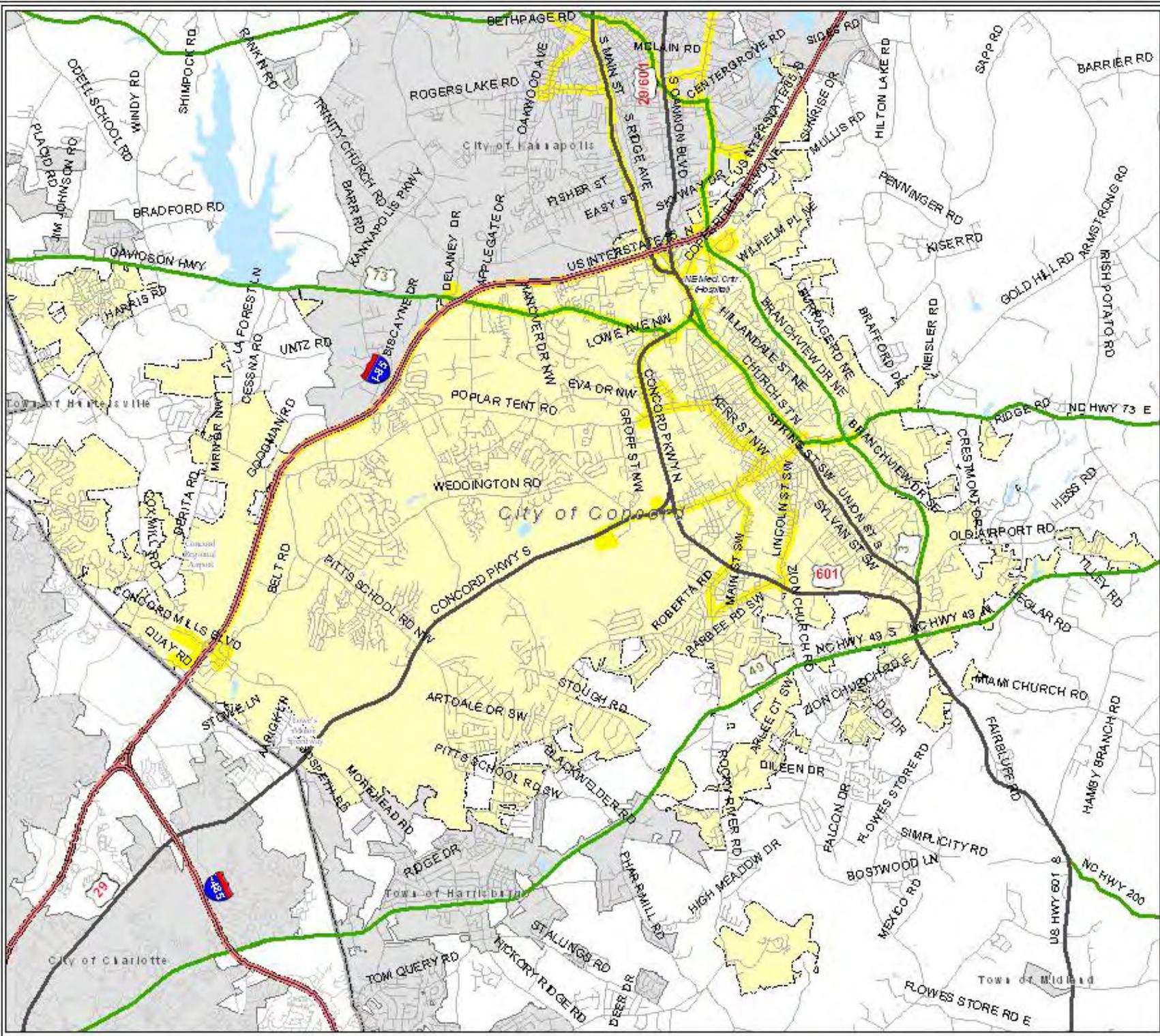
- Population Density
- Airport
- Streets
- Lakes & Ponds
- City of Concord
- Cabarrus Co.





Main Transportation Arteries

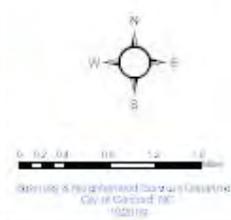
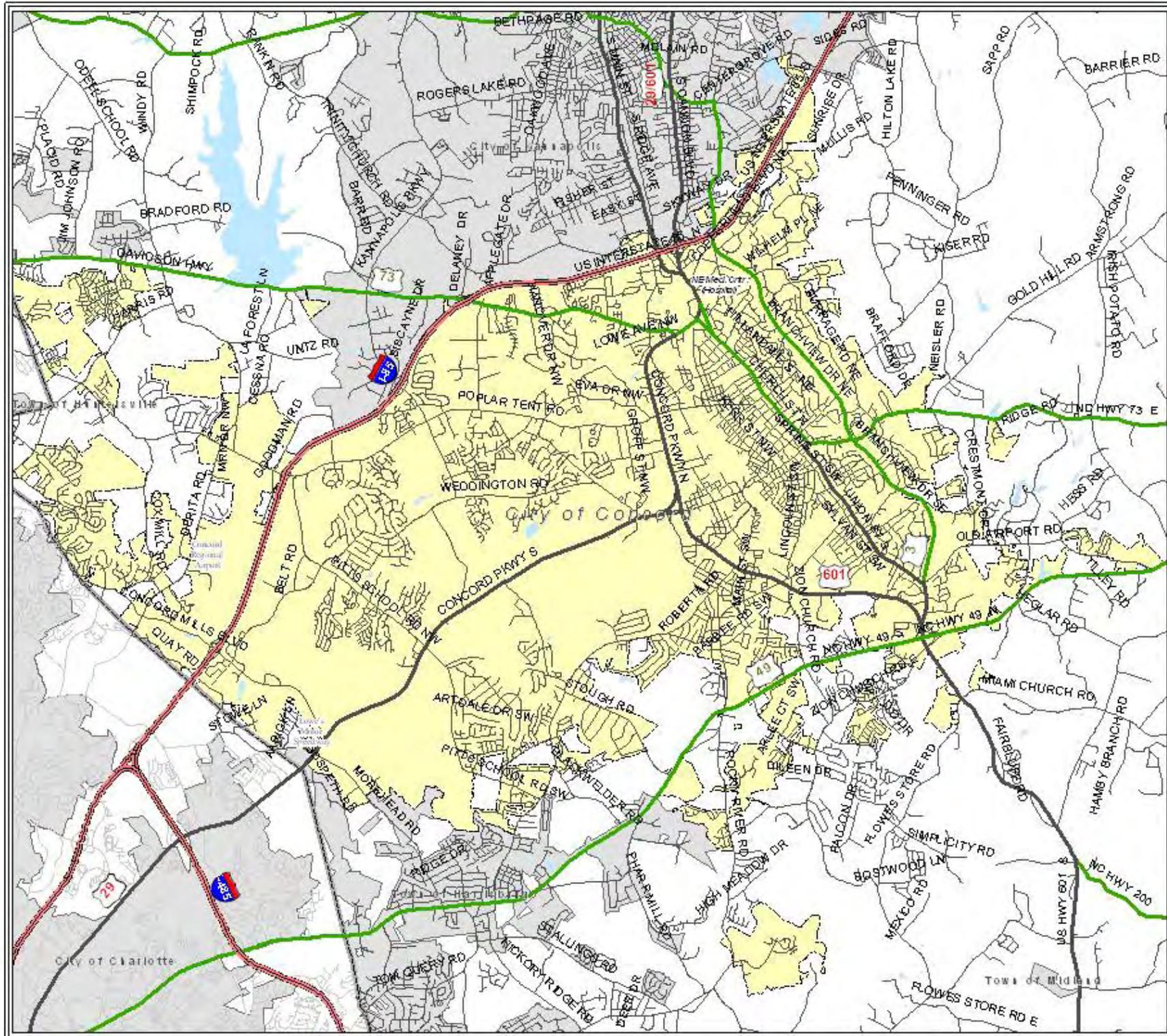
- Legend**
- Interstates
 - Highways**
 - TYPE**
 - IN
 - NC
 - US
 - Streets**
 - Bus Routes
 - Lakes & Ponds
 - Cabarrus Co.
 - City of Concord
 - Other Cities





Motorized Transportation Network

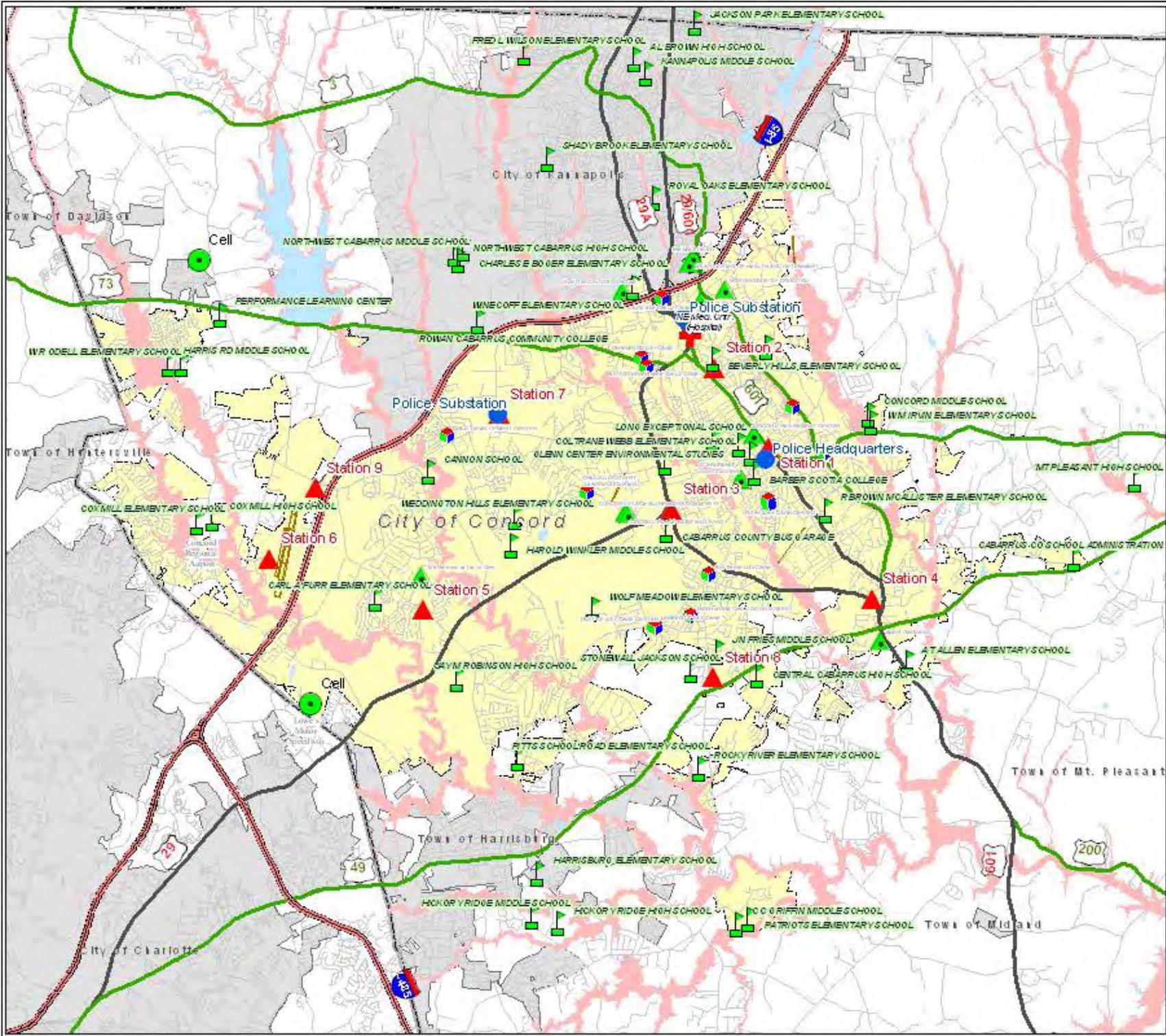
- Legend**
- Streets
 - Lakes & Ponds
 - ▭ Cabarrus Co.
 - ▭ City of Concord
 - ▭ Other Cities



Planning & Transportation Services
City of Concord, NC
10/2019

Critical Facilities

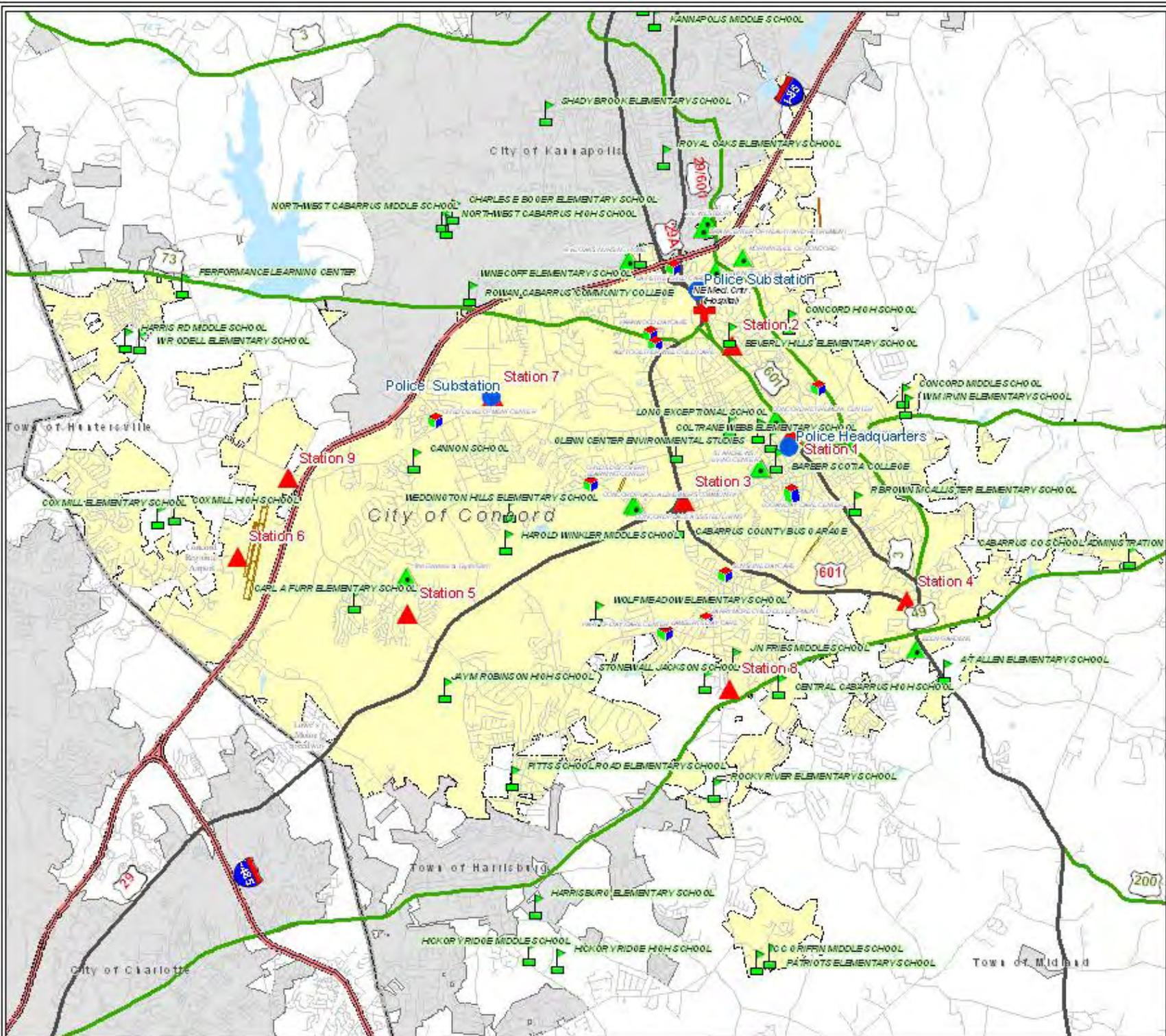
- Legend**
- Airport
 - Hospital
 - Cell Towers
 - Schools
 - Daycares
 - Homes for the Aged
 - Fire Stations
 - Police Stations
 - 100 year flood plain
 - Streets
 - Lakes & Ponds
 - Cabarrus Co.
 - City of Concord
 - Other Cities



Community Facilities

Legend

- Airport
- Hospital
- Schools
- Daycares
- Homes for the Aged
- Fire Stations
- Police Stations
- Streets
- Lakes & Ponds
- Cabarrus Co.
- City of Concord
- Other Cities



Fire Districts

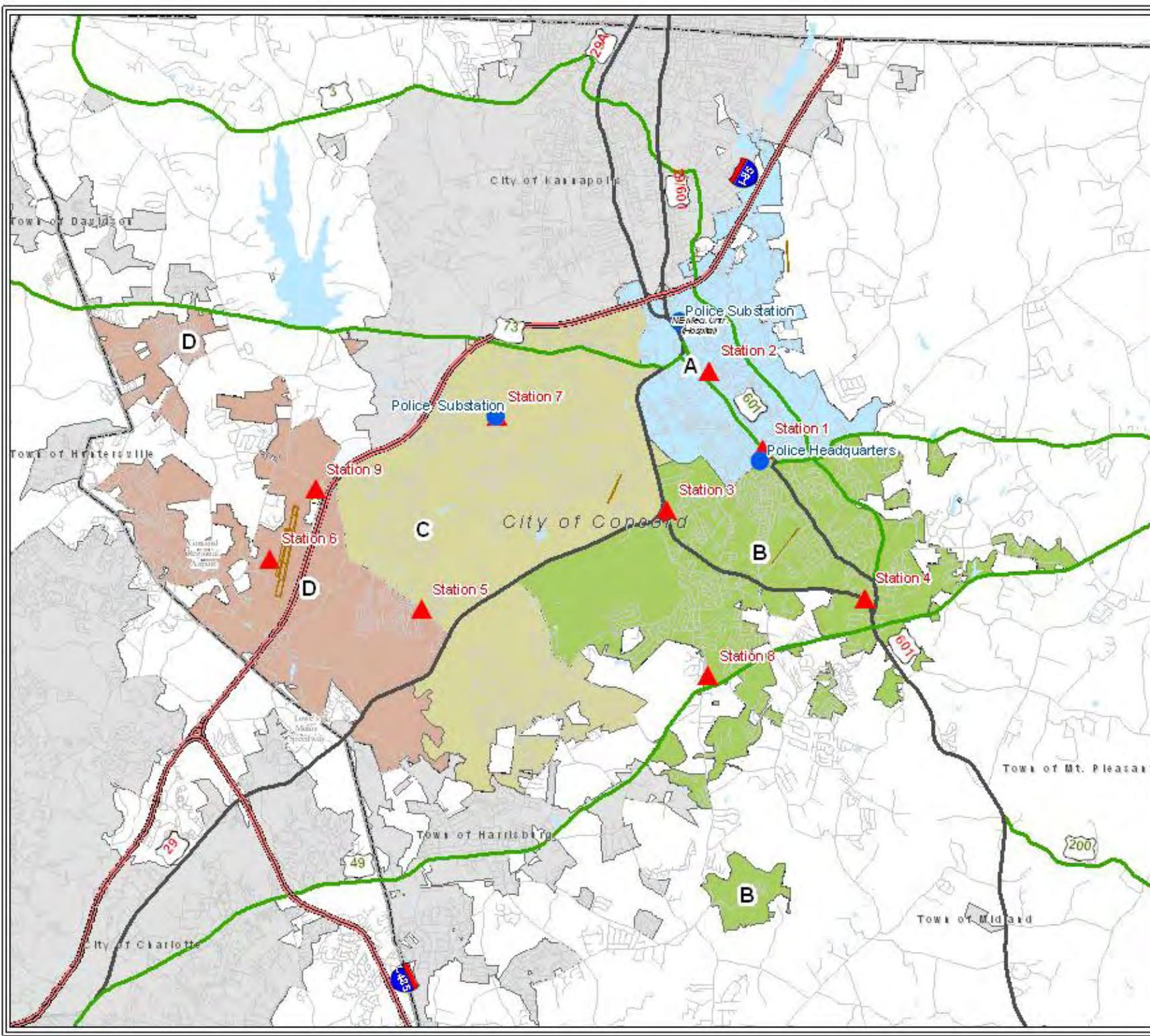
Legend

- Apartment
- Fire Stations
- Police Stations
- Skate
- Lakes & Ponds

Fire District Zones

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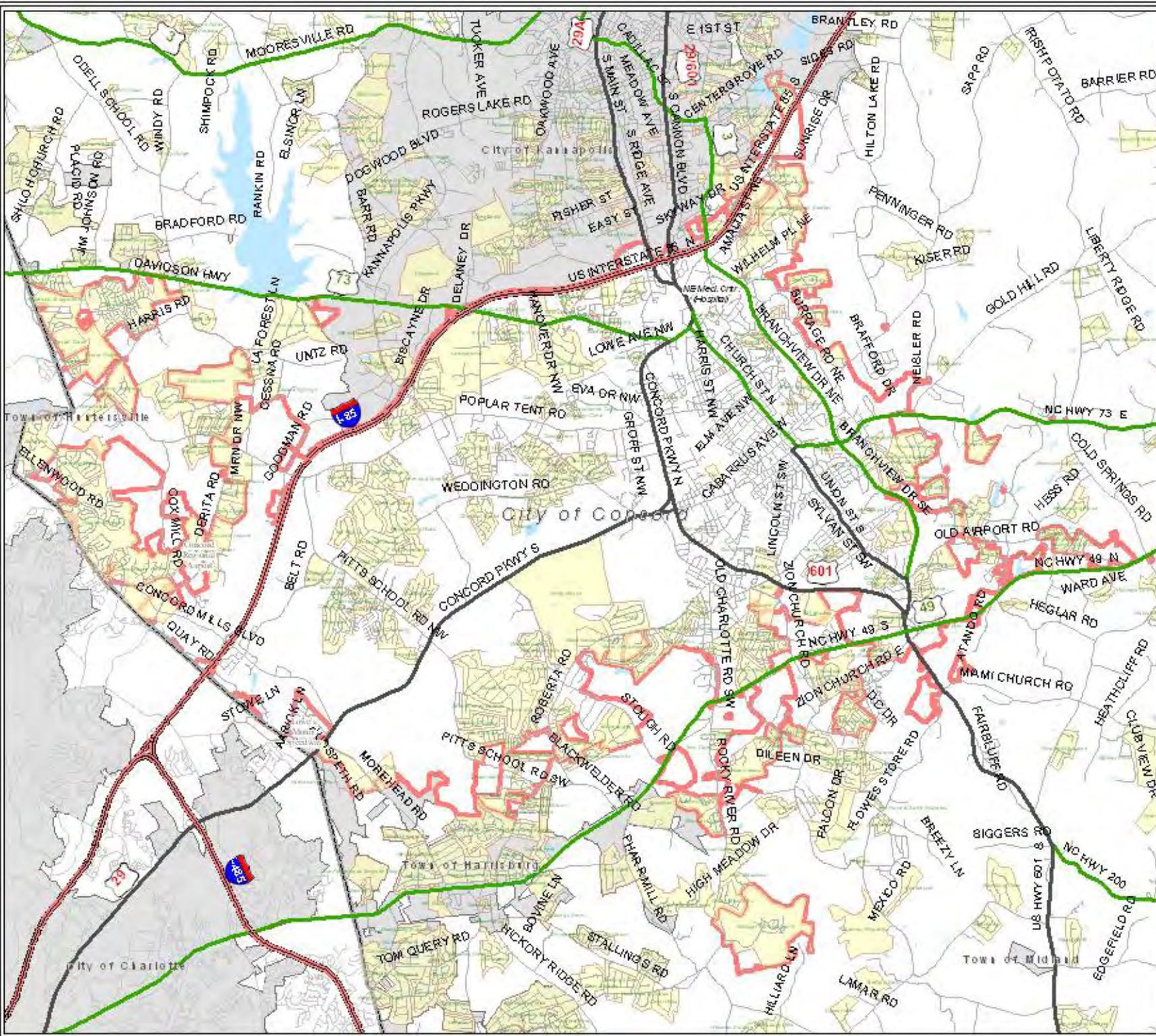
Police Districts



- Legend**
- Airport
 - Fire Stations
 - Police Stations
 - Streets
 - Lakes & Ponds
 - Police Districts**
 - A
 - B
 - C
 - D
 - Cabarrus Co.
 - City of Concord
 - Other Cities



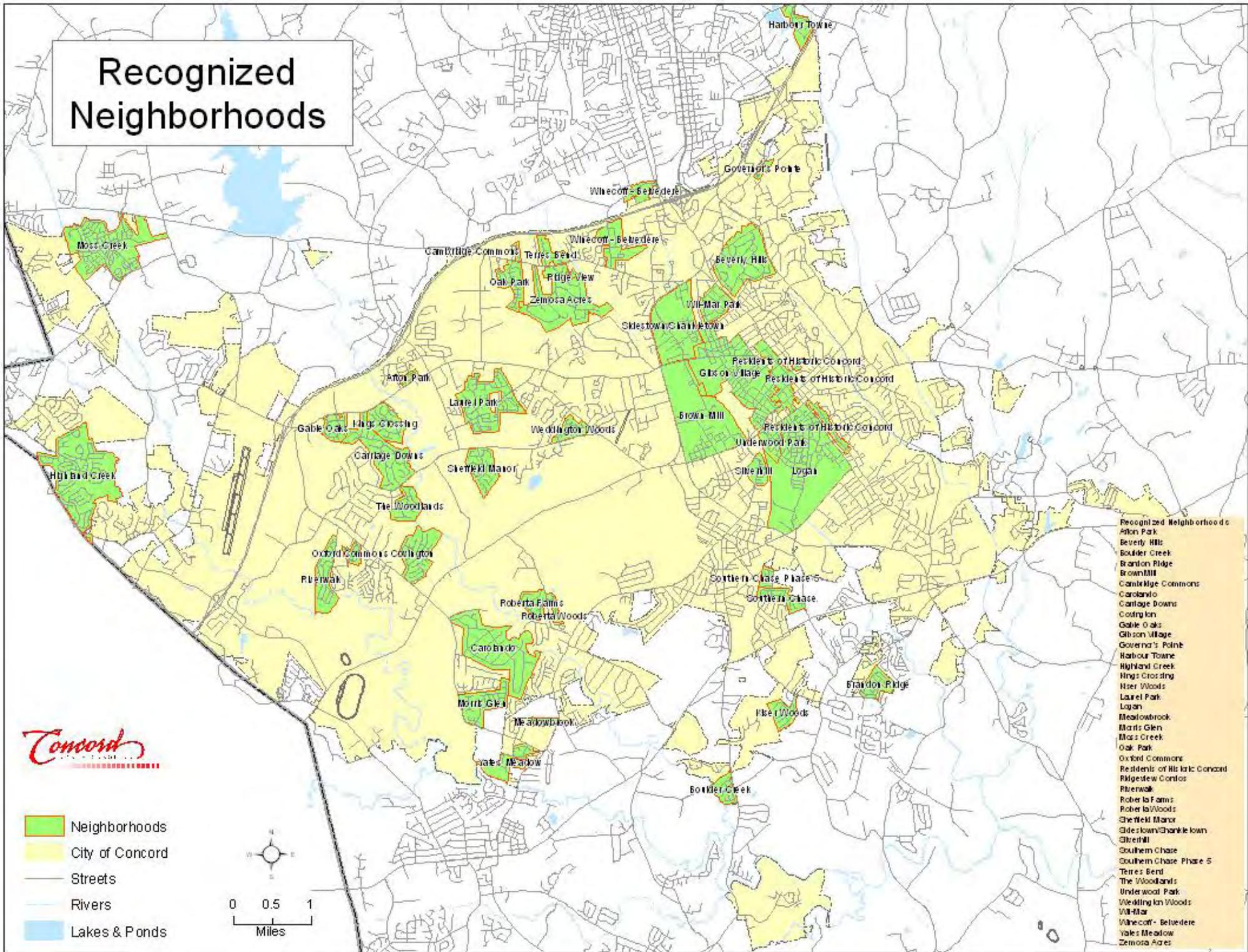
Subdivisions



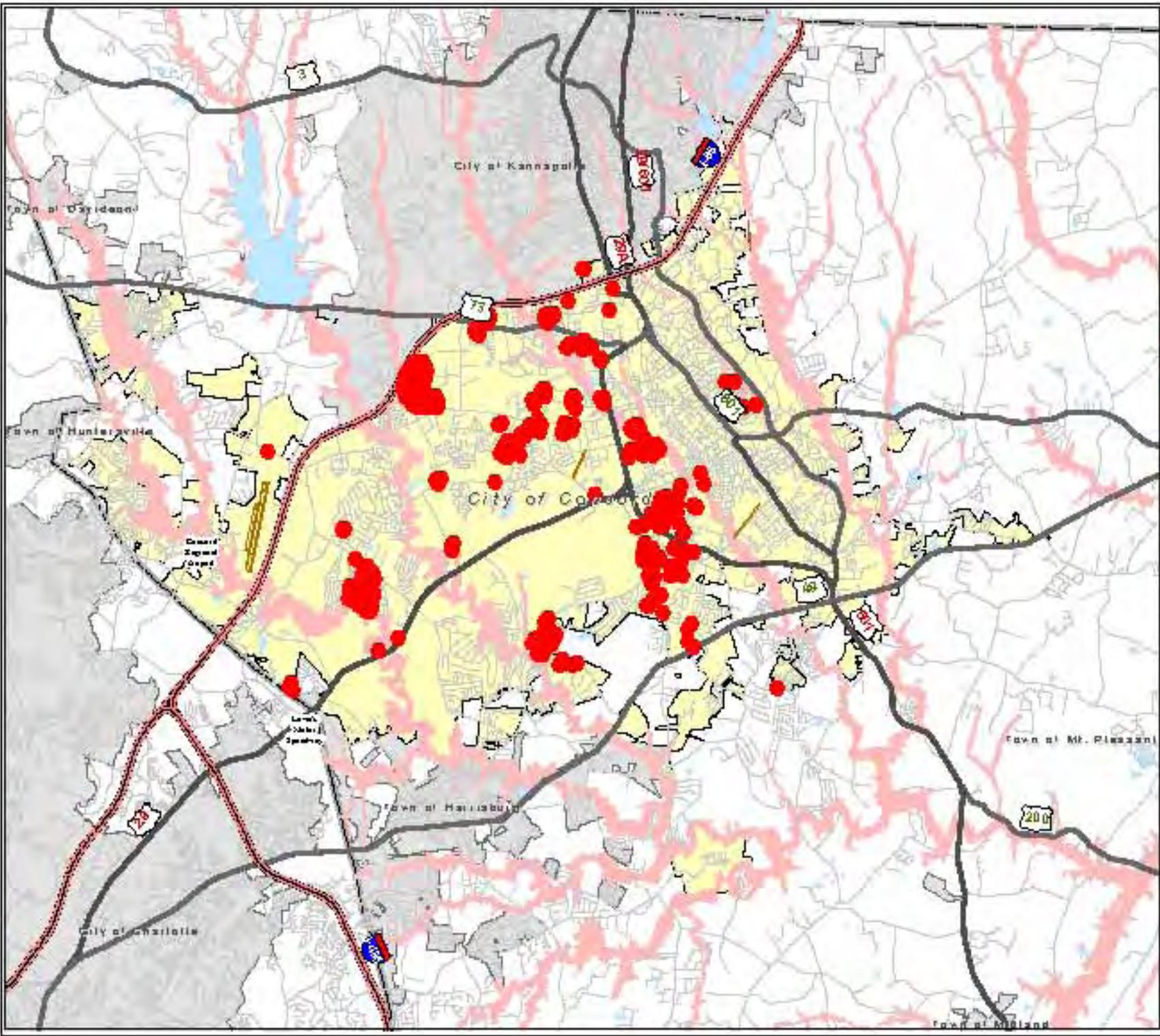
- Legend**
- Interstates
 - Highways**
 - TYPE**
 - IN
 - NC
 - US
 - Streets
 - Lakes & Ponds
 - Subdivisions
 - Cabarrus Co.
 - City of Concord
 - Other Cities



Recognized Neighborhoods

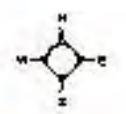


Manufactured Homes in Concord



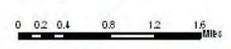
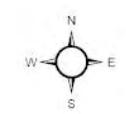
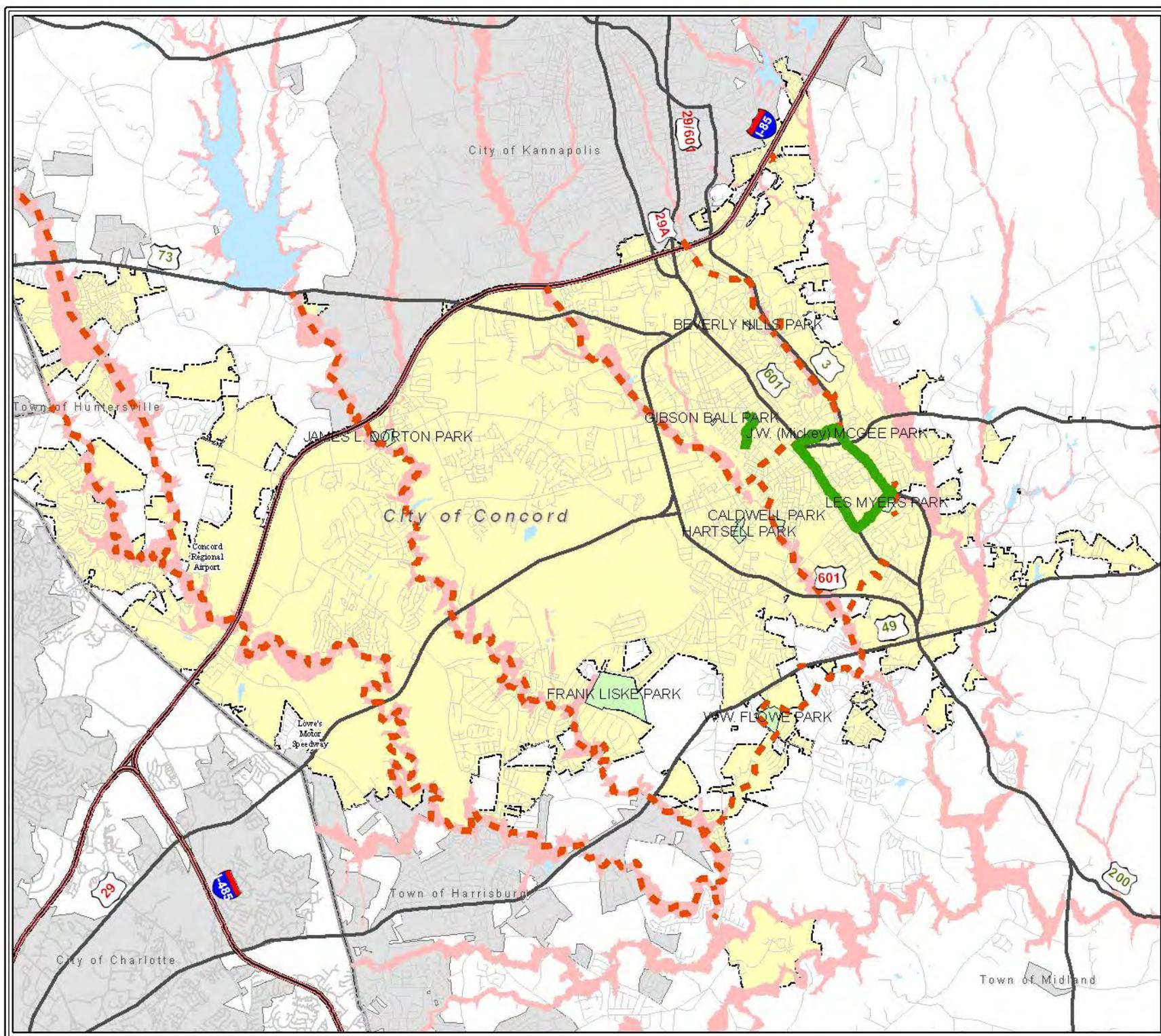
- Legend
- Manufactured Homes
 - 100 year flood plain
 - Airport
 - Streets
 - Lakes & Ponds
 - Cabarrus Co.
 - City of Concord
 - Other Cities

There are 1377 manufactured homes in Concord.
5 are in the 100-year floodplain.



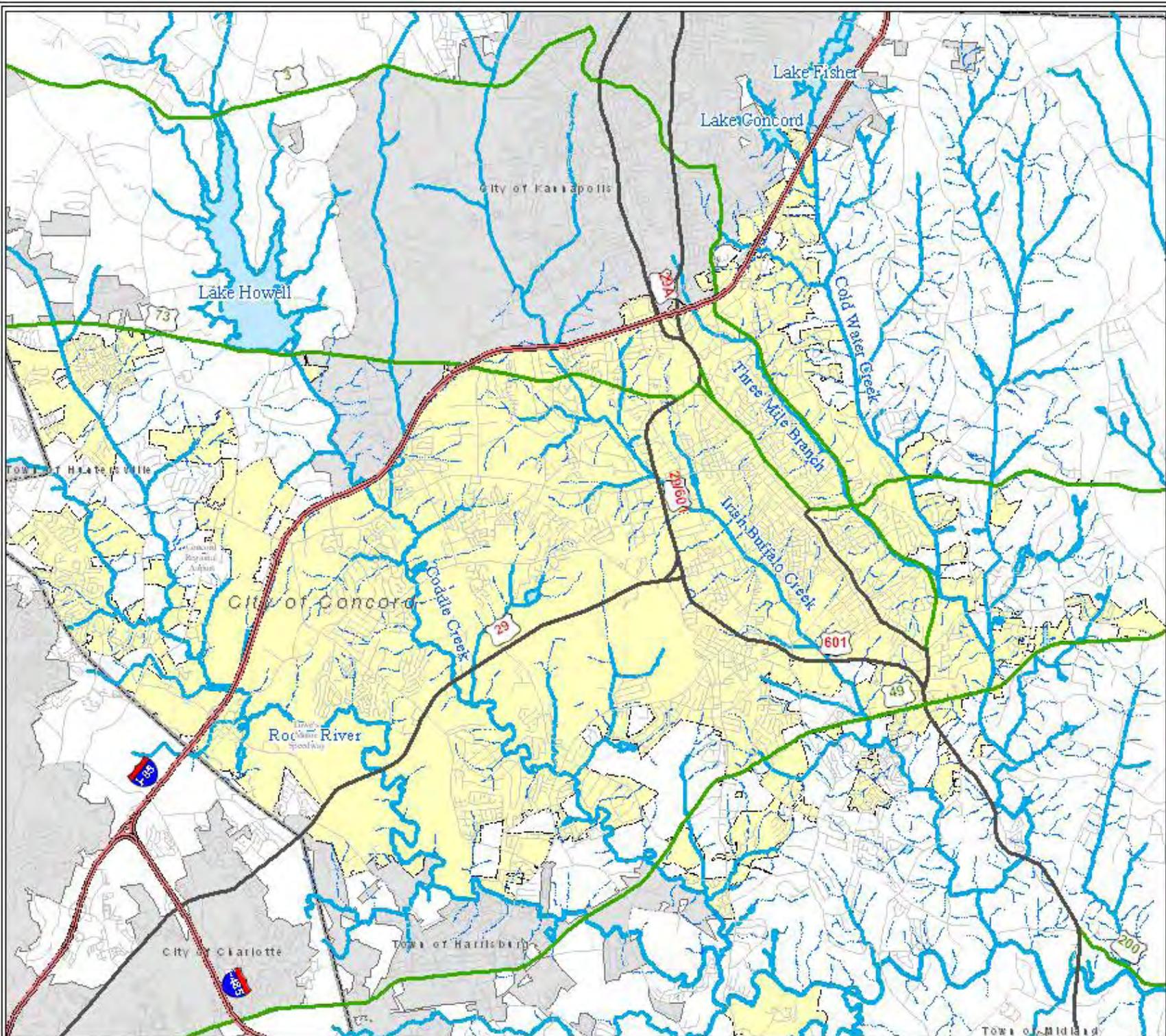
Existing & Proposed Greenways

- Legend**
- █ Existing Greenways
 - █ Proposed Greenways
 - █ 100 year flood plain
 - █ Parks
 - Streets
 - █ Lakes & Ponds
 - Cabarrus Co.
 - City of Concord
 - Other Cities



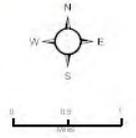
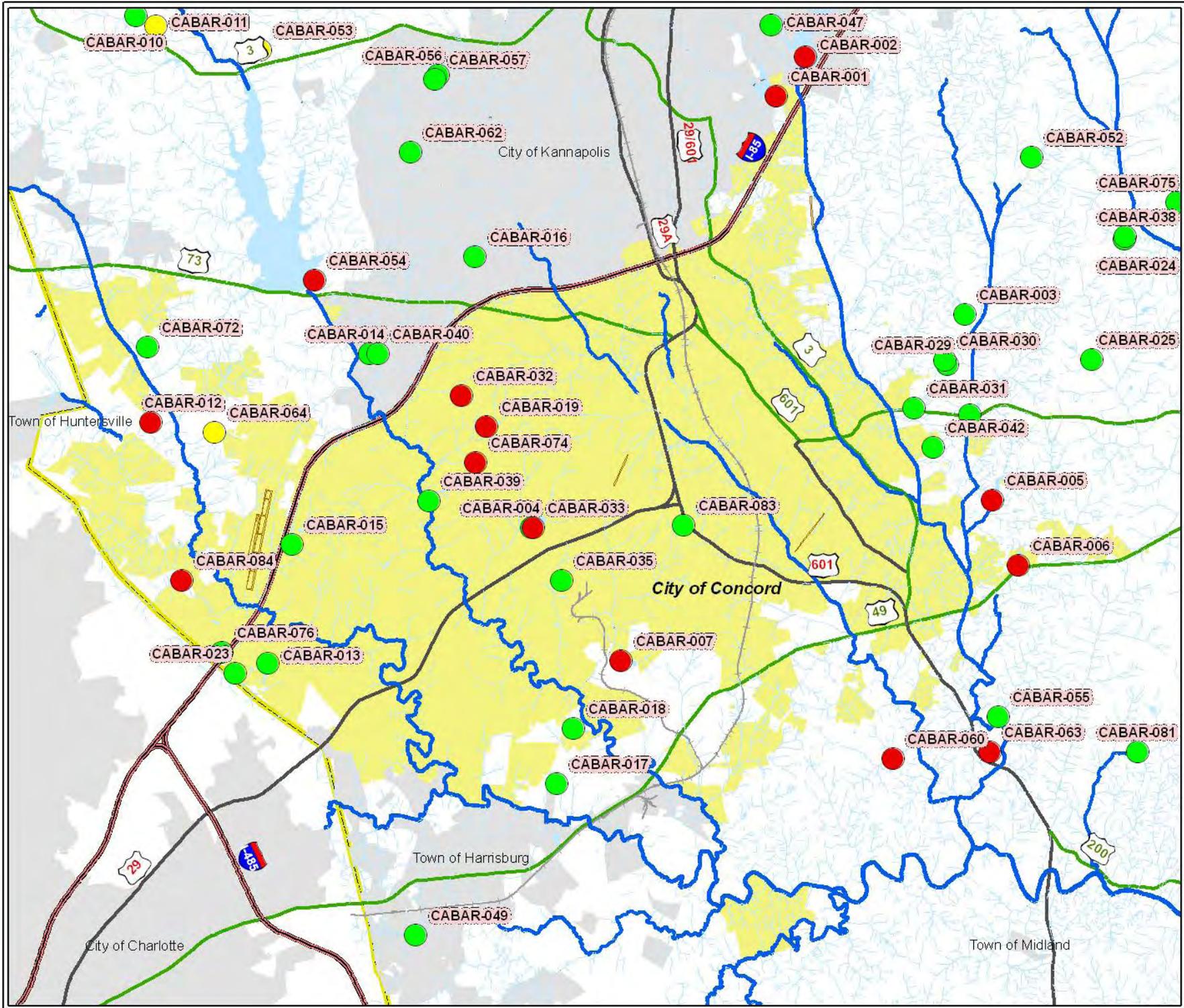
Streams and Lakes

- Legend**
- Streets
 - Streams**
 - CODE**
 - NRCS Intermittent
 - USGS Intermittent
 - USGS Perennial
 - Lakes & Ponds
 - Cabarrus Co.
 - City of Concord
 - Other Cities



Dams

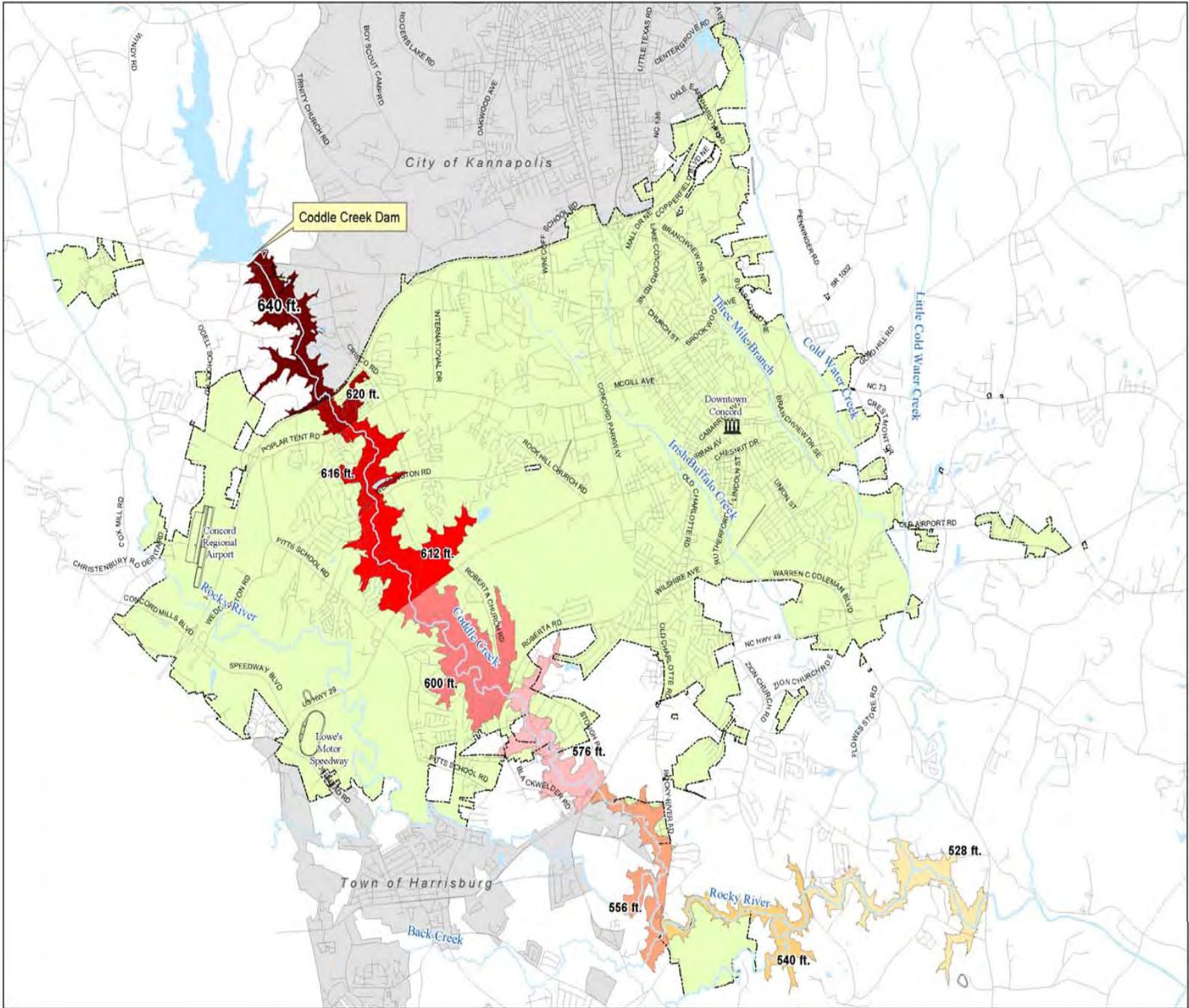
- Legend**
- Dams Hazard**
- High
 - Intermediate
 - Low
- Streams Type**
- Major
 - Minor
 - Concord





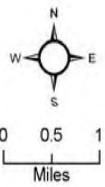
Dam Failure Event

Approx. Max. Flood Elevations
Sunny Day Breach

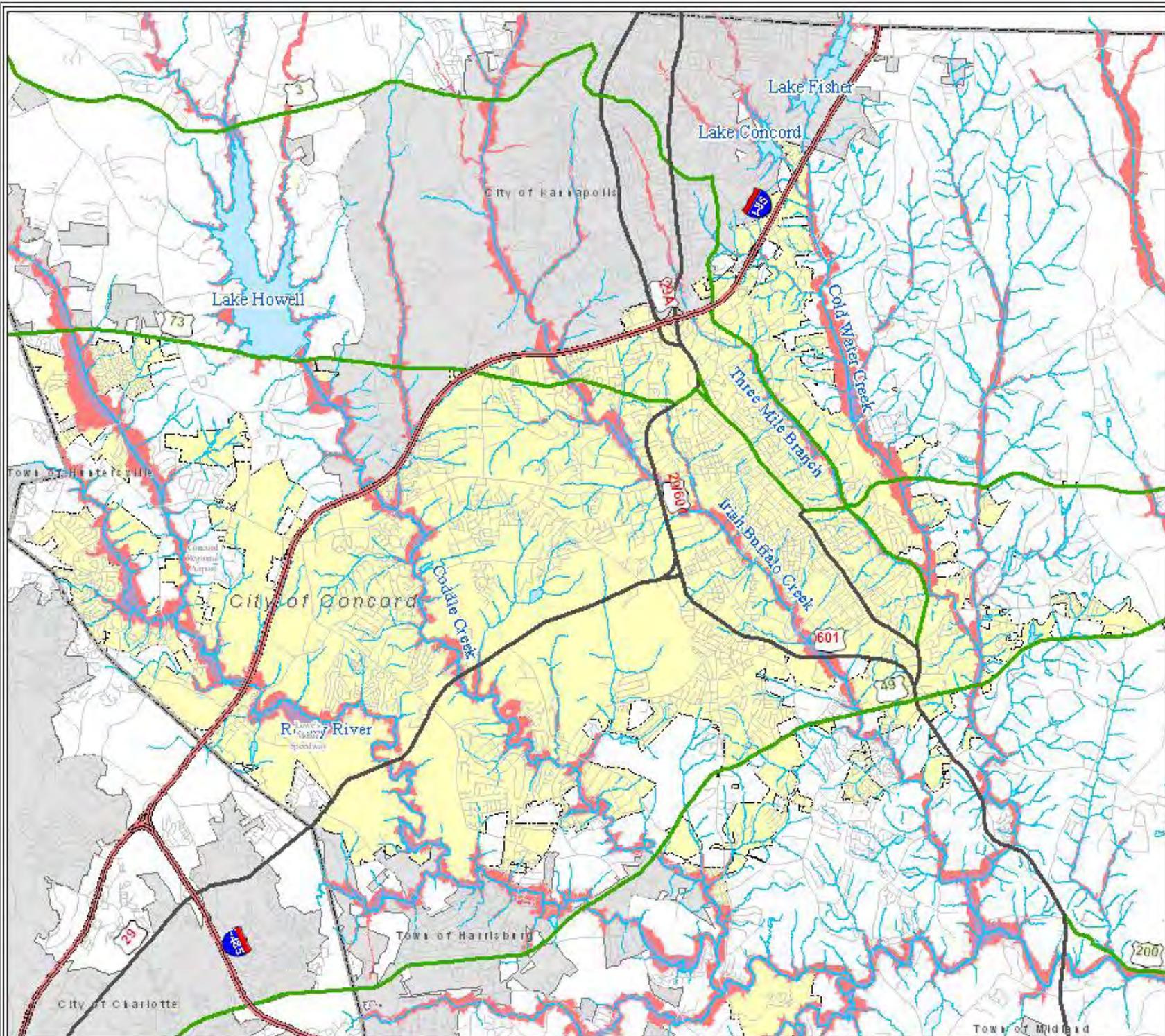


Flood Elevations

- 640 ft. Elev.
- 620 ft. Elev.
- 616 ft. Elev.
- 612 ft. Elev.
- 600 ft. Elev.
- 576 ft. Elev.
- 556 ft. Elev.
- 540 ft. Elev.
- 528 ft. Elev.
- Rivers & Streams
- Lakes & Ponds
- Streets
- Cabarrus Co.
- City of Concord
- Kannapolis
- Harrisburg



Existing and Potential Flood Hazard Areas



- Legend**
- ▬ Existing Flood Hazards
 - Potential Flood Hazards
 - Streets
 - Streams
 - Lakes & Ponds
 - Floodway
 - Cabarrus Co.
 - City of Concord
 - Other Cities

Scale: 0 100 200 300 Feet

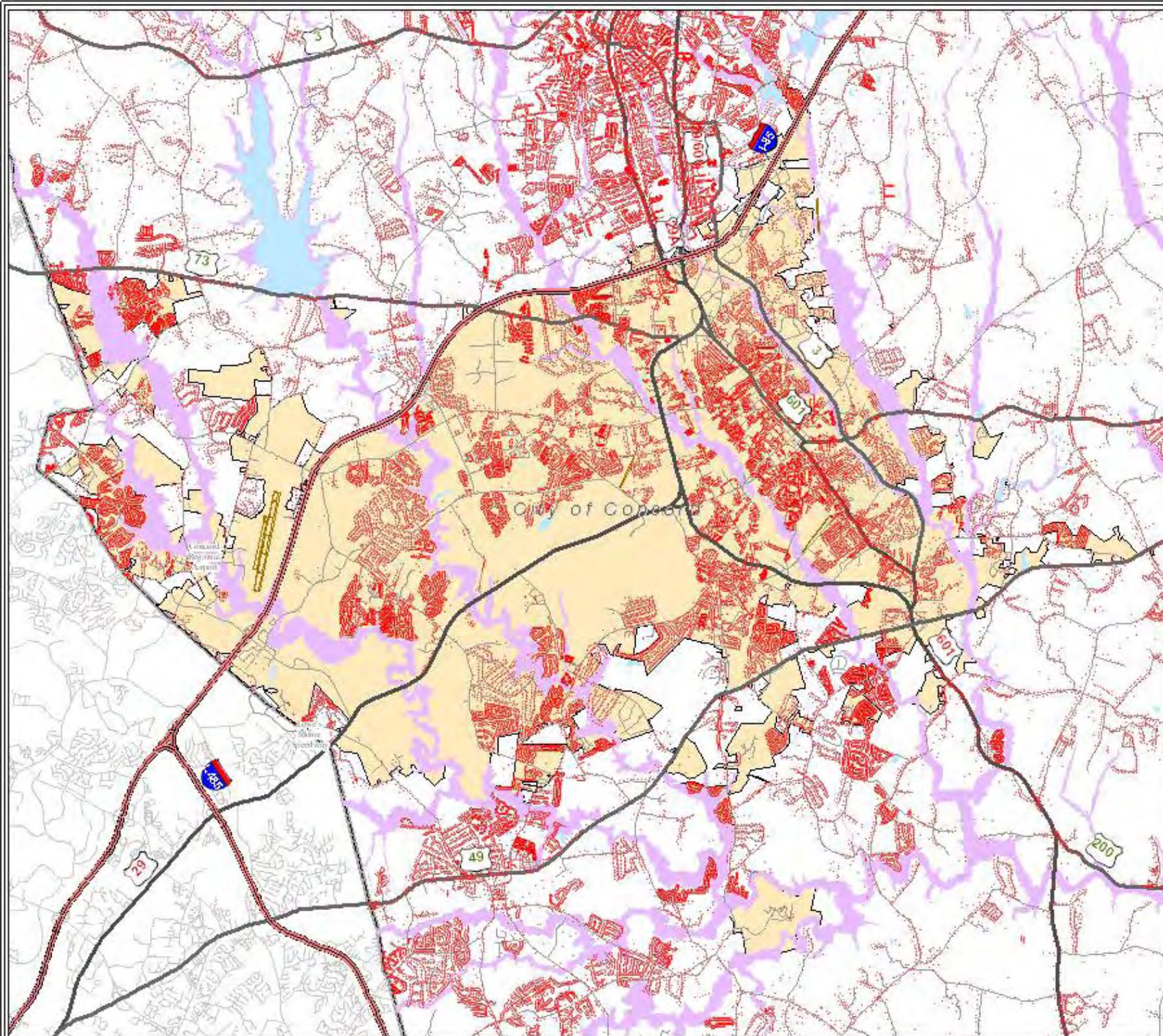
Prepared by: Planning & Development Department
City of Concord, NC
10/2019

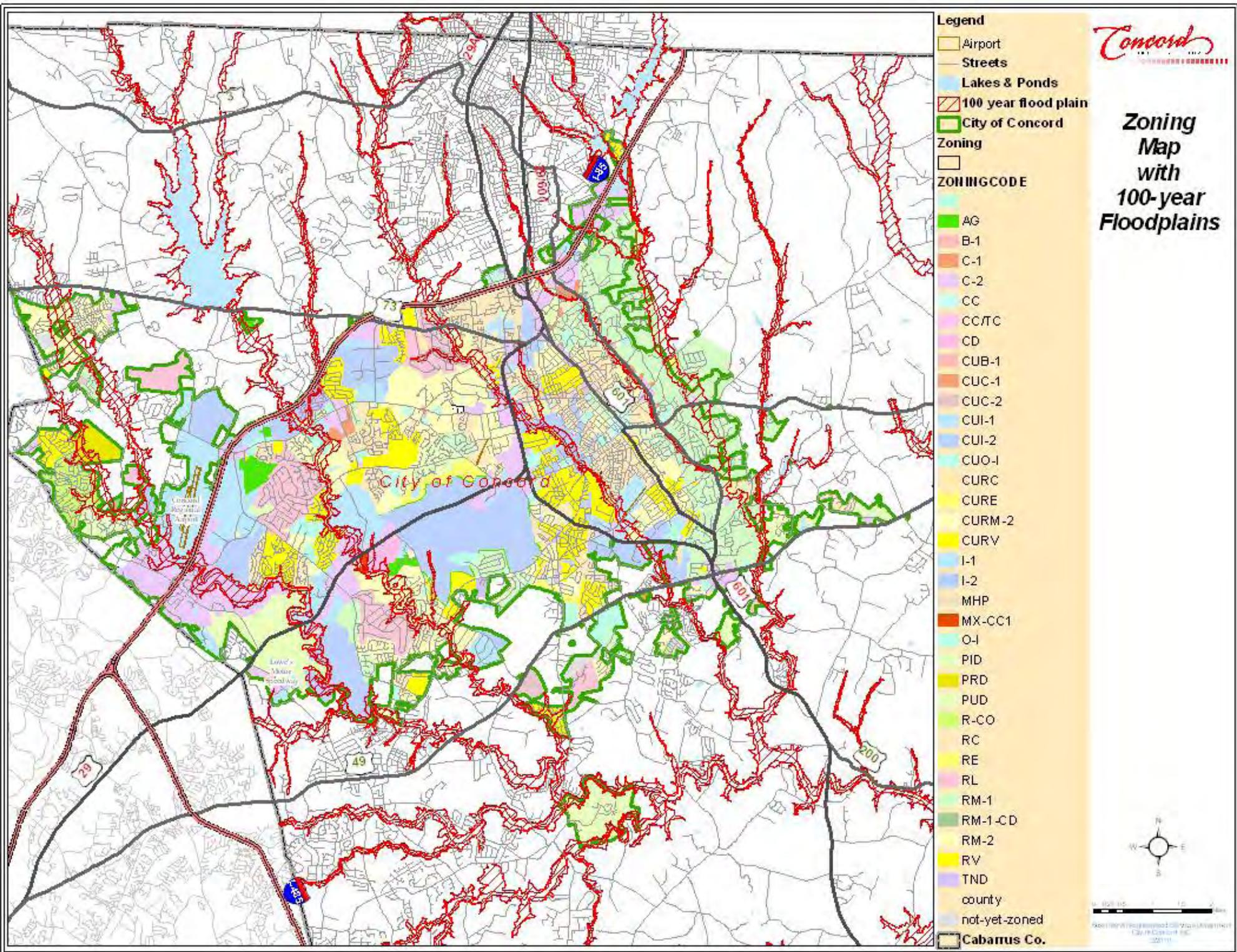
Population Density with 100-year Floodplain

(Populations are signified by red areas)

Legend

- Population Density
- Airport
- Streets
- Lakes & Ponds
- 100 year flood plain
- City of Concord
- Cabarrus Co.





Appendix B Glossary

A

Acquisition of hazard-prone structures: Local governments can acquire lands in high hazard areas through conservation easements, purchase of development rights, or outright purchase of property.

B

Base Flood: A term used in the National Flood Insurance Program to indicate the minimum size flood to be used by a community as a basis for its floodplain management regulations; presently required by regulation to be that flood which has a one-percent chance of being equaled or exceeded in any given year. Also known as a 100-year flood or one-percent chance flood.

Base Flood Elevation (BFE): Elevation of the base flood in relation to a specified datum, such as the National Geodetic Vertical Datum of 1929. The Base Flood Elevation is used as a standard for the National Flood Insurance Program.

Base Floodplain: The floodplain that would be inundated by a one-percent chance (100-year) flood.

Benefit-cost analysis (BCA): Benefit-cost analysis is a systematic, quantitative method of comparing the projected benefits to projected costs of a project or policy. It is used as a measure of cost effectiveness.

Best Management Practices (BMPs): Appropriate, site-specific management techniques that maximize the benefits of land and natural resource management actions, while minimizing impacts.

Bond: A debt obligation issued by states, cities, counties, and other governmental entities to raise money to pay for public projects, such as government facilities and infrastructure.

Building: A structure that is walled and roofed, principally above ground and permanently affixed to a site. The term includes a manufactured home on a permanent foundation on which the wheels and axles carry no weight.

Building codes: Regulations that set forth standards and requirements for the construction, maintenance, operation, occupancy, use, or appearance of buildings, premises, and dwelling units. Building codes can include standards for structures to withstand natural hazards.

C

Capability assessment: An assessment that provides an inventory and analysis of a community or state's current capacity to address the threats associated with hazards. The capability assessment attempts to identify and evaluate existing policies, regulations, programs, and practices that positively or negatively affect the community or state's vulnerability to hazards or specific threats.

Channel maintenance: Ensuring that flood channels, storm sewers, retaining ponds, etc. do not become blocked by debris, sedimentation, overgrowth, or structural failure.

Community: Any state or area or political subdivision thereof, or any Indian tribe or authorized tribal organization which has the authority to adopt and enforce regulations for the areas within its jurisdiction.

Community Rating System (CRS): CRS is a program that provides incentives for National Flood Insurance Program communities to complete activities that reduce flood hazard risk. When the community completes specified activities, the insurance premiums of the policyholders in those communities are reduced. Concord's current rating is an 8.

Comprehensive plan: A document, also known as a "general plan," covering the entire geographic area of a community and expressing community goals and objectives. The plan lays out the vision, policies, and strategies for the future of the community, including all of the physical elements that will determine the community's future development. This plan can discuss the community's desired physical development, desired rate and quantity of growth, community character, transportation services, location of growth, and siting of public facilities and transportation. In most states, the comprehensive plan has no authority in and of itself, but serves as a guide for community decision-making.

Construction of barriers around structures: Protective structures, such as berms and retaining walls, created by grading or filling areas with soil meant to keep floodwaters from reaching buildings.

Critical facilities: Facilities vital to the health, safety, and welfare of the population and that are especially important following hazard events. Critical facilities include, but are not limited to, shelters, police and fire stations, and hospitals.

D

Dams: Dams are artificial barriers that impound water, wastewater, or any liquid-borne material for the purpose of storage or control of water. For a more detailed definition, see the National Dam Safety Program Act (as amended through P.L. 106-580, December 29, 2000).

Debris: The scattered remains of assets broken or destroyed in a hazard event. Debris caused by a wind or water hazard event can cause additional damage to other assets.

Density controls: Regulations that manage growth by limiting the density of development, often expressed in terms of the number of dwelling units per acre. Density controls allow the community to plan in an orderly way for infrastructure.

Design Flood: Commonly used to mean the magnitude of flood used for design and operation of flood control structures or other protective measures. It is sometimes used to denote the magnitude of flood used in floodplain regulation.

Design review standards: Guidelines enacted by local governments requiring new development to meet certain appearance and aesthetic standards and establishing a process by which local officials can examine site plans or structure blueprints to assess compliance with those standards. Design review standards can help ensure new development blends with existing buildings and the landscape or meet other priorities, including hazard loss reduction.

Design standards: A set of guidelines pertaining to the appearance and aesthetics of buildings or improvements that governs construction, alteration, demolition, or relocation of a building or improvement of land.

Disaster Mitigation Act of 2000 (DMA 2000): DMA 2000 (Public Law 106-390) is the latest legislation to improve the planning process. It was signed into law on October 30, 2000. This new legislation reinforces the importance of mitigation planning and emphasizes planning for disasters before they occur.

E

Earthquake: A sudden motion or trembling that is caused by a release of strain accumulated within or along the edge of earth's tectonic plates.

Easements: Grant a right to use property, or restrict the landowner's right to use the property in a certain way.

Elevation of structures: Raising structures above the base flood elevation to protect structures located in areas prone to flooding.

Emergency response services: The actions of first responders such as firefighters, police, and other emergency services personnel at the scene of a hazard event. The first responders take appropriate action to contain the hazard, protect property, conduct search and rescue operations, provide mass care, and ensure public safety.

Eminent domain: The right of a government to appropriate private property for public use, with adequate compensation to the owner.

Enabling Statute: A State law that transfers some of the police power residing in the State to localities within it for the purposes of zoning, subdivision, regulations, building codes, and the like.

Environmental review standards: Guidelines established to ensure new development adheres to certain construction and site design standards to minimize the impact on the environment.

Erosion: Wearing away of the land surface by detachment and movement of soil and rock fragments during a flood or storm over a period of years, through the action of wind, water, or other geologic processes.

F

Federal Emergency Management Agency (FEMA): Independent agency created in 1979 to provide a single point of accountability for all federal activities related to disaster mitigation and emergency preparedness, response, and recovery.

Fireproofing: Actions taken on and around buildings to prevent the spread of fires.

Flash Flood: A flood that reaches its peak flow in a short length of time (hours or minutes) after the storm or other event causing it. Often characterized by high velocity flows.

Flood or Flooding: Temporary inundation of normally dry land areas from the overflow of inland or tidal waters, or from the unusual and rapid accumulation or runoff of surface waters from any source. The rise in water may be caused by excessive rainfall, snowmelt, natural stream blockages, and windstorms over a lake, or any combination of such conditions.

Flood Control: Keeping flood waters away from specific developments or populated areas by the construction of flood storage reservoirs, channel alterations, dikes and levees, bypass channels, or other engineering works.

Flood Depth: Height of the flood water above the ground surface.

Flood Insurance Rate Maps (FIRMS): The official map of a community prepared by FEMA, showing base flood elevations along with the special hazard areas and the risk premium zones.

Flood Insurance Study (FIS): A study that provides an examination, evaluation, and determination of flood hazards, and if appropriate, corresponding water surface elevations in a community or communities.

Flood Mitigation Assistance (FMA) Program: A program created as part of the National Flood Insurance Reform Act of 1994. FMA provides funding to assist communities and states in implementing actions that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other NFIP insurable structures, with a focus on repetitive loss properties.

Floodplain: Any normally dry land area that is susceptible to being inundated from any natural source. This area is usually low adjacent land to a river, stream, watercourse, ocean or lake.

Floodplain development regulations: Regulations requiring flood insurance and mandating certain design aspects of new or substantially improved structures that lie within regulated flood-prone areas. Current federal regulations through the National Flood Insurance Program require that, at a minimum, new residential buildings in the Special Flood Hazard Area have their lowest floor at or above the base flood elevation.

Floodplain Management: The operation of a program of corrective and preventive measures for reducing flood damage, including but not limited to flood control projects, floodplain land use regulations, flood proofing of buildings, and emergency preparedness plans.

Floodplain zoning: Zoning regulations that prescribe special uses for and serve to minimize development in floodplain areas.

Flood-proofing: Actions that prevent or minimize future flood damage. Making the areas below the anticipated flood level watertight or intentionally allowing floodwaters to enter the interior to equalize flood pressures are examples of flood proofing.

Floodway: The channel of a watercourse and those portions of the adjoining floodplain required providing for the passage of the selected flood (normally the 100-year flood) with an insignificant increase in the flood levels above that of natural conditions. As used in the National Flood Insurance Program, floodways must be large enough to pass the 100-year flood without causing an increase in elevation of more than a specified amount (one foot in most areas).

Forest and vegetation management: The management of forests and vegetation so they are resilient to landslides, high-winds, and other storm-related hazards.

Forest fire fuel reduction: Minimizing fuel loads in forested areas by clearing excess ground cover and thinning diseased or damaged woodland to create healthier forests and to decrease the vulnerability to the devastation of forest fire.

Freeboard: A factor of safety expressed in feet above a design flood level for flood protective or control works. Freeboard is intended to allow for all of the uncertainties in analysis, design and construction that cannot be fully or readily considered in an analytical fashion.

G

General obligation bond: A bond secured by the taxing and borrowing power of the municipality issuing it.

Geographic Information System (GIS): A computer software application that relates physical features on the earth to a database to be used for mapping and analysis.

Goals: General guidelines that explain what you want to achieve. They are usually broad policy statements, long-term in nature.

H

Hazard: A source of potential danger or adverse condition.

Hazard mitigation: Sustained actions taken to reduce or eliminate long-term risk from hazards and their effects.

Hazard Event: A specific occurrence of a particular type of hazard.

Hazard Mitigation Grant Program (HMGP): Authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, HMGP is administered by FEMA and provides grants to states, tribes, and local governments to implement hazard mitigation actions after a major disaster declaration. The purpose of the program is to reduce the loss of life and property due to natural disasters and to enable mitigation activities to be implemented as a community recovers from a disaster.

Hazard profile: A description of the physical characteristics of hazards and a determination of various descriptors, including magnitude, duration, frequency, probability, and extent. In most cases, a community can most easily use these descriptors when they are recorded and displayed as maps.

Hazard treat recognition: The process of identifying possible hazards and estimating potential consequences.

Hazard warning systems: Systems or equipment such as community sirens and National Oceanic Atmospheric Administration (NOAA) weather radios designed to provide advanced warning of an impending hazard. Warning systems allow communities to take protective actions before a hazard event occurs, including taking cover, finding shelter, or moving furniture, cars, and people out of harm's way.

HAZUS, HAZUS-MH: A GIS-based, nationally standardized, loss estimation tool developed by FEMA. HAZUS-MH is the new multi-hazard version that includes earthquake, wind, hurricane, and flood loss estimate components.

Health and safety maintenance: Sections of emergency response/operations plans that provide for the security of affected areas, including clean up and special precautions for each type of hazard (e.g., draining standing water after a flood, cautioning about aftershocks after an earthquake or successive tsunami waves, etc.).

Hillside development regulations: Site design and engineering techniques prescribed through regulations such as selective grading, drainage improvements, and vegetation clearance to eliminate, minimize, or control development on hillsides, thereby protecting the natural features of hillsides and reducing the likelihood of property damage from landslides.

I

Infrastructure: Refers to the public services of a community that have a direct impact on the quality of life. Infrastructure includes communication technology such as phone lines or Internet access, vital services such as public water supplies and sewer treatment facilities and an areas transportation system, roads, bridges, railways, etc...

Intensity: A measure of the strength of a hazard event. The intensity (also referred to as severity) of a given hazard event is usually determined using technical measures specific to the event.

L

Levees and floodwalls: Flood barriers constructed of compacted soil or reinforced concrete walls.

Loss estimation: Forecasts of human and economic impacts and property damage from future hazard events, based on current scientific and engineering knowledge.

M

Mitigation: Any actions taken to permanently reduce or eliminate long-term risk to people and their property from the effects of hazards. Some examples include elevating houses above base flood levels, acquiring land in high hazard areas, and zoning land in floodplains for parkland or low-density use.

Mitigation actions: Activities, measures, or projects that help achieve the goals and objectives of a mitigation plan.

Mitigation Plan: A systematic evaluation of the nature and extent of vulnerability to the effects of natural hazards typically present in the community and includes policy and implementation procedures designed to minimize present and future vulnerability.

N

National Flood Insurance Program (NFIP): Federal program created by Congress in 1968 that makes flood insurance available in communities that enact minimum floodplain management regulations as indicated in 44 CFR 60.3.

O

Objectives: Objectives define strategies or implementation steps to attain the identified goals. Unlike goals, objectives are specific and measurable.

Open space preservation: Preserving undeveloped areas from development through any number of methods, including low-density zoning, open space zoning, easements, or public or private acquisition. Open space preservation is a technique that can be used to prevent flood damage in flood-prone areas, land failures on steep slopes or liquefaction-prone soils, and can enhance the natural and beneficial functions of floodplains.

Ordinance: A term for a law or regulation adopted by a local government.

P

Performance standards: Standards setting the allowable effects or levels of impact of development. Often used in conjunction with traditional zoning, the standards typically address specific environmental conditions, traffic, or storm water runoff. Can also be imposed on structures in hazard areas to ensure they withstand the effect of hazards.

Planning team: A group composed of government, private sector, and individuals with a variety of skills and areas of expertise, usually appointed by a city or town manager, or chief elected official. The group finds solutions to community mitigation needs and seeks community acceptance of those solutions.

Policy: A course of action or specific rule of conduct to be followed in achieving goals and objectives.

Post-disaster mitigation: Mitigation actions taken after a disaster has occurred, usually during recovery and reconstruction.

Post-disaster recovery ordinance: An ordinance authorizing certain governmental actions to be taken during the immediate aftermath of a hazard event to expedite implementation of recovery and reconstruction actions identified in a pre-event plan.

Post-disaster recovery planning: The process of planning those steps the jurisdiction will take to implement long-term reconstruction with a primary goal of mitigating its exposure to future hazards. The post-disaster recovery planning process can also involve coordination with other types of plans and agencies, but it is distinct from planning for emergency operations.

Private activity bond: A bond whose interest may or may not be federally taxable. Under the Internal Revenue Code, private activity bonds are described generally as any bond: (1) of which more than 10% of the proceeds is to be used in a trade or business of any person or persons other than a governmental unit, and which is to be directly or indirectly repaid, or secured by revenues from, a private trade or business; and (2) in which an amount exceeding the lesser of 5% or \$5 million of the proceeds is to be used for loans to any person or persons other than a governmental unit. Certain private activity bonds are tax exempt when used to finance private water, wastewater, and multifamily housing projects.

Public education and outreach programs: Any campaign to make the public more aware of hazard mitigation and mitigation programs, including hazard information centers, mailings, public meetings, etc.

R

Real estate disclosure: Laws requiring the buyer and lender to be notified if a property is located in a hazard-prone area.

Regulation: Most states have granted local jurisdictions broad regulatory powers to enable the enactment and enforcement of ordinances that deal with public health, safety, and welfare. These include building codes, building inspections, zoning, floodplain and subdivision ordinances, and growth management initiatives.

Relocation out of hazard areas: A mitigation technique that features the process of demolishing or moving a building to a new location outside the hazard area.

Repetitive Loss Plan: Under the Community Rating System (CRS), a Category C repetitive loss community has 10 or more repetitive loss properties. Because repetitive flooding accounts for approximately 33% of all flood insurance losses, Category C repetitive loss communities must prepare floodplain management plans for their repetitive loss areas. The CRS no longer provides separate credit for “repetitive loss plans.” A Category C community can either prepare a floodplain management plan for all of its know flood problem areas, or it can prepare one that covers just its repetitive loss areas.

Replacement Value: The cost of rebuilding a structure. This is usually expressed in terms of cost per square foot, and reflects the present-day cost of labor and materials to construct a building of a particular size, type, and quality.

Reservoirs: Large water storage facilities that can be used to hold water during peak runoff periods for controlled release during off-peak periods.

Resources: Resources include the people, materials, technologies, money, etc., required to implement strategies or processes. The costs of these resources are often included in a budget.

Retrofitting: See definition for structural retrofitting.

Riparian Buffer: An area contiguous to one or both sides of a watercourse that is maintained in a natural vegetative state.

Risk: The estimated impact that a hazard would have on people, services, facilities, and structures in a community; the likelihood of a hazard event resulting in an adverse condition that causes injury or damage. Risk is often expressed in relative terms such as a high, moderate, or low likelihood of sustaining damage above a particular threshold due to a specific type of hazard event. It also can be expressed in terms of potential monetary losses associated with the intensity of the hazard.

Riverine: Of or produced by a river.

Runoff: That portion of precipitation that is not intercepted by vegetation, absorbed by the land surface or evaporated, and thus flows overland into a depression, stream, lake or ocean (runoff called “immediate subsurface runoff” also takes place in the upper layer of the soil).

S

Safe room/shelter: A small interior room constructed above grade and used to provide protection from tornadoes and other severe storm events. Bathrooms and large closets often double as safe rooms.

Sediment and erosion control regulations: Regulations that stipulate the amount of sediment and erosion that is acceptable for land undergoing development.

Special Flood Hazard Areas: Areas in a community that have been identified as susceptible to a one-percent or greater chance of flooding in any given year. A one-percent-probability flood is also known as the 100-year flood or the base flood. Special Flood Hazard Areas are usually designated on the Flood Hazard Boundary Map (FHBM) as Zone A. After detailed evaluation of local flooding characteristics, the Flood Insurance Rate Map (FIRM) will refine this categorization into Zones A, AE, AH, AO, AL-30, VE, and V1-30.

Special tax bond: A bond secured by the pledge of a specific special tax.

Special use permits: Permits granted by local governments for land uses that have the potential for creating conflicts with uses on adjacent properties.

Stakeholder: Individual or group that will be affected in any way by an action or policy. Stakeholders include businesses, private organizations, and citizens.

State Hazard Mitigation Officer: The representative of state government who is the primary point of contact with FEMA, other state and federal agencies, and local units of government in the planning and implementation of pre- and post-disaster mitigation activities.

Storm water management regulations: Regulations governing the maintenance and improvement of urban storm water systems and the implementation of land treatment actions to minimize the effects of surface water runoff. Land treatment actions include maintenance of vegetative cover, terracing, and slope stabilization.

Strategy: Collection of actions to achieve goals and objectives.

Stream corridor restoration: The restoration of the areas bordering creeks, including the stream bank and vegetation.

Stream dumping regulations: Regulations prohibiting dumping in the community's drainage system, thereby maintaining stream carrying capacities and reducing the possibility of localized flooding.

Structural retrofitting: Modifying existing buildings and infrastructure to protect them from hazards.

Subdivision: The division of a tract of land into two or more lots for sale or development.

Subdivision and development regulations: Regulations and standards governing the division of land for development or sale. Subdivision regulations can control the configuration of parcels, set standards for developer-built infrastructure, and set standards for minimizing runoff, impervious surfaces, and sediment during development. They can be used to minimize exposure of buildings and infrastructure to hazards.

T

Taxation: Taxes and special assessments can be an important source of revenue for governments to help pay for mitigation activities. The power of taxation can also have a profound impact on the pattern of development in local communities. Special tax districts, for example, can be used to discourage intensive development in hazard-prone areas.

Transfer of development rights (TDR): A growth management technique through which development rights are transferred from a designated "sending" area to a designated "receiving" area. The sending area is generally prohibited from development and the receiving area is a targeted development area that can be built at a higher density.

U

Urban forestry and landscape management: Forestry management techniques that promote the conservation of forests and related natural resources in urbanized areas, with a focus on obtaining the highest social, environmental, and economic benefits.

V

Vulnerability: Describes how exposed or susceptible to damage an asset is. Vulnerability depends on an asset's construction, contents, and the economic value of its functions.

W

Wetlands: Areas that are inundated or saturated at a frequency and for duration sufficient to support a prevalence of vegetative or aquatic life requiring saturated or seasonally saturated soil conditions for growth and production.

Wetlands development regulations: Regulations designed to preserve and/or minimize the impact of development on wetlands.

Wind-proofing: Modification of design and construction of buildings to withstand wind damage.

Z

Zoning: The division of land within a local jurisdiction by local legislative regulation into zones of allowable types and intensities of land uses.

Zoning or land use map: A map that identifies the various zoning district boundaries and the uses permitted by a zoning ordinance within those boundaries.

Zoning ordinance: Designation of allowable land use and intensities for a local jurisdiction.

Appendix C Internet Research Information

Federal Emergency Management Agency (FEMA)

<http://www.fema.gov>

FEMA Headquarters

500 C Street, SW, Washington, D.C. 20472

Phone: 202-646-4600

FEMA Publications Warehouse 800-480-2520

FEMA Library

<http://www.fema.gov/library/>

FEMA Mitigation Resource Library

<http://www.eeri.org/mitigation/category/resource-library>

Web Sites:

American Planning Association

<http://www.planning.org>

Catalog of Federal Domestic Assistance

<https://www.cfda.gov>

Center for Disease Control and Prevention

<http://www.cdc.gov/flu/pandemic/>

Disaster Mitigation Planning Assistance Website

<http://matrix.msu.edu/~disaster/>

FEMA Disaster Assistance for Individuals

http://www.fema.gov/media/fact_sheets/individual-assistance.shtm

FEMA Mitigation Planning

<http://www.fema.gov/plan/mitplanning/index.shtm>
FEMA Public Assistance Grant Program
<http://www.fema.gov/government/grant/pa/index.shtm>
Flood Hazard Mitigation Handbook
<http://www.conservaiontech.com/FEMA-WEB/FEMA-subweb-flood/index.htm>
Flood Mitigation Assistance Program
<http://www.fema.gov/government/grant/fma/index.shtm>
Hazard Mitigation Grant Program
<http://www.fema.gov/government/grant/hmgrp>
FEMA National Flood Insurance Program
<http://www.fema.gov/plan/prevent/floodplain/index.shtm>
FEMA HAZUS and HAZUS-MH
<http://www.fema.gov/plan/prevent/hazus/index.shtm>
FEMA Landslide Hazard
<http://www.fema.gov/hazard/landslide/index.shtm>
FEMA Mitigation Best Practices
<http://www.fema.gov/plan/prevent/bestpractices/index.shtm>
FEMA Pre-Disaster Mitigation Program
<http://www.fema.gov/government/grant/pdm/>
Hazards Planning Research Center
<http://planning.org/research/hazards/pdf/hazardsbibliography.pdf>
Multi-hazard Mapping Initiative
<http://gcmd.nasa.gov/records/FEMA-HazardMaps.html>
National Dam Safety Program
<http://www.fema.gov/plan/prevent/damfailure/ndsp.shtm>
National Earthquake Hazard Reduction Program
<http://www.nehrp.gov/>
National Flood Insurance Program
<http://www.floodsmart.gov/floodsmart/>
National Hurricane Program
<http://www.fema.gov/plan/prevent/nhp/index.shtm>

National League of Cities

<http://www.nlc.org>

North Carolina Division of Emergency Management

<http://www.nccrimecontrol.org/Index2.cfm?a=000003,000010>

Ready NC

<http://readync.org/>

North Carolina State Mitigation Plan October 2007 Update

<http://www.nccrimecontrol.org/Index2.cfm?a=000003,000010,001623,000177,001563>

North Carolina Crime Control and Public Safety General Guidance for Local Mitigation Plan Updates

http://www.nccrimecontrol.org/div/em/hazardmitigation/localplan/FEMAMemoLocalPlanUpdatesMay_62007.doc

Are You Ready - Tornadoes

<http://www.fema.gov/areyouready/tornadoes.shtm>

Protecting Against Wind Damage

<http://training.fema.gov/EMIWeb/IS/IS394A/03wind-0306.pdf>

Preparing A Safe Room

http://www.fema.gov/hazard/tornado/to_saferoom.shtm

Small Business Administration

<http://www.sba.gov/services/disasterassistance/>

U.S. Army Corps of Engineers

<http://www.usace.army.mil>

U.S. Department of Agriculture Disaster and Drought Assistance

http://www.usda.gov/wps/portal/!ut/p/_s.7_0_A/7_0_1OB?navid=DISASTER_ASSISTANCE

U.S. Department of Agriculture, Natural Resources Conservation Service

<http://www.nrcs.usda.gov>

U.S. Department of Transportation

<http://www.fhwa.dot.gov/programadmin/erelief.cfm>

U.S. Environmental Protection Agency

<http://www.epa.gov/>

U.S. Geological Survey

<http://www.usgs.gov/>

U.S. State and Local Government Gateway

http://www.firstgov.gov/Government/State_Local.shtml

Wildfire Hazard Mitigation

<http://www.wildfireprograms.usda.gov/>

Publications:

FEMA: Landslide Loss Reduction: A Guide for State and Local Government Planning (08/07)

National League of Cities: Hazard Mitigation Planning Made Easy.

Report: Hazard Mitigation in North Carolina: Measuring Success (Vol. II) February 2000.

Emergency Management: Principles and Practices for Local Government, 2nd Edition, ICMA Press December 2007