Transylvania County
Multi-Jurisdictional Hazard Mitigation Plan

DRAFT
June 6, 2011

Prepared for:
Transylvania County
21 East Main Street
Brevard, NC 28712

In Coordination with:

City of Brevard
95 West Main Street
Brevard, NC 28712

Town of Rosman
6 Main Street
Rosman, NC 28772

This Final Document Prepared for

Transylvania County, North Carolina
The City of Brevard, North Carolina
The Town of Rosman, North Carolina

Prepared by

Transylvania County Emergency Services

And

The Transylvania County Multi – Jurisdictional
Hazard Mitigation Planning Committee

With Technical Assistance From

Jessica McCall, Transylvania County Tax Administration
Brad Burton, City of Brevard
Kenneth McJunkin, North Carolina Division of Forest Resources
Steve Pagano, Gorges State Park
Ryan Wiedenman, North Carolina Emergency Management

Reviewed by

Mike Hawkins, Transylvania County Chairman
Kelvin Phillips, Transylvania County Vice – Chairman
Daryle Hogsed, Transylvania County Commissioner
Jason Chappell, Transylvania County Commissioner
Larry Chapman, Transylvania County Commissioner
Jimmy Harris, City of Brevard Mayor
Rodney Locks, City of Brevard Mayor Pro – Tem
Mac Morrow, City of Brevard Councilman
Mack McKeller, City of Brevard Councilman
Larry Canady, City of Brevard Councilman
Dee Dee Perkins, City of Brevard Councilwoman
Brian Shelton, Town of Rosman Mayor
Jimmy Lance, Town of Rosman Councilman
Doyle Stubbefield, Town of Rosman Councilman
Roger Petit, Town of Rosman Councilman
J. C. Chapman, Town of Rosman Councilman
John E. Raines, Town of Rosman Councilman

TABLE OF CONTENTS

List of Tables

EXECUTIVE SUMMARY

Plan Mission
The mission of the Transylvania County Multi-Jurisdictional Hazard Mitigation Plan is to either substantially reduce or permanently reduce the planning area's vulnerability to natural hazards. The plan intends to promote sound public policy designed to protect citizens, critical facilities, infrastructure, private property, and the natural environment. Accomplishment of this task is by increasing public awareness, documenting resources for risk reduction and loss-prevention, and identifying activities to guide the planning area towards the development of a safer, more sustainable community.

Plan Organization
The Transylvania County Multi-Jurisdictional Hazard Mitigation Plan has been developed and organized within the rules and regulations established under the 44 CFR 201.6. The plan contains an Action Plan, a discussion on the purpose and methodology used to develop the plan, a Hazard Identification and Analysis, and a profile of Transylvania County, the City of Brevard, and the Town of Rosman. In addition, the plan offers a thorough discussion of the planning areas current capability to implement goals, objectives, and strategies identified herein. To assist in the explanation of the above-identified contents there are several appendices included which provide more detail on specific subjects. This Multi-Jurisdictional Hazard Mitigation Plan is intended to improve the ability of the planning area to mitigate disasters and will document valuable local knowledge on the most efficient and effective ways to reduce loss.

Plan Financing
Funding for the update of the Transylvania County multi-Jurisdictional Hazard Mitigation Plan has been provided by Transylvania County Emergency Management. This plan was developed as a Multi-Jurisdictional Plan with the full cooperation and participation of Transylvania County, the City of Brevard, and the Town of Rosman. All jurisdictions are continuing participants in the plan.

Plan Participation
The Transylvania County Multi-Jurisdictional Hazard Mitigation Plan was developed as a result of a collaborative effort between Transylvania County, the City of Brevard, and the Town of Rosman, governing boards of each jurisdiction, paid staff from each jurisdiction, citizens from each jurisdiction, public agencies from each jurisdiction, non-profit organizations, the private sector, as well as, regional, state, and federal agencies. Interviews conducted with stakeholders from each jurisdiction, a public hearing and draft plan display provided many opportunities for public participation. Any comments, questions, and discussion resulting from these activities were given strong consideration in the development of this plan. A Mitigation Planning Committee comprised of representatives from Town of Rosman, City of Brevard, and Transylvania County guided and assisted Transylvania County Emergency Services in the development of the plan.

Interagency and Intergovernmental Coordination
The Mitigation Planning Committee made a sound effort to include outside agencies and other governments in the development of the plan. Notices of plan display and a public

hearing was posted which encouraged all local businesses, not-for-profits, academic institutions, as well as, surrounding communities, state and federal agencies to review the document and provide feedback. In addition, numerous state and federal agencies were contacted directly for specific information. Below is a listing of the agencies that chose to participate in the development of the plan and what they provided to the overall planning process.

- *United States Forest Service (USFS) and the North Carolina Forest Resources (NCDFR):* assisted in the development of the methodology and the ultimate reviews of the Wildland Interface Map. Additionally, they attended a mitigation-planning meeting and provided phone conference assistance on an as needed basis.

- *United States Geological Survey (USGS):* phone conversations and GIS assistance provided by the USGS were key in developing the hazard vulnerability assessment for landslides and earthquakes. In addition, they provided significant data in the development of the Countywide Topographical Map, Earthquake Probability Map, and Landslide Susceptibility Map.

Hazards Identified
General review and research determined hazards most prevalent to the planning area. This resulted in examination of eleven natural hazards: Winter storms, Severe Thunderstorms/windstorms, Tornadoes, Tropical Storms, Floods, Riverine Erosion, Drought, Extreme Temperatures, Landslides, Earthquakes, and Wildfires. One technological event was examined which was dam/levee failure.

The more thorough Vulnerability Analysis identified the following hazards as being most prevalent and posing the highest potential risk to the planning area.

- Winter Storms
- Flooding
- Extreme Temperatures
- Riverine Erosion
- Landslides
- Wildfire
- Severe Thunderstorms
- Tornadoes
- Earthquakes
- Dam/Levee Failure

Plan Goals
In an effort to become proactive and develop a more effective solution to mitigating the impact of future disasters, Transylvania County, the City of Brevard, and the Town of Rosman have defined the purpose for the Multi-Jurisdictional Hazard Mitigation Plan. The primary purpose of this plan is to substantially, or permanently reduce the planning areas vulnerability to natural hazards. The plan design compliments existing governing documents such as zoning ordinances, land use plans, subdivision ordinances, comprehensive development plans, and the like, with the intent to protect life, health, and general welfare of

the citizens of Transylvania County, the City of Brevard, and the Town of Rosman. In addition, the plan design protects the local tax base and local areas of environmental concern while promoting harmonious development between the built environment and natural environment. Additionally, the governing bodies have elaborated on the primary purpose by identifying goals, objectives, and strategies that will ensure the primary purpose of this plan is met. These goals, objectives, and strategies will specifically:

- Improve public education/awareness.
- Minimize the potential for damage to personal property, infrastructure, and loss of life due to flooding.
- Reduce or eliminate the vulnerability of flooding to personal property, roadway systems, bridges, and loss of life.
- Improve emergency equipment used to respond to and recover from disasters.

Mitigation Goal, Objective, and Strategy Organization

This plan has established a set of goals to assist the community in fulfilling the established mission of this plan. In an effort to ensure the goals in this plan are met, each goal is broken down into a series of objectives, which are further broken down into a series of strategies. Each strategy identifies the hazard(s) addressed by said strategy, the type of strategy, responsible party/organization, monitoring and evaluation indicators, potential funding sources and a target completion date.

Plan Implementation

Adoption

The Transylvania County Multi-Jurisdictional Hazard Mitigation Plan will be incorporated into the Transylvania County Emergency Operations Plan and administered by the Transylvania County Emergency Management Agency. The adoption will be by the County, as well as, each individual governing jurisdiction participating in the planning process. Local adoption will occur after approval by NCDEM and FEMA.

Pursuant to the authority of the Transylvania County Code of Ordinances, the Transylvania County Board of Commissioners has the legislative capacity to adopt policies, ordinances and amendments. Based on that authority, the Transylvania County Board of Commissioners adopted the Transylvania County Multi-Jurisdictional Hazard Mitigation Plan on XX.

Pursuant to the authority of the City of Brevard Code of Ordinances, the City of Brevard Board of Commissioners has the legislative capacity to adopt policies, ordinances and amendments. Based on that authority, the City of Brevard Board of Commissioners adopted the Transylvania County Multi-Jurisdictional Hazard Mitigation Plan on XX.

Pursuant to the authority of the Town of Rosman Code of Ordinances, the Town of Rosman Town Council has the legislative capacity to adopt policies, ordinances and amendments. Based on that authority, the Town of Rosman Town Council adopted the Transylvania County Multi-Jurisdictional Hazard Mitigation Plan on XX.

Monitoring, Evaluation, Update, and Revision

The Mitigation Planning Committee has developed a method to ensure that regular review and update of the Multi-Jurisdictional Hazard Mitigation Plan for Transylvania County occurs. The Mitigation Planning Committee will be converted to a Sub-Committee of the Transylvania County Local Emergency Planning Committee. This Committee will consist of representatives from each department within each governing jurisdiction participating in the plan. The Transylvania County Emergency Management Department is responsible for contacting committee members, organizing, and publicizing the annual meetings. The meeting will be held in of each year, and committee members will be responsible for monitoring and evaluating the progress of mitigation strategies in the plan.

Monitoring and evaluation involves the ongoing process of compiling information on the outcomes that result from implementing the hazard mitigation strategies contained in this plan or is a measure of success the planning area has seen through the implementation of each strategy. It also provides the planning area with an opportunity to make necessary revisions as local conditions change. Changes in development, technology or the capability of the planning area to implement the strategies adopted in the plan could necessitate the need for revisions in the plan itself.

The monitoring and evaluation process should include many issues:

- The adequacy of the planning areas resources to implement the strategies as adopted,
- Any redundancy among strategies that can be eliminated to free-up resources,
- Whether adequate funding is available for implementation of the strategies as adopted,
- Any technical, legal or coordination problems associated with implementation, and
- Whether mitigation actions are being implemented according to the prioritization scope.

However, the primary issue that monitoring and evaluation should address is whether the vulnerability of the planning area has decreased because of the strategies adopted in the plan. Where vulnerability has decreased, the Committee should determine why and consider implementing successful mitigation strategies in other locations. Where vulnerability has remained constant or increased, the Committee should identify whether additional measures might be more successful or whether revisions should be made to existing measures.

As previously noted, changes in development, technology or the capability of the planning area to implement the strategies adopted in the plan could alter the ability of the planning area to implement the mitigation strategies identified and adopted in their plan or could necessitate the need for new strategies to be identified. As a result, update and revision is a necessary part of the Multi-Jurisdictional Hazard Mitigation planning process. While monitoring and evaluation are ongoing processes, update and revision should occur at regularly scheduled intervals. Updates to the Multi-Jurisdictional Hazard Mitigation Plan will occur every 5 years.

Members of the Mitigation Planning Committee will also serve as the Mitigation Update and Revision Committee. This Committee will be responsible for updates and revisions to the Transylvania County Multi-Jurisdictional Hazard Mitigation Plan within five years or following a Presidential Declared Disaster, if necessary, to access how effective implemented

mitigation strategies have been. The Committee will collect and review all of the information examined and reported and will have one year from the fourth annual meeting to update and make changes to the Multi-Jurisdictional Hazard Mitigation Plan before submitting it to the governing boards for review and approval. The plan will then be submitted to NCDEM and FEMA for review and approval within five years or after a presidential declared disaster, if necessary.

Implementation through Existing Programs

- Transylvania County addresses planning goals and legislative requirements through its Comprehensive Development Plan, Watershed Protection Ordinance, Subdivision Regulations, Emergency Management Ordinance, Emergency Operations Plan, Manufactured Home Park Ordinance, and the North Carolina State Building Codes.

- The City of Brevard addresses it's planning goals and legislative requirements through it's Unified Development Ordinance, Flood Damage Prevention Ordinance, and the North Carolina Building Codes.

- The Town of Rosman addresses planning goals and legislative requirements through its Flood Damage Prevention Ordinance, Stream Bank Buffer Zone Ordinance, and the North Carolina Building Codes.

The Multi-Jurisdictional Hazard Mitigation Plan provides a series of goals, objectives, and strategies that are closely related to the goals and objectives of these existing planning programs. Transylvania County, the City of Brevard, and the Town of Rosman will have the opportunity to implement adopted mitigation strategies through existing programs and procedures. These previously identified documents are updated on a schedule established within each individual plan. By the established schedule, each of these documents will be revised and updated to continue to include a proactive mitigation processes. At such time, the plans will be cross-referenced to the Multi-Jurisdictional Hazard Mitigation Plan to ensure that each document includes mitigation activities identified within the Multi-Jurisdictional Hazard Mitigation Plan that will reduce and potentially eliminate the vulnerability of property and life to the hazards prevalent in the area. Subsequently, the Multi-Jurisdictional Hazard Mitigation Plan will be revised on its established schedule to include any additional information from the previously listed documents.

Continued Public Involvement

During the development of this plan, the public has been provided many opportunities to participate in its development. The Mitigation Planning Committee recognizes that though the plan has been posted on the County's website and in the local libraries and Administrative Buildings for review by the local citizenry there has been little participation by the residents of Transylvania County. Nonetheless, Transylvania County, the City of Brevard, and the Town of Rosman are dedicated to the continued involvement of the public during the annual review and the 5-year update, as well as, in the interim. The following is a schematic of how the public will be encouraged in the planning process in the future.

- Upon adoption of the plan by each governing board, a public information notice will be posted in all local newspapers that the plan has been adopted by the governing jurisdictions and is available for review for further review by the public.

- Subsequently, a copy of the adopted plan will be placed at the County Administration Building, City Hall, and Town Hall, as well as, at the public library for public review. These copies will have contact information for the Transylvania County Emergency Management Office for the public to provide input on the plan.

- A copy of the plan and any proposed revisions will be displayed on the County and City sponsored websites with a response icon and a phone number for the public to direct questions or comments regarding the plan to the Transylvania County Emergency Management Director.

- Two weeks prior to all annual review meetings of the Mitigation Planning Committee a public announcement will be posted in all local newspapers, and on the websites sponsored by Transylvania County, the City of Brevard, and the Town of Rosman to solicit public participation in the annual review process.

- Prior to any significant revisions to the plan, the Mitigation Planning Committee will hold advertised, public hearings in each governing jurisdiction to solicit public participation in the planning revision process.

Mitigation Action Plan

The strategies identified herein are organized within the Action Plan. The plan identifies each strategy into one of five categories: new policy, amended policy, continued policy, new project and continued project. In addition to the categorization of each strategy, the action plan also identifies the type of strategy, target completion date, responsible party/organization, potential funding source, monitoring and evaluation indicators, and the hazard(s) addressed by said strategies.

Type of Strategy

There are five strategy types and each strategy will be classified as one of the five types.

- Preventative – activities that are intended to keep vulnerability from increasing.

- Property Protection – measures that protect existing structures by modifying buildings to withstand hazardous events, removing structures from hazardous locations, or adopting policy that specifically addresses hazard issues in relation to current property.

- Natural Resource Protection – activities that reduce the impacts of hazards by preserving or restoring natural areas and their mitigative functions.

- Structural Projects – projects that are intended to lessen the impact of a hazard by modifying the environment or natural progression of the hazard event.

- Public Information – activities that are used to advise citizens, business owners, potential property buyers, and visitors about hazards, hazardous areas, and mitigation techniques they can use to protect themselves and their property.

Target Completion Date
A target completion date is established to provide a timeline for completion of the strategies identified herein. The target completion date is the date established for the project to be fully complete. Many strategies, especially those that will take multiple years to complete, will require the project manager to establish an individual timeline where benchmarks can be used to monitor the progression of the strategy.
The target completion dates are established under two categories: short-term and long-term. Short-term strategies are those that can be implemented within existing resources and authorities and should be completed within a period of 6 months to 2 years. Short-term activities also include those activities that should be implemented immediately following the adoption of this plan and should be implemented on a continuous basis. Long-term strategies requiring new or additional resources or authorities and should be organized to be implemented within a period of 3 – 5 years.

Responsible Party/Organization
The responsible party/organization will organize the implementation of the strategy, seek out appropriate funding, oversee strategy implementation, and be a liaison between the community and any other organization participating in the project. In addition, the responsible party/organization will report to the monitoring and evaluation party regarding the progress of the strategy implementation.

Potential Funding Source
It is a well-known fact that many local jurisdictions often lack the resources to implement strategies, which will assist in reducing the county/community vulnerability to hazards. Thus, this plan identifies potential funding sources for each strategy identified herein. The funding sources are those sources that are currently available to counties/communities and may change from year to year. As a result, the responsible party/organization for each strategy should always research funding sources not listed in this document.

Monitoring and Evaluation Indicators
Monitoring and evaluation indicators are benchmarks that will allow the monitoring and evaluating party to determine if a strategy has been completely implemented. Additionally, they will identify if a strategy is achieving the goal intended. If it is found that, the strategy is not successful in the community it may need to be altered or discontinued.

SECTION 1: INTRODUCTION

Hazard Mitigation
Mitigation is defined by the Federal Emergency Management Agency (FEMA) as any sustained action taken to reduce or eliminate long-term risk to people and property from hazards and their effects (NCDEM, 2001). Mitigation is an ongoing effort to lessen the impact that disasters have on people and property. In practice, mitigation can take many forms and include many actions, which happen locally. Local governments must recognize hazards and initiate mitigation action. According to the North Carolina Division of Emergency Management (NCDEM), at a minimum, local governments should:

- *Enact and enforce building codes, zoning ordinances, and other measures to enhance their legal capability in an effort to protect life and property.*
- *Make the public aware of hazards that present risks to people and property and measures they can take to reduce their risk and possible losses.*
- *Comply with Federal and other regulations that are designed to reduce disaster costs as well as preserve and protect natural, historical, and cultural resources.*

Through the application of mitigation technologies and practices, Transylvania County, the City of Brevard, and the Town of Rosman are working to ensure that fewer citizens and fewer local businesses become victims of disasters that are prevalent in their area.

Planning is the key to making mitigation a proactive process and pre-disaster planning is an essential element in building an effective mitigation program. Mitigation plans emphasize actions taken before a disaster happens to reduce or prevent future damages. Preparing a plan to reduce the impact of a disaster before it occurs can provide a county and it is communities with a number of benefits (NCDEM, 2001):

- *Saves lives and property*: In light of the fact that every county and community exists in a distinct natural, economic and social environment, hazard mitigation plans must fit within the specific needs of individual county/communities. A plan must consider the geography, demography, county/community size, economy, land uses, current county/community goals, and the hazards that define the county and community. Mitigation plans are designed to correspond with other county and community goals in order to provide a plan that best suits the overall needs of the planning area.

- *Achieves Multiple Objectives*: Mitigation plans can cover numerous hazards. By conducting a concurrent assessment of county and community vulnerability and capability to deal with various hazards, counties and communities are able to prioritize needs and develop appropriate solutions to current and potential problems. This evaluation provides a comprehensive strategy to contend with the multiple facets of hazard preparation, response and recovery.

- *Saves Money:* The county and communities will experience cost savings by not having to provide emergency services, rescue operations, or recovery measures to areas that are dangerous to people in the event of a hazard. They will also avoid costly repairs

or replacement of buildings and infrastructure that would have been if preventive mitigation measures had not been taken.

- *Facilitates post-disaster funding*: Many disaster assistance agencies and programs, including FEMA, require pre-disaster mitigation plans as a condition for both mitigation funding and for disaster relief funding. Such plans must include a thorough evaluation of potential hazards and readiness for potential disasters of the county and community. Programs that require such a plan include the Hazard Mitigation Grant Program (HMGP), which is authorized by Section 404 of the Stafford Act, the Flood Mitigation Assistance Program (FMA) and the Pre-Disaster Mitigation Program (PDM), all of which are overseen by FEMA and run by the state.

  The Stafford Act, which authorizes HMGP funding, requires that counties and communities include the following components in their mitigation plan:

  44 CFR 206.405

  (a) General. In order to fulfill the requirement to evaluate natural hazards within the designated area and to take appropriate action to mitigate such hazards, the State shall prepare and implement a hazard mitigation plan or plan update. At a minimum the plan shall contain the following:

  - *An evaluation of the natural hazards in the designated area;*
  - *A description and analysis of the state and local hazard mitigation policies, programs and capabilities to mitigate the hazards in the area;*
  - *Hazard mitigation goals and objectives and proposed strategies, programs and actions to reduce or avoid long-term vulnerability to hazards;*
  - *A method of implementing, monitoring, evaluating and updating the mitigation plan. Such evaluation is to occur at least a 5-year basis to ensure that implementation occurs as planned, and to ensure that the plan remains current*

Hazard Mitigation and Sustainable Development

When structures are built in inappropriate or dangerous areas, they can significantly alter the natural integrity of the area and place life and property at risk. In an effort to deter development in hazardous areas, a new initiative, sustainable development, has become an integral part of mitigation planning.

Sustainability is development that maintains or enhances economic prosperity and county/community well being while respecting, protecting and restoring the natural environment upon which people and economics depend.

Sustainable Development

A report published by NCDEM and FEMA, entitled *Hazard Mitigation in North Carolina - Measuring Success*, provides guidelines and strategies for counties and communities seeking to achieve sustainable development goals. According to the report, local governments and citizens can build sustainable counties/communities by concentrating on housing, business, infrastructure and critical facilities, and the environment. These five factors must be linked to a comprehensive mitigation plan that includes information dissemination to all

stakeholders about hazards and preparedness. In addition, the report recommends the following strategies to promote sustainable development:

- *Sustainable Housing*
  - *Avoid development in hazardous areas*
  - *Protect and strengthen buildings through design and building codes*
- *Sustainable Business*
  - *Integrate business and community risk assessments into business management practices*
  - *Integrate response and recovery plans for business and local government*
  - *Improve the capability of small business to effectively recover from natural disasters*
- *Sustainable Infrastructure and Critical Facilities*
  - *Promote improved hazard resistant design and construction practices for new, replaced or repaired infrastructure*
  - *Promote land use planning practices to encourage new infrastructure in appropriate areas*
  - *Promote rehabilitation of existing critical facilities that are most vulnerable to natural hazards*
- *Sustainable Environment*
  - *Relocate and prohibit unsafe land use activities*
  - *Maintain and restore the natural mitigation function of floodplains*
  - *Acquire environmentally sensitive areas in order to minimize development*

Sustainable development practices allow counties and communities to continue to develop and grow while also maintaining the social and environmental factors that make the planning area an attractive place to live, visit, and do business. Creating a resilient county/community is a fluid process. Once a county/community has completed visioning, design and implementation of sustainable development goals, these same principles are integrated into everyday development decisions.

The Mitigation Planning Process

Planning is the key to making hazard mitigation a proactive process rather than a reactive process. In addition, it ensures that areas subject to hazards are identified and managed appropriately to reduce vulnerability. Planning ensures that individual mitigation measures are carried out in a cooperative manner such that all local activities contribute to the mitigation effort and no single measure detracts from the overall goal of creating a safer, less vulnerable county and community. Planning also plays an important role in generating citizen understanding of and support for hazard mitigation. The mitigation planning process serves to publicize hazard information and create a forum for discussion of how best to balance the public interest and private property rights.

The mitigation planning process in Transylvania County was in general a step by step process where each step was designed to be supported by the previous step, and in turn provide support for the next. FEMA regulations require participation by each jurisdiction in the development of this plan. Participation as defined by the Transylvania County Mitigation Planning Committee is: local representation in mitigation planning meetings, review of the draft plan as developed by the Mitigation Planning Committee and Transylvania County Emergency Management, review of the final document as developed by

the Mitigation Planning Committee and Transylvania County Emergency Management, and adoption by each participating jurisdiction of the final document.

- *Development of a Mitigation Planning Committee.* Each governing jurisdiction selected key personnel within it's jurisdiction to participate in the development of the Transylvania County Multi-Jurisdictional Hazard Mitigation Plan. These individuals are collectively referred to as the Mitigation Planning Committee. The Mitigation Planning Committee for the development of the Multi-Jurisdictional Hazard Mitigation Plan for Transylvania County is overseen by the Transylvania County Emergency Management Coordinator and comprised of the following participants:

  - Transylvania County: Communications Director, Emergency Management Staff, Fire Marshal, Planning and Economic Development Director, Building Permitting and Enforcement;
  - the City of Brevard: Planning Director/Assistant Planning Director, Public Services Director, Police Chief, and Fire Chief;
  - The Town of Rosman: Mayor.
  - NC Division of Forest Resources: County Ranger
  - Gorges State Park: Park Superintendent
  - USDA Natural Resources Conservation Service: District Conservationist

The Mitigation Planning Committee, under the guidance of Transylvania County Emergency Management was responsible for the development of the plan. During the review process, the 2005 plan was posted on the Transylvania County website with a web form for citizens to provide input and comments during the planning process. Other jurisdictions participating were encouraged to link to this website as well. Despite efforts to solicit comments from the public, no comments were received. The Committee met multiple times, with an expanded final meeting before submission to cover the plans development period, with favorable participation at each meeting, in order to:

- Develop a Planning Area Profile;
- Identify and collect data on population development trends, residential development trends, commercial development trends, industrial development trends, as well as, governmental development trends;
- Identify and profile the hazards prevalent to the area;
- Assess the areas vulnerability to each identified hazard;
- Identify and discuss all governing documents for each jurisdiction;
- Identify the level of mitigation planning necessary to successfully reduce the vulnerability of the planning area to the identified hazards;
- Establish goals, objectives, and strategies to be implemented through this plan; and
- To review each section of the plan as it was updated (as follows).
  - **Executive Summary:** Reviewed by Transylvania County Emergency Services – minor revisions made and presented at meeting of Planning Committee with no further edits.

- **Section 1-Introduction**: Reviewed by Transylvania County Emergency Management – revised/updated "Mitigation Planning Process" and presented at meeting of Planning Committee with no further edits.
- **Section 2- Planning Area Profile:** Reviewed during planning committee meeting by committee participants line by line – revisions and updates made to "Water Resources" and "Demographic Profile".
- **Section 3 – Hazard Vulnerability Assessment:** Reviewed during planning committee meeting by committee participants line by line – hazards that were in plan that did not apply to any jurisdiction within the plan were deleted, historical occurrences were updated with most recent data, minor formatting changes at request of committee, added vulnerability table which applies to all hazards and deleted old vulnerability tables.
- **Section 4 – Community Capability Assessment:** Reviewed during planning committee meeting by committee participants line by line – corrections made to inaccurate data and updates to capabilities were made based on new infrastructure and ordinances/plans.
- **Section 5 – Mitigation Strategies:** Reviewed during planning committee meeting by committee participants line by line – committee identified actions that had been completed from the previous planning cycle; actions that were either no longer applicable or not practical, and new actions for the current planning cycle. A person responsible, possible resources, prioritization, and time frame for completion were assigned to all actions.
- **Section 6 – Prioritization Scope:** Reviewed by Transylvania County Emergency Services – minor revisions made and presented at meeting of Planning Committee with no further edits.
- **References:** Reviewed and updated by Transylvania County Emergency Services – minor revisions made and presented at meeting of Planning Committee with no further edits.
- **Appendix A – NOAA List of Past Storm Events:** This appendix was deleted. Historical Event Data Table was included with each specific hazard in this update.
- **Appendix B - Potential Funding Sources for Mitigation Activities – Became Appendix A:** Reviewed by Transylvania County Emergency Services – no changes were noted.
- **Appendix C – Adoption Resolutions – Became Appendix B:** Reviewed by Transylvania County Emergency Services and updated with current information. Signed Resolutions will be incorporated upon official adoption by jurisdictions after approval from NCDEM and FEMA.
- **Appendix D – State Compliance Letter:** Deleted based on guidance from NCDEM.

- **Appendix E – GIS Products – Became Appendix C:**
  - **The following GIS products were reviewed by Transylvania County Emergency Management and deleted from the plan during this planning cycle:** Population Distribution Map, Town of Rosman Parcels, Town of Rosman Wildland Interface Slope Analysis, Transylvania County Unincorporated Parcels, City of Brevard Brush Fire History, City of Brevard Parcels by DHS Listing, City of Brevard Topographical Map, City of Brevard Water Features, City of Brevard Wildland Interface Map, Brevard Wildand Interface Slope Analysis, Cemetery Map, Water Features, Transylvania County Land Use Map, Transylvania County Landslide History Map, Repetitively Damaged Flood Areas, River Erosion, Town of Rosman Parcels Effected by Flooding, Town of Rosman, Brush Fire History, Town of Rosman Repetitive Loss, Town of Rosman Topographical Map, Town of Rosman Water Features, Town of Rosman Wildland Interface Map
  - **The following GIS products were reviewed and updated or changed during this planning cycle:** Educational Facilities, Transylvania County Flood Plain Map, Fire & Rescue-EMS-Hospital, Government Offices-Law Enforcement Offices, Town of Rosman Flood Plain Map, Transylvania County Township Map, City of Brevard Flood Plain Map, City of Brevard Parcels Effected by Flooding, City of Brevard Zoning,
  - **The following GIS Products were reviewed and remained unchanged for this planning cycle:** Transylvania County Wildland Interface Map, Transylvania County Land Cover Map, Landslide Susceptibility, Seismic Probability, Transylvania County Topographic Map, Transylvania County Slope Study Map, Transylvania County Base Map, and Transylvania County Wildland Interface Slope Analysis.
  - **The following GIS products were added during this planning cycle:** Transylvania County Dam Classification Map, Federally Owned Land, City of Brevard Future Land Use Map

Blue Ridge Community College, Transylvania County Chamber of Commerce, American Red Cross, Brevard College, and Transylvania Regional Hospital were invited to the expanded meeting and it was advertised in The Transylvania Times to solicit public comment. A second public meeting was help prior to local adoption by each jurisdiction in order to provide another opportunity for public comment. No comments were received.

During the planning process the Hazard Mitigation Planning Committee considered each of the following available mechanisms for incorporating the requirements of the Transylvania County Multi-Jurisdictional Hazard Mitigation Plan:

Table 2.1
Existing Plans Incorporated into Hazard Mitigation Plan

Planning Mechanism	**How was the information in this plan incorporated into the Hazard Mitigation Plan Update?**
Emergency Operation Plan	The EOP was integral to the Hazard Mitigation Plan because it helped to identify the hazards that might affect the jurisdictions represented.
Comprehensive Plan	The Comprehensive Plan provided information concerning future growth of the county and helped determine future ordinances/policies/regulations that may be needed. This was important in determining mitigation goals and actions.
Floodplain Management Plan	The Floodplain Management Plan contains information about the location of floodplains within the jurisdictions and was in important factor in identifying areas that are prone to flooding.

At these meetings, each governing jurisdiction was provided the opportunity to add, delete, or question any information (directly related to their jurisdiction) that was present in any section of the plan. They were also allowed to question information regarding other jurisdictions participating in the plan and to provide feedback on any questions that may have been developed during other meetings.

Subsequently, Emergency Management developed the GIS products used to guide the hazard profiling and vulnerability assessment within this plan. These products were reviewed by County Departments, the NC Division of Forest Resources, as well as, the Fire Marshal to ensure their accuracy.

- *Hazard Identification and Analysis*: This step was conducted by gathering data on the hazards that occurred in the planning area. This information was gathered from local, state, and federal agencies and organizations, as well as, from newspaper and other media accounts, state and local weather records, conversations, interviews and meetings with key informants within the planning area. Planning Committee

members had the opportunity to review the general information on previous hazards and comment on them in a more specific manner. There was also a forum for discussion on the background information that was needed to gain a general understanding of any changes to the geography, geology, recreation, natural resources and water resources for the planning area.

- *Area Vulnerability Assessment*: This step was conducted through a review of a local base map, topography maps, flood-prone areas map, landslide susceptibility map, earthquake probability map, as well as, others. A more detailed analysis was conducted through inventory development with such documents as the United States Census, County tax records, county and community walk-throughs, as well as, conversations, interviews and meetings with key informants within the planning area. Planning Committee members had the opportunity to review the specific information on previous hazards accumulated and provide comments. The committee was provided the opportunity to review all GIS products and to review areas of vulnerability in association with specific hazards.

- *Community Capability Assessment*: To conduct this step a review of all documents governing the development of the planning area was completed. This step identified the community's current legal, institutional, political, and technical capability in carrying out mitigation activities. Most importantly, it determined the mitigation efforts already taken by the community. The planning committed discussed proactive mitigation measures already in place and discussed legal short falls in current governing documents. Additionally, GIS documents received a second review.

- *Acceptability Assessment*: This step was conducted by reviewing all the information discovered within the first three steps and determining whether the community should move forward with the planning process. As a part of the assessment, the plan was placed on the County website and in the local libraries and Administrative Buildings. The location of the plan was advertised in the local newspapers and notices were placed in all County and local Administrative buildings and the County Library. The notices requested not only the participation of the public but also of local businesses, not-for-profits, academia, surrounding Counties and Communities as well as state and federal agencies. Though the plan was well publicized there were no comments or input provided by the public.

- *Community Goal Assessment*: This step was conducted through a review of the governing documents of the planning area, as well as, conversations and interviews within the planning area. This step identified what goals are already established and adopted for the planning area and whether or not they promote or deter mitigation activities.

- *Mitigation Strategy Development*: In this step all, the information developed in previous steps was taken into consideration. Subsequently programs and policies were developed when an insufficiency was identified. At this time, each member of the Mitigation Planning Committee provided insight and information as to the future

needs of the planning area. They assisted in determining appropriate goals and strategies in an effort to reduce the planning areas vulnerability to hazards identified in previous steps.

- *Establish Procedures for Monitoring, Evaluating, and Reporting on Progress*: This step involved a series of tasks that assisted in setting procedures for ongoing monitoring, evaluation after the plan has been completed, and implementation has begun.

- *Establish Procedures for Revisions and Updates*: Here steps for establishing procedures to ensure that every five years (or following a Presidential Declared Disaster, if necessary) an evaluation report is completed that, when warranted, will result in revisions and updates to the plan.

- *Draft Review for State Compliance:* Upon the completion of the final draft of the plan, it was forwarded to the State of North Carolina, Department of Emergency Management, Hazard Mitigation Section, Risk Assessment and Planning Branch. This review was completed on June 23, 2011 and the plan was found to meet all requirements of the DMA2K and SB300.

- *Adoption*: The plan went through a public hearing process in Transylvania County TBD, the City of Brevard TBD and the Town of Rosman TBD and was adopted, by each, according to the enabling legislation and established legal procedures of the governing body (see Appendix B for adoption resolutions). All the public hearings were advertised in the Transylvania Times and notices were placed in all County and local Administration buildings as well as at the County Library.

- *Compliance Review*: Following adoption, the plan was reviewed by FEMA to ensure the plan's compliance with federal guidelines.

Public Information: At the first Board meeting, of each governing jurisdiction, following adoption and a successful state compliance review the Emergency Management Coordinator announced that the Transylvania County Multi-Jurisdictional Hazard Mitigation Plan is displayed on the County and City sponsored websites with a response icon and a phone number for the public to direct questions or comments regarding the plan to the Transylvania County Emergency Management Coordinator and that a hard copy will be posted at the Transylvania County Communications Office and local Administration buildings for public review and comment.

SECTION 2: PLANNING AREA PROFILE

History
Transylvania County was formed in 1861 from parts of Henderson County and Jackson County.

The City of Brevard was simultaneously formed under the same bill as Transylvania County. The City was named after Ephriam Brevard a colonel in the Revolutionary Army and surgeon.

The Town of Rosman was formed in 1905. It was named after Joseph Rosenthal and Morris Omausky, two business partners of Joseph Silversteen. The first major industry in Transylvania County, lumbering, was originally instituted in Rosman and the Silversteen Sawmill Company was the first industry to provide off-the-farm employment in the area.

Geography
The topography of Transylvania County is mountainous with an elevation that ranges from 1,265 to 6,043 above mean sea level. The western and northern borders are formed by a chain of mountains embracing the Tanasee and Pisgah Ridges. The highest elevations are along the northwestern border and along the Tanasee Ridge and Pisgah Ridge near the Blue Ridge Parkway. Southward beyond the French Broad River to the South Carolina border, the landscape is mountainous but the highest elevation reaches only 3,500 feet above mean sea level. There are many deep, narrow valleys between the mountains and a broad valley through the east-central part of the County.

Climate
According to Ryan Boyles, Assistant North Carolina State Climatologist, the climate of Transylvania County is strongly influenced by elevation where irregular elevation causes large differences in climate within the County. However, latitude, location on the continent, and other lesser factors help to control the general climatic features. Other related factors are average storm paths and wind patterns.

The mean annual temperature at Brevard averages 56 degrees and the average freeze-free growing season is about 190 days. Whereas temperatures of 90 degrees or higher occurs, on average, about 15 days each summer. The mean average temperature during the summer months of June, July and August is 72 degrees.

The County is located in the eastern part of the wettest area of North Carolina and of the eastern United States. Data for the North Carolina Climatic Data Center shows that there is rarely a month that passes that does not receive 1 or 2 inches except September and October. Rain in early summer is commonplace. Precipitation in winter usually results from low-pressure storms, which frequently pass through the area. The Average Annual Precipitation is about 56 inches.

Water Resources
Except for about 80 square miles in the southwestern part, Transylvania County is located in the Tennessee River basin, which provides excellent drainage through the French Broad

River and its tributaries (USDA 1974). The French Broad River originates with Transylvania County. Its tributaries consist of the West Fork, North Fork, and East Fork. In addition to drainage by the French Broad River, the County also drains through the Toxaway, Horsepasture, and Thompson Rivers as well as their tributaries.

The remaining 80 square miles in the southwestern part of the county is located in the Savannah Watershed.

The water for municipal and industrial use is obtained largely from surface streams. However, water for residential use is largely obtained from wells and springs. According to USDA, water from streams on federally owned land is used by the Town of Brevard and industry. The water is soft, generally pure, and well protected from runoff. However, the USDA reports the waters near the mouth of the Davidson River have in the past suffered from pollution by industrial waste.

Soils

The *USDA Soil Survey of April 1980* displays the general soil associations located within Transylvania County. General soil associations can be used to guide major land use considerations such as urban uses (residential, commercial, and industrial development), intensive recreation areas or campsites, and cultivation for farm crops. According to the U.S. Department of Agriculture Soil Survey of Transylvania County published in April 1980, Transylvania County has six general soil associations. These are:

- ROSMAN -TOXAWAY- TRANSYLVANIA association: Nearly level to sloping soils. They are well drained to poorly drained soils which county's land mass. These soils can be found primarily along the French Broad River.
- ASHE-EDNEYVILLE association: Moderately to very steep soils. They are well drained and comprise approximately 37 percent of the County's land mass. They can be found on narrow ridge tops and rough steep slopes.
- CHESTER-EDNEYVILLE-HAYESVILLE association: Rolling to sloping soils. They are well-drained soils and comprise approximately 20 percent of the County's land mass. They can be found on broad ridge tops and steep slopes.
- CHANDLER-FANNIN-WATAUGA association: Rolling to very steep soils. They are excessively drained soils and comprise approximately 21 percent of the County's land mass. They can be found on narrow ridge tops and rough steep slopes.
- BRANDYWINE-PORTERS-BURTON association: Moderately steep to very steep soils. They are well drained to moderately drained soils and comprise approximately 8 percent of the County's land mass. They can be found on narrow ridge tops and rough steep slopes, mostly at elevations above 3,500 feet.
- TALLADEGA-FLETCHER-FANNIN association: Rolling to very steep soils. They are well drained and comprise approximately 6 percent of the County's land mass. They can be found on narrow sloping ridge tops and on very steep slopes.

Natural Resources
According to the North Carolina Heritage Program, there are several endangered, threatened, significantly rare, and extirpated species or species of special concern for Transylvania County. The National Heritage Program List of at Risk Resources for Transylvania County identifies these species with their state and federal classification. It is important that during the planning process, as well as, the implementation process of the mitigation strategies identified herein to give special consideration to these resources so that they are not put at further risk.

Additionally, Transylvania County is home to more than 250 waterfalls. The highest fall is Whitewater Falls, which is the highest falls east of the Rocky Mountains. However, the most well known falls is Looking Glass Falls, which has a 60-foot cascade and Moore Cove Falls, which can be walked behind.

Demographic Profile
In an effort to mitigate the multiple hazards prevalent to the Transylvania County Multi-Jurisdictional Hazard Mitigation Planning Area, it was necessary to examine the demographics of said area (see the *Population Distribution* map for a GIS representation of current data). In this sub-section, an analysis of present and future populations (including age, racial, and gender compositions) was completed. By developing this profile, the community was able; determine where the largest populations currently reside or where they will statistically reside in the future. This provides an opportunity to analyze the effect each hazard will have on certain pockets of the population. In addition, it will provide an opportunity to determine what human phenomena may be occurring that increases or reduces the impacts a hazard may have on a particular section of the planning area.

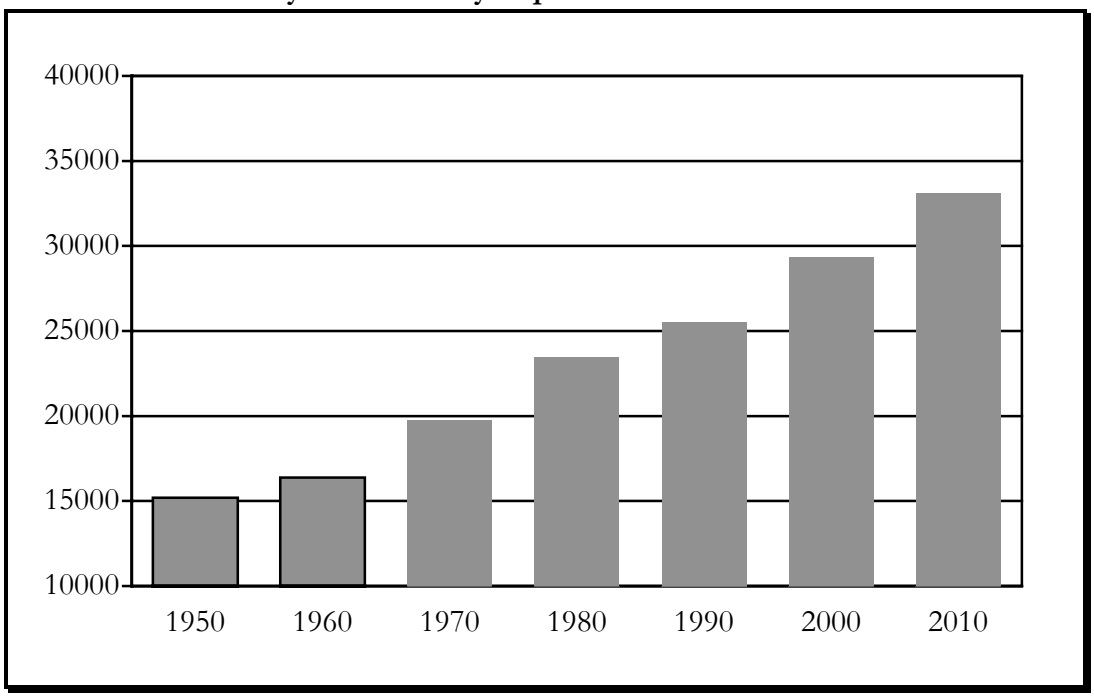
Demographic data was taken from the most recent U.S. Census reports (1950, 1960, 1970, 1980, 1990, 2000, and 2010) available and includes estimates and projections by the National Planning Data Corporation as well as the North Carolina Data Center. It is difficult to project, with a great deal of accuracy, future projections because of changing economic climates. Thus, the following projections are based on past growth performance and the assumption that the economic climate will continue to prosper and remain solid.

County Population
Research shows that the growth rate in Transylvania County has been steady and constant over the last 60 years (see Chart 2.1). In 2010, the U.S. Census counted 33,090 persons residing in the County. During the sixty-year period between 1950 and 2010, Transylvania County's population has more than doubled (see Table 2.2). This increase represents an addition of 17,896 absolute persons since 1950 (see Table 2.2). However, the majority of this growth was seen in the period between 1960 and 1970, with an addition of 3,341 absolute persons being added to the County census and an average growth rate of 20.4 % (see Table 2.2).

According to the Transylvania County Comprehensive Plan, the summer population in Transylvania County fluctuates significantly and is difficult to calculate. The best estimate is that the resident population increases by 13,000 to 15,000 persons during peak summer and fall seasons when the County's 19 summer camps as well as Brevard College and Brevard Music Center are open, part-time residents move back to the County, and local motels are

filled to capacity. The 19 summer camps each have an average of 385 campers and staff at any given time during the season.

Chart 2.1
Transylvania County Population Trends 1950-2010



Source: U.S. Census Bureau

Table 2.2

Transylvania County 1950-2010 Population		
Year	**Total Population**	**% Change**
1950	15,194	N/A
1960	16,372	7.80%
1970	19,713	20.40%
1980	23,417	18.80%
1990	25,520	9.00%
2000	29,334	14.90%
2010	33,090	12.80%

Source: U.S. Census Bureau

Municipal Populations
Transylvania County currently includes two incorporated municipalities: the City of Brevard and the Town of Rosman. When assessing the population trends of the County it is important to consider the population trends of its municipalities (see Table 2.3).

Table 2.3

Transylvania County Municipal Population Trends 1990-2010					
Municipality	**1990**	**2000**	**2010**	**% Change 1990-2000**	**% Change 2000-2010**
City of Brevard	5,388	6,789	6,569	26.00%	-3.24%
Town of Rosman	385	490	511	27.27%	4.29%
TOTAL	**5,773**	**7,279**	**7,080**	**N/A**	**N/A**

Source: U.S. Census Bureau

The City of Brevard, the largest municipality in Transylvania County and the County seat, experienced the largest growth in absolute persons from 1990 – 2000 with an additional 1,401 persons being added to the City's population. Based on the figures in Table 2.2 the City of Brevard experienced a 26.00% growth between 1990 and 2000, which decreased to -3.24% between 2000 and 2010.

The Town of Rosman is much smaller than the larger city of Brevard. The Town experienced a 32.72% increase between 1990 and 2010 but between 1990 and 2000, the Town saw a sharp increase in population of 27.27% or 105 absolute persons.

Township Populations
Transylvania County is made up of eight townships: Boyd Township, Brevard Township, Cathey's Creek Township, Dunn's Rock Township, Eastatoe Township, Gloucester Township, Hogback Township, and Little River Township (see *Transylvania County Township Map* Appendix C). County township demographics play an important role in developing a multi-jurisdictional plan in that townships section the entire County both unincorporated and incorporated areas which allows a clear view of the location of large amounts of population. This is especially important when planning for an area such as Transylvania County as the largest portion of the population is located in unincorporated areas.

Table 2.4 shows the populations of the townships from 1980 through 2000. Although each of the County's townships has experienced continued growth over the last twenty years, the most recent years are a primary point of analysis. During the decade between 1990 and 2000, the Gloucester Township experienced a significant increase in absolute population with a 56.4 % increase. The Little River, Dunn's Rock, and Hogback Townships followed closely with population percentage changes ranging from 41.5 % down to 33.5 %. The Brevard Township showed the lowest growth of all the townships during this period with a 0.1 % change between 1990 and 2000 and a -.09% change between 1980 and 2000.

Table 2.4

Transylvania County Township Populations 1980-2000					
Township	**1980**	**1990**	**2000**	**% Change 1980-2000**	**% Change 1990-2000**
Boyd	2,559	2,806	3,349	30.90%	19.40%
Brevard	10,450	10,340	10,354	-0.90%	0.10%
Cathey's Creek	3,216	3,302	3,606	12.10%	9.20%
Dunn's Rock	2,129	3,006	4,106	92.90%	36.60%
Eastatoe	1,714	2,335	2,557	49.20%	9.50%
Gloucester	807	715	1,118	38.50%	56.40%
Hogback	1,218	1,488	1,986	63.10%	33.50%
Little River	1,324	1,528	2,162	63.30%	41.50%
County Total	**23,417**	**25,520**	**29,334**	**25.30%**	**14.90%**

Source: U.S. Census Bureau

**Note updated 2010 census information was not available at the time of submission*

Age Composition

The ages represented within a population can have a significant impact on the needs and trends of a planning area. During mitigation planning it is necessary to assess, the level of vulnerability an area has in reference to different hazards. If a population has a large amount of children or elderly persons, the vulnerability to certain hazards is higher. Table 2.5 reflects the age composition of Transylvania County from 1980 – 2000.

Table 2.5

Transylvania County Population by Age Category 1980-2000					
Age Category	**1980**	**1990**	**2000**	**% Change 1980-2000**	**% Change 1990-2000**
Persons 0-4	1,522	1,430	1,435	-5.7%	0.0%
Persons 5-17	4,857	4,142	4,537	-6.6%	9.5%
Persons 18-54	11,599	12,329	13,168	13.5%	6.8%
Persons 55-64	2,499	2,892	3,911	56.5%	35.2%
Persons 65 & Up	2,940	4,727	6,283	113.7%	32.9%
Total	23,417	25,520	29,334	25.3%	14.9%
Median Age	32	38	43	37.2%	15.5%

Source: U.S. Census Bureau

**Note updated 2010 census information was not available at the time of submission*

Table 2.5 shows that a large portion of the population in Transylvania County is of working age. However, the 55-64 age group grew by 56.5% between 1980 and 2000 and the 65 and up group grew an amazing 113.7% showing that the age of retirement population is among the fastest growing population in the County. The child population has also experienced significant change over the past few decades. The 0-4 age group experienced a -5.7% decrease between 1980 and 2000 and the 5-17 age group experienced a -6.6% decrease during the same period.

This shows that the County is quickly becoming an area where during mitigation, response, and recovery Emergency Management Officials will have to pay special attention to the needs of older individuals.

Language Composition

During the planning stage of a mitigation plan, it is important to identify any non-English speaking populations that may be located within the planning area. Such populations represent a special need when determining the vulnerability of those populations to certain hazards. For example, if a population has a large number of Spanish speaking persons, it may be necessary to publish all hazard warnings in Spanish or it may be necessary to have a Spanish interpreter on hand during disaster recovery. The U.S. Census Bureau uses four main categories to classify language: *English, Spanish, Other than Indo-European Language,* and *Asian and Pacific Island Language.* Table 2.6 displays the language composition by municipality.

Table 2.6

Transylvania County Language Composition 2000

Language Composition	English Only	Spanish*	Other than Indo-Eurpoean Language*	Asian or Pacific Island Language*
City of Brevard	6,215	78	61	10
Town of Rosman	471	6	0	1
Unincorporated County Areas	26,768	151	111	18

* Number represents those persons who "Speak English Less than Well"

Source: U.S. Census Bureau

**Note updated 2010 census information was not available at the time of submission*

The largest population of Transylvania County is identified as English speaking persons (see Table 2.6). This means that English is either their primary language or that they speak it fluently as a second language. The second most spoken language is Spanish. According to the U.S. Census Bureau, the largest population of Spanish speaking persons in Transylvania County is located in the unincorporated areas of the County. However, the City of Brevard also has a significant number of Spanish speaking persons residing with their City limits. Though not as numerous, there are populations of Spanish speaking persons in Rosman as well (see Table 2.6).

Future Population Trends and Projections

Formulating population projections is complex and ambiguous. Many factors that are not easily predicted can play a significant role in the outcome of the projections. However, with accurate data available, population projections can serve as an invaluable tool for planning purposes. The U.S. Census Bureau provides certified population data that is detailed and easily accessible. The North Carolina State Data Center also provides information for recent population trends. By the year 2020, the County's population could range from 36,399 to 39,708 persons. By 2030, the County's population could possibly approach 47,000 (see Table 2.7).

Table 2.7

Transylvania County Population Projections 2010-2030					
Year	**2000-2010 % Change**	**Total Population**	**Year**	**Percent Change**	**Total Population**
2020	10%	36,399	2030	10%	40,039
			2030	15%	41,859
			2030	20%	43,679
2020	15%	38,053	2030	10%	41,858
			2030	15%	43,761
			2030	20%	45,664
2020	20%	39,708	2030	10%	43,679
			2030	15%	45,664
			2030	20%	47,650

Source: US Census & NC State Data Center

Residential Development

In addition to the demographic profile for Transylvania County, it was important to profile residential development within the planning area. This profile will further assist in determining the planning area's vulnerability to different hazards and will assist in determining how many residential structures are at risk.

General Housing Characteristics

The Transylvania County Residential Development Table indicates the most significant potential vulnerability is located in the unincorporated areas of Transylvania County with a total of 25,849 residential properties at a value of 4,430,695,205 (see Table 2.8). These figures include singlewide mobile homes.

Table 2.8

Transylvania County Residential Development		
Jurisdiction	**Parcels**	**Value**
Unincorporated Transylvania County	25,849	$4,430,695,205
City of Brevard	2,251	$426,936,441
Town of Rosman	360	$13,715,627
TOTAL	28,460	$4,871,347,273

Source: Transylvania County Tax Administration

Commercial Development

To gain an understanding of the current commercial development in Transylvania County a list identifying the properties zoned for commercial use was developed. The list was divided into those properties that were developed and those that were not. In total, there are 2,758 commercial properties located in Transylvania County with a total value of $497,474,866 (see Table 2.9). The list of developed properties was further divided by area (see Table 2.9). The largest amount of commercial development was found in the City of Brevard where there are 2,204 commercial properties have an approximate tax value of $435,283,868 (see Table 2.9). The second largest amount of commercial development was found in the Unincorporated Areas of Transylvania County where there are 470 commercial properties with an approximate value of $57,158,555 (see Table 2.9). The Town of Rosman also contains commercial development with density than Brevard with a total of 84 commercial properties with an approximate value of $5,032,443 (see Table 2.9)

Table 2.9

Transylvania County Commercial Development		
Governing Body	**Number of Properties**	**Approximate Value of Properties**
Unincorporated Areas	470	$57,158,555
City of Brevard	2,204	$435,283,868
Town of Rosman	84	$5,032,443
Transylvania County	2,758	$497,474,866.00

Source: Transylvania County Tax Administration

Industrial Development

To gain an understanding of the current industrial development in Transylvania County a list identifying the properties zoned for industrial use was developed. These values include developed and undeveloped parcels zoned for industrial use. In total, there are 919 industrial properties located in Transylvania County with a total value of $165,824,955 (see Table 2.10). The list of properties was further divided by area (see Table 2.10). The largest amount of industrial properties was found in the unincorporated areas of the County where there are 875 industrial properties with an approximate value of $157,119,278 (see Table 2.10). The second largest number of industrial properties was found in the City of Brevard where there are 44 industrial properties have an approximate value of $8,705,677 (see Table 2.10). The Town of Rosman currently has no industrial development.

Table 2.10

Transylvania County Industrial Development		
Governing Body	**Number of Properties**	**Approximate Value of Properties**
Unincorporated Areas	875	$157,119,278
City of Brevard	44	$8,705,677
Town of Rosman	0	$0
Transylvania County	919	$165,824,955.00

Source: Transylvania County Tax Administration

Critical Facility Development

Critical facilities are those facilities that are necessary to the day-to-day operation of the County and Municipalities and should those facilities be destroyed or should their services be interrupted, they would hinder the continued operation of the County or Municipality. Many critical facilities such as the Law Enforcement Departments, Fire Departments, Rescue Squads, Public Works Department, Public Utilities Departments, and Administration Departments, EMS, Educational Facilities, and Hospital provide extensive recovery assistance following disasters. Schools are often used during disasters as shelters to remove citizens from harm's way or to house citizens after they have lost their home and possessions in a disaster. The following sub-sections provide general information on the critical facilities in Transylvania County and its incorporated municipalities. In total there are 99 properties identified for critical facility use at a value of $272,005,130. The developed properties that fall within the previously mentioned definition are discussed below.

Government Administration Facilities

Government Administration Offices serve as core information providers during disaster recovery. The Government Administration Office is where critical records are stored and having access to these records is pertinent during disaster recovery. There are three Administration Offices located within Transylvania County (see *Transylvania County Governments Offices– Law Enforcement* map, Appendix C). Specific information on the value and employee status can be requested through the Transylvania County Communications Office due to the sensitivity of the information.

Law Enforcement Facilities

Law enforcement facilities provide immediate emergency response for Transylvania County and its municipalities and are a primary force in disaster recovery operations. Collectively, these departments work together through memorandums of agreement or memorandums of understanding to ensure that the citizens of Transylvania County and its municipalities are less vulnerable to potential disasters. There are two law enforcement facilities within Transylvania County (see *Transylvania County Governments Offices – Law Enforcement* map, Appendix C). Specific information on the value and employee status can be requested through the Transylvania County Communications Office due to the sensitivity of the information.

Fire and Rescue Departments

In addition to law enforcement facilities, Fire and Rescue Departments also provide immediate emergency response for Transylvania County and its municipalities and are a primary force in disaster recovery operations. Collectively, these departments work together through memorandums of agreement or memorandums of understanding to ensure that the citizens of Transylvania County and its municipalities are less vulnerable to potential disasters. There are 9 fire and rescue departments and two substations within Transylvania County (see *Transylvania County Fire & Rescue Departments, EMS and Hospital* map, Appendix C). Specific information on the value and employee status can be requested through the Transylvania County Communications Office due to the sensitivity of the information.

Public Works Departments

Public Works Departments provide immediate emergency response for Transylvania County and its municipalities and are a primary service during mitigation and disaster recovery operations. During mitigation operations, public works departments are often responsible for tree pruning and debris removal, which can cause damage or power outages during disasters that have high wind or ice and snow. Following disasters, the public works departments are responsible for debris removal and road clearing which if left unattended can impede regular and emergency traffic. Specific information on the value and employee status can be requested through the Transylvania County Communications Office due to the sensitivity of the information.

Educational Facilities

Public schools are considered critical facilities in that they house a significant number of persons in a small area who require evacuation assistance and because during disaster recovery they are used as shelters. There are nine schools in Transylvania County and all are used for shelters by the Transylvania County Emergency Management Office, if needed. There are a total of four elementary schools units at a value of $29,656,770 dispersed throughout Transylvania County. There are a total of five middle and high schools including one alternative school with a total value of $25,080,479 within Transylvania County. There are two High Schools at a value of $40,790,180 (where Rosman Middle School and Rosman High School share a building site.) (see *Transylvania County Educational Facilities* map, Appendix C). Specific information on the student and employee status can be requested through the Transylvania County Communications Office due to the sensitivity of the information.

In addition to public schools the following educational facilities are within the City of Brevard: Brevard College, Blue Ridge Community College, Brevard Academy (Charter School), and Bethany Christian School with a total value of $61,545,190.

SECTION 3: HAZARD VULNERABILITY ASSESSMENT

In this section the past hazard, events of Transylvania County are recorded and analyzed (see Appendix A). This information is identified by using both primary and secondary research materials, which will include but is not limited to reports from local, state, and national agencies, as well as, media accounts, state and local weather records, and conversations with key personnel and residents in Transylvania County. This analysis will include the possible severity and magnitude, as well as, the potential impact of damage within the each governing jurisdiction from future hazards. All risks identified in this plan effect all jurisdictions participating in this plan.

For the purpose of ranking hazards affecting the planning area, in order of the importance for mitigating their effects, a hazard index has been assigned (see Table 3.1) that takes into account the anticipated Frequency of Occurrence (see Table 3.2) and specific Consequences of Impact (see Table 3.3). This is not meant to be a scientific process, but will serve as a way to prioritize mitigation measures based on the potential frequency and the likely extent of damage from hazards known to affect the community. This ranking will be considered when specific mitigation measures are prioritized for implementation, along with other factors, such as stated community goals, citizen concerns, on-going projects, and opportunities for funding.

Table 3.1

Hazard Index Ranking				
Impact → / **Frequency of Occurrence ↓**	**Catastrophic**	**Critical**	**Limited**	**Negligible**
Highly Likely	5 *(Highest)*	4 *(High)*	4 *(High)*	3 *(Medium)*
Likely	5 *(Highest)*	4 *(High)*	3 *(Medium)*	2 *(Low)*
Possible	4 *(High)*	3 *(Medium)*	2 *(Low)*	2 *(Low)*
Unlikely	3 *(Medium)*	2 *(Low)*	1 *(Lowest)*	1 *(Lowest)*
Highly Unlikely	2 *(Low)*	1 *(Lowest)*	1 *(Lowest)*	1 *(Lowest)*

Hazard Index Scale: 1-5, with five indicating the highest priority for considering mitigation measures (Highest, High, Medium, Low, and Lowest). *Source: FEMA, 1997*

Table 3.2

Frequency of Occurance	
Highly Likely	Near 100 percent probability in the next year.
Likely	Between 10 and 100 percent probability in the next year, or at least one chance in the next 10 years.
Possible	Between 1 and 10 percent probability in the next year or at least one chance in the next 100 years.
Unlikely	Less than 1 percent probability in the next year or less than one chance in the next 100 years.
Highly Unlikely	Little to no probability in next 100 years.

Source: FEMA and NCDEM

Table 3.3

Consequences of Impact	
Catastrophic	Multiple deaths, complete shutdown of facilities for 30 days or more, more than 50 percent of property is severly damaged.
Critical	Multiple severe injuries, complete shutdown of critical facilities for at least 2 weeks, more than 25 percent of property is severely damaged.
Limited	Some injuries, complete shutdown of critical facilities for more than one week, more than 10 percent of property severely damaged.
Negligible	Minor injuries, minimal quality-of-life impact, shutdown of critical facilities and services for 24 hours or less, less than 10 percent of property is severely damaged.

Source: FEMA and NCDEM

The criteria provided by NCDEM for the development of the Hazard Mitigation Plan identifies 11 and one Technological Hazard natural hazards and states that, at a minimum, Transylvania County must address: Tropical Storms, Flooding, Erosion, Severe Thunderstorms/ Windstorms, Wildfires, Tornadoes, Winter Storms, Droughts, Extreme Temperatures, Earthquakes, Landslides, and Dam/Levee Failure.

The Mitigation Planning Committee chose to examine 11 natural hazards and 1 technological hazard. The hazards examined herein are divided into two categories: Natural Hazards, which include Tropical Storms, Flooding, Erosion, Severe Thunderstorms/ Windstorms, Wildfires, Tornadoes, Winter Storms, Droughts, Extreme Temperatures, Earthquakes, Landslides, and Technological Hazards, which include Dam/Levee Failures. In addition to the identification and ranking of each hazard, this section used the information identified in the community profile section of this plan and compared it to the hazards identified to determine the areas vulnerability to each hazard. This assessment provides detailed information on the number of structures and the potential population that could be affected by each hazard.

All of the hazards described in this plan often impact large areas and cross jurisdictional boundaries, leaving all existing and future buildings, facilities, and populations exposed to the impact of these hazards. Though some area may experience a lesser impact from the hazards, all areas of the county are still considered at risk. Many hazards, such as hurricanes and tropical storms, can cause damage through numerous additional hazards such as flooding, erosion, high winds and precipitation, thus it is difficult to estimate total potential losses from these cumulative effects. Nevertheless, Table 3.4 describes the total number of structures located in each jurisdiction that is participating in this plan. In this assessment, all of the structures in each jurisdiction are considered vulnerable to each of the hazards described in this plan.

Table 3.4
All Hazard Vulnerability

Jurisdiction	Population	Residential Structures	Residential Structure Value	Commercial Structures	Commercial Structure Value	Critical Facilities	Critical Facilities Value
Transylvania County	33,090	11,979	$2,198,864,800	1,633	$299,845,200	42	$12,647,690
City of Brevard	6,569	1,559	$297,997,113	1,622	$310,160,261	49	$165,968,460
Town of Rosman	511	114	$9,689,472	44	$3,768,128	8	$23,758,130
TOTALS	33,090	13,652	$2,506,551,385	3,299	$613,773,589	99	$202,374,280

Source: Transylvania County Emergency Management; City of Brevard Planning; Transylvania County Tax Records; 2010 US Census

NATURAL HAZARDS

Natural hazards such as tropical cyclones, floods, tornadoes, winter storms, and the like are an enduring condition around the human environment. Natural hazards become disasters when they intersect with the human environment and in North Carolina, particularly; natural disasters have left a profound imprint causing devastating loss of life, property, economy and community. While most processes present little danger to human well being, some develop into hazardous situations that place life, property, economy, and community at higher risk. For the purpose of this plan, natural hazards will be divided into 5 sub-sections: Atmospheric Hazards, Hydrologic Hazards, Geologic Hazards, Seismic Hazards, and Other Natural Hazards.

ATMOSPHERIC HAZARDS

The group "Atmospheric Hazards" includes weather-generated events. Each has its own natural characteristics, geographic location or aerial extent, seasonality, severity, and associated risks. Though these characteristics allow identification of each individual hazard many of these hazards are interrelated (FEMA 1997). For example, tornadoes can be a product of severe thunderstorms or tropical cyclones and snow or ice can be a byproduct of nor'easters. These hazards may also be directly linked to other categories of natural hazards (i.e. excessive rain can cause the geologic hazard of landslides). In addition they can be interlinked with Technological Hazards as well (i.e. excessive rains can cause dam/levee failure which can lead to flooding) These linkages make it difficult to attribute damage to

one hazard or to access the risk one hazard has on the planning area but mitigation strategies quite often have beneficial effects on several types of hazards.

In this sub-section, five atmospheric hazards were addressed: winter storms, severe thunderstorms/windstorms, tropical cyclones, tornadoes, and extreme temperatures. Each category has a general description of the hazard, a vulnerability summary for the planning area, and specific hazard information for each individual governing jurisdiction.

Winter Storms – Hazard Ranking 3

Winter storms originate as mid-latitude depressions of cyclonic weather systems and can cause snowstorms, blizzards, and ice storms. Winter storms can paralyze a county/community by shutting down normal day-to-day operations and can produce an accumulation of snow and ice on trees and utility lines resulting in loss of electricity and blocked transportation routes. These storms can also lead to frozen water pipes, which when erupted, can lead to extensive property damage and the depletion of a natural resource. When county's/communities have long-term loss of utilities elderly and extremely young populations become more vulnerable to the effects of the extreme temperatures associated with these storms.

Winter Storm Vulnerability Summary

To determine the County's vulnerability to winter storms a period from 1970 to 2004 was examined. Numerous sources were used in identifying the winter storm hazards that have occurred in Transylvania County since 1970 both primary and secondary. Primary sources used included the Emergency Management Coordinators and Emergency Management after Action Reports. Secondary sources included the Transylvania Times, Cable News Network, NOAA, National Climatic Data Center, the North Carolina Climate Center, and the Weather Channel. The entire jurisdiction of Transylvania County is equally susceptible to winter storms

Transylvania County is located in the southwestern portion of North Carolina in and around the Blue Ridge Mountains where elevations are high making them more susceptible to the hazard of winter storms. In fact, since 1970 Transylvania County has been affected by 56 winter storm events (mostly minor events). The most active period was the eight years between 1996 and 2004 when the area averaged 6.88 events per year. The most significant storms affecting the area were the March 13, 1993 storm (not in the identified most active period) and the February 2, 1996 storm (at the beginning of the most active period).

In March of 1993, the Governor declared a state of emergency within 40 counties in North Carolina one of which was Transylvania County. This storm had the highest accumulation of snow and ice in the time period examined. In total, there was a total accumulation of 18 inches of snow and ice across the County. According to Emergency Management Reports, there were numerous primary and secondary roads closed due to tree and limb debris, which left several cars stranded across the County. In addition, numerous homes and businesses that received damage from said debris with an accumulated damage value of $1.9M. There were approximately 5,500 Transylvania County homes without power, which resulted in the opening of several disaster shelters by the Red Cross. The 911 center received 169 calls as a

result of storm related accidents, injuries, and damages. There were two persons injured that were transported by medical helicopter due to the poor road conditions.

The ice storm of February 2, 1996 was a problem not only because of the ice accumulation but also because of the extreme cold temperatures. Ice accumulation caused treacherous road conditions, extensive debris and power outages throughout the County. The Department of Transportation reported numerous roads or highways were closed due to tree and limb debris. The debris also causes minor damage to numerous homes throughout the County in the way of roof and shingle damage. Electric Companies reported more than half of the County was without power for 48 to 72 hours. This prompted the Red Cross to open shelters in the County where persons without power could seek refuge. There were minor injuries from accidents because of poor road conditions.

The two previously listed storms are examples of how Transylvania County and its municipalities are affected by severe winter storms and extreme cold temperatures. In general, Transylvania County and its municipality's actually fair well during (average) winter storm conditions. On average, accumulation ranges from 2 – 6 inches across the County. There is minor damage to structures in the form of roof and shingle damage. However, the largest issue for the County and its municipalities is that these storms are quite often a transportation issue as debris from damaged trees covers roads interrupting the flow of traffic. Power outages are also common during average winter storm incidences. However, reports from Power Companies show that they are quick to restore power so that there is no interruption of critical services within the County.

The hazard index ranking for winter storms was a complicated determination (see Table 3.22). It was determined that due to the geographic location and the range of elevation in Transylvania County; it is highly likely the entire County will be affected by winter storms in the future. The intensity rating for winter storms is moderate as the largest portions of storms are general in nature. Because there were two major injuries resulting from the March 1993 storm and because the March 1993 storm had a higher than normal level- of property damage, the future impact for winter storms should be listed as limited. However, future impacts will most likely be negligible as the most of the winter storms that affect the area are of a general nature. This means that there will be minor injuries, minimal quality-of-life impact, loss of critical services for 24 hours or less, and less than 10 percent of property would be damaged. These factors suggest a hazard index ranking of three for winter storms in the planning area (see Table 3.22). This indicates that winter storms are one of the most important considerations in determining mitigation strategies for the area. Based on historical data maximum accumulations are expected to be no more than 36 inches.

Table 3.5
Winter Storm Historical Data 1950-February 2011
Source: National Climatic Data Center

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 Statewide	03/12/1993	1600	Winter Storm	N/A	2	10	50.0M	0
2 Northern Interior And	02/10/1994	1000	Ice Storm	N/A	0	0	0	0

3 NCZ051>053 - 058>059 - 062>065	02/01/1996	08:00 PM	Freezing Rain	N/A	0	0	0	0
4 NCZ033 - 048>053 - 058>059 - 062>065	02/07/1996	12:00 PM	Snow	N/A	0	0	0	0
5 NCZ033 - 048>059 - 062>072	02/16/1996	02:00 AM	Snow	N/A	0	0	0	0
6 NCZ033>037 - 048 - 059 - 062>067	12/18/1996	06:00 PM	Heavy Snow	N/A	0	0	0	0
7 NCZ033>037 - 048>055 - 058>059 - 062>067 - 069	01/09/1997	12:00 AM	Ice Storm	N/A	0	0	2.0M	0
8 NCZ033 - 048>053 - 058>059 - 062>065	01/10/1997	08:00 PM	Heavy Snow	N/A	0	0	0	0
9 NCZ049 - 053>055 - 064>070	02/13/1997	10:00 AM	Winter Storm	N/A	0	0	0	0
10 NCZ048 - 052>055 - 059 - 062 - 064>067	12/08/1997	11:00 AM	Wintry Mix	N/A	0	0	0	0
11 NCZ052>055 - 058>059 - 063>065	12/27/1997	12:00 AM	Snow	N/A	0	0	0	0
12 NCZ033 - 048>053 - 058>059 - 062>065	12/29/1997	10:00 AM	Heavy Snow	N/A	0	0	0	0
13 NCZ033 - 048>053 - 058>059 - 063>065	12/30/1997	05:00 PM	Heavy Snow	N/A	0	0	0	0
14 NCZ033 - 048>055 - 058>059 - 062>065	01/18/1998	08:00 PM	Snow	N/A	0	0	0	0
15 NCZ033 - 048>049 - 053>054 - 059 - 062>064	01/18/1998	10:00 PM	Heavy Snow	N/A	0	0	0	0
16 NCZ033>034 - 048>055 - 058>059 - 062>067	01/27/1998	04:00 AM	Heavy Snow	N/A	0	0	0	0
17 NCZ048 - 050 - 052>053 - 064>065	02/03/1998	12:00 AM	Snow	N/A	0	0	0	0
18 NCZ033 - 048>052 - 058>059 - 062>064	03/02/1998	12:00 AM	Snow	N/A	0	0	0	0
19 NCZ033 - 048>050 - 052>053 - 055 - 058>059 - 062>064	03/11/1998	04:00 PM	Snow	N/A	0	0	0	0

20 NCZ033 - 035>036 - 048>053 - 055 - 058>059 - 062>064 - 066>068 - 070>071 - 082	12/23/1998	09:00 AM	Freezing Rain/sleet	N/A	0	0	0	0
21 NCZ034 - 054>055 - 064>067	12/24/1998	10:00 PM	Snow	N/A	0	0	0	0
22 NCZ034 - 049>050 - 053>055 - 064	02/23/1999	06:00 AM	Snow	N/A	0	0	0	0
23 NCZ034 - 053>054 - 058>059 - 062>065	03/03/1999	12:00 PM	Snow	N/A	0	0	0	0
24 NCZ035 - 048 - 052 - 056 - 059 - 064>070 - 072	03/09/1999	03:00 AM	Snow And Sleet	N/A	0	0	0	0
25 NCZ048 - 050>053 - 058>059 - 062>064	03/26/1999	06:00 AM	Heavy Snow	N/A	0	0	0	0
26 NCZ034>037 - 048>049 - 051>056 - 058>059 - 062>067	12/24/1999	08:00 AM	Snow	N/A	0	0	0	0
27 NCZ033 - 048>053 - 058>059 - 062>065	01/16/2000	06:00 AM	Freezing Rain/sleet	N/A	0	0	0	0
28 NCZ034>037 - 051>059 - 064	01/20/2000	04:00 AM	Snow	N/A	0	0	0	0
29 NCZ033>037 - 048>056 - 058>059 - 062>072 - 082	01/22/2000	03:00 PM	Heavy Snow	N/A	0	0	0	0
30 NCZ033 - 048>053 - 058 - 064>065 - 070>072 - 082	01/29/2000	09:00 PM	Ice Storm	N/A	0	0	0	0
31 NCZ033 - 048>053 - 059 - 062 - 064>065	04/08/2000	02:00 PM	Snow	N/A	0	0	0	0
32 NCZ033>037 - 048>059 - 062>072 - 082	11/19/2000	06:00 AM	Snow	N/A	0	0	0	0
33 NCZ052>053 - 059 - 062>067 - 069	12/13/2000	02:00 PM	Freezing Rain	N/A	0	0	0	0
34 NCZ033 - 048>053 - 056 - 059 - 062>065	12/17/2000	06:00 AM	Snow	N/A	0	0	0	0
35 NCZ034>037 - 051>056 - 058>059 - 064>067	12/19/2000	03:00 AM	Snow	N/A	0	0	0	0

36 NCZ033 - 048>053 - 058>059 - 062>065	01/01/2001	12:00 PM	Snow	N/A	0	0	0	0
37 NCZ033 - 048>050 - 052>055 - 059 - 063>065 - 067>068	03/20/2001	08:00 AM	Heavy Snow	N/A	0	0	0	0
38 NCZ063>065	01/03/2002	04:00 AM	Heavy Snow	N/A	0	0	0	0
39 NCZ033 - 048 - 050>051 - 058 - 062>065	02/03/2002	04:00 PM	Snow	N/A	0	0	0	0
40 NCZ033 - 048>055 - 058>059 - 062>065	02/06/2002	09:00 AM	Winter Weather	N/A	0	0	0	0
41 NCZ063>064 - 068 - 070>072 - 082	12/04/2002	03:00 PM	Ice Storm	N/A	0	0	99.0M	0
42 NCZ033 - 048>053 - 058>059 - 062>065	01/16/2003	06:00 PM	Heavy Snow	N/A	0	0	0	0
43 NCZ033 - 048>053 - 058>059 - 062>065	02/06/2003	08:00 PM	Heavy Snow	N/A	0	0	0	0
44 NCZ033>034 - 048>053 - 058>059 - 062>065	02/09/2003	09:00 PM	Winter Weather/mix	N/A	0	0	0	0
45 NCZ033 - 048>053 - 058>059 - 063>065	04/10/2003	11:00 AM	Heavy Snow	N/A	0	0	0	0
46 NCZ033>034 - 048>054 - 058>059 - 062>065	11/28/2003	03:00 PM	Winter Weather/mix	N/A	0	0	0	0
47 NCZ033 - 048>053 - 058>059 - 062>065	12/03/2003	10:00 PM	Winter Weather/mix	N/A	0	0	0	0
48 NCZ033 - 048>053 - 059 - 063>064	12/04/2003	06:00 AM	Winter Storm	N/A	0	0	0	0
49 NCZ033>037 - 048>050 - 053>057 - 062>067	01/25/2004	12:00 PM	Heavy Snow	N/A	0	0	0	0
50 NCZ049>053 - 059 - 062>065	02/02/2004	05:00 AM	Winter Weather/mix	N/A	0	0	0	0
51 NCZ052 - 062>064	02/05/2004	01:00 PM	Winter Weather/mix	N/A	0	0	0	0
52 NCZ051 - 058>059 - 062>065	02/12/2004	12:00 AM	Winter Weather/mix	N/A	0	0	0	0

53 NCZ062>064	02/15/2004	06:00 AM	Winter Weather/mix	N/A	0	0	0	0
54 NCZ048 - 051>053 - 059 - 062>065	02/26/2004	09:00 AM	Heavy Snow	N/A	0	0	0	0
55 NCZ034 - 048 - 051>055 - 058>059 - 062>066	03/30/2004	12:00 AM	Winter Weather/mix	N/A	0	0	0	0
56 NCZ051>052 - 058>059 - 062>065	04/13/2004	09:00 PM	Winter Weather/mix	N/A	0	0	0	0
57 NCZ049>050 - 064>065	01/29/2005	03:00 AM	Winter Weather/mix	N/A	0	0	0	0
58 NCZ049>050 - 064>065	01/29/2005	10:00 AM	Winter Storm	N/A	0	0	0	0
59 NCZ050 - 053 - 064	02/02/2005	08:00 PM	Winter Weather/mix	N/A	0	0	0	0
60 NCZ050 - 064>065	02/03/2005	03:00 AM	Ice Storm	N/A	0	0	0	0
61 NCZ033>034 - 049>050 - 053>055 - 064>065	02/27/2005	08:00 PM	Winter Weather/mix	N/A	0	0	0	0
62 NCZ033>034 - 049>050 - 053>055 - 064>065	02/28/2005	03:00 AM	Heavy Snow	N/A	0	0	0	0
63 NCZ033>037 - 048>050 - 052>057 - 059 - 063>068	03/17/2005	02:00 AM	Winter Weather/mix	N/A	0	0	0	0
64 NCZ033 - 048>055 - 058>059 - 062>064	11/21/2005	07:00 PM	Winter Weather/mix	N/A	0	0	0	0
65 NCZ033 - 048>049 - 052>053 - 059 - 062>064	12/03/2005	10:00 AM	Winter Weather	N/A	0	0	0	0
66 NCZ033>034 - 036>037 - 048>050 - 052>053 - 055>056 - 064 - 066>069	12/08/2005	04:00 PM	Winter Weather	N/A	0	0	0	0
67 NCZ053 - 064	12/15/2005	07:00 AM	Ice Storm	N/A	0	0	125K	0
68 NCZ053 - 064	12/15/2005	12:00 AM	Winter Weather	N/A	0	0	0	0
69 NCZ033 - 048>050 - 052>053 - 059 - 062>065	02/08/2006	08:00 PM	Winter Weather	N/A	0	0	0	0

70 NCZ033>034 - 048>055 - 058 - 064>065	02/11/2006	02:00 AM	Winter Weather	N/A	0	0	0	0
71 NCZ033 - 048>053 - 058>059 - 062>064	03/22/2006	09:00 PM	Winter Weather	N/A	0	0	0	0
72 NCZ053 - 062>065 - 501 - 503 - 505	01/09/2007	10:00 AM	Winter Weather	N/A	0	0	0K	0K
73 NCZ033 - 035>037 - 049>050 - 053 - 056>057 - 063>065 - 068>072 - 082 - 501	01/18/2007	06:00 AM	Winter Weather	N/A	0	0	0K	0K
74 NCZ033 - 048>053 - 058>059 - 062>065 - 501 - 503 - 505>507 - 509	01/21/2007	06:00 AM	Winter Weather	N/A	0	0	0K	0K
75 NCZ053 - 064 - 501	01/28/2007	21:00 PM	Winter Weather	N/A	0	0	0K	0K
76 NCZ051 - 058 - 064>065 - 509	02/01/2007	04:00 AM	Heavy Snow	N/A	0	0	0K	0K
77 NCZ051 - 053 - 058 - 062>064 - 501 - 510	01/01/2008	22:00 PM	Winter Weather	N/A	0	0	0K	0K
78 NCZ062>065 - 509	01/16/2008	18:00 PM	Heavy Snow	N/A	0	0	0K	0K
79 NCZ033 - 035 - 048>050 - 052>053 - 056 - 059 - 062>065 - 068 - 501	01/19/2008	11:00 AM	Winter Weather	N/A	0	0	0K	0K
80 NCZ033 - 049 - 053 - 064>065 - 501 - 503 - 505 - 507 - 509	01/31/2008	21:00 PM	Winter Weather	N/A	0	0	0K	0K
81 NCZ033 - 049 - 053 - 064>065 - 501 - 503 - 505 - 507 - 509	02/01/2008	00:00 AM	Ice Storm	N/A	0	0	0K	0K
82 NCZ033 - 048>053 - 058>059 - 062>064 - 501 - 503 - 505	10/27/2008	17:00 PM	Winter Weather	N/A	0	0	0K	0K
83 NCZ053 - 059 - 062>064 - 501 - 503 - 505	12/01/2008	03:00 AM	Winter Weather	N/A	0	0	0K	0K
84 NCZ053 - 062>065 - 501 - 503 - 505	01/19/2009	21:00 PM	Winter Weather	N/A	0	0	0K	0K
85 NCZ048 - 052 -	03/01/2009	13:00 PM	Heavy Snow	N/A	0	0	0K	0K

064>065 - 507 - 509								
86 NCZ048 - 052 - 064>065 - 507 - 509	03/01/2009	13:00 PM	Winter Storm	N/A	0	0	0K	0K
87 NCZ033 - 035>037 - 049>050 - 053 - 056 - 062>065 - 501>507 - 509	12/12/2009	18:00 PM	Winter Weather	N/A	0	0	0K	0K
88 NCZ051>053 - 058>059 - 062>065 - 507 - 509	12/18/2009	06:00 AM	Winter Storm	N/A	0	0	0K	0K
89 NCZ035 - 056 - 064 - 502 - 504 - 506>507 - 509	12/25/2009	01:00 AM	Winter Weather	N/A	0	0	0K	0K
90 NCZ048>050 - 052>053 - 059 - 062>065 - 068 - 503	12/30/2009	21:00 PM	Winter Weather	N/A	0	0	0K	0K
91 NCZ033 - 035 - 049 - 053 - 062>065 - 501>507 - 509	01/18/2010	05:00 AM	Winter Weather	N/A	0	0	0K	0K
92 NCZ051>053 - 058>059 - 062>065 - 507 - 509	01/29/2010	15:00 PM	Heavy Snow	N/A	0	0	0K	0K
93 NCZ053 - 063>065 - 507 - 509	02/04/2010	17:00 PM	Winter Storm	N/A	0	0	0K	0K
94 NCZ062>065 - 507 - 509	02/12/2010	15:00 PM	Heavy Snow	N/A	0	0	0K	0K
95 NCZ051>053 - 058>059 - 064	12/12/2010	00:00 AM	Heavy Snow	N/A	0	0	0K	0K
96 NCZ048 - 051>053 - 058>059 - 062>065 - 501 - 503 - 505 - 507 - 509	12/15/2010	21:00 PM	Winter Weather	N/A	0	0	0K	0K
97 NCZ053 - 059 - 062>065 - 505 - 507 - 509	12/25/2010	06:00 AM	Heavy Snow	N/A	0	0	0K	0K
98 NCZ051>053 - 058>059 - 062>065 - 509	01/10/2011	00:00 AM	Heavy Snow	N/A	0	0	0K	0K
99 NCZ033 - 048>053 - 058>059 - 062>065 - 501 - 503 - 505 - 507 - 509	01/24/2011	03:00 AM	Winter Weather	N/A	0	0	0K	0K

TOTALS:	2	10	151.125M	0

Severe Thunderstorms/Windstorms – Hazard Ranking 4
Severe Thunderstorms/windstorms are generated by atmospheric imbalance due to the combination of unstable warm air rising rapidly into the atmosphere, sufficient moisture to form clouds and rain, and an upward lift of air currents caused by colliding waterfronts, sea breezes, or mountains. Thunderstorms/windstorms can produce damaging tornadoes, hailstorms, intense downburst and microburst winds, lightning, and flash floods.

Severe Thunderstorm/Windstorm Vulnerability Summary
To determine to County's vulnerability to severe thunderstorms/windstorms a period from 1970 to 2004 was examined. Numerous sources were used in identifying the winter storm hazards that have occurred in Transylvanian County since 1970 both primary and secondary. Primary sources used included the Emergency Management Directors and Emergency Management after Action Reports. Secondary sources included the Transylvania Times, Cable News Network, NOAA, National Climatic Data Center, the North Carolina Climate Center, and the Weather Channel. The entire jurisdiction of Transylvania County is equally susceptible to severe thunderstorms and windstorms.

Severe Thunderstorms/Windstorms are common occurrences in Transylvania County and more often than not, they are minor occurrences. Since 1970 there have been more than 82 severe thunderstorms/windstorms reported in the planning area. These storms can be wind events, precipitation events, or lightning events and in general produce heavy rains, which lead to flooding and erosion, strong winds, hail, and lightning.

Heavy rains from severe thunderstorms have led to riverine flooding and flooding from stormwater pooling. One of the most severe (water event) storms was in January 1996. Prolonged rains from this storm flooded roads and creating landslides, which caused transportation routes to be closed. The Transylvania County Emergency Management Office reported that the only way out of the County at the time was HWY 280. In total, there was $30K in property damages reported in the County. However, there were no fatalities or injuries because of the storm.

In a separate incident, (January 1998) excessive rain in conjunction with significant flooding of the French Broad and North Transylvania Rivers resulted in 40-50 mobile homes and two bridges being destroyed. In addition to flooding, the storm resulted in major mudslides and high gradient winds. In total, there was $1.5M in property damages reported, 10 injuries but no fatalities. For a more extensive discussion on this event, please refer to the flooding section of this plan.

For vulnerability to specific effects of heavy precipitation, refer to:

- Flooding Vulnerability in Tables 3.12 and 3.13;
- Roads Subject to Flooding Table 3.13

- *Floodplain Map* (Appendix C);
- *Landslide Susceptibility* map (Appendix C);

In addition to heavy rains, these storms can also produce strong winds, which have historically averaged 50 knots. In some instances, these storms have also led to tornado events in the area. The winds from these storms have caused damage to roofs and shingles and often cause debris from trees to fall on homes and businesses which not only has led to damage to property (averaging $1M) but also to multiple minor and major injuries. The most extensive and widespread damage with strong winds and the debris they produce, is the blockage of primary and secondary road systems which interrupts the flow of traffic that can lead to serious ramifications for emergency vehicles. Additionally, the breakage of power lines from fallen debris often leads to power outages across the County. In the past power, outages have lasted up to 2 days and have caused power companies millions of dollars to repair. The vulnerability to high winds is a countywide issue. As a result, all structures within the County and its municipalities are vulnerable to high wind. Based on historical data maximum winds are expected to be no more than 70 knots.

The final aspect of severe thunderstorms/windstorms addressed here is lightning. The Fire Departments located in Transylvania County respond to all reported lightning incidences and have provided after action reports that have assisted in accessing the damage and locating where strikes have historically occurred in Transylvania County. In the past 10-years, lightning strikes associated with severe thunderstorms/windstorms have caused an average of $10,000 in property damage. According to Emergency Management Records, lightning has been responsible for minor injuries.

Severe thunderstorms/windstorms have been a common occurrence in Transylvania County in the past and it is highly likely they will continue to be so in the future. Though some storms have resulted in severe damage in the unincorporated areas of Transylvania County, Brevard, and Rosman, on average, the damage from these storms is limited in nature. In the past, the planning area, as a whole, has had minimal loss of critical facilities (48 hours being the most extensive period). In addition, there have been reports of property damage most being the result of flooding or wind. There have been minor injuries reported most because of debris falling on populated structures. Additionally, there have been landslides within the County because of excessive precipitation. Future damages are estimated to be limited for the County, Brevard, and Rosman. This means that on average there would be some injuries, the shutdown of critical services and more than 10 percent of property severely damaged. These factors suggest a hazard index ranking of four for severe in the planning area (see Table 3.22). This indicates that severe thunderstorms/windstorms are one of the most important considerations in determining mitigation strategies for the area.

TYPES OF THUNDERSTORMS

Source: NOAA

THE SINGLE CELL STORM

Single cell thunderstorms usually last between 20-30 minutes. A true single cell storm is actually quite rare because often the gust front of one cell triggers the growth of another.

Most single cell storms are not usually severe. However, it is possible for a single cell storm to produce a brief severe weather event. When this happens, it is called a pulse severe storm. Their updrafts and downdrafts are slightly stronger, and typically produce hail that barely reaches severe limits and/or brief microbursts (a strong downdraft of air that hits the ground and spreads out). Brief heavy rainfall and occasionally a weak tornado are possible. Though pulse severe storms tend to form in more unstable environments than a non-severe single cell storm, they are usually poorly organized and seem to occur at random times and locations, making them difficult to forecast.

THE MULTICELL CLUSTER STORM

The multicell cluster is the most common type of thunderstorm. The multicell cluster consists of a group of cells, moving along as one unit, with each cell in a different phase of the thunderstorm life cycle. Mature cells are usually found at the center of the cluster with dissipating cells at the downwind edge of the cluster.

Multicell Cluster storms can produce moderate size hail, flash floods and weak tornadoes.

Each cell in a multicell cluster lasts only about 20 minutes; the multicell cluster itself may persist for several hours. This type of storm is usually more intense than a single cell storm, but is much weaker than a supercell storm.

THE MULTICELL LINE STORM (SQUALL LINE)

The multicell line storm, or squall line, consists of a long line of storms with a continuous well-developed gust front at the leading edge of the line. The line of storms can be solid, or there can be gaps and breaks in the line.

Squall lines can produce hail up to golf-ball size, heavy rainfall, and weak tornadoes, but they are best known as the producers of strong downdrafts. Occasionally, a strong downburst will accelerate a portion of the squall line ahead of the rest of the line. This produces what is called a bow echo. Bow echoes can develop with isolated cells as well as squall lines. Bow echoes are easily detected on radar but are difficult to observe visually.

THE SUPERCELL STORM

The supercell is a highly organized thunderstorm. Supercells are rare, but pose a high threat to life and property. A supercell is similar to the single-cell storm because they both have one main updraft. The difference in the updraft of a supercell is that the updraft is extremely strong, reaching estimated speeds of 150-175 miles per hour. The main characteristic which sets the supercell apart from the other thunderstorm types is the presence of rotation. The rotating updraft of a supercell (called a mesocyclone when visible on radar) helps the supercell to produce extreme severe weather events, such as giant hail (more than 2 inches in diameter, strong downbursts of 80 miles an hour or more, and strong to violent tornadoes.

The surrounding environment is a big factor in the organization of a supercell. Winds are coming from different directions to cause the rotation. And, as precipitation is produced in the updraft, the strong upper-level winds blow the precipitation downwind. Hardly any precipitation falls back down through the updraft, so the storm can survive for long periods of time.

The leading edge of the precipitation from a supercell is usually light rain. Heavier rain falls closer to the updraft with torrential rain and/or large hail immediately north and east of the main updraft. The area near the main updraft (typically towards the rear of the storm) is the preferred area for severe weather formation.

Table 3.6
Severe Thunderstorm (Hail, Lightening, Thunderstorm Winds, High Winds)
Historical Data 1950-February 2011
Source: National Climatic Data Center

Hail

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 TRANSYLVANIA	05/15/1970	1857	Hail	1.00 in.	0	0	0	0
2 TRANSYLVANIA	04/03/1974	2050	Hail	0.75 in.	0	0	0	0
3 TRANSYLVANIA	06/07/1985	1400	Hail	0.75 in.	0	0	0	0
4 TRANSYLVANIA	07/09/1985	1459	Hail	1.00 in.	0	0	0	0
5 TRANSYLVANIA	07/09/1985	1526	Hail	1.00 in.	0	0	0	0
6 TRANSYLVANIA	06/24/1986	1400	Hail	2.75 in.	0	0	0	0
7 TRANSYLVANIA	05/01/1987	1450	Hail	0.75 in.	0	0	0	0
8 TRANSYLVANIA	05/14/1988	1315	Hail	0.75 in.	0	0	0	0
9 TRANSYLVANIA	06/24/1988	1415	Hail	0.75 in.	0	0	0	0
10 TRANSYLVANIA	06/25/1988	1400	Hail	0.75 in.	0	0	0	0
11 TRANSYLVANIA	05/02/1990	1532	Hail	1.00 in.	0	0	0	0
12 TRANSYLVANIA	05/02/1990	1556	Hail	1.00 in.	0	0	0	0
13 TRANSYLVANIA	07/02/1991	1330	Hail	1.00 in.	0	0	0	0
14 Lake Toxaway	03/31/1993	2100	Hail	1.75 in.	0	0	0	0
15 Pisgah Forest	03/31/1993	2115	Hail	0.75 in.	0	0	0	0
16 Pisgah Forest	06/09/1995	1518	Hail	0.75 in.	0	0	0	0
17 Lake Toxaway	03/15/1996	01:37 PM	Hail	0.75 in.	0	0	0	0
18 Brevard	04/20/1996	12:15 PM	Hail	0.75 in.	0	0	50K	0
19 Lake Toxaway	05/24/1996	03:29 PM	Hail	0.75 in.	0	0	0	0
20 Countywide	07/04/1997	07:25 PM	Hail	1.25 in.	0	0	0	0

21 Lake Toxaway	01/08/1998	07:15 PM	Hail	1.00 in.	0	0	0	0
22 Brevard	05/27/1998	01:23 PM	Hail	1.00 in.	0	0	0	0
23 Rosman	05/19/2001	05:19 PM	Hail	0.75 in.	0	0	0	0
24 Connestee	04/17/2002	12:10 PM	Hail	0.75 in.	0	0	0	0
25 Rosman	07/01/2002	02:10 PM	Hail	1.25 in.	0	0	20K	0
26 Lake Toxaway	06/11/2003	01:30 PM	Hail	0.75 in.	0	0	0	0
27 Brevard	08/08/2003	01:35 PM	Hail	0.75 in.	0	0	0	0
28 Balsam Grove	05/10/2005	01:05 PM	Hail	0.75 in.	0	0	0	0
29 Brevard	06/20/2005	01:58 PM	Hail	0.75 in.	0	0	0	0
30 Brevard	06/20/2005	02:20 PM	Hail	0.88 in.	0	0	0	0
31 Brevard	06/20/2005	02:30 PM	Hail	0.50 in.	0	0	0	5K
32 Brevard	08/04/2005	04:05 PM	Hail	0.75 in.	0	0	0	0
33 Penrose	04/03/2006	05:10 AM	Hail	0.75 in.	0	0	0	0
34 Brevard	04/19/2006	08:45 AM	Hail	0.75 in.	0	0	0	0
35 Brevard	04/19/2006	09:35 AM	Hail	0.88 in.	0	0	0	0
36 Rosman	05/20/2006	05:38 PM	Hail	0.88 in.	0	0	0	0
37 Rosman	05/25/2006	11:56 AM	Hail	0.75 in.	0	0	0	0
38 Balsam Grove	05/28/2006	03:06 PM	Hail	0.75 in.	0	0	0	0
39 Cedar Mtn	06/11/2006	02:31 PM	Hail	0.75 in.	0	0	0	0
40 Brevard	07/01/2006	02:30 PM	Hail	0.75 in.	0	0	0	0
41 Lake Toxaway	07/02/2006	03:12 PM	Hail	0.75 in.	0	0	0	0
42 Balsam Grove	07/04/2006	04:18 PM	Hail	0.88 in.	0	0	0	0
43 Rosman	08/10/2006	02:36 PM	Hail	0.75 in.	0	0	0	0
44 Brevard	05/11/2007	15:56 PM	Hail	0.75 in.	0	0	0K	0K
45 Penrose	06/12/2007	15:18 PM	Hail	0.75 in.	0	0	0K	0K
46 Brevard	06/12/2007	15:28 PM	Hail	1.00 in.	0	0	0K	0K
47 Pisgah Forest	06/12/2007	16:03 PM	Hail	0.75 in.	0	0	0K	0K
48 Rosman	06/23/2007	17:25 PM	Hail	1.00 in.	0	0	0K	0K
49 Brevard	05/09/2008	21:30 PM	Hail	1.75 in.	0	0	0K	0K
50 Brevard	05/09/2008	21:32 PM	Hail	0.75 in.	0	0	0K	0K

51 Brevard	06/10/2008	16:20 PM	Hail	0.75 in.	0	0	0K	0K
52 Balsam Grove	07/21/2008	18:00 PM	Hail	0.88 in.	0	0	0K	0K
53 Grange	06/09/2009	16:10 PM	Hail	0.88 in.	0	0	0K	0K
54 Grange	06/16/2009	15:23 PM	Hail	0.88 in.	0	0	0K	0K
55 Oakland	07/27/2009	14:37 PM	Hail	0.75 in.	0	0	0K	0K
56 Cedar Mtn	09/09/2009	15:05 PM	Hail	1.00 in.	0	0	0K	0K
57 Penrose	05/06/2010	16:55 PM	Hail	0.75 in.	0	0	0K	0K
58 Grange	05/06/2010	17:04 PM	Hail	1.25 in.	0	0	0K	0K
59 Bohaynee	05/15/2010	13:35 PM	Hail	1.00 in.	0	0	0K	0K
60 Powelltown	06/15/2010	16:12 PM	Hail	0.75 in.	0	0	0K	0K
61 Reid	06/15/2010	16:16 PM	Hail	0.75 in.	0	0	0K	0K
62 Penrose	07/25/2010	16:30 PM	Hail	0.75 in.	0	0	0K	0K
				TOTALS:	0	0	70K	5K

Lightning

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 Brevard	06/04/1999	12:30 PM	Lightning	N/A	0	0	200K	0
2 Brevard	07/27/1999	02:26 PM	Lightning	N/A	0	3	0	0
3 Brevard	06/06/2002	02:00 AM	Lightning	N/A	0	0	0	0
4 Sapphire	08/10/2003	03:00 PM	Lightning	N/A	0	1	0	0
5 Connestee	07/11/2004	07:30 PM	Lightning	N/A	0	0	200K	0
6 Cedar Mtn	07/06/2008	17:30 PM	Lightning	N/A	0	0	150K	0K
7 Davidson River	08/20/2009	16:00 PM	Lightning	N/A	0	0	15K	0K
8 Oakland	05/15/2010	12:30 PM	Lightning	N/A	0	0	200K	0K
9 Blantyre	02/28/2011	16:40 PM	Lightning	N/A	0	0	30K	0K
				TOTALS:	0	4	795K	0

Thunderstorm Winds

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 TRANSYLVANIA	04/02/1970	0445	Tstm Wind	0 kts.	0	0	0	0
2 TRANSYLVANIA	07/09/1985	1459	Tstm Wind	0 kts.	0	0	0	0

3 TRANSYLVANIA	07/09/1985	1526	Tstm Wind	0 kts.	0	0	0	0
4 TRANSYLVANIA	07/22/1986	1315	Tstm Wind	0 kts.	0	0	0	0
5 TRANSYLVANIA	01/12/1988	2030	Tstm Wind	0 kts.	0	0	0	0
6 TRANSYLVANIA	07/10/1988	1320	Tstm Wind	0 kts.	0	0	0	0
7 TRANSYLVANIA	07/15/1988	1553	Tstm Wind	0 kts.	0	0	0	0
8 TRANSYLVANIA	07/16/1988	1611	Tstm Wind	0 kts.	0	0	0	0
9 TRANSYLVANIA	09/17/1991	1237	Tstm Wind	0 kts.	0	0	0	0
10 TRANSYLVANIA	08/27/1992	1800	Tstm Wind	0 kts.	0	0	0	0
11 Brevard	04/20/1996	12:30 PM	Tstm Wind	0 kts.	0	0	50K	0
12 Pisgah Forest	02/21/1997	03:50 PM	Tstm Wind	50 kts.	0	0	0	0
13 Connestee	06/02/1997	04:00 AM	Tstm Wind	50 kts.	0	0	0	0
14 Countywide	07/04/1997	07:25 PM	Tstm Wind	50 kts.	0	0	0	0
15 Brevard	05/27/1998	01:23 PM	Tstm Wind	50 kts.	0	0	0	0
16 Brevard	06/19/1998	11:20 AM	Tstm Wind	50 kts.	0	0	0	0
17 Brevard	06/24/1998	06:30 PM	Tstm Wind	50 kts.	0	0	0	0
18 Brevard	06/24/1998	07:15 PM	Tstm Wind	50 kts.	0	0	0	0
19 Brevard	01/23/1999	10:00 AM	Tstm Wind	50 kts.	0	0	25K	0
20 Brevard	07/27/1999	02:26 PM	Tstm Wind	50 kts.	0	0	0	0
21 Brevard	08/10/2000	02:15 AM	Tstm Wind	50 kts.	0	0	0	0
22 Brevard	05/19/2001	05:30 PM	Tstm Wind	50 kts.	0	0	0	0
23 Little River	06/14/2001	02:00 PM	Tstm Wind	50 kts.	0	0	0	0
24 Brevard	08/23/2001	04:23 PM	Tstm Wind	50 kts.	0	0	0	0
25 Brevard	06/06/2002	02:00 AM	Tstm Wind	50 kts.	0	0	0	0
26 Brevard	08/18/2002	03:58 PM	Tstm Wind	50 kts.	0	0	1K	0
27 Brevard	11/11/2002	04:15 AM	Tstm Wind	50 kts.	0	0	1K	0
28 Lake Toxaway	05/02/2003	02:30 PM	Tstm Wind	50 kts.	0	0	0	0
29 Brevard	05/02/2003	02:45 PM	Tstm Wind	50 kts.	0	0	0	0
30 Lake Toxaway	06/11/2003	01:30 PM	Tstm Wind	50 kts.	0	0	0	0
31 Brevard	07/16/2003	05:27 PM	Tstm Wind	52 kts.	0	0	2K	0
32 Brevard	07/18/2003	02:49 PM	Tstm Wind	50 kts.	0	0	0	0

33 Brevard	08/08/2003	02:00 PM	Tstm Wind	50 kts.	0	0	0	0
34 Rosman	06/06/2005	01:30 PM	Tstm Wind	50 kts.	0	0	0	0
35 Brevard	08/04/2005	04:05 PM	Tstm Wind	50 kts.	0	0	0	0
36 Rosman	04/22/2006	01:20 AM	Tstm Wind	50 kts.	0	0	0	0
37 Brevard	06/22/2006	01:05 PM	Tstm Wind	50 kts.	0	0	0	0
38 Balsam Grove	08/04/2006	05:00 PM	Tstm Wind	50 kts.	0	0	0	0
39 Rosman	09/28/2006	04:13 PM	Tstm Wind	50 kts.	0	0	0	0
40 Rosman	06/23/2007	17:25 PM	Thunderstorm Wind	50 kts.	0	0	0K	0K
41 Lake Toxaway	05/20/2008	16:23 PM	Thunderstorm Wind	50 kts.	0	0	0K	0K
42 Grange	05/20/2008	16:30 PM	Thunderstorm Wind	50 kts.	0	0	0K	0K
43 Balsam Grove	07/21/2008	18:00 PM	Thunderstorm Wind	50 kts.	0	0	0K	0K
44 Brevard Arpt	07/29/2008	14:40 PM	Thunderstorm Wind	50 kts.	0	0	0K	0K
45 Sapphire	06/17/2009	20:30 PM	Thunderstorm Wind	50 kts.	0	0	0K	0K
46 Grange	06/25/2010	14:01 PM	Thunderstorm Wind	55 kts.	0	0	0K	0K
47 Balsam Grove	10/25/2010	07:18 AM	Thunderstorm Wind	50 kts.	0	0	0K	0K
48 Selica	02/28/2011	16:38 PM	Thunderstorm Wind	55 kts.	0	0	0K	0K
				TOTALS:	0	0	79K	0

High Winds

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 NCZ033>034 - 048>054 - 058>059 - 062 - 064>065 - 067	10/05/1995	0300	High Winds	0 kts.	2	10	15.0M	0
2 NCZ053>054 - 058>059 - 062>064	01/07/1998	04:00 PM	High Wind	50 kts.	0	0	30K	0
3 NCZ035 - 053>054 - 062 - 064>065 - 067 - 069>071 - 082	09/15/1999	08:00 PM	High Wind	45 kts.	0	1	0	0
4 NCZ033>034 - 048 - 050 - 050 - 052>054 - 063>065	11/02/1999	02:00 AM	High Wind	55 kts.	0	0	0	0
5 NCZ064>066 - 072	02/16/2001	10:00 PM	High Wind	55 kts.	0	0	0	0
6 NCZ033 - 048>054 - 058>059 - 062>066	03/06/2001	12:00 AM	High Wind	55 kts.	0	0	0	0
7 NCZ034>036 - 049>050 -	03/20/2001	07:00 AM	High	55	0	0	1.0M	0

052>057 - 059 - 062>071			Wind	kts.				
8 NCZ033 - 048 - 051>053 - 058 - 062 - 064>065	11/29/2001	10:00 PM	High Wind	50 kts.	0	0	0	0
9 NCZ033 - 048>053 - 058>059 - 062>065	02/04/2002	12:00 PM	High Wind	50 kts.	0	0	0	0
10 NCZ033 - 048>053 - 059 - 062>065	09/27/2002	03:00 AM	High Wind	50 kts.	0	0	0	0
11 NCZ034 - 048 - 053 - 059 - 063>066	01/23/2003	08:00 PM	High Wind	60 kts.	0	0	16K	0
12 NCZ033>034 - 048>055 - 058>059 - 064>067	10/14/2003	08:00 PM	High Wind	50 kts.	0	0	18K	0
13 NCZ033>034 - 048>050 - 053>055 - 064>065 - 067	11/13/2003	06:00 AM	High Wind	50 kts.	0	0	25K	0
14 NCZ033 - 048>053 - 058>059 - 062>065	03/07/2004	06:00 PM	High Wind	50 kts.	0	0	85K	0
15 NCZ048>049 - 052>053 - 059 - 062>067	07/05/2004	07:30 PM	High Wind	55 kts.	0	0	10K	0
16 NCZ033>034 - 059 - 063>065	09/07/2004	11:00 AM	High Wind	50 kts.	0	0	330K	0
17 NCZ033 - 048>053 - 058>059 - 062>065	09/16/2004	05:00 PM	High Wind	55 kts.	1	1	1.6M	0
18 NCZ033>035 - 048>055 - 059 - 063>067	09/17/2004	08:00 PM	High Wind	50 kts.	0	0	75K	0
19 NCZ033 - 049>051 - 064	01/22/2005	10:00 PM	High Wind	50 kts.	0	0	0	0
20 NCZ033>034 - 049>050 - 052>055 - 064>067	04/02/2005	08:00 PM	High Wind	60 kts.	0	0	700K	0
21 NCZ052>055 - 062>067	01/14/2006	08:00 AM	High Wind	60 kts.	0	0	10K	0
22 NCZ053 - 059 - 063 - 064	11/15/2006	20:00 PM	High Wind	50 kts.	0	0	0K	0K
23 NCZ058 - 062>065 - 505 - 507 - 509	12/01/2006	07:00 AM	High Wind	55 kts.	0	0	0K	0K
24 NCZ033 - 049 - 053 - 062>065 - 501	04/15/2007	17:00 PM	High Wind	70 kts.	0	0	0K	0K
25 NCZ033 - 035>037 - 048>052 - 056>059 - 062>064 -	04/16/2007	09:00 AM	High Wind	60 kts.	0	0	500K	0K

068>072 - 501>502 - 508								
26 NCZ033 - 048>050 - 052>053 - 064>065 - 501>507 - 509	02/10/2008	10:00 AM	High Wind	55 kts.	0	0	0K	0K
27 NCZ033 - 048>050 - 052>053 - 059 - 062>065 - 501 - 503 - 505 - 507 - 510	05/11/2008	20:00 PM	High Wind	60 kts.	0	0	0K	0K
28 NCZ033 - 048>053 - 058>059 - 062>065 - 501 - 503 - 505 - 507	12/09/2009	10:00 AM	High Wind	55 kts.	0	0	0K	0K
				TOTALS:	3	12	19.349M	0

Tropical Storms – Hazard Ranking 3

Hurricanes, tropical storms and typhoons are collectively known as tropical cyclones. These cyclones are defined by FEMA (1997) as low-pressure areas of closed circulation winds that originate over tropical waters. For the purpose of understanding tropical storms within the context of this plan it should be understood that tropical storms have stained surface wind speed that ranges from 39 to < 74 mph and that hurricanes have a minimum sustained surface wind speed of at least 74 mph. For a more detailed breakdown of hurricane intensity classifications, this plan will reference the Saffir-Simpson Hurricane Scale (see Table 3.7).

Table 3.7

Saffir-Simpson Hurricane Scale					
Scale Number (Category)	**Central Pressure**		**Wind Speed (mph)**	**Storm Surge (ft)**	**Potential Damage**
	(mbar)	**(in)**			
1	≥ 980	≥ 28.94	74 - 95	4 - 5	Minimal
2	965 - 979	28.50 - 28.91	96 - 110	6 - 8	Moderate
3	945 - 964	27.91 - 28.47	111 - 130	9 - 12	Extensive
4	920 - 944	27.17 - 27.88	131 - 155	13-18	Extreme
5	< 920	< 27.17	> 155	> 18	Catostrophic

Source: FEMA, 1997.

Tropical Storm Vulnerability Summary

The period from 1900 – 2004 was studied for information on tropical cyclone events. Both primary and secondary sources were used in identifying the tropical cyclone occurrences in Transylvania County since 1900. Primary sources used included the Emergency Management Director and Emergency Management after Action Reports. Secondary sources included Barnes, Jay, 1998 and 2002; the Transylvania Times; Cable News Network; NOA; National Climatic Data Center; the North Carolina Climate Center; and the Weather

Channel. The entire jurisdiction of Transylvania County is equally susceptible to tropical storms.

Because Transylvania County is located in the western, portion of North Carolina and is not a coastal community it is not as susceptible to tropical storm events as the coastal communities located in eastern North Carolina are. This, however, does not mean that the County is immune to the effects of these storms but that they are less likely to be the recipient of said storms. Since 1900, there have only been nine storms that have affected Transylvania County. These storms have caused flooding due to excessive precipitation and damage from strong sustained winds, as well as, erosion of local rivers and creeks. For vulnerability to specific effects of excessive precipitation, refer to:

- Flooding Vulnerability in Tables 3.12 and 3.13;
- Roads Subject to Flooding I Table 3.13
- *Floodplain Map* (Appendix C);
- *Landslide Susceptibility* map (Appendix C);

One of the most costly tropical events to affect Transylvania County was Tropical Storm Opal, which brought extensive precipitation and packed sustained winds of 60 mph. Though Opal was not an extremely strong storm, when it hit Transylvania County, it still caused damage that was extensive enough for the County to be among those declared in a state of emergency by Governor Hunt. The damage by Opal consisted of widespread power outages. Approximately ¾'s of the residents were without power in Transylvania County. There were numerous roads labeled impassable due to debris and flooding. In total, there was $1.5M in damages to personal property, public property, and infrastructure in Transylvania County.

More recently were the storms of September 2004, Hurricanes Frances and Ivan. Hurricanes Frances and Ivan were primarily water events for Transylvania County and caused the County to be among those counties declared under a Presidential Declaration. In total Hurricane Frances left 75 residential structures and 10 businesses substantially damaged by floodwaters from the French Broad River and the Little River. Among those were 60 residential structures and 10 businesses declared substantially damaged during Ivan. Additionally, the County Communications Building was damaged during Hurricane Ivan by Floodwaters. Though the structure did not lose functionality, there was approximately $26K in damage to the communications system and approximately $5K in damage to the onsite generator, which was also, received approximately $3K in damage during Hurricane Frances. Between the two storms, there was $52,521 in debris removal and approximately $1.5M in structural losses. Numerous roads were closed due to floodwaters, including portions of highway 276, which was closed for several days. Evacuations lasted approximately 24 hours but many residents of the County sought shelter for approximately 8 days due to the significant damage to their homes. In addition to the damage from the flood and wind, Transylvania County also suffered two major landslides and several minor landslides. For more information on the location and severity of these slides, see the landslide section of this plan.

Historical records indicate that, it is likely tropical cyclone events will affect the unincorporated areas of Transylvania County in the future. However, these records also indicate that the average storm will have a considerable impact on the unincorporated areas of the County. The damage will consist mostly of flood and landslide issues and some wind damage issues. As seen in the flooding portion of this plan, flooding has been a repetitive issue for the County and has caused significant damage to residential and commercial properties, as well as, critical facilities. In the past, there have been minor injuries reported most because of debris falling on populated structures. Additionally, excessive precipitation has been known to cause landslides in portions of the County. Future damages are estimated to be limited for the unincorporated areas of the County. This means that on average there would be some injuries, the shutdown of critical services and more than 10 percent of property severely damaged. These factors suggest a hazard index ranking of three for tropical cyclone events was issued for the unincorporated areas of the County (see Table 3.22).

Historical records indicate that, it is likely tropical cyclone events will affect the City of Brevard in the future. However, these records also indicate that the average storm could have a significant impact on the planning area. The damage will consist mostly of flood issues. As seen in the flooding portion of this plan, flooding has been a repetitive issue for the City and has caused significant damage to residential and commercial properties. In the past, there have been no major injuries or deaths reported in the City. However, there has been loss of electricity for several hours and there has been interference of transportation routes due to the flooding and debris caused by wind. As a result, future damages should be limited. This means that on average there would be some injuries, the shutdown of critical services and more than 10 percent of property severely damaged. These factors suggest a hazard index ranking of three for tropical cyclone events was issued for the City of Brevard (see Table 3.22).

Historical records indicate that, it is likely tropical cyclone events will affect the Town of Rosman in the future. However, these records also indicate that the average storm could have a moderate impact on the planning area. The damage will consist mostly of flood issues. As seen in the flooding portion of this plan, flooding has been a repetitive issue for the Town and has caused damage to residential and commercial properties, as well as, critical facilities. In the past, there have been no injuries or deaths reported in the Town. However, there has been loss of electricity for several hours and there has been interference of transportation routes due to the flooding and debris caused by wind. As a result, future damages should be limited. This means that on average there would be some injuries, the shutdown of critical services and more than 10 percent of property severely damaged. These factors suggest a hazard index ranking of three for tropical cyclone events was issued for the Town of Rosman (see Table 3.22).

Hurricane/Tropical Storm Historical Data 1950-February 2011

No historical record of Hurricanes and/or Tropical Storms was found from the National Climatic Data Center.

Extreme Temperatures – Hazard Ranking (3 cold) (4 heat)
To accurately examine extreme temperatures, a review of two categories, extreme cold and extreme heat, was conducted. Each category was examined separately and given a separate likelihood occurrence, intensity rating, impact, and hazard index ranking.

Extreme cold/wind chill occurs when there are low temperatures combined with high winds. These issues are common in mountainous areas of North Carolina and can lead to high levels of frozen precipitation and severe winter storms (i.e. snow storms, ice storms, blizzards, and the like). In addition, these temperatures can affect the population by causing frost bite and hypothermia.

Extreme heat/heat waves occur when there are high temperatures combined with high humidity persist over an extended period. This can lead to overall issues of drought and extended dry spells. However, it can also affect the population in different ways as well and should have close attention paid to it.

According to FEMA (1997), extreme heat/heat waves can cause the following disorders:

1. *Heat Stroke:* The body is unable to control its temperature. It will rise rapidly. Sweating does not occur. This can cause permanent disability. Those at highest risk included outdoor laborers, elderly, children, and people in poor health.
2. *Heat Exhaustion:* occurs when there is an excessive loss of water and salt released in sweat. Those at highest risk include the elderly, people with high blood pressure, outdoor laborers, and those exercising outdoors.
3. *Heat Syncope:* results in a sudden loss of consciousness, which generally returns when the person lies down. There is little or no permanent harm because of heat syncope. This is associated with people who are not properly acclimated to the weather.
4. *Heat Cramps:* occurs because of a mild fluid and electrolyte imbalance and generally ceases to be a problem after acclimatization. This occurs in people who exercise outdoors when they are unaccustomed to the activity.

The National Weather Service categorizes heat index in relation to heat disorders (see Table 3.8).

Table 3.8

Heat Index in Relation to Heat Disorders		
Danger Category	**Heat Disorder**	**Apparent Temperature °F**
IV Extreme Danger	Heat Storke or Sunstroke Imminent	>130
III Danger	Sunstroke, heat cramps, or heat exhaustion likely; heat stroke possible with prolonged exposure and physical activity	105-130
II Extreme Caution	Sunstroke, heat cramps, and heat exhaustion possible with prolonged exposure and physical activity	90-105
I Caution	Fatigue possible with prolonged exposure and physical activity	80-90

_Source: National Weather Service, 1997.

Extreme Temperatures Vulnerability Summary

In an effort to examine extreme temperatures in Transylvania County a period from 1949 – 2004 was examined. The data was compiled by the North Carolina State Climatology Office. According to Ryan Boyles, Assistant State Climatologist, the temperatures within Transylvania County are very similar to those in the adjoining Transylvania County. The entire jurisdiction of Transylvania County is equally susceptible to extreme temperatures.

Extreme Cold – Hazard Ranking 3

Data was complied for extreme cold by reviewing 55 years of temperature, wind, and frozen precipitation data. Out of those years, 1 year (1963) had incomplete data. As a result, that year was excluded when assessing extreme cold. To determine the County's vulnerability to extreme cold the average number of days per year the wind chill was below freezing was determined. The results showed that on average there were 30.17 days per year where the temperature was between 31°F and 21°F, 12.36 days a year where the temperature was between 20°F and 11°F, 4.63 days a year where the temperature was between 10°F and 0°F, and 2.05 days a year where the temperature was between -0°F and -45°F. Winter is from December 22 to March 19. However, it is not uncommon for Transylvania County to have cold snaps in October, November and April. Quite often these cold days are associated with severe winter storms and result in heavy frozen precipitation. As previously identified in the winter storms sub-section of this plan winter storms have led to property damage, power outages, high levels of debris, and minor injuries.

The hazard index ranking for extreme cold was a complicated determination as it is so closely associated with winter storms (see Table 3.22). It was determined that due to the geographic location and the range of elevation in Transylvania County; it is highly likely they will be affected by extreme cold in the future. The intensity rating for extreme cold is moderate as they are quite often associated with winter storms. Future impacts will most likely be negligible, which means that there will be minor injuries, minimal quality-of-life impact, loss of critical services for 24 hours or less, and less than 10 percent of property would be damaged. These factors suggest a hazard index ranking of three for extreme cold in the planning area (see Table 3.22). This indicates that extreme cold is one of the most important considerations in determining mitigation strategies for the area.

Extreme Heat – Hazard Ranking 2

Data results were complied for extreme heat by reviewing 55 years of temperature, dew point, and relative humidity data. Out of those 55 years, 1 year (1963) had incomplete data. As a result, that year was excluded when assessing extreme heat. To determine the County's vulnerability to extreme heat the average number of days the heat index is over 105°F was identified. Summer, the hottest part of the year, lasts from June 21 to September 22, thus, that was the period examined for extreme heat. The results showed that on average there were no days in June with a heat index over 105°F, 1.5 days in July with a heat index over 105°F, 2.5 days in August with a heat index over 105°F and no days in September with a heat index over 105°F.

Historical records indicate that it is possible extreme heat will affect Transylvania County in the future. According to local officials, there has been no loss of critical services and there has been no property damage due to extreme heat. Additionally there have been no reports of major injuries or fatalities due to extreme heat. As a result, future impacts will most likely be negligible meaning minor injuries may occur; critical services may be shut down for 24 hours or less; and less than 10 percent of property would be damaged. These factors suggest a hazard index ranking of two for extreme heat/heat waves for Transylvania County. This indicates that extreme heat/heat waves are not one of the most important considerations in determining the County's mitigation strategies (see Table 3.22).

Table 3.9
Extreme Temperature Historical Data 1950-February 2011
Source: National Climatic Data Center

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 Statewide	01/15/1994	0000	Extreme Cold	N/A	3	0	500K	0
2 Statewide	01/19/1994	0000	Extreme Cold	N/A	6	0	0	0
3 NCZ064>065	03/08/1996	05:01 AM	Extreme Cold	N/A	2	0	0	0
4 NCZ033>037 - 048>059 - 062>072 - 082	04/01/1997	12:00 AM	Cold	N/A	0	0	0	0
5 NCZ033>037 - 048>059 - 062>072 - 082	12/01/2000	12:00 AM	Extreme Cold	N/A	0	0	0	0
				TOTALS:	11	0	500K	0

Tornadoes – Hazard Ranking 2
A Tornado is a rapidly rotating vortex of air extending groundward from a cumulonimbus cloud. Tornadoes can reach wind speeds in excess of 300 mph causing various intensities of destruction within its path. Often tornadoes are related to larger vortex formations and, as a result, often form in convective cells such as thunderstorms or in the right forward quadrant of a hurricane, far from the hurricane eye. In addition, earthquake induced fires, fires from atomic bombs, and wildfires may produce tornadoes (FEMA, 1997).

The damage severity of a tornado is measured by the Fujita-Pearson Tornado Scale (see Table 3.10). This scale assigns numerical values to a tornado based on wind speeds and subsequently categorized the tornadoes from zero to five. Table 3.8 identifies the wind speed, intensity, and types of damage for each category of tornado.

Tornado Vulnerability Summary

The period from 1950 – 2004 was studied for information on tornadoes. Numerous sources were used in identifying the tornado occurrences in Transylvania County since 1950 both primary and secondary. Primary sources used included the Emergency Management Coordinator and Emergency Management after Action Reports. Secondary sources included the Transylvania Times, Cable News Network, NOAA, National Climatic Data Center, the North Carolina Climate Center, and the Weather Channel. The entire jurisdiction of Transylvania County is equally susceptible to tornadoes.

Transylvania County has had few tornadoes reported within the county limits. In fact, NOAA only reports three tornado events since 1970. In 1974, a tornado, in the unincorporated area of the county, caused approximately $25,000 in property damage, which mostly consisted of roof damages and trees being uprooted. The 1975 event cause approximately $25,000 in property damage.

Table 3.10

Fujita-Pearson Tornado Scale			
Scale Value	**Wind Speed (mph)**	**Intensity**	**Type of Damage**
F0	40 - 72	Light Damage	Some damage to chimneys; tree branches broken off; shallow-rooted trees pushed over, sign boards damaged.
F1	73 - 112	Moderate Damage	Roof surfaces peeled off; mobile homes pushed off foundations or overturned; moving automobiles pushed off roads.
F2	113 - 157	Considerable Damage	Roofs torn from houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light-object missiles generated.
F3	158 – 206	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.
F4	207 – 260	Devastating Damage	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown; large missiles generated.
F5	261 – 318	Incredible Damage	Strong frame homes lifted off foundations and carried considerable distances to disintegrate; automobile-size missiles fly through the air in excess of 100 yards; trees debarked.
F6	> 318	Inconceivable Damage	These wind speeds have rarely been recorded. The area of damage would be completely obliterated and unrecognizable. Large missiles would be thrown in excess of 100 yards.

_*Source: FEMA, 1997.*-

The third incident, a 1984 cloud, caused approximately $250,000 in damage to property in the unincorporated area of the county. In addition, two planes were overturned near the airport. Though there has been property damage and a minor interruption of utilities there has not been any deaths or injuries reported because of tornado activity in Transylvania County.

The history of tornadoes in the unincorporated areas of Transylvania County is not a significant one. However, tornadoes can be a side effect of tropical cyclones and severe thunderstorms/ windstorms even though none has been reported to date. As a result it was determined that, it is likely that the County will be affected by tornadoes in the future. It was further determined that future impacts will most likely continue to be negligible meaning minor injuries may occur; critical facilities may be shut down for 24 hours or less; and less than 10 percent of property in the county would be damaged. These factors suggest a hazard index ranking of two for tornadoes in Transylvania County. This indicates that tornadoes are not one of the most important considerations in determining mitigation strategies in this plan (see Table 3.22).

There is no recorded history of tornadoes within the incorporated areas of Transylvania County. However, these areas are still susceptible to the effects of tropical cyclone events and severe thunderstorms/windstorms. As a result, it was determined that it is possible the incorporated areas of the County will be affected by tornadoes in the future. As with the unincorporated areas of the county, it was further determined that future impacts will most likely continue to be negligible meaning minor injuries may occur; critical facilities may be shut down for 24 hours or less; and less than 10 percent of property in the county would be damaged. These factors suggest a hazard index ranking of two for tornadoes in the City of Brevard and the Town of Rosman. This indicates that tornadoes are not one of the most important considerations in determining mitigation strategies in this plan (see Table 3.22).

Table 3.11
Tornado Historical Data 1950-February 2011
Source: National Climatic Data Center

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 TRANSYLVANIA	04/03/1974	1500	Tornado	F1	0	0	25K	0
2 TRANSYLVANIA	01/10/1975	2030	Tornado	F2	0	0	25K	0
3 TRANSYLVANIA	06/20/1984	1300	Tornado	F0	0	0	250K	0
				TOTALS:	0	0	300K	0

HYDROLOGIC HAZARDS

The group "Hydrologic Hazards" includes water related events. Each has its own natural characteristics, geographic location, severity, seasonality, and associated risks. Hydrologic hazards include floods, storm surges, erosion, and droughts. As with atmospheric hazards, many hydrologic hazards are interrelated. For example, erosion can be acerbated by extreme flooding. Additionally these hazards are often intertwined with other natural and technological hazards. For example, winds from a tropical cyclone can exacerbate storm surge and coastal erosion or excessive rains can cause dam/levee failure, which leads to flooding. These linkages make it difficult to attribute damage to one hazard or to access the risk one hazard has on the planning area.

In this sub-section, three hydrologic hazards were addressed: floods, riverine erosion, and drought. Each category has a general description of the hazard, a vulnerability summary for the planning area, and specific hazard information for the area.

Floods – Hazard Ranking 4

According to FEMA (1997), flooding is defined as "the accumulation of water within a water body and the overflow of excess water onto adjacent floodplains." There are numerous types of flooding all being created by different circumstances and all having different effects on an area which can be by development in the floodplain. For the purpose of this plan an examination of riverine flooding, flash flooding, and dam/levee break flooding.

Riverine flooding is caused by an overflow of rivers and streams and is the most common type of flooding. Large-scale weather systems are usually the cause of flooding in large rivers as they generate prolonged rainfall over wide areas (FEMA, 1997). Whereas, more localized weather systems that cause intense rainfall over small areas are the general reason for the flooding of small rivers and streams. In the event of a flood event, the flood depth will likely not exceed 25 feet.

Flash floods are characterized by a rapid rise in water level, high velocity, and large amounts of debris (FEMA, 1997). Flash floods may be a direct result of dam/levee failure or the breakup of an ice jam (which is not discussed here). However, in more urban areas (i.e. cities and towns) flash flooding is a serious problem due to the decrease or removal of vegetation, the use of impervious surfaces, which increase runoff of stormwater, and the construction of drainage systems that increase the speed of runoff and are often inadequate to handle the amount of runoff necessary.

Dam/Levee break flooding occurs because of structural failures, such as progressive erosion of an embankment or overtopping and breaching by a severe flood. These floods are associated with a large amount of water moving at a high velocity and are most often unexpected.

Flooding Vulnerability Summary

The period from 1900 – 2004 was studied for information on flooding events. Numerous sources were used in identifying the flooding occurrences in Transylvania County since 1900 both primary and secondary. Primary sources used included the Emergency Management Coordinator and Emergency Management after Action Reports. Secondary sources included Barnes, Jay, 1998 and 2002; the Transylvania Times; Cable News Network; NOA; National Climatic Data Center; the North Carolina Climate Center; and the Weather Channel. The entire jurisdiction of Transylvania County is equally susceptible to flooding.

Transylvania County, Town of Rosman, and the City of Brevard all participate in the National Flood Insurance Program. The NFIP identifies the 100 – Year flood zone and the 500 – Year flood zone. These zones cover approximately 6.7 percent of the county showing that the county has a moderate vulnerability to flooding. The largest portion of this percentage lies in the 100 – year floodplain. A list of properties located within the floodplain was developed by the Transylvania County Emergency Management Department. The Department further queried the developed parcel database to identify those properties that were labeled developed. Those developed properties were further queried to identify the type of structure located on said properties. Table 3.12 identifies the total number and approximate value of properties at risk in the 100-year and 500-year floodplain.

Table 3.12

Approximate Vulnerability to the Effects of Flooding				
Type of Development	**Number of Existing Structures**		**Current Value**	
	100-Year	**500-Year**	**100-Year**	**500-Year**
Unincorporated Areas of Transylvania County				
Residential	1,642	1,279	$58,938,845	$373,536,230
Commercial	168	131	$6,027,836	$38,202,569
Industrial	56	44	$2,009,279	$12,734,190
Critical Facilities	4	18	$2,598,150	$111,797,450
Total	1,870	1,472	$69,574,110	$536,270,439
City of Brevard				
Residential	91	33	$19,444,780	$9,988,084
Commercial	94	34	$19,856,680	$10,191,923
Industrial	2	1	$381,764	$202,838
Critical Facilities	5	2	$41,349,870	$1,053,980
Total	192	70	$81,033,094	$21,436,825
Town of Rosman				
Residential	20	19	$2,790,093	$1,350,713
Commercial	7	7	$1,055,337	$525,277
Industrial	0	0	$0	$0
Critical Facilities	3	3	$5,711,900	$1,822,360
Total	30	29	$9,557,330	$3,698,350

Source: Transylvania County Tax Administration

The most significant vulnerability to residential structures is located in the unincorporated areas of the County as seen in the *100-Year Floodplain* maps and the *500-Year Floodplain* maps. However, the most significant vulnerability to commercial and industrial properties to flooding is located in or directly adjacent to boundaries of the City of Brevard.

Parcels effected by flooding over the last 10 years have not all been located in the 100 – Year or 500 – Year floodplain, thus, identifying areas of poor stormwater drainage. According to the map, the unincorporated areas of the County have had the highest level of damage located within the historically flooded areas with the most significant vulnerability being in the residential areas of the County. The City of Brevard and the Town of Rosman have had moderate damage. For the City of Brevard, the largest amount of damage has been to the commercial and residential areas of the community but with Rosman, the largest vulnerability has been in the residential areas of the community.

There are two residential properties and zero commercial properties that are identified by NFIP as repetitive loss properties. Both repetitive loss properties are in the unincorporated areas of the county.

Historical records indicate that flooding has repetitively affected the unincorporated areas of Transylvania County, Brevard, and Rosman. In addition, there are numerous residential, commercial, and industrial structures located within the floodplain, as well as, critical facilities. In 2004 the County, Brevard, and Rosman were extensively affected by flooding that received presidential declarations. In the past, the County has lost power for several hours because of flooding and has suffered extensive damage to property and infrastructure (see incident specifics). Additionally, flooding has led to mudslides in the unincorporated areas of the County, which caused the closing, and damage of several roads. Because of this history, the geographic location, and due to the frequency of severe thunderstorms/windstorms, and tropical cyclones it is highly likely that the unincorporated areas of Transylvania County, the City of Brevard, and the Town of Rosman will be affected by flooding in the future. Future impacts will most likely be limited meaning some injuries may occur, there will be a disruption of utilities for more than a week and more than 10 percent of the property in the county will be damaged. These factors suggest a hazard index ranking of four for floods in Transylvania County. This indicated that floods are one of the most important considerations in determining mitigation strategies in this plan (see Table 3.22).

Significant Flooding Incident Specifics Since 1970

- *January 1996:* Flood – Several inches of rain fell across the mountains during the day causing an increase in the French Broad River, which led to evacuations in downtown Rosman. There was minor damage to some commercial properties but no injuries or deaths were reported. Evacuations lasted approximately 2 hours.
- *November 1996:* Flash Flood – Heavy rain caused flash flooding on the Pigeon River and Big East Fork River resulting in several evacuations. The French Broad River crested above flood stage around 10.5 feet in Rosman but did not damage any structures, did not cause any injuries or deaths.
- *November 2003:* Riverine Flood – The French Broad River flooded several roads near Rosman. Other streams and creeks flooded in the same general area, and the French Broad increased to a level that required evacuation of apartments and houses along the river in Rosman. There was no structural damage, injuries or deaths reported because of this storm.
- *September 2004:* Riverine Flood – The most significant damage resulting from flooding in the history of Transylvania County was from the remnants of Hurricanes Frances and Ivan. In total, Hurricane Frances cause substantial damage to 75 residential structures and 10 commercial structures in Transylvania County. According to the Emergency Management Coordinator 60 of the residential structures and 10 commercial structures damaged during Hurricane Frances were also substantially damaged during Hurricane Ivan several days later. There was approximately $8M in structural damage to residential and commercial structures.
- *September 2009:* Flash Flood - Periods of heavy rain fell between the 18th and 22nd across the southern mountains of North Carolina. Over the five day period, over 17 inches of rain fall in a few locations, with many areas reporting 10 inches of more. The most significant flooding started early in the morning on the 20th when three nearly stationary areas thunderstorms produced very heavy rain along the eastern escarpment of the Blue Ridge. Widespread flooding of streams and some large rivers developed over the region. Wilson Rd was closed due to flooding along the French

Broad River. Davidson River Rd was also closed when the Davidson River overflowed its banks. In addition, Green Rd and Barclay Rd were covered with water from overflowing streams.

Table 3.13

Roads Subject to Flooding During Significant Flood Events		
Road Name	**Normal Flooding**	**Flooding During 2004 Season**
Green Road	X	X
HWY 178-Pickens HWY	X	X
Island Road	X	X
Main Street (Rosman)	X	X
East Fork	X	X
Hannah Ford Road	X	X
Island Ford Road	X	X
Lyons Mountain Road	X	X
Davidson River Road	X	X
Cascade Lake Road	X	X
Merrill Lane	X	X
South Broad HWY 64 (Brevard) & Varsity Street & Miner Street	X	X
HWY 276 S - Cascade Lake & GreenvilleHwy	X	X
Barclay Road	X	X
Becky Mountain Road	X	X
Crab Creek Road at train tracks	X	X
Everett Road at double bridges	X	X
Hart Road	X	X
Wilson Road	X	X
Poplar Lane	X	X
Cherry Street	X	X
Old Hendersonville Hwy - multiple points	X	X
Sugarloaf Road	X	X
Talley Road	X	X
Cemetary Road	X	X
Glen Cannon & Wilson Road	X	X
Burnette Drive		X
Spruce Street		X
Idlewood Street		X
Cofer Lane		X
Gallimore Road		X

Source: Transylvania County Emergency Management Department

In addition, the Emergency Management Coordinator reported a total of $52,521 in debris removal for PA categories A and B. The Turkey Pen Bridge was damaged by floodwaters and has been slotted for replacement by NCDOT for $75K in 2005. The Transylvania County Dispatch and Communications Center was damaged by floodwaters during Ivan. However, the building remained operational during disaster response and recovery repairs to damages were required at a cost of $26K. In addition, the Transylvania County Dispatch and Communications Center generator was damaged during Frances and Ivan requiring $3K in repairs following Frances and $5K in repairs following Ivan. The flooding and landslides that resulted from the storms caused numerous road closures throughout the County (see Table 3.13). There were numerous minor injuries reported because of these storms but no major injuries or deaths. Evacuations from the storms lasted approximately 24 hours but families left homeless because of the storm sought shelter in public spaces for up to 8 days following each storm.

Table 3.14
Flood Impact Depths
Source: NOAA-NWS

Return to:
French Broad River Point Selection Page

Important Note:
Book-marking page saves current search criteria

at Rosman
Flood Stage: 9 Feet
Latest Stage: 2.46

Current
Warnings/Statements/Advisories:
None currently.

Complete information about the French Broad River at Rosman available from NWS Greenville-Spartanburg, SC.

Flood Impacts

15	MAJOR FLOODING CONTINUES. ADDITIONAL AREAS IN ROSMAN...SUCH AS THE TURNPIKE AND LYONS MOUNTAIN RAIN WILL BEGIN TO FLOOD. THE SEWAGE TREATMENT PLANT AND POWER SUBSTATION WILL BE SURROUNDED BY WATER.
14	MAJOR FLOODING BEGINS. THE RIVER WILL FLOOD SEVERAL MORE BUSINESSES...HOMES AND CHURCHES IN THE TOWN OF ROSMAN.
13.5	MODERATE FLOODING CONTINUES. ADDITIONAL HOMES ON HIGHWAY 178...AND THE POST OFFICE ALONG MAIN STREET WILL BEGIN TO FLOOD.
13	MODERATE FLOODING BEGINS. THE RIVER WILL CONTINUE TO EXPAND AND FLOOD MORE HOMES AND BUSINESSES ALONG CHESTNUT AND MAIN STREET...ALONG WITH THE HIGHWAY 178 BRIDGE. FLOODING AT THIS LEVEL WILL BE SIMILAR TO FLOODING THAT OCCURRED ON SEPTEMBER 8 AND 17...2004.
11.7	MINOR FLOODING WILL EXPAND FURTHER...AND WILL FLOOD US HIGHWAY 178...ABOUT 100 FT DOWNSTREAM OF GAGE. THE RIVER WILL EXPAND INTO SOME HOMES AND A CHURCH YARD. AT THIS LEVEL...THE DOWNSTREAM CREST AT BLANTYRE WILL RANGE FROM 19 TO 22 FT.
10	HANNAH FORD ROAD WILL BE FLOODED WHICH IS LOCATED BETWEEN ROSMAN AND BREVARD. A 10 FT RIVER LEVEL READING AT ROSMAN WILL RESULT IN A RIVER LEVEL DOWNSTREAM AT BLANTYRE OF AROUND 19 FT.
9	FLOOD STAGE. MINOR FLOODING OF BUILDINGS AND ROADS SUCH AS EAST MAIN ST BETWEEN DEPOT AND BROAD STREETS. A RIVER STAGE OF 9 FT AT THE ROSMAN GAGE WILL CAUSE A RIVER STAGE OF 17 TO 19 FT DOWNSTREAM AT THE BLANTYRE RIVER GAGE SITE ABOUT 12 HOURS LATER.

8.5	THE RIVER WILL SPREAD OUT MORE AND APPROACH HOMES ON EAST MAIN AND DEPOT STREETS DOWNSTREAM OF THE GAGE SITE.
8	EXPECT A BROAD OVERFLOW OF THE RIVER INTO LOW LYING FARMFIELDS AND LOW SPOTS ON ROADWAYS ONE MILE UP AND DOWNSTREAM OF THE RIVER GAGE.
7	HANNAH FORD, ISLAND FORD AND GREEN ROADS WILL BEGIN TO FLOOD. THESE ARE 1/2 WAY BTWN ROSMAN AND BLANTYRE.
5.3	THIS RIVER READING WILL LIKELY RESULT IN A RISE TO AROUND 16 FT AT THE BLANTYRE GAGE SITE.
4.5	A READING OF 4.5 FT ALONG WITH WIDESPREAD RAIN WILL CAUSE THE RIVER TO RISE TO AROUND 15 FT AT THE BLANTYRE GAGE SITE.
4	4 TO 5 INCH IN 12 HR AT BSGN7 & RMNN7 CAUSES A 4 TO 5 FT RISE AT ROSMAN.
3	3.00 INCHES OF RAIN IN 3 HOURS WILL CAUSE A 1.75 FT RISE ON THE RIVER.

Flood Categories (in feet)	
Major Flood Stage:	14
Moderate Flood Stage:	13
Flood Stage:	9
Action Stage:	7

Historical Crests
(1) 14.95 ft on 10/04/1964
(2) 14.12 ft on 08/17/1994
(3) 13.90 ft on 07/01/1916
(4) 13.31 ft on 09/29/1964
(5) 12.90 ft on 09/08/2004

Source: NWS Advanced Hydrologic Prediction Service

Return to:
French Broad River Point Selection Page

Important Note:
Book-marking page saves current search criteria

at Blantyre
Flood Stage: 16 Feet
Latest Stage: 7.22

Current Warnings/Statements/Advisories:
None currently.

Complete information about the French Broad River at Blantyre available from NWS Greenville-Spartanburg, SC.

Flood Impacts

27.1	RECORD FLOODING WITH HOMES DAMAGED CAUSING SOME EVACUATIONS.
25.5	NEAR RECORD FLOODING WILL OCCUR. FLOODING AT THIS LEVEL WILL BE SIMILAR TO FLOODING THAT OCCURRED ON SEPTEMBER 9 ... 2004.
23	MAJOR FLOODING OF SECONDARY ROADS AND PARTS OF HIGHWAY 64 WILL CONTINUE WITH 2 FEET OF WATER ON MOST ROADWAYS.
21	MODERATE FLOODING OF ROADS IN THE LOCAL AREA SUCH AS GROVE BRIDGE...PLEASANT GROVE AND WILLOW ROADS WILL CONTINUE. FLOODING AT THIS LEVEL WILL BE SIMILAR TO FLOODING THAT OCCURRED ON SEPTEMBER 22 2009.
20	MODERATE FLOODING ON PARTS OF HIGHWAY 64 UP AND DOWN STREAM OF THE GAGE SITE WILL BE LIKELY. A FEW BUILDINGS BETWEEN THE RIVER AND HIGHWAY 64 WILL ALSO BE FLOODED.
19	MODERATE FLOODING STARTS. FLOODING AT THIS LEVEL WILL BE SIMILAR TO FLOODING THAT OCCURRED ON JANUARY TWENTY SIXTH 2010.
18	MINOR FLOODING OF MOST OF THE SECONDARY ROADS ALONG THE FRENCH BROAD RIVER WILL OCCUR. RIVER ROAD WILL HAVE ABOUT A FOOT OF WATER ON IT.
17.5	MINOR FLOODING....ADDTIONAL ROADS SUCH AS WILLIAMS ROAD AND POPULAR LANE WILL BE FLOODED.
17	MINOR FLOODING CONTINUES...ADDITIONAL PARTS OF GROVE BRIDGE AND PLEASANT GROVE ROADS WILL FLOOD. BUILDINGS BETWEEN THE FRENCH BROAD RIVER AND

	HIGHWAY 64 WILL BEGIN TO SEE WATER APPROACH THEM.
16	FLOOD STAGE IS REACHED...FARMFIELDS IN LOW LYING AREAS AND A LOCAL TREE FARM AND GREENHOUSE NEAR GROVE BRIDGE ROAD WILL BEGIN TO FLOOD. PARTS OF PLEASANT GROVE ROAD WILL BE COVERED WITH 6 INCHES OF WATER.
15.8	MINOR FLOODING BEGINS...THE RIVER WILL COME UP TO...BUT NOT COVER PLEASANT GROVE ROAD BETWEEN TALLY RD AND CREEKS EDGE DRIVE.
14.5	THE RIVER WILL OVERFLOW THE BANKS DOWNSTREAM OF THE GAGE SITE AND WILL APPROACH PARTS OF BIG WILLOW AND RIVER ROADS NEAR ETOWAH.
12	BANKFULL STAGE IS REACHED UPSTREAM OF THE GAGE SITE ON GROVE ROAD.

Flood Categories (in feet)	
Major Flood Stage:	23
Moderate Flood Stage:	19
Flood Stage:	16
Action Stage:	15

Historical Crests
(1) 27.10 ft on 07/16/1916
(2) 25.81 ft on 09/09/2004
(3) 25.50 ft on 10/04/1964
(4) 23.81 ft on 08/18/1994
(5) 22.90 ft on 08/16/1928

Source: NWS Advanced Hydrologic Prediction Service

Table 3.15
Flooding Historical Data 1950-February 2011
Source: National Climatic Data Center

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 NCZ001>510	03/23/1993	1200	Flash Floods	N/A	0	0	0	0
2 TRANSYLVANIA	07/27/1994	0555	Flash Flood	N/A	0	0	0	0
3 TRANSYLVANIA	08/27/1995	0030	Flash Flood	N/A	0	0	0	0
4 Various	10/04/1995	0900	Flash Flood	N/A	0	0	0	0
5 NCZ033 - 050 - 052>053 - 055 - 059 - 062 - 064>065	01/18/1996	10:00 PM	Flood	N/A	0	0	0	0
6 NCZ034 - 048>049 - 051>055 - 059 - 062 - 064>067 - 082	01/26/1996	08:55 PM	Flood	N/A	0	0	30K	0
7 NCZ064	09/28/1996	03:00 PM	Flood	N/A	0	0	0	0
8 Rosman	11/08/1996	04:00 AM	Flash Flood	N/A	0	0	0	0
9 Countywide	12/01/1996	10:25 AM	Flash Flood	N/A	0	0	0	0
10 Rosman	03/14/1997	02:00 AM	Flood	N/A	0	0	0	0

11 Rosman Area	03/14/1997	05:00 AM	Flood	N/A	0	0	0	0
12 Rosman	01/07/1998	07:00 PM	Flash Flood	N/A	0	10	1.5M	0
13 Countywide	01/07/1998	12:00 PM	Flood	N/A	0	0	0	0
14 Countywide	02/03/1998	07:00 PM	Flood	N/A	0	0	0	0
15 Countywide	11/26/1999	02:30 AM	Flood	N/A	0	0	0	0
16 Countywide	09/22/2003	06:00 PM	Flash Flood	N/A	0	0	20K	0
17 NCZ064	11/19/2003	04:30 AM	Flood	N/A	0	0	0	0
18 NCZ064	02/06/2004	02:00 PM	Flood	N/A	0	0	0	0
19 Cedar Mtn	06/21/2004	09:15 PM	Flash Flood	N/A	0	0	3K	0
20 NCZ052 - 064>065	09/07/2004	01:30 PM	Flood	N/A	0	0	10.5M	11.5M
21 South Portion	09/07/2004	09:00 PM	Flash Flood	N/A	0	0	0	0
22 NCZ064	09/16/2004	11:00 PM	Flood	N/A	0	0	1.5M	1.9M
23 Brevard	09/27/2004	09:15 PM	Flash Flood	N/A	0	0	0	0
24 NCZ064	12/23/2004	08:00 AM	Flood	N/A	0	0	0	0
25 NCZ064	06/12/2005	06:30 PM	Flood	N/A	0	0	0	0
26 Rosman	07/13/2005	02:00 PM	Flash Flood	N/A	0	0	40K	0
27 Brevard	07/19/2005	06:45 PM	Flash Flood	N/A	0	0	0	0
28 NCZ064	11/29/2005	06:30 AM	Flood	N/A	0	0	0	0
29 Lake Toxaway	03/04/2008	15:15 PM	Flash Flood	N/A	0	0	0K	0K
30 Rosman	03/04/2008	18:00 PM	Flood	N/A	0	0	0K	0K
31 John Rock	09/20/2009	05:00 AM	Flash Flood	N/A	0	0	10K	0K
32 John Rock	09/20/2009	07:00 AM	Flood	N/A	0	0	0K	0K
33 Ecusta	09/21/2009	13:30 PM	Flood	N/A	0	0	10K	0K
34 Ecusta	01/24/2010	21:15 PM	Flash Flood	N/A	0	0	0K	0K

35 Ecusta	01/24/2010	23:00 PM	Flood	N/A	0	0	0K	0K
36 Grange	11/30/2010	12:00 PM	Flash Flood	N/A	0	0	0K	0K
37 Blantyre	11/30/2010	13:30 PM	Flash Flood	N/A	0	0	10K	0K
38 Ecusta	11/30/2010	21:00 PM	Flood	N/A	0	0	0K	0K
39 Ecusta	12/01/2010	00:00 AM	Flood	N/A	0	0	0K	0K
				TOTALS:	0	10	13.623M	13.400M

Riverine Erosion – Hazard Ranking 2

Erosion is a process that involves the wearing away, transportation, and movement of land. Erosion rates can vary significantly, as erosion can occur quite quickly as the result of a flash flood, storm, or other natural event. It can also occur slowly as the result of long-term environmental changes and can be exacerbated by human activity.

Riverine Erosion Vulnerability Summary

Riverine erosion occurs in various ways. Most often, it is initiated by high sediment loads or heavy rainfall. This generates high volume and velocity run-off, which will concentrate in the lower drainages within the river's catchment area. When stress applied by these river flows exceeds the resistance of the riverbank material, erosion will occur. As the sediment load increases, fast-flowing rivers will erode their banks downstream. Eventually the river becomes overloaded or velocity is reduced, leading to the deposition of sediment further downstream or in dams and reservoirs (Strahler and Strahler, 1997). Riverine erosion rarely causes death or injury but does cause the destruction of property, development, and infrastructure.

Transylvania County is transected by the French Broad River, North Fork, West Fork, East Fork, and Davidson Rivers. Presently the unincorporated areas of Transylvania County contain 295.96 miles of shoreline from these rivers. The City of Brevard has approximately 7.58 miles and the Town of Rosman has approximately .80 miles.

There are no problem erosion areas located in the City of Brevard or the Town of Rosman. All areas prone to significant erosion are located with the unincorporated areas of the County.

The Transylvania County Emergency Management Department queried the flooding database to determine the properties most susceptible to erosion. It was found these properties were located in the 100-year floodplain of the unincorporated areas of the County (see Table 3.12 for vulnerability specifics). However, this does not mean that not all property considered waterfront property is at risk to effects of erosion.

Research shows that there are numerous rivers and creeks in Transylvania County there are numerous properties located along the rivers that transect the County and its incorporated jurisdictions. Any property that is waterfront property should be considered vulnerable to

erosion. Thus, erosion is considered to have a limited impact on the planning area. Reports by the North Carolina Division of Natural Resources identify that though all the rivers and creeks in the county experience different levels of erosion but the French Broad River has experienced higher levels of erosion. Because erosion results from natural and human factors it is highly likely that it will continue to happen in the planning area.

Recent erosion concerns in Transylvania County have stemmed from clearing on steep slopes. Specifically, clearing land for building home sites and roads to home sites have become a concern due to most of the good, more level sites having been built on already causing a push to build on more marginal sites. When steep slopes are cleared of their natural groundcover, the soil which has been held in place by dense vegetation becomes unstable. The shallow root system of grasses alone is not adequate to restabilize steep slopes. The result is heavy erosion from storm water which can lead to large amounts of sedimentation being carried down the slope causing flooding, property damage, road blockage, and in extreme cases the occurrence of mud slides.

Though there have been no losses to structures in the past from erosion there are enough properties, which have the potential loss to consider erosion as having a limited impact on the planning area. Future impacts will most likely be negligible meaning minor injuries may occur; critical facilities may be shut down for 24 hours or less; and less than 10 percent of property in the county would be damaged. These factors suggest a hazard index ranking of two for erosion in Transylvania County, the City of Brevard, and the Town of Rosman (see Table 3.22).

According to the Soil and Water District Office, based on the 36 miles of the main stem of the French Broad River from the forks near Rosman to Blantyre there is an average loss of 211,200 cubic yards annually. It is estimated that the remaining streams within the county experienced an average loss of approximately 300,000 cubic yards from stream banks. The estimated total loss for the county is approximately 511,200 cubic yards annually. The expected average annual loss is 511,200 cubic yards. With further development in marginal areas this number could increase.

Drought – Hazard Ranking 2

Drought is defined by FEMA (1997) as being a water shortage caused by a deficiency of rainfall. During severe droughts, agricultural crops do not mature, wildlife and livestock suffer, land values decline where fire suppression and human consumption is limited to well, and agriculture related unemployment increases. Droughts can cause a shortage of water for human and industrial consumption, hydroelectric power, recreation and navigation. Water quality may decline and the number of wildfires may increase.

There are four types of droughts (FEMA, 1997):

1. Meteorological Drought – This is a reduction of precipitation over time. This definition is regionally based. In the United States, this is indicated by less than 2.5 mm of rainfall in 48 hours, which is the first indication of drought.
2. Agricultural Drought – This happens when soil moisture cannot meet the demands of a crop. This type of drought happens after a meteorological drought but before a hydrological drought.

3. Hydrological Drought – This refers to reduction in surface and subsurface water supplies. This is measured through stream flow and lake, reservoir, and ground water levels.
4. Socioeconomic Drought – This occurs when water shortages affect people, in terms of either water supply or economic impacts (i.e. loss of crops so price increases).

It is difficult to determine when a drought is approaching because of slowly accumulating effects and because there is no commonly accepted approach for measuring drought risk. However, several indices can be helpful in determining the risk. The Palmer Drought Severity Index (See Table 3.16) is especially well known. This index is used to measure drought impact on agriculture and water supplies. However, the National Drought Mitigation Center is using a newer index, the Standardized Precipitation Index, to monitor moisture supply conditions. Distinguishing traits of this index are that it identifies emerging drought months sooner than the Palmer Index does and that it is computed on various time scales.

Table 3.16
Palmer Drought Severity Index (The Palmer; PDSI)

Overview: The Palmer is a soil moisture algorithm calibrated for relatively homogeneous regions. Many U.S. government agencies and states rely on the Palmer to trigger drought relief programs.

Weekly maps:
http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/ regional_monitoring/palmer.gif.

Palmer Classifications	
4.0 or more	extremely wet
3.0 to 3.99	very wet
2.0 to 2.99	moderately wet
1.0 to 1.99	slightly wet
0.5 to 0.99	incipient wet spell
0.49 to -0.49	near normal
-0.5 to -0.99	incipient dry spell
-1.0 to -1.99	mild drought
-2.0 to -2.99	moderate drought
-3.0 to -3.99	severe drought
-4.0 or less	extreme drought

Drought Vulnerability Summary

Historical records show that drought and extreme dry spells have affected Transylvania County in the past, which indicated that it is likely that the County will be affected by drought in the future. Records also indicate that these situations have not caused property damage, injury, death, or interruption of service for the County. In fact, drought is very unlikely to have affects on structures in the planning area. However, the records indicate that extreme dry spells have caused a depletion of ground and surface water and have caused many wells in the area to dry up. Future impacts will most likely be negligible meaning minor injuries may occur; critical facilities may be shut down for 24 hours or less; and less

than 10 percent of property in the county would be damaged. These factors suggest a hazard index ranking of two for drought in Transylvania County (see Table 3.22). The entire jurisdiction of Transylvania County is equally susceptible to drought.

Drought Research Specifics

In an effort to examine, the severity of drought because of a lack of precipitation a table was produced which provides the average monthly/annual inches of precipitation for Transylvania County from 1949 – 2003. Out of those 54 years, one year (1963) had incomplete data. As a result, the year 1963 was excluded when assessing annual drought patterns. The average precipitation from 1949 – 2003 was 55.46 inches. Over the years, there have been several extremely dry years and one multi-year dry spell. During the period from 1949 – 2002, the six driest years were in 1955 (40.44"), 1970 (41.80"), 1981 (36.95"), 1988 (35.59"), 2000 (42.07", and 2001 (42.25"). The most severe dry year was 1988, when the County registered 19.87 inches below the average annual precipitation rate. The multi-year dry spell was 2000 and 2001 when, in the two years combined, the County registered 26.6 inches below the average annual precipitation rate.

The six wettest years on record for the time period examined were 1949 (71.79"), 1961 (73.36"), 1973 (71.80"), 1979 (68.77", 1989 (69.81"), and 1994 (81.12"). The wettest year on record for the time period examined was 1994 when the county registered 81.12 inches of precipitation, which was 25.66" above the average annual precipitation rate. This significant increase came because of a summer that registered the highest precipitation producing thunderstorms in recent history.

In summary, drought and extended dry spells are a normal part of the climate in Transylvania County and can be aggregated by other factors such as high temperatures, high winds, and low relative humidity. The severity of droughts not only depends on its duration, intensity, and geographic location but also on regional water supply demands made by human activities and vegetation.

Table 3.17
Drought Historical Data 1950-February 2011
Source: National Climatic Data Center

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 NCZ033>037 - 048>059 - 062>072 - 082	10/01/1998	12:00 AM	Drought	N/A	0	0	0	0
2 NCZ033>037 - 048>059 - 062>072 - 082	11/01/1998	12:00 AM	Drought	N/A	0	0	0	0
3 NCZ033>037 - 048>059 - 062>072 - 082	08/01/1999	12:00 AM	Drought	N/A	0	0	0	0
4 NCZ033>037 - 048>059 - 062>072 - 082	09/01/1999	12:00 AM	Drought	N/A	0	0	0	0
5 NCZ033>037 - 048>059 -	10/01/1999	12:00 AM	Drought	N/A	0	0	0	0

062>072 - 082								
6 NCZ033>037 - 048>059 - 062>072 - 082	08/01/2000	12:00 AM	Drought	N/A	0	0	0	0
7 NCZ033>037 - 048>059 - 062>072 - 082	09/01/2000	12:00 AM	Drought	N/A	0	0	0	0
8 NCZ033>037 - 048>059 - 062>072 - 082	10/01/2000	12:00 AM	Drought	N/A	0	0	0	0
9 NCZ033>037 - 048>059 - 062>072 - 082	11/01/2000	12:00 AM	Drought	N/A	0	0	0	0
10 NCZ033>037 - 048>059 - 062>072 - 082	02/01/2001	12:00 AM	Drought	N/A	0	0	0	0
11 NCZ033>037 - 048>059 - 062>072 - 082	03/01/2001	12:00 AM	Drought	N/A	0	0	0	0
12 NCZ033>037 - 048>059 - 062>072 - 082	04/01/2001	12:00 AM	Drought	N/A	0	0	0	0
13 NCZ033>037 - 048>059 - 062>072 - 082	05/01/2001	12:00 AM	Drought	N/A	0	0	0	0
14 NCZ033>037 - 049>059 - 062>072 - 082	08/01/2001	12:00 AM	Drought	N/A	0	0	0	0
15 NCZ033>037 - 048>059 - 062>072 - 082	11/01/2001	12:00 AM	Drought	N/A	0	0	0	0
16 NCZ033>037 - 048>059 - 062>072 - 082	12/01/2001	12:00 AM	Drought	N/A	0	0	0	0
17 NCZ033>037 - 048>059 - 062>072 - 082	08/01/2002	12:00 AM	Drought	N/A	0	0	0	0
18 NCZ033 - 035>037 - 048>053 - 056>059 - 062>065 - 068>072 - 082 - 501	05/01/2007	00:00 AM	Drought	N/A	0	0	0K	0K
19 NCZ033 - 035>037 - 048>053 - 056>059 - 062>065 - 068>072 - 082 - 501	06/01/2007	00:00 AM	Drought	N/A	0	0	0K	0K
20 NCZ033 - 035>037 - 048>052 - 056>059 - 062>065 - 068>072 - 082 - 501	07/01/2007	00:00 AM	Drought	N/A	0	0	0K	0K
21 NCZ033 - 035>037 - 048>053 - 056>059 - 062>065 - 068>072 - 082 - 501	08/01/2007	00:00 AM	Drought	N/A	0	0	0K	0K

22 NCZ033 - 035>037 - 048>053 - 056>059 - 062>065 - 068>072 - 082 - 501	09/01/2007	00:00 AM	Drought	N/A	0	0	0K	0K
23 NCZ033 - 035>037 - 048>053 - 056>059 - 062>065 - 068>072 - 082 - 501	10/01/2007	00:00 AM	Drought	N/A	0	0	0K	0K
24 NCZ033 - 035>037 - 048>053 - 056>059 - 062>065 - 068>072 - 082 - 501	11/01/2007	00:00 AM	Drought	N/A	0	0	0K	0K
25 NCZ033 - 035>037 - 048>053 - 056>059 - 062>065 - 068>072 - 082 - 501	12/01/2007	00:00 AM	Drought	N/A	0	0	0K	0K
26 NCZ033 - 035>037 - 048>053 - 056>059 - 062>065 - 068>072 - 082 - 501	01/01/2008	00:00 AM	Drought	N/A	0	0	0K	0K
27 NCZ033 - 035>037 - 048>053 - 056>059 - 062>065 - 068>072 - 082 - 501	06/01/2008	00:00 AM	Drought	N/A	0	0	0K	0K
28 NCZ033 - 035>037 - 048>053 - 056>059 - 062>065 - 068>072 - 082 - 501	07/01/2008	00:00 AM	Drought	N/A	0	0	0K	0K
29 NCZ033 - 035>037 - 048>053 - 056>059 - 062>065 - 068>072 - 082 - 501	08/01/2008	00:00 AM	Drought	N/A	0	0	0K	0K
30 NCZ033 - 035>037 - 048>053 - 056>059 - 062>065 - 068>072 - 082 - 501	09/01/2008	00:00 AM	Drought	N/A	0	0	0K	0K
31 NCZ033 - 035 - 048>053 - 056 - 058>059 - 062>065 - 068>069 - 501	10/01/2008	00:00 AM	Drought	N/A	0	0	0K	0K
32 NCZ033 - 035 - 048>053 - 056 - 058>059 - 062>065 - 068>069 - 501	11/01/2008	00:00 AM	Drought	N/A	0	0	0K	0K
				TOTALS:	0	0	0	0

GEOLOGIC HAZARDS

The group "Geologic Hazards" includes non-seismic ground failures. These failures include landslides, land subsidence, and expansive soils. The occurrence of geologic hazards is often interrelated with other natural phenomena such as heavy rains, earthquakes, flooding, droughts, and the like.

In this sub-section landslides are addressed with a general description of the hazard, a vulnerability summary for the planning area, and specific hazard information for the area.

Landslides – Hazard Ranking 4

Landslides are described as the downward and outward movement of slope forming materials reacting under the force of gravity (FEMA, 1997). Landslides usually start on steep slopes and move downward by the force of gravity, accelerating to speeds of 35 miles per hour. The principal factors, which play a role in landslide potential, are topography, geology, and precipitation. For example, areas with steep slopes are more susceptible to landslides than flat areas and areas, which have a higher level of precipitation, are more susceptible than other areas. Colluvium, a loose type of sediment composed of silt, sand, gravel, and cobblestones is the material most prone to landslides (NOAA). Human factors also play a great role in inducing landslides. The major human induced factors are mining, forestry, construction of roads and the traditional clearing of land for residential development.

There are four major types of landslides:

- Slides: slides are characterized by the downward movement of material along one or more failure surfaces (NOAA).
- Flows: flows are similar to slides but differ in the fact that they are characterized by high water content and move similar to fluids (NOAA).
- Lateral Spreads: lateral spreads are usually associated with loose, sandy soils with high liquefaction potential and can occur on very gentle slopes (NOAA).
- Falls and Topples: falls and topples are movements in which masses of rock or other material fall from cliffs or other steep slopes (NOAA). These are commonly triggered by earthquakes.

Landslide Vulnerability Summary

The period from 1950 – 2004 was studied for information on landslide events. Numerous sources were used in identifying the landslide occurrences in Transylvania County since 1950 both primary and secondary. Primary sources used included the Emergency Management Director and Emergency Management after Action Reports. Secondary sources included the Transylvania Times, Cable News Network, NOAA, and the USGS. The entire jurisdiction of Transylvania County is equally susceptible to landslides.

Historical records indicate that landslides have affected portions of the unincorporated areas of Transylvania County in the past. In addition, the USGS identified the most significant portion of Transylvania County as having a high incidence and susceptibility to landslides with a small portion of the western portion of the county having a high incidence and the rest having a high susceptibility (see the *Landslide Susceptibility* map, Appendix C). The County is also prone to severe thunderstorms/windstorms, flooding and is located in the

Tennessee valley seismic zone. Based on these factors it is highly likely that landslides will affect the County in the future.

In the past in the unincorporated areas of the County, there has been one residential structure destroyed and no damage to commercial or industrial property because of landslides. In addition, there have been no reported deaths or injuries. However, the county has received significant damage to its infrastructure because of landslides specifically in the 2004 hurricane season. There has been no landslide damage in any of the incorporated areas of Transylvania County. Though the potential for damage to residential structures is low, the potential for significant damage to infrastructure is high. Thus, it was determined that there is a potential for landslides to have limited effects on the unincorporated areas of the County in the future. Meaning some injuries may occur, there will be a minimal quality-of-life impact, a shutdown of critical facilities and services for an extended period, and 10 percent of property severely damaged. These factors suggest a hazard index ranking of four for landslides in Transylvania County (see Table 3.22).

Landslide Specifics

The USGS studied the United States in terms of landslide incidence and susceptibility. Susceptibility to landsliding is defined as the probable degree of response of (the area) rocks and soils to natural or artificial cutting or loading of slopes, or to anomalously high precipitation (USGS). High, moderate, and low susceptibility are determined by the same percentages used in classifying the incidence of landsliding. For general information, this study was used in performing the assessment for Transylvania County. The *Landslide Susceptibility* map (see Appendix C) shows the results compiled by the USGS. The largest portion of Transylvania County has a high incidence and susceptibility regarding landslides where as other portions has a high susceptibility or high incidence.

For results that are more specific the County Emergency Management Department mapped areas that have been prone to landslides in the past. These areas were determined by conducting a slope analysis, reviewing emergency management incident reports and thorough discussions with the Emergency Management Coordinator. According to the Emergency Management Coordinator the most significant issues the County faces with landslides is road closures, as was seen by torrential rains from Hurricanes Frances and Ivan. These rains spawned numerous slides in the unincorporated areas of Transylvania County. However, two slides were considered significant events. First, a slide covered portions of Sky Drive causing the road to giveaway causing $400K in damage. The second major event was on Cardinal Drive West where a slide caused $300K in damages to the infrastructure. The slide not only resulted in road damages but the debris from the slide flowed into Cardinal Lake causing debris blockage issues. The NCDOT has repaired and stabilized the both roads that were damaged.

A comparison of the Brevard *Zoning Map,* jurisdictional land use maps and the *Landslide Susceptibility* map indicate there is little to no vulnerability to landslides in Brevard and Rosman. However, the unincorporated areas of the County have areas of significant vulnerability. The County land use map shows that most landslide susceptibility is in areas that are defined as having residential use and are identified as having a high incidence and susceptibility. To date there has been 1 residential structure destroyed, and no commercial, or industrial structures damaged or destroyed by landslides in the County as most of the designated areas are undeveloped at this time.

No landslides have occurred in the past 5 years.

Table 3.18
Landslide Historical Data 1975- 2011
Source: Hazards and Vulnerability Research Institute – Spatial Hazard Events and Losses Database for the United States

Begin Date	Hazard Type	State	County	Injuries	Fatalities	Property Damage*	Crop Damage*
9/8/2004	Landslide	NC	Transylvania	0.00	0.00	1166666.66	0.00
11/5/1977	Flooding - Landslide	NC	Transylvania	2.80	0.44	200000.00	200000.00
7/14/2005	Landslide	NC	Transylvania	0.00	0.00	50000.00	0.00
4/4/1977	Flooding - Landslide	NC	Transylvania	0.00	0.00	20833.33	0.00
9/7/1977	Flooding - Landslide	NC	Transylvania	0.00	0.00	10000.00	0.00
3/12/1977	Flooding - Landslide	NC	Transylvania	0.00	0.00	2083.33	0.00
3/14/1975	Landslide	NC	Transylvania	0.00	0.00	2083.33	0.00
Total				2.80	0.44	1451666.65	200000.00

SEISMIC HAZARDS

The group "Seismic Hazards" includes earthquakes. In general, these events are a result of sudden ground motion caused by a release of accumulated strain acting on the tectonic plates that comprise the earth's crust (FEMA, 1997). Seismic hazards often trigger other hazards, which can have devastating results. For example, earthquakes can cause landslides and can damage dams/levees, which can lead to extensive, flash flooding.
In this section, earthquakes are addressed with a general description of the hazard, a vulnerability summary of the planning area, and specific hazard information for the area.

Earthquakes – Hazard Ranking 3

Earthquakes are seismic events that involve movement or shaking of the earth's crust. Earthquakes are usually caused by the release of stress accumulated because of a rupture of rocks along opposing fault planes in the earth's outer crust. These fault planes are typically found along borders of the earth's 10 tectonic plates.

The areas of greatest tectonic instability occur at the perimeters of the slowly moving plates, as these locations are subjected to the greatest strains from plates traveling in opposite directions and at different speeds. Deformation along plate boundaries can cause strain in the rock and the consequent buildup of stored energy. When the built-up stress exceeds the rock's strength, a rupture occurs. The rock on both sides of the fracture is snapped, releasing the stored energy and producing seismic waves, generating an earthquake.

Earthquakes are measured in terms of their magnitude and intensity. Magnitude is measured using the Richter Scale, an open-ended logarithmic scale that describes the energy release of an earthquake through a measure of shock wave amplitude. Each unit increase in magnitude on the Richter Scale corresponds to a 10-flod increase in wave amplitude. Intensity is most

commonly measured using the Modified Mercalli Intensity (MMI) Scale. It is a 12-level scale based on direct and indirect measurements of seismic effects. A detailed description of the MMI of earthquake intensity (and its correspondence to the Richter Scale) is given in Table 3.19.

Table 3.19

Modified Mercalli Scale of Earthquake Intensity			
Intensity	**Description of Effects**	**Maximum Accelleration (mm/sec)**	**Corresponding Richter Scale**
Instrumental	Detected only on seismographs	<10	
Feeble	Some people feel it	<25	<4.2
Slight	Felt by people resting; like a truck rumbling by	<50	
Moderate	Felt by people walking	<100	
Slightly Strong	Sleepers awake; church bells ring	<250	<4.8
Strong	Trees sway; suspended objects swing, objects fall off shelves	<500	<5.4
Very Strong	Mild alarm; walls crack; plaster falls	<1000	<6.1
Destructive	Moving cars uncontrollable; masonry fractures, poorly constructed buildings damaged	<2500	
Ruinous	Some houses collapse; ground cracks; pipes break open	<5000	<6.9
Disastrous	Ground cracks profusely; many buildings destroyed; liquefaction and landslides widespread	<7500	<7.3
Very Disastrous	Most buildings and bridges collapse; roads, railways, pipes and cables destroyed; general triggering of other hazards	<9800	<8.1
Catastrophic	Total destruction; trees fall; ground rises and falls in waves	>9800	>8.1

Source: FEMA, 1997.-Richter Scale

Earthquake Vulnerability Summary

An extensive history was reviewed to examine the effects on earthquakes in Transylvania County. Numerous sources were used in identifying the earthquake occurrences in Transylvania County both primary and secondary. Primary sources used included the Emergency Management Director and Emergency Management after Action Reports and readings from the USGS. Secondary sources included the Transylvania Times and Cable News Network. The entire jurisdiction of Transylvania County is equally susceptible to earthquakes.

There have been 16 earthquakes that have affected western North Carolina since 1811. The earliest was the quakes of 1811 and 1812. The largest quake was in 1916, which cause structural damage to private property, and the most recent was in June 2003, which had a feeble intensity. Damage in the County has been negligible mostly due to the lower level of development and a low population density.

Historical records indicate that earthquakes have affected Transylvania County in the past. In addition, the USGS identified Transylvania County as having a seismic hazard acceleration value of 4-8% (see *Transylvania County Seismic Probability* map, Appendix C). The County is located in the Tennessee valley seismic zone. Based on these factors it is likely

that earthquakes will affect the County in the future. In the recent past, there has been no significant damage to property or infrastructure. However, there are no reports of injuries or deaths in Transylvania County because of earthquakes, the probability of these increases as development and population density increases within the County. As a result, it was determined that there is a potential for earthquakes to have limited effects on the area in the future. Meaning if a significant quake were to occur there might be some injuries, minimal quality-of-life impact, a shutdown of critical facilities, damage to public utilities and underground infrastructure, and services for an extended period, and 10 percent of property severely damaged. These factors suggest a hazard index ranking of three for earthquakes in Transylvania County (see Table 3.22).

Earthquake Incident Specifics

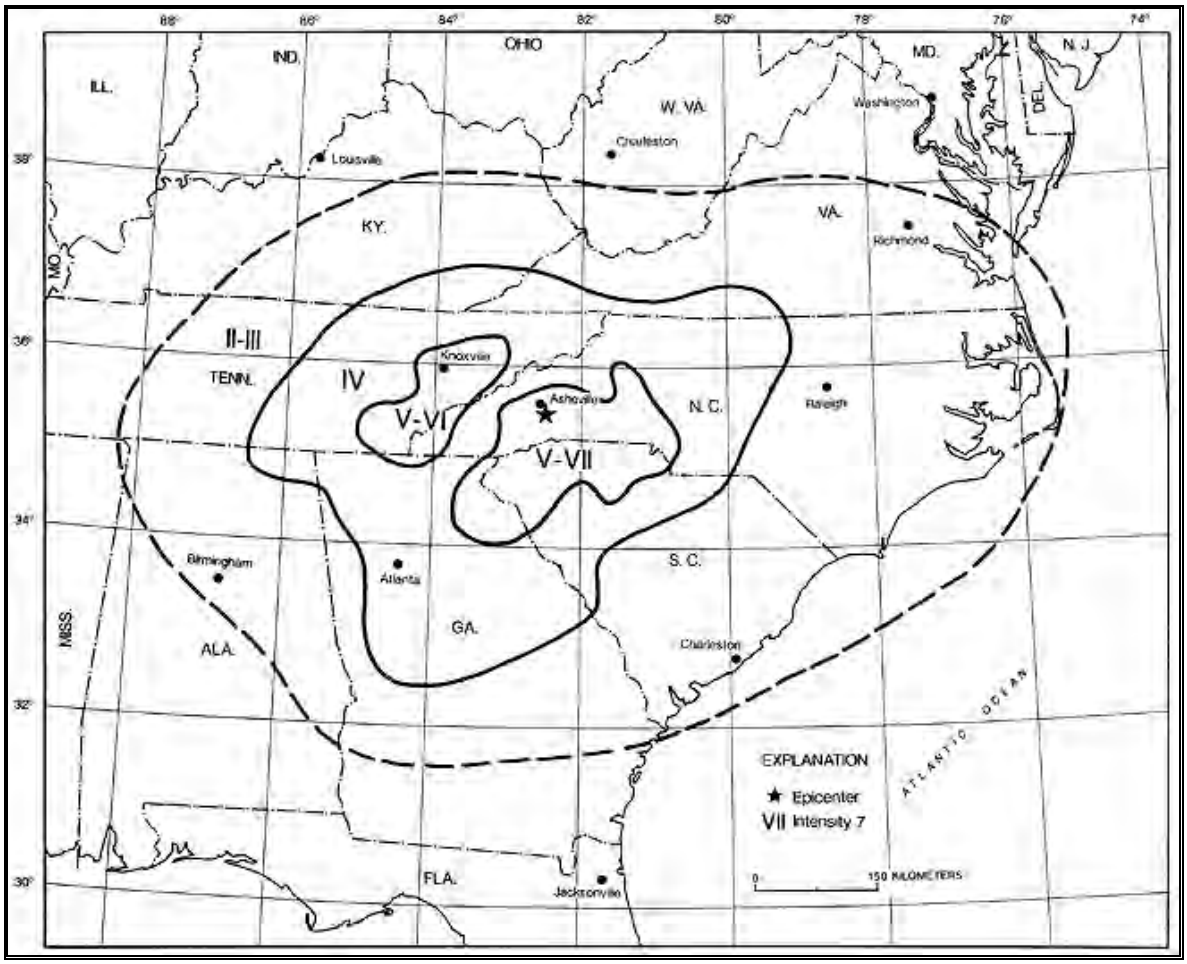
The USGS identified seismic hazard acceleration values for the United States. Seismic Hazard acceleration values represent the probability that ground motion will reach a certain level during an earthquake. The data show peak horizontal ground acceleration (the fastest measured change in speed, for a particle at ground level that is moving horizontally due to an earthquake) with a 10 percent probability of exceedance in 50 years. The *Seismic Probability* map (see Appendix C) is a representation of the findings by the USGS for a portion of North Carolina. Transylvania County is delineated with a bright border for easy identification. According to the representation, Transylvania County ranks a 4 – 8 in acceleration value.

- *Earliest Earthquake:* According to the USGS the earliest earthquakes know to affect the western portion of North Carolina were the earthquakes of 1811 – 1812, which were centered in the Mississippi Valley near New Madrid, Missouri. These quakes had a very strong intensity according to the MMI scale and a Richter Scale of a six. Though the quakes had a very strong intensity, they caused a relatively small amount of damage due to the low population density of the area at the time.

- *Largest Earthquake:* According to the USGS, the largest earthquake on record to affect western North Carolina (including Transylvania County) was the earthquake of February 21, 1916. Depending on a county's location, the intensity as measured by the MMI scale was strong to ruinous or a 5 – 7 on the Richter Scale (see Figure 3.1). The epicenter of this quake was in Asheville. Damage from the quake consisted of broken or cracked foundations, chimneys, and plaster.

- *Most recent earthquake:* According to the USGS, the most recent earthquake felt in the County was in June 2003. This quake had a feeble MMI rating, which rattled cupboards and bookshelves. There was no structural damage reported and there was no damage to infrastructure or critical facilities.

Figure 3.1
Isothermal of the Largest Earthquake in North Carolina
Source: United States Geological Survey



There were no historical records found for earthquakes from the National Climatic Data Center or from the Hazards and Vulnerability Research Institute – Spatial Hazard Events and Losses Database for the United States.

OTHER NATURAL HAZARDS

There are hazards that are naturally occurring events but that do not fit well into any specific category. As a result the "Other Natural Hazards" category was formed. Each hazard within this category has its own natural characteristics, geographic location or aerial extent, severity and associated risks. However, these hazards are a result of other hazards lightning or human negligence is often the driving force behind wildfire ignition.

In this subsection, wildfires are addressed with a description of the hazard, a vulnerability summary for the planning area, and specific hazard information for the area.

Wildfire – Hazard Ranking 4

A wildfire is the uncontrolled burning of woodlands, brush, or grasslands. According to FEMA (1997), there are four categories of wildfires that are experienced throughout the United States:

- *Wildland Fires*: are fueled by natural vegetation. They typically occur in national forests and parks, where Federal agencies are responsible for fire management and suppression.
- *Interface or Intermix Fires*: are urban/wildland fires in which vegetation and the built-environment provide fuel.
- *Firestorms*: are events of such an extreme intensity that effective suppression is virtually impossible. They occur during extreme weather and generally, burn until conditions change or the available fuel is exhausted.
- *Prescribed Fires and Prescribed Natural Fires*: are fires that are intentionally set or selected natural fires that are allowed to burn for beneficial purposes.

Wildfires can be a result of naturally occurring influences such as lightning, extreme drought, and heat, as well as human influences such as an improperly extinguished campfire. The potential for threat of wildfires is dependent upon topography and slope, surface fuel characteristics, recent climate conditions, current meteorological conditions, and fire behavior. Surface fuels have increased between 2003 and 2009 due to naturally occurring meteorological events. Once a wildfire threatens a community, it is often too late to protect nearby structures and populations have to be evacuated for their own safety.

Wildfire Vulnerability Summary

The period from 2002-2009 was studied for information on wildfire events. Sources used in identifying the wildfire occurrences in Transylvania County since 2002 were the North Carolina Division of Forest Resources Transylvania County Office and Transylvania County Emergency Management. The entire jurisdiction of Transylvania County is equally susceptible to wildfires.

Historical records indicate that wildfires have affected portions of Transylvania County in the past. During the period examined there were 215 wildfires in Transylvania County with individual fires burning an average of approximately 2 acres. Based on these factors it is highly likely that wildfires will affect the unincorporated areas of Transylvania County, the City of Brevard, and the Town of Rosman in the future. In the past, there have been no injuries or deaths resulting from wildfires. There has been no significant damage to property and infrastructure or a loss of utilities. However, the jurisdictions identified have developed in the rural/urban interface. Additionally, they continue to grow and develop and as the population, density begins to increase the potential for damage to property and the potential for injuries and deaths from wildfire increases.

To determine the potential vulnerability to wildfires a Wildland Interface Slope Analysis was conducted. As indicated, the unincorporated areas have the highest vulnerability to wildfire.

Because of the wildland interface slope analysis, it was determined that there is a high potential for wildfire to have limited effects the unincorporated areas of Transylvania County, the City of Brevard, and the Town of Rosman in the future. Meaning some injuries may occur, there will be a minimal quality-of-life impact, a shutdown of critical facilities and services for an extended period, and 10 percent of property severely damaged. These factors suggest a hazard index ranking of four for wildfires in Transylvania County, the City of Brevard, and the Town of Rosman (see Table 3.22).

Table 3.20
Wildland Fire History & Acres Burned
Source: North Carolina Division of Forest Resources – Transylvania County Office

FIVE-YEAR SUMMARY OF FIRES BY CAUSE												
	Light-ning	Camp fire	Smoking	Debris	Incend	Mach Use	Rail-road	Child-ren	Misc.	Total	Acres Burned	Avg.
2002	0	0	2	10	0	1	0	3	5	21	18.4	0.8
2003	0	0	3	11	2	3	0	2	3	24	19.6	0.8
2004	0	0	3	9	2	3	0	3	2	22	13.5	0.6
2005	0	1	3	9	1	3	0	0	8	24	125.2	5.2
2006	0	1	2	20	2	1	0	2	8	36	127.7	3.5
Total	0	2	13	59	7	10	0	10	26	127	304.4	2.4
Avg. #/ 5 yrs.	0	0.4	2.6	11.8	1.4	2	0	2	5.2	25.4	60.8	
% of 5 yr. Total	0%	1%	10%	46%	5%	8%	0%	8%	20%	100%		

FIVE-YEAR SUMMARY OF FIRES BY CAUSE												
	Light-ning	Camp fire	Smoking	Debris	Incend	Mach Use	Rail-road	Child-ren	Misc.	Total	Acres Burned	Avg.
2006	0	1	2	20	2	1	0	2	8	36	127.7	3.5
2007	1	3	5	12	1	1	0	2	9	34	48	1.4
2008	1	0	3	18	1	0	0	0	7	30	61.2	2.04
2009	0	0	2	12	3	0	0	2	5	24	13.8	1.74
Total												

The NCDENR has actively been pursuing FireWise Community Program over the last 10 years.

- Pisgah Forest Farms is the only Fire wise Community in the county.
- Other Fire wise grant programs are being utilized throughout the county, such as the Community Protection Program, Community Wildfire Protection Plan.
- Extensive efforts have been made to inform the public about the potential of wildfires and living in the Urban /Interface.
- Fire Departments are being trained to work in the Urban /Interface fire zones.
- It is recommended to continue reaching the public by, media, public and community meeting and on the ground hazard assessments.

NC Division of Forest Resources expects completion and delivery of the Community Wildfire Protection Plan for Transylvania County in 2011. This plan will include Wildfire Interface Maps for each fire district within Transylvania County and will be incorporated into the Hazard Mitigation Plan when received.

TECHNOLOGICAL HAZARDS

All hazards do not fall in the natural hazard category but can still have a negative impact on life, property, economy and community. Some hazards originating from within the human environment and resulting from fabricated conditions such as dam failures, nuclear events, and hazardous materials events are classified as technological hazards. Technological hazards can affect localized areas, are frequently unpredictable and can cause property damage, loss of life, economy and community.

In this section, one technological hazard is addressed: dam/levee failure. There is a general description of the hazard, a vulnerability summary for the planning area, and specific hazard information for the area.

Dam/Levee Failures – Hazard Ranking 2

FEMA (1997) defines a dam/levee as a barrier constructed across a watercourse for the purpose of storage, control, or diversion of water. They are typically constructed of earth, rock, concrete, or mine tailings. According to the North Carolina Dam Safety Program (NCDSP), there are eight types of dams/levees in North Carolina.

- *Earth Dams:* are the majority of the dams/levees in North Carolina; are safe if properly designed, constructed, and maintained; and are not designed to be overtopped.
- *Concrete Gravity:* use their mass to resist sliding and shape to resist overturning; used where a strong foundation is present; relatively resistant to overtopping and seismic events.
- *Arch Dams:* used to narrow sites with strong abutments; use less concrete than gravity dams and increase over the top spill capacity; more difficult to design and construct than gravity dams.
- *Gravity Arch:* conservative design but uses more concrete.

- *Buttress:* requires a strong foundation but resistant to sliding, overturning, and overflowing, conserves concrete but difficult to design and construct.
- *Arch and Buttress*
- *Stone Masonry*
- *Combinations*

In addition to the different types of dams, the NCDSP identifies three hazard classifications for dams in North Carolina.

- *Low Hazard (Class A):* The failure of the dam would not be expected to result in loss of life but may damage uninhabited low value non-residential buildings, agriculture land, or low volume roads.
- *Intermediate Hazard (Class B):* The failure of a dam would not be expected to result in loss of life but may damage moderately traveled roads, interrupt use or service of public utilities, and may cause minor damage to isolated homes, commercial or industrial buildings in back water areas.
- *High Hazard (Class C):* The failure of a dam would likely cause loss of life or serious damage to homes, industrial and commercial buildings, important public utilities, and heavily traveled roads.

Dam/Levee Vulnerability Summary and Specifics

The period from 1993 – 2002 was studied for information on dam/levee failures. Numerous sources were used in identifying the dam/levee failures in Transylvania County since 1993 both primary and secondary. Primary sources used included the North Carolina Dam Safety Program, Emergency Management Director and Emergency Management after Action Reports. Secondary sources included the Transylvania Times, and the Cable News Network. In the event of a dam/levee failure, the flood depth would likely not exceed 25 feet. The entire jurisdiction of Transylvania County is equally susceptible to dam/levee failure.

Historical records indicate that there have been no dam/levee failures in Transylvania County, the City of Brevard, and the Town of Rosman over the last 10 years but that there are currently 79 total dams located in the County, which are registered and monitored by the NCDSP. However, there are other smaller, privately owned and maintained dams which are not listed by the NCDSP and which do not pose a real threat to the area. A list of dams/levees in Transylvania County was compiled by the NCDSP including the information on the failure of said dams/levees. Table 3.1 identifies the number of dams/levees in Transylvania County by hazard category. According to the table, there are 12 dams/levees with a class A ranking, 34 with a class B ranking, and 33 with a class C ranking.

Table 3.21

Dam/Levee Class Ranking for Transylvania County				
Class	**Class A**	**Class B**	**Class C**	**Total**
Number	13	31	41	85

Source: North Carolina Dam Safety Program

The *Dams Classification* map (see Appendix C) shows that the unincorporated areas of Transylvania County have the largest number of dams in the area. The City of Brevard has

four dams within its borders and several that are adjacent to the city limits. The Town of Rosman has no dams within its borders and there are no dams adjacent to its borders. However, because the largest numbers of dams are located on the French Broad River basin and the French Broad River flows through Rosman they are still at risk for flooding. According to the Emergency Management Director for Transylvania County, there have been no significant incidents with dam failures in Transylvania County within the last 60 years.

Based on these factors it is possible that dam/levee failures will affect the County and its incorporated jurisdictions in the future. In the past 60 years, there have been no injuries or deaths resulting from dam/levee failures. There has been no significant damage to property and infrastructure or a loss of utilities within the past 60 years. Nonetheless, as the County and its incorporated jurisdictions continues to develop and as the population density begins to increase the potential for damage to property and the potential for injuries and deaths from dam/levee failure increases. However, if development is monitored and if there are policies put in place, the impacts of future failures can be limited. As a result, it was determined that there is a potential for dam/levee failures to have effects on the area in the future. Meaning the possibility for injuries or deaths to occur is existent, there will be a quality-of-life impact, a shutdown of critical facilities and services for an extended period, and 10 percent of property severely damaged. These factors suggest a hazard index ranking of two for dam/levee failures in Transylvania County (see Table 3.22).

Table 3.22

Transylvania County Hazard Identification and Analysis Worksheet			
Type of Hazard and Associated Elements	**Transylvania County (unincorporated areas)**	**City of Brevard**	**Town of Rosman**
Atmospheric Hazards			
Winter Storms	3	3	3
Severe Thunderstorms/windstorms	4	4	4
Tropical Storms	3	3	3
Extreme Temperatures	N/A	N/A	N/A
Extreme Cold	3	3	3
Extreme Heat	2	2	2
Tornadoes	2	2	2
Hydrologic Hazards			
Flooding	4	4	4
Erosion	N/A	N/A	N/A
Riverine Erosion	2	2	2
Drought	2	2	2
Geologic Hazards			
Landslides	4	4	4
Seismic Hazards			
Earthquakes	3	3	3
Other Natural Hazards			
Wildfire	4	4	4
Technological Hazards			
Dam/Levee Failures	2	2	2

SECTION 4: COUNTY AND MUNICIPAL CAPABILITY ASSESSMENT

The capability assessment helped analyze the County and the Towns current capability to mitigate the threats hazards pose. To conduct a complete and thorough assessment of the county/municipal capability an examination of the legal, institutional, technological, political, and fiscal capability was conducted.

The local government has created a process by which the requirements of this hazard mitigation plan will be incorporated into other local plans. During the planning process for new and updated local planning documents, such as a comprehensive plan, CAMA land-use plan, capital improvements plan, or emergency management plan, to name a few examples, the local planner will provide a copy of the hazard mitigation plan to each respective advisory committee member. The local planner will recommend the advisory committee members to ensure that all goals and strategies of new and updated local planning documents will incorporate are consistent with the hazard mitigation plan as appropriate.

First, an assessment of the county/municipal Legal Capability was conducted. During this step all county and municipal governing documents (i.e. zoning ordinance, land use plan, sub-division ordinance, unified development ordinance, flood damage prevention ordinance, and the like) were reviewed (see reference section for specifics on documents reviewed during this process). That review identified existing policies, practices, programs, regulations, and activities currently in place and determined if they promote or hinder the mitigation process.

Subsequently, the Institutional Capability of the area was examined with a review of the various local departments, agencies, and organizations. This step helped identify if adequate personnel is available to assist in the implementation of the mitigation strategies determined necessary to reduce the vulnerability of the planning area.

Following the institutional capability assessment, a Political Capability assessment was conducted. In this process the county and municipal governing bodies were examined to determine if they were organized, responsive to the needs of the county/municipality, educated about the hazards prevalent to their area, and if they understood, supported, and promoted the mitigation process.

Additionally, the Technological Capability of the area was examined. In this process, a review of the county/municipal current technology was conducted. This was accomplished by examining if the county/municipality has primary and secondary phone systems, internet and/or a county/municipal sponsored website, and if they have a geographic information system and trained staff to use said system.

Finally, the Fiscal Capability of the community was assessed. Here the ability of the planning area to financially afford the implementation of the mitigations strategies herein was determined. In addition, the ability of the county/municipality to research and seek alternate sources of funding was examined, as well as, the ability of the county/municipality to integrate funding sources.

LEGAL CAPABILITY

General Authority

Enabling legislation in North Carolina delegates' legal authority to local governments to implement regulatory measures. The basis for much of this authority is the police power designed to protect public health, safety and welfare. This authority enables county/municipal officials to enact and enforce ordinances and to define and abate nuisances. As hazard mitigation is a form of protecting public health, safety and welfare, it falls under the general regulatory powers of local governments. Enabling legislation also extends to building codes and inspections, land use, acquisition, and floodway regulation.

Building Codes and Inspections

Building codes and inspections provide local governments with the means to maintain county/municipal structures that are resilient to natural hazards. The North Carolina State Building Code prescribes minimum standards for building construction, which ensures structures are built to standards that have a high wind resistance and developed within flood-proofing measures. County/municipal governments are permitted to adopt additional codes as long as the regulations are at least as stringent as the state standards. State-enabling legislation authorizes local governments to carry out building inspections to ensure local structures adhere to the minimum state building standards.

Land Use Planning

Through land use, regulatory powers granted by the state, local governments could control the location, density, type and timing of land use and development in the community. Land Use Plans should incorporate the following issues into the plan: resource protection, resource production and management, economic and community development, continuing public participation, as well as storm hazard mitigation, post-disaster recovery and evacuation plans. Provisions of the land use plans are implemented through regulatory tools that include zoning and subdivision ordinances, land acquisition and taxation. The Transylvania County Comprehensive Plan addresses land use within the Transylvania County and the Town of Rosman. Provisions of Comprehensive Plan are implemented through regulatory tools that include zoning, subdivision, or comprehensive development. This is more fully discussed below. The City of Brevard implemented a land use plan in 2006.

Zoning

Within its zoning authority, a county/municipal government is authorized to divide the planning area into districts (see City of Brevard Zoning Map, Appendix C). For each type of district, as defined in a written code and by zoning maps, the county/municipal government may "regulate and restrict construction, reconstruction, alteration, repair or use of buildings, structures of land" (N.C.G.S. 160A-382). The purpose of zoning is to help protect individuals and property from unwanted development. Zoning is a tool used by local governments to implement various land use policies and goals managing the impacts of growth and development.

Transylvania County

Transylvania County has a small area of zoning in place governed by the Pisgah Forest Community Zoning Ordinance adopted May 10, 2010 (Effective August 1, 2010). Other

areas within the County have been designated by the Tax Office for commercial, residential, industrial, and critical facility use. However, the Transylvania County Comprehensive Plan states there are misconceptions and cultural barriers that might prevent the adoption of zoning in the County.

City of Brevard
The *City of Brevard Zoning Ordinance was superseded by the Unified Development Ordinance adopted on* April 3, 2006. The code identifies use districts for residential, commercial, industrial, as well as varying degrees of mixed uses, which are defined in the *City of Brevard Unified Development Ordinance*. The UDO, through its accompanying Official Zoning Map, does not delineate specific environmental conservation or open space areas but does identify natural resource protection standards. These standards are to minimize future flooding problems by encouraging, to the greatest extent possible, development outside of flood prone areas, to protect land and watercourses from pollutants, sedimentation and erosion, to retain open spaces to protect their environmentally-sensitive character, to discourage steep-slope development, and to protect and conserve natural resources by means of ecosystem-aware planning and established land development best-management practices. The Planning Director is given authority to administer the code. In addition, the City has Planning and Zoning Department that employs a highly trained and sworn staff who assists in the administration and enforcement of the ordinance. Variances and appeals are received and processed by the City's Zoning Board of Adjustment.

Town of Rosman
The Town of Rosman does not presently have a zoning ordinance. However, there are areas within Rosman that have been designated for commercial, residential, industrial, and critical facility use.

Subdivision Ordinance
County/Municipal governments are authorized under N.C.G.S. 160A-371 to regulate the subdivision of land within their jurisdiction.

Transylvania County
The *Transylvania County Subdivision Regulations* were last revised in April 2009. These regulations establish procedures and standards for the development and subdivision of land within the territorial jurisdiction of Transylvania County. In addition, the regulations provide for erosion and sedimentation control, restrictions on the subdivision of land in identified hazard areas, limits and mitigates the flow of stormwater on development projects, and provides setback requirements. The ordinance does not regulate the amount or type of impervious surface used by developers. As a result, this activity will be addressed within the mitigation strategies of this plan. The Subdivision Regulations authorize the Administrator or the Planning Board to use all available resources to ensure that lots are suitable for development. The County Inspections Department administers the regulations. For information on the specific regulations, please refer to the most recent regulations manual.

City of Brevard
The *City of Brevard Subdivision Ordinance* was repealed in 2006 and its regulations were incorporated into the *Unified Development Ordinance*. These regulations support and guide the proper subdivision and resubdivision of land within the subdivision jurisdiction of the City

of Brevard (see the Unified Development Ordinance for specific regulations). The regulations limit and restrict the development of any land, which is found to be subject to the conditions of flooding, improper drainage, severe erosion or slides, or other characteristics, which pose an ascertainable danger. The Subdivision Regulations authorize the Brevard Planning and Zoning Board to use all available resources to ensure that lots are suitable for development.

Town of Rosman
The Town of Rosman does not presently have subdivision regulations. However, the development of such regulations would greatly assist in mitigating the vulnerability of the Town to Flooding which has been identified as the greatest vulnerability within the Town.

Acquisition
Under the North Carolina General Statutes (160A-240.1), local governments have the power to acquire property "by gift, grant, devise, bequest, exchange, purchase, lease, or any other lawful method," pursuant to state eminent domain laws (N.C.G.S. 40A). This regulatory tool may be used by County/Municipal governments to reduce local vulnerability to natural hazards by directly controlling development and use of areas especially vulnerable to hazards. The option of acquisition is a strategy that has been applied in other areas and has been deemed successful in reducing the level of vulnerability to specific hazards. This option is available to the County and its municipalities and could be an option the County and its municipalities will consider in reducing the vulnerability to repetitively damaged structures.

Floodway Regulation
<u>County</u>
The Legislature of the State of North Carolina has in Part 6, Article 21 of chapter 143; Parts 3 and 4 of Article 18 of Chapter 153A; and Article 6 of chapter 153A of the North Carolina General Statutes, delegates the responsibility to local governmental units to adopt regulations designed to promote the public health, safety and general welfare of it's citizenry.

<u>Municipal</u>
The Legislature of the State of North Carolina has in Part 6, Article 21 of Chapter 143; Parts 3, 5, and 8 or Article 19 of Chapter 160A; and Article 8 of Chapter 160A of the North Carolina General Statutes, delegates the responsibility to local governmental units to adopt regulations designed to promote the public health, safety and general welfare of it's citizenry.

According to state statute, the channel and part of the floodplain of each stream are to be designated as a floodway in order to limit flood disaster as much as possible. Within the floodway, local governments, through permitting, are to prevent obstructions that may increase the height of floods and the extent of flood damage.

Transylvania County
Transylvania County last revised their Flood Damage Prevention Ordinance in February 1998. The purpose of the ordinance is to minimize or eliminate public and private losses due to flood conditions in specified areas. The ordinance has provisions which prohibit uses dangerous health and safety due to water or erosion hazards or which result in damaging increases in erosion or in flood heights or velocities. In addition, it provides for

the control of the alteration of natural floodplains, stream channels and natural protective barriers, which are involved in the accommodation of floodwaters. The Zoning Administrator (Planning and Economic Development Director) administers and implements the provisions of the ordinance. Variances and appeals are heard and determined by the Zoning Board of Adjustment.

City of Brevard
The City of Brevard last revised their Flood Damage Prevention Ordinance in September 2009. The purpose of the ordinance is to minimize public and private losses due to flood conditions in specified areas. The ordinance has provisions which prohibit uses dangerous to health and safety due to water or erosion hazards or which result in damaging increases in erosion or in flood heights or velocities. In addition, it provides for the control of the alteration of natural floodplains, stream channels and natural protective barriers, which are involved in the accommodation of floodwaters. The Zoning Administrator administers and implements the provisions of the ordinance. Variances and appeals are heard and determined by the Zoning Board of Adjustment.

Town of Rosman
The Town of Rosman last revised their Flood Damage Prevention Ordinance in April 2004. The purpose of the ordinance is to minimize public and private losses due to flood conditions in specified areas. The ordinance has provisions, which restrict or prohibit uses, which are dangerous to health, safety, and property due to water or erosion hazards, or which result in damaging increases in erosion or in flood heights or velocities. In addition, it provides for the control of the alteration of natural floodplains, stream channels and natural protective barriers, which are involved in the accommodation of floodwaters, and controls filling, grading, dredging, and other development, which may increase erosion or flood damage. The Zoning Administrator administers and implements the provisions of the ordinance. Variances and appeals are heard and determined by the Zoning Board of Adjustment.

National Flood Insurance Program and Community Rating System
The National Flood Insurance Program (NFIP) provides flood insurance to individuals in communities that are members of the program. Membership in the program is contingent on the community adopting and enforcing floodplain management and development regulations. Part of the NFIP is the Community Rating System (CRS), a program that adjusts flood insurance premiums in relation to a community's investment in flood damage mitigation. To be included in the system, a community's floodplain management procedures must be reported and evaluated. There are ten classes within the CRS system, with one providing the greatest premium reduction and 10 providing no reduction. Table 4.1 identifies the current participation of Transylvania County and its municipalities in the NFIP and CRS programs. Currently Transylvania County, the City of Brevard, and the Town of Rosman all participate in the NFIP. However, Brevard is the only jurisdiction presently participating in the CRS program.

Table 4.1

NFIP and CRS Status				
Jurisdiction	**Date of NFIP Entry**	**Current Effective Map**	**Date of CRS Entry**	**Current CRS Class**
Transylvania County	1/2/1980	10/2/2009	None	None
City of Brevard	9/28/1978	10/2/2009	10/1/1992	8
Town of Rosman	6/2/1972	10/2/2009	None	None

Source: FEMA, NFIP

Stormwater Management

The Division of Environmental Management is authorized to administer the requirements set forth in 15A NCAC 2H.1003. This section of the administrative code regulates the density of developments and mandates standards for engineered stormwater controls. These regulations could provide local governments with the ability to restore and preserve water quality and the natural ecological functions of surface waters that are included in its planning area. In addition, it could assist in regulating existing developments, future developments, and construction activities, as well as, instituting mandatory requirements to prevent careless pollution to surface waters. To date, Transylvania County and the Town of Rosman do not have a Stormwater Management Ordinance in place. The Emergency Management Director has indicated that a significant issue with flooding in Rosman and Brevard is poor stormwater management and has indicated this is something that the two jurisdictions should address to reduce their vulnerability to flooding in the future. This issue will be addressed further in the mitigation strategies section of this plan. The City of Brevard address Stormwater Management within the Unified Development Ordinance adopted in April 2006.

FEMA's Floodplain Map Modernization Program:

The North Carolina Floodplain Mapping Program

This information is courtesy of NCFMP, as adapted from FEMA Floodplain Management Bulletin 1-98, "Use of Flood Insurance Study (FIS) Data as Available Data."

The President's Budget of the U.S. Government for the Fiscal Year 2003 recognizes that,

> *"Flooding stands out as the single most pervasive disaster hazard facing the nation. It causes an estimated $6 billion in property damages annually. In the past, many of the nation's efforts to avert flood disasters have focused on structural changes to waterways – for example, building dams and levees. Focusing flood reduction efforts on identifying the areas at risk for flooding and steering development away from those areas can be a less costly long-term approach to mitigation. Modernizing the nation's flood maps is critical to that effort. Many of the nation's Flood Insurance Rate Maps (FIRM's) are out of date and inaccurate –63 percent of the maps are more than 10 years old [50 percent in North Carolina are more than 13 years old]. A third of the maps are more than 15 years old. About 2,700 communities [125 in North Carolina] are not mapped at all. New and updated FIRM's can provide crucial guidance for future building, development, and flood mitigation efforts-determining how and where individuals, private developers, and local governments build."*

Background of The North Carolina Floodplain Mapping Program

The State of North Carolina, through the Federal Emergency Management Agency's (FEMA's) Cooperating Technical Partners initiative, is the nation's first Cooperating Technical State (CTS). As a CTS, the State assumed primary ownership and responsibility of the FIRM's for all North Carolina counties/communities. Under the CTS agreement, the State of North Carolina, FEMA, and numerous other Federal, State, and local agencies have collaborated to conduct a statewide mapping program. The program involves producing updated, digital Flood Insurance Rate Map (FIRM) panels for the entire State of North Carolina, implementing a state-of-the-art, dynamic Information Technology infrastructure, and developing a real-time flood forecasting and inundation mapping system. It should be noted that one disadvantage to the Floodplain Mapping Program is that it assumes that there is unobstructed flow. Participants in this plan through historical flooding events have firsthand knowledge that obstructions are common during flooding events. There are several reasons why the State initiated this program, including:

- Accurate floodplain maps are needed to understand flood risk;
- Knowing the flood risk helps counties/communities manage development to dramatically reduce long-term flood losses;
- Most flood maps in the State are outdated and lack sufficient detail to effectively assess and manage flood risk, as demonstrated by the flood losses experienced during Hurricane Floyd; and
- FEMA's mapping budget is finite and many counties and communities have indicated that they do not have the resources to take on the responsibility of generating new flood maps.

The statewide effort occured in three phases. Phase I started in 2000 and included the six river basins in eastern North Carolina, which were most impacted by Hurricane Floyd. Phase II encompassed six river basins in the middle of the State and began in February 2003. Phase III addressed the five remaining basins in the western part of the State. The entire State was remapped by the end of 2009.

Transylvania County is in phase III of the mapping initiative. However, the maps will became effective six months after the preliminary maps are issued. Preliminary flood hazard maps contain valuable information that can be used for floodplain management before they become effective.

The new flood hazard information was released to the public as a preliminary Flood Insurance Study (FIS) Report and FIRM for review and comment during a statutory 90-day appeal period. The preliminary BFE and floodway data are subject to change until a notice of final flood elevation determination is provided in a Letter of Final Determination (LFD) to the community.

A Flood Insurance Study (FIS) uses detailed hydrologic and hydraulic analyses to model the 1% annual chance flood event, determine the Base Flood Elevations (BFEs), and designate floodways and flood risk zones (e.g., Zones AE and Zone). The flood hazard data is shown

in tables in a FIS Report, shown graphically as flood profiles, and portrayed planimetrically on a Flood Insurance Rate map (FIRM).

Most counties/communities participating in the NFIP have a FIRM depicting areas expected to be inundated during the 1% annual chance flood (i.e., Special Flood Hazard Areas [SFHAs] determined by using one of two types of engineering methods: 1) detailed studies which determine BFEs, and 2) approximated studies which do not determine BFEs and are designated as Zone A.

When land has been designated as being located in the SFHA on a community's Flood Hazard Boundary Map (FHBM) or FIRM, and no BFEs or floodway have been identified, counties/communities are required to apply the provision contained in Subparagraph 60.3(b)(4). This provision requires that counties/communities, "obtain, review and reasonably utilize any base flood elevation and floodway data available from a Federal, State, or other source…"

Counties/communities should use preliminary flood data as criteria to require that new construction and/or substantial improvement projects are built such that the lowest floor is elevated to or above the BFE. Counties/communities should also prohibit any encroachment in the floodway that would result in any increase in base flood levels during the occurrence of a base (1% annual chance) flood discharge event. Subparagraph 60.3(b)(4) also states that BFE or floodway data obtained should be used as long as they, "reasonably reflect flooding conditions expected during the base flood; are not known to be scientifically or technically incorrect; and represent the best data available. Data from a preliminary FIS constitute available data."

Use of Preliminary FIS Data –

Land Currently within Zone A

For areas currently identified within a Zone A on the community's effective FHBM or FIRM, the BFE and floodway/non-encroachment data from a preliminary FIS Report constitute available data under Subparagraph 60.3(b)(4). The requirement in Subparagraph 60.3(b)(4) is an important floodplain management tool for reducing flood damage in areas currently designated as Zone A. Counties/communities are required to reasonably utilize the data from a preliminary FIS Report or FIRM under the section of their ordinance that applies to this Subparagraph.

When all appeals have been resolved and the LFD is issued, counties/communities are required to use the new BFE and floodway/non-encroachment data; these data are considered to be the best data available for regulating floodplain development in accordance with Subparagraph 60.3(b)(4). This includes meeting the standards of Subparagraphs 60.3(c) and (d), such as the requirement that new construction, substantial improvements, and other development have the lowest floor elevated to or above the BFE. Counties/communities must regulate floodplain development using the data in the preliminary FIS Report and FIRM under Subparagraph 60.3(b) (4) even before the community has officially adopted the new FIS Report and FIRM into its floodplain management ordinance.

In Zone A areas, the requirement for using BFE and floodway/non-encroachment data in a preliminary FIS Report makes sense because there is no other BFE or floodway data. Further, counties/communities need to protect new or substantially improved structures from flood damage until the appeal period ends and the data are incorporated into local ordinances. The use of the qualifier "reasonable, "contained in Subparagraph 60.3(b) (4), reflects FEMA's statutory obligation to provide the public with an opportunity to appeal proposed elevation data.

If a county/community decides not to use the BFE or floodway/non-encroachment data in the preliminary FIS Report and FIRM because it is questioning the data through a valid appeal, the community must continue to ensure that buildings are constructed using methods and practices that minimize flood damage in accordance with the floodplain management requirements under Subparagraphs 60.3(a) (3) and (4):

- Review of Permit Applications: Subparagraph 60.3(a) (3) requires counties/communities to review permit applications to determine whether proposed building sites are reasonably safe from flooding. If a proposed building site is flood prone, counties/communities must require that new construction and substantial improvements be adequately anchored, use flood-resistant materials, are constructed to minimize flood damages, and protect utilities during a flood.
- Review of Proposals for New Development: Subparagraphs 60.3(a)(4) requires counties/communities to review subdivision proposals and other proposed new development, including manufactured home parks or subdivisions, to determine whether proposed developments will be reasonably safe from flooding. Counties/communities are required to review such proposals for flood prone areas to ensure that potential flood damage is minimized, utilities are constructed to minimize or eliminate damage, and adequate drainage is provided to reduce the exposure to flood hazards.

Land Currently within Zones AE

The NFIP floodplain management criteria do require counties/communities to use BFE and floodway data from a preliminary FIS Report or FIRM in areas designates as Zones AE in lieu of using the BFE and floodway data contained in an existing effective FIS Report and FIRM. Because counties/communities have the opportunity to appeal BFE data from a restudy, a presumption of validity is given to existing effective BFE data that have been through the formal statutory appeals process and adopted by the community. However, counties/communities are strongly encouraged to refer to the preliminary FIS Report and FIRM and the existing effective FIS Report and FIRM when reviewing proposals for new development and permit applications, as described below, around land currently within Zones AE that has been restudied.

- Increase in BFEs/Wider Floodways: When BFEs increase and/or floodways widen in the restudied area, counties/communities have the responsibility of ensuring that new or substantially improved structures are protected. FEMA cannot require a community to use BFE and floodway data in a preliminary FIS Report or FIRM as available data or to use the data at the time FEMA issues the LFD. However, FEMA encourages counties/communities to reasonably use this information in

instances where BFEs increase and floodways are revised to ensure that citizen's health, safety, and property are protected.

- Decrease in BFEs/Narrower Floodways: When BFEs decrease or floodways narrow, the community should not use the preliminary FIS Report or FIRM to regulate floodplain development until the LFD has been issued. If the preliminary FIS Report or FIRM provides information that BFEs are decreasing when compared with the current FIS Report or FIRM, but an appeal actually results in higher BFEs, the community could place its citizens at greater flood risk by using the preliminary FIS Report or FIRM to regulate floodplain development. In addition, structures could be subject to increased flood insurance premiums if built using data from a preliminary FIS Report or FIRM that is revised to show increased BFEs or wider floodways.

In county's or community's where floodways have not been designated for all or some of the flooding sources, but BFEs have been provided, counties/communities are required to apply the criteria contained in Subparagraph 60.3(c)(10). This provision requires that, "Until a regulatory floodway is designated, no new construction, substantial improvements, or other development shall be permitted unless it is demonstrated that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the water-surface elevation of the base flood more than 1.0 foot at any point within the community."

However, if a preliminary FIS Report and FIRM have designated floodways and/or non-encroachment areas where none had previously existed, counties/communities should reasonably use this best available data in lieu of applying the encroachment performance standard contained in Subparagraph 60.3(c) (10). By using the floodway/non-encroachment data from a preliminary FIS Report, counties/communities avoid the expense of conducting the hydraulic analysis necessary to demonstrate compliance with Subparagraph 60.3(c) (10). In addition, counties/communities can minimize flood damage by ensuring that the flood-carrying capacity of the floodway is preserved because obstruction of floodways can significantly increase the potential for flooding upstream.

Land Currently within Zones Shaded Zone X, Unshaded Zone X

The NFIP floodplain management criteria do not require the use of BFE and floodway/non-encroachment data from a preliminary FIS Report or FIRM under Subparagraph 60.3(b)(4) for an area or areas within Zones Shaded Zone X or Unshaded Zone X on the community's FIRM that are being revised to Zone AE. FEMA cannot mandate or require a community to use the information contained in the preliminary FIS Report or FIRM pertaining to areas designated as Shaded/Unshaded Zone X as available data or use the data at the time FEMA issues the LFD to the community. However, FEMA encourages counties/communities to reasonably use this information to ensure that their citizens' health, safety, and property are protected.

Ordinance Requirements – Adoption of the Data

Land Currently within Zones A, AE, Shaded Zone X, and Unshaded Zone X
Counties/communities have several months from the date of the LFD to adopt the revised FIS Report and FIRM. FEMA is required to provide a reasonable amount of time for the community to adopt floodplain management ordinances that are consistent with the final flood elevation determinations. Subparagraph 59.24(a) provides for a 6-month compliance period in which the community must adopt the effective FIS Report and FIRM and amend existing ordinances to incorporate any additional requirements under Paragraph 60.3. Under the North Carolina Floodplain Mapping Program, this 6-month period typically starts when a preliminary FIS Report and FIRM are issued.

Floodplain management ordinances generally contain a section titled "Basis for Establishing the Areas of Special Flood Hazard" in which the current effective FIS Report and FIRM are cited. Language in the ordinance may adopt by reference any subsequent revisions (i.e., a revised FIS Report and FIRM) without a subsequent formal adoption procedure. However, this wording should not be used as the basis for a community to use the preliminary FIS Report prior to the issuance of the LFD. If a community uses preliminary BFE and Floodway/non-encroachment data, it is advised that the community formally adopt this information.

Insurance Implications

Land Currently within Zone A
For a new or substantially improved structure, counties/communities can use information from a preliminary FIS Report to complete the Elevation Certificate in Zone A areas. When this is the case, "other" in Block 10 of the Elevation Certificate is checked and the preliminary FIS and FIRM panel and date are noted. THE flood insurance policies for new or substantially improved structures in Zone A that are rated using BFE data from a preliminary FIS Report will often qualify for significantly lower insurance rates than policies that are rated without a BFE.

Land Currently within Zones AE,
For flood insurance rating purposes in Zones AE new or substantially improved structures are rated based on the BFE and FIRM zone in effect on the date of construction until the revised FIRM becomes effective. This is the case regardless of whether the preliminary FIS Report indicates that the proposed BFEs will increase or decrease.
If a county/community chooses to use proposed BFEs from a preliminary FIS Report for a new or substantially improved structure, the flood insurance rate is still based on the BFE and FIRM zone in effect on the date of construction. The flood insurance rate will be based on the difference between the elevation of the lowest floor and the BFE and FIRM zone in effect. Therefore, if a new or substantially improved structure is built to the proposed FE from a preliminary FIS Report and FIRM and this BFE is higher than the BFE in effect, the flood insurance rate may be significantly lower. However, a new or substantially improved structure built to the proposed BFE that is lower than the BFE in effect may result in a higher flood insurance rate. In this case, the insured will qualify for a premium pro rata refund once the revised FIRM is effective.

Land Currently within Zones Shaded Zone X, Unshaded Zone X
For flood insurance rating purposes, new or substantially improved structures are rated based on the FIRM zone in effect (i.e., Shaded/Unshaded Zone X) on the date of start of construction. If a community chooses to use proposed BFEs from a preliminary FIS Report and FIRM for a new or substantially improved structure, the flood insurance rate is still based on the FIRM zone in effect (i.e., one Shaded/Unshaded X) on the date of construction. Structures in Zones Shaded/Unshaded X may be eligible for Preferred Risk Policies until the New FIRM is effective.

Comprehensive Development Plan
The Transylvania County Comprehensive Development Plan is a general, long-range policy guide for decisions making and addresses the County's overall growth and development. The plan was adopted by the Transylvania Board of Commissioners in June of 1994 and last updated in February 2005. The plan establishes goals to promote affordable, safe and adequate housing for all residents and promotes the best use of land while protecting citizen's property rights. The plan establishes objectives to continue developing the County's GIS system that shows where existing resources are located in relation to the floodplain, steep slopes, and existing roads; updating and promoting through aggressive outreach and education the County's best management practices for corridors and staffing to collect and planning board to review different land use practices from other rural jurisdictions.

Town of Rosman Stream Bank Buffer Zone Ordinance
The Town of Rosman adopted a Stream Bank Buffer Zone Ordinance in April 2004. This ordinance requires all buildings to be a minimum of 35' away from any waterway.

Emergency Management
The regulatory authority for Emergency Management in Transylvania County is set forth in the Transylvania County Emergency Management Ordinance and by the North Carolina General Statute 166-A. The Transylvania County Emergency Management Office (TCEM) coordinates all emergency management operations (mitigation, preparedness, response, and recovery) for Transylvania County and the incorporated municipalities. TCEM maintains the County Emergency Operations Plan (EOP), which sets forth responsibilities within various departments to ensure prompt emergency response and delivery of necessary services. The County Emergency Management Director or said designee has the power to activate the EOP and is responsible for its update and revision on an annual basis. In addition, TCEM is responsible for the development, implementation, revisions, and subsequent updates of this Transylvania County Multi-Jurisdictional Hazard Mitigation Plan.

TCEM coordinates all pre-disaster, disaster, post-disaster resource needs. In addition, all damage assessment is coordinated through TCEM. Assessment is coordinated by the Emergency Management Director and carried out by Emergency Management staff, local fire & rescue department personnel, tax administration, and inspections departments. After a state or federal disaster declaration, TCEM forwards all damage assessments and reports to the state or federal government for consideration and review.

INSTITUTIONAL CAPABILITY

Transylvania County
Transylvania County is a chartered county governed by a Board of Commissioners. The Board is chosen every four years in partisan elections. They set policy, determine budgets for county agencies and set property tax rates for the county. The Board of Commissioners is responsible for appointing a County Manager. The Board is assisted in an advisory position by several Boards, Commissions, and Committees who can assist in the implementation and/or oversight of the mitigation strategies identified herein.

The County Manager is the chief administrative officer, who prepares and recommends the annual budget and is responsible for program development and personnel management. In addition, the County has separate departments such as the Emergency Management Department, Planning Department, and Sheriff's Department, which are staffed with trained personnel who are effective in administering the day-to-day requirements of their department and who will be highly effective in assisting in the implementation of the strategies identified herein.

City of Brevard
The City of Brevard has a Council – Manager form of government. The Mayor is elected for a four – year term and the Council are elected on a four – year staggered term. The Mayor and five Council members set policy and determine budget for the City. The Council is assisted in an advisory position by several Boards, Commissions, and Committees who can assist in the implementation and/or oversight of the mitigation strategies identified herein.

- The Planning Board reviews and recommends on both current and long range planning activities.
- The Zoning Board of Adjustment hears and decides appeals from actions, decisions, etc. of the Zoning Administrator, to interpret unclear parts of the Zoning Ordinance, to grant conditional use permits, to potentially issue variances relative to provisions in the Ordinance other than land uses when practical difficulties or unnecessary hardship would result from strict enforcement of the Ordinance.

The City Manager is the chief administrative officer for the City. He prepares and recommends the budget, provides oversight to multiple departments and is responsible for program development and personnel management. In addition, the City has separate departments such as the Police Department, Public Works Department, Fire Department, Planning and Zoning Department, and others, which are staffed with trained personnel who are effective in administering the day-to-day activities of their department and who will subsequently be effective in assisting in the implementation of the strategies identified herein.

Town of Rosman
The Town of Rosman has a Council form of government. The Mayor is elected for a four – year term and the Council are elected on a four – year staggered term. The Mayor and five Council members set policy and determine budget for the Town. The Council is assisted in

an advisory position by several Boards, Commissions, and Committees who can assist in the implementation and/or oversight of the mitigation strategies identified herein.

POLITICAL CAPABILITY

Opposition to mitigation measures is not evident in Transylvania County or its incorporated municipalities. In fact, Transylvania County, Brevard, and Rosman have taken a proactive approach to mitigation through the development of governing documents, which promote the mitigation process. This approach will be further promoted in the strategies identified herein.

Transylvania County is responsive to the needs of its residents through memorandums of understanding or memorandums of agreement which provide services to its municipalities. The Transylvania County governing board is well educated on the hazards that threaten the County and have advisory boards that specialize in specific areas of hazard reduction. The residents of Transylvania County actively participate in public hearings, board meetings, and workshops relevant to the continued growth and development of the County. In addition, there are boards, committees, and commissions that are established with the specific purpose of receiving and evaluating citizen comments and advising the governing board on said comments and information. The County (its governing board, staff, and citizenry) appear highly capable and willing to promote the economic efficiency and social utility of the mitigation measures contained in this plan. In addition, they appear willing to assist all local municipalities in the implementation of strategies identified herein and specific to municipal jurisdictions.

The Brevard and Rosman political structure, in cooperation with the County government is well organized and responsive to community needs. The governing boards are educated and remain up-to-date on the hazards that threaten their jurisdiction and on the most recent mitigative actions that can be taken to reduce the vulnerability to said hazards. In addition, the level of citizen participation in each jurisdiction is high. Citizens actively participate in public hearings, board meetings, and workshops relevant to continued safe growth and development. Brevard and Rosman (the governing boards, staff, and citizen population) appear highly capable and willing to promote the economic efficiency and social utility of the mitigation measures contained in this plan.

TECHNICAL CAPABILITY

Transylvania County

Transylvania County is secured with a high level of technology needed to mitigate and respond to natural and technological disasters.

- The County Emergency Management staff is well trained and participates in continuing education classes and seminars to serve the County and its municipalities during a disaster.
- The County is equipped with telephone and fax lines and a fully equipped emergency operations center in case of disaster.
- All primary County personnel are equipped with cellular phones, which can act as a backup to land lines in case local service is lost.

- The County has redundant broadband internet access, which is a valuable source of information on approaching hazards, as well as, mitigation measures. The County sponsors a website at http://www.transylvaniacounty.org. The site provides links to all the Transylvania County departments and provides a section for citizen response.
- The County has a well-equipped Information Technology Department with a staff trained in the most recent programs and applications.

City of Brevard

The City of Brevard is secured with a high level of technology needed to mitigate and respond to natural and technological disasters.

- The Fire Department, Police Department and Public Services staffs are well trained and participate in continuing education classes and seminars to serve the City during a disaster. In addition, they work closely with the County in disaster coordination.
- The City is equipped with primary telephone and fax lines.
- All primary City personnel are equipped with cellular phones, which can act as a backup to land lines in case local service is lost.
- The City has broadband access to the Internet, which is a valuable source of information on approaching hazards, as well as, mitigation measures. The City sponsors a website at http://www.cityofbrevard.com. The site provides links to all the City departments and provides a section for citizen response.
- The City has a well-equipped staff trained in the most recent programs and applications for GIS.

Town of Rosman

The Town of Rosman is secured with basic technology needed to mitigate and respond to natural and technological disasters.

- The Town works closely with the County in disaster coordination.
- The Town is equipped with primary telephone and fax lines.
- All primary Town personnel are equipped with cellular phones, which can act as a backup to land lines in case local service is lost.
- The Town is connected to the Internet, which is a valuable source of information on approaching hazards, as well as, mitigation measures.

FISCAL CAPABILTY

Transylvania County and its municipalities are not unique in the trials and tribulations felt by local governments to retain the staff and resources necessary to accomplish the strategies necessary to mitigate the hazards in their area. However, Transylvania County and its municipalities realize that there are diverse funding sources available to counties and communities to assist in the fiscal responsibility required to implement local hazard mitigation plans, including both government and private programs (see Appendix B for details).

While federal and state programs carry out the bulk of disaster relief programs that provide funds for mitigation, local governments are encouraged to open the search field as widely as possible, and include alternative funding sources to supplement the local hazard mitigation budget. Transylvania County, the City of Brevard, and the Town of Rosman are staffed with persons educated in the project planning area, which includes fiscal planning and the identification of multiple funding sources to ensure the success of said project. In addition, they realize that before effective mitigation strategies can be applied, stable funding sources and effective incentives must be established on a per project basis to encourage participation by the private and public sectors.

ANALYSIS CONCLUSION

The County and its municipalities have a strong legal, institutional, technical, political, and fiscal capability but do have areas, which require update or improvement. Many of the goals identified in the documents are specific in nature and address a specific hazard. It is suggested that the County and its incorporated municipalities continue this path, make the goals in this plan specific in nature, and ensure that they too address specific hazards as often as possible.

Legal Capability Conclusion

Transylvania County and the City of Brevard have subdivision ordinances in effect to assist in controlling development within their jurisdictions. Additionally, Brevard has a Unified Development ordinance, which extends their control to allow only specific development in specific areas. Transylvania County, the City of Brevard and the Town of Rosman are members of the NFIP. The City of Brevard is the only jurisdiction that extended that membership to include participation in the CRS program. In addition, they all have flood damage prevention ordinances, which assist in the control of development in and near the floodplain. To further improve the legal capability of Rosman, the Town of Rosman should develop a stormwater management ordinance to assist in the control of stormwater and to assist in placing restrictions on the amount and type of impervious surfaces used during development of high hazard areas.

Institutional Capability Conclusion

The County and the City of Brevard all have a solid institutional capability. Each has a governing board, a manager and staff that are well trained and educated in the skills necessary to perform their day-to-day activities and to assist in the response and recovery efforts following a disaster. In addition, each jurisdiction has boards, commissions, and committees that are available to assist in the implementation and oversight of goals and strategies that will promote the mitigation process. The Town of Rosman has limited

institutional capability. They do have a governing board, which is assisted by a Town Clerk but relies on the County for much of its institutional capability.

Political Capability Conclusion
Transylvania County, Brevard, and Rosman all have a solid political capability in that their governing boards are educated about the disasters that are prevalent to their area and the mitigation techniques needed to reduce their level of vulnerability to said hazards. In addition, all the jurisdictions have regulations in place for continued citizen participation. All public hearings and workshops are advertised in the local paper, on local websites and at County and municipal administration buildings.

Technical Capability Conclusion
Transylvania County and the City of Brevard have a high level of technical capability. The Town of Rosman has limited technical capability. All jurisdictions have primary phone lines to fill their communications needs and subsequently have cell phones or two-way radios as a backup system in case of primary line failure.

All jurisdictions have computers, which are connected to the internet, and Transylvania County and the City of Brevard sponsor websites that can be used for information dissemination during and following a disaster. In addition, Transylvania County and Brevard have GIS capabilities with a staff trained in the latest software and hardware use. The Town of Rosman partners with the county for their GIS needs.

Table 4.2
Incorporation into Existing Planning Mechanisms

County Plans	Review Process and Incorporation	Recommendations for Incorporation in the Future
Emergency Operations Plan (EOP)	The EOP has been used in the past for the development of hazard identification and analysis. Information on how the county responds to disasters was considered to decide how the County needs to mitigate for the hazards affecting the area.	The hazards identified in the MJHMP will be identified and addressed in the county emergency operations plan.
City of Brevard Land Use Plan	The hazard mitigation plan was not used in the development of the Land Use Plan.	The City of Brevard could use the revised hazard mitigation plan to identify areas susceptible to flooding.
City of Brevard Stormwater Management Plan	The hazard mitigation plan was not used in the development of the Stormwater Management Plan.	The City of Brevard could use the revised hazard mitigation plan to identify areas susceptible to flooding.
NCFS Transylvania County Wildfire Protection Plan	The hazard mitigation plan was not used in the development of the Stormwater Management Plan.	The hazard mitigation plan could be used by local fire departments and NCFS to identify potential fire hazards in communities.

SECTION 5: MITIGATION STRATEGIES

This section contains a detailed strategy that promotes the current achievement of hazard mitigation, impact reduction and other county/community goals. This section will address mitigation strategies for the hazards the planning area is most vulnerable too. All goals, strategies, and action in this section will apply to all jurisdiction within the plan.

This section is organized with general goals that are to be met by accomplishing the accompanying objectives and subsequent strategies all discussed in the following action plan. The action plan provides a quick reference for each governing jurisdiction during the implementation process. It identifies each goals, objectives, and strategies. It further identifies the hazards addressed by each strategy, type of strategy, target completion date, responsible party/organization for implementation, potential funding source, as well as, monitoring and evaluation indicators. Specific information on potential funding sources is found in Appendix B of this plan.

As discussed in the mitigation planning section of this plan, the goals, objectives, and strategies identified herein were developed through a multi-step process. Following the hazard identification and analysis, which identified the hazards most prevalent to the area, and following the area vulnerability assessment, which identified the portions of the planning area most vulnerable to the previously identified hazards a planning area capability assessment was conducted. The planning area capability assessment identified what steps the community had already taken towards reducing their vulnerability to hazards by reviewing the legal, institutional, political, technical, and fiscal capability of each governing jurisdiction in the planning area. In addition, this step identified their capability to implement future mitigation measures. Following this, an acceptability assessment was conducted which included this plan being posted on the County and City website and in the local administration offices and local Library. In this step, citizens, the governing boards, as well as, others were given an opportunity to provide input on the results of the hazard identification and analysis, area vulnerability assessment, and the planning area capability assessment. Based on the already proactive approach the County and its incorporated municipalities have taken towards mitigation in the past and based on the current level of development and population increase it was decided to use the mitigation plan as an avenue to make Transylvania County and its incorporated municipalities less vulnerable to all hazards that could potentially affect the area and that a high level of planning was needed to continue the proactive approach the planning area had already taken. Subsequently a county/community goals assessment was conducted. This step involved a review of all the governing documents in the planning area, as well as, interviews and meetings with key informants. Here the current goals and strategies already adopted by the community were identified and examined to determine if they promoted or hindered the mitigation process. The following is the list of goals, objectives, and strategies identified and agreed upon by each participating jurisdiction. This information identified the jurisdiction each strategy specifically addresses. However, many of the goals, objectives, and strategies identified for Transylvania County will not only benefit the County and reduce the County's vulnerability to different hazards but will also benefit and reduce the vulnerability of all the incorporated municipalities as well.

Mitigation Goal 1

Improve Public Awareness/Education: Public awareness/education is a strategy that addresses all hazards. The list of strategies to achieve the goal of public awareness/education is unlimited. However, it is important in the process of education that as many people as possible are reached and provided information. Thus, it is best to identify multiple strategies that can be used to accomplish this goal. In an effort to assist the municipalities located within the County the goal of improving public awareness will be a joint effort between the County and its municipalities.

First, sponsoring a seminar based on hazards and mitigation activities to address those hazards reaches large amounts of people at one time. In addition, it provides a forum for citizens to interact with persons about the best way to reduce their personal vulnerability to hazards. A seminar would provide illiterate persons the opportunity to hear the necessary information that quite often is dispersed in written format only. However, a seminar alone is not an effective way for a county/community to provide public awareness, as there are many citizens incapable of attending such an event. Because a seminar is a proven way of reaching large numbers of persons at one time, Transylvania County has chosen to hold a joint seminar with the City of Brevard and the Town of Rosman based on their strategies.

In addition, the dispersment of written materials is another way of reaching the largest number of residents in the community, as well as, business owners, specifically those involved in the development and construction process of new structures in the area. It also provides people with written materials for future reference. However, the cost of dispersing written materials can be costly and could reach an illiterate population who cannot use it. Nonetheless, providing written materials to citizens has been a proven way of conducting public awareness/education strategies. These strategies could include displaying the information on an information board at the County and municipal administrative offices, handing out information to those applying for permits or to new home buyers, sending out inserts in local gas/utility bills or water bills, and posting information on County or municipally sponsored websites. Because Transylvania County has a highly literate population and because there is a high level of personal computer ownership and utility usage in the area the County has chosen to implement all the aforementioned strategies in an effort to provide the public with the necessary information.

Public awareness/education can serve two major points in the mitigation efforts of the planning area. First, in an education capacity, the seriousness of the potential for disaster because of hazards can be communicated. Here the saying "knowledge is power" is an adequate statement, for the more knowledge the public has on the potential hazards that affect Transylvania County, the more likely they are to take appropriate steps in securing their property and protecting their families against the dangers associate with said hazards. Second, citizens and visitors alike can be made aware of evacuation routes, which physically remove people from the path of danger. Many lives have been saved through public awareness/education during pending emergencies. Since new residents and seasonal visitors in Transylvania County may be unaware of mountainous hazards, public awareness should be implemented on an ongoing basis.

Mitigation Objective 1.1

Launch a public awareness/education campaign in the planning area. This activity should be completed in coordination with the City of Brevard and the Town of Rosman.

Mitigation Implementation Measures

1.1.1 Hold a hazard mitigation seminar, including information on preparedness for all hazards significant to Transylvania County, Brevard, and Rosman and promotion of participation in FireWise.
Hazards Addressed: All
Jurisdiction Affected: Transylvania County, Brevard, and Rosman
Type of Strategy: Public Information
Responsible Party/Organization: County Manager, Town of Rosman (Mayor), City Manager (City of Brevard)
Prioritization – Short-Term
Target Completion Date: 6/2013
Possible Resources: Local & State
Monitoring & Evaluation Indicators: Determine if the mitigation seminar has been held.

1.1.2 Educate contractors about principles for quality redevelopment and safe housing development through written materials or a County sponsored workshop.
Hazards Addressed: Flooding, Tornadoes, Severe Thunderstorms/Wind Storms, Hurricanes/Tropical Storms, Wildfires Riverine Erosion, Earthquake, Landslides, and Nor'easters
Jurisdiction Affected: Transylvania County, Brevard, and Rosman
Type of Strategy: Public Information
Responsible Party/Organization: Building Inspections
Prioritization: Short-Term
Target Completion Date: 06/2013
Possible Resources: Local
Monitoring & Evaluation Indicators: Determine if materials have been made available or if the County, City, and Town has displayed information on the subject in a common area easy for contractors to see.

1.1.3 Provide new home and property buyers with information on quality redevelopment, safe housing development, and FireWise Communities. The information is probably most efficiently dispersed at the community administration buildings.
Hazards Addressed: Flooding, Tornadoes, Severe Thunderstorms/Wind storms, Hurricanes, Wildfires, Riverine Erosion, Earthquake, Landslides and Nor'easters
Jurisdiction Affected: Transylvania County, Brevard, and Rosman
Type of Strategy: Public Information
Responsible Party/Organization: Building Inspector
Prioritization: Short-Term
Target Completion Date: 12/2013
Possible Resources: Local

Monitoring & Evaluation Indicators: Determine if all juridictions have displayed information on the subject in a common area easy for property owners to see or if the information is being provided when permits are being applied for.

Mitigation Objective 1.2
Publicize the documents associated with mitigation.

Mitigation Implementation Measures

1.2.1 Manually disperse and have a website posting on the County and City websites, which provides information about the Multi-Jurisdictional Hazard Mitigation Plan for Transylvania County, and relevant mitigation measures the public can take. In addition, provide a response/reply section where residents can comment on the effectiveness of the current plan and where they can make suggestions for future revisions on the plan.
Hazards Addressed: All
Jurisdiction Affected: Transylvania County, City of Brevard, and Town of Rosman
Type of Strategy: Public Information
Responsible Party/Organization: County Manager, City Manager, Mayor
Prioritization: Short-Term
Target Completion Date: 6/2013
Possible Resources: Local
Monitoring & Evaluation Indicators: Determine if the County and City website has been updated with the information required and hard copies are available in each jurisdictions administrative offices.

Mitigation Goal 2

Minimize the potential for damage to personal property, infrastructure, and life due to flooding: Transylvania County has a mountainous topography, and, as seen in the previously discussed maps, is highly susceptible to flooding in some areas. Flooding can lead to structural damage, infrastructure damage, the loss of life or major injury as well as, damage to natural resources. During the Planning Area Capability Assessment, it was found that the County, City and Town have adequate control over development in their floodplain but the control could always be improved. The aim of this goal is to address this issue by improving the County, City and Town's current legal capability to control the development of their floodplain and to improve the infrastructure within the floodplain to mitigate the potential damage to natural resources and ecosystems.

Currently, each jurisdiction participates in the NFIP and has adopted a Flood Damage Prevention Ordinance. In addition, the City of Brevard participates in the CRS program. The purpose of the Flood Damage Prevention Ordinance is to restrict or prohibit uses, which are dangerous to health, safety, and property due to water or erosion hazards, or which result in damaging increases in erosion or in flood heights or velocities. The ordinance should require that uses vulnerable to floods, including facilities, which serve such uses, be protected against flood damage at the time of initial construction. It will assist in controlling the alteration of the natural flood plains, stream channels, and natural protective barriers, which are involved in the accommodation of floodwaters. In addition, it should provide controls for filling, grading, dredging and other development, which may increase

erosion or flood damage and prevents or regulates the construction of flood barriers which will unnaturally divert floodwaters or which may increase flood hazards to other lands.

The NFIP is a Federal program enabling property owners in participating communities to purchase insurance as a protection against flood losses in exchange for State and community floodplain management regulations that reduce future flood damages. Participation in the NFIP is based on an agreement between communities and the Federal Government. If a county or community adopts and enforces a flood damage ordinance to reduce future flood risk to new construction in floodplains, the Federal Government will make flood insurance available within the community as a financial protection against flood losses. This insurance is designed to provide an insurance alternative to disaster assistance to reduce the escalating costs of repairing damage to buildings and their contents caused by floods.

The National Flood Insurance Program's (NFIP) Community Rating System (CRS) allows communities to reduce flood insurance rate premiums for citizen property owners. In order to capitalize on these reductions, a community must take specific steps to improve upon the minimum floodplain management requirements of the NFIP. The CRS awards flood insurance premium discounts from 5-45% for eighteen different flood management activities that fall into the following four categories: public information, mapping and regulation, flood damage reduction, and flood preparedness. Participation in the CRS, which is contingent upon community compliance with NFIP rules, will provide Transylvania County and the Town of Rosman with the opportunity to reduce flood insurance rate premiums for its residents. In order to participate, the County and Rosman must designate a CRS coordinator to handle the application and serve as a liaison between the community and the Federal Emergency Management Agency. Work on a CRS plan is facilitated by completion of the Transylvania County Multi-Jurisdictional Hazard Mitigation Plan, participation in the NFIP, and adoption of a Flood Damage Prevention Ordinance.

The adoption of Stormwater Management Ordinance could provide the County with the ability to restore and preserve water quality and the natural ecological functions of surface waters that are included in its planning area. In addition, it could work with the Zoning Ordinance, Subdivision Ordinance, and Flood Damage Prevention Ordinance to assist in regulating existing developments, future developments, and construction activities, as well as, instituting mandatory requirements to prevent careless pollution to surface waters.

Mitigation Objective 2.1
Improve the ability of City of Brevard to control development in the floodplain.

Mitigation Implementation Measures

2.1.1 Encourage participation in the Community Rating System Program and the development of a CRS plan for the City of Brevard.
Hazards Addressed: Flooding, Erosion, Hurricanes/Tropical Storms, Severe Thunderstorms/Wind Storms, and Nor'easters
Jurisdiction Affected: City of Brevard
Type of Strategy: Preventative
Responsible Party/Organization: City of Brevard
Possible Resources: Local
Prioritization: Long-Term

Target Completion Date: Ongoing
Monitoring & Evaluation Indicators: Improvement in City of Brevard CRS rating.

2.1.2 Develop a Stormwater Management Plan in the Town of Rosman and the City of Brevard.
Hazards Addressed: Flooding
Jurisdiction Affected: Brevard and Rosman
Type of Strategy: Preventative
Responsible Party/Organization: City and Town Floodplain Manager
Prioritization: Long-Term
Target Completion Date: July 2009 This action has been completed by the City of Brevard and no longer an applicable action to the Town of Rosman for this planning cycle.
Monitoring & Evaluation Indicators: Determine if the City and Town have developed plans to alleviate stormwater drainage problems.

2.1.3 Obtain inundation maps for high hazard dams that pose the greatest risk to life and property.
Hazards Addressed: Dam/Levee Failure, Flooding
Jurisdiction Affected: ALL
Type of Strategy: Preventative and Response
Responsible Party/Organization: County Emergency Management
Prioritization: Long - Term
Target Completion Date: 07/2015
Possible Resources: Local
Monitoring & Evaluation Indicators: Maps obtained for identified dams.

2.1.4 County Building Inspections Residential Home Plan Review
Hazards Addressed: Flooding
Jurisdiction Affected: ALL
Type of Strategy: Preventative
Responsible Party/Organization: Building Inspections – Will require support and adoption from Board of Commissioners
Prioritization: Long-Term
Target Completion Date: 07/2015
Monitoring & Evaluation Indicators: Implementation of Residential Home Plan Review

2.1.5 Mitigation Of or Buyout Of Properties Frequently Damaged by Flooding
Hazards Addressed: Flooding
Jurisdiction Affected: City of Brevard
Type of Strategy: Property Protection
Responsible Party/Organization: City of Brevard Planning Department with Technical Assistance from Building Inspections
Prioritization: Long-Term
Target Completion Date: Contingent upon future flooding events
Monitoring & Evaluation Indicators: Implementation of successful mitigation through buyout of properties.

Mitigation Goal 3

During the plan review the Hazard Mitigation Planning Committee determined this goal was not practical and created other hazards. Therefore this goal and all related actions are being deleted and are no longer applicable in this planning cycle. Reduce or eliminate the vulnerability of flooding to personal property, roadway systems, bridges, and loss of life. As identified in Table 3.13 many roads in Transylvania County, Brevard, and Rosman are damaged, blocked, and closed because of flooding. Areas that have been identified as having a particularly high vulnerability are Main Street, Cherry Street, Old Hendersonville HWY, Island Ford Road, Wislon Rd, and Green Road. These are the areas each jurisdiction has chosen to address in the initial set of mitigation strategies.

Mitigation Objective 3.1

Minimize effects of flooding on infrastructure.

Mitigation Implementation Measures

3.1.1 *Elevate Main Street between Depot Street and Old Rosman HWY:* During flood events in the town of Rosman, areas near the river have to be evacuated due to being isolated. The homes the people live in have not all been elevated to necessary limits, but the roadway they utilize to access their property is still well below flood stage. A section of Main St from Depot Street to almost Old Rosman Highway would need to be elevated to equal amounts of building elevation. This would eliminate the need for evacuation of this area. Cleaning of drainage ditches would also be needed for this to be successful. A total of 1,089 feet of road would need to be elevated.
Hazards Addressed: Flooding, Hurricanes, Severe Thunderstorms, and Nor'easters
Jurisdiction Affected: Rosman
Type of Strategy: Structural Project
Responsible Party/Organization: Mayor
Approximate Project Cost: $300,000 (a final budget could not be finalized until engineering was completed)
Target Completion Date: July 2008
Monitoring & Evaluation Indicators: Determine if the road was elevated and if the ditches were cleaned.

3.1.2 *Elevate Old Hendersonville HWY between Osborne Road and Cherry Street and between Cherry Street and Dodson Flats:* During flood events, Old Hendersonville Hwy floods between Osborne Road and Cherry St and between Cherry Street and Dodson Flats. Elevation of this roadway would eliminate the need for evacuation of this area and the closure of a main access corridor. Elevations of homes along Old Hendersonville Hwy have been completed or are in progress. The raising of these two sections of roadway could be accomplished at the same time as the replacement of the culvert at Cherry St and Old Hendersonville Hwy. With the elevation of the roadway, dry reservoirs could be created to allow for the pooling of floodwater similar to the Interstate system in Florida. This could eliminate the need for evacuations and damage to homes not elevated in the area. Additional cleaning of ditches would be necessary for this project as well. 44 properties and a total of 70 homes or businesses would be affected by this project.

Hazards Addressed: Flooding, Hurricanes, Severe Thunderstorms, and Nor'easters
Jurisdiction Affected: Brevard
Type of Strategy: Structural Project
Responsible Party/Organization: City Manager
Approximate Project Cost: $500,000 (a final budget could not be finalized until engineering was completed)
Target Completion Date: July 2008
Monitoring & Evaluation Indicators: Determine if the road was elevated.

3.1.3 *Elevate Island Ford Road between Walnut Hollow Road and S. County Club Road:* The area of Island Ford Road between Walnut Hollow Rd and S Country Club Rd is a normal area of flooding during high-water events. This is an area of high development and causes additional burden on already heavily traveled access points during flood events. The elevation of this roadway would allow access for emergency service personnel during flood events and eliminate the staging of personnel and equipment before the road becomes impassible. The bridge that crosses the river is already at an adequate level and is of material to withstand floodwaters.
Hazards Addressed: Flooding, Hurricanes, Severe Thunderstorms, and Nor'easters
Jurisdiction Affected: Brevard
Type of Strategy: Structural Project
Responsible Party/Organization: County Manager
Approximate Project Cost: $1,000,000 (a final budget could not be finalized until engineering was completed)
Target Completion Date: July 2009
Monitoring & Evaluation Indicators: Determine if the road was elevated.

3.1.4 *Elevate Green Road Bridge:* Green Road is a normal road, which must be closed during flood events. The elevation and replacement of the bridge, which crosses the river, would be necessary. The current bridge is a single lane pier supported structure. The road approaching the bridge is normally underwater during flood events and prevents access to the bridge. The bridge would be more usable to emergency service vehicles and community if it were upgraded to allow the weight limits of modern vehicles.
Hazards Addressed: Flooding, Hurricanes, Severe Thunderstorms, and Nor'easters
Jurisdiction Affected: County
Type of Strategy: Structural Project
Responsible Party/Organization: County Manager
Approximate Project Cost: $1,000,000 (a final budget could not be finalized until engineering was completed)
Target Completion Date: July 2009
Monitoring & Evaluation Indicators: Determine if the bridge was elevated and replaced.

Mitigation Objective 3.2
Minimize effects of flooding on private property and the potential for loss of life.

Mitigation Implementation Measures

3.2.1 *Increase the culvert at Cherry Street and Old Hendersonville HWY:* During flood events, it has been found that the culvert at Cherry St and Old Hendersonville Hwy is causing the water to backup into the Mountain View Subdivision. Increased development in this area is causing additional run off to occur in this stream. Increasing the size of the culvert and cleaning the drainage ditches should help to eliminate the need for evacuation and home damage during flood events. Drainage ditches would need to be cleaned to the French Broad River. Years of buildup have occurred and contribute to the backup of water as well. Elevation of homes could be looked at, but the first key project to complete is the culvert increase to allow quicker elimination of water buildup. This culvert increase directly affects 35 property owners in the Mountain View Subdivision with an assessed value of $2,684,840.00.
Hazards Addressed: Flooding, Hurricanes, Severe Thunderstorms, and Nor'easters
Jurisdiction Affected: Brevard
Type of Strategy: Preventative
Responsible Party/Organization: Public Works Department
Approximate Project Cost: $70,000 (a final budget could not be finalized until engineering was completed)
Target Completion Date: July 2007
Monitoring & Evaluation Indicators: Determine if the culvert has been increased.

Mitigation Goal 4
Improve emergency equipment used to respond and recover from disasters.

Mitigation Objective 4.1
Improve the County's communication system.

Mitigation Implementation Measures

4.1.1 *Install a new reverse 911 system:* It has been found through various emergencies that getting information to citizens can be difficult. During the last, two flood events, evacuations were needed and the only method of alerting the people affected in a timely manner was door-to-door notification. To mitigate this problem, and expedite the delivery of needed information to the citizens of the entire county, a reverse 911 system is deemed most appropriate. A reverse 911 system can be utilized to notify the public anytime there is a problem that they should be directly notified. Examples of information include but not limited to: floods, tornadoes, evacuations, hazardous materials incidents, escaped prisoner, searches, etc. The system could be installed following the completion of the addressing project December 2005. After consulting with different venders on this type of project, they all recommend waiting until the addressing project is complete. The system could then be operation within six weeks. Since 911 is the responsibility of the county, Transylvania County will be responsible for the implementation of the system and it will serve the entire county.

Hazards Addressed: All
Jurisdiction Affected: County, Brevard, and Rosman
Type of Strategy: Public Information
Responsible Party/Organization: County Communications Director
Approximate Project Cost: $30,000 (a final budget could not be finalized until engineering was completed)
Target Completion Date: December 2005 – Completed October 2009
Possible Resources: Local
Monitoring & Evaluation Indicators: Determine if the 911 system has been installed.

Mitigation Objective 4.2
Improve the ability of the Town of Rosman to maintain its water supply following a disaster.

Mitigation Implementation Measures

4.2.1 *Purchase and install generators for the Town's four wells:* It has become increasingly a problem during various natural events such as floods, winter storms, high wind events, etc that water supply could become an issue for the town. Currently six wells supply the water needs for the town. During power outages, the reservoir tank that these six wells supply is the only means of water for the town. Normally, a half-day supply of water is all that is kept in the tank. The six wells are located at geographically different locations. None of the wells has backup power. For the project, it would be essential to provide a generator for each site in order that all six wells could be utilized and continue the alternating method of pumping from each to eliminate the potential of running an individual well dry or burning up a pump. This project would eliminate the potential of having to truck in bottled water to a population of approximately 700 people.
Hazards Addressed: All
Jurisdiction Affected: Rosman
Type of Strategy: Preventative
Responsible Party/Organization: Mayor
Approximate Project Cost: $60,000 ($10,000 per site)
Prioritization: Long-Term
Target Completion Date: Main well on generator since last planning cycle; 7/2015
Possible Resources: Local, State
Monitoring & Evaluation Indicators: Determine if generators were purchased and installed.

SECTION 6: PRIORITIZATION SCOPE

The strategies identified herein are organized within a 5-Year Action Plan. The plan identifies the type of strategy, target completion date, responsible party/organization, potential funding source, monitoring and evaluation indicators, and the hazard(s) addressed by said hazard.

In addition to the plan, prioritization is needed to identify what order project strategies should be implemented. The prioritization of strategies is critical to the implementation of a Multi-Jurisdictional Hazard Mitigation Plan. A county/community can only implement the measures adopted in a manner consistent with the resources available to that county/community. The Emergency Management Director completed a cost effectiveness review when identifying each project previously identified. However, prior to the projects implementation, a full cost benefit analysis should be completed to ensure the project is cost-effective and that its benefits outweigh its cost. The cost benefit will identify the approximate cost of the project and the approximate value of the reduction of the vulnerability if the strategy was implemented.

The prioritization will be established under two categories: short-term and long-term. Short-term strategies are those that can be implemented within existing resources and authorities and should be completed within a period of 6 months to 2 years. Short-term activities also include those activities that should be implemented immediately following the adoption of this plan and should be implemented on a continuous basis. Long-term strategies may require new or additional resources or authorities and should be organized to be implemented within a period of 3 – 5 years. Many strategies, especially those that will take multiple years to complete, will require the project manager to establish an individual timeline where benchmarks can be used to monitor the progression of the strategy.

The mitigation measures in the Transylvania County Multi-Jurisdictional Hazard Mitigation Plan will be prioritized by each separate governing district in accordance with that districts capability and the likelihood of implementation. Cost effectiveness will be taken into consideration and weighed against other factors to determine the priority of the strategies.

REFERENCES

City of Brevard website. http://www.cityofbrevard.com.

City of Brevard Flood Damage Prevention Ordinance. February 1998.

City of Brevard Unified Development Ordinance. April 2006.

Federal Emergency Management Agency. 2009. *State Multi-Hazard Mitigation Planning Guidance (Mitigation Planning "Blue Book").* Washington, D.C.

Federal Emergency Management Agency. 2007. *National Flood Insurance Program CRS Coordinator's Manual, 2007 Edition.* Washington, D.C.

National Weather Service. http://water.weather.gov .
National Oceanic and Atmospheric Administration. http://www.nhc.noaa.gov/.

National Oceanic and Atmospheric Administration. National Hurricane Center. http://www.nhc.noaa.gov.

National Climatic Data Center. *Storm Events.* http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms.

National Flood Insurance Program. http://www.fema.gov/nfip/northcarolina.htm.

North Carolina Department of Crime Control and Public Safety, Emergency Management Division. July 2008. *Local Hazard Mitigation Plan Update Materials.*

North Carolina Division of Water Resources.
http://www.ncwater.org/perl/news/viewnews.cgi?category=all&id=1026745469.
http://www.ncwater.org/water_supply_planning/drought_monitoring_council/recommendations.

North Carolina Drought Monitoring Council.
http://www.dwr.whnr.state.nc.us/water_supply_planning/drought_monitoring_council.

North Carolina Hazards Page. http://www.csc.noaa.gov/products/nchz/htm/hother.htm.

Pasch, Richard J. *Storm of the Century.* http://www.firstscience.com/site/articles/floyd.asp.

Rodbruch-Hall, D.H.; et.al. 1982. *Landslide Overview Map of the Conterminous U.S.* Scale 1:7,500,500. USGS Professional Paper 1183.

Superstorm 1993.
http://www.ldeo.columbia.edu/dees/ees/climate/slides/lec3fig14superstorm/html.

Town of Rosman Stream Bank Buffer Ordinance. April 2004..

Town of Rosman Flood Damage Prevention Ordinance. April, 1994.

Transylvania County Comprehensive Plan. February 2005.

Transylvania County Flood Damage Control Ordinance. February 1998.

Transylvania County Hazard Mitigation Plan. 2005.

Transylvania County Manufactured Home Park Ordinance. February 2001.

Transylvania County Subdivision Ordinance. April 2009.

Transylvania County website: http://www.transylvaniacounty.org .

United States Army Corps of Engineers, Mobile District, Operations Division Readiness Branch. *Saffir-Simpson Scale for Hurricane Classification.* http://www.sam.usace.army.mil/op/opr/hurrclass.htm.

United States Census Bureau. http://www.census.gov.

United States Geological Survey. http://wwwneci/usgs.gov/neis/states/north_carolina_history.html.

NC Division of Forest Resources, Transylvania County Community Wildfire Protection Plan, 2011.

Page Intentionally Left Blank

APPENDIX A

POTENTIAL FUNDING SOURCES FOR MITIGATION ACTIVITIES

LOCAL RESOURCES

1. **Capital Improvements Projects**
2. **Community Empowerment Groups**
3. **Donations**
4. **Economic Development Funds**
5. **Formation of Separate Benefit Assessment Districts**
6. **Insurance**
7. **Private Not-for-Profit**
8. **Public/Private Partnerships**
9. **School Bonds**
10. **Volunteer Organizations**
11. **Internal Funds**

STATE AND FEDERAL RESOURCES

When local resources are inadequate, the town can seek additional assistance from the state and federal governments. Many of these programs are categorized as pre-disaster, post-disaster, and disaster-applicable. Pre-disaster programs exist without a disaster declaration and support pre-disaster mitigation activity. Post-disaster programs generally require a Presidential disaster declaration to become applicable. Disaster applicable programs are available for non-emergency purposes but may be redirected after a disaster declaration.

12. Adopt-a-Trail Program
Through the North Carolina Department of Environment and Natural Resources, this program provides grant funding for trail planning, construction, maintenance and administration.
Contact: NCDENR, 919-846-9991, http://www.enr.state.nc.us/

13. Assistance to Firefighters Grant Program
Through the Federal Emergency Management Agency, this program provides four grant categories to assist state, local, and tribal Fire Departments with funding necessary for training, equipment purchase, vehicle acquisition, public awareness, code enforcement, arson prevention, and the like.
Contact: FEMA, 866-274-0960, 301-447-1608, or http://www.usfa.fema.gov/grants

14. Clean Water Management Trust Fund
An agency of the North Carolina Department of Environment and Natural Resources (NCDENR), the Clean Water Management Trust Fund (CWMTF) provides grants for enhancement and restoration of degraded waters. In addition, funding is provided for development of buffers and greenways near rivers for environmental, educational and recreational needs.
Contact: 252-830-3222, http://www.cwmtf.net/

15. Community Facilities Loans
The U.S. Department of Agriculture (USDA), Rural Housing Service (RHS) provides funding for construction of community facilities for public use.
Contact: USDA, RHS Williamston Area Office, 252-792-7603, http://www.rurdev.usda.gov/rhs/index.html

16. Disaster Preparedness Improvement Grant
Funding for the Disaster Preparedness Improvement Grant (DPIG) is provided by FEMA and the North Carolina Division of Emergency Management (NCDEM). Grants fund community mitigation plan preparation, updates, and preparation of plans required to receive Hazard Mitigation Grant Program funding.
Contact: NCDEM, 919-715-8000, http://www.ncem.org

17. Flood Insurance
The Federal Emergency Management Agency, Federal Insurance Administration provides the opportunity to purchase flood insurance under the Emergency Program of the National Flood Insurance Program (NFIP).
Contact: NFIP, 1-888-CALL-FLOOD ext. 445, http://www.fema.gov/nfip

18. Flood Mitigation Assistance Program (FMA)
With the goal of reducing repetitive losses to the National Flood Insurance Program, this program provides funding for cost-effective actions to reduce or eliminate flood damages.
Contact: NCDEM. 919-715-8000, http://www.ncem.org

19. Hazard Mitigation Grant Program
Funding from this FEMA program is available to areas affected by a presidential-declared disaster. The program (75% federal, 25% state) funds mitigation measures through the post-disaster planning process.
Contact: NCDEM. 919-715-8000, http://www.ncem.org

20. North Carolina Wetlands Restoration Program
This program, through the North Carolina Department of Environment and Natural Resources (NCDENR), Division of Water Quality, provides in-kind services for the restoration of wetlands and for increased effectiveness of wetland mitigation efforts.
Contact: NCDENR, Div. of Water Quality, 919-733-5083, http://www.nceep.net/abouteep/wetlands.html

21. Parks and Recreation Trust Fund (PARTF)
Through the North Carolina Department of Environment and Natural Resources, this program provides matching funds for local parks and recreation public facility development.
Contact: NCDENR, 919-715-2662, http://www.enr.state.nc.us/

22. Physical Disaster Loans
The Small Business Administration (SBA) offers loans to victims of declared physical disasters for uninsured losses. The loan limit on these funds may be increased by twenty percent to provide for mitigation measures.
Contact: SBA, 1-800-827-5722, http://www.sba.gov/

23. Property Improvement Loan Insurance
The U.S. Department of Housing and Urban Development (HUD) insures lenders against loss on loans for alterations, repairs and improvements to existing structures and new construction of nonresidential structures.
Contact: HUD, (202) 708-1112, http://www.hud.gov/

24. Public Assistance Program
This FEMA program provides federal funding to communities in the immediate aftermath of a disaster. Grants focus on recovery, repair, and restoration of state and local facilities and non-profit organizations.
Contact: FEMA, http://www.fema.gov/r-n-r/pa/index.htm

25. Resource Conservation and Development
The U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) provides technical and assistance to communities for resource conservation projects including land conservation, water management and environmental enhancement.
Contact: NRCS, http://www.nrcs.usda.gov

26. River Basin Surveys and Investigations
The U.S. Department of Agriculture, Natural Resources Conservation Service provides technical assistance to local agencies for planning activities to solve problems related to the river basin, including wetland preservation, flood control, water management, and conservation.
Contact: NRCS, http://www.nrcs.usda.gov

27. Soil and Water Conservation
The U.S. Department of Agriculture, Natural Resources Conservation Service provides technical and financial assistance in order to provide for the conservation, development and productive use of the nation's soil, water and related natural resources.
Contact: USDA, NRCS, http://www.nrcs.usda.gov

Locally the Natural Resources Conservation Service and Transylvania County Soil and Water Conservation District provide technical assistance in debris removal and financial assistance when available

28. Snagging and Clearing for Flood Control
The Office of the Chief of Engineers, Department of the Army, Department of Defense provides this service in order to reduce flood control.
Contact: http://www.usace.army.mil

29. Urban Park and Recreation Recovery Program
This program of the Department of the Interior, National Park Service (NPS) provides grants for local governments for improvements in park system management and recreational opportunities.
Contact: NPS, (202) 565-1200, http://www.cr.nps.gov/index.htm

30. Watershed Protection and Flood Prevention Loans
This U.S. Department of Agriculture, Rural Utilities Services (RUS) program provides loans to local organizations for the local share of costs for watershed improvement. Funding includes support for drainage, flood prevention and sedimentation control
Contact: RUS, http://www.rurdev.usda.gov/rus/index.html

31. Watershed Surveys and Planning
The U.S. Department of Agriculture, Natural Resources Conservation Service provides technical and financial assistance for sharing costs of watershed protection measures, including flood prevention, sedimentation control and recreation.
Contact: NRCS, http://www.nrcs.usda.gov

APPENDIX B

Adoption Resolutions – These resolutions will be replaced when adopted by local jurisdictions after FEMA approval is received

Transylvania County
Resolution 21-05

RESOLUTION ADOPTING THE TRANSYLVANIA COUNTY MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN

WHEREAS, on June 15, 2002, Transylvania County received a grant ($20,000) from the North Carolina Division of Emergency Management for the development of a Multi-Jurisdictional Hazard Mitigation Plan; and

WHEREAS, as a result of collaborative efforts of Transylvania County, the City of Brevard, the Town of Rosman, and other outside agencies, the Transylvania County Multi-Jurisdictional Hazard Mitigation Plan has been developed; and

WHEREAS, the mission of the Transylvania County Multi-Jurisdictional Hazard Mitigation Plan is to substantially and permanently reduce the planning area's vulnerability to natural hazards. The plan is intended to promote sound public policy designed to protect citizens, critical facilities, infrastructure, private property, and the natural environment. This can be achieved by increasing public awareness, documenting resources for risk reduction and loss-prevention, and identifying activities to guide the planning area toward the development of a safer, more sustainable community; and

WHEREAS, after a public hearing on August 8, 2005, it is the desire of Transylvania County to adopt the Transylvania County Multi-Jurisdictional Hazard Mitigation Plan;

NOW, THEREFORE, BE IT RESOLVED by the Board of Commissioners of Transylvania County, North Carolina, that:

Section 1. The Transylvania County Multi-Jurisdictional Hazard Mitigation Plan was adopted and approved on August 8, 2005.

Section 2. The Transylvania County Multi-Jurisdictional Hazard Mitigation Plan is available for review in the office of the County Clerk.

Section 3. This Resolution shall become effective upon its adoption and approval.

Approved this 12th day of September, 2005.

Raymond D. Miller
Raymond D. Miller, Chairman
Board of County Commissioners

ATTEST:
Kimberly T. Conover
Kimberly T. Conover, Clerk to Board

"An Equal Opportunity Employer"

TOWN OF ROSMAN

RESOLUTION 4-2005

A RESOLUTION ADOPTING THE TRANSYLVANIA COUNTY MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN

WHEREAS, on June 15th, 2002, Transylvania County received a grant ($20,000) from the N.C. Division of Emergency Management for the development of a Multi-Jurisdictional Hazard Mitigation Plan; and

WHEREAS, as a result of collaborative efforts of Transylvania County, the Town of Rosman, the City of Brevard and other outside agencies, the Transylvania County Multi-Jurisdictional Hazard Mitigation Plan has been developed; and

WHEREAS, the mission of the Transylvania County Multi-Jurisdictional Hazard Mitigation Plan is to substantially and permanently reduce the planning area's vulnerability to natural hazards. The plan is intended to promote sound public policy designed to protect citizens, critical facilities, infrastructure, private property, and the natural environment. This can be achieved by increasing public awareness, documenting resources for risk reduction and loss-prevention, and identifying activities to guide the planning area towards the development of a safer, more sustainable community; and

WHEREAS, after a public hearing on July 11th, 2005, it is the desire of the Board of Aldermen to adopt the Transylvania County Multi-Jurisdictional Hazard Mitigation Plan.

NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF ALDERMEN OF THE TOWN OF ROSMAN, NORTH CAROLINA THAT:

Section 1. The Transylvania County Multi-Jurisdictional Hazard Mitigation Plan is hereby adopted and approved.

Section 2. The Transylvania County Multi-Jurisdictional Hazard Mitigation Plan is available for review in the office of the Town Clerk.

Section 3. This Resolution shall become effective upon its adoption and approval.

Adopted and Approved this the 11th day of July, 2005.

Johnny H. Rogers
Mayor

Angela Woodson
Town Clerk

RESOLUTION NO. 37-05

A RESOLUTION ADOPTING THE TRANSYLVANIA COUNTY MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN

WHEREAS, on June 15, 2002, Transylvania County received a grant ($20,000) from the N.C. Division of Emergency Management for the development of a Multi-Jurisdictional Hazard Mitigation Plan; and

WHEREAS, as a result of collaborative efforts of Transylvania County, the Town of Rosman, the City of Brevard and other outside agencies, the Transylvania County Multi-Jurisdictional Hazard Mitigation Plan has been developed; and

WHEREAS, the mission of the Transylvania County Multi-Jurisdictional Hazard Mitigation Plan is to substantially and permanently reduce the planning area's vulnerability to natural hazards. The plan is intended to promote sound public policy designed to protect citizens, critical facilities, infrastructure, private property, and the natural environment. This can be achieved by increasing public awareness, documenting resources for risk reduction and loss-prevention, and identifying activities to guide the planning area towards the development of a safer, more sustainable community, and.

WHEREAS, after a public hearing on June 20, 2005, it is the desire of City Council to adopt the Transylvania County Multi-Jurisdictional Hazard Mitigation Plan.

NOW, THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF BREVARD, NORTH CARLINA THAT:

Section 1. The Transylvania County Multi-Jurisdictional Hazard Mitigation Plan is hereby adopted and approved.

Section 2. The Transylvania County Multi-Jurisdictional Hazard Mitigation Plan is available for review in the office of the City Clerk and City Planning Director and the City's website at http://www.cityofbrevard.com/.

Section 3. This Resolution shall become effective upon its adoption and approval.

Adopted and Approved this the 20th day of June, 2005.

Jimmy Harris
Mayor

ATTEST:

Glenda W. Sansosti, MMC
City Clerk

APPENDIX C

GIS Products