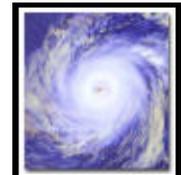


City of Attleboro
NATURAL HAZARDS DISASTER MITIGATION PLAN

November 2004



Chapter One: Introduction

Introduction and Purpose of the Plan

The evolution of the City of Attleboro can be traced from an agricultural village to a mill town to a bustling industrial center to today's regional urban center. The City developed around the Ten Mile, with the more densely developed areas being at prime locations where water could be harnessed for power and cooling. In the late twentieth century, Attleboro was known as a center for jewelry manufacturing. In the past fifty years, manufacturing has declined but the City remains a vital economic and regional job center. This urbanized area is subject to typical New England weather. Each season presents its own challenges and extremes—heavy spring rains, summer droughts, early fall hurricanes, and winter snowstorms. The intersection of these natural hazards with a man-made environment that centers on water, can transform these routine events into natural disasters.

This Plan examines the natural hazards facing the City of Attleboro, assesses the vulnerability of the area's residents, property and businesses, and makes recommendations on ways to mitigate the negative effects of typical natural hazards. The effort has drawn from the local knowledge of a group of officials and residents, and the recommendations presented are meant to be realistic and effective steps for mitigating natural hazards. Ultimately it is hoped that these actions will translate into savings – fewer lives lost, less property destroyed, and minimal disruption to essential services.

Development of the Plan

In September of 2004, Mayor Dumas appointed a local Pre-Disaster Mitigation Planning Committee and charged it with the development of this Plan. A list of the Committee members is attached. The group was diverse covering a wide range of disciplines and areas including: Parks and Forestry, Council on Aging, Health, Building Inspection, Conservation Commission, Planning and Development, Police, Fire, Sewer, and Water. The group held four (4) public meetings to discuss and develop the plan. The Southeastern Regional Planning and Economic Development District (SRPEDD) provided mapping and technical assistance and the SRPEDD Region Pre-Disaster Natural Hazard Mitigation Plan was used as a reference. The Municipal Council adopted the plan, after public input, at their meeting of _____ (see Resolution in Appendix).

Committee Membership

Scott McPartlin, Senior Land Use Planner, Committee Chair

Aurelio Almeida, Superintendent of Parks and Forestry

DeAnne Auclair, Executive Secretary to the Mayor

Steve Brasier, Watershed Tender, Water Division

Michael Burgess, Acting Assistant Water Superintendent

George Bussiere, Police Captain, Police Department

John Clover, Acting DPW Superintendent

Mark Cuddy, Richardson & Cuddy Insurance Agency

Norman Daniels, Wastewater Division Maintenance Foreman

Bruce Hagerman, Conservation Commission

Glenn Livesey, Deputy Fire Chief, Fire Department

Madeline McNeilly, Council on Aging Director

Ronald Merigold, Conservation Commission Chairman

James Mooney, Health Agent

Alan Murrant, Fire Captain, Fire Department

Gregory O'Brien, Water Division Senior Head Operator

Richard Pierce, Police Chief

Douglas Semple, Building Inspector

Edward Tanner, Environmental Planner/Conservation Agent

Facilitated By:

Department of Planning and Development

Gary G. Aryssian, Director

Southeastern Regional Planning and Economic Development District (SRPEDD)

Marijoan Bull, AICP Principal Planner

Attleboro City Hall 77 Park Street Attleboro, MA 02703 (508) 223 -2222

Chapter Two: Profile of the Community

Geography, Geology, Topography, and Climate

- The City of Attleboro is an urban community located in southeastern Massachusetts and is bordered by North Attleborough and Mansfield to the north; Norton, Rehoboth and Seekonk to the east and south; and Cumberland and Pawtucket Rhode Island to the west and south. Attleboro is 32 miles southwest of Boston and 12 miles north of Providence, Rhode Island. It has a total land area of 27.5 square miles.
- Geologists classify the southeastern Massachusetts area as part of the Northeast Coastal Lowlands/Coastal Plain region. The area is characterized by the conditions created over 12,000 years ago when massive glaciers receded. These characteristics include: low hills; highly porous soils; deposits of sand and gravel; multiple swamps, lakes, rivers and ponds; and a high water table. The glaciers left behind glacial till that contains thick deposits of both sand and gravel, lying over bedrock. There are occasionally boulders, known as glacial erratics, of different rock types that were carried from northern regions and left behind as the glaciers receded. Attleboro has a relatively level terrain with gently rolling hills, ranging from 100 – 140 feet above sea level. There are three major hills in the city: Oak Hill (266 feet above sea level), Walnut Grove Hill (255 feet above sea level) and Ides Hill (260 feet above sea level).
- The water resources of Attleboro have played a central role in its development. There are eight miles of the Ten Mile River in the City running from the north to the downtown where it converges with the Bungay River, then flows southerly into the Town of Seekonk on its way towards Narragansett Bay. The upstream area of the Ten Mile begins in North Attleborough where it is channelized and impounded at Falls Pond and this is also true in Attleboro’s core area. These are sites where during the heyday of industrialization the river was used to power manufacturing. In addition to these two rivers, portions of the Seven Mile River are also located in Attleboro.
- Surface water accounts for .79 square miles of area, and there are nine (9) ponds in the City: Manchester Pond (253.8 acres), Orrs Pond (59.6 acres), Dodgeville Pond (52.9 acres), Chartley Pond (30.1 acres), Hebronville Pond (24 acres), Mechanic’s Pond (19 acres), Luther Reservoir (16.5 acres), Cooper’s Pond (13.2 acres), and Cranberry Pond (12.4 acres).¹
- The Massachusetts Bureau of Dam Safety (BDS), a division of DCR, reports that Attleboro has 16 dams, of which the City owns eleven. Four of these dams are classified as high risk – an indication that failure of these dams could do considerable

▪ ¹ Comprehensive Plan Attleboro, 1990, p.18.

damage to persons and/or property: Manchester Pond Dam; Hebronville Pond Dam, Manchester Reservoir South Dike, and Manchester Reservoir East Dike.

City/Town	Dam Name	Owner	Caretaker	Hazard Code*
Attleboro	Sutton Falls Dam	William H. Weber	William H. Weber	L
Attleboro	Luther Reservoir Dam	City Of Attleboro	Dept of Water & Wastewater	L
Attleboro	Manchester Pond Reservoir Dam	City Of Attleboro	Dept of Water & Wastewater	H
Attleboro	Dodgeville Pond Dam	Mossberg Realty Corp.	Demers Trucking	S
Attleboro	Mechanics Pond Dam*	City Of Attleboro	Dept of Water & Wastewater & Conservation Department	S
Attleboro	Hebronville Pond Dam	Hebronville Pond Dam	A M C / Federal Management	H
Attleboro	Orrs Pond Dam	City Of Attleboro	Dept of Water & Wastewater	L
Attleboro	Manchester Pond South Dike	City Of Attleboro	Dept of Water & Wastewater	H
Attleboro	Manchester Reservoir East Dike	City Of Attleboro	Dept of Water & Wastewater	H
Attleboro	Orrs Pond #1 Dam	City Of Attleboro	Dept of Water & Wastewater	L
Attleboro	Attleboro #2 Dam	City Of Attleboro	Dept of Water & Wastewater	L
Attleboro	Orrs Pond #2 Dam	City Of Attleboro	Dept of Water & Wastewater	L
Attleboro	Simmons Pond Dam (AKA Blackinton Pond Dam)	City Of Attleboro	Dept of Public Works	
Attleboro	Attleboro #1 Dam	City Of Attleboro	Dept of Water & Wastewater	S
Attleboro	Farmers Pond Dam	Mass Electric Co.	Mass Electric Co.	S
Attleboro	Lake Como Dam	Seventh - Day Adventist	Seventh-Day Adventist	

Source: Massachusetts Bureau of Dam Safety. * H=High; S=Significant; L=Low.
 * The city owns the spillway, but the rest of the structure is privately owned.

- The Bureau of Dam Safety has jurisdictional authority over dams that meet the following criteria: dam structure six feet or higher, or impoundment of 15 acre feet or more², or a significant downstream hazard as determined by staff review (e.g. campground, densely developed area, major thoroughfare, etc.). This includes government and privately owned dams. Regulations that went into effect at the end of 2003 require owners to register the dams and have them professionally inspected at the owner's expenses every two years. While the monitoring of dam condition falls to the owner, be it a private or public entity, damage from dam failure may include multiple owners and even property across town boundaries.

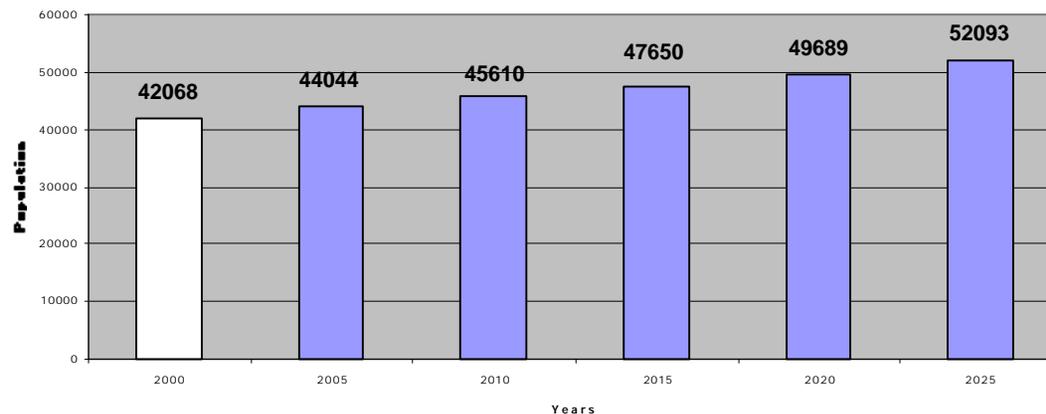
² Acre foot = Amount of water that fills one acre of land to a depth of one foot, approx. 300,000 gallons of water.

- Massachusetts in general has a humid climate with temperatures that average 68 to 72 degrees in the summer and about 28 to 32 degrees in the winter. The National Climatic Data Center reports the following normal temperatures by season in Attleboro: January- 25.9 Degrees F and July 71.2 Degrees F.
- The normal annual precipitation is 46.7 inches. The growing season, from the last killing frost in the spring to the first killing frost in the fall, runs between 180 – 200 days. The area is subject to a variety of severe weather events: hurricanes, Northeasters, thunderstorms, blizzards, tornadoes, and drought. All of these are discussed more fully in the next chapter.

Population Characteristics and Political Structure

- The 2000 US Census indicates that Attleboro has a total population of 42,068. With a land area of 27.5 square miles, the average population density is 1,530 persons per square mile. The population can be broken down by ages in the following manner: 2,942 (7%) under 5 years; 8,622 (20.1%) between 5 and 19 years old; 25,082 (60.0%) between 20 and 64 years old; and 5,422 (12.9%) 65 years or older. With a total of 16,019 households, the average household size is 2.63 persons.
- Attleboro has experienced steady population increases over the past thirty years, and is expected to continue this growth. The figure below indicates census population figures and growth projections prepared by SRPEDD & MassHighway.

City of Attleboro Population Projections



(Source: SRPEDD 2003 Transportation Plan)

- Consistent with national trends, Attleboro has seen a steady increase in the number of residents whom are over 65 years of age. This is a trend that is expected to continue as the “baby-boomer” generation ages. The number of residents over the age of 65 has increased from 3,838 (11.2%) in 1980 to 4,629 (12.1%) in 1990 to 5,422 (12.9%) in 2000. This population generally has a higher incidence of special needs for emergency response-- due to health afflictions and mobility restrictions—although overall this population is a healthier and more active group than they were thirty years ago. The Federal Administration on Aging notes the following as reasons the elderly are more vulnerable to disasters:
 - ✓ They have difficulty getting assistance due to progressive physical and mental impairments and other frailties that accompany aging;
 - ✓ They are slower to fill out forms for disaster notification and/or disaster relief assistance;
 - ✓ They are often at higher post-disaster nutritional risk and medication risk;
 - ✓ They are often targeted by fraudulent contractors; and
 - ✓ They may be susceptible to abuse as overall family stress levels increase in the later stages of a disaster.³

- Other vulnerable populations are youth and the disabled. Youth are vulnerable due to their need for supervision and guidance in times of emergency—especially groups of children under the care of a limited amount of adults. This is best assessed at the local level through critical facilities identification of childcare centers and schools. These facilities are indicated on Attleboro’s map of critical facilities and include seventeen (17) daycare centers and sixteen (16) schools. (See List at end of this Chapter.)

- The 2000 Census represents the first time that data on the disabled was collected. The Census long form allowed self-reporting by the respondent on questions that would indicate disabilities of various types:

-sensory disability,	-physical disability,
-mental disability,	-self-care disability,
-going outside the home disability	-employment disability.

The Census reports that Attleboro had a total of 7,130 respondents to these categories. Due to the ability to select more than one category, this translates into a smaller number of residents. The special circumstances of the disabled population that may affect disaster response include:

- ✓ the visually-impaired are reluctant to leave familiar surroundings;
- ✓ those with mental retardation or cognitive impairment may not understand or may become confused;

³ “Disaster Preparedness for Older Americans”, 2002. Business Publishers, Inc.: Silver Spring, MD, p.1.

- ✓ guide dogs and other assistance animals may become disoriented in a disaster;
- ✓ proper transport techniques are required to reassure anyone being carried that they will not be dropped;
- ✓ many respiratory illnesses are aggravated by stress;
- ✓ medically-dependent individuals may not be able to communicate their needs; and
- ✓ all temporary shelters must meet accessibility standards.⁴

Transportation Network

- Attleboro has an estimated total of 181 miles of roadway. Route 152/Main Street acts as the major north/south route and Route 123 serves as the major east/west route. Nearly 8 miles (7.7) of Interstate 95 runs through the western side of the City. According to the 2003 Regional transportation Plan, four bridges in Attleboro are classified as structurally deficient and 12 bridges are classified as functionally obsolete.

<i>Attleboro</i>					
Miles of Roadway	Interstate	Arterials	Collectors	Local	Total
Structural Deficient Bridges	7.72	33.94	8.05	131.36	181.07
	Over				
County Street Bridges	Amtrak and Seven Mile River				
Thatcher St (Closed until 2006)	RR Amtrak/MBTA				
Olive St	RR Amtrak/MBTA				
Rt 1A/Newport Ave	RR Amtrak/MBTA				
Functionally Obsolete Bridges	Over		Yr Built	Owner	
I-95 SB	Route 1 Washington St		1959	State Highway	
I-95 NB	Route 1A Newport Ave		1959	State Highway	
I-95 SB	Route 1A Newport Ave		1961	State Highway	
County Street	RR Amtrak/MBTA		1907	State Highway	
I-95 SB	Rt 123 South Avenue		1959	State Highway	
Thurber Ave	RR Amtrak/MBTA		1990	State Highway	
I-95 NB	Rt 123 South Ave		1959	State Highway	
Rt 152 Main Street	RR Amtrak/MBTA		1949	State Highway	
Olive Street	Ten Mile River		1920	City Highway	
Wall Street	Ten Mile River		1976	City Highway	
I-295 SB	Clifton Street		1967	State Highway	
Water Street	Ten Mile River		1922/2004	City Highway	

Source: SRPEDD and MassHighwa.y

⁴ Ibid, p.20.

Land Use: Housing, Commerce, Industry and Agriculture.

- Statistics compiled by the Attleboro Assessor’s Office in 2000 indicate the following breakdown of land uses for the total acres of Attleboro:

<u>LAND USE</u>	<u>% OF ASSESSED TOTAL</u>
6,296.93 acres Residential	Developed (40.4 %)
3,359.66 acres Residential	Vacant (21.6 %)
595.49 acres Chapters 61, 61A, 61B	(3.8 %)
681.95 acres Commercial	Developed (4.4 %)
121.37 acres Commercial	Vacant (0.8 %)
1,158.80 acres Industrial	Developed (7.4 %)
64.47 acres Industrial	Vacant (0.4 %)
3,303.71 acres non taxable (public/non-profit)	(21.2 %)

(Source: City of Attleboro Land Use Growth Management Study from Attleboro’s Assessor’s Office April 2000.)

The remaining area consists of highways, rivers and surface waters and is not included in the assessor’s property records.

- Using MassGIS data layers, SRPEDD has estimated that there is 1,759.489 acres of Attleboro land in the 100 year flood plain that is neither permanently protected nor under the River’s Protection Act. (Some of this land may be wetlands or portions of developed lots.) SRPEDD took the 100-year floodplain layer, subtracted the River’s Protection Act 25 foot area, and subtracted the layer of permanently protected land to arrive at these figures. This figure should be considered a gross estimate as the protected layer may not be current and when wetlands and parcel divisions are included, the actual amount at risk for development may be lower.
- Residential growth has been steady. Between 1993 and 2003 inclusive, 1,808 residential building permits were issued, an average of 164 per year.
- The housing stock in Attleboro is mixed. According to the 2000 Census 51.7% of the units (8,556) are single-family detached units with the other units in multi-family structures. Of the city-wide total of 16,554 housing units, 58% (9,659) were constructed prior to 1969. The Attleboro Health Department reports that as of September, 827 mobile homes licenses were issued in the City for 2004. These units are generally located in one of the eight mobile home parks in the City, of which 6 are for residents over 55 and the Council on Aging reports that over 580 residents of these parks are over 60 years. These include:

<u>Park</u>	<u>Address</u>	<u>Type of Park</u>
Birchwood	1340 County	Family
Oak Hill Ave	1003 Oak Hill	Family
Libert Estates	County Street	Over 55
Eastlande	1346 Newport Ave	Over 55
Tripp	Colvin Street	Over 55
Case Mobile Home	Colvin Street	Over 55
Red Oak	Collin Street	Over 55
Sandcastle	500 Mendon Road	Over 55

- The table below indicates that while there are many properties in Attleboro covered through the National Flood Insurance Program (NFIP), there have been few repetitive loss properties.

<i>Attleboro and the National Flood Insurance Program (NFIP)</i>					
Policies in Force (#)	Property Value Insured (\$)	Total # Losses Paid Out	Total Losses (\$)	Total Repetitive Loss Structures (Two or more Claims)	Total Repetitive Loss Claims Paid (\$)
102	12,918,100	23	419,968.30	2	3,362
<i>Source: NFIP data obtained from DCR's Flood Hazard Management Dept.</i>					

- Attleboro has retained some of its industrial and jewelry manufacturing uses. Many of these uses are registered as users of hazardous materials. MassGIS indicates that Attleboro has 31 points registered as Large Quantity Generators of Hazardous Waste (LQG), Large Quantity Toxic Users (LQTU), Hazardous Waste Treatment, Storage and/or Disposal Facilities (TSDF) and other related facilities. Of these 15 are in the dense, riverfront downtown area. In addition, MassGIS indicates that Attleboro has 25 sites that are known hazardous waste spill sites, and 25 sites with underground storage tanks. A natural disaster that causes a spill or movement of any of these hazardous materials could be very dangerous. Correct storage, monitoring, and disposal of these materials are critical to protecting residents and the environment.

Cultural and Historical Sites (on Critical Facilities Map)

- Attleboro has nine (9) individual historic properties and two (2) historic districts on the National Register of Historic Places. The districts are the Blackinton Houses and Park on North Main Street, and the Hebronville Mill Historic District. Together these districts include 45 structures. In addition, cemeteries, stonewalls, and known and unknown archeological sites are also significant cultural and historical resources of the City.
- Capron Park is a 40-acre facility located in the central part of the City. The park includes the six-acre Capron Park Zoo, home to approximately 110 animals (including sloths, snow leopards, llamas and kangaroos), Sweet Memorial Forest, a tot-lot, softball fields and open recreation areas.

Utilities/Special Facilities

- Attleboro has a municipal water and sewer system. Municipal water comes from the upper reaches of the Seven Mile River including impounded reservoirs at Luther Reservoir, Manchester Reservoir and Orrs Pond and is then treated at the Russell F. Tennant Water Treatment Plant. Approximately 2/3 of the City is served by the sewer system. Attleboro is working on regulations for compliance with the EPA Phase II stormwater management regulations.
- The railroad tracks in Attleboro host Amtrak and the MBTA. According to a survey by SRPEDD in 2000, approximately 1,200 inbound commuters board at Attleboro each weekday. A parking area for 780 cars is associated with the station. Comparable figures for the station located in South Attleboro are 1,771 inbound commuters per weekday and 762 parking spaces. The Attleboro line has the greatest ridership of all the MBTA commuter lines with 15 inbound trains per weekday from South Attleboro and 16 inbound trains per weekday from Attleboro. In addition CSX operates freight lines within the City which may include tankers with hazardous materials.

Community	Electric Provider	Gas Provider	Water Source	Wastewater	Hospitals
Attleboro	Massachusetts Electric	Bay State Gas	Municipal system	Sewer	Sturdy

Conclusions

The following general characteristics, drawn from this profile, are relevant to the design of a disaster mitigation strategy:

- The historical development pattern has concentrated development along the waterways. The core downtown area includes many buildings at the river’s edge, and buildings in close proximity to a channelized and dammed river. There are many properties in flood zones (102 participate in NFIP) but only two with repetitive losses.
- Attleboro is a growing community with a dense downtown area and varying degrees of densely developed outlying areas. Development will take the form of re-development and infill in the downtown, and new development in the outskirts.
- Mobile homes are particularly vulnerable to natural hazards and according to the Attleboro Health Department over 827 mobile homes were licensed in the city, and the Council on Aging reports that many of the residents of these mobile homes are elderly.
- The Capron Park and Zoo represents a unique resource that needs its own natural disaster plan to protect the animals and the public.
- The aging housing stock means many of the buildings pre-date current building codes, and the infrastructure in general (bridges, roadways, and dams) is aging.
- Privately owned dams present a particular problem as the City has little control over the condition of these facilities, but they could pose a risk to property. In particular the Dodgeville, Mechanics Pond, and North Attleborough controlled Falls Pond dam, are all concerns for Attleboro.
- The frequent commuter and Amtrak runs in the community should be considered when planning for natural disasters.
- Attleboro has a high concentration of users of hazardous materials. Enforcement of regulations on storage and monitoring are important to prevent a natural disaster from causing a greater danger due to a hazardous materials release.

Attleboro Critical Facilities			
FACILITY NAME	FACILITY ADDRESS	FACILITY TYPE	MAP ID
Happy Days Child Care Center	26 Colts Way	Day Care	4
Little Folks School	121 North Main Street	Day Care	6
Markman Children's Programs, Inc.	95 Pine Street	Day Care	9
ABC Learning	1382 County Street	Day Care	10
Little Blessings Preschool	841 North Main Street	Day Care	13
Busy Bees Learning Center, Inc	209 South Main Street	Day Care	16
For Pete's Sake Preschool, Inc	18 Baltic Street	Day Care	2
Early Childhood Center	7 James St.	Day Care	15
Step Forward/Markman	118 South Main Street	Day Care	14
Markman School Age Enrichment Program	505 North Main Street	Day Care	8
Jack and Jill Nursery School	50 Park Street	Day Care	5
Maple Street Learn & Play Daycare, Inc	107 Maple Street	Day Care	1
Good Shepherd Child Care Center	60 May Street	Day Care	7
Sneakers Preschool at Attleboro Y/Site 1)	39 North Main Street	Day Care	12
Sneakers Preschool at Attleboro Y/Site 2)	63 North Main Street	Day Care	3
Self Help, Inc Head Start-Attleboro	95 Pine Street	Day Care	17
Community Care Services Total Achievement	50 Walton Street	Day Care	11
Council on Aging Larson Senior Center	25 S.Main St.	Elderly	22
Hebron Mill Elderly Apts	169 Knight Ave.	Elderly	23
River Court Senior Housing	4 Hodges St.	Elderly	21
Hillside Adult Day Health	50 Walton St.	Elderly Day Care	24
Attleboro Emergency Mgt/Fire HQ	100 Union St	Emergency Facili	64
So Attleboro Fire Station	1476 West St (Rt 123)	Emergency Facili	63
Twin Village Fire Station	796 So Main St (Rt 152)	Emergency Facili	62
AEMA /EOC	75 Park St (Basmt Old Post Office)	Emergency Facili	65
City Hall Annex - Basement (Old Post Off	77 Park St.	EOC	19
Attleboro Fire Department	100 Union St.	EOC	18
Briggs Corner Fire Station	1276 Park St	EOC	20
Dam E	Manchester Reservoir/East Dike	Hazard Level H	71
Dam D	Manchester Pond/So Dike	Hazard Level H	70
Dam A	Hebronville Pond	Hazard Level H	67

FACILITY NAME	FACILITY ADDRESS	FACILITY TYPE	MAP ID
Dam F	Mechanic Pond	Hazard Level S	72
Dam C	Dodgeville Pond	Hazard Level S	69
Dam B	Farmers Pond	Hazard Level S	68
Attleboro City Hall	77 Park Street	Infrastructure	66
STURDY MEMORIAL HOSPITAL	211 PARK STREET	Medical Facilities	31
Police Station	12 Union St.	EOC	33
Attleboro Health Center	County St.	Medical Facilities	34
Victorian Mansion	574 Newport Ave.	Elderly	30
Pleasant Street Rest Home	144 Pleasant St.	Medical Facilities	27
Pleasant Manor Nursing Home	195 Pleasant St.	Elderly	35
General Health Care	168 N. Main St.	Medical Facilities	32
Life Care Center Of Attleboro	969 Park St.	Medical Facilities	29
Arbour-Fuller Hospital	200 May St.	Medical Facility	36
Hebron Mill Apts	999 Read St.	Misc/Spec Needs	39
Project Connect	908 Oak Hill Ave.	Misc/Spec Needs	42
Gardner Terrace Apts	46 Pine Street	Elderly	44
Hope Gardens	847 Park St.	Elderly	43
Attleboro Housing Authority	37 Carlon St.	Elderly	37
Oak Hurst Apts.	1 South Ave.	Elderly	41
Nickerson Courts Apts.	100 South Ave	Elderly	45
Christopher Heights	45 South Main Street	Elderly	40
Maple Terrace	200 South Ave.	Elderly	38
Thomas E. Willett Elementary School	32 Watson Ave.	School	52
Wamsutta Middle School	300 Locust Street	School	56
DAYSRING CHRISTIAN	1052 NEWPORT AVE	School	54
Studley Elementary School	299 Rathbun Willard Dr.	School	59
Coelho Middle School	91 Brown St.	School	51
St. Johns School	13 Hodges St.	School	50
Bishop Feehan High School	70 Holcott Dr.	School	49
Cyril K. Brennan Middle School	320 Rathbun Willard Drive	School	46
Finberg School	1125 S.Main St	School	53
Thacher Elementary School	30 James Street	School	58
Baptist School	1000 Oakhill Avenue	School	----
Hill Roberts School	80 Roy St.	School/ Shelters	61

FACILITY NAME	FACILITY ADDRESS	FACILITY TYPE	MAP ID
Attleboro High School/Vocational Technical School	100 Rathbun Willard Dr.	School/MassCare Shelt	60
Hyman Fine Elementary School	790 Oak Hill Ave	School/MassCare Shelt	48
Attleboro WPCF	77 Park St.	Waste Water Treatment	26
Route 95 Evacuation Route	So Attleboro and Attleboro		74
Route 152 Evacuation Route	Attleboro		77
Route 123 Evacuation Route	So Attleboro and Attleboro		76
Route 118 Evacuation Route	Attleboro		75
Route 1 Evacuation Route	So Attleboro		73
Canterbury Woods	100 Garfield Avenue	Assisted Living	To be added
Ridgewood Court Nursing Home	27 George Street	Nursing Home	To be added
<i>Source: Attleboro Comprehensive Emergency Management Plan.</i>			

Chapter Three: Hazard Identification and Risk Assessment

This chapter will discuss the natural hazards and evaluate the risk they pose residents, homes and businesses. Each natural hazard is identified and profiled with information on the hazard's dimensions, history, and risk factors. Risk will be examined in terms of the likelihood of the natural hazard occurring; the geographic area that the natural hazard could affect; and the impacts that could be expected. The "likelihood" or probability of an event occurring is determined by reviewing historical events and consulting expert opinion, while GIS mapping is used to evaluate the area that could be affected. Information on the development characteristics of Attleboro from the profile chapter is used to estimate the impacts of natural hazards on critical facilities, vulnerable populations, and infrastructure.

Attleboro uses the same Hazard Index (see Table 3-1) used by the Regional Community Planning Team, to rate the categories of natural hazards in terms of likelihood, location, and magnitude of impacts. Each of these criteria was rated with a point value along a scale as indicated in Table 3-2. The Hazard Index in Table 3-1 is a gross assessment that was used to shape the focus areas of Attleboro's Mitigation Plan.

The discussion here on risk assessment draws heavily from the discussion in the Regional Plan. Maps for this section are provided at the end of the chapter.

- A. Flood Related Hazards: Regional Maps Hurricane Data: Wind and Flood Related Hazards; Flood Data: Flood Related Hazards; Nor'Easters/ Blizzards: Flood and Wind Related Hazards

The state Hazard Mitigation Plan of 1999, records flooding as the number one hazard faced within the state.⁵ This is not surprising given that a number of natural hazards can cause flooding including: hurricanes, Nor'easters, thunderstorms, and winter storms. Attleboro has a few areas, streets and neighborhoods, where repetitive flooding occurs and flooding after a hurricane may be more severe, and flooding associated with upstream dam releases has been an issue. The growth of Attleboro has meant that pervious land has become impervious, increasing the amount of runoff from normal precipitation. According to MassGIS the total area developed during 1971 - 1999 was 1,916 acres or an additional 10.8% of the City's land area.

⁵ Massachusetts Hazard Mitigation Plan, 1999 Update, p.10.

Table 3-1

Natural Hazard	Likelihood/ Frequency	Impact Area Assessment	Severity/ Magnitude	Hazard Index
FLOOD RELATED HAZARDS <ul style="list-style-type: none"> ➤ Riverine/Coastal Erosion/Dam Failures ➤ Thunderstorms/Winter Storms ➤ Coastal Storms/ Nor'easters ➤ Hurricanes 	3	2	1	6
WIND RELATED HAZARDS <ul style="list-style-type: none"> ➤ Hurricanes ➤ Coastal Storms/ Nor'easters ➤ Winter Storms ➤ Downspouts/Tornadoes 	3	1	1	5
FIRE-RELATED HAZARDS <ul style="list-style-type: none"> ➤ Drought ➤ Wildfires/Urban Fires ➤ Flooding 	2	1	1	4
GEOLOGIC HAZARDS <ul style="list-style-type: none"> ➤ Earthquakes/Landslides ➤ Sink Holes/Subsidence 	1	1	1	3

Table 3-2

FREQUENCY/ LIKELIHOOD		
POINT VALUE	CATEGORY	CHARACTERISTICS
3	Highly Likely	Near 100% Probability in the next year
2	Likely	Between 10 – 100% probability in the next year; or at least one chance in 10 years
1	Possible	Between 1- 10% probability in the next year; or at least one chance in the next 100 years
0	Unlikely	Less than 1% probability in the next 100 years

IMPACT ASSESSMENT		
POINT VALUE	CATEGORY	CHARACTERISTICS
3	Large	Relative to total land area and concentrations of population/structures and critical facilities
2	Medium	Relative to total land area and concentrations of population/structures and critical facilities
1	Small	Relative to total land area and concentrations of population/structures and critical facilities

MAGNITUDE/SEVERITY		
POINT VALUE	CATEGORY	CHARACTERISTICS
3	Catastrophic	Multiple Deaths. Complete shutdown of facilities for 30 days or more. Property severely damaged >50%.
2	Critical	Injuries and/or illness result in permanent disability. Complete shutdown of critical facilities for at least two weeks. Property severely damaged <50%, >25%.
1	Limited	Injuries and/or illness do not result in permanent disability. Complete shutdown of critical facilities for more than one week. Property severely damaged <25%, >10%.
0	Negligible	Injuries and/or illnesses are treatable with first aid Minor quality of life loss. Shutdown of critical facilities and services for 24 hours or less. Property severely damaged <10%.

(Source: State of North Carolina Emergency Management Agency)

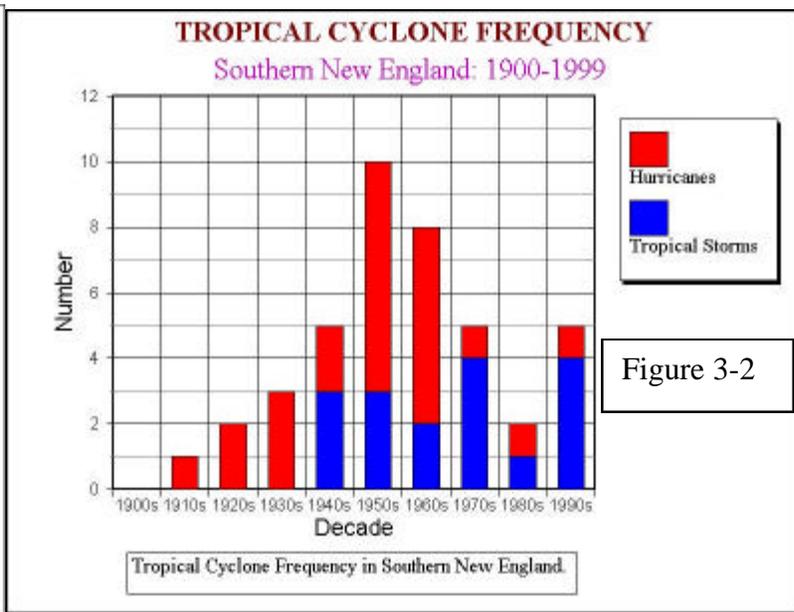
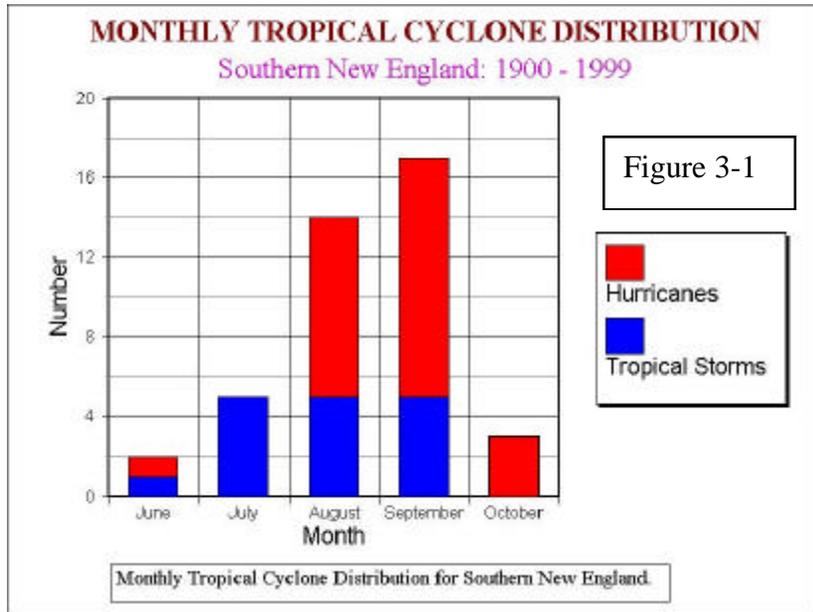
Hurricanes

While New England is not the area of the United States most burdened by hurricanes, the Atlantic coast of the United States can expect to see an average of 2 major hurricanes every 3 years⁶ and New England can expect one major landfall in each decade.⁷ This is in part due to the geography of Massachusetts—its projection easterly into the Atlantic places it in the typical path of storms that originate in Cape Verde or the Bahamas. Hurricanes are tropical storms that obtain wind speeds of 74 miles per hour or greater and are accompanied by heavy rainfall. Since hurricanes are formed at sea, storm surge is a concern when hurricanes make landfall. The National Weather Service reports, “southern New England has been affected by forty-one such storms since 1900, 12 of which made landfall with significant impact.”⁸ Table 3-3 reflects the history of these events. The tracks of storms that made landfall within the region are reflected on the map, *Hurricane Data: Wind and Flood Related Hazards*. It should be noted, however, that these paths are neither indicators of future behavior nor the full representation of hurricane impacts in the region. The heaviest areas of hurricane damage are on the eastern side of landfall, as the storm moves in a large counter-clockwise spinning spiral. **The most damaging storms have made landfall and tracked to the west of this region-** including the major 1938 unnamed hurricane that made landfall in Milford Connecticut and the 1954 Hurricane Carol that made landfall in Old Saybrook, Connecticut. Mapping the paths of hurricanes that made landfall in the region since 1860 shows that eight hurricanes, of varying intensity, crossed the region. The inset tells a more complete story about hurricane damage, by indicating those hurricanes that made landfall as far west of the region as the Rhode Island border with Connecticut. Figures 3-1 and 3-2 indicate the frequency of hurricane events in southern New England during the past hundred years. As it looks highly likely that southeastern Massachusetts will experience a hurricane on a semi-annual basis, flooding in Attleboro from the hurricane is also likely given that there are known areas of flooding.

⁶ Jarrel et al, 4.

⁷ Vallee, D. “A Centennial Review of Major Land Falling Tropical Cyclones in Southern New England. [Available at: www.erh.noaa.gov/er/box/tropical_cyclones.htm], p.2.

⁸ Vallee “A Centennial Review”,p 1.



Vallee, D. "A Centennial Review of Major Land Falling Tropical Cyclones in Southern New England. [Available at: www.erh.noaa.gov/er/box/tropical_cyclones.htm] 1, p.2.

TABLE 3-3 History of Southern New England Hurricanes			
	NAME	DATE	INTENSITY
<p><i>Twelve significant tropical cyclones impacted southern New England, 1900-1999. Storm intensity at landfall is given by the Saffir/Simpson scale or TS for tropical storm.</i></p>	Unnamed	7/21/1916	CAT 1
	Unnamed	9/21/1938	CAT 3
	Unnamed	9/14-15/1944	CAT 3
	Carol	8/31/1954	CAT 3
	Edna	9/11/1954	CAT 3
	Diane	8/18-20/1955	TS
	Donna	9/12/1960	CAT 2
	Belle	8/9-10/1976	CAT 1
	Gloria	9/27/1985	CAT 2
	Bob	8/19/1991	CAT 2
	Bertha	7/12-13/1996	TS
	Floyd	9/18/1999	TS

Source: Vallee, D. "A Centennial Review of Major Land Falling Tropical Cyclones in Southern New England. [Available at: www.erh.noaa.gov/er/box/tropical_cyclones.htm]

Table 3-4 Saffir-Simpson Scale for Hurricane Classification			
Strength	Wind Speed (mph)	Pressure (millibars)	Storm Surge (feet)
Category 1	74-95	>980mb	4-5 ft.
Category 2	96-110	965-979mb	6-8 ft.
Category 3	96-113	945-964	9-12 ft.
Category 4	131-155	920-944	13-18 ft.
Category 5	>135	919	18 ft.
Tropical Cyclone Classification			
Tropical Depression		20-34 kt or 23-39 mph	
Tropical Storm		35-64 kt or 40-73 mph	
Hurricane		65+ kt or 74+ mph	

In assessing the magnitude or severity of damage from a hurricane in southeastern Massachusetts, consideration must be given to the timing of the event. Hurricanes that make landfall during high tide will have much greater storm surge and thus flood larger areas. In addition, hurricane season runs from June 1 to November 30, a period that includes the summer population swells experienced by several southeastern Massachusetts communities. The timing of the storm relative to other weather events also has a bearing on the overall impact of the hurricane. If a hurricane follows another hurricane or a major rain event, the effects can be magnified as flooding is greater, and weakened or loosened trees are more susceptible to toppling.

The severity of an event considers the potential for loss of life, property damage, and critical facility or business interruption. **Most experts anticipate that the next major New England hurricane will have severe impacts because present residents are unaware of the serious danger and major property investment has increased the value of structures in the region.** Given that the last major storm event was over thirteen years ago, there is concern that those who have re-located to the area during this period or come of age during this period, are unaware of the real danger posed by a powerful hurricane. NOAA (National Oceanic and Atmospheric Administration) estimates that 80-90% of the population now living in United States coastal areas has never experienced a major hurricane.⁹ This lack of firsthand knowledge can cause lax response to warnings and poor or little preparedness.¹⁰ When residents are slow to respond to warnings the severity of impacts can be expected to be greater.

⁹ “Hurricanes: Unleashing Nature’s Fury”, August, 2001, ARC 5030, NOAA/PA 94050, p.8.

¹⁰ Jarrell, J. “The Deadliest, Costliest, and Most Intense United States Hurricanes from 1900 – 2000. NOAA Technical Memorandum NWS TPC-1, [Available at www.aoml.noaa.gov/hrd/Landsea/deadly/index.html], p. 8.

The new population has come with increased residential construction. As described in the Profile section, Attleboro has had over 4,000 new housing units constructed to accommodate the population growth during the years 1980 - 2000. Given the rating categories within severity of impacts (see Table 3-2), “**limited**” described, as “complete shutdown of critical facilities for more than one week, up to 25% property damage, and injuries but no permanent disabilities” appears to fit the severity of damages Attleboro could expect. Of course, a powerful storm on a particular tract could inflict much greater damage.

Nor’easters, Winter Storms, and Thunderstorms

The Massachusetts Hazard Mitigation Plan reports that while hurricanes strike the area with much more force than Nor’easters, the state suffers more damage in total from Nor’easters because they are a more frequent occurrence.¹¹

Nor’easters are a common winter event in New England (1-2 each year¹²) and they bring high winds and sustained rains or sleet, snow and freezing rain. They are more problematic in part because they have a longer duration – 12 hours to 3 days, versus 6 to 12 hours for hurricanes. Many southeastern Massachusetts communities will have flooding associated with the heavy precipitation of Nor’easter storms. Problems can be exacerbated when rains fall and the melting of snow and ice is added to the flow. The large chunks of ice that are freed can clog drainage passages and increase localized flooding. This flooding can affect private residences, businesses, and public infrastructure such as roadways and storm drains. The hazard map for Attleboro, *Nor’Easters & Blizzards* indicates the snowfall pattern. Attleboro falls within a band of average annual snowfall of 36 to 48 inches per year. According to NOAA, the greater Providence area (where Attleboro is located) has a 20% chance each year of having at least 1 snowfall amounting to 12 inches or more, and is likely to experience 9.88 snowstorms each year. While melting snow adds to flooding, snowfall also presents a non-flooding hazard as access to critical facilities may be compromised by large amounts of snowfall. Variations on this hazard are a snowstorm in combination with rain that produces a very heavy wet snow or ice storms both of which weigh down trees and power lines.

In February of 2004, the American Meteorological Society initiated a rating scale for winter storms. The Category 1- 5 scale is intended to be used to assess damage rather than predict impacts. Snowstorms are difficult to predict and small temperature fluctuations mean the difference between snow and rain. The scale that includes by increasing intensity- notable, significant, major, crippling and extreme storms- assesses the amount of snow, area affected, and population impacted.¹³

¹¹ Massachusetts Hazard Mitigation Plan, 1999, p.11.

¹² Ibid.

¹³ Allen, Diane. “Snow Watchers now rate the effects from 1-5.” *The Boston Globe*, March 17, 2004, p.B4.

Table 3-5 Northeast Snowfall Impact Scale					
Category	Cat 1 Notable	Cat 2 Significant	Cat 3 Major	Cat 4 Crippling	Cat 5 Extreme
Snow Depth	4-10 inches	10+ inches	10-20 inches	20+ inches	10, 20, or 30 inches
Area	Size of RI	Southern New England	1-3 times NY State	Northeast	Northeast
Population Affected	10 million	10-20 million	20-40 million	50 million	60 million
<i>(Source: American Meteorological Society)</i>					

Riverine Flooding and Dam Failures

As indicated by the Critical Facility and Flood map, the 100-year floodplain areas in Attleboro are located primarily along riverine corridors. A regional map, 100 Year Flood Plain and Land Use (on the associated CD), indicates land area within the 100- year floodplain that, as of 2000, was undeveloped and not preserved in perpetuity. The area within this category in Attleboro is approximately 1,750 acres 10% of the total land area, although this may also include wetlands that are not developable. **In order to decrease future flooding damage and preserve areas to hold floodwaters, Attleboro should consider the mitigation value of conserving these properties when setting priorities for acquisitions and conservation restrictions.** Further evaluation should be undertaken to assess whether this land area is the rear portion of developed lots, wetland areas, or in any other way restricted from development.

Upstream from Attleboro along the Ten Mile River, there are several dams in North Attleborough at Falls Pond and Whiting Pond. North Attleborough tends to release waters in these dams in anticipation of storm events, in order to avoid localized flooding. In the past there were problems due to a lack of communication and coordination with Attleboro. An upstream release will cause flooding problems in Attleboro if the City does not react by correspondingly adjusting levels within holding areas of the Ten Mile River at Mechanics Pond and monitoring culverts under bridges and roadways. If the release is not managed Attleboro can experience flooding of the Willet School Field and the Riverbank Road/County Street area. In October of 2002 an agreement was developed between the two communities that outlines the coordination steps necessary to avoid flooding problems (See Appendix). When the agreement is followed coordination is ensured and problems are avoided. Issues arise only when one party neglects to follow the implementation steps of the agreement.

In addition to this agreement, the Attleboro Department of Water and Wastewater maintains a water level monitoring station at the treatment facility. This monitoring station has data on rainfall going back over 40 years and the records indicate by day, the precipitation in inches. Street flooding is possible for storm events that are over 2 inches of precipitation.

The Massachusetts Bureau of Dam Safety reports that the region's dams, like many other parts of New England infrastructure, are an aging infrastructure that is expensive to repair. Routine maintenance is necessary to control the growth of trees and keep the area clear so defects can be detected. In addition to aging, the region's dams are often doing work beyond their original design. The increase in impervious surfaces leads to increased flows in some streams and rivers and thus greater demands are placed on the dams. In 2003, a dam in a north shore community "overtopped" after heavy precipitation. When this happens the dams can fail quickly as the earthen structures are subject to erosion pressures. Attleboro should be concerned with the private dam structures within its own borders, but also the condition of the dams upstream in North Attleborough.

The Riverways Program within the Massachusetts Department of Fisheries, Wildlife, and Environmental Law Enforcement (DFWELE), has been studying the larger environmental costs of both operational dams and dam failures. Dam failures may cause loss of life and property downstream, but they may also degrade the environment. Many dams act as a holding area for contaminated sediments. With a dam failure, these sediments are released and can damage wildlife and the ecology of the river system. An associated cost of dam failures is the potential for such destruction to affect fish ladders or culverts for directing water. The Riverways program is looking to develop an assessment tool for evaluating dams for all aspects of safety, including environmental safety.

In summary, flooding due to a variety of causes (hurricanes, Nor'easters, thunderstorms, winter storms, dam failure) is **highly likely** in Attleboro, and would affect a moderate geographic area and population base thus having an **impact of medium** degree. The **severity** of the impacts on persons, property, and public infrastructure can be expected to be significant but **limited**.

B. Wind Related Hazards: Regional Maps Hurricane Data: Wind and Flood Related Hazards; Tornado Data: Wind Related Hazards; Nor'Easters/Blizzards: Flood and Wind Related Hazards;

A number of the storm events discussed under "Flood Related Hazards", also represent wind hazards to the region. Hurricanes and Nor'easters typically have high winds that can topple trees, knock out power lines, and carry dangerous debris. Consistent with flooding, the occurrence of these storm events can be expected to be "**highly likely**", that is the frequency of 1-2 times each year means that southeastern Massachusetts communities need to be prepared for high wind events. Wind has primary and secondary

impacts. That is, property damage may occur as roofs are blown off or power lines blown down, but this is often followed by secondary impacts as the debris from one structure is blown into another structure or vehicle, and downed power lines cause fire or electrocution.

The Attleboro map *Hurricane & Tornado* reflects the 100-year wind exposure zones defined by the American Society of Civil Engineers (ASCE) construction standards. The wind exposure standard is used to determine the construction needed to withstand an average wind gust lasting 3 seconds at 33 feet off the ground. Attleboro is in the 110 mph zone. The ASCE standards are only used for high-rise structures, but the mapped zones indicate wind patterns as determined through readings and modeling. These patterns are consistent with the general regional weather patterns that indicate inland areas have less severe winds than coastal areas.

Occasional contributors to wind hazards are tornadoes. Since 1950, the southeastern Massachusetts region has experienced 15 tornadoes but as indicated on the Attleboro map, *Hurricane & Tornado* none were in Attleboro. Table 3-7 lists the dates and intensity of the event as determined by the tornado Fujita Scale, which is detailed in Table 3-8. Within this region, tornadoes tend to be more likely in the months of May – September and the hours of 3 – 6PM. The National Weather Service reports that despite technological advances in equipment, the warning window for a tornado is still only about 2 minutes. In addition, this warning is very general, typically covering an area as large as a county.¹⁴ Massachusetts ranks nationally as 35th in occurrences of tornadoes for the period 1950 – 1995, but 16th in fatalities and 12th in property damages based on these same events.¹⁵ Massachusetts can expect on average, three tornadoes per year through out the state.¹⁶ Tornadoes and other natural hazards that bring high winds, can affect the entire southeastern Massachusetts region. Thus all populations are vulnerable, but given that 38% of tornado fatalities are in mobile homes¹⁷, mobile home park residents are a more vulnerable group than the general population. The higher fatalities does not reflect that mobile home parks are more likely to be hit by a tornado, but rather that if hit mobile homes are more vulnerable to damage. According to the Attleboro Board of Health, there are 847 mobile homes in seven mobile home parks within the City.

In 2000, residents reported a microburst in the northern part of the City that inflicted very localized and limited damage including downed trees and power lines. No injuries or property damage was reported.

¹⁴ Interview with Glenn Field, July 2003.

¹⁵ http://nebraskaweather.unl.edu/severe/USspc_state_tornado_information_alpha_2.htm

¹⁶ <http://www.ncdc.noaa.gov/img/climate/severeweather/small/avgt5095.gif>

¹⁷ <http://nebraskaweather.unl.edu/severe/USstornfacts.htm>

Table 3-6 Tornadoes 1950 – 1995 Bristol & Plymouth Counties		
Bristol County	Date	F-Scale
	June 9, 1953	F3
	September 7, 1958	F0
	August 9, 1968	F1
	August 9, 1968	F1
	August 2, 1970	F1
	August 28, 1970	F2
	September 14, 1972	F0
Plymouth County	Date	F-Scale
	September 7, 1958	F0
	July 4, 1964	F1
	June 9, 1965	F0
	November 18, 1967	F2
	August 9, 1968	F1
	September 16, 1986	F1
	July 10, 1989	F1
	July 10, 1989	F0
Table 3-7 Fujita Tornado Damage Scale		
SCALE	WIND (MPH)	TYPICAL DAMAGE
F0	< 73	Light Damage: Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; sign boards damaged
F1	73-112	Moderate Damage: Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads.
F2	113-157	Considerable Damage: Roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground
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 away some distance; cars thrown and large missiles generated.
F5	261-318	Incredible Damage: Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in

		excess of 100 meters (109 yds); trees debarked; incredible phenomena will occur.
--	--	--

In summary, wind damage due to a variety of causes (hurricanes, Nor'easters, winter storms, tornadoes) is **highly likely** in Attleboro, and would affect a large geographic area and population base thus having an **impact of small** degree. The **severity** of the impacts on persons, property, and public infrastructure can be expected to be significant but **limited**.

C. Fire-Related Hazards: Regional Map Forest Vegetation and Wildfire Data: Fire Related Hazards

Wildfires are a natural part of the southeastern Massachusetts ecosystem. Fires keep the forest floor clean of debris, encourage the growth of grasses that serve as wildlife feed, and ensure that trees have plenty of room to grow. Natural fires, recurring in a cyclical manner, can recycle nutrients and create a diversity of natural habitats. In these ways, wildfires that occur in isolated areas can be a positive force. Increasingly, however, development is encroaching into isolated areas and wildfires present a danger to human life and manmade facilities. **Forest fires that were in remote areas are now forest fires in people's backyards.** The dual issues of human suppression of forest fires and human encroachment into forest areas, has increased the risks associated with wildfire. Portions of southeastern Massachusetts are classified as "pine barrens". These are areas where the vegetation is predominately pitch pine with an understory of scrub oak and black huckleberry. Not only is this vegetation highly flammable, the ecosystem of the pine-barrens relies on periodic fire to perpetuate the barrens.¹⁸

The dispersion of growth into rural and undeveloped areas described in the Profile Chapter is consistent with the national phenomenon documented in discussions of the Wildlands/Urban Interface. The Wildlands/Urban Interface is getting attention because as development (particularly low-density residential development) pushes into flammable vegetative areas the threats of wildfires increase. Attleboro is not located within the pine-barrens, and there is less development sited within forested landscapes than in the more rural communities of southeastern Massachusetts. One area of concern is the train tracks where sparks from the trains have been known to cause small fires. The continued development of the City has lead to isolated wildfires of very small sizes 12 – 15 acres at the greatest.

¹⁸ Barbour, Henry et al, "Our Irreplaceable Heritage: Protecting Biodiversity in Massachusetts" 1998, p.46-7(NHESP & MA Audubon).

Table 3-10 Vegetative Coverage in Southeastern Massachusetts		
Vegetation Type	Acres	Percent of Total*
Pitch Pine/Scrub Oak	120,332.00	23 %
Northern Hardwood	41,423.49	8 %
Red Maple Dominant	19,191.91	4 %
Oak/Maple Birch	3,908.96	1 %
Open Meadow	7,283.46	1 %
Forested Wetlands	56,101.70	11 %
Mixed Hardwood Pine	42,023.78	8 %
Suburban Forest	92,233.93	18 %
Water Bodies/Beaches/No Vegetation	132,883.69	26 %

The Attleboro map, *Wildfire* indicates vegetative coverage of the region that can be used to assess flammability. Pitch pine/scrub oak vegetation is resinous and waxy, characteristics that make it the most highly flammable vegetation in the region. The red areas on the Forest Vegetation Map are pitch pine/scrub oak vegetation.

In conclusion, the probability of wildfire in Attleboro is “**likely**” and the area that could be affected is rated along Table 3-2 as “**small**”. The severity of the impacts that could be expected from wildfire in the region are best categorized as “**limited**”, and would include property damage, injuries and disruption of critical facilities.

Drought

Drought is the main factor that determines the intensity of a wildfire season - the less moisture present in trees and vegetation, the more likely they are to ignite and the hotter they will burn. Table 3-11 indicates the amount of time it takes for vegetation to dry after rainfall, to reach its point of flammability.

Table 3-11 Drying Hours to Reach Flammability	
Size of Fuel	Hours Post Rain to Reach Flammability
¼" diameter or less	1 hour
¼ – 1" diameter	10 hours
1 - 3" diameter	100 hours
4 – 7" diameter	1,000 hours
8" + diameter	10,000 hours
<i>Source: MA Bureau of Fire Control.</i>	

Beyond its role as a factor leading to wildfire, drought also has impacts on public safety for all firefighting activity, agricultural production, and economic vitality of large users such as golf courses or industrial processes. According to the December 2001 Draft Massachusetts Drought Management Plan, Massachusetts generally has enough precipitation to support the demands residents and businesses place on water. Periods of drought are not unheard of though, with the 1960s and more recently 1999 – 2000 and 2002 being notable times of water stress in the southeastern region.¹⁹ The Attleboro municipal water system has not experienced a major drought, and under the Massachusetts Water Management Act has prepared a drought plan.

D. Geologic Hazards – Regional Map Earthquake Data: Geological Related Hazards

The hazards that present the least risk to southeastern Massachusetts are geologic hazards such as earthquakes and landslides. The United States Geological Service (USGS) categorizes the region as one of low risk for earthquakes, although small-scale earthquakes (under 3 on the Richter scale) are common in the region. The Weston MA Observatory of Boston College tracks earthquake activity throughout New England and reports that recent earthquakes in the vicinity of this region include an April 1996 3.5 Mn magnitude in Swansea; a July 11, 2002, 3.0 Mn magnitude in Martha’s Vineyard; and a February 23, 2004 2.0 Mn magnitude in Dartmouth.

The Attleboro hazard map, *Earthquake* indicates that there were no recorded earthquakes in Attleboro for the period 1668-1998. Also indicated is Attleboro’s classification within Peak Ground Acceleration (PGA) zones. The majority of the community falls within the 4-5% PGA classified as moderate shaking, no damage. The PGA zones are based on modeling data that indicates areas where there is a 10% chance in the next fifty years of an earthquake exceeding the PGA for that zone. PGA is a measurement that compares the shaking of the ground with the force of gravity. While the likelihood of a powerful earthquake in the region is low, the actual risk is high because of how old the buildings are and because few structures have been built to withstand earthquakes. Critical infrastructure such as bridges and dams would be vulnerable. Overall the likelihood of a geological hazard in the region is considered to be **possible**

¹⁹ Working Draft: Massachusetts Drought Management Plan, p4, December 21, 2001.

but the type of event would be such that the impacts would be **small** and the severity **limited**, because earthquakes in the area are typically very small.

Table 3-12 Richter Scale	
M= 1-3	Recorded on local seismographs, but generally not felt
M= 3-4	Often felt, no damage
M= 5	Felt widely, slight damage near epicentre
M= 6	Damage to poorly constructed buildings and other structures within 10's km
M= 7	"Major" earthquake, causes serious damage up to ~100 km
M= 8	"Great" earthquake, great destruction, loss of life over several 100 km
M=9	Rare great earthquake, major damage over a large region over 1000 km

Chapter Four

The following table lists mitigation actions by category that the City of Attleboro presently has in place.

EXISTING PROTECTION MATRIX: CITY OF ATTLEBORO

<i>Category of Protection Measure</i>	<i>Description</i>	<i>Area Covered</i>	<i>Effectiveness and/or Enforcement</i>	<i>Improvements or Changes Needed</i>
Capital Improvement Planning/ Structural Improvements	Capital Improvement Planning (CIP) is undertaken annually. A CIP is prepared for a 5 year planning horizon by the Department of Planning and Development after soliciting input from all municipal departments.	City-wide	Effective – a five-year plan is adopted annually.	Limited by municipal budget
	Drainage improvements made to the “back bay” section of Attleboro along Manchester and Garden Streets about 6 years ago to correct repetitive flooding problem.	Manchester/ Garden Streets	Effective	Problem corrected with improvements.
	Dam Repairs were made at Mechanics Pond by the private owner.	Mechanics Pond	Mechanics Pond	Effective Completed.

<i>Category of Protection Measure</i>	<i>Description</i>	<i>Area Covered</i>	<i>Effectiveness and/or Enforcement</i>	<i>Improvements or Changes Needed</i>
Capital Improvement Planning/ Structural Improvements (cont)	The City of Attleboro increased storage at Manchester Pond by 1 ½ feet. Rip-rap was added to the bank along the highway to support this increase.	Manchester Pond.	Effective	Completed with municipal funding.
Regulations/ Bylaws/Codes	Floodplain Regulations Section 17-12 of City Ordinances Requires review and Comment by Inspector of Buildings; Conservation Commission; and Zoning Board of Appeals.	100-year floodplain	Strictly enforced	Effective as in – no changes needed in regulations, but the City does believe new floodplain maps are appropriate given the changes in impervious coverage up and along the rivers.
	Local Wetlands Regulations Section 18-1 of City Ordinances with 25-foot no-build zone.	City-wide-wetlands and floodplain areas.	Enforced	Effective
	Earth Removal Regulations Section 17-10.2 of City Ordinances	City-wide	Enforced	Effective
	Open Space Residential Dev and Planned Unit Residential Dev. Sections 17-10.5 & 17-10.6 of the City Ordinances provide for clustering homes – reduces impervious coverage and permits clustering away from areas subject to flooding.	City-Wide	Used	Open Space Red. Dev. could be improved to be a by-right option – that could increase the number of users.

<i>Category of Protection Measure</i>	<i>Description</i>	<i>Area Covered</i>	<i>Effectiveness and/or Enforcement</i>	<i>Improvements or Changes Needed</i>
Regulations/ Bylaws/Codes (cont.)	Water Resource Protection District Section 17-13 of City Ordinances.	Overlay District	Enforced	Focuses on Best Management Practices and standards for protecting water quality.
	Phase II Stormwater Management Plan and Actions.	City-wide	Pending	Under development – not yet finalized.
Operations, Administration, and Enforcement	Building Inspection Department has professional enforcement of all provisions of the Massachusetts State Building Code (780 CMR 6 th Edition) relevant to disaster mitigation including: structural integrity; egress; storage of materials; and material attachment methods	City-wide; all construction	Highly effective	No changes needed
	Ongoing clearing of rivers and culverts especially ones that can be affected by upstream dam releases. This includes vegetation, tree limbs, debris, and litter such as shopping carts. This has been done in conjunction with the non-profit conservation group the Ten Mile River Alliance.	Particular locations	Effective	Maintain as regular practice – keep partnership approach. Many areas are difficult to access as they are along the rear of private property

<i>Category of Protection Measure</i>	<i>Description</i>	<i>Area Covered</i>	<i>Effectiveness and/or Enforcement</i>	<i>Improvements or Changes Needed</i>
Operations, Administration, and Enforcement (cont.)	Close monitoring of water and precipitation levels along major rivers by the Department of Water and Wastewater.	At Water Treatment Plant	Effective – has over 40 years of records.	No changes needed.
	Ten Mile River Flood Warning Plan – An agreement between North Attleborough and Attleboro about notice and coordination of actions relative to water releases at dams along the Ten Mile River.	North Attleborough Falls Pond and Whiting Pond; Attleboro Dodgeville, Mechanics and length of Ten Mile.	Effective when followed	Despite this written agreement there are lapses in communication.
	Tree maintenance – completed by Department of Parks and Forests with municipal equipment and vegetation taken to compost site at Water Treatment Facility.	City-wide Where needed.	Effective but limited by manpower and equipment. Does respond to particular requests prior to a storm event.	No changes needed.

<i>Category of Protection Measure</i>	<i>Description</i>	<i>Area Covered</i>	<i>Effectiveness and/or Enforcement</i>	<i>Improvements or Changes Needed</i>
Operations, Administration, and Enforcement (cont.)	Animal Shelter & Municipal Zoo	Zoo & shelter	Zoo has back-up generator has not had any problems with flooding and does not anticipate problem with natural hazards. The shelter is in poor condition and has appeared in the CIP for improvements.	Improvements in the CIP.
	Disaster Warning System- Installing Reverse 911 presently. Also use cable TV and radio stations. Roughly 80 – 80% of households subscribe to Cable TV. Last resort is door-to-door notification.	City-wide	Effective. School Department has Channel 98 and Channel 15 serves as the Public Access Channel.	Could use a portable PA system on a trailer and means for periods when power is out.
Planning	Comprehensive Plan underway disaster mitigation will be integrated into plan.	City-wide	Effective	Underway Expected completion 2005
	Open Space Plan addresses disaster mitigation – in particular issues related to dam functions, flooding, runoff and maintenance of wetlands.	City-wide	Effective- plan adopted 2002.	No changes needed.

<i>Category of Protection Measure</i>	<i>Description</i>	<i>Area Covered</i>	<i>Effectiveness and/or Enforcement</i>	<i>Improvements or Changes Needed</i>
Planning	Water Department Plans: Emergency Response Plan and Drought Plan	City-wide	Effective	
Education & Training	LEPC meets on emergency planning issues	City-wide	Meets on as-needed basis.	Irregular schedule; need to integrate Sturdy Hospital.
	Council on Aging has targeted homebound elderly 90+ and sent out disaster preparedness information and a small number of disaster kits.	City-wide 90+ years was targeted	Effective	Could widen efforts to larger group of the homebound.

Chapter Five: Proposed Pre-Disaster Mitigation Actions City of Attleboro

The following table represents recommended mitigation actions. Some of these activities will require grant funding, others will require the cooperation of other agencies. The City of Attleboro will make a good faith effort to implement these actions within the constraints of the local budget, staff resources, and new demands from state and federal agencies.

PROPOSED MITIGATION ACTIONS: CITY OF ATTLEBORO

GOAL: Reduce the loss of life, property, infrastructure, and cultural resources from natural disasters.

<i>Objective</i>	<i>Action</i>	<i>Responsible Parties</i>	<i>Timeline</i>	<i>Resources Needed</i>
Undertake Capital and Structural Improvements to achieve disaster mitigation.	(1) Correct drainage problems in the vicinity of Forest Street	City Council/Mayor/DPW	Next five years	Funding under HMGP/PDM with state of municipal 25% match.
	(2) Correct drainage problems in the vicinity of Peck Street	City Council/Mayor/DPW	Next five years	Funding under HMGP/PDM with state of municipal 25% match.
	(3) Acquire easements or property along the river in downtown that provides some flood protection and decreases impervious surface at the river's edge.	Mayor/City Council	Next five years.	Funding under HMGP/PDM with state of municipal 25% match.
	(4) Purchase generators for the Emergency Operations Center and Senior Center.	Public Safety Officials working with Mayor/City Council	Next two years	Funding under HMGP/PDM with state of municipal 25% match.
	(5) Study the potential for a new siren system that could be used as a means of getting the public to tune into Cable and radio stations for emergency information.	Public Safety Officials working with Mayor/City Council	Over next five years	Pursue grant funding

<i>Objective</i>	<i>Action</i>	<i>Responsible Parties</i>	<i>Timeline</i>	<i>Resources Needed</i>
Adopt Regulations to address disaster mitigation.	(6) Study the pros and cons of mandating Underground Utilities in new subdivisions.	Planning Board/Planning Department	City-wide	Findings will determine outcome.
	(7) Study the pros and cons of adopting an uplands requirement for new lots by district.	Planning Board/Planning Department	City-wide	Findings will determine outcome.
	(8) Have revisions made to the National Flood Insurance Program (NFIP) maps for Attleboro. This is needed given the changes that have been made since the 1981 maps were prepared including alterations to dams, increased impervious coverage, and other drainage pattern changes.	Planning Department working with MA DCR and Army Corps Of Engineers (ACOE).	City-wide	Needs funding or prioritization by DCR/ACOE.
Improve Operations, Administration, and Enforcement that is under municipal control to achieve disaster mitigation.	(9) Additional manpower is needed to undertake more detailed monitoring of hazards waste users and storage practices, including the construction of a data-base and efforts to keep it up to date.		City-wide	Need funding.
Integrate disaster mitigation into ongoing planning efforts.	(10) Comprehensive Plan process underway will integrate disaster mitigation.	Planning Board/Planning Department	City-wide	Underway to be complete in 2005.
	(11) Update Pre-Disaster Mitigation Plan at least every 5 years, or as needed.	Planning Department with Emergency Management Director.	Every 5 years	If major work required look into funding through HMGP or PDM.

<i>Objective</i>	<i>Action</i>	<i>Responsible Parties</i>	<i>Timeline</i>	<i>Resources Needed</i>
Run Education & Training programs on disaster mitigation topics.	(12) Develop a direct mail piece for Attleboro households on disaster mitigation.	Public Safety Officials working with Mayor/City Council	City-wide	Needs funding – work cooperatively with neighboring communities, too.
	(13) Pursue Storm Ready Certification	Public Safety Officials working with Mayor/City Council	City-wide	If funding needed, pursue grant opportunities.
	(14) Expand outreach to the 500 homebound seniors and others in the community that could use disaster preparedness assistance and kits.	Council on Aging and Public Safety Officials, working with Mayor/City Council	City-wide	Pursue grant funding for this work.

Appendix