

CHAPTER V

DETERMINING HOW MUCH WILL BE AFFECTED

Identifying Vulnerable Facilities

It is important to determine which critical facilities are the most vulnerable and to estimate their potential loss. The first step is to identify the facilities most likely to be damaged in a hazard event. To do this, the location of critical facilities illustrated on Map 3 was compared to the location of various topographical elements, floodplains, roads, and water bodies using GIS (Geographic Information Systems). Vulnerable facilities were identified by comparing their location to possible hazard events. For example, all of the structures within the 100-year and 500-year floodplains were identified and used in conducting the potential loss analysis for flooding.

Calculating the Potential Loss

The next step in completing the loss estimation involved assessing the level of damage from a hazard event as a percentage of the facility's structural value. The Federal Emergency Management Agency (FEMA) has developed a process in which replacement values for structures located in the 100 and 500-year floodplains can be calculated according to the amount of damage suffered¹³. In Salem, the assessed values were determined for every structure identified in the floodplain. The potential loss was then calculated by multiplying the assessed value of the structure by the percent of damage expected from a hazard event (i.e., 100-year, 4-foot flood, etc.). The following discussion summarizes the potential loss estimates to structures (residential and non-residential) due to natural hazard events.

Flooding

Flooding is often associated with hurricanes, ice jams, rapid snow melt in the spring and heavy rains. The average replacement value was calculated by adding up the assessed values of all structures in the 100 and 500 year floodplains. These structures were identified by overlaying digital versions of FEMA's FIRM maps on digital aerial photography of the Town of Salem. Because of the scale and resolution of the FIRM maps and imagery this is only an approximation of the total structures located within the 100 and 500 year floodplains identified on Map 4.

The Federal Emergency Management Agency (FEMA) has developed a process to calculate potential loss for structures during flood. The potential loss was calculated by multiplying the replacement value by the percent of damage expected from the hazard event. Residential and non-residential structures were combined. The costs for repairing or replacing bridges, railroads, power lines, telephone lines, and contents of structures are not included in this estimate. In addition, the figures used were based on buildings which are one or two stories high with basements. The following calculation is based on eight-foot flooding and assumes that, on average, one or two story buildings with basements receive 49% damage (Understanding Your Risks, Identifying Hazards and Estimating Losses, FEMA page 4-13):

Potential Structure Damage: 49%

Approximately 617 structures assessed at \$238,370,000 = \$116,801,349 potential damage

13 "Understanding Your Risks, Identifying Hazards and Estimating Losses", FEMA, page 4-13.

The following calculation is based on four-foot flooding and assumes that, on average, one or two story buildings with basements receive 28% damage (Understanding Your Risks, Identifying Hazards and Estimating Losses, FEMA page 4-13):

Potential Structure Damage: 28%

Approximately 370 structures assessed at \$143,022,060 = \$40,046,176 potential damage

The following calculation is based on two-foot flooding and assumes that, on average, one or two story buildings with basements receive 20% damage (Understanding Your Risks, Identifying Hazards and Estimating Losses, FEMA page 4-13):

Potential Structure Damage: 20%

Approximately 222 structures assessed at \$85,813,236 = \$17,162,647 potential damage

Several areas of Salem were identified as having high risk of flooding. These areas are identified on Map 5 losses were calculated for these at-risk areas in the same manner as those structures in the 100 and 500 year floodplains. Again these assessments are only based on the potential damages to building within the identified at-risk areas.

Table 11: Possible flooding damage to localized high risk areas of Salem

Potential Flood Hazard Area	Total Assessed Value of Buildings	49% Damage	28% Damage	20% Damage
Bluff Street Extension	211,300	103,537	59,164	42,260
Cluff Crossing Road	No buildings			
Emerson Way	No buildings			
Fairmont Road	No buildings			
Haigh Avenue	4,073,100	1,995,819	1,140,468	814,620
Hampshire Road	2,947,200	1,444,128	825,216	589,440
Lawrence Road	56,300	27,587	15,764	11,260
Lou Avenue	No buildings			
Main Street	2,235,500	1,095,395	625,940	447,100
Millville Street	No buildings			
North Main Street	1,024,800	502,152	286,944	204,960
Pleasant Street	1,514,700	742,203	424,116	302,940
Shadow Lake Road	1,797,700	880,873	503,356	359,540
South Broadway (State line)	Flooding in Massachusetts			
South Broadway (Goodluck Trailer Park)	796,700	390,383	223,076	159,340
South Broadway (Larry's Country Square)	1,516,500	743,085	424,620	303,300
Town Farm Road	No buildings			

Dam Breach and Failure

There are potentially 3 dams that should they suffer a breach or failure could impact Salem through flooding. Potential losses will depend on the extent of the breach and could include both residential and non-residential damage, including town owned facilities. The area identified by the Hazard Mitigation Planning Committee as at risk to flooding from a Wheeler Dam breach is identified on Map 6; a Millville Dam breach on Map 7; and an Island Pond Dam breach on Map 8.

~ Wheeler Dam

The assessed value of the structures in the inundation area is \$220,053,500. Potential Damages calculated as above could reach \$107,826,215 (8-foot flood, 49% damage), \$36,968,988 (4-foot flood, 28% damage) or \$15,843,852 (2-foot flood, 20% damage).

~ Millville Dam

The assessed value of the structures in the inundation area is \$16,581,300. Potential Damages calculated as above could reach \$8,124,837 (8-foot flood, 49% damage), \$2,785,658 (4-foot flood, 28% damage) or \$1,193,854 (2-foot flood, 20% damage).

~ Island Pond Dam

The assessed value of the structures in the inundation area is \$2,836,000. Potential Damages calculated as above could reach \$1,389,640 (8-foot flood, 49% damage), \$476,448 (4-foot flood, 28% damage) or \$204,192 (2-foot flood, 20% damage).

Hurricane/ High Wind Events

~Hurricane

Hurricanes do affect the Northeast coast periodically. Since 1900, 2 hurricanes have made landfall in the State of New Hampshire. Due to the inland location of the Town of Salem most hurricanes would likely degrade to tropical storms by the time they impact the Town. Even degraded hurricanes or tropical storms could still cause significant damage to the structures and infrastructure of the Town of Salem. The assessed value of all residential and commercial structures in the Town of Salem, including exempt structures such as schools and churches, is \$1,580,251,000 (Salem Assessor). Assuming 1% to 5% damage, a hurricane could result in \$158,025,100 to \$790,125,500 of structure damage.

~Tornado

Tornadoes are relatively uncommon natural hazards in New Hampshire. On average, about six touch down each year. Damage largely depends on where the tornado strikes. If it strikes an inhabited area, the impact could be severe. In the State of New Hampshire, the total cost of tornadoes between 1950 and 1995 was \$9,071,389 (The Disaster Center). The assessed value of all residential and commercial structures in the Town of Salem, including exempt structures such as schools and churches, is \$1,580,251,000 (Salem Assessor). Assuming 1% to 5% damage, a tornado could result in \$158,025,100 to \$790,125,500 of structure damage.

~Severe Lightning

The amount of damage caused by lightning will vary according to the type of structure hit and the type of contents inside. There is no record of monetary damages inflicted in the Town of Salem from lightning strikes.

Severe Winter Weather

~Heavy Snowstorms

Heavy snowstorms typically occur during January and February. New England usually experiences at least one or two heavy snow storms with varying degrees of severity each year. Power outages, extreme cold and impacts to infrastructure are all effects of winter storms that have been felt in Salem in the past. All of these impacts are a risk to the community, including isolation, especially of the elderly, and increased traffic accidents. Damage caused as a result of this type of hazard varies according to wind velocity, snow accumulation and duration. The assessed value of all residential and commercial structures in the Town of Salem, including exempt structures such as schools and churches, is \$1,580,251,000 (Salem Assessor). Assuming 1% to 5% damage, a heavy snow storm could result in \$158,025,100 to \$790,125,500 of structure damage.

~Ice Storms

Ice storms often cause widespread power outages by downing power lines, making power lines at risk in Salem. They can also cause severe damage to trees. In 1998, an ice storm inflicted \$12,466,202 worth of damage to New Hampshire as a whole. Ice storms in Salem could be expected to cause damage ranging from a few thousand dollars to several million, depending on the severity of the storm.

Wildfire

The risk of fire is difficult to predict based on location. Forest fires are more likely to occur during years of drought. The area identified as at risk to wildfire is identified on Map 9 by the Hazard Mitigation Committee and includes the Town Forest. The assessed value of all residential and commercial structures in the Town of Salem, including exempt structures such as schools and churches, in the hazard area is \$12,389,300 (Salem Assessor). Assuming 1% to 5% damage, a wildfire could result in \$619,465 to \$123,893 of structure damage.

Earthquakes

Earthquakes can cause buildings and bridges to collapse, disrupt gas, electric and phone lines and are often associated with landslides and flash floods. Four earthquakes in New Hampshire between 1924-1989, had a magnitude of 4.2 or more. Two of these occurred in Ossipee, one west of Laconia, and one near the Quebec border. If an earthquake were to impact the Town of Salem, underground lines would be susceptible. In addition, buildings that are not built to a high seismic design level would be susceptible to structural damage. The assessed value of all residential and commercial structures in the Town of Salem, including exempt structures such as schools and churches, is \$1,580,251,000 (Salem Assessor). Assuming 1% to 5% damage, an earthquake could result in \$158,025,100 to \$790,125,500 of structure damage.

Drought

Historically, droughts in Salem have had limited effect because of plentiful water resources and sparse population. The major effects have been decreased crop yields, decreased water supplies, dry wells, and decreased hydropower production. Since 1960, the population has more than doubled; this growth has increased demand for the Town's water resources. The effect of droughts or decreased precipitation is indicated through measurements of soil moisture, groundwater levels, and streamflow; however, not necessarily all of these indicators will be minimal during a particular drought. For example, frequent minor rainstorms can replenish the soil moisture without raising ground-water levels or increasing streamflow. Low streamflow also correlates with low ground-water levels, because it is ground water discharge to streams and rivers that maintains streamflow during extended dry periods. Low streamflow and low ground-water levels commonly cause diminished water supply. Salem's municipal water system relies heavily on two reservoirs one replenished by groundwater recharge and the other by streamflow. Water rationing is usually enforced at the first indication of a lower than normal water levels in the reservoirs followed by water purchases if the drought persists. In recent history socioeconomic droughts have had a far greater financial impact to the community than blizzards or hurricanes. The municipal water system is identified on Map 10. Water purchases to support this system would cost the community approximately \$6,000 daily in 2004 dollars.