Chapter 3. Vulnerability Assessment

Chapter 2 reviewed the hazards that face Kankakee County. If they struck vacant land, there would not be much cause for concern. Because the County has over 100,000 residents and thousands of homes, businesses and critical facilities, the potential for damage and deaths can be high.

This chapter reviews how vulnerable Kankakee County is to property damage, adverse impact on the local economy, and threats to public health and safety. The potential for property damage is measured in dollars. It accounts for how much is exposed to damage and the likelihood of damage occurring.

Except where noted, this assessment does not include the municipalities that did not participate in the planning process.

A four step process was followed to calculate the cost to Kankakee County of the hazards reviewed in Chapter 2:

Step 1: Inventory appropriate categories of property subject to damage

Step 2: Determine the exposure of the properties and people to the hazards

Step 3: Determine the cost of various levels of damage to the properties

Step 4: Calculate the impact, based on the exposure and the probability of occurrence

Sections 3.1 and 3.2 review the first step. Sections 3.3 – 3.10 describe the exposure of people and property to each hazard. Section 3.11 summarizes the findings.

3.1. Properties

The chapter is based on the assumption that natural hazards do not damage land, only manmade structures. Therefore, we reviewed four categories of buildings to assess the County's vulnerability to property damage:

- Single family homes
- Manufactured homes
- Multi-family structures
- Non-residential

The last includes government buildings, commercial properties, factories, churches, and schools. Critical facilities are included in this last category, too, in order to simplify the dollar calculations of property damage. The impact of a critical facility being damaged is considered in the discussions on impact on safety and health.

While these categories may appear to be general, they are sufficient for our planning purposes: to assess the relative vulnerability of properties to the hazards facing Kankakee County.

The number of buildings in each category is shown in the table to the right. These figures came from 2010 US Census block data and municipal boundaries in the County's geographic information system (GIS). In some cases, Census data were refined by a review of the GIS' aerial photographs. The numbers have also been reviewed and refined, as needed, by each municipality and the College.

Buildings in Kankakee County

	Single Family Homes	Manufactured Homes	Other Residential	Non-Residential	Total
Aroma Park	300	0	6	10	316
Bourbonnais	6,497	0	2,002	59	8,558
Bradley	4,913	45	1,427	58	6,443
Kankakee	6,943	288	3,606	247	11,084
Manteno	2,147	584	619	18	3,368
Momence	1,083	0	247	8	1,338
Sun River Terrace	152	10	22	2	186
Uninc. County	8,700	2,055	109	108	10,972
Total	30,735	2,982	8,038	617	42,372

Municipalities not participating in the mitigation plan are not included

FEMA's HAZUS software and US Census data provided replacement costs for buildings in Illinois in 2010. These figures were adjusted to account for three years of inflation, compared to recent area sales, and rounded off to the following:

- Single family homes: $161,000
- Manufactured homes: $45,000
- Multi-family structures: $858,000
- Non-residential: $2,980,000

The value of contents is taken from guidance in FEMA's *Understanding Your Risks*, page 3-11. For residential structures, contents are valued at 50% of the building's value. For non-residential structures, 100% is used. These numbers are used in the following sections when calculating contents damage.

3.2. Other Impacts

One cannot put dollar figures on the impact of a hazard on the community and on individual people. Therefore, three subjective measures of low, moderate, and high are used here for:

- Overall economic impact on businesses, transportation and the tax base
- Safety hazard, including threat to critical facilities
- Health hazard, including threat to critical facilities, such as water and wastewater treatment plants

In section 3.11, these subjective statements are converted to numerical values to facilitate incorporating the frequency or risk of a hazard hitting somewhere in the County.

3.3. Overbank Flooding

Buildings: Using US Census block data and floodplain boundaries in the County's GIS, the table to the right was produced. The numbers were refined by a review of the GIS' aerial photographs and community input. This table shows that most of the floodprone buildings in Kankakee County are single-family residences.

Floodplain Buildings

	Single Family Homes	Manufactured Homes	Other Residential	Non-Residential	Total number
Aroma Park	67	0	1	3	71
Bourbonnais	264	0	27	8	299
Bradley	269	0	17	3	289
Kankakee	388	1	56	54	499
Manteno	0	0	0	10	10
Momence	49	1	3	0	53
Sun River Terrace	15	0	0	0	15
Uninc. County	1,832	127	5	11	1,963
K. Com. College	0	0	0	0	0
Total	2,872	129	109	89	3,199

Buildings undergo a variety of stresses and damage when flooded:

- Impacts on the sides of the building from velocity flows and debris, such as ice (next page),
- Hydrostatic pressure that can break walls and floors and even float a structure,
- Scouring that undercuts a building's foundation,
- Deterioration of materials, such as insulation and wallboard, the decompose when wet (next page),
- Warping of wet wood that is dried too fast, and
- Deposits of sediment and other contaminants.

Soldier Creek flood damage, 1957

Kankakee County Planning Department, Michael Quigley

Kankakee River ice jam damage, 1982

French & Associates

The table to the right shows the number and dollar values of flood insurance claims by community. Communities not in the National Flood Insurance Program (NFIP) are not listed. Chebanse and Sun River Terrace are in the NFIP, but no claims have been paid there. It can be noted that in a community where there is deep river flooding, like Aroma Park, average claim payments are higher than for a community on smaller streams, like Manteno.

Flood Insurance Claims, 1978 – 2004

	Single-Family		Other	
	Number	Average	Number	Average
Aroma Park	6	$6,037	2	$2,002
Bourbonnais	5	$1,588		
Bradley	2	$21,355		
Kankakee	36	$5,781	1	$1,760
Manteno	3	$1,280	1	$4,690
Momence	27	$3,776		
Uninc. County	208	$6,324	3	$8,218
Totals	287	$5,979	7	$5,015

FEMA

A detailed review of flood insurance claims and other damage data had been conducted for a nearby community with similar average claims. Using these historical figures, bringing them up to 2005 costs and accounting for contents damage, deductibles, and deeper flooding during a 100-year flood, resulted in an average building damage figure of $20,000 (*Natural Hazards Mitigation Plan*, Calumet City, Illinois, page 2-7).

Structural flood damage includes broken walls and damage to insulation and wallboard

This figure accounts for debris removal, cleaning, repairing the floors, and replacing walls, insulation, wooden doors, electrical services, furnace, washer, dryer, and contents. It does not include damage to vehicles, landscaping, swimming pools, and other uninsurable items.

An analysis of Kankakee County claims since 1995 showed that the more recent claim payments have been 40% greater. Further, unlike Calumet City which has many homes subject to shallow flooding, much of the exposure to flooding in Kankakee County is to homes very close to the Kankakee and Iroquois Rivers. Because of the increase in value of buildings on the larger rivers and the deeper flooding and ice jam hazard, the $20,000 figure was increased to $40,000 as the average cost to repair a flooded home.

A figure of $30,000 is used for manufactured homes. Even though their replacement cost is lower than single family homes, a little water can do a lot of damage.

These figures show that damage to single-family homes is approximately 30% of the building's replacement cost. Extrapolating on this percentage, produces the dollar damage figures for multi-family and non-residential buildings. It should be noted that this is the *average*. Buildings close to the river will receive much more damage while buildings at the edge of the base floodplain will suffer less.

Extrapolating on these figures and the number of floodplain buildings in the table on page 3-3 produced dollar figures for the 100-year flood for each community with a mapped floodplain. These figures are shown in the table on page 3-7.

Economic impacts: Floods cause other problems that aren't so easy to identify or measure. Businesses are closed when they are flooded, they lose their inventories, people can't get to them or the employees are busy protecting or cleaning up their flooded homes. However, there are not very many businesses in the floodplain.

Roads and bridges are flooded and there is a cost of flood fighting and recovery that is borne by the communities. Repetitively flooded areas tend to deteriorate over time and property values go down, resulting in a social cost.

Flooded farm fields can mean loss of the season's crops. This is primarily an impact on the County, but the area of floodplain that is farmed is a relatively small percentage of the total.

Overall economic impact of a 100-year flood: moderate. Because there are no non-residential properties in Sun River Terrace's floodplain, its economic impact is "low."

Safety: A car will float in less than 2 feet of moving water and can be swept downstream into deeper waters. This is one reason floods kill more people trapped in vehicles than anywhere else (see table, next page). Victims of floods have often put themselves in perilous situations by ignoring warnings about travel or mistakenly thinking that a washed-out bridge is still there.

People die of heart attacks, especially from exertion during a flood fight. Electrocution is a cause of flood deaths, claiming lives in flooded areas that carry a live current created when electrical components short out. Floods also can damage gas lines, floors, and stairs, creating secondary hazards such as gas leaks, unsafe structures, and fires. Fires are particularly damaging in areas made inaccessible to fire-fighting equipment by high water or flood-related road or bridge damage.

Warning and evacuation: The threat to life and safety posed by a flood can be avoided if people can evacuate before the waters reach their buildings or close their evacuation routes. This requires advance notice that a flood is coming and a system to disseminate flood warnings. Flood warning programs are discussed in Chapter 7. With the gages and National Weather Service river level predictions, there can be lead time on the Kankakee and Iroquois Rivers to allow protective steps to be taken.

Other, smaller, streams rise so fast during a heavy local rain, that expensive systems of remote rain and stream gages would be needed to provide adequate notice to emergency managers. Even then, there would be little time for people to do much more than escape to high ground.

Overall safety hazard: Moderate.

Health: Three general types of health problems accompany floods. The first comes from the water itself. Floodwaters carry whatever was on the ground that the stormwater runoff picked up, including dirt, oil, and farm and industrial chemicals.

Post-flood silt, mold and mildew

The second type of health problem comes after the water is gone. Stagnant pools become breeding grounds for mosquitoes, and wet areas of a building that have not been cleaned breed mold and mildew (see photo). A building that is not thoroughly and properly cleaned becomes a health hazard, especially for small children and the elderly.

The third problem is the long-term psychological impact of having been through a flood, seeing one's home damaged and irreplaceable keepsakes destroyed. There is a long-term problem for those who know that their homes can be flooded again. The resulting strain on floodplain residents takes its toll in the form of aggravated health and mental health problems. Children are particularly susceptible to this post-traumatic stress.

Overall health hazard: Moderate.

Critical facilities: The following critical facilities are in the base floodplain (A Zone):

- Kankakee: Aqua Illinois water treatment plant on Cobb Boulevard. One of three facilities that provide potable water to Kankakee, Bradley, Manteno, Aroma Park and Grant Park. In 2003, emergency sandbagging saved the site from inundation by high water, although the site has since been floodproofed (see page 6-6).
- Kankakee: KRMA regional wastewater treatment facility
- Kankakee: County Highway Department offices
- Aroma Park: Fire protection district fire station
- Sun River Terrace's wastewater treatment facility

If flooded, the water and wastewater treatment facilities would be shut down, thereby giving a "high" overall health hazard for Kankakee and Sun River Terrace. While Aroma Park's fire station is in the floodplain, it is high enough to have time to evacuate the vehicles in case of a flood, so the operations could continue at a different location.

Kankakee Community College has some of its main building in the 500-year floodplain (X500 Zone). There would be no property damage from the 100-year flood, but there would be some economic costs and a minor safety and health hazard.

Overbank Flood Vulnerability

	Property Damage	Economic Impact	Safety Hazard	Health Hazard
Aroma Park	$5,146,000	Mod	Mod	Mod
Bourbonnais	$22,392,000	Mod	Mod	Mod
Bradley	$16,682,000	Mod	Mod	Mod
Kankakee	$68,146,000	Mod	Mod	High
Manteno	$7,500,000	Mod	Mod	Mod
Momence	$2,638,000	Mod	Mod	Mod
Sun River Terrace	$600,000	Low	Mod	High
Uninc. County	$85,940,000	Mod	Mod	Mod
K. Com. College	$0	Low	Low	Low
Total	$209,044,000			

Note on FEMA Flood Insurance Claims Data: Insurance claim data was requested for this update but was not obtained in time for publication. Therefore the 2004 statistics were not adjusted for increase in claims, however, the percentages and trends remain representative of Kankakee County's overbank flooding problem.

3.4. Repetitive Losses

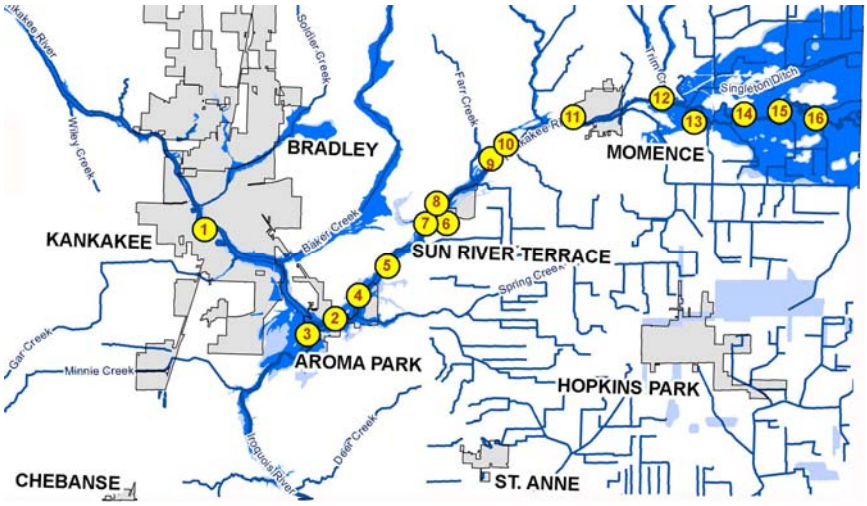
There are several different definitions of a "repetitive loss property." This *Plan* uses the Community Rating System's definition, in part because data are readily available: a repetitive loss property is one which has received two flood insurance claim payments for at least $1,000 each since 1978. These properties are important to the National Flood Insurance Program and the Community Rating System because even though they comprise 2% of the policy base, they account for 33% of the country's flood insurance claim payments.

There are several FEMA mitigation grant programs that encourage communities to identify the causes of their repetitive losses and develop a plan to mitigate the losses. This *Plan* meets FEMA's repetitive loss planning criteria.

There are 37 repetitive loss properties in unincorporated Kankakee County and one each in the City of Kankakee and Aroma Park. The Privacy Act prohibits publishing the exact locations or addresses of insured properties in a public document. A review of the properties and their sites concluded that three are mistakes, i.e., the property is on high ground and the insurance records must reflect the address of the property owner, not the location of the insured property. Another five could not be located because the address was a rural route or other mailing address that cannot be plotted.

As a result of this review, the remaining 30 properties were used to identify 16 repetitive loss *areas*. A repetitive loss *area* contains one or more properties on the FEMA list plus adjacent properties that have the same or similar exposure to flooding and flood damage. The general locations of these areas are shown on the map below.

Since the original plan 26 additional repetitive loss properties have been added to unincorporated Kankakee County's inventory. However, these properties lie within the existing 16 repetitive loss areas. No new repetitive loss areas were added to the Plan. Of the 26, 3 could not be located due to address deficiencies, 2 were elevated, and 1 was demolished.



Repetitive loss areas

Repetitive Loss Areas			
Area	**Bldgs**	**Zone**	**Months Flood Claims Submitted**
1	1	X Zone	3/79, 3/84
2	6	Floodway	3/79, 6/81
3	31	Floodway	3/79, 3/98, 2/84, 2/85, 3/98, 5/02, 1/05
4	4	Floodway	3/79, 2/84, 2/85, 12/96, 1/99, 5/02, 1/05
5	1	Fringe/X	3/79, 2/85
6	2	Floodway	3/79, 2/85, 1/99, 1/05
7	3	Floodway	3/79, 2/85, 1/99
8	1	Floodway	3/79, 2/85
9	14	Floodway	3/79, 6/81, 2/82, 3/82, 2/85, 11/90, 12/90, 1/93, 1/91, 7/96, 2/97, 6/97, 3/98, 1/99, 5/02, 1/05
10	22	Fringe/ Floodway	3/79, 4/81, 1/82, 3/82, 4/82, 2/85, 11/85, 11/90, 2/91, 1/93, 6/93, 5/96, 7/96, 2/97, 6/97, 3/98, 5/02
11	1	X Zone	3/79, 2/82
12	3	Fringe	3/79,6/81
13	10	Floodway	3/79,6/81
14	28	Floodway	3/79, 6/81, 2/82, 5/83, 2/85
15	2	Floodway	3/82, 2/85
16	13	Floodway	2/82, 12/90

Note: Repetitive loss buildings were added to Areas 2, 3, 9, 10, 12, 14 & 16 but information on the date of flood claims was unavailable for this update. It is assumed any claims on these properties occurred between 2005 and 2013.

As seen in the table above, the 16 areas range in size from one building that appears to be the only one subject to repetitive flooding to 31 similarly situated properties. All of them are on the Kankakee River, except for number 3, which is on the Iroquois.

All but two of the areas are in the base or 100-year floodplain. Areas 1 and 11 are in the X Zones, but are right next to the mapped floodplain and were flooded when the Kankakee River flooded. Most of the rest of the areas are in the regulatory floodway, i.e., the central portion of the floodplain adjacent to the channel. Two areas (5 and 10) are borderline.

The dates in the "years flooded" column are taken from flood insurance claims that were submitted for both the repetitive loss properties and the other properties in the same area. The larger areas had more claims. While nine of the areas have not had any claims since February 1985, they still had at least two floods during a preceding 10 year period and therefore qualify as repetitive losses.

Properties can be removed from FEMA's list if it can be shown that there has been a flood control project or the building has been removed or retrofitted. It should be noted that at least one of the properties on FEMA's list has been cleared and at least one has been elevated above the flood level. Three of them were for sale when they were visited in May 2005. Two appeared to have been vacant for some time. Additionally, between 2005 and 2013 two repetitive loss structures have been raised and one has been demolished.

While individual properties on the FEMA list may have been mitigated, each area still has one or more properties subject to the same degree of flood damage and are considered "repetitive loss properties in waiting." Mitigation of these properties is discussed in Chapter 6, section 6.7.

3.5. Local Drainage Problems

Buildings: All communities are equally susceptible to local drainage problems. For planning purposes, it is estimated that 1% of each community's buildings are subject to local drainage problems.

Between 1978 and 2005, there have been 55 flood insurance claims paid for properties located outside the mapped floodplain. Because there were no floods greater than 100-year recurrence interval during this time, it is concluded that these claims were for local drainage problems. These 55 claims had an average payment of $4,868 or 2/3 the average claim for properties flooded in the mapped floodplain. This coincides with the Calumet City study's findings. The average damage to a building from local drainage is projected to be $6,000. This is much less than the figure for overbank flooding, because the latter is based on a deeper 100-year flood.

Local Drainage Problems Vulnerability

	Property Damage	Economic Impact	Safety Hazard	Health Hazard
Aroma Park	$18,960	Low	Low	Low
Bourbonnais	$513,480	Low	Low	Low
Bradley	$386,580	Low	Low	Low
Kankakee	$665,040	Low	Low	Low
Manteno	$202,080	Low	Low	Low
Momence	$80,280	Low	Low	Low
Sun River Terrace	$11,160	Mod	Low	Low
Uninc. County	$658,320	Low	Low	Low
Total	$2,535,900			

Local drainage problems are considered the same each year and the dollar value of the damage is the same for residential and non-residential properties. The table for local drainage problems uses 1% of the community's buildings times $6,000 to calculate a total dollar property cost.

Economic impacts: Street ponding is usually not severe enough to close a street to traffic, at least not to emergency vehicles. Disrupted traffic and businesses that may be closed for a few hours means a low economic impact. However, several of the smaller communities have reported that maintaining drainage ways and roadside ditches is quite a drain on their budgets.

Overall economic impact: Larger communities: Low; smaller communities: Moderate.

Safety and health hazards: These problem storms do not kill or injure anyone. There are few reported health problems, although some septic systems, especially in repetitively

flooded areas, need work. As reported by one Bourbonnais resident, the potential for mold problems increases with repetitive flooding.

Safety and health hazard: Low.

3.6.Tornadoes

Buildings: Although tornadoes strike at random, making all buildings vulnerable, three types of structures are more likely to suffer damage:

- Manufactured homes,
- Homes on crawlspaces (more susceptible to lift), and
- Buildings with large spans, such as shopping malls, gymnasiums and factories, as seen by the damage below, which was caused by the tornado that hit south of Kankakee in April 2004.

Damage from the April 2004 tornado

Damage from the April 2004 tornado
WGFA Radio

Structures within the direct path of a tornado vortex are often reduced to rubble. However structures adjacent to the tornadoes path are often severely damaged by high winds flowing into the tornado vortex, known as inflow winds. It is here, adjacent to the tornado's path where the building type and construction techniques are critical to the structure's survival.

In 1999, FEMA conducted an extensive damage survey of residential and non-residential buildings in Oklahoma and Kansas following an outbreak of tornadoes on May 3, 1999, which killed 49 people. The assessment found:

- The failure of many residential structures occurred where the framing was attached to the foundation or when

Tornado damage to residences
Utica, Illinois, 2004

nails were the primary connectors between the roofing and the walls.
- Roof geometry also played a significant role in a building's performance.
- Failure of garage doors, commercial overhead doors, residential entry doors or large windows caused a significant number of catastrophic building failures.
- Manufactured homes on permanent foundations were found to perform better than those that were not on solid walls.

It can be seen that some types of structures, especially manufactured housing, are more susceptible to damage. This would include the west campus of Kankakee Community College, which has four "temporary" wood frame buildings and a steel veneer "Butler" building. This is one critical facility that would expose many people to injury.

While some types of structures, especially manufactured homes, are more susceptible to damage, all *areas* of Kankakee County are equally exposed to the tornado threat. It is estimated that an *average* tornado in the County would cause destruction and damage to 5% of each community's buildings and their contents at an average of 50% damage. Ten percent of the manufactured homes would be 100% damaged. Again, this is an average. While, a tornado that hit a shopping center would cause more damage, one that hit a park or farm fields would cause less.

Economic impact: The major impact of a tornado on the local economy is damage to businesses and infrastructure. A heavily damaged business, especially one that was barely making a profit, often has to be closed. The 1990 Plainfield tornado post-disaster damage report stated that at least 50 businesses were destroyed.

Infrastructure damage is usually limited to above ground utilities, such as power lines. The 1990 tornado knocked out two 345,000 volt transmission towers, leaving 65,000 Com Ed costumers without power. Damage to phone lines left 14,000 customers without service. Damage to utility lines can usually be repaired or replaced relatively quickly.

Damage to roads and railroads is also localized. If it can't be repaired promptly, alternate transportation routes are usually available. Transportation was disrupted when highways were closed during the August 1990 storm due to high winds and debris.

Public expenditures include search and rescue, shelters, and emergency protection measures. The largest expenses are for repairs to public facilities and clean up and disposal of debris. Most public facilities are insured, so the economic impact on the local treasury may well be small. However, some public buildings, such as schools and fire stations, may be particularly susceptible to damage because of their long roof spans.

Clean up and disposal can be a larger problem, especially with limited landfill capacity near the damage site. Preliminary damage assessments for public expenditures after the 1990 tornado totaled $4 million, 2/3 of that for debris clearance.

Overall economic impact: High

Safety: The tornado section in Chapter 2 notes that two people have been killed by tornadoes in Kankakee County since 1950.

The 1990 Plainfield twister caused 28 deaths and the 2004 Utica tornado killed eight people.

The major hazard from tornadoes is physical injury from flying debris or being in a collapsed building or mobile home. Within a building, flying debris or missiles are generally stopped by interior walls.

Based on national statistics for 1970 – 1980, for every person killed by a tornado, 25 people were injured and 1,000 people received some sort of emergency care. The 1990 Plainfield twister injured 350 people.

The number of people who live in mobile homes is far smaller than the number that live in permanent a home however they have practically the same number of deaths.

Overall safety hazard: High

Health: Following a tornado, damaged buildings are a potential health hazard due to instability, electrical system damage, and gas leaks. Sewage and water lines may also be damaged. However, these problems would be localized.

Overall health hazard: Low

Tornado Vulnerability

	Property Damage	Economic Impact	Safety Hazard	Health Hazard
Aroma Park	$3,018,750	High	High	Low
Bourbonnais	$65,205,000	High	High	Low
Bradley	$49,495,250	High	High	Low
Kankakee	$71,156,750	High	High	Low
Manteno	$49,127,750	High	High	Low
Momence	$10,867,500	High	High	Low
Sun River Terrace	$1,456,000	High	High	Low
Uninc. County	$97,230,000	High	High	Low
Total	$347,557,000			

3.7. Earthquakes

Buildings: Generally, wood frame buildings and structures on solid ground fare best during an earthquake. Wood frame buildings are flexible enough to withstand some ground shaking and swaying. Evaluations of recent earthquakes found that a greater amount of damage was primarily caused by or attributed to:

- Unreinforced masonry structures
- Buildings without foundation ties
- Older buildings with some degree of deterioration
- Multi-story structures with open or "soft" first floors

Most building codes have standards related to the first two concerns. This means that the most threatened buildings are older masonry ones (built before current codes) and taller ones with open first floors.

In addition to the building type, damage is related to the underlying soils. Buildings on stiff soils fare better than those on loose or sandy soils, which will amplify earthquake shaking. These soils can be found in floodplains. If there is enough water present, the shaking can liquefy the underlying soils, which removes the support under the foundation, causing the building to settle, sometimes unevenly.

The most likely type of earthquake damage in Kankakee County would be to masonry buildings and structural overhangs.

FEMA

Given the relatively low threat of a quake at a MMI scale of VII or greater, the threat to buildings in Kankakee County would be limited to large, older, unreinforced masonry structures. These are found in every community, especially in the older downtown areas. The dollar damage estimate is 2% of the value of 25% of the communities' non-residential buildings (no damage to contents).

Economic impact: As with tornadoes, the major impact of an earthquake on the local economy is damage to businesses and infrastructure. Given the relatively minor amount of damage expected, the overall economic impact is considered: Low.

Safety: "Trauma caused by partial or complete collapse of human-made structures is the overwhelming cause of death and injury in most earthquakes." (*The Public Health Consequences of Disasters, pages 18 – 19.*) Approximately 1,600 people have been killed by earthquakes in the US since colonial times, 1,000 of them were in California and 700 of those were in the 1906 San Francisco quake.

Because the greatest potential for loss of life is to people within a collapsing building or outside where one may be struck by part of a falling wall or chimney, the threat to

residents is directly related to the condition of the buildings and the expected quake energy. Other life safety threats include collapsing roads and bridges, fires from ruptured gas lines, and release of hazardous chemicals from broken storage tanks or trucks. However, given the minor effects of a Modified Mercali Intensity of VII, the likelihood of such damage is low.

Overall safety hazard: Moderate

Health: The main health concerns from earthquakes arise from sheltering people and caring for injuries. These would be the same as for other quick and destructive hazards, such as tornadoes.

Overall health hazard: Low

Earthquake Vulnerability

	Property Damage	Economic Impact	Safety Hazard	Health Hazard
Aroma Park	$149,000	Low	Mod	Low
Bourbonnais	$879,100	Low	Mod	Low
Bradley	$864,200	Low	Mod	Low
Kankakee	$3,680,300	Low	Mod	Low
Manteno	$268,200	Low	Mod	Low
Momence	$119,200	Low	Mod	Low
Sun River Terrace	$29,800	Low	Mod	Low
Uninc. County	$1,609,200	Low	Mod	Low
Total	$7,599,000			

3.8. Winter Storms

Buildings: Historically, roofs would collapse due to heavy snow loads, but most buildings in Kankakee County are now constructed with low temperatures, snow loads and ice storms in mind. With today's energy consciousness, buildings are much better insulated than they were 50 years ago. Winter storms do not have a major impact on buildings.

A dollar figure of $1,000 is used to represent the damage to a structure and its contents from water due to ice seepage and/or broken water lines. The table page 3-17 bases the dollar damage to buildings on $1,000 in damage to ½ of 1% of each community's buildings.

Economic impact: Being in a Northern climate, businesses in Kankakee County are prepared for the average winter storm. The major impacts of snow and ice storms on property are to utilities and roads. Power lines and tree limbs can be coated with heavy ice resulting in disrupted power and telephone service. Loss of power means businesses and stores must close down. The Village of Chebanse reported that the March 1991 ice storm knocked out power for five days.

Loss of access due to snow or ice covered roads has a similar effect. However, it still costs to keep the streets open. Kankakee County received a Presidential snow emergency for the storms of January 1999 and December 2000. FEMA provided $250,000 and $200,000 in Public Assistance to Kankakee County communities, townships, and schools. Chebanse reported extraordinary public expenses to shelter travelers when I-57 is closed by the State Police during winter storms.

Above ground lines are especially susceptible to damage by ice storms.

Matthew Masek, University of Nebraska

Overall economic impact: Larger communities: Low; smaller communities: Moderate

Safety: Winter storms bring hazardous driving and walking conditions and heart attacks from shoveling snow. Even small accumulations of ice can be dangerous to motorists and pedestrians. Bridges and overpasses are particularly dangerous because they freeze before other surfaces. About 70% of the injuries caused by snow and ice storms result from vehicle accidents and 25% occur to people caught out in the storm.

Injuries Related to Cold

- 50% happen to people over 60 years old
- More than 75% happen to males
- About 20% happen at home

The table in Chapter 2's section on winter storms shows that six people have been killed by winter storms that have affected Kankakee County over the last ten years. The table to the right shows that winter storms have led to more deaths in Illinois that any other natural hazard except extreme heat. Certain populations are especially vulnerable to the cold, including the elderly, the homeless, and lower income families with heating problems.

Overall safety hazard: Moderate

Health: Winter storms bring extreme cold, due to low temperatures and loss of heat during power outages. The effect of cold on people is usually made more severe by the impact of wind chill factors. Wind chill is reported as a temperature, but is not the actual temperature. Rather it is how wind and cold feel on exposed skin. As the wind increases, heat is carried away from the body at an accelerated rate, driving down the body temperature.

Extreme cold can result in people and animals suffering from frostbite and hypothermia. Frostbite is damage to tissue caused by the effects of ice crystals in frozen tissue.

Extremities (hands, feet, ears, nose) with more circulation difficulties are most frequently affected.

Hypothermia is the lowering of the core body temperature. It is "clinically significant" when the body temperature is below 95°F. Severe hypothermia occurs when the body's temperature drops below 85°F, resulting in unconsciousness. If help does not come, death follows. Great care is needed to properly rewarm even mild cases.

Overall health hazard: Moderate

Winter Storm Vulnerability

	Property Damage	Economic Impact	Safety Hazard	Health Hazard
Aroma Park	$1,580	Mod	Mod	Mod
Bourbonnais	$42,790	Low	Mod	Mod
Bradley	$32,215	Low	Mod	Mod
Kankakee	$55,420	Low	Mod	Mod
Manteno	$16,840	Low	Mod	Mod
Momence	$6,690	Low	Mod	Mod
Sun River Terrace	$930	Mod	Mod	Mod
Uninc. County	$54,860	Low	Mod	Mod
Total	$211,325			

3.9. Thunderstorms

Buildings: As with tornadoes, mobile homes are at a high risk to damage from thunderstorms. Wind and water damage can result when windows are broken by flying debris or hail. Lightning can cause direct damage to structures (especially those without lightning protection systems) and can cause fires that damage forests and structures. The Village of Chebanse lost its siren when lightning struck it in April 2004.

Straight line winds will damage roofs, overturn or push mobile homes off foundations, push autos off the road and may destroy attached garages. Straight line winds are the leading cause of wind related damage. Although they do not receive as much recognition as tornado events, high winds cause more damage year-to-year than tornadoes.

Hail can inflict severe damage to roofs, windows and siding, depending on hailstone size and winds. Hail caused property damage over $73 million and crop damage over $5 million in the last 53 years in Illinois (*Illinois Hazard Mitigation Plan*, page III-25). Two residents reported experience with hail damage to their roofs, vehicles and landscaping that cost them $5,000−$6,000.

One study of insured losses from hail found that 75% of the dollar damage was to roofing, 12% to awnings, 6% to exterior paint, 4% to glass and 3% to siding (*Hail Loss Potential in the US*, page 2).

During the period 1994 – 2000, the insurance industry paid out $17.5 billion in claims, or an average of $2.5 billion per year. Sixty-six percent of the losses were to personal buildings, 15% to commercial buildings, and 19% to vehicles (IBHS website). Of the

nation's "Top Ten" hailstorms between 1994 and 2000, number 4 was the May 18, 2000, storm in the Chicago suburbs. A total of $572 million was paid in property claims.

For this *Plan's* purposes, thunderstorms are estimated to cause $5,000 in damage to 1% of each community's buildings each year from wind, hail and lightning. No damage is expected to contents.

Economic impact: Thunderstorms can impact transportation and utilities. Airplanes have crashed when hit by downbursts or lightning. Power lines can be knocked out by lightning or knocked down by wind and debris. Lightning can also cause power surges that damage appliances, electronic equipment and computers. However, many buildings have lightning rods and back up power systems that can recover quickly.

Overall economic impact: Low

Safety: The threat to life varies by the cause of death. Between 1995 and 2000, the National Weather Service reported 20 people in Illinois were killed by flash floods, wind and lightning brought by thunderstorms (see table). Hail rarely causes loss of life.

Lighting kills more people than tornadoes. Most lightning fatalities and injuries occur outdoors at recreation events and under or near trees. Nationwide it is estimated that 25 million cloud-to-ground lightning flashes occur each year, 1,000 people are injured, 52 are killed (*Illinois Hazard Mitigation Plan*, page III-25). A related concern is the damage to critical facilities. Buckingham lost its siren's control board two times in four years due to lightning strikes.

Most of these deaths can be prevented through safe practices. Much information has come out over the last 20 years about lightning safety, for example. Before 1990, an average of 89 people were killed by lightning each year. By 2000, this number had dropped to 52.

Hail occurs frequently in Illinois averaging 74 times a year or 3,951 times since 1950. There have been no deaths, but 23 injuries.

Overall safety hazard: Moderate

Thunderstorm Vulnerability

	Property Damage	Economic Impact	Safety Hazard	Health Hazard
Aroma Park	$15,800	Low	Mod	Low
Bourbonnais	$427,900	Low	Mod	Low
Bradley	$322,150	Low	Mod	Low
Kankakee	$554,200	Low	Mod	Low
Manteno	$168,400	Low	Mod	Low
Momence	$66,900	Low	Mod	Low
Sun River Terrace	$9,300	Low	Mod	Low
Uninc. County	$548,600	Low	Mod	Low
Total	$2,113,250			

Health: No special health problems are attributable to thunderstorms, other than the potential for tetanus and other

diseases that arise from injuries and damaged property. When lightning strikes a human being, serious burns or death are the common outcomes.

Overall health hazard: Low

3.10. Drought/Extreme Heat

Buildings: There is little or no damage to structures caused by drought, high temperatures or humidity.

Economic impact: During a period of drought and/or extreme heat, there will be a higher demand for water and electricity. Both of these can be supplied in the municipalities with no economic disruption. In rural areas and villages on water from shallow wells, rationing or lawn watering bans may be needed.

The greater impact is to agriculture. There are no available figures on the cost of drought or heat to Kankakee County. The 1988 drought/heat wave resulted in $382 million in disaster relief payments to landowners and farmers throughout the state. While not the major factor it used to be, agriculture is still important to the County's economy. A severe drought would have a ripple effect on other sectors, especially in the rural areas.

Overall economic impact: Moderate

Safety: Heat kills by pushing the human body beyond its limits. Normally the body's internal thermostat produces perspiration that evaporates to cool and regulate the body's temperature to 98.6 degrees. Sweating does nothing to cool the body unless the water is removed by evaporation. High humidity retards this process. The combination of heat and humidity is measured as the heat index

Heat Index/Heat Disorders	
Heat Index	**Possible Heat Disorders (for people in higher risk groups)**
130º or higher	Heat stroke/sun stroke, highly likely with continued exposure
106º - 130º	Sun stroke/heat cramps or heat exhaustion likely, and heat stroke possible with prolonged exposure and/or physical activity
90 º -108º	Sun stroke, heat cramps and heat exhaustion possible with prolonged exposure and/or physical activity
80 º - 90º	Fatigue possible with prolonged exposure and/or physical activity

Heat waves kill more people in the United States than all other natural disasters combined (New York Times, August 13, 2002). The article goes on to state that a University of Delaware study indicated that 1,500 American city dwellers die each year because of heat compared with 200 from tornadoes, earthquakes and floods combined.

Overall safety hazard: High

Health: Young children, the elderly, those who are sick, overweight or have alcohol problems and men in general (because they sweat more and become more quickly dehydrated) are more susceptible to extreme heat. Usually the victims have been overexposed to heat or have over-exercised for their age and physical condition. Stagnant atmospheric (humid and muggy) conditions and poor air quality can induce heat-related illnesses.

Drought/Extreme Heat Vulnerability

	Property Damage	Economic Impact	Safety Hazard	Health Hazard
All communities	− 0 −	Mod	High	Mod

In addition to air quality, concrete and asphalt store heat longer and gradually release the heat at night which produces higher nighttime temperatures. Therefore, people living in urban areas may be at a greater risk than people in rural regions.

Overall health hazard: Moderate

3.11. Wildfire

Buildings: Given the nature of wildfires and the limits of fire fighting capabilities during a wildfire, a building that catches fire is considered destroyed. There would be no structures suffering partial damage. Because this hazard has been limited to the southeast part of the County, only Hopkins Park and the unincorporated areas are considered affected. Because most development in the urban-wildland interface is of single family homes, the primary type of structure exposed to wildfire damage is a single family home. As noted in section 2.8, it is expected that on the average each year two homes will be destroyed by wildfires. For this cost estimate, it is assumed that one single family home (and its contents) will be burned in Hopkins Park and one in the unincorporated areas on the average each year.

Buildings are generally destroyed by wildfires

FEMA

Economic impact: There has been little or no economic impact of wildfires to urban development. Local government expenses are limited to fire fighting, traffic control, and clean up. A federal disaster declaration is unlikely, so all costs are funded locally. During a mutual aid call in 2003, the Salina Township Fire District lost a brush truck fighting a fast moving wildfire. It cost the District $65,000 to replace, although 70% was covered by insurance (the contents were not insured, costing an additional $15,000).

Overall economic impact: low.

Safety: Wildfires in Kankakee County have not killed or injured anyone (so far), so the life safety threat is low. Fires are hazardous to residents and fire fighters, though.

Overall safety hazard: low.

Health: There is a health problem with smoke, but people can avoid that hazard.

Overall health hazard: low.

Wildfire Vulnerability

	Property Damage	Economic Impact	Safety Hazard	Health Hazard
Aroma Park	$0	Low	Low	Low
Bourbonnais	$0	Low	Low	Low
Bradley	$0	Low	Low	Low
Hopkins Park	$241,500	Low	Low	Low
Kankakee	$0	Low	Low	Low
Manteno	$0	Low	Low	Low
Momence	$0	Low	Low	Low
Sun River Terrace	$0	Low	Low	Low
Uninc. County	$241,500	Low	Low	Low
K. Com. College	$0	Low	Low	Low
Total	$483,000			

3.12. Summary Tables

The following tables are for the entire County, including all participating municipalities. Similar tables can be created for any individual community.

Buildings: There are over 40,000 buildings in the planning area subject to some level of damage from the eight natural hazards. In the table below, the damage figures for one occurrence (taken from the tables earlier in this chapter) are multiplied times the annual chance of an occurrence (taken from the "frequency" sections in Chapter 2). The result is the expected average annual damage.

The flood damage figures are for the 100-year flood for each community with a mapped floodplain. In fact, these communities are flooded more frequently than once every 100 years (frequency of 0.01). Severe floods have occurred on the average every 10 years. To account for more frequent flooding of areas smaller than the 100-year floodplain, a frequency of 0.033 is used in the table below.

Building Damage Summary

Hazard	Building Damage from Single Occurrence	Annual Chance	Average Annual Damage
Overbank flooding	$209,044,000	0.0330	$6,898,452
Local drainage	$2,535,900	1.0000	$2,535,900
Tornadoes	$347,557,000	0.0006	$208,534
Earthquakes	$7,599,000	0.0100	$75,900
Winter storms	$211,325	1.0000	$211,325
Thunderstorms	$2,113,250	1.0000	$2,113,250
Drought/Heat	$0	0.0670	$0
Wildfire	$483,000	1.0000	$483,000
Total			$10,413,111

Economic impact: The subjective measures for overall economic impact of "low," "moderate," and "high" were converted to numerical values of 10, 50 and 100. These are multiplied times the annual chance of occurrence to produce a number that represents the relative impact of that hazard on the City's businesses, transportation and tax base.

Overall Economic Impact

Hazard	Overall Impact		Frequency	Economic Score
Overbank flooding	Mod	50	0.0330	1.65
Local drainage	Low	10	1.0000	10.00
Tornadoes	High	100	0.0006	0.06
Earthquakes	Low	10	0.0100	0.10
Winter storms	Mod	50	1.0000	50.00
Thunderstorms	Low	10	1.0000	10.00
Drought/Heat	Mod	50	0.0670	3.35
Wildfire	Low	10	0.5000	5.00

Impact on safety and health: In the following table, the subjective measures for overall safety and health impacts of "low," "moderate," and "high" are converted to numerical values of 10, 50 and 100. These are multiplied times the annual chance of occurrence to produce a number that represents the relative impact of that hazard on people. The safety and health scores are added together to get a "combined score" the represents the impact of the hazard on people.

Overall Safety and Health Impact

Hazard	Safety				Health				Comb Score
	Impact		Freq.	Score	Impact		Freq.	Score	
Overbank flooding	Mod	50	0.0330	1.65	Mod	50.0	0.0330	1.65	3.30
Local drainage	Low	10	1.0000	10.00	Low	10.0	1.0000	10.00	20.00
Tornadoes	High	100	0.0006	0.06	Low	10.0	0.0006	0.01	0.07
Earthquakes	Mod	50	0.0100	0.50	Low	10.0	0.0100	0.10	0.60
Winter storms	Mod	50	1.0000	50.00	Mod	50.0	1.0000	50.00	100.00
Thunderstorms	Mod	50	1.0000	50.00	Low	10.0	1.0000	10.00	60.00
Drought/Heat	High	100	0.0670	6.70	Mod	50.0	0.0670	3.35	10.05
Wildfire	Low	10	0.5000	5.00	Low	10.0	0.5000	5.00	10.00

3.13. Conclusions

1. The natural hazard that causes the most property damage is overbank flooding. Local drainage and thunderstorms come in second. The expected average annual property damage from tornadoes, earthquakes, winter storms and drought/heat is relatively minor. Wildfires deserve attention in Pembroke and St. Anne townships.

2. Tornadoes cause the most economic disruption. However, on a regular basis, winter storms are more disruptive and cost local governments more than the other hazards.

3. Tornadoes and drought/heat kill more people, but from an overall safety and health concern, more attention should be given to winter storms and thunderstorms.

4. In most cases, the relative amount of property damage, economic disruption and safety and health threat is the same throughout the county. The exceptions are:

   - Overbank flooding affects the County, Kankakee City, Bradley and Bourbonnais the most. Affected to a lesser extent are Aroma Park, Manteno, Momence, and Sun River Terrace. The other municipalities have no mapped overbank flood hazard.
   - Repetitive flood losses (using the flood insurance definition) are almost all along the Kankakee River, in the unincorporated areas of the County.
   - Wildfires are a concern primarily for Hopkins Park and the unincorporated areas in the southeast corner of the County.

3.14 References

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