Hazard Vulnerability Assessment:
Kent County, DE - 1998

prepared for

Delaware Emergency Management Agency

by

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Introduction

Hazard vulnerability assessment is the process of identifying and valuing critical assets that may be impacted by natural and man-made events. In this process, it may be possible to mitigate the potential damages in one or more ways. Mitigation is not without costs but those costs must be balanced against the costs avoided, should the hazard become real. One only has to remember the devastation following Hurricane Andrew and wonder whether better building codes and the associated increases in housing construction costs would have been far less to pay.

From 1953 to 1997 there have been seven presidential approved disaster declarations in Delaware. A total of $30 million has been provided in aid. The disasters included one coastal storm, one severe storm, two floods, two snow/ice storms, and two droughts. Sussex County was included in all seven declarations, Kent County followed with five, and New Castle County was included in two declarations.

Hazard vulnerability assessment is itself an uncertain process. It is easy to count up the costs after the event has occurred, e.g. Hurricane Andrew. Prior to the event, the probability of a Category III or greater hurricane striking in that vicinity was about 1 in 9 (11 in the last 96 years). The probability of a storm the size of Andrew was even smaller. The calculus for the politicians who must pass and enforce stricter building codes is between the certainty of increased building costs and some probability of massive destruction.

For emergency management agencies, hazard vulnerability assessment and mitigation is the proactive side of a function that is largely reactive. If they have fewer people living in flood plains, then the management of a flood becomes less difficult. If the bridges on evacuation routes are intact, then the evacuation of affected populations is more manageable. In other words, a proactive emergency agency will be more effective reacting when the emergency occurs. Hopefully, the damage avoided will far outweigh the costs of the mitigation.

This report is a reference to how hazards and vulnerabilities interact in Kent County. It will cover five hazards and 14 potential vulnerabilities. The objective is first and foremost to

identify which critical assets are likely to be affected. Second, the potential population, employment, and property affected will be ascertained. Third, the probability of each hazard occurring will be addressed. Finally, where the information is sufficient, some measures of priority for mitigation will be addressed.

Following this overview, the report is structured in five sections, one for each hazard. Maps are provided in each section showing the affected vulnerabilities. Data describing the specific hazards and affected vulnerabilities are found in the Appendices and in machine-readable Excel spreadsheets organized by hazard.

Kent County

Kent County has a population of approximately 124,300 as of July 1, 1999. Nearly 25% of that population is found in Dover (30,000 pop) with a much larger part of the population spreading north and south of Dover around US13. In recent years, considerable growth has occurred to the west of Dover. Altogether, more than half of the population is concentrated in the center of the county around Dover. Kent County's population is the youngest of the state's three counties.

Approximately 53,500 jobs are found in Kent County with 2,500 people leaving the county each day for work elsewhere. In addition, there are 4,600 military personnel stationed at Dover Air Force Base. Since Dover is the capital of Delaware, a large proportion of the labor force works for the government. The annual economy is estimated to be in excess of $4.3 billion and the market value of property is approximately $6 billion excluding government owned property.

US 13 and to a lesser extent US113 dominate the transportation system in Kent County. Recently opened parts of DE 1 have succeeded in removing much of the through traffic from US13. Air service is available by charter, but there is no regular passenger service available to and from Kent County. There is some public transportation operating in the Dover area and limited service to points outside the county.

The health care system is supported by a single hospital, Kent General, which was recently acquired by Bay Health. That group also operates the Milford Memorial Hospital, which services part of Kent County as well. Both are category 2 hospitals.

The eastern part of the county (east of DE 1) is principally wetlands and much of the activity in it is regulated under Delaware's Coastal Zone Management legislation. The only port along this coast of any size, other than docks and ramps used for recreational fishing, is Port Mahon, which is used by Dover AFB for the delivery of fuel.

Police services are split between the Delaware State Police, the Capital Police, and a number of municipal police departments, the largest of which by far is the Dover Police. Local volunteer fire companies and the State Paramedics provide ambulance services. Volunteer fire departments provide all fire-fighting services.

Hazards

This report covers five hazards that have some probability of occurring in Kent County. They are floods, Category 3 hurricane slosh, dams, hazardous materials sites, and nuclear power plants. All share the common characteristics that there is a reasonably designed spatial component that can be used to identify potential vulnerabilities.

Two other hazards were considered but were discarded. According to historical record the last known earthquake felt in Kent County was March 25, 1879 at 7:30pm. According to the Delaware Geological Survey, there is no basis for spatially differentiating earthquake risk in Kent County. Similarly, there is one chance in 50 of sustained winds in excess of 100mph occurring in Kent County in a given year. This too is not spatially differentiable. All parts of the county are at equal risk. Tornado activity over the past 50 years is presented in Figure 1.1, below. Since mobile homes are particularly vulnerable to high winds wherever they are located, the spatial distribution of mobile homes in Kent County is provided in Figure 1.2 at the end of this section.

100-year Floods. This hazard is differentiated by the fact that it will broadly affect either large segments of the county's hydrography or at least particular basins. The primary problem with large-scale floods is fast moving water. This water can result in loss of life, destruction of property, pollution of the water supply, creation of health problems, and general environmental damage. Fires, loss of power, and loss of access to medical facilities can produce secondary impacts apart from water damage. Disruption of transportation systems can impact both employment and delivery of critical government services.

A number of 100-year floods have occurred in Kent County drainage basins this century.

Category 3 Hurricane Slosh. This hazard primarily affects coastal areas but broadly so since accompanying winds can force significant waters onshore independent of any flooding produced by rain. The primary problem with hurricane slosh is also fast moving water. This water can produce loss of life, destruction of property, pollution of the water supply, creation of health problems, and general environmental damage. Fires, loss of power, and loss of access to medical facilities can produce secondary impacts apart from water damage. Disruption of transportation systems can impact both employment and delivery of critical government services.

No Category 3 hurricane has hit Delaware in the last 100 years.

Dams. The primary result of a dam failure is fast moving water. The main impact is usually property destruction, injury and loss of life. Depending on the nature of the vulnerabilities in its path, there will likely be damage to power and communications system, disruption of transportation and other government services, environmental damage, and health problems associated with water pollution, sewage and waste disposal, and secondary unplanned chemical releases. The impact of these secondary failures will extend both upstream and downstream depending on the type of failure and alternate sources of services available for those affected.

There are 18 dams at risk in Kent County. The Lake Como dam in Smyrna produced the best-known dam failures in Kent County (1940,1960). There was no loss of life although US 13 was washed out in the earlier event.

Hazardous Materials. The primary result of an accident at a hazardous material site is usually a toxic release. This may be accompanied by fire and explosion which can aid and exacerbate the problem. There will be problems on the site and depending on the circumstance the toxic release may leave the boundaries of the property. In benign situations, the result may be nothing more than a bad odor in the air. In more serious situations, the site itself and even contiguous areas may have to be evacuated. Depending on the toxicity of the release, there may be health problems and even loss of life. If the site is next to a transportation facility, that facility may have to close until the situation is under control. There also may be water pollution if the release is of that type. Both the primary and secondary effects must be considered when assessing the hazard. The duration of the event is critical in determining its impact.

There have been 69 reported releases of toxic materials in Kent County from 1990 through 1998. Eighteen of these releases were to the air, 29 were water related, 14 were onto land, and the other eight were not classified. The end results were 29 people evacuated, one death, and one injury for all 69 events.

Nuclear Power Plants. Essentially, any release from one of the three nuclear power plants in the region, Salem, Peach Bottom or Calvert Cliff, would have the same effect as a release at a hazardous materials site with all the attendant problems. This may be accompanied by fire and explosion, which can aid and exacerbate the problem. There will be problems on the site and depending on the circumstance the toxic release will leave the boundaries of the property. The amount of radiation released and the prevailing winds will determine how much of Kent County is affected. In a major accident at Salem Nuclear Power Plant, with radiation traveling 50 miles, all of Kent County would be impacted. This could require a mass evacuation and a total disruption of the local economy for an undetermined period of time depending on the levels of radiation.

No nuclear power plant toxic release has affected Kent County since the plants were built. The only release of any kind in the region was during the worst accident in the nuclear power industry at Three Mile Island nuclear power plant in 1979. No deaths or serious injuries occurred. An event like Chernobyl in 1986 is several orders of magnitude more damaging.

Vulnerabilities

For convenience, the 14 potential vulnerabilities have been collapsed into eight functional groupings. Each of these groupings is examined in later chapters to determine which if any of its individual members will be impacted by a particular hazard.

Transportation. This category includes airports (10), bridges (273), and ports (18). The size of the airports (excluding Dover AFB) and ports in Kent County are such that they have limited impact on transportation or the economy in general. Port Mahon is the only port with any economic importance and it is used almost exclusively to bring in fuel to Dover AFB. All of the other ports are ramps used by recreational boaters and the occasional emergency/regulatory service.

Bridges are another story. There are 273 bridges in Kent County, nine are rail-over-water, 239 are road over water, and 25 are road-over-road. One hundred and one of the bridges are classified as being on an evacuation route. To varying degrees these bridges can affect the economy, and public safety particularly if they interfere with evacuation. The roadways themselves can be impassable even if the bridge is intact, however the time and cost to restore service when a roadway is lost may be considerably less than that for a bridge. However, the mere fact that a bridge or road fails, does not imply that there are no good alternatives.

Communications. This category includes sirens, dispatch centers, television and radio stations, newspapers, communication towers, and emergency operation centers. All of these facilities in some way impact the way information is disseminated during an emergency. Any loss reduces the warning time or information that could have a negative outcome for households and firms in Kent County. To some degree however they are substitutes for each other and the failure of any one may not be critical.

Employers and Government. This category includes major employers (57), those with more than 100 employees and government facilities (74). Government not only is the provider of essential public services but also is one of the major employers in Kent County. Disruption of major businesses will have significant effects on many other firms with which they do business. The loss of key government services during an emergency can exacerbate situations and affect public safety, transportation, and health. Most firms of any size have disaster recovery plans and many including key state government agencies have alternate locations. Small business is probably the most vulnerable to hazards of the type discussed here.

Education and Corrections. This category includes schools (103), colleges and universities (5), as well as correction facilities (1). This is important either because the facilities may have to be evacuated or, in the case of schools, they may also be needed as shelter. However, the vulnerability of these facilities will depend largely on the number of people that would have to be evacuated and access to the transportation system.

Fragile Populations. This category includes hospitals (1), nursing homes (8), and daycare centers (45). All could require evacuation in the case of an emergency and the only hospital in Kent County might be unable to provide services to the community. There are good

alternatives to Kent General Hospital although the transportation system must be intact to access them. Alternative housing for nursing home residents would be the most difficult to find.

Power Distribution. This category includes substations (5) and taps (6) by municipalities, industry, and REA into the power grid. These areas are sensitive since they would impact power delivery to significant areas of Kent County if they were inoperative. The knowledge of how the power companies would deal with this situation and what alternative connections were available would permit a more accurate assessment of the true vulnerability of these sites.

Emergency Services. This category includes police (10), fire (22), and ambulance services (3) in Kent County. These agencies not only play a major role during emergencies, they have an ongoing daily role that could be hampered if they lost their primary facility. However, all three services are mobile and have on board communications so they can relocate. If they are isolated and/or their equipment is destroyed, then they are clearly less effective.

Other Services. This last category is a catchall and includes landfills (1), weather stations (10), sewage treatment plants (10), and hotels/motels (12). Landfills and sewage treatment plants that are no longer operating can be a significant health hazard and also provide critical services to the Kent County community. Hotels and motels are a concern both as potential sites requiring evacuation and also as potential shelters for evacuees.

Setting Priorities

One of the single most vexing problems in hazard mitigation is deciding where and how to mitigate the potential damage to the selected vulnerabilities and to the population and economy in general. The reason this process is so difficult is that it is both complex and layered with uncertainty. On top of that, the mitigation strategies that could be applied may differ by hazard and those hazards themselves have different frequencies and damage functions.

Selecting vulnerabilities for mitigation priority assumes that a lot of information is known. Consider a simple four step process for assigning priorities among competing vulnerabilities:

1. Identify the vulnerabilities that are affected by the hazard. In the hazards discussed in this report, that process is done spatially. While that is the most precise measurement possible, it is not without error.

2. Once vulnerabilities of the same type for a given hazard have been identified, each must be examined to determine if in fact it is vulnerable. For example, a bridge may well be subject to a 100-year flood, but its design characteristics may have taken that into account. In other words, it is not vulnerable to that hazard and should be removed from the list and the bridge database should be updated to reflect that. Also determine if there are changes that will affect the vulnerability's status. DELDOT's ongoing bridge inspection and maintenance process is a good example of that.

3. Once the vulnerabilities have "certified" in 2 above, the question is what priority should be assigned. Other things equal, one needs some idea of the value of the vulnerability. This might be a simple concept like the fact that a bridge is on or off an evacuation route. It also might depend on the number of vehicles that use the bridge in a given period. That will also be affected by alternatives to using that particular bridge if it was closed. The likely duration of the situation also comes into play here.

4. When all vulnerabilities have been assigned a computed value, these must be adjusted for the frequency of occurrence. Assume two bridges are of "equal value", but one is subject to a hazard that will occur once in 50 years and the other to a hazard that will occur once in 100-years. The expected value of the first vulnerability is twice that of the second.

The typical method used in hazard assessment for assigning priorities ignores most of these issues. Step one is essentially the same. Step 2 is ignored. Step 3 consists of determining if the vulnerability does or does not affect several broad categories, e.g. lifelines or the economy, without reference to "how much". Step 4 is to add up the number of hazards affecting the vulnerability (without reference to probability of occurrence or damage) and add that total to the count in Step 3.

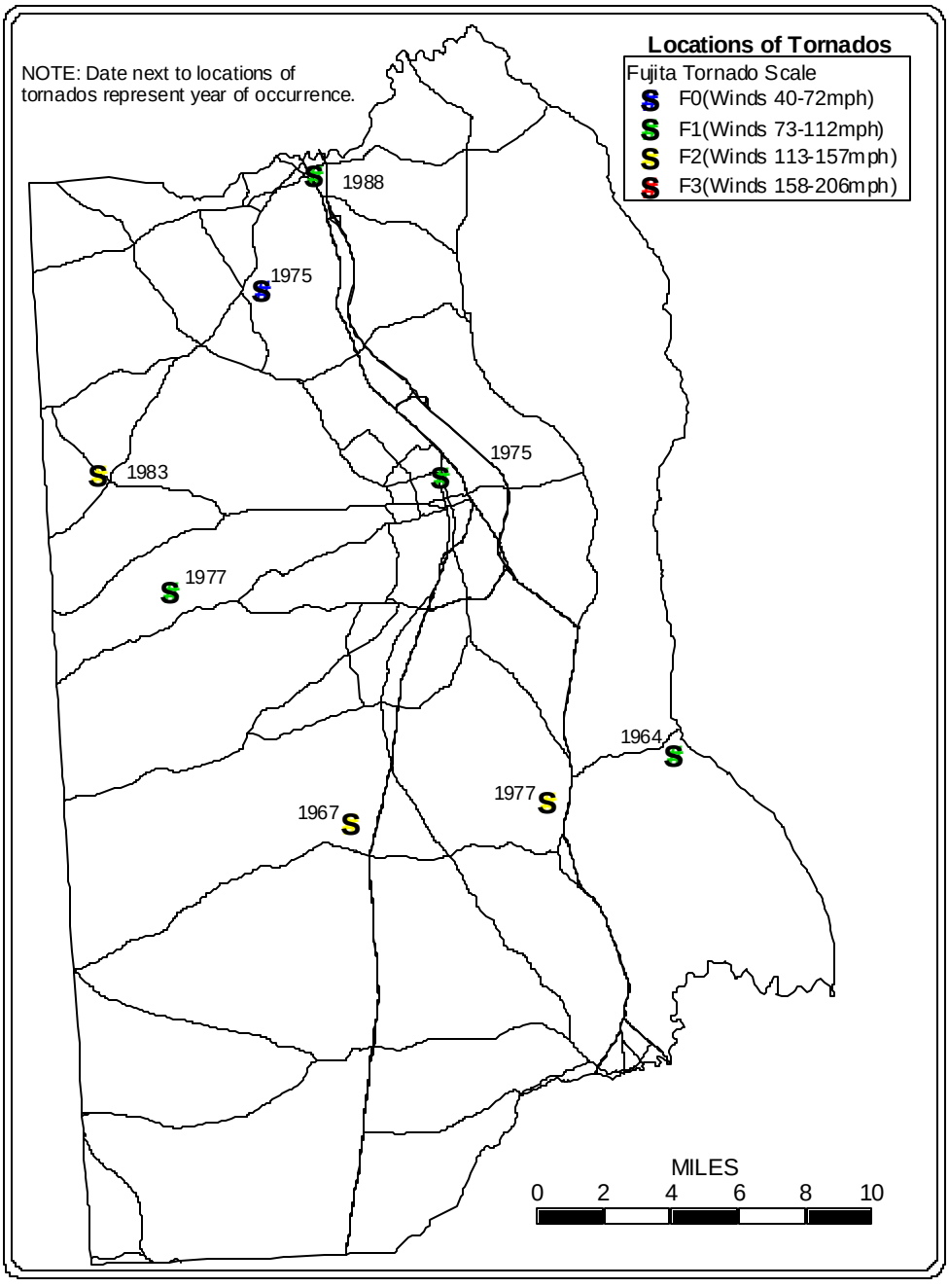
There are a couple of other issues that also further complicate this problem. In some cases, mitigation may operate best on the hazard and not on the vulnerability. This is particularly true for dams, hazardous material sites, and nuclear power plants. The best outcome is avoidance of the problem. This means regulation, inspection, working with responsible parties to understand the risk, and collecting/sharing as much information about the hazard as possible. In the case of floods, hurricanes, and other natural phenomenon it as yet is not possible to greatly influence their occurrence or to steer them away from vulnerable areas. There is no choice but to either prevent or reduce the value of the vulnerabilities by relocation and/or zoning and land-use restrictions; or to reduce the impact of the hazard on them and requirements for having flood insurance. In either case good evacuation plans, routes, and shelters become the fallback position and the only choice in some cases to reduce loss of life.

The other issue is the way a hazard affects the vulnerability. Floods, hurricanes, and dam failures all have the possibility of doing physical damage to the structure. This suggests that the duration of the failure is still another consideration. Release of toxic materials usually does not imply damages to the physical component of a vulnerability and in most cases those situations are of short duration. Of course, the other end of the spectrum is a major catastrophe at Salem that would render Kent County uninhabitable though the facilities were still standing. Hopefully, the probability of that event is so small that the expected value of the damage is essentially zero.

All of these calculations require substantial information. Some of that information is available and is accurate. Other information is collected but it is not in a form that can be brought to bear on this problem. In the balance of this report, people, jobs, and property values will be used as replacements for the categories used in earlier analyses. In addition, some assessment of the frequency of these events will be presented whenever possible. In some respects, the identification of holes in the data sets may be as valuable an outcome as any in impacting hazard assessment in Delaware in the future.

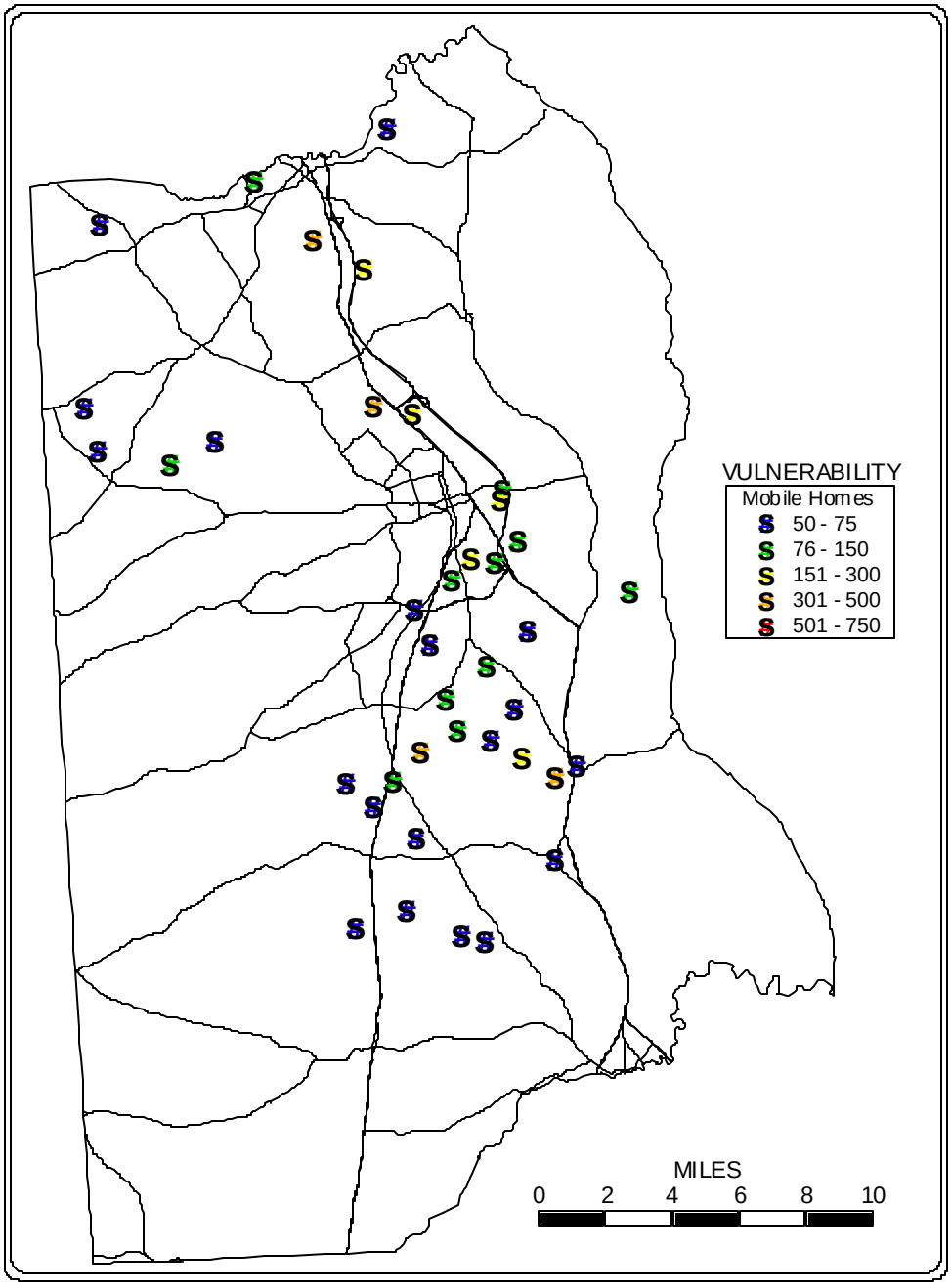
There is detailed information available that will help establish priorities for mitigation. It is found on the CDROM that was produced with this report. In addition a complete listing of the vulnerabilities for each hazard is found in a separate appendix at the conclusion of the report. This information is arranged spatially using the ADC map grid location.

Figure 1.1
Tornado Activity in Kent County:
1950-1998



Source: Center for Applied Demography & Survey Research, University of Delaware.

Figure 1.2
Spatial Distribution of Mobile Homes in Kent County:
September, 1999



Source: Center for Applied Demography & Survey Research, University of Delaware.

100-year Floods

Background

Floods of this magnitude in Delaware are relatively infrequent as is indicated by the name. These floods are usually of relatively short duration and of low intensity at least in contrast with water flows that might result from a dam failure. Since floods of this magnitude build over time, they are not usually predictable in advance. They also can occur anytime of the year. Hence, it is not unusual to see people trapped by the rising water.

The damage caused by floods is largely a function of what is in the flood plain. Because of the risk and restrictions brought about by zoning, the level of damage is usually low to moderate. Beyond these restrictions there is probably a limited amount one can do to mitigate the effects of a flood.

The primary result of any flood is fast moving water. The main impact is usually property destruction, injury and loss of life. Depending on the nature of the vulnerabilities in the flood plain, there will likely be damage to power and communications system, disruption of transportation and other government services, environmental damage, and health problems associated with water pollution, sewage and waste disposal, and secondary unplanned chemical releases.

The source of the 100-year flood information for Delaware is the FEMA flood insurance database and associated overlays.

Kent County Floods

There are three drainage basins in Kent County for which stream gauge measurements are available for at least some period of time. These are the Broadkill-Smyrna, Nanticoke, and the Choptank. There was at least a 500-year flood recorded in the Broadkill-Smyrna drainage basin on 8/4/1967. It is also classified as a 100-year flood. In the Choptank drainage basin that same flood on 8/4/1967 was classified as only a 100-year flood. The largest flood recorded in the

Nanticoke drainage basin was a 25-year flood on 7/13/1975. There are no stream gauges currently active in the Choptank drainage basin.

Taken together the 100-year flood could impact 14,700 people and 5,500 jobs. The current market value of residential property in the flood plain is $487 million dollars and the total value of commercial, industrial, and utility property is approximately $338 million dollars. These estimates do not include the value of state owned property that is not subject to the property tax and there are significant properties of that type in the impacted areas. An estimated $165,000,000 in annual wages and $236,000,000 in annual revenues is at risk. These are upper bound estimates since the exact area of the flood is approximate and the location of the employment is an estimate. Essentially, about 12% of the population, 10% of the employment and 14% of the property value in the county is at risk from this hazard. While these numbers are large, the data on floods show that the impact can be regional within the county.

Estimating potential economic losses due to flood is hazardous at best. For example, at least some of the employment affected is government. It is unlikely that those people would be terminated in the case of a disaster. In other situations, where there are significant labor contracts (the automobile industry for one), 95% of wages may be paid for as long as a year even though the workplace is closed. Finally, in most cases the duration of the impact would be less than a year and companies routinely have disaster recovery plans that would relocate employees to alternative sites.

Vulnerabilities

In the eight maps that follow, each of the 14 vulnerabilities identified as being within the 100-year flood plain are displayed. Any vulnerability that lies within the area of risk is coded yellow independent of its type. In some cases, the actual number of yellow symbols on the map may not agree with the list of affected vulnerabilities in the associated appendix table. This will happen when two vulnerabilities of the same type are co-located and thus have the same latitude and longitude and the same symbol.

The maps show three sub-areas of the 100-year flood plain. The dark blue area, coded as VE, represents the area affected by high velocity flooding. The second sub-area is coded AE and

is colored in a lighter blue. It represents areas where flood elevations have been precisely measured. The third area is coded A and is colored the lightest blue. It is the most extensive but flood elevations have not as yet been precisely determined.

Transportation. None of the airports is located in the 100-year flood plain but 14 of the 18 ports are at risk. There are 184 bridges that fall in the inundation area. Of those 54 are located on evacuation routes. Once again, some of those are currently designed to deal with a 100-year flood. However, those design characteristics are not available in DELDOT's database.

Communications. KENTCOM's communications tower is listed as being sited just off the St. Jones River south of Dover and thus is in the 100-year flood plain. If the tower is not actually in that location or has been certified free of the hazard, the database should be updated to reflect that fact. The database is unclear as to whether this planned site was actually built. All three sirens used to warn people in the event of a nuclear accident are in the 100-year flood plain.

Employers and Government. Peninsula Oil Co. of Milford is both a hazardous materials site and also is in the 100-year flood plain. Since some of the secondary effects of flooding are fire, explosion, and contamination, this major employer could be a major problem. It also suggests that there may need to be an examination of hazard-to-hazard relationships.

Two state agencies were also listed as being within the inundation area namely, the Department of Education and the State Personnel Office. This qualification as a major employer and the lack of the appearance of the Townsend Building on the list of government buildings in the 100-year flood plain shows some inconsistency in the databases that needs to be addressed. The collection of databases from different sources within the state government with different levels of accuracy can lead to some inaccuracies. The difference of 100 yards can make the difference from being inside to outside the flood plain.

Seven government facilities are in the 100-year flood plain area including the town halls of Little Creek and Bowers Beach. The post offices in both Cheswold and Little Creek are also at risk. The Family Court building is another major facility that is in the flood plain.

Education and Corrections. Only two of the 103 schools in Kent County are in the 100-year flood plain.

Fragile Populations. None of the nursing homes nor Kent General Hospital was at risk of flooding. However, one daycare center with 47 seats is at risk.

Power Distribution. None of the 11 power-related facilities is in the 100-year flood plain.

Emergency Services. Fire departments in Leipsic and Bowers Beach are inside the 100-year flood plain as is the Milford Police department.

Other Services. Two sewage treatment facilities including the one operated by Playtex, and another operated by Harrington are at risk. The weather station at the Esturine Research Reserve is in the 100-year flood plain.

Next Steps

Several issues are suggested by these data:

1. Both the latitude and longitude of all government buildings need to be accurately measured.

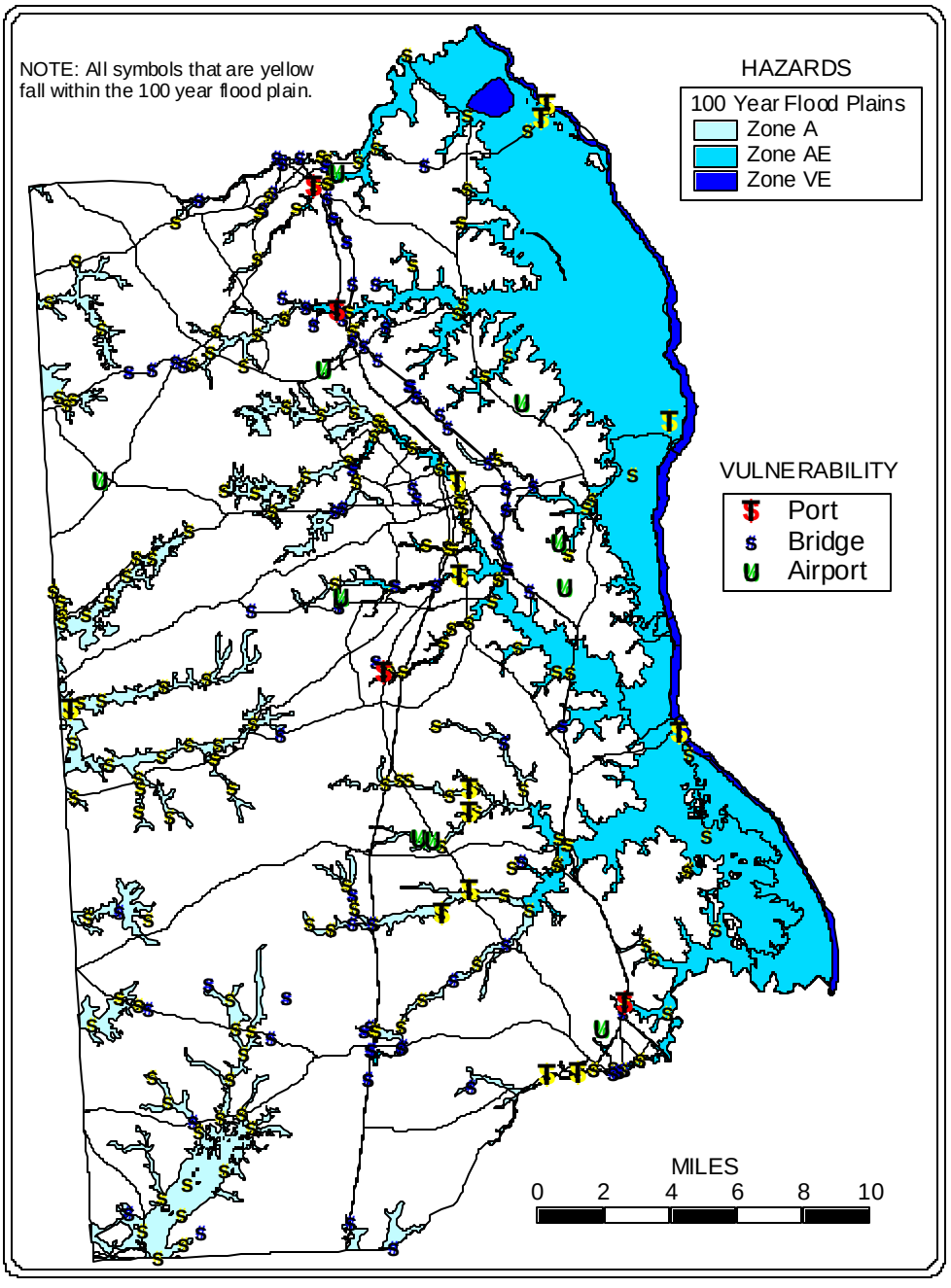
2. Actual employment of both the government sites and the private sector employers should be added to the database and updated periodically.

3. There needs to be an analysis of hazard-to-hazard intersections to determine if one hazard could increase the risk of another.

4. Capacity of each of the schools needs to be added to the database along with the employment at each school. This will further help in evaluating the risk.

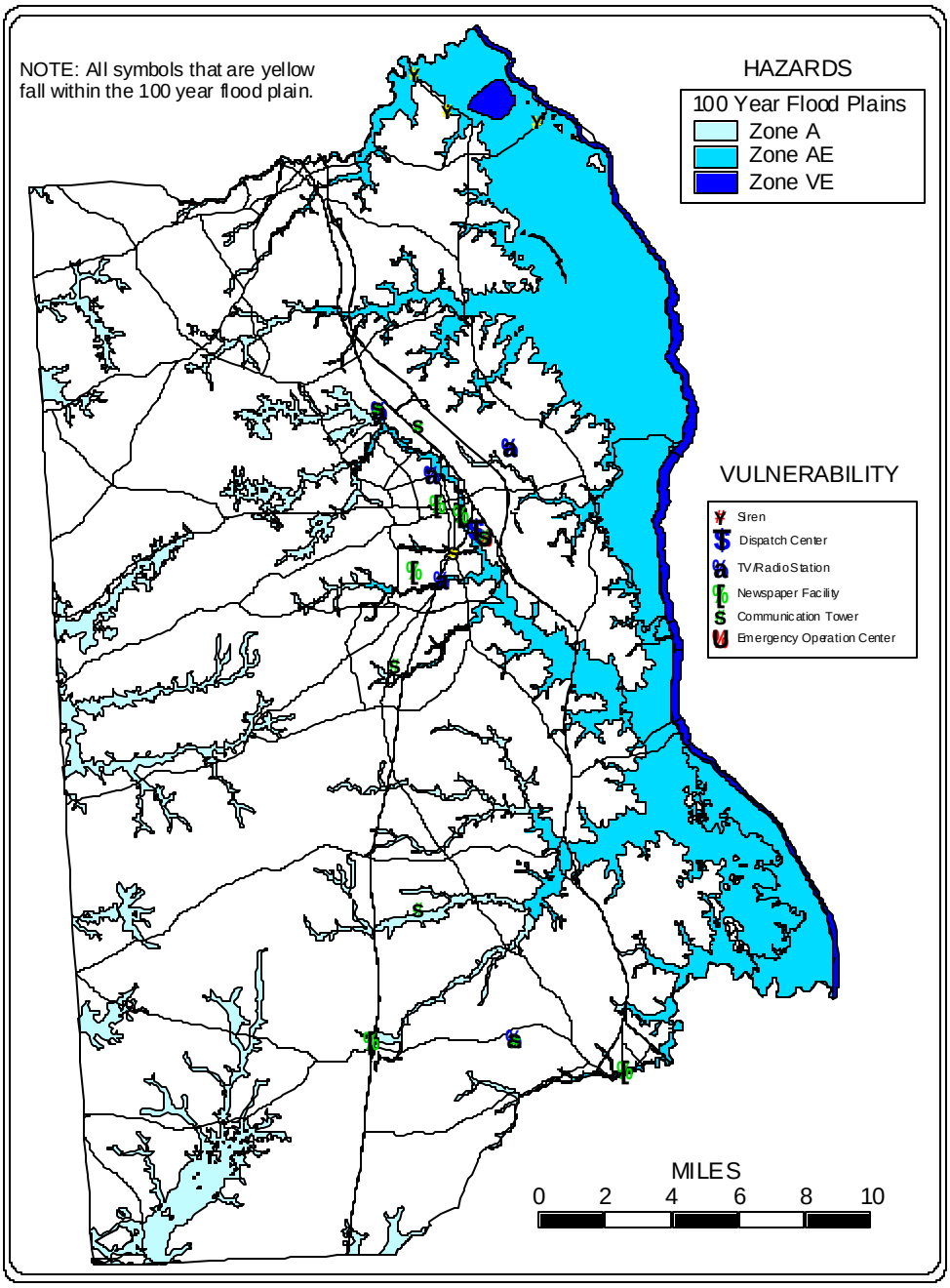
5. Design characteristics relative to bridges needs to be in the database. In particular, height above the water and the roadway.

Figure 2.1
Selected Vulnerabilities within the 100-year Flood Plain:
Transportation



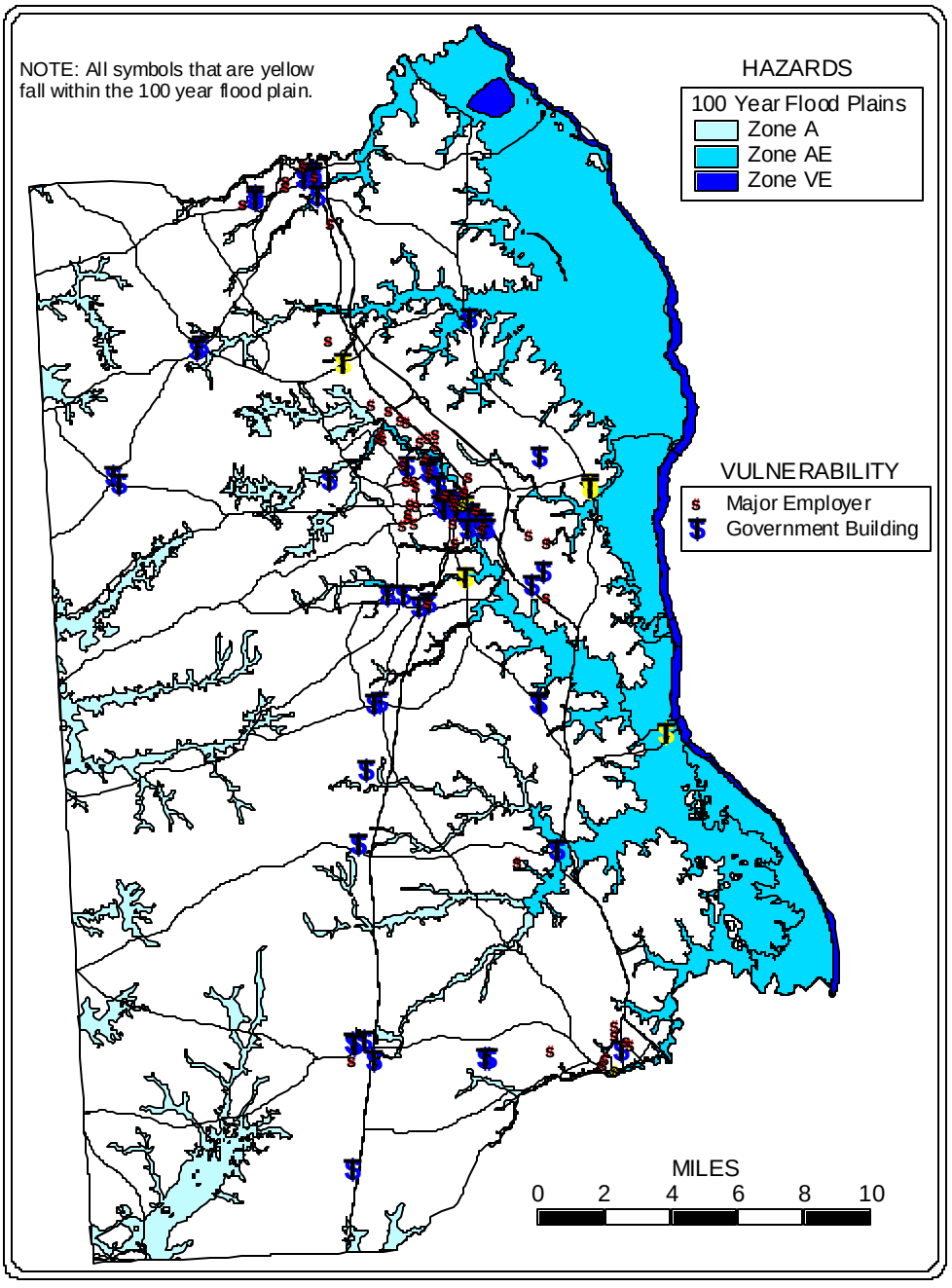
Source: Center for Applied Demography & Survey Research, University of Delaware.

Figure 2.2
Selected Vulnerabilities within the 100-year Flood Plain:
Communications



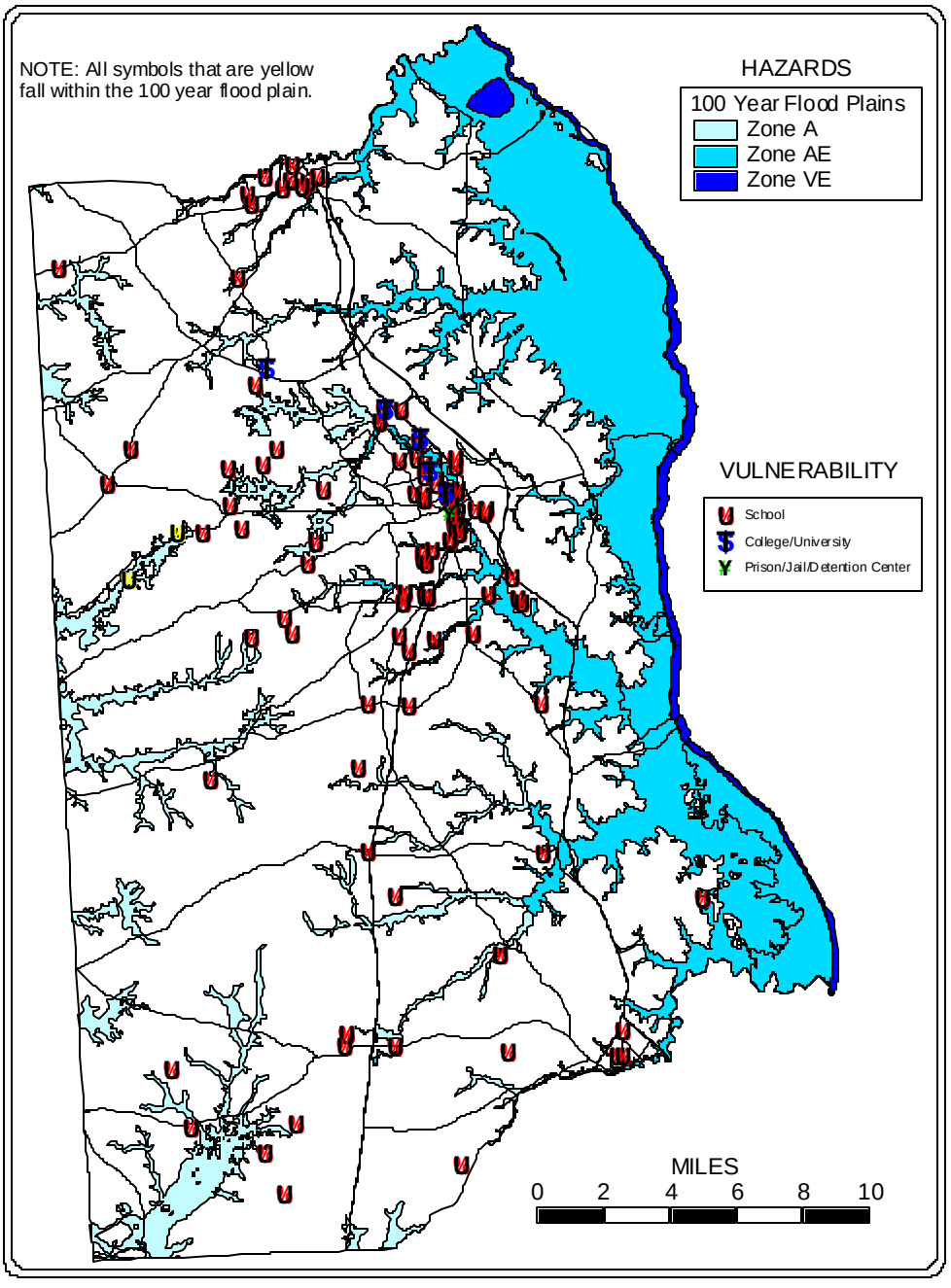
Source: Center for Applied Demography & Survey Research, University of Delaware.

Figure 2.3
Selected Vulnerabilities within the 100-year Flood Plain:
Employers and Government



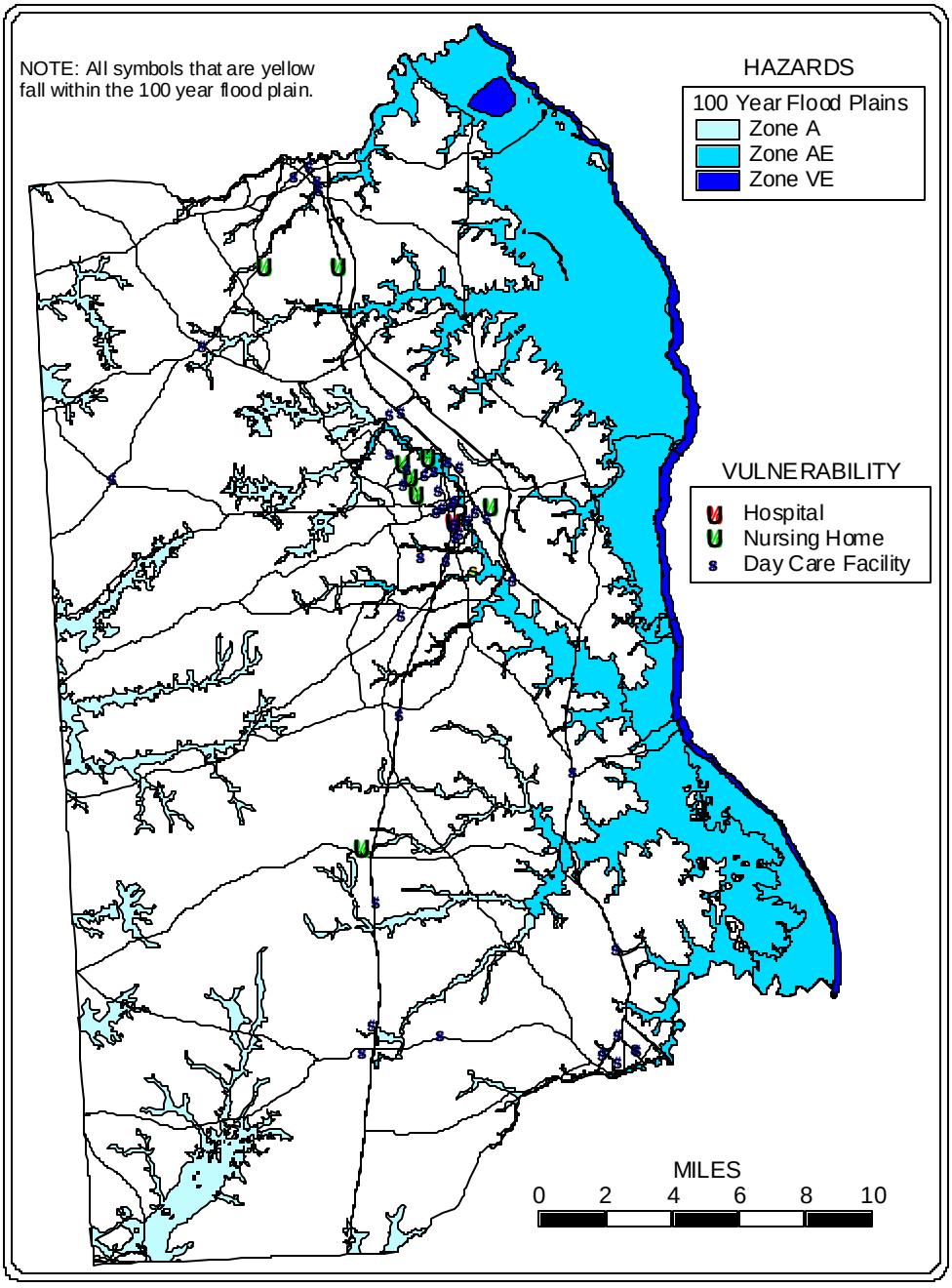
Source: Center for Applied Demography & Survey Research, University of Delaware.

Figure 2.4
Selected Vulnerabilities within the 100-year Flood Plain:
Education and Corrections



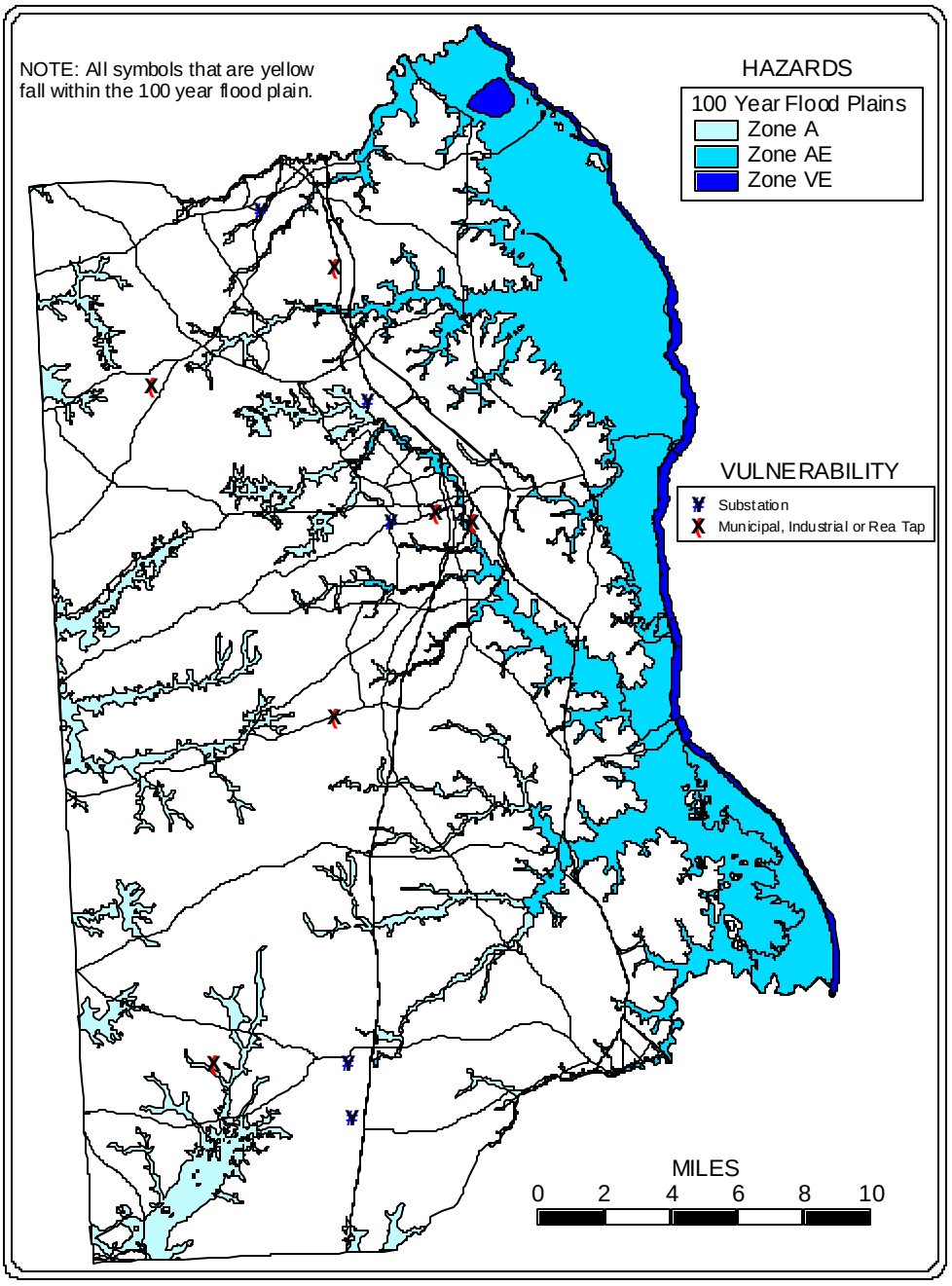
Source: Center for Applied Demography & Survey Research, University of Delaware.

Figure 2.5
Selected Vulnerabilities within the 100-year Flood Plain:
Fragile Populations



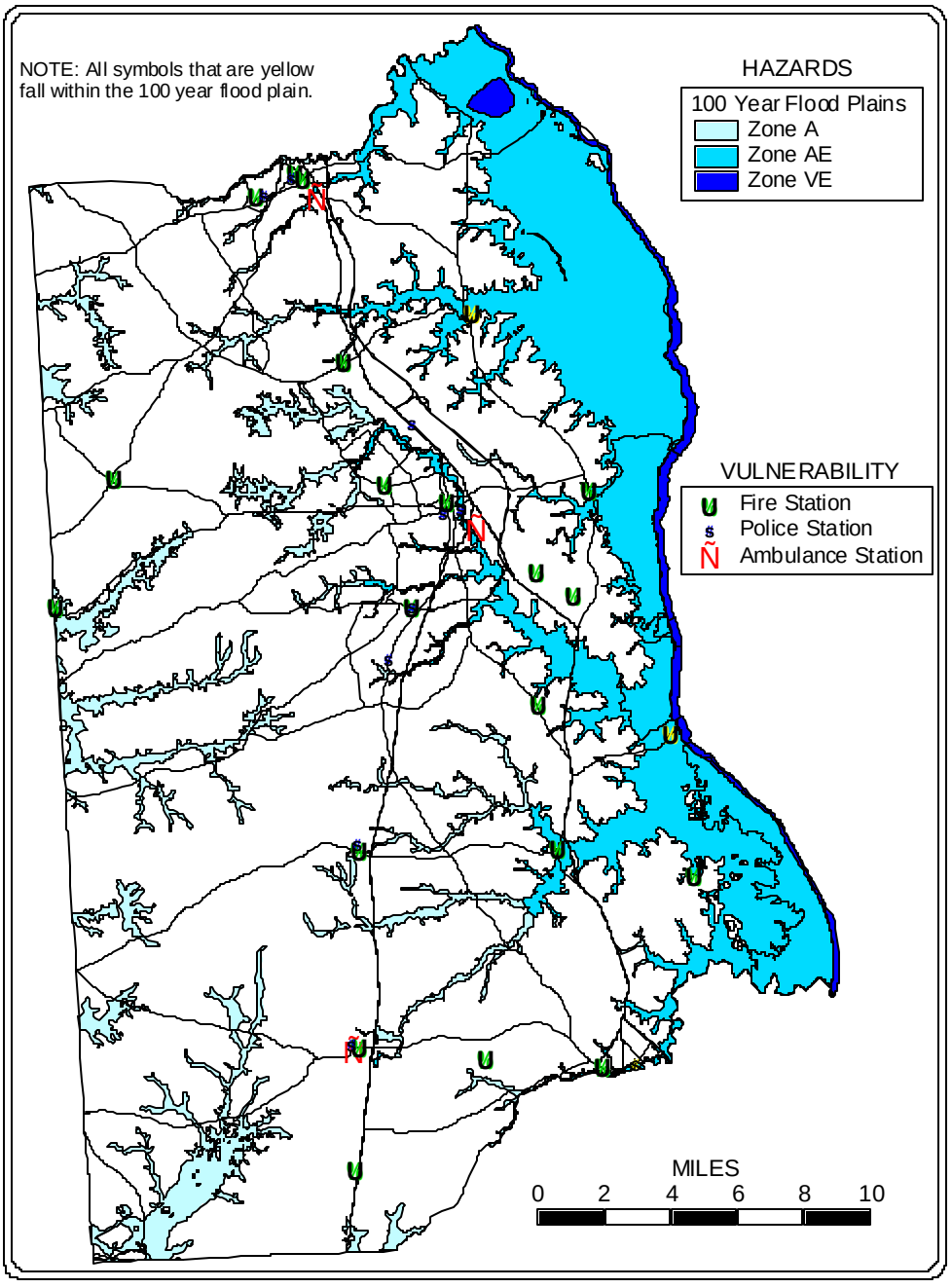
Source: Center for Applied Demography & Survey Research, University of Delaware.

Figure 2.6
Selected Vulnerabilities within the 100-year Flood Plain:
Power Distribution



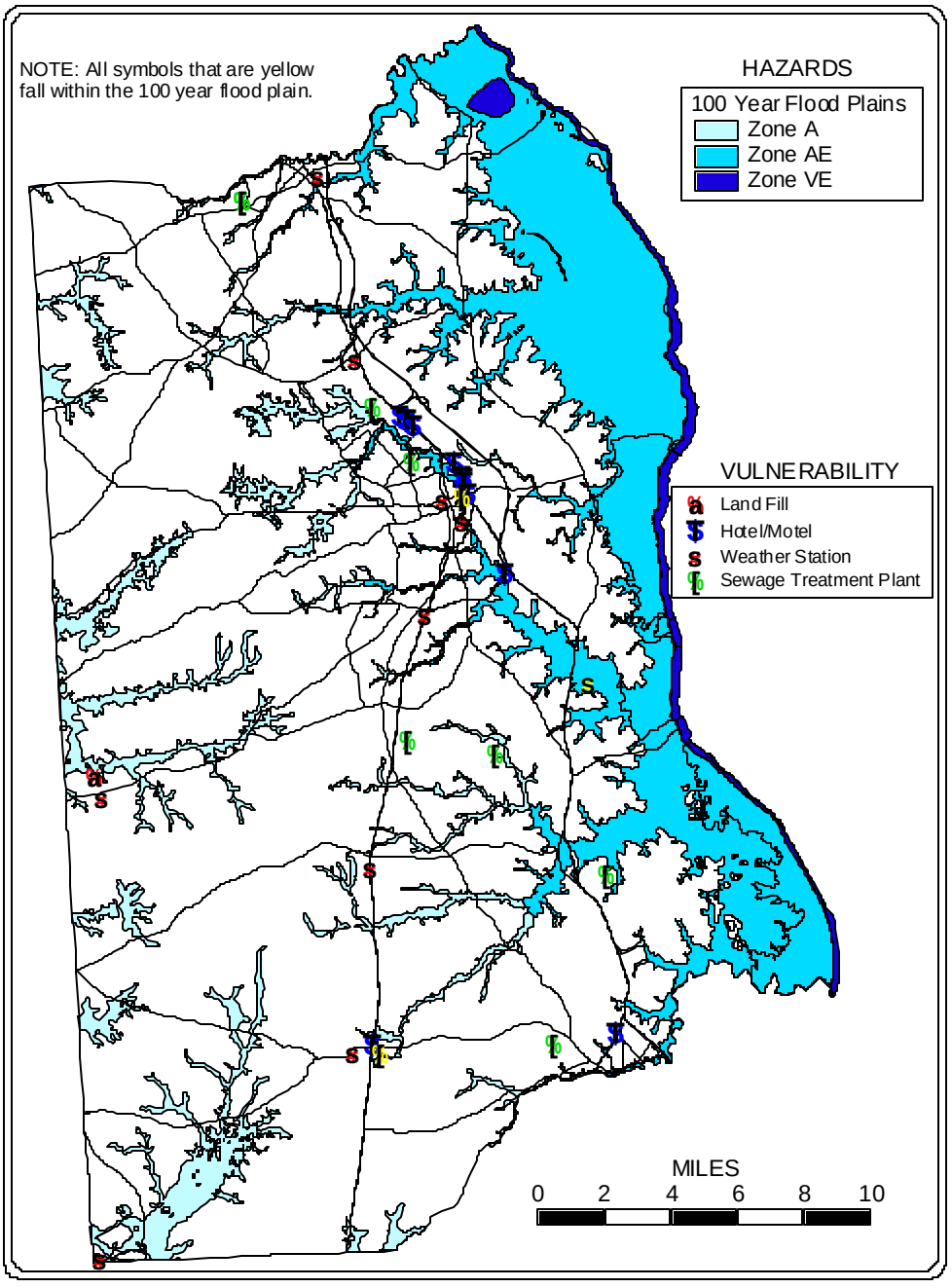
Source: Center for Applied Demography & Survey Research, University of Delaware.

Figure 2.7
Selected Vulnerabilities within the 100-year Flood Plain:
Emergency Services



Source: Center for Applied Demography & Survey Research, University of Delaware.

Figure 2.8
Selected Vulnerabilities within the 100-year Flood Plain:
Other



Source: Center for Applied Demography & Survey Research, University of Delaware.

Category 3 Hurricane Inundation Area

Background

A Category 3 hurricane has not occurred in Delaware during this century. Thus, they are clearly of very low frequency. If such an event were to occur the intensity would be high and the recovery times would be extensive. The flooding caused by a Category 3 hurricane would be extensive but it would be largely confined to the coastal area as opposed to more generally across the county, which is in direct contrast to the 100-year flood. Hurricanes occur for the most part during the summer and fall, which means the period of risk is shorter than that for floods in general.

The damage caused by a Category 3 hurricane slosh is largely a function of the strength of the storm surge (putting aside the direct affect of wind). Because of the velocity of this surge, the damage can be extensive. In contrast with mitigation used for more general flooding and flood plain management, the effectiveness of mitigation strategies such as restrictive zoning is even more limited. The beach communities are always going to be at risk and the people who live there will continue to take those risks.

The primary result of flooding associated with a hurricane is fast moving water. The main impact is usually property destruction, injury and loss of life. Depending on the nature of the vulnerabilities in the flood plain, there will likely be damage to power and communications system, disruption of transportation and other government services, environmental damage, and health problems associated with water pollution, sewage and waste disposal, and secondary unplanned chemical releases.

The source of hurricane inundation information for Delaware is the US Corps of Engineers database and associated overlays.

Kent County Hurricanes

In contrast to the 100-year flood, the primary inundation area that could be affected is along the Kent County coastline. However, the penetration of the storm surge from the coastline is much deeper than would be expected by the 100-year flood. Since there has never been a Category 3 hurricane affect Kent County, these results are somewhat tenuous. Further, just as 100-year floods are usually regional within the county, it would be reasonable to expect differential depths of penetration along the coastline.

Taken together the Category 3 hurricane slosh could impact 17,000 people and 8,500 jobs. The current market value of residential property in the inundation area is $483,000,000 and the total value of commercial, industrial, and utility property is approximately $252,000,000. These estimates do not include the value of state owned property that is not subject to the property tax and there are significant properties of that type in the impacted areas. An estimated $255,000,000 in annual wages and $364,000,000 in annual revenues is at risk. These are upper bound estimates since the exact area of the inundation is approximate and the location of the employment is an estimate. Essentially, about 14% of the population, 16% of the employment and 14% of the property value in the county is at risk from this hazard.

Estimating potential economic losses due to hurricane slosh is hazardous at best. For example, at least some of the employment affected is government. It is unlikely that those people would be terminated in the case of a disaster. In other situations, where there are significant labor contracts (the automobile industry for one), 95% of wages may be paid for as long as a year even though the workplace is closed. Finally, in most cases the duration of the impact would be less than a year and companies routinely have disaster recovery plans that would relocate employees to alternative sites.

Vulnerabilities

In the eight maps that follow, each of the 14 vulnerabilities identified as being within the hurricane inundation area are displayed. Any vulnerability that lies within the area of risk is coded yellow independent of its type. In some cases, the actual number of yellow symbols on the map may not agree with the list of affected vulnerabilities in the associated appendix table. This will

happen when two vulnerabilities of the same type are co-located and thus have the same latitude and longitude and the same symbol.

The map provides information for three categories of hurricane that could conceivably affect Kent County. The Category 1 hurricane would affect the least area but presumably would be the most likely. It is coded in dark blue. The Category 2 hurricane inundation area includes both the dark-blue area and the area coded in a middle-blue. Finally, the Category 3 inundation area includes the entire area colored in any of the shades of blue.

Transportation. The Smyrna airport, which is located east of town, is within the inundation area along with 12 of the 18 ports. There are 74 bridges that fall in the inundation area. Of those 33 are located on evacuation routes. Once again, some of those are currently designed to deal with a Category 3 hurricane. However, those design characteristics are not available in DELDOT's database.

Communications. KENTCOM's communications tower is listed as being sited just off the St. Jones River south of Dover and thus is in the inundation area. The Kent County 911 center is also listed as being in the inundation area. If neither the tower nor the 911 center are actually in that location or have been certified free of the hazard, the database should reflect that. The database is unclear as to whether this planned site was actually built. One of the five newspaper facilities is in the inundation area. All three sirens used to warn people in the event of a nuclear accident are in the inundation area. This could conceivably be a problem if a radiation release occurred as a result of a Category 3 hurricane. Presumably these sites have already been mitigated for both floods and hurricane slosh and should have a field in the vulnerability database that reflects that.

Employers and Government. Dover AFB and Peninsula Oil Co. of Milford, both of which are hazardous materials sites, are also in the inundation area. Since some of the secondary effects of flooding are fire, explosion, and contamination these major employers could be a major problem. It also suggests that there may need to be an examination of hazard-to-hazard relationships.

Two state agencies were also listed as being within the inundation area namely, the Department of Education and the State Personnel Office. This qualification as a major employer

and the lack of the appearance of the Townsend Building on the list of government buildings in the inundation shows some inconsistency in the databases that needs to be addressed. The collection of databases from different sources within the state government with different levels of accuracy can lead to some inaccuracies. The difference of 100 yards can make the difference from being inside to outside the inundation area.

Nine government facilities are in the inundation area including the town halls of Leipsic, Little Creek, Bowers Beach, and Frederica. Their post offices were also at risk.

Education and Corrections. Six of the 103 schools in Kent County are in the inundation area along with one correctional facility.

Fragile Populations. None of the nursing homes or Kent General Hospital was at risk of inundation. However, two daycare centers with a capacity of 148 children are inside the inundation area. Both are on the St. Jones River.

Power Distribution. Of the 11 power-related facilities, only the Dover tap to the electrical grid is in a potentially risky area.

Emergency Services. Fire departments located in Leipsic, Little Creek, Bowers Beach, South Bowers, and Frederica are well-inside the inundation area should a Category 3 hurricane strike. If the St. Jones River overflows its banks, the Kent County paramedics, and the Milford Police Department will join them.

Other Services. Three sewage treatment facilities including the one operated by Playtex, one at Southwood Acres, and a third operated by Kent County southeast of Frederica are all in the inundation area. One hotel is in the risk area, the Best Western Galaxy off DE 10. Finally, weather stations in Blackbird Forest and the Esturine Research Reserve are at risk.

Next Steps

Several issues are suggested by these data:

1. Both the latitude and longitude of all government buildings need to be accurately measured.

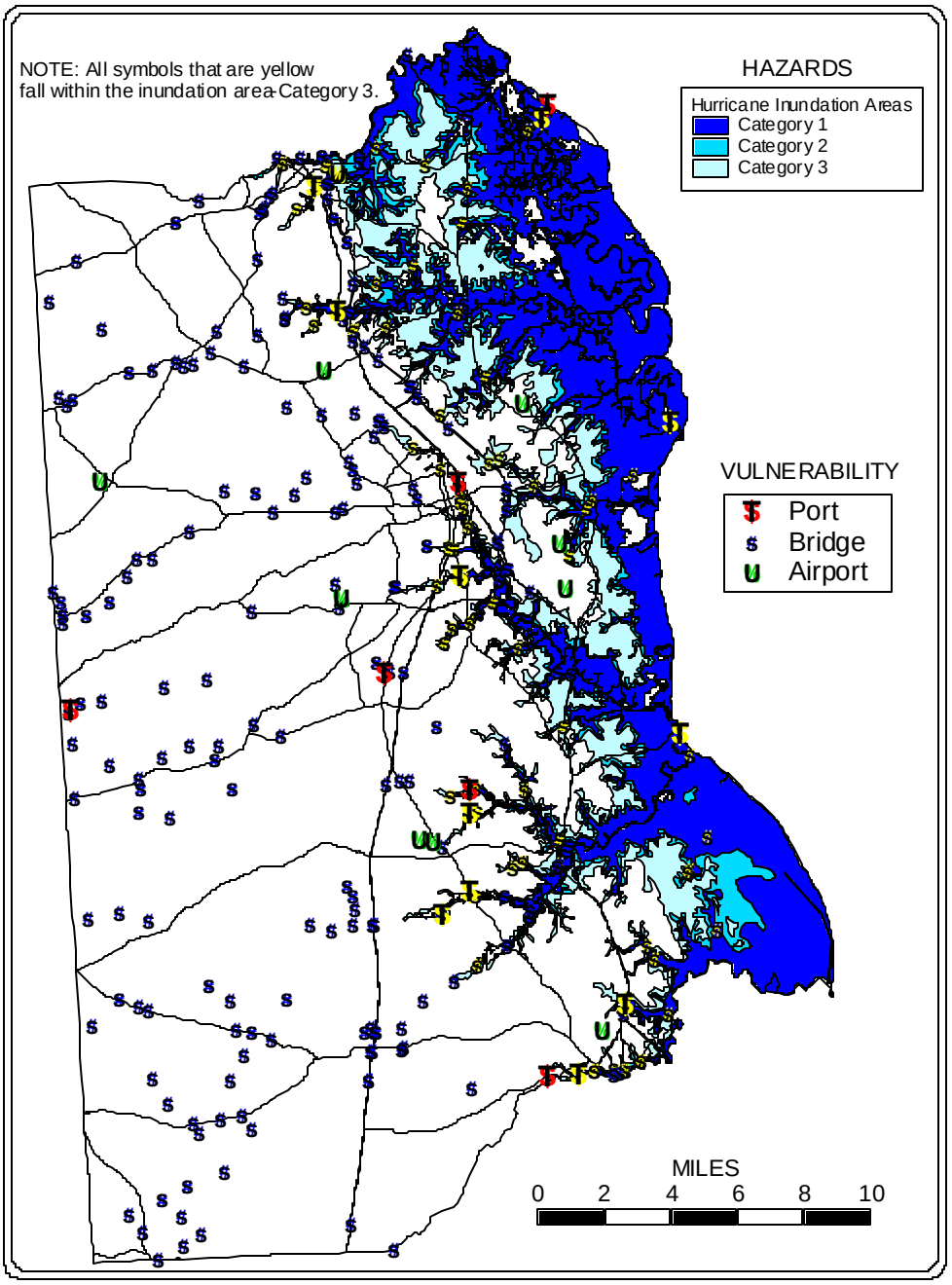
2. Actual employment of both the government sites and the private sector employers should be added to the database and updated periodically.

3. There needs to be an analysis of hazard-to-hazard intersections to determine if one hazard could increase the risk of another.

4. Capacity of each of the schools needs to be added to the database along with the employment at each school. This will further help in evaluating the risk.

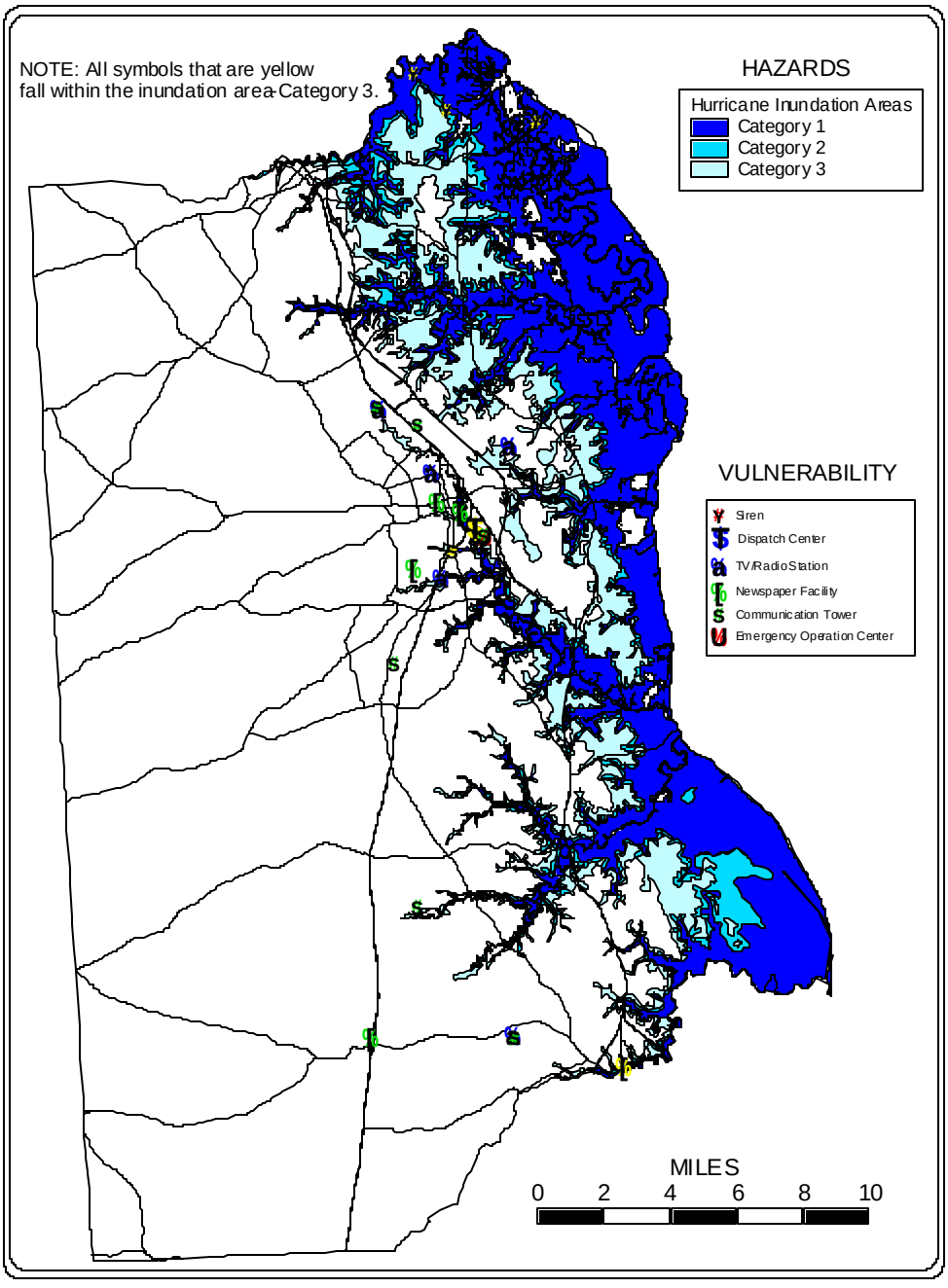
5. Design characteristics relative to bridges needs to be in the database, in particular, height above the water and the roadway.

Figure 3.1
Selected Vulnerabilities within the Category 3-Hurricane Inundation Area: Transportation



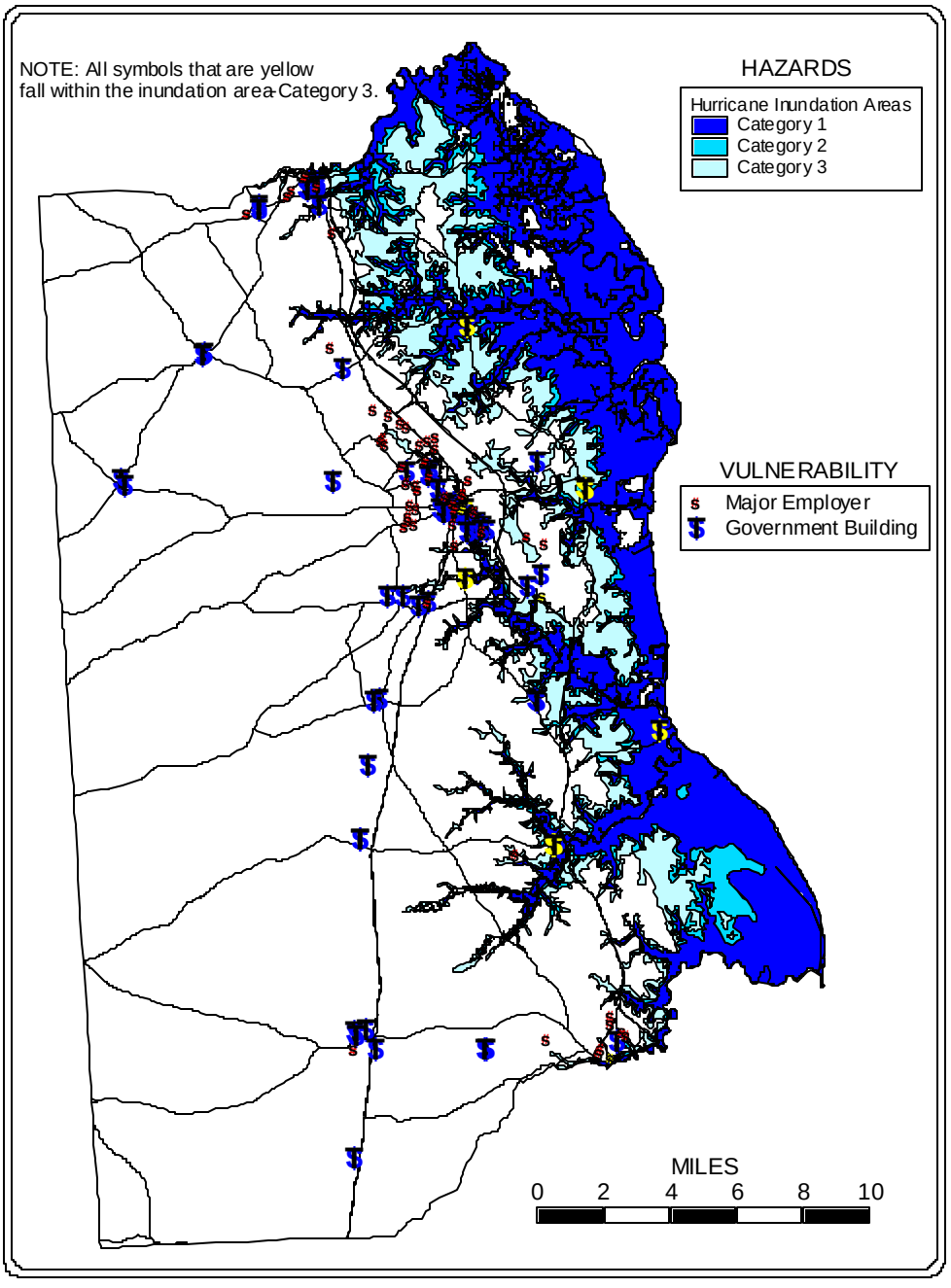
Source: Center for Applied Demography & Survey Research, University of Delaware.

Figure 3.2
Selected Vulnerabilities within the Category 3-Hurricane Inundation Area: Communications



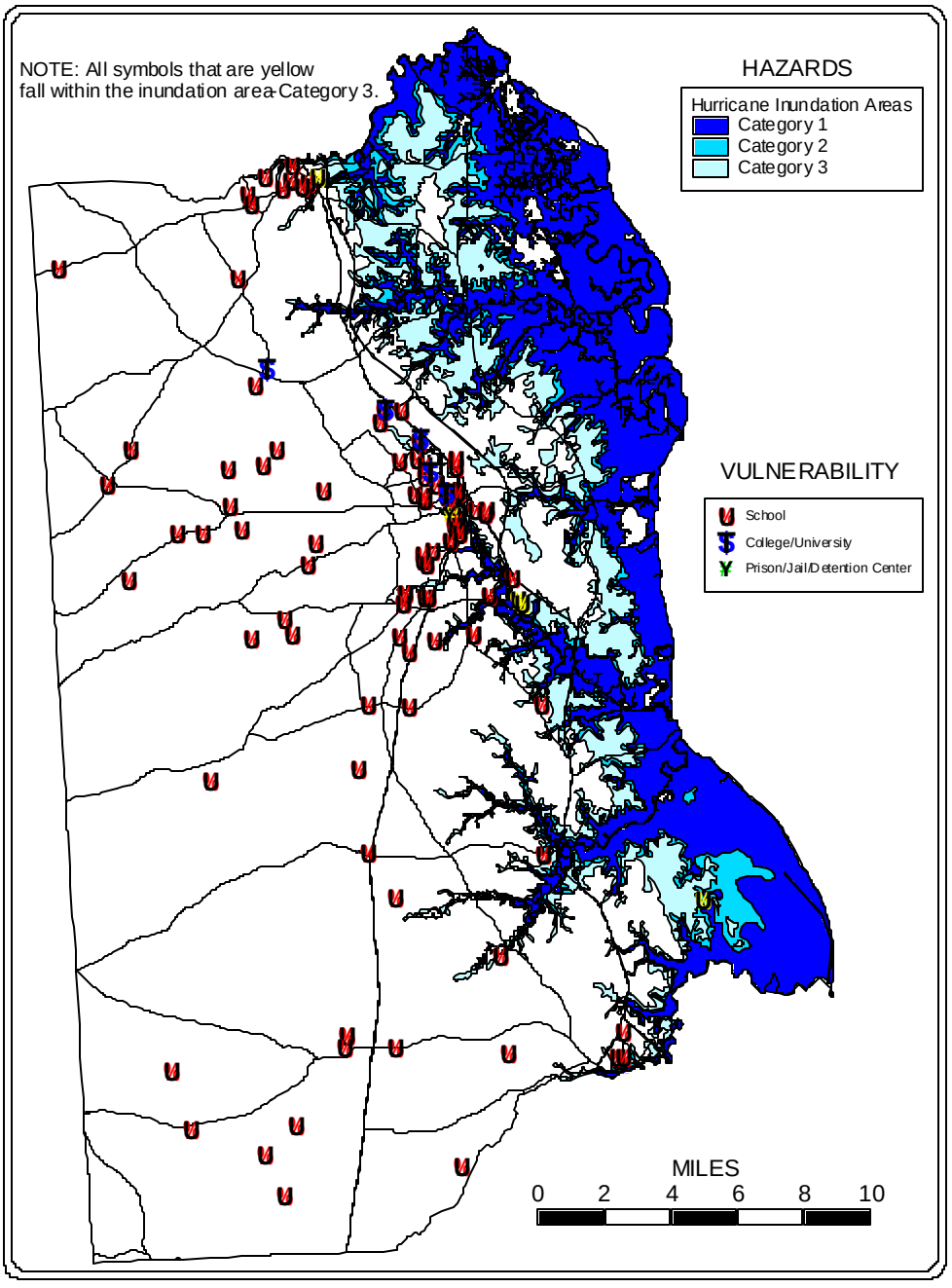
Source: Center for Applied Demography & Survey Research, University of Delaware.

Figure 3.3
Selected Vulnerabilities within the Category 3-Hurricane Inundation Area: Employers and Government



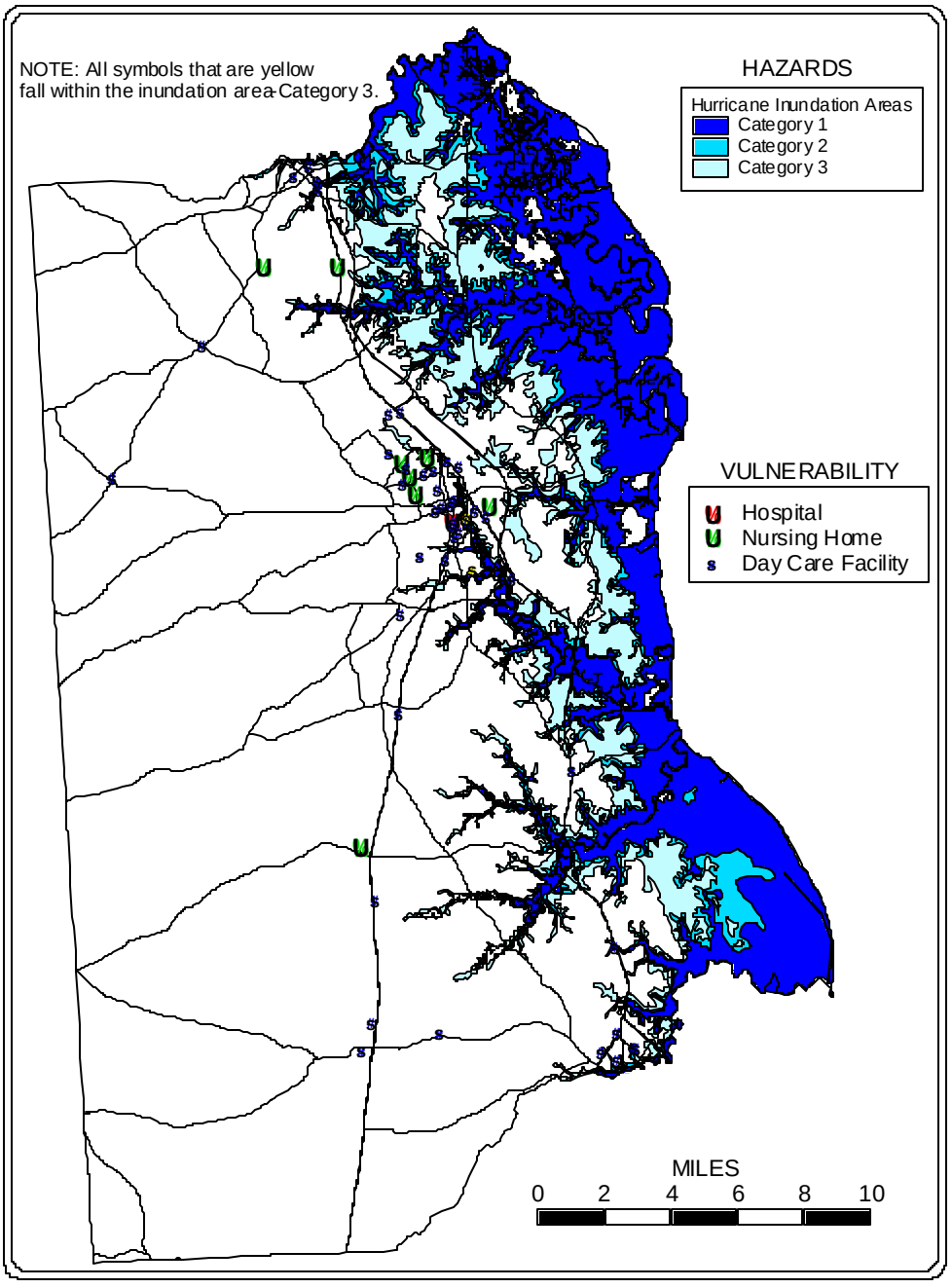
Source: Center for Applied Demography & Survey Research, University of Delaware.

Figure 3.4
Selected Vulnerabilities within the Category 3-Hurricane Inundation Area
Education and Corrections



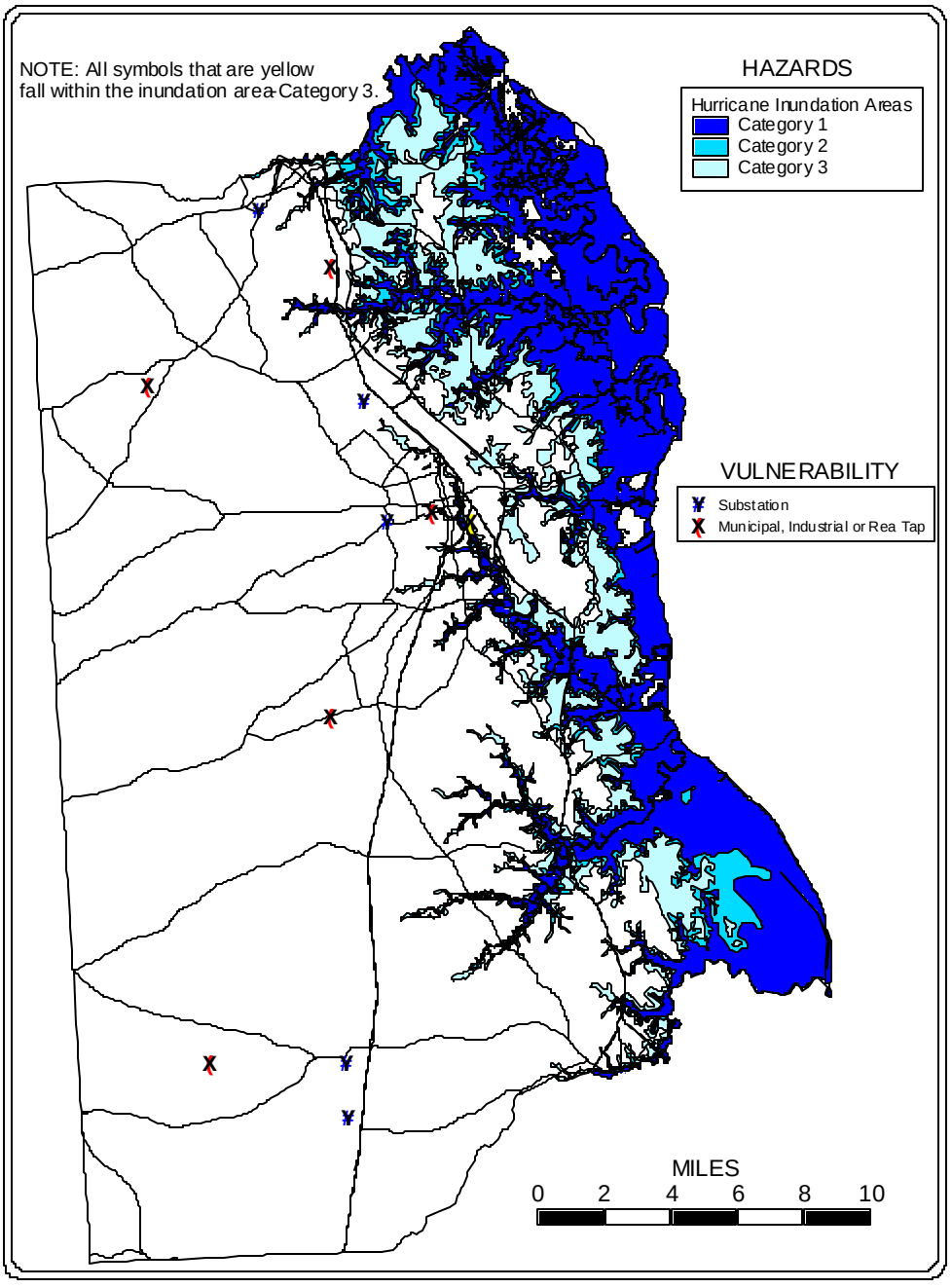
Source: Center for Applied Demography & Survey Research, University of Delaware.

Figure 3.5
Selected Vulnerabilities within the Category 3-Hurricane Inundation Area: Fragile Populations



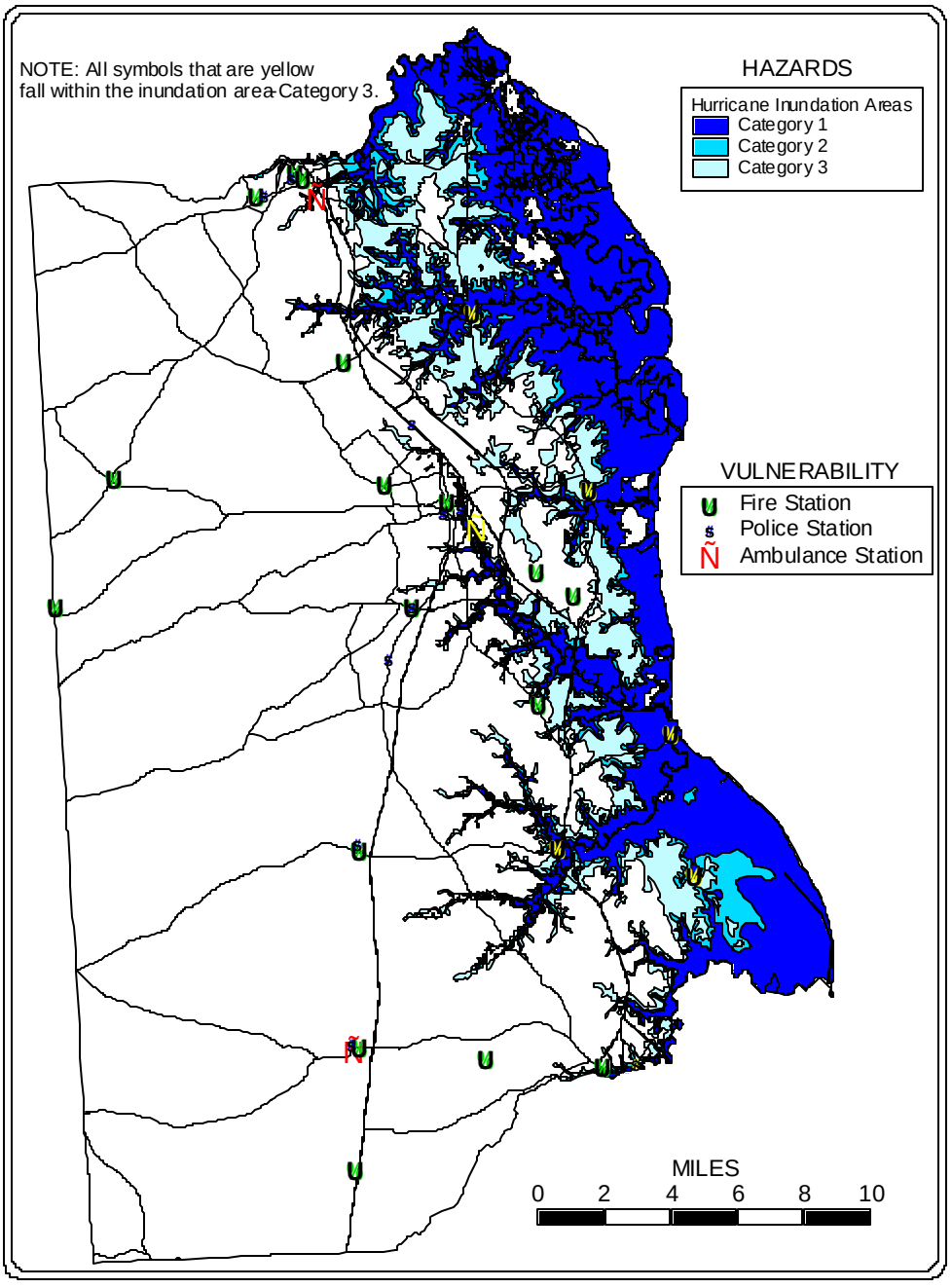
Source: Center for Applied Demography & Survey Research, University of Delaware.

Figure 3.6
Selected Vulnerabilities within the Category 3-Hurricane Inundation Area: Power Distribution



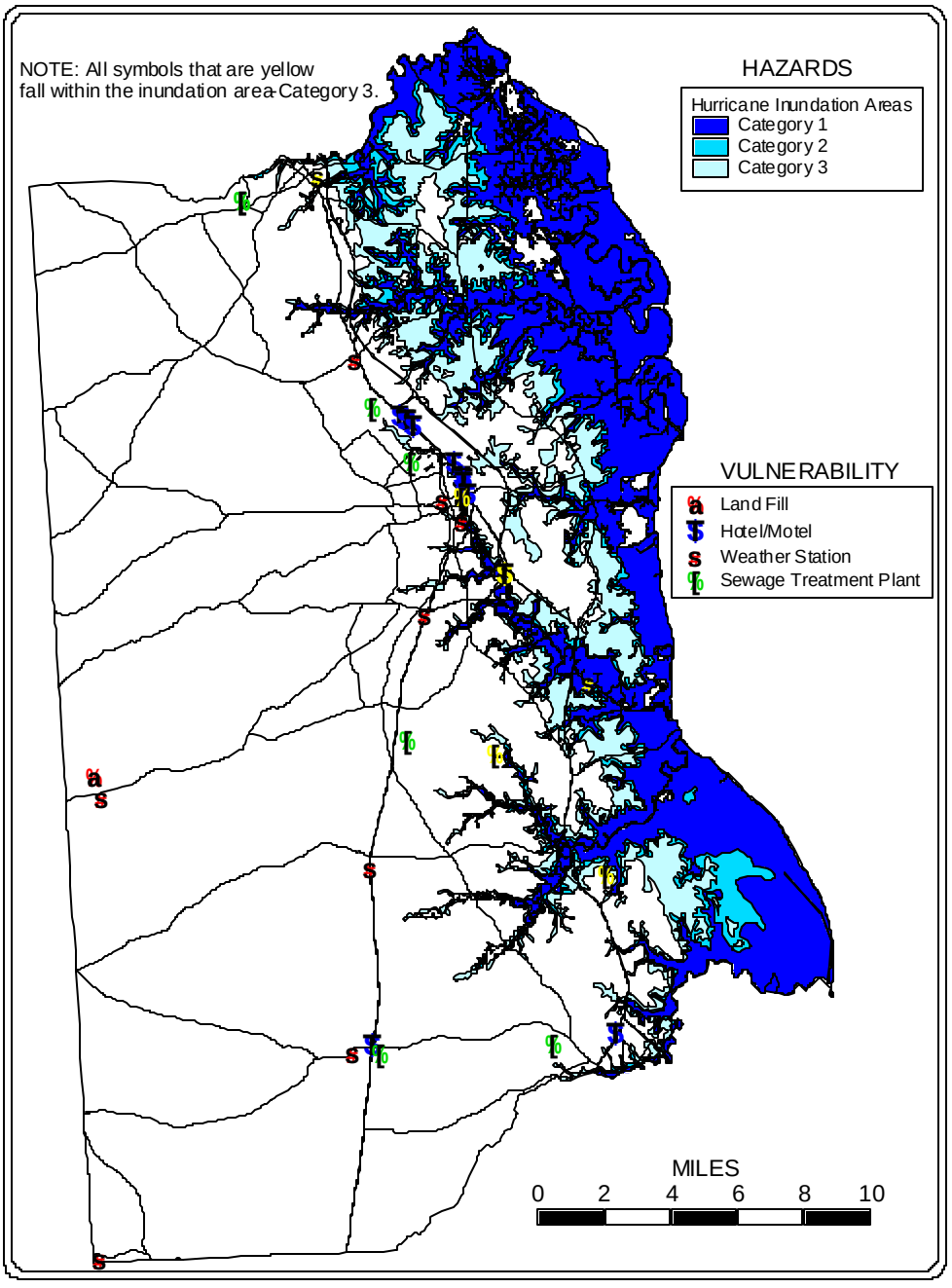
Source: Center for Applied Demography & Survey Research, University of Delaware.

Figure 3.7
Selected Vulnerabilities within the Category 3-Hurricane Inundation Area: Emergency Services



Source: Center for Applied Demography & Survey Research, University of Delaware.

Figure 3.8
Selected Vulnerabilities within the Category 3-Hurricane Inundation Area: Other



Source: Center for Applied Demography & Survey Research, University of Delaware.

Dams

Background

Dams are an important part of the state's infrastructure. They provide irrigation water for crops and flood control for rivers, creeks, and streams. They also are a source of drinking water and under certain circumstances provide water-based recreation. If they are not maintained properly, they can be dangerous. Those that are approaching their fiftieth year are of particular concern since that is generally considered the design life of a dam.

In 1996, the Public Law 104-303 was signed into law. That act established the National Dam Safety Act, which is coordinated by FEMA. Its main function is to promote dam safety and mitigate the effects of any dam failures.

The hazards presented by dams have a somewhat different character than those identified with natural events, although the failure of a dam may be caused by a natural event. First, the area that will be affected by an unplanned release is fairly well defined. This makes the assessment of the vulnerabilities more precise assuming the information has been collected. Second, the size and the intensity of the event has a fairly well understood upper limit. If the contents of the dam storage basin are known, then the release is also predictable. While the upper limit or the maximum storage of the dam is known, the amount of water actually available for release may be somewhat less depending on current weather conditions. The third factor is the age of the dam. As the age of a dam increases and approaches its useful life, the probability of failure (absent any maintenance that extends its life) increases significantly. This probability is likely to be non-linear with very low probabilities in the early years and accelerating probabilities in later years.

The primary result of a dam failure is fast moving water. The main impact is usually property destruction, injury and loss of life. Depending on the nature of the vulnerabilities in its path, there will likely be damage to power and communications system, disruption of transportation and other government services, environmental damage, and health problems associated with water pollution, sewage and waste disposal, and secondary unplanned chemical releases. The impact of these secondary failures will extend both upstream and downstream depending on the type of failure and alternate sources of services available for those affected.

The source of data on dams in the State of Delaware is the National Dam Inventory. This resource lists each dam in the state and provides a number of key characteristics. The current database is based on information from 1995/96. There is a draft of the 1998 data available now but it does not seem to improve substantially on its predecessor. A careful review of this information suggests that it may be useful to have a state review of this information to see if any of the missing information could be added. Of particular interest are the date completed and the maximum storage capacity. In addition, little if any information is available about the frequency of inspection or the last time the dam was inspected. Priority for mitigation will depend on this type of data. Finally, all this work is predicated on the latitude and longitude of the dam appearing in the National Dam Inventory. There is no information as to how accurate those measurements are. Thus, it may be useful to consider getting a GPS location for each dam in Delaware to verify that information.

Kent County Dams

There are 18 dams listed in the 1995/96 national dam inventory and 15 in the most recent draft. Almost all of these dams are intended for recreational purposes. Only one dam is classified as used for irrigation and one other is classified for flood control. Both cite recreation as a secondary use. Lake Como in Smyrna produced the best-known dam failures in Kent County (1940,1960). There was no loss of life although US 13 was washed out in the earlier event.

Taken together, these dams could impact nearly 700 people and 400 jobs. The current market value of residential property within 0.25 miles downstream from the dam is $22,000,000 and the total value of commercial, industrial, and utility property is approximately $18,000,000. These estimates do not include the value of state owned property that is not subject to the property tax and there are significant properties of that type in impacted areas. There is no record of a significant dam failure in Kent County that has caused any loss of life or property. An estimated $12,000,000 in annual wages and $17,000,000 in annual revenues could potentially be lost. These are upper bound estimates since the exact drainage area of the dams has not as yet been digitized. Essentially, about 0.5% of the population, employment and property is at risk from this hazard.

Estimating potential economic losses is hazardous at best. For example, at least some of the employment affected is government. It is unlikely that those people would be terminated in the

case of a disaster. In other situations, where there are significant labor contracts (the automobile industry for one), 95% of wages may be paid for as long as a year even though the workplace is closed. Finally, in most cases the duration of the impact would be less than a year and companies routinely have disaster recovery plans that would relocate employees to alternative sites.

All but one of the dams in Kent County are classified as earthen dams. Two of the dams namely Haven Lake and Silver Lake (Milford) are characterized as being "High Risk" for loss of life and property. Of the remaining 17, eight are classified as having "Low Risk" for loss of life and property with the remaining nine having "Significant Risk". Only the two "High Risk" dams have Emergency Action Plans.

Four dams in Kent County are over 50 years old; Masseys Mill Pond (1933), Lake Como (1938), Silver Lake-Dover (1900), and Wyoming Lake (1925). Of those only Masseys Mill Pond dam has a "Low Risk" rating for loss of life and property. Five of the dams do not have a "Year Built" in the data base. Of those, only Blairs Pond is rated as having a "Significant Risk" of damage. All of the older dams with the exception of Masseys Mill Pond plus the two "High Risk" dams have had a Phase I inspection.

Vulnerabilities

In the eight maps that follow, each of the 14 vulnerabilities identified as being within 0.25 miles downstream of one of the 18 dams is displayed. Any vulnerability that lies within the area of risk is coded yellow independent of its type. In some cases, the actual number of yellow symbols on the map may not agree with the list of affected vulnerabilities in the associated appendix table. This will happen when two vulnerabilities of the same type are co-located and thus have the same latitude and longitude and the same symbol. The hazard (dam) is also shown on the map. It has the symbol of an X within a light blue square.

Transportation. This category includes ports (however small), airports, and bridges. First, of all, there are no airports in the buffer zone of any dam in Kent County. There are seven boat ramps, which might become unusable for a variety of purposes if there was a major unplanned release of water. It would be reasonable to expect that these ramps would be up stream from the dam and would be made unavailable because of the depth. Obviously, the

recreational value of the lake behind the dam would be lost and there could be damage to recreational fishing as well. While this would be a loss, there are significant alternatives for those who use those services.

There are eight bridges that could be affected by a dam failure in Kent County. Both the bridges and the roadways they join are also subject to the impact of fast moving water. Bridges may be more critical because the time necessary to repair or reconstruct is likely to be far greater than to make a roadway passable. Of particular interest are those bridges that lie on evacuation routes. Two of the eight bridges are on evacuation routes. Since a dam failure might reasonably happen with a major flood, the loss of those evacuation routes could be crucial. The actual impact could best be determined by evaluating traffic network models that remove the affected road from the transportation system. In addition, it would be very useful to measure the average daily traffic count over each of the vulnerable bridges.

It is important to note that the roadways may be just as likely to be damaged although the duration of the failure is likely to be far less than in the case of a bridge. Many dams are the roadways themselves with spillways created for keeping the level well below the roadway.

Communications. There are no significant disruptions to communication facilities that would result from a dam failure in Kent County. There is always the possibility of a secondary impact occurring outside of the 0.25-mile buffer zone, e.g. extended power outages.

Employers and Government. There are no major employers located within the buffer zone of a dam in Kent County. Of the entire list of government buildings in Kent County only the state fish hatchery, located in the vicinity of the Moores Lake dam, is identified as vulnerable.

Education and Corrections. No school or other educational facility is located within the buffer zone around a dam. None of the correction facilities in Kent County appears to be vulnerable to a failed dam.

Fragile Populations. Like the previous set of vulnerabilities, there are two reasons for understanding the risks they face. First, all three contain fragile populations that might need to be evacuated. Second, hospitals are obviously of great importance in the event of an unrelated emergency.

There are two day care centers in the Smyrna area that are within the buffer zone of the Lake Como dam. Together they have a capacity of about 110 children. No nursing homes are in the zone.

The only hospital located in Kent County is not within the buffer zone of any dam.

Power Distribution. Any power distribution facility that was a victim of a dam failure would undoubtedly cause problems far beyond the buffer zone of a dam. For that reason alone it is important to assess the risk to those facilities.

None of the power distribution sub-stations or municipal, industrial, or REA tap sites is within the buffer zone of a dam in Kent County.

Emergency Services. Police, fire, and ambulance services are crucial on a daily basis. Any event such as the failure of a dam must be assessed to determine if the effectiveness of emergency services would be compromised.

No ambulance, police stations, or fire stations are within the buffer zone of a dam.

Other Services. This last group is a mixture of different kinds of vulnerabilities. Hotels/motels may need to be evacuated but they also can be a source of shelter. Land fills and sewage treatment plants are needed for the health and safety of the entire population. Weather stations may provide critical information for emergency services and emergency management.

One weather station in the Smyrna area is in the buffer zone of Lake Como. In addition, the sewage treatment plant in Harrington is within the buffer zone of an unnamed dam on Browns Branch.

Next Steps

There are a number of steps that could be taken to improve the accuracy of this risk assessment for dams:

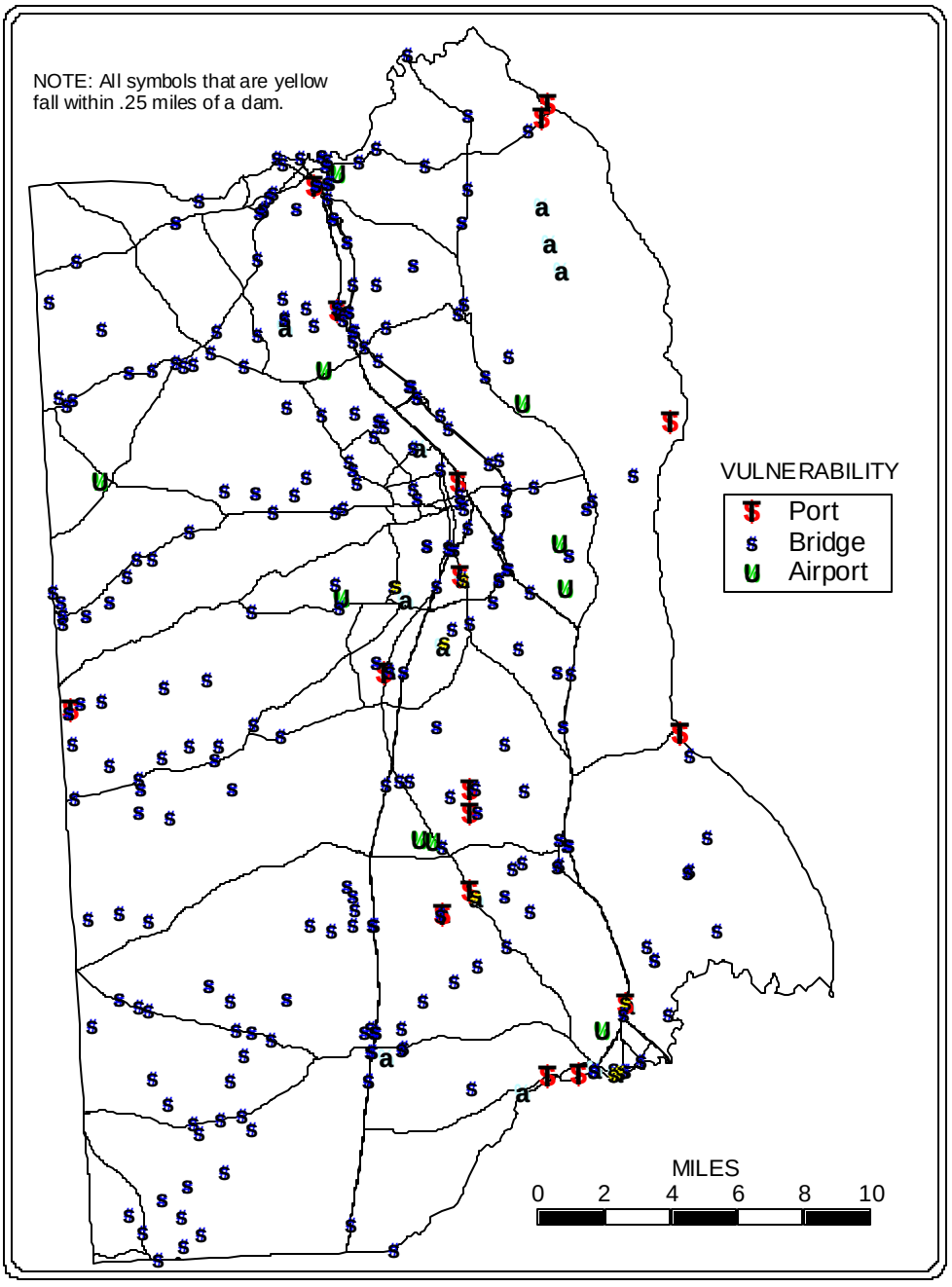
1. Validate the latitude and longitude of each Delaware dam in the National Dam Inventory with GPS, if it has not already been done.

2. Digitize the drainage basin of each dam should it fail. This will give a much more precise estimate of the primary impact than the buffer zone approach.

3. Begin to fill in any critical data that is not currently in the NDI.

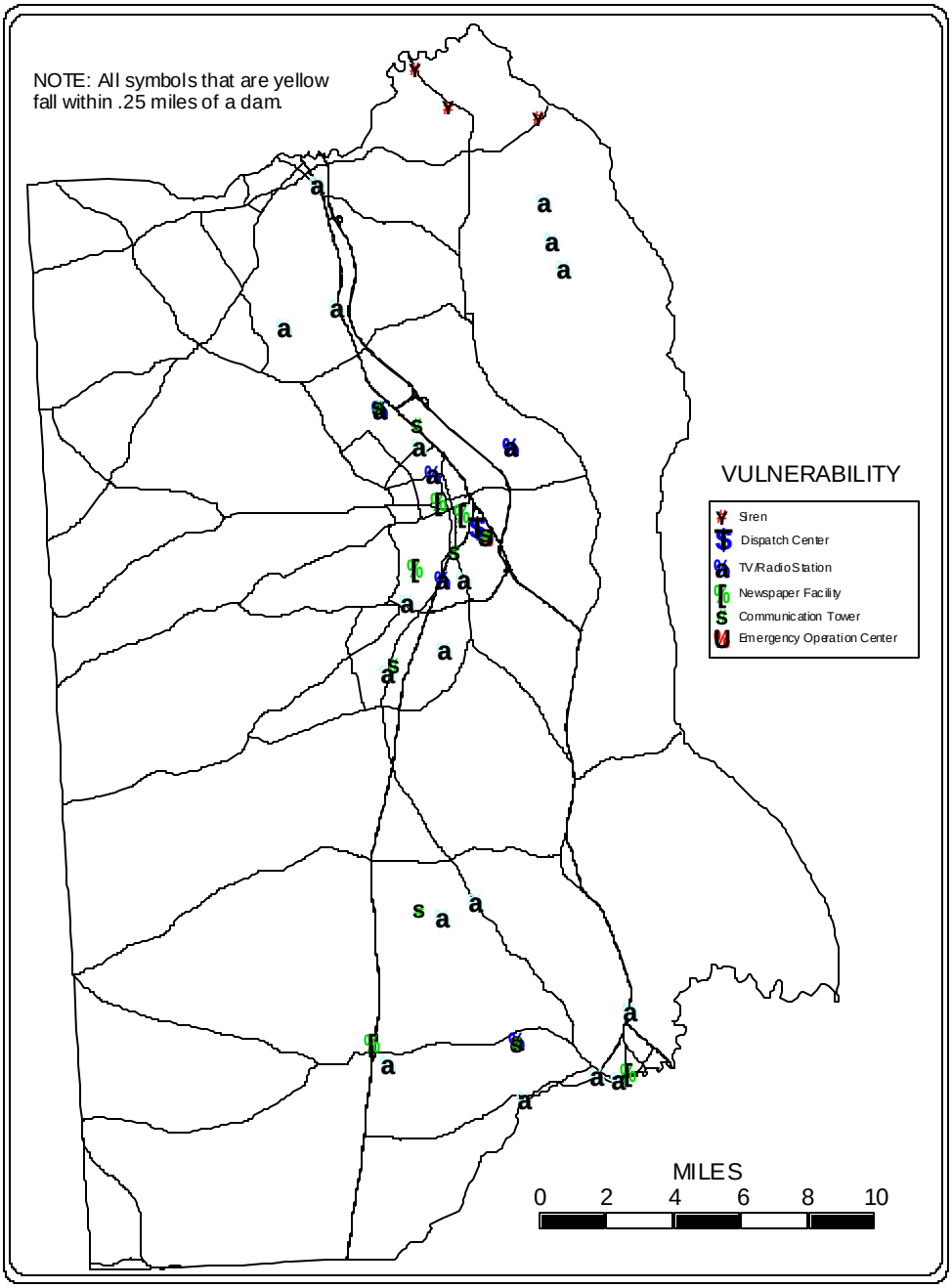
4. Add average daily traffic counts for each bridge. Ask DELDOT to model the impact of losing each bridge.

Figure 4.1
Selected Vulnerabilities within 0.25 Miles of a Dam:
Transportation



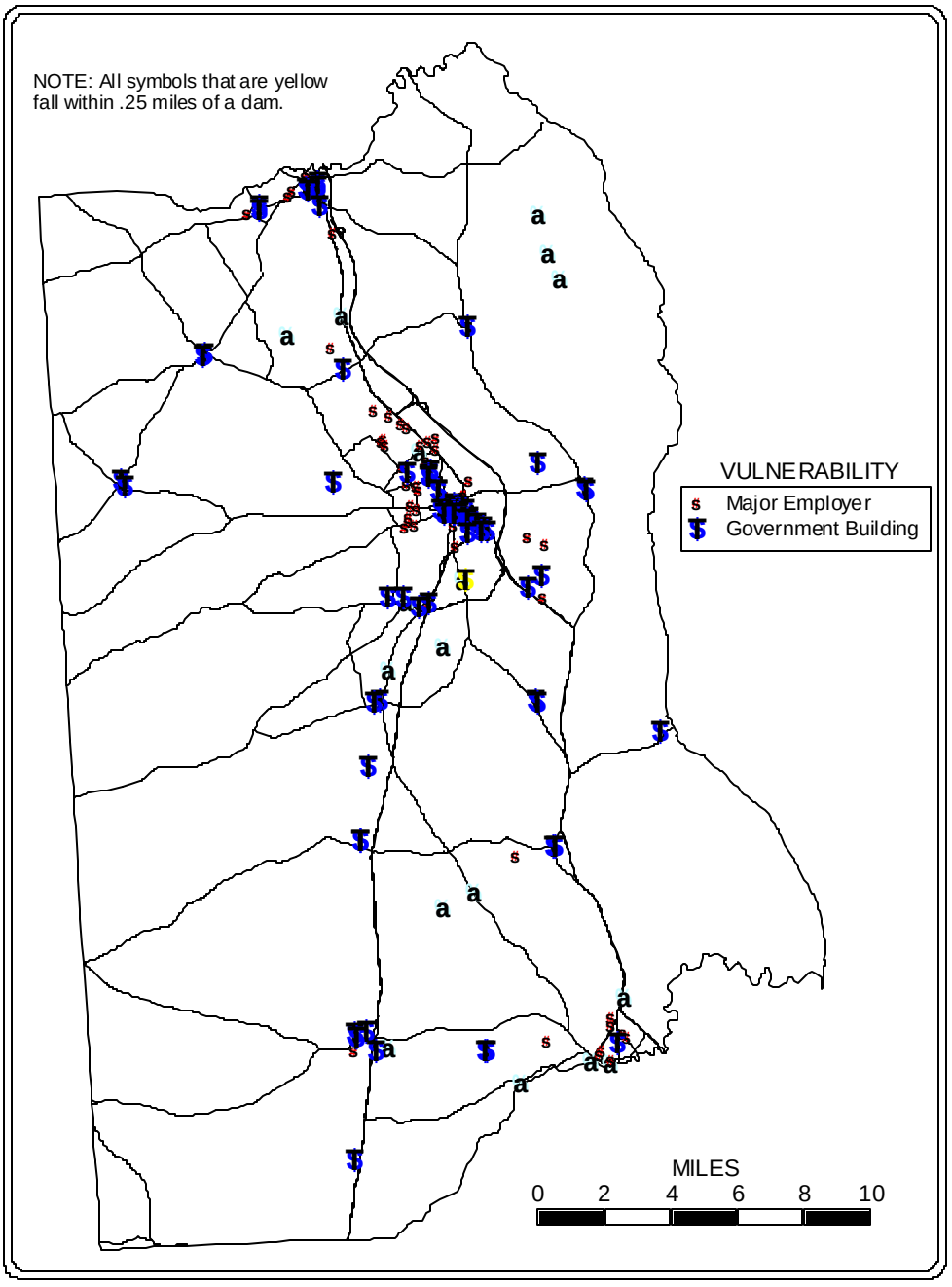
Source: Center for Applied Demography & Survey Research, University of Delaware.

Figure 4.2
Selected Vulnerabilities within 0.25 Miles of a Dam:
Communications



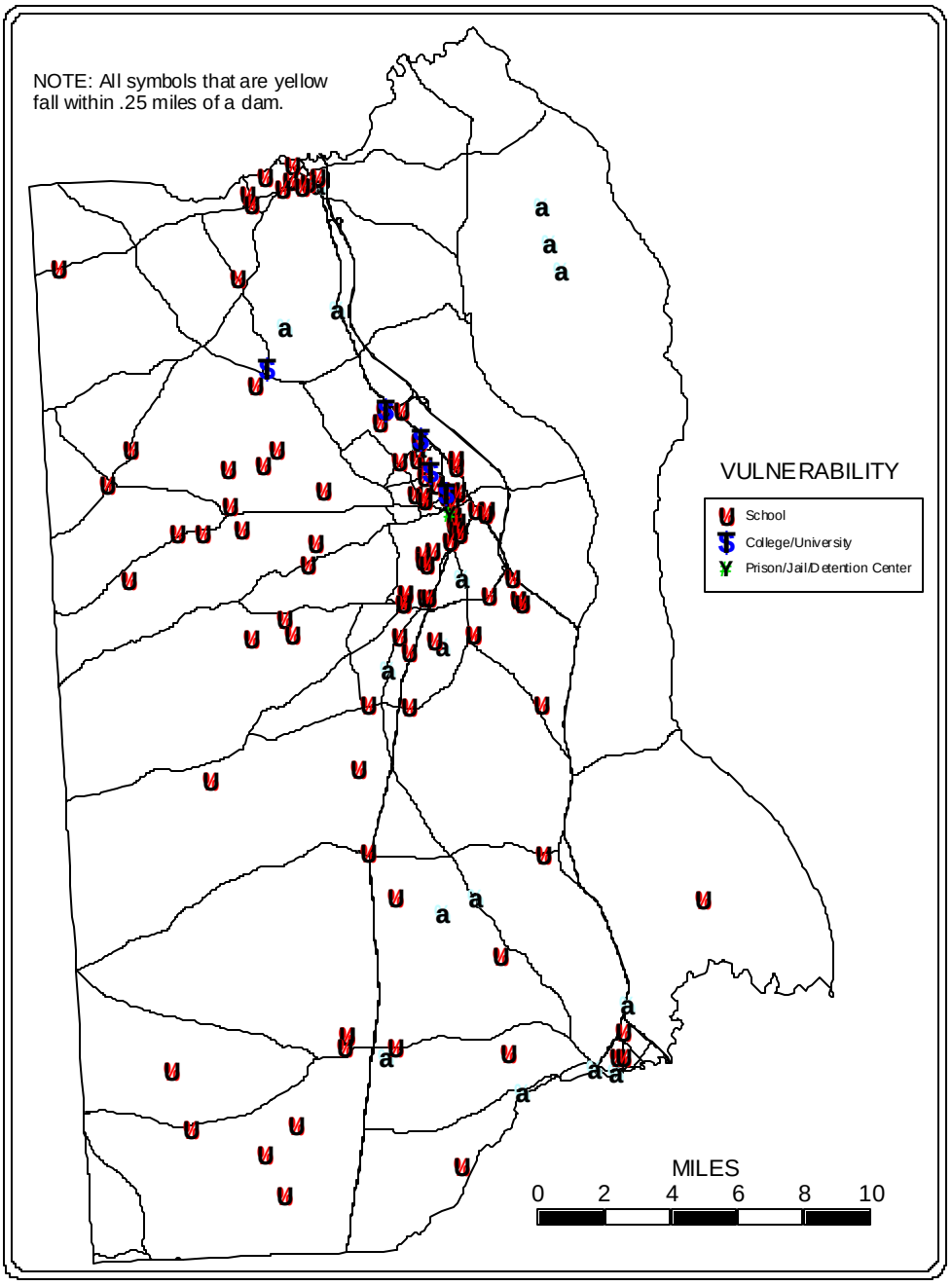
Source: Center for Applied Demography & Survey Research, University of Delaware.

Figure 4.3
Selected Vulnerabilities within 0.25 Miles of a Dam:
Employers and Government



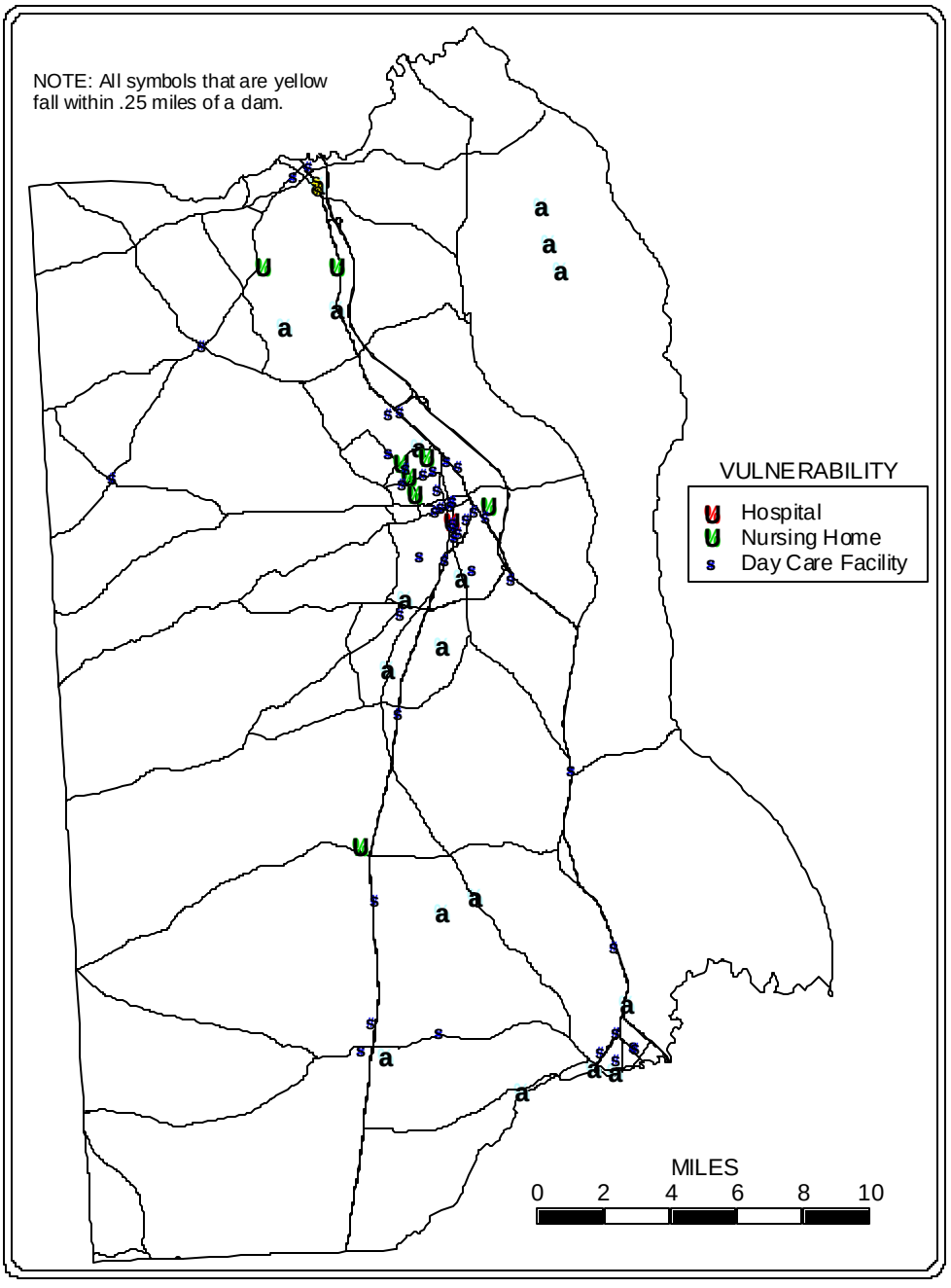
Source: Center for Applied Demography & Survey Research, University of Delaware.

Figure 4.4
Selected Vulnerabilities within 0.25 Miles of a Dam:
Education and Corrections



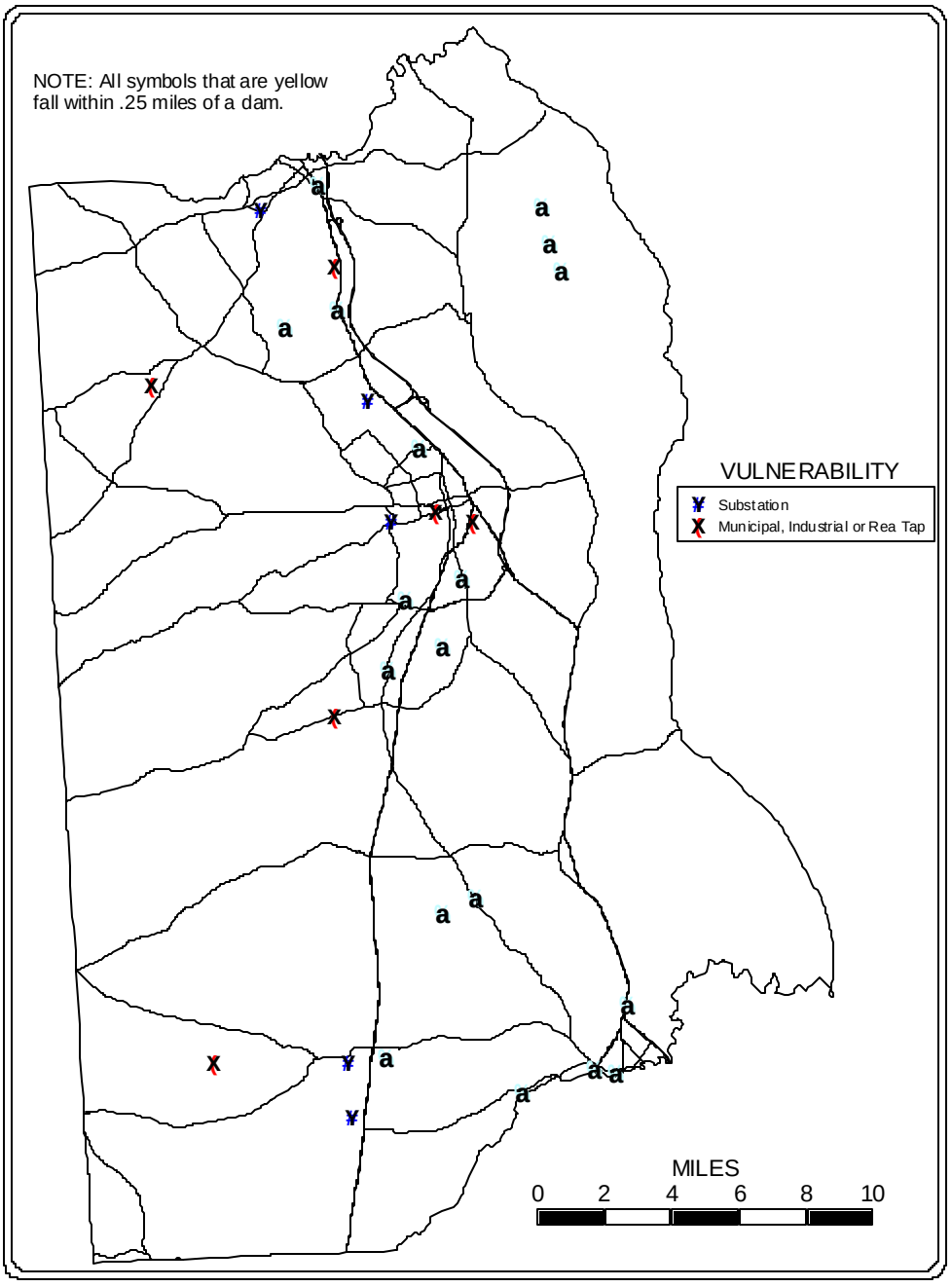
Source: Center for Applied Demography & Survey Research, University of Delaware.

Figure 4.5
Selected Vulnerabilities within 0.25 Miles of a Dam:
Fragile Populations



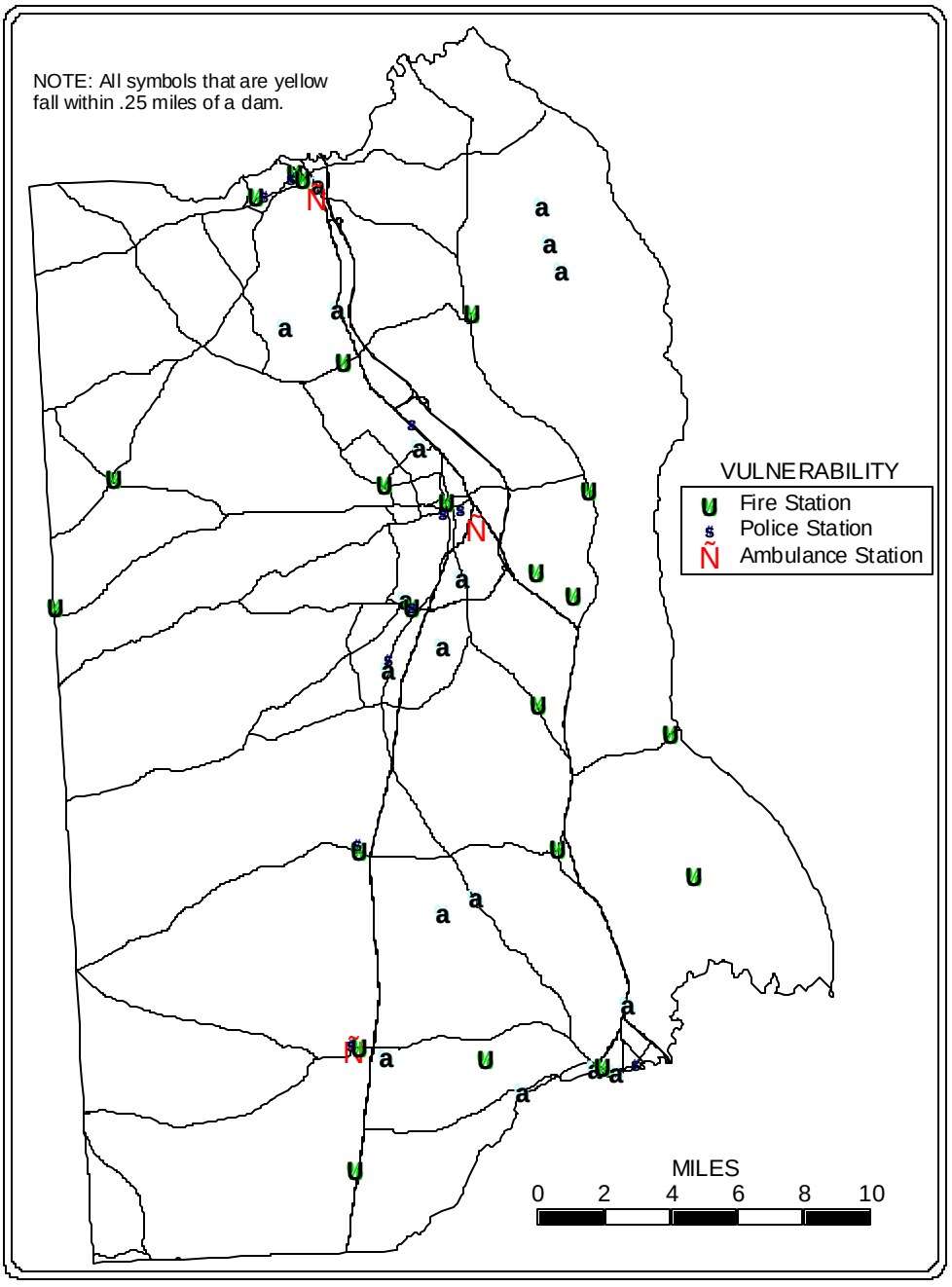
Source: Center for Applied Demography & Survey Research, University of Delaware.

Figure 4.6
Selected Vulnerabilities within 0.25 Miles of a Dam:
Power Distribution



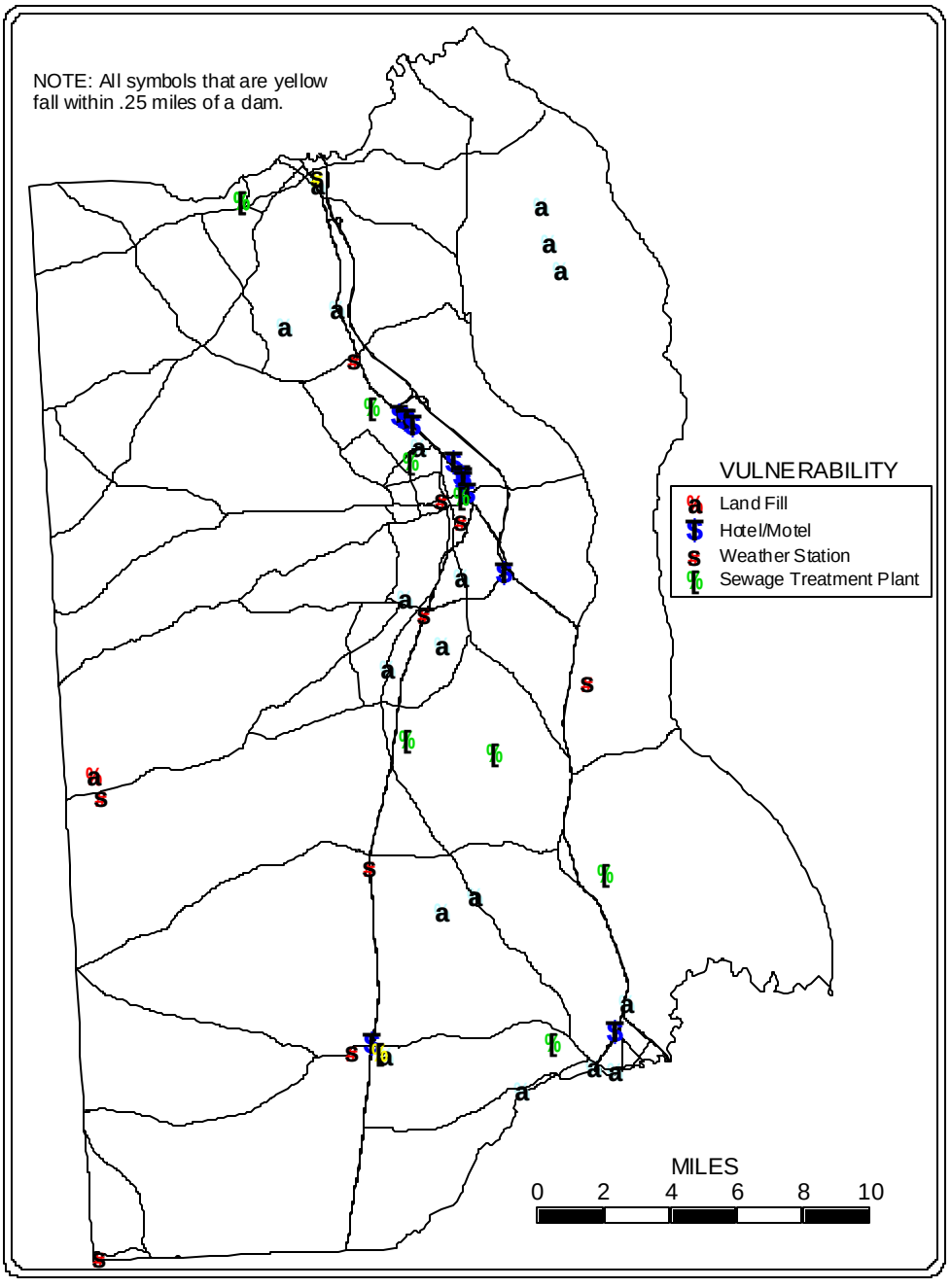
Source: Center for Applied Demography & Survey Research, University of Delaware.

Figure 4.7
Selected Vulnerabilities within 0.25 Miles of a Dam:
Emergency Services



Source: Center for Applied Demography & Survey Research, University of Delaware.

Figure 4.8
Selected Vulnerabilities within 0.25 Miles of a Dam:
Other Services



Source: Center for Applied Demography & Survey Research, University of Delaware.

Hazardous Material Sites

Background

The use of hazardous materials is a fact of life. Under controlled conditions these materials provide beneficial products and services to everyone in Delaware. For example, people and companies depend on propane gas for heat and power. They also use refrigerants for food processing. Chemicals are used to treat sewage. All of these uses are planned and the outcome of their use is almost always positive. On rare occasions mistakes are made or equipment fails to operate properly and an unexpected release of those otherwise beneficial products occurs.

Unplanned releases are frequent relative to other hazards discussed here. They can have some long term impacts, and the impacts are usually of medium intensity. The character of these releases is such that they cannot be predicted, i.e. they are almost always accidents. Mitigation strategies usually focus on the hazard rather than the vulnerability.

The hazardous materials sites present a somewhat different problem than natural phenomenon. The location of the potential problem is known. There is some knowledge about the frequency of toxic releases. What is difficult to estimate is the magnitude of the release and the distance it will travel. Those are subject to the weather conditions at the time of the release into the air or water. Under certain conditions the damage might be minimal, under other circumstances the effect could be lethal.

The primary result of an accident at a hazardous material site is usually a toxic release. This may be accompanied by fire and explosion, which can aid and exacerbate the problem. There will be problems on the site and depending on the circumstance the toxic release may leave the boundaries of the property. In benign situations, the result may be nothing more than a bad odor in the air. In more serious situations, the site itself and even contiguous areas may have to be evacuated. Depending on the toxicity of the release, there may be health problems and even loss of life. If the facility is next to a transportation facility, that facility may have to close until the situation is under control. There also may be water pollution if the release is of that type. Both the primary and secondary effects must be considered when assessing the hazard.

Kent County Sites

There are 23 properties listed by the DNREC and EPA in Kent County as capable of generating releases that have impact beyond their own property. These are the ones considered in this analysis. For the others, it is assumed that those companies/organizations have plans for coping with any problem that is limited to their own site.

According to the National Response Center, which is charged with receiving all reports of improper discharge of toxic materials, there were 69 reported releases of toxic materials in Kent County from 1990 through 1998. Eighteen of these releases were to the air, 29 were water related, 14 were onto land, and the other eight were not classified. The end results were 29 people evacuated, one death, and one injury for all 69 events. Examples of these events are the 1993 release of ammonia in Wyoming, DE requiring evacuation around the plant and the explosion of a propane distribution tank in Dover, DE during 1992 that singed cars on US 13.

Taken together these hazardous material sites could impact nearly 6,000 people and 5,500 jobs. The current market value of residential property within 0.25 miles of the sites is $192,000,000 and the total value of commercial, industrial, and utility property is approximately $283,000,000. These estimates do not include the value of state owned property that is not subject to the property tax and there are significant properties of that type in impacted areas. An estimated $165,000,000 in annual wages and $236,000,000 in annual revenues could potentially be lost. These are upper bound estimates since the extent of any release will impact only a small part of the potential. Essentially 5% of the population, 10% of the employment, and 5% of the property in Kent County is exposed to this hazard.

Estimating potential economic losses due to hazardous materials sites is itself hazardous at best. For example, at least some of the employment affected is government. It is unlikely that those people would be terminated in the case of a disaster. In other situations, where there are significant labor contracts (the automobile industry for one), 95% of wages may be paid for as long as a year even though the workplace is closed. Finally, in most cases the duration of the impact would be less than a year and companies routinely have disaster recovery plans that would relocate employees to alternative sites.

Vulnerabilities

In the eight maps that follow, each of the 14 vulnerabilities identified as being within a circle 0.25 miles in radius of one of the hazardous materials sites are displayed. Any vulnerability that lies within the area of risk is coded yellow independent of its type. In some cases, the actual number of yellow symbols on the map may not agree with the list of affected vulnerabilities in the associated appendix table. This will happen when two vulnerabilities of the same type are co-located and thus have the same latitude and longitude and the same symbol. The hazard (site) is also shown on the map. It has the symbol of an X within a light blue circle.

Transportation. The impact on the transportation system is very different for a release of hazardous materials than for a physical phenomenon like a major flood or a dam failure. Both of those events are more likely to physically damage the facility. In this case, we are denied use of the facility for some period of time but the facility is not usually damaged. There have been a few notable exceptions to this rule when the transport of hazardous material produced a fire that heavily damaged a bridge on I495. This however is an exception particularly for fixed site releases being discussed here.

There are no airports or ports affected by hazardous materials sites in Kent County. (Dover Air Force Base is a hazardous material site and is not a vulnerability in this context.) There are however 10 bridges that are within the buffer zones of four sites using hazardous materials. Three of those bridges are on evacuation routes.

Communications. The WDOV transmission tower is the only communications facility within the buffer zone of a hazardous materials site.

Employers and Government. There are 11 employers with 100 or more employees within 0.25 miles of a hazardous material site. However, seven of the 11 are the hazardous materials sites themselves. Only Thriftway, Kent-Sussex Industries, DTCC-Terry Campus, and Dover Wipes are outside of those sites.

Five government facilities are within 0.25 miles of a hazardous material site including the Kent Federal Building and JP Court #7. The post offices of Smyrna and Clayton are also at risk. The Smyrna town hall is the other government facility that is within 0.25 miles of a hazardous material site.

Education and Corrections. Six of the 103 schools in Kent County are within the buffer zone of a hazardous materials site along with DTCC (Terry Campus) and the Morris Correctional Institution.

Fragile Populations. No nursing homes are within a buffer zone, however there are six day care centers with a capacity of 576 children within a zone.

Power Distribution. One municipal tap (Dover) along with substations in Clayton, Cheswold, and Harrington are within range of five different hazardous material sites.

Emergency Services. The Citizens Hose and Clayton volunteer fire companies and the Dover police department are within the buffer zones of four different sites.

Other Services. Two hotels (Howard Johnson's and the Comfort Inn) are within range of site. There are two sewage treatment plants that are located on hazardous materials sites (Reichold and Playtex) and two weather stations. One weather station is in Cheswold and the other is in Harrington.

Next Steps

There are several steps that could be taken to improve the information and further define the risk:

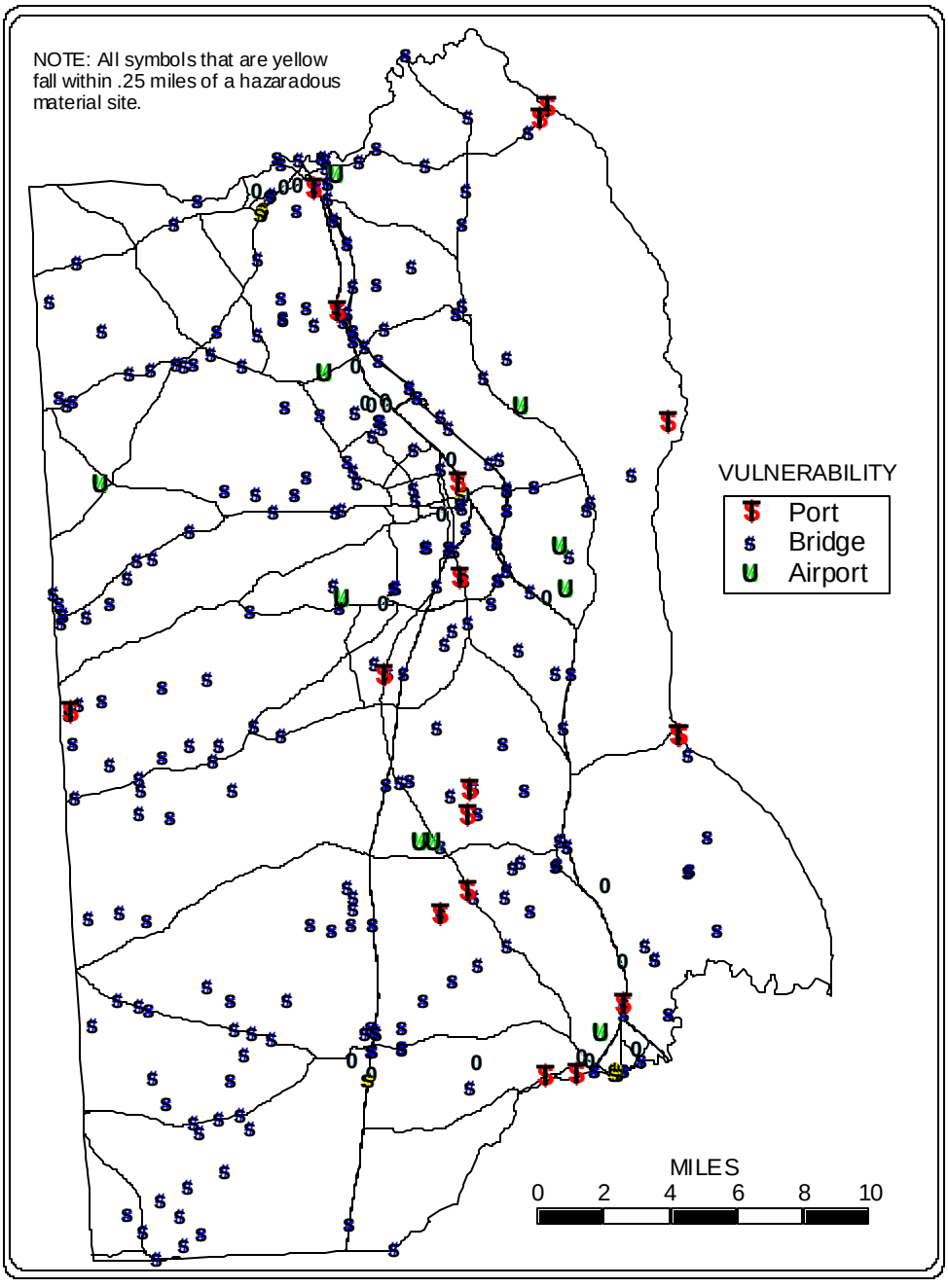
1. Add information to the database that says the nature of any likely event. For example, is it a gas explosion, release of ammonia, discharge of effluent, etc.

2. What medium would be affected (water, air, land)? Would any adjacent roadway have to be closed? What type of injuries might occur? Is evacuation likely? What is the likely range of the toxic effect?

3. Add additional information from regulators files into the database such as the date of any inspections, existence of a plan, adequacy of emergency planning, support of emergency services and history of any discharges.

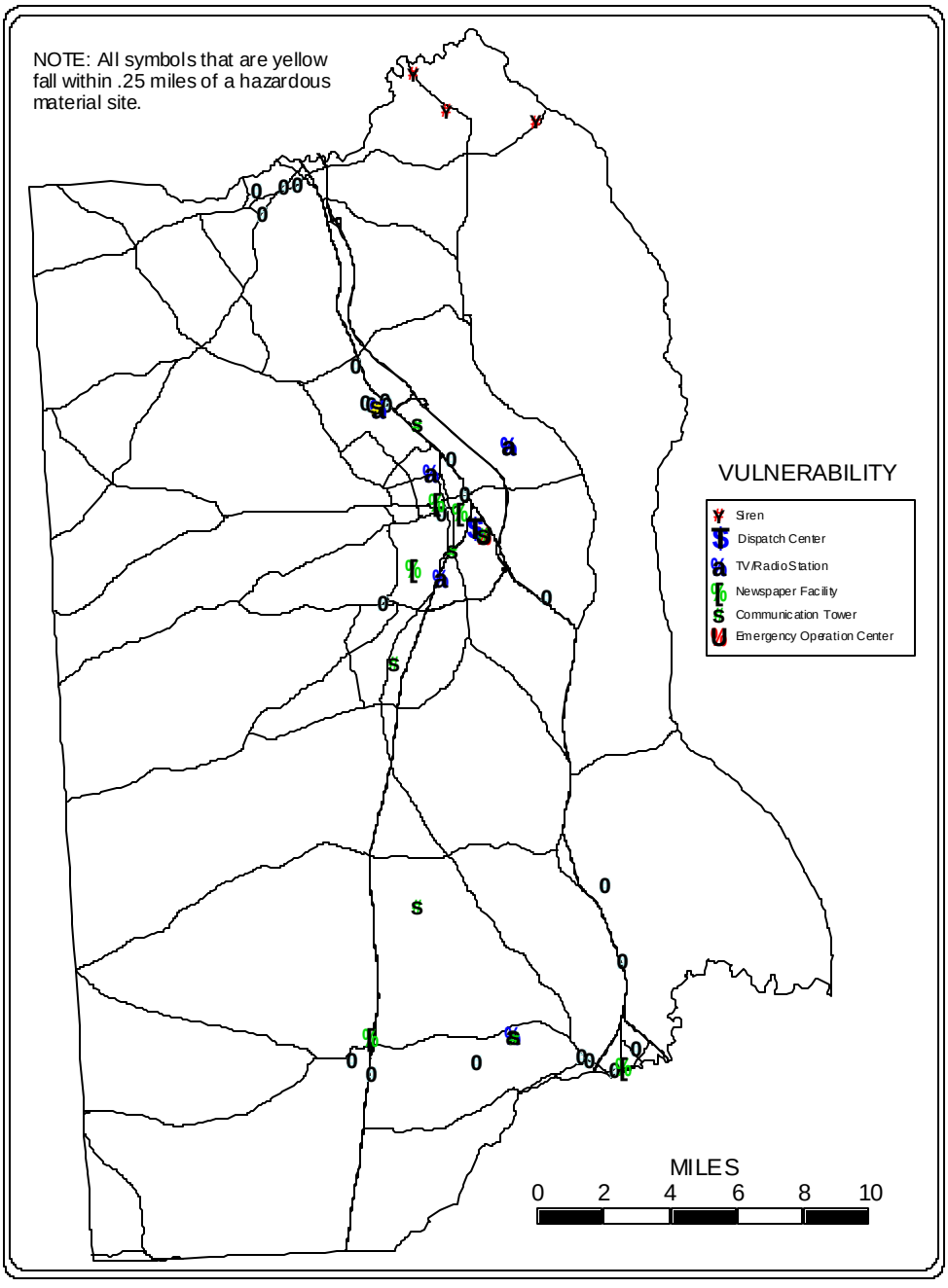
4. Determine the accuracy of the National Response Center information by cross checking information with the state regulators. Fill in any missing information if available.

Figure 5.1
Selected Vulnerabilities within 0.25 Miles of a Hazardous Material Site: Transportation



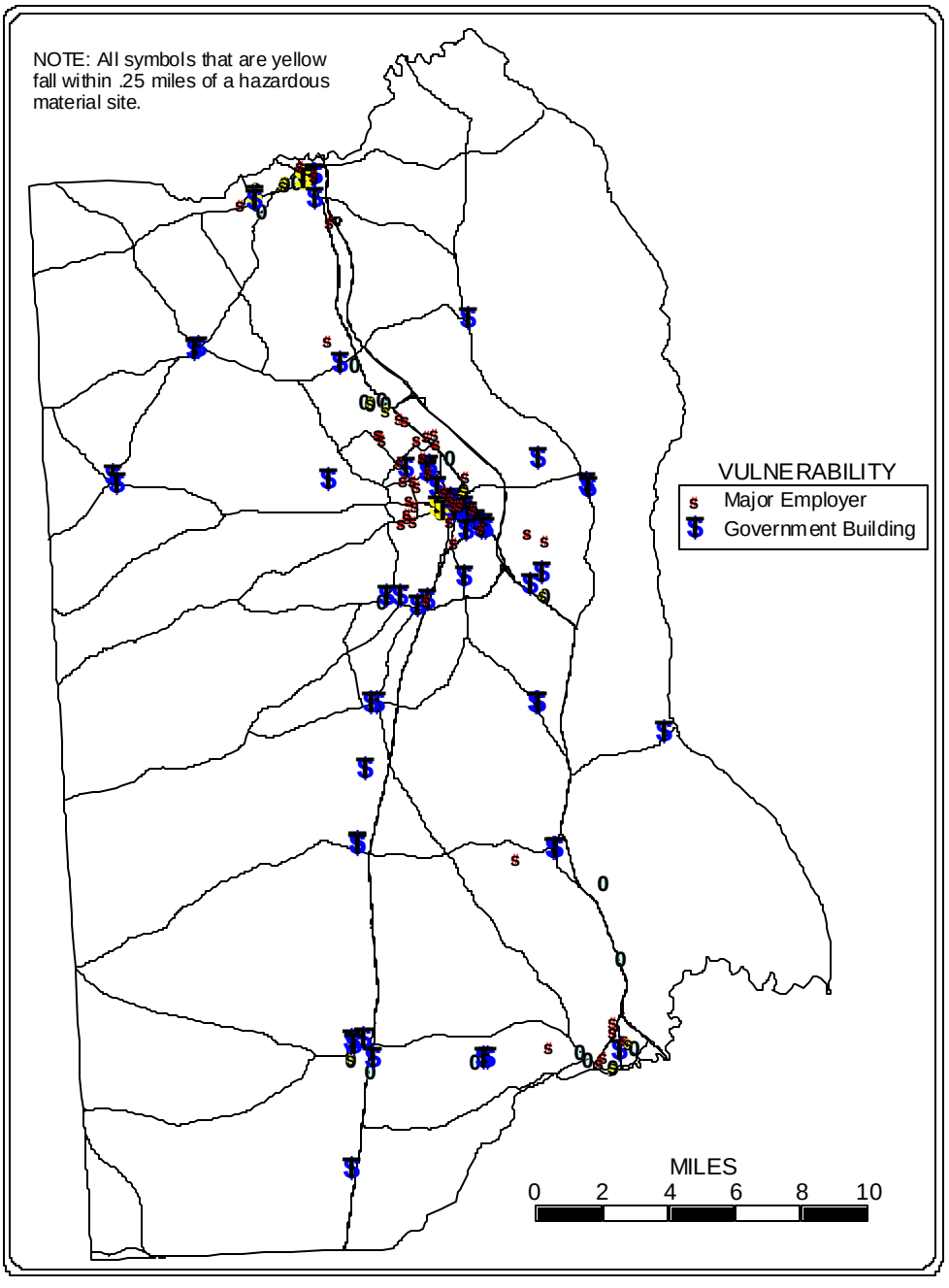
Source: Center for Applied Demography & Survey Research, University of Delaware.

Figure 5.2
Selected Vulnerabilities within 0.25 Miles of a Hazardous Material Site: Communications



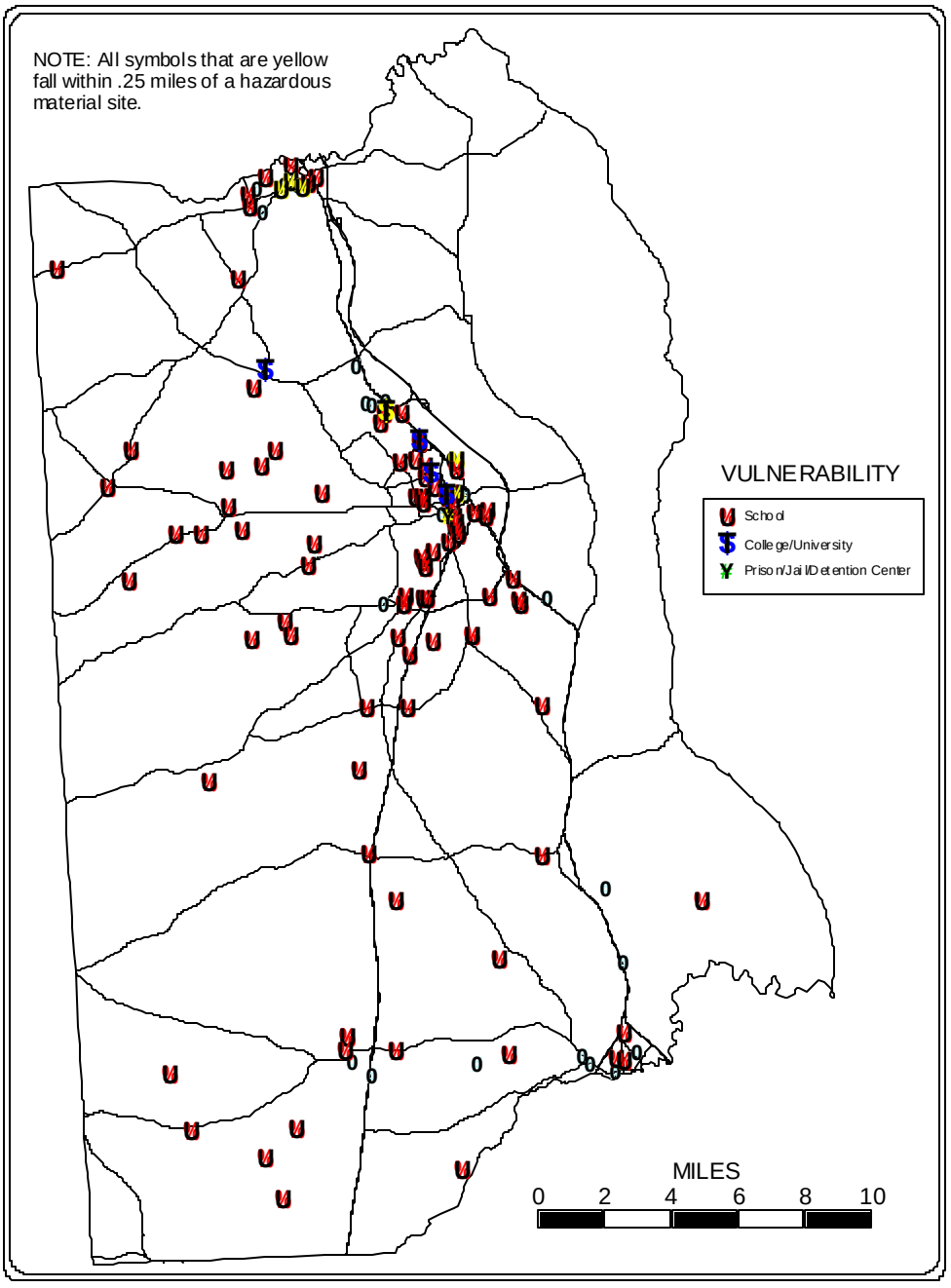
Source: Center for Applied Demography & Survey Research, University of Delaware.

Figure 5.3
Selected Vulnerabilities within 0.25 Miles of a Hazardous Material Site: Employers and Government



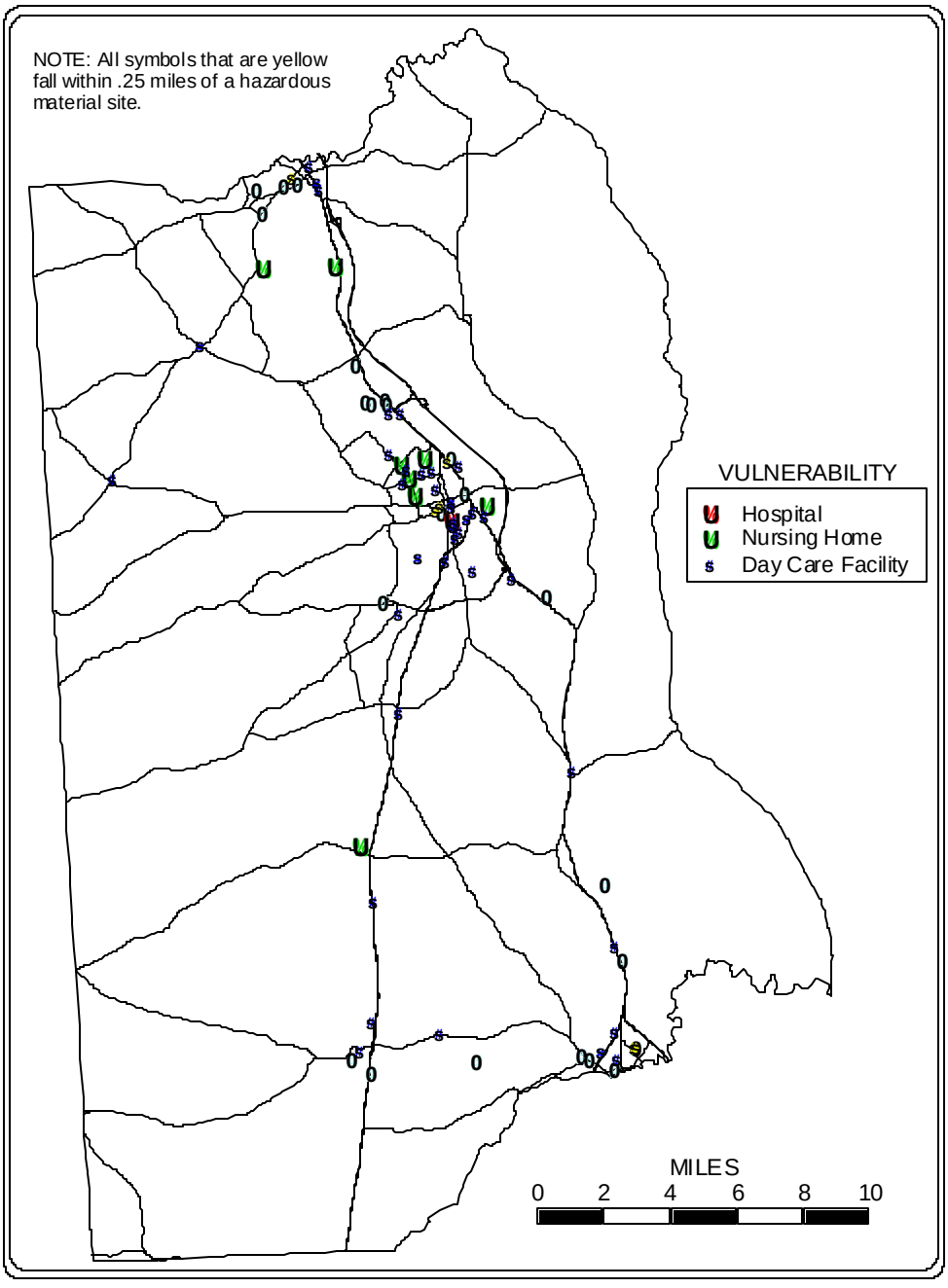
Source: Center for Applied Demography & Survey Research, University of Delaware.

Figure 5.4
Selected Vulnerabilities within 0.25 Miles of a Hazardous Material Site: Education and Corrections



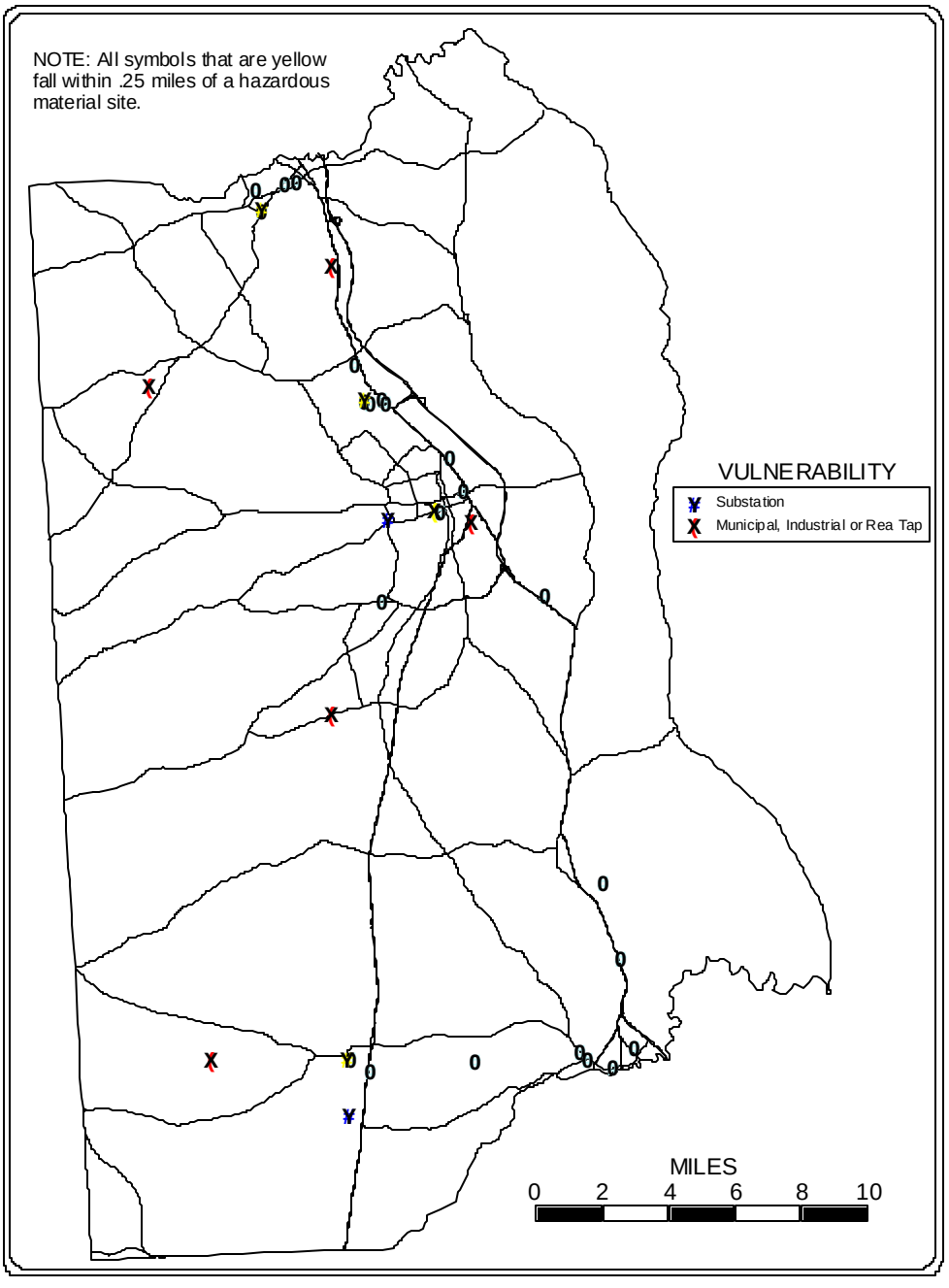
Source: Center for Applied Demography & Survey Research, University of Delaware.

Figure 5.5
Selected Vulnerabilities within 0.25 Miles of a Hazardous Material Site: Fragile Populations



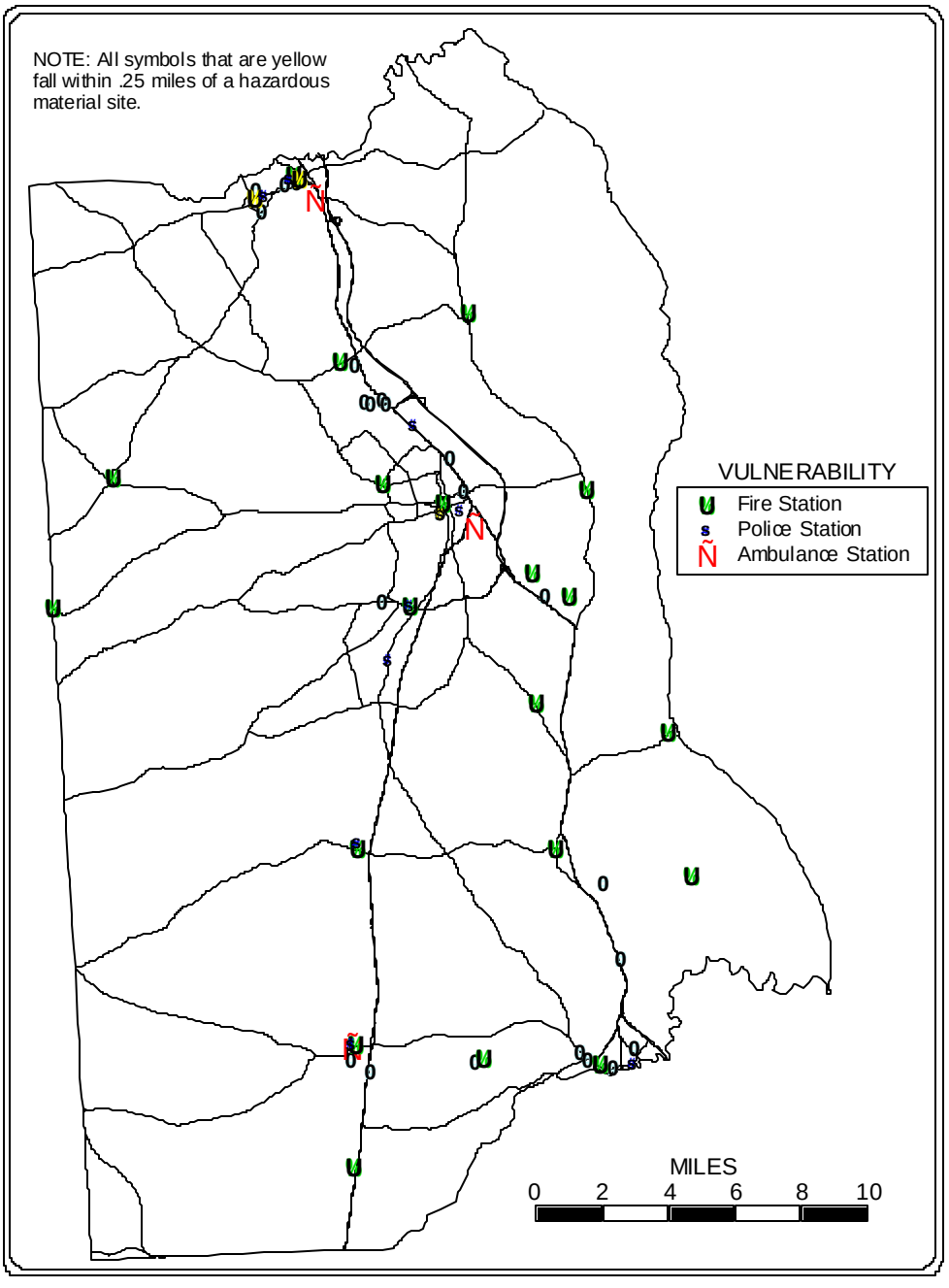
Source: Center for Applied Demography & Survey Research, University of Delaware.

Figure 5.6
Selected Vulnerabilities within 0.25 Miles of a Hazardous Material Site: Power Distribution



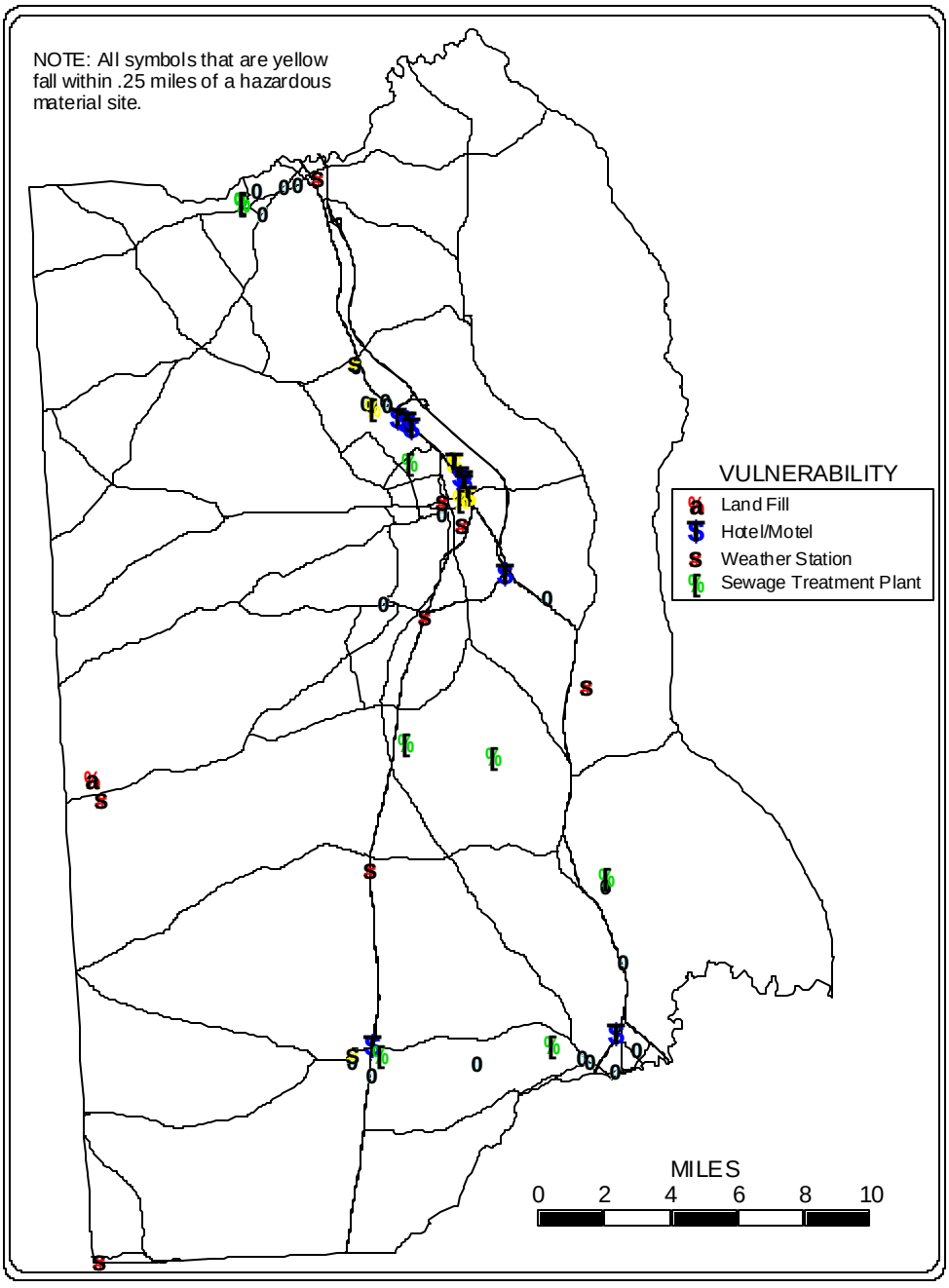
Source: Center for Applied Demography & Survey Research, University of Delaware.

Figure 5.7
Selected Vulnerabilities within 0.25 Miles of a Hazardous Material Site: Emergency Services



Source: Center for Applied Demography & Survey Research, University of Delaware.

Figure 5.8
Selected Vulnerabilities within 0.25 Miles of a Hazardous Material Site: Other



Source: Center for Applied Demography & Survey Research, University of Delaware.

Nuclear Power Plants

Background

Releases of toxic materials from nuclear plants adjacent to Delaware are fortunately infrequent. In fact, no such release has ever occurred from the three plants within range of Kent County. The range of intensity and duration of any release is substantial and that makes this a particularly difficult event to mitigate anywhere but at the hazard. Such releases should they occur would almost inevitably be the result of an accident and thus are not usually predictable in advance. They also could occur anytime of the year.

The damage caused by a toxic release is largely a function of the amount released, the amount of area affected, and the contents of the area.

The nuclear power plants present a somewhat different problem from natural phenomenon. The location of the potential problem is known. There is little knowledge about the frequency of radioactive releases. What is difficult to estimate is the magnitude of the release and the distance it will travel. Those are subject to the weather conditions at the time of the release into the air. Under certain conditions the damage might be minimal, under other circumstances the effect could be lethal.

The primary result of an accident at a nuclear power plant is usually a radioactive release. This may be accompanied by fire and explosion, which can aid and exacerbate the problem. There will be problems on the site and depending on the circumstance the toxic release may leave the boundaries of the property. In some situations, the resulting releases may be minimal, e.g. Three Mile Island (1979). In more serious situations, the site itself and even contiguous areas may have to be evacuated. In the most serious situations, e.g. Chernobyl (1986), the area was permanently evacuated, serious long-term damage was done to the food chain, and there were thousands of injuries and deaths.

Kent County Nuclear Plants

There are three nuclear plants capable of affecting Kent County. Both the 50 mile EPZ for Peach Bottom and for Calvert Cliffs intersect Kent County. The 10, 20 and 50 mile EPZ of the Salem nuclear plant cover some or all of Kent County.

The Calvert Cliffs 50 mile EPZ (C50) includes 200 people and no jobs. The current market value of residential property affected is $7,000,000 and the total value of commercial, industrial, and utility property is approximately $80,000.

The Peach Bottom 50 mile EPZ (P50) includes 15,000 people and 4,700 jobs. The current market value of residential property affected is $437,000,000 and the total value of commercial, industrial, and utility property is approximately $93,000,000.

The Salem 10 mile EPZ (S10) includes 400 people and 100 jobs. The current market value of residential property affected is $3,000,000 and the total value of commercial, industrial, and utility property is approximately $500,000.

The Salem 20 mile EPZ (S20) includes 30,000 people and 15,000 jobs. The current market value of residential property affected is $1,100,000,000 and the total value of commercial, industrial, and utility property is approximately $607,000,000.

The Salem 50 mile EPZ (S50) includes 124,300 people and 53,500 jobs. The current market value of residential property affected is $4,300,000,000 and the total value of commercial, industrial, and utility property is approximately $1,700,000,000.

These estimates do not include the value of state owned property that is not subject to the property tax and there are significant properties of that type in impacted areas. These are upper bound estimates since the exact area of the flood is approximate and the location of the employment is an estimate.

Vulnerabilities

In the eight maps that follow, each of the 14 vulnerabilities identified as being within the various radiuses of the EPZs are displayed. Any vulnerability that lies within the area of a circle is at risk. In some cases, the actual number of symbols on the map may not agree with the list of

affected vulnerabilities in the associated appendix table. This will happen when two vulnerabilities of the same type are co-located and thus have the same latitude and longitude and the same symbol.

Since the Salem 50 mile EPZ covers the entire county and there is no spatial differentiation, all vulnerabilities in all categories are at risk and will not be referred to further.

Transportation. Smyrna airport is inside both S20 and P50. Delaware Airpark and Chandelle Estates are inside S20. No airports are affected by C50.

Port Mahon is inside S20 along with four other boat ramps. There is one boat ramp inside S10 and another inside P50.

There are three bridges inside of C50 but none is on an evacuation route. A total of 40 bridges are inside P50 and 18 are on evacuation routes. S10 contains 2 bridges both of which are on evacuation routes. S20 contains 86 bridges and 40 of those are on evacuation routes.

Communications. Of the seven TV/radio stations in Kent County, four (WDOV, WDSD, W27AJ, and WMDJ) are inside S20. Two of seven communication towers (WDOV and the Delaware State Police) are also inside S20. Two of three sirens are located inside S10 with the same two inside P50. All of the sirens are within S20.

All of the newspapers, the Emergency Operations Center, and the Kent County 911 Center are outside S10, S20, C50, and P50.

Employers and Government. There are no major employers or government offices within S10,C50. Nine government offices including facilities in Kenton, Clayton and Smyrna are within P50 and S20. An additional five offices are inside S20.

Six major employers are within P50 and an additional 14 major employers are inside S20.

Education and Corrections. Of the 103 schools in Kent County, 11 are within the P50 EPZ with those plus an additional 12 inside S20. Three of the five university/college facilities are within S20 (DSU, Hickory Hill, and DTCC-Terry).

Fragile Populations. Four of the nursing homes in Kent County are inside S20 with one also inside P50 (Delaware Hospital for the Chronically Ill in Smyrna).

No day care facility is inside S10 but 12 are inside S20 and five of those are also within P50.

Kent General Hospital is outside of everything except S50.

Power Distribution. Two municipal power taps, one southeast of Smyrna and the other southwest of Kenton are in S20. The Kenton site is also in P50. The substations in Clayton and Cheswold are in S20 and the one in Clayton is also in P50.

Emergency Services. Only the Smyrna Paramedics are in S20 and P50. The Smyrna and Clayton Police departments are inside both S20 and P50 while the Delaware State Police Headquarters is only inside S20.

There are four fire companies within S20 including Citizens, Clayton, Leipsic, and Cheswold. Citizens and Clayton are also within P50. The American Legion Ambulance Service is within both S20 and P50.

Other Services. Five of the 12 hotels in Kent County are within S20. Four out of 10 sewage treatment plants are also inside. Two of the plants east of Clayton (Hanover) are also in P50. The state weather station in Blackbird Forest is in both S20 and P50 and is joined by a private weather station also in S20.

Next Steps

There are several additional issues that could improve the utility of this information. Since hazard mitigation is under the management of the US Department of Energy and the plant operators, the primary strategy will probably be evacuation. The extent of the evacuation will depend on the weather and the size of the release.

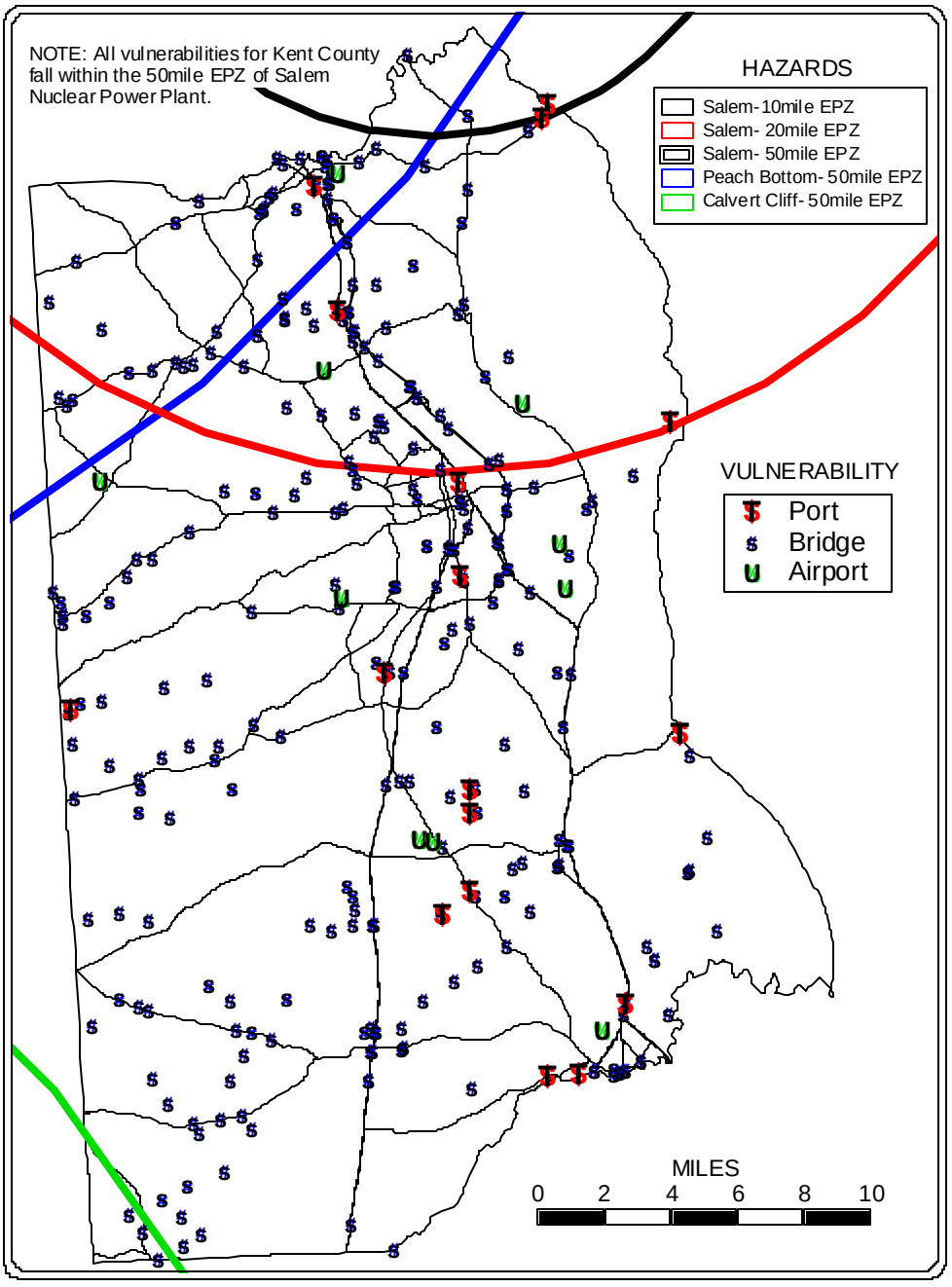
1. Build a new layer in the geographic information system using the DEMA segmentation of the EPZs. Calculate the populations and employment that might have to be evacuated.

2. Obtain weather information by time of year that might suggest the parts of the county that might have a greater risk.

3. Identify farms along with crops and livestock that might be subjected to ingestion of radioactive material.

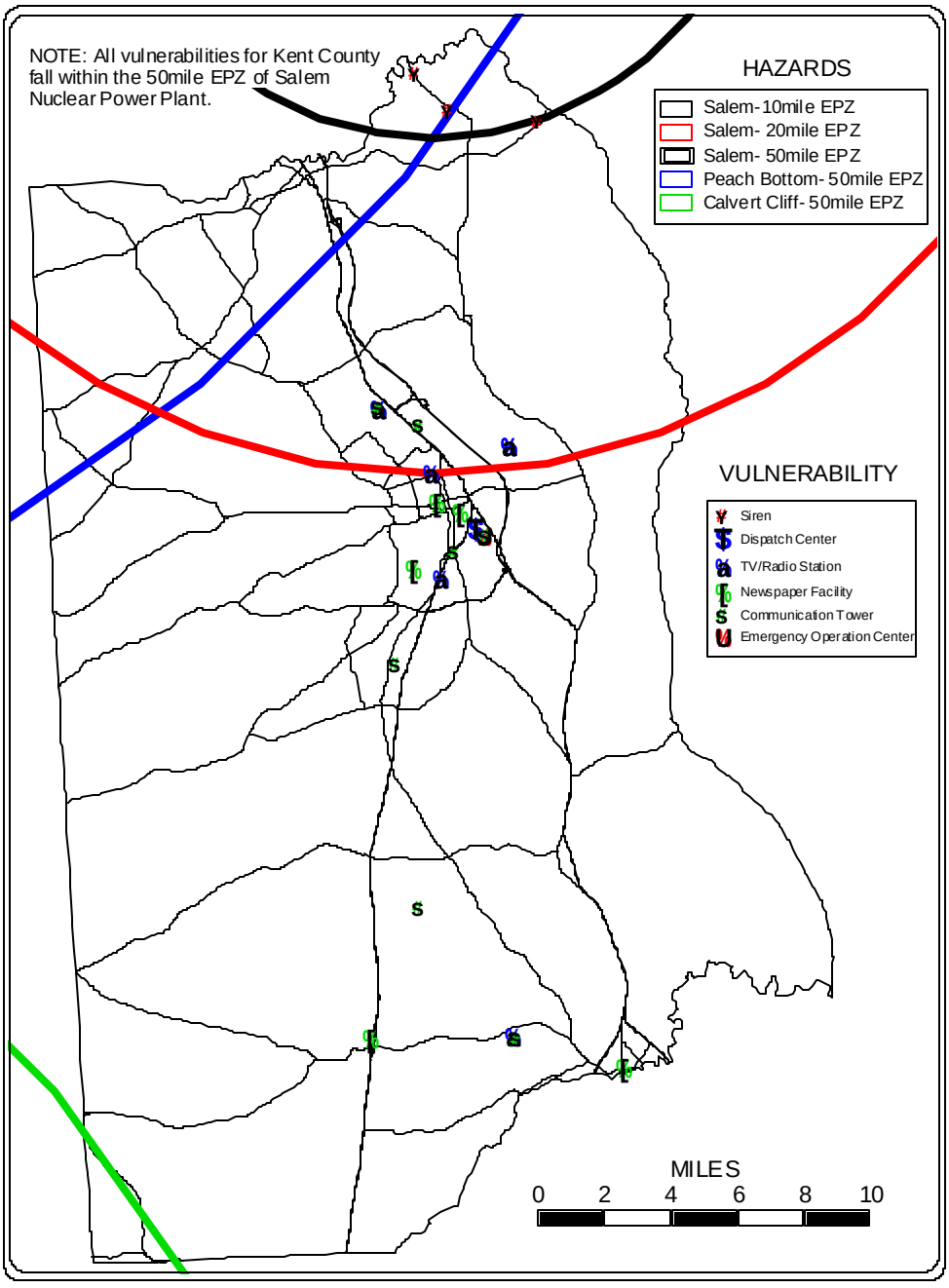
4. Add capacity information to all facilities both private and public that might have to be evacuated.

Figure 6.1
Selected Vulnerabilities within 10/20/50 Mile EPZs of Nuclear Power Plants: Transportation



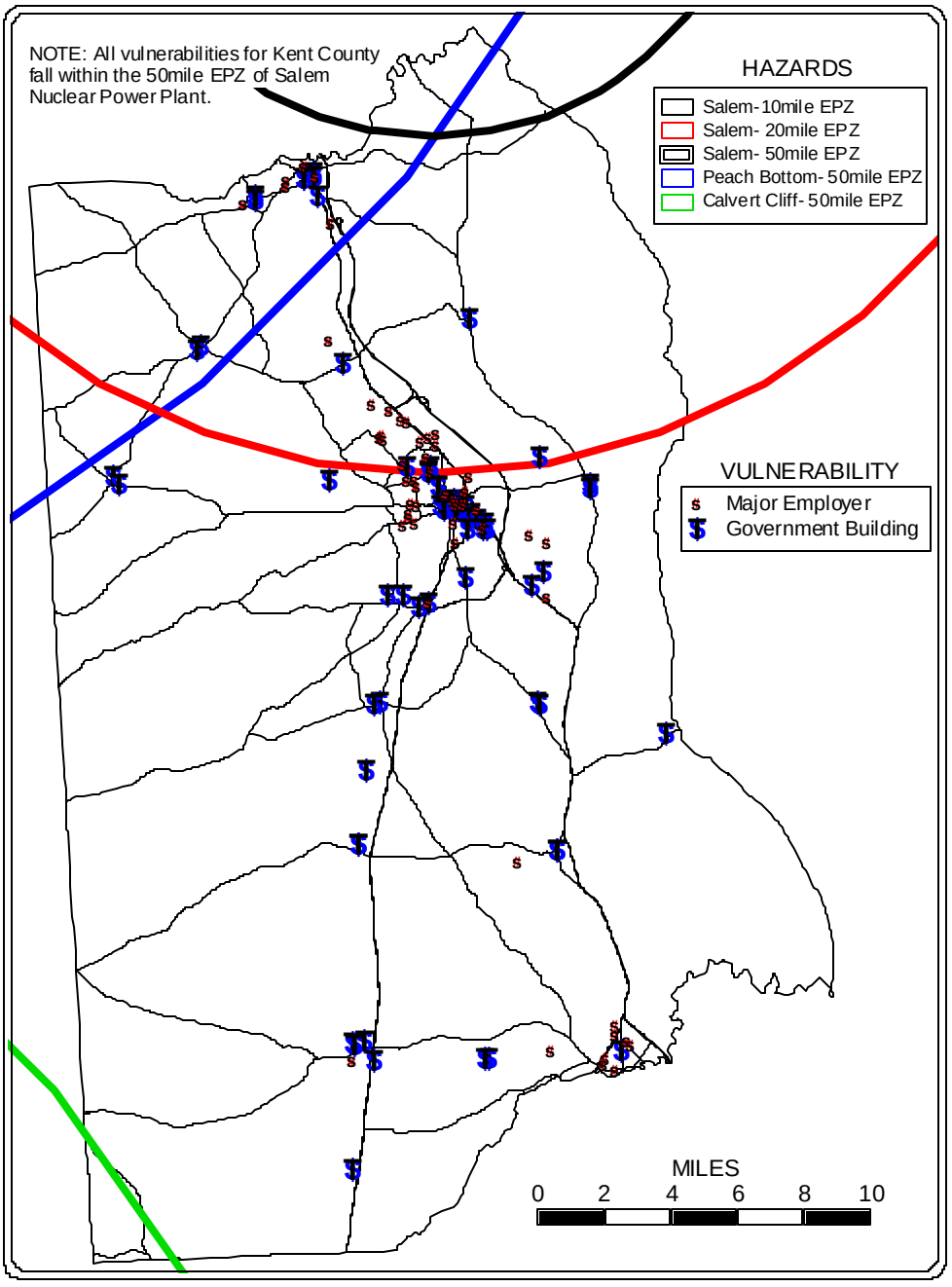
Source: Center for Applied Demography & Survey Research, University of Delaware.

Figure 6.2
Selected Vulnerabilities within 10/20/50 Mile EPZs of Nuclear Power Plants: Communications



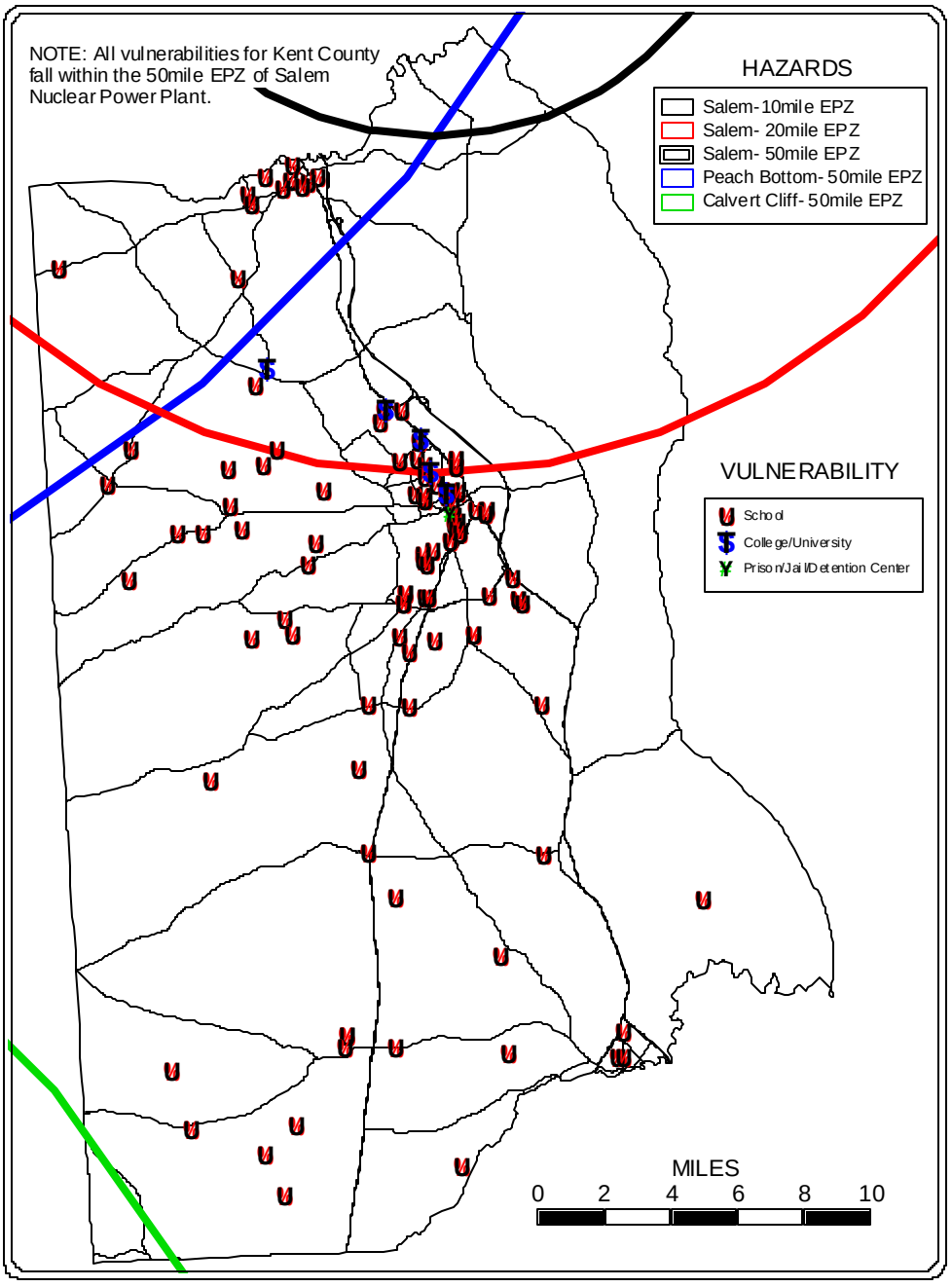
Source: Center for Applied Demography & Survey Research, University of Delaware.

Figure 6.3
Selected Vulnerabilities within 10/20/50 Mile EPZs of Nuclear Power Plants: Employers and Government



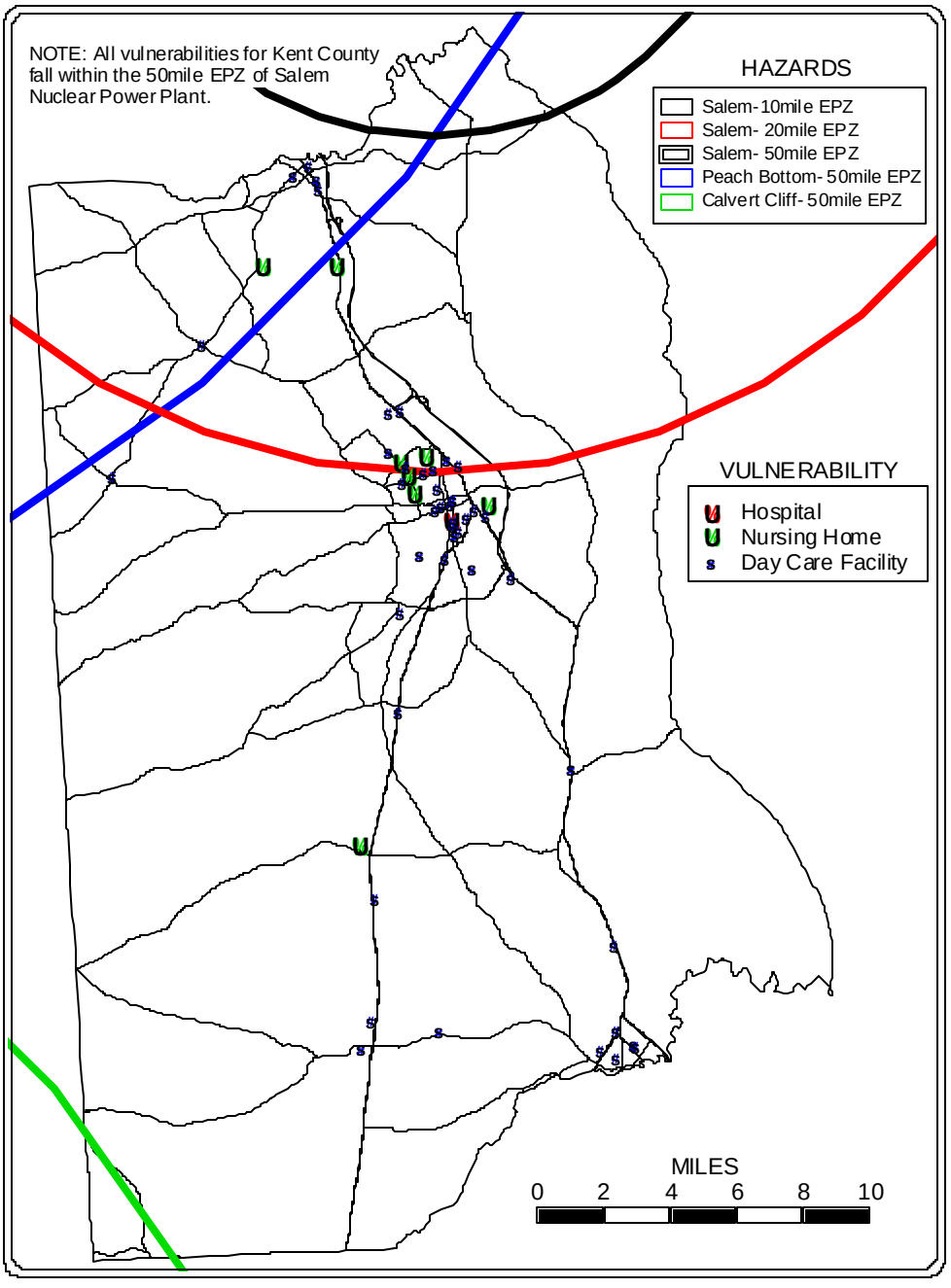
Source: Center for Applied Demography & Survey Research, University of Delaware.

Figure 6.4
Selected Vulnerabilities within 10/20/50 Mile EPZs of Nuclear Power Plants: Education and Corrections



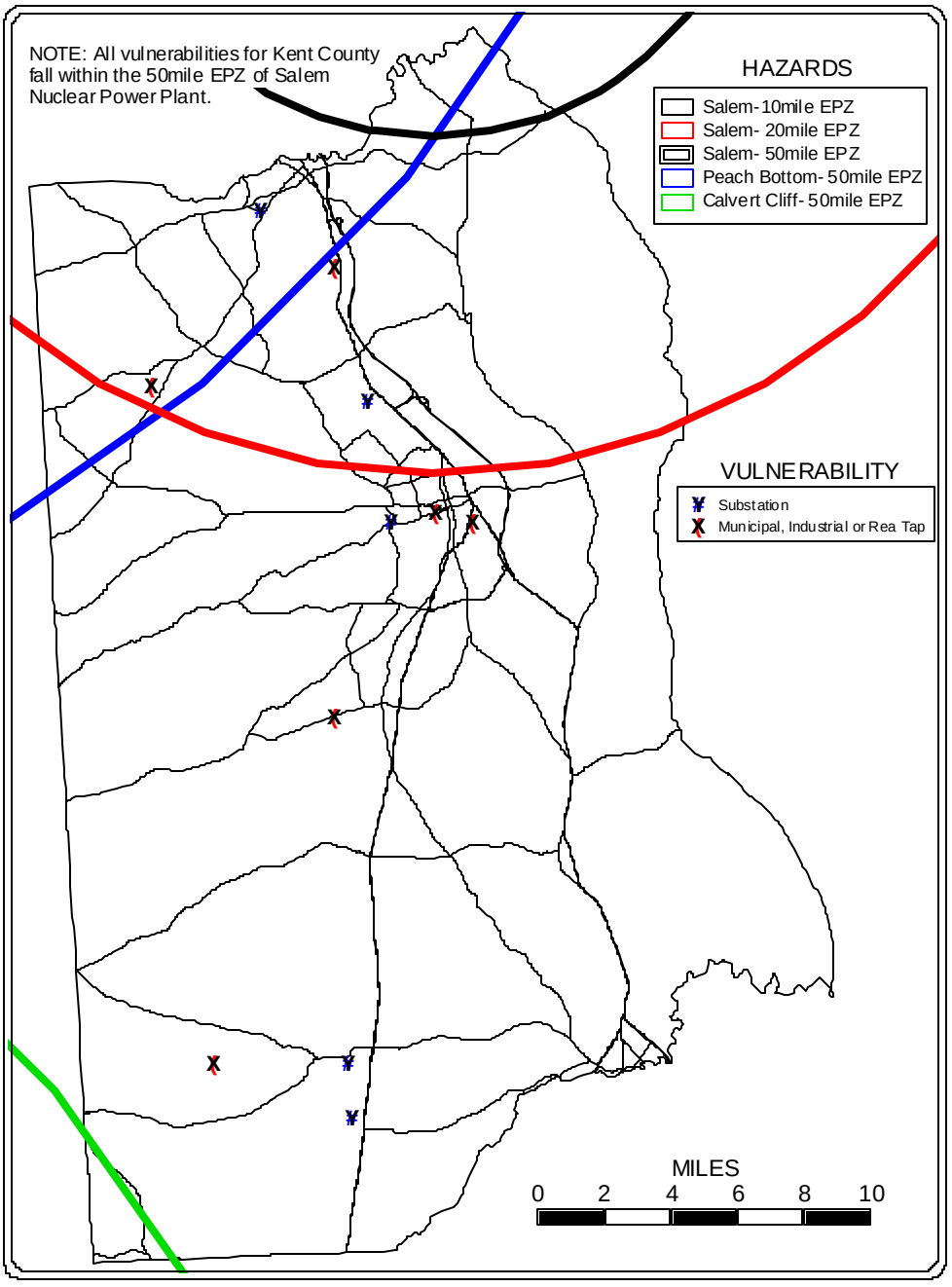
Source: Center for Applied Demography & Survey Research, University of Delaware.

Figure 6.5
Selected Vulnerabilities within 10/20/50 Mile EPZs of Nuclear Power Plants: Fragile Populations



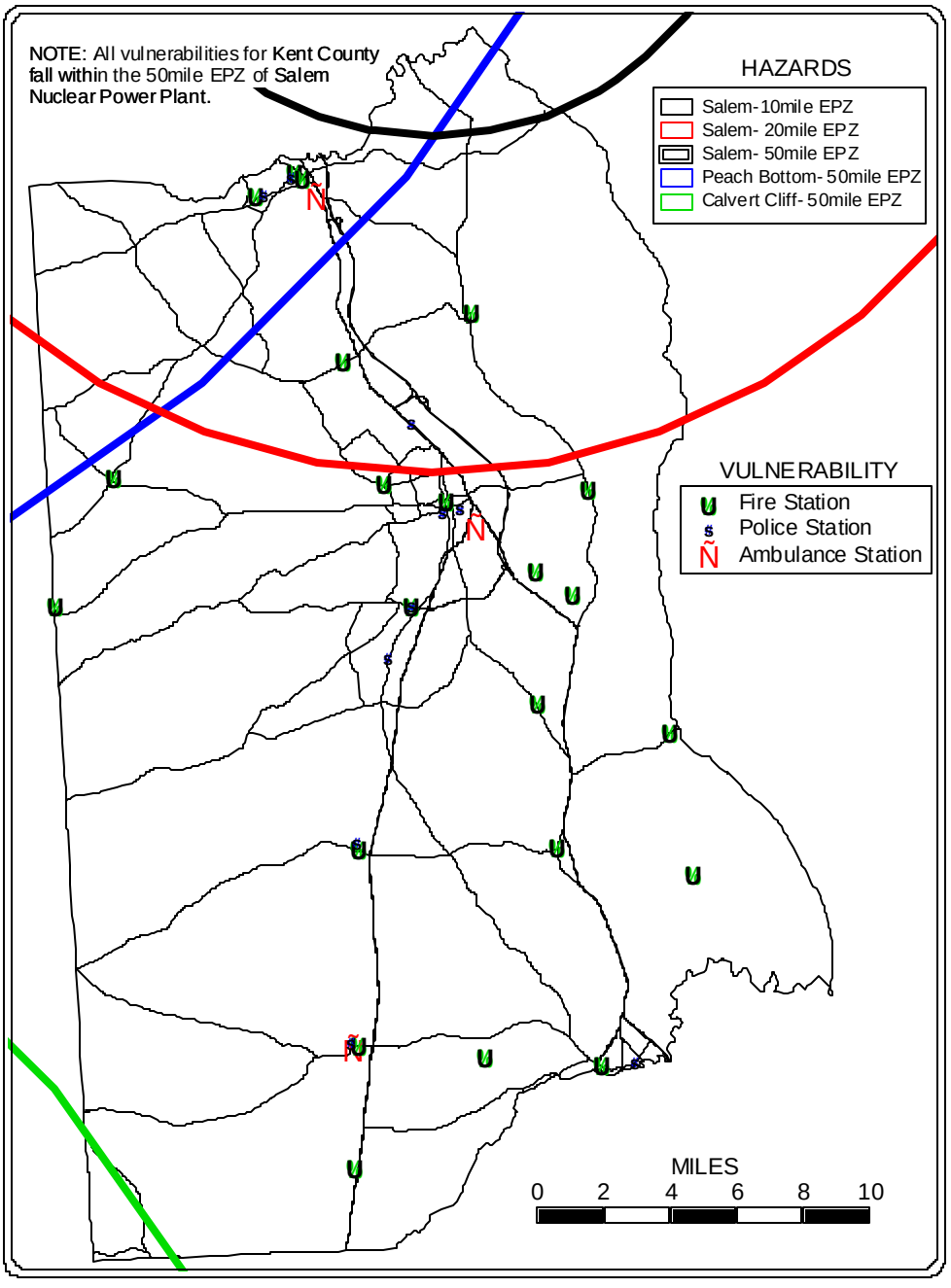
Source: Center for Applied Demography & Survey Research, University of Delaware.

Figure 6.6
Selected Vulnerabilities within 10/20/50 Mile EPZs of Nuclear Power Plants: Power Distribution



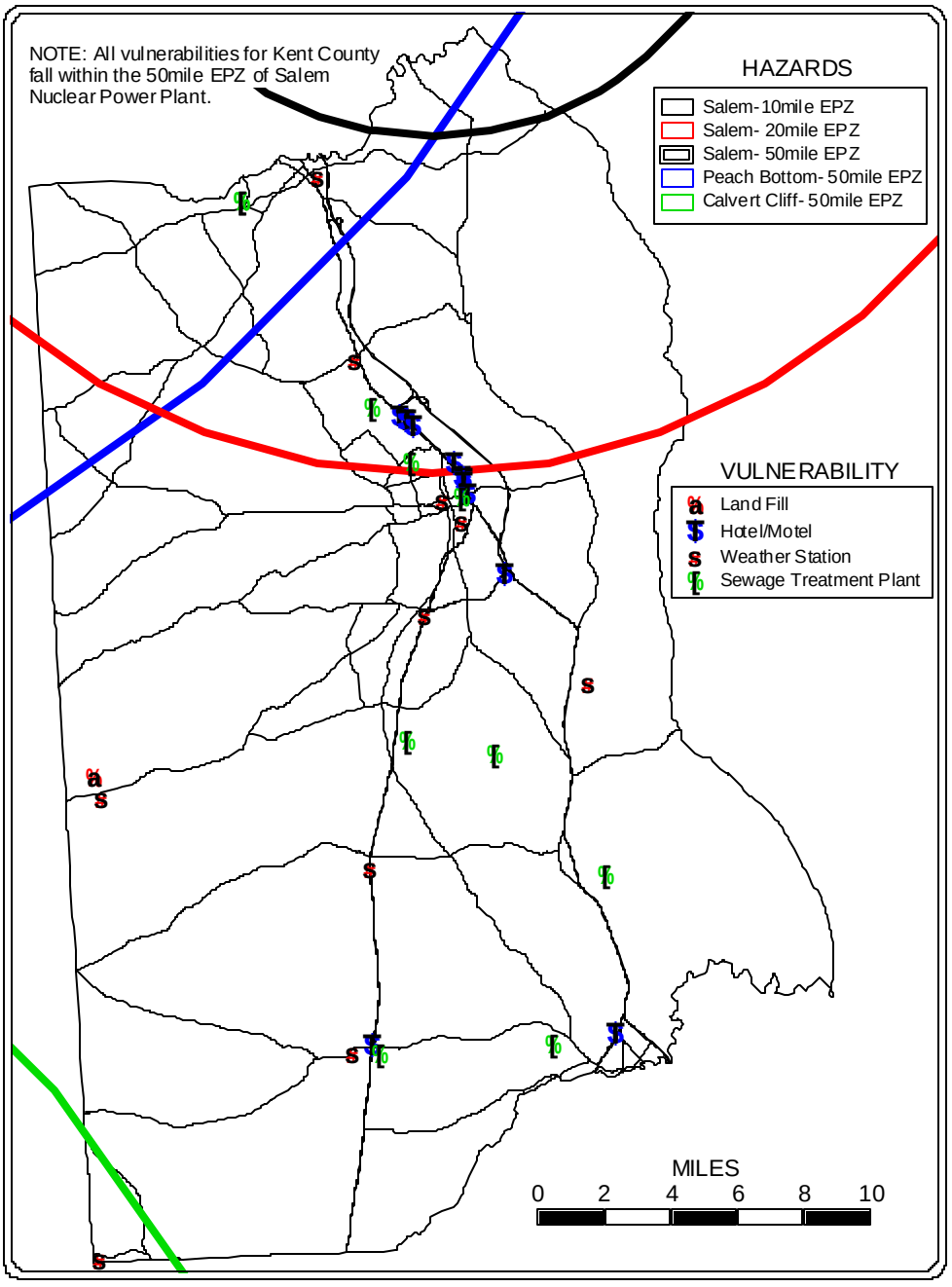
Source: Center for Applied Demography & Survey Research, University of Delaware.

Figure 6.7
Selected Vulnerabilities within 10/20/50 Mile EPZs of Nuclear Power Plants: Emergency Services



Source: Center for Applied Demography & Survey Research, University of Delaware.

Figure 6.8
Selected Vulnerabilities within 10/20/50 Mile EPZs of Nuclear Power Plants: Other



Source: Center for Applied Demography & Survey Research, University of Delaware.

Observations

After completing this analysis, it is possible to reach a number of conclusions. It is important to understand that these conclusions are arrived at within a framework of economic and policy analysis and not particularly from the point of view of disaster research or emergency management.

The most fruitful area to focus on is probably the hazardous materials sites. They are clearly the most frequent events and have a potential for serious damage including loss of life, injury, disruption of the transportation system, and damage to the economy. While no single event may do all of this, the potential losses coupled with the frequency of such events are significant. There is also a significant possibility of an event occurring because of the onset of another event such as a flood. This interaction at a critical time may make management of the release more difficult.

Further, since the strategy is largely one of hazard mitigation with sensitivity to the interaction with the vulnerabilities, there is a significant coordination role to be played. Many different emergency services may respond to such an event. The level of knowledge and training related to these events may vary significantly. Frequently, those first to respond are the first casualties in a toxic or explosive release.

In addition, the regulatory authority may or may not routinely and systematically advise all that could respond what they will be facing. This is another role that emergency management, if it is not already doing so, may well be able to assist in. There is definitely room for improving the information set available for managing these incidents.

The second most frequent event is the 100-year flood. There have been 100-year floods in parts of Kent County during this century but they are still infrequent events. Since the expected value of costs avoided is related to frequency, mitigation efforts might better be focused on vulnerabilities in 25-year floods. This will exclude some vulnerabilities listed in this report, but all of those included will be at risk more often. Since floods are generally low intensity events with

short-term impact, sharpening the focus to the most vulnerable may enhance the effectiveness of the planning effort and make any restrictive mitigation efforts easier to sell. Further, this approach may aid the valuation calculus as well.

The third area in terms of frequency is the failure of a dam. There have been incidents of this type and the results were damaging to the transportation system. More importantly, there may have been an interaction with a 25-year flood that occurred in the same year. Like the case with floods and hazardous materials, these two hazards probably should be managed in concert. The initiating event may be the flood, but the high intensity, long term impact may be the dam failure. Dam failures are more likely to be avoided by hazard mitigation rather than vulnerability mitigation.

The fourth area, a Category 3 hurricane has never occurred and may never occur simply because Delaware is a physically small place. Florida, which has suffered through 24 of these events this century has 25 times the land area of Delaware for a target, has 20 times the coast line and faces hurricanes from two directions. Delaware is on the periphery of hurricane paths along with Maryland which also has not experienced a Category 3 hurricane, and Virginia which has had one this century. In contrast, North Carolina has had 11. If one looks at all hurricanes, Category 1 through 5, Delaware has been struck by none, Maryland by one, Virginia by four, North Carolina by 25, and Florida by 57. Planning for such a low probability event of this type may be of little value. This is especially true since planning for floods covers much the same area as the Category 3 inundation area.

Finally, planning and mitigation for an event at one of the three nuclear power plants is probably prudent but has an extremely low probability given current experience. None of the plants are under Delaware's control and thus are not open to hazard mitigation which is rightly the purview of the Department of Energy and the operator of the facility. Any release that would occur would presumably be accidental and thus is not predictable. Should a release of any size occur at Salem that would cross the Delaware River, the idea that a 10/20/50 mile zone could be accurately forecast seems remote. In all probability, the primary strategy would have to be an orderly evacuation. The implication is that a great deal of interstate coordination would be required by all the emergency management agencies since there would be considerable cross-border movements. In these circumstances, the integrity of the evacuation routes becomes paramount.

The one topic that runs through all of the hazards consistently is the transportation system. Very few of the vulnerabilities, if any, are without alternatives as long as the populations and/or services can be moved to other locations. A major problem will develop if those affected by the hazard are isolated and have to withstand the brunt of the event.

The transportation system can withstand the loss of bridges as long as there are alternatives. When the St. Georges Bridge was closed, traffic was rerouted to Reedy Point or Summit bridges. There was a loss of time and a redistribution of the traffic. When the railroad bridge over the canal was closed, freight was moved to truck. True there are higher costs in terms of time and money, but the system does not fail.

The real problems begin when a vulnerability and its alternatives fail simultaneously, e.g. all bridges over the C&D Canal fail simultaneously and the population becomes isolated. This could happen when an area is serviced by a single road and a bridge on that road fails. There is a very real need to identify these situations if they exist.

The other situation occurs when the transportation system fails in that it cannot move people out of the way fast enough. That is, there are bottlenecks, which occur because the roads are being used at levels beyond their capacity or there are failures in the system that diminished its capacity, e.g. a bridge fails on an evacuation route and a less capable alternative must be used.

Both situations need to be modeled to identify both roads and bridges that could fail if one or more of the hazards occur. If that has already been done, then the database of vulnerabilities needs to be updated with that information.

APPENDIX A

100-year Flood Vulnerabilities

Hazard	Layer	Name	ADC Grid
flood	siren	237	1-F10
flood	bridge	9001	1-F9
flood	siren	235	1-J13
flood	bridge	9002	2-A13
flood	port	WOODLAND BEACH RAMP	2-G13
flood	bridge	039A	3-F12
flood	bridge	039B	4-D9
flood	bridge	041F	5-A12
flood	bridge	040A	5-A8
flood	bridge	040C	5-A8
flood	bridge	137A	5-B7
flood	bridge	137B	5-D8
flood	bridge	064A	5-F4
flood	bridge	915N	5-F4
flood	bridge	915S	5-F4
flood	bridge	001A	5-F6
flood	bridge	065C	5-F6
flood	bridge	916N	5-G6
flood	bridge	916S	5-G6
flood	bridge	009A	5-J4
flood	bridge	009B	6-A3
flood	bridge	084B	6-D12
flood	bridge	011B	6-H6
flood	bridge	011A	6-H9
flood	bridge	010A	7-C2
flood	siren	214	7-D1
flood	port	WOODLAND BEACH WILDLIFE AREA RAMP	7-D1
flood	bridge	095A	8-C2
flood	bridge	143A	8-D10
flood	bridge	041A	8-E10
flood	bridge	041B	8-E10
flood	bridge	094A	8-H4
flood	bridge	166B	9-F7
flood	bridge	041E	9-G4
flood	bridge	045A	9-G6
flood	bridge	045B	9-K7
flood	bridge	091A	10-A5
flood	bridge	101B	10-C10
flood	bridge	042A	10-C3
flood	bridge	042B	10-C3
flood	bridge	104C	10-F11
flood	bridge	919N	10-H3

Hazard	Layer	Name	ADC Grid
flood	bridge	919S	10-H3
flood	government	CHESWOLD POST OFFICE	10-H7
flood	bridge	156A	10-J11
flood	bridge	927N	10-J4
flood	bridge	927S	10-J4
flood	bridge	156C	10-K13
flood	bridge	9003	11-A11
flood	bridge	100A	11-A11
flood	bridge	9004	11-A12
flood	bridge	014B	11-G3
flood	bridge	012B	11-H2
flood	fd	LEIPSIC VFC (Co. 53)	11-H3
flood	bridge	015A	11-K8
flood	bridge	086A	12-B6
flood	port	PORT MAHON	13-E12
flood	bridge	185A	14-D12
flood	bridge	186A	14-D13
flood	bridge	221A	14-J13
flood	bridge	220A	14-K11
flood	school	CHRISTIAN OPPORTUNITY LEARNING INC.	14-K11
flood	bridge	050C	15-A9
flood	bridge	103A	15-B9
flood	school	COMMUNITY LEARNING INSTITUTE, INC.	15-D7
flood	bridge	050D	15-E7
flood	bridge	101A	15-H4
flood	bridge	163A	16-A4
flood	bridge	051A	16-B6
flood	bridge	162B	16-D4
flood	bridge	160A	16-E3
flood	bridge	203A	16-G11
flood	bridge	104B	16-H2
flood	bridge	158A	16-J3
flood	bridge	9006	17-B12
flood	bridge	195A	17-B12
flood	bridge	069A	17-D1
flood	bridge	9005	17-E8
flood	bridge	190A	17-E8
flood	bridge	003C	17-F2
flood	port	MOORES LAKE RAMP	17-G11
flood	port	SILVER LAKE RAMP	17-G3
flood	government	KENT CO. TOURISM	17-G5
flood	bridge	003B	17-G8
flood	bridge	024B	17-G9

Hazard	Layer	Name	ADC Grid
flood	bridge	027D	17-G9
flood	tower	KENTCOM 911 CENTER	17-G9
flood	bridge	027B	17-H11
flood	bridge	027C	17-H11
flood	government	STATE FISH HATCHERY	17-H11
flood	stp	1	17-H4
flood	bridge	016A	17-H4
flood	bridge	023A	17-H5
flood	bridge	067A	17-H5
flood	mjremp	DEPT OF INSTRUCTION	17-H5
flood	government	FAMILY COURT	17-H5
flood	mjremp	STATE PERSONNEL OFFICE	17-H5
flood	bridge	024A	17-H7
flood	daycare	WONDER YEARS DAY CARE	17-J10
flood	bridge	356A	17-K13
flood	bridge	356B	18-A11
flood	bridge	356C	18-A11
flood	bridge	066A	18-A2
flood	bridge	348A	18-G9
flood	government	LITTLE CREEK POST OFFICE	18-H4
flood	government	LITTLE CREEK TOWN HALL	18-H4
flood	bridge	067C	18-H5
flood	bridge	017A	18-J5
flood	bridge	089A	19-B3
flood	bridge	050A	20-E1
flood	bridge	050B	20-E1
flood	bridge	208A	20-E1
flood	bridge	211A	20-E11
flood	port	JOHN B. MEDFORD RAMP	20-E8
flood	bridge	207A	20-E9
flood	bridge	210A	20-F8
flood	bridge	222A	20-G1
flood	bridge	208C	20-H13
flood	bridge	208B	20-H8
flood	bridge	212A	21-C12
flood	bridge	223A	21-C7
flood	bridge	213A	21-E11
flood	bridge	053C	21-G12
flood	bridge	225A	21-G6
flood	bridge	214A	21-H11
flood	bridge	053D	21-K9
flood	bridge	004A	23-B5
flood	bridge	024C	23-C5

Hazard	Layer	Name	ADC Grid
flood	bridge	105B	23-F10
flood	bridge	360A	23-F3
flood	bridge	029A	23-G2
flood	bridge	027A	23-H1
flood	bridge	363A	24-B3
flood	bridge	364B	24-F5
flood	bridge	007B	24-G5
flood	wstall	24	24-H6
flood	government	BOWERS BEACH TOWN HALL	25-E10
flood	fd	BOWERS VFC (Co. 40)	25-E10
flood	port	BOWERS BEACH RAMP	25-F10
flood	port	BOWERS BEACH RAMP	25-F10
flood	bridge	121B	25-G12
flood	bridge	053A	26-F2
flood	bridge	268A	26-G12
flood	bridge	053B	27-A1
flood	bridge	254A	27-A2
flood	bridge	055A	27-A3
flood	bridge	265B	27-B12
flood	bridge	055B	27-C4
flood	bridge	249A	27-J1
flood	bridge	285A	28-E12
flood	bridge	284A	28-G13
flood	bridge	284C	28-H9
flood	bridge	286A	28-J11
flood	bridge	005D	28-K12
flood	bridge	005E	29-A1
flood	bridge	033B	29-B1
flood	bridge	371C	29-C1
flood	bridge	384A	29-F11
flood	port	KILLENS POND RAMP	29-F12
flood	bridge	033A	29-F6
flood	bridge	381A	29-G2
flood	port	COURSEY POND RAMP	29-H10
flood	port	MCGINNIS POND RAMP	29-H2
flood	port	ANDREWS LAKE RAMP	29-H4
flood	bridge	378B	29-J1
flood	bridge	388A	29-J10
flood	bridge	380A	29-J3
flood	bridge	035A	30-A10
flood	bridge	035B	30-B8
flood	bridge	390C	30-C11
flood	bridge	371A	30-C2

Hazard	Layer	Name	ADC Grid
flood	bridge	008G	30-F6
flood	bridge	008F	30-F7
flood	bridge	389A	30-F8
flood	bridge	008H	30-G6
flood	bridge	008I	30-G6
flood	bridge	120A	31-F8
flood	bridge	121A	31-G8
flood	bridge	418A	31-H5
flood	bridge	123A	31-J13
flood	bridge	291A	33-G7
flood	bridge	059A	33-J5
flood	bridge	059B	34-A6
flood	bridge	295A	34-B11
flood	bridge	296A	34-C13
flood	bridge	299B	34-J12
flood	bridge	277A	34-J5
flood	bridge	059D	34-J8
flood	bridge	111A	34-K10
flood	bridge	059E	34-K8
flood	bridge	005A	35-K8
flood	bridge	005B	36-A8
flood	stp	4	36-A9
flood	bridge	430A	36-C7
flood	bridge	429A	36-E5
flood	bridge	398B	36-J2
flood	port	GRIFFITHS LAKE RAMP	37-E11
flood	port	HAVEN LAKE RAMP	37-G11
flood	bridge	008A	37-J11
flood	bridge	008B	37-J11
flood	bridge	022A	37-K11
flood	mjremp	PENINSULA OIL CO.	37-K11
flood	bridge	502	38-A11
flood	bridge	008D	38-A5
flood	police	MILFORD	38-B10
flood	bridge	019A	38-C1
flood	bridge	021A	38-C10
flood	bridge	124B	38-D2
flood	bridge	124D	38-D2
flood	bridge	409A	38-E6
flood	bridge	112B	41-A10
flood	bridge	063A	41-B13
flood	bridge	113C	41-C8
flood	bridge	308B	41-D9

Hazard	Layer	Name	ADC Grid
flood	bridge	114E	41-E12
flood	bridge	307A	41-E7
flood	bridge	305A	41-F3
flood	bridge	060B	41-H2
flood	bridge	304C	41-H6
flood	bridge	060C	41-J1
flood	bridge	114A	41-K2

APPENDIX B

Category 3 Hurricane Inundation Vulnerabilities

Hazard	Layer	Name	ADC Grid
inundation	siren	237	1-F10
inundation	siren	235	1-J13
inundation	bridge	065B	5-C4
inundation	bridge	137B	5-D8
inundation	port	LAKE COMO RAMP	5-E6
inundation	bridge	009D	5-F4
inundation	wstall	21	5-F5
inundation	school	SMYRNA KINDERGARTEN CENTER	5-F5
inundation	bridge	001A	5-F6
inundation	bridge	065C	5-F6
inundation	airport	SMYRNA AIRPORT	5-G5
inundation	bridge	009B	6-A3
inundation	bridge	084B	6-D12
inundation	bridge	009C	6-E4
inundation	bridge	011B	6-H6
inundation	bridge	011A	6-H9
inundation	bridge	010A	7-C2
inundation	siren	214	7-D1
inundation	port	WOODLAND BEACH WILDLIFE AREA RAMP	7-D1
inundation	bridge	9007	10-E3
inundation	bridge	9008	10-E4
inundation	bridge	002C	10-G3
inundation	bridge	002D	10-G3
inundation	port	GARRISONS LAKE RAMP	10-G3
inundation	bridge	927N	10-J4
inundation	bridge	927S	10-J4
inundation	bridge	084A	11-A1
inundation	bridge	014A	11-A4
inundation	bridge	088A	11-F11
inundation	bridge	014B	11-G3
inundation	fd	LEIPSIC VFC (Co. 53)	11-H3
inundation	government	LEIPSIC TOWN HALL	11-H4
inundation	bridge	015A	11-K8
inundation	port	PORT MAHON	13-E12
inundation	bridge	069A	17-D1
inundation	bridge	003A	17-F11
inundation	bridge	003C	17-F2
inundation	port	MOORES LAKE RAMP	17-G11
inundation	government	KENT CO. TOURISM	17-G5
inundation	prison	MORRIS CORRECTIONAL INSTITUTION	17-G6
inundation	school	POSITIVE OUTCOMES CHARTER SCHOOL	17-G6
inundation	bridge	003B	17-G8

Hazard	Layer	Name	ADC Grid
inundation	bridge	024B	17-G9
inundation	bridge	027D	17-G9
inundation	tower	KENTCOM 911 CENTER	17-G9
inundation	bridge	027B	17-H11
inundation	bridge	027C	17-H11
inundation	government	STATE FISH HATCHERY	17-H11
inundation	stp	3	17-H4
inundation	bridge	016A	17-H4
inundation	bridge	023A	17-H5
inundation	bridge	067A	17-H5
inundation	mjremp	DEPT OF INSTRUCTION	17-H5
inundation	government	FAMILY COURT	17-H5
inundation	mjremp	STATE PERSONNEL OFFICE	17-H5
inundation	daycare	DOVER EDUCATIONAL & COMMUNITY CENTER	17-H6
inundation	bridge	024A	17-H7
inundation	daycare	WONDER YEARS DAY CARE	17-J10
inundation	mirea	UNKNOWN	17-J6
inundation	paramedic	K.C. PARAMEDICS	17-J7
inundation	dispatch	KENT COUNTY 911 CENTER	17-J7
inundation	bridge	356A	17-K13
inundation	bridge	066B	17-K2
inundation	hotel	BEST WESTERN GALAXY	18-A11
inundation	bridge	066A	18-A2
inundation	school	DOVER AIR FORCE BASE MIDDLE SCHOOL	18-B13
inundation	school	WELCH (Major George S.) ELEMENTARY SCHOOL	18-B13
inundation	school	ARNOLD (Gen. Henry H.) ELEMENTARY SCHOOL	18-C13
inundation	bridge	016B	18-D4
inundation	mjremp	DOVER AIR FORCE BASE-DAFB	18-E12
inundation	bridge	348A	18-G9
inundation	government	LITTLE CREEK POST OFFICE	18-H4
inundation	government	LITTLE CREEK TOWN HALL	18-H4
inundation	fd	LITTLE CREEK VFC (Co. 54)	18-H4
inundation	bridge	067C	18-H5
inundation	bridge	017A	18-J5
inundation	bridge	089A	19-B3
inundation	bridge	360A	23-F3
inundation	bridge	029A	23-G2
inundation	bridge	027A	23-H1
inundation	stp	4	23-K12
inundation	bridge	363A	24-B3
inundation	bridge	007A	24-F10
inundation	wstall	24	24-H6
inundation	government	BOWERS BEACH TOWN HALL	25-E10

Hazard	Layer	Name	ADC Grid
inundation	fd	BOWERS VFC (Co. 40)	25-E10
inundation	port	BOWERS BEACH RAMP	25-F10
inundation	port	BOWERS BEACH RAMP	25-F10
inundation	bridge	121B	25-G12
inundation	port	KILLENS POND RAMP	29-F12
inundation	bridge	381A	29-G2
inundation	port	COURSEY POND RAMP	29-H10
inundation	port	ANDREWS LAKE RAMP	29-H4
inundation	bridge	378B	29-J1
inundation	bridge	388A	29-J10
inundation	bridge	380A	29-J3
inundation	bridge	035B	30-B8
inundation	bridge	371A	30-C2
inundation	bridge	035C	30-C7
inundation	government	FREDERICA POST OFFICE	30-E6
inundation	bridge	008G	30-F6
inundation	government	FREDERICA CITY HALL	30-F6
inundation	fd	FREDERICA VFC (Co. 49)	30-F6
inundation	bridge	008F	30-F7
inundation	stp	1	30-K8
inundation	bridge	120A	31-F8
inundation	bridge	121A	31-G8
inundation	fd	SOUTH BOWERS VFC (Co. 57)	31-G9
inundation	school	HOMESTEAD MOTIVATION ACADEMY	31-H10
inundation	bridge	418A	31-H5
inundation	bridge	123A	31-J13
inundation	bridge	398B	36-J2
inundation	port	HAVEN LAKE RAMP	37-G11
inundation	bridge	008A	37-J11
inundation	bridge	008B	37-J11
inundation	bridge	022A	37-K11
inundation	mjremp	PENINSULA OIL CO.	37-K11
inundation	newspaper	THE CHRONICLE	38-A10
inundation	bridge	501	38-A11
inundation	bridge	502	38-A11
inundation	bridge	504	38-A11
inundation	bridge	008D	38-A5
inundation	port	TUB MILL POND RAMP	38-A6
inundation	police	MILFORD	38-B10
inundation	bridge	019A	38-C1
inundation	bridge	021A	38-C10
inundation	bridge	124B	38-D2
inundation	bridge	124D	38-D2

Hazard	Layer	Name	ADC Grid
inundation	bridge	409A	38-E6

APPENDIX C

Dam Vulnerabilities

Hazard	Layer	Name	ADC Grid
dam	wstall	21	5-F5
dam	daycare	SMYRNA DAY NURSERY	5-F6
dam	daycare	TELAMON HEAD START (SMYRNA)	5-F6
dam	bridge	190B	17-B12
dam	bridge	027B	17-H11
dam	government	STATE FISH HATCHERY	17-H11
dam	bridge	360A	23-F3
dam	bridge	388A	29-J10
dam	stp	2	36-A9
dam	bridge	503	37-K11
dam	bridge	504	38-A11
dam	bridge	505	38-A11
dam	bridge	008D	38-A5

APPENDIX D

Hazardous Material Sites Vulnerabilities

Hazard	Layer	Name	ADC Grid
hazmat	fd	CLAYTON VFC (Co. 45)	5-A7
hazmat	government	CLAYTON POST OFFICE	5-A7
hazmat	bridge	040C	5-A8
hazmat	bridge	040B	5-A8
hazmat	bridge	040A	5-A8
hazmat	subst	UNKNOWN	5-A8
hazmat	mjremp	THRIFTWAY	5-C6
hazmat	mjremp	METAL MASTERS FOODSERVICE EQUIP	5-C6
hazmat	school	IMMACULATA SCHOOL	5-C6
hazmat	school	JAMES SAMMONS HOME SCHOOL	5-C6
hazmat	daycare	LOVING CARE NURSERY SCHOOL	5-D5
hazmat	fd	CITIZENS HOSE VFC (Co. 44)	5-D6
hazmat	school	SMYRNA ELEMENTARY SCHOOL	5-D6
hazmat	government	SMYRNA POST OFFICE	5-E5
hazmat	government	SMYRNA TOWN HALL	5-E6
hazmat	wstall	20	10-J7
hazmat	mjremp	REICHOLD CHEMICALS INC.	10-K10
hazmat	stp	7	10-K10
hazmat	subst	UNKNOWN	10-K10
hazmat	tower	WDOV RADIO TOWER	11-A10
hazmat	college	DELAWARE TECH & C.C.(Terry Campus)	11-A11
hazmat	mjremp	DELAWARE TECH & C.C.(Terry Campus)	11-A11
hazmat	mirea	UNKNOWN	17-E6
hazmat	daycare	TELAMON KENT COUNTY HEAD START	17-F2
hazmat	daycare	LOVE-A-CHILD DAY CARE, INC.	17-F5
hazmat	government	JP COURT #7/JP COURT 16	17-F5
hazmat	daycare	KCCA CHILD CARE PROGRAMS	17-F6
hazmat	government	KENT FEDERAL BLDG	17-F6
hazmat	police	DOVER	17-F6
hazmat	hotel	HOWARD JOHNSONS	17-G2
hazmat	school	TOWNE POINT ELEMENTARY	17-G2
hazmat	school	TOWNE POINT ES INTENSIVE LEARNING CENTER	17-G2
hazmat	school	MURPHEY SCHOOL	17-G4
hazmat	prison	MORRIS CORRECTIONAL INSTITUTION	17-G6
hazmat	bridge	016A	17-H4
hazmat	hotel	COMFORT INN	17-H4
hazmat	mjremp	PLATEX SALES & SERVICE INC.	17-H4
hazmat	mjremp	DOVER WIPES COMPANY (THE)	17-H4
hazmat	mjremp	PLATEX PRODUCTS INC.	17-H4
hazmat	stp	3	17-H4
hazmat	mjremp	DOVER AIR FORCE BASE-DAFB	18-E12
hazmat	subst	UNKNOWN	35-H10
hazmat	wstall	19	35-H9

Hazard	Layer	Name	ADC Grid
hazmat	mjremp	BURRIS FOODS INC.	35-J10
hazmat	bridge	006B	35-K11
hazmat	bridge	006E	35-K12
hazmat	bridge	022A	37-K11
hazmat	bridge	503	37-K11
hazmat	mjremp	PENINSULA OIL CO.	37-K11
hazmat	bridge	504	38-A11
hazmat	bridge	505	38-A11
hazmat	daycare	"TLC-AND BABY MAKE THREE"	38-B9
hazmat	daycare	THE LEARNING CENTER "TLC" INC.	38-B9
hazmat	mjremp	KENT-SUSSEX INDUSTRIES	38-B9

APPENDIX E

10/20/50 Nuclear Plant EPZ Vulnerabilities

Hazard	Layer	Name	ADC Grid	S10	S20	S50	C50	P50
nuclear	siren	237	1-F10	Y	Y	Y		Y
nuclear	bridge	9009	1-F9	Y	Y	Y		
nuclear	siren	235	1-J13	Y	Y	Y		Y
nuclear	bridge	9010	2-A13	Y	Y	Y		
nuclear	port	WOODLAND BEACH RAMP	2-G13	Y	Y	Y		Y
nuclear	school	CHILDREN UNDER CONSTRUCTION	3-D13		Y	Y		Y
nuclear	bridge	039A	3-F12		Y	Y	Y	
nuclear	bridge	039B	4-D9		Y	Y	Y	
nuclear	bridge	133A	4-F7		Y	Y	Y	
nuclear	school	HEART-IN-HAND SCHOOL	4-J13		Y	Y		Y
nuclear	stp	25	4-J7		Y	Y		Y
nuclear	school	CLAYTON ELEMENTARY SCHOOL	4-K7		Y	Y		Y
nuclear	government	CLAYTON TOWN HALL	4-K7		Y	Y		Y
nuclear	school	SAINT JOSEPH INDUSTRIAL	4-K7		Y	Y		Y
nuclear	stp	26	4-K7		Y	Y		Y
nuclear	bridge	041F	5-A12		Y	Y	Y	
nuclear	nhome	DELAWARE HOSPITAL FOR THE CHRONICALLY ILL	5-A12		Y	Y		Y
nuclear	school	SMYRNA HIGH SCHOOL	5-A5		Y	Y		Y
nuclear	police	CLAYTON	5-A7		Y	Y		Y
nuclear	government	CLAYTON POST OFFICE	5-A7		Y	Y		Y
nuclear	fd	CLAYTON VFC (Co. 45)	5-A7		Y	Y		Y
nuclear	bridge	040A	5-A8		Y	Y	Y	
nuclear	bridge	040B	5-A8		Y	Y	Y	
nuclear	bridge	040C	5-A8		Y	Y	Y	
nuclear	subst	CLAYTON	5-A8		Y	Y		Y
nuclear	bridge	065A	5-B4		Y	Y	Y	
nuclear	bridge	039C	5-B7		Y	Y	Y	
nuclear	bridge	137A	5-B7		Y	Y	Y	
nuclear	bridge	065B	5-C4		Y	Y	Y	
nuclear	police	SMYRNA	5-C5		Y	Y		Y
nuclear	school	IMMACULATA SCHOOL	5-C6		Y	Y		Y
nuclear	school	JAMES SAMMONS HOME SCHOOL	5-C6		Y	Y		Y
nuclear	bridge	001C	5-D4		Y	Y	Y	
nuclear	school	NORTH SMYRNA ELEMENTARY SCHOOL	5-D4		Y	Y		Y
nuclear	fd	AMERICAN LEGION AMB. SRV. (Amb. 64)	5-D5		Y	Y		Y
nuclear	daycare	LOVING CARE NURSERY SCHOOL	5-D5		Y	Y		Y
nuclear	fd	CITIZENS HOSE VFC (Co. 44)	5-D6		Y	Y		Y
nuclear	school	SMYRNA ELEMENTARY SCHOOL	5-D6		Y	Y		Y
nuclear	bridge	137B	5-D8		Y	Y	Y	
nuclear	daycare	SHONNA'S LICENSED DAY CARE	5-E4		Y	Y		Y
nuclear	government	COURT #8	5-E5		Y	Y		Y
nuclear	government	DE CORRECTION DEPT	5-E5		Y	Y		Y
nuclear	government	SMYRNA POST OFFICE	5-E5		Y	Y		Y

Hazard	Layer	Name	ADC Grid	S10	S20	S50	C50	P50
nuclear	port	LAKE COMO RAMP	5-E6		Y	Y		Y
nuclear	school	MOORE (John Bassett) SCHOOL	5-E6		Y	Y		Y
nuclear	government	SMYRNA TOWN HALL	5-E6		Y	Y		Y
nuclear	bridge	009D	5-F4		Y	Y	Y	
nuclear	bridge	064A	5-F4		Y	Y	Y	
nuclear	bridge	915N	5-F4		Y	Y	Y	
nuclear	bridge	915S	5-F4		Y	Y	Y	
nuclear	wstall	21	5-F5		Y	Y		Y
nuclear	school	SMYRNA KINDERGARTEN CENTER	5-F5		Y	Y		Y
nuclear	bridge	001A	5-F6		Y	Y	Y	
nuclear	bridge	065C	5-F6		Y	Y	Y	
nuclear	daycare	SMYRNA DAY NURSERY	5-F6		Y	Y		Y
nuclear	daycare	TELAMON HEAD START (SMYRNA)	5-F6		Y	Y		Y
nuclear	paramedic	SMYRNA PARAMEDICS	5-F7		Y	Y		Y
nuclear	government	STATE DEPT OF HEALTH PUBLIC LAB	5-F7		Y	Y		Y
nuclear	nhome	INTEGRATED HEALTH SERVICES OF DE AT KENT	5-G12		Y	Y		
nuclear	mirea	JONES	5-G12		Y	Y		
nuclear	airport	SMYRNA AIRPORT	5-G5		Y	Y	Y	
nuclear	bridge	916N	5-G6		Y	Y	Y	
nuclear	bridge	916S	5-G6		Y	Y	Y	
nuclear	bridge	012C	5-G7		Y	Y	Y	
nuclear	bridge	917N	5-G9		Y	Y	Y	
nuclear	bridge	917S	5-G9		Y	Y	Y	
nuclear	bridge	918N	5-H10		Y	Y		
nuclear	bridge	918S	5-H10		Y	Y		
nuclear	bridge	009A	5-J4		Y	Y	Y	
nuclear	bridge	009B	6-A3		Y	Y	Y	
nuclear	bridge	084B	6-D12		Y	Y		
nuclear	bridge	009C	6-E4		Y	Y		
nuclear	bridge	011B	6-H6		Y	Y		
nuclear	bridge	011A	6-H9		Y	Y		
nuclear	bridge	010A	7-C2		Y	Y		
nuclear	siren	214	7-D1		Y	Y		
nuclear	port	WOODLAND BEACH WILDLIFE AREA RAMP	7-D1		Y	Y		Y
nuclear	bridge	095A	8-C2		Y	Y	Y	
nuclear	bridge	143A	8-D10			Y	Y	
nuclear	bridge	041A	8-E10			Y	Y	
nuclear	bridge	041B	8-E10			Y	Y	
nuclear	bridge	094A	8-H4		Y	Y	Y	
nuclear	bridge	041C	8-K8		Y	Y	Y	
nuclear	bridge	041D	9-B7		Y	Y	Y	
nuclear	mirea	NEW MEREDITH	9-B9		Y	Y		Y
nuclear	bridge	046A	9-D7		Y	Y	Y	

Hazard	Layer	Name	ADC Grid	S10	S20	S50	C50	P50
nuclear	bridge	170A	9-E7		Y	Y	Y	
nuclear	daycare	KENTON CHILD CARE CENTER	9-F6		Y	Y		Y
nuclear	government	KENTON COMM HALL	9-F6		Y	Y		Y
nuclear	government	KENTON POST OFFICE	9-F6		Y	Y		Y
nuclear	bridge	166B	9-F7		Y	Y	Y	
nuclear	bridge	041E	9-G4		Y	Y	Y	
nuclear	bridge	045A	9-G6		Y	Y	Y	
nuclear	bridge	045B	9-K7		Y	Y		
nuclear	school	GREEN HILL AMISH SCHOOL	9-K9		Y	Y		
nuclear	bridge	091A	10-A5		Y	Y		
nuclear	college	HICKORY HILL FORAGE RSRCH FARM(DSU)	10-A8		Y	Y		
nuclear	bridge	101B	10-C10		Y	Y		
nuclear	bridge	042C	10-C2		Y	Y	Y	
nuclear	bridge	042A	10-C3		Y	Y		
nuclear	bridge	042B	10-C3		Y	Y		
nuclear	bridge		10-E3		Y	Y		
nuclear	bridge		10-E4		Y	Y		
nuclear	bridge	104C	10-F11		Y	Y		
nuclear	airport	DELAWARE AIRPARK	10-F8		Y	Y		
nuclear	bridge	002C	10-G3		Y	Y		
nuclear	bridge	002D	10-G3		Y	Y		
nuclear	port	GARRISONS LAKE RAMP	10-G3		Y	Y		
nuclear	bridge	002B	10-H3		Y	Y		
nuclear	bridge	919N	10-H3		Y	Y		
nuclear	bridge	919S	10-H3		Y	Y		
nuclear	government	CHESWOLD POST OFFICE	10-H7		Y	Y		
nuclear	fd	CHESWOLD VFC (Co. 43)	10-H7		Y	Y		
nuclear	bridge	084C	10-J1		Y	Y		
nuclear	bridge	156A	10-J11		Y	Y		
nuclear	bridge	927N	10-J4		Y	Y		
nuclear	bridge	927S	10-J4		Y	Y		
nuclear	bridge	002A	10-J5		Y	Y		
nuclear	wstall	20	10-J7		Y	Y		
nuclear	subst	CHESWOLD	10-K10		Y	Y		
nuclear	stp	7	10-K10		Y	Y		
nuclear	bridge	156C	10-K13		Y	Y		
nuclear	bridge	014C	10-K6		Y	Y		
nuclear	bridge	084A	11-A1		Y	Y		
nuclear	tower	WDOV RADIO TOWER	11-A10		Y	Y		
nuclear	bridge	100A	11-A11		Y	Y		
nuclear	college	DELAWARE TECH & C.C.(Terry Campus)	11-A11		Y	Y		
nuclear	school	POLYTECH ADULT EDUCATION	11-A11		Y	Y		
nuclear	tvrad	WDOV 1410AM	11-A11		Y	Y		

Hazard	Layer	Name	ADC Grid	S10	S20	S50	C50	P50
nuclear	tvrad	WDSD 92.9FM	11-A11		Y	Y		
nuclear	bridge		11-A11		Y	Y		
nuclear	school	FORK BRANCH	11-A12		Y	Y		
nuclear	bridge		11-A12		Y	Y		
nuclear	bridge	014A	11-A4		Y	Y		
nuclear	bridge	345	11-A7		Y	Y		
nuclear	hotel	COMFORT SUITES	11-B11		Y	Y		
nuclear	daycare	DTCC, TERRY CAMPUS (ECAP)	11-B11		Y	Y		
nuclear	school	KENT CHRISTIAN ACADEMY	11-C11		Y	Y		
nuclear	daycare	KENT CHRISTIAN DAY CARE AND LEARNING CENTER	11-C11		Y	Y		
nuclear	hotel	HAMPTON INN	11-C12		Y	Y		
nuclear	hotel	SHERATON INN DOVER	11-C12		Y	Y		
nuclear	bridge	920N	11-C9		Y	Y		
nuclear	bridge	920S	11-C9		Y	Y		
nuclear	bridge	921E	11-D10		Y	Y		
nuclear	bridge	921W	11-D10		Y	Y		
nuclear	tower	D.S.P. HEADQUARTERS	11-D12		Y	Y		
nuclear	hotel	DOVER BUDGET INN	11-D12		Y	Y		
nuclear	police	STATE POLICE HQ/ACAD	11-D12		Y	Y		
nuclear	college	DELAWARE STATE UNIVERSITY	11-D13		Y	Y		
nuclear	school	EARLY CHILDHOOD LABORATORY SCHOOL	11-D13		Y	Y		
nuclear	bridge	088A	11-F11		Y	Y		
nuclear	bridge	088B	11-G12		Y	Y		
nuclear	bridge	014B	11-G3		Y	Y		
nuclear	bridge	012B	11-H2		Y	Y		
nuclear	fd	LEIPSIC VFC (Co. 53)	11-H3		Y	Y		
nuclear	government	LEIPSIC TOWN HALL	11-H4		Y	Y		
nuclear	bridge	015A	11-K8		Y	Y		
nuclear	bridge	086A	12-B6		Y	Y		
nuclear	airport	CHANDELLE ESTATES AIRPORT	12-C10		Y	Y		
nuclear	port	PORT MAHON	13-E12		Y	Y		
nuclear	bridge	185A	14-D12			Y		
nuclear	bridge	186A	14-D13			Y		
nuclear	fd	MARYDEL VFC (Co. 56)	14-D13			Y		
nuclear	airport	LASH AIRFIELD	14-H3			Y		
nuclear	school	HARTLY ELEMENTARY SCHOOL	14-H4			Y		
nuclear	bridge	221A	14-J13			Y		
nuclear	government	HARTLY TOWN HALL	14-J3			Y		
nuclear	fd	HARTLY VFC (Co. 51)	14-J3			Y		
nuclear	daycare	KINGDOM KIDS DAY CARE	14-J3			Y		
nuclear	government	HARTLY POST OFFICE	14-J4			Y		
nuclear	school	HARTLY HOME-SCHOOLING ASSOCIATION	14-K1			Y		
nuclear	bridge	220A	14-K11			Y		

Hazard	Layer	Name	ADC Grid	S10	S20	S50	C50	P50
nuclear	school	CHRISTIAN OPPORTUNITY LEARNING INC.	14-K11			Y		
nuclear	bridge	050C	15-A9			Y		
nuclear	bridge	103A	15-B9			Y		
nuclear	school	COMMUNITY LEARNING INSTITUTE, INC.	15-D7			Y		
nuclear	bridge	050D	15-E7			Y		
nuclear	school	SHADY LANE	15-F7			Y		
nuclear	school	CENTRAL CHRISTIAN SCHOOL	15-H2			Y		
nuclear	bridge	101A	15-H4			Y		
nuclear	school	CEDAR GROVE AMISH SCHOOL	15-H5			Y		
nuclear	school	WEST CENTER AMISH SCHOOL	15-J7			Y		
nuclear	school	WILEYS SCHOOL	16-A2			Y		
nuclear	bridge	163A	16-A4			Y		
nuclear	school	HONEYSUCKLE KNOLL SCHOOL	16-B1		Y	Y		
nuclear	bridge	051A	16-B6			Y		
nuclear	bridge	162B	16-D4			Y		
nuclear	school	APPLE GROVE AMISH SCHOOL	16-E10			Y		
nuclear	bridge	160A	16-E3			Y		
nuclear	school	ROSE VALLEY SCHOOL	16-E8			Y		
nuclear	school	BYLERS CHRISTIAN DAY SCHOOL	16-F4			Y		
nuclear	bridge	203A	16-G11			Y		
nuclear	bridge	052B	16-G13			Y		
nuclear	government	DE ST FIRE & FIRE MARSHALL	16-G3			Y		
nuclear	bridge	051B	16-G6			Y		
nuclear	airport	JENKINS AIRPORT	16-H12			Y		
nuclear	bridge	104B	16-H2		Y	Y		
nuclear	bridge	162A	16-H5			Y		
nuclear	bridge	104A	16-J2			Y		
nuclear	bridge	158A	16-J3			Y		
nuclear	fd	ROBBINS HOSE VFC (Co. 46-Sta #2)	17-A4			Y		
nuclear	daycare	KIDS R US	17-B1		Y	Y		
nuclear	bridge	190B	17-B12			Y		
nuclear	bridge	195A	17-B12			Y		
nuclear	government	WYOMING TOWN HALL	17-B12			Y		
nuclear	bridge		17-B12			Y		
nuclear	school	NORTH DOVER ELEMENTARY SCHOOL	17-B2		Y	Y		
nuclear	subst	KENT	17-B6			Y		
nuclear	school	SIMPSON (W. B.) ELEMENTARY SCHOOL	17-C12			Y		
nuclear	school	SIMPSON (W. B.) ES INTENSIVE LEARNING CENTER	17-C12			Y		
nuclear	government	WYOMING POST OFFICE	17-C12			Y		
nuclear	school	RODNEY JHS INTENSIVE LEARNING CENTER	17-C13			Y		
nuclear	school	RODNEY JUNIOR HIGH SCHOOL	17-C13			Y		
nuclear	government	DEPT OF CORRECTION	17-C2		Y	Y		
nuclear	daycare	S. LOWAN PITTS DAY CARE CENTER	17-C2		Y	Y		

Hazard	Layer	Name	ADC Grid	S10	S20	S50	C50	P50
nuclear	stp	6	17-C2		Y	Y		
nuclear	nhome	WESTMINSTER VILLAGE HEALTH CENTER	17-C2		Y	Y		
nuclear	nhome	CAPITOL HEALTHCARE SERVICES	17-C3			Y		
nuclear	daycare	THE LEARNING LODGE	17-C3			Y		
nuclear	bridge	069A	17-D1		Y	Y		
nuclear	newspaper	DELAWARE STATE NEWS	17-D10			Y		
nuclear	school	MAPLE ACADEMY MONTESSORI (The)	17-D10			Y		
nuclear	school	RODNEY (Caesar) HIGH SCHOOL	17-D12			Y		
nuclear	police	CAMDEN	17-D13			Y		
nuclear	government	CAMDEN TOWN HALL	17-D13			Y		
nuclear	fd	CAMDEN-WYOMING VFC (Co. 41)	17-D13			Y		
nuclear	school	KINDER CARE LEARNING CENTER, INC.	17-D2		Y	Y		
nuclear	daycare	KINDER CARE	17-D3			Y		
nuclear	bridge	156E	17-D4			Y		
nuclear	school	FAITH ELEMENTARY AND MIDDLE SCHOOL	17-D4			Y		
nuclear	nhome	GREEN MEADOWS	17-D4			Y		
nuclear	bridge	156D	17-D5			Y		
nuclear	school	KENT COUNTY COMMUNITY SCHOOL	17-D5			Y		
nuclear	school	WASHINGTON (Booker T.) ELEMENTARY SCHOOL	17-D5			Y		
nuclear	school	WILLIAM HENRY MIDDLE SCHOOL	17-D5			Y		
nuclear	school	WILLIAM HENRY MS INTENSIVE LEARNING CENTER	17-D5			Y		
nuclear	school	CAPITOL BAPTIST SCHOOL	17-D9			Y		
nuclear	daycare	DOVER EARLY LEARNING CENTER	17-D9			Y		
nuclear	nhome	SILVER LAKE CENTER	17-E1		Y	Y		
nuclear	school	BROWN (W. Reily) ELEMENTARY SCHOOL	17-E10			Y		
nuclear	school	LONG BRANCH ACADEMY	17-E12			Y		
nuclear	government	STATE DEPT. OF AGRICULTURE	17-E13			Y		
nuclear	government	DELAWARE STATE HOUSING AUTHORITY	17-E2			Y		
nuclear	school	DOVER HIGH SCHOOL	17-E2		Y	Y		
nuclear	daycare	FIRST BAPTIST PLAYTIME PRE-SCHOOL	17-E2			Y		
nuclear	government	PUBLIC SERVICE COMMISSION	17-E2		Y	Y		
nuclear	school	FAIRVIEW ELEMENTARY SCHOOL	17-E3			Y		
nuclear	government	SILVER LAKE PLAZA	17-E3			Y		
nuclear	college	WILMINGTON COLLEGE	17-E3			Y		
nuclear	tvrad	WKEN	17-E3			Y		
nuclear	mirea	DOVER	17-E6			Y		
nuclear	bridge	190A	17-E8			Y		
nuclear	bridge		17-E8			Y		
nuclear	school	FAMILY EDUCATION CENTER	17-E9			Y		
nuclear	bridge	003A	17-F11			Y		
nuclear	tvrad	WBOC CH16	17-F11			Y		
nuclear	bridge	003C	17-F2		Y	Y		
nuclear	daycare	TELAMON KENT COUNTY HEAD START	17-F2		Y	Y		

Hazard	Layer	Name	ADC Grid	S10	S20	S50	C50	P50
nuclear	daycare	AFTERNOON LITTLE	17-F4			Y		
nuclear	government	ARMY NATIONAL GUARD	17-F4			Y		
nuclear	government	ARMY NATIONAL GUARD	17-F4			Y		
nuclear	school	LITTLE SCHOOL, INC. (The)	17-F4			Y		
nuclear	college	WESLEY COLLEGE	17-F4			Y		
nuclear	wstall	12	17-F5			Y		
nuclear	school	CAMPUS COMMUNITY SCHOOL	17-F5			Y		
nuclear	newspaper	DOVER POST	17-F5			Y		
nuclear	government	JP COURT #7/JP COURT 16	17-F5			Y		
nuclear	daycare	LOVE-A-CHILD DAY CARE, INC.	17-F5			Y		
nuclear	fd	ROBBINS HOSE VFC (Co. 46-Sta #1)	17-F5			Y		
nuclear	police	DOVER	17-F6			Y		
nuclear	daycare	KCCA CHILD CARE PROGRAMS	17-F6			Y		
nuclear	government	KENT FEDERAL BLDG	17-F6			Y		
nuclear	daycare	BRIGHTER BEGINNINGS	17-F9			Y		
nuclear	port	MOORES LAKE RAMP	17-G11			Y		
nuclear	hotel	HOWARD JOHNSONS	17-G2		Y	Y		
nuclear	school	LAMBERTSONS DAY CARE, INC.	17-G2		Y	Y		
nuclear	daycare	LAMBERTSON'S DAY CARE, INC.	17-G2		Y	Y		
nuclear	school	TOWNE POINT ELEMENTARY	17-G2		Y	Y		
nuclear	school	TOWNE POINT ES INTENSIVE LEARNING CENTER	17-G2		Y	Y		
nuclear	port	SILVER LAKE RAMP	17-G3			Y		
nuclear	school	CENTRAL MIDDLE SCHOOL	17-G4			Y		
nuclear	school	CENTRAL MS INTENSIVE LEARNING CENTER	17-G4			Y		
nuclear	school	MURPHEY SCHOOL	17-G4			Y		
nuclear	government	DEPT. OF NATURAL RESOURCES	17-G5			Y		
nuclear	government	DOVER CITY HALL	17-G5			Y		
nuclear	government	DOVER FIELD OFFICE	17-G5			Y		
nuclear	government	DOVER POST OFFICE	17-G5			Y		
nuclear	daycare	ELIZABETH W. MURPHEY SCHOOL	17-G5			Y		
nuclear	government	HALL OF RECORDS	17-G5			Y		
nuclear	government	KENT CO. TOURISM	17-G5			Y		
nuclear	daycare	SANFORD S. MURPHEY DAY CARE	17-G5			Y		
nuclear	government	STATE CAPITOL	17-G5			Y		
nuclear	government	TOWNSEND BUILDING	17-G5			Y		
nuclear	daycare	WESLEY PLAY CARE	17-G5			Y		
nuclear	school	WESLEY PRESCHOOL	17-G5			Y		
nuclear	government	COOPER BUILDING	17-G6			Y		
nuclear	government	DE STATE SUPREME COURT	17-G6			Y		
nuclear	government	DOVER ARMORY	17-G6			Y		
nuclear	government	KENT CO. ADMINISTRATION BLDG	17-G6			Y		
nuclear	government	KENT CO. COURTHOUSE	17-G6			Y		
nuclear	prison	MORRIS CORRECTIONAL INSTITUTION	17-G6			Y		

Hazard	Layer	Name	ADC Grid	S10	S20	S50	C50	P50
nuclear	government	O'NEILL BUILDING	17-G6			Y		
nuclear	school	POSITIVE OUTCOMES CHARTER SCHOOL	17-G6			Y		
nuclear	government	TATNALL BUILDING	17-G6			Y		
nuclear	government	VISITOR CENTER	17-G6			Y		
nuclear	wstall	3	17-G7			Y		
nuclear	daycare	BAYHEALTH / KGH CHILD CARE & LEARNING CTR	17-G7			Y		
nuclear	school	HOLY CROSS ELEMENTARY SCHOOL	17-G7			Y		
nuclear	hospital	KENT GENERAL	17-G7			Y		
nuclear	school	PLAYHOUSE NURSERY	17-G7			Y		
nuclear	school	SOUTH DOVER ELEMENTARY SCHOOL	17-G7			Y		
nuclear	school	ST. JOHN EARLY LEARNING CENTER	17-G7			Y		
nuclear	daycare	ST. JOHN'S LUTHERAN EARLY LEARNING CENTER	17-G7			Y		
nuclear	daycare	THE PLAYHOUSE NURSERY SCHOOL	17-G7			Y		
nuclear	bridge	003B	17-G8			Y		
nuclear	daycare	CHILDREN'S CORNER (YMCA)/ DOVER	17-G8			Y		
nuclear	school	KENT INTENSIVE LEARNING CENTER	17-G8			Y		
nuclear	bridge	024B	17-G9			Y		
nuclear	bridge	027D	17-G9			Y		
nuclear	tower	KENTCOM 911 CENTER	17-G9			Y		
nuclear	bridge	027B	17-H11			Y		
nuclear	bridge	027C	17-H11			Y		
nuclear	government	STATE FISH HATCHERY	17-H11			Y		
nuclear	hotel	DAYS INN	17-H3			Y		
nuclear	hotel	RAMADA INN	17-H3			Y		
nuclear	hotel	SUPER LODGE	17-H3			Y		
nuclear	bridge	016A	17-H4			Y		
nuclear	hotel	COMFORT INN	17-H4			Y		
nuclear	stp	3	17-H4			Y		
nuclear	bridge	023A	17-H5			Y		
nuclear	bridge	067A	17-H5			Y		
nuclear	government	FAMILY COURT	17-H5			Y		
nuclear	police	CAPITOL POLICE	17-H6			Y		
nuclear	daycare	DOVER EDUCATIONAL & COMMUNITY CENTER	17-H6			Y		
nuclear	newspaper	NEWS JOURNAL	17-H6			Y		
nuclear	government	STATE SERVICE CENTER	17-H6			Y		
nuclear	government	THOMAS COLLINS BUILDING	17-H6			Y		
nuclear	bridge	024A	17-H7			Y		
nuclear	government	COURT #5	17-H7			Y		
nuclear	daycare	WONDER YEARS DAY CARE	17-J10			Y		
nuclear	government	DOT-HIGHWAY DIVISION	17-J6			Y		
nuclear	mirea	DOVER	17-J6			Y		
nuclear	school	LOVE-N-LEARN NURSERY-N-PRESCHOOL	17-J6			Y		
nuclear	daycare	LOVE-N-LEARN PRESCHOOL TOO	17-J6			Y		

Hazard	Layer	Name	ADC Grid	S10	S20	S50	C50	P50
nuclear	government	DMV	17-J7			Y		
nuclear	paramedic	K.C. PARAMEDICS	17-J7			Y		
nuclear	dispatch	KENT COUNTY 911 CENTER	17-J7			Y		
nuclear	eoc	KENT COUNTY EOC	17-J7			Y		
nuclear	government	PUBLIC SAFETY BUILDING	17-J7			Y		
nuclear	school	CALVARY CHRISTIAN ACADEMY	17-K12			Y		
nuclear	bridge	356A	17-K13			Y		
nuclear	bridge	066B	17-K2		Y	Y		
nuclear	nhome	COURTLAND MANOR NURSING HOME	17-K5			Y		
nuclear	daycare	CORPORATE KIDS LEARNING CENTER	17-K6			Y		
nuclear	school	CORPORATE KIDS LEARNING CENTER	17-K6			Y		
nuclear	school	EAST DOVER ELEMENTARY SCHOOL	17-K6			Y		
nuclear	tower	DOVER SIGN SHOP	17-K7			Y		
nuclear	government	TRANSPORTATION ADMINISTRATION	17-K7			Y		
nuclear	bridge	356B	18-A11			Y		
nuclear	bridge	356C	18-A11			Y		
nuclear	hotel	BEST WESTERN GALAXY	18-A11			Y		
nuclear	bridge	066A	18-A2		Y	Y		
nuclear	bridge	922N	18-A4			Y		
nuclear	bridge	922S	18-A4			Y		
nuclear	bridge	923N	18-A5			Y		
nuclear	bridge	923S	18-A5			Y		
nuclear	bridge	924N	18-A8			Y		
nuclear	bridge	924S	18-A8			Y		
nuclear	tvrad	W27AJ CH27	18-B1		Y	Y		
nuclear	tvrad	WMDJ CH47	18-B1		Y	Y		
nuclear	bridge	925N	18-B10			Y		
nuclear	bridge	925S	18-B10			Y		
nuclear	daycare	DOVER MONTESSORI COUNTRY DAY SCHOOL	18-B11			Y		
nuclear	school	DOVER MONTESSORI COUNTRY DAY SCHOOL	18-B11			Y		
nuclear	school	DOVER AIR FORCE BASE MIDDLE SCHOOL	18-B13			Y		
nuclear	school	WELCH (Major George S.) ELEMENTARY SCHOOL	18-B13			Y		
nuclear	government	DAFB POST OFFICE	18-C12			Y		
nuclear	bridge		18-C12			Y		
nuclear	school	ARNOLD (Gen. Henry H.) ELEMENTARY SCHOOL	18-C13			Y		
nuclear	government	DOVER WATER TREATMENT	18-D1		Y	Y		
nuclear	fd	DOVER AIR FORCE BASE (Co. 58-Sta #1)	18-D10			Y		
nuclear	government	DOVER AIR FORCE BASE	18-D11			Y		
nuclear	bridge	016B	18-D4			Y		
nuclear	airport	DOVER AIRFORCE BASE	18-F12			Y		
nuclear	airport	CENTRAL DELAWARE COM. AIR FAC.	18-F8			Y		
nuclear	fd	DOVER AIR FORCE BASE (Co. 58-Sta #2)	18-G12			Y		
nuclear	bridge	348A	18-G9			Y		

Hazard	Layer	Name	ADC Grid	S10	S20	S50	C50	P50
nuclear	government	LITTLE CREEK POST OFFICE	18-H4			Y		
nuclear	government	LITTLE CREEK TOWN HALL	18-H4			Y		
nuclear	fd	LITTLE CREEK VFC (Co. 54)	18-H4			Y		
nuclear	bridge	067C	18-H5			Y		
nuclear	bridge	017A	18-J5			Y		
nuclear	bridge	089A	19-B3			Y		
nuclear	bridge	050A	20-E1			Y		
nuclear	bridge	050B	20-E1			Y		
nuclear	bridge	208A	20-E1			Y		
nuclear	bridge	211A	20-E11			Y		
nuclear	port	JOHN B. MEDFORD RAMP	20-E8			Y		
nuclear	bridge	207A	20-E9			Y		
nuclear	bridge	210A	20-F8			Y		
nuclear	bridge	222A	20-G1			Y		
nuclear	bridge	208C	20-H13			Y		
nuclear	bridge	208B	20-H8			Y		
nuclear	bridge	212A	21-C12			Y		
nuclear	bridge	223A	21-C7			Y		
nuclear	bridge	213A	21-E11			Y		
nuclear	bridge	053C	21-G12			Y		
nuclear	bridge	225A	21-G6			Y		
nuclear	bridge	214A	21-H11			Y		
nuclear	bridge	052A	21-K1			Y		
nuclear	school	COOPERS CORNER SCHOOL	21-K3			Y		
nuclear	bridge	053D	21-K9			Y		
nuclear	school	CHRISTIAN EDUCATION	22-C1			Y		
nuclear	bridge	054A	22-C10			Y		
nuclear	school	SOUTHERN MEADOW SCHOOL	22-D2			Y		
nuclear	mirea	VAUGHN	22-G9			Y		
nuclear	school	A STEP AHEAD	22-J13			Y		
nuclear	government	VIOLA POST OFFICE	22-K13			Y		
nuclear	bridge		22-K5			Y		
nuclear	school	VINES ACADEMY	22-K8			Y		
nuclear	government	WOODSIDE POST OFFICE	22-K8			Y		
nuclear	port	DERBY POND RAMP	23-A6			Y		
nuclear	government	WOODSIDE TOWN HALL	23-A8			Y		
nuclear	school	Stokes (Nellie Hughes) Elementary School	23-B2			Y		
nuclear	police	STATE TROOP #3	23-B4			Y		
nuclear	bridge	004A	23-B5			Y		
nuclear	tower	D.S.P. TROOP 3(Radio shop)	23-B5			Y		
nuclear	daycare	CARE-A-LOT, LTD.	23-B9			Y		
nuclear	daycare	TOT'S TURF CHILD CARE (DAPI)	23-C1			Y		
nuclear	stp	2	23-C11			Y		

Hazard	Layer	Name	ADC Grid	S10	S20	S50	C50	P50
nuclear	school	CENTRAL DELAWARE CHRISTIAN ACADEMY	23-C4			Y		
nuclear	bridge	024C	23-C5			Y		
nuclear	school	POLYTECH HIGH SCHOOL	23-C8			Y		
nuclear	wstall	30	23-E1			Y		
nuclear	school	STAR HILL ES (Star Hill School)	23-E3			Y		
nuclear	bridge	105B	23-F10			Y		
nuclear	bridge	360A	23-F3			Y		
nuclear	bridge	029A	23-G2			Y		
nuclear	bridge	027A	23-H1			Y		
nuclear	school	CHARLTON (John S.) SCHOOL	23-J2			Y		
nuclear	school	FREAR (Allen) ELEMENTARY SCHOOL	23-J2			Y		
nuclear	stp	4	23-K12			Y		
nuclear	bridge	031A	24-A11			Y		
nuclear	bridge	363A	24-B3			Y		
nuclear	government	MAGNOLIA POST OFFICE	24-D8			Y		
nuclear	government	MAGNOLIA TOWN HALL	24-D8			Y		
nuclear	fd	MAGNOLIA VFC (Co. 55)	24-D8			Y		
nuclear	school	STAR HILLES (McIlvaine Annex)	24-D8			Y		
nuclear	bridge	007A	24-F10			Y		
nuclear	bridge	364B	24-F5			Y		
nuclear	daycare	ABC DAY CARE AND LEARNING CENTER	24-G13			Y		
nuclear	bridge	007B	24-G5			Y		
nuclear	wstall	24	24-H6			Y		
nuclear	government	BOWERS BEACH TOWN HALL	25-E10			Y		
nuclear	fd	BOWERS VFC (Co. 40)	25-E10			Y		
nuclear	port	BOWERS BEACH RAMP	25-F10			Y		
nuclear	port	BOWERS BEACH RAMP	25-F10			Y		
nuclear	bridge	121B	25-G12			Y		
nuclear	bridge	053A	26-F2			Y		
nuclear	landfill	DSWA CENTRAL SOLID WASTE MANAGEMENT CTR	26-G1			Y		
nuclear	bridge	268A	26-G12			Y		
nuclear	wstall	25	26-H2			Y		
nuclear	bridge	266A	26-J11			Y		
nuclear	bridge	053B	27-A1			Y		
nuclear	bridge	254A	27-A2			Y		
nuclear	bridge	055A	27-A3			Y		
nuclear	bridge	265B	27-B12			Y		
nuclear	bridge	055B	27-C4			Y		
nuclear	school	SPARROW CHRISTIAN ACADEMY	27-G1			Y		
nuclear	bridge	249A	27-J1			Y		
nuclear	bridge	285A	28-E12			Y		
nuclear	bridge	284A	28-G13			Y		
nuclear	bridge	284C	28-H9			Y		

Hazard	Layer	Name	ADC Grid	S10	S20	S50	C50	P50
nuclear	bridge		28-J10			Y		
nuclear	bridge	286A	28-J11			Y		
nuclear	bridge		28-J12			Y		
nuclear	police	FELTON	28-J6			Y		
nuclear	government	FELTON CITY HALL	28-J6			Y		
nuclear	fd	FELTON COMMUNITY VFC (Co. 48)	28-J6			Y		
nuclear	nhome	FELTON CONVALESCENT HOME	28-J6			Y		
nuclear	government	FELTON POST OFFICE	28-J6			Y		
nuclear	daycare	PLAYTIME LEARNING CENTER, INC. II	28-K10			Y		
nuclear	bridge	005C	28-K12			Y		
nuclear	bridge	005D	28-K12			Y		
nuclear	school	LAKE FOREST NORTH ELEMENTARY SCHOOL	28-K7			Y		
nuclear	wstall	38	28-K8			Y		
nuclear	bridge	005E	29-A1			Y		
nuclear	bridge	033B	29-B1			Y		
nuclear	school	LAKE FOREST HIGH SCHOOL	29-B10			Y		
nuclear	bridge	371C	29-C1			Y		
nuclear	tower	LAKE FOREST PROPERTY	29-D11			Y		
nuclear	airport	HENDERSON AIRPORT	29-D6			Y		
nuclear	airport	YORDE AVAITION AIRPORT	29-E6			Y		
nuclear	bridge	384A	29-F11			Y		
nuclear	port	KILLENS POND RAMP	29-F12			Y		
nuclear	bridge	033A	29-F6			Y		
nuclear	bridge	381A	29-G2			Y		
nuclear	port	COURSEY POND RAMP	29-H10			Y		
nuclear	port	MCGINNIS POND RAMP	29-H2			Y		
nuclear	port	ANDREWS LAKE RAMP	29-H4			Y		
nuclear	bridge	378B	29-J1			Y		
nuclear	bridge	388A	29-J10			Y		
nuclear	bridge	380A	29-J3			Y		
nuclear	bridge	035A	30-A10			Y		
nuclear	bridge	035B	30-B8			Y		
nuclear	bridge	390C	30-C11			Y		
nuclear	bridge	371A	30-C2			Y		
nuclear	bridge	035C	30-C7			Y		
nuclear	school	LAKE FOREST EAST ELEMENTARY SCHOOL	30-D7			Y		
nuclear	government	FREDERICA POST OFFICE	30-E6			Y		
nuclear	bridge	008G	30-F6			Y		
nuclear	government	FREDERICA CITY HALL	30-F6			Y		
nuclear	fd	FREDERICA VFC (Co. 49)	30-F6			Y		
nuclear	bridge	008F	30-F7			Y		
nuclear	bridge	389A	30-F8			Y		
nuclear	bridge	008H	30-G6			Y		

Hazard	Layer	Name	ADC Grid	S10	S20	S50	C50	P50
nuclear	bridge	008I	30-G6			Y		
nuclear	stp	1	30-K8			Y		
nuclear	bridge	120A	31-F8			Y		
nuclear	bridge	121A	31-G8			Y		
nuclear	fd	SOUTH BOWERS VFC (Co. 57)	31-G9			Y		
nuclear	school	HOMESTEAD MOTIVATION ACADEMY	31-H10			Y		
nuclear	bridge	418A	31-H5			Y		
nuclear	bridge	123A	31-J13			Y		
nuclear	bridge	291A	33-G7			Y		
nuclear	bridge	059A	33-J5			Y		
nuclear	bridge	059B	34-A6			Y		
nuclear	bridge	295A	34-B11			Y		
nuclear	bridge	059C	34-B6			Y		
nuclear	school	K AND A LEARNING CENTER	34-C11			Y		
nuclear	bridge	296A	34-C13			Y		
nuclear	mirea	VERNON	34-G10			Y		
nuclear	bridge	275A	34-G4			Y		
nuclear	bridge	299B	34-J12			Y		
nuclear	bridge	277A	34-J5			Y		
nuclear	bridge	059D	34-J8			Y		
nuclear	bridge	111A	34-K10			Y		
nuclear	bridge	059E	34-K8			Y		
nuclear	bridge	059F	35-B8			Y		
nuclear	bridge	275C	35-C5			Y		
nuclear	subst	HARRINGTON	35-H10			Y		
nuclear	school	CHIPMAN (W. T.) MIDDLE SCHOOL	35-H8			Y		
nuclear	school	LAKE FOREST SOUTH ELEMENTARY SCHOOL	35-H8			Y		
nuclear	wstall	19	35-H9			Y		
nuclear	school	DELAWARE EARLY CHILDHOOD CENTER	35-H9			Y		
nuclear	police	HARRINGTON	35-J9			Y		
nuclear	government	HARRINGTON CITY HALL	35-J9			Y		
nuclear	daycare	HARRINGTON HEAD START/ TELAMON	35-J9			Y		
nuclear	paramedic	HARRINGTON PARAMEDIC	35-J9			Y		
nuclear	government	HARRINGTON POST OFFICE	35-J9			Y		
nuclear	fd	HARRINGTON VFC (Co. 50)	35-J9			Y		
nuclear	government	COURT #6	35-K10			Y		
nuclear	bridge	006B	35-K11			Y		
nuclear	bridge	006E	35-K12			Y		
nuclear	bridge	081B	35-K7			Y		
nuclear	daycare	HARRINGTON DAY CARE CENTER,INC	35-K7			Y		
nuclear	bridge	005A	35-K8			Y		
nuclear	bridge	081A	35-K8			Y		
nuclear	government	DELAWARE NATIONAL GUARD	35-K8			Y		

Hazard	Layer	Name	ADC Grid	S10	S20	S50	C50	P50
nuclear	newspaper	THE HARRINGTON JOURN	35-K8			Y		
nuclear	bridge	006C	35-K9			Y		
nuclear	bridge	006D	35-K9			Y		
nuclear	hotel	COLONY INN	35-K9			Y		
nuclear	bridge	005B	36-A8			Y		
nuclear	stp	2	36-A9			Y		
nuclear	school	LIGHTHOUSE ACADEMY	36-B9			Y		
nuclear	bridge	430A	36-C7			Y		
nuclear	bridge	036A	36-C9			Y		
nuclear	bridge	431A	36-C9			Y		
nuclear	bridge	429A	36-E5			Y		
nuclear	daycare	PLAYTIME LEARNING CENTER	36-F8			Y		
nuclear	bridge	384C	36-G4			Y		
nuclear	bridge	384D	36-H12			Y		
nuclear	bridge	398B	36-J2			Y		
nuclear	government	HOUSTON POST OFFICE	36-K10			Y		
nuclear	government	HOUSTON TOWN HALL	36-K10			Y		
nuclear	fd	HOUSTON VFC (Co. 52)	36-K10			Y		
nuclear	bridge	388B	37-A1			Y		
nuclear	school	ST. CAHTERINE ACADEMY	37-A2			Y		
nuclear	tvrad	WAFL 97.7FM	37-B8			Y		
nuclear	tower	WTHD RADIO TOWER	37-B8			Y		
nuclear	school	BAERS SCHOOL	37-B9			Y		
nuclear	port	GRIFFITHS LAKE RAMP	37-E11			Y		
nuclear	stp	27	37-E9			Y		
nuclear	port	HAVEN LAKE RAMP	37-G11			Y		
nuclear	bridge	008A	37-J11			Y		
nuclear	bridge	008B	37-J11			Y		
nuclear	fd	CARLISLE VFC (Co. 42)	37-J11			Y		
nuclear	airport	MILFORD AIR PARK	37-J8			Y		
nuclear	daycare	CHALLENGE DAY SCHOOL - KENT/SUSSEX	37-J9			Y		
nuclear	daycare	KIDS KAMPUS	37-K1			Y		
nuclear	bridge	022A	37-K11			Y		
nuclear	bridge	503	37-K11			Y		
nuclear	hotel	COLONY INN	37-K8			Y		
nuclear	daycare	TEDDY BEAR DAY CARE & LEARNING CENTER	37-K8			Y		
nuclear	school	BANNEKER (Benjamin) ELEMENTARY SCHOOL	38-A10			Y		
nuclear	daycare	MILFORD HEAD START	38-A10			Y		
nuclear	school	PATHWAY CHRISTIAN ACADEMY	38-A10			Y		
nuclear	newspaper	THE CHRONICLE	38-A10			Y		
nuclear	bridge	501	38-A11			Y		
nuclear	bridge	502	38-A11			Y		
nuclear	bridge	504	38-A11			Y		

Hazard	Layer	Name	ADC Grid	S10	S20	S50	C50	P50
nuclear	bridge	505	38-A11			Y		
nuclear	bridge	008D	38-A5			Y		
nuclear	bridge	008J	38-A6			Y		
nuclear	port	TUB MILL POND RAMP	38-A6			Y		
nuclear	school	MILFORD SENIOR HIGH SCHOOL	38-A8			Y		
nuclear	government	MILFORD ARMORY	38-A9			Y		
nuclear	police	MILFORD	38-B10			Y		
nuclear	daycare	THE LEARNING CENTER "TLC" INC.	38-B9			Y		
nuclear	daycare	THE LEARNING CENTER, "TLC-AND BABY	38-B9			Y		
nuclear	bridge	019A	38-C1			Y		
nuclear	bridge	021A	38-C10			Y		
nuclear	bridge	124B	38-D2			Y		
nuclear	bridge	124D	38-D2			Y		
nuclear	bridge	409A	38-E6			Y		
nuclear	wstall	6	40-H13			Y	Y	
nuclear	bridge	113B	40-K9			Y		Y
nuclear	bridge	112B	41-A10			Y		Y
nuclear	bridge	063A	41-B13			Y		Y
nuclear	bridge	113C	41-C8			Y		
nuclear	bridge	308B	41-D9			Y		
nuclear	bridge	114E	41-E12			Y		
nuclear	bridge	060A	41-E2			Y		
nuclear	school	GREEN BRIAR CHRISTIAN ACADEMY	41-E2			Y		
nuclear	bridge	307A	41-E7			Y		
nuclear	bridge	308A	41-F11			Y		
nuclear	bridge	305A	41-F3			Y		
nuclear	bridge	060B	41-H2			Y		
nuclear	bridge	304C	41-H6			Y		
nuclear	bridge	060C	41-J1			Y		
nuclear	bridge	114A	41-K2			Y		
nuclear	school	SUNBEAM HOME EDUCATION	42-A4			Y		
nuclear	school	HEARTH AND HOME COUNTRY SCHOOL	42-C8			Y		
nuclear	school	HOME LEARNING CENTER	42-D2			Y		
nuclear	subst	SOUTH HARRINGTON	42-H1			Y		
nuclear	bridge	006A	42-H10			Y		
nuclear	government	FARMINGTON POST OFFICE	42-J6			Y		
nuclear	fd	FARMINGTON VFC (Co. 47)	42-J6			Y		
nuclear	bridge	118A	43-B12			Y		
nuclear	school	JOSHUAS CHOICE SCHOOL	43-H5			Y		