Planning and Mitigation for Emergency Situations and Natural Disasters in Hennepin County, Minnesota Utilizing GIS

Katherine D. Hurley [1, 2]

[1] Saint Mary's University of Minnesota
Department of Resource Analysis, Minneapolis, Minn. 55404

[2] Hennepin County
Emergency Preparedness Division, Medina, Minn. 55340

Overview

- Introduction
- Methodology
- Results
- Discussion

Introduction

Introduction

- **1990's Study** (Cutter, 2003)
  - **535,000** people killed;
  - **$684** billion in direct damages.
- **Hennepin County Emergency Preparedness**
  - GIS implementation.
- **Benefits of GIS**
  - Spatial reference;
  - Assess vulnerable areas;
  - Speedy relief efforts:
    - Infrastructure at your fingertips!

Images Courtesy of the Hennepin County Emergency Preparedness Division

Introduction

- **Mitigation Plan**
  - Basis for Emergency Planning
  - Transition from Paper **–to–>** Electronic?
- **Hazard Assessment**
  - Create an assessment for Hennepin County;
    - Model.
- **Web Applications**
  - Hennepin County Emergency Preparedness staff utilize tools without GIS training?

Image Courtesy of ESRI

Methodology

- **Data acquisition**
  - *Locate* existing datasets;
    - Hennepin County
      - Finding the right Department/Division
    - Metro GIS Datafinder
  - ***Edit* existing datasets**;
  - *Create* new datasets;
  - *Create* address locators.
- **Create a data repository**
  - Backup Emergency Preparedness GIS data;
  - *Metadata*, Metadata, *Metadata*.

Full Metadata View Attributes View Sample Get Data

302 Facilities

This page last updated: 07/06/2009

Metadata created using Minnesota Geographic Metadata Guidelines

Metadata Summary

Originator	Hennepin County Emergency Preparedness Division
Abstract	Chemicals are found everywhere. They purify drinking water, increase crop production, and simplify household chores. But chemicals can also be hazardous to humans or the environment if used or released improperly. Hazards can occur during production, storage, transportation, use, or disposal. The environment is at risk if a chemical is used unsafely or released in harmful amounts where people live, work, or play. The presence of a hazardous material may or may not be readily evident. Some hazardous materials do not have an odor or taste. Some hazardous materials can cause immediate physical reactions such as nausea or watering eyes. 302 sites have filed a notification of reportable quantities of extremely hazardous substances. These are of most value in the event of a disaster or emergency situation and should be utilized before the hazardous waste dataset provided by the Department of Environmental Services.
Browse Graphic	None available
Time Period of Content Date	2009
Currentness Reference	
Access Constraints	None
Use Constraints	Contact Distributor
Distributor Organization	Hennepin County

Image of Metadata Pertaining to 302 Facilities

Methodology

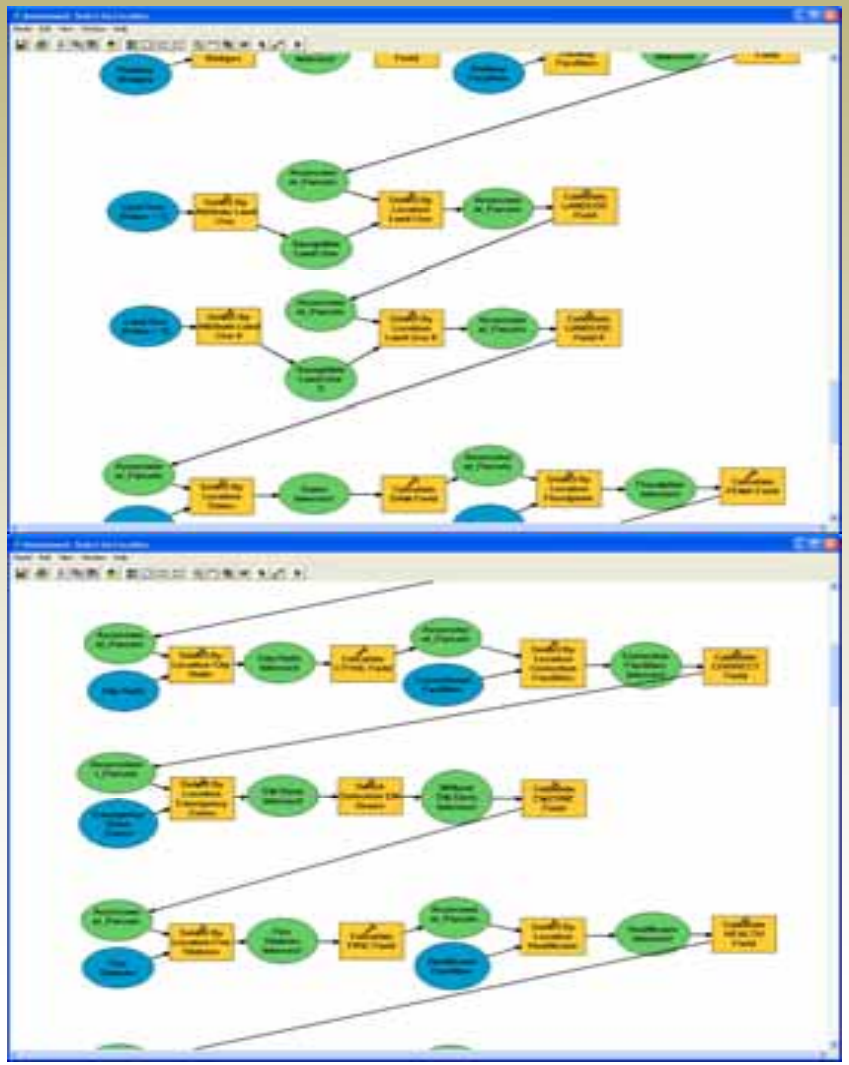
- **Create & Modify the 2004 Mitigation Plan**
  - Binder/Paper versus Digital edition.
- **Create a County-wide Assessment Map**
  - Determine appropriate datasets;
  - Assign individual ranking for each dataset:
    - Dependent upon vulnerability within Hennepin County.

Dataset Name	Weighted Score	Definition and Explanation of Rank	Future Analyses (Y/N)
302 Facilities	4	302 facilities are facilities that have extremely hazardous substances (EHS) that exceed the Threshold Planning Quantity (TPQ). The owner or operator must submit a notification to the state emergency response commission (SERC). Due to the hazard 302 facilities impose, a weight of four was assigned.	N
Dump Sites	1	A dump site is a site where waste is stored that may have potential health effects on the human population, however the risks of human health in relation to dump sites are extremely low even in the event of a flood. Thus, dump sites were given a rank of one.	N
Leak Sites	3	Leak sites are sites that have potential for soil and groundwater contamination. These sites are critical in the event of hazardous materials entering the site or potential redevelopment on the site. Thus, a moderate rank of three was granted for leak sites.	N
Superfund Sites	1	Superfund sites are sites where toxic wastes have been dumped and the Environmental Protection Agency (EPA) has designated them to be cleaned up. However, since Superfund sites are located in very small businesses or are unoccupied their rank does not need to be listed as higher than one.	N
Voluntary Investigation Cleanup (VIC) Sites	1	Sites that are being investigated and/or cleaned up may have hazardous materials. However, since VIC sites are unoccupied their rank does not need to be listed as higher than one.	N
65+ Aged Populations	N/A	The current Census dataset from 2000 is outdated information, Hennepin County is waiting on 2010 Census information. Additionally, the 65+ aged population dataset is situational dependent.	Y

Image of Dataset Rankings

Methodology

- **Create a Model for future needs**
  - Copy the parcels dataset from the Survey Division's data repository;
  - *Create* fields;
  - *Select* parcels;
    - Dependent upon the dataset.
  - *Calculate* fields;
  - *Calculate* all fields into *EM_Rank* field;
  - Create symbology for *EM_Rank* field.



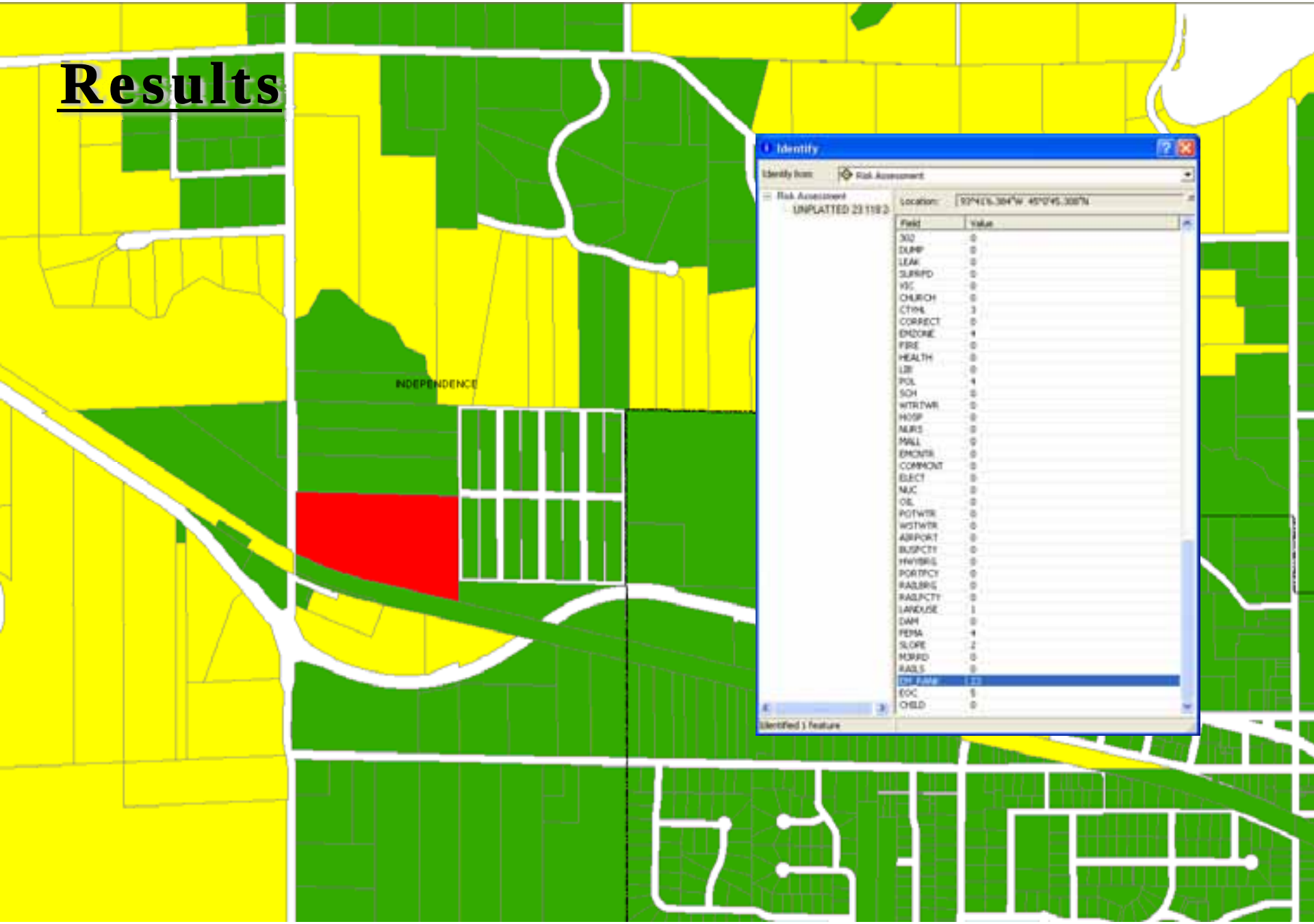
Images of selecting parcels, dataset dependent

Results

- **Emergency Preparedness Data Repository;**
  - **36** File Geodatabases;
  - **137** Geospatial Datasets.
- **Mitigation Plan**
  - Floodplain Assessment
- **Assessment Map**

Facility Type	*Number of Structures*		
	Total # in cnty	# in hazard area	% in hazard area
Airports	6	3	50.00%
Bus Facilities	12	1	8.33%
Child Care Facilities	379	1	0.26%
Churches	776	3	0.39%
City Halls	46	2	4.35%
Communication	15	6	40.00%
Correctional	3	0	0.00%
Dams	21	21	100.00%
EOC Facilities	32	1	3.13%
Electrical	4	0	0.00%
Emergency Sirens	236	2	0.85%
Fire Stations	82	0	0.00%
Healthcare Facilities	850	23	2.71%
Highway Tunnels	4	0	0.00%
Hospitals	10	0	0.00%
Libraries	41	0	0.00%
Nursing Homes	48	2	4.17%
Oil Facilities	1	0	0.00%
Police Stations	37	1	2.70%
Potable	5	0	0.00%
Railways (mi)	397.5	25.3	6.36%
Railway Facilities	10	1	10.00%
Roadways (Major) mi	1724.13	65.22	3.78%
Schools	371	8	2.16%
Wastewater Facilities	3	1	33.33%
Total	5113.63	166.52	3.26%

Results


INDEPENDENCE
Identify
Identify from:
Risk Assessment
Location:
Field
Value
Identified 1 feature

Discussion

- **Other Application;**
  - May **not** apply to all geographic areas;
    - Availability of data within study area;
    - Functionality of the infrastructure in the study area.
- **Future Work;**
  - Virtual EOC Integration;
  - Web EOC™ Implementation;
  - Further incorporation of FEMA's HAZUS;
  - Models:
    - Flood Model;
    - Emergency Model;
      - Create alternate routes;
      - Allow user to place barriers.

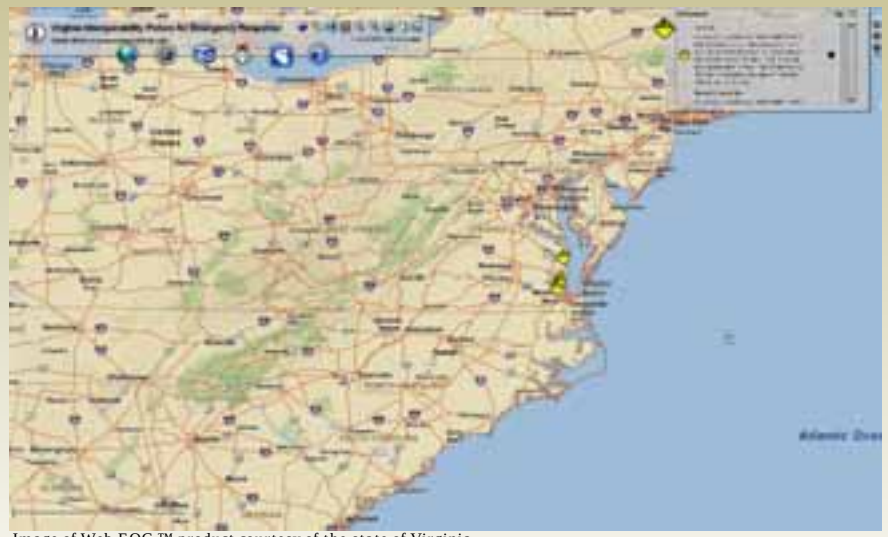


Image of Web EOC ™ product courtesy of the state of Virginia

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References

- Bovitz, D. Personal Interview. October 19, 2009.
- Cutter, S. L., Mitchell, J. T., Scott M.S. 2000. Revealing the Vulnerability of People and Places: A Case Study of Georgetown County, South Carolina. *Annals of the Association of American Geographers*. 90(4): 713-737.
- Cutter, S.L. 2003. GI Science, Disasters, and Emergency Management. *Transactions in GIS*. 7(4): 439-445.
- Givens, J. Personal Interview. January 27, 2009.
- Gunes, A. E., and Kovel, J. P. 2000. Using GIS in Emergency Management Operations. *Journal of Urban Planning and Development*. 126(3): 136-148.
- Johnson, R. 2000. GIS Technology for Disasters and Emergency Management. *ESRI White Paper*. pp.6.
- Koxvold, D. Personal Interview. December 15, 2008.
- Newsome, D. E., and Mitrani, J. E. 1993. Geographic Information System Applications in Emergency Management. *Journal of Contingencies and Crisis Management*. 1(4): 199-202.
- Pal A., Graettinger A. J., Triche M. H. 2003. Emergency Evacuation Modeling Based On Geographical Information System Data. Retrieved January 2009 from http://www.ltrc.lsu.edu/TRB_82/TRB2003-001689.pdf.
- Rue, J. Personal Interview. January 5, 2009.
- U.S. Census. 2000. Retrieved January 2009 from http://factfinder.census.gov.
- U.S. Census. 2006. Retrieved January 2009 from http://factfinder.census.gov.

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Bottom right image courtesy of WCCO Television.