



FEMA



## Using Hazus at Devils Lake, North Dakota

While a graduate student at the University of North Dakota, Christina Cummings worked with FEMA Risk Analyst/GIS Coordinator Jesse Rozelle, Dr. Paul Todhunter, and Dr. Brad Rundquist of the Department of Geography, to conduct a site-specific analysis of potential flooding in Minnewaukan, North Dakota. She was able to provide accurate maps and flood damage profiles to officials at the local, state, and federal levels to assist them in making more informed decisions regarding relocation as a flood mitigation alternative. For Minnewaukan, the Hazus-MH model was applied in an innovative manner to examine the effects of lakeshore flood hazards.

With the support of the Minnewaukan government and FEMA, Tina Cummings created a site-specific database using building information provided by the Benson County Tax Assessor's Office. Information from the database included building square footage, number of stories, foundation type, etc. The database was then imported into ArcGIS and Hazus-MH's User Defined Facilities. The analysis which started outside of Hazus, produced a series of flood maps and flood damage profiles for water surface elevations (WSE) between 1452 to 1460 feet that local officials and citizens used in making flood mitigation decisions. The purple circles in the maps below show the location of inundated buildings; the circles are graduated according to the assessed value of the properties.

### Background

Devils Lake, a terminal lake in eastern North Dakota, has risen nearly 29 feet since 1993, destroying hundreds of homes and commercial buildings, and inundating thousands of acres of productive farmland. Over the last 19 years, five Presidential Disaster Declarations have been declared for the counties within the Devils Lake region. The Federal government and local governments have spent over \$1 billion to raise roads, bridges, and levees and to protect other infrastructure in the Devils Lake Basin. During this time more than 450 homes and 650 total structures have been moved or destroyed by the rising lake.

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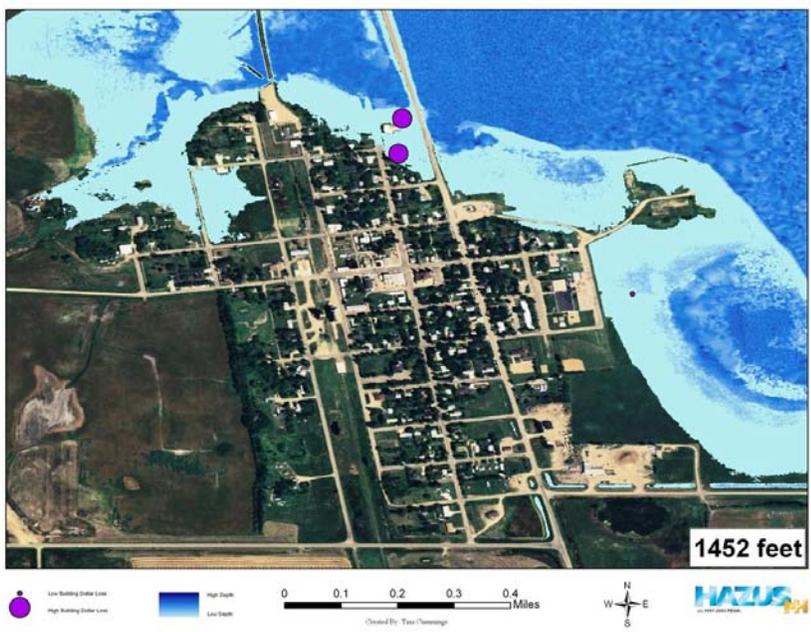


Figure 1: Hazus map showing the WSE at 1452 feet.

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## Conclusion

The maps of the City of Minnewaukan and the surrounding region produced in Hazus-MH show that the model could be used to examine lakeshore inundation at one-foot increments from 1452 to 1460 feet WSE. Hazus-MH can successfully identify areas at immediate risk, show the number of buildings damaged, and determine the building dollar losses.

The damage estimation profiles for the City of Minnewaukan at increasing WSE's produced expected results. There was an increase in number of buildings damaged and increase in building dollar losses, with each increasing WSE. Conducting a site-specific analysis, and representing building location and dollar loss with graduated symbols in ArcMap systematically identified the commercial and residential buildings affected at these increasing WSE's. For example, the school becomes completely flooded at WSE 1456 feet. Main Street, at the entrance of the City, becomes impassible at WSE 1457 feet, due to increased floodwaters filling the side ditches and spilling onto the road. Because Main Street is a major transportation route into the city and critical infrastructure would be cut off due to flooding, partial relocation should be considered at WSE 1456 feet. This study met all of its stated objectives and goals, showing that Hazus-MH functionality can be extended to lakeshore flooding hazards.

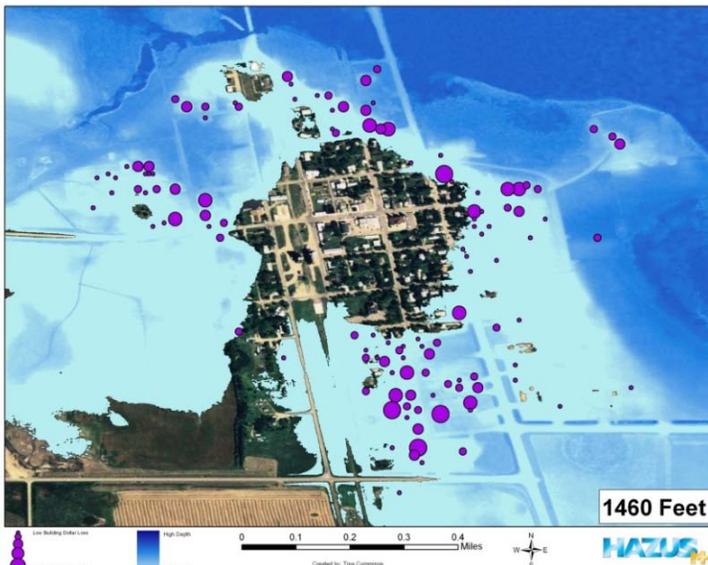


Figure 2: Hazus map showing the WSE at 1460 feet.

However, there are limitations to this study. The “best available” data, which was assessed value, was used for this study. The input data chosen determines dollar loss estimates based on buildings’ assessed value, not their market value. The Minnewaukan government does not collect information on tax-exempt buildings, such as churches and community centers, therefore, the Hazus-MH loss estimate does not include assessed value, square footage, or foundation type, for these buildings. If the City were to buy or move these buildings they would not have the benefit of knowing their assessed or fair market value.

## Future Work

Hazus-MH can be used to provide accurate and up-to-date information to officials at the local, state, regional, and federal levels to assist them in making more informed decisions regarding flood mitigation alternatives. If Devils Lake continues to rise, then the City of Minnewaukan will be prepared to manage increasing WSE within the city because of this study.

The techniques utilized in the Minnewaukan site-specific analysis can also be applied to other lakeshore hazard studies. For example, there are multiple lakes in Minnesota where cabin development has increased without flood management planning or ordinances in effect. These cabins are significantly increasing in market value and being built in locations without proper flood protection. In the future, lakeshore developers could utilize Hazus-MH for land management and lakeshore development guidelines.