US Army Corps
of Engineers
North Central Division

Great Lakes Update

No. 113 December 2, 1994

Field Trials Successfully Completed for Great Lakes Storm Damage Reporting System

A test made of the Great Lakes Storm Damage Reporting System (GLSDRS) was launched in July 1993. This was reported on in the March 2, 1994 Great Lakes Update No. 104. The subsequent cycle of field trials was successfully completed on September 30, 1994. This update summarizes results of the field trials, noting changes made in the reporting system itself, along with highhlights of key findings on damages recorded.

Prior to showing test results, a review is presented of the nature and key characteristics of the System. The System, created by the Chicago District's Economic Analysis Branch, monitors meteorological data (water levels, wave heights, wind speed, and wind direction). The purpose is to identify storm activity on the Great Lakes and then to conduct a telephone survey to collect damage information from the impacted areas. Damages are reported by the riparian homeowners and consist of both monetary damages to property and land lost to erosion. The GLSDRS uses the National Oceanic and Atmospheric Administration (NOAA) CoastWatch Program's Marine Observation Network to gather the meteorological data which serve as storm descriptors.

Through CoastWatch, this information is downloaded daily and compared to storm characterization criteria developed by the Chicago District's Coastal Engineering Branch. When actual meteorological measurements meet or exceed storm characterization criteria, a telephone survey of riparian property owners is immediately conducted in the counties located in the storm area. Following receipt of the survey findings for each storm, a report is prepared profiling the water level, wind direction, wind speed, and storm duration, along with derived storm damages.

In sum, computerized storm monitoring, rapid turn-around telephone surveying, and in-house data processing are combined to enable the GLSDRS to report near real-time information for the entire U.S. shoreline of the Great Lakes Basin.

In order to test its performance quality in several aspects, certain modifications were introduced during the trial period. For example, changes were made in the questionnaire used by the telephone interviewers obtaining the shore damage information in order to make it easier for respondents to provide erosion damage information. Also, a toll-free 800 number was made available so that participant questions about the survey could be answered directly either by the telephone market survey company (working under contract to the Corps of Engineers) or by a Chicago District Representative.

At the onset of the field trials, survey telephone calls were directed to a respondent's real estate tax bill address, which frequently was not a riparian address. To obtain more informed responses concerning storm damage, the

data collection procedure was altered so that only residents whose primary, permanent dwelling units are on Great Lakes' riparian property are qualified respondents. Also, the telephone calling hours during which respondents could be contacted were further restricted so as to minimize interrupting the participants' quality time.

As previously reported here, the original storm selection criteria (wind velocity, wave height, storm duration, and wind direction) frequently resulted in very limited damages being reported. As such, the wind speed threshold values were raised by three knots for all lakes, and the storm duration requirement increased by two hours, as shown by the adjacent tabulation.

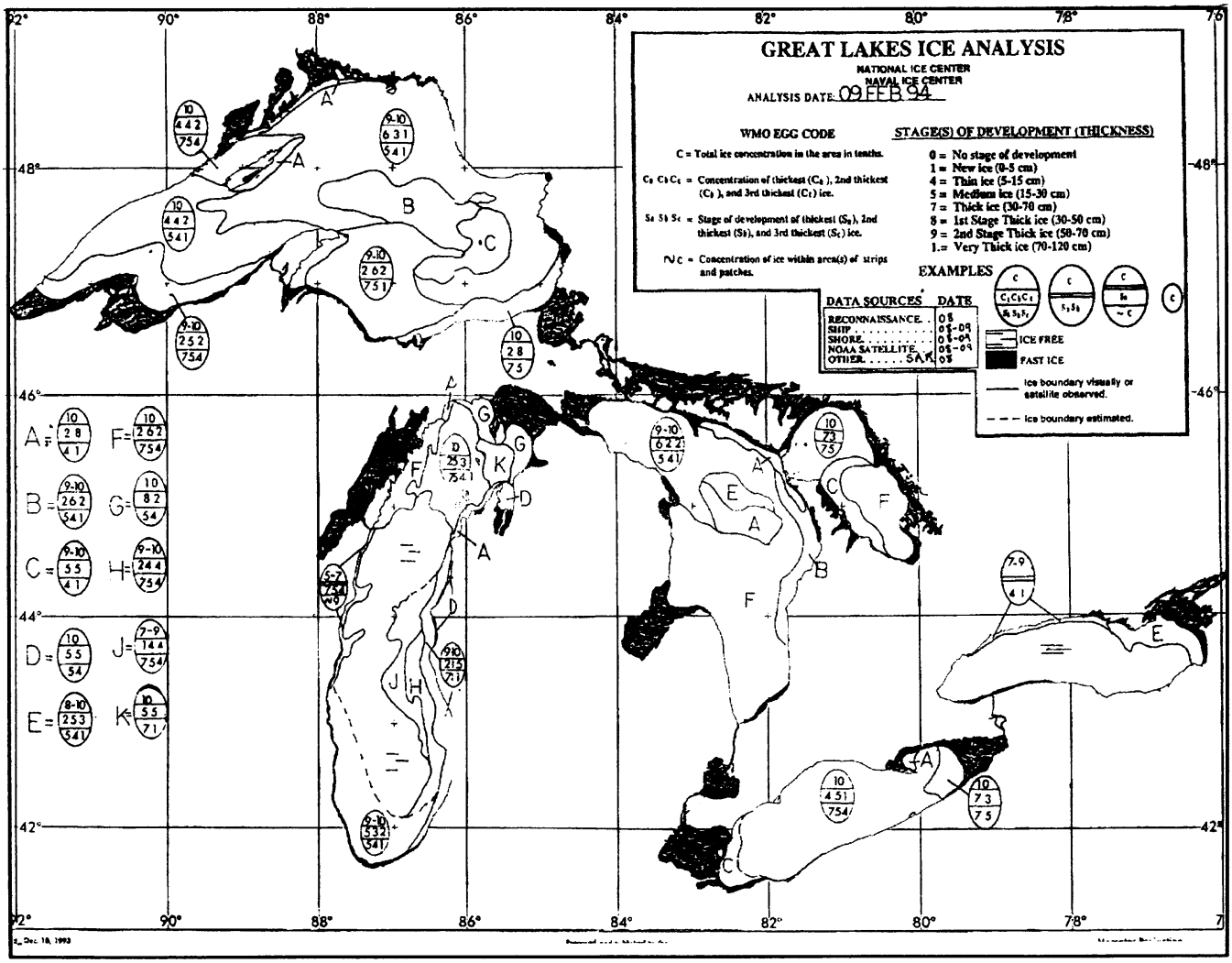
During the Winter of 1993, information on ice formation throughout the Great Lakes was added to the GLSDRS. From field tests, it was demonstrated that ice along the shoreline can prevent or mitigate storm damages by acting as a barrier to waves that would normally strike the shore. Thus, even if marine meteorological data indicate a storm event has occurred, a telephone survey is not conducted if there is significant ice cover protecting the study area.

Wind Speed Criteria

Lake	Knots
Superior	20
Michigan	20
Huron	20
Erie	16
Ontario	16

Storm Duration Criterion

All Lakes	12 Hours



Map No. 1. Navy/NOAA Joint Ice Center Analysis for February 9, 1994.

Ice data are received via facsimile from the Navy/NOAA Joint Ice Center (JIC) in ·tland, Maryland. The JIC ..stributes a map analyzing ice conditions three times a week. Map 1 is typical and illustrates the concentration and development of ice layers for February 9, 1994, encapsulated in the World Meteorological Organization (WMO) Egg symbol (shown in the upper right quadrant). As the legend states, the top number in the egg shows the total prevalence of ice in the region in tenths, and the numbers below it represent the concentration and thickness of the ice layers. Thus, for 8 - 9 February 1994, marine observation data from NOAA's CoastWatch system indicated that a storm event (lasting 12 hours, with 20 to 26 knot winds, and 3 to 4 feet waves) had occurred on Lake Michigan in Sheboygan County, Wisconsin, near the city of Sheboygan. No survey was conducted, however, because the JIC map showed some fast ice (ice bound to the shoreline) in the county, and the nearest egg showed 5 to 7 tenths (50% to 70%) total ice concentration in the area, with the ice layers in thick, medium, and thin stages of development, and the concentration of slob ice (broken ice) at 9 tenths (90%).

Turning now to selected findings of the field trials, storm-related surveys were conducted in 36 (or 45%) of a total of 80 riparian counties. The counties included, of course, are dependent upon the incidence and location of storms which meet previously established storm selection criteria. Table 1, below, shows data reported by state.

During the test period, 34 surveys were conducted (as explained in the Table 1 footnote), with about 3,300 respondents participating. These surveys reported storm-related damages of $1,184,727 during the field trial period. When these sample findings are projected to all Great Lakes' riparian properties in the sampled counties, inferential damages equaled about $11,171,000 during the test period.

The same data sorted by lake appear in the matrix displayed in Table 2. Here again, the number of surveys conducted in counties for a given lake are dependent on

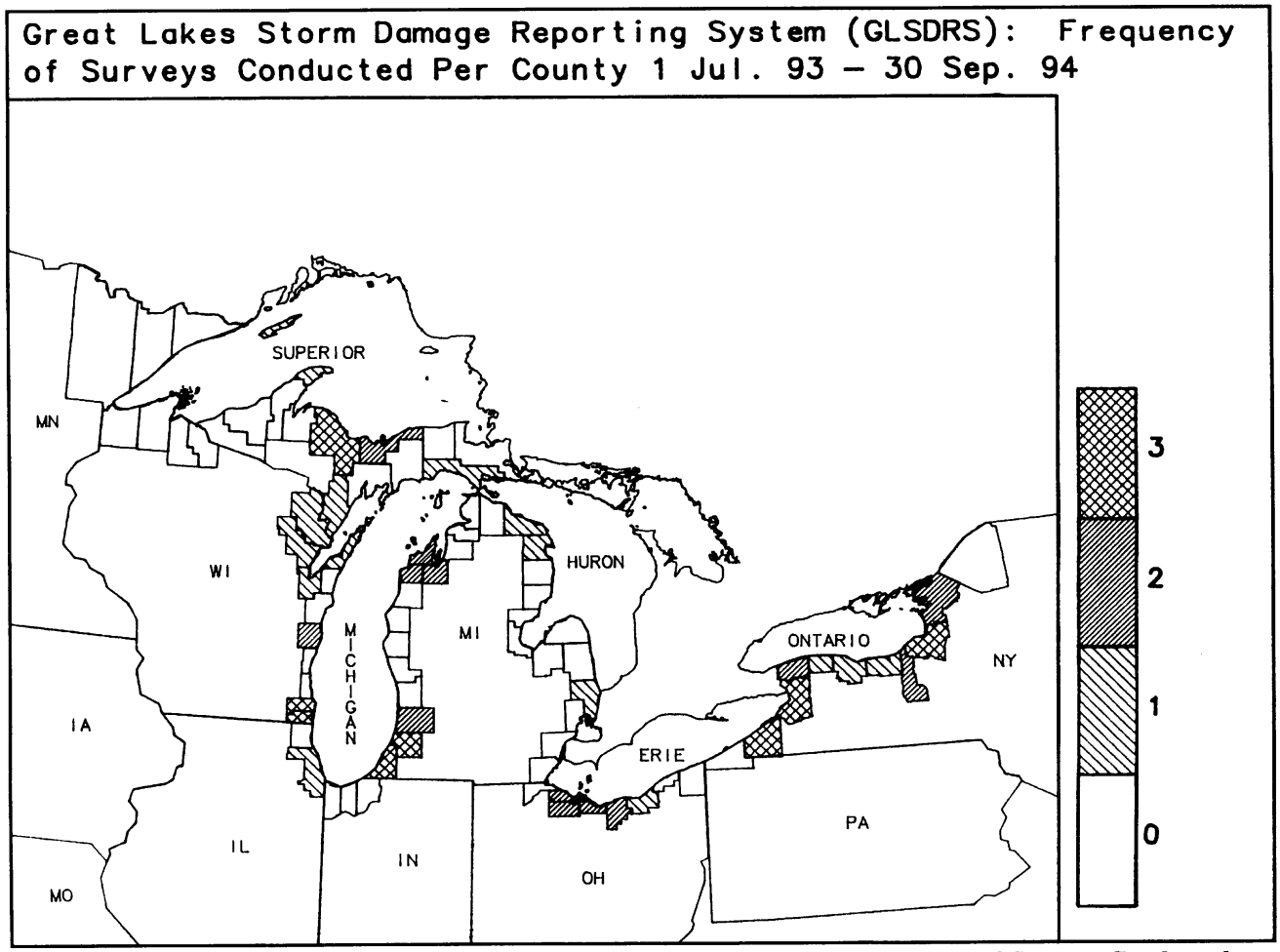
Table 1
Number of Riparian Homeowners and Property Damages by State for the Trial Period July 1, 1993 to September 30, 1994

State	Number of Total Surveys	Number of Different Counties Surveyed	Number of Owners Surveyed	Total Reported Damages	Projected Damages for all Riparians
IL	1	1	15	$0	$0
MI	13	14	1,110	$408,236	$4,104,000
NY	10	9	1,163	$462,117	$4,463,000
OH	4	5	504	$270,839	$2,233,000
WI	6	7	511	$43,535	$371,000
Total	34	36	3,303	$1,184,727	$11,171,000

Note: Storm survey report number 19 (for a storm event on 13 November 1993) covered counties in both Michigan and Wisconsin, the survey is counted for both states in the "Number of Total Surveys" column. For other columns, survey report number 19 data are split by county for Michigan and Wisconsin.

Table 2
Number of Riparian Homeowners and Property Damages by Lake for the Trial Period July 1. 1993 to September 30, 1994

Lake	Number of Total Surveys	Number of Different Counties Surveyed	Number of Owners Surveyed	Total Reported Damages	Projected Damages for all Riparians
Superior	4	3	221	$4,515	$43,000
Michigan	12	16	1,172	$444,076	$4,399,000
Huron	3	3	243	$3,180	$33,000
Erie	7	7	750	$414,638	$3,628,000
Ontario	7	7	917	$318,318	$3,068,000
Total	33	36	3,303	$1,184,727	$11,171,000



Map No. 2. Great Lakes Storm Damage Reporting System (GLSDRS): Frequency of Surveys Conducted Per County July 1, 1993 -- September 30, 1994

the incidence and location of qualifying storms in the local area.

Map 2 shows the survey frequency on a county-by-county level, based on the incidence of qualifying storms affecting a particular county. Three surveys have been conducted in eight counties (Marquette, Berrien and Van Buren, Michigan; Kenosha and Racine, Wisconsin; and, Erie, Chautauqua, and Oswego, New York); two surveys have

Table 3
Types of Reported Property Damage for Surveyed Riparians by State

State	Structure and Contents	Landscaping	Shore Protection Structures	Other	Total Property Damages
IL	$0	$0	$0	$0	$0
MI	$12,546	$166,455	$175,800	$53,435	$408,236
NY	$143,427	$57,006	$183,225	$78,459	$462,117
OH	$176,007	$26,182	$10,500	$58,150	$270,839
WI	$1,800	$9,925	$16,980	$14,830	$43,535
Total	$333,780	$259,568	$386,505	$204,874	$1,184,727
Percent of Total Damages	28.2%	21.9%	32.6%	17.3%	100.0%

Table 4
Types of Reported Property Damage for Surveyed Riparians by Lake

Lake	Structure and Contents	Landscaping	Shore Protection Structures	Other	Total Property Damages
Superior	$225	$300	$0	$3,990	$4,515
Michigan	$14,121	$173,200	$192,780	$63,975	$444,076
Huron	$0	$2,880	$0	$300	$3,180
Erie	$254,427	$35,996	$31,725	$92,490	$414,638
Ontario	$65,007	$47,192	$162,000	$44,119	$318,318
Total	$333,780	$259,568	$386,505	$204,874	$1,184,727
Percent of Total Damages	28.2%	21.9%	32.6%	17.3%	100.0%

been conducted in 13 counties; and one survey was conducted in 15 counties. Unshaded counties have not been surveyed.

Separately, the Structure and Content component of property damage findings includes physical damages to houses and garages, and to their contents such as furnishings and appliances. Landscaping losses consist primarily of reported damages to yard plantings. The Shore Protection Structures component includes breakwall, seawall, or retaining wall damages. The category labelled "Other" shows damages to boats, docks, and other miscellaneous items. Tables 3 and 4 contain the same basic data but are organized differently by state and by lake, respectively.

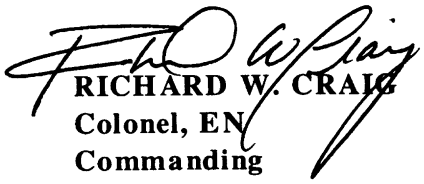
Shore and protection structures are the components reported to have experienced the largest fraction (about 1/3) of reported total damages. In second place were damages to structures and contents accounting for about 3/10 (28.2%) of total damages reported. For the last specific damage category, landscaping, reported damages approximate 1/5 (21.9%) of the total. Finally, as noted earlier, damages reported by both lake and state are a function of the incidence and location of storms occurring in a given local area.

Overall, the GLSDRS data base continues to grow as additional survey findings are included. However, the System's development is still in its early stages with no "qualifying" storms having occurred during the field trials in over one-half (55%) of Great Lakes' riparian counties. With the continued expansion of the data base, additional relevant, current storm damage information will become available for analysis to guide development of future shoreline protection pr jects.

For additional specific information on the surveys or their results you may write to:

LTC Robert Slockbower
Commander, Chicago District
U.S. Army Corps of Engineers
111 North Canal Street
Chicago, IL 60606-7206

For telephone inquiries, contact Mr. Kim Bloomquist at the Chicago District's Economics Branch, (312) 353-6475.



RICHARD W. CRAIG
Colonel, EN
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Table 1

Possible Storm Induced Rises (in feet) at Key Locations on the Great Lakes December 1994

	Degrees of Possibility				
	20%	10%	3%	2%	1%
LAKE SUPERIOR					
Duluth	1.0	1.1	1.4	1.5	1.7
Grand Marais	0.6	0.7	0.8	0.8	0.9
Marquette	0.8	0.9	1.0	1.1	1.2
Ontonagon	0.6	0.7	0.9	1.0	1.1
Point Iroquois	1.1	1.3	1.5	1.7	1.8
Two Harbors	0.8	0.9	1.0	1.1	1.3
LAKE MICHIGAN					
Calumet Harbor	1.6	1.9	2.2	2.5	2.8
Green Bay	1.9	2.4	3.3	4.1	5.0
Holland	1.1	1.3	1.6	1.9	2.2
Kewaunee	0.9	1.0	1.2	1.3	1.4
Ludington	0.9	1.1	1.2	1.3	1.4
Milwaukee	1.1	1.3	1.5	1.7	1.8
Port Inland	1.2	1.3	1.4	1.4	1.5
Sturgeon Bay	1.0	1.2	1.4	1.5	1.7
LAKE HURON					
Detour Village	0.6	0.7	0.8	0.8	0.9
Essexville	2.2	2.6	3.1	3.4	3.7
Harbor Beach	0.8	0.9	1.0	1.1	1.2
Harrisville	0.7	0.8	1.0	1.1	1.3
Lakeport	1.4	1.7	2.0	2.3	2.6
Mackinaw City	0.8	1.0	1.2	1.4	1.5
LAKE ST. CLAIR					
St. Clair Shores	0.6	0.7	0.8	0.8	0.9
LAKE ERIE *					
Barcelona	2.3	2.7	3.2	3.5	3.8
Buffalo	5.0	5.8	6.8	7.4	8.1
Cleveland	1.1	1.3	1.6	1.7	1.9
Erie	2.4	2.8	3.2	3.5	3.8
Fairport	0.9	1.0	1.1	1.1	1.2
Fermi Power Plant	2.4	2.8	3.4	3.8	4.2
Marblehead	1.8	2.1	2.5	2.8	3.1
Sturgeon Point	4.2	4.8	5.5	6.0	6.5
Toledo	2.9	3.4	4.1	4.6	5.0
LAKE ONTARIO					
Cape Vincent	1.0	1.2	1.4	1.6	1.7
Olcott	0.5	0.5	0.6	0.7	0.8
Oswego	0.7	0.9	1.2	1.5	1.8
Rochester	0.5	0.6	0.7	0.8	0.9

* The water surface of Lake Erie has the potential to tilt in strong winds, producing large differentials between the ends of the lake.

Note: The rises shown above, should they occur, would be in addition to the still water levels indicated on the Monthly Bulletin. Values of wave runup are not provided in this table.

Great Lakes Basin Hydrology

During the month of November precipitation on the Lake Superior basin was below average while the remaining basins were above average. For the year to date, precipitation on the entire Great Lakes basin is at the average. The net supply of water to Lakes Superior and Erie was below average, while the net supply to Lakes Michigan-Huron and Ontario were above aver: Table 2 lists November precipitation and water supply information for all of the Great Lakes.

In comparison to their long-term (1918-1993) averages, the November monthly mean water level of Lakes Superior and Ontario were at their average, while Lakes Michigan-Huron, St. Clair and Erie were 9, 11 and 10 inches above average respectively. Shoreline residents are cautioned to be alert whenever adverse weather conditions exist, as these could cause rapid short-term rises in water levels. Should the lakes approach critically high levels, further information and advice will be provided by the Corps of Engineers.

TABLE 2
GREAT LAKES HYDROLOGY[1]

PRECIPITATION (INCHES)								
BASIN	NOVEMBER				YEAR-TO-DATE			
	1994[2]	Average (1900-1991)	Diff.	% of Average	1994[2]	Average (1900-1991)	Diff.	% of Average
Superior	2.3	2.5	-0.2	92	27.2	28.3	-1.1	96
Michigan-Huron	3.3	2.7	0.6	122	31.3	29.7	1.6	105
Erie	2.9	2.8	0.1	104	29.6	32.2	-2.6	92
Ontario	4.0	3.1	0.9	129	31.0	32.2	-1.2	96
Great Lakes	3.0	2.7	0.3	111	29.9	29.9	0.0	100

LAKE	NOVEMBER WATER SUPPLIES[3] (CFS)		NOVEMBER OUTFLOW[4] (CFS)	
	1994[2]	Average (1900-1989)	1994[2]	Average (1900-1989)
Superior	-7,000	18,000	76,000	80,000
Michigan-Huron	65,000	36,000	201,000[5]	190,000
Erie	-10,000	-5,000	220,000[5]	199,000
Ontario	24,000	20,000	261,000	236,000

[1]Values (excluding averages) are based on preliminary computations.
[2]Estimated.
[3]Negative water supply denotes evaporation from lake exceeded runoff from local basin.
[4]Does not include diversions.
[5]Reflects effects of ice/weed retardation in the connecting channels.

CFS = cubic feet per second.

For Great Lakes basin technical assistance or information, please contact one of the following Corps of Engineers District Offices:

For NY, PA, and OH:
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