USGS-NOAA Joint Office
for Mapping and Research

GREAT LAKES COASTAL MAPPING WORKSHOP

October 29-31, 1990

Held at the

Woods Hole Oceanographic Institution

Woods Hole, MA

Edited by

Polloni, C.F.

Open File Report 91-20

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INTRODUCTION

The Great Lakes Coastal Mapping Plan (Folger and others, 1990) was developed by the National Oceanic and Atmospheric Administration (NOAA) and the U. S. Geological Survey (USGS) in response to a congressional mandate to update the coastal maps around the U. S. side of the Great Lakes with particular emphasis on areas undergoing severe (>1 ft/yr) erosion. Within the plan is a requirement to develop a cartographic and geologic database integrated with a Geographic Information System (GIS) that will be easily accessible to the user community.

This workshop was convened to investigate some of the problems associated with developing the database and GIS within the context of the large community of State and Federal Agencies that have management responsibilities in the Great Lakes. Several prior meetings concerned with Great Lakes GIS developement have been held in Detroit (Parks and others, 1989; Gauthier and others, 1990), Cleveland (Law and others, 1990), and in Windsor, Ontario (Horvath, 1990). From these a Great Lakes GIS Coordinating Committee (GLGISCC) has been organized (Appendix A) that will serve as an advisory group to NOAA and USGS during the Great Lakes Mapping Program.

The focus and agenda of this workshop resulted from discussions formulated in the first meeting (Appendix B) of the GLGISCC at the International Joint Commission (IJC) offices in Windsor, Ontario in May of 1990. The three main objectives of this workshop were to discuss (1) GIS system interoperability, (2) data transfer standards, and (3) data distribution. The GIS systems will be capable of deriving products (Appendix C) as specified in the Great Lakes Coastal Mapping Plan.

Included below are summaries[1] of talks addressing these subjects that were given by members of the GLGISTCC, and invited speakers from the various State, Provincial, and Federal Agencies, academia, and private industry. The workshop concluded with a panel discussion that set forth problems and objectives for future meetings.

[1]Some participants sent in proposed abstracts. Others I have summarized from the audio tape. These are noted "summary".

USGS-NOAA Joint Office for Mapping and Research

GREAT LAKES COASTAL MAPPING WORKSHOP

NOS, U S G S, and RTCM
WOODS HOLE OCEANOGRAPHIC INSTITUTION
Woods Hole, MA 02543

PURPOSE: To review work accomplished and discuss plans for FY 91 and beyond.

MONDAY, October 29, Overview

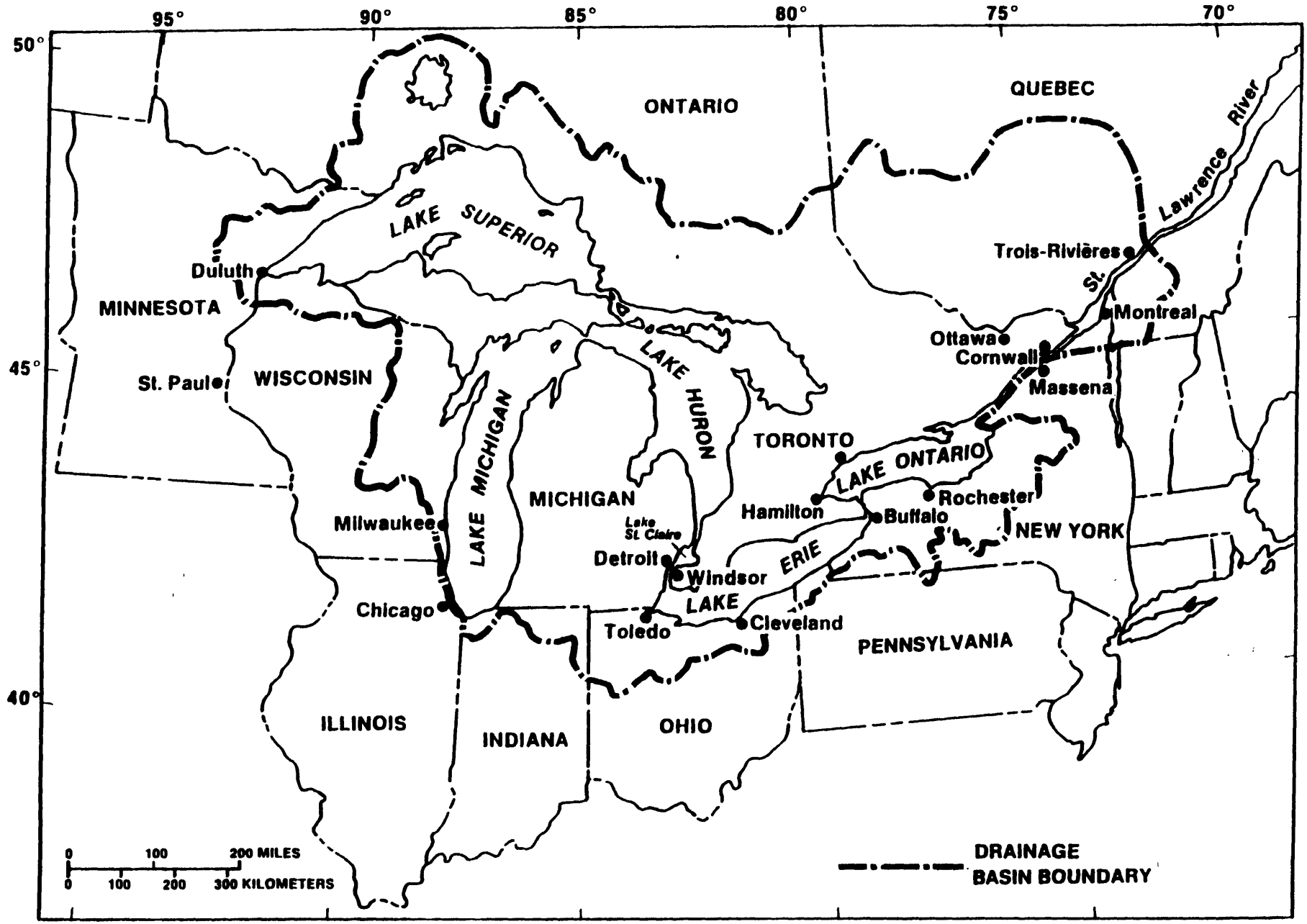
Workshop Introduction and Coastal Mapping Session A

1330 - 1345	Introduction - Arthur Gaines, W H O I Marine Policy Center Robert Gagosian, Associate Director for Research
1345 - 1415	USCG ECDIS activities - Lee Alexander, USCG, Groton, Ct
1415 - 1445	RTCM/ WHOI ECDIS test bed program - Mort Rogoff
1445 - 1515	Coffee and discussion
1515 - 1520	Coastal Mapping-Welcome to Woods Hole - Dave Folger
1520 - 1530	Introduction to Mapping Workshop - Chris Polloni
1530 - 1600	USACE Great Lakes Coastal GIS - Roger Gauthier, USACE
1600 - 1630	Great Lakes States GIS - Frank Horvath, Michigan DNR
1630 - 1700	GIS data interchange - Bill Enslin, Michigan State Univ.
1700 - 1730	Discussion

GREAT LAKES COASTAL MAPPING WORKSHOP

TUESDAY, 30 October, Technical sessions

0820 - 0830	Coastal Mapping Session B - Dave Folger, USGS
0830 - 0900	NOAA Mapping Systems - Chris Andreason, NOAA,NOS
0900 - 0930	Status of SDTS - Karen Irby, USGS, NMD
0930 - 1000	Coastwatch data distribution - George Leshkevich,GLERL
1000 - 1030	Coffee and Discussion
1030 - 1100	Ontario Province data distribution - Mark Law, MNR
1100 - 1130	GIS Production applications in Ontario - Del Coleman,Geomatics
1130 - 1200	Discussion
1200 - 1325	LUNCH
1325 - 1330	Coastal Mapping Session C - Chris Polloni, USGS
1330 - 1400	Canadian Centre for IW, GIS Applications - Laurie Maynard,CCIW
1400 - 1430	CD-ROM Atlas production - Russ Ambroziak, USGS, OEMG
1430 - 1500	USGS/NOAA Joint Office Products - Chris Andreason
1500 - 1515	coffee
1515 - 1530	Hazard/Damage Assessment Model, Will Knauss, ASA
1530 - 1545	Electronic Charting in an INS, Richard Gregory-Allen, Laser Plot
1545 - 1600	Data Management Systems for the Great Lakes - Chris Polloni
1600 - 1700	Discussion panel "Great Lakes Data Distribution"
	Don Parsons, IJC, moderator
	Christian Andreason, NOAA Roger Gauthier, COE Laurie Maynard, CCIW Chris Polloni, USGS



Base from U.S. Geological Survey, The National Atlas, 1:7,500,000, 1970.

WORKSHOP ABSTRACTS

Coastal Mapping Session A

Development of a GIS for the U. S. Great Lakes Shoreline

Roger L. Gauthier
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The Computer Mapping Center of the Detroit District, U. S. Army Corps of Engineers (USACE) is developing a Geographic Information System (GIS) to contain physiographic, demographic, and economic information of the U.S. shoreline of the Great Lakes. Emphasis is being placed on incorporating environmental and economic data for modeling erosion/recession, wetlands changes, and storm-surge flooding caused by fluctuating Great Lakes water levels.

The GIS framework is developed to utilize both raster (gridded) systems approaches and vector (linear and polygonic) mapping and analytic capabilities. Shoreline characteristics are encoded in a raster base and current cover/use characteristics are encoded in vector formats. Future directions include the porting of demographic and land value data bases into the vector domain and linking project design files to GIS real-world depictions for modeling and analysis.

The GIS systems being used are mostly Integraph Workstations. These systems are tools to be applied to the large basin planning model. The IJC study of 1988-89 provided the GIS framework for the basin with a focus on three studies of the shoreline: 1) impacts of storm surge, 2) flood terrain impacts, and 3) erosion. These studies consisted of IR overflights referenced to 1:24,000 scale base. A GIS coordination committee, to improve technical planning, needs to meet at least twice a year to function and develop the necessary requirements for a basin wide GIS database.

Great Lakes States GIS

Frank J. Horvath

Michigan DNR, Lansing, MI 48909

The Michigan Resource Information System (MIRIS) and the Great Lakes Information System (GLIS) is managed by the Michigan Department of Natural Resources(DNR). MIRIS is the parent program of GLIS. GLIS is being expanded in cooperation with the U.S. Army Corps of Engineers (USACE) and other states. GLIS integrates data of all types to enhance resource management programs not only within the state but within the basin. Michigan, being centrally located, is affected by whatever the other states do and therefore has an interest in the activities throughout the basin. The GLIS program identifies needs and advocates research to fulfill those needs.

The Saginaw Bay prototype project was conceived to develop a method to map, classify and catalog Great Lakes coastal wetlands for management and protection. The main issue was to determine the extent of flood zones. Wetlands, which are important to the integrity of the Great Lakes Basin, are under attack both by developers and by natural processes such as erosion.

An example of cooperation between the eight Great Lakes states and the USACE is a project to map coastal resources of Sandusky Bay in

Lake Erie. This was done as part of Phase I of the IJC funded water levels reference study. The entire U.S. shoreline was cataloged using the 64-part land-use classification which includes 4 wetlands types. This was the first time this level of detail has been achieved. The classification system has been integrated with the Canadians who have fewer codes.

The GIS used in the cooperative with the USACE is an Integraph system.

GIS Data Interchange in Michigan

William R. Enslin
Center for Remote sensing, Michigan State University, East Lansing, MI 48824

Geographic Information System (GIS) data is currently being moved between six principal systems (Arc/Info, C-Map, CRIES, ERDAS, GRASS, Integraph) using one of five exchange formats (DIG, DLG, DXF, MIRIS, SIF). The main data flow is from the Integraph-based Michigan Resource Information System (MIRIS) to over 80 sites using PC software called C-Map which was developed at Michigan State University.

Prior to the transfer of data to a new system, there should be an evaluation of the acceptability of the source data for the new application. This assessment includes such factors as data structure, accuracy, data currency, coverage, coding scheme, data quality, and costs.

Digital data for GIS's are still principally available only on 9-track tapes from State and Federal Agencies. However, once the data have been taken off tape, several organizations in Michigan are transferring data files via other exchange media (e.g. floppy diskette, Bernoulli cartridge, and tape cartridge). Presently,

there is very little use of CD-ROM discs or electronic communications for GIS data interchange, yet MIRIS and several federal agencies have plans to distribute data on CD-ROMS.

The process of running a data conversion program is usually quite simple and relatively quick compared to the resources that may be required for quality assessment, editing, and data restructuring. This post-conversion process is particularly needed when moving data from a CAD-based cartographic system to a polygon (arc/node) GIS. Problems that may be encountered include: 1) certain entity types are not transferable, 2) different features on the same CAD layer, 3) character field width limits, 4) text justification, 5) errors in original data, 6) topological consistency, 7) attribute table restructuring, 8) mosaicking and edge matching, and 9) conflicts in the representation of the same feature.

Looking to the future, there is a need to develop standards both for data exchange (terms, formats, and procedures) and tailored binary-to-binary GIS translators that support feature attributes and polygon topology. GIS data sets must be better documented to include information on file history and data quality. The GIS community should establish coordination committees on data exchange, partnerships in data sharing, and training programs.

NOAA Mapping Systems

Christian Andreasen
Chief, Nautical Charting Division, NOAA, Rockville, MD 20852

The National Ocean Service (NOS) Office of Charting and Geodetic Services is responsible for approximately 95,000 miles of shoreline for the United States and its territories. This includes an area of 3.5 million square nautical miles for all US charting. To support this activity approximately 1000 nautical charts and 700 bathymetric maps are in production. The charts are updated as changes warrant updates. This office is also responsible for 10,000 aeronautical charts many of which are updated every 56 days. The nautical charts are part of a totally manual system(a failed automated effort was just shut down). A contract has been signed with Integraph to develop an automated charting system to be on line in 1992. Integraph equipment is currently in use at Interior and Defense.

NOS is an advocate for standards and is assisting in the development of the DX-90 International Hydrographic Data Exchange Format which will be discussed in a separate paper at this workshop by Walt Winn. We are converting to NAD 83 and WGS 84 datums by year end. Currently 17 charts are metric. All field parties have

converted to the metric system. This conversion requires a complete revamp since you must go back to the original source data. It is not a simple conversion.

The NOAA fleet is being upgraded. Contractual ships will be used as needed. To complete the survey of the territorial waters requires 400 ship-years for nearshore work and 180 ship-years to survey off-shore. Side-scan is being used extensively for wrecks and obstructions. The Purse, the Great Lakes survey ship, cost an average of one million/year. The last work in the Great Lakes was the St. Mary's River effort that was completed last year. No work was done this year. Any new work will be done by the Purse with field party support.

Airborne Photogrammetry with GPS controlled aircraft to produce >1 meter resolution has been a research activity supported by NOS. A graduate student at Ohio State is finishing a thesis on the specifics of the system that has been developed. This capability is available for experimental use.

New work in the Great Lakes will probably start in Lake Michigan using GPS control at 1:10,000 scale. It may be coordinated using a predefined nested grid. Coastal mapping will be totally kinematic - wave heights, tides with rms at the cm level. The funding for next year appears to be $.5 - 1 million.

PROMOTING THE SPATIAL DATA TRANSFER STANDARD

Karen A. Irby

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The success of any standard depends on its acceptance by the community of potential users. Accordingly, the process coordinated by the U.S. Geological Survey to develop a spatial data transfer standard for use by Federal agencies and the earth science professions was tailored to involve all segments of the profession, including Federal agencies involved in mapping, private industry, and the academic community. This development effort has been difficult and time consuming; however, with a broad base of involvement by a wide range of organizations, a good standard has been produced that will significantly benefit users of spatial data.

The Spatial Data Transfer Standard includes: 1) Logical Specifications--a conceptual model of spatial data and definitions of fundamental cartographic objects and key terms that serve as conceptual building blocks for the constructs presented in the standard, a transfer specification that defines the logical file structure for the transfer of the data, and data quality requirements that specify the form of the quality report and require the data provider to supply detailed information about the

data set being transferred in order for the user to evaluate the fitness of that data for a particular use; 2) Spatial Features--a domain of cartographic entities and attributes with standard definitions and a list of included terms to facilitate cross referencing from user feature categories to standard categories; and 3) ISO Implementation--a mechanism that uses the existing international standard, "Information Processing Specification for a Data Descriptive File for Information Interchange," for physical encoding of SDTS data. Having such a standard in place will be a great step forward for users to interact with and transfer a variety of digital spatial data formats between different computer systems.

In support of the Spatial Data Transfer Standard the U.S. Geological Survey will coordinate the development of software tools to assist users in interfacing with the standard. The availability of user-friendly software support tools is considered to be a critical element that will enhance the promotion of the standard and secure its acceptance throughout the community.

Great Lakes Coastwatch Data Distribution

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To address critical coastal environmental problems, the National Oceanic and Atmospheric Administration has established the Coastal Ocean Program. Within that program NOAA CoastWatch is designed to provide a rapid supply of up-to-date, coordinated, environmental (remotely sensed, chemical, biological, and physical) information to support Federal and state decision makers and researchers who are responsible for managing the Nation's living marine resources and ecosystems. NOAA CoastWatch focuses on specific regional and national priorities, such as unusual environmental events (e.g. red tides), accumulating algal biomass, and mapping wetland change.

The goal of CoastWatch is to develop and deliver environmental data and products for near real-time monitoring of U.S. coastal waters to support environmental science and decision making. One objective is to provide access to near real-time and retrospective satellite and aircraft observations for the coastal waters of the U.S. for Federal, State, and local decision-making and supporting research. Communications requirements and data distribution are done electronically via the NOAA Ocean Communications Network (NOCN).

As a CoastWatch Regional Site (CRS) and Regional NOCN Node (RNN) the NOAA Great Lakes Environmental Research Laboratory located in Ann Arbor, Michigan is currently receiving and archiving satellite derived surface temperature (SST) images in four Great Lakes windows: 1) Great Lakes basin 2) Lake Superior 3) Lakes Michigan and Huron 4) Lakes Erie and Ontario.

Ontario Province Data Distribution

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Until recently the Coastal Zone Atlas prepared in 1976 by Environment Canada and the Ontario Ministry of Natural Resources (ONMR) was the only document that comprehensively mapped Ontario's Great Lakes flood and erosion hazard shorelands. The hazard shorelands were depicted as a series of 1:100 year flood lines and 100 year erosion lines on a set of 1:20000 air photographs taken in 1973. Due to scale and age of the mapping the current utility of this Atlas to provincial field staff responsible for implementing shoreland management programs is limited.

In an effort to supply more recent and useful mapping, in 1989 the Canada/Ontario Flood Damage Program (FDRP) initiated Great Lakes shoreland mapping. The 1:2000 maps are produced from 1:8000 air photographs. Furthermore a decision was made to produce digital mapping that is GIS compatible. This has been accomplished through the creation of new digital mapping specifications that meet both national and provincial standards.

By December 1991 through the FDR Program approximately 40% of the lower Great Lakes shorelands will have been mapped. The priority is to map hazard shorelands that are or will be experiencing

development pressures. No mapping is currently being undertaken on Lake Superior or the north-eastern shore of Lake Huron.

The goal of the ONMR is integrated resource management with an ecosystem perspective. The FDRP mapping therefore only addresses one portion of the coastal system zone. Nearshore and offshore information is not available from this mapping. This information is of course critical to effective management of the entire coastal zone. Currently nearshore and offshore bathymetric data is collected by the Canadian Hydrographic Service (CHS). However since the CHS mapping is done for the purpose of navigation this database is a composite of a variety of scales, years, and resolutions. Due to the differences in age, scale and resolutions, the CHS and FDRP databases are often incompatible and therefore should not be used as a single database in a GIS environment.

Considering the Provincial and State jurisdiction and responsibility for coastal zone management there is a real need to undertake comprehensive coastal zone mapping that will encompass both on and offshore physical, biological and social factors but only at a scale that is considered useful to the end users.

GIS Production Applications in Ontario

Dell E. Coleman
Geomatics International, Burlington, Ontario L7N 3M6

Geomatics International Inc. is an environmental and resource management consulting firm which specializes in the application of Remote Sensing and Geographic Information Systems. There are three principal GIS systems that are used; Tydac's SPANS software, ESRI's ARC/INFO, and Pamap's PAMAP. We employ approximately 30 professional staff, many with 15-20 years of scientific research experience. Their professional expertise includes; foresters, soil scientists, remote sensing and GIS applications specialists, computer programming specialists, and statistical and model development.

Three examples of GIS consulting that we have done recently represent the kind of analysis that relates to the Great Lakes shoreline where an environmental database is needed as a reference for land use planning and/or regulation. The first example is the Ministry of Housing in Ontario where a 700 acre site was under pressure for a housing development after it failed to be built as an airport. The aim was to construct a sophisticated database of environmental data that could be used to establish guidelines for the land use and its eventual development. The environmental

database consisted of variables such as; habitat and vegetation, surface geology, streams, aquifer, soil types, etc.. The environmental guidelines were developed as a result of rules built into the GIS to validate restricted areas and to provide input to the development process.

The second example is the Fathom Five National Park which is part of Bruce Peninsula on Lake Huron. Here we had to map the land use types which were seasonal dwelling, vacant lots, and residential lots. At issue here was the positioning accuracy of the base mapping and the overlays. Edge matching was difficult in many cases and required that one base be established and used throughout. Both layers cannot be rubbersheeted or the error will be compounded.

The third example is an environmental quality map set of 10 1:50,000 map sheets that had to be merged to produce a large overview map for the client. This set required transformation from vector to rastor which is another complicated issue.

These samples demonstrate that GIS problem solving capabilities are real. The key aspect of GIS systems is that you must define the problem before you start.

Coastal Mapping Session C

Canadian Centre for Inland Waters, GIS Applications

Laurie Maynard

GIS Centre, CCIW, Burlington, Ontario L7R 4A6

The Great Lakes Coastal Zone Database (GLCZDB) was initiated as part of the International Joint Commission Great Lakes Water Levels Reference Study. Due to the bilateral nature of the IJC and the Reference Study, and current investments in existing systems and data, both American and Canadian Geographic Information Systems are being employed to store and analyze the integrated Great Lakes Coastal Zone Data Base.

The GLCZDB and the application of GIS technology will provide a means to generate comprehensive cross-section pictures and tabular summaries of the coastal zone. Through the process of overlaying maps, the biophysical, human activity, wetlands, and aquatic components of the Great Lakes environment can be viewed in an integrative manner to identify and analyze those areas susceptible to fluctuating lake levels, flooding and erosion. The biophysical, wetlands, and aquatic resources at risk within these hazard areas can be displayed, summarized, and tabulated.

The GLCZDB and GIS technology can be applied to assess the impacts of measures or actions on the environment. The key component in

this capability is the linked process sub-models describing wetlands, aquatic, terrestrial and process inter-relationships. Induced or secondary impacts and feedback impacts which dampen or magnify impacts can be identified. impacts can be identified at various scales, for example, a specific reach, littoral cell or even an entire lake.

To date the GLCZDB has been used to decribe various components of the Great Lakes ecosystem, to address the potential for assessing the impacts of fluctuating water levels and to assess possible remedial actions.

Description of the Database:

The outline of the Canadian Great Lakes shoreline has been taken from 1:25000 and 1:50000 National Topographic Series (NTS) maps. A total of 255 map sheets will be digitized which represents the entire Canadian Great Lakes shoreline from the western border of Lake Superior to Trois Rivieres on the St. Lawrence River.

Reach Information

The effects of fluctuating water levels vary with different shore types (bluff, sandy beach, etc.). For this reason the shoreline has been subdivided into reaches based on shore types. For each lake a number of littoral drift cells are identified based on the

OMNR Littoral Cell Definition report (Ontario Ministry of Natural Resources, 1988). For each littoral cell a sediment source, transport, and sink zone can be identified. The shoreline had been further divided into "reaches" as initially defined by Great Lakes Erosion Monitoring Program (Boyd, 1981). The GIS facilitates the analysis of measures and fluctuating water levels at a number of scales: the lake; littoral cell; and the reach. For the CAnadian portion of the shoreline there are approximately 1700 reaches. Shore type, physiography, and orientation to waves are used to delineate the reach boundaries alongshore. A number of attributes associated with the physical location of the reach which are also important for process modelling are being compiled and entered into the GIS in a lotus format.

Land Use

Land use coverage from 1:8000 scale air photographs flown in 1985 and 1988 is being mapped up to 1.6 kilometres inland onto the NTS topographic maps. Thirteen classes of land use have been mapped and this information has been entered in the GIS (agricultural field crops, agricultural specialty crops, residential, commercial and institutional, industrial, transportation and communications, recreation, extraction, water, wetlands, forest, grassland, barren/denuded).

Wetlands

Wetland information for Lake Erie and Lake Ontario has been mapped at a scale of 1:25000. Several vegetative zones and categories of wetland types have been identified and associated with wetland locations.

Aquatic Information

All known data presently available on the location of fish (spawning, juvenile and adult) habitiat and migration routes for 50 fish species have been compiled and will be entered in to the GIS database.

CD ROM Atlas Production

Russell A. Ambroziak
Office of Energy and Marine Geology, Reston, VA 22092

The USGS now has the ability to combine raster images with vector data and several types of point data with interactive, user-friendly software published on CD ROMS. Klein or Gloria sidescan sonar data are ideal raster data types for this product. Vector files can include such data as bathymetry, track lines, and dump sites that are in latitude/longitude format. Point data can be place names, multiple lines of text describing a point, color photographs of the location, etc. Data input to the system is controlled by text files which allow the user to add their own data to the system. This approach provides the user with (1) an interactive color atlas product on a PC with at least EGA color, (2) the complete digital set in easy to read format, and the ability to tailor the display and add data.

This presentation includes a large screen display of the PC graphics being developed for the above-mentioned CD ROM Atlas.

The USGS/NOAA Joint Office structure

Christian Andreasen
Chief, Nautical Charting Division, NOAA, Rockville, MD 20852

The USGS/NOAA Joint Office for Mapping and Research (JOMAR) was originally established in a memorandum of understanding between the two agencies. The main purpose of this office is to provide a mechanism for the coordination of mapping and research activities in the Exclusive Economic Zone (EEZ). Coordination will avoid duplication of activities, assure adequate response to needs of the multiple-use community and provide for timely delivery of products and services and exchange of data. Coordination will also facilitate private sector involvement in the direction and use of EEZ-related data products.

The Joint Office can serve as a mechanism to collate and compile the large volume of data that has already been acquired in and around the Lakes by Federal, State, and local agencies, universities, and private industry.

Hazard/Damage Assessment Model for the Great Lakes

Will Knauss

Applied Science Associates, Narragansett, RI 02882

This is an example of a GIS system in the form of a computer model for the Great Lakes region being developed for the Department of Interior's Office of Environmental Affairs by Applied Science Associates. The Natural Resource Damage Assessment Model for the Great Lakes Environment (NRDAM/GLE) is designed to assess economic damages for small scale spills of oils, petroleum products and hazardous chemicals. The model represents another class of GIS user as it included its own GIS system to provide the model with accurate environmental information about the area in which a spill occurs.

The system includes bathymetry, shoreline, current, biological habitat and ice data derived from data collected by various Great Lakes research groups. The model uses this data to create the dynamic model grid for each specific run scenario. This is in marked contrast to the standard modeling strategy of having a static grid which is used for all run scenarios in a given area. The model will be distributed by the Department of the Interior during its review period and will be available from NTIS after that.

Electronic Charting in an Inertial Navigation System

Richard Gregory-Allen
Laser Plot Inc., Auburn, MA 01501

An electronic chart system demo using CD ROM technology and a DOS based PC with an extended VGA, 256 color display(640 x 480). This system represents an off-the-shelf navigation and chart display package. A demonstration of the zoom and pan capabilities and the logging facility are examples of pre and post cruise data can be manipulated with the chart base. CD ROM charts are inexpensive and reliable for this type of application.

Data Management Systems for the Great Lakes mapping program

Christopher F. Polloni
USGS, Woods Hole, MA 02543

No one GIS or database is adequate to deal with vector, raster, and tabular data collected in the Great Lakes. However, these data can be moved between the existing systems now and tranfers will become easier and more reliable in the future as new standards are implemented.

We have a technical advisory group of Geographic Information System (GIS) and database specialists that are serving as the consultants to develop these standards for data storage and distribution. Goals have been established. What is needed now is the initiative and organizational support to establish this activity formally.

The USGS has demonstrated the ability to use a mix of GIS systems to preview, model, review, and publish Great Lakes data which has been collected from Federal, State, and local sources. The one area that has presented problems is the publication stage where I hope future standards will eliminate the current stalemate in electronic map publication.

Discussion panel "Great Lakes Data Distribution"

Donald Parsons, moderator
IJC, Washington, DC

panel members:
Chris Andreason, NOAA
Roger Gauthier, USACE
Laurie Maynard, CCIW
Chris Polloni, USGS

The initial discussion reviewed the status of the GIS User Profile survey that was initiated by Brad Parks and expanded by Mark Law to include the Canadian input. A new combined survey summary needs to be published.

Don Parsons voiced concern about budgets and the IJC. Will there be state support forthcoming and what are the priorities? Some discussion followed.

Dr. Dave Folger began with a discussion on data availability of both present and future holdings. A data set for high priority inclusion in the database is lake bottom sediment sample analysis. It was agreed that the Thomas sediment base was the most complete but that a larger effort should be initiated that would integrated with EMAP-EPA and the National Sediment Database. Chris Andreason mentioned that the National Academy of Sciences had recommended a similar focus and that this should be a budgeted activity.

Roger Gauthier suggested that the USACE data holdings will be available for distribution on a CD ROM. Data sets that should be mature and distributable are: USACE Great Lakes shoreline, NOAA/GLERL snow cover, ice, surface temperature, IJC basic water level, USACE harbor, site plans(1:2400), and the Terrain data base from FEMA were some of those mentioned.

SELECTED BIBLIOGRAPHY

Folger, D.W., Andreasen, Christian, Chambers, M.J., 1990, U.S. Great Lakes Shoreline Mapping Plan: U.S. Geological Survey, Open File Report 90-97, 71 p.

Gauthier, R. L., 1990, Geographic Database Design Workshop for the Great Lakes Shoreline and Drainage Basin, January 22-26, Detroit, MI, 5 p.

Horvath, F. J., 1990, International Association for Great Lakes Research Symposium, Session Nine A, Geographic Information Systems, Thursday May 17, abstracts and program, p. 109-114.

Johnson, C. A., 1990, International Association for Great Lakes Research Symposium, Session Thirteen, Shoreline Erosion, Tuesday May 15, abstracts and program, p. 61-67.

Parks, Bradley, 1990, Results of the Great Lakes GIS Workshop, October 11-12, 1989, Program and Abstracts, 33rd Conference on Great Lakes Research, University of Windser, p. 111.

Saunders, R.E., Law, M.N., MacKinnon-Burwell, N.D., Abel, M.J., 1990, Delineation of Erosion Hazard Shorelands, Workshop Summary, June 21-23, Cleveland, Ohio, 204 p.

Scott, David J., Alper, S., 1990, Automated Chart Production System Development at NOS; Program and abstracts, American Society of Photogrametry, Spring Annual Convention, Denver, CO, March, 1990, 12 p.

APPENDIX A

Proposed Membership/Assoc. Great Lakes GIS Coord. Comm.

Great Lakes GIS Coordinating Committee
proposed membership/associates * denotes ad-hoc member

U.S. State Agencies & academics

	phone#	FAX#	
Illinois			
Warren Brigham,Nat. Hist. Ill. GIS	217-333-0954	217-333-4949	
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Indiana			
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Bill Enslin, MSU,remote sense	517-355-3276	517-353-1821	
Ann Maclean, Mich Tech U.	906-487-2030	906-487-2915	
Mike Scieszka, DNR	517-335-3445	517-373-9965	
Minnesota			
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Lloyd Queen, UofMinn, St. Paul	612-624-5359	612-625-5212	
Alan Robinette, State Planning	612-296-1209	612-296-3698	
New York			
Sean Ahearn, Hunter College	212-772-5327	212-772-5268	
Jon Banta,NYS Adirondack	518-891-4050	same-ask con	
Hugh Calkins, SUNY, Buffalo	716-636-2264	716-636-2329	
Robert Kitchen, Albany	518-474-6742	518-474-3864	
George Stafford, Albany	518-474-3643	518-473-2464	
Ohio			
Don Bossler	614-292-1600		
Wayne Channell, Ohio DNR	614-265-6769	614-447-9503	
Dave Crecelius, Larry Wickstrom	614-265-6776	614-447-9503	
Jonathan Fuller, Ohio DNR, GS	419-626-4296	419-626-8767	
Carl Wilhelm, Ohio EPA	614-644-3020		
Pennsylvania			
Nicki Kasi, Victor Funk, Harrisburg,DER	717-540-5080	717-540-5081	
Gary Peterson, Penn State	814-863-0291	814-865-3378	
Wisconsin			
Bob Gurda	608-262-6850	none	
Tom Lillesand, UofWisc, Madison	608-263-3251	608-262-5964	
Paul Tessar, WiscDNR, Madison	608-266-3054	608-267-3579	

Great Lakes GIS Coordinating Committee
proposed membership/associates * denotes ad-hoc member

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International Joint Commission(IJC)			
Murray Clamen, IJC, Ottawa	613-995-2984	613-993-5583	
Dave Dolan, IJC, Windsor	313-226-2170	519-256-7821	*
Don Parsons, IJC, Washington,DC	202-673-6222	202-673-6238	
Canadian Provincial			
Del Coleman, Geomatics Inc,Burlington	416-632-4259	416-333-0798	*
Mark Law, Ontario MNR, Toronto	416-965-1271	416-965-0999	*
Pearl Mckeen, Ontario MNR, Toronto	416-965-6285	416-965-0999	
Canadian Federal			
Bill Bien,Env. Canada, Burlington	416-336-4551	416-336-4906	*
Laurie Maynard, CCIW	416-336-4551	416-336-4906	

Great Lakes GIS Coordinating Committee
proposed membership/associates * denotes ad-hoc member

U.S. Federal Agencies

	phone#	FAX#	
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Katherine Axton, Forest, East reg.	414-297-3171	414-297-3808	
Gayle Teselle, Soil Con.,Wash,DC	202-447-5381		
Commerce			
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Defense			
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John Kangas, USACE, Chicago	312-353-4333	312-353-5439	
Don Leonard, USACE, north	312-353-6355	312-353-5439	
Env. Protection Agency			
John Anagnost,	312-886-0143	312-886-1420	
John Schneider,GIS, Chicago	312-886-6224	312-886-2591	
Brad Parks,LLRS, AScI	313-692-7633	313-692-7603	*
William Sandville, Duluth	218-720-5723	218-720-5539	
FEMA			
Dan Cotter, Wash, DC	202-646-2757	202-646-3445	
Mark Crowell, Wash	202-646-3432	202-646-3445	
Norbert Schwartz, Chicago	312-408-5552	312-408-5521	
Interior			
Mike Chambers, NMD, Great Lakes Mapping	703-648-4137	703-648-5585	
John Cooper, FWS, East Lansing	fts 374-6650	fts 374-6899	
Ron Erickson, FWS, Minneappolis	612-725-3417		
Harvey Fleet, NPS, Denver	fts 327-2590	fts 327-2822	
Stephen Guptill, NMD, standards	703-648-4520	703-648-5542	
Jeff List, USGS, Coastal Program	813-893-9813	813-893-9809	
Chris Polloni, USGS, Coastal Program	508-457-2280	508-457-2301	*
David Rosenburg, Env. Affairs	202-208-3301	202-289-7405	
Transportation			
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APPENDIX B

Objectives

GREAT LAKES STUDIES

Great Lakes GIS Coordinating Committee

meeting notes 5/16/90 Internation Joint Commission(IJC)
Windsor, Ontario

Committee goals [objectives]

- Reduction of redundancy

  data collection
  database development
  database dictionaries

- Establish data transfer mechanisms

interoperability - Intergraph - Arc/Info - SPANS - ERDAS - GRASS - GLIS etc

- Promote communication e.g. data exchange

  CD-ROMS

- Encourage use of accepted data standards

  DLG DLG-E SDTS

- Identify un-met data needs

  common parameters for the Great Lakes Basin
  (Canada and United States)

- Establish identity - Land, Lake, Atmospheric

  primary focus - Great Lakes drainage basin
  representation from 8 states, province of Ontario, etc

APPENDIX C

Products

PRODUCTS

Data for each lake will be compiled on a CD ROM with software that can be accessed from a variety of systems.

In addition to papers published after individual study elements are completed, an Atlas will be assembled as a USGS Bulletin or Professional Paper to integrate the new data into the already established data base. These documents will be published first as USGS Open-File Reports (approximately one year after studies are completed) and in more formal USGS and NOAA publications two to four years later as analyses and processing are completed.

The processed digital geographic and geologic data will be centralized in the USGS/Marine Geology and National Mapping Division and NOAA National Geophysical Data Center in Boulder, Colorado, for general public dissemenition. Products that can be generated from the processed data include:

- Print-on-demand shoreline change maps.
- Digital topographic, bathymetric, and geophysical data sets, including historical shoreline data as available.
- More accurate nautical charts and bathymetric maps due to more frequent updates of shoreline detail and nearshore bathymetry.
- Improved models for predicting coastal hazards, such as shoreline change, storm surge, and sediment transport.
- Improved long-term record of lake-level fluctuations and shoreline responses to those fluctuations.
- Defined long-term record of subsidence/uplift for use in the design of coastal engineering structures and for planning related to future shorelines.
- Photography to support ancillary studies of environmental conditions.

taken from page 9 of U.S. Great Lakes Shoreline Mapping Plan (Folger and others, 1990).

APPENDIX D

Database Workshops Agendas(USGS/NOAA, RTCM, USCG)

Digital Data Bases for Electronic Maps and Charts
A Joint Conference of NOS, USGS and RTCM
October 29-31, 1990
Woods Hole, MA 02543

Monday, October 29, 1990

10:00	Registration and Logistics	*Clark 507 Conference Room*
12:00	Light Luncheon	*Carriage House*
13:30	Welcome -- **Robert Gagosian** **Associate Director for Research, WHOI**	*Clark 507 Conference Room*
	Introductory Comments -- **Arthur Gaines** **Marine Policy Center, WHOI**	
13:50	RTCM/WHOI ECDIS Testbed Project -- **Mortimer Rogoff**	
14:20	USCG ECDIS Activities -- **Lee Alexander** **USCG, Groton**	
14:50	Coffee	
15:15	Great Lakes Coastal Mapping Workshop - Session A --see separate agenda--	
17:00	Light Reception Dinner on your own	

Tuesday, October 30, 1990

08:00	Great Lakes Coastal Mapping Workshop - Session B	*Clark 507 Conference Room*
12:00	Light Luncheon	*Carriage House*
13:30	RTCM Special Committee 109 on Electronic Charts	*Clark 201 Conference Room*
13:30	Great Lakes Coastal Mapping Workshop - Session C	*Redfield Auditorium*
17:00	Reception	*Fenno House*
18:00	Conference Dinner - Speaker: **Dr. Craig Dorman** **Director, WHOI**	

Wednesday, October 31, 1990

08:00	DX-90 Workshop - Session A	*Clark 507 Conference Room*
12:00	Light Luncheon	*Carriage House*
13:30	DX-90 Workshop - Session B	
17:00	Conference Adjourns	

APPENDIX E

List of Attendees/Mailing List

Digital Data Base Conference
October 29 - 31, 1990
Participants Mailing List

Name & Address	Phone
Mr. William T. Adams President Radio Technical Commission for Maritime Services 655 15th Avenue, N.W. Suite 300 Washington, D. C. 20005	(202) 639-4006
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