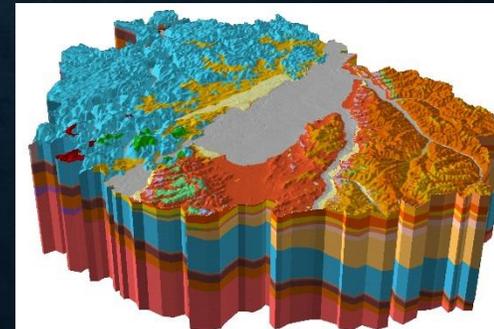
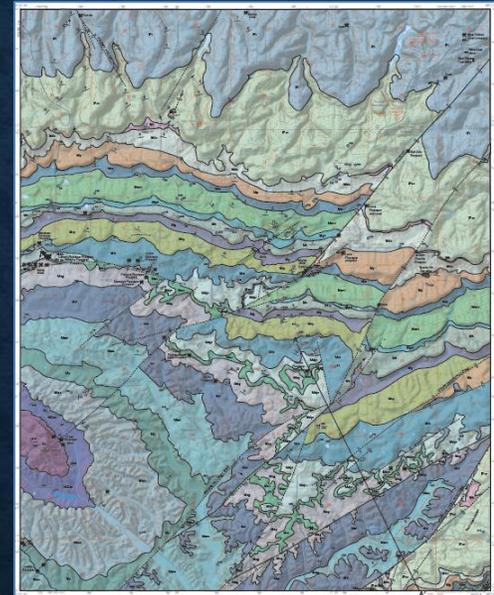


Geological Mapping

What It Is, Who Does It, and Why We Do It

Richard C. Berg
Director, Illinois State Geological Survey

- Geologic mapping portrays the **distribution, composition, and structure of geologic materials** at land surface and at depth (e.g., a 2D map of a subsurface unit), with observations and interpretations depicted by colors and symbols.
 - **Primary driver - economic development** by governments and private industry, that prosper from the numerous discoveries of minerals, coal, oil, and natural gas that mapping reveals.
 - **Secondary driver – identification/delineation of aquifers**, environmental protection of land and water, and assessment of hazards all became very prominent societal issues.
- **3D geological mapping/geological modeling** creates 3D representations of the Earth based on geological and geophysical observations made on land surface, but focuses primarily on the subsurface.





Great Lakes Geologic Mapping Coalition

**First 5 Now 10 Geological Surveys
Working Toward Uniform Goals**



Problem - Scientific Issues

Multiple Landscapes Due to Glaciation

- **Layers of glacial sediment** (1) thicken and thin or may be absent; (2) successive ice sheets advanced to different places at different times; and (3) ice carried debris of varying compositions.
- **Each major glacial advance left an ancient landscape** similar to today's landscape - hills, valleys, rivers, streams, and lakes.
- **Weathering/soil formation/erosion/deposition** acted on these landscapes between glacial episodes, adding complexity.
- **Old landscapes were overridden**, some features were preserved, others eroded away and were replaced by new glacial materials.

Problem - Scientific Issues

“Haphazard” Arrangement of S&G Aquifers

- Meltwater flowed away from ice margins and **sand and gravel was deposited in channels at different times.**
- Because of multiple landscapes/changing environments, **sand and gravel aquifers are at various depths**, often not uniformly distributed, may change character, and difficult to predict.
 - **Subsurface sand and gravel deposits are challenging to understand** - characteristics must be interpreted from drilling records, cores, geophysics, and outcrops.
 - **Locations of deposits are critical** - used by a large percentage of the population (~50%) as a drinking water resource and for aggregate materials.

Glaciation's Complex Geology



Braided stream with outwash
Fan
Moraines
Delta
Glacier

Bylot Island, Canada



Ponded lake
End moraine
Melting ice

Hummocky topography of the end moraine in the snout area of Aktineq Glacier. Small mounds range up to 10m high and are covered by diamicton that lies over glacier ice (and insulates it from melting).

180,000 - 125,000: Illinois
Episode Glaciation



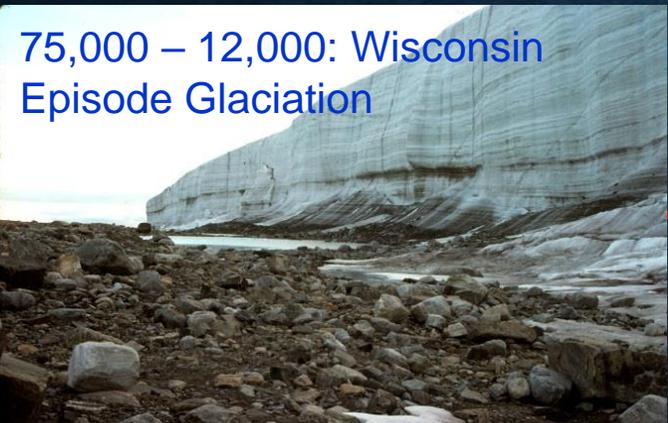
This is what we
see today.



125,000 – 75,000 Sangamon
Episode Interglacial



75,000 – 12,000: Wisconsin
Episode Glaciation

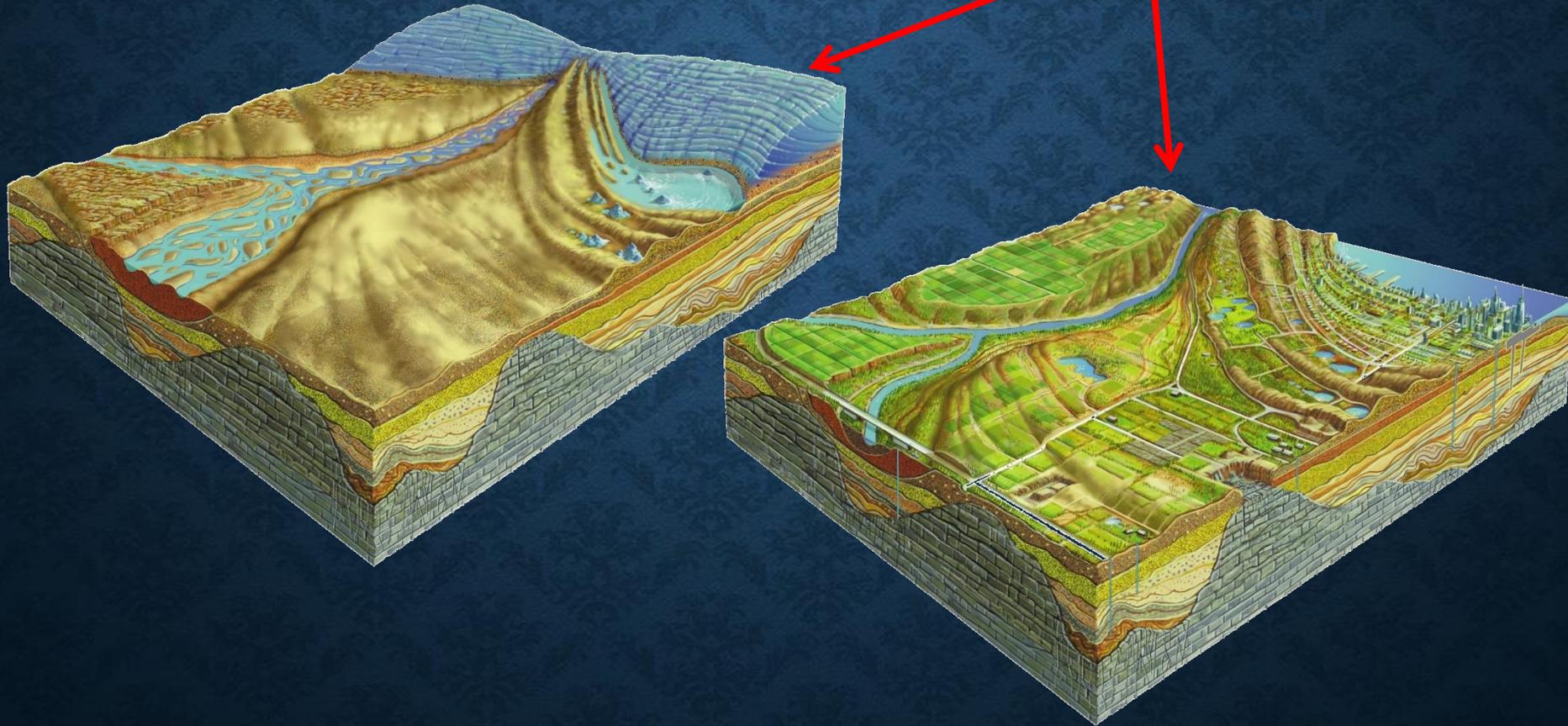


Modern Landscape



Problem Summary

We went from this to this



Problem - Scientific Issues

Earth Hazards

- Difficult to assess potential for **natural hazards** and their consequences affecting land use.
- Earthquakes, landslides, subsidence, floods, karst, and coastal erosion are geologic events.
- **Mapping the distribution of deposits, particularly in the subsurface, permits development of interpretive hazard maps and potential impacts.**

Problem - Scientific Issues

Mineral Resources

- Identification of **sand and gravel, coal, and oil and gas** is important to the region's economy.
- All construction projects require **high-quality aggregate**.
 - **Hauling** >costs - 2X, 8-24 mi. from source and 3X, @ 50 mi.
 - **Land-use zoning ordinances** may prevent pits/quarries from locating and expanding.
 - **Land-use conflicts** - must prevent "**resource sterilization**", and concurrently promote economic/residential growth and development of those same s & g deposits for drinking water.

Problem - Human Factors

- Attitude: **Out of sight - out of mind.**
- Attitude: **Not in my back yard.**
- **Land-use planning decisions are made every day based on “best guesses”.**
 - Geology is overlooked.
 - Balance can be attained between economic development and resource-based land-use planning.



Problem - Human Factors

Result - Bad and Expensive Siting

- **Millions of dollars are wasted each year** for mitigation, waste disposal, industrial and commercial siting.
- A low-level radioactive waste disposal facility siting cost about **\$86,000,000**.
- Clean-up for a high-end SuperFund site can cost **\$50,000,000**.
- The average SuperFund clean-up cost is about **\$15,000,000**.
- **With detailed 3D geologic information, many of these “problem sites” would not have been located where they are in the first place.**
- **Good planning minimizes problems.**

Addressing the Problem

Answering Critical Scientific/Land-use Questions

Three-dimensional Geological Mapping

The Central Great Lakes Geologic Mapping Coalition

Regional Similarities – Glacial geology,
demographics, rust belt, agriculture, and the Great Lakes

Bottom Line

- **STATEMAP could NOT address the mapping needs.**
 - Very complex glacial geology requiring subsurface information to address critical scientific issues.
 - Need to portray 3D geology, answer development questions, and deliver scientific and derivative products to users.
- **Takes >1 Survey to address issues.**



Central Great Lakes Geologic Mapping Coalition

- State geological surveys of Illinois, Indiana, Michigan, and Ohio and the USGS in 1997 formed the **Central Great Lakes Geologic Mapping Coalition**.
- Mission to (1) develop, in partnership with map users, dynamic databases of geologic information and **create updatable, 3-D geologic maps** and map products delineating the region's surficial deposits and bedrock surface of the region of the four states, and (2) to produce, with partner groups, **derivative map folios, assessments, and economic analyses that directly support critical decisions** concerning natural resources, hazards, and environmental management.
- **Prioritize mapping** in urban-suburban, high recreational use, point/non point-source environmental problem regions, transportation corridors, and areas with known hazards.

Need for Three-dimensional Geological Information

- Decision makers, planners, educators, engineers, and consultants **evaluate complex and often competing public policy options** involving earth resources.
- Federal, state, and local governments and private industry **need uniform and unbiased information** about earth materials for managing water, land, and biological resources.
- **Geologic information needed to balance economic growth with natural resource needs** of an increasing population, to assess hazards, and to manage the environment in a sustainable manner.

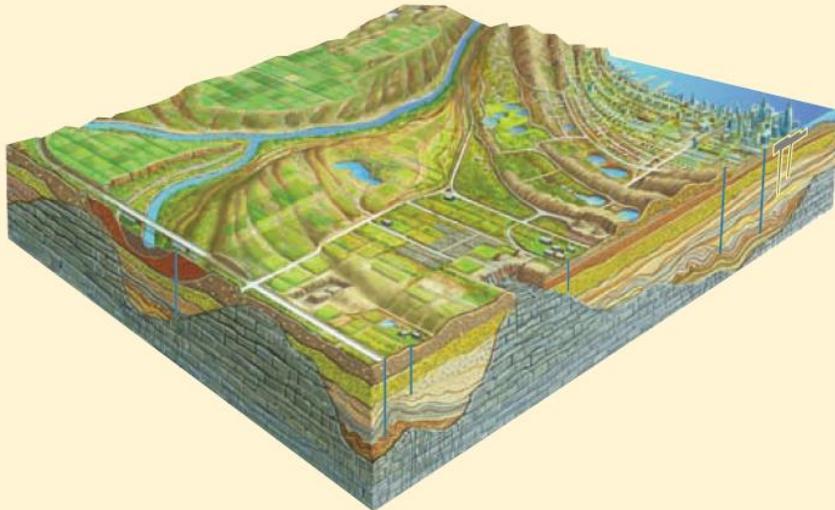
The Plan



Mapping the Glacial Geology of the Central Great Lakes Region in Three Dimensions— A Model for State-Federal Cooperation

U.S. GEOLOGICAL SURVEY OPEN-FILE REPORT 99-349

Prepared in cooperation with the
Illinois State Geological Survey
Indiana Geological Survey
Michigan Geological Survey Division
Ohio Division of Geological Survey



U.S. Department of the Interior
U.S. Geological Survey

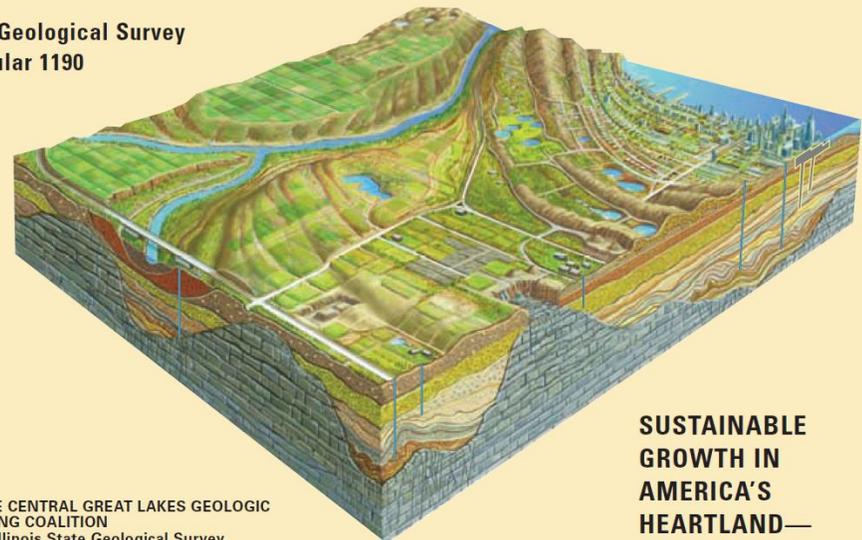
The work plan – USGS OFR 99-349



The societal reasons for the work
– USGS Circular 1190



U.S. Geological Survey
Circular 1190

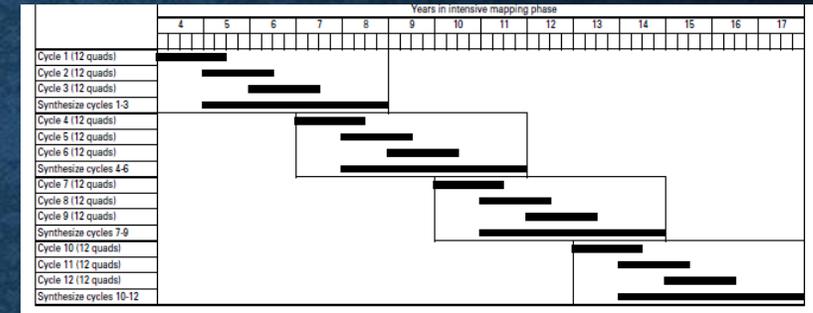


BY THE CENTRAL GREAT LAKES GEOLOGIC
MAPPING COALITION
Illinois State Geological Survey
Indiana Geological Survey
Michigan Geological Survey Division
Ohio Division of Geological Survey
U.S. Geological Survey

SUSTAINABLE
GROWTH IN
AMERICA'S
HEARTLAND—
3-D GEOLOGIC MAPS
AS THE FOUNDATION

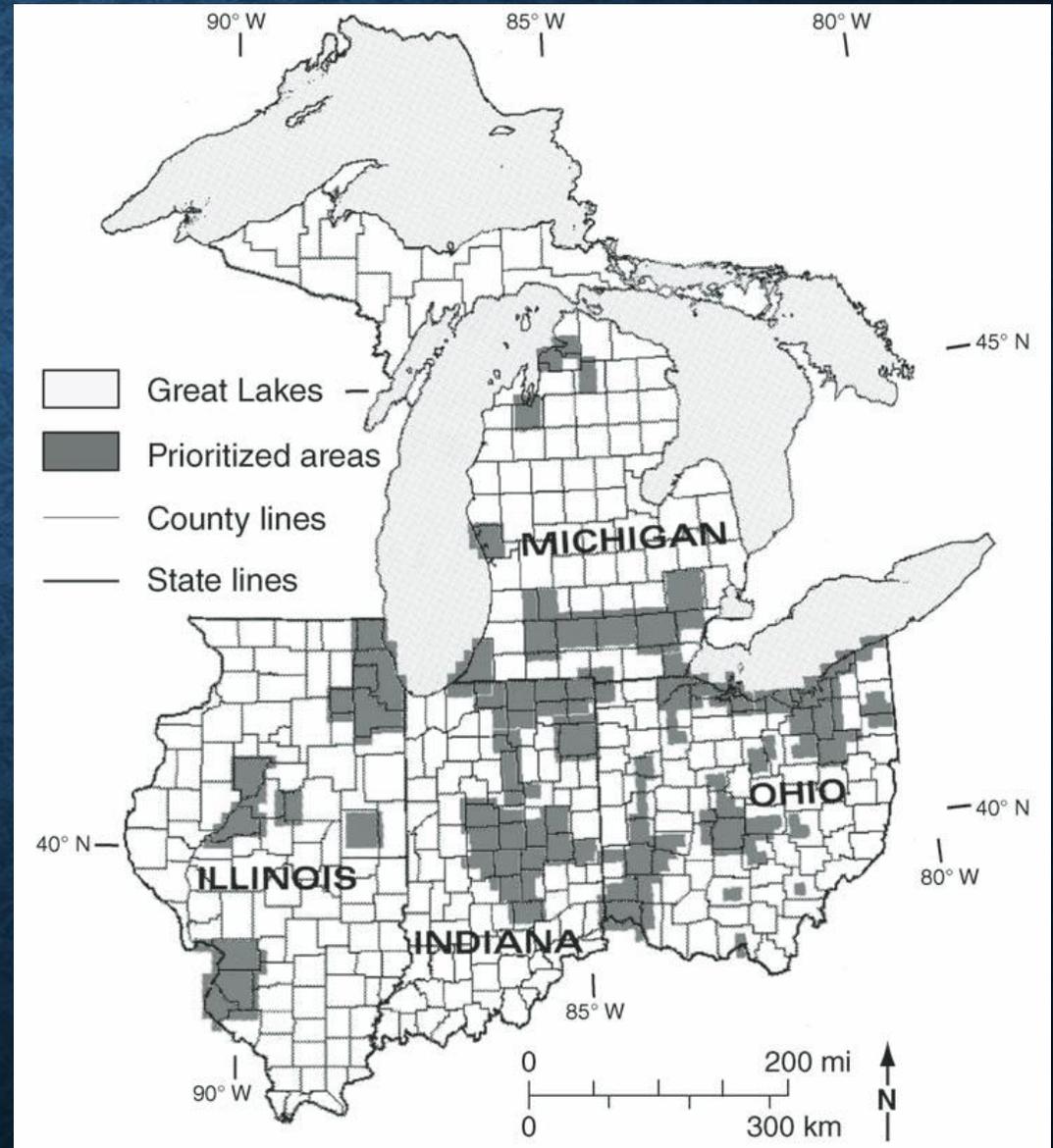
3D Geological Mapping Program Timeline, Capabilities, and Needs

- Developed long-and short-term **priorities**.
 - Included information delivery and outreach plans.
- **Provided a timeline** - 2.5 yr. mapping cycles.
 - About 12 maps (~700 mi² – Lake County, IL size).
- **Assessed staffing/equipment** capabilities/needs of each survey.
- **Provided cost estimates** – ~\$250,000/topographic quad (~56 mi²)
 - ~\$7.00/acre for 3D mapping.
- **Provided a full implementation plan** (\$20M/yr. for 15 yrs.)
 - 16 new staff + present staff.
 - Included support staff (GIS, database, editors, graphics, lab technicians, drillers, etc.).
 - 3 support staff per 2 scientific staff.



Original Coalition Mapping Management Plan

Focuses on areas of greatest need, as determined by customers.



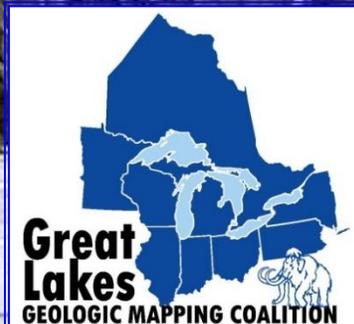
Brief History

- **1997 - Central Great Lakes Geologic Mapping Coalition was established by the IL, IN, OH, and MI SGSs, in partnership with the USGS.**
- **1999/FY2000 - A \$500,000 line item (President's Budget) in the USGS' Earth Surface Dynamics Program.**
 - **“Unrequested funding increase” - reprogrammed funds from the NCGMP. Congress approved and permission was granted for the funds to be allocated to States.**
- **2002/FY2003 - Eliminated from the President's Budget, but the Senate requested a funding restoration.**
- **2003/FY2004 - Reinstated \$500,000 in the President's Budget. The Senate recommended a \$500,000 decrease, the House restored the funding, and the Conference Report supported the action. Funds and support remained unchanged from FY2005 through FY2008.**
- **2008/FY2009 - Expanded to include the MN, WI, PA, and NY SGSs.**
 - **\$500,000 again removed from the President's Budget. Omnibus Approp. Act of 2009 restored the program at an increased level of \$750,000.**
 - **Coalition placed within the USGS' NCGMP. Funds/support remained unchanged since FY2009.**
 - **Name changed to Great Lakes Geologic Mapping Coalition.**
- **2012 - Added the Ontario Geological Survey as a non-U.S. funded member.**

Congressional Interactions/Support

**How did we overcome multiple
program removals and reinstatements?
Organized >800 meetings with Washington
DC House/Senate offices and District offices.**

Great Lakes Geologic
Mapping Coalition



Hundreds of Support Letters

County and municipal government

Janet Agnoletti, Executive Director, Barrington Area Council of Governments
Mike Bacon, Public Health Administrator, Winnebago County Health Department
Jack Bajor, Trustee, Village of Winfield
Bonnie Thompson Carter, President, Lake County Forest Preserve
Mark Kern, Chair, St. Clair County Board
Patrick J. McNulty, Public Health Administrator, McHenry County Department of Health
Suzi Schmidt, Board Chairman, Lake County
Mark Toalson, GIS Manager, Champaign County
Craig Weber, Village President, Village of Oswego
Jeff Wilkins, Administrator, Kendall County

Economic development groups

James Allen, Executive Director, Montgomery Economic Development Corporation
Tim Angell, Deputy Director, Community and Economic Development Dept, City of Des Plaines
Nora Fesco-Ballerine, Executive Director, North Central Illinois Council of Governments
Randy Blankenhorn, Executive Director, Chicago Metropolitan Area Planning
Monica Bristow, President, Growth Association of Southwestern Illinois
Bob Campbell, Consultant, Williamson County Regional Economic Development Corporation
Vickie Clark, Senior VP and CEO, Economic Development Council for Central Illinois
Tom Cuculich, Director, DuPage County Department of Economic Development
Tracy Epps, President, Ford County Community and Economic Development Foundation
Mike Finnegan, Grundy Economic Development Council
Katie Forystek, Community Development Planner, Oak Forest
Stephen Gonzalez, Chairman, Southwestern Illinois Resource Conservation and Development
Jeanne Gustafson, President & CEO, Champaign Co. Economic Development Corporation
Bud Hamer, Consultant, Hamer Consultants & Developers
Deirdre Hirner, Executive Director, Illinois Environmental Regulatory Group
Roger Hopkins, Executive Director, DeKalb County Economic Development Corporation
George Lofton, President, Metro Economic Growth Alliance of Chicago
Michael Lundy, Executive Director, Southwestern Illinois Development Authority
Chris Manheim, President, McHenry County Economic Development Corporation
Michael Mays, Director of Planning and Development, Village of Woodridge
Jim McConoughey, President and Chief Executive Officer, Heartland Partnership
Brian Moody, Executive Director, Tuscola Economic Development, Inc.
Michael Neuenkrichen, Vice Chairman, LaSalle County Development Connection
Roberta Parks, Senior VP and Chief Operating Officer, Peoria Area Chamber of Commerce
Gary Skoog, Director of Economic Development, Hoffman Estates
Betty Steinert, Economic Development Director, Whiteside County Development Dept.

Educational institutions

Richard Anderson, Professor Emeritus, Augustana College
Jeffrey Bates, Associate Professor, Columbus State Community College
Steven Bennett, Associate Professor, Dept. of Geology, Western Illinois University

Steven Esling, Chair, Department of Geology, Southern Illinois University Carbondale
Lynn M. Kantner, Professor, Columbus State Community College
David Kirschner, Associate Professor, Saint Louis University
Melissa Lenczewski, Assoc. Prof., Dept. of Geol. & Environ. Geosciences, N. Illinois University
David Malone, Chair, Dept. of Geography and Geology, Illinois State University
Jeffrey Strasser, Assistant Professor, Augustana College
Stephen J. Van der Hoven, Asst. Professor, Dept. of Geog. and Geol., Illinois State University

Environmental groups

Joe Brammeier, Associate Director for Policy, Alliance for the Great Lakes
Glynnis Collins, Executive Director, Prairie Rivers Network
Jacki Golike, Executive Director, McHenry County Defenders
Ksenia Rudensiuk, President, Fox River Ecosystem Partnership
Ksenia Rudensiuk, Director, Conservation Development and Legal Affairs, The Conservation Foundation
Mark Wilson, President, Land Stewards, LLC

Geotechnical consulting firms

Jack Bajor, Environmental and Civil Engineer, Manhard Consulting, Ltd.
Greg Buffington, General Manager, Layne-Western Company
Andrew R. Deitchman, Engineering Enterprises, Inc.
Herbert B. Eagon, Hydrologist, Eagon & Associates, Inc.
Martin Fallon, Project Manager, Shaw Environmental, Inc.
Garry Getz, Geologist, Bowser-Morner
Bill Graham, Project Manager, TSI Engineering
Douglas J. Hermann, Vice President, STS Consultants, Ltd.
Liviu Iordache, Geotechnical Services Manager, Wang Engineering, Inc.
John Jansen, Sr. Geoscientist, Aquifer Science and Technology, Ruekert/Mielke, Inc.
Robert Kohlhasse, Engineering Manager, Farnsworth Group, Inc.
John Kotteman, Principal Engineer, Shively Geotech
Tracy Lundin, Senior Vice President, Hanson Engineers, Inc.
Alberto Nieto, Chief Executive Officer, ENGEON Corporation
Justin Pearce, Senior Project Geologist, William Lettis & Associates
Patrick Poepping, President, Poepping, Stone, Bach & Associates, Inc.
Mark R. Rowland, Director of Environmental Services, Burgess & Niple, Inc.
Erik Spande, Hydrogeologist, CH2M Hill
Jim Thompson, Owner/Member, Caprock Environmental Services, LLC
Peter Vagt, Principal Hydrogeologist and Vice President, MWH Americas, Inc.

Industry (other)

Tim Agnello, Realtor & Geologist, Teroso Real Estate
Don Frank, Board President, Illinois Central Ethanol, LLC
Randy Gebke, General Manager, Kohnen Concrete Products
Tim Kelly, Senior Project Manager, Water Well Solutions - Drilling Division LLC
John Pitz, President, N. L. Pitz, Inc.
William Schubert, Environmental Engineering Director, Waste Management, Inc.
Gary Sitler, President, Flint Ridge Energy, LTD

Private consulting geologists

Steven W. Cox, Independent Consulting Geologist
Polly Doyle, Consultant
David Favero, Consultant
Doug Hambley, Consultant

Professional associations

Sue Bohenstengel Executive Director, Illinois Association of Groundwater Professionals
Robert Church, Executive Director, Illinois Professional Land Surveyors Association
Martin Hamper, President, American Institute of Professional Geologists, Illinois-Indiana Section
John Henriksen, Executive Director, Illinois Association of Aggregate Producers
Patrick A. Jacomet, Executive Director, Ohio Aggregates & Industrial Minerals Association
Robert G. Jones, Executive Director, Indiana Mineral Aggregates Association
Jim Owens, Executive Director, Indiana Limestone Institute of America, Inc.
Karen Stonehouse, President, Illinois Chapter of the American Planning Association
Mark White, Chair, Assoc. of Environmental and Engineering Geologists, North-Central Section

Soil and water conservation districts

Deanna Bazan, Chairman, Kendall County Soil and Water Conservation District
Diane Freeman, Resource Conservationist, Woodford County Soil and Water District

State and federal government

Joe Angleton, Director, Office of Mines and Minerals, Illinois Department of Natural Resources
Stuart R. Davis, Council Chair, Ohio Geographically Referenced Information Program, Ohio Office of Information Technology
Bob Gibson, Abandoned Mined Lands Reclamation, Office of Mines and Minerals, IDNR
Samuel J. Indorante, Soil Scientist
Paul Kesich, Fermilab
Ken Lovett, Manager, GIS and Statistics Section, Illinois Department of Revenue
Douglas Scott, Director, Illinois Environmental Protection Agency
John Washburn, Illinois Department of Transportation, Retired
Gerald A. Unterreiner, LPG, Hydrogeologist, Indiana Department of Natural Resources

State and local political office holders

The Honorable Michael W. Frerichs, Illinois State Senator, 52nd District
The Honorable William R. Haine, Illinois State Senator, 56th District
The Honorable David Luechtefeld, Illinois State Senator, 58th District
The Honorable William E. Peterson, Illinois State Senator, 26th District
The Honorable Gerald J. Schweighart, Mayor, City of Champaign

April 12, 2007

The Honorable Dianne Feinstein
Chairman
Senate Appropriations Subcommittee
on Interior and Related Agencies
131 Dirksen Senate Office Building
Washington, DC 20510

The Honorable Larry E. Craig
Ranking Member
Senate Appropriations Subcommittee
on Interior and Related Agencies
123 Hart Senate Office Building
Washington, DC 20510

Dear Chairman Feinstein and Ranking Member Craig:

We are writing to express our support for \$5 million in the FY 2008 Interior Appropriations bill for the Central Great Lakes Geological Mapping Coalition. This coalition of State Geological Surveys of Illinois, Indiana, Michigan and Ohio, in partnership with the US Geological Survey, creates three-dimensional images that detail the region's geology to depths of several hundred feet.

Three-dimensional geologic mapping is particularly important for the Great Lakes Region, because of the area's unique geologic history characterized by the layers of thick deposits left by the glaciers. The maps provided by coalition geologists allow developers, planners, and communities to identify both resources and hazards below the earth's surface. The information obtained from these maps is crucial to making wise development decisions.

We recognize the importance of the fresh water aquifers that many residents of the Great Lakes Region depend on for drinking water. Geologic mapping can assist communities in locating vital groundwater resources and identifying land parcels that may be prone to erosion, flooding, or subsidence. In the hands of local decision-makers these maps encourage residential development in areas where it is most sustainable. These maps also prove valuable in finding suitable locations for industrial sites by detecting aquifers that, due to geologic features, are vulnerable to contamination and should be avoided. By delineating groundwater flow the maps provide useful information about drainage conditions that help farmers make the best possible use of their land.

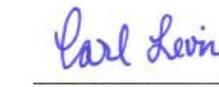
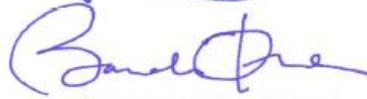
In addition, the geologic maps provided by the coalition help us better understand local ecosystems, allowing resource managers to designate appropriate areas for preservation, restoration and reclamation. In short, the information contained in these maps are important to developers, companies, local officials and the general public as further development is planned in our communities.

Result of this
action?
~\$12,000,000

The Central Great Lakes Mapping Coalition is supported by state funding, with federal support of \$500,000 per year. Even if the coalition limits its mapping to priority areas, it will take 12 years at a cost of \$240 million. Additional federal funding is necessary to ensure that this program is able to continue providing critical data for sustainable development of the Great Lakes states.

We appreciate your past support for this program and your consideration of this request for continued support in FY 2008.

Sincerely,



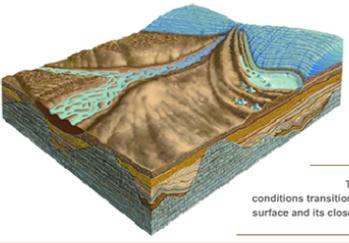
Where We are Today

www.greatlakesgeology.org

- Shared mapping tools.
- Shared field equipment.
- Shared geological survey staff.
- Shared scientific perspectives.
- Long-range/detailed mapping plans.
- Featured products.
- "White Paper" issue statements.
- Hundreds of publication citations and poster presentations.
- User and supporting statements.



Great Lakes Geologic Mapping Coalition
producing urgently needed, detailed, three-dimensional surficial materials maps of the Great Lakes states



...to address critical water resource, environmental, and landuse issues

The block diagram showing generalized ice-age conditions transitions to a block diagram showing the modern land surface and its close ties to the underlying geological deposits.

Homepage

› Click to go home...

Geologic Mapping

› Introduction
› National Cooperative Geologic Mapping Program
› Mapping Tools
› Long-Range Plan

Delivering Information

Featured Products

- Coalition Brochure
- Allen Co. Geologic Atlas
- Marion Co. Geologic Atlas

Issue Statements

Presentations

- ScholarWorks (Posters)
- Publications

Users and Supporters

Users
Supporting Statements

Members and Affiliates



Coalition in Action



Geologists analyze and sample geologic... [more...](#)

News

New Publication:
A new Coalition publication entitled "A multiagency and multi-jurisdictional approach to mapping the glacial deposits of the Great Lakes region in three dimensions" is now available at the GSA Special Papers *Online First* web page. The manuscript is a chapter in GSA Special Paper 520: *Geoscience for the Public Good and Global Development. Toward a Sustainable Future*. Link follows: <http://specialpapers.gsapubs.org/online-first/520>.

*Manuscripts appearing on the *Online First* page have been accepted, edited, and prepared for publication. The manuscripts are removed from the *Online First* page once the complete volume has been published.

Upcoming Events:

2017 Events

- GSA Annual Meeting
Seattle, Washington
October 22-25, 2017
- NGMDB Digital Mapping Techniques Workshop
Minneapolis, Minnesota
May 21-24, 2017
- Coalition Annual Meeting
Pittsburgh, Pennsylvania
March 22, 2017
- GSA NE-NC Joint Section Meeting
Pittsburgh, Pennsylvania
March 19-21, 2017

Past Events:

2016 Events

- GSA Annual Meeting
Denver, Colorado
September 25-26, 2016
- GSA NC Meeting
Urbana-Champaign, Illinois
April 16-20, 2016
- Coalition Annual Meeting

2015 Events

- GSA Annual Meeting
Baltimore, Maryland
November 1-4, 2015
- GSA NC Meeting
Madison, Wisconsin
May 19-20, 2015
- Coalition Annual Meeting

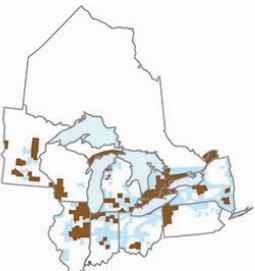
2014 Events

- GSA Annual Meeting
Northeastern FOP Field Conference
56th Midwest FOP Field Conference

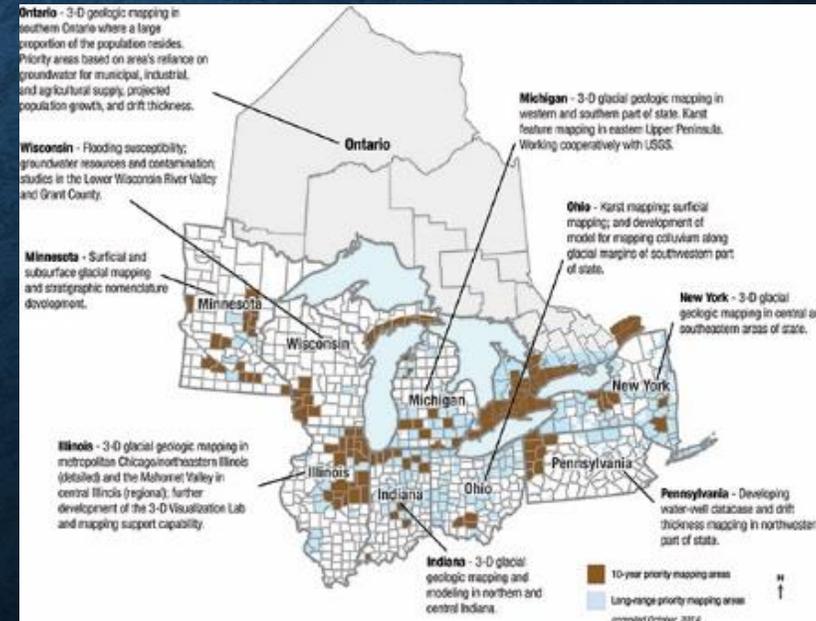
Why a geologic mapping coalition?

In the late 1990s, the state geological surveys of Illinois, Indiana, Michigan, and Ohio joined with the U.S. Geological Survey to form the Central Great Lakes Geologic Mapping Coalition. More recently, the Coalition has expanded to include four additional states bordering the Great Lakes—Minnesota, New York, Pennsylvania, and Wisconsin. These eight states have similar geologic conditions and must address common societal issues about land and water resources, the environment, and geologic hazards. By integrating their expertise and resources, the geological surveys are addressing these issues more effectively than could any one agency.

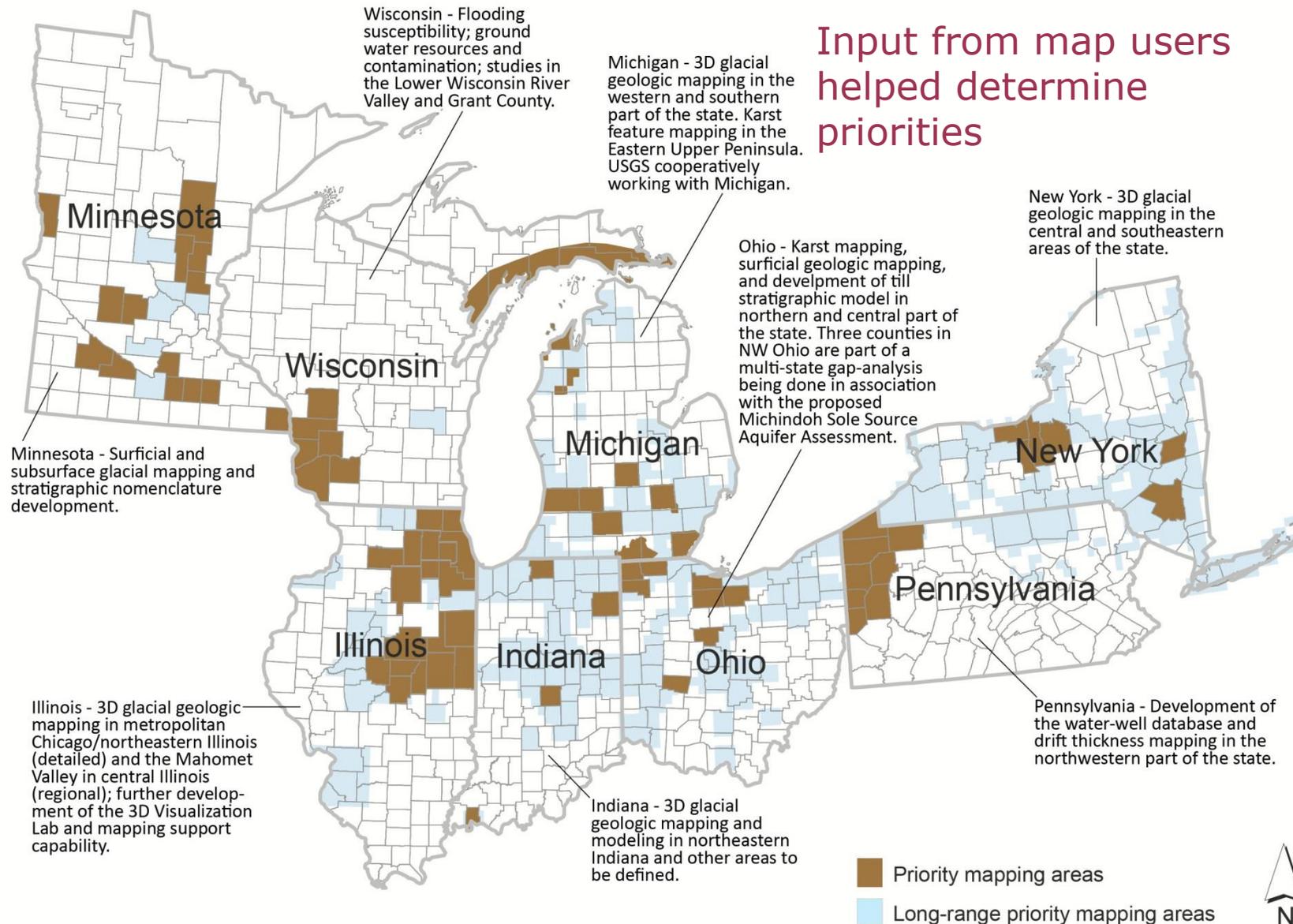
Priority Areas



*click a state to view its corresponding page



Great Lakes Geologic Mapping Coalition 10-year and Long-Range Priority Mapping Areas



***A multiagency and
multijurisdictional approach to
mapping the glacial deposits of
the Great Lakes region in three
dimensions***

**2016 GSA Special Paper 520, p.
415-447.**

**Quote – “It’s as if there was
just one geological survey.”**

The Geological Society of America
Special Paper 520
2016

***A multiagency and multijurisdictional approach to mapping
the glacial deposits of the Great Lakes region in three dimensions***

**Richard C. Berg
Steven E. Brown
Jason F. Thomason**

*Illinois State Geological Survey, Prairie Research Institute, University of Illinois at Urbana-Champaign,
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**Nancy R. Hasenmueller
Sally L. Letsinger**

Indiana Geological Survey, Indiana University, 611 North Walnut Grove Avenue, Bloomington, Indiana 47405, USA

Kevin A. Kincare

U.S. Geological Survey, 12201 Sunrise Valley Drive, Reston, Virginia 20192, USA

John M. Esch

*Michigan Department of Environmental Quality, Office of Oil, Gas, and Minerals,
125 Allegan Street, Lansing, Michigan 48909, USA*

Alan E. Kehew

*Michigan Geological Survey, Department of Geosciences, Western Michigan University,
1903 Michigan Avenue, Kalamazoo, Michigan 49008, USA*

L. Harvey Thorleifson

*Minnesota Geological Survey, Department of Earth Sciences, University of Minnesota,
2642 University Avenue West, St. Paul, Minnesota 55114, USA*

**Andrew L. Kozlowski
Brian C. Bird**

New York State Geological Survey, 3000 Cultural Education Center, Albany, New York 12230, USA

Richard R. Pavey

*Ohio Department of Natural Resources, Division of Geological Survey,
2045 Morse Road, Building C-1, Columbus, Ohio 43229, USA*

**Andy F. Bajc
Abigail K. Burt**

*Ontario Geological Survey, Ministry of Northern Development and Mines,
933 Ramsey Lake Road, Sudbury, Ontario P3E 6B5, Canada*

Berg, R.C., Brown, S.E., Thomason, J.F., Hasenmueller, N.R., Letsinger, S.L., Kincare, K.A., Esch, J.M., Kehew, A.E., Thorleifson, L.H., Kozlowski, A.L., Bird, B.C., Pavey, R.R., Bajc, A.F., Burt, A.K., Flegler, G.M., and Carson, E.C., 2016. A multiagency and multijurisdictional approach to mapping the glacial deposits of the Great Lakes region in three dimensions, in Wessel, G.R., and Greenberg, J.K., eds., *Geoscience for the Public Good and Global Development: Toward a Sustainable Future*; Geological Society of America Special Paper 520, p. 415–447, doi:10.1130/2016.2520(37). For permission to copy, contact editing@geosociety.org. © 2016 The Geological Society of America. All rights reserved.

USGS Circular 1190 Foreword

FOREWORD

I am especially pleased to present this Circular describing the Central Great Lakes Geologic Mapping Coalition, because the Coalition represents several important new directions for the U.S. Geological Survey. The plans developed by the Coalition provide a new model for State-Federal collaboration in research, information delivery, and outreach, as well as a most welcome opportunity to work more closely with the various information-user communities. These are activities that I will foster within the U.S. Geological Survey during my tenure as Director, acknowledging the many benefits that come from interacting closely with our customers and the State Geological Surveys, who will be our principal partners in this enterprise. The scope of this activity is such that no single agency can go it alone. Only by actively sharing and combining our resources can we hope to achieve the worthy goals set forth by the Coalition. Although this Circular deals primarily with the geologic foundation for sustainable growth, the program it describes will also serve as the cornerstone in a new integrated science effort that will focus all of the capabilities of the USGS (biology, geography, geology, and hydrology) to address societal needs in the Central Great Lakes region.



Charles G. Groat, Director

USGS OF 99-349 Organization Chart

