

**MISSOURI I-TEAM PLAN
MARCH 2003
DRAFT**

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Section 1. NSDI Implementation in Missouri

Introduction

It is critical that geospatial information assets are created, maintained, and made available to those who need them for analysis of issues and decision-making. At the national level, the White House Office of Management and Budget (OMB) proposed a new initiative referred to as Implementation Teams (I-Teams). A state I-Team provides an opportunity for public and private agencies in Missouri to form mutually beneficial partnerships to build the framework data layers for the state for the National Spatial Data Infrastructure (NSDI).

Overview of the Plan

This Implementation Plan identifies the organizational structure of the Implementation Team for Missouri, defines a process based on planning and policy issues for prioritizing data themes that will contribute to building the NSDI, and provides a summary of the data themes that will be included in the prioritization process

Jurisdiction

This plan addresses issues and information needs statewide for Missouri and reflects the collaboration of federal and state agencies and educational institutions and other interested parties.

Implementation Team

The Missouri GIS Advisory Committee (MGISAC) has agreed to serve as the Implementation Team for the state. Members of the MGISAC are listed in Appendix 3 – Missouri GIS Advisory Committee Membership List. The chair of the MGISAC will serve as the lead coordinator. The MGISAC is composed of members from state, local, and federal government agencies and educational institutions. In accordance with the Governor's Initiative commenced in April 1995, the purpose of MGISAC is to foster cooperation among these government agencies, educational institutions, and private industry. The committee provides guidance for the Missouri Spatial Data Information Service (MSDIS), develops GIS standards for the state, and provides an arena for discussions of relevant GIS issues. The I-Team subcommittees are made up of volunteers from across the state. Responsible agencies/individuals were chosen from state and federal agencies and the private sector with a vested interest in the priority data layers.

Missouri Spatial Data Information Service

The Missouri Spatial Data Information Service (MSDIS) serves as the National Spatial Data Infrastructure (NSDI) Clearinghouse node for the state providing easy access to spatial data at any time. MSDIS was established at the University of Missouri's Geographic Resources Center in 1995 following initial funding provided by the Legislature. The Budget Bill provided monies to the GRC to establish the spatial data clearinghouse and provide services to state agencies and others.

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Approach

This plan addresses the seven framework themes as defined by the FGDC, and in addition, the I-Team chose to include Soils, Geology, Land Use Land Cover, and Critical Infrastructures in the plan. A list of layers is provided in Section 3 of this plan.

A work group was chosen for each of the layers (Section 3). Each group was given the following tasks to complete:

- Inventory existing data and provide a status report;
- Develop cost estimate and time requirement for completion of the data layer;
- Describe how investment has been leveraged to provide data for multiple uses;
- Identify standards and document;
- Develop a strategy for completing the data layer;
- Assign responsibility for creation, integration, and maintenance of the data layer;
- And provide data access through the MSDIS or other Missouri NSDI nodes.

An I-Team status report will be given monthly at the MGISAC meeting. The report will describe progress, identified needs, and alterations to the Implementation Plan.

Principles

The I-Team principles are as follows:

- Data should be developed and maintained by agencies that have a programmatic need or mandated responsibility for specific layers.
- Local governments should be encouraged to create and share data.

- The MGISAC should lead in the coordination of state, local, and federal data development and sharing effort.

Return on Investment

The Department of Natural Resources (DNR) uses GIS to evaluate the vulnerability of Missouri drinking water to chemical contamination. Under Phase II of the Safe Drinking Water Act, the United States Environmental Protection Agency (EPA) requires each state to routinely monitor for specific chemical parameters. The department uses GIS to identify which public water systems are at risk for chemical contamination, and which can be expected to be free from contamination. This analysis helps justify a reduction in expensive chemical monitoring. Using GIS has reduced monitoring cost for the department in excess of \$20 million.

Section 2. Driving Issues

Data Development and Integration

An assessment of data needs in the state of Missouri reveals there are gaps in the following areas: current digital orthophoto quarter quads, street centerlines, and information about critical infrastructure. The state needs readily accessible and shareable to be prepared for the future.

Emergency Response

Missouri is striving to be prepared in the post 9-11 world. A large disaster event would highlight many issues including: emergency responders need the assistance provided by map products to respond to citizens in distress, emergency coordinators need to map effective escape routes and track the movement of people to shelters.

Section 3. Priority Data Layers and Workgroups

1) Boundaries

2) Census/Demographics

Office of Administration, Ryan Burson (Chair)

United States Census Bureau, Wes Flack

United States Geological Survey, Jerry Wagner

3) Cadastral

Public Land Survey System

DNR, GSRAD, Land Survey Section, John Paulsmeyer, Chair

- 4) Digital Orthoimagery
 - Missouri Department of Conservation (MDC), Tony Spicci, Chair
 - United State Geological Survey (USGS), Ray Fox
 - USDA Natural Resource Conservation Service (NRCS), Elizabeth Cook
 - MSDIS, Timothy Haithcoat
 - Department of Natural Resources (DNR), Jeff Schloss
 - Missouri Department of Transportation (MODOT), Arnold Williams

- 5) Elevation
 - CARES, Chris Barnett (Chair)
 - USGS, Ray Fox
 - Missouri Resource Assessment Partnership (MORAP), Robbyn Abbitt
 - DNR, Dean Martin
 - DNR, Jeff Schloss

- 6) Geodetic Control
 - DNR, Geological Survey and Resource Assessment Division (GSRAD),
 - John Paulsmeyer (Chair)

- 7) Hydrography
 - MORAP, Robbyn Abbitt (Chair)
 - USGS, Ray Fox

- 8) Transportation
 - MODOT, Arnold Williams (Chair)
 - US Census, Wes Flack
 - USGS, Dan Canfield
 - City of Springfield, Mike Fonner
 - Northrop Grumman, Joyce Hoffman & Vickie Flack

- 9) Geology
 - DNR, GSRAD, Steve Sturgess (Chair)

- 10) Land Use/Land Cover
 - MORAP, Clayton Blodgett (Chair)

- 11) Soils
 - DNR, Dean Martin (Chair)
 - NRCS, Liz Cook
 - CARES, Bryan Mayhan

- 12) Critical Infrastructure
 - MDC, Tony Spicci (Chair)
 - Springfield City Utilities, Jennifer Peterson
 - Cooper County Emergency Management, Tom White
 - City of Springfield, Mike Fonner

Section 4. Boundaries

The framework includes the geographic areas of units of government. These units include:

- the nation;
- states and statistically equivalent areas;
- counties and statistically equivalent areas;
- incorporated places and consolidated cities; and
- functioning and legal minor civil divisions.

Each of these features includes the attributes of name and the applicable Federal Information Processing Standard (FIPS) code. Features boundaries include information about other features (such as roads, railroads, or streams) with which the boundaries are associated and a description of the association (such as coincidence, offset, or corridor). Governmental unit boundaries are used for a wide variety of applications. Some need the boundaries only for information and orientation; others require the polygons to determine inclusion related to a number of other features. Business GIS is a very active field that uses these boundaries for statistical analysis and decision making.”¹

Section 5. Census/Demographics

Theme Description

A mission of the State of Missouri and the U.S. Census Bureau is to collect and provide quality information about the population economy. This is accomplished through a decennial census, annual population estimates, and population projections. This theme will consist of census TIGER boundaries and decennial census data from the Census Bureau, and population estimates and projections from the Missouri State Demographer. All will be maintained and served by the Missouri Spatial Data Information Service (MSDIS) and the Missouri Census Data Center (MCDC).

Status

The last decennial census was conducted April 1, 2000. Data compiled from questions asked of every household are presently available. Population items include sex, age, race, Hispanic or Latino, household relationship, and group quarters. Housing items include occupancy status, vacancy status, and tenure. Sample data collected from one in every six households include, but are not limited to:

- place of birth, citizenship and year of entry;
- school enrollment and educational attainment;
- ancestry;
- migration (residence in 1995);
- language spoken at home and ability to speak English;

¹ Page 20-21, “Framework Introduction and Guide,” Federal Geographic Data Committee, 1997.

- veteran status;
- disability;
- grandparents as caregivers;
- labor force status;
- place of work and journey to work;
- occupation, industry, and work status in 1999;
- income in 1999;
- marital status;
- place of birth, citizenship and year of entry; and
- school enrollment and educational attainment.

Data from previous censuses are also available. Spatial data layers available from MSDIS include point and polygon coverages for:

- blocks;
- block groups;
- census tracts;
- townships;
- incorporated and census-designated places;
- counties;
- voting districts (1992, 2002);
- legislative districts (1992, 2002);
- school districts; and
- zip code tabulation areas.

Population estimates are available in periodic series for the United States, states, counties, and incorporated places for years from 1960 to 2002. Population projections are available for counties and selected cities in five-year intervals to 2025. Demographic characteristics available in the estimates and projections include age, sex, race and Hispanic origin.

Sources

U.S. Census Bureau, Missouri State Demographer. The Missouri State Demographer, in the Office of Administration, is responsible for official state population projections and estimates, and is the state's representative in the Federal State Cooperatives for Population Estimates and projections programs first initiated with the Census Bureau in the 1960s. MSDIS is a spatial data retrieval and archival system begun in 1994. It is responsible for data storage and access, standardization of both digital and tabular data, creation of a data dictionary, compilation of metadata, and statewide GIS user information networks. MCDC is part of a cooperative program begun in 1979 between the State Library and the U.S. Census Bureau. Its mission is to provide socioeconomic information to Missourians and others in a timely and cost-effective manner.

Standards

Federal Geographic Data Committee metadata standards are used to document TIGER spatial data. The U.S. Congress in consultation with the Census Bureau and the Office of Management and Budget sets standards for decennial census data. The

Missouri Office of Administration sets standards for population estimates and projections in consultation with the federal and local governments.

Priority

It is a high priority for the Missouri Census Data Center (MCDC) and the State Demographer's Office to give the citizens of the state access to census and demographic data. Dissemination of census data, population estimates and projections is accomplished through the CDC's website. In addition, the CDC produces publications which are distributed throughout the state.

Estimated Total Investment

Billions of dollars have been invested from federal, state and local sources.

Contributions by Sector

The State Demographer, MCDC and MSDIS are funded by state appropriations totaling \$450,00, which is largely dedicated to this theme. There is no local funding.

What is Needed?

Funding for MSDIS, MCDC and state demographic operations has been reduced due to budget shortfalls in recent years, even as demand for services from these organizations has increased.

Likely Source

Unknown.

Estimated Total Investment to Complete

Unknown.

Possible Ways to Overcome This Gap

While Missouri state participants receive state appropriations for creation and maintenance of this theme, some theme collaboration with local governments and the Census Bureau is not funded. Additional staff resources devoted to TIGER modernization would immensely improve the files for Missouri.

Most Appropriate Data Stewards

Missouri State Demographer, MSDIS, MCDC

Maintenance Process and Cost

Missouri State Demographer, MSDIS, MCDC
Maintenance Cost is Unknown.

Section 6. Cadastral

Theme Description

Cadastral information refers to property interests. Cadastral data represent the geographic extent of the past, current, and future rights and interests in real property. The spatial information necessary to describe the geographic extent and the rights and interests includes surveys, legal description reference systems, and parcel-by-parcel surveys and descriptions.

Two aspects of cadastral information are included in the framework:

- cadastral reference systems, such as the Public Land Survey System (PLSS) and similar systems for areas not covered by the PLSS (for example, the Connecticut Western Reserve in Ohio), and
- publicly administered parcels, such as military reservations, national forests, and state parks.

Features include the survey corner, survey boundary, and parcel. Each instance of a feature has the attributes of name (or other common identifier) and information about data quality. Each instance also should have a permanent feature identification code. For the PLSS, the minimum content is the boundaries of sections, including deflection points and the positions for quarter corners along section boundaries. Boundaries that have been surveyed are the preferred content for cadastral reference systems. Cadastral information is the basis of many analysis, decision-making, and operational applications, such as site selection, land use administration, and transportation planning. The reference system can be used to register locally produced information into the framework. Information about publicly owned lands serves both those who administer the lands and those who have interests in them. Framework representation of these lands provides useful information about their location, boundaries, extent, and relationships to other geographic features and phenomena. Because parcels play an important role in many public and private sector activities, and parcel information is a basic ingredient of many applications, there is interest in providing multiple levels of cadastral data. These levels would be based on available data and customer requirements. The framework provides a means to link existing parcel data into the larger cadastral network. 2

Part A. Public Land Survey System

Status

A database of corner documents pertaining to corners of the US Public Land Survey System (USPLSS) is currently maintained by the Land Survey Program of the Geological Survey and Resource Assessment Division of the DNR. In addition, the Land Survey Program is developing an improved USPLSS data layer based on the original layer obtained from the USGS and using coordinate data from the corner document database to

2 Page 21, "Framework Introduction and Guide," Federal Geographic Data Committee, 1997.

improve the location of the section, township and range lines. Currently, there are approximately 70,000 corner documents in the database, of which something less than 10 percent have state plane coordinates associated with them. The Land Survey Program is currently developing methods to obtain coordinate data for those documents that do not have coordinate data listed and to qualify the accuracy of the coordinates on those documents that do have coordinate data.

Source

These corner documents come from a variety of sources to include government agencies such as the MDC, the US Corps of Engineers and the US Forest Service as well as those generated in house by the Land Survey Program, but the bulk of these documents are submitted by Professional Land Surveyors throughout the state.

Standards

Accuracy standards for the determination and publication of coordinates on these corner documents in Missouri are specified in Minimum Standards For Property Boundary Surveys as published jointly by the Missouri Board for Architects, Professional Engineers and Land Surveyors and the DNR (4 CSR 30-16 & 10 CSR 30-2) and Mapping Standards (10 CSR 30-6) published by the DNR.

Priority

The Cadastral layer should be considered a high priority theme as it represents one of the base layers of any GIS system used for mapping in the state.

Estimate of Total Investments

The creation and maintenance of the USPLSS corner document database has been the sole responsibility of the Land Survey Program of the Geological Survey and Resource Assessment Division of the DNR.

Contributions by Sector

The Land Survey Program funds creation and maintenance of the corner document database, which is totally user fee supported.

What is Needed?

There is no gap.

Likely Source

Not applicable.

Estimated Total Investment to Complete

Layer is under constant revision and improvement by the Land Survey Program.

Possible Ways to Overcome This Gap

Not applicable.

Most Appropriate Data Steward

The most appropriate steward of the data contained in the USPLSS corner document database would be the Land Survey Program of the Geological Survey and Resource Assessment Division of the DNR since the Land Survey Program is statutorily charged with that task.

Maintenance Process and Cost

The Land Survey Program is responsible for the maintenance of the monumentation and documentation associated with the USPLSS corner document. Maintenance cost is unknown.

Part B. Publicly Administered Parcels

Publicly administered parcels include any publicly-owned lands.

Part C. Private Parcels

Private parcels include property owned by businesses and private citizens. This layer will most likely be developed by cities and counties.

Section 6. Digital Orthoimagery

Theme Description

The FGDC “Framework Introduction and Guide” explains that “Orthoimagery provides a positionally correct image of the earth. An orthoimage is a georeferenced image prepared from an aerial photograph or other remotely sensed data from which displacements of images caused by sensor orientation and terrain relief have been removed.”³

Digital orthoimagery is typically utilized in a digital orthophoto format. A digital orthophoto is a georeferenced image that has the properties of an orthographic projection – positionally correct image of the earth – composed of an array of georeferenced pixels that encode ground reflectance as a discrete digital value. The orthophoto combines the image characteristics of a photograph with the geometric qualities of a map.⁴

This dataset can be utilized to derive and compile many geographic features that are part of the framework for utilization in Geographic Information System (GIS) applications. In particular, numerous vector data themes can be compiled from digital orthoimagery. The dataset can also be used to analyze or reference other data and to update older data

³ Page 18, “Framework Introduction and Guide,” Federal Geographic Data Committee, Washington D.C., 1997.

⁴ USGS “National Mapping Program Technical Instructions Standards for Digital Orthophotos,” December 1996 and “Framework Introduction and Guide,” Federal Geographic Data Committee (FGDC), Washington D.C., 1997.

based on the visible features on the digital orthoimagery. Change detection is another use of this data.

Status

Completion of once-over DOQ coverage for the State of Missouri was completed in 1997. This first generation product was initiated in 1996 using 1995 National High Altitude Aerial Photography (NAPP). Missouri and its federal and local government partners expect to extend this program to again develop second-generation DOQs statewide in 2003.

Data Sources

There are various datasets for digital orthoimagery. The U.S. Geological Survey (USGS) compiles and produces a standard digital orthoimage in 1-meter ground resolution quarter quadrangles (1:12,000-scale, 3.75- x 3.75-minute in extent) that are referred to as digital orthophoto quads (DOQ).⁵ The U.S. Department of Agriculture Forest Service (FS) also produces this standard dataset.

Standards

Standards for DOQs are described in the USGS “National Mapping Program Technical Instructions Standards for Digital Orthophotos,” dated December 1996. The Missouri GIS Advisory Committee (MGISAC) is currently developing a DOQ standard for Missouri.

Priority

Replacement of DOQs produced with older NAPP aerial photography is a second-generation coverage priority. Additional second-generation coverage would be identified based on issues pertinent to federal, state, and local requirements for the data.

Estimated Total Investment

Approximately over \$5,700,000 has been spent to date for DOQ coverage for the state.⁶

Estimated Current State and Local Funding

The first-generation DOQ layer (\$5,700,000) was funded by the three Federal partners: Farm Service Agency (FSA), Natural Resources Conservation Service (NRCS) and USGS, as well as the State of Missouri. Funding from the State of Missouri was provided by the Department of Conservation (MDC) and Department of Transportation (MoDOT).

What is Needed?

Estimated cost for second-generation coverage for the State of Missouri is approximately \$1,300,000.00. This estimate is based on coordinating a statewide effort with the USDA Aerial Photography Field Office (APFO)’s National Agricultural Imagery Program (NAIP). The NAIP program will produce 2m DOQs for approximately 83 counties in Missouri. A partnership of the Mark Twain National Forest (MTNF), NRCS, MDC and

⁵ Another term is quarter quad or DOQQ.

⁶ Based on previous production cost of \$5.7 million funded by Federal govt. and State of Missouri.

MoDOT will fund filling in the rest of the counties and upgrading the imagery to 1m CIR.

The intent is to create new DOQs on a five year cycle. There are approximately 1301 quads covering the State. The total cost for quarter quad creation will be \$1,300,000 over each five year interval.

Likely Source

The APFO is currently funding and producing 2m DOQs for approximately 83 counties in Missouri in 2003. The NRCS will fund 50% of the cost of upgrading that product to 1m resolution and complete state-wide coverage. MDC, MoDOT and the MTNF will fund the rest.

Estimated Total Investment to Complete

\$1,300,000.

Possible Ways to Fund This Gap

Funding for the second-generation orthoimagery would come from cost share partnerships between the state and federal governmental agencies with interests in the area for the production of orthoimagery. Coordination for these efforts would be through the state's Geographic Information System Advisory Council (MGISAC), which has the leadership and authority for this effort.

Most Appropriate Data Steward

The primary archive and distribution point for orthoimagery data produced by the APFO is located at the Aerial Photography Field Office (APFO) in Salt Lake City Utah. The general public can order orthoimagery data from this database. Local distribution of the data will be managed by the MSDIS.

Maintenance Process and Cost.

Unknown.

Section 7. Elevation

Theme Description

The FGDC "Framework Introduction and Guide" defines elevation data on page 19 as: "Elevation data provide information about terrain. Elevation refers to a spatially referenced vertical position above or below a datum surface. The Framework includes the elevations of land surfaces and the depths below water surfaces (bathymetry)."

The elevation data models commonly used in Missouri include the USGS Digital Elevation Model (DEM) collected in 10 or 30 meter grid spacing originally collected from the standard USGS 7.5-minute quadrangle map contour separate, now available in a seamless grid of the state. Other examples of elevation data include a vector digital file of the USGS contour separates being collected by the Missouri Center for Agricultural

and Environmental Systems (CARES) in cooperation with USGS. This Hypsography data can be used to produce a DEM of any post spacing, although the contour separates do not provide the source for better than a 10-meter DEM.

Status

USGS 30-meter DEMs are complete and available either in 7.5-minute format, or in the seamless National Elevation Dataset from USGS-Eros Data Center. Status graphics are available on line at: <http://mapping.usgs.gov/www/products/status.html>

There are 266 USGS 10-meter DEMs either available or currently in work. Status graphics are available on line at: <http://mapping.usgs.gov/www/products/status.html>

High-resolution elevation data collected by the Scientific Assessment and Strategy Team (SAST) along the Mississippi and Missouri rivers in response to the 1993 floods is being resampled by USGS for inclusion into the National Elevation Dataset. This data, from bank to bank of the rivers, has a horizontal accuracy of 15 feet, and a vertical accuracy exceeding 2 feet.

Sources

Primary sources for DEMs are the USGS and U.S. Department of Agriculture Forest Service (FS). DEM data is available at: <http://msdis.missouri.edu/data.html>, USGS data, both in 7.5-minute format, and seamless data from the National Elevation Dataset is available at: <http://edcwww2.cr.usgs.gov/>

The hypsography Digital Line Graphs (DLGs) being produced by CARES are a potential source for 10-meter DEMs with additional processing.

Standards

Standards for DEMs are described in the USGS 'National Mapping Program Technical Instructions Standards for Digital Elevation Models,' available on line at: <http://mapping.usgs.gov/standards/>

Standards for the National Elevation Dataset are available at: <http://gisdata.usgs.net/ned/>

Priority

USGS has several elevation data priorities in Missouri. One, complete 10-meter DEM coverage in the state, especially in the urban areas; two, develop a maintenance strategy for updating elevation data in areas of change; three, improve the vertical accuracy of elevation data in floodplains and urban areas. The DEMs were collected from the 7.5-minute topographic quadrangle map separates, which are recognized as being out of date in many areas of the state. These include the urban areas, the areas around major rivers, and in areas of surface mining.

The Federal Emergency Management Agency (FEMA) is working to improve their National Flood Insurance Program maps through the Map Modernization Program. Elevation data collected through this program needs to be incorporated in Missouri's

elevation data holdings, through the National Elevation Dataset, and the Missouri Spatial Data Information Service.

Estimated Total Investment

Unknown.

Contributions by Sector

Contributions have been from both the state and federal sectors. Local contributions are expected for higher resolution data. As of July 2002 there are 33 10-meter DEMs in production. CARES and USGS are also producing 227 Hypsography DLGs under a work-share agreement.

What is Needed?

Unknown.

Likely Source

Unknown.

Possible Ways to Overcome This Gap

The MGISAC will determine priorities and develop funding partnerships to achieve these priorities. Both USGS and MGISAC are actively involved in Homeland Security requiring current higher resolution data to support other data layers needed for Homeland Security GIS activities.

Most Appropriate Data Steward

The primary archive and distribution point of elevation data produced by USGS is located at the EROS Data Center in Sioux Falls, South Dakota. Establishment of the USGS sponsored *The National Map* for Missouri calls for a partnership between USGS and the State, MSDIS being the logical candidate for joint stewardship.

Maintenance Process and Cost

Maintenance process will be developed through *The National Map* project for Missouri. Maintenance cost is unknown.

Section 8. Geodetic Control

Theme Description

The Missouri Geographic Reference System contains all horizontal and vertical control stations found in the National Geographic Reference System in Missouri as well as those established by the Land Survey Program.

Status

The Land Survey Program of the Geological Survey and Resource Assessment Division of the DNR currently maintains a database of all existing horizontal and vertical geodetic control.

Source

Geodetic Control is obtained from the National Geographic Reference System established by the National Geodetic Survey and from the Missouri Geographic Reference System established by the Land Survey Program of the Geological Survey and Resource Assessment Division of the DNR.

Standards

Accuracy standards for the establishment of Geodetic Control in Missouri are specified in Horizontal and Vertical Control Standards as published jointly by the Missouri Board for Architects, Professional Engineers and Land Surveyors and the DNR (4 CSR 30-18 & 10 CSR 30-4) and Mapping Standards (10 CSR 30-6) published by the DNR.

Priority

Geodetic Control should be considered a high priority theme as it represents the base layer of any GIS system used for mapping in the state. The use of Geodetic Control in creating various GIS data layers allows those layers to be integrated into one multilayered GIS.

Estimate of Total Investment in this Theme

The creation and maintenance of Geodetic Control has been the sole responsibility of the Land Survey Program of the Geological Survey and Resource Assessment Division of the DNR. The National Geodetic Survey no longer directly maintains the monumentation of the horizontal and vertical stations comprising the National Geographic Reference System in the state of Missouri. The Land Survey Program has assumed that function. Creation and maintenance of the Missouri Geographic Reference System is funded by the Land Survey Program, which is totally user fee supported.

Most Appropriate Data Steward

The most appropriate steward of the Geodetic Control data contained in the Missouri Geographic Reference System would be the Land Survey Program of the Geological Survey and Resource Assessment Division of the DNR since the Land Survey Program is statutorily charged with that task.

Maintenance Process and Cost

The Land Survey Program maintains the monumentation and documentation associated with the Geodetic Control data contained in the Missouri Geographic Reference System. Maintenance cost is unknown.

Section 9. Hydrography

Theme Description

The National Hydrography Dataset (NHD) is a comprehensive set of digital spatial data that contains information about surface water features such as lakes, ponds, streams, rivers, springs and wells (see <http://nhd.usgs.gov>). Within the NHD, surface water features are combined to form "reaches," which provide the framework for linking water-related data to the NHD surface water drainage network. These linkages enable the analysis and display of these water-related data in upstream and downstream order.

The NHD is based upon the content of USGS Digital Line Graph (DLG) hydrography data integrated with reach-related information from the EPA Reach File Version 3 (RF3). The NHD supersedes DLG and RF3 by incorporating them, not by replacing them. Users of DLG or RF3 will find the National Hydrography Dataset both familiar and greatly expanded and refined.

Status

All subbasins in Missouri have been completed at the medium resolution scale (1:100,000). The Missouri Resource Assessment Partnership (MoRAP;<http://www.cerc.cr.usgs.gov/morap/default.asp>) has partnered with the USGS Mid Continent Mapping Center (<http://mcmweb.er.usgs.gov>) to create the high resolution (1:24,000) NHD for the state of Missouri. All subbasins should be completed by winter 2002. As these are checked for quality assurance and quality control by USGS the subbasins will be made available through the NHD data viewer (<http://edcnts14.cr.usgs.gov/Website/nhdserver/viewer.htm>). To see MoRAP's progress In addition, low resolution (1:100,000) Missouri NHD data can be obtained at: <http://maps.cares.missouri.edu/maproom/download.html> go to <http://www.cerc.cr.usgs.gov/morap/projects.asp> and choose "Missouri 1:24K National Hydrography Dataset (NHD)."

Data Sources

The NHD map, which is available at <http://edcnts14.cr.usgs.gov/Website/nhdserver/viewer.htm>, shows the current contents of the NHD database (both low and high resolutions). NHD data can be downloaded by subbasin (formerly known as cataloging unit) at no charge. The metadata for each subbasin is available and provides information on the content of the subbasin including descriptions of updates. As NHD data are updated, users will be able to select and retrieve subbasins based upon the information found in their metadata. The summary of Known problems can be found at <http://nhd.usgs.gov/problems.html>) and provides additional information about the data.

Standards

Standards for NHD are available at:

<http://rmmweb.cr.usgs.gov/public/nmpstds/nhdstds.html>

Priority

Completion of 1:24,000-scale NHD is a priority for USGS and the Missouri Resource Assessment Partnership. Work is proceeding on completing coverage using existing 1:24,000-scale hydrologic data as shown on the USGS topographic quadrangles.

Update of the 1:24,000-scale NHD has been identified as the second highest priority after replacement of the digital orthophotos.

Estimated Total Investments

MORAP and USGS are in the fourth year of a work-share agreement to complete the high-resolution data.

Contributions by Sector

Contributions have been from both the state and federal sectors. Local contributions are expected for higher resolution data.

What is Needed?

Unknown.

Likely Source?

Unknown.

Ways to Overcome Gap

Unknown.

Most Appropriate Data Steward

USGS and MORAP

Maintenance Process and Cost

Unknown.

Section 10. Transportation

Theme Description

The transportation data include the following major common features of transportation networks and facilities:

- roads -- centerlines, feature identification code
- trails -- centerlines, feature identification code
- railroads -- centerlines, feature identification code
- waterways -- centerlines, feature identification code
- airports and ports -- feature identification code and name; and

The Missouri Department of Transportation (MoDOT) roadway data is based on a Dynamic Segmentation model. Dynamic Segmentation models linear features using routes and events, associating multiple sets of attributes to any portion of a linear feature. The Dynamic Segmentation model is used to reference specific data or events (functional class, accidents, pavement type, speed limit, signage, etc.) to locations along a route or travelway, allowing more specific analysis or modeling. MoDOT refers to a “route” as a travelway. A travelway is a publicly used path or corridor for movement of vehicles, goods, and/or people. A travelway can be a road, a bike path, a waterway, a railway, etc. This plan will only address roads at this time.

Status

The state system travelways consisting of Interstate routes (IS), US numbered routes (US), Missouri numbered routes (MO), and Missouri lettered routes (RT), originated from 1980-Dual Independent Map Encoding (DIME) data, and has been updated with 1995 Topologically Integrated Geographic Encoding and Referencing (TIGER) files from the US Census Bureau. Currently the coverage is updated monthly utilizing design plans, GPS, DOQQ and county and city maps. Spatial resolution of this data is generally considered 1:100,000, updates are frequently made using much more accurate means (ex. GPS, DOQQ).

MoDOT utilizes the Transportation Management System (TMS) which is an automated system for bridge, pavement, safety, and congestion management; traffic monitoring; travelway features; and travelway maintenance. TMS offers a number of queries and reports that have already been designed based on requirements identified by MoDOT employees. These canned queries and reports are available through Impromptu and ArcView.

Data Sources

Data in the MoDOT enterprise database comes from several sources. All of the data originally came from existing files (known as the legacy system) such as signal inventories, bridge inspection and inventory files, and accident records, etc.

Standards

Unknown.

Priority

The transportation theme is considered to be a high priority, because so many other applications depend on the location of roads in the state.

Estimated Total Investment

Unknown.

Contributions By Sector

Missouri’s roads coverage has been funded completely by state funds.

What is Needed?

Unknown

Likely Source?

Unknown.

Ways to Overcome Gap

Unknown..

Most Appropriate Data Steward

Missouri Department of Transportation

Maintenance Process and Cost

Currently MoDOT spends about \$3.6 million per year on Transportation Management Systems. This includes approximately \$2.2 million on automation. The automation budget includes maintenance and support plus any new developments. GIS is included in this total, but does not comprise all of it. The larger part is devoted to the Oracle database and the associated applications that support data entry and reporting. GIS maintenance of linework is included here. The other \$1.4 million is used for analysis of the data, of which GIS is a major part and an indispensable tool.

Section 11. Geology

The geology theme can be broken down into three basic subsections: (A) geologic maps of surface exposures, (B) geologic hazard maps, and (C) geologic resource maps. Other specialized geology maps, such as gravity anomaly, magnetic, subcrop, alteration, surficial deposits, etc. are not considered basic geology themes and are not considered here, although they may merit inclusion in the future.

Part A. Geologic Maps of Surface Exposures

Theme Description

Geologic maps of surface exposures are the “standard” geologic maps that form the basis for most specialized geologic maps and studies of large or small areas. The Geological Survey and Resource Assessment Division (GSRAD) focuses on three standard scales of geologic maps: 1:24,000-scale (7.5' quadrangle bases), 1:100,000-scale (30'x60' quadrangle bases), and 1:500,000-scale (state map). Each scale has different uses, and eventually all three should be completed in GIS format.

Status

(1) Currently, new geologic mapping through STATEMAP and Missouri Department of Natural Resources funding has produced geologic data for 60, 7.5' quadrangles. The GSRAD is working on sixteen 7.5' quadrangles for completion in GIS format by summer 2003.

(2) Two of the fifty-one 30'x60' quadrangle maps at 1:100,000-scale are completed in GIS format by GSRAD, and are available. The remaining quadrangles will be compiled as new 7.5' geologic mapping is completed.

(3) The revision to the 1979 Geologic Map of Missouri is currently being undertaken as a GIS product.

Data Sources

(1) Approximately 170 of the 1,292 quadrangles in the 7.5' series (1:24,000-scale) are currently completed as “detailed” geologic maps, although none are not suitable for all purposes. GSRAD has a team of geologists working in the field to complete new geologic mapping. About ten 7.5' quadrangles in GIS format are completed as new geologic maps each year.

(2) Geologic maps at 1:100,000-scale are compiled in GIS format from “detailed” 7.5' geologic maps. For much of the state, new geologic mapping is required to complete maps at this scale.

(3) The Geologic Map of Missouri (Anderson, 1979) is the 1:500,000-scale geologic map of the state. Its revision will also be in a GIS format.

Standards

The GSRAD follows field standards established by its Geologic Mapping Review Committee (GMRC) and publication standards set by the same and the National Cooperative Geologic Map Program (NCGMP). The U. S. Geological Survey and the Association of American State Geologists head this program.

Priority

Mapping priorities are set by the Missouri Geologic Mapping Advisory Committee (GMAC), a group of fourteen representatives from the community of geologic map users. Representatives are appointed by organizations from academia, industry, and government. The GMAC meets once a year to set priorities for 30'x60' project areas and individual 7.5' quadrangles.

Estimated Total Investment

The Missouri Department of Natural Resources has spent approximately \$1,080,000 in the past 10 years for new geologic mapping, matched by NCGMP funding.

What is Needed?

There are 1122, 7.5' quadrangles and forty-nine, 30'x60' quadrangle maps that need to be completed. Currently, a 7.5' quadrangle costs approximately \$30,000 (\$33,660,000 for the 1122) to complete and the compilation of this data in the 30'x60' quadrangle approximately \$10,000 (\$490,000 for the 49).

Ways to Overcome Gap

Most GSRAD mapping and GIS compilation is completed as cooperative projects between the GSRAD and the U.S. Geological Survey through the National Cooperative

Geologic Mapping Program. Some funds may also be available through other federal, state, and local government agencies that have an interest in particular parts of the state.

Most Appropriate Data Steward

The GSRAD must maintain and update this geologic data.

Maintenance Process and Cost

An estimated \$10,000/year (1/4 FTE) is required to maintain and update existing GIS data. This cost will increase as maps are added to the database.

Part B. Geologic Hazards

Theme Description

Geologic hazards affecting Missouri include earthquakes, landslides, rockfalls, problem surficial materials, flooding including sinkhole flooding, drought, ground subsidence (karst and mining related ground collapse), erosion and stream and radon gas. Other well-known geologic hazards that do not currently affect Missouri include volcanoes, tsunamis, coastal erosion, avalanches, glacial advances or retreats and desertification. Geologic hazards are important to consider in land-use regulation, urban development and engineering planning and design. Maps depicting the hazards are used by city and county planners, transportation officials, developers, planning and engineering consultants, and many others involved in land-use planning. Emergency management officials also use these maps, both in attempting to mitigate hazards before emergency events and in planning for response and recovery operations after a geologic hazard event. Public health officials use radon hazard potential maps to target their epidemiological studies. Maps have been produced in hard copy medium showing some of the various hazards at scales ranging from 1:500,000 or smaller to 1:24,000. The 1:500,000-scale state maps are useful in depicting the statewide extent of a hazard, but cannot be used by cities, counties and others in land use decisions. Maps at scales of 1:24,000 or larger are needed for this purpose, and they need to be in digital form for incorporation into local government and others GIS systems. Unlike many other GIS themes or layers, such as political boundaries, hydrography, transportation, elevation, agricultural soils, geology, etc., geologic hazards are not spatially mutually exclusive with a single value at any point, line or polygon. Each type or category of geologic hazard has its own spatial distribution, spatial resolution, defining parameters and use analysis characteristics resulting in each geologic hazard most frequently being depicted on its own type of map. Therefore, geologic hazards should not be thought of as a single theme or layer in a GIS environment. There should be a theme or layer for each geologic hazard category and in some cases for each subcategory.

Status

(1) Earthquake: (including ground shaking in bedrock, ground shaking amplification by surficial materials, Quaternary surface fault rupture, soil liquefaction, lateral spreading, earthquake induced landsliding, earthquake induced subsidence and ground collapse,

earthquake induced uplift and seiches – several separate themes or layers are needed to map these subcategories)

(1A) Ground shaking in bedrock: Available for all of Missouri from the United States Geological Survey (USGS) as part of a national mapping effort. Mapping is available in GIS format. There are 12 different maps available for Missouri showing the shaking acceleration for different combinations of probability (recurrence interval and probability of exceedence) and earthquake wave frequency. Mapping scale is not given by USGS but the maps are estimated to be usable at perhaps 1:500,000 or smaller.

(1B) Ground shaking amplification by surficial materials: The Missouri Department of Natural Resources (MoDNR), Geological Survey and Resource Assessment Division (GSRAD), Geological Survey Program (GSP) with one-time cooperative funding from the USGS Earthquake Program through a grant to the Association of Central United States Earthquake Consortium State Geologists (CUSEC-SG) has mapped ground shaking amplification by surficial materials in Missouri. In 1997 all of Missouri was mapped in very general terms at 1:2,000,000 scale. This map was compiled using GIS at the Illinois State Geological Survey (ISGS) and was published in printed hard copy format. The map was revised and reprinted in cooperation with the USGS in 1999. In 1999, 5 of Missouri's 17, 1:250,000 quadrangles, all in southeast Missouri, were mapped in greater detail for ground shaking amplification by surficial materials. This mapping was compiled using GIS at the GSP. These maps are targeted for use in Federal Emergency Management Agency's (FEMA) earthquake loss estimation software named HAZUS (Hazards US) which runs on a GIS platform. Distribution of these maps to date has been in ArcView shapefile format via an FTP server at the ISGS (on longer available) and through FEMA. In 2001, one of Missouri's 1300, 1:24,000 (7.5') quadrangles was mapped in even greater detail for ground shaking amplification by surficial materials. This map was compiled using GIS at the GSP. The map is available in printed hard copy format plotted on demand as an Open-File Map. One additional 1:24,000 map of ground shaking amplification by surficial materials is in progress as of spring 2003. No metadata has been produced for any of these maps and no provisions have been made to make the GIS shapefiles available outside the GSRAD.

(1C) Quaternary surface fault rupture: No organized program to map Quaternary surface fault rupture exists. A few small areas have been investigated and map at very large scales, approximately 1:100 +/-, and those maps published in scientific reports and papers.

(1D) Soil liquefaction: In 1997 the GSP with one-time cooperative funding from the USGS Earthquake Program through a grant to the CUSEC-SG has mapped all of Missouri for soil liquefaction potential in very general terms at 1:2,000,000 scale. This map was compiled using GIS at the Illinois State Geological Survey (ISGS) and was published in printed hard copy format. The map was revised and reprinted in cooperation with the USGS in 1999. The GSP with one-time cooperative funding from the State Emergency Management Agency (SEMA) has mapped soil liquefaction potential in parts of Missouri at scales of 1:300,000 and 1:100,000. In 1993, 22 of southeast Missouri's

counties plus the City of St. Louis were mapped in low detail for soil liquefaction potential at 1:300,000 scale. This mapping was compiled using GIS at the GSP. In 1995 to 1999, 6 of Missouri's 55, 1:100,000 quadrangles in southeast Missouri were mapped in moderate detail for soil liquefaction potential at 1:100,000 scale. This mapping was compiled using GIS at the GSP. In 2001, one of Missouri's 1300, 1:24,000 (7.5') quadrangles was mapped in even greater detail for soil liquefaction potential. This map was compiled using GIS at the GSP. This map is available in printed hard copy format plotted on demand as an Open-File Map. One additional 1:24,000 map of soil liquefaction potential is in progress as of spring 2003. No metadata has been produced for any of these maps and no provisions have been made to make the GIS shapefiles available outside the GSRAD.

(1E) Lateral spreading: No program to map potential lateral spreading is known to exist.

(1F) Earthquake induced landsliding: The GSP with one-time cooperative funding from the State Emergency Management Agency (SEMA) has mapped earthquake induced landsliding potential in parts of Missouri at scales of 1:300,000 and 1:100,000. In 1993, 22 of southeast Missouri's counties plus the City of St. Louis were mapped in low detail for landsliding potential at 1:300,000 scale. This mapping was compiled using GIS at the GSP. In 1995 to 1999, 6 of Missouri's 55, 1:100,000 quadrangles in southeast Missouri were mapped in moderate detail for landsliding potential at 1:100,000 scale. This mapping was compiled using GIS at the GSP. No metadata has been produced for any of these maps and no provisions have been made to make the GIS shapefiles available outside the GSRAD.

(1G) Earthquake induced subsidence and ground collapse: No program to map potential earthquake induced subsidence is known to exist. The GSP with one-time cooperative funding from the State Emergency Management Agency (SEMA) has mapped earthquake induced ground collapse potential related to karst and underground mines in parts of Missouri at scales of 1:300,000 and 1:100,000. In 1993, 22 of southeast Missouri's counties plus the City of St. Louis were mapped in low detail for ground collapse potential related to karst and underground mines at 1:300,000 scale. This mapping was compiled using GIS at the GSP. In 1995 to 1999, 6 of Missouri's 55, 1:100,000 quadrangles in southeast Missouri were mapped in moderate detail for ground collapse potential at 1:100,000 scale. This mapping was compiled using GIS at the GSP. No metadata has been produced for any of these maps and no provisions have been made to make the GIS shapefiles available outside the GSRAD.

(1H) Earthquake induced uplift: No program to map potential earthquake induced uplift is known to exist.

(1I) Seiches: No program to map potential seiches (an earthquake induced free or standing-wave oscillation of the surface of water in an enclosed or semienclosed basin, especially on inland bodies of water such as lakes or rivers) is known to exist.

(2) Landslides: In 1982 the GSP with one-time cooperative funding from the USGS has mapped all of Missouri for landslide potential in very general terms at 1:500,000 scale.

This map was compiled and provided to USGS in hard copy format. The map was incorporated in to the USGS Landslide Overview Map of the Conterminous United States. This map is now available for downloading in GIS format from the USGS.

(3) Rockfalls: In 1982 the GSP with one-time cooperative funding from the USGS has mapped all of Missouri for rockfall incidence in very general terms at 1:500,000 scale. This map was compiled and provided to USGS in hard copy format.

(4) Problem surficial materials: No program to map problem surficial materials, shrinking and swelling surficial materials, is known to exist in GSRAD. The Natural Resources and Conservation Service (NRCS) and probably the DNR Soil and Water Conservation Program (SWCP) map problem surficial materials in the upper 4-6 feet of agricultural soils at 1:24,000 scale. This mapping is available in GIS format from NRCS and the Missouri Spatial Data Information Service (MSDIS).

(5) Flooding, including sinkhole flooding: No program to map flooding, including sinkhole flooding, is known to exist in GSRAD. The status of mapping for this hazard by other agencies, such as SEMA or other parts of DNR has not been determined at this time.

(6) Drought: Drought mapping is thought to exist in GSRAD Water Resources Program (WRP). However the status of the mapping has not been determined at this time.

(7) Ground subsidence (karst and mining related ground collapse): No program to map non-earthquake related ground subsidence (karst and mining related ground collapse) is known to exist.

(8) Erosion and stream migration: No program to map erosion and stream migration is known to exist in GSRAD. The status of mapping for this hazard by other agencies, such as Missouri Department of Conservation (DOC) and other parts of DNR, is unknown at this time.

(9) Radon gas: No program to map potential radon gas hazards is known to currently exist. The GSP is thought to have mapped this hazard in the past with cooperative USGS funding. The mapping results are thought to be incorporated in the USGS map Radon Potential Map of the United States.

Data Sources

The GSP is the main sources of geologic hazard maps as most of them are derived from primary geologic maps (bedrock and surficial materials) and other data that must be collected in the field. Other State agencies, the USGS, NRCS, local government geologists and planning departments, and geotechnical consultants also produce these maps.

Standards

No generally accepted standards are available for geologic hazards mapping.

Priority

The strongest series of earthquakes to strike the conterminous United States occurred near the town of New Madrid in southeast Missouri in 1811-1812. Although Missouri was sparsely populated at the time, the impact of these quakes nonetheless was enormous. If a similar series of earthquakes were to occur today, the impact would be catastrophic, with huge loss of life and property. Although such events are infrequent, significant earthquake events in the New Madrid Seismic Zone are considered to be very possible within the next few decades. Therefore, this is a high priority theme. Other geological hazards, such as rockfalls, subsidence and others, are also a significant priority.

Estimated Total Investment

The Federal agency lead themes have probably had millions of dollars invested in them. The GSP lead themes have probably had several hundred thousand dollars invested in them.

Contributions By Sector

The estimated current State contribution to these themes is probably about ten thousand dollars per year, 0.25 FTE. This is work conducted to perform geologic hazard mapping and associated tasks, including GIS. There is no known local contribution to these themes.

What is Needed?

To properly characterize geologic hazards and fully develop this theme would require a fundamental change in federal and/or state funding priorities to provide adequate resources. This would be in the form of geologists and technicians who would conduct hazards mapping and associated tasks. The current level of federal funding for such activities is relatively low in comparison with the risk, and state funding even less. State legislation was passed in 1990 that addresses geologic hazards (Section 256.170-256.175 RSMo), but funding has not been provided to implement this legislation.

To complete the geologic hazards themes at 1:24,000 it is first necessary to have appropriate detailed 1:24,000 bedrock geology and surficial materials mapping. These types of mapping and their investment needs should be addressed as separate themes (see associated Geologic Mapping theme). Assuming adequate bedrock geology and surficial materials mapping, the mapping of detailed geologic hazards themes for the entire state of Missouri will require approximately \$52 million. This cost includes approximately half professionals and half technicians, field expenses and equipment purchase, operation and maintenance. This is only a very rough estimate based on the geologic hazard responsibilities of the GSP, which includes earthquakes, landslides, rockfalls, problem surficial materials, sinkhole flooding, karst and mining related ground collapse and radon gas. This cost is based on a rough estimated average of \$40,000 per 1:24,000 quadrangle to map all of these hazards in 1300 quadrangles. Geologic hazards are complex and difficult to map because they are not always apparent or identifiable based solely on surface visual inspection and/or simple field testing techniques. To map geologic hazards often requires extensive drilling and sampling of subsurface materials and/or use of geophysical subsurface investigation techniques. Drilling, sampling and geophysical

investigations can not be done by an individual but requires a team of professionals and technicians working together. Sophisticated and expensive equipment is needed for these investigations and the testing. Samples must be extensively characterized and tested in the laboratory and geophysical field data must be intensively manipulated and refined in the laboratory by computer software. Then these results need to be modeled analytically to determine the hazard potential. Of course, work can be prioritized to focus mapping in areas of the state that are more vulnerable to earthquakes or other geologic hazards.

Likely Source?

The National Earthquake Hazards Reduction Program (NEHRP) is a federal program that funds various projects related to earthquake hazard delineation and preparedness. Although this is a possible source of funds, NEHRP grants are competitive and generally limited in scope. The Association of Central United States Earthquake Consortium – State Geologists (CUSEC State Geologists) receives funding from NEHRP, which is distributed to member states. Although Missouri receives some of these funds, they are very limited and can only be used for equipment and expenses (E&E). The Missouri Department of Transportation (MoDOT) performs data collection activities primarily related to bridge construction projects. The data is collected with GSRAD technical assistance. GSRAD utilizes the data to perform limited hazards mapping. Increased funding by MoDOT for such activities would accelerate hazard mapping in areas of bridge and other construction.

Perhaps the most appropriate source of funds for conducting geological hazards work would be state general revenue funds appropriated to allow the state to implement the Geologic Hazards Act (Section 256.170-256.175 RSMo). However, the current dismal status of Missouri's budget makes such funding highly unlikely, at least in the near term.

Contributions By Sector

The estimated current State contribution to these themes is probably about ten thousand dollars per year or 0.25 FTE. There is no known local contribution to these themes. There is currently no staff GIS specialist working on these themes.

Ways to Overcome this Gap

Federal funding from the National Earthquake Hazard Reduction Program (NEHRP) does allow for some focused mapping projects. The Missouri Department of Transportation has also funded a few focused projects. Certain local governments have provided funding for projects. However, the level of funding from these sources is extremely limited and the scope of the projects is relatively narrow. Significant increases in the amount of federal and state funds for characterizing geologic hazards is needed. Appropriating state general revenue funds to fully implement the Geologic Hazards Act (Section 256.170-256.175 RSMo) would provide resources for implementing this theme.

Most Appropriate Data Steward

Under Section 256.170-256.175 RSMo, GSP is responsible for maintaining and updating geologic hazards data.

Maintenance

The GSP periodically updates digital maps, as new information becomes available.

Estimated Maintenance Cost

The estimated maintenance cost for these geologic hazards themes, if completed at 1:24,000 scale, is \$100 thousand per year, which includes 2 FTE's.

Part C. Geologic Resources

Theme Description

The geologic resources of Missouri fall into three broad categories: industrial minerals, mineral fuels, and metals. Industrial minerals subcategories are barite, cement, clay-shale, construction sand-gravel, industrial (silica) sand, lime, and stone. Mineral fuels subcategories are coal and petroleum-natural gas. Metals subcategories are aluminum, cobalt-nickel-copper, copper, iron, lead-zinc, manganese, pyrite, and tungsten-silver. The subcategories are further subdivided to bring out differences in mineralogy, mode of occurrence, and type of industrial use. A shapefile is near completion that will show 1) the generalized distributions of the different kinds of resources and 2) the locations of noteworthy fields, mines, quarries, processing plants, smelters, and kilns. The shapefile is intended for use at 1:500,000 scale. The long-term goal is to produce shapefiles that are suitable for use at 1:24,000 scale.

Status

As of February 2003, the shapefile is in the final draft stage.

Data Sources

(1) Mineral Resources and Industrial Map of Missouri, 1:500,000 scale published in 1988 by the Missouri Department of Natural Resources, Geological Survey and Resource Assessment Division (GSRAD). This is a paper-copy-only wall map.

(2) Inventory of Mine Occurrences and Prospects (IMOP), digital database created and maintained by the Missouri Department of Natural Resources, Geological Survey and Resource Assessment Division. The information in IMOP is compiled from a variety of sources of sources.

Standards

GSRAD follows standards set by the National Cooperative Geologic Map Program, which is headed by the U.S. Geological Survey and the Association of American State Geologists, and works closely with the FGDC.

Priority

In regard to maintaining and updating the 1:500,000 scale shapefile and future efforts to produce 1:24,000 scale shapefiles, the resources that are currently being developed most intensely by industry will receive highest priority. Accordingly, high priority will be

given to cement, clay-shale, lime, and stone. The remaining resource categories range from intermediate to low priority.

Estimated Total Investments

One technician familiar with ArcView GIS and working variously from full-time to half-time generated the 1:500,000 shapefile during the course of one year at a cost of about \$20,000.

Contributions by Sector

The 1:500,000 scale theme was generated using GSRAD general revenue. No outside funding sources were involved and none were available.

What is Needed?

One full-time technician at approximately \$30,000 per year over ten years would be required to produce the 1:24,000 scale theme or themes. Not more than \$10,000 per year investment will be required to maintain and update the existing 1:500,000 scale theme.

Likely Source?

Currently there is no funding specifically allocated for completion of the themes. Due to state budget problems, there likely will be no state funds available any time in the foreseeable future. Maintenance and update will be done when need arises and when personnel have spare time to do it.

Ways To Overcome Gap

It may be possible to solicit voluntary funding from the mineral industry. To date, however, no attempts have been made to pursue this possible money source.

Most Appropriate Data Steward

The most appropriate steward for the geologic resources theme is the Missouri Department of Natural Resource, Geological Survey and Resource Assessment Division (GSRAD). The Missouri Spatial Data Information Service (MSDIS) will provide a role in dissemination of the theme to the public.

Maintenance Process and Cost

An estimated \$10,000/year (1/4 FTE) is required to maintain and update existing 1:500,000 theme.

Section 12. Land Use – Land Cover

In Geographic Information Systems (GIS) applications, the use of land surfaces by man for human activities is referred to as Land Use, while the natural and manmade features of the land itself are referred to as Land Cover. Whether the data is to be used for new highway construction planning, habitat protection, or the location of a new school, more

and more government officials are relying on LULC data to help their planners and administrators provide them with the information they need to make important decisions.

The demand for large-scale LULC information has increased recently, especially in rapidly growing metropolitan areas. Many Federal, State, regional, and local planning agencies require up-to-date LULC information for various applications. These applications include modeling urban growth, determining land suitability for future development, monitoring how land use changes affect the environment, understanding land use patterns, and developing policies concerning land use development.

To meet the needs of State and local government's data must be current and detailed enough to provide the resolution needed for the environmental and urban analysis, planning, and management. In addition to currency and accuracy the data must also be of sufficient detail so that the entities utilizing this information can make intelligent decisions.

Section 13. Soils

Digital soil data are available for all of Missouri. The Natural Resources Conservation Service (NRCS) and the MDNR developed the data as a cooperative effort. All digital soils meet (or soon will meet) the NCRS Soil Survey Geographic Standards (SSURGO) for 1:24,000-scale information. Thirty-three surveys currently require additional processing before being SSURGO-certified.

NRCS has also processed 28 counties as Version II SSURGO data. Version II data include attribute information in a relational database format, and are ready for use in an ArcView 3.x extension called Soil Data Viewer. Soil Data Viewer makes accessing and mapping soil interpretations and attributes easier for users. Version II data production is projected to be completed in about one year.

With first generation soil mapping completed, MNDR and NRCS have collaborated to establish six Major Land Resource Area (MLRA) project offices. MLRA Project Office staffs are evaluating the quality of existing soil surveys in their areas and establishing recommendations for second-generation mapping.

Section 14. Critical Infrastructure

Critical facilities and infrastructure are human-built systems that are essential to the safety, security, health and economic well being of our modern society. These systems are vulnerable to disruption by natural disasters or human caused events. Many critical facilities are part of the system for responding to disrupting events. Examples of critical facilities and infrastructure include police and fire stations; hospitals and other medical care facilities; schools; transportation systems; energy distribution; water distribution; telecommunications.

Planning for and responding to threats to critical infrastructure, including the use of key response resources at essential facilities can be significantly enhanced through spatial representation. While a large amount of spatial data already exists to support the Homeland Security efforts in the state of Missouri, a number of key databases are missing. These data are primarily point-specific locations, or highly detailed databases.

Tony Spicci, MGISAC Chair, has submitted the Missouri Homeland Security GIS Action Plan to Tim Daniel, Missouri's Homeland Security Director for review. Several point and polygon features were identified in the plan as important to the homeland security effort in the state. These features include the following: hospitals, schools, nuclear facilities, fire protection districts, police districts, and ambulance districts.

Appendix 1. Missouri GIS Advisory Committee Members

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