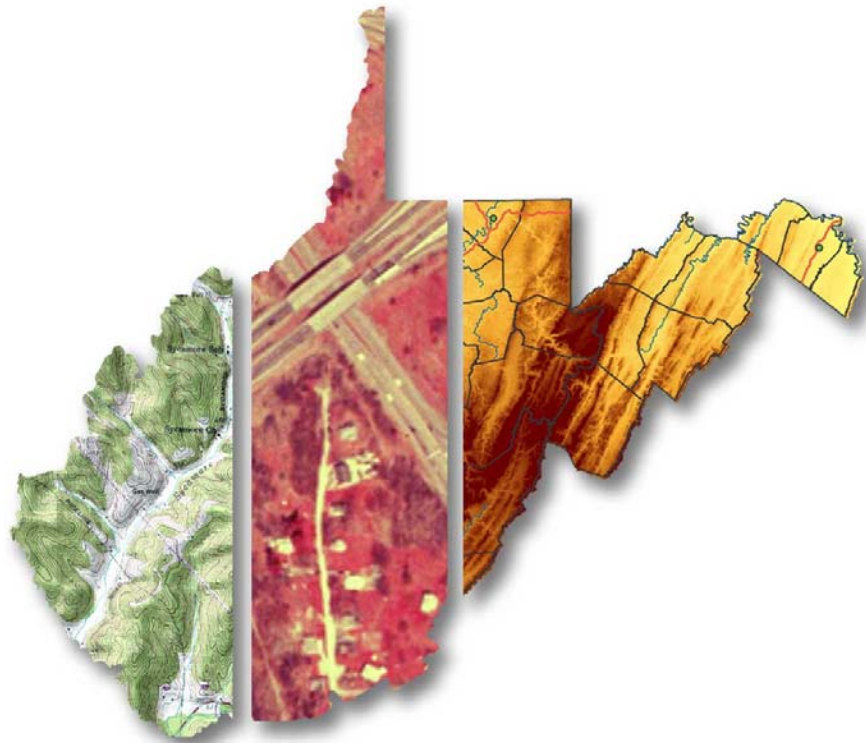


# Strategic Plan

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## Executive Summary

### Vision and Mission of the West Virginia State GIS Technical Center

The West Virginia Geographic Information Systems Technical Center (WVGISTC) provides a focal point for the State for the coordination of developments in Geographic Information Systems, distributes geospatial data, conducts research in the latest GIS technologies, and makes training and education available in GIS topics for state and local agencies. Geographic information is vital for the 21<sup>st</sup> century. About 80% of all computerized data contain some form of locational information; consequently geographical data are incorporated increasingly in private and public sector decision-making. Geographic information systems (GIS) are used extensively by business and government organizations in West Virginia at statewide, regional and local scales of analysis for mapping, modeling, investigating and forecasting. GIS technologies are evolving rapidly and are central to the new information technologies and infrastructure that support geographic data acquisition, analysis and dissemination. In November 1993 Executive Order No. 4-93 directed the Technical Center to provide services to support the development and operation of GIS in West Virginia. Currently the Center is funded through provisions of House Bill 2222 (1995), the Mineral Lands Mapping Program, and other state and federal sources. As the state of West Virginia's primary GIS resource, the Center provides state-of-the-art technology and professional expertise to support the development of GIS statewide.

The principal objectives of the State GIS Technical Center are to:

1. Advance the State's Spatial Data Infrastructure through digital data conversion, data development, and coordination with federal geospatial data initiatives and local data producers.
2. Develop, maintain, coordinate, and provide the infrastructure to support Web-based access to geospatial data and information through the WV Geographic Information Network and FGDC State Data Clearinghouse node.
3. Coordinate with state, federal, local government, and private sector entities to define, refine, and implement the State Strategic Plan for GIS initiatives and standards-based geospatial data development.
4. Provide outreach, educational and training support, and advisory services to the citizens, government agencies, non-profit organizations, and businesses of West Virginia in the area of GIS and related spatial data handling technologies
5. Undertake and support research and projects in GIS that improve the safety, quality of life, and economic well being of all West Virginia citizens.

Since its inauguration, the Technical Center has continued to meet each of these objectives in a number of ways that are detailed in this plan.

GIS is a major component of the information economy. Geospatial data in the form of remotely sensed images, on-line maps and global positioning coordinates are essential for economic growth, emergency preparedness and response, E-911, location-based services and environmental management and conservation. WVGISTC seeks to expand and maintain a complete range of digital geographic data for West Virginia, improve the geographic representation of its diverse physical and cultural entities, and investigate the dynamic earth, economic and social processes that shape planning and decisions. The WVGISTC benefits all state and local agencies that incorporate

geographic information, interpret spatial data, and employ spatial decision-making to advance their missions. Simultaneously, the WVGISTC serves West Virginia's society at large by improving access to geographic information, encouraging more and better use of geographic technology, and providing new insights.

Current priorities include five major goals seen to be continuing and critical elements of WVGISTC's mission. These goals are:

- ***Digital Mapping, Data Development and Coordination Services:*** WVGISTC advances the Spatial Data Infrastructure in West Virginia through data generation, data sharing agreements, enabling data conflation and interoperability, database development and digital mapping services. Continuing projects include:
  - *Digital Line Graph (DLG) Conversion Project:* Convert USGS 1:24,000-scale map sheets for the entire State into a standards-based digital format for use in GIS. Geospatial data layers include hydrology, contours (elevation), transportation (road, rail), and boundaries.
  - *Flood Hazard Mapping:* Prepare digital flood map layers for West Virginia.
  - *Critical Infrastructure Mapping:* Coordinate with the WV Office of Emergency Services and other agencies in the development of statewide critical infrastructure data sets.
  - *County Mapping Projects:* Provide assistance to counties for tax map conversion, transportation and land use mapping.
  - *Municipal Boundaries:* Coordinate with Census and the WV Legislature to create standards and procedures for the electronic submission of incorporated boundaries.
  - *WV Gazetteer:* Partner with the U.S. Geological Survey to keep current the Geographic Names Information System (GNIS), a names database of 38,000 physical and cultural geographic features.
- ***Geographic Information Network Services:*** WVGISTC provides a variety of geographic information services to disseminate data and geospatial news over the Internet.
  - *Data Access and Distribution Services:* These services allow users access to certified, documented geospatial data through distribution services such as Data Clearinghouses and metadata catalogs.
  - *Geospatial News and Directory Services:* WVGISTC disseminates geospatial information about relevant Internet map services, statewide mapping activities, and GIS standards and publications. Other geographic information services include promulgating GIS news and a statewide directory of GIS professionals.
- ***Strategic Planning and Mapping Standards:*** WVGISTC develops strategic business plans for the production and stewardship of standards-based geospatial data to make state and local governments more efficient.
  - *Digital Tax Mapping Procedures:* WVGISTC is spearheading an effort to create digital tax mapping guidelines for the State.
  - *Local Government GIS Business Plan:* WVGISTC is creating a business plan template to assist counties and municipalities with GIS implementation.
  - *State GIS Plan:* WVGISTC is developing geographic information technology reports and business plans that will contribute to the State GIS Plan.

- **Advisory and Training Services:**
  - *Technical Advisory Services:* WVGISTC provides consulting services to develop high quality geospatial data.
  - *Technical Support Services:* WVGISTC averages over four hundred service requests per year via e-mail or telephone from West Virginia GIS users.
  - *Outreach Services:* WVGISTC provides outreach services to select organizations throughout West Virginia. Recent outreach services include the statewide critical infrastructure and economic development maps for the WV Office of Emergency Services and WV Development Office, respectively.
  - *Training and Educational Services:* WVGISTC trains and certifies GIS specialists of today and the future. The Center continues to conduct a variety of GIS workshops, educational seminars, and conference poster displays.
  
- **Research and Applications:**
  - *Research:* The Technical Center interfaces with and builds upon the resources and experience of the Department of Geology and Geography at West Virginia University. Co-directors of the Technical Center also serve as Professors of Geography in the Eberly College of Arts and Sciences. GIS research focuses on basic and emerging topics across multiple disciplines.
  - *Applications:* Current application-focused areas include homeland security, flood hazard mitigation, transportation, cadastral, health, community planning, economic development and geology

## Preparing for the Future

A sound business model for any organization such as WVGISTC requires an analysis of the best estimate of return on an investment. Since the Technical Center is not revenue-generating in the sense of selling a product, returns are best measured in terms of savings due to reduced redundancy of data conversion, data sharing, and the provision of innovative information products unavailable through any other state agency. In state government agencies specializing in mapping applications, GIS have been found to provide a 2-to-1 benefit to cost ratio and for state agencies that analyze spatial data a 4-to-1 benefit to cost ratio has been demonstrated. These returns are compounded when GIS is deployed in interagency and inter-institutional environments on the enterprise model. Additionally the WV GIS Technical Center needs to prepare for circumstances outside its control. External events necessitate an orderly response and a contingency plan is essential for effective management. The most likely eventualities will be budgetary in nature, but planning for other events, such as personnel changes, disaster response and recovery strategies is appropriate.

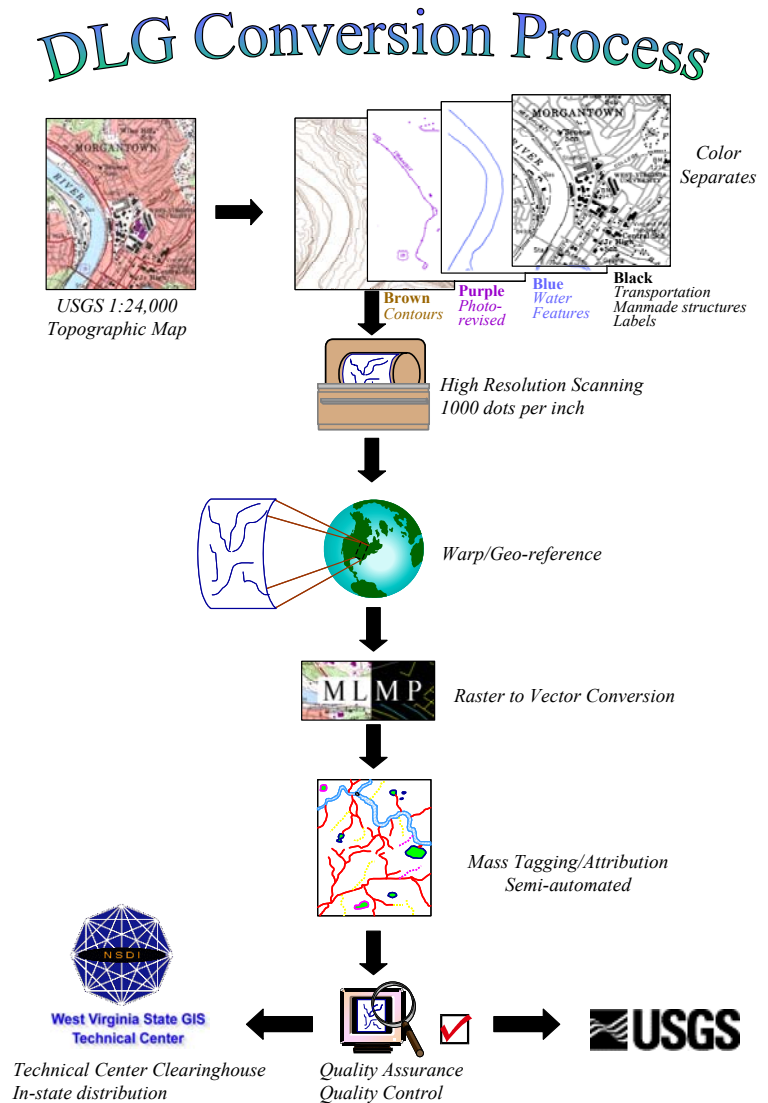
The Technical Center is a principal component in West Virginia's information infrastructure for future growth and development. It will continue in its mission to provide focus, direction and leadership to users of geographic information systems (GIS), digital mapping and remote sensing within the state of West Virginia.

# West Virginia GIS Technical Center Strategic Plan

## I. The Strategic Plan Review Context

Several factors have contributed to the initiation of this strategic plan review. The leading reason is one of timely review; it has been almost five years since Governor Underwood dedicated the current State GIS Technical Center facility and ten years since operations began. A necessary requirement of any responsible organization is to review its mission and future objectives in the light of past achievements, especially in the rapidly changing technological environment of GIS. Several other factors have also contributed to the need for this review including the wide spread adoption of GIS for many functions at the state and county level, and the dramatic increase in the generation and means of distribution of spatial data. Additionally, several projects have reached maturity necessitating a re-evaluation of priorities.

First among these latter factors is that progress on the Digital Line Graph (DLG) project has been very good and this phase of the Technical Center's responsibilities is scheduled for completion in 2005. The DLG project (Figure 1.1) entails converting the traditional USGS 1:24,000 map sheets for the entire State into a digital format for use in GIS. Digital layers include rivers and streams (hydrology), roads and trails, rail and utilities, political jurisdictions (boundaries), elevation contours (hypso-graphy) and photo-revised features. These base GIS data layers contribute to the important Framework GIS data layers that support all state, community, and corporate GIS development in West Virginia. These data sets are also crucial elements in the Mineral Lands Mapping Project that was tasked with developing a Statewide Electronic Mineral Lands Taxation System to provide equitable taxation assessments for state and private interests. The DLG project has been an important component of the work of the Technical Center and now is a timely moment to consider the next phase in data development in support of statewide GIS activities.

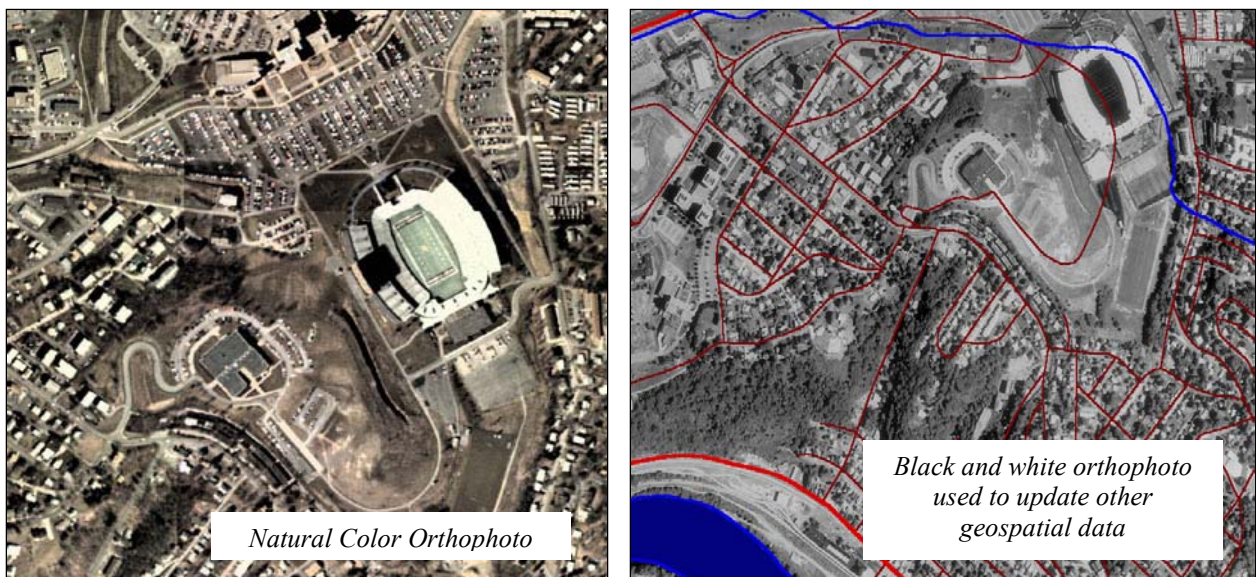


**Figure 1.1** Digital Line Graph (DLG) conversion process



A second factor is that GIS is embedded in science and technology that is evolving extremely rapidly. GIS software has experienced rapid growth and change and new data models and major advances in system capability have emerged since the Center was founded. Coupled with decreasing costs of use, these changes significantly influence the use of GIS and the support infrastructure demanded of the Technical Center. GIS is resource intensive and can still involve significant start-up and operating costs, especially to the inexperienced user. Positioning the Technical Center in readiness to support the needs of all public-sector users statewide will considerably lower these costs and improve the effectiveness and timeliness of GIS implementation. Rapid changes in GIS are no less significant in the area of spatial data collection. New aerial and satellite sensors, as well as analog-to-digital data conversion techniques, are on the threshold of revolutionizing the availability, extent, and scale of digital GIS. In order to support the capture, encoding, and dissemination of this data for the State demands that the Technical Center position itself well in advance of such data becoming available.

A third factor involves the need to coordinate with new and ongoing federal and state initiatives that continuously influence the field of GIS. Coordination is an important role of the Technical Center because we seek to facilitate and maximize state resources to the benefits of all state GIS users. At the state level new initiatives in the State Address Mapping initiative and high resolution Digital Orthophotographs (Figure 1.2) are likely to have significant impacts on GIS and spatial data usage. The Technical Center must prepare for such opportunities well in advance of the need. In addition, federal initiatives in terms of the National Map and Homeland Security equally require the Technical Center to coordinate between state and federal spatial data projects.



**Figure 1.2** Orthophotos are a digital map representation of aerial photography and serve a variety of purposes, from interim maps to field references for earth science investigations and analysis. The orthophoto is a key layer of a geographic information system and as a tool for revision of other geospatial data.

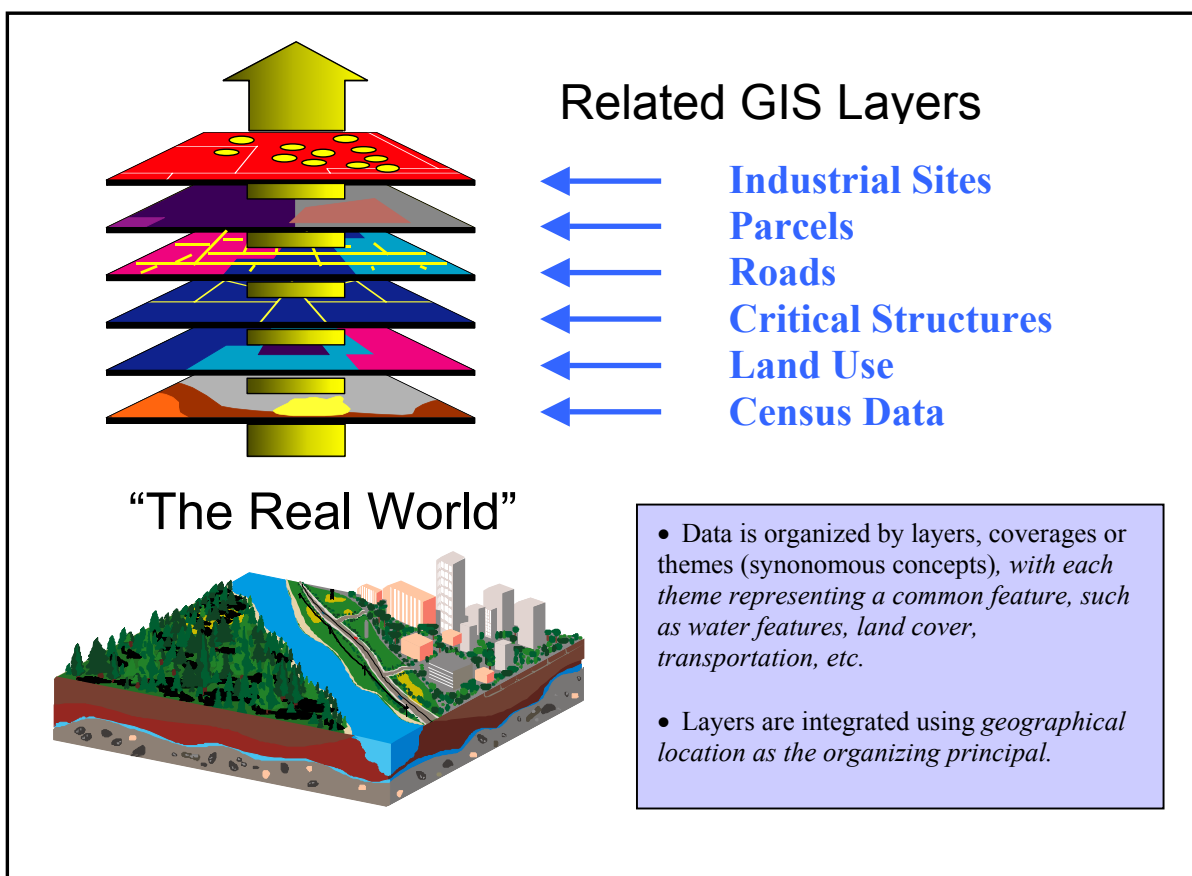
Finally, GIS is made up of various hardware, software, and data components that must be interoperable in order to operate at maximum efficiency in a statewide organization. While one major purpose of interoperability is to enable GIS developed by differing vendor companies to communicate and interact, another important intent is for user communities to be able to exchange geospatial data. To do so entails that the issues raised by data semantics – the different meanings that data producers assign to their data – must be addressed. There can be few areas that contribute more to resource efficiencies and the effectiveness of statewide GIS usage than the minimization of

spatial data duplication and the maximization of data sharing. Several important steps are needed to make data available to as broad a community of state users as possible and to minimize data redundancy. Metadata plays a crucial role toward this goal. The Technical Center must be at the forefront in state interoperability issues. The number of GIS users in the state has increased considerably over the past several years and the Technical Center must constantly review its role in supporting GIS interoperability between GIS users in the State.

## II. The Benefits of GIS for WV Citizens

We live in an information age characterized by benefits from useful data realized by the economy and society at large. Most data used in business and by government today have a geographic component that can be referenced to a location on the earth’s surface, mapped, and converted into digital form (Figure 2.1). Global Positioning Systems (GPS) facilitates the acquisition of spatial data. Decision-making using GIS creates a strategic advantage for West Virginians in business, economic development, land management, health care, geologic mapping, environmental issues, transportation and utilities, and in many other fields of interest.

Geographic Information Science (GISci) is a new and rapidly expanding field that studies the fundamental issues arising from the creation, handling, storage and use of geographic information. One part of GISci., Geographic Information Systems, consist of computer database, analysis and presentation tools for handling spatial data and providing valuable geographic information for decision-makers. Useful spatial data must be managed and coordinated to minimize redundancy, ensure interoperability and maximize its benefits. Among the most useful products of GIS are Internet and electronic maps, visualizations, statistical evaluations and spatial analyses.



**Figure 2.1** In geographic information systems (GIS) different data themes are integrated by their geographic location.



The concept of an ‘enterprise’ GIS is to maximize the utilization of GIS capabilities by networking up-to-date spatial and non-spatial data from various sources within a government or corporate organization. Distributed computer systems have made enterprise GIS possible through the Internet and Local Area Networks (LAN). Instead of a single department using its own GIS for separate projects, the GIS is enabled across an entire organization. This results in increased efficiency through coordination, cooperation and reduced redundancy. West Virginia citizens benefit directly from the economies realized by the production of electronic maps and the sharing of spatial data, and by the reduction of duplication of expensive data generation and revision. The Technical Center is the lead agency in providing shared spatial data, enabling and coordinating its use within the State, and promulgating standards through which greater data sharing may be achieved.

Some examples of the benefits of GIS in service of the citizens of West Virginia include:

Spatial Data Generation and Sharing - The Technical Center supports the National Spatial Data Infrastructure Clearinghouse node and produces and disseminates multi-scale, digital data with associated metadata. Metadata are an essential component of spatial data that enable producers to share digital maps and users to search and find their specific needs.

Enabling Tax Fairness - the Mineral Lands Mapping Program (MLMP), which uses GIS extensively, is designed to evaluate the value of West Virginia's coal reserves fairly, providing mineral owners and the state Department of Tax and Revenue accurate information on the location, ownership, quantity and quality of coal.



*Coal Reserves*

Emergency Response and Disaster Management - Recent floods have devastated several southern West Virginia communities and have affected most counties. By integrating satellite imagery with GIS topological maps the Technical Center assists in disaster mapping and relief coordination by pinpointing flooded locations and their severity. Hazardous spills are an all too frequent event in West Virginia. Coal slurry, oil, chemicals and other pollutants have inundated the Ohio and Kanawa Rivers, Tug Fork, and many other water bodies. GIS can create hazard maps, monitor spills and plumes, and create forecasts to mitigate damage through effective response and efficient clean up. Identifying locations at greatest risk assists in reducing likely damage.



*Natural Disasters*

Forestry and Agriculture - In the rugged terrain of West Virginia, GIS is vital in soil conservation, forestry management, and for non-point source pollution run-off control, particularly from livestock and poultry operations. GIS monitoring of insect pests has saved thousands of acres of West Virginia forest from defoliation by Gypsy Moth.



*Natural Resources*

Economic Development – GIS assists in attracting business and industry to the State by identifying and promoting suitable sites for development by interested companies. Economic development patterns in counties and along transportation corridors are mapped and the growth and change of business activity documented for state and local authorities.



*Economic Development*

### III. Strategic Plan

The WVGISTC has identified five strategic objectives that define the Center's primary activities and goals over the next five years. These comprise:

#### 1. Advance the State's Spatial Data Infrastructure through digital data conversion, data development, and coordination with federal geospatial data initiatives and local data producers.

WVGISTC enhances government efficiency and improves citizen services by coordinating data development efforts among organizations and users of GIS within the state of West Virginia, as well as to external organizations requiring digital geospatial data of the State. Data development is very expensive and thus reducing duplicating efforts is a primary objective. In concert with the federal framework and national mapping initiatives, the Center coordinates the acquisition of new and existing data additions to the West Virginia Spatial Data Infrastructure.

##### 1.1. Data Coordination Services

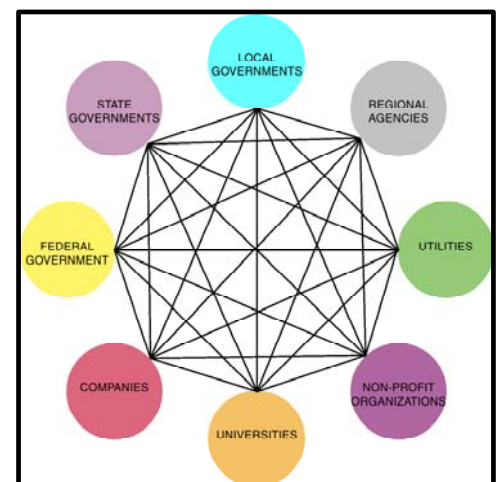
Where possible, WVGISTC obtains spatial data from data producers and makes that data accessible to other statewide users, in a seamless format consistent with other themes. The Center ensures that the data are documented to prescribed metadata standards describing the content, quality, condition, and other characteristics, facilitating data sharing and use. Geographic spatial data originates from existing digital databases, new data sources via GPS, engineering and survey design files, digital aerial photography and satellite imagery, and from analog maps. Key components of these GIS data development initiatives will include data surveys, data sharing agreements, data conflation, data interoperability, and database and digital mapping services.

##### 1.1.1. Data Survey and Coordination

The WVGISTC will continue to conduct statewide GIS data surveys and coordination within the WV geospatial community. The WVGISTC pursues service requests and utilization reports to determine data acquisition priorities that contribute significantly to the availability of governmental and commercial spatial data sets to multiple users.

##### 1.1.2. Data Sharing

WVGISTC establishes formal and informal data sharing agreements with data stewards to enhance the Spatial Data Infrastructure. WVGISTC does not sell public data but rather seeks to maximize accessibility and usage while reducing duplication. Sharing certified, consistent data reduces costly data duplication and greatly improves the efficiency and cost effectiveness of government services. WVGISTC supports and promulgates open data policies that extend data sharing at all levels of government. Public/private data sharing partnerships are also formed for the creation, maintenance, and sharing of GIS data.



**Figure 3.1** Data sharing makes government more efficient and improves citizen services

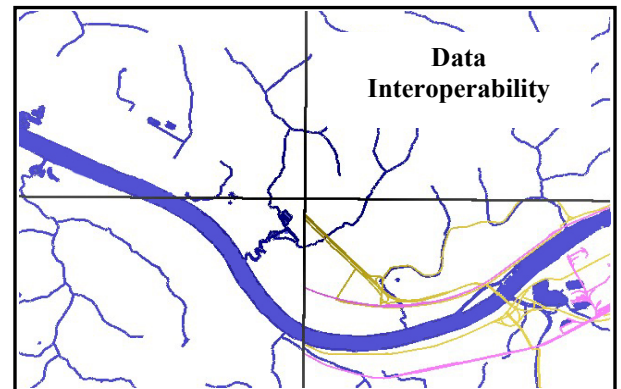
In 2002, for example, WVGISTC integrated existing U.S. Forest Service Cartographic Feature Files into the Mineral Lands Mapping Program and the National Hydrography Dataset (NHD). WVGISTC also assists associations such as the WV Remote Sensing Consortium to share remote sensing imagery among users.

### 1.1.3. *Data Conflation*

Data conflation is a procedure for creating and updating new ‘master’ datasets from the best spatial and attribute qualities of two or more source datasets. As an example, WVGISTC has generated an extensive dataset of railroad 1:24,000 Digital Line Graphs for West Virginia. However, mapping projects tend to use the 1:100,000 Federal Rail Authority GIS layer because the attributes are more current. Amalgamating the best parts from different GIS datasets, such as linking (or conflating) the 1:24,000 railway network geometry to the attribution contained in the 1:100,000 Federal Rail Authority data into a single dataset provides valuable additions to the existing databases. WVGISTC conflates datasets in the Spatial Data Infrastructure to create master datasets and thereby reduce the costs stemming from the maintenance of multiple, independent, layers, and the generation of entirely new data coverages.

### 1.1.4. *Data Interoperability*

A key objective in GIS is to make data layers spatially compatible (Figure 3.2). WVGISTC pursues open interfaces, protocols, and other interoperable solutions as defined by [OpenGIS Specifications](#). The GIS Technical Center seeks technical solutions that overcome the barriers to data interoperability and address issues of scale, format, projection, schema, and accuracy. WVGISTC resolves administrative and commercial issues concerning data ownership, cost, availability, service fulfillment, security, privacy, and liability that hinder the advancement of the Spatial Data Infrastructure.



**Figure 3.2** Data compatibility issues arise when combining multiple themes collected at different temporal and positional accuracies.

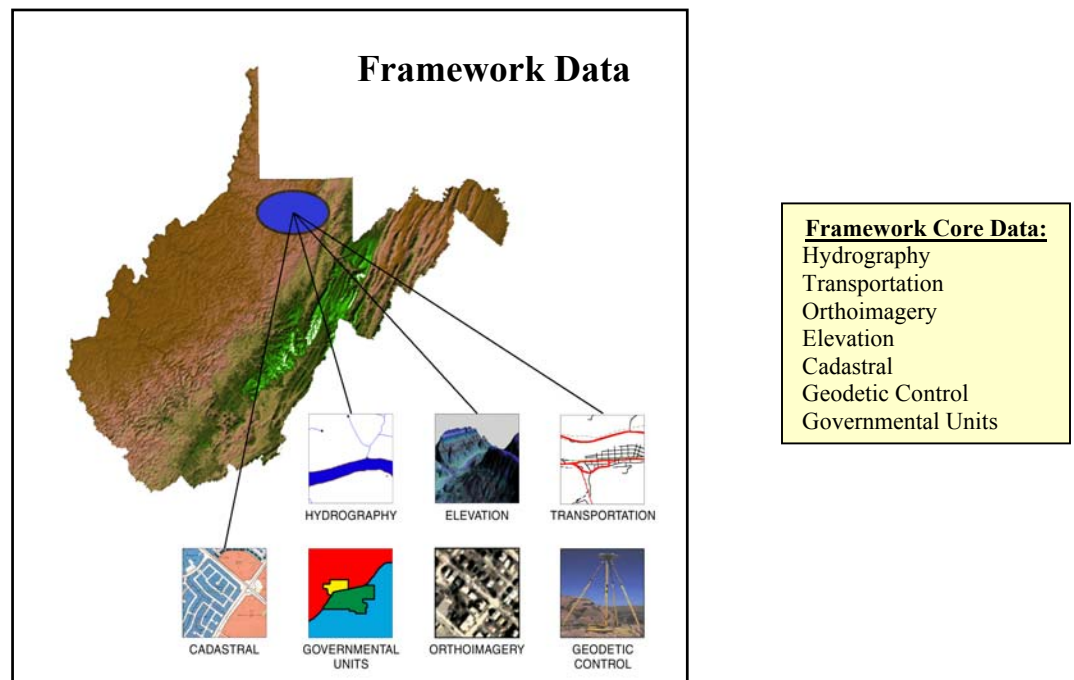
## 1.2. **Digital Mapping and Database**

Most state-based mapping projects draw heavily on commonly used spatial data sets contained in the Framework and application-specific non-Framework of the Spatial Data Infrastructure. Mapping projects also create geographic databases through the conversion of paper maps into digital form or through the modification and enhancement of existing digital geospatial data. Database design is an integral component of all digital data projects and standardized procedures that compile, convert, and validate geospatial data in accordance with approved state and national mapping guidelines. Developing and contributing to the state component of the national data Framework initiative is a central element of the WVGISTC goal to maximize data sharing and minimize costly data duplication and redundancy.

### 1.2.1. Core Framework Projects

Framework data mapping projects integrate the ‘best quality available’ base mapping data into the Spatial Data Infrastructure. Framework delivers basic geographic data in a common format through an easily accessible Internet environment. Framework data form the foundation of most mapping applications. Seven core themes (Figure 3.3) make up the nationwide **Framework** data: hydrography, transportation, orthoimagery, elevation, cadastral, geodetic control, and governmental units (Appendix J).

WVGISTC has undertaken several initiatives that contribute to the state Framework database including the development of cadastral maps for tax districts in WV, and the compilation and data compression of over 2000 one-meter-resolution color-infrared digital orthophoto images into countywide sets. The statewide Digital Line Graph (DLG) Project will further add to the statewide Framework database through the addition of 1:24,000-scale, topographic-based boundaries, hydrography, transportation, and elevation contours. WVGISTC will continue the development of essential Framework data layers such as planimetric and elevation contours for the entire State. WVGISTC hopes to increase the value of the State Addressing and Mapping Board project through enhanced products and the dissemination of high-resolution (1:4800-scale or better) aerial photography, transportation, and hydrography data for the entire state of West Virginia. Framework data made available from this project will provide the foundation for a new, accurate and updated digital map of the State.



**Figure 3.3** Seven nationwide core themes serve as the *framework* or foundation for most mapping applications.

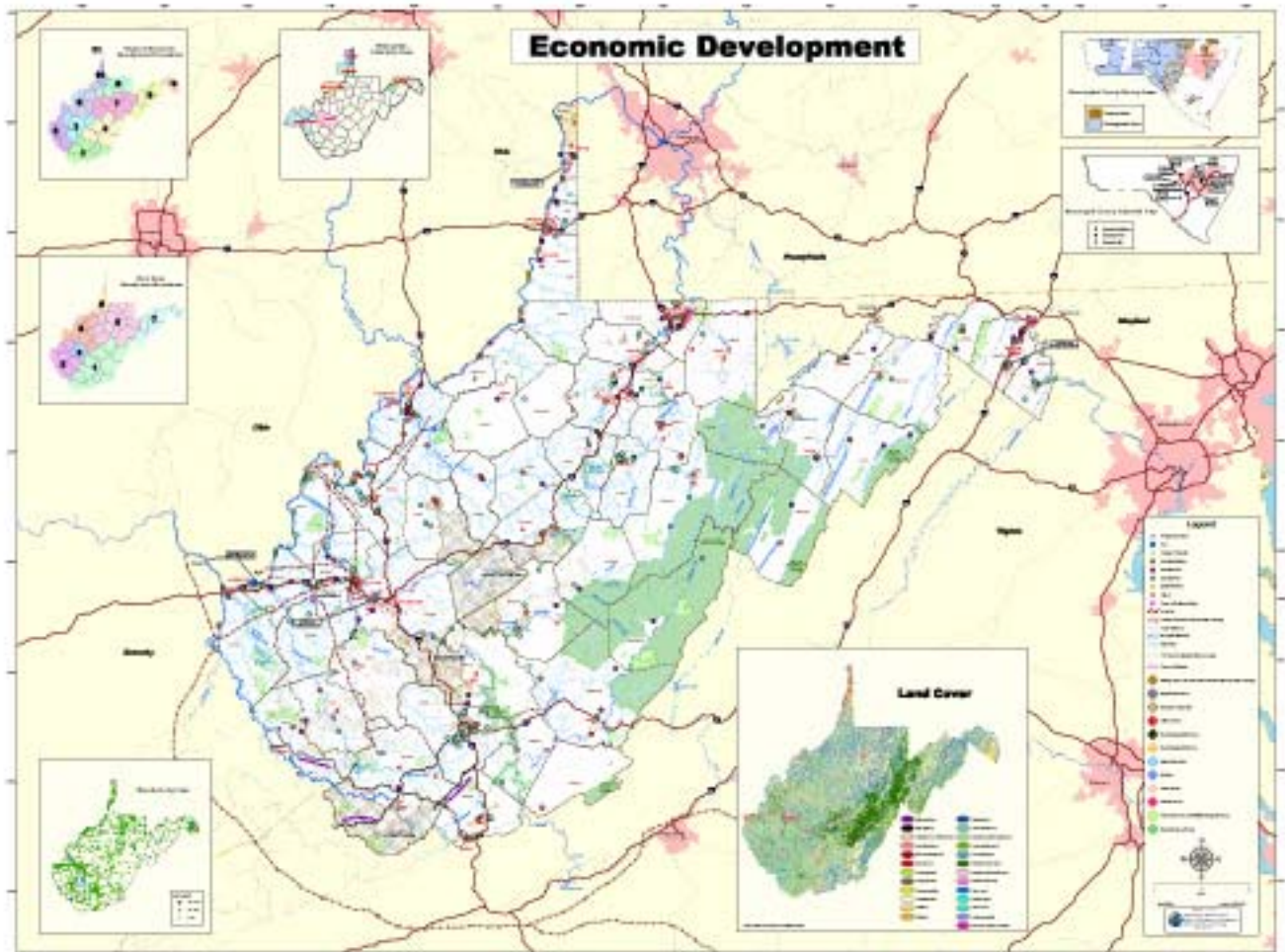


1.2.2. *Non-Framework Projects*

While the primary focus of WVGISTC is directed toward expanding Framework data, the Center also provides for non-Framework projects when they support the information needs of decision makers in WV. Accordingly, critical infrastructure data for homeland security and industrial property maps (Figure 3.4) for the WV Development Office have been developed because state benefits are clearly identified. For similar reasons petroleum and recreational Internet mapping applications have been undertaken. WVGISTC will work closely with the WV Statewide Addressing and Mapping Board, the WV Office of Emergency Services, and FEMA for human-induced and natural disaster mitigation mapping.

**Non-Framework Applications Data:**

- Soils
- Geology
- Land Cover / Land Use
- Critical Structures
- Economic Development
- Public Health
- Demographics
- Natural Resources
- Environment



**Figure 3.4** State Economic Development map created for the WV Development Office.

**2. Develop, maintain, coordinate, and provide the infrastructure to support Web-based access to geospatial data and information through the WV Geographic Information Network and FGDC State Data Clearinghouse node.**

Providing easy and effective access to spatial data is central to the mission of the WVGISTC. The Internet is a core component of our geographic information dissemination strategy. Access of West Virginia citizens to geographic information is made possible through the WV Geographic Information Network, a suite of Internet services that includes the Data Clearinghouse, a Federal Geographic Data Committee (FGDC) Clearinghouse Node, metadata catalogs, and geospatial newsletters and postings (Figure 3.5). The Center’s website has garnered significant recognition, including state website of the month for June 2001. Data and information dissemination is a rapidly changing technology and WVGISTC will continue to explore and implement effective data sharing services through the Internet.

Web Site Features

- ❖ GIS News
  - Current and archived GIS news
  - Job announcements
  - Electronic newsletters
- ❖ Data
  - Data Clearinghouse
  - Interactive mapping catalog
  - FGDC and summary metadata
- ❖ Statewide GIS Directory
- ❖ Statewide GIS Activities & Guidelines
  - Statewide Mapping Activities
  - Mapping Guidelines and Policies
  - State GIS Meeting Notes
- ❖ Links to GIS software and stakeholders
- ❖ Context Help

**Figure 3.5** The WV GIS Technical Center provides a variety of geographic information services to disseminate data and geospatial news over its World Wide Web Server: <http://wvgis.wvu.edu/>.

**2.1. Data Access and Distribution Services**

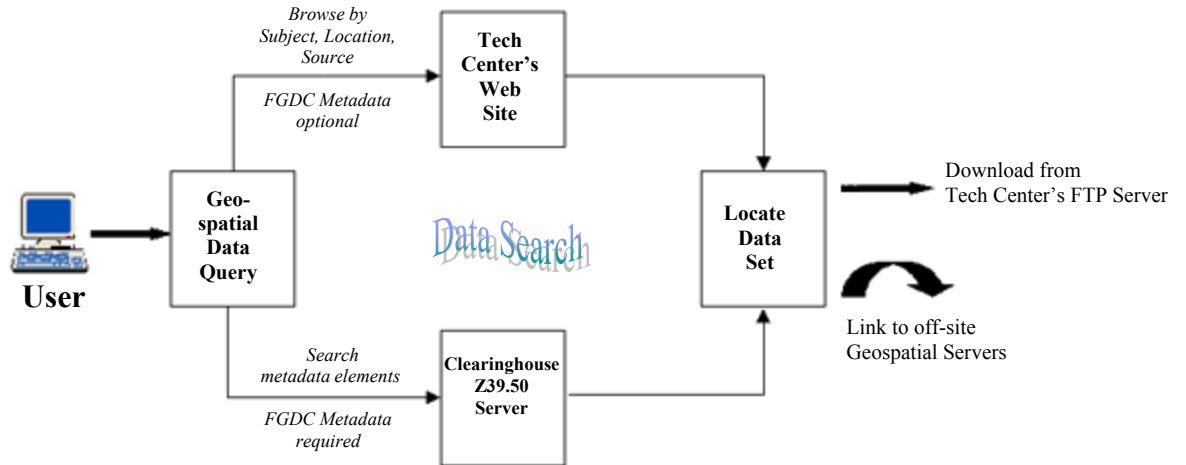
The State Data Clearinghouse and metadata catalogs allow users complete access to the WVGISTC data holdings that currently comprise 215 data coverages amounting to a terabyte of data. The Center focuses on providing the best available geographic data and information through the Internet to state users. The Data Clearinghouse, state and federal portals, along with published metadata, will continue to be the primary mechanisms by which users can efficiently and easily access certified and documented geospatial data through the Internet (Figures 3.6-3.7; Appendices G-I). To this end, a primary goal of the WVGISTC is to maintain and further develop the State Data Clearinghouse and geospatial data portals.

The screenshot shows the West Virginia GIS Technical Center website. At the top is a navigation menu with links: Home, About, News, Data, Internet Mapping, Education, Directory, State Activities, Software, and Links. Below the menu is a search interface for the 'West Virginia GIS Data Clearinghouse'. The search results show 213 hits for the query 'Census'. A table lists the results:

Title	Primary Source	Scale	Location
Census Block Groups with Population Data	U.S. Census	1:500,000	Statewide
Cities with Population > 10,000	U.S. Census	1:100,000	Statewide

**Figure 3.6** WVGISTC’s Web Site

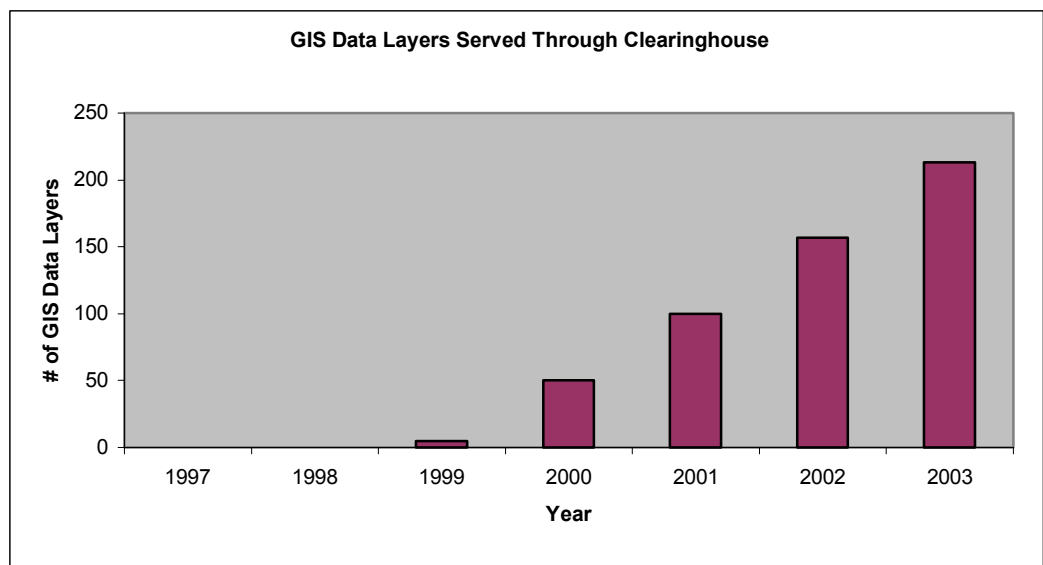




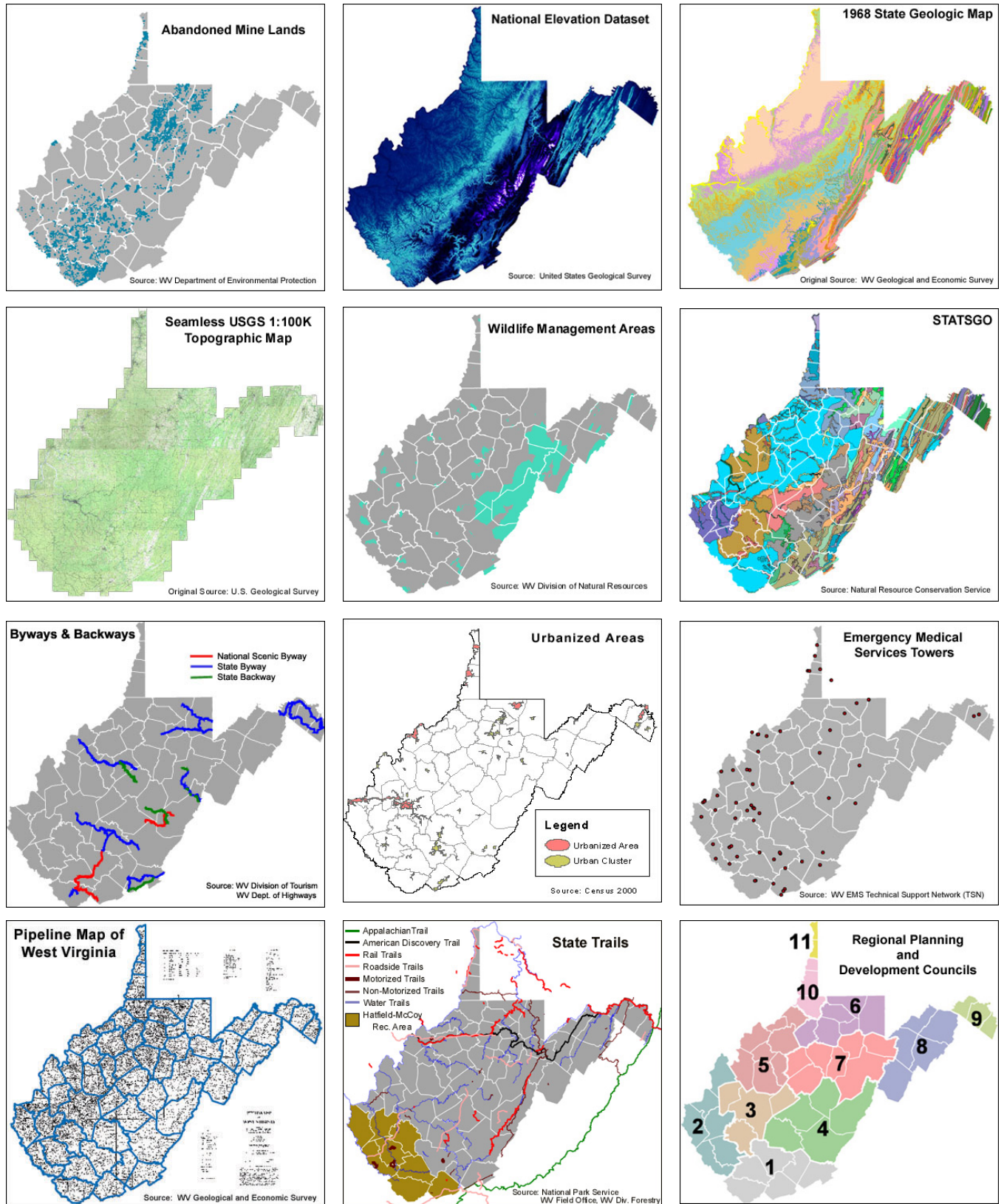
**Figure 3.7 Spatial Data Access and Distribution.** Spatial data can be accessed through multiple channels, primarily by browsing the Technical Center’s website (<http://wvgis.wvu.edu>) or by searching metadata elements through the Technical Center’s National Spatial Data Infrastructure (NSDI) Clearinghouse Server node (<http://www.fgdc.gov/clearinghouse/>).

2.1.1. *WV Data Clearinghouse Website*

The [WV Data Clearinghouse](#), accessed through the Technical Center’s website, serves the largest archive of geospatial data specific to West Virginia. WVGISTC supports Internet access to over [200 spatial datasets](#) and metadata that continues to expand as spatial datasets become available (Figures 3.8 and 3.9). Our [utilization report](#) (Appendix C) shows that the Data Clearinghouse is the most visited feature of our website and reflects the state demand for geospatial data.



**Figure 3.8** Growth of data served through the WV Data Clearinghouse



**Figure 3.9** Samples of over 200 geographic data layers published on the WV Data Clearinghouse

2.1.2. *National Portals: FGDC Clearinghouse Server Node / GeoData.gov Portal*  
Other channels from which spatial data can be accessed are the national [geodata.gov portal](http://geodata.gov) and the [National Spatial Data Infrastructure \(NSDI\) Clearinghouse Server Node](#). Presently WVGISTC serves as the designated national Clearinghouse Node for West Virginia. The national Clearinghouse Server Node network, sponsored by the Federal Geographic Data Committee (FGDC), is a decentralized system of servers located on the Internet that contain field-level descriptions of available digital spatial data. The Center's gateway node uses FGDC compliant metadata and Z39.50 Server to provide user access to WV Framework GIS layers.

2.1.3. *Metadata*

Metadata provides detailed information about spatial data and services, such as content, quality, and condition. WVGISTC provides abbreviated metadata for all datasets published on its website, and full metadata – using the Federal Geographic Data Committee (FGDC) Metadata Standard and its Z39.50 protocol server – for specific datasets. In the future, WVGISTC will publish metadata on Web portals that reference map services, Internet mapping systems, geographic data, mapping activities, and Clearinghouses.

2.2. *Geospatial News and Directory Services*

Electronic newsletters and submitted news postings to the Technical Center's website disseminate current GIS news about specific data sets, relevant Internet map data, statewide mapping activities, GIS standards protocols, and educational and training materials. An online directory provides the important linkages between GIS professionals and map users in the State.

2.2.1. *Internet Mapping Applications Catalog*

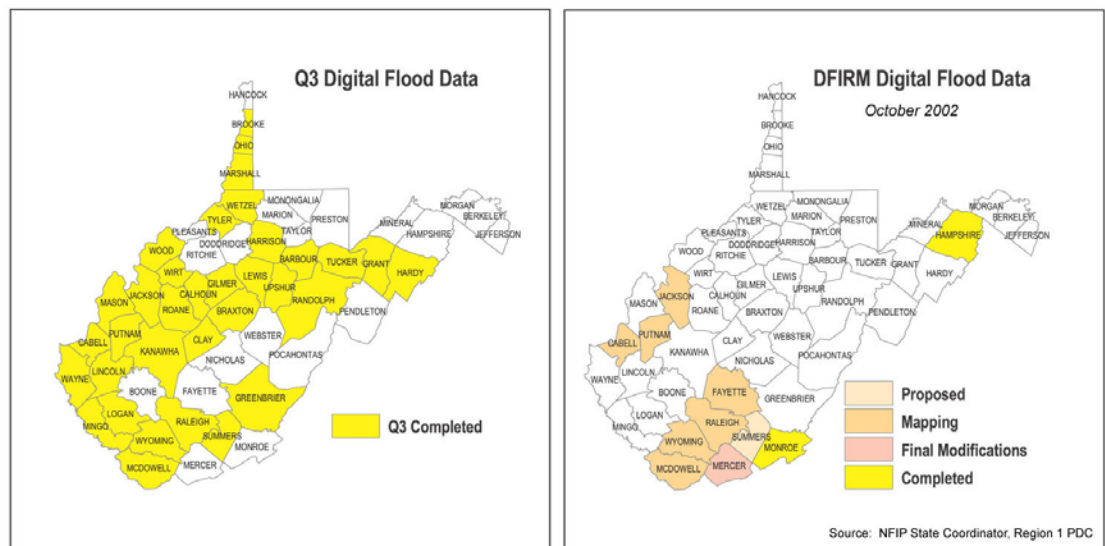
WVGISTC provides a catalog of [links](#) to Internet mapping applications that provide geographic information and downloadable data about West Virginia.

2.2.2. *Mapping Activities*

WVGISTC informs GIS professionals about major statewide activities through the [West Virginia GIS Activities](#) section. Major activities include status graphics of mapping activities and details of WV Framework data (Appendix J). Up-to-date information about major statewide mapping projects provides a list of ongoing and new state mapping and data development initiatives. WVGISTC publishes [status maps](#) and information about statewide mapping activities that support the WV Geospatial Community (Figure 3.10).



*GIS Mapping*



**Figure 3.10** Sample status graphics published on the Technical Center's website of ongoing, statewide mapping activities

### 2.2.3. Standards and Publications

Appropriate [standards and publications](#) for the WV Spatial Data Infrastructure are located by the Center and posted on WVGISTC's website.

### 2.2.4. GIS News

The WVGISTC will keep the WV geospatial community informed of statewide geospatial data and GIS activities through its bi-annual electronic newsletters [GIS news](#). GIS professionals [submit](#) news items, job or grant announcements for posting on the WVGISTC's website. WVGISTC also maintains an online [directory](#) of over 400 GIS professionals conducting GIS related activities in West Virginia. Name and organizational directory searches are available.

## 3. Coordinate with state, federal, local government, and private firms to define, refine, and implement state strategic GIS initiatives and standards-based geospatial data development.

WVGISTC provides a pivotal coordination and strategic planning capability between state, federal, and local government and private sector initiatives. WVGISTC advises organizations on statewide GIS integration and standards to ensure effective mapping activities and policy coordination. The Center monitors geospatial data development and map modernization programs at the state and federal levels.

### 3.1. National Spatial Data Infrastructure



The [National Spatial Data Infrastructure \(NSDI\)](#) is a visionary concept for organizations across the U.S. and abroad to cooperatively produce and share the 'best' available geographic data through all levels of government, the private and non-profit sectors, and the academic community. NSDI components include [Framework](#) data (base layers), [standards](#), [metadata](#), [Clearinghouse](#), and partnerships. The WV Spatial Data Infrastructure maintained by the Center is a geographic subset of the National Spatial Data Infrastructure and consists of key geospatial base layers such as hydrography, transportation, orthoimagery, elevation,



cadastral, geodetic control, governmental units, structures, and geographic names (Appendix J). Future Center Framework initiatives will integrate high-resolution (1:4800 scale or better) WV Statewide Addressing and Mapping Board ([WVSAMB](#)) data into the NSDI. These Framework data layers are compiled from local, state and federal agencies, representing the most common themes required by geographic data users in the State.

### 3.2. National Initiatives

WVGISTC is participating in several new national mapping initiatives to promote and accelerate completion of the Spatial Data Infrastructure. These initiatives include I-Teams, Geospatial One-Stop, and America View

#### 3.2.1. Framework Implementation-Teams (I-Teams)



[I-Teams](#) consist of GIS policy-makers who develop strategic plans about the production and stewardship of geospatial data. The GIS Development I-Team Plan provides support to organizations in the State within the executive and legislative branches. With assistance from the State GIS Coordinator, WVGISTC will lead the development of a comprehensive West Virginia GIS Development Plan to highlight spatial data as a strategic asset. A primary focus of West Virginia I-Teams is to oversee the development and maintenance of the base layers mentioned above. In February 2003, WVGISTC and the State GIS Coordinator invited cooperators to a [WV Framework Layer Coordination Meeting](#) to secure funding and technical services to enhance geospatial data sets generated by the WV Statewide Addressing and Mapping Board (WVSAMB), and to integrate new, standards-based geospatial base layers as part of the National Spatial Data Infrastructure (NSDI) at a minimum statewide scale of 1:4800 (1 inch equals 400 feet). These 'next generation' statewide geospatial datasets will constitute the 'West Virginia Spatial Framework' or digital base map for the State.

#### 3.2.2. GeoData.gov (Geospatial One-Stop)



The [GeoData.gov](#), also known as the [Geospatial One-Stop](#), serves as a public gateway for improving access to geospatial information and data under the Geospatial One-Stop e-government initiative. Launched by the Office of Management and Budget (OMB) and the Department of Interior, GeoDdata.gov features "one-stop" access to geospatial information and resources and allows multiple users in different locations to share information, while integrating data from many sources. It also allows easy searches for existing and planned data with a goal of "two clicks to content."

#### 3.2.3. America View



[America View](#) is a locally controlled and nationally coordinated program that builds on a congressional initiative to advance the availability, timely distribution, and widespread use of remotely sensed data. [West Virginia View](#), which complements the WV Data Clearinghouse, is a consortium that promotes remote sensing in West Virginia under the auspices of a starter grant from NASA.

### 3.3. State Technological Initiatives

The WVGISTC will represent and coordinate geospatial initiatives with information technology (IT) developments in the State to ensure efficient and cost effective government. Linked to this is the Governor’s direction to the Governor’s Office of Technology (GOT) to lead an e-government initiative for enterprise-wide IT planning and management efforts ([West Virginia Enterprise Information Technology Blueprint](#)). The WVGISTC, in collaboration with the State GIS Coordinator and other members of the geospatial community, will integrate and align a comprehensive WV GIS Development Plan with the State’s information technology plan. The WV GIS Development Plan will enable state and local entities to become more effective through the efficient use of GIS technologies and data.



### 3.4. National Map Modernization Programs

National modernization programs seek to improve the geospatial data quality and geoservices associated with National Map layers. National Map layers follow rigorous data content standards, incorporate additional attribution and functionality, and are easier to maintain and distribute on a long-term basis. Modernization facilitates the development of Web services such as state and national Portals for data visualization and sharing. Major national programs include *The National Map*, Flood Map Modernization, MAF/TIGER Modernization, Homeland Security Infrastructure Program (HSIP), and the Common Land Unit Program.

#### 3.4.1. USGS National Map

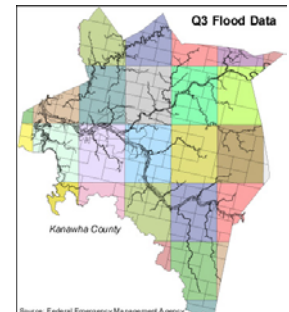
The USGS national program seeks to create a seamless, nationally consistent set of basic geographic data that will link topographic maps with best available quality, continually maintained spatial data that allows for print-on-demand maps from computer terminals that access the Internet. WVGISTC has initiated a [National Map](#) proposal to become a cooperative partner with USGS in their effort to synthesize base geographic information.



*The National Map*

#### 3.4.2. Involvement in Federal Map Modernization Initiatives

The WVGISTC is a [Cooperative Technical Partner](#) with the Federal Emergency Management Agency to implement a statewide digital flood-mapping program. Currently WVGISTC is creating digital flood map layers for WV counties. Eventually these flood map layers will comprise FEMA’s Digital Flood Insurance Rate Map (DFIRM) series.



*Digital Flood Data*

WVGISTC will provide statewide coordination and support for a major objective of the Census MAF/TIGER Modernization Program to realign existing 1:100,000-scale TIGER geographic database features like roads and rivers to a much greater locational accuracy (3 to 10 meter horizontal accuracy) for all of the nation’s 3,232 counties ([MAF/TIGER AIP](#)).



WVGISTC will continue to support the USGS / NIMA Homeland Security Infrastructure Program (HSIP) in the development of statewide critical infrastructure data sets. This is part of a national initiative to create a single integrated geospatial database for homeland security mapping and includes the 133 Cities Project, which designates the state capital, Charleston, WV, for high priority urban mapping. As part of the Department of Homeland Security's grant program, WVGISTC will assist the WV Office of Emergency Services to develop critical infrastructure mapping datasets that can be utilized by all levels of government, along with a Web-enabled critical infrastructure mapping system to disseminate this information in a secure environment.

WVGISTC will provide an advisory role in the implementation of GIS hazard mitigation databases for state and local plans as part of the Hazard Mitigation Grant Program [HMGP](#). This program is administered by the Federal Emergency Management Agency (FEMA), and provides grants to state and local governments to implement long-term hazard mitigation measures after declaration of a major disaster. The purpose of the program is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery period following a disaster.

WVGISTC will provide the USDA's Farm Service Agency (FSA) with technical assistance to implement its Common Land Unit Program in WV. This program is part of a nationwide effort to map the nation's farms and fields and establish the [Common Land Unit](#) (CLU) as a standardized GIS data layer that will allow mapping to be integrated easily on a nationwide basis.

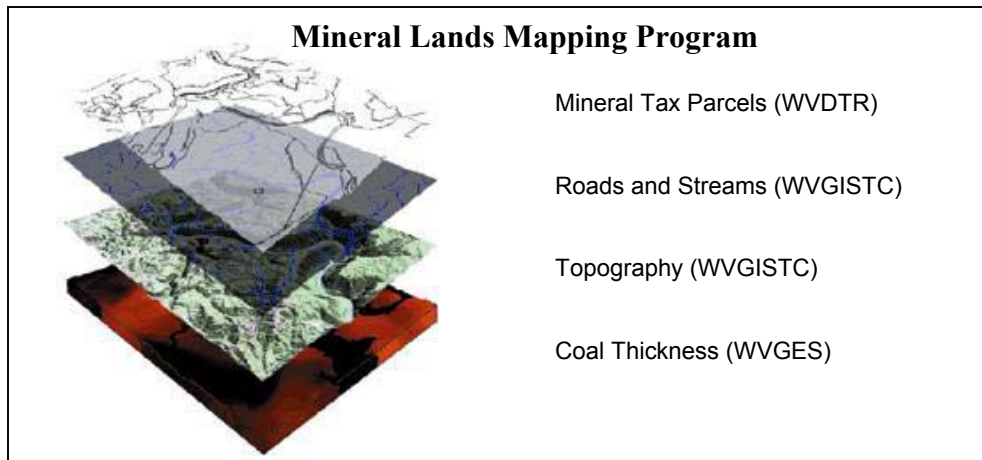
### 3.5. State Map Programs

The WVGISTC will continue to be integrally involved in the Mineral Lands Mapping project and support the Statewide Addressing and Mapping Board program. These two programs promise to have a profound impact on the WV Spatial Data Infrastructure.

#### 3.5.1. Mineral Lands Mapping Program (MLMP)



Established in 1995, West Virginia's Mineral Lands Mapping Program (MLMP) is a multi-agency, cooperative effort working to evaluate and quantify coal mineral properties for property tax purposes. The MLMP uses Geographic Information Systems (GIS) to model coal-bearing lands throughout West Virginia for natural resource assessment (Figure 3.10). The WV Department of Tax and Revenue's (WVDTR) Mineral Parcel Mapping Project (MPMP) reconciles and attributes mineral parcel records and maps. The WV Geological and Economic Survey's Coal Bed Mapping Project (CBMP) delineates, correlates, and maps coal seams. The WVGISTC's Digital Line Graph (DLG) Conversion Project produces planimetric and elevation vectors from USGS 7.5-minute topographic base maps.



**Figure 3.10** The (MLMP) is a collaborative effort to develop a comprehensive, statewide Geographic Information System for natural resource property mapping in West Virginia.

### 3.5.2. *WVSAMB Project*



In 2001 the WV State Legislature established the West Virginia Statewide Addressing and Mapping Board (**WVSAMB**) to develop and implement a statewide digital mapping system to assist public safety officials and emergency response personnel. Funded by Verizon, the system will include aerial photography for the development of digital maps and a GIS that will be integrated with Enhanced 911 services, state and local government agencies, telephone companies, the U.S. Postal Service and public utility systems. Michael Baker Corporation was selected as the project manager to provide oversight for the design, development, and implementation of the statewide addressing and mapping system. BAE SYSTEMS ADR was selected to deliver statewide orthophotos at 1:4800 scale (1" = 400 ft.), true color, along with derived planimetrics for street centerlines, hydrography, building centroids, footprints for major structures, and digital terrain models by December 2004. MicroDATA GIS, Inc., was selected to complete the statewide addressing files by 2007. Potential WVGISTC services to WVSAMB include data distribution, development of value-added products, or to act as an "area integrator" for spatial databases that comprise the addressing maintenance system.

### 3.6. **State Mapping Standards**

WVGISTC provides leadership in the implementation of statewide mapping standards that conform to national mapping guidelines. The Center played a lead role in establishing the WV Coordinate Systems standard, and currently is developing mapping standards and guidelines for the digital conversion of tax maps and large-scale geological maps.

### 3.7. **Contributions to the Statewide Organization Plan for GIS Technology**

The statewide organizational approach to GIS effects how business plans are coordinated among agencies and how well decision-makers, such as elected officials, understand the benefits of a robust Spatial Data Infrastructure.

3.7.1. *State Information Technology Office*



WVGISTC will seek to guide the integration of GIS into the State's information technology infrastructure. In 2003 Governor Wise merged two programs that oversee technology – the Governor's Office of Technology (GOT) and the Administration Department's Office of Information Services and Communications. This restructuring may lead to closer business relationships between the Office of State GIS Coordinator and the State Information Technology Office.

3.7.2. *Office of State GIS Coordinator*

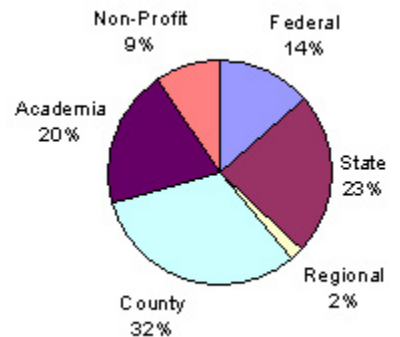
The WVGISTC will continue to work closely with the office of the State GIS Coordinator. The State GIS Coordinator, located within the West Virginia Geological & Economic Survey (GES), is the focal point for GIS coordination activities in West Virginia. Currently a "two-person" operation, the [State GIS Coordinator](#) receives additional administrative and technical assistance through the GES and has a working relationship with WVGISTC and the state tax department. The Coordinator does not develop, collect, or distribute geospatial data for any specific GIS project, but is responsible for the promotion, coordination, and implementation of GIS activities that integrate all levels of data development and varying types of GIS applications within the State. The Coordinator plays a principal role in several ongoing GIS database initiatives, primarily through the purchase of existing data sources or allocation of funds for contractual and consulting activities. Every 18 months the Coordinator organizes the WV GIS Forum and Exhibition, the largest GIS conference in the State.



*Craig Neidig  
WV GIS Coordinator*

3.7.3. *State GIS Professionals*

WVGISTC will continue to maintain and cultivate close contacts with GIS professionals in the State. Full-time GIS professionals occupy positions at all levels of government, academia, and the private sector (Appendix F). Presently, state agencies associated with natural resources have the largest full-time GIS staffs, although numerous governmental employees use GIS technologies to complement their projects.



*Full-time GIS Professionals  
working in West Virginia*

3.7.4. *WV GIS Steering Committee*



The WVGISTC is an active member of the State GIS Steering Committee and will continue to provide leadership, direction, geospatial news, and reports at each meeting. Chaired by the State GIS Coordinator, the WV Steering Committee serves as a forum for state and federal geospatial professionals to coordinate mapping activities and policies.

#### 4. Provide outreach, educational and training support, and advisory services to the citizens, government agencies, non-profit organizations, and businesses of West Virginia in the area of GIS and related spatial data handling technologies

##### 4.1. Technical Advisory Services

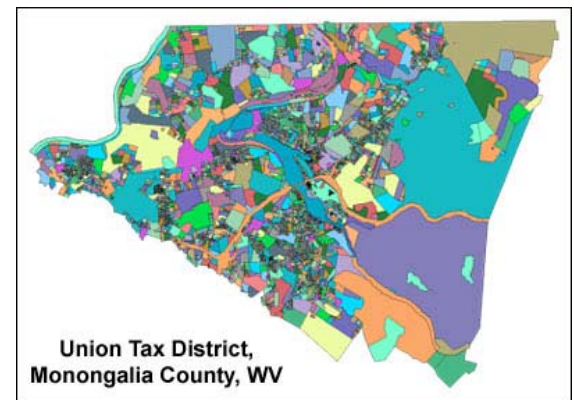
WVGISTC will continue to organize advisory committees to advance the WV Spatial Data Framework and provide advisory and coordination services to help specific entities implement successful GIS programs. Within its resources, WVGISTC will continue to offer these vital geographic services to the state GIS community.

##### 4.1.1. *Geodetic Control / Surveying Task Force*

WVGISTC will continue its coordinating role in the advisory task force to recommend data coordinate systems and datums to serve as the **official data exchange** standard for statewide geospatial data.

##### 4.1.2. *Digital Tax Maps Technical Advisory Committee*

The GIS Technical Center is spearheading the formation of a Digital Tax Mapping Advisory Committee to modernize procedures for creating digital tax maps in West Virginia. Cadastral mapping experts from both the public and private geospatial community can serve on the Tax Mapping Advisory Committee, with the first meeting held in February 2003. The Committee will explore legislation that will provide a framework for digital tax mapping procedures in the State. The proposed procedures will include topics such as the (1) digital conversion and parcel maintenance of seamless map files; (2) linkage of map files to assessment databases; and the (3) electronic and hardcopy map production of tax maps. New procedures will be tested and validated



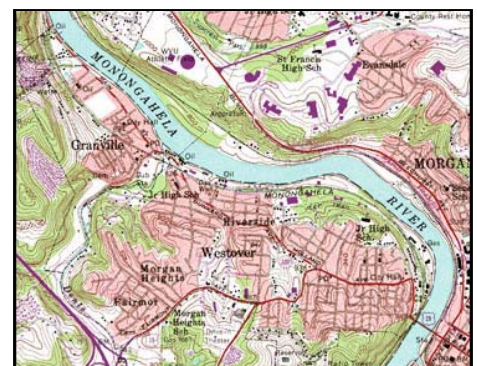
*Tax Mapping*

##### 4.1.3. *County Government Business Plans*

The WVGISTC will continue to work closely with county government to provide GIS strategic planning services. This is actively ongoing in several counties such as Preston and Monongalia Counties.

##### 4.1.4. *DRG Technical Advisory Committee*

USGS topographic maps in a georeferenced digital format are a popular reference layer for mapping applications. WVGISTC is leading an effort to create uniform, collarless Digital Raster Graphics (DRG) of USGS topographic maps in both GeoTIFF and ArcSDE formats. Issues being addressed are the (1) no data value, (2) color model, (3) scan resolution, and (4) horizontal datums.



*Scanned Topo Map or DRG*



4.1.5. *Other Advisory Groups*

To develop high quality spatial datasets, WVGISTC will lead efforts to create digital conversion procedures for (1) 1:24,000-scale geological maps, (2) consistent high-resolution land cover, and a (3) statewide digital gazetteer with updated cultural features. The Center will also participate in organized efforts to attain statewide, high-resolution elevation data.



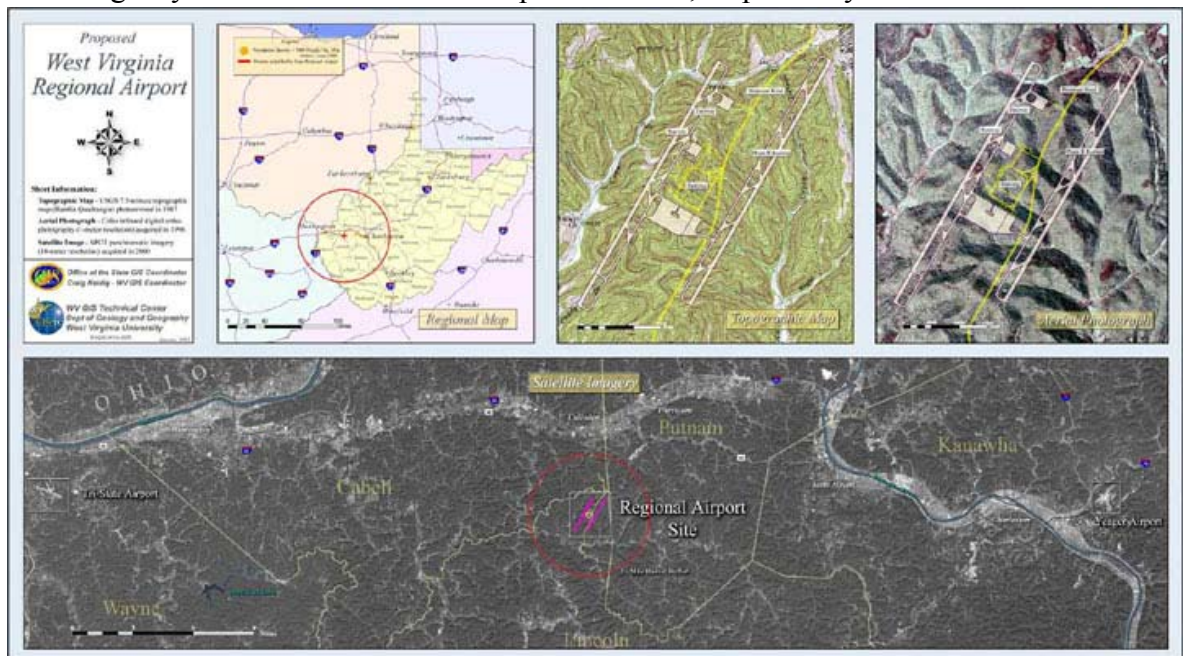
*High-resolution elevation data*

4.2. **Technical Support Services**

WVGISTC receives several service requests per day via e-mail or telephone. Service requests are categorized as data requests, data conversion, or miscellaneous technical support. Over half of the service requests are data requests related to the WV Spatial Data Infrastructure. According to WVGISTC’s [Utilization Report](#) (Appendix C), requests for digital orthophotos are the top data service request. The report also reveals that 35% of all service requests are from the private sector. In the past year WVGISTC has supported groups in their development of local transportation planning and state trail maps. WVGISTC may charge a fee for special map requests, data conversion, and CD reproduction.

4.3. **Outreach Services**

To promote GIS in the community, WVGISTC will continue to provide outreach services to organizations throughout West Virginia. Notable completed projects include maps of a local Rail Trail and the proposed Kanawha Valley regional airport (Figure 3.11). WVGISTC also created statewide critical infrastructure and economic development maps for the WV Office of Emergency Services and WV Development Office, respectively.



**Figure 3.11** Proposed WV Regional Airport, Lincoln County, WV

#### 4.4. Training and Education

One of the primary goals of WVGISTC is to promote the best appropriate use of GIS through training and educational services. WVGISTC will expand its efforts in this area still further in the next five years to provide relevant and quality training to the statewide GIS community.

##### 4.4.1. *GIS Training and Certification*

Faculty and staff at West Virginia University train and certify students in Geographic Information Science, GIS technology, and GIS applications. Periodically WVGISTC provides GIS training courses. When circumstances need, WVGISTC “outsources” GIS staff to government agencies such as the State Historic Preservation Office, providing these agencies with the expertise necessary to develop and maintain a state-of-the-art GIS. WVGISTC is in the process of becoming an ESRI Authorized Learning Center, whereby certified instructors teach ESRI GIS courses.



*GIS Teaching Lab*

##### 4.4.2. *Workshops and Conferences*

WVGISTC conducts a variety of GIS workshops, educational seminars, and poster displays at conferences. For the 2001 West Virginia GIS Forum and Exhibition, WVGISTC coordinated workshop classes for over 100 attendees. In 2002 WVGISTC conducted four workshops and 11 educational presentations. In spring 2003, the Center sponsored the Appalachian Remote Sensing Conference and ESRI Land Records Management seminar. In spring 2004, WVGISTC is hosting a GIS Conference and Workshops.



*State GIS Conference*

##### 4.4.3. *GIS Day*

**GIS Day** is an event held every November to promote awareness of GIS practices. Vendors and users open their doors to schools and businesses to promote the uses of GIS technology. On GIS Day WVGISTC provides on-site GIS education for local school children.



*GIS Day*



#### 4.5. GIS Users Groups

WVGISTC will continue to lead GIS presentations and support GIS Users Groups.

User group meetings allow for members of the GIS community to discuss ongoing projects, applications, and the latest GIS tools. The meetings also help GIS software companies to keep in touch with users and to answer questions about current and planned technology, and issues raised by users about their GIS. Presently an ESRI GIS Users Group meets biannually.

### 5. Undertake and support research and projects in GIS that improve the safety, quality of life, and economic well being of all West Virginia citizens.

The GIS Technical Center conducts research and provides support to statewide users in the development, improvement, application and access to geographic information technologies, including GIS, Global Positioning Systems (GPS), remote sensing, Geovisualization, and other emerging geospatial technologies.

#### 5.1. Geographic Information Technologies Research

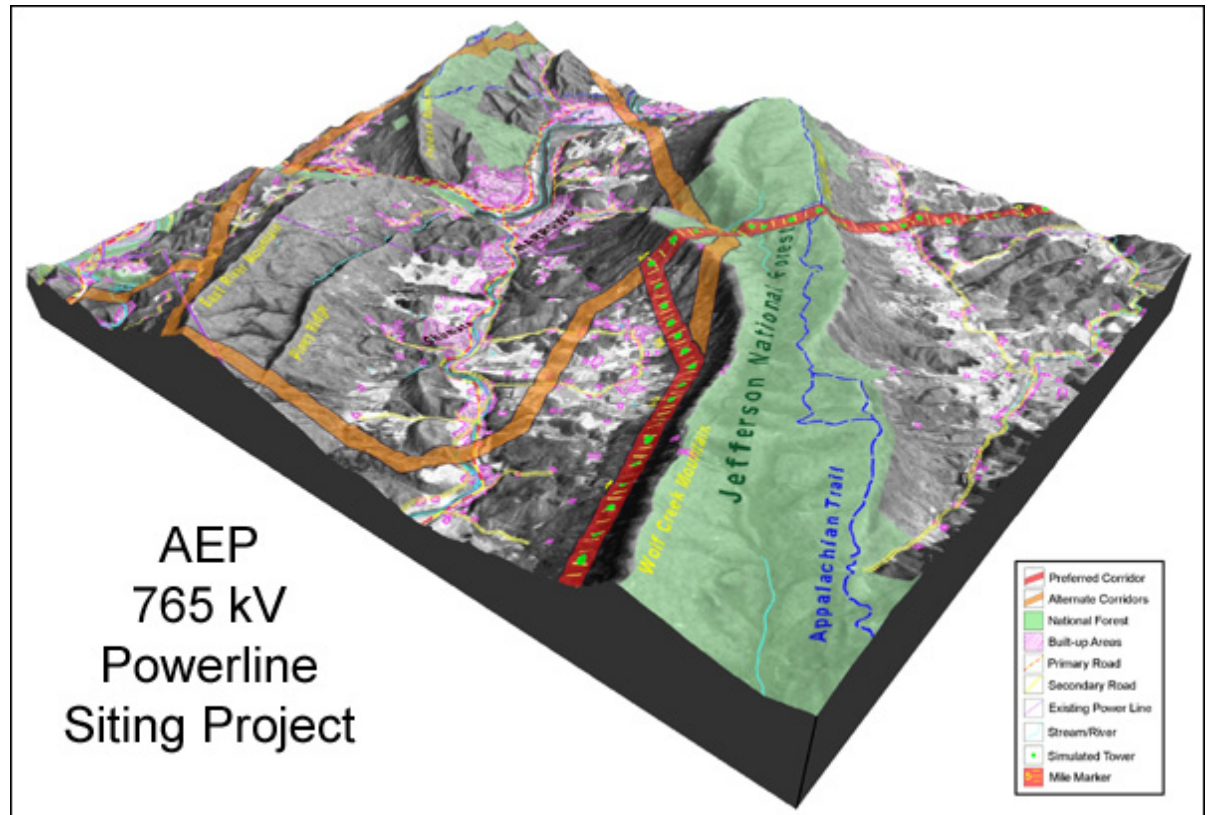
The WVGISTC will undertake research activities in GIS and Geographic Information Science (GISci) that contribute to the effective and cost efficient use of the technologies by state entities, and improve the economic well being and quality of life of West Virginia residents. Technologies such as remote sensing, GPS, and GIS perform essential everyday tasks in government and business. In studying the science behind GIS technologies the Center draws upon its research and educational focus to identify emerging topics that will keep the State apprised of the latest developments in GISci and able to participate and benefit from these advances in a timely manner. The complexity of the GISci discipline extends beyond the ability of most organizations to be involved in all the contributory multidisciplinary fields, for example, cognitive science, computer science, engineering, geography, information science, mathematics, philosophy, psychology, social science, and statistics. By focusing on the most recent advancements in GIScience to generate digital spatial data, process that data, or disseminate the information via the Internet, the Center is able to provide a research support capability to all geospatial data users in the State. WVGISTC staff are expert and experienced in GIS and will continue to contribute to GIS developments in the State.



*GIS Faculty*

## 5.2. Support GIS Application Projects

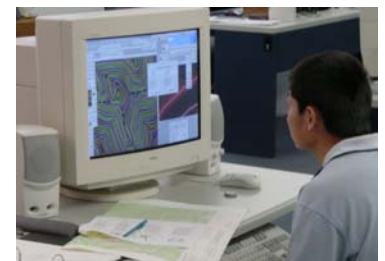
The Center will continue to undertake GIS application projects that support and enable local, state, and private sector organizations to benefit the people of WV. GIS applications extend geographic information technologies across a number of domain areas to enhance decision-making and generate significant time and cost savings to state agencies. The current Center focus on state homeland security, hazard mitigation planning, transportation, cadastral, health, community planning, economic development, and environment will be augmented as the priority of other projects becomes known. Application projects will be developed through contact with government agencies, businesses, and non-profit organizations.



**Figure 3.12** Example GIS Application: an environmental, cultural, and visual impact study associated with locating a transmission line in West Virginia and Virginia.

## IV. WVGISTC Capacity

WVGISTC possesses new hardware resources and a superior software library that includes a full suite of ESRI GIS products, GPS equipment, and image processing. Most importantly, WVGISTC has a staff of full-time, degreed professionals organized to meet state needs for the use of GIS and related technologies.



*GIS Professional*

## People and Expertise

The Technical Center features an experienced staff with diversified backgrounds in many aspects of GIS (Appendix A). Drs. Harris and Elmes are the Center's co-directors, and each has over 20 years of experience in the field of GIS. Dr. Harris has applied knowledge of visualization, expert systems and environmental and social impact assessment to the field of GIS. Likewise, Dr. Elmes brings considerable knowledge of GIS in the management of environmental and human resources and in health applications. The Center's supervisory staff features backgrounds as diverse as geology, software engineering, wildlife management, physics, database design, computer science, and economic geography. Our technicians are well-trained professionals in the field of GIS, with a cumulative experience of more than 35 years. Additional graduate assistants, interns, and temporary workers are hired for specific projects as required.

The Technical Center benefits greatly from its affiliation with West Virginia University and draws on a wealth of expertise in nearly every discipline from engineering to law, and medicine to economics. The Regional Research Institute provides direct connection to state population statistics and forecasts, and economic modeling and planning. Cooperative agreements can be made on an as needed basis with nearly any department or agency associated with the University.



**Figure 4.1** WVGISTC Computer Lab

## Computer Facilities and Hardware

Located on the third floor of White Hall at West Virginia University, the Technical Center is housed in a modern computer lab environment and has a large open work area where its employees can freely collaborate to projects (Figure 4.1). Mapping projects are completed with a variety of hardware and software resources. Hardware at the Technical Center consists of high-end computer workstations, large-format plotters, and a high-resolution color drum scanner. An extensive library of software includes new mapping and remote sensing/image processing software such as ESRI, Bentley MicroStation, ERDAS Imagine, and AutoDesk.



## Computing Resources

WVGISTC has a full array of computer resources to carry out its mission. The facilities include:

- High-resolution, large-format color drum scanner (1000 pixels per inch)
- 500 Gigabytes networked, mirror / RAID data storage
- Sun UNIX server
- 30 PC workstations and servers with 350, 450, 500 and 1200 MHz processors
- Large-format color plotter (54-inch capacity, 600 dpi resolution)
- Mapping software: ESRI ArcGIS, AutoCAD, Bentley MicroStation, and ERDAS Imagine
- GPS equipment and related software
- 2,000 sq. foot custom-built suite of computer labs



The Technical Center typically works from source material on mylar, paper, and digital media. The Center features a large format drum scanner capable of converting hardcopy source materials to digital format. Once in digital format, technicians use an assortment of software to process, manipulate, and incorporate this digital data into GIS products. Each workstation may be easily reconfigured to meet the specific needs of any given project. Several specialty stations in the Technical Center are configured to accomplish a variety of specialty tasks, from image editing, to GPS post-processing, to CD burning.



Each of the personal computers, workstations and peripheral devices is networked on a high-speed gigabit backbone. Very large files can be moved quickly over the network. Several servers control the network and meet a wide range of needs, including basic domain level networking, Web and FTP serving to data storage, and multiple security and data redundancy and failure management. Data storage needs are met via a high capacity RAID system. To satisfy diverse requirements, the Center's server system operates on a mix of Unix, Linux, and Windows platforms.

Final products are created on several specialty tools. Digital products can be written on several forms of storage media for delivery, including DVD, CD-RW, CD-ROM. Large paper products, up to 54 inches in width, are printed on one of two large format plotters (Figure 4.2). Smaller paper products can be printed on laser printers, one of which is capable of color output.



Field data collection is accomplished through the use of GPS units (Figure 4.3) and digital cameras. Although data production is a significant portion of the Technical Center's capacity, the Center is also capable of housing a wealth data. The RAID system mentioned above can house 240 gigabytes of compressed digital data.



**Figure 4.2** Plotting Equipment



**Figure 4.3** GPS Equipment

## Appendix A: WVGISTC Personnel

Dr. Trevor M. Harris, Co-director

Dr. Gregory A. Elmes, Co-director

Kurt Donaldson, Project Manager

Frank LaFone, Internet Applications Programmer

Nicole Edwards, Professional Technologist

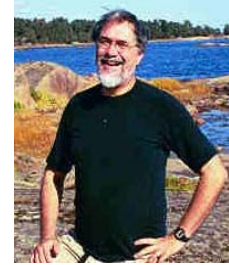
Eric Hopkins, Professional Technologist

Kevin Kuhn, GIS Technician

Scott Lamon, GIS Technician



*Dr. Harris*



*Dr. Elmes*



*Technical Center Staff:*

*(Top) Kurt Donaldson, Eric Hopkins, Scot Lamon, Kevin Kuhn*

*(Bottom) Frank LaFone, Brenden Duffy, Nicole Edwards*

## TREVOR HARRIS

Co-Director

### EDUCATION

**Ph.D. Geography**, University of Hull, UK  
**BA Geography and History**, University of Hull, UK

### EXPERIENCE

Eberly professor of Geography and Chair,  
 Department of Geology and Geography 8 years  
 Co-director WV GIS Technical Center 11 years

### TEACHING

Advanced Geographic Information Science  
 Geographic Information Science Applications  
 Digital Mapping and Computer Graphics  
 Exploratory Spatial Data Analysis  
 Environmental Impact Assessment

### PUBLICATIONS 2002-2003:

Harris, T. M. and D. Weiner (forthcoming) Reflections on Participatory Geographic Information Systems, in Francis Harvey (ed), *GIS in Critical Geography*, Taylor and Francis

Lock, G. and Harris, T. (forthcoming) Enhancing predictive modeling: location, landscape, and culture, (ed) Mark Mehrer and Konnie L. Westcott, *GIS and Archaeological Predictive Modeling*, Taylor and Francis.

Weiner, D. and Harris, T. M. (forthcoming) Community-Integrated GIS for Land Reform in South Africa, *URISA*.

Harris, T. M. (2002) GIS in Archaeology, in Knowles, A.. (ed) *Past Time, Past Place: GIS for History*, ESRI Press, Redlands California, pp131-143.

Craig, W., Harris, T. M. and Weiner, D. (eds) (2002) *Community Participation and Geographic Information Systems*, Taylor and Francis, London.

Weiner, D., Harris, T. M. and Craig, W. (2002) Community Participation and GIS, in Craig, W., Harris, T. M. and Weiner, D. (eds) (2002) *Community Participation and Geographic Information Systems*, Taylor and Francis, London.

Craig, W., Harris, T. M. and Weiner, (2002) Conclusion in Craig, W., Harris, T. M. and Weiner, D. (eds) (2002) *Community Participation and Geographic Information Systems*, Taylor and Francis, London.

Harris, T. and Weiner, D. (2002) Implementing PPGIS: Perspectives from South Africa fieldwork, in Craig, W., Harris, T. M. and Weiner, D. (eds) (2002) *Community Participation and Geographic Information Systems*, Taylor and Francis.

### Funded research projects 2000-2003:

Using GIS and Virtual Reality to deliver real-time, virtual information spatially embedded in mission critical environments. Co-Principal Investigator. Sponsor: Research Challenge Grant, WV Higher Education Policy Committee (\$460,394)

Integrating Light Distance and Ranging (LIDAR) technology with Geographic Information Systems (GIS) and Virtual Reality. Principal Investigator. Sponsor: The State of West Virginia Research Challenge Grant Competition (\$150,000)

Application of GIS software to occupational lung disease health and hazard surveillance data. Co-Principal Investigator. Sponsor: National Institute of Occupational Safety and Health (\$24,900)

Integrating GIS and Immersive Technologies. Principal Investigator. Sponsor: National Science Foundation EPSCoR (\$499,927)



## EDUCATION

**Ph.D. Geography**, The Pennsylvania State University  
**M.Sc. in GIS**, University of Edinburgh, Scotland  
**MA Geography**, The Pennsylvania State University  
**BSc Geography**, University of Newcastle upon Tyne

## EXPERIENCE

West Virginia GIS Technical Center, 11 years  
West Virginia Univ., Dept. of Geology and  
Geography, 25 years

## TEACHING

Intro and Advanced Geographic Information Systems  
Digital Cartography  
Spatial and Quantitative Analysis  
Research Design

## PUBLICATIONS:

- Casper M., Barnett, E., Halverson, J. A., Elmes G. A.,  
Braham, V.E., Majeed Z. A., Bloom A. and  
Stanley S. (2001) *Heart Disease in Men: An  
Atlas of Racial and Ethnic Disparity in  
Mortality*, CDC, Office for Social and  
Environmental Health Research, WVU,  
Morgantown, ISBN 0-9665085-2-1.  
Elmes G. A. and Wright R., (2000) Cross-  
Cutting the UCGIS Challenges in  
geographic Information Science: Reviews  
of Essential Progress and Vision in Major  
Application Domains, Journal of the Urban  
and Regional Information Systems  
Association, Vol. 12, No. 2, 4-5.
- Rushton J., Elmes G., and McMaster R. (2000)  
Considerations for Improving Geographic  
Information System Research in Public Health,  
Journal of the Urban and Regional Information  
Systems Association, Vol. 12 No. 2. Pp. 31-47
- Barnett E., Braham V.E. Halverson J. A., and Elmes G.  
(2000) Urban-Rural Trends in Coronary Heart  
Disease Mortality in Appalachia, 1980 –1993,  
Annals of Epidemiology Vol. 10 No. 6.
- Casper M., Barnett, E., Halverson, J.A., Elmes G. A.,  
Braham, V.E. (2000) *Heart Disease in Women:  
An Atlas of Racial and Ethnic Disparity in  
Mortality*, CDC, Office for Social and  
Environmental Health Research, WVU,  
Morgantown, ISBN 0-9665085-0-6.
- Barnett, E., Elmes G. A., Braham, V.E. and Halverson, J.  
A. (1998) Coronary Heart Disease Mortality  
Trends Among Whites and Blacks – Appalachia  
and United States, 1980 –1993, Morbidity and  
Mortality Weekly Report (MMWR), Vol 47,  
No. 46, pp. 1005 et seq.

## FUNDED RESEARCH PROJECTS

- Co-Investigator (D.Weiner PI; C. Masilela,  
Brent Mcusker, Ge Lin, Co-  
Investigators) Monitoring Beira  
(Mozambique) Using Geographic  
Urban Indicators, UCGIS/HUD, in  
cooperation with CIDD, Catholic  
University of Mozambique.
- Co-Investigator (Trevor Harris and Ge Lin,) “Application of GIS software to occupational lung disease health and hazard surveillance data,” NIOSH, \$25,000.
- Co-Investigator with Elizabeth Barnett, “Spatial Analyses of Cardiovascular Disease: A GIS Approach.” CDC funding through the Association of Teachers of Preventive Medicine (ATPM)
- Co-Investigator (Elizabeth Barnett, P. I.; Luc Anselin, Co-Investigators) Stroke in the Elderly: Small Area Analyses to Support Prevention Efforts Among Medicare Beneficiaries,” West Virginia Medical Institute & Health Care Financing Administration, (HCFA)
- Principal Investigator, “Developing Dynamic Multimedia-based Educational Outreach Software for Presentation of NSDI Concepts,” US Geological Survey.
- Co-Principal Investigator with Trevor Harris, Chetan Desai and Joseph Sewash, “Implementing the Foundation of an Operational Framework for West Virginia,” US Geological Survey.

## COMPUTER/TECHNICAL EXPERIENCE

**GIS:** ArcView, ArcGIS 8.x, ArcInfo, IDRISI, GRASS

**Applications:** GYPSES: Gypsy Moth IPM Expert System.

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## **EDUCATION**

MS, Geology, West Virginia University  
BS, Computer Science, Augusta State University, GA

## **MANAGEMENT EXPERIENCE**

West Virginia GIS Technical Center 4 years  
WVU GIS Laboratory 4 years  
Active Duty Army 3 years

## **MAJOR COMPLETED PROJECTS**

- AEP 765kV Transmission Line Siting
- Digital Line Graph Conversion Project
- Digital Tax Map Conversion
- Statewide Economic Development Map
- Statewide Critical Infrastructure Map
- Petroleum Gas Well Internet Mapping Project
- National Register Accuracy Improvement Project
- Geologic Map Conversion Project
- WVU Campus Map

## **Profile**

Mr. Donaldson is project manager of the West Virginia GIS Technical Center. Mr. Donaldson advances the State's Spatial Data Infrastructure through digital mapping projects and services focused on data development and coordination. He oversees public access to geospatial data and information via the WV Geographic Information Network, a suite of Internet services that includes the Data Clearinghouse, metadata catalogs, and geospatial newsletters and postings. Mr. Donaldson implements and promotes statewide mapping guidelines that conform to national mapping standards, and extends geographic information technologies and scientific research to GIS applications that improve the safety and quality of life for all West Virginia citizens.

Under his leadership since 1999, the WV GIS Technical Center has grown in many areas. The Center's geospatial archive and geographic information network services increased 200% and 600%, respectively, leading to significant utilization of the Center's resources by the public and private sectors. Mr. Donaldson has supervised the completion of diverse mapping projects including an Innovative Partnership Agreement with the U.S. Geological Survey to prepare statewide digital topographic base maps. These elevation, transportation, hydrology and administrative maps have a variety of uses for GIS applications and are available in the public domain.

Previously, Mr. Donaldson was project manager for a large, multifaceted, \$2 million 765 kV power line siting project of unprecedented scope for American Electric Power. Mr. Donaldson planned, developed, and coordinated technical aspects of the transmission line study in WV / VA, completing project requirements within strict deadlines and with minimal staff.

With technical experience in geographic information systems and comprehensive experience in project administration and management, Mr. Donaldson ensures that the WV GIS Technical Center continues to provide vital mapping services to the statewide geospatial community.

## **Mapping Publications**

Standards for WV Coordinate Systems (2002)  
WV Framework Data Report (2002)  
WVDOT GIS Implementation Plan (2002)  
Digital map conversion for geologic maps (2003)  
WV Local Government GIS Business Plan Template (in progress)  
Digital Tax Mapping Guidelines (in progress)

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## **EDUCATION**

**MA**, International Relations, Syracuse University  
**BS**, Computer Science, West Virginia University  
**BA**, International Relations, West Virginia University

## **EXPERIENCE**

West Virginia GIS Technical Center	3 years
VTLS, Inc	1 year
Lockheed Martin	2 years

## **TRAINING**

Introduction to ArcSDE using ArcInfo 8  
Creating, Editing, and Managing Geodatabases  
ArcGIS

## **COMPUTER/TECHNICAL EXPERIENCE**

**GIS:** ArcGIS, ArcIMS, Mapserver  
**Languages:** C/C++, Visual Basic, Perl, PHP, XML, Javascript  
**Database/analysis:** Microsoft Access, MySQL  
**Operating Systems:** Windows 95/98/NT/2000, MS-DOS, unix, Solaris, linux, Mac OS 8.x/9.x  
**Hardware:** component building & maintenance of PCs, Group Networking  
**Technical Areas:** Internet Applications Programming, Database design, Internet Mapping, Image processing applications development, Software Engineering, IV&V

## **Profile**

Mr. LaFone is charged with software development projects for the West Virginia GIS Technical Center. His primary focus is Internet Mapping Applications, an increasingly critical component of GIS systems. He is also highly involved in technical research for up and coming technical solutions to current problems in GIS. Mr. LaFone is heavily involved in the Open Source community and continues to adapt these solutions to GIS applications development. Beyond his programming expertise, Mr. LaFone is charged with specifying, purchasing, developing, and maintaining the technical systems of the WV GIS Technical Center.

Prior to working at the Technical Center, Mr. LaFone worked in a broad range of positions that brought him in contact with a wide variety of technical fields. He has developed software interfaces for scientific instruments connected to truck engines. He also worked closely with the electrical components of these test devices; including helping develop new testing devices created from component parts. Following his educational years, Mr. LaFone worked in the defense industry making software systems for the military. He worked on a variety of areas, including image-processing systems, Internet interface systems, testing systems, systems design, and applied security systems. The majority of this work was done under a Department of Defense security clearance. He then took his experience in the defense industry and applied it to the field of library systems development. Here Mr. LaFone gained valuable experience in large-scale database design and maintenance. In addition, he was able to branch out his computer language skills to incorporate other, more specialized programming languages. This allowed him to quickly learn new languages and techniques as tasked dictated.

In addition to his work at the Technical Center, Mr. LaFone has developed Internet systems for other University agencies. This has allowed him to flex his creative skills. Furthermore, he has had the opportunity to work outside of the office on a wide variety of technical projects. He has helped develop interfaces for medical monitoring equipment, fire fighter safety equipment, and environmental monitoring equipment.

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## EDUCATION

BS, Geology, West Virginia University

## EXPERIENCE

West Virginia GIS Technical Center 5 years

West Virginia Univ., Dept. of Physics 7 years

## TRAINING

Digital Image Processing

Intro and Advanced Remote Sensing

## COMPUTER/TECHNICAL EXPERIENCE

**GIS/CAD:** ArcView, ArcGIS 8.x, ArcInfo, ERDAS Imagine, Microstation, Autodesk CAD/Map

**Graphics/Image Processing:** Adobe Photoshop

**Servers:** WarFTPd (Windows), ncFTPd (unix), ESRI Map Objects IMS set up

**Database/analysis:** Microsoft Access

**Other:** Experience with all Microsoft Office Products

**Operating Systems:** Windows 95/98/NT/2000, MS-DOS, unix, Solaris, linux, Mac OS 8.x/9.x

**Hardware:** large format drum scanner, digital camera, component building & maintenance of PCs, Ethernet set up, large format printers

## Profile

Mr. Hopkins, a professional technologist at the West Virginia GIS Technical Center, contributes to all aspects of digital line graph (DLG) production, from source material acquisition, scanning and image processing to digitizing, quality control and final product delivery. He supervises permanent technicians and student assistants working on DLG and other GIS / mapping projects, and is the senior analyst for a 1:24,000 scale geology quadrangle digital map conversion pilot study.

Previous experience in a solid state materials analysis lab in the West Virginia University Department of Physics brought Mr. Hopkins into contact with a broad range of scientific computer hardware and software and their respective data input / output processes. Mr. Hopkins collected and analyzed x-ray, thermal, optical and infrared data in support of collaborative projects and submissions for publication to peer-review journals.

Mr. Hopkins, in addition to his GIS tasks, administers network log-in accounts and the ftp service associated with the Technical Center's web site, implements data backup strategies, and maintains Windows and Sun/unix computer hardware and software. He is the primary in-house contact for maintenance service of Sun workstations and the Center's high-resolution large format color drum scanner.

## Publications

X-ray diffraction analysis of the products of coal-liquefaction and co-liquefaction. Poster presented at the Ninth Annual Technical Meeting of the Consortium for Fossil Fuels Liquefaction Science, 15-18 August 1995, Pipestem, WV.

Ibrahim, Manjula M., Eric Hopkins and Mohindar S. Seehra. Thermal and catalytic degradation of commingled plastics. Fuel Process. and Technol. (1996), 49 (1-3), 65-73.



**NICOLE EDWARDS**  
 Professional Technologist

**EDUCATION**

MS, Wildlife Biology, Clemson University  
 BA, Biology, Boston University

**EXPERIENCE**

West Virginia GIS Technical Center	5 years
U.S. Fish and Wildlife Service	8 years
Clemson University	5 years

**TRAINING**

Introduction to ArcSDE using ArcInfo 8  
 Creating, Editing, and Managing Geodatabases  
 Introduction to Oracle: SQL and PL/SQL  
 Oracle Developer: Build Forms I

**COMPUTER/TECHNICAL EXPERIENCE**

**GIS/CAD:** Fragstats, Idrisi, Microstation, R2V, ArcView, ArcGIS 8.x, ArcInfo  
**Database/analysis:** dBase, Paradox, Microsoft Access, SQL, SAS  
**Other:** Proficient in all Microsoft Office Products. Experience with Adobe Photoshop.  
**Operating Systems:** Windows 95/98/2000, Windows NT, MS-DOS, UNIX  
**Hardware:** Flatbed, slide, and large format scanners, digital camera, CD-ROM recorder, network cable construction, inkjet, laser, and large format printers

**Profile**

Ms. Edwards is a professional technologist at the West Virginia GIS Technical Center. Ms. Edwards supervises GIS technicians in Digital Line Graph conversion of topographic maps and performs quality control of digital products to meet federal standards. She has five years experience with ESRI GIS software including ArcView, ArcGIS, and ArcINFO. Ms. Edwards develops project and administrative database applications in Microsoft Access, and supervises the implementation of mapping projects. She has set up a Geospatial Data Clearinghouse node and produced metadata accessed via the Internet. She coordinates with internal and external colleagues for data transfer and management of public ftp site. Ms. Edwards trains new staff, state and local government staff in GIS and Microstation software and is responsible for tours and presentations in the Tech Center and at state conferences.

Ms. Edwards received her Masters in Wildlife Biology in 1995 from Clemson University and then worked for the university for two years as Data Coordinator. She designed and conducted a three-year research project where she collected, analyzed, and summarized data using SAS and published results in peer-reviewed journal. Her field/technical experience included habitat mapping and classification, vegetation sampling, aerial photo-interpretation, avian census techniques, wetland plant identification, and extensive software/hardware training. As Data Coordinator, she designed, developed, and maintained several MS Access databases, created data collection forms, performed analyses using SAS, and produced reports. She also synthesized scientific papers into manuals for use by forestry professionals and assisted in the production and publication of a conference proceedings. Ms. Edwards managed grant accounts and met federal guidelines for USGS Fish and Wildlife Cooperative Research Unit. Finally, she trained and participated in the Clemson University Technology Support Program, acting as liaison between system users and computer center and consulting with students and faculty on software and hardware issues.

Ms. Edwards has been employed part time by the U.S. Fish and Wildlife Service since 1994. She is responsible for information management for a small field office in South Carolina. She uses Microsoft Access to manage a species population database and also publishes annual updates to the species bibliography. Most recently, she was associate chair for a conference attended by over 300 people who are involved in species management.

**PUBLICATIONS** (maiden name McKay):

Edwards, N.T. and Susan L. Miller. 2003. Red-cockaded woodpecker population data collection and dissemination in the information age. Proceedings of the Red-cockaded Woodpecker Symposium IV. In Press.  
 Edwards, N.T. and D.L. Otis. 1999. Avian communities and habitat relationships in South Carolina Piedmont beaver ponds. American Midland Naturalist 141(1): 158-171.  
 Costa, R., T. Stevens, N.T. McKay, and T. Engstrom. 1995-2002. A Bibliographic Resource for the Red-cockaded Woodpecker. U.S. Fish and Wildl. Serv., Clemson, S.C. 105pp. Annually updated.  
 McKay, N.T. 1995. Avian and vegetative community characteristics and associations in South Carolina beaver ponds. M.S. Thesis, Clemson University, Clemson, S.C. 108pp.

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## **EDUCATION**

BA, Geography, West Virginia University

## **EXPERIENCE**

West Virginia GIS Technical Center 2 years

## **TRAINING**

Introduction to ArcSDE using ArcInfo 8  
Creating, Editing, and Managing Geodatabases  
Arc GIS 8 Intro Course  
**Microsoft Access Classes:**  
Introduction to Access  
Queries and Reports  
Database Design  
Form Design  
Macros

## **COMPUTER/TECHNICAL EXPERIENCE**

**GIS/CAD:** Microstation, ArcView, ArcGIS 8.x  
**Database/analysis:** Microsoft Access  
**Other:** Proficient in all Microsoft Office Products. Experience with Adobe Photoshop, HTML, Trimble Pathfinder GPS Correction Software  
**Operating Systems:** Windows 95/98/2000, Windows NT, MS-DOS, UNIX  
**Hardware:** Trimble Pathfinder Pro XL, XR, XM GPS units, Flatbed, slide, and large format scanners, digital camera, CD-ROM recorder, inkjet, laser, and large format printers

## **Profile**

Mr. Lamon is a GIS Analyst at the West Virginia GIS Technical Center. Mr. Lamon performs Digital Line Graph conversion of topographic maps and quality control of digital products to meet federal standards. He identifies and resolves software related problems and has three years experience with ESRI GIS software including ArcView, and the various components of ArcGIS. Mr. Lamon maintains and operates Trimble GPS equipment for the Technical Center. He is responsible for training students and staff on the use and application of GPS technology and has developed a training manual for use with the GPS equipment. He also gives instructional seminars regarding GPS. Mr. Lamon assists in the training of new staff, and external agencies in GIS and Microstation software and aids with tours and presentations in the Tech Center and at state conferences. Mr. Lamon supervises interns, assuring they have the necessary data to do their jobs effectively and provides guidance and assistance when needed.

Mr. Lamon has been involved in mapping initiatives ranging from the mapping of local recreational bike trails to the creation of West Virginia's first Homeland Security Critical Structure map. Much of the data for these maps was acquired through GPS, aerial photography, and using address matching software to obtain latitude and longitude coordinates from street addresses. Other maps have been used to enforce the Morgantown Police Departments housing policy, numerous maps for the West Virginia medical community, and a map used for a study being done by the Division of Exercise Physiology

When creating high-density maps, Mr. Lamon has designed and implemented new symbols that allow map users to better understand and differentiate the vast amounts of displayed information. He assists other technicians in learning to effectively display their data and their maps to the unfamiliar user. Mr. Lamon has produced maps to meet publishing specifications.

With the Technical Center, Mr. Lamon performs computer assembly and hardware upgrades when necessary. Previously, Mr. Lamon worked as a computer maintenance assistant for Department of Defense Dependant Schools in Mons, Belgium. There, he was responsible for resolving hardware issues and installing classroom and laboratory computers.

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**EDUCATION**

2 years Landscape Architecture Program WVU  
Currently working towards BA in Geography

**EXPERIENCE**

West Virginia GIS Technical Center	3 years
Natural Resource Analysis Center	1 year
College of Agriculture and Sciences	2 years

**TRAINING**

Introduction to ArcGIS 8  
AutoCAD 14  
**Microsoft Access Classes:**  
Introduction to Access  
Queries and Reports  
Database Design  
Form Design  
Macros

**COMPUTER/TECHNICAL EXPERIENCE**

**GIS/CAD:** Microstation, R2V, ArcView 3.x, ArcGIS 8.x, ArcInfo, AutoCAD, ERDAS Imagine, ESRI Licensing  
**Database:** Microsoft Access  
**Other:** Proficient in all Microsoft Office Products. Skilled in Adobe Photoshop, Adobe Illustrator, Notetab Pro  
**Operating Systems:** Windows 95/98/2000, Windows NT, MS-DOS, UNIX  
**Hardware:** all standard office equipment, network design, troubleshooting and construction, personal computer design, assembly and maintenance, Trimble GPS units

**Profile**

Mr. Kuhn is a GIS Analyst at the West Virginia GIS Technical Center. Mr. Kuhn performs Digital Line Graph conversion of topographic maps and performs quality control of digital products to meet federal standards. He has developed multiple GIS projects of importance to the State; some examples are the WV Regional Airport location maps for the WV Public Port Authority and the Critical Structure Maps (Homeland Security mapping) for the Office of Emergency Services. Mr. Kuhn was responsible for the collection and conversion of all DOQQ imagery for WV from multiple state agencies. He has produced data and metadata for the FGDC Clearinghouse Node and Technical Center website. He has also created many West Virginia digital data layers for use in GIS applications.

Mr. Kuhn provides technical support for Technical Center cooperators. Mr. Kuhn trains new Technical Center staff and external agencies in ArcGIS and Microstation software. He is responsible for tours and presentations in the Tech Center and at state conferences. Mr. Kuhn trains and supervises interns. He is responsible for research, purchase and maintenance of hardware and peripherals for the Technical Center. He is skilled at building, troubleshooting and repairing computers, printers and local area networks.

Mr. Kuhn has demonstrated ability in graphics design and has enhanced the WV GIS Technical Center work. He has designed several promotional items for the Technical Center including new logo shirts and mousepads, which are used to promote the Technical Center at conferences and meetings. Mr. Kuhn is in charge of designing awards and other honorary presentations.

Mr. Kuhn is the ESRI site license administrator for West Virginia University. His responsibilities include issuing new licenses, maintaining a database of current licenses, updating the campus-wide licenses, resolving licensing trouble issues, installation of ESRI software and license manager, and giving continued support to ESRI software users on campus.

Mr. Kuhn has previously worked for the Natural Resource Analysis Center (NRAC) at West Virginia University as a GIS technician. He was part of a team that set up the Hollowfill Surface Mine Mapping Project. Responsibilities included workstation and network setup for staff, using a large format roll-feed scanner and heads-up digitizing in ArcInfo.

## Appendix B: WVGISTC Projects and Activities (FY 2004)

### • **Advancement of Spatial Data Infrastructure**

Advance the State's Spatial Data Infrastructure through digital data conversion, data development, and coordination with federal geospatial data initiatives, statewide mapping programs, and local data producers.

### • **WV Geographic Information Network**

Support public access to geospatial data and information through the WV Geographic Information Network, a suite of Internet services that includes the Data Clearinghouse (FGDC Z39.50 and WVGISTC Servers), metadata catalogs, and geospatial newsletters and postings. Develop a Portal for basic mapping layers that will enhance existing Clearinghouse viewing and access functions.

### • **Strategic Planning**

Assist with strategic planning, development and implementation of statewide mapping guidelines. Specific activities include updating the WV Gazetteer, electronic submission of incorporated boundaries, and statewide digital tax mapping guidelines. Coordinate with state, federal, local government, and private sector entities to define, refine, and implement the State Strategic Plan for GIS initiatives and geospatial data development.

### • **Technical Support Services**

Provide outreach, educational and training support, and advisory services to the citizens, government agencies, non-profit organizations, and businesses of West Virginia in the area of GIS and related spatial data handling technologies.

### • **The National Map**

Partnership with the U.S. Geological Survey to develop a consistent set of seamless, core geographic layers for *The National Map*.

### • **Digital Line Graph Development**

As part of the Mineral Lands Mapping Program -- a multi-agency, cooperative effort to evaluate and quantify coal mineral properties for property tax purposes -- create a statewide digital base map for West Virginia based on U.S. Geological Survey 1:24,000 topographic maps. These elevation, transportation, hydrology and administrative map layers have a variety of uses for state and local governments and are available in the public domain

### • **Flood Hazard Mapping**

As a Cooperative Technical Partner with the Federal Emergency Management Agency, assist in the implementation of a statewide digital flood-mapping program.

### • **Critical Infrastructure Mapping**

As part of the Homeland Security Grant Program, assist the WV Office of Emergency Services and other agencies to develop statewide critical infrastructure data sets.

### • **Geological Map Digital Conversion**

Partner with the WV Geological and Economic Survey (WVGES) to generate GIS coverages of 1:24,000-scale geological maps. Publish a report on digital conversion procedures for geologic maps.

### • **National Register Mapping**

Assist the State Historic Preservation Office (SHPO) to update and print its National Register geographic database onto the USGS 7.5-minute quadrangle map series.



## Appendix C: WVGISTC Utilization Report

February – September 2002

**I. Service Request Report** – 240 e-mailed or telephone requests for data, conversion of data, technical support, or map projects for the time period 2/1/02 to 9/30/02.

**Report by Service Type**

Data Request.....	55%
Technical Support.....	35%
Map Projects.....	9%
Data Conversion.....	1%

**Report by Organization Type**

Commercial.....	33%
Education.....	28%
State.....	18%
Non-Profit.....	8%
County.....	4%
Regional.....	4%
Federal.....	3%
City.....	2%

**Top Data Request for Support**

Digital Orthophotos

**Report by Application** – a wide range of applications use geographic information

- |   |  |
|---|--|
| <ul style="list-style-type: none"> <li>• Architecture</li> <li>• Art</li> <li>• Biology</li> <li>• Cadastral</li> <li>• Criminal Justice</li> <li>• Demographics</li> <li>• Economic Development</li> <li>• Education</li> <li>• Energy</li> <li>• Engineering / Land Survey</li> <li>• Environmental Studies</li> <li>• Facilities and Planning</li> <li>• Flood Mapping / Planning</li> </ul> | <ul style="list-style-type: none"> <li>• Forestry</li> <li>• Geology</li> <li>• Health</li> <li>• History / Cultural</li> <li>• Hydrology</li> <li>• Land Use / Land Cover</li> <li>• Local Government</li> <li>• Natural Resources</li> <li>• Soils</li> <li>• Tourism / Recreation</li> <li>• Transportation</li> <li>• Utilities</li> </ul> |
|---|--|

**II. Web Usage Report** - website accessed by over 175 average users per day, or triple the volume of network traffic recorded a year ago.

**General Usage Statistics**

(2/1/02-9/30/02)

Average Hits/Day.....	8963
Users/Day.....	175

**Top 3 Web Sections Accessed**

(2/1/02-9/30/02)

- (1) Data Section
- (2) Interactive Mapping
- (3) News

**III. FTP Log Report** - FTP logs reveal that 1029 unique clients downloaded 73,325 files (260 GB) for the eight-month period of February-September 2002.

**Top 5 Single Files Downloaded (2/1/02 – 9/30/02)**

- (1) Statewide County Boundary (1:24,000 Scale) (111 times)
- (2) USGS Topographic Quadrangle Index (91 times)

- (3) WV GAP Land Cover (70 times)
- (4) Statewide WV DRG (1:100,000 Scale) (65 times)
- (5) State Geological Map (63 times)

**Top 5 Data Types Downloaded (2/1/02-9/30/02)**

- (1) DOQQ.....55284 files
- (2) DLG.....8182 files
- (3) DRG.....3710 files
- (4) DEM.....2033 files
- (5) Water Resource Datasets...742 files

**Top 8 Clients with FTP Sessions (2/1/02-9/30/02)**

- (1) Federal Emergency Management Agency.....1228 sessions
- (2) mursac04.MARSHALL.EDU (Marshall University).....832 sessions
- (3) U.S. Army Corps of Engineers.....800 sessions
- (4) Mountain CAD.....325 sessions
- (5) 63.175.220.10.....195 sessions
- (6) The Elexco Group, Energy Land Consulting.....114 sessions
- (7) vsat-148-63-83-94.c002.t7.mrt.starband.net.....112 sessions
- (8) Michael Baker Corporation.....111 sessions

**IV. Outreach Report** - Conducted 17 GIS workshops, training sessions, and educational seminars this past year.

**Report by Outreach Type (2/1/02-9/30/02)**

- Presentations.....11
- Training / Workshops.... 4
- Conference Displays.....2

## Appendix D: WVGISTC Awards and Milestones

Since its creation WVGISTC has been recognized by several prestigious awards and has met some significant milestones. Among these are:

- 1993 • Executive Order No. 4-93 creates GIS Technical Center
- 1994 • Mineral Land Mapping Program begins
- 1994 • Digital Map conversion for US Geological Survey begins
- 1998 • Dedication of Technical Center by Governor Underwood
- 1998 • Special Achievement in GIS award from the ESRI Corporation
- 1999 • FGDC Spatial Clearinghouse Node established
- 2000 • Rail Trails Brochure Map
- 2000 • County Tax Parcel Conversion Projects
- 2000 • Statewide Directory of GIS Personnel
- 2001 • Second Special Achievement in GIS award from ESRI
- 2001 • First statewide GIS electronic newsletter
- 2001 • State “featured website”
- 2001 • West Virginia Remote Sensing Cooperative established
- 2001 • WV Framework Data Report
- 2001 • Statewide digital aerial photos compiled and made accessible via the Internet
- 2002 • New WVU campus map
- 2002 • Standards approved for WV Coordinate Systems
- 2002 • State Homeland Security Maps
- 2002 • PTTC Gas Well Internet Mapping Project
- 2002 • National Register Accuracy Improvement Project
- 2002 • Statewide 1:24,000-scale hydrography vector layer
- 2002 • WVDOT GIS Implementation Plan
- 2002 • Over 200 GIS themes published on Data Clearinghouse
- 2003 • State Economic Development Map
- 2003 • Interactive WVU Campus Map
- 2003 • West Virginia View Remote Sensing Consortium
- 2003 • Geologic STATEMAP GIS Conversion Project
- 2003 • Statewide 1:24,000-scale transportation vector layer
- 2003 • Internet Map Services Catalog
- 2003 • Digital Tax Map Advisory Group
- 2003 • WV Gazetteer
- 2003 • FEMA Cooperative Technical Partner
- 2003 • Strategic Plan

### WVGISTC Milestones

Technical Center Created	MLMP Begins					Clearinghouse Node Established		State Featured Website		200 GIS Layers Published
1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

## Appendix E: GIS Coverages: A Strategic Asset

Spatial data served on the Data Clearinghouse is worth an estimated 50 million dollars. It is a strategic asset, freely available to the public and private sectors for their mapping needs so that they don't have to duplicate these costs. These valuable map layers are in the public domain and include disclaimers and documentation that describe their accuracy and completeness.

The agencies below have and will continue to make valuable spatial data contributions to the State's Spatial Data Infrastructure. This is not a complete listing but an estimate of the impact that mapping partners' contributions have had on the development of the State's Spatial Data Infrastructure. Contribution values were provided by agencies or calculated from fixed rate costs. This estimate does not include "in-kind" and technical support services provided by agencies to the State.

### U.S. Geological Survey

\$500,000	1:24k Digital Line Graphs (roads, streams, transportation, elevation, boundaries)
\$120,000	Elevation rasters: 10-m DEMs and 30-m National Elevation Dataset
\$1,800,000	Revised Topographic Maps
\$1,000,000	Statewide DOQQs
\$250,000	1:24k National Hydrography Dataset
\$600,000	1:24k Geological Mapping

### Natural Resources Conservation Service

\$30,000,000	Digital Soil Surveys
\$400,000	Statewide DOQQs
\$375,000	WVSAMB orthophotos

### Farm Service Agency

\$500,000	Statewide DOQQs
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### Federal Emergency Management Agency

\$500,000	Elevation: Lidar for Wyoming and Jackson Counties
\$2,500,000	Flood Insurance Studies and Digital Maps for 9 Counties

### U.S. Forest Service

\$250,000	1:24k National Hydrography Dataset
\$800,000	Single-Edition topographic maps
\$100,000	County Geological Reports

### Environmental Protection Agency

\$100,000	Watershed Boundaries
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### U.S. Census Bureau

\$200,000	TIGER Line files, Boundary Annexation files
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U.S. Army Corps Engineers  
\$150,000 At-Risk Structures ID for the WV Statewide FP Plan

National Park Service  
\$80,000 State Trail Plan

U.S. Mine Safety and Health Administration  
\$1,200,000 Abandoned Underground Mines  
\$1,000,000 Coal Impoundments

WV Geologic and Economic Survey  
\$4,000,000 Coal Bed Mapping Project

WV Department of Tax and Revenue  
\$3,000,000 Tax Map Conversion Project

WV Department of Environmental Protection  
\$1,000,000 Mine Permit Mapping, Environmental Maps

WV Department of Natural Resources  
\$800,000 Natural Resource Mapping

WV Department of Transportation  
\$850,000 Enhancement of WVSAMB data

WV GIS Technical Center  
\$900,000 Map Modernization Projects

WV Bureau of Public Health  
\$700,000 Water Resources Mapping

WV Health Care Authority  
\$200,000 Health Care Maps

State Addressing and Mapping Board / Verizon  
\$11,000,000 (projected)

## **Appendix F: Statewide GIS Personnel**

Below is a count of full-time employees (FTE) working in West Virginia in the geographic information system profession (digitizer, technician, analyst, manager, etc.) in which computer mapping is their primary job duty. A more detailed survey is required to validate its accuracy.

### **Federal**

National Park Service (2)  
U.S. Geological Survey (2)  
U.S. Forest Service (3)  
Natural Resources Conservation Service (3)

### **State**

Geological & Economic Survey (3)  
Division of Natural Resources (4)  
Department of Environmental Protection (6)  
Bureau of Public Health (2)  
Office of Emergency Services (1)  
Department of Tax and Revenue (5)  
Health Care Authority (1)  
WV Army National Guard (2)

### **Regional**

Region 1 Planning and Development Council (2)

### **County**

Offices of Assessor, E-911, and Planning (30)

### **Educational** (excluding professors)

WVU GIS Technical Center (6)  
Natural Resource Analysis Center (5)  
WVU Division of Forestry (1)  
Marshall U. Rahall Transportation Institute (3)  
Marshall U. Center for Environmental, Geotechnical, & Applied Sciences (3)  
Wheeling Jesuit University Center for Educational Technologies (1)

### **Non-Profit**

Canaan Valley Institute (9)

## Appendix G: State Web-Based Portal

The WVGISTC is designing a Web-based portal for WV Framework spatial data founded on the [geodata.gov portal](#) and [National Map Layer](#) concepts. This portal will make it easier, faster and less expensive for the public to access WV Framework spatial databases. The portal will model the [Delaware DataMIL](#), an interactive, on-line *National Map* pilot project of which commonly used base map layers, or *Framework layers*, are the primary focus.

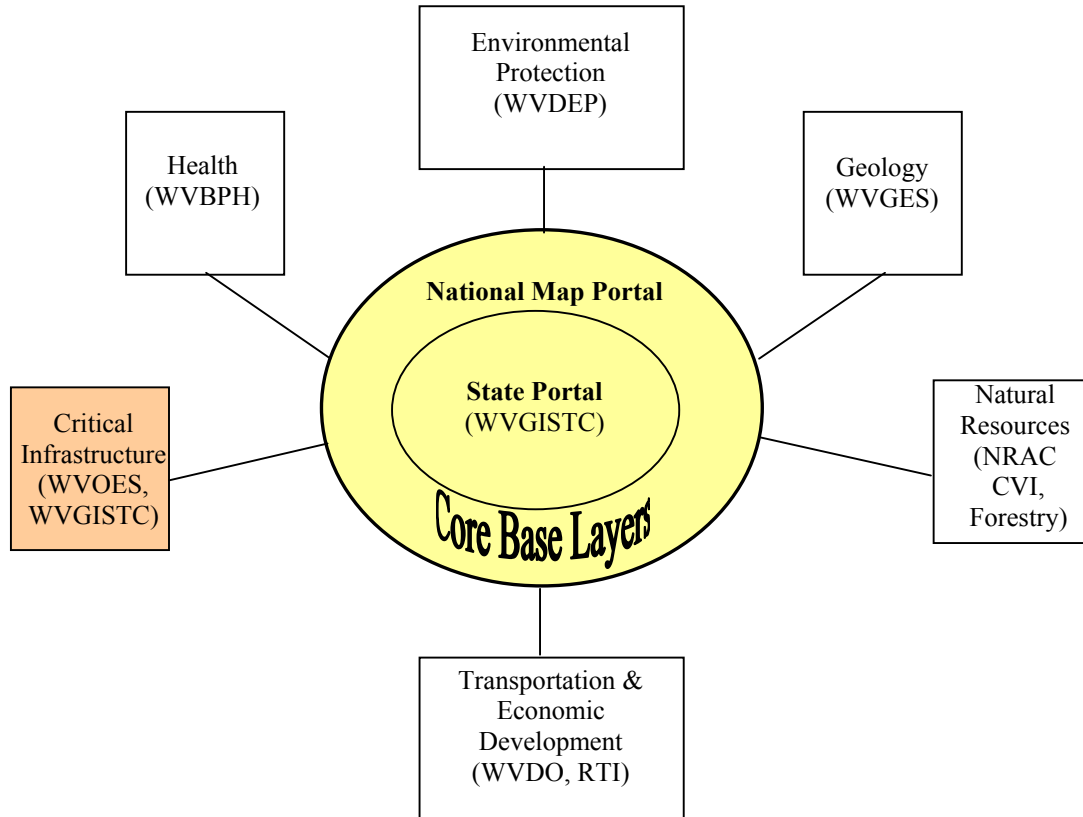
- ❖ *Proposed Framework Layers*
  - Hydrography: (National Hydrography Dataset: 1:24,000 or 1:4800 scale)
  - Transportation:
    - Roads (WVSAMB 1:4800 scale)
      - Railroads (Conflation of WVSAMB/RTI data with Federal Rail Authority datasets)
      - Elevation (National Elevation Dataset 30m DEMs; 1:24,000 USGS DLG hypsography)
  - Governmental Units (1:24,000 scale county boundary; Census municipal boundaries)
  - Land Cover: (USGS National Land Cover Dataset)
  - Orthoimagery: 2003 WVSAMB natural color orthophotos; 1:4800 scale
  - Geographic Names: USGS GNIS and WVSAMB: 1:24,000 scale or better
  - Structures: WVSAMB?
  - Cadastral: Not available
- ❖ *Other Datasets*
  - Reference Datasets: Collarless 1:24,000-scale DRGs; Hillshaded Dataset
  - Flood Hazards: Statewide Flood Hazard Map Layer

**PROGRAMMED FUNCTIONS:** The mapping system will allow searches for existing and planned data with a goal of “two clicks to content.” Functional requirements will include place name and address searches, coordinate identification, and as the system matures, user-defined data extractions and print-on-demand maps.

- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li>❖ <i>Search and Map Display Functions</i> <ul style="list-style-type: none"> <li>➤ Search – search by               <ul style="list-style-type: none"> <li>▪ Place name</li> <li>▪ Street address</li> <li>▪ Geographic location</li> </ul> </li> <li>➤ Map Display               <ul style="list-style-type: none"> <li>▪ Zoom, Pan, Move, Identify and Measure Tools</li> <li>▪ Draw Select and Erase Tool</li> <li>▪ Quick Zoom functions (city and preset scale)</li> <li>▪ Collapsible, scale-dependent layers</li> <li>▪ Descriptive legends</li> <li>▪ Locator map</li> <li>▪ Display coordinate locations (lat/long &amp; UTM)</li> </ul> </li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>❖ <i>Analysis</i> <ul style="list-style-type: none"> <li>➤ Buffer</li> <li>➤ Calculate Distance</li> </ul> </li> <li>❖ <i>Data and Metadata Access</i> <ul style="list-style-type: none"> <li>➤ View metadata for map layers and services</li> <li>➤ Download data with user-defined geographic extent</li> <li>➤ Transform data or maps to other coordinate systems</li> </ul> </li> <li>❖ <i>Publication</i> <ul style="list-style-type: none"> <li>➤ Create print-on-demand maps with legend</li> <li>➤ Export maps to other image formats</li> </ul> </li> </ul> |
|--|---|

WVGISTC would like to have a prototype completed in 2005. This “public” portal will integrate with other portals and can serve as a foundation for Internet system applications integration (Figure G-1). In the future an enterprise GIS may be implemented that allows multiple users to edit spatial data concurrently and continuously over the Internet.

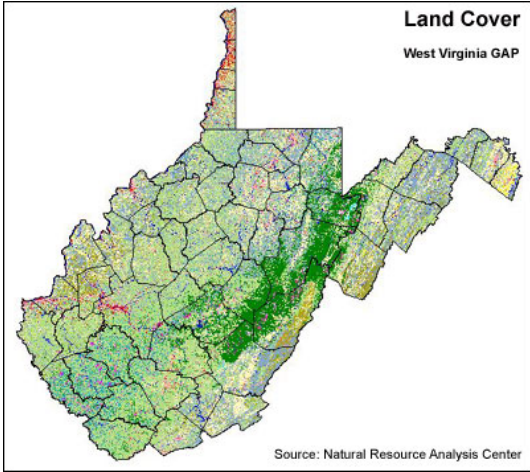
**Figure G-1:** Web services integration. The proposed “public” state portal focuses on core framework layers that synthesize with *The National Map* portal and other statewide Internet applications. Core framework layers in a Web exchange format will be accessible to other Internet applications to minimize redundancy, ensure interoperability, and maximize benefits.





## Appendix H: Sample Clearinghouse Data Set and Metadata

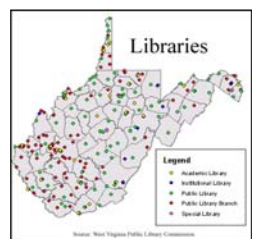
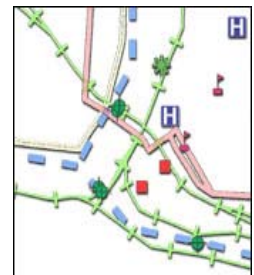
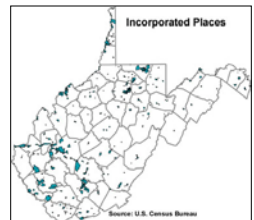
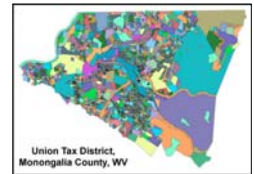
Sample from <http://wvgis.wvu.edu/stateactivities/mappingactiv.php>

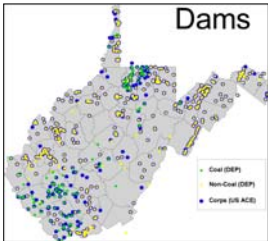
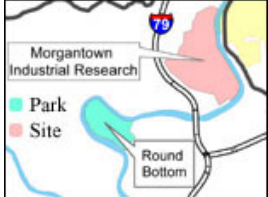
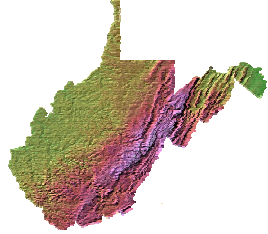
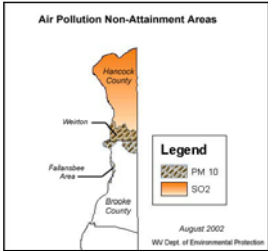

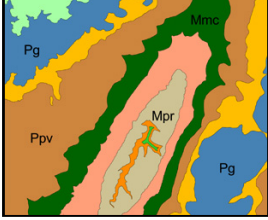
WV GIS Technical Center Land Cover (WV GAP)	
<a href="#">Download</a>	<a href="#">Summary Metadata</a>
	<a href="#">Full Metadata</a>
	
DESCRIPTION	Land Cover data set is a raster representation of vegetation/land cover for the state of West Virginia. This data can be used for landscape scale analysis in various disciplines such as wildlife ecology, forestry, or land use planning. The data have been developed for inclusion in the Gap Analysis Program.
SCALE	1:50,000
LOCATION	Statewide
ATTRIBUTE INFORMATION	25 land cover codes and labels ( <a href="#">wvgaplulc.doc</a> ). Load the ArcView legend file ( <a href="#">wvgaplulc.avl</a> ) to view preselected classification scheme colors and labels.
DATA SOURCE LINEAGE	Land cover data were collected as part of the West Virginia Gap Analysis Project, a collaborative effort between West Virginia University's Natural Resource Analysis Center, the West Virginia Cooperative Fish and Wildlife Research Unit, the West Virginia Division of Natural Resources, and the Biological Resources Division of the US Geological Survey. The source data were acquired from multiple 30-meter Landsat imagery obtained between 1992-1994 and field checked with videography. Final report published in April 2002.
<b><u>COORDINATE SYSTEM</u></b>	Cast on the Universal Transverse Mercator (UTM) projection, Zone 17, on the North American Datum of 1927 (NAD27) with coordinates in meters.
<b><u>FILE FORMAT</u></b>	Compressed ARC/INFO grid (with ESRI legend files)
SUPPLEMENTAL INFORMATION	On-line linkage: <a href="http://www.gap.uidaho.edu/">http://www.gap.uidaho.edu/</a> Contact Information: Jacquelyn Strager, Research Coordinator, Natural Resource Analysis Center, WVU, Morgantown, WV, 26506, 304-293-4832 ext. 4455, <a href="mailto:jmstrager@mail.wvu.edu">jmstrager@mail.wvu.edu</a> ; <a href="http://www.nrac.wvu.edu/gap/">http://www.nrac.wvu.edu/gap/</a>
<b><u>Full Metadata</u></b>	: <a href="#">wvgaplulc.htm</a>
DOWNLOAD:	<a href="ftp://ftp.wvgis.wvu.edu/pub/Clearinghouse/wv_gap/wvgaplulc.zip">ftp://ftp.wvgis.wvu.edu/pub/Clearinghouse/wv_gap/wvgaplulc.zip</a>

# Appendix I: WV GIS Data Catalog

For current listing refer to <http://wvgis.wvu.edu/data/data.php>

Subject	Dataset
<b>Cadastral (Tax)</b>	Monongalia County Tax Districts Tax District Boundaries
<b>Census</b>	Census Block Groups with Population Data Cities with Population > 10,000 (Census) Cities with Population > 2,500 (Census) Incorporated Places/Census Designated Places Metropolitan Statistical Areas (1999) Minor Civil Divisions (County Subdivisions) Populated Places (Census) Urbanized Areas (1990 Census) Urbanized Areas (2000 Census) Voting Districts (2000) Voting Districts (2002)
<b>Communications</b>	Telephone Central Offices Towers (EMS) Towers (FCC) Towers (Public Broadcasting) Towers (State Police) Towers (WV DOH)
<b>Cultural Resources</b>	Archeological Sites Architectural Surveys (Proposed / Eligible NR Sites) Armories Buildings (GNIS) Cemeteries (GNIS) Churches (GNIS) Churches and Religious Centers Colleges Courthouses Fire Departments Golf Courses (GNIS) Hospitals (GNIS) Hospitals (HCA) Libraries Local Place Names (GNIS) National Register of Historic Places Nursing Homes Populated Places (GNIS) Prisons Regional Jails Schools (GNIS)

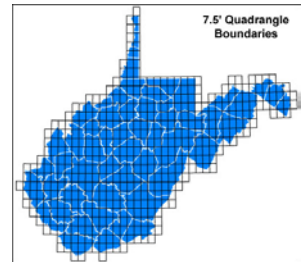


<b>Dams</b>	<p>Schools (WV DE)                  State Police Detachments</p> <p>Dams (DMR)                  Dams (NID)                  Dams (Non-Coal)</p>	
<b>Economic Development</b>	<p>Appalachian Counties                  EZ/EC Communities                  Industrial Buildings, Sites, and Parks                  Manufacturers                  Regional Planning and Development Councils                  Workforce Investment Areas</p>	
<b>Elevation</b>	<p>Contour lines and spot elevations (USGS DLG)                  Digital Elevation Models - 10-meter (USGS)                  Digital Elevation Models - 10-meter (WVGES-WVU)                  Digital Elevation Models - 30-meter                  LIDAR                  National Elevation Dataset (NED) - 30-meter                  SRTM - 30-meter</p>	
<b>Environment</b>	<p>Air Pollution Non-Attainment Areas                  Ecoregions                  EPA Facilities                  Safe Drinking Water                  Solid Waste Facilities                  Superfund / Hazardous Waste                  Toxic Release Inventory                  Weather Stations</p>	
<b>Fish &amp; Wildlife</b>	<p>Fish Hatcheries                  Rare &amp; Endangered Species                  Wildlife (Game, Non-Game, Birds)                  Wildlife Distributions (WV GAP)</p>	
<b>Flood Planning</b>	<p>Q3 / DFIRM Flood Data                  At-risk floodplain structures                  McDowell County May 2002 Floods</p>	
<b>Geodetics</b>	<p>Geodetic Survey Control Points</p>	
<b>Geology</b>	<p>Appalachian Basin                  Caves                  Coal Fields of West Virginia                  Generalized Geology                  Geologic Map of State                  Geological Maps - Early 1900 County Reports                  Geology - Bedrock                  Geology - Coal Beds                  Karst                  Mineral Operations</p>	

Oil and Gas Data  
 Oil and Gas Wells  
 Oil and Gas Wells  
 Recently-Permitted Trenton & Deeper Wells

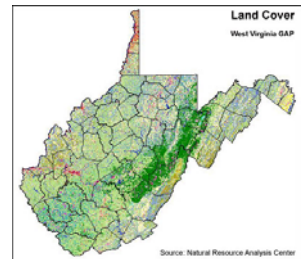
**Index Grids**

Index - 1:100,000-Scale USGS Topo Map Quadrangles  
 Index - 1:24,000-Scale / 7.5-minute USGS Quadrangles  
 Index - 1:250,000-Scale USGS Topo Map Quadrangles  
 Index - 15-Minute Latitude / Longitude Grid  
 Index - 1-Degree Latitude / Longitude Grid  
 Index - 2-Degree Latitude / Longitude Grid  
 Index - 3.75-minute USGS Quarter Quadrangles  
 Index - 5-Minute Latitude / Longitude Grid  
 NAPP Index



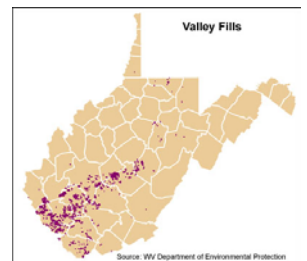
**Land Cover / Land Use**

Forest Service Land Cover  
 Land Cover (WV GAP)  
 National Land Cover Dataset (NLCD) 1992  
 Nature Conservancy Preserves  
 Roadless Areas  
 Timber Removal Volume



**Mining and Reclamation**

Abandoned Mine Lands  
 Adjacent Permits (DMR Data)  
 Auger Mining (DMR)  
 Drainage Control Structures (DMR)  
 Mineral Removal Area (DMR)  
 Mountaintop Removal Mining  
 NPDES Outlets (DMR)  
 Overburden Core Holes (DMR)  
 Permit Boundaries (DMR)  
 Roads (DMR)  
 Underground Mining Limits (DMR)  
 Valley Fills (DMR)  
 Water Sample Locations (DMR)



**National Forests**

Boundaries - Monongahela National Forest (MNF)  
 Forest Maps - Monongahela National Forest (MNF)  
 National Forest Boundaries  
 Roads - Monongahela National Forest (MNF)  
 Single-Edition Quadrangle Maps  
 USFS Cartographic Feature Files (CFF)  
 USFS Softcopy Primary Base Series (PBS)

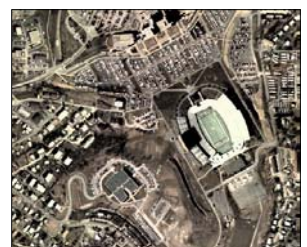


**Natural Hazards**

Natural Hazard Rank

**Photography**

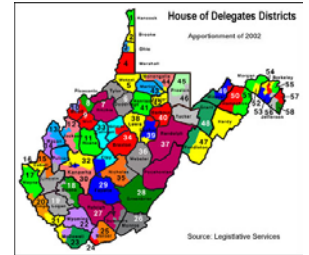
City of Bluefield Orthophoto (1992)  
 Historical Photography  
 Monongalia County Orthophotos (1997)  
 USGS DOQQS (1996-1999)





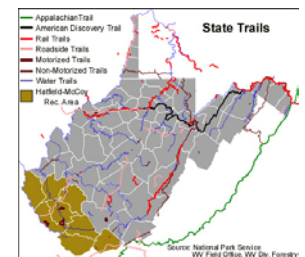
**Political Boundaries**

- County Boundaries
- County Boundaries (1:24,000-scale)
- County Seats
- County, Municipal (USGS DLG)
- State Boundary (1:100,000-scale)
- State Boundary (1:24,000 scale)
- State House Districts (1992)
- State House Districts (2002)
- State Senate Districts (1992)
- State Senate Districts (2002)
- U.S. Congressional Districts (107th)
- U.S. Congressional Districts (108th)



**Public Lands**

- National Park Boundaries
- Public Lands / Land Stewardship (WV GAP)
- State Forest Boundaries
- State Parks
- Wildlife Management Areas
- Wilderness Areas



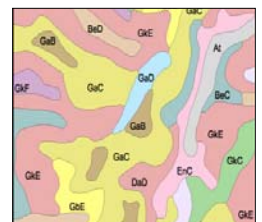
**Recreation**

- Boat Launches
- Excursion Passenger Trains
- Public Fishing Areas
- State Trails
- Trails of Monongahela National Forest
- Trails of State Forests



**Satellite Imagery**

- ASTER Satellite Imagery
- CVI Landsat Imagery Archive
- Landsat 7 ETM+ - Chesapeake from Bay Project
- Landsat Mosaic
- SPOT 10-m Panchromatic
- SPOT Multispectral Imagery of July 2001 Flood West Virginia View
- WV Remote Sensing Cooperative

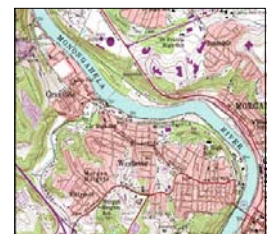


**Soils**

- Soil Survey Geographic Database (SSURGO)
- State Soil Survey Database (STATSGO)

**Topographic Maps**

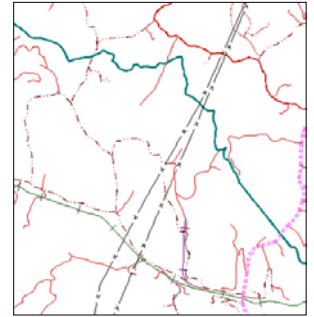
- Geographical Names on USGS Topo Maps (GNIS)
- Seamless DRGs (1:24K-1:250K)
- Seamless USGS 100K-Scale Digital Raster Graphic Summits (GNIS)
- Scanned 1:100,000-Scale USGS Topographic Maps
- Scanned 1:24,000-Scale USGS Topographic Maps
- Scanned 1:250,000-Scale USGS Topographic Maps



**Transportation**

- Airport Runways
- Airports
- Amtrak

- Bridges
- General Highway County Maps
- Intermodal Terminal Facilities
- Interstates
- Major Road Network
- Miscellaneous Transportation (USFS CFF)
- Miscellaneous Transportation (USGS DLG)
- National Waterway Network
- New Roads - Proposed Coalfields Expressway
- New Roads - Proposed King Coal Highway
- New Roads - Proposed Shawnee Highway
- Railroads (National Rail Network)
- Railroads (USGS DLG)
- Regional Airport
- Roads (TIGER)
- Roads (USFS CFF)
- Roads (USGS DLG)
- Scenic Byways
- U.S. Highways
- U.S. Routes

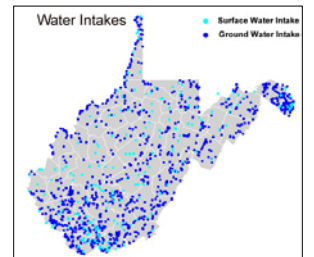
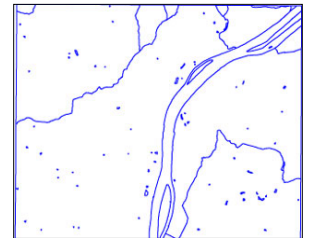


**Utilities**

- Compressor Stations
- National Pipeline Mapping System (NPMS)
- Pipelines

**Water Resources**

- At-Risk Floodplain Structures
- Ground Water / Surface Water Intakes
- Hydrography (TIGER)
- Hydrography (USFS CFF)
- Hydrography (USGS DLG)
- Hydrologic Unit - Sub-basin (8-digit/4th level)
- Hydrologic Unit - Watershed (10-digit/5th level)
- Major Rivers and Lakes
- National Atlas Streams
- National Hydrology Dataset
- National Wetlands Inventory
- Realtime Streamflow Stations
- Sewer Treatment Plants
- Springs (Avg Flow >= 100gpm)
- Trout Streams (Natural, Stocked, High Quality)
- Wild and Scenic Rivers



**Wildfires**

- Fire Occurrence

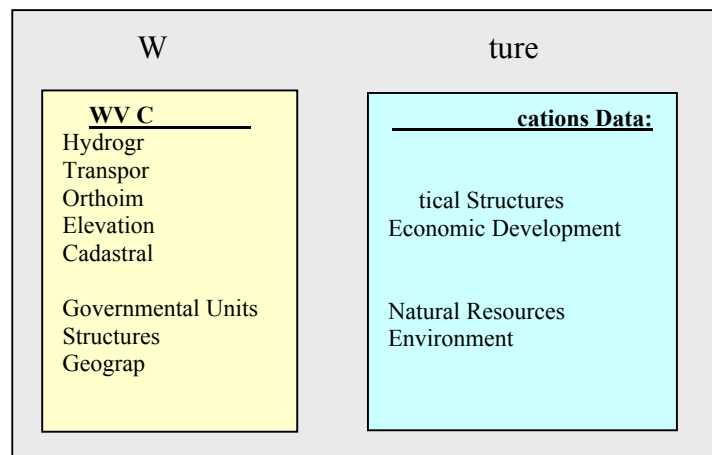
**Zip Codes**

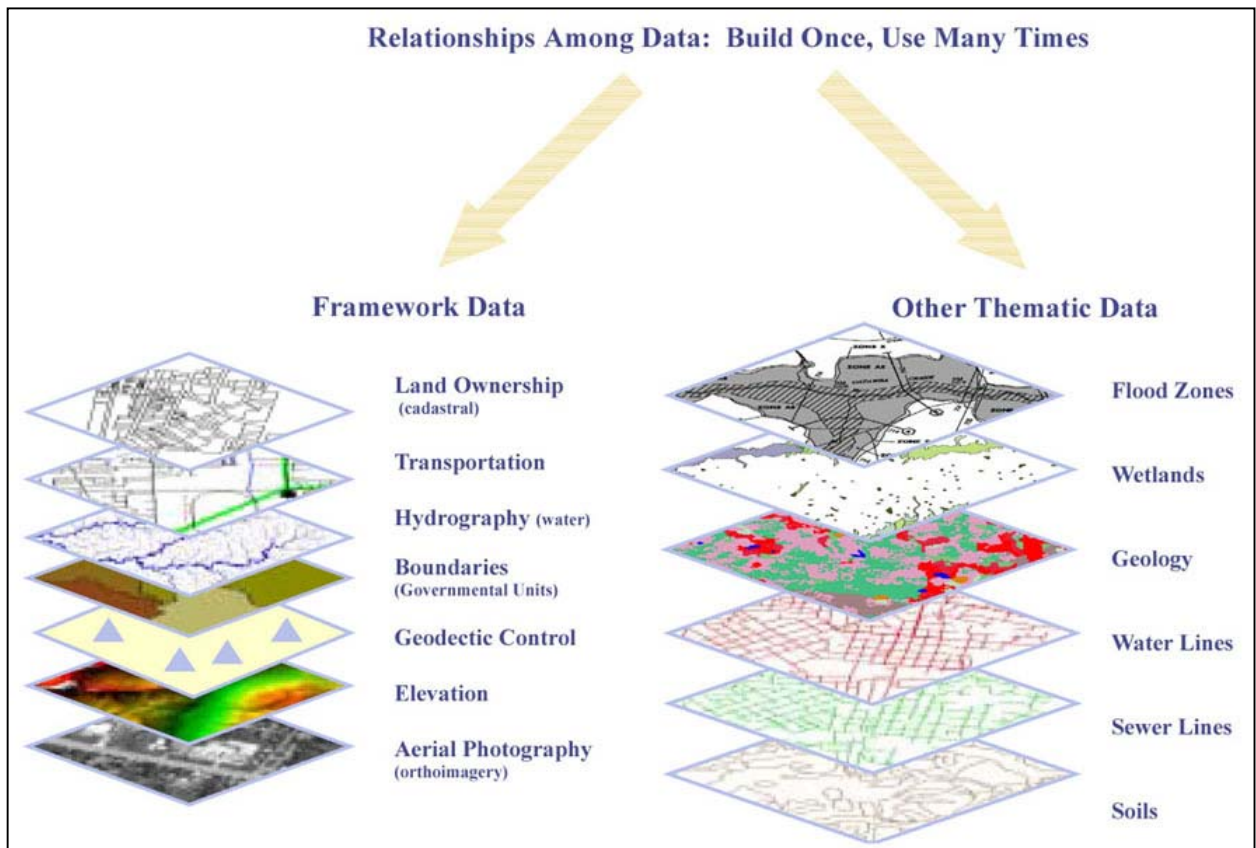
- 5-Digit ZIP Code Tabulation Areas (ZCTAs)
- Postal/Zip Codes

## Appendix J: WV Spatial Data Infrastructure (January 2004 Status Report)

**WV Spatial Data Infrastructure Report:** The West Virginia GIS Technical Center (WVGISTC) periodically publishes a report on the availability and development of geospatial data specific to West Virginia. This report focuses on the best available, core geographic data sets that form the backbone or “Framework” for local, State, and National Spatial Data Infrastructures. The report identifies base geographic data layers needed by organizations to implement successful computer mapping applications. Within the Spatial Data Infrastructure, organizations cooperatively produce and share the “best” available geographic data throughout all levels of government, private and non-profit sectors, and the academic community. Spatial Data Infrastructure components include “Framework” or core geographic base layers, standards, metadata, Clearinghouses, and partnerships.

**WV Framework Base Layers:** West Virginia’s Framework geographic layers consists of nine core themes (*hydrography, transportation, orthoimagery, elevation, land ownership (cadastral), geodetic control, boundaries (governmental units), structures, geographic names*) used by most GIS mapping applications at the state and local level, and targeted as National Map layers for future topographic map production. This report also includes six application-specific data themes (*soils, geology, land cover, critical structures, flood hazards, economic development*) built on top of the core Framework layers and USGS *digital topographic maps*, a commonly used base image reference layer. The following is provided for each data theme: brief description, mapping status, ultimate mapping goal, and data producer information, including originator(s) of data, resolution, currency, and data availability. In the future this report will be an integral part of the State’s GIS Development Plan.



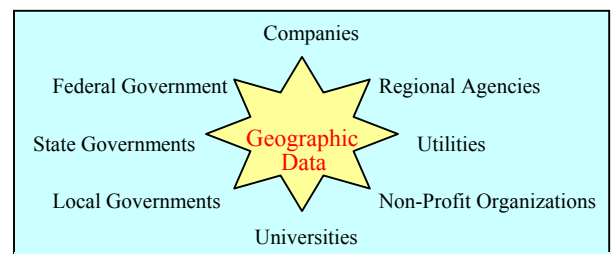


Mapping applications consist of commonly used Framework base layers and other thematic layers.  
 (Source: Indiana Geographic Information Council)

**Why Develop Framework Base Data for inclusion into the Spatial Data Infrastructure?**

Developing and sharing base geographic data layers minimizes redundancy, ensures interoperability, and maximizes the benefits to the citizens of West Virginia. Spatial data is a valuable resource and strategic asset. The WV Spatial Data Infrastructure is valued at 50 million dollars, with an additional 11 million dollars being invested through the statewide addressing and mapping project. Creating digital geospatial data can cost millions of dollars, but when there is a network for data sharing via partnerships, an organization’s individual costs are substantially reduced. Reasons for creating Framework base layers to advance the Spatial Data Infrastructure include:

- Commonly used base spatial data – almost always need it to make a map
- High resolution spatial and temporal accuracies
- Spatial databases complete in geometry and attribution
- Standards-based, well-documented
- Enhanced functionality (i.e., NHD stream flow, linear referencing)
- Seamless Distribution
- Reduces costly data duplication efforts
- Facilitates data exchange (i.e., NHD to TIGER/Line)



**Data Sharing  
Saves Money**  
 \$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$

**Framework Principles:** Approved mapping standards, along with cooperative efforts of local, state, federal, and private organizations, are necessary to create a reliable, seamless, continually maintained, consistent set of core geographic data. West Virginia Framework data is built on the best available data and adheres to the following principles:


- *Data Access:* Framework data must be widely accessible through data clearinghouses and Web portals that standardize the systematic collection and management of information. Restrictions may apply for sensitive or private information.
- *Data Charges:* Charges for access to Framework data are limited to the costs of providing access and dissemination.
- *Data Certification:* Framework data are complete, quality checked, and geometrically and topologically clean.
- *Standards:* Framework data must conform to approved technical and administrative standards.
- *Metadata:* FGDC metadata is preferred for all Framework data, but abbreviated metadata is acceptable if it includes the following summary information: description, scale, location, attribute documentation, source lineage, coordinate system, and file format. Metadata also can be collected at the feature level.
- *Coordinate Referencing System:* The Geographic Coordinate System (longitude and latitude) is encouraged for Framework data, although the following common coordinate systems are also acceptable: (1) Universal Transverse Mercator (UTM), Zone 17 North, map units in meters, for statewide GIS data sets, and (2) WV State Plane Coordinate System (SPCS), North and South Zones, map units in U.S. feet, for countywide data sets. Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83) and vertical coordinate information is referenced to the North American Vertical Datum of 1988 (NAVD 88).
- *GIS File Format:* Framework data are in a digital format that can be easily imported into a Geographic Information System.
- *Seamless:* Framework data are seamless (no arbitrary edges) across political or other collection area boundaries.
- *Integrated within and between Themes of Data:* Framework data are positional and logically consistent among themes, such as the coincidental alignment of a stream and political boundary.
- *Multiple Resolutions and Generalization:* Framework data consists of variable resolutions to satisfy different users' needs. To avoid independent data collection, more detailed and complete data sets are generalized for those agencies requiring less detailed data that cover a large area.
- *Continually Maintained and Complete:* Framework data is built on the best available data. Data stewards continually maintain consistently classified data.
- *Geographic:* Framework data contains no cartographic generalizations.

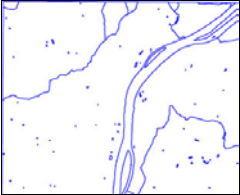
**Future Directions:** Leadership, cooperation, and coordination are required among numerous agencies to advance the WV Spatial Data Infrastructure in West Virginia. Presently, the WV Spatial Data Infrastructure for the State is progressing on four fronts: (1) development of new digital mapping standards; (2) creation of communicative networks and business partnerships to coordinate data sharing; (3) collection of more current, higher resolution data; and (4) promotion of GIS to the statewide community. For most Framework base layers, the ultimate goal is to achieve statewide coverage and integration of more current, higher-resolution thematic data. In the future, most core geographic data will be collected at mapping scales of 1:4800 or larger.

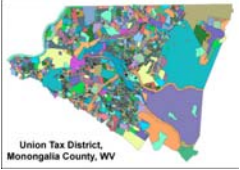
If you have any questions or remarks about this report or want to participate in advancing the WV Spatial Data Infrastructure, please contact Kurt Donaldson of the WV GIS Technical Center or the State GIS Coordinator, Craig Neidig.

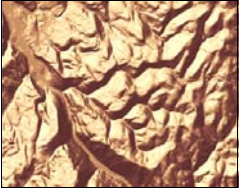
Technical Center Staff  
WV GIS Technical Center  
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e-mail: [wvgis@wvu.edu](mailto:wvgis@wvu.edu)  
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<b>TRANSPORTATION</b>					
	<p><b>DESCRIPTION:</b> Transportation networks and facilities to include roads, trails, railroads, waterways, airports, bridges and tunnels. Road centerlines should incorporate street address ranges for geocoding applications and a linear referenced system for routing applications.</p>				
	<p><b>COORDINATION:</b> Coordination among transportation data producers in the State is necessary to establish core content standards and business relationships. Through such coordination will foster formal/informal agreements for sharing, creating, and maintaining statewide transportation data.</p>				
<b>MAPPING STATUS:</b>					
<p>(1) <b>WV Statewide Addressing and Mapping Board (WVSAMB):</b> By 2007, the WVSAMB Addressing Vendor will attribute transportation files based on NENA-2-010 format for road centerlines, major driveways, railroad centerlines, navigable waterways, overpasses, bridges and tunnels, building points, major structure polygons, and dams and spillways. <a href="http://www.addressingwv.org">http://www.addressingwv.org</a></p> <p>(2) <b>WV Department of Transportation (WV DOT):</b> The WVDOT plans, designs, builds and maintains more than 34,000 miles of state roads. The WVDOT does not have a GIS Section, although they are contracting the private sector to generate a digital cartographic copy of their existing general highway county map series. In 2002 the Rahall Appalachian Transportation Institute and the West Virginia Department of Transportation funded Marshall University and West Virginia to develop a strategic plan for the implementation of a geographic information system (GIS). This plan supports the efforts of WVDOT to develop an integrated GIS resource management system to meet its evolving operational and managerial business needs. <a href="http://wvgis.wvu.edu/stateactivities/transportation.html">http://wvgis.wvu.edu/stateactivities/transportation.html</a>.</p> <p>(3) <b>U.S. Census Bureau (Census):</b> Harris Corporation has been awarded an eight-year contract, valued in excess of \$200 million, by the U.S. Census Bureau for the Master Address File/Topologically Integrated Geographic Encoding and Referencing Accuracy Improvement Project (MAF/TIGER AIP). The objectives of this program are to align existing 1:100,000-scale roads, hydrography, railroads, structures, landmarks, pipelines, power lines and other TIGER database features to a horizontal accuracy standard of 7.6 meters for all of the nation's 3,232 counties by FY 2008. <a href="http://www.census.gov/geo/mod/maftiger.html">http://www.census.gov/geo/mod/maftiger.html</a></p> <p>(4) <b>U.S. Geological Survey (USGS) and U.S. Forest Service (USFS):</b> In 2003 WVGISTC completed statewide, 1:24,000-scale topographic-based transportation vector files. These files are digital vector representations of roads, trails, bridges, exit ramps, tunnel portals and other detailed transportation features derived from USFS and USGS 1:24,000-scale topographic maps. USGS Digital Line Graph (DLG) road attribute data is limited to road classification and federal/state highway route numbers. <a href="http://wvgis.wvu.edu/data/data.php">http://wvgis.wvu.edu/data/data.php</a> (search on roads). The Monongahela National Forest maintains a trail and road geographic database for 3,300 miles of roads (<a href="http://wvgis.wvu.edu/data/data.php">http://wvgis.wvu.edu/data/data.php</a>, search on roads). The spatial databases originated from 1:24,000-scale USFS Cartographic Feature Files and are linked to Oracle INFRA attribute tables which include linear referencing measures for event themes. <a href="http://www.fs.fed.us/eng/road_mgt/documents.shtml">http://www.fs.fed.us/eng/road_mgt/documents.shtml</a></p> <p>(5) <b>U.S. Department of Transportation (US DOT):</b> The Federal Highway Administration (FHWA) is in the process of enhancing the National Highway Planning Network (NHPN), a comprehensive network database of the nation's major highway system. The current 1:100,000-scale geographic database consists of over 400,000 miles of the nation's highways comprised of Rural Arterials, Urban Principal Arterials and all National Highway System routes (<a href="http://www.fhwa.dot.gov/hep10/gis/gis.html">http://www.fhwa.dot.gov/hep10/gis/gis.html</a>). The National Transportation Atlas Data (NTAD) is a set of transportation-related geospatial data for the United States compiled by the Bureau of Transportation Statistics (BTS). The data consist of transportation networks such as the NHPN, transportation facilities, and other spatial data used as geographic reference. <a href="http://www.bts.gov/gis/ntatlas/index.html">http://www.bts.gov/gis/ntatlas/index.html</a></p> <p>(6) <b>National Park Service (NPS):</b> In 2003 the Rivers &amp; Trails Program of the National Park Service completed state trails at a nominal scale of 1:100,000. <a href="http://wvgis.wvu.edu/data/data.php">http://wvgis.wvu.edu/data/data.php</a> (search on trails)</p> <p>(7) <b>Local Government:</b> Local data producers maintain countywide road centerlines with street ranges, supplemented with double-line (edge of pavement) roads for urban areas.</p>					
<b>DATA PRODUCERS:</b>					
<i>DATASET NAME</i>	<i>ORIGINATOR(S)</i>	<i>SCALE</i>	<i>MAP UNIT</i>	<i>% WV</i>	<i>CURRENCY</i>
TIGER	U.S. Census	1:100,000	County	100	2000
National Transportation Atlas	U.S. DOT	1:100,000	State	100	2001
County Highway Maps (Not Vector)	WV DOT	1:63,500	County	100	Variable
Digital Line Graphs (DLG)	USGS	1:24,000	7.5 Min. Quad	85	1950-1997
Cartographic Feature Files (CFF)	USFS	1:24,000	7.5 Min. Quad	15	1995
E-911 Road Centerlines & Addresses	WVSAMB	1:4800	SAMB Index	?	
Local Road Databases	County/City Govts.	1:600 to 1:4800	Jurisdiction	?	Variable
New Roads	WV DOT / Contractors	Survey-scale	Planned Route	N/A	Variable
Major Trails	NPS, WV DNR, USFS	GPS to 1:100,000	Jurisdiction	100	2003
<p><b>ULTIMATE GOAL:</b> Statewide 1:4800 or larger scale addressing and mapping database of core transportation features.</p>					

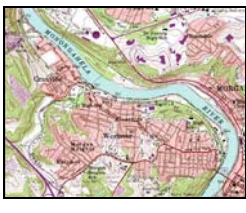
<b>HYDROGRAPHY (Water)</b>																																															
<p><b>DESCRIPTION:</b> The National Hydrography Dataset (NHD) is a comprehensive set of digital spatial data that contains information about surface water features such as lakes, ponds, streams, rivers, springs and wells. Within 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 users to access information about the connectivity and flow direction of stream networks as well as to provide a system for a linear referencing. The Watershed Boundary Dataset is a national geospatial database containing the hydrologic unit boundaries for the 1st through 6th level units.</p>																																															
	<p><b>MAPPING STATUS:</b></p> <ul style="list-style-type: none"> <li>• In 2002 WVGISTC completed statewide coverage of 1:24,000-scale USGS Hydrography DLGs. <a href="http://wvgis.wvu.edu/data/data.php">http://wvgis.wvu.edu/data/data.php</a> (search on streams and rivers)</li> <li>• In 2003 WVU NRAC completed high-resolution (1:24,000-scale or larger) NHD mapping by conflating 1:24,000-scale hydrography USGS DLGs/USFS CFFs for all sub-basins (8-digit HUC) of the State. Status graphic at <a href="http://nhd.usgs.gov/data.html">http://nhd.usgs.gov/data.html</a></li> <li>• WVSAMB hydrography will have limited attribution and connectivity. Funding sources are needed to integrate WVSAMB 1:4800-scale streams into NHD. A State Hydrography Board should be established to oversee maintenance of NHD.</li> <li>• In 2004 the newly certified 1:24,000-scale subwatershed boundaries (6th level, 12-digit HUCs) should be available. The embedded watershed boundaries (5th level, 10-digit HUCs) will change but the subbasin boundaries (4th level, 8-digit HUCs) will remain the same. (<a href="http://www.ftw.nrcs.usda.gov/huc_data.html">http://www.ftw.nrcs.usda.gov/huc_data.html</a>)</li> </ul>																																														
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<p><b>ULTIMATE GOAL:</b> Statewide high resolution (1:24,000 or larger scale) National Hydrography Dataset (NHD) and Watershed Boundary Dataset (WBD).</p>																																															

<b>Land Ownership (Cadastral)</b>																							
<p><b>DESCRIPTION:</b> Cadastral information refers to land ownership. Other geographic information such as orthoimagery, transportation, hydrography, and coordinate geometry are required to create a seamless digital tax parcel district file from hundreds of hardcopy maps or deed surveys. Vector-based cadastral data should be geometrically and topologically clean and linked to a single, comprehensive parcel database.</p>																							
	<p><b>MAPPING STATUS:</b></p> <ul style="list-style-type: none"> <li>• Approximately 76% of WV Counties have implemented or are transitioning to a GIS file format for their digital tax mapping.</li> <li>• WVGISTC is spearheading an effort to create digital tax mapping guidelines for the State. The Center is working with the Property Valuation Training and Procedures Commission and other public/private stakeholders to revise the procedural regulations, <i>The Statewide Procedures for the Manual Maintenance of Surface Tax Maps</i>, Title-Series 189-04 (<a href="http://www.wvsos.com/csrdocs/worddocs/189-04.doc">http://www.wvsos.com/csrdocs/worddocs/189-04.doc</a>). These updated procedures will provide necessary guidance and clarification procedures for the "digital" collection, maintenance, and electronic display of surface tax parcels. Training workshops and online resources for mapping professionals are also part of this effort.</li> <li>• In 2003 WVGISTC created a digital version of the official tax district boundary lines adopted by the WV Legislature in 1973.</li> </ul>																						
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<p><b>ULTIMATE GOAL:</b> Statewide, seamless, georeferenced, vector-based surface tax parcel mapping system integrated with external assessment databases.</p>																							

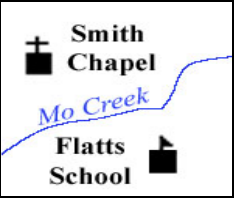
<b>ELEVATION</b>																																																														
<b>DESCRIPTION:</b> Terrain represented by contour lines or by a Digital Elevation Model (DEM), an array of elevations for ground positions at regularly spaced intervals.																																																														
	<p align="center"><b>MAPPING STATUS:</b></p> <ul style="list-style-type: none"> <li>• DOI high-priority program revising USGS 1:24,000-scale topographic maps with contour updates in mountaintop mining areas of central and southern WV. A by-product is 10-meter, Level 2 DEMs. See status graphic: <a href="http://mcmweb.er.usgs.gov/status/mac/wv/wv_dem10.html">http://mcmweb.er.usgs.gov/status/mac/wv/wv_dem10.html</a></li> <li>• Mineral Lands Mapping Program (MLMP) creating 10-meter, Level 2 DEMs using the ArcInfo TOPOGRID command. Coordination is necessary between the State and USGS to derive similar 10-meter products. See status graphic at <a href="http://wvgis.wvu.edu/stateactivities/dem10m_status.html">http://wvgis.wvu.edu/stateactivities/dem10m_status.html</a></li> <li>• USGS 1:24,000-scale hypsography DLGs will continue to be created at WVU until superseded by newer products. State 77% complete.</li> <li>• Wyoming County LIDAR data created by Enerquest Systems for FEMA was processed incorrectly and thus needs to be rectified.</li> <li>• WV DEP hopes to acquire radar for the coalfield areas. License restrictions may apply.</li> <li>• WVDOT has committed funds to enhance the WVSAMB elevation data. NRCS and USGS are interested in this dataset. The vertical accuracy and availability of future WVSAMB elevation data is unknown.</li> </ul>																																																													
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<b>ULTIMATE GOAL:</b> Statewide higher resolution (10 meters or better) surface elevation data.																																																														

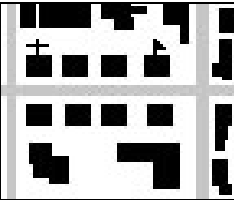
<b>BOUNDARIES (Governmental Units )</b>																													
<b>DESCRIPTION:</b> Governmental unit boundaries for counties, incorporated places, minor civil divisions, and public lands. Each of these features includes the attributes of name and the applicable Federal Information Processing Standard (FIPS) code.																													
	<p align="center"><b>MAPPING STATUS:</b></p> <ul style="list-style-type: none"> <li>• The Census Geography Division, WV Redistricting Office, and WVGISTC are reviewing business partnerships regarding digital boundary and annexation submissions.</li> <li>• A request has been made to the BAE Systems mapping contractor of the WVSAMB project to code ridgeline breaklines with a unique label to facilitate immediate use in the subsequent refinement of political boundaries.</li> <li>• Organizations should review procedures for ensuring coincidental features share the same boundary.</li> </ul>																												
	<p align="center"><b>DATA PRODUCERS:</b></p> <table border="1"> <thead> <tr> <th><i>DATASET NAME</i></th> <th><i>ORIGINATOR(S)</i></th> <th><i>SCALE / RESOLUTION</i></th> <th><i>MAPPING SYSTEM UNIT</i></th> <th><i>% WV</i></th> <th><i>CURRENT-NESS</i></th> </tr> </thead> <tbody> <tr> <td>County Boundaries</td> <td>USGS / USFS</td> <td>1:24,000</td> <td>State</td> <td>100</td> <td>1950-1997</td> </tr> <tr> <td>Public Lands</td> <td>State / Federal</td> <td>1:24,000</td> <td>State</td> <td>100</td> <td>Varies</td> </tr> <tr> <td>Municipal Boundaries</td> <td>Municipality</td> <td>Varies</td> <td>Jurisdiction</td> <td>?</td> <td>Varies</td> </tr> </tbody> </table>						<i>DATASET NAME</i>	<i>ORIGINATOR(S)</i>	<i>SCALE / RESOLUTION</i>	<i>MAPPING SYSTEM UNIT</i>	<i>% WV</i>	<i>CURRENT-NESS</i>	County Boundaries	USGS / USFS	1:24,000	State	100	1950-1997	Public Lands	State / Federal	1:24,000	State	100	Varies	Municipal Boundaries	Municipality	Varies	Jurisdiction	?
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Municipal Boundaries	Municipality	Varies	Jurisdiction	?	Varies																								
<b>ULTIMATE GOAL:</b> Governmental unit boundaries of high spatial and temporal resolution.																													

<b>ORTHOIMAGERY</b>					
<p><b>DESCRIPTION:</b> An orthoimage is a georeferenced image prepared from a aerial photograph or other remotely sensed data from which displacements of images caused by sensor orientation and terrain relief have been removed. An orthoimage has the same metric properties as a map and has a uniform scale. Orthoimages with pixel resolution one meter or finer are most useful for collecting detailed framework features.</p>					
	<b>MAPPING STATUS:</b>				
	<ul style="list-style-type: none"> <li>• 1996-99 one-meter CIR orthophotos are accessible from either the WV Department of Environmental Protection or the WV GIS Technical Center.</li> <li>• WVSAMB project captured statewide natural color aerial photography in spring 2003. These 1:4800-scale, 2 foot resolution orthophotos should be available by December 2004. WVSAMB is seeking federal cost sharing for its orthophotos and mapping layers. Funds are needed to resample, reproject, and re-index the WVSAMB orthophotos to a 2-foot, single UTM zone coordinate system, and referenced to the popular USGS 3.75-minute quarter quad index.</li> <li>• In spring 2003 the National Park Service captured aerial photography for its three parks in southern WV.</li> <li>• The WV View Remote Sensing consortium was established in 2003 to catalog and share remote sensing inventories. The WV View (<a href="http://www.wvview.org/">http://www.wvview.org/</a>) complements the WV Data Clearinghouse and other geospatial data libraries.</li> </ul>				
<b>DATA PRODUCERS:</b>					
<i>DATASET NAME</i>	<i>ORIGINATOR(S)</i>	<i>SCALE / RESOLUTION</i>	<i>MAPPING SYSTEM UNIT</i>	<i>% WV</i>	<i>CURRENT-NESS</i>
Landsat 7	USGS	1:40,000 (30 meter)	Path / Row	100	2000-present
USA Select SPOT	SPOT	1:24,000 (10 meter pan)	Path / Row	100	2000
USGS DOQQs (CIR)	USGS	1:12,000 (1 meter)	7.5 Min. Quad	100	1996-99
WVSAMB	WVSAMB	1:4800 (2 foot)	SAMB index	?	2003
Local Government Databases	County/Municipal Governments	1:1200 to 1:4800 (1 foot)	Jurisdiction	?	Variable
<p><b>ULTIMATE GOAL:</b> Statewide multiple resolution digital orthoimagery ranging from 30-meter to 1-foot pixels.</p>					


<b>TOPOGRAPHIC MAPS</b>					
<p><b>DESCRIPTION:</b> A scanned topographic map, or digital raster graphic (DRG), is a useful reference layer. An unclipped scanned image includes all marginal information, while a clipped or seamless scanned image clips off the collar information.</p>					
	<b>MAPPING STATUS:</b>				
	<ul style="list-style-type: none"> <li>• A revised DRG product standard released in May 2001 allows for higher scan and color resolutions. <a href="http://wvgis.wvu.edu/stateactivities/toporevisions.html">http://wvgis.wvu.edu/stateactivities/toporevisions.html</a></li> <li>• A USGS DOI mapping initiative is creating basic revision/contour updates for approximately 44 quads in WV. Presently 65 NAD83 DRGs exist for WV, with another 14 basic revision quads being processed as part of the Panther DOI.</li> <li>• A Joint Funding Agreement (JFA) between the USGS and WV created DRGs for 75 FS Single-Edition quads using non-standard colors at 400 dpi.</li> <li>• A 1:24,000-scale USGS Topographic Map Series status graphic is posted at <a href="http://wvgis.wvu.edu/statusgraphics/toporevisions.html">http://wvgis.wvu.edu/statusgraphics/toporevisions.html</a>.</li> <li>• WVGISTC is leading an effort to create uniform, collarless Digital Raster Graphics (DRG) of USGS topographic maps in both GeoTIFF and ArcSDE formats. Issues being addressed are the (1) consistent no data value for clipped collars, (2) color model, (3) scan resolution, and (4) horizontal datums. A complete, consistent set of collar and collarless DRGs is needed.</li> <li>• The NRCS, CVI, and WV DEP have created DRG mosaics.</li> </ul>				
<b>DATA PRODUCERS:</b>					
<i>DATASET NAME</i>	<i>ORIGINATOR</i>	<i>SCALE / RESOLUTION</i>	<i>MAPPING SYSTEM UNIT</i>	<i>% WV</i>	<i>CURRENT-NESS</i>
Digital Raster Graphic (DRG)	USGS	1:24,000 to 1:250,000	USGS Quad Series Index	100	1950-1997
Single-Edition	USFS / USFS	1:24,000	7.5 Min. Quad	15	1995
Primary Base Series (PBS) Soft-copy	USFS	1:24,000	7.5 Min. Quad	15	1995
<p><b>ULTIMATE GOAL:</b> Consistent and current scanned topographic maps.</p>					

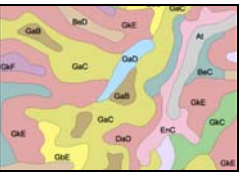



<b>GEOGRAPHIC NAMES</b>					
<b>DESCRIPTION:</b> The Geographic Names Information System (GNIS), developed by the USGS in cooperation with the U.S. Board on Geographic Names (BGN), contains information about almost 38,000 physical and cultural geographic features in West Virginia. The GNIS is our Nation's official repository of domestic geographic names information.					
	<b>MAPPING STATUS:</b>				
	<ul style="list-style-type: none"> <li>In coordination with the BGN and USGS, a State Geographic Names Board should be established to promote accord regarding the proper names of geographic features and places for use in official documents and maps. The State Geographic Names Board would consist of members who can assist in determining the correct and most appropriate names for geographical features in West Virginia. An initial function of the Board would be to formulate a maintenance plan for keeping the Geographic Names Information System (GNIS) database current.</li> <li>In partnership with USGS GNIS Division, WVGISTC currently is coordinating maintenance for the following feature classes: public lands (parks, forests), hospitals, and schools. New, innovative update procedures to the GNIS are being reviewed.</li> <li>WVGISTC created a WV Gazetteer Web service to facilitate updates to the GNIS and to serve as a place names search mechanism for future Internet Mapping Applications. <a href="http://wvgis.wvu.edu/data/gazetteer.php">http://wvgis.wvu.edu/data/gazetteer.php</a></li> <li>WVGES has published a statewide gazetteer of geographic names compiled from topographic maps.</li> </ul>				
<b>DATA PRODUCERS:</b>					
<i>DATASET NAME</i>	<i>ORIGINATOR(S)</i>	<i>SCALE / RESOLUTION</i>	<i>MAPPING SYSTEM UNIT</i>	<i>% WV</i>	<i>CURRENT-NESS</i>
Geographic Names Information System	USGS	1:24,000 or larger	7.5 Min. Quad	100	Varies
<b>ULTIMATE GOAL:</b> A current Geographic Names Information System (GNIS) database for West Virginia.					


<b>STRUCTURES</b>					
<b>DESCRIPTION:</b> Habitable or addressable structures where individuals may reside or gather for business, meetings, entertainment, recreation, religion, or any other social events.					
	<b>MAPPING STATUS:</b>				
	<ul style="list-style-type: none"> <li>The WV Statewide Addressing and Mapping Board's (WVSAMB) goal is to create a statewide, addressable structure layer by 2007. Building centroids and footprint polygons of major structures are being compiled from 1:4800-scale orthophotos. WVSAMB also will develop a long-term maintenance plan to keep addressing databases current. (<a href="http://www.addressingwv.org">http://www.addressingwv.org</a>)</li> <li>WVSAMB structures should be conflated with local government structure databases to create a master spatial database of addressable structures.</li> </ul>				
<b>DATA PRODUCERS:</b>					
<i>DATASET NAME</i>	<i>ORIGINATOR(S)</i>	<i>SCALE / RESOLUTION</i>	<i>MAPPING SYSTEM UNIT</i>	<i>% WV</i>	<i>CURRENT-NESS</i>
State Addressing and Mapping	WVSAMB	1:4800	WVSAMB index	100	Future (2007)
Local Government Databases	County/Municipal Governments	1:1200 to 1:4800	Jurisdiction	?	Variable
<b>ULTIMATE GOAL:</b> A statewide addressable structures spatial database that is continually maintained and consistent.					

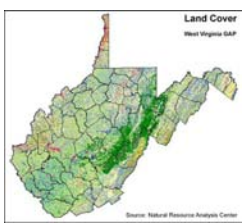


<b>GEODETIC CONTROL</b>					
<b>DESCRIPTION:</b> The horizontal and vertical geodetic control layer. It is the “transparent layer” of a Geographic Information System that provides a common reference system for establishing the coordinate positions of all geographic data.					
	<b>MAPPING STATUS:</b>				
	<ul style="list-style-type: none"> <li>• WV High Accuracy Reference Network (HARN) for Federal Base Network (FBN) and Cooperative Base Network (CBN) Stations completed in Year 2000.</li> <li>• In August 2002 the GIS Steering Committee approved Standards for WV Coordinate Systems.</li> <li>• A survey grade GPS base station has been installed at the Glenville State College, Survey Program. This is the second (public) survey grade GPS base station in West Virginia, the first being in Beckley. Another is scheduled for central Pocahontas County.</li> </ul>				
<b>DATA PRODUCERS:</b>					
<i>DATASET NAME</i>	<i>ORIGINATOR(S)</i>	<i>SCALE / RESOLUTION</i>	<i>MAPPING SYSTEM UNIT</i>	<i>% WV</i>	<i>CURRENT-NESS</i>
Geodetic Control Stations	NGS, WVALS	Survey Scale	Point Location	N/A	N/A
<b>ULTIMATE GOAL:</b> Very high-accuracy network of permanently monumented geodetic control points.					

<b>SOILS</b>					
<b>DESCRIPTION:</b> The Soil Survey Geographic Database (SSURGO) is a detailed field verified inventory of the kinds and distribution of soils on the landscape, whereas the State Soil Geographic Database (STATSGO) is a generalized soils database.					
	<b>MAPPING STATUS:</b>				
	<ul style="list-style-type: none"> <li>• In 2007 SSURGO mapping will be completed in West Virginia. Status graphic: <a href="http://wvgis.wvu.edu/graphics/statusgraphics/soilsurvey1.jpg">http://wvgis.wvu.edu/graphics/statusgraphics/soilsurvey1.jpg</a></li> </ul>				
<b>DATA PRODUCERS:</b>					
<i>DATASET NAME</i>	<i>ORIGINATOR(S)</i>	<i>SCALE / RESOLUTION</i>	<i>MAPPING SYSTEM UNIT</i>	<i>% WV</i>	<i>CURRENT-NESS</i>
STATSGO	NRCS	1:250,000	State	100	1994
SSURGO	NRCS	1:24,000 or larger scale	7.5 Min. Quad	60	1997-present
<b>ULTIMATE GOAL:</b> Statewide SSURGO maps.					

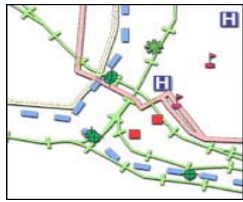
<b>GEOLOGY</b>					
<b>DESCRIPTION:</b> Bedrock and surficial geology, coal-bed mapping, oil and gas exploration.					
	<b>MAPPING STATUS:</b>				
	<ul style="list-style-type: none"> <li>• The North American Geologic Map Data Model Steering Committee is developing mapping standards for digital geological mapping data for inclusion into the National Geologic Map Database as required by the National Geologic Mapping Act.</li> <li>• STATEMAP 1:24k mapping progress (1993-present) <a href="http://www.wvgs.wvnet.edu/www/statemap/statemap.htm">http://www.wvgs.wvnet.edu/www/statemap/statemap.htm</a></li> <li>• In 2003 WVGISTC completed a digital conversion of seven 1:24,000-scale geological maps for the WV Geological and Economic Survey (WVGES). WVGISTC published a technical report on the digital conversion procedures for geologic maps.</li> <li>• In 2003 WVGES created scanned files of the early 1900 county geological maps.</li> </ul>				
<b>DATA PRODUCERS:</b>					
<i>DATASET NAME</i>	<i>ORIGINATOR(S)</i>	<i>SCALE / RESOLUTION</i>	<i>MAPPING SYSTEM UNIT</i>	<i>% WV</i>	<i>CURRENT-NESS</i>
Coal Bed Mapping Program	WVGES	1:24,000	7.5 Min. Quad	16	1999-present
Bedrock Geology	WVGES	1:24,000	7.5 Min. Quad	5	1999-present
Oil and Gas	WVGES / WVDEP / PTTC	Variable	Point Location	N/A	N/A
<b>ULTIMATE GOAL:</b> Statewide geologic maps at 1:24,000 scale.					

<b>FLOOD MAPPING</b>		
<b>DESCRIPTION:</b> Flood mapping involves aspects as delineating accurate floodplains and mitigating flood hazards.		
 <p>Q3 Flood Data</p> <p>Kanawha County</p> <p>Source: Federal Emergency Management Agency</p>	<b>MAPPING STATUS:</b> <ul style="list-style-type: none"> <li>• In 2002 the West Virginia Soil Conservation Agency was the lead agency in developing a <a href="#">Statewide Flood Protection Plan</a> that recommends GIS technologies be employed for floodplain mapping and flood damage assessment.</li> <li>• As a Cooperative Technical Partner, WVGISTC is assisting FEMA in its efforts to create statewide digital flood-mapping themes.</li> <li>• An interagency team needs to compile repetitive flood loss information into a single spatial database.</li> <li>• WVOES has contracted Baker Engineering and CVI to assist in developing the State's All-Hazards Mitigation Plan, mandated by the Disaster Act of 2000, for such hazards as flooding, winter storms, wildfires, dam failure, and landslides.</li> <li>• Digital flood data exists for 38 counties (69%).</li> <li>• In 2003 WV DEP created a statewide Q3 composite floodplain coverage.</li> <li>• In 2003 U.S Army Corps of Engineers created a GIS file of at-risk structures in floodplains for 37 counties.</li> </ul>	
	<b>DATA PRODUCERS:</b>	
Data producers include federal, state, local government and private companies.		
<i>PRODUCT</i>	<i>STATUS</i>	<i>COUNTY</i>
<b>Q3</b>	Q3 Completed	Barbour Braxton Brooke Cabell Calhoun Clay Gilmer Grant Greenbrier Hardy Harrison Jackson Kanawha Lewis Lincoln Logan Marshall Mason McDowell Mingo Ohio Putnam Raleigh Randolph Roane Summers Tucker Tyler Upshur Wayne Wetzel Wirt Wood Wyoming
<b>DFIRM</b>	PRE-DFIRM	Jefferson, Berkeley
	DFIRM Proposed	Gilmer
	DFIRM Mapping	Cabell Fayette Jackson Logan McDowell Ohio Putnam Raleigh Wyoming
	DFIRM Final Modifications	Mercer
	DFIRM QC	Jackson
	DFIRM Completed	Hampshire Monroe
<b>ULTIMATE GOAL:</b> Develop a statewide, GIS-based Floodplain Mapping Information System that adheres to state and federal mapping guidelines.		

<b>LAND COVER</b>					
<b>DESCRIPTION:</b> Land cover relates to the type of feature present on the surface of the earth. Both land cover datasets, WV-USGS Gap Analysis Program (GAP) and National Land Cover Dataset (NLCD), were created from classified 1992-94 Landsat TM imagery purchased as part of the Multi-Resolution Land Characteristics Consortium (MRLC) program.					
 <p>Land Cover</p> <p>West Virginia GAP</p> <p>Source: Natural Resource Analysis Center</p>	<b>MAPPING STATUS:</b> <ul style="list-style-type: none"> <li>• The U.S. Forest Service and Westvaco Corporation maintain their own land cover data sets for timber management.</li> <li>• WV Division of Forestry, WV Division of Natural Resources, and WVU's Appalachian Hardwood Center are conducting GIS mapping for all eight State Forests. GIS data layers include management compartments, forest cover, timber stands, and recreational data.</li> <li>• The Natural Resource Analysis Center (NRAC) at WVU will release a more current WV-GAP Land Cover dataset in FY 2003.</li> <li>• Rahall Transportation Institute (RTI) is creating master land cover plans for 8 southern counties.</li> <li>• Penn State University's Land Analysis Laboratory has been funded by a grant from the EPA to generate land use data within the Chesapeake Bay Watershed.</li> <li>• More coordination is needed to standardize the collection efforts of high-resolution (1:24,000-scale or better) land cover data sets.</li> </ul>				
	<b>DATA PRODUCERS:</b>				
<i>DATASET NAME</i>	<i>ORIGINATOR(S)</i>	<i>SCALE / RESOLUTION</i>	<i>MAPPING SYSTEM UNIT</i>	<i>% WV</i>	<i>CURRENT-NESS</i>
WV-GAP	WVU-USGS	1:40,000 (30 meter)	State	100	1992-94
NLCD	USGS	1:40,000 (30 meter)	State	100	1992-93
<b>ULTIMATE GOAL:</b> Current and higher resolution statewide land cover data sets.					

## CRITICAL STRUCTURES

**DESCRIPTION:** Critical structures are human-built systems that are essential to the safety, security, health and economic well-being of our modern society. Transportation networks such as rail lines, navigable waterways, along with utility and telecommunication systems, are an integral part of the State's critical infrastructure. Critical facilities and infrastructure are vulnerable to disruption by natural or technological disasters.



**MAPPING STATUS:**

- Coordination needed to collect utility and telecommunication networks.
- Certain datasets need to be collected at higher spatial accuracies and validated by the appropriate agency or by emergency management officials at the local level. The WV OES is coordinating the collection of better quality spatial data along with appropriate disclosure statements for sensitive data.
- The WVSAMB Addressing Vendor will create spatial Emergency Service Zone (ESN) polygons and other address-based files useful for emergency response.

**DATASETS REQUESTED BY WV OFFICE OF EMERGENCY SERVICES:**

SA = spatial accuracy (1:24,000-scale or better)      CO = Completeness (geometry and attributes)      CU = Currency  
 Y = Yes      N = No      U = Unknown      ? = No Data Available

DATASET NAME	ORIGINATOR(S) / DATA SOURCE	SA	CO	CU
Airports (Public)	U.S. Department of Transportation	N	Y	Y
Communications Transmitter Sites	Emergency Medical Services, State Police, WV Public Broadcasting, WV Division of Highways	N	Y	Y
Courthouses	Federal and county registers	Y	Y	Y
Dams (federal, state and local)	U.S. Corps of Engineers, WV Department of Environmental Protection	Y	N	Y
Electric Power Systems / Facilities (trans. lines, plants, substations)	U.S. Environmental Protection Agency, Public Service Commission, American Electric Power, Allegheny Power	N	U	Y
Fire Stations	WV State Fire Marshal's Office, WV Division of Forestry	Y	Y	Y
Gasoline Bulk Plants	Petroleum Industry Association	Y	Y	Y
Hospitals	WV Health Care Authority	Y	Y	Y
Intermodal Terminal Facilities	U.S. Department of Transportation	N	Y	Y
Landfills	WV Department of Environmental Protection	Y	U	Y
Major Chemical Facilities	National Institute for Chemical Studies	Y	Y	Y
Major Natural Gas Compressors	WV Public Service Commission	Y	Y	Y
Major Natural Gas Pipelines	U.S. DOT, Utility Companies	Y	N	N
Municipal Water Reservoirs	WV Bureau of Public Health	Y	U	Y
National Guard Armories	WV Army National Guard	Y	Y	Y
Nursing Homes	WV Health Care Authority	N	Y	Y
Ports / Navigable Waterways	U.S. Department of Transportation	N	Y	Y
Prisons (state)	WV Division of Corrections	Y	Y	Y
Regional Jails	WV Regional Jail Authority	N	Y	Y
Schools (PK-12 and college)	WV Department of Education, WV Army National Guard WV Higher Education Policy Commission	N	N	Y
Sewer Treatment Plants	WV Division of Water Resources	N	Y	N
Significant Critical Structures (communications, military, energy)	WV Office of Emergency Services	Y	Y	Y
Significant Critical Bridges (Rail and Highway)	WV Division of Highways, WV Public Service Commission	U	Y	Y
Sports Arenas		Y	U	Y
State Police Detachments	WV State Police	N	Y	Y
Telephone Central Offices	Verizon, Citizen	Y	Y	Y
Water Treatment Plants	WV Bureau of Public Health	Y	U	Y

**ULTIMATE GOAL:** Statewide critical facilities and infrastructure mapping files that are spatially accurate, complete, and current.

## ECONOMIC DEVELOPMENT

**DESCRIPTION:** Economic development facilitates business opportunities and growth throughout the state. It focuses on enhancing the factors of productive capacity - land, labor, capital, and technology.



**MAPPING STATUS:**

- The WV Development Office (WV DO) has contracted RTI to develop an online, GIS-based Economic Development Information System similar to Kentucky's <http://www.thinkkentucky.com/edis/>.
- WVGIST has created GIS datasets for industrial sites, empowerment zones, enterprise communities, foreign trade zones, air-pollution non-attainment area, proposed highways, regional economic development and workforce boundaries, and other economic development data <http://wvgis.wvu.edu/data/data.php?action=search&subject=Economic%20Development&location=ALL+LOCATIONS>
- The WV DO can link spatial data to DEP's Environmental Resource Information System (ERIS) to obtain surface mine status

**DATASETS REQUESTED BY WV DEVELOPMENT OFFICE:**

*Italics = sensitive dataset*

GIS coverage available (Y = Yes, N = No, P = Partial, U = Unknown)

#	<i>DATASET NAME</i>	<i>ORIGINATOR(S) / DATA SOURCE</i>	<i>GIS</i>
1	State, county and municipal boundaries	U.S. Geological Survey (USGS), U.S. Census	Y
2	Public lands	U.S. Forest Service, USGS-WV GAP, WV Division of Natural Resources (DNR)	Y
3	Metropolitan Statistical Areas and Urbanized Areas	U.S. Census, Office of Management and Budget	Y
4	Regional Economic Development and Workforce Development boundaries	Governor's Workforce Investment Office	Y
5	Federal Empowerment Zones, Enterprise Communities, Foreign Trade Zones	U.S. Department of Agriculture, U.S. Department of Housing and Urban Development (HUD), WV Development Office (DO)	Y
6	Street, road and highway network, including proposed major highways	U.S. Department of Transportation (DOT), WV DOT	Y
7	Rail network, including rail spurs by type/frequency of service	US DOT, USGS	Y
8	Existing and proposed airports and ports	US DOT	Y
9	Streams, lakes, wetlands, navigable waterways and 100 year floodplains (67% coverage)	USGS, U.S. Fish & Wildlife Service, US DOT, FEMA, USACE, WV Soil Conservation Service	P
10	Known industrial sites (166), parks (82) and buildings (83)	WV Development Office (WV DO)	P
11	<i>Water, sewer, gas, electric and fiber optic communications lines (by size, condition, capacity)</i>	U.S. DOT, WV Public Service Commission, Utility Companies, Miss Utility	P
12	Existing, proposed and reclaimed surface mines (updated annually)	WV Geological Survey (27% coverage), WV Department of Environmental Protection (88% open permits, 40% closed permits)	P
13	Air pollution non-attainment areas and <i>endangered streams</i>	WV DEP, WV DNR	Y
14	Brownfield sites	WV DEP	U
15	<i>Major highway and rail underpasses and clearance height</i>	WV DOT	N
16	Vo-tech schools, colleges and universities	WV Department of Education, WV Higher Education Policy Commission	P
17	Large employers	WV DO, WV Bureau of Employment Programs	P
18	Major recreation and resort facilities (public and private)	Public land databases, national business directories	P
19	Generalized Land Use	USGS, RTI, satellite imagery	Y
20	Parcel Boundaries	WV Department of Tax and Revenue, Assessors	P

**ULTIMATE GOAL:** Develop a GIS-based Economic Development Information System for the state.