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Final Report

Improving the Availability and Delivery of Critical Information for Tight Gas Resource Development in the Appalachian Basin

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ABSTRACT

To encourage, facilitate and accelerate the development of tight gas reservoirs in the Appalachian basin, the geological surveys in Pennsylvania and West Virginia collected widely dispersed data on five gas plays and formatted these data into a large database that can be accessed by individual well or by play. The database and delivery system that were developed can be applied to any of the 30 gas plays that have been defined in the basin, but for this project, data compilation was restricted to the following: the Mississippian-Devonian Berea/Murrysville sandstone play and the Upper Devonian Venango, Bradford and Elk sandstone plays in Pennsylvania and West Virginia; and the "Clinton"/Medina sandstone play in northwestern Pennsylvania. In addition, some data were collected on the Tuscarora Sandstone play in West Virginia, which is the lateral equivalent of the Medina Sandstone in Pennsylvania.

Modern geophysical logs are the most common and cost-effective tools for evaluating reservoirs. Therefore, all of the well logs in the libraries of the two surveys from wells that had penetrated the key plays were scanned, generating nearly 75,000 scanned e-log files from more than 40,000 wells. A standard file-naming convention for scanned logs was developed, which includes the well API number, log curve type(s) scanned, and the availability of log analyses or half-scale logs.

In addition to well logs, other types of documents were scanned, including core data (descriptions, analyses, porosity-permeability cross-plots), figures from relevant chapters of the Atlas of Major Appalachian Gas Plays, selected figures from survey publications, and information from unpublished reports and student theses and dissertations. Monthly and annual production data from 1979 to 2007 for West Virginia wells in these plays are available as well. The final database also includes digitized logs from more than 800 wells, sample descriptions from more than 550 wells, more than 600 digital photos in 1-foot intervals from 11 cores, and approximately 260 references for these plays.

A primary objective of the research was to make data and information available to producers through an on-line data delivery model designed for public access on the Internet. The web-based application that was developed utilizes ESRI's ArcIMS GIS software to deliver both well-based and play-based data that are searchable through user-originated queries, and allows interactive regional geographic and geologic mapping that is play-based. System tools help users develop their customized spatial queries.

A link also has been provided to the West Virginia Geological Survey's *"pipeline"* system for accessing all available well-specific data for more than 140,000 wells in West Virginia. However, only well-specific queries by API number are permitted at this time.

The comprehensive project web site resides on West Virginia Geological Survey's servers and links are provided from the Pennsylvania Geological Survey and Appalachian Oil and Natural Gas Research Consortium web sites.

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EXECUTIVE SUMMARY

The Appalachian Oil and Natural Gas Research Consortium, a program within the National Research Center for Coal and Energy at West Virginia University, was awarded a contract by the Department of Energy to simplify and accelerate the data collection process for independent producers interested in developing tight gas reservoirs in the Appalachian basin.

Data collection was concentrated on five gas plays of regional significance, as determined by historical and current activity, and remaining gas resources. These five plays are the Mississippian-Devonian Berea/Murrysville sandstone Play and three Upper Devonian sandstone plays (Venango, Bradford and Elk) in Pennsylvania and West Virginia, and the Lower Silurian "Clinton"/Medina Play in Pennsylvania. Additional data were collected for the Tuscarora Sandstone play in West Virginia, which is a lateral equivalent to the Medina in Pennsylvania.

The first objective of this project was to advance the understanding of these tight gas accumulations by collecting and compiling into a comprehensive project database, a broad range of data and information formerly dispersed in public records, file drawers, core facilities, publications, and digital databases created while performing former contractual work. The second objective was to make the information in this new database more readily available through an on-line, interactive geospatial delivery model designed for public access on the internet.

To meet these objectives, three research tasks were designed and implemented. The first of these was to assemble a broad spectrum of relevant data, including well logs, cores and core descriptions, analyses and photos, for wells in the five tight gas reservoirs, and to assemble published and unpublished maps and cross sections of these plays and convert them to a digital format. A second task was to devise an internet-based geospatial data delivery model that would allow easy access to these diverse data by industry and the general public, and the final task was to transfer technology through a cooperative effort with the Petroleum Technology Transfer Council.

The main products of this project are a fully-functional, publicly-available, geospatial database for the five tight gas plays in the two states, and an interactive, web-based GIS application with well-specific and regional data organized by plays.

The final well-specific database includes "header" information on more than 125,000 wells which penetrate the selected plays in the two states, and scanned e-logs for more than 40,000 of those wells. In addition, the database also includes digitized logs for more than 800 wells penetrating these plays; sample descriptions from more than 550 wells; more than 600 digital photos in 1-foot intervals for 11 cores; and approximately 260 references for these plays, including theses, dissertations and numerous unpublished studies. Selected pages, core descriptions, core data, abstracts, conclusions, maps and cross sections were scanned from several of these references, where permitted to do so.

Users can create their own data collection by generating queries through any of several search mechanisms, including: the well header search; the well-based e-log search; the play-based search; or the reference search. Search results can be viewed on-screen, or exported to Microsoft Excel spreadsheets.

The web-accessible, geospatial, interactive mapping system for the six tight gas plays utilizes ESRI's ArcIMS GIS software to display well-specific and play-specific regional data organized by gas play. In addition to well data by play penetration, a basic layer of more than 200,000 oil and gas well locations is provided. The system allows interactive mapping by play that can display geographic and geologic layers, play-specific data and documents, a link to the well-based data search, digitized cross sections, maps of play outlines and fields in the play, maps digitized from the Gas Atlas, other maps digitized for this project, and a link to the scanned documents for each play. System tools are provided to help users develop their customized spatial queries.

The final project web site resides on West Virginia Geological Survey servers; links are provided to the site from the Pennsylvania Geological Survey and Appalachian Oil & Natural Gas Research Consortium web sites. Both surveys plan to maintain the site by providing data updates in the future.

Applications developed for this project are scalable, and can be extended to additional plays in the Appalachian basin, including historic shale plays, such as the Huron, and emerging, frontier plays, such as the Marcellus Shale play, that currently has attracted numerous companies to the Appalachian basin.

REPORT DETAILS

OVERVIEW

Modern geophysical logs are the best and most cost-effective tools for evaluating reservoirs, but ready access to publicly-held logs has not always been possible, especially at the desk of the user. In addition, other important pieces of publicly available information are widely scattered, stored in a variety of places, and usually unknown to producers, or, if known, not readily available. Therefore, to encourage and facilitate the development of tight gas reservoirs in the Appalachian basin, the government sector needed to simplify and accelerate the data collection process and create an effective delivery system to place these data in the hands of independents.

The database format and delivery system that were developed can be applied to any of the 30 gas plays that have been defined in the Appalachian basin. However, for this initial project, data were collected for only five tight gas plays: the Berea/Murrysville sandstone play in Pennsylvania and West Virginia; the Upper Devonian Venango, Bradford and Elk sandstone plays in Pennsylvania and West Virginia; and the "Clinton"/Medina sandstone play in northwestern Pennsylvania. Additionally, data were collected for the Tuscarora Sandstone play in West Virginia because it is a lateral stratigraphic equivalent of the Medina Sandstone is Pennsylvania.

METHODS

The scope of the project was limited not only to the tight sandstone plays listed above, but also to data that could be collected within the offices and libraries of the Pennsylvania and West Virginia geological surveys. Teams were organized within each survey to search their files, map drawers, libraries and warehouses and collect a broad spectrum of relevant data for wells in the plays, and to locate published and unpublished studies on these reservoirs and plays.

This task began with both survey teams identifying all wells that were logged through the five plays of interest. All of these well logs were scanned and further individual well data to be collected were restricted to these wells. These data included cores, core slabs, core photos, core analyses, thin sections made from cores, thin section descriptions and microphotographs. To further enhance the value of the database, a small subset of the well logs was selected to be digitized.

While these relevant data were being collected and organized into a database, another team at the West Virginia Geological Survey was developing an Internet-based geospatial data delivery system that would deliver not only the data described above, but also certain information on stratigraphy, pays, completions, shows and production from the survey's oil and gas database.

RESULTS AND DISCUSSION

Task 1: Research Management Plan

A research management plan for this project was prepared and submitted in October 2005. The report identified the West Virginia University Research Corporation as the prime contractor, but specified that the contract work would be performed by the Appalachian Oil & Natural Gas Research Consortium (AONGRC), an oil- and gas-related research program within the National Research Center for Coal and Energy at West Virginia University. Project management was assigned to the Director of the AONGRC.

The report further defined the research team, consisting of professionals at the Pennsylvania Geological & Topographic Survey (PGTS) and the West Virginia Geological & Economic Survey (WVGES). Two supervisors from each survey joined with the Director of AONGRC to form the complete management team.

The report also documented the work breakdown structure and provided a supporting narrative that included the objectives and approach, work schedule, deliverables and budget for each of the research tasks.

Task2: Technology Status Assessment

A technology status assessment was performed and the results were included in a report submitted in November 2005. The report concluded that although the five plays defined in the work plan have been historically significant in terms of gas production and activity, they also will continue to be important in the future, with remaining resources estimated to range from 20 to 25 trillion cubic feet (Tcf). The report also concluded, that although most gas companies in the Appalachian basin have developed digital databases containing information on their own wells, their presence at geological surveys in search of other data provides testimony as to the need to gather and deliver this information, especially widely scattered, hard to find data, to Appalachian producers at their desktop.

Data to be collected, organized and delivered were to include both individual well and play-based summaries, often in the form of a graphical illustration. Thus, a major problem facing the research team, once the data were actually located, was the amount of time that would be required to organize these widely diversified data in one database and deliver the information to industry. However, it was recognized by the authors of the report, that the successful completion of this project would result in a very important database that could be accessed with relative ease in the office, thereby eliminating costly and time-consuming trips to separate geological surveys. Providing more and better data in this manner should allow industry to accelerate their drilling programs, thus increasing domestic gas supply while reducing finding and production costs.

Task 3: Assemble a broad spectrum of relevant data for wells in the selected tight gas reservoirs of the selected area of the Appalachian basin

Subtask 3.1 – Identify wells with logs (from the two State Geological Survey log libraries) that penetrate selected tight gas reservoirs of the Lower Mississippian/Upper Devonian Berea/Murrysville play, Upper Devonian Venango, Bradford and Elk plays and the Lower Silurian "Clinton"/Medina play

The availability of wireline or electric logs (e-logs) for wells penetrating the selected tight gas reservoirs in the two states was the primary selection parameter for the development of the geospatial data delivery interface. The West Virginia Geological and Economic Survey (WVGES) identified 16,211 wells with wireline logs in its log library which penetrated the associated formations of the five tight gas plays in West Virginia (i.e., the Berea, Venango, Bradford, Elk, and Tuscarora plays). The Pennsylvania Geological Survey (PGS) identified 23,977 wells with wireline logs which penetrated the associated formations of the six tight gas plays in Pennsylvania (i.e., the plays listed above, plus the Medina/"Clinton" play).

It should be noted that although the project proposal did not specifically identify the Tuscarora as one of the plays to be studied, geologists at the two state surveys decided to include that play because it is stratigraphically equivalent to the Medina/"Clinton" of Pennsylvania and because it occurs in both states. Also, any logs or cores that penetrate the Tuscarora would prove useful to both the project and to producers in their evaluation of areas for drilling or recompletion potential in any of the other, stratigraphically higher plays.

Subtask 3.2 – Determine the availability of other types of data for wells with logs; e.g., cores, slabs, thin-sections, etc

WVGES geologists identified 32 cores in the agency's core library which penetrated the five selected plays. Of those, only 11 had been slabbed and were available for photographing; logs were available and were scanned and digitized for 10 of those 11 cores. The remaining 21 cores were either not slabbed (cutting core was not part of the project plan) or exist predominantly as core chips which could not be photographed. However, logs were available and were scanned for 16 of those 21 non-photographed cores which penetrated the selected plays.

To date, nearly 50 records of core data, including core descriptions, core data analyses, and porosity-permeability cross-plots, have been entered as "documents" into the project data system.

In addition to e-logs, other types of documents were scanned. A compendium of potential project references for the six plays was developed; selected pages within some of these references were scanned for inclusion/availability on-line within the project. Among those references specifically targeted for inclusion were unpublished reports,

WVGES and federal publications, and thesis/dissertation data. Among the reference types scanned were:

- figures from the relevant chapters of ***The Atlas of Major Appalachian Gas Plays*** (also known as the *Gas Atlas;* see references) that were not able to be digitized;
- selected figures from WVGES publications, federal reports and publications, and field trip guides;
- core analysis and description data from various published or unpublished sources;
- thin-section photographs;
- relevant unpublished reports from the files of WVGES, including those reports generated for the Tight Sands Projects of the early 1980's;
- introductory material, tables of content, abstracts, conclusions, and specific maps, cross-sections, or data from some unpublished student theses and dissertations from the West Virginia University (WVU) Department of Geology and Geography.

Monthly and annual production data for individual wells are available in the WVGES oil and gas well database for the period 1979 (when production reporting first became required the by the oil and gas regulatory authority in West Virginia) through 2007. Because these data are in the database, they are available to users of this project.

Subtask 3.3 – Scan logs that haven't already been scanned

WVGES scanned e-logs for 16,211 wells identified as penetrating the plays, generating 35,254 scanned e-log files – i.e., an average of more than two individual scanned log files per well. All available e-logs for each identified well were scanned in their complete top-to-bottom intervals. The TIFF image format was selected for the scanning output because it preserves the original image, can be rather easily manipulated and incorporated into other software applications, and is commonly used as a log image format by other state geological surveys.

A standard file-naming convention for scanned e-log files was developed. The file name identifies the well API number, the log curve type(s) scanned, and the availability of log analyses or half-scale logs. The file-naming convention for both the scanned and the digitized e-logs is as follows: 10-digit API number, plus

- one-letter designation for each log curve type* (see list below) with "o" (curves without a specific designation) shown last;
- a number, if necessary, to distinguish files containing logs with the same curve types but which are distinctly different logs (such as different intervals, time frames, etc.);
- "_a" for the presence of a "Log Analysis" on the log itself, if included;
- "_h", if necessary, for reduced scale (half-scale) logs.

*Types of Log Curves

Code	Log Curve Type	Includes
c	caliper	
d	density	includes bulk density, compensated density, density, density porosity, grain density, matrix density, etc.
g	gamma ray	
i	induction	dual induction, medium induction, deep induction, spherically focused, etc.
n	neutron	neutron porosity, sidewall neutron, etc.
t	temperature	borehole temperature, differential temperature, etc.
b	cement bond	
e	photoelectric absorption	PE or Pe, etc.
l	laterolog	
m	dipmeter	
p	perforation depth control or perforate	
s	sonic or velocity	
z	spontaneous potential or potential	
o	Other**	** may include, but not limited to, curves such as audio, bit size, CCL, collar locator, continuous meter, directional survey, gas detector, guard, NCTL, Nuclear Cement Top Locator, radioactive tracer, tension

Following are several examples of file names for scanned e-logs:

- 4710900302dnietgco.tif – for a scanned log file containing density, neutron, induction, photoelectric, gamma ray, caliper, and other log curves
- 4710700803dgc_a.tif – for a scanned log with density, gamma ray, and caliper curves and a log analysis at the end of the image;
- 4701500063bsgo.tif – for a scanned log with a cement bond, sonic, gamma ray, and other log curves;
- 4701500098gto1.tig, 4701500098gto2.tif – for a well that has the same log curve types but some other distinction such as date or time.

File-naming for digitized logs was the same as for scanned logs, except that the 4-character code "**dlog**" was inserted after the API number.

Database records about the logs themselves (e.g., specific log curves available, top and bottom of each log type, availability of scanned or digitized logs, comments about the

availability of log analyses, etc.) were keyed into the Mechanical Log Catalog (MLC) data table of the WVGES oil and gas well database, in order to enable users to efficiently query the system about the availability of specific types of logs.

The PGS scanned e-logs for 23,977 wells that penetrated the 6 plays in that state, generating a total of 39,573 scanned e-log files.

Subtask 3.4 – Scan core slabs. Enter core analysis data into a database

Project staff could not scan core slabs because the technology that was previously available to us at a reasonable cost was no longer available by the time the project started. Instead, slabbed cores from the plays utilized for this project were digitally photographed at 1-foot intervals (see Subtask 3.7).

Core analysis and core description data for more than 40 wells were entered into the project database or scanned.

Subtask 3.5 – Evaluate existing data for quality management (QA/QC)

Data quality management was emphasized from the beginning of the project; it was continuous and on-going in every phase of the project that dealt with basic data.

In order to assure continuity in the management of the data and ease in the development of data queries, file-naming conventions were developed and followed for scanned e-logs, digitized e-logs, and other scanned documents and data. Previously-scanned log files were renamed in order to assure consistency of file-naming conventions. All curves for West Virginia logs were checked to identify the availability of log analyses at the end of log sections; that availability was indicated in the file name and was also coded into the WVGES MLC data table for ease in querying the availability of the data.

Instructional materials for scanning e-logs, digitizing e-logs, photographing cores, naming files, and updating MLC and Well Samples and Cores (WSC) data tables were developed. Project staff members were trained and their progress and work was monitored. Files were spot-checked on a regular basis, to assure compliance with defined procedures.

The process of determining which representative logs should be digitized started with e-logs for those wells with cores, e-logs included in the *Gas Atlas*, and those wells which provided a broader stratigraphic and geographic extent across the state (e.g., for cross-sections). Supervisory staff defined which log curves should be digitized (typically, all available curves) and trained other staff on how to digitize logs using NeuraLog software.

WVGES oil and gas well MLC database records were edited/updated for every scanned e-log to include information about specific types of logs available, specific log intervals, the presence of log analyses on the logs, and the availability of half-scale or other size logs. WSC database records were updated to include information about specific core

intervals, available core and/or cuttings/sample descriptions, and the availability of permeability data, thin-sections, or photographed core intervals. These database records will enable the development of user queries with other database fields.

Because well locations are the most basic of data utilized in these interactive digital mapping applications, a major effort was undertaken to improve the precision of "older" West Virginia well locations by digitizing those which were previously available only in a less-precise 15' scale (i.e., 1:62,500 scale) into a 7.5' scale (1:24,000 scale). Data entry staff were trained to digitize the newer locations from a variety of georeferenced maps; their work and outputs were monitored. While more than 15,000 of these older well locations were digitized to a 1:24,000 scale, not all of the 1:62,500 scale well locations were able to be converted. Work on these remaining older well locations will continue beyond this project.

A program to validate West Virginia oil and gas well data was rewritten in PL/SQL in order to assure general compliance to the agency's data coding standards and to check data across the several Oracle database tables (e.g., do the details provided in the "PAYS" record agree with the well type field in the "COMPLETIONS" record?, etc.).

Subtask 3.6 – Assemble a group of representative logs for each play and digitize the tight pay intervals to create .las files

Geographically and stratigraphically representative e-logs were selected to be digitized from the cross-sections presented in the play descriptions in the *Gas Atlas*. Additional logs were selected to be digitizing either because of the log types that they contained or to further extend the geographic availability of this type of supportive data.

WVGES staff utilized the NeuraLog software for log digitizing and digitized as many curves per log as possible. Logs were digitized by project staff for 70 West Virginia wells and operators provided .las files for an additional 34 wells, for a total 104 West Virginia wells with logs digitized for this project. PGS provided an additional 720 digitized logs files for the project.

The availability of digitized log .las (Log ASCII Standard format) files is noted in the project web site in two sections: the "Oil & Gas Well Header Data Search" (for identifying wells with digitized logs by play, county, quadrangle name, operator, surface owner, or deepest formation penetrated), and the "Well-Based E-Files (Logs)" page link (for identifying digitized logs by play, county, and/or API number).

Subtask 3.7 – Take digital photographs of available thin-sections. Photograph available core slabs

WVGES geologists identified 32 cores in its core library which penetrated the five selected plays in the state. Of those, only 11 cores had been slabbed; the remainder of the cores was either not slabbed or exist predominantly as core chips that were not photographed. The available footage of the 11 slabbed cores was digitally photographed.

Photographic images were edited and cropped to 1-foot sections, and then resized for viewing on the Internet. Large thumbnail images were created to a size of 250 pixels in width, typically placing four photos/images per web page for easy viewing. The original 1-foot image is accessible by clicking on the individual 1-foot thumbnail. Each play in West Virginia is represented by photographed core. Four cores from the Berea play were photographed with a total of 89 1-foot images, along with 2 cores from the Venango play (54 images), 1 core from both the Bradford play (12 images) and Elk play (15 images), 1 core covering the Elk play alone (45 images), and 3 cores from the Tuscarora play (359 images), for a total of 574 1-foot images. These core photographs can be viewed on the project web site at http://www.wvgs.wvnet.edu/ATG/CoresList.aspx , in the "Slabbed Core Photos" section of the web site.

The other 21 non-photographed cores are listed in a separate table on the cores web page, providing information for users who may wish to examine them in the core library. Arrangements must be made in advance to visit the core library in either state.

WVGES and PGS staff were unable to obtain privately-held thin-sections for photographing. However, photographs of some thin-sections from theses/dissertations or other references were scanned for presentation in the application.

Subtask 3.8 – Assemble relevant maps and cross-sections from the "Atlas of Major Appalachian Gas Plays" and other State Survey publications; convert these products to digital form

For each of the six plays (Berea/Murrysville, Venengo, Bradford, Elk, Medina/"Clinton", and Tuscarora), maps and cross-sections from the selected *Gas Atlas* play descriptions were scanned, cropped, georeferenced, and digitized; other tables, illustrations, and figures from the selected plays were scanned. *Gas Atlas* maps which were digitized include isopachs, isoliths, producing trends, productive gas fields/pools, outcrop and subcrop, formation limits, faults, and probable and possible resources. Maps digitized from other sources include play outlines, gas fields, oil fields, significant wells, regional thickness maps, and some structure maps. Some cross-sections were created using selected wells.

For these products, a total of 104 layers (including 6 cross-sections and 40 maps from the *Gas Atlas* and 4 maps from other sources) were digitized, as typically several layers are contained within a single map. These include:

- Berea play: 12 *Gas Atlas* layers (6 maps and 1 cross-section), and 1 other layer/map;
- Venango play: 17 *Gas Atlas* layers (5 maps and 1 cross-section), and 1 other layer/map;
- Bradford play: 15 *Gas Atlas* layers (6 maps and 1 cross-section), and 1 other layer/map;
- Elk play: 28 *Gas Atlas* layers (9 maps and 1 cross-section), and 1 other layer/map;

- Medina/"Clinton" play: 10 *Gas Atlas* layers (7 maps and 1 cross-section); and
- Tuscarora play: 22 *Gas Atlas* layers (7 maps and 1 cross-section).

More than 260 references were identified from other sources that are relevant to these plays. These other sources include university theses/dissertations, abstracts, published and unpublished reports, field trip guides, etc.

Among the data types gathered for the project's interactive mapping system are: structural, stratigraphic, paleogeographic, production, and other types of maps by specific play or regionally in general; structural and stratigraphic cross-sections; stratigraphic logs; and others.

All project images and documents are managed within a customized document management system designed and constructed in-house within an Oracle database. The Appalachian Basin Tight Gas Reservoirs Project web application which was built using .NET technology uses this document management system along with the WVGES oil and gas database to provide the user with a robust search environment for acquiring relevant material (images, documents, or data).

Task 4.0 – Devise an Internet-based geospatial data and delivery model (such as ESRI's ArcIMS) for delivery of the broad variety of data to the public

The primary objective of this task was to make data and information on the selected tight gas reservoirs available to producers and the public though an on-line, interactive geospatial data delivery model designed for public access on the Internet.

Development of this web-based application concentrated on two components: the delivery of well-based and play-based data that are searchable through user-originated queries, and interactive regional mapping that is play-based.

Subtask 4.1 – Define attribute data to be included for public access

The primary selection parameter for the project was all wells with wireline logs; the availability of cores that penetrate at least one of the selected plays also was important in that selection.

Well-Specific Database

More than 125,000 wells penetrate the six selected tight gas plays in Pennsylvania and West Virginia; the two state geological surveys have e-logs for 40,188 of those wells. All of those logs were scanned.

Project geologists from West Virginia and Pennsylvania decided to include the following data fields in the well-specific project database from which queries may be run: API

number, county name, permit number, operator name, surface owner name, farm/well number, elevation of the well, well location coordinates, 7.5' quadrangle, well type, completion date, deepest formation penetrated name, total depth, and the availability of logs and/or cores. These fields were selected because they include typical "header" data fields with which producers are familiar.

Additionally, WVGES decided to add the following data fields to the project database, to enable more robust data queries and searches: oil and gas mineral rights owner, company number, field name, and the availability of sample descriptions.

One of the goals of this project was to amass a variety of reference materials associated with these plays. Selected references, including several with limited distribution, were collected, evaluated, categorized, and – where particularly applicable to the project – scanned for presentation on the project web site. A document management system was developed within an Oracle database to manage the variety and breadth of documents, photographs, and files that were scanned for presentation in the system.

Interactive Mapping System

The attribute data accessible from the on-line interactive mapping system are briefly described below. In addition, a complete list of attribute data presented by layer is provided in Appendix A. The Appendix A compendium includes layer name, file name, data source, attribute name, attribute data type, attribute data length, and attribute description. In determining what attribute data to include, the following factors were considered: anticipated usefulness to an operator (based on discussions with operators), mapping system speed, and data availability.

- General Geography Layers: All of the general geography layers were obtained from other sources. The layers contain the attributes as obtained from the source.
- General Geology Layers: With the exception of the "All Gas and Oil Wells" layer, all of the general geology layers were obtained from other sources and contain the attributes as obtained from the source. The "All Gas and Oil Wells" layer contains basic data and attributes from the geological surveys' oil and gas well databases about the well location, owner(s), completion(s), any logs available, any cores/samples available, and plays that were penetrated.
- Play-Specific Layers and Documents (included for each of the six plays):
    - Wells that Penetrate Play
        - Pennsylvania:
        - West Virginia: Attribute data include basic data about the well location, owner(s), completion(s), any logs available, any cores/samples available, and plays that were penetrated. In addition, basic data about the pay zone is included for "Wells with Reported Pay" layers.
    - Cross-Sections

      Any attribute data that could be extracted from the cross-section image was included. In general, cross-section attribute data are

very limited and include the figure label, the cross-section label, and cross-section file name.

- Maps

  Any attribute data that could be extracted from the map image were included. In general, map attribute data are very limited and depend on the type of map. For example, play outline maps contain geometry values; field maps contain field name, producing formation, and production type; and contour maps contain contour values.

Subtask 4.2 – Design and develop an Internet-based geospatial data delivery model; design public access by tight gas play, API number, spatial attributes

The Appalachian Tight Gas Reservoirs application has two major components: the web-based data applications and the interactive mapping system. The overall project application serves as a foundation for a collection of services designed to present interactive well-based maps that can be further defined by location- and attribute-based queries, show regional data such as outline maps and cross-sections, display supplemental images such as logs and photographs, and permit image and data downloads empowering users with data that can be used to meet specific needs. Screenshots of each of the data and interactive mapping application sections, along with sample queries and results, are provided in Appendix B.

Well-Specific Database

The web-based data application was developed using the Microsoft .NET platform and uses an Oracle database on the back end to allow users to search the data system developed for the project. The data system consists of three primary datasets:

- well-specific "header"-type data for Pennsylvania and West Virginia wells, with the assignment of plays based on well penetrations;
- well-based scanned documents and images, with the assignment of plays based on well penetrations; and
- play-based scanned documents and images.

Users can navigate through the web-based data application and interactively search the system through the forms that have drop-down list boxes to select from and text boxes to fill in. All of the datasets noted above are searchable by play, geography, or several other basic data fields.

User-originated database searches can be created from any number of fields available on the search forms. For a well-header-based data search, search fields include: play; geographic extents such as county or quadrangle; type of log available; log bottom depth; the availability of scanned logs, digitized logs, sample descriptions, and/or core photos; API number; total depth; completion year; operator; surface owner; field name; deepest formation penetrated; and/or well type.

For a search of well-based e-files, search fields can include any combination of play penetrated, well API number, and data type (such as core photos, core descriptions or analyses, sample descriptions, scanned or digitized logs, or thin-section photos); results can be retrieved for viewing on-screen or downloading to a user's desktop.

For play-based searches, users can query the system for play-based documents such as reports, theses or dissertations, maps, cross-sections, stratigraphic or paleogeographic illustrations, or other types of information. Additionally, users are able to search for references by play, year published or written, or author. Results from several of the searches are returned in a grid format along with an optional link enabling the user to view the results on-screen or open the results in – and export the results to – a Microsoft Excel spreadsheet. When searching documents, images and photos, results are available for viewing online or can be downloaded to the user's desktop.

The Appalachian Tight Gas Reservoirs data application includes an interactive page for viewing photos of cores. The user can select from a table listing the cores which have been photographed, and can navigate through the large thumbnails of 1-foot intervals in sets typically displayed at four photos per page. Full-size images are available by clicking on a selected 1-foot interval. These core photos also are available for downloading.

The data application also provides an overview of the project, detailed help for using the system, links to pertinent other information available for the project (e.g., the file repository of downloads available and the WVGES well-specific ***"pipeline"*** access to all well data that they have available for West Virginia), and contact information for the project. Some functions (such as the ability to view scanned logs) are repeated within several sections of the application, in order to provide users with options for accessing data from a number of points within the entire application.

Interactive Mapping System

The Appalachian Basin Tight Gas Reservoirs web-based interactive mapping system presents well-based maps that can be further defined by location- and attribute-based queries; it also shows regional data such as play and field outline maps and cross-sections, and displays supplemental data, empowering users with extensive data that can be used to meet their specific needs.

The interactive mapping system provides access to data layers and documents categorized by play for each of the six plays included in the project. Each play contains well, cross-section, and map layers. A number of tools are available for examining the layers, including the zoom, pan, identify, and query tools. Also, layers are downloadable using the data extraction tool. Supplemental information and data may be obtained for the well layers by using hyperlinks; this supplemental information includes basic data about the well such as the API number, location, plays that were penetrated, owner(s), completion(s), any logs, any cores/samples, and any pay zones. Play-based layers are

supplemented by documents that may be accessed through the system. These documents include such items as charts, diagrams, and reports.

The initial version of the Appalachian Basin Tight Gas Reservoirs interactive mapping system was developed using ESRI ArcIMS (Interactive Map Server) software. The system is accessible by the public through two links on the WVGES web site: the project's main web page (URL: http://www.wvgs.wvnet.edu/ATG) and the interactive mapping system's page (URL: http://imsdev.wvgs.wvnet.edu/website/ATG/viewer.htm). The current plan is to eventually transfer the system to ESRI ArcGIS Server software when WVGES implements such enterprise software system-wide.

Subtask 4.3 – Gather, assemble, and populate the datasets

Well-Specific Database

The project database is a combination of in-house data from the WVGES database and data provided by the PGS. A master data table was built to identify each of the plays which each well penetrates, since many wells penetrate more than one play. Fields were added to the master table to help manage the information that was available for each well – e.g., scanned e-logs, digitized e-logs, core photos, scanned sample descriptions, etc. The database fields that were defined in Subtask 4.1 were used to create a project "header" record for each well. Well information that is displayed on-screen as the result of a system search is created "on the fly" from the WVGES database (using a database join/view) and from a separate database housing the Pennsylvania well data; the project web-based data application merges the two when the system is queried.

Project geologists identified more than 125,000 wells that penetrate the selected plays in the two states. From that base of project well data, the following additional well data were created for inclusion in the project database:

- e-logs were scanned for 40,188 of those wells which penetrate the selected plays in the 2 states (scanned e-logs for 23,977 Pennsylvania wells and 16,211 West Virginia wells);
- 11 West Virginia cores penetrating 5 plays in that state were digitally photographed, resulting in 627 photographs at 1-foot intervals within the cores;
- e-logs were digitized, creating .las files, for more than 800 wells in the selected plays in the two states (digitized e-logs for 720 Pennsylvania wells and 104 West Virginia wells); and
- available core analyses and thin-section photos were scanned; Excel spreadsheets were prepared for core analysis data for some wells.

Data of a more interpretative nature was also gathered, including:

- 569 well sample descriptions which were scanned;
- nearly 260 individual references which were identified and recorded in the system; and

- a myriad of other well-specific and play-specific data which was scanned, including: structure maps, paleogeographic maps, stratigraphic sections, cross-sections, various other kinds of maps, core descriptions, thin-sections and point counts, well sample descriptions, relevant portions of unpublished reports, and selected abstracts and conclusions from unpublished theses and dissertations.

Well-based and play-based images and documents were scanned and entries were recorded in the data system's document management system. A Microsoft .NET web-form application was built to allow staff to record data for each reference and each scanned document, to create a user-searchable file. The back end of this application has an Oracle data table to manage the variety and breadth of documents, photographs, and files that were scanned for presentation in the system.

Interactive Mapping System

A comprehensive list of the 104 layers in the interactive mapping system is given in Appendix A. All of the datasets or layers contained in the Appalachian Basin Tight Gas Reservoirs interactive mapping system were gathered or developed specifically for the project, while keeping in mind producer needs. Development of map layers specifically for this project is described in Subtask 3.8.

The interactive mapping system contains both well-specific and regional datasets organized within general geography, general geology, and play-specific folders. Well-specific layers include wells with reported pay or production, wells with core/sample data, wells with digitized logs, wells with scanned logs, and wells that penetrate the play for each of the six plays in the project. A general layer of all gas and oil wells (regardless of play) also is included. Well-based data were obtained from the PGS and WVGES.

Play-based regional layers include cross-sections and maps. What is contained within a play in the mapping system varies, as it was dependent on what was available. Play-based regional layers primarily were extracted from the *Gas Atlas*. In addition to play-based regional layers, the IMS includes a number of general regional or base layers as presented in Appendix A.

Subtask 4.4 – Develop metadata

In conjunction with the development of this GIS application, metadata were prepared for the project data types as required by FGDC guidelines (http://www.fgdc.gov/metadata/). The metadata format for the Appalachian Basin Tight Gas Reservoirs interactive mapping system datasets or layers is presented in Appendix C.

Task 5.0 – Technology Transfer

Subtask 5.1 – Demonstrate the geospatial data and delivery model

Public presentation of the project is available through the WVGES web site at: http://www.wvgs.wvnet.edu/atg/ . The "atg" or "ATG" initials are used to denote the "Appalachian Basin Tight Gas Reservoirs" project.

Presentations about the project, its developments, and its planned benefits were made to the producer community at the following meetings:

- a RPSEA regional conference, in Morgantown, WV, in February 2007;
- a meeting of the Appalachian Geological Society, in Charleston, WV, in March 2007;
- a Petroleum Technology Transfer Council Appalachian Region Workshop on "The Digital Revolution: Archive, Organize, Deliver", in Morgantown, WV, in June 2007.

The Appalachian Basin Tight Gas Reservoirs Project products were demonstrated at the 2008 joint meeting of the Eastern Section of the American Association of Petroleum Geologists (AAPG) and the Eastern Region of the Society of Petroleum Engineers (SPE). The following were provided in conjunction with that meeting:

- an exhibit booth highlighting the project was staffed for two and one-half days;
- on-demand demonstrations of the project were given using a live Internet connection, a laptop, and a projection screen;
- the booth contained posters explaining the project, and handouts were available.

Subtask 5.2 – Link the two State Geological Survey web sites to the PTTC web site and scanned log IMS-type application

The Appalachian Basin Tight Gas Reservoirs Project web site resides on WVGES servers; links are provided to this application from the WVGES and AONGRC web sites and are expected to be available from the PGS web site. At the beginning of the project, the Appalachian Region PTTC web site was to contain the project application link. This task is now assumed under the Appalachian Oil and Natural Gas Research Consortium's (AONGRC) web site (URL: http://karl.nrcce.wvu.edu). In addition, WVGES will be tracking project-related Web traffic through the use of web statistics software.

Subtask 5.3 – Advertise availability of the new web site

The Appalachian Basin Tight Gas Reservoirs Project web-based products were demonstrated and advertised at the 2008 Eastern Meeting of the American Association of Petroleum Geologists (AAPG)/Society of Petroleum Engineers (SPE) in Pittsburgh, PA, in October 2008. The meeting was attended by more than 1,300 industry and government professionals from more than 30 states and Canada. An exhibit booth highlighting the project was staffed for two and one-half days during the meeting. On-demand demonstrations of the project were given using a live Internet connection, a laptop, and a projection screen. In addition, the booth contained posters explaining the project and handouts were available.

Consideration is being given to making presentations to various industry organizations in the region during the coming year.

SUMMARY AND CONCLUSIONS

The data delivery interface developed for this project can help users to construct a digital stratigraphic framework for these plays and can enhance producers' abilities to evaluate wells in these tight gas plays. It can facilitate public access to a greater depth and breadth of useful data and information for exploration and development in these plays. These applications can be used to query for information designed to extend current areas of exploration or development for natural gas.

A "System Overview" section of the project web site presents a basic description of each of the eight sections of the web site, along with "Help" sections.

The digital database for Pennsylvania and West Virginia provides a comprehensive presentation of oil and gas well "header" data for tight gas wells penetrating the six plays: the Mississippian Berea/Murrysville play, three Upper Devonian sandstone plays (Venango, Bradford and Elk), and the Silurian Tuscarora Sandstone play in Pennsylvania and West Virginia, and the Silurian Medina/ "Clinton" play in Pennsylvania. The well-specific database includes not only basic well "header" data for more than 125,000 wells which penetrate the selected plays in the two states, but also scanned e-logs for more than 40,000 of those wells.

Among the other data types included in the database are digitized logs for more than 800 wells penetrating the selected plays, sample descriptions for more than 550 wells, 627 digital photos in 1-foot intervals for 11 cores, and approximately 260 references for these plays including numerous unpublished studies. Selected pages, core descriptions, core data, abstracts, conclusions, maps, and cross-sections were scanned from several references; these "documents" are managed by a document management system developed in-house and utilizing an Oracle database table. The scanned documents are viewable on the right-hand side of the Web browser page, if a user's web browser has either a PDF or TIFF viewer plug-in. Along with the scanned image, full reference information and scanned document information is given on the left side of the page.

In order to create their own collection of data based on their specific needs or interests, users can generate their own database queries through any of several search mechanisms: the well "header" search (including variables such as county, quad, type of log, presence of specific types of logs or cores or samples, total depth, operator, surface owner, field, well type, or deepest formation penetrated); the well-based e-file search (including searches based on county or data type, such as scanned e-logs, digitized e-logs, cores analyses, core descriptions, core photos, thin-section photos, or well sample descriptions); the play-based search (including play, data type, maps, cross-sections, etc.); or the reference search (including play, author, title, or year). Search results can be viewed on-screen or exported to Microsoft Excel spreadsheets.

The fully-functional, web-accessible, geospatial, interactive mapping system for the six tight gas plays utilizes ESRI's ArcIMS GIS software to display well-specific and play-specific regional data organized by tight gas play. In addition to the well data by play penetration, a more basic layer of all oil and gas well locations provides users with "header" data for 200,000 wells. The system allows interactive mapping by play, showing a number of query and display types.

Basic maps can be developed to display the following layers:

- geographic layers (such as state boundaries, county boundaries, 7.5-minute quadrangles, cities, roads, streams, bodies of water, public lands, shaded relief, and topographic maps);
- geologic layers (including all oil and gas wells, folds, faults, gravity data, and aeromagnetic data);
- play-specific data and documents (including wells that penetrate the play, wells with a reported pay zone in the play, wells with core or sample data, wells with scanned e-logs, wells with digitized e-logs, wells that penetrate an equivalent of that play);
- a link to the well-based data search;
- digitized cross-sections including that play;
- maps of play outlines and gas and oil fields in that play;
- maps digitized from the *Gas Atlas*;
- other maps in the play that were digitized for this project; and
- a link to the scanned documents for that play.

System tools help users develop their customized spatial queries. Wells meeting the query are displayed on the interactive map in a different color and the well-based attribute data can be displayed through a separate pop-up screen for all of the wells that meet the query criteria. Users can interactively customize maps from queries developed from any of these fields and can download results as ESRI shapefiles; data from queries can be downloaded from the database applications as Microsoft Excel files. Cross-section lines can be accessed by making the cross-section layer active and then by clicking on one of the cross-section lines with the hyperlink tool; the cross-section image is then displayed on the screen in a new window. Digitized regional maps, such as isopach, isolith, structure, field, or production maps, can also be accessed through the interactive mapping system.

In the "File Repositories" section, an HTTP server allows the user to navigate the directory structure to download or view the file(s) of interest. This provides an alternate type of direct entry into data access, for viewing and downloading of all of the data. The variety of e-files currently available include: scanned e-logs, digitized e-logs, photographs of cores, well sample descriptions, and core data and descriptions. Within each data type directory, the data are organized by county and permit number.

A link is also provided to WVGES' separate ***"pipeline"*** system for accessing all available well-specific data for more than 140,000 oil and gas wells in West Virginia. Only well-

specific queries by API number are enabled within ***"pipeline"*** at this time, with results viewable on a user's computer screen; this system does not provide wholesale system queries, nor does it provide for data download. Those features are currently available only for the tight gas plays in this project's applications.

The comprehensive project web site resides on WVGES servers and links are provided from the AONGRC and PGS web sites. It is available 24x7 for use by producers, government agencies, and the general public. Both PGS and WVGES plan to maintain the system by providing data updates in the future.

The applications developed for this project are scalable and can be extended to include additional plays in the stratigraphic column and/or additional geographic areas of the Appalachian basin. There has been notable interest among users in having these applications extended to include the Devonian shale gas plays, but they were not specifically included in the original proposal for this project.

The geospatial approach to data delivery is a proven methodology for the delivery of data to the public. It is currently being used by WVGES for detailed coal geology data in West Virginia and by the Midwest Regional Carbon Sequestration Partnership for carbon dioxide sequestration potential in a 7-state area. It also was used by AONGRC for delivery of geospatial data to their partners for the Trenton-Black River play book project. Users are now accustomed to geospatial query utilizing GIS tools, interactive mapping, and downloading results. In addition to this project, future applications in this region can include the compilation of similar information for established (i.e., Devonian Huron Shale) and emerging (i.e., Marcellus Shale) shale gas plays, and evaluation of oil fields for enhanced oil recovery and coal beds for coalbed methane potential.

The evaluation of core, e-log, stratigraphic, and production data for nearby wells can help producers develop methodologies and make decisions about the recompletion of existing wells as well as infill drilling. The value of this project is in making data more readily available to gas producers; breakthroughs in terms of scientific knowledge per se were not anticipated. Rather, the potential for breakthrough is in terms of meeting the increased demand for natural gas in the region in the near term.

REFERENCES

Roen, J.B., and Walker, B.J., eds., 1996, The Atlas of Major Appalachian Gas Plays: West Virginia Geological and Economic Survey, volume V-25, 201 p.

LIST OF ACRONYMS AND INITIALS USED

AAPG – American Association of Petroleum Geologists
AGS – Appalachian Geological Society
AONGRC – Appalachian Oil and Natural Gas Research Consortium
API – American Petroleum Institute
ATG – Appalachian Basin Tight Gas Reservoirs Project
DOE – Department of Energy
EIA – Energy Information Agency
ESRI – Environmental Systems Research Corp.
FGDC – Federal Geographic Data Committee
GIS – Geographic Information System
HTML – Hypertext Markup Language
IMS – Interactive Map Server; interactive mapping system
IOGA – Independent Oil and Gas Association
las – Log ASCII Standard (format for digitized log files)
NRCCE – National Research Center for Coal and Energy at West Virginia University
PAPG – Pittsburgh Association of Professional Geologists
PGTS – Pennsylvania Geological & Topographic Survey
PTTC – Petroleum Technology Transfer Council
SPE – Society of Petroleum Engineers
TORIS – Total Oil Recovery Information System
WVGES – West Virginia Geological and Economic Survey
WVONGA – West Virginia Oil and Natural Gas Association
WVU – West Virginia University

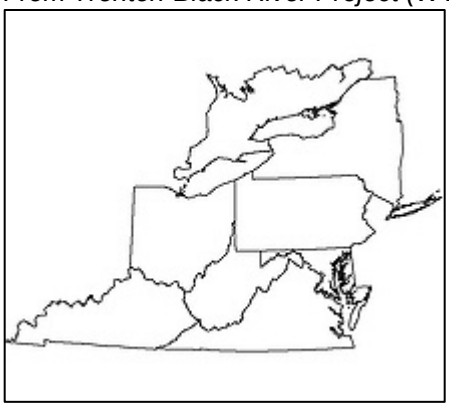
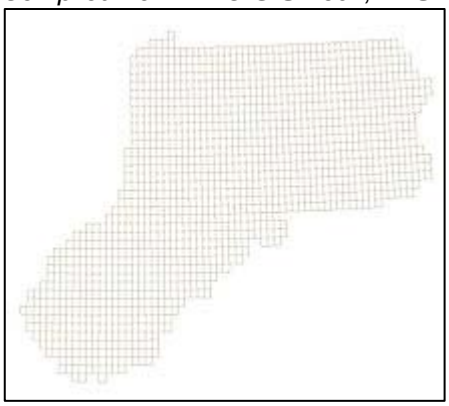
APPENDICES

Appendix A – Appalachian Basin Tight Gas Interactive Mapping System: Layer Attribute Descriptions

Appendix B – Appalachian Basin Tight Gas Reservoirs: Screen Shots of the Web-based Application

Appendix C – Appalachian Basin Tight Gas Reservoirs: Interactive Mapping System Metadata

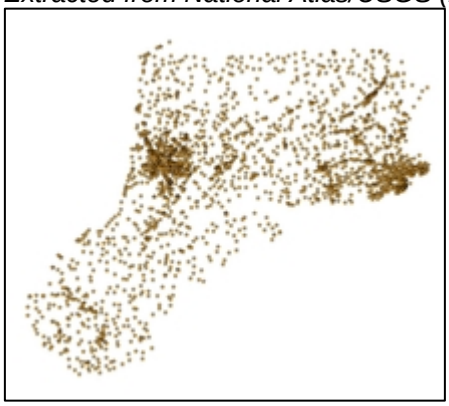
General Geography Layers

Layer Name / File / Source	Attribute Name	Type	Length	Attribute Description
State Boundaries				
State_Boundaries				
From Trenton-Black River Project (WVGES/AONGRC)				
	ST	Text	7	State or Province Abbreviation
	CNT_ST	Long	9	Number of Counties, State/Province
	ST_NAME	Text	25	State Name
	POLYID	Double	10	Polygon ID
	FEATUREID	Text	10	Feature ID
	CNTRLONG	Double	10	Polygon Centerpoint, Longitude
	CNTRLAT	Double	10	Polygon Centerpoint, Latitude
Counties				
Counties				
From Trenton-Black River Project (WVGES/AONGRC)				
	COUNTY	Text	30	County or Province Name
	ST	Text	7	State or Province Abbreviation of County
Quadrangles				
WV_PA_MD_Quads_NAAEAC				
Compiled from WVU GIS Tech, PASDA, MD-DNR				
	USGS_QD_ID	Text	8	USGS Quadrangle ID
	QUAD_NAME	Text	41	Quadrangle Name
	NM6	Text	9	6 Character Quadrangle Abbreviation (WV)
	COUNTIES	Text	51	Counties Holding or Bisecting the Quadrangle
	STATE1	Text	9	Main State Containing Quadrangle
	STATE2	Text	9	Secondary State Containing Quadrangle
	STATE3	Text	10	Tertiary State Containing Quadrangle
	STATE4	Text	2	Quaternary State Containing Quadrangle

Cities

PA_WV_Cities_NAAEAC

Extracted from National Atlas/USGS (http://nationalatlas.gov/atlasftp.html)



CITIESX020	Double	11	Internal Feature Number
FEATURE	Text	27	Type of City or Town ("Populated Place" or "County Seat")
NAME	Text	48	City or Town Name
POP_RANGE	Text	21	The Population Range of the City or Town Based on 2000 U.S. Census Bureau Data
POP_2000	Long	8	The 2000 Population of a City or Town
FIPS55	Text	5	The 5-Digit FIPS Code of the Named Populated Place, Primary County Division, or other Locational Entity of the US.
COUNTY	Text	55	County Name Containing the City or Town
FIPS	Text	5	5-Digit FIPS Code of the County or County Equivalent
STATE	Text	2	State Abbreviation of City or Town
STATE_FIPS	Text	2	2-Digit FIPS Code of the State or State Equivalent

Roads

WV_PA_Major_Roads_NAAEAC

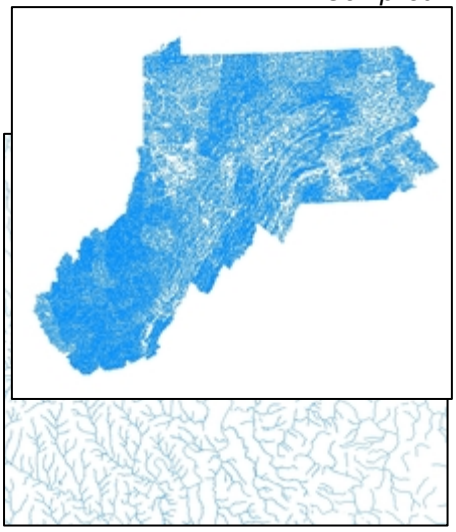
Compiled from WVU GIS Tech Center (SAMB) and PASDA

Route	Text	3	3-Digit Route Number (Leading Zeros)
Label	Text	25	Raw Route Number with Suffixes Where Appropriate
LocalName	Text	254	Local Name of Road
TRAF_RT_NO	Text	2	Road type (Interstate, US, State)

Streams

WV_PA_MD_TIGER_Streams_NAAEAC

Compiled 2007 TIGER Data (http://www.census.gov/cgi-bin/geo/shapefiles/national-files)

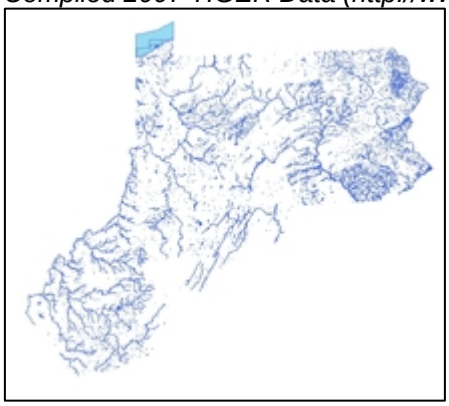


STATEFP	Text	2	Current State FIPS Code
COUNTYFP	Text	3	Current County FIPS Code
COUNTYNS	Text	8	Current county ANSI code
TLID	Double	10	Permanent edge ID
TFIDL	Double	10	Permanent face ID on the left of the edge
TFIDR	Double	10	Permanent face ID on the right of the edge
MTFCC	Text	5	MAF/TIGER Feature Class Code of the primary feature for the edge
FULLNAME	Text	100	Full Name
SMID	Text	22	Spatial metadata identifier
FEATCAT	Text	1	General feature classification category
HYDROFLG	Text	1	Hydrography feature indicator

Bodies of Water

WV_PA_MD_TIGER_AreaWater_NAAEAC

Compiled 2007 TIGER Data (http://www.census.gov/cgi-bin/geo/shapefiles/national-files)

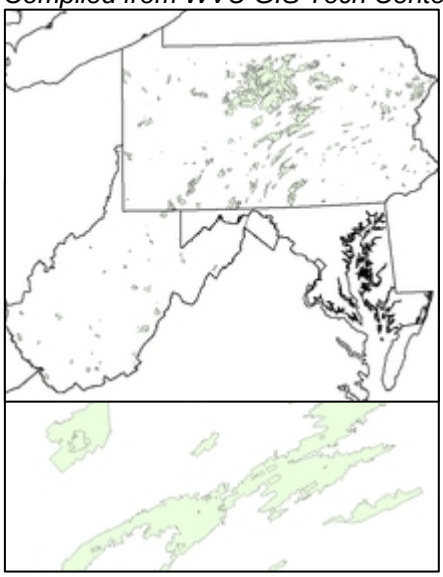


STATEFP	Text	2	Current State FIPS Code
COUNTYFP	Text	3	Current County FIPS Code
COUNTYNS	Text	8	Current County ANSI Code
ANSICODE	Text	8	Current official code for use by federal agencies for data transfer and dissemination, if applicable
HYDROID	Text	22	Area Hydrography Identifier
FULLNAME	Text	120	Full Name of Water Feature
MTFCC	Text	5	MAF/TIGER Feature Class Code

State Forests and Parks

WV_PA_LandsState_NAAEAC

Compiled from WVU GIS Tech Center and PASDA



AREA	Double	19	Area of feature in internal units squared
ACREAGE	Double	19	Acreage
AREA_M2	Double	19	Area in Square Meters
NAME	Text	70	State Forest or Park Name
STEW_NAME	Text	40	Land Steward's name
OWNER_NAME	Text	30	Owner's Name
SRC_INFO	Text	75	Source Information, WV
HECTARES	Double	19	Hectares

National Forests and Parks

WV_PA_MD_LandsNational_NAAEAC

Extracted from National Atlas/USGS (http://nationalatlas.gov/atlasftp.html)

AREA	Float	13	Size of the Shape in Square Dec. Deg.
PERIMETER	Float	13	Perimeter of the Shape in Square Dec. Deg.
FEATURE1	Text	80	Primary or Only Type of Federal Land and the Owning Agency
FEATURE2	Text	80	Secondary Type of Federal Land and the Owning Agency
AGBUR	Text	7	A code for the owning or administering agency
URL	Text	150	Web Address of a Federal Agency Website
NAME1	Text	80	The name associated with Feature1
NAME2	Text	80	The name associated with Feature2
STATE_FIPS	Text	14	2-digit State code for the State in which the Federal land is located

Rasters

Shaded Relief (raster)

ned_albers2

From Trenton-Black River Project (WVGES/AONGRC)

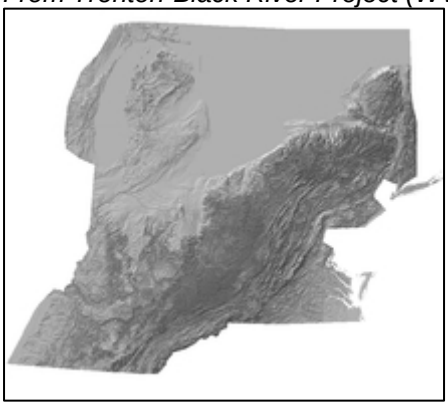


Image File – No Attribute Data

West Virginia Topography (raster mosaic)

Topographic_Map_Mosaic

WVGES

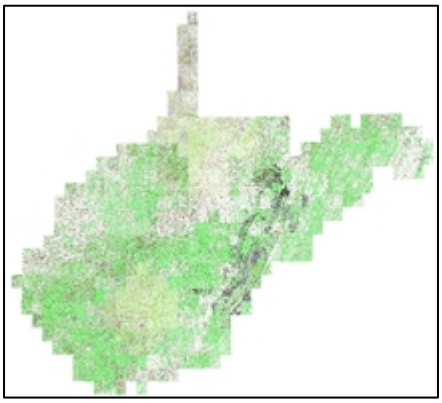


Image File – No Attribute Data

Pennsylvania Topography (raster mosaic or IMS service)

PA_Topo

PASDA ArcIMS Image Service (http://maps.pasda.psu.edu)

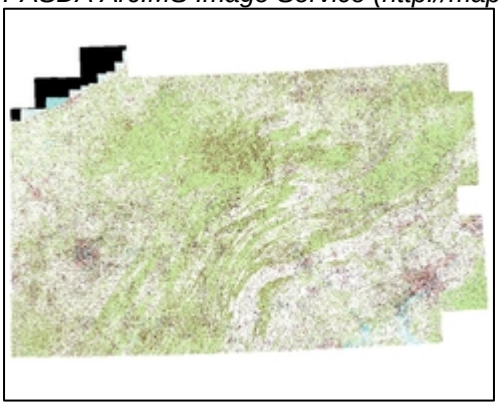


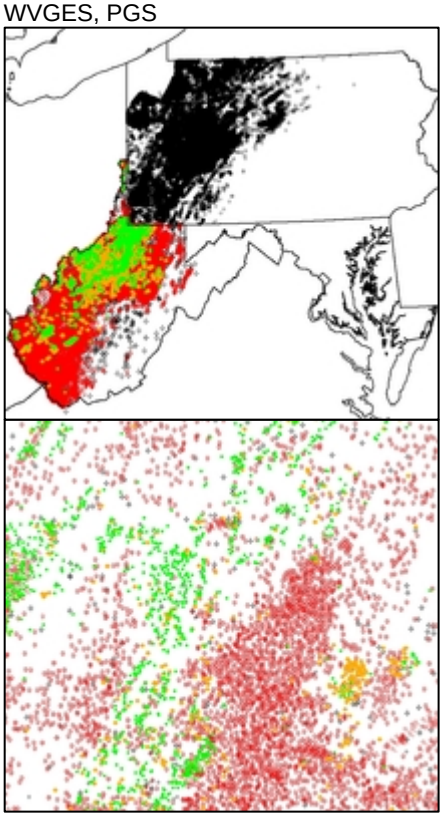
Image File – No Attribute Data

General Geology Layers

All Gas and Oil Wells

ALLWELLS_PAWV_NAAEAC

WVGES, PGS



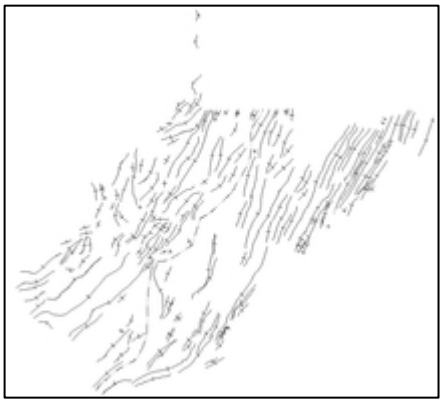
Layer Name / File / Source	Attribute Name	Type	Length	Attribute Description
	API	Double	19	API Number
	COUNTYNAME	Text	10	County Name
	PERMIT	Long	5	Permit Number
	OPERNM	Text	55	Operator Name
	CO_NUM	Text	15	Company Number
	FARM	Text	40	Surface Owner
	WELL_NUM	Text	6	Farm Number
	MINERAL	Text	24	Oil and Gas Rights Owner
	ELEV	Short	4	Elevation (Surface of the Well), Feet Above Mean Sea Level
	DATUMTR	Text	15	Elevation Datum
	TD	Long	5	Total Depth, Feet
	DFMNM	Text	20	Deepest Formation Name
	DFM	Text	3	Deepest Formation Code
	DFMTNM	Text	20	Deepest Formation Tested Name
	DFMT	Text	3	Deepest Formation Tested Code
	LSDEEPPLAY	Text	3	Deepest Play (*Project Plays Only*)
	FIELDNM	Text	15	Oil and Gas Field Name
	WELLTYPETR	Text	15	Well Type
	WELLTYPE	Text	1	Well Type Code
	SUFFIXTR	Text	14	Suffix--Describes the Episode of Drilling/Deviated Drilling
	STATUSTR	Text	9	Status--Describes the Status of the Drilling Permit
	CMPMN	Short	2	Completion Month
	CMPDY	Short	2	Completion Day
	CMPYR	Short	4	Completion Year
	LOGS_AVAIL	Text	14	Logs Available
	LOG_TOP	Long	5	Log Top Depth (Gross Interval), Feet
	LOG_BOT	Long	5	Log Bottom Depth (Gross Interval), Feet
	SCAN	Text	1	Log Scanned--Denotes if Log Scanned or Not
	DIGITIZED	Text	1	Log Digitized--Denotes if Log Digitized or Not
	CORE1TOP	Long	5	Core 1 Top Depth, Feet
	CORE1BTM	Long	5	Core 1 Bottom Depth, Feet
	TOPFM1NM	Text	20	Core 1 Top Formation Name
	TOPFM1	Text	3	Core 1 Top Formation Code
	BTMFM1NM	Text	20	Core 1 Bottom Formation Name
	BTMFM1	Text	3	Core 1 Bottom Formation Code
	CORE2TOP	Long	5	Core 2 Top Depth, Feet
	CORE2BTM	Long	5	Core 2 Bottom Depth, Feet
	TOPFM2NM	Text	20	Core 2 Top Formation Name
	TOPFM2	Text	3	Core 2 Top Formation Code
	BTMFM2NM	Text	20	Core 2 Bottom Formation Name
	BTMFM2	Text	3	Core 2 Bottom Formation Code
	SAMPLE	Text	7	Sample Available--Denotes if Sample Available or Not

SLABC1PHOT	Text	1	Core Photograph 1 Available--Denotes if Core Photograph Exists or Not
SLABC2PHOT	Text	1	Core Photograph 2 Available--Denotes if Core Photograph Exists or Not
LAT_DD	Double	9	Latitude, Decimal Degrees
LON_DD	Double	10	Longitude, Decimal Degrees
UTME	Float	8	Universal Transverse Mercator Easting, Meters
UTMN	Double	9	Universal Transverse Mercator Northing, Meters
QUAD75NM	Text	21	7.5' Quadrangle Name
TXDSTNM	Text	18	Tax District Name
LOCFLAGTR	Text	37	Location Flag--Describes Source or Type of Well Location Data
BEREA	Text	1	Berea Penetrated--Denotes if Berea Penetrated or Not
VENANGO	Text	1	Venango Penetrated--Denotes if Venango Penetrated or Not
BRADFORD	Text	1	Bradford Penetrated--Denotes if Bradford Penetrated or Not
ELK	Text	1	Elk Penetrated--Denotes if Elk Penetrated or Not
MEDINA	Text	1	Medina Penetrated--Denotes if Medina Penetrated or Not
TUSCARORA	Text	1	Tuscarora Penetrated--Denotes if Tuscarora Penetrated or Not
COUNTY	Text	9	County Name

Folds

WV_Folds_NAAEAC

WVU GIS Tech Center / WVGES

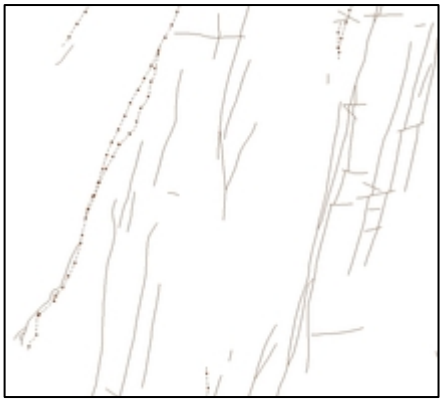


FNODE_	Long	9	
TNODE_	Long	9	
LPOLY_	Long	9	
RPOLY_	Long	9	
LENGTH	Float	13	Fold Length
WVFOLD_	Long	9	
WVFOLD_ID	Long	9	
TYPE	Text	10	Fold Type (anticline, syncline, boundary)
NAME	Text	30	Fold Name

Faults

WV_Faults_NAAEAC

WVU GIS Tech Center / WVGES

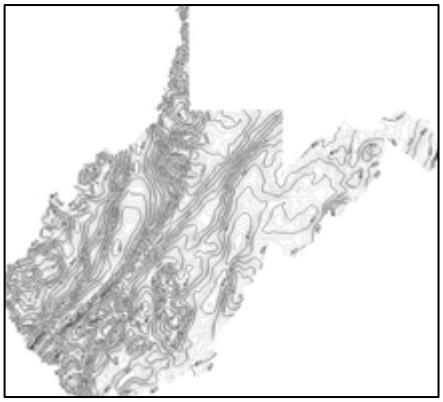


FNODE_	Long	9	
TNODE_	Long	9	
LPOLY_	Long	9	
RPOLY_	Long	9	
LENGTH	Float	13	Fault Length
WVFAULT_	Long	9	
WVFAULT_ID	Long	9	
TYPE	Test	10	Fault Type
NAME	Test	30	Fault Name

Aeromagnetic Data (WV)

WV_AeroAllContours_NAAEAC

WVU GIS Tech Center / WVGES

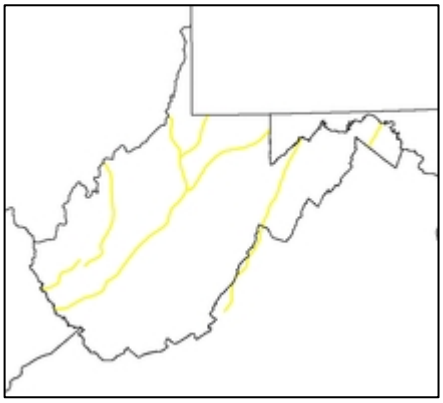


OBJECTID	Long	9	Object Identifier
Contour_Va	Short	4	Aeromagnetic Contour Value
SHAPE_Leng	Double	19	
Hachured	Text	3	Contour Hachured (no, yes)
Shape_Le_1	Double	19	
Cntr_Type	Text	9	Contour Type (primary, secondary)

Axial Trace of Persistent Gravity High or Low

WV_GravityAxialTrace_NAAEAC

WVU GIS Tech Center / WVGES

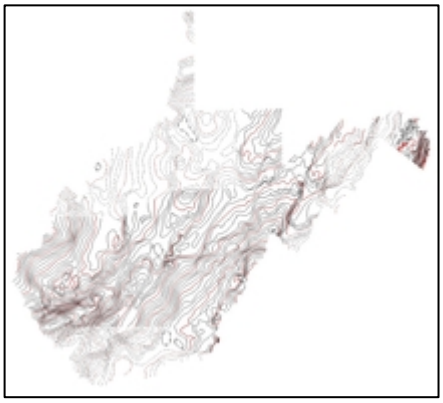


SHAPE_Leng	Double	19	Line Length
Axis	Text	4	Axis (high, low)

Gravity Contours

WV_GravityContours_NAAEAC

WVU GIS Tech Center



Id	Long	9	
milligal_c	Short	4	Contour Value, Milligals
Shape_Leng	Double	19	Line Length
Hatchered	Text	50	Hachured (no, yes)
Line_style	Text	5	Line Style (solid, dashed)

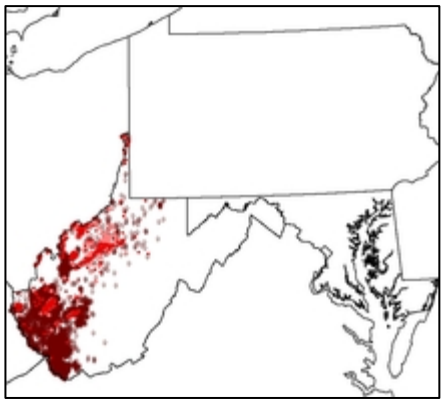
Play Layers: Berea/Murrysville (BERE)

Wells

Wells with Reported Pay, BERE

BERE_WVGESOGDSPAY_NAAEAC

WVGES



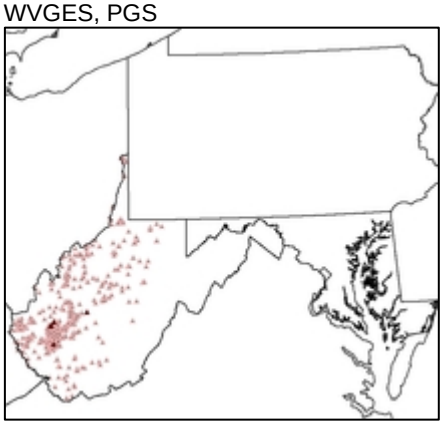
Layer Name / File / Source	Attribute Name	Type	Length	Attribute Description
	API	Double	19	API Number
	COUNTYNAME	Text	10	County Name
	PERMIT	Long	5	Permit Number
	OPERNM	Text	55	Operator Name
	CO_NUM	Text	15	Company Number
	FARM	Text	40	Surface Owner
	WELL_NUM	Text	6	Farm Number
	MINERAL	Text	30	Oil and Gas Rights Owner
	ELEV	Short	4	Elevation (Surface of the Well), Feet Above Mean Sea Level
	DATUMTR	Text	15	Elevation Datum
	TD	Long	5	Total Depth, Feet
	DFMNM	Text	20	Deepest Formation Name
	DFM	Text	3	Deepest Formation Code
	DFMTNM	Text	20	Deepest Formation Tested Name
	DFMT	Text	3	Deepest Formation Tested Code
	LSDEEPPLAY	Text	3	Deepest Play (*Project Plays Only*)
	FIELDNM	Text	15	Oil and Gas Field Name
	WELLTYPETR	Text	15	Well Type
	WELLTYPE	Text	1	Well Type Code
	SUFFIXTR	Text	14	Suffix--Describes the Episode of Drilling/Deviated Drilling
	STATUSTR	Text	9	Status--Describes the Status of the Drilling Permit
	CMPMN	Short	2	Completion Month
	CMPDY	Short	2	Completion Day
	CMPYR	Short	4	Completion Year
	LOGS_AVAIL	Text	14	Logs Available
	LOG_TOP	Long	5	Log Top Depth (Gross Interval), Feet
	LOG_BOT	Long	5	Log Bottom Depth (Gross Interval), Feet
	SCAN	Text	1	Log Scanned--Denotes if Log Scanned or Not
	DIGITIZED	Text	1	Log Digitized--Denotes if Log Digitized or Not
	CORE1TOP	Long	5	Core 1 Top Depth, Feet
	CORE1BTM	Long	5	Core 1 Bottom Depth, Feet
	TOPFM1NM	Text	20	Core 1 Top Formation Name
	TOPFM1	Text	3	Core 1 Top Formation Code
	BTMFM1NM	Text	20	Core 1 Bottom Formation Name
	BTMFM1	Text	3	Core 1 Bottom Formation Code
	CORE2TOP	Long	5	Core 2 Top Depth, Feet
	CORE2BTM	Long	5	Core 2 Bottom Depth, Feet
	TOPFM2NM	Text	20	Core 2 Top Formation Name
	TOPFM2	Text	3	Core 2 Top Formation Code
	BTMFM2NM	Text	20	Core 2 Bottom Formation Name
	BTMFM2	Text	3	Core 2 Bottom Formation Code

SAMPLE	Text	7	Sample Available--Denotes if Sample Available or Not
SLABC1PHOT	Text	1	Core Photograph 1 Available--Denotes if Core Photograph Exists or Not
SLABC2PHOT	Text	1	Core Photograph 2 Available--Denotes if Core Photograph Exists or Not
LAT_DD	Double	15	Latitude, Decimal Degrees
LON_DD	Double	16	Longitude, Decimal Degrees
UTME	Double	9	Universal Transverse Mercator Easting, Meters
UTMN	Double	10	Universal Transverse Mercator Northing, Meters
QUAD75NM	Text	21	7.5' Quadrangle Name
TXDSTNM	Text	18	Tax District Name
LOCFLAGTR	Text	37	Location Flag--Describes Source or Type of Well Location Data
BEREA	Text	1	Berea Penetrated--Denotes if Berea Penetrated or Not
VENANGO	Text	1	Venango Penetrated--Denotes if Venango Penetrated or Not
BRADFORD	Text	1	Bradford Penetrated--Denotes if Bradford Penetrated or Not
ELK	Text	1	Elk Penetrated--Denotes if Elk Penetrated or Not
MEDINA	Text	1	Medina Penetrated--Denotes if Medina Penetrated or Not
TUSCARORA	Text	1	Tuscarora Penetrated--Denotes if Tuscarora Penetrated or Not
ACTIVITYTR	Text	21	Activity--Describes Completed Interval ("*Pay" Activity Only for Project*)
ACTIVITY	Text	1	Activity Code
PRODUCTTR	Text	18	Product--Denotes Gas, Oil or Combination Associated with Activity Interval
PRODUCT	Text	1	Product Code
TOPDEPTH	Long	5	Pay Top Depth, Feet
TOPFMNM	Text	20	Pay Top Formation Name
TOPFM	Text	3	Pay Top Formation Code
BTMDEPTH	Long	5	Pay Bottom Depth, Feet
BTMFMNM	Text	20	Pay Bottom Formation Name
BTMFM	Text	3	Pay Bottom Formation Code
GASBEFORE	Long	6	Gas Volume Before Treatment, Thousand Cubic Feet
GASAFTER	Long	6	Gas Volume After Treatment, Thousand Cubic Feet
OILBEFORE	Long	5	Oil Volume Before Treatment, Barrels
OILAFTER	Long	5	Oil Volume After Treatment, Barrels

Wells with Core/Sample Data, BERE

BERE_WVGESOGDSCORE_NAAEAC

WVGES, PGS



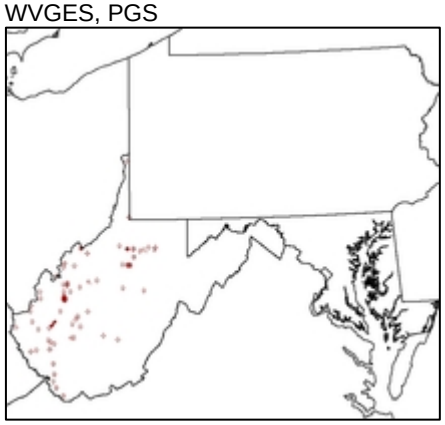
API	Double	19	API Number
COUNTYNAME	Text	10	County Name
PERMIT	Long	5	Permit Number
OPERNM	Text	55	Operator Name
CO_NUM	Text	15	Company Number
FARM	Text	40	Surface Owner
WELL_NUM	Text	6	Farm Number
MINERAL	Text	30	Oil and Gas Rights Owner
ELEV	Short	4	Elevation (Surface of the Well), Feet Above Mean Sea Level
DATUMTR	Text	15	Elevation Datum
TD	Long	5	Total Depth, Feet
DFMNM	Text	20	Deepest Formation Name
DFM	Text	3	Deepest Formation Code
DFMTNM	Text	20	Deepest Formation Tested Name
DFMT	Text	3	Deepest Formation Tested Code
LSDEEPPLAY	Text	3	Deepest Play (*Project Plays Only*)
FIELDNM	Text	15	Oil and Gas Field Name
WELLTYPETR	Text	15	Well Type
WELLTYPE	Text	1	Well Type Code
SUFFIXTR	Text	14	Suffix--Describes the Episode of Drilling/Deviated Drilling
STATUSTR	Text	9	Status--Describes the Status of the Drilling Permit
CMPMN	Short	2	Completion Month
CMPDY	Short	2	Completion Day
CMPYR	Short	4	Completion Year
LOGS_AVAIL	Text	14	Logs Available
LOG_TOP	Long	5	Log Top Depth (Gross Interval), Feet
LOG_BOT	Long	5	Log Bottom Depth (Gross Interval), Feet
SCAN	Text	1	Log Scanned--Denotes if Log Scanned or Not
DIGITIZED	Text	1	Log Digitized--Denotes if Log Digitized or Not
CORE1TOP	Long	5	Core 1 Top Depth, Feet
CORE1BTM	Long	5	Core 1 Bottom Depth, Feet
TOPFM1NM	Text	20	Core 1 Top Formation Name
TOPFM1	Text	3	Core 1 Top Formation Code
BTMFM1NM	Text	20	Core 1 Bottom Formation Name
BTMFM1	Text	3	Core 1 Bottom Formation Code
CORE2TOP	Long	5	Core 2 Top Depth, Feet
CORE2BTM	Long	5	Core 2 Bottom Depth, Feet
TOPFM2NM	Text	20	Core 2 Top Formation Name
TOPFM2	Text	3	Core 2 Top Formation Code
BTMFM2NM	Text	20	Core 2 Bottom Formation Name
BTMFM2	Text	3	Core 2 Bottom Formation Code
SAMPLE	Text	7	Sample Available--Denotes if Sample Available or Not
SLABC1PHOT	Text	1	Core Photograph 1 Available--Denotes if Core Photograph Exists or Not

SLABC2PHOT	Text	1	Core Photograph 2 Available--Denotes if Core Photograph Exists or Not
LAT_DD	Double	15	Latitude, Decimal Degrees
LON_DD	Double	16	Longitude, Decimal Degrees
UTME	Double	9	Universal Transverse Mercator Easting, Meters
UTMN	Double	10	Universal Transverse Mercator Northing, Meters
QUAD75NM	Text	21	7.5' Quadrangle Name
TXDSTNM	Text	18	Tax District Name
LOCFLAGTR	Text	37	Location Flag--Describes Source or Type of Well Location Data
BEREA	Text	1	Berea Penetrated--Denotes if Berea Penetrated or Not
VENANGO	Text	1	Venango Penetrated--Denotes if Venango Penetrated or Not
BRADFORD	Text	1	Bradford Penetrated--Denotes if Bradford Penetrated or Not
ELK	Text	1	Elk Penetrated--Denotes if Elk Penetrated or Not
MEDINA	Text	1	Medina Penetrated--Denotes if Medina Penetrated or Not
TUSCARORA	Text	1	Tuscarora Penetrated--Denotes if Tuscarora Penetrated or Not

Wells with Digitized Logs, BERE

BERE_WVGESOGDSDIGITIZED_NAAEAC

WVGES, PGS



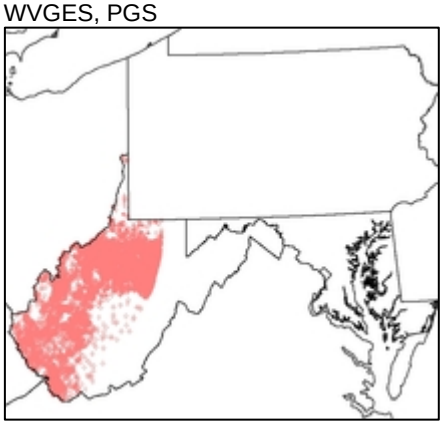
API	Double	19	API Number
COUNTYNAME	Text	10	County Name
PERMIT	Long	5	Permit Number
OPERNM	Text	55	Operator Name
CO_NUM	Text	15	Company Number
FARM	Text	40	Surface Owner
WELL_NUM	Text	6	Farm Number
MINERAL	Text	30	Oil and Gas Rights Owner
ELEV	Short	4	Elevation (Surface of the Well), Feet Above Mean Sea Level
DATUMTR	Text	15	Elevation Datum
TD	Long	5	Total Depth, Feet
DFMNM	Text	20	Deepest Formation Name
DFM	Text	3	Deepest Formation Code
DFMTNM	Text	20	Deepest Formation Tested Name
DFMT	Text	3	Deepest Formation Tested Code
LSDEEPPLAY	Text	3	Deepest Play (*Project Plays Only*)
FIELDNM	Text	15	Oil and Gas Field Name
WELLTYPETR	Text	15	Well Type
WELLTYPE	Text	1	Well Type Code
SUFFIXTR	Text	14	Suffix--Describes the Episode of Drilling/Deviated Drilling
STATUSTR	Text	9	Status--Describes the Status of the Drilling Permit
CMPMN	Short	2	Completion Month
CMPDY	Short	2	Completion Day
CMPYR	Short	4	Completion Year
LOGS_AVAIL	Text	14	Logs Available
LOG_TOP	Long	5	Log Top Depth (Gross Interval), Feet
LOG_BOT	Long	5	Log Bottom Depth (Gross Interval), Feet
SCAN	Text	1	Log Scanned--Denotes if Log Scanned or Not
DIGITIZED	Text	1	Log Digitized--Denotes if Log Digitized or Not
CORE1TOP	Long	5	Core 1 Top Depth, Feet
CORE1BTM	Long	5	Core 1 Bottom Depth, Feet
TOPFM1NM	Text	20	Core 1 Top Formation Name
TOPFM1	Text	3	Core 1 Top Formation Code
BTMFM1NM	Text	20	Core 1 Bottom Formation Name
BTMFM1	Text	3	Core 1 Bottom Formation Code
CORE2TOP	Long	5	Core 2 Top Depth, Feet
CORE2BTM	Long	5	Core 2 Bottom Depth, Feet
TOPFM2NM	Text	20	Core 2 Top Formation Name
TOPFM2	Text	3	Core 2 Top Formation Code
BTMFM2NM	Text	20	Core 2 Bottom Formation Name
BTMFM2	Text	3	Core 2 Bottom Formation Code
SAMPLE	Text	7	Sample Available--Denotes if Sample Available or Not
SLABC1PHOT	Text	1	Core Photograph 1 Available--Denotes if Core Photograph Exists or Not

SLABC2PHOT	Text	1	Core Photograph 2 Available--Denotes if Core Photograph Exists or Not
LAT_DD	Double	15	Latitude, Decimal Degrees
LON_DD	Double	16	Longitude, Decimal Degrees
UTME	Double	9	Universal Transverse Mercator Easting, Meters
UTMN	Double	10	Universal Transverse Mercator Northing, Meters
QUAD75NM	Text	21	7.5' Quadrangle Name
TXDSTNM	Text	18	Tax District Name
LOCFLAGTR	Text	37	Location Flag--Describes Source or Type of Well Location Data
BEREA	Text	1	Berea Penetrated--Denotes if Berea Penetrated or Not
VENANGO	Text	1	Venango Penetrated--Denotes if Venango Penetrated or Not
BRADFORD	Text	1	Bradford Penetrated--Denotes if Bradford Penetrated or Not
ELK	Text	1	Elk Penetrated--Denotes if Elk Penetrated or Not
MEDINA	Text	1	Medina Penetrated--Denotes if Medina Penetrated or Not
TUSCARORA	Text	1	Tuscarora Penetrated--Denotes if Tuscarora Penetrated or Not

Wells with Scanned Logs, BERE

BERE_WVGESOGDSSCANNED_NAAEAC

WVGES, PGS



API	Double	19	API Number
COUNTYNAME	Text	10	County Name
PERMIT	Long	5	Permit Number
OPERNM	Text	55	Operator Name
CO_NUM	Text	15	Company Number
FARM	Text	40	Surface Owner
WELL_NUM	Text	6	Farm Number
MINERAL	Text	30	Oil and Gas Rights Owner
ELEV	Short	4	Elevation (Surface of the Well), Feet Above Mean Sea Level
DATUMTR	Text	15	Elevation Datum
TD	Long	5	Total Depth, Feet
DFMNM	Text	20	Deepest Formation Name
DFM	Text	3	Deepest Formation Code
DFMTNM	Text	20	Deepest Formation Tested Name
DFMT	Text	3	Deepest Formation Tested Code
LSDEEPPLAY	Text	3	Deepest Play (*Project Plays Only*)
FIELDNM	Text	15	Oil and Gas Field Name
WELLTYPETR	Text	15	Well Type
WELLTYPE	Text	1	Well Type Code
SUFFIXTR	Text	14	Suffix--Describes the Episode of Drilling/Deviated Drilling
STATUSTR	Text	9	Status--Describes the Status of the Drilling Permit
CMPMN	Short	2	Completion Month
CMPDY	Short	2	Completion Day
CMPYR	Short	4	Completion Year
LOGS_AVAIL	Text	14	Logs Available
LOG_TOP	Long	5	Log Top Depth (Gross Interval), Feet
LOG_BOT	Long	5	Log Bottom Depth (Gross Interval), Feet
SCAN	Text	1	Log Scanned--Denotes if Log Scanned or Not
DIGITIZED	Text	1	Log Digitized--Denotes if Log Digitized or Not
CORE1TOP	Long	5	Core 1 Top Depth, Feet
CORE1BTM	Long	5	Core 1 Bottom Depth, Feet
TOPFM1NM	Text	20	Core 1 Top Formation Name
TOPFM1	Text	3	Core 1 Top Formation Code
BTMFM1NM	Text	20	Core 1 Bottom Formation Name
BTMFM1	Text	3	Core 1 Bottom Formation Code
CORE2TOP	Long	5	Core 2 Top Depth, Feet
CORE2BTM	Long	5	Core 2 Bottom Depth, Feet
TOPFM2NM	Text	20	Core 2 Top Formation Name
TOPFM2	Text	3	Core 2 Top Formation Code
BTMFM2NM	Text	20	Core 2 Bottom Formation Name
BTMFM2	Text	3	Core 2 Bottom Formation Code
SAMPLE	Text	7	Sample Available--Denotes if Sample Available or Not
SLABC1PHOT	Text	1	Core Photograph 1 Available--Denotes if Core Photograph Exists or Not

SLABC2PHOT	Text	1	Core Photograph 2 Available--Denotes if Core Photograph Exists or Not
LAT_DD	Double	15	Latitude, Decimal Degrees
LON_DD	Double	16	Longitude, Decimal Degrees
UTME	Double	9	Universal Transverse Mercator Easting, Meters
UTMN	Double	10	Universal Transverse Mercator Northing, Meters
QUAD75NM	Text	21	7.5' Quadrangle Name
TXDSTNM	Text	18	Tax District Name
LOCFLAGTR	Text	37	Location Flag--Describes Source or Type of Well Location Data
BEREA	Text	1	Berea Penetrated--Denotes if Berea Penetrated or Not
VENANGO	Text	1	Venango Penetrated--Denotes if Venango Penetrated or Not
BRADFORD	Text	1	Bradford Penetrated--Denotes if Bradford Penetrated or Not
ELK	Text	1	Elk Penetrated--Denotes if Elk Penetrated or Not
MEDINA	Text	1	Medina Penetrated--Denotes if Medina Penetrated or Not
TUSCARORA	Text	1	Tuscarora Penetrated--Denotes if Tuscarora Penetrated or Not

Wells that Penetrate, BERE

BERE_WVGESOGDSPPLAY_NAAEAC

WVGES, PGS

API	Double	19	API Number
COUNTYNAME	Text	10	County Name
PERMIT	Long	5	Permit Number
OPERNM	Text	55	Operator Name
CO_NUM	Text	15	Company Number
FARM	Text	40	Surface Owner
WELL_NUM	Text	6	Farm Number
MINERAL	Text	30	Oil and Gas Rights Owner
ELEV	Short	4	Elevation (Surface of the Well), Feet Above Mean Sea Level
DATUMTR	Text	15	Elevation Datum
TD	Long	5	Total Depth, Feet
DFMNM	Text	20	Deepest Formation Name
DFM	Text	3	Deepest Formation Code
DFMTNM	Text	20	Deepest Formation Tested Name
DFMT	Text	3	Deepest Formation Tested Code
LSDEEPPLAY	Text	3	Deepest Play (*Project Plays Only*)
FIELDNM	Text	15	Oil and Gas Field Name
WELLTYPETR	Text	15	Well Type
WELLTYPE	Text	1	Well Type Code
SUFFIXTR	Text	14	Suffix--Describes the Episode of Drilling/Deviated Drilling
STATUSTR	Text	9	Status--Describes the Status of the Drilling Permit
CMPMN	Short	2	Completion Month
CMPDY	Short	2	Completion Day
CMPYR	Short	4	Completion Year
LOGS_AVAIL	Text	14	Logs Available
LOG_TOP	Long	5	Log Top Depth (Gross Interval), Feet
LOG_BOT	Long	5	Log Bottom Depth (Gross Interval), Feet
SCAN	Text	1	Log Scanned--Denotes if Log Scanned or Not
DIGITIZED	Text	1	Log Digitized--Denotes if Log Digitized or Not
CORE1TOP	Long	5	Core 1 Top Depth, Feet
CORE1BTM	Long	5	Core 1 Bottom Depth, Feet
TOPFM1NM	Text	20	Core 1 Top Formation Name
TOPFM1	Text	3	Core 1 Top Formation Code
BTMFM1NM	Text	20	Core 1 Bottom Formation Name
BTMFM1	Text	3	Core 1 Bottom Formation Code
CORE2TOP	Long	5	Core 2 Top Depth, Feet
CORE2BTM	Long	5	Core 2 Bottom Depth, Feet
TOPFM2NM	Text	20	Core 2 Top Formation Name
TOPFM2	Text	3	Core 2 Top Formation Code
BTMFM2NM	Text	20	Core 2 Bottom Formation Name
BTMFM2	Text	3	Core 2 Bottom Formation Code
SAMPLE	Text	7	Sample Available--Denotes if Sample Available or Not
SLABC1PHOT	Text	1	Core Photograph 1 Available--Denotes if Core Photograph Exists or Not

SLABC2PHOT	Text	1	Core Photograph 2 Available--Denotes if Core Photograph Exists or Not
LAT_DD	Double	15	Latitude, Decimal Degrees
LON_DD	Double	16	Longitude, Decimal Degrees
UTME	Double	9	Universal Transverse Mercator Easting, Meters
UTMN	Double	10	Universal Transverse Mercator Northing, Meters
QUAD75NM	Text	21	7.5' Quadrangle Name
TXDSTNM	Text	18	Tax District Name
LOCFLAGTR	Text	37	Location Flag--Describes Source or Type of Well Location Data
BEREA	Text	1	Berea Penetrated--Denotes if Berea Penetrated or Not
VENANGO	Text	1	Venango Penetrated--Denotes if Venango Penetrated or Not
BRADFORD	Text	1	Bradford Penetrated--Denotes if Bradford Penetrated or Not
ELK	Text	1	Elk Penetrated--Denotes if Elk Penetrated or Not
MEDINA	Text	1	Medina Penetrated--Denotes if Medina Penetrated or Not
TUSCARORA	Text	1	Tuscarora Penetrated--Denotes if Tuscarora Penetrated or Not

Cross Sections

Gas Atlas Cross Sections (MDe-7)

MDeFig7_XSection_NAAEAC

WVGES

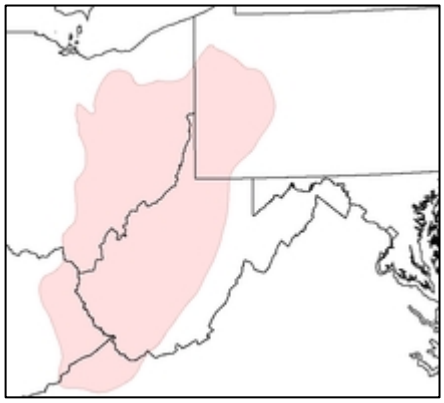
Figure	Text	15	Gas Atlas Figure Reference
XSection	Text	25	Cross Section Direction
Comment	Text	200	Comment
XSecFile	Text	50	Cross Section File Name (for Mapping Hyperlink)

General

Play Outline, BERE

OGLAYERS_Berea_Polygon_NAAEAC

WVGES

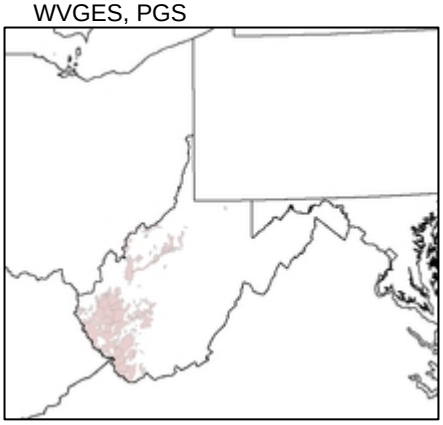


SHAPE_LENG	Double	19	Shape Length
SHAPE_AREA	Double	19	Shape Area
SHAPE_LEN	Double	19	Shape Length

Gas Fields, BERE

WV_GASRES_MDe_NAAEAC

WVGES, PGS

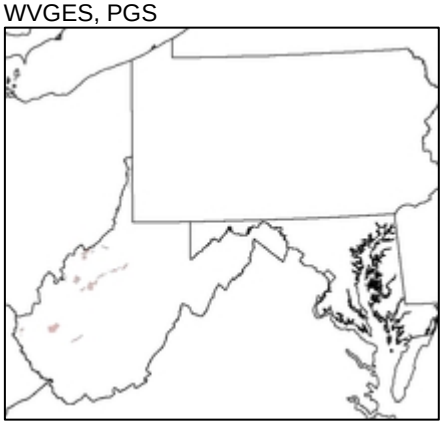


ID	Double	12	Shape Identifier
FIELD_NAME	Text	35	Field Name
FIELD_ID	Double	12	Field Number
PLAY	Text	4	Play
FM	Text	5	Formation Name
FM_DETAILS	Text	66	Formation Name Details
PROD_TYPE	Text	26	Production Type

Oil Fields, BERE

WV_OILRES_MDe_NAAEAC

WVGES, PGS



ID	Double	12	Shape Identifier
FIELD_NAME	Text	35	Field Name
FIELD_ID	Double	12	Field Number
PLAY	Text	4	Play
FM	Text	5	Formation Name
FM_DETAILS	Text	66	Formation Name Details
PROD_TYPE	Text	26	Production Type

Gas Atlas: Producing Trends (MDe-2)

Producing Trends, MDe2

MDeFig2_ProducingTrends_NAAEAC

WVGES

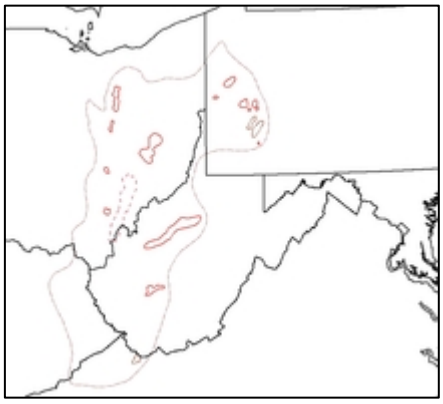


Figure	Text	15	Gas Atlas Figure Reference
TrendName	Text	65	Trend Name

Outcrop and Subcrop, MDe2

MDeFig2-4-26_Outcrops_NAAEAC

WVGES

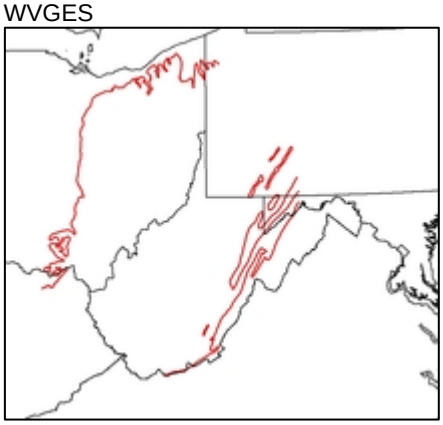


Figure	Text	15	Gas Atlas Figure Reference
TrendName	Text	65	Trend Name

Gas Atlas: Productive Gas Pools/Fields, Selected (MDe-3)

Pools and Fields, MDe3

MDeFig3_PoolsFields_NAAEAC

WVGES

Figure	Text	15	Gas Atlas Figure Reference
FieldName	Text	35	Field Name

Gas Atlas: Formation Distribution (MDe-4)

Limits, MDe4

MDeFig4_Limits_NAAEAC

WVGES

Figure	Text	15	Gas Atlas Figure Reference
BereaTypes	Text	25	Berea Types (Boundaries)

Outcrop and Subcrop, MDe4

MDeFig2-4-26_Outcrops_NAAEAC

WVGES

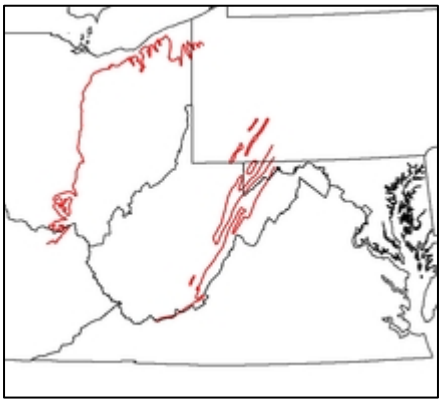


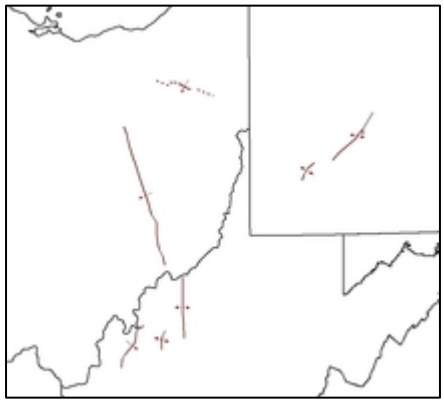
Figure	Text	15	Gas Atlas Figure Reference
TrendName	Text	65	Trend Name

Gas Atlas: Major Structural Features (MDe-11)

Faults, MDe11

MDeFig11_Faults_NAAEAC

WVGES



FaultName	Text	30	Fault Name
Figure	Text	15	Gas Atlas Figure Reference

Gas Atlas: Isopach, Berea Sandstone, Gay-Fink/Cabin Creek Fields, WV (MDe-20)

Contours, MDe20

MDeFig20_Contours_NAAEAC

WVGES

Figure	Text	10	Gas Atlas Figure Reference
TrendName	Long	9	Contour Value, Feet

Fields, MDe20

MDeFig20_Fields_NAAEAC

WVGES

Figure	Text	10	Gas Atlas Figure Reference
FieldName	Text	25	Field Name

Gas Atlas: Gas Resources (MDe-26)

Probable Resources, MDe26

MDeFig26_ProbableResources_NAAEAC

WVGES

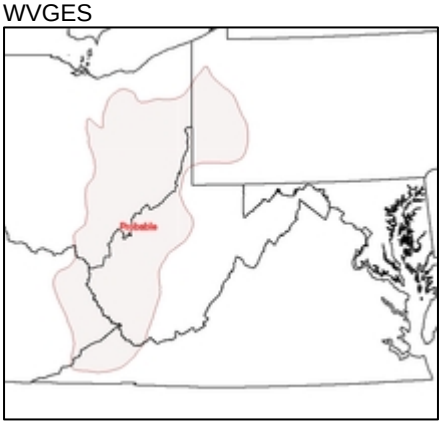


Figure	Text	15	Gas Atlas Figure Reference
TrendName	Long	90	Trend Name

Possible Resources, MDe26

MDeFig26_PossibleResources_NAAEAC

WVGES

Figure	Text	15	Gas Atlas Figure Reference
TrendName	Long	90	Trend Name

Outcrop and Subcrop, MDe26

MDeFig2-4-26_Outcrops_NAAEAC

WVGES

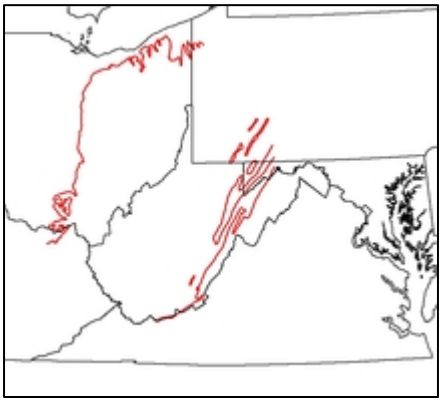


Figure	Text	15	Gas Atlas Figure Reference
TrendName	Text	65	Trend Name

Other

Thickness--Regional, BERE

BEREBoswell1993_Thickness_NAAEAC

DOE

Id	Long	6	Gas Atlas Figure Reference
Thickness	Text	15	Thickness, Feet

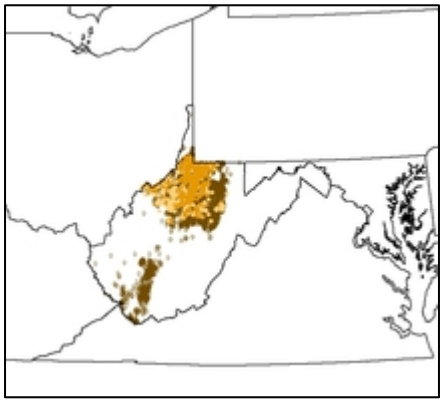
Play Layers: Venango (VNNG)

Wells

Wells with Reported Pay, VNNG

VNNG_WVGESOGDSPAY_NAAEAC

WVGES



Layer Name / File / Source	Attribute Name	Type	Length	Attribute Description
	API	Double	19	API Number
	COUNTYNAME	Text	10	County Name
	PERMIT	Long	5	Permit Number
	OPERNM	Text	55	Operator Name
	CO_NUM	Text	15	Company Number
	FARM	Text	40	Surface Owner
	WELL_NUM	Text	6	Farm Number
	MINERAL	Text	30	Oil and Gas Rights Owner
	ELEV	Short	4	Elevation (Surface of the Well), Feet Above Mean Sea Level
	DATUMTR	Text	15	Elevation Datum
	TD	Long	5	Total Depth, Feet
	DFMNM	Text	20	Deepest Formation Name
	DFM	Text	3	Deepest Formation Code
	DFMTNM	Text	20	Deepest Formation Tested Name
	DFMT	Text	3	Deepest Formation Tested Code
	LSDEEPPLAY	Text	3	Deepest Play (*Project Plays Only*)
	FIELDNM	Text	15	Oil and Gas Field Name
	WELLTYPETR	Text	15	Well Type
	WELLTYPE	Text	1	Well Type Code
	SUFFIXTR	Text	14	Suffix--Describes the Episode of Drilling/Deviated Drilling
	STATUSTR	Text	9	Status--Describes the Status of the Drilling Permit
	CMPMN	Short	2	Completion Month
	CMPDY	Short	2	Completion Day
	CMPYR	Short	4	Completion Year
	LOGS_AVAIL	Text	14	Logs Available
	LOG_TOP	Long	5	Log Top Depth (Gross Interval), Feet
	LOG_BOT	Long	5	Log Bottom Depth (Gross Interval), Feet
	SCAN	Text	1	Log Scanned--Denotes if Log Scanned or Not
	DIGITIZED	Text	1	Log Digitized--Denotes if Log Digitized or Not
	CORE1TOP	Long	5	Core 1 Top Depth, Feet
	CORE1BTM	Long	5	Core 1 Bottom Depth, Feet
	TOPFM1NM	Text	20	Core 1 Top Formation Name
	TOPFM1	Text	3	Core 1 Top Formation Code
	BTMFM1NM	Text	20	Core 1 Bottom Formation Name
	BTMFM1	Text	3	Core 1 Bottom Formation Code
	CORE2TOP	Long	5	Core 2 Top Depth, Feet
	CORE2BTM	Long	5	Core 2 Bottom Depth, Feet
	TOPFM2NM	Text	20	Core 2 Top Formation Name
	TOPFM2	Text	3	Core 2 Top Formation Code
	BTMFM2NM	Text	20	Core 2 Bottom Formation Name
	BTMFM2	Text	3	Core 2 Bottom Formation Code
	SAMPLE	Text	7	Sample Available--Denotes if Sample Available or Not

SLABC1PHOT	Text	1	Core Photograph 1 Available--Denotes if Core Photograph Exists or Not
SLABC2PHOT	Text	1	Core Photograph 2 Available--Denotes if Core Photograph Exists or Not
LAT_DD	Double	15	Latitude, Decimal Degrees
LON_DD	Double	16	Longitude, Decimal Degrees
UTME	Double	9	Universal Transverse Mercator Easting, Meters
UTMN	Double	10	Universal Transverse Mercator Northing, Meters
QUAD75NM	Text	21	7.5' Quadrangle Name
TXDSTNM	Text	18	Tax District Name
LOCFLAGTR	Text	37	Location Flag--Describes Source or Type of Well Location Data
BEREA	Text	1	Berea Penetrated--Denotes if Berea Penetrated or Not
VENANGO	Text	1	Venango Penetrated--Denotes if Venango Penetrated or Not
BRADFORD	Text	1	Bradford Penetrated--Denotes if Bradford Penetrated or Not
ELK	Text	1	Elk Penetrated--Denotes if Elk Penetrated or Not
MEDINA	Text	1	Medina Penetrated--Denotes if Medina Penetrated or Not
TUSCARORA	Text	1	Tuscarora Penetrated--Denotes if Tuscarora Penetrated or Not
ACTIVITYTR	Text	21	Activity--Describes Completed Interval ("*Pay" Activity Only for Project*)
ACTIVITY	Text	1	Activity Code
PRODUCTTR	Text	18	Product--Denotes Gas, Oil or Combination Associated with Activity Interval
PRODUCT	Text	1	Product Code
TOPDEPTH	Long	5	Pay Top Depth, Feet
TOPFMNM	Text	20	Pay Top Formation Name
TOPFM	Text	3	Pay Top Formation Code
BTMDEPTH	Long	5	Pay Bottom Depth, Feet
BTMFMNM	Text	20	Pay Bottom Formation Name
BTMFM	Text	3	Pay Bottom Formation Code
GASBEFORE	Long	6	Gas Volume Before Treatment, Thousand Cubic Feet
GASAFTER	Long	6	Gas Volume After Treatment, Thousand Cubic Feet
OILBEFORE	Long	5	Oil Volume Before Treatment, Barrels
OILAFTER	Long	5	Oil Volume After Treatment, Barrels

Wells with Core/Sample Data, VNNG

VNNG_WVGESOGDSCORE_NAAEAC_NEW

WVGES, PGS

API	Double	19	API Number
COUNTYNAME	Text	10	County Name
PERMIT	Long	5	Permit Number
OPERNM	Text	55	Operator Name
CO_NUM	Text	15	Company Number
FARM	Text	40	Surface Owner
WELL_NUM	Text	6	Farm Number
MINERAL	Text	30	Oil and Gas Rights Owner
ELEV	Short	4	Elevation (Surface of the Well), Feet Above Mean Sea Level
DATUMTR	Text	15	Elevation Datum
TD	Long	5	Total Depth, Feet
DFMNM	Text	20	Deepest Formation Name
DFM	Text	3	Deepest Formation Code
DFMTNM	Text	20	Deepest Formation Tested Name
DFMT	Text	3	Deepest Formation Tested Code
LSDEEPPLAY	Text	3	Deepest Play (*Project Plays Only*)
FIELDNM	Text	15	Oil and Gas Field Name
WELLTYPETR	Text	15	Well Type
WELLTYPE	Text	1	Well Type Code
SUFFIXTR	Text	14	Suffix--Describes the Episode of Drilling/Deviated Drilling
STATUSTR	Text	9	Status--Describes the Status of the Drilling Permit
CMPMN	Short	2	Completion Month
CMPDY	Short	2	Completion Day
CMPYR	Short	4	Completion Year
LOGS_AVAIL	Text	14	Logs Available
LOG_TOP	Long	5	Log Top Depth (Gross Interval), Feet
LOG_BOT	Long	5	Log Bottom Depth (Gross Interval), Feet
SCAN	Text	1	Log Scanned--Denotes if Log Scanned or Not
DIGITIZED	Text	1	Log Digitized--Denotes if Log Digitized or Not
CORE1TOP	Long	5	Core 1 Top Depth, Feet
CORE1BTM	Long	5	Core 1 Bottom Depth, Feet
TOPFM1NM	Text	20	Core 1 Top Formation Name
TOPFM1	Text	3	Core 1 Top Formation Code
BTMFM1NM	Text	20	Core 1 Bottom Formation Name
BTMFM1	Text	3	Core 1 Bottom Formation Code
CORE2TOP	Long	5	Core 2 Top Depth, Feet
CORE2BTM	Long	5	Core 2 Bottom Depth, Feet
TOPFM2NM	Text	20	Core 2 Top Formation Name
TOPFM2	Text	3	Core 2 Top Formation Code
BTMFM2NM	Text	20	Core 2 Bottom Formation Name
BTMFM2	Text	3	Core 2 Bottom Formation Code
SAMPLE	Text	7	Sample Available--Denotes if Sample Available or Not
SLABC1PHOT	Text	1	Core Photograph 1 Available--Denotes if Core Photograph Exists or Not

SLABC2PHOT	Text	1	Core Photograph 2 Available--Denotes if Core Photograph Exists or Not
LAT_DD	Double	15	Latitude, Decimal Degrees
LON_DD	Double	16	Longitude, Decimal Degrees
UTME	Double	9	Universal Transverse Mercator Easting, Meters
UTMN	Double	10	Universal Transverse Mercator Northing, Meters
QUAD75NM	Text	21	7.5' Quadrangle Name
TXDSTNM	Text	18	Tax District Name
LOCFLAGTR	Text	37	Location Flag--Describes Source or Type of Well Location Data
BEREA	Text	1	Berea Penetrated--Denotes if Berea Penetrated or Not
VENANGO	Text	1	Venango Penetrated--Denotes if Venango Penetrated or Not
BRADFORD	Text	1	Bradford Penetrated--Denotes if Bradford Penetrated or Not
ELK	Text	1	Elk Penetrated--Denotes if Elk Penetrated or Not
MEDINA	Text	1	Medina Penetrated--Denotes if Medina Penetrated or Not
TUSCARORA	Text	1	Tuscarora Penetrated--Denotes if Tuscarora Penetrated or Not

Wells with Digitized Logs, VNNG

VNNG_WVGESOGDSDIGITIZED_NAAEAC_NEW

WVGES, PGS

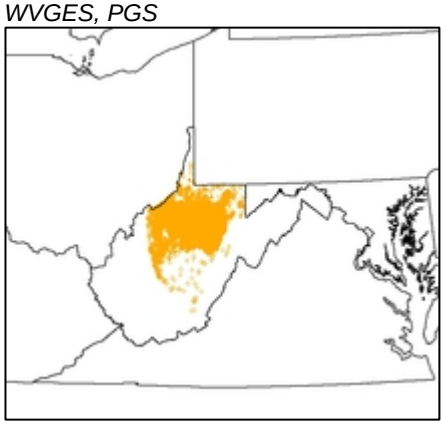
API	Double	19	API Number
COUNTYNAME	Text	10	County Name
PERMIT	Long	5	Permit Number
OPERNM	Text	55	Operator Name
CO_NUM	Text	15	Company Number
FARM	Text	40	Surface Owner
WELL_NUM	Text	6	Farm Number
MINERAL	Text	30	Oil and Gas Rights Owner
ELEV	Short	4	Elevation (Surface of the Well), Feet Above Mean Sea Level
DATUMTR	Text	15	Elevation Datum
TD	Long	5	Total Depth, Feet
DFMNM	Text	20	Deepest Formation Name
DFM	Text	3	Deepest Formation Code
DFMTNM	Text	20	Deepest Formation Tested Name
DFMT	Text	3	Deepest Formation Tested Code
LSDEEPPLAY	Text	3	Deepest Play (*Project Plays Only*)
FIELDNM	Text	15	Oil and Gas Field Name
WELLTYPETR	Text	15	Well Type
WELLTYPE	Text	1	Well Type Code
SUFFIXTR	Text	14	Suffix--Describes the Episode of Drilling/Deviated Drilling
STATUSTR	Text	9	Status--Describes the Status of the Drilling Permit
CMPMN	Short	2	Completion Month
CMPDY	Short	2	Completion Day
CMPYR	Short	4	Completion Year
LOGS_AVAIL	Text	14	Logs Available
LOG_TOP	Long	5	Log Top Depth (Gross Interval), Feet
LOG_BOT	Long	5	Log Bottom Depth (Gross Interval), Feet
SCAN	Text	1	Log Scanned--Denotes if Log Scanned or Not
DIGITIZED	Text	1	Log Digitized--Denotes if Log Digitized or Not
CORE1TOP	Long	5	Core 1 Top Depth, Feet
CORE1BTM	Long	5	Core 1 Bottom Depth, Feet
TOPFM1NM	Text	20	Core 1 Top Formation Name
TOPFM1	Text	3	Core 1 Top Formation Code
BTMFM1NM	Text	20	Core 1 Bottom Formation Name
BTMFM1	Text	3	Core 1 Bottom Formation Code
CORE2TOP	Long	5	Core 2 Top Depth, Feet
CORE2BTM	Long	5	Core 2 Bottom Depth, Feet
TOPFM2NM	Text	20	Core 2 Top Formation Name
TOPFM2	Text	3	Core 2 Top Formation Code
BTMFM2NM	Text	20	Core 2 Bottom Formation Name
BTMFM2	Text	3	Core 2 Bottom Formation Code
SAMPLE	Text	7	Sample Available--Denotes if Sample Available or Not
SLABC1PHOT	Text	1	Core Photograph 1 Available--Denotes if Core Photograph Exists or Not

SLABC2PHOT	Text	1	Core Photograph 2 Available--Denotes if Core Photograph Exists or Not
LAT_DD	Double	15	Latitude, Decimal Degrees
LON_DD	Double	16	Longitude, Decimal Degrees
UTME	Double	9	Universal Transverse Mercator Easting, Meters
UTMN	Double	10	Universal Transverse Mercator Northing, Meters
QUAD75NM	Text	21	7.5' Quadrangle Name
TXDSTNM	Text	18	Tax District Name
LOCFLAGTR	Text	37	Location Flag--Describes Source or Type of Well Location Data
BEREA	Text	1	Berea Penetrated--Denotes if Berea Penetrated or Not
VENANGO	Text	1	Venango Penetrated--Denotes if Venango Penetrated or Not
BRADFORD	Text	1	Bradford Penetrated--Denotes if Bradford Penetrated or Not
ELK	Text	1	Elk Penetrated--Denotes if Elk Penetrated or Not
MEDINA	Text	1	Medina Penetrated--Denotes if Medina Penetrated or Not
TUSCARORA	Text	1	Tuscarora Penetrated--Denotes if Tuscarora Penetrated or Not

Wells with Scanned Logs, VNNG

VNNG_WVGESOGDSSCANNED_NAAEAC_NEW

WVGES, PGS



API	Double	19	API Number
COUNTYNAME	Text	10	County Name
PERMIT	Long	5	Permit Number
OPERNM	Text	55	Operator Name
CO_NUM	Text	15	Company Number
FARM	Text	40	Surface Owner
WELL_NUM	Text	6	Farm Number
MINERAL	Text	30	Oil and Gas Rights Owner
ELEV	Short	4	Elevation (Surface of the Well), Feet Above Mean Sea Level
DATUMTR	Text	15	Elevation Datum
TD	Long	5	Total Depth, Feet
DFMNM	Text	20	Deepest Formation Name
DFM	Text	3	Deepest Formation Code
DFMTNM	Text	20	Deepest Formation Tested Name
DFMT	Text	3	Deepest Formation Tested Code
LSDEEPPLAY	Text	3	Deepest Play (*Project Plays Only*)
FIELDNM	Text	15	Oil and Gas Field Name
WELLTYPETR	Text	15	Well Type
WELLTYPE	Text	1	Well Type Code
SUFFIXTR	Text	14	Suffix--Describes the Episode of Drilling/Deviated Drilling
STATUSTR	Text	9	Status--Describes the Status of the Drilling Permit
CMPMN	Short	2	Completion Month
CMPDY	Short	2	Completion Day
CMPYR	Short	4	Completion Year
LOGS_AVAIL	Text	14	Logs Available
LOG_TOP	Long	5	Log Top Depth (Gross Interval), Feet
LOG_BOT	Long	5	Log Bottom Depth (Gross Interval), Feet
SCAN	Text	1	Log Scanned--Denotes if Log Scanned or Not
DIGITIZED	Text	1	Log Digitized--Denotes if Log Digitized or Not
CORE1TOP	Long	5	Core 1 Top Depth, Feet
CORE1BTM	Long	5	Core 1 Bottom Depth, Feet
TOPFM1NM	Text	20	Core 1 Top Formation Name
TOPFM1	Text	3	Core 1 Top Formation Code
BTMFM1NM	Text	20	Core 1 Bottom Formation Name
BTMFM1	Text	3	Core 1 Bottom Formation Code
CORE2TOP	Long	5	Core 2 Top Depth, Feet
CORE2BTM	Long	5	Core 2 Bottom Depth, Feet
TOPFM2NM	Text	20	Core 2 Top Formation Name
TOPFM2	Text	3	Core 2 Top Formation Code
BTMFM2NM	Text	20	Core 2 Bottom Formation Name
BTMFM2	Text	3	Core 2 Bottom Formation Code
SAMPLE	Text	7	Sample Available--Denotes if Sample Available or Not
SLABC1PHOT	Text	1	Core Photograph 1 Available--Denotes if Core Photograph Exists or Not

SLABC2PHOT	Text	1	Core Photograph 2 Available--Denotes if Core Photograph Exists or Not
LAT_DD	Double	15	Latitude, Decimal Degrees
LON_DD	Double	16	Longitude, Decimal Degrees
UTME	Double	9	Universal Transverse Mercator Easting, Meters
UTMN	Double	10	Universal Transverse Mercator Northing, Meters
QUAD75NM	Text	21	7.5' Quadrangle Name
TXDSTNM	Text	18	Tax District Name
LOCFLAGTR	Text	37	Location Flag--Describes Source or Type of Well Location Data
BEREA	Text	1	Berea Penetrated--Denotes if Berea Penetrated or Not
VENANGO	Text	1	Venango Penetrated--Denotes if Venango Penetrated or Not
BRADFORD	Text	1	Bradford Penetrated--Denotes if Bradford Penetrated or Not
ELK	Text	1	Elk Penetrated--Denotes if Elk Penetrated or Not
MEDINA	Text	1	Medina Penetrated--Denotes if Medina Penetrated or Not
TUSCARORA	Text	1	Tuscarora Penetrated--Denotes if Tuscarora Penetrated or Not

Wells that Penetrate, VNNG

VNNG_WVGESOGDSPPLAY_NAAEAC_NEW

WVGES, PGS

API	Double	19	API Number
COUNTYNAME	Text	10	County Name
PERMIT	Long	5	Permit Number
OPERNM	Text	55	Operator Name
CO_NUM	Text	15	Company Number
FARM	Text	40	Surface Owner
WELL_NUM	Text	6	Farm Number
MINERAL	Text	30	Oil and Gas Rights Owner
ELEV	Short	4	Elevation (Surface of the Well), Feet Above Mean Sea Level
DATUMTR	Text	15	Elevation Datum
TD	Long	5	Total Depth, Feet
DFMNM	Text	20	Deepest Formation Name
DFM	Text	3	Deepest Formation Code
DFMTNM	Text	20	Deepest Formation Tested Name
DFMT	Text	3	Deepest Formation Tested Code
LSDEEPPLAY	Text	3	Deepest Play (*Project Plays Only*)
FIELDNM	Text	15	Oil and Gas Field Name
WELLTYPETR	Text	15	Well Type
WELLTYPE	Text	1	Well Type Code
SUFFIXTR	Text	14	Suffix--Describes the Episode of Drilling/Deviated Drilling
STATUSTR	Text	9	Status--Describes the Status of the Drilling Permit
CMPMN	Short	2	Completion Month
CMPDY	Short	2	Completion Day
CMPYR	Short	4	Completion Year
LOGS_AVAIL	Text	14	Logs Available
LOG_TOP	Long	5	Log Top Depth (Gross Interval), Feet
LOG_BOT	Long	5	Log Bottom Depth (Gross Interval), Feet
SCAN	Text	1	Log Scanned--Denotes if Log Scanned or Not
DIGITIZED	Text	1	Log Digitized--Denotes if Log Digitized or Not
CORE1TOP	Long	5	Core 1 Top Depth, Feet
CORE1BTM	Long	5	Core 1 Bottom Depth, Feet
TOPFM1NM	Text	20	Core 1 Top Formation Name
TOPFM1	Text	3	Core 1 Top Formation Code
BTMFM1NM	Text	20	Core 1 Bottom Formation Name
BTMFM1	Text	3	Core 1 Bottom Formation Code
CORE2TOP	Long	5	Core 2 Top Depth, Feet
CORE2BTM	Long	5	Core 2 Bottom Depth, Feet
TOPFM2NM	Text	20	Core 2 Top Formation Name
TOPFM2	Text	3	Core 2 Top Formation Code
BTMFM2NM	Text	20	Core 2 Bottom Formation Name
BTMFM2	Text	3	Core 2 Bottom Formation Code
SAMPLE	Text	7	Sample Available--Denotes if Sample Available or Not
SLABC1PHOT	Text	1	Core Photograph 1 Available--Denotes if Core Photograph Exists or Not

SLABC2PHOT	Text	1	Core Photograph 2 Available--Denotes if Core Photograph Exists or Not
LAT_DD	Double	15	Latitude, Decimal Degrees
LON_DD	Double	16	Longitude, Decimal Degrees
UTME	Double	9	Universal Transverse Mercator Easting, Meters
UTMN	Double	10	Universal Transverse Mercator Northing, Meters
QUAD75NM	Text	21	7.5' Quadrangle Name
TXDSTNM	Text	18	Tax District Name
LOCFLAGTR	Text	37	Location Flag--Describes Source or Type of Well Location Data
BEREA	Text	1	Berea Penetrated--Denotes if Berea Penetrated or Not
VENANGO	Text	1	Venango Penetrated--Denotes if Venango Penetrated or Not
BRADFORD	Text	1	Bradford Penetrated--Denotes if Bradford Penetrated or Not
ELK	Text	1	Elk Penetrated--Denotes if Elk Penetrated or Not
MEDINA	Text	1	Medina Penetrated--Denotes if Medina Penetrated or Not
TUSCARORA	Text	1	Tuscarora Penetrated--Denotes if Tuscarora Penetrated or Not

Cross Sections

Gas Atlas Cross Sections (Dvs-5,7,8,19,23)

DvsFig-5-7-8-19-23_XSection_NAAEAC

WVGES

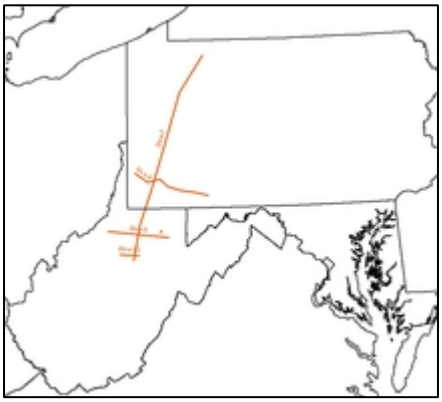


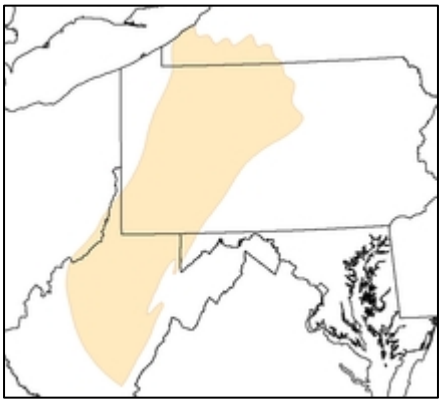
Figure	Text	15	Gas Atlas Figure Number
XSection	Text	25	Cross Section Direction
Comment	Text	200	Comment
XSecFile	Text	50	Cross Section File Name (for Mapping Hyperlink)

General

Play Outline, VNNG

OGLAYERS_Venango_Polygon_NAAEAC

WVGES



SHAPE_LENG	Double	19	Shape Length
SHAPE_AREA	Double	19	Shape Area
SHAPE_LEN	Double	19	Shape Length

Gas Fields, VNNG

WV_GASRES_Dvs_Corrected_NAAEAC

WVGES

ID	Double	12	Shape Identifier
FIELD_NAME	Text	35	Field Name
FIELD_ID	Double	12	Field Number
PLAY	Text	4	Play
FM	Text	5	Formation Name
FM_DETAILS	Text	66	Formation Name Details
PROD_TYPE	Text	26	Production Type

Oil Fields, VNNG

WV_OILRES_Dvs_withMetadata_NAAEAC

WVGES

ID	Double	12	Shape Identifier
FIELD_NAME	Text	35	Field Name
FIELD_ID	Double	12	Field Number
PLAY	Text	4	Play
FM	Text	5	Formation Name
FM_DETAILS	Text	66	Formation Name Details
PROD_TYPE	Text	26	Production Type

Gas Atlas: Significant Wells/Fields (Dvs-2)

Significant Wells, Dvs2

DvsFig2_SignificantWells_NAAEAC

WVGES

Figure	Text	15	Gas Atlas Figure Reference
WellName	Text	50	Well Name

Upper Devonian Outcrop, Dvs2

DvsFig2_Outcrop_NAAEAC

WVGES

Figure	Text	15	Gas Atlas Figure Reference
Comment	Text	50	Comment

Historic Shallow Gas Belt, Dvs2

DvsFig2_GasBelt_NAAEAC

WVGES

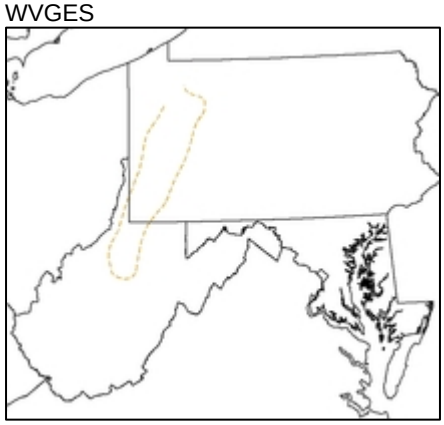


Figure	Text	15	Gas Atlas Figure Reference
Comment	Text	50	Comment

Significant Fields, Dvs2

DvsFig2_SignificantFields_NAAEAC

WVGES

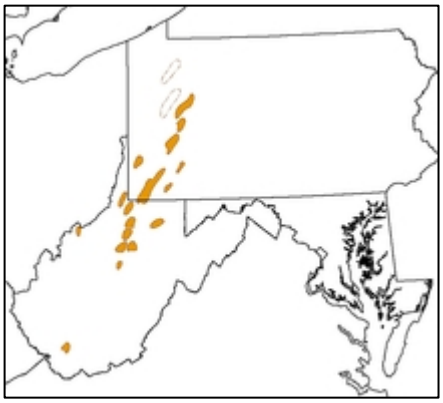


Figure	Text	15	Gas Atlas Figure Reference
FieldName	Text	50	Field Name

Gas Atlas: Isolith, Total Sandstone, Northern WV (Dvs-14)

Wells, Dvs14

DvsFig14_Wells_NAAEAC

WVGES

Figure	Text	15	Gas Atlas Figure Reference

Isoliths, Sandstone, Dvs14

DvsFig14_Isoliths_NAAEAC

WVGES

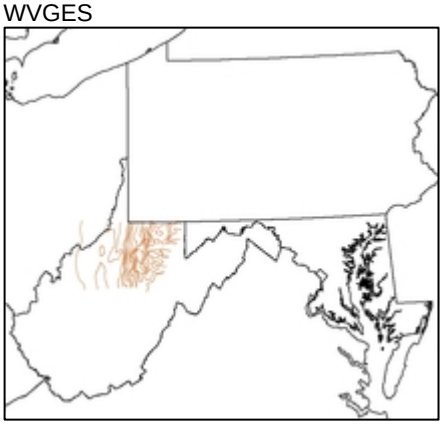


Figure	Text	15	Gas Atlas Figure Reference
Contour	Long	9	Contour Value

Outcrop Belt, Dvs14

DvsFig14_OutcropBelt_NAAEAC

WVGES

Figure	Text	15	Gas Atlas Figure Reference
Comment	Text	50	Comment

Gas Atlas: Isolith, V-2 Interval, Regional (Dvs-9)

Control Wells, Dvs9

DvsFig9_Wells_NAAEAC

WVGES

Figure	Text	15	Gas Atlas Figure Reference

Isoliths, Sandstone, Dvs9

DvsFig9_Isoliths_NAAEAC

WVGES

Figure	Text	15	Gas Atlas Figure Reference
Contour	Long	9	Contour Value

Unconformity, Dvs9

DvsFig9_Unconformity_NAAEAC

WVGES

Figure	Text	15	Gas Atlas Figure Reference

Gas Atlas: Isolith, V-3 Interval, Regional (Dvs-17)

Control Wells, Dvs17

DvsFig17_Wells_NAAEAC

WVGES

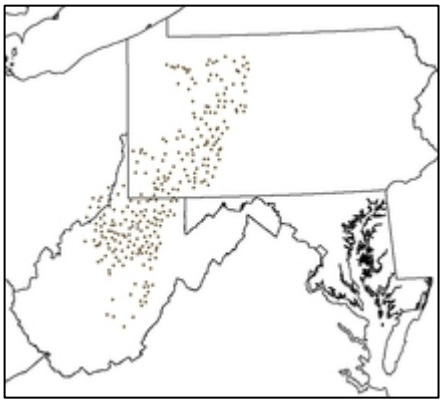


Figure	Text	15	Gas Atlas Figure Reference

Isoliths, Sandstone, Dvs17

DvsFig17_Isoliths_NAAEAC

WVGES

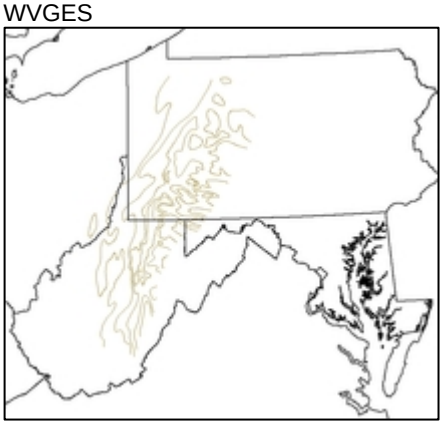


Figure	Text	15	Gas Atlas Figure Reference
Contour	Long	9	Contour Value

Unconformity, Dvs17

DvsFig17_Unconformity_NAAEAC

WVGES

Figure	Text	15	Gas Atlas Figure Reference
Comment	Text	200	Comment

Gas Atlas: Isolith, V-4 Interval, Regional (Dvs-10)

Control Wells, Dvs10

DvsFig10_Wells_NAAEAC

WVGES

Figure	Text	15	Gas Atlas Figure Reference

Isoliths, Sandstone, Dvs10

DvsFig10_Isoliths_NAAEAC

WVGES

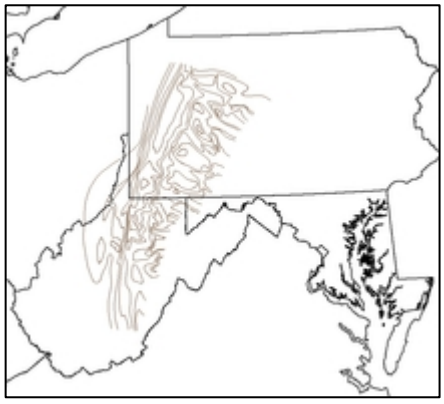


Figure	Text	15	Gas Atlas Figure Reference
Contour	Long	9	Contour Value

Unconformity, Dvs10

DvsFig10_Unconformity_NAAEAC

WVGES

Figure	Text	15	Gas Atlas Figure Reference

Other

Thickness--Regional, VNNG

VNNGBoswell1993_Thickness_NAAEAC

DOE

Id	Long	6	Gas Atlas Figure Reference
Thickness	Text	15	Thickness, Feet

Play Layers: Bradford (BDFD)

Wells

Wells with Reported Pay, BDFD

BDFD_PAY_NAAEAC

WVGES

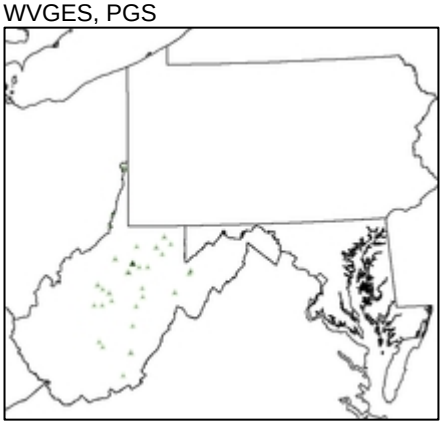
Attribute Name	Type	Length	Attribute Description
API	Double	19	API Number
COUNTYNAME	Text	10	County Name
PERMIT	Long	5	Permit Number
OPERNM	Text	55	Operator Name
CO_NUM	Text	15	Company Number
FARM	Text	40	Surface Owner
WELL_NUM	Text	6	Farm Number
MINERAL	Text	30	Oil and Gas Rights Owner
ELEV	Short	4	Elevation (Surface of the Well), Feet Above Mean Sea Level
DATUMTR	Text	15	Elevation Datum
TD	Long	5	Total Depth, Feet
DFMNM	Text	20	Deepest Formation Name
DFM	Text	3	Deepest Formation Code
DFMTNM	Text	20	Deepest Formation Tested Name
DFMT	Text	3	Deepest Formation Tested Code
LSDEEPPLAY	Text	3	Deepest Play (*Project Plays Only*)
FIELDNM	Text	15	Oil and Gas Field Name
WELLTYPETR	Text	15	Well Type
WELLTYPE	Text	1	Well Type Code
SUFFIXTR	Text	14	Suffix--Describes the Episode of Drilling/Deviated Drilling
STATUSTR	Text	9	Status--Describes the Status of the Drilling Permit
CMPMN	Short	2	Completion Month
CMPDY	Short	2	Completion Day
CMPYR	Short	4	Completion Year
LOGS_AVAIL	Text	14	Logs Available
LOG_TOP	Long	5	Log Top Depth (Gross Interval), Feet
LOG_BOT	Long	5	Log Bottom Depth (Gross Interval), Feet
SCAN	Text	1	Log Scanned--Denotes if Log Scanned or Not
DIGITIZED	Text	1	Log Digitized--Denotes if Log Digitized or Not
CORE1TOP	Long	5	Core 1 Top Depth, Feet
CORE1BTM	Long	5	Core 1 Bottom Depth, Feet
TOPFM1NM	Text	20	Core 1 Top Formation Name
TOPFM1	Text	3	Core 1 Top Formation Code
BTMFM1NM	Text	20	Core 1 Bottom Formation Name
BTMFM1	Text	3	Core 1 Bottom Formation Code
CORE2TOP	Long	5	Core 2 Top Depth, Feet
CORE2BTM	Long	5	Core 2 Bottom Depth, Feet
TOPFM2NM	Text	20	Core 2 Top Formation Name
TOPFM2	Text	3	Core 2 Top Formation Code
BTMFM2NM	Text	20	Core 2 Bottom Formation Name
BTMFM2	Text	3	Core 2 Bottom Formation Code
SAMPLE	Text	7	Sample Available--Denotes if Sample Available or Not

SLABC1PHOT	Text	1	Core Photograph 1 Available--Denotes if Core Photograph Exists or Not
SLABC2PHOT	Text	1	Core Photograph 2 Available--Denotes if Core Photograph Exists or Not
LAT_DD	Double	15	Latitude, Decimal Degrees
LON_DD	Double	16	Longitude, Decimal Degrees
UTME	Double	9	Universal Transverse Mercator Easting, Meters
UTMN	Double	10	Universal Transverse Mercator Northing, Meters
QUAD75NM	Text	21	7.5' Quadrangle Name
TXDSTNM	Text	18	Tax District Name
LOCFLAGTR	Text	37	Location Flag--Describes Source or Type of Well Location Data
BEREA	Text	1	Berea Penetrated--Denotes if Berea Penetrated or Not
VENANGO	Text	1	Venango Penetrated--Denotes if Venango Penetrated or Not
BRADFORD	Text	1	Bradford Penetrated--Denotes if Bradford Penetrated or Not
ELK	Text	1	Elk Penetrated--Denotes if Elk Penetrated or Not
MEDINA	Text	1	Medina Penetrated--Denotes if Medina Penetrated or Not
TUSCARORA	Text	1	Tuscarora Penetrated--Denotes if Tuscarora Penetrated or Not
ACTIVITYTR	Text	21	Activity--Describes Completed Interval ("*Pay" Activity Only for Project*)
ACTIVITY	Text	1	Activity Code
PRODUCTTR	Text	18	Product--Denotes Gas, Oil or Combination Associated with Activity Interval
PRODUCT	Text	1	Product Code
TOPDEPTH	Long	5	Pay Top Depth, Feet
TOPFMNM	Text	20	Pay Top Formation Name
TOPFM	Text	3	Pay Top Formation Code
BTMDEPTH	Long	5	Pay Bottom Depth, Feet
BTMFMNM	Text	20	Pay Bottom Formation Name
BTMFM	Text	3	Pay Bottom Formation Code
GASBEFORE	Long	6	Gas Volume Before Treatment, Thousand Cubic Feet
GASAFTER	Long	6	Gas Volume After Treatment, Thousand Cubic Feet
OILBEFORE	Long	5	Oil Volume Before Treatment, Barrels
OILAFTER	Long	5	Oil Volume After Treatment, Barrels

Wells with Core/Sample Data, BDFD

BDFD_CORE_NAAEAC

WVGES, PGS



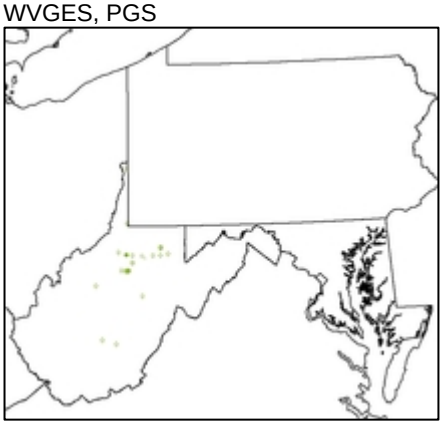
API	Double	19	API Number
COUNTYNAME	Text	10	County Name
PERMIT	Long	5	Permit Number
OPERNM	Text	55	Operator Name
CO_NUM	Text	15	Company Number
FARM	Text	40	Surface Owner
WELL_NUM	Text	6	Farm Number
MINERAL	Text	30	Oil and Gas Rights Owner
ELEV	Short	4	Elevation (Surface of the Well), Feet Above Mean Sea Level
DATUMTR	Text	15	Elevation Datum
TD	Long	5	Total Depth, Feet
DFMNM	Text	20	Deepest Formation Name
DFM	Text	3	Deepest Formation Code
DFMTNM	Text	20	Deepest Formation Tested Name
DFMT	Text	3	Deepest Formation Tested Code
LSDEEPPLAY	Text	3	Deepest Play (*Project Plays Only*)
FIELDNM	Text	15	Oil and Gas Field Name
WELLTYPETR	Text	15	Well Type
WELLTYPE	Text	1	Well Type Code
SUFFIXTR	Text	14	Suffix--Describes the Episode of Drilling/Deviated Drilling
STATUSTR	Text	9	Status--Describes the Status of the Drilling Permit
CMPMN	Short	2	Completion Month
CMPDY	Short	2	Completion Day
CMPYR	Short	4	Completion Year
LOGS_AVAIL	Text	14	Logs Available
LOG_TOP	Long	5	Log Top Depth (Gross Interval), Feet
LOG_BOT	Long	5	Log Bottom Depth (Gross Interval), Feet
SCAN	Text	1	Log Scanned--Denotes if Log Scanned or Not
DIGITIZED	Text	1	Log Digitized--Denotes if Log Digitized or Not
CORE1TOP	Long	5	Core 1 Top Depth, Feet
CORE1BTM	Long	5	Core 1 Bottom Depth, Feet
TOPFM1NM	Text	20	Core 1 Top Formation Name
TOPFM1	Text	3	Core 1 Top Formation Code
BTMFM1NM	Text	20	Core 1 Bottom Formation Name
BTMFM1	Text	3	Core 1 Bottom Formation Code
CORE2TOP	Long	5	Core 2 Top Depth, Feet
CORE2BTM	Long	5	Core 2 Bottom Depth, Feet
TOPFM2NM	Text	20	Core 2 Top Formation Name
TOPFM2	Text	3	Core 2 Top Formation Code
BTMFM2NM	Text	20	Core 2 Bottom Formation Name
BTMFM2	Text	3	Core 2 Bottom Formation Code
SAMPLE	Text	7	Sample Available--Denotes if Sample Available or Not
SLABC1PHOT	Text	1	Core Photograph 1 Available--Denotes if Core Photograph Exists or Not
SLABC2PHOT	Text	1	Core Photograph 2 Available--Denotes if Core Photograph Exists or Not

LAT_DD	Double	15	Latitude, Decimal Degrees
LON_DD	Double	16	Longitude, Decimal Degrees
UTME	Double	9	Universal Transverse Mercator Easting, Meters
UTMN	Double	10	Universal Transverse Mercator Northing, Meters
QUAD75NM	Text	21	7.5' Quadrangle Name
TXDSTNM	Text	18	Tax District Name
LOCFLAGTR	Text	37	Location Flag--Describes Source or Type of Well Location Data
BEREA	Text	1	Berea Penetrated--Denotes if Berea Penetrated or Not
VENANGO	Text	1	Venango Penetrated--Denotes if Venango Penetrated or Not
BRADFORD	Text	1	Bradford Penetrated--Denotes if Bradford Penetrated or Not
ELK	Text	1	Elk Penetrated--Denotes if Elk Penetrated or Not
MEDINA	Text	1	Medina Penetrated--Denotes if Medina Penetrated or Not
TUSCARORA	Text	1	Tuscarora Penetrated--Denotes if Tuscarora Penetrated or Not

Wells with Digitized Logs, BDFD

BDFD_DIGITIZED_NAAEAC

WVGES, PGS



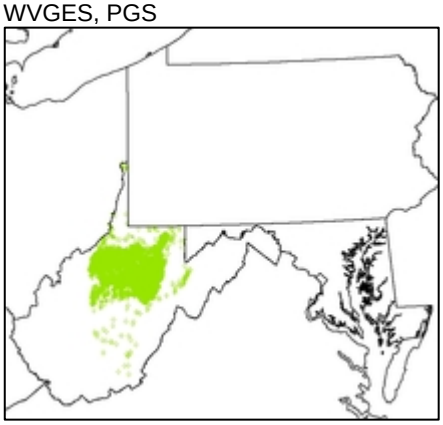
API	Double	19	API Number
COUNTYNAME	Text	10	County Name
PERMIT	Long	5	Permit Number
OPERNM	Text	55	Operator Name
CO_NUM	Text	15	Company Number
FARM	Text	40	Surface Owner
WELL_NUM	Text	6	Farm Number
MINERAL	Text	30	Oil and Gas Rights Owner
ELEV	Short	4	Elevation (Surface of the Well), Feet Above Mean Sea Level
DATUMTR	Text	15	Elevation Datum
TD	Long	5	Total Depth, Feet
DFMNM	Text	20	Deepest Formation Name
DFM	Text	3	Deepest Formation Code
DFMTNM	Text	20	Deepest Formation Tested Name
DFMT	Text	3	Deepest Formation Tested Code
LSDEEPPLAY	Text	3	Deepest Play (*Project Plays Only*)
FIELDNM	Text	15	Oil and Gas Field Name
WELLTYPETR	Text	15	Well Type
WELLTYPE	Text	1	Well Type Code
SUFFIXTR	Text	14	Suffix--Describes the Episode of Drilling/Deviated Drilling
STATUSTR	Text	9	Status--Describes the Status of the Drilling Permit
CMPMN	Short	2	Completion Month
CMPDY	Short	2	Completion Day
CMPYR	Short	4	Completion Year
LOGS_AVAIL	Text	14	Logs Available
LOG_TOP	Long	5	Log Top Depth (Gross Interval), Feet
LOG_BOT	Long	5	Log Bottom Depth (Gross Interval), Feet
SCAN	Text	1	Log Scanned--Denotes if Log Scanned or Not
DIGITIZED	Text	1	Log Digitized--Denotes if Log Digitized or Not
CORE1TOP	Long	5	Core 1 Top Depth, Feet
CORE1BTM	Long	5	Core 1 Bottom Depth, Feet
TOPFM1NM	Text	20	Core 1 Top Formation Name
TOPFM1	Text	3	Core 1 Top Formation Code
BTMFM1NM	Text	20	Core 1 Bottom Formation Name
BTMFM1	Text	3	Core 1 Bottom Formation Code
CORE2TOP	Long	5	Core 2 Top Depth, Feet
CORE2BTM	Long	5	Core 2 Bottom Depth, Feet
TOPFM2NM	Text	20	Core 2 Top Formation Name
TOPFM2	Text	3	Core 2 Top Formation Code
BTMFM2NM	Text	20	Core 2 Bottom Formation Name
BTMFM2	Text	3	Core 2 Bottom Formation Code
SAMPLE	Text	7	Sample Available--Denotes if Sample Available or Not
SLABC1PHOT	Text	1	Core Photograph 1 Available--Denotes if Core Photograph Exists or Not
SLABC2PHOT	Text	1	Core Photograph 2 Available--Denotes if Core Photograph Exists or Not

LAT_DD	Double	15	Latitude, Decimal Degrees
LON_DD	Double	16	Longitude, Decimal Degrees
UTME	Double	9	Universal Transverse Mercator Easting, Meters
UTMN	Double	10	Universal Transverse Mercator Northing, Meters
QUAD75NM	Text	21	7.5' Quadrangle Name
TXDSTNM	Text	18	Tax District Name
LOCFLAGTR	Text	37	Location Flag--Describes Source or Type of Well Location Data
BEREA	Text	1	Berea Penetrated--Denotes if Berea Penetrated or Not
VENANGO	Text	1	Venango Penetrated--Denotes if Venango Penetrated or Not
BRADFORD	Text	1	Bradford Penetrated--Denotes if Bradford Penetrated or Not
ELK	Text	1	Elk Penetrated--Denotes if Elk Penetrated or Not
MEDINA	Text	1	Medina Penetrated--Denotes if Medina Penetrated or Not
TUSCARORA	Text	1	Tuscarora Penetrated--Denotes if Tuscarora Penetrated or Not

Wells with Scanned Logs, BDFD

BDFD_SCANNED_NAAEAC

WVGES, PGS



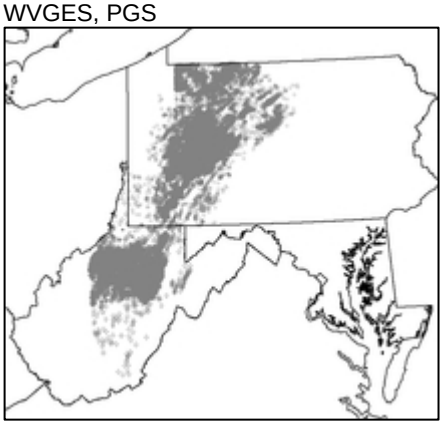
API	Double	19	API Number
COUNTYNAME	Text	10	County Name
PERMIT	Long	5	Permit Number
OPERNM	Text	55	Operator Name
CO_NUM	Text	15	Company Number
FARM	Text	40	Surface Owner
WELL_NUM	Text	6	Farm Number
MINERAL	Text	30	Oil and Gas Rights Owner
ELEV	Short	4	Elevation (Surface of the Well), Feet Above Mean Sea Level
DATUMTR	Text	15	Elevation Datum
TD	Long	5	Total Depth, Feet
DFMNM	Text	20	Deepest Formation Name
DFM	Text	3	Deepest Formation Code
DFMTNM	Text	20	Deepest Formation Tested Name
DFMT	Text	3	Deepest Formation Tested Code
LSDEEPPLAY	Text	3	Deepest Play (*Project Plays Only*)
FIELDNM	Text	15	Oil and Gas Field Name
WELLTYPETR	Text	15	Well Type
WELLTYPE	Text	1	Well Type Code
SUFFIXTR	Text	14	Suffix--Describes the Episode of Drilling/Deviated Drilling
STATUSTR	Text	9	Status--Describes the Status of the Drilling Permit
CMPMN	Short	2	Completion Month
CMPDY	Short	2	Completion Day
CMPYR	Short	4	Completion Year
LOGS_AVAIL	Text	14	Logs Available
LOG_TOP	Long	5	Log Top Depth (Gross Interval), Feet
LOG_BOT	Long	5	Log Bottom Depth (Gross Interval), Feet
SCAN	Text	1	Log Scanned--Denotes if Log Scanned or Not
DIGITIZED	Text	1	Log Digitized--Denotes if Log Digitized or Not
CORE1TOP	Long	5	Core 1 Top Depth, Feet
CORE1BTM	Long	5	Core 1 Bottom Depth, Feet
TOPFM1NM	Text	20	Core 1 Top Formation Name
TOPFM1	Text	3	Core 1 Top Formation Code
BTMFM1NM	Text	20	Core 1 Bottom Formation Name
BTMFM1	Text	3	Core 1 Bottom Formation Code
CORE2TOP	Long	5	Core 2 Top Depth, Feet
CORE2BTM	Long	5	Core 2 Bottom Depth, Feet
TOPFM2NM	Text	20	Core 2 Top Formation Name
TOPFM2	Text	3	Core 2 Top Formation Code
BTMFM2NM	Text	20	Core 2 Bottom Formation Name
BTMFM2	Text	3	Core 2 Bottom Formation Code
SAMPLE	Text	7	Sample Available--Denotes if Sample Available or Not
SLABC1PHOT	Text	1	Core Photograph 1 Available--Denotes if Core Photograph Exists or Not
SLABC2PHOT	Text	1	Core Photograph 2 Available--Denotes if Core Photograph Exists or Not

LAT_DD	Double	15	Latitude, Decimal Degrees
LON_DD	Double	16	Longitude, Decimal Degrees
UTME	Double	9	Universal Transverse Mercator Easting, Meters
UTMN	Double	10	Universal Transverse Mercator Northing, Meters
QUAD75NM	Text	21	7.5' Quadrangle Name
TXDSTNM	Text	18	Tax District Name
LOCFLAGTR	Text	37	Location Flag--Describes Source or Type of Well Location Data
BEREA	Text	1	Berea Penetrated--Denotes if Berea Penetrated or Not
VENANGO	Text	1	Venango Penetrated--Denotes if Venango Penetrated or Not
BRADFORD	Text	1	Bradford Penetrated--Denotes if Bradford Penetrated or Not
ELK	Text	1	Elk Penetrated--Denotes if Elk Penetrated or Not
MEDINA	Text	1	Medina Penetrated--Denotes if Medina Penetrated or Not
TUSCARORA	Text	1	Tuscarora Penetrated--Denotes if Tuscarora Penetrated or Not

Wells that Penetrate, BDFD

BDFD_PPLAY_NAAEAC

WVGES, PGS



API	Double	19	API Number
COUNTYNAME	Text	10	County Name
PERMIT	Long	5	Permit Number
OPERNM	Text	55	Operator Name
CO_NUM	Text	15	Company Number
FARM	Text	40	Surface Owner
WELL_NUM	Text	6	Farm Number
MINERAL	Text	30	Oil and Gas Rights Owner
ELEV	Short	4	Elevation (Surface of the Well), Feet Above Mean Sea Level
DATUMTR	Text	15	Elevation Datum
TD	Long	5	Total Depth, Feet
DFMNM	Text	20	Deepest Formation Name
DFM	Text	3	Deepest Formation Code
DFMTNM	Text	20	Deepest Formation Tested Name
DFMT	Text	3	Deepest Formation Tested Code
LSDEEPPLAY	Text	3	Deepest Play (*Project Plays Only*)
FIELDNM	Text	15	Oil and Gas Field Name
WELLTYPETR	Text	15	Well Type
WELLTYPE	Text	1	Well Type Code
SUFFIXTR	Text	14	Suffix--Describes the Episode of Drilling/Deviated Drilling
STATUSTR	Text	9	Status--Describes the Status of the Drilling Permit
CMPMN	Short	2	Completion Month
CMPDY	Short	2	Completion Day
CMPYR	Short	4	Completion Year
LOGS_AVAIL	Text	14	Logs Available
LOG_TOP	Long	5	Log Top Depth (Gross Interval), Feet
LOG_BOT	Long	5	Log Bottom Depth (Gross Interval), Feet
SCAN	Text	1	Log Scanned--Denotes if Log Scanned or Not
DIGITIZED	Text	1	Log Digitized--Denotes if Log Digitized or Not
CORE1TOP	Long	5	Core 1 Top Depth, Feet
CORE1BTM	Long	5	Core 1 Bottom Depth, Feet
TOPFM1NM	Text	20	Core 1 Top Formation Name
TOPFM1	Text	3	Core 1 Top Formation Code
BTMFM1NM	Text	20	Core 1 Bottom Formation Name
BTMFM1	Text	3	Core 1 Bottom Formation Code
CORE2TOP	Long	5	Core 2 Top Depth, Feet
CORE2BTM	Long	5	Core 2 Bottom Depth, Feet
TOPFM2NM	Text	20	Core 2 Top Formation Name
TOPFM2	Text	3	Core 2 Top Formation Code
BTMFM2NM	Text	20	Core 2 Bottom Formation Name
BTMFM2	Text	3	Core 2 Bottom Formation Code
SAMPLE	Text	7	Sample Available--Denotes if Sample Available or Not
SLABC1PHOT	Text	1	Core Photograph 1 Available--Denotes if Core Photograph Exists or Not
SLABC2PHOT	Text	1	Core Photograph 2 Available--Denotes if Core Photograph Exists or Not

LAT_DD	Double	15	Latitude, Decimal Degrees
LON_DD	Double	16	Longitude, Decimal Degrees
UTME	Double	9	Universal Transverse Mercator Easting, Meters
UTMN	Double	10	Universal Transverse Mercator Northing, Meters
QUAD75NM	Text	21	7.5' Quadrangle Name
TXDSTNM	Text	18	Tax District Name
LOCFLAGTR	Text	37	Location Flag--Describes Source or Type of Well Location Data
BEREA	Text	1	Berea Penetrated--Denotes if Berea Penetrated or Not
VENANGO	Text	1	Venango Penetrated--Denotes if Venango Penetrated or Not
BRADFORD	Text	1	Bradford Penetrated--Denotes if Bradford Penetrated or Not
ELK	Text	1	Elk Penetrated--Denotes if Elk Penetrated or Not
MEDINA	Text	1	Medina Penetrated--Denotes if Medina Penetrated or Not
TUSCARORA	Text	1	Tuscarora Penetrated--Denotes if Tuscarora Penetrated or Not

Cross Sections

Gas Atlas Cross Sections (Dbs-6,8,9,15,20,27)

DbsFig6-8-9-15-20-27_XSection_NAAEAC

WVGES

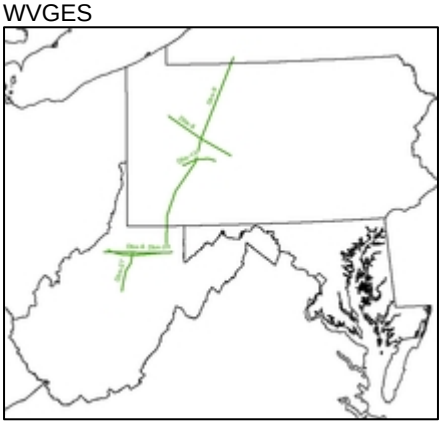


Figure	Text	15	Gas Atlas Figure Reference
XSection	Text	25	Cross Section Label
Comment	Text	200	Comment
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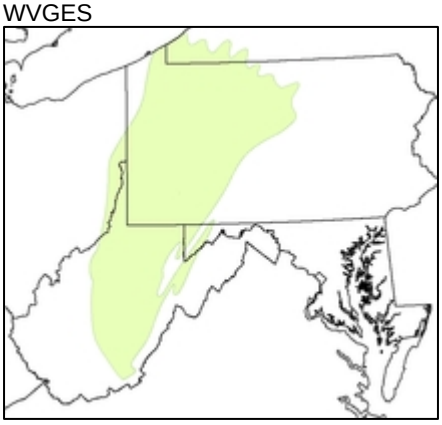
General

Play Outline, BDFD

OGLAYERS_Bradford_Polygon_NAAEAC

WVGES



OBJECTID	Double	10	Object Identifier
SHAPE_LENG	Double	19	Play Polygon Length
SHAPE_AREA	Double	19	Play Polygon Area

Gas Fields, BDFD

WV_GASRES_Dbs_Corrected_NAAEAC

WVGES

ID	Double	12	Object Identifier
FIELD_NAME	Text	35	Gas Field Name
FIELD_ID	Double	12	Gas Field Code
PLAY	Text	4	Play Code
FM	Text	5	Formation Code
FM_DETAILS	Text	66	Formation Details
PROD_TYPE	Text	26	Production Type

Gas Atlas: Significant Wells/Fields (Dbs-2)

Discovery Well, Dbs2

DbsFig2_DiscoveryWell_NAAEAC

WVGES

Figure	Text	15	Gas Atlas Figure Reference
WellName	Text	30	Well Name

Upper Devonian Outcrop, Dbs2

DbsFig2_UpperDevonianOutcrop_NAAEAC

WVGES

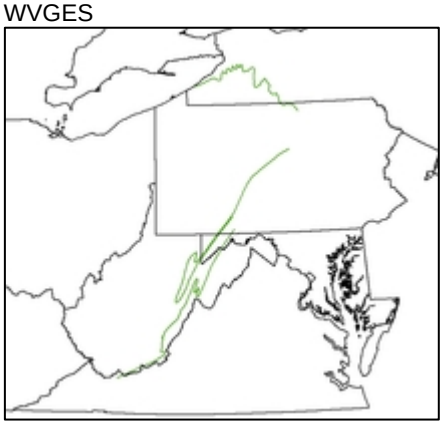


Figure	Text	15	Gas Atlas Figure Reference
TrendName	Text	60	Trend Name

Significant Fields, Dbs2

DbsFig2_SsignificantFields_NAAEAC

WVGES

Figure	Text	15	Gas Atlas Figure Reference
FieldName	Text	50	Gas Field Name

Early Oil Producing Regions, Dbs2

DbsFig2_OilRegions_NAAEAC

WVGES

Figure	Text	15	Gas Atlas Figure Reference
FieldName	Text	50	Oil Field Region

Gas Atlas: Gas Production, Bradford Play, Armstrong County+, PA (Dbs-4)

Producing Areas, Dbs4

DbsFig4_ProducingAreas_NAAEAC

WVGES

Figure	Text	15	Gas Atlas Figure Reference
FieldName	Text	50	Gas Field/Producing Region
Comment	Text	200	Comment

Gas Atlas: Isolith, Net Siltstone, WV (Dbs-22b)

Isoliths, Siltstone, Dbs22b

DbsFig22b_Isoliths_NAAEAC

WVGES

Figure	Text	15	Gas Atlas Figure Reference
Contour	Long	9	Contour Value, Percentage of Interval >= 25% Clean Sand
Unit	Text	2	Contour Value Unit (Contour Value see above)

Shelf Slope Break, Dbs22b

DbsFig22b_ShelfSlope_NAAEAC

WVGES

Figure	Text	15	Gas Atlas Figure Reference
Comment	Text	200	Comment

Gas Atlas: Isolith, B-2 Interval, Regional (Dbs-13)

Control Wells, Dbs13

DbsFig13_Wells_NAAEAC

WVGES

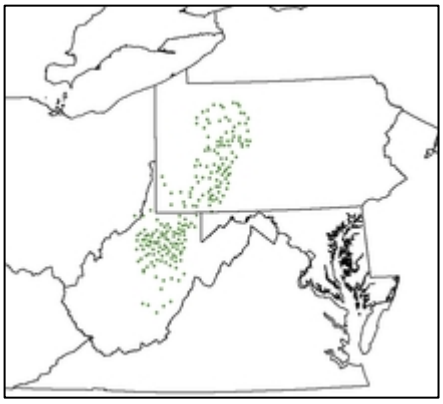
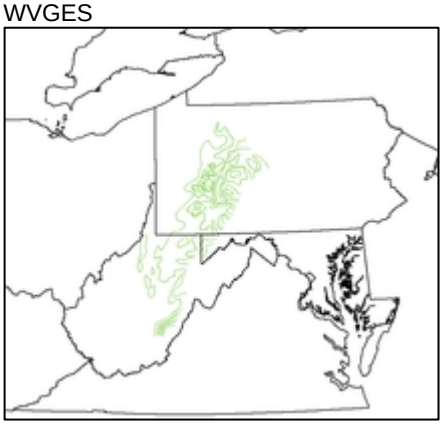


Figure	Text	15	Gas Atlas Figure Reference

Isoliths, Sandstone, Dbs13

DbsFig13_Isoliths_NAAEAC

WVGES



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Contour	Long	9	Contour Value, Feet

Unconformity, Dbs13

DbsFig13_Unconformity_NAAEAC

WVGES

Figure	Text	15	Gas Atlas Figure Reference
Comment	Text	100	Comment

Gas Atlas: Isopach, Total Interval, Northern WV (Dbs-22a)

Isopachs, Dbs22a

DbsFig22a_Isopachs_NAAEAC

WVGES

Figure	Text	15	Gas Atlas Figure Reference
Contour	Long	9	Contour Value, Feet
Comment	Text	200	Comment

Thickening Trend, Dbs22a

DbsFig22a_ThickeningTrend_NAAEAC

WVGES

Figure	Text	15	Gas Atlas Figure Reference
Comment	Text	200	Comment

Gas Atlas: Isopach, Upper Balltown Sandstone, Harrison County, WV (Dbs-21)

Control Wells, Dbs21

DbsFig21_Wells_NAAEAC

Figure	Text	15	Gas Atlas Figure Reference

Isopachs, Dbs21

DbsFig21_Isopachs_NAAEAC

WVGES

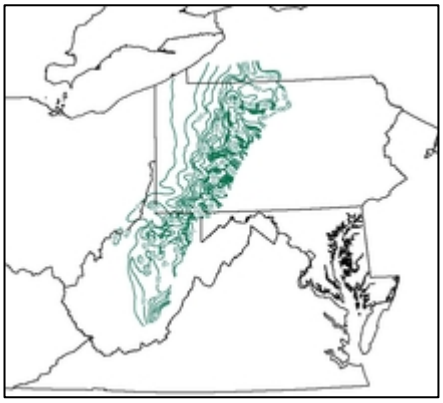
Figure	Text	15	Gas Atlas Figure Reference
Contour	Long	9	Contour Value, Feet
Comment	Text	200	Comment

Other

Thickness--Regional, BDFD

BDFDBoswell1993_Thickness_NAAEAC

DOE



Thickness	Text	15	Thickness Value, Feet

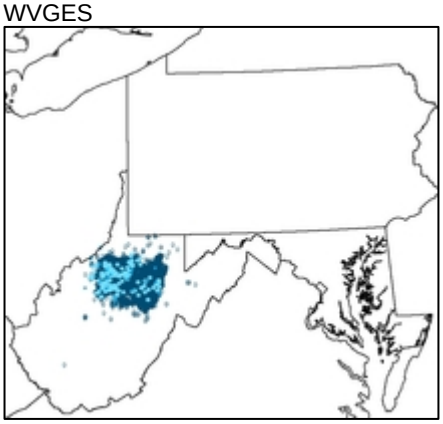
Play Layers: Elk (ELK)

Wells

Wells with Reported Pay, ELK

ELK_PAY_NAAEAC

WVGES



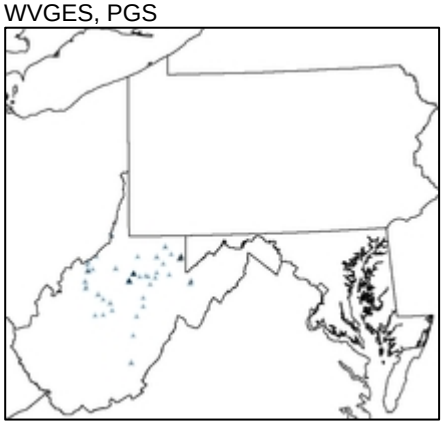
Attribute Name	Type	Length	Attribute Description
API	Double	19	API Number
COUNTYNAME	Text	10	County Name
PERMIT	Long	5	Permit Number
OPERNM	Text	55	Operator Name
CO_NUM	Text	15	Company Number
FARM	Text	40	Surface Owner
WELL_NUM	Text	6	Farm Number
MINERAL	Text	30	Oil and Gas Rights Owner
ELEV	Short	4	Elevation (Surface of the Well), Feet Above Mean Sea Level
DATUMTR	Text	15	Elevation Datum
TD	Long	5	Total Depth, Feet
DFMNM	Text	20	Deepest Formation Name
DFM	Text	3	Deepest Formation Code
DFMTNM	Text	20	Deepest Formation Tested Name
DFMT	Text	3	Deepest Formation Tested Code
LSDEEPPLAY	Text	3	Deepest Play (*Project Plays Only*)
FIELDNM	Text	15	Oil and Gas Field Name
WELLTYPETR	Text	15	Well Type
WELLTYPE	Text	1	Well Type Code
SUFFIXTR	Text	14	Suffix--Describes the Episode of Drilling/Deviated Drilling
STATUSTR	Text	9	Status--Describes the Status of the Drilling Permit
CMPMN	Short	2	Completion Month
CMPDY	Short	2	Completion Day
CMPYR	Short	4	Completion Year
LOGS_AVAIL	Text	14	Logs Available
LOG_TOP	Long	5	Log Top Depth (Gross Interval), Feet
LOG_BOT	Long	5	Log Bottom Depth (Gross Interval), Feet
SCAN	Text	1	Log Scanned--Denotes if Log Scanned or Not
DIGITIZED	Text	1	Log Digitized--Denotes if Log Digitized or Not
CORE1TOP	Long	5	Core 1 Top Depth, Feet
CORE1BTM	Long	5	Core 1 Bottom Depth, Feet
TOPFM1NM	Text	20	Core 1 Top Formation Name
TOPFM1	Text	3	Core 1 Top Formation Code
BTMFM1NM	Text	20	Core 1 Bottom Formation Name
BTMFM1	Text	3	Core 1 Bottom Formation Code
CORE2TOP	Long	5	Core 2 Top Depth, Feet
CORE2BTM	Long	5	Core 2 Bottom Depth, Feet
TOPFM2NM	Text	20	Core 2 Top Formation Name
TOPFM2	Text	3	Core 2 Top Formation Code
BTMFM2NM	Text	20	Core 2 Bottom Formation Name
BTMFM2	Text	3	Core 2 Bottom Formation Code

SAMPLE	Text	7	Sample Available--Denotes if Sample Available or Not
SLABC1PHOT	Text	1	Core Photograph 1 Available--Denotes if Core Photograph Exists or Not
SLABC2PHOT	Text	1	Core Photograph 2 Available--Denotes if Core Photograph Exists or Not
LAT_DD	Double	15	Latitude, Decimal Degrees
LON_DD	Double	16	Longitude, Decimal Degrees
UTME	Double	9	Universal Transverse Mercator Easting, Meters
UTMN	Double	10	Universal Transverse Mercator Northing, Meters
QUAD75NM	Text	21	7.5' Quadrangle Name
TXDSTNM	Text	18	Tax District Name
LOCFLAGTR	Text	37	Location Flag--Describes Source or Type of Well Location Data
BEREA	Text	1	Berea Penetrated--Denotes if Berea Penetrated or Not
VENANGO	Text	1	Venango Penetrated--Denotes if Venango Penetrated or Not
BRADFORD	Text	1	Bradford Penetrated--Denotes if Bradford Penetrated or Not
ELK	Text	1	Elk Penetrated--Denotes if Elk Penetrated or Not
MEDINA	Text	1	Medina Penetrated--Denotes if Medina Penetrated or Not
TUSCARORA	Text	1	Tuscarora Penetrated--Denotes if Tuscarora Penetrated or Not
ACTIVITYTR	Text	21	Activity--Describes Completed Interval ("*Pay" Activity Only for Project*)
ACTIVITY	Text	1	Activity Code
PRODUCTTR	Text	18	Product--Denotes Gas, Oil or Combination Associated with Activity Interval
PRODUCT	Text	1	Product Code
TOPDEPTH	Long	5	Pay Top Depth, Feet
TOPFMNM	Text	20	Pay Top Formation Name
TOPFM	Text	3	Pay Top Formation Code
BTMDEPTH	Long	5	Pay Bottom Depth, Feet
BTMFMNM	Text	20	Pay Bottom Formation Name
BTMFM	Text	3	Pay Bottom Formation Code
GASBEFORE	Long	6	Gas Volume Before Treatment, Thousand Cubic Feet
GASAFTER	Long	6	Gas Volume After Treatment, Thousand Cubic Feet
OILBEFORE	Long	5	Oil Volume Before Treatment, Barrels
OILAFTER	Long	5	Oil Volume After Treatment, Barrels

Wells with Core/Sample Data, ELK

ELK_CORE_NAAEAC

WVGES, PGS



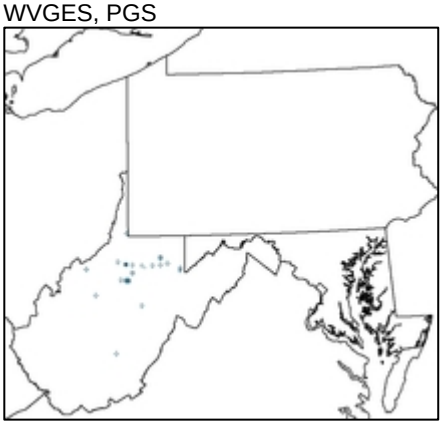
API	Double	19	API Number
COUNTYNAME	Text	10	County Name
PERMIT	Long	5	Permit Number
OPERNM	Text	55	Operator Name
CO_NUM	Text	15	Company Number
FARM	Text	40	Surface Owner
WELL_NUM	Text	6	Farm Number
MINERAL	Text	30	Oil and Gas Rights Owner
ELEV	Short	4	Elevation (Surface of the Well), Feet Above Mean Sea Level
DATUMTR	Text	15	Elevation Datum
TD	Long	5	Total Depth, Feet
DFMNM	Text	20	Deepest Formation Name
DFM	Text	3	Deepest Formation Code
DFMTNM	Text	20	Deepest Formation Tested Name
DFMT	Text	3	Deepest Formation Tested Code
LSDEEPPLAY	Text	3	Deepest Play (*Project Plays Only*)
FIELDNM	Text	15	Oil and Gas Field Name
WELLTYPETR	Text	15	Well Type
WELLTYPE	Text	1	Well Type Code
SUFFIXTR	Text	14	Suffix--Describes the Episode of Drilling/Deviated Drilling
STATUSTR	Text	9	Status--Describes the Status of the Drilling Permit
CMPMN	Short	2	Completion Month
CMPDY	Short	2	Completion Day
CMPYR	Short	4	Completion Year
LOGS_AVAIL	Text	14	Logs Available
LOG_TOP	Long	5	Log Top Depth (Gross Interval), Feet
LOG_BOT	Long	5	Log Bottom Depth (Gross Interval), Feet
SCAN	Text	1	Log Scanned--Denotes if Log Scanned or Not
DIGITIZED	Text	1	Log Digitized--Denotes if Log Digitized or Not
CORE1TOP	Long	5	Core 1 Top Depth, Feet
CORE1BTM	Long	5	Core 1 Bottom Depth, Feet
TOPFM1NM	Text	20	Core 1 Top Formation Name
TOPFM1	Text	3	Core 1 Top Formation Code
BTMFM1NM	Text	20	Core 1 Bottom Formation Name
BTMFM1	Text	3	Core 1 Bottom Formation Code
CORE2TOP	Long	5	Core 2 Top Depth, Feet
CORE2BTM	Long	5	Core 2 Bottom Depth, Feet
TOPFM2NM	Text	20	Core 2 Top Formation Name
TOPFM2	Text	3	Core 2 Top Formation Code
BTMFM2NM	Text	20	Core 2 Bottom Formation Name
BTMFM2	Text	3	Core 2 Bottom Formation Code
SAMPLE	Text	7	Sample Available--Denotes if Sample Available or Not
SLABC1PHOT	Text	1	Core Photograph 1 Available--Denotes if Core Photograph Exists or Not
SLABC2PHOT	Text	1	Core Photograph 2 Available--Denotes if Core Photograph Exists or Not

LAT_DD	Double	15	Latitude, Decimal Degrees
LON_DD	Double	16	Longitude, Decimal Degrees
UTME	Double	9	Universal Transverse Mercator Easting, Meters
UTMN	Double	10	Universal Transverse Mercator Northing, Meters
QUAD75NM	Text	21	7.5' Quadrangle Name
TXDSTNM	Text	18	Tax District Name
LOCFLAGTR	Text	37	Location Flag--Describes Source or Type of Well Location Data
BEREA	Text	1	Berea Penetrated--Denotes if Berea Penetrated or Not
VENANGO	Text	1	Venango Penetrated--Denotes if Venango Penetrated or Not
BRADFORD	Text	1	Bradford Penetrated--Denotes if Bradford Penetrated or Not
ELK	Text	1	Elk Penetrated--Denotes if Elk Penetrated or Not
MEDINA	Text	1	Medina Penetrated--Denotes if Medina Penetrated or Not
TUSCARORA	Text	1	Tuscarora Penetrated--Denotes if Tuscarora Penetrated or Not

Wells with Digitized Logs, ELK

ELK_DIGITIZED_NAAEAC

WVGES, PGS



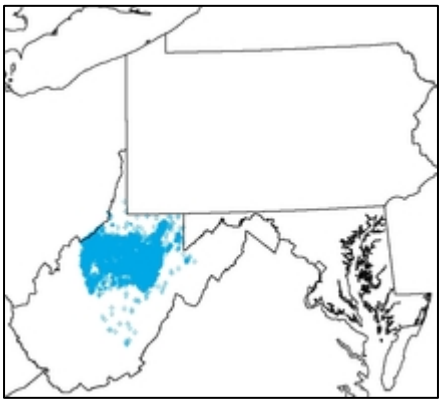
API	Double	19	API Number
COUNTYNAME	Text	10	County Name
PERMIT	Long	5	Permit Number
OPERNM	Text	55	Operator Name
CO_NUM	Text	15	Company Number
FARM	Text	40	Surface Owner
WELL_NUM	Text	6	Farm Number
MINERAL	Text	30	Oil and Gas Rights Owner
ELEV	Short	4	Elevation (Surface of the Well), Feet Above Mean Sea Level
DATUMTR	Text	15	Elevation Datum
TD	Long	5	Total Depth, Feet
DFMNM	Text	20	Deepest Formation Name
DFM	Text	3	Deepest Formation Code
DFMTNM	Text	20	Deepest Formation Tested Name
DFMT	Text	3	Deepest Formation Tested Code
LSDEEPPLAY	Text	3	Deepest Play (*Project Plays Only*)
FIELDNM	Text	15	Oil and Gas Field Name
WELLTYPETR	Text	15	Well Type
WELLTYPE	Text	1	Well Type Code
SUFFIXTR	Text	14	Suffix--Describes the Episode of Drilling/Deviated Drilling
STATUSTR	Text	9	Status--Describes the Status of the Drilling Permit
CMPMN	Short	2	Completion Month
CMPDY	Short	2	Completion Day
CMPYR	Short	4	Completion Year
LOGS_AVAIL	Text	14	Logs Available
LOG_TOP	Long	5	Log Top Depth (Gross Interval), Feet
LOG_BOT	Long	5	Log Bottom Depth (Gross Interval), Feet
SCAN	Text	1	Log Scanned--Denotes if Log Scanned or Not
DIGITIZED	Text	1	Log Digitized--Denotes if Log Digitized or Not
CORE1TOP	Long	5	Core 1 Top Depth, Feet
CORE1BTM	Long	5	Core 1 Bottom Depth, Feet
TOPFM1NM	Text	20	Core 1 Top Formation Name
TOPFM1	Text	3	Core 1 Top Formation Code
BTMFM1NM	Text	20	Core 1 Bottom Formation Name
BTMFM1	Text	3	Core 1 Bottom Formation Code
CORE2TOP	Long	5	Core 2 Top Depth, Feet
CORE2BTM	Long	5	Core 2 Bottom Depth, Feet
TOPFM2NM	Text	20	Core 2 Top Formation Name
TOPFM2	Text	3	Core 2 Top Formation Code
BTMFM2NM	Text	20	Core 2 Bottom Formation Name
BTMFM2	Text	3	Core 2 Bottom Formation Code
SAMPLE	Text	7	Sample Available--Denotes if Sample Available or Not
SLABC1PHOT	Text	1	Core Photograph 1 Available--Denotes if Core Photograph Exists or Not

SLABC2PHOT	Text	1	Core Photograph 2 Available--Denotes if Core Photograph Exists or Not
LAT_DD	Double	15	Latitude, Decimal Degrees
LON_DD	Double	16	Longitude, Decimal Degrees
UTME	Double	9	Universal Transverse Mercator Easting, Meters
UTMN	Double	10	Universal Transverse Mercator Northing, Meters
QUAD75NM	Text	21	7.5' Quadrangle Name
TXDSTNM	Text	18	Tax District Name
LOCFLAGTR	Text	37	Location Flag--Describes Source or Type of Well Location Data
BEREA	Text	1	Berea Penetrated--Denotes if Berea Penetrated or Not
VENANGO	Text	1	Venango Penetrated--Denotes if Venango Penetrated or Not
BRADFORD	Text	1	Bradford Penetrated--Denotes if Bradford Penetrated or Not
ELK	Text	1	Elk Penetrated--Denotes if Elk Penetrated or Not
MEDINA	Text	1	Medina Penetrated--Denotes if Medina Penetrated or Not
TUSCARORA	Text	1	Tuscarora Penetrated--Denotes if Tuscarora Penetrated or Not

Wells with Scanned Logs, ELK

ELK_SCANNED_NAAEAC

WVGES, PGS



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COUNTYNAME	Text	10	County Name
PERMIT	Long	5	Permit Number
OPERNM	Text	55	Operator Name
CO_NUM	Text	15	Company Number
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DFM	Text	3	Deepest Formation Code
DFMTNM	Text	20	Deepest Formation Tested Name
DFMT	Text	3	Deepest Formation Tested Code
LSDEEPPLAY	Text	3	Deepest Play (*Project Plays Only*)
FIELDNM	Text	15	Oil and Gas Field Name
WELLTYPETR	Text	15	Well Type
WELLTYPE	Text	1	Well Type Code
SUFFIXTR	Text	14	Suffix--Describes the Episode of Drilling/Deviated Drilling
STATUSTR	Text	9	Status--Describes the Status of the Drilling Permit
CMPMN	Short	2	Completion Month
CMPDY	Short	2	Completion Day
CMPYR	Short	4	Completion Year
LOGS_AVAIL	Text	14	Logs Available
LOG_TOP	Long	5	Log Top Depth (Gross Interval), Feet
LOG_BOT	Long	5	Log Bottom Depth (Gross Interval), Feet
SCAN	Text	1	Log Scanned--Denotes if Log Scanned or Not
DIGITIZED	Text	1	Log Digitized--Denotes if Log Digitized or Not
CORE1TOP	Long	5	Core 1 Top Depth, Feet
CORE1BTM	Long	5	Core 1 Bottom Depth, Feet
TOPFM1NM	Text	20	Core 1 Top Formation Name
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BTMFM1NM	Text	20	Core 1 Bottom Formation Name
BTMFM1	Text	3	Core 1 Bottom Formation Code
CORE2TOP	Long	5	Core 2 Top Depth, Feet
CORE2BTM	Long	5	Core 2 Bottom Depth, Feet
TOPFM2NM	Text	20	Core 2 Top Formation Name
TOPFM2	Text	3	Core 2 Top Formation Code
BTMFM2NM	Text	20	Core 2 Bottom Formation Name
BTMFM2	Text	3	Core 2 Bottom Formation Code
SAMPLE	Text	7	Sample Available--Denotes if Sample Available or Not
SLABC1PHOT	Text	1	Core Photograph 1 Available--Denotes if Core Photograph Exists or Not

SLABC2PHOT	Text	1	Core Photograph 2 Available--Denotes if Core Photograph Exists or Not
LAT_DD	Double	15	Latitude, Decimal Degrees
LON_DD	Double	16	Longitude, Decimal Degrees
UTME	Double	9	Universal Transverse Mercator Easting, Meters
UTMN	Double	10	Universal Transverse Mercator Northing, Meters
QUAD75NM	Text	21	7.5' Quadrangle Name
TXDSTNM	Text	18	Tax District Name
LOCFLAGTR	Text	37	Location Flag--Describes Source or Type of Well Location Data
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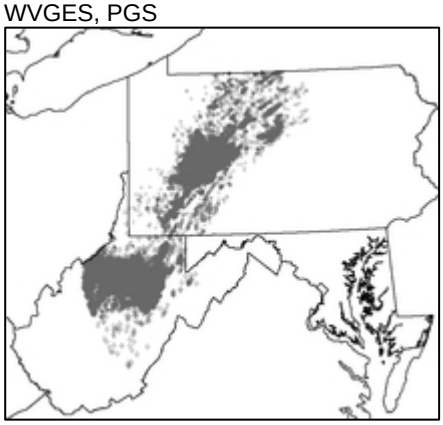
VENANGO	Text	1	Venango Penetrated--Denotes if Venango Penetrated or Not
BRADFORD	Text	1	Bradford Penetrated--Denotes if Bradford Penetrated or Not
ELK	Text	1	Elk Penetrated--Denotes if Elk Penetrated or Not
MEDINA	Text	1	Medina Penetrated--Denotes if Medina Penetrated or Not
TUSCARORA	Text	1	Tuscarora Penetrated--Denotes if Tuscarora Penetrated or Not

Wells that Penetrate, ELK

ELK_PPLAY_NAAEAC

WVGES, PGS



API	Double	19	API Number
COUNTYNAME	Text	10	County Name
PERMIT	Long	5	Permit Number
OPERNM	Text	55	Operator Name
CO_NUM	Text	15	Company Number
FARM	Text	40	Surface Owner
WELL_NUM	Text	6	Farm Number
MINERAL	Text	30	Oil and Gas Rights Owner
ELEV	Short	4	Elevation (Surface of the Well), Feet Above Mean Sea Level
DATUMTR	Text	15	Elevation Datum
TD	Long	5	Total Depth, Feet
DFMNM	Text	20	Deepest Formation Name
DFM	Text	3	Deepest Formation Code
DFMTNM	Text	20	Deepest Formation Tested Name
DFMT	Text	3	Deepest Formation Tested Code
LSDEEPPLAY	Text	3	Deepest Play (*Project Plays Only*)
FIELDNM	Text	15	Oil and Gas Field Name
WELLTYPETR	Text	15	Well Type
WELLTYPE	Text	1	Well Type Code
SUFFIXTR	Text	14	Suffix--Describes the Episode of Drilling/Deviated Drilling
STATUSTR	Text	9	Status--Describes the Status of the Drilling Permit
CMPMN	Short	2	Completion Month
CMPDY	Short	2	Completion Day
CMPYR	Short	4	Completion Year
LOGS_AVAIL	Text	14	Logs Available
LOG_TOP	Long	5	Log Top Depth (Gross Interval), Feet
LOG_BOT	Long	5	Log Bottom Depth (Gross Interval), Feet
SCAN	Text	1	Log Scanned--Denotes if Log Scanned or Not
DIGITIZED	Text	1	Log Digitized--Denotes if Log Digitized or Not
CORE1TOP	Long	5	Core 1 Top Depth, Feet
CORE1BTM	Long	5	Core 1 Bottom Depth, Feet
TOPFM1NM	Text	20	Core 1 Top Formation Name
TOPFM1	Text	3	Core 1 Top Formation Code
BTMFM1NM	Text	20	Core 1 Bottom Formation Name
BTMFM1	Text	3	Core 1 Bottom Formation Code
CORE2TOP	Long	5	Core 2 Top Depth, Feet
CORE2BTM	Long	5	Core 2 Bottom Depth, Feet
TOPFM2NM	Text	20	Core 2 Top Formation Name
TOPFM2	Text	3	Core 2 Top Formation Code
BTMFM2NM	Text	20	Core 2 Bottom Formation Name
BTMFM2	Text	3	Core 2 Bottom Formation Code
SAMPLE	Text	7	Sample Available--Denotes if Sample Available or Not
SLABC1PHOT	Text	1	Core Photograph 1 Available--Denotes if Core Photograph Exists or Not
SLABC2PHOT	Text	1	Core Photograph 2 Available--Denotes if Core Photograph Exists or Not
LAT_DD	Double	15	Latitude, Decimal Degrees

LON_DD	Double	16	Longitude, Decimal Degrees
UTME	Double	9	Universal Transverse Mercator Easting, Meters
UTMN	Double	10	Universal Transverse Mercator Northing, Meters
QUAD75NM	Text	21	7.5' Quadrangle Name
TXDSTNM	Text	18	Tax District Name
LOCFLAGTR	Text	37	Location Flag--Describes Source or Type of Well Location Data
BEREA	Text	1	Berea Penetrated--Denotes if Berea Penetrated or Not
VENANGO	Text	1	Venango Penetrated--Denotes if Venango Penetrated or Not
BRADFORD	Text	1	Bradford Penetrated--Denotes if Bradford Penetrated or Not
ELK	Text	1	Elk Penetrated--Denotes if Elk Penetrated or Not
MEDINA	Text	1	Medina Penetrated--Denotes if Medina Penetrated or Not
TUSCARORA	Text	1	Tuscarora Penetrated--Denotes if Tuscarora Penetrated or Not

Cross Sections

Gas Atlas Cross Sections (Des-10,11,12,14,17b,18,20b,26,29a/b,33,34b)

DesFig10-11-12-14-17b-18-20b-26-29ab-33-34b_XSection_NAAEAC

WVGES

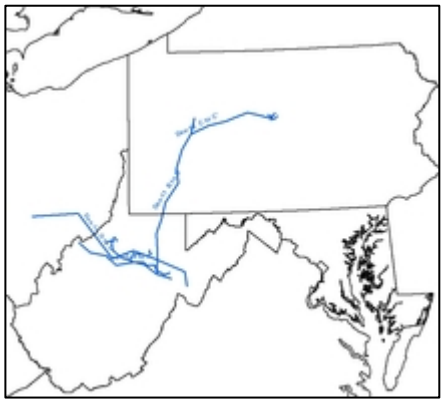


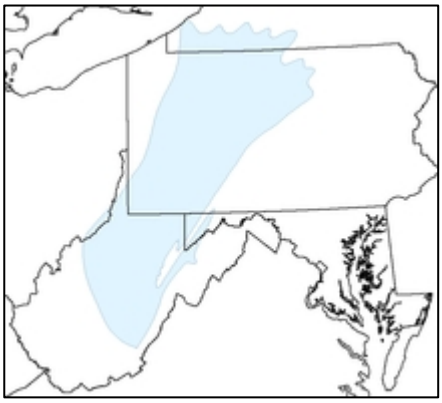
Figure	Text	15	Gas Atlas Figure Reference
XSection	Text	25	Cross Section Label
Comment	Text	200	Comment
XSecFile	Text	50	Cross Section File Name (for Mapping Hyperlink to Cross Section Image)

General

Play Outline, ELK

OGLAYERS_Elk_Polygon_NAAEAC

WVGES



OBJECTID	Double	10	Object Identifier
SHAPE_LENG	Double	19	Play Polygon Length
SHAPE_AREA	Double	19	Play Polygon Area

Gas Fields, ELK

WV_GASRES_Des_NAAEAC

WVGES

ID	Double	12	Object Identifier
FIELD_NAME	Text	35	Gas Field Name
FIELD_ID	Double	12	Gas Field Code
PLAY	Text	4	Play Code
FM	Text	5	Formation Code
FM_DETAILS	Text	66	Formation Details
PROD_TYPE	Text	15	Production Type

Gas Atlas: Significant Wells/Fields (Des-2)

First Producing Wells, Des2

DesFig2_Wells_NAAEAC

WVGES

Figure	Text	15	Gas Atlas Figure Reference
WellName	Text	50	Well Name

Upper Devonian Outcrop, Des2

DesFig2_UpperDevonianOutcrop_NAAEAC

WVGES

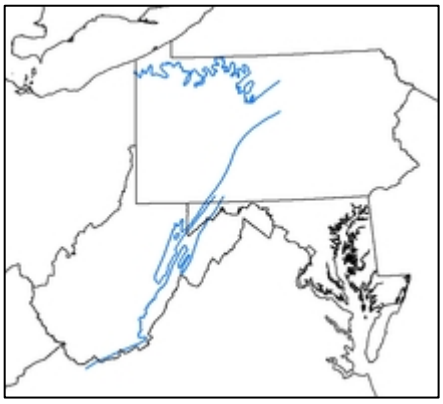


Figure	Text	15	Gas Atlas Figure Reference
TrendName	Text	50	Trend Name

Fields, Des2

DesFig2_Fields_NAAEAC

WVGES

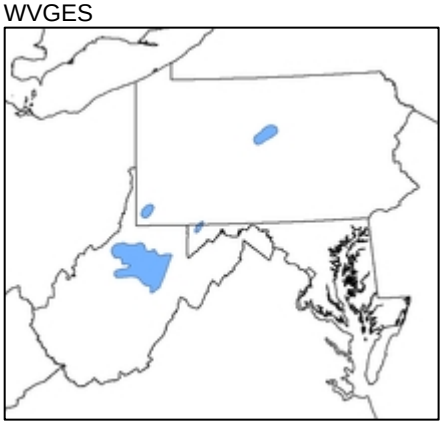


Figure	Text	15	Gas Atlas Figure Reference
FieldName	Text	50	Gas Field Name

Gas Atlas: Fields in the Benson 30-Field Consolidated Area, North-Central WV (Des-3)

Cored Wells, Des3

DesFig3_Wells_NAAEAC

WVGES

Figure	Text	15	Gas Atlas Figure Reference
WellName	Text	20	Well Name

Outcrops, Des3

DesFig3_Outcrops_NAAEAC

WVGES

Figure	Text	15	Gas Atlas Figure Reference
Trend	Text	50	Trend Name

Fields, Des3

DesFig3_Fields_NAAEAC

WVGES

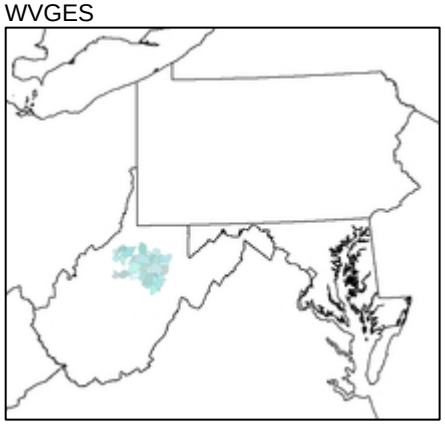


Figure	Text	15	Gas Atlas Figure Reference
FieldName	Text	50	Gas Field Name

Gas Atlas: Facies, Upper Benson, North-Central WV (Des-17a)

Outer Lobe, Des17a

DesFig17a_OuterLobe_NAAEAC

WVGES

Figure	Text	10	Gas Atlas Figure Reference

Inner Lobe, Des17a

DesFig17a_InnerLobe_NAAEAC

WVGES

Figure	Text	10	Gas Atlas Figure Reference

Gas Atlas: Inner Lobe Subfacies/Thickness, Upper Benson, North-Central WV (Des-15,19)

Contours, Des15

DesFig15_Contours_NAAEAC

WVGES

Figure	Text	10	Gas Atlas Figure Reference
Contour	Long	9	Contour Value, Feet

Structural Features, Des15/19

DesFig15-19_StructuralFeatures_NAAEAC

WVGES

Figure	Text	10	Gas Atlas Figure Reference
StructFea	Text	30	Structural Feature Name

Cross-Strike Discontinuities, Des15/19

DesFig19_Discontinuities_NAAEAC

WVGES

Figure	Text	10	Gas Atlas Figure Reference
CrsStrkDis	Text	50	Cross-Strike Discontinuity Name
Label	Text	5	Cross-Strike Discontinuity Label

Turbidite Proximal Deposits, Inner Lobe Subfacies, Des19

DesFig19_TurbiditeDeposits_NAAEAC

WVGES

Figure	Text	10	Gas Atlas Figure Reference
Subfacies	Text	30	Subfacies Name
Comment	Text	85	Comment

Wilbur Field, Des15/19

DesFig15-19_Wilbur_NAAEAC

WVGES

Figure	Text	10	Gas Atlas Figure Reference
FieldName	Text	20	Gas Field Name/Label

Gas Atlas: Isolith, Benson, Regional (Des-13)

Selected Field Locations, Des13

DesFig13_FieldLocations_NAAEAC

WVGES

Figure	Text	10	Gas Atlas Figure Reference
FieldName	Text	20	Gas Field Name

Isoliths, Sandstone, Des13

DesFig13_Isoliths_NAAEAC

WVGES

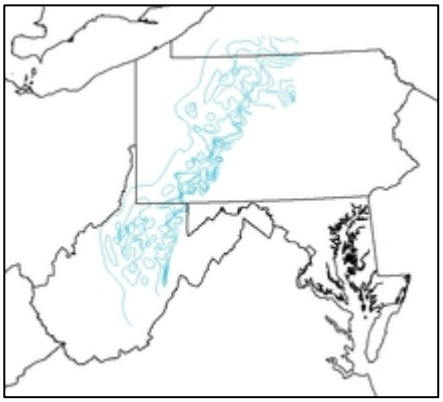


Figure	Text	10	Gas Atlas Figure Reference
Contour	Long	9	Contour Value, Feet

Gas Atlas: Isopach, Fifth Elk, Council Run Field, Centre and Clinton Counties, PA (Des-31,34a)

Wells, Des34a

DesFig34a_Wells_NAAEAC

WVGES

Figure	Text	15	Gas Atlas Figure Reference
WellName	Text	35	Well Name

Isopachs, Des34a

DesFig34a_Isopachs_NAAEAC

WVGES

Figure	Text	15	Gas Atlas Figure Reference
Contour	Long	9	Contour Value, Feet

Isopachs, Regional, Des31

DesFig31_Isopachs_NAAEAC

WVGES

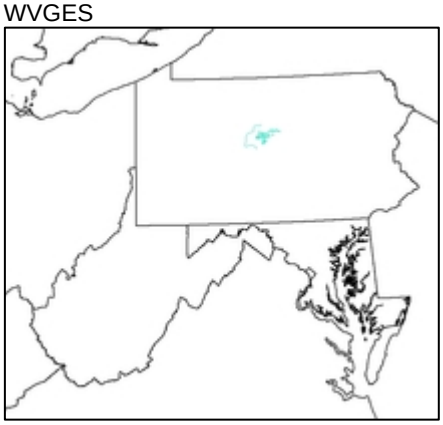


Figure	Text	15	Gas Atlas Figure Reference
Contour	Long	9	Contour Value, Feet

Upper Devonian Outcrop, Approximate Location, Des31

DesFig31_UpperDevonianOutcrop_NAAEAC

WVGES

Figure	Text	15	Gas Atlas Figure Reference
Comment	Text	65	Comment

Gas Atlas: Isopach, Net Pay and Structure, Benson, Wilbur Field, Doddridge+ County, WV (Des-27,30)

Wells, Des27

DesFig27_Wells_NAAEAC

WVGES

Figure	Text	10	Gas Atlas Figure Reference

Isopachs, Des27/30

DesFig27_Isopachs_NAAEAC

WVGES

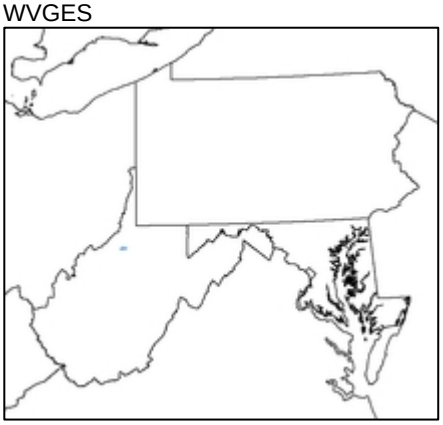


Figure	Text	10	Gas Atlas Figure Reference
Contour	Long	9	Contour Value, Feet
Comment	Text	70	Comment

Structure Contours, Des30

DesFig30_StructureContours_NAAEAC

WVGES

Figure	Text	15	Gas Atlas Figure Reference
Contour	Long	9	Contour Value, Feet
Comment	Text	200	Comment

Fold Axes, Des30

DesFig30_FoldAxes_NAAEAC

WVGES

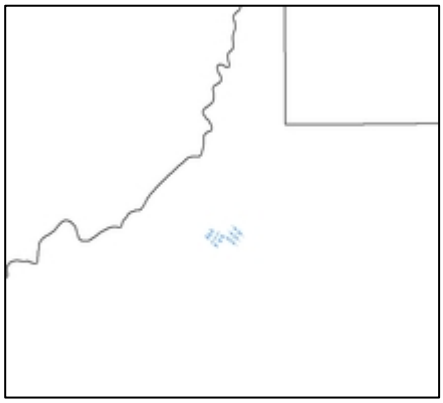


Figure	Text	10	Gas Atlas Figure Reference
Structure	Text	20	Structure Type

Gas Atlas: Net Pay, Benson, Weston-Jane Lew Field, Lewis County, WV (Des-22)

Wells, Des22

DesFig22_Wells_NAAEAC

WVGES

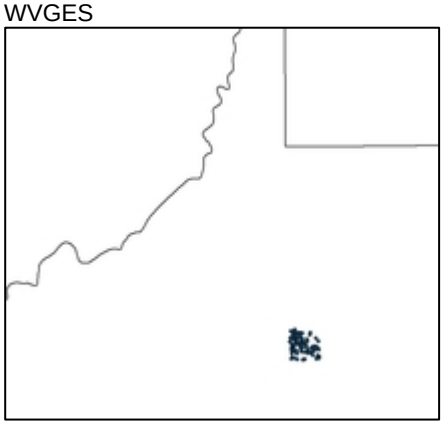


Figure	Text	10	Gas Atlas Figure Reference

Contours, Des22

DesFig22_Contours_NAAEAC

WVGES

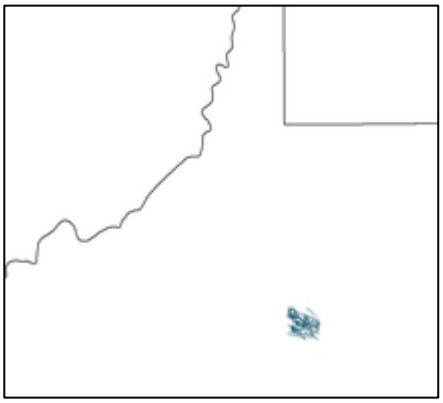


Figure	Text	10	Gas Atlas Figure Reference
Contour	Long	9	Contour Value, Feet

Gas Atlas: Isoline, First Year Cumulative Production, Weston-Jane Lew Field, Lewis County, WV (Des-24)

Wells and Type Log Wells, Des24

DesFig24_WellsEtc_NAAEAC

WVGES

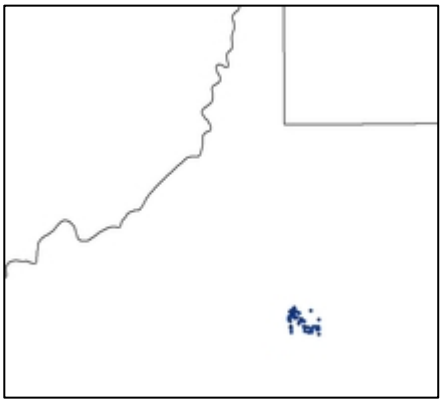


Figure	Text	15	Gas Atlas Figure Reference
WellType	Text	25	Well Type

Isolines, Des24

DesFig24_Isolines_NAAEAC

WVGES

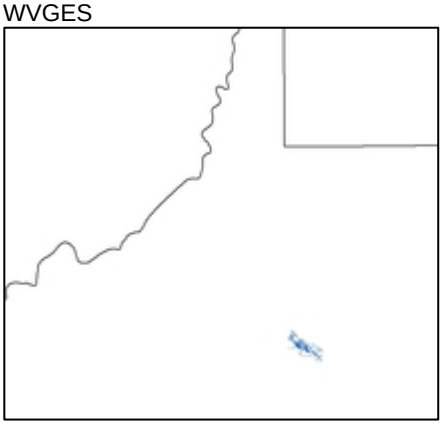


Figure	Text	10	Gas Atlas Figure Reference
Contour	Long	9	Contour Value, Million Cubic Feet
Comment	Text	90	Comment

Other

Thickness--Regional, Benson Only

ELKBoswell1993_Thickness_NAAEAC

DOE

Thickness	Text	15	Thickness Value, Feet

Play Layers: Medina/"Clinton" (MDIN)

Layer Name / File / Source	Attribute Name	Type	Length	Attribute Description
Wells				
Wells with Reported Pay, MDIN *MDIN_PAY_NAAEAC* WVGES				
Image Unavailable	API	Double	19	API Number
	COUNTYNAME	Text	10	County Name
	PERMIT	Long	5	Permit Number
	OPERNM	Text	55	Operator Name
	CO_NUM	Text	15	Company Number
	FARM	Text	40	Surface Owner
	WELL_NUM	Text	6	Farm Number
	MINERAL	Text	30	Oil and Gas Rights Owner
	ELEV	Short	4	Elevation (Surface of the Well), Feet Above Mean Sea Level
	DATUMTR	Text	15	Elevation Datum
	TD	Long	5	Total Depth, Feet
	DFMNM	Text	20	Deepest Formation Name
	DFM	Text	3	Deepest Formation Code
	DFMTNM	Text	20	Deepest Formation Tested Name
	DFMT	Text	3	Deepest Formation Tested Code
	LSDEEPPLAY	Text	3	Deepest Play (*Project Plays Only*)
	FIELDNM	Text	15	Oil and Gas Field Name
	WELLTYPETR	Text	15	Well Type
	WELLTYPE	Text	1	Well Type Code
	SUFFIXTR	Text	14	Suffix--Describes the Episode of Drilling/Deviated Drilling
	STATUSTR	Text	9	Status--Describes the Status of the Drilling Permit
	CMPMN	Short	2	Completion Month
	CMPDY	Short	2	Completion Day
	CMPYR	Short	4	Completion Year
	LOGS_AVAIL	Text	14	Logs Available
	LOG_TOP	Long	5	Log Top Depth (Gross Interval), Feet
	LOG_BOT	Long	5	Log Bottom Depth (Gross Interval), Feet
	SCAN	Text	1	Log Scanned--Denotes if Log Scanned or Not
	DIGITIZED	Text	1	Log Digitized--Denotes if Log Digitized or Not
	CORE1TOP	Long	5	Core 1 Top Depth, Feet
	CORE1BTM	Long	5	Core 1 Bottom Depth, Feet
	TOPFM1NM	Text	20	Core 1 Top Formation Name
	TOPFM1	Text	3	Core 1 Top Formation Code
	BTMFM1NM	Text	20	Core 1 Bottom Formation Name
	BTMFM1	Text	3	Core 1 Bottom Formation Code
	CORE2TOP	Long	5	Core 2 Top Depth, Feet
	CORE2BTM	Long	5	Core 2 Bottom Depth, Feet
	TOPFM2NM	Text	20	Core 2 Top Formation Name
	TOPFM2	Text	3	Core 2 Top Formation Code
	BTMFM2NM	Text	20	Core 2 Bottom Formation Name
	BTMFM2	Text	3	Core 2 Bottom Formation Code
	SAMPLE	Text	7	Sample Available--Denotes if Sample Available or Not

SLABC1PHOT	Text	1	Core Photograph 1 Available--Denotes if Core Photograph Exists or Not
SLABC2PHOT	Text	1	Core Photograph 2 Available--Denotes if Core Photograph Exists or Not
LAT_DD	Double	15	Latitude, Decimal Degrees
LON_DD	Double	16	Longitude, Decimal Degrees
UTME	Double	9	Universal Transverse Mercator Easting, Meters
UTMN	Double	10	Universal Transverse Mercator Northing, Meters
QUAD75NM	Text	21	7.5' Quadrangle Name
TXDSTNM	Text	18	Tax District Name
LOCFLAGTR	Text	37	Location Flag--Describes Source or Type of Well Location Data
BEREA	Text	1	Berea Penetrated--Denotes if Berea Penetrated or Not
VENANGO	Text	1	Venango Penetrated--Denotes if Venango Penetrated or Not
BRADFORD	Text	1	Bradford Penetrated--Denotes if Bradford Penetrated or Not
ELK	Text	1	Elk Penetrated--Denotes if Elk Penetrated or Not
MEDINA	Text	1	Medina Penetrated--Denotes if Medina Penetrated or Not
TUSCARORA	Text	1	Tuscarora Penetrated--Denotes if Tuscarora Penetrated or Not
ACTIVITYTR	Text	21	Activity--Describes Completed Interval ("*Pay" Activity Only for Project*)
ACTIVITY	Text	1	Activity Code
PRODUCTTR	Text	18	Product--Denotes Gas, Oil or Combination Associated with Activity Interval
PRODUCT	Text	1	Product Code
TOPDEPTH	Long	5	Pay Top Depth, Feet
TOPFMNM	Text	20	Pay Top Formation Name
TOPFM	Text	3	Pay Top Formation Code
BTMDEPTH	Long	5	Pay Bottom Depth, Feet
BTMFMNM	Text	20	Pay Bottom Formation Name
BTMFM	Text	3	Pay Bottom Formation Code
GASBEFORE	Long	6	Gas Volume Before Treatment, Thousand Cubic Feet
GASAFTER	Long	6	Gas Volume After Treatment, Thousand Cubic Feet
OILBEFORE	Long	5	Oil Volume Before Treatment, Barrels
OILAFTER	Long	5	Oil Volume After Treatment, Barrels

Wells with Core/Sample Data, MDIN

MDIN_CORE_NAAEAC

WVGES, PGS

Image Unavailable

API	Double	19	API Number
COUNTYNAME	Text	10	County Name
PERMIT	Long	5	Permit Number
OPERNM	Text	55	Operator Name
CO_NUM	Text	15	Company Number
FARM	Text	40	Surface Owner
WELL_NUM	Text	6	Farm Number
MINERAL	Text	30	Oil and Gas Rights Owner
ELEV	Short	4	Elevation (Surface of the Well), Feet Above Mean Sea Level
DATUMTR	Text	15	Elevation Datum
TD	Long	5	Total Depth, Feet
DFMNM	Text	20	Deepest Formation Name
DFM	Text	3	Deepest Formation Code
DFMTNM	Text	20	Deepest Formation Tested Name
DFMT	Text	3	Deepest Formation Tested Code
LSDEEPPLAY	Text	3	Deepest Play (*Project Plays Only*)
FIELDNM	Text	15	Oil and Gas Field Name
WELLTYPETR	Text	15	Well Type
WELLTYPE	Text	1	Well Type Code
SUFFIXTR	Text	14	Suffix--Describes the Episode of Drilling/Deviated Drilling
STATUSTR	Text	9	Status--Describes the Status of the Drilling Permit
CMPMN	Short	2	Completion Month
CMPDY	Short	2	Completion Day
CMPYR	Short	4	Completion Year
LOGS_AVAIL	Text	14	Logs Available
LOG_TOP	Long	5	Log Top Depth (Gross Interval), Feet
LOG_BOT	Long	5	Log Bottom Depth (Gross Interval), Feet
SCAN	Text	1	Log Scanned--Denotes if Log Scanned or Not
DIGITIZED	Text	1	Log Digitized--Denotes if Log Digitized or Not
CORE1TOP	Long	5	Core 1 Top Depth, Feet
CORE1BTM	Long	5	Core 1 Bottom Depth, Feet
TOPFM1NM	Text	20	Core 1 Top Formation Name
TOPFM1	Text	3	Core 1 Top Formation Code
BTMFM1NM	Text	20	Core 1 Bottom Formation Name
BTMFM1	Text	3	Core 1 Bottom Formation Code
CORE2TOP	Long	5	Core 2 Top Depth, Feet
CORE2BTM	Long	5	Core 2 Bottom Depth, Feet
TOPFM2NM	Text	20	Core 2 Top Formation Name
TOPFM2	Text	3	Core 2 Top Formation Code
BTMFM2NM	Text	20	Core 2 Bottom Formation Name
BTMFM2	Text	3	Core 2 Bottom Formation Code
SAMPLE	Text	7	Sample Available--Denotes if Sample Available or Not
SLABC1PHOT	Text	1	Core Photograph 1 Available--Denotes if Core Photograph Exists or Not

SLABC2PHOT	Text	1	Core Photograph 2 Available--Denotes if Core Photograph Exists or Not
LAT_DD	Double	15	Latitude, Decimal Degrees
LON_DD	Double	16	Longitude, Decimal Degrees
UTME	Double	9	Universal Transverse Mercator Easting, Meters
UTMN	Double	10	Universal Transverse Mercator Northing, Meters
QUAD75NM	Text	21	7.5' Quadrangle Name
TXDSTNM	Text	18	Tax District Name
LOCFLAGTR	Text	37	Location Flag--Describes Source or Type of Well Location Data
BEREA	Text	1	Berea Penetrated--Denotes if Berea Penetrated or Not
VENANGO	Text	1	Venango Penetrated--Denotes if Venango Penetrated or Not
BRADFORD	Text	1	Bradford Penetrated--Denotes if Bradford Penetrated or Not
ELK	Text	1	Elk Penetrated--Denotes if Elk Penetrated or Not
MEDINA	Text	1	Medina Penetrated--Denotes if Medina Penetrated or Not
TUSCARORA	Text	1	Tuscarora Penetrated--Denotes if Tuscarora Penetrated or Not

Wells with Digitized Logs, MDIN

MDIN_DIGITIZED_NAAEAC

WVGES, PGS

Image Unavailable

API	Double	19	API Number
COUNTYNAME	Text	10	County Name
PERMIT	Long	5	Permit Number
OPERNM	Text	55	Operator Name
CO_NUM	Text	15	Company Number
FARM	Text	40	Surface Owner
WELL_NUM	Text	6	Farm Number
MINERAL	Text	30	Oil and Gas Rights Owner
ELEV	Short	4	Elevation (Surface of the Well), Feet Above Mean Sea Level
DATUMTR	Text	15	Elevation Datum
TD	Long	5	Total Depth, Feet
DFMNM	Text	20	Deepest Formation Name
DFM	Text	3	Deepest Formation Code
DFMTNM	Text	20	Deepest Formation Tested Name
DFMT	Text	3	Deepest Formation Tested Code
LSDEEPPLAY	Text	3	Deepest Play (*Project Plays Only*)
FIELDNM	Text	15	Oil and Gas Field Name
WELLTYPETR	Text	15	Well Type
WELLTYPE	Text	1	Well Type Code
SUFFIXTR	Text	14	Suffix--Describes the Episode of Drilling/Deviated Drilling
STATUSTR	Text	9	Status--Describes the Status of the Drilling Permit
CMPMN	Short	2	Completion Month
CMPDY	Short	2	Completion Day
CMPYR	Short	4	Completion Year
LOGS_AVAIL	Text	14	Logs Available
LOG_TOP	Long	5	Log Top Depth (Gross Interval), Feet
LOG_BOT	Long	5	Log Bottom Depth (Gross Interval), Feet
SCAN	Text	1	Log Scanned--Denotes if Log Scanned or Not
DIGITIZED	Text	1	Log Digitized--Denotes if Log Digitized or Not
CORE1TOP	Long	5	Core 1 Top Depth, Feet
CORE1BTM	Long	5	Core 1 Bottom Depth, Feet
TOPFM1NM	Text	20	Core 1 Top Formation Name
TOPFM1	Text	3	Core 1 Top Formation Code
BTMFM1NM	Text	20	Core 1 Bottom Formation Name
BTMFM1	Text	3	Core 1 Bottom Formation Code
CORE2TOP	Long	5	Core 2 Top Depth, Feet
CORE2BTM	Long	5	Core 2 Bottom Depth, Feet
TOPFM2NM	Text	20	Core 2 Top Formation Name
TOPFM2	Text	3	Core 2 Top Formation Code
BTMFM2NM	Text	20	Core 2 Bottom Formation Name
BTMFM2	Text	3	Core 2 Bottom Formation Code
SAMPLE	Text	7	Sample Available--Denotes if Sample Available or Not
SLABC1PHOT	Text	1	Core Photograph 1 Available--Denotes if Core Photograph Exists or Not

SLABC2PHOT	Text	1	Core Photograph 2 Available--Denotes if Core Photograph Exists or Not
LAT_DD	Double	15	Latitude, Decimal Degrees
LON_DD	Double	16	Longitude, Decimal Degrees
UTME	Double	9	Universal Transverse Mercator Easting, Meters
UTMN	Double	10	Universal Transverse Mercator Northing, Meters
QUAD75NM	Text	21	7.5' Quadrangle Name
TXDSTNM	Text	18	Tax District Name
LOCFLAGTR	Text	37	Location Flag--Describes Source or Type of Well Location Data
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VENANGO	Text	1	Venango Penetrated--Denotes if Venango Penetrated or Not
BRADFORD	Text	1	Bradford Penetrated--Denotes if Bradford Penetrated or Not
ELK	Text	1	Elk Penetrated--Denotes if Elk Penetrated or Not
MEDINA	Text	1	Medina Penetrated--Denotes if Medina Penetrated or Not
TUSCARORA	Text	1	Tuscarora Penetrated--Denotes if Tuscarora Penetrated or Not

Wells with Scanned Logs, MDIN

MDIN_SCANNED_NAAEAC

WVGES, PGS

Image Unavailable

API	Double	19	API Number
COUNTYNAME	Text	10	County Name
PERMIT	Long	5	Permit Number
OPERNM	Text	55	Operator Name
CO_NUM	Text	15	Company Number
FARM	Text	40	Surface Owner
WELL_NUM	Text	6	Farm Number
MINERAL	Text	30	Oil and Gas Rights Owner
ELEV	Short	4	Elevation (Surface of the Well), Feet Above Mean Sea Level
DATUMTR	Text	15	Elevation Datum
TD	Long	5	Total Depth, Feet
DFMNM	Text	20	Deepest Formation Name
DFM	Text	3	Deepest Formation Code
DFMTNM	Text	20	Deepest Formation Tested Name
DFMT	Text	3	Deepest Formation Tested Code
LSDEEPPLAY	Text	3	Deepest Play (*Project Plays Only*)
FIELDNM	Text	15	Oil and Gas Field Name
WELLTYPETR	Text	15	Well Type
WELLTYPE	Text	1	Well Type Code
SUFFIXTR	Text	14	Suffix--Describes the Episode of Drilling/Deviated Drilling
STATUSTR	Text	9	Status--Describes the Status of the Drilling Permit
CMPMN	Short	2	Completion Month
CMPDY	Short	2	Completion Day
CMPYR	Short	4	Completion Year
LOGS_AVAIL	Text	14	Logs Available
LOG_TOP	Long	5	Log Top Depth (Gross Interval), Feet
LOG_BOT	Long	5	Log Bottom Depth (Gross Interval), Feet
SCAN	Text	1	Log Scanned--Denotes if Log Scanned or Not
DIGITIZED	Text	1	Log Digitized--Denotes if Log Digitized or Not
CORE1TOP	Long	5	Core 1 Top Depth, Feet
CORE1BTM	Long	5	Core 1 Bottom Depth, Feet
TOPFM1NM	Text	20	Core 1 Top Formation Name
TOPFM1	Text	3	Core 1 Top Formation Code
BTMFM1NM	Text	20	Core 1 Bottom Formation Name
BTMFM1	Text	3	Core 1 Bottom Formation Code
CORE2TOP	Long	5	Core 2 Top Depth, Feet
CORE2BTM	Long	5	Core 2 Bottom Depth, Feet
TOPFM2NM	Text	20	Core 2 Top Formation Name
TOPFM2	Text	3	Core 2 Top Formation Code
BTMFM2NM	Text	20	Core 2 Bottom Formation Name
BTMFM2	Text	3	Core 2 Bottom Formation Code
SAMPLE	Text	7	Sample Available--Denotes if Sample Available or Not
SLABC1PHOT	Text	1	Core Photograph 1 Available--Denotes if Core Photograph Exists or Not

SLABC2PHOT	Text	1	Core Photograph 2 Available--Denotes if Core Photograph Exists or Not
LAT_DD	Double	15	Latitude, Decimal Degrees
LON_DD	Double	16	Longitude, Decimal Degrees
UTME	Double	9	Universal Transverse Mercator Easting, Meters
UTMN	Double	10	Universal Transverse Mercator Northing, Meters
QUAD75NM	Text	21	7.5' Quadrangle Name
TXDSTNM	Text	18	Tax District Name
LOCFLAGTR	Text	37	Location Flag--Describes Source or Type of Well Location Data
BEREA	Text	1	Berea Penetrated--Denotes if Berea Penetrated or Not
VENANGO	Text	1	Venango Penetrated--Denotes if Venango Penetrated or Not
BRADFORD	Text	1	Bradford Penetrated--Denotes if Bradford Penetrated or Not
ELK	Text	1	Elk Penetrated--Denotes if Elk Penetrated or Not
MEDINA	Text	1	Medina Penetrated--Denotes if Medina Penetrated or Not
TUSCARORA	Text	1	Tuscarora Penetrated--Denotes if Tuscarora Penetrated or Not

Wells that Penetrate, MDIN

MDIN_PPLAY_NAAEAC

WVGES, PGS

Image Unavailable

API	Double	19	API Number
COUNTYNAME	Text	10	County Name
PERMIT	Long	5	Permit Number
OPERNM	Text	55	Operator Name
CO_NUM	Text	15	Company Number
FARM	Text	40	Surface Owner
WELL_NUM	Text	6	Farm Number
MINERAL	Text	30	Oil and Gas Rights Owner
ELEV	Short	4	Elevation (Surface of the Well), Feet Above Mean Sea Level
DATUMTR	Text	15	Elevation Datum
TD	Long	5	Total Depth, Feet
DFMNM	Text	20	Deepest Formation Name
DFM	Text	3	Deepest Formation Code
DFMTNM	Text	20	Deepest Formation Tested Name
DFMT	Text	3	Deepest Formation Tested Code
LSDEEPPLAY	Text	3	Deepest Play (*Project Plays Only*)
FIELDNM	Text	15	Oil and Gas Field Name
WELLTYPETR	Text	15	Well Type
WELLTYPE	Text	1	Well Type Code
SUFFIXTR	Text	14	Suffix--Describes the Episode of Drilling/Deviated Drilling
STATUSTR	Text	9	Status--Describes the Status of the Drilling Permit
CMPMN	Short	2	Completion Month
CMPDY	Short	2	Completion Day
CMPYR	Short	4	Completion Year
LOGS_AVAIL	Text	14	Logs Available
LOG_TOP	Long	5	Log Top Depth (Gross Interval), Feet
LOG_BOT	Long	5	Log Bottom Depth (Gross Interval), Feet
SCAN	Text	1	Log Scanned--Denotes if Log Scanned or Not
DIGITIZED	Text	1	Log Digitized--Denotes if Log Digitized or Not
CORE1TOP	Long	5	Core 1 Top Depth, Feet
CORE1BTM	Long	5	Core 1 Bottom Depth, Feet
TOPFM1NM	Text	20	Core 1 Top Formation Name
TOPFM1	Text	3	Core 1 Top Formation Code
BTMFM1NM	Text	20	Core 1 Bottom Formation Name
BTMFM1	Text	3	Core 1 Bottom Formation Code
CORE2TOP	Long	5	Core 2 Top Depth, Feet
CORE2BTM	Long	5	Core 2 Bottom Depth, Feet
TOPFM2NM	Text	20	Core 2 Top Formation Name
TOPFM2	Text	3	Core 2 Top Formation Code
BTMFM2NM	Text	20	Core 2 Bottom Formation Name
BTMFM2	Text	3	Core 2 Bottom Formation Code
SAMPLE	Text	7	Sample Available--Denotes if Sample Available or Not
SLABC1PHOT	Text	1	Core Photograph 1 Available--Denotes if Core Photograph Exists or Not

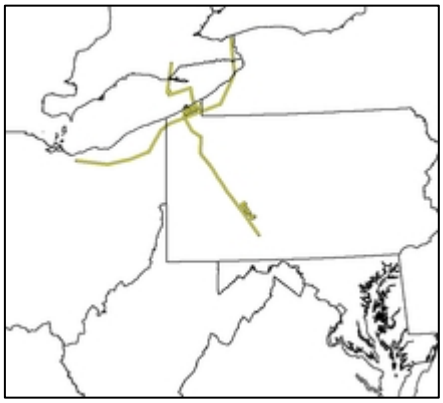
SLABC2PHOT	Text	1	Core Photograph 2 Available--Denotes if Core Photograph Exists or Not
LAT_DD	Double	15	Latitude, Decimal Degrees
LON_DD	Double	16	Longitude, Decimal Degrees
UTME	Double	9	Universal Transverse Mercator Easting, Meters
UTMN	Double	10	Universal Transverse Mercator Northing, Meters
QUAD75NM	Text	21	7.5' Quadrangle Name
TXDSTNM	Text	18	Tax District Name
LOCFLAGTR	Text	37	Location Flag--Describes Source or Type of Well Location Data
BEREA	Text	1	Berea Penetrated--Denotes if Berea Penetrated or Not
VENANGO	Text	1	Venango Penetrated--Denotes if Venango Penetrated or Not
BRADFORD	Text	1	Bradford Penetrated--Denotes if Bradford Penetrated or Not
ELK	Text	1	Elk Penetrated--Denotes if Elk Penetrated or Not
MEDINA	Text	1	Medina Penetrated--Denotes if Medina Penetrated or Not
TUSCARORA	Text	1	Tuscarora Penetrated--Denotes if Tuscarora Penetrated or Not

Cross Sections

Gas Atlas Cross Sections (Scm-4,5)

ScmFig4-5_XSection_NAAEAC

WVGES



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XSection	Text	25	Cross Section Label
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General

Play Outline, MDIN

OGLAYERS_Medina_Polygon_NAAEAC

WVGES

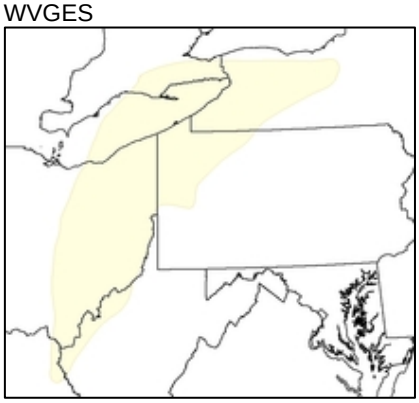


Figure	Text	15	Gas Atlas Figure Reference
PlayName	Text	100	Play Name

Gas Atlas: Significant Gas Fields (Scm-2)

Fields, Scm2

ScmFig2_Fields_NAAEAC

WVGES

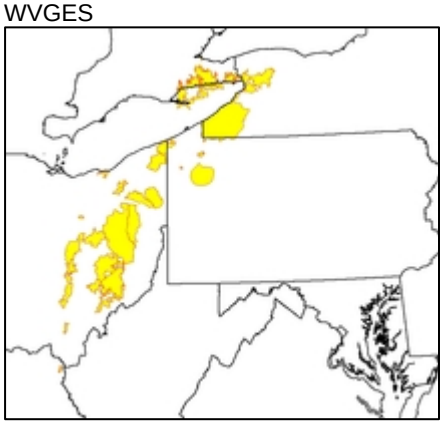


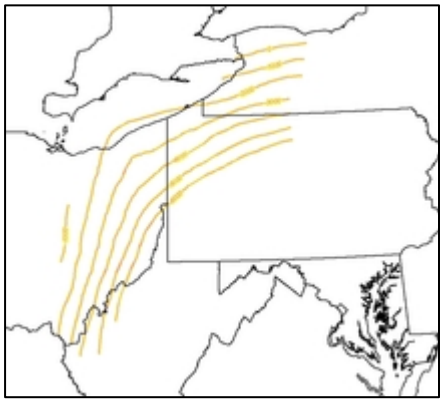
Figure	Text	15	Gas Atlas Figure Reference
FieldName	Text	50	Gas Field Name

Gas Atlas: Structure, Medina, Regional (Scm-9)

Contours, Scm9

ScmFig9_Contours_NAAEAC

WVGES



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Contour	Long	9	Contour Value, Feet

Gas Atlas: Isopach, Net Sandstone, Grimsby, Regional (Scm-8)

Contours, Scm8

ScmFig8_Contours_NAAEAC

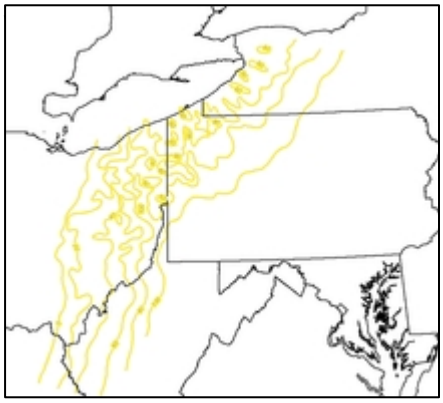


Figure	Text	15	Gas Atlas Figure Reference
Contour	Long	9	Contour Value, Feet

Gas Atlas: Isopach, Net Pay, Grimsby, Regional (Scm-11)

Boundary, Scm11

ScmFig11_Boundary_NAAEAC

WVGES

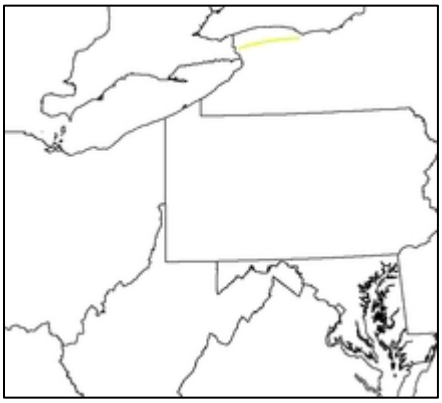
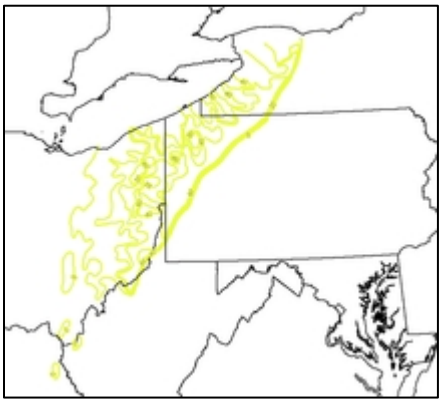


Figure	Text	15	Gas Atlas Figure Reference

Isopachs, Scm11

ScmFig11_Isopachs_NAAEAC

WVGES



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Contour	Long	9	Contour Value, Feet

Gas Atlas: Isopach, Net Sandstone, Whirlpool, Regional (Scm-7)

Boundary, Scm7

ScmFig7_Boundary_NAAEAC

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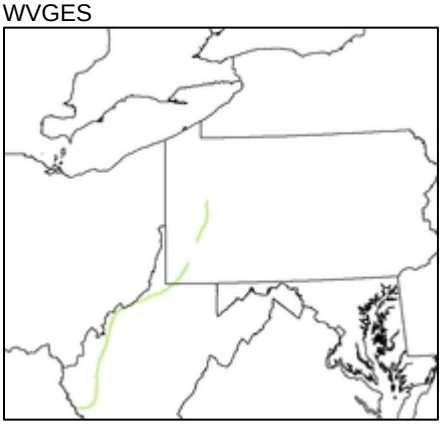


Figure	Text	15	Gas Atlas Figure Reference

Isopachs, Scm7

ScmFig7_Isopachs_NAAEAC

WVGES

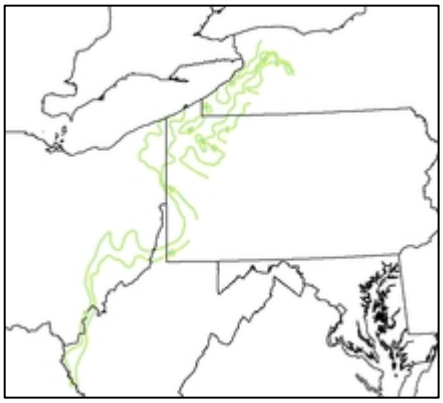


Figure	Text	15	Gas Atlas Figure Reference
Contour	Long	9	Contour Value, Feet

Gas Atlas: Isopach, Net Pay, Whirlpool, Regional (Scm-10)

Isopachs, Scm10

ScmFig10_Isopachs_NAAEAC

WVGES

Figure	Text	15	Gas Atlas Figure Reference
Contour	Long	9	Contour Value, Feet

Gas Atlas: Reservoir Trends, Cataract/Medina Group, Regional (Scm-31)

Resource, Scm31

ScmFig31_Resource_NAAEAC

WVGES

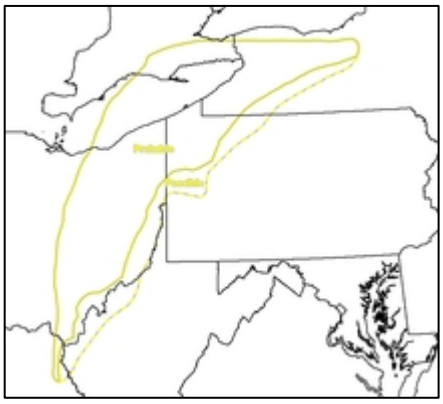


Figure	Text	15	Gas Atlas Figure Reference
Resource	Test	30	Resource Type

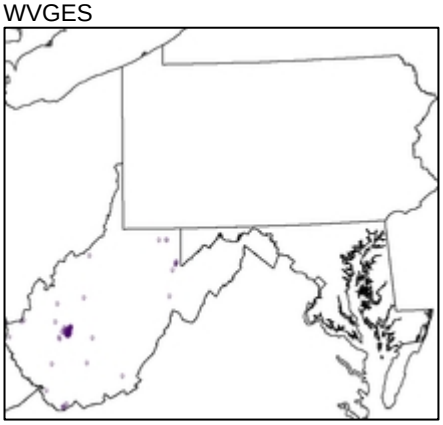
Play Layers: Tuscarora (TCRR)

Wells

Wells with Reported Pay, TCRR

TCRR_PAY_NAAEAC

WVGES



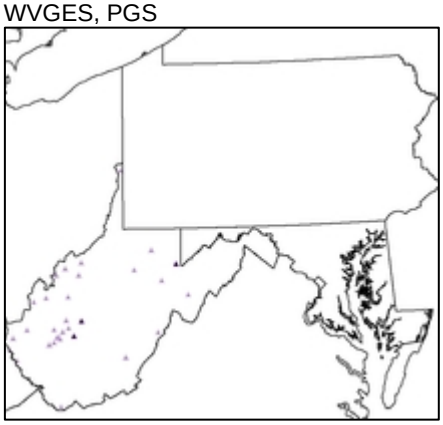
Attribute Name	Type	Length	Attribute Description
API	Double	19	API Number
COUNTYNAME	Text	10	County Name
PERMIT	Long	5	Permit Number
OPERNM	Text	55	Operator Name
CO_NUM	Text	15	Company Number
FARM	Text	40	Surface Owner
WELL_NUM	Text	6	Farm Number
MINERAL	Text	30	Oil and Gas Rights Owner
ELEV	Short	4	Elevation (Surface of the Well), Feet Above Mean Sea Level
DATUMTR	Text	15	Elevation Datum
TD	Long	5	Total Depth, Feet
DFMNM	Text	20	Deepest Formation Name
DFM	Text	3	Deepest Formation Code
DFMTNM	Text	20	Deepest Formation Tested Name
DFMT	Text	3	Deepest Formation Tested Code
LSDEEPPLAY	Text	3	Deepest Play (*Project Plays Only*)
FIELDNM	Text	15	Oil and Gas Field Name
WELLTYPETR	Text	15	Well Type
WELLTYPE	Text	1	Well Type Code
SUFFIXTR	Text	14	Suffix--Describes the Episode of Drilling/Deviated Drilling
STATUSTR	Text	9	Status--Describes the Status of the Drilling Permit
CMPMN	Short	2	Completion Month
CMPDY	Short	2	Completion Day
CMPYR	Short	4	Completion Year
LOGS_AVAIL	Text	14	Logs Available
LOG_TOP	Long	5	Log Top Depth (Gross Interval), Feet
LOG_BOT	Long	5	Log Bottom Depth (Gross Interval), Feet
SCAN	Text	1	Log Scanned--Denotes if Log Scanned or Not
DIGITIZED	Text	1	Log Digitized--Denotes if Log Digitized or Not
CORE1TOP	Long	5	Core 1 Top Depth, Feet
CORE1BTM	Long	5	Core 1 Bottom Depth, Feet
TOPFM1NM	Text	20	Core 1 Top Formation Name
TOPFM1	Text	3	Core 1 Top Formation Code
BTMFM1NM	Text	20	Core 1 Bottom Formation Name
BTMFM1	Text	3	Core 1 Bottom Formation Code
CORE2TOP	Long	5	Core 2 Top Depth, Feet
CORE2BTM	Long	5	Core 2 Bottom Depth, Feet
TOPFM2NM	Text	20	Core 2 Top Formation Name
TOPFM2	Text	3	Core 2 Top Formation Code
BTMFM2NM	Text	20	Core 2 Bottom Formation Name
BTMFM2	Text	3	Core 2 Bottom Formation Code
SAMPLE	Text	7	Sample Available--Denotes if Sample Available or Not

SLABC1PHOT	Text	1	Core Photograph 1 Available--Denotes if Core Photograph Exists or Not
SLABC2PHOT	Text	1	Core Photograph 2 Available--Denotes if Core Photograph Exists or Not
LAT_DD	Double	15	Latitude, Decimal Degrees
LON_DD	Double	16	Longitude, Decimal Degrees
UTME	Double	9	Universal Transverse Mercator Easting, Meters
UTMN	Double	10	Universal Transverse Mercator Northing, Meters
QUAD75NM	Text	21	7.5' Quadrangle Name
TXDSTNM	Text	18	Tax District Name
LOCFLAGTR	Text	37	Location Flag--Describes Source or Type of Well Location Data
BEREA	Text	1	Berea Penetrated--Denotes if Berea Penetrated or Not
VENANGO	Text	1	Venango Penetrated--Denotes if Venango Penetrated or Not
BRADFORD	Text	1	Bradford Penetrated--Denotes if Bradford Penetrated or Not
ELK	Text	1	Elk Penetrated--Denotes if Elk Penetrated or Not
MEDINA	Text	1	Medina Penetrated--Denotes if Medina Penetrated or Not
TUSCARORA	Text	1	Tuscarora Penetrated--Denotes if Tuscarora Penetrated or Not
ACTIVITYTR	Text	21	Activity--Describes Completed Interval (*"Pay" Activity Only for Project*)
ACTIVITY	Text	1	Activity Code
PRODUCTTR	Text	18	Product--Denotes Gas, Oil or Combination Associated with Activity Interval
PRODUCT	Text	1	Product Code
TOPDEPTH	Long	5	Pay Top Depth, Feet
TOPFMNM	Text	20	Pay Top Formation Name
TOPFM	Text	3	Pay Top Formation Code
BTMDEPTH	Long	5	Pay Bottom Depth, Feet
BTMFMNM	Text	20	Pay Bottom Formation Name
BTMFM	Text	3	Pay Bottom Formation Code
GASBEFORE	Long	6	Gas Volume Before Treatment, Thousand Cubic Feet
GASAFTER	Long	6	Gas Volume After Treatment, Thousand Cubic Feet
OILBEFORE	Long	5	Oil Volume Before Treatment, Barrels
OILAFTER	Long	5	Oil Volume After Treatment, Barrels

Wells with Core/Sample Data, TCRR

TCRR_CORE_NAAEAC

WVGES, PGS



API	Double	19	API Number
COUNTYNAME	Text	10	County Name
PERMIT	Long	5	Permit Number
OPERNM	Text	55	Operator Name
CO_NUM	Text	15	Company Number
FARM	Text	40	Surface Owner
WELL_NUM	Text	6	Farm Number
MINERAL	Text	30	Oil and Gas Rights Owner
ELEV	Short	4	Elevation (Surface of the Well), Feet Above Mean Sea Level
DATUMTR	Text	15	Elevation Datum
TD	Long	5	Total Depth, Feet
DFMNM	Text	20	Deepest Formation Name
DFM	Text	3	Deepest Formation Code
DFMTNM	Text	20	Deepest Formation Tested Name
DFMT	Text	3	Deepest Formation Tested Code
LSDEEPPLAY	Text	3	Deepest Play (*Project Plays Only*)
FIELDNM	Text	15	Oil and Gas Field Name
WELLTYPETR	Text	15	Well Type
WELLTYPE	Text	1	Well Type Code
SUFFIXTR	Text	14	Suffix--Describes the Episode of Drilling/Deviated Drilling
STATUSTR	Text	9	Status--Describes the Status of the Drilling Permit
CMPMN	Short	2	Completion Month
CMPDY	Short	2	Completion Day
CMPYR	Short	4	Completion Year
LOGS_AVAIL	Text	14	Logs Available
LOG_TOP	Long	5	Log Top Depth (Gross Interval), Feet
LOG_BOT	Long	5	Log Bottom Depth (Gross Interval), Feet
SCAN	Text	1	Log Scanned--Denotes if Log Scanned or Not
DIGITIZED	Text	1	Log Digitized--Denotes if Log Digitized or Not
CORE1TOP	Long	5	Core 1 Top Depth, Feet
CORE1BTM	Long	5	Core 1 Bottom Depth, Feet
TOPFM1NM	Text	20	Core 1 Top Formation Name
TOPFM1	Text	3	Core 1 Top Formation Code
BTMFM1NM	Text	20	Core 1 Bottom Formation Name
BTMFM1	Text	3	Core 1 Bottom Formation Code
CORE2TOP	Long	5	Core 2 Top Depth, Feet
CORE2BTM	Long	5	Core 2 Bottom Depth, Feet
TOPFM2NM	Text	20	Core 2 Top Formation Name
TOPFM2	Text	3	Core 2 Top Formation Code
BTMFM2NM	Text	20	Core 2 Bottom Formation Name
BTMFM2	Text	3	Core 2 Bottom Formation Code
SAMPLE	Text	7	Sample Available--Denotes if Sample Available or Not
SLABC1PHOT	Text	1	Core Photograph 1 Available--Denotes if Core Photograph Exists or Not
SLABC2PHOT	Text	1	Core Photograph 2 Available--Denotes if Core Photograph Exists or Not

LAT_DD	Double	15	Latitude, Decimal Degrees
LON_DD	Double	16	Longitude, Decimal Degrees
UTME	Double	9	Universal Transverse Mercator Easting, Meters
UTMN	Double	10	Universal Transverse Mercator Northing, Meters
QUAD75NM	Text	21	7.5' Quadrangle Name
TXDSTNM	Text	18	Tax District Name
LOCFLAGTR	Text	37	Location Flag--Describes Source or Type of Well Location Data
BEREA	Text	1	Berea Penetrated--Denotes if Berea Penetrated or Not
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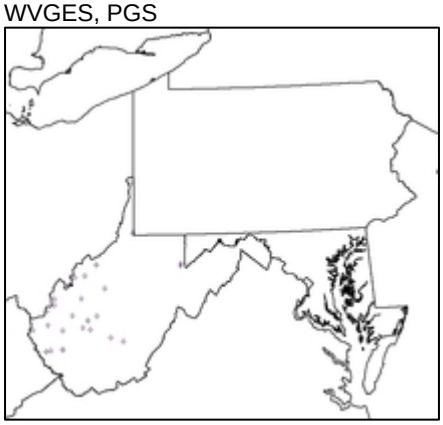
ELK	Text	1	Elk Penetrated--Denotes if Elk Penetrated or Not
MEDINA	Text	1	Medina Penetrated--Denotes if Medina Penetrated or Not
TUSCARORA	Text	1	Tuscarora Penetrated--Denotes if Tuscarora Penetrated or Not

Wells with Digitized Logs, TCRR

TCRR_DIGITIZED_NAAEAC

WVGES, PGS



API	Double	19	API Number
COUNTYNAME	Text	10	County Name
PERMIT	Long	5	Permit Number
OPERNM	Text	55	Operator Name
CO_NUM	Text	15	Company Number
FARM	Text	40	Surface Owner
WELL_NUM	Text	6	Farm Number
MINERAL	Text	30	Oil and Gas Rights Owner
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DFM	Text	3	Deepest Formation Code
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LSDEEPPLAY	Text	3	Deepest Play (*Project Plays Only*)
FIELDNM	Text	15	Oil and Gas Field Name
WELLTYPETR	Text	15	Well Type
WELLTYPE	Text	1	Well Type Code
SUFFIXTR	Text	14	Suffix--Describes the Episode of Drilling/Deviated Drilling
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CMPYR	Short	4	Completion Year
LOGS_AVAIL	Text	14	Logs Available
LOG_TOP	Long	5	Log Top Depth (Gross Interval), Feet
LOG_BOT	Long	5	Log Bottom Depth (Gross Interval), Feet
SCAN	Text	1	Log Scanned--Denotes if Log Scanned or Not
DIGITIZED	Text	1	Log Digitized--Denotes if Log Digitized or Not
CORE1TOP	Long	5	Core 1 Top Depth, Feet
CORE1BTM	Long	5	Core 1 Bottom Depth, Feet
TOPFM1NM	Text	20	Core 1 Top Formation Name
TOPFM1	Text	3	Core 1 Top Formation Code
BTMFM1NM	Text	20	Core 1 Bottom Formation Name
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CORE2TOP	Long	5	Core 2 Top Depth, Feet
CORE2BTM	Long	5	Core 2 Bottom Depth, Feet
TOPFM2NM	Text	20	Core 2 Top Formation Name
TOPFM2	Text	3	Core 2 Top Formation Code
BTMFM2NM	Text	20	Core 2 Bottom Formation Name
BTMFM2	Text	3	Core 2 Bottom Formation Code
SAMPLE	Text	7	Sample Available--Denotes if Sample Available or Not
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LAT_DD	Double	15	Latitude, Decimal Degrees
LON_DD	Double	16	Longitude, Decimal Degrees
UTME	Double	9	Universal Transverse Mercator Easting, Meters
UTMN	Double	10	Universal Transverse Mercator Northing, Meters
QUAD75NM	Text	21	7.5' Quadrangle Name
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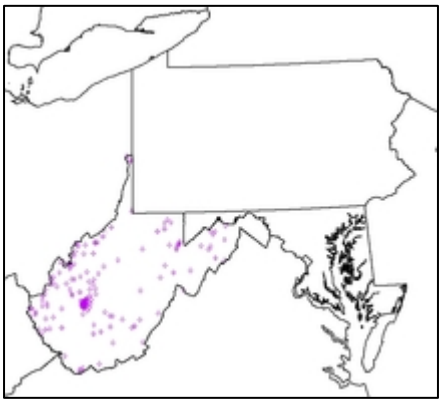
BRADFORD	Text	1	Bradford Penetrated--Denotes if Bradford Penetrated or Not
ELK	Text	1	Elk Penetrated--Denotes if Elk Penetrated or Not
MEDINA	Text	1	Medina Penetrated--Denotes if Medina Penetrated or Not
TUSCARORA	Text	1	Tuscarora Penetrated--Denotes if Tuscarora Penetrated or Not

Wells with Scanned Logs, TCRR

TCRR_SCANNED_NAAEAC

WVGES, PGS



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PERMIT	Long	5	Permit Number
OPERNM	Text	55	Operator Name
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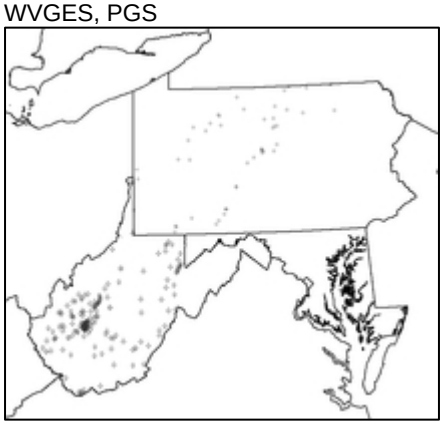
DFM	Text	3	Deepest Formation Code
DFMTNM	Text	20	Deepest Formation Tested Name
DFMT	Text	3	Deepest Formation Tested Code
LSDEEPPLAY	Text	3	Deepest Play (*Project Plays Only*)
FIELDNM	Text	15	Oil and Gas Field Name
WELLTYPETR	Text	15	Well Type
WELLTYPE	Text	1	Well Type Code
SUFFIXTR	Text	14	Suffix--Describes the Episode of Drilling/Deviated Drilling
STATUSTR	Text	9	Status--Describes the Status of the Drilling Permit
CMPMN	Short	2	Completion Month
CMPDY	Short	2	Completion Day
CMPYR	Short	4	Completion Year
LOGS_AVAIL	Text	14	Logs Available
LOG_TOP	Long	5	Log Top Depth (Gross Interval), Feet
LOG_BOT	Long	5	Log Bottom Depth (Gross Interval), Feet
SCAN	Text	1	Log Scanned--Denotes if Log Scanned or Not
DIGITIZED	Text	1	Log Digitized--Denotes if Log Digitized or Not
CORE1TOP	Long	5	Core 1 Top Depth, Feet
CORE1BTM	Long	5	Core 1 Bottom Depth, Feet
TOPFM1NM	Text	20	Core 1 Top Formation Name
TOPFM1	Text	3	Core 1 Top Formation Code
BTMFM1NM	Text	20	Core 1 Bottom Formation Name
BTMFM1	Text	3	Core 1 Bottom Formation Code
CORE2TOP	Long	5	Core 2 Top Depth, Feet
CORE2BTM	Long	5	Core 2 Bottom Depth, Feet
TOPFM2NM	Text	20	Core 2 Top Formation Name
TOPFM2	Text	3	Core 2 Top Formation Code
BTMFM2NM	Text	20	Core 2 Bottom Formation Name
BTMFM2	Text	3	Core 2 Bottom Formation Code
SAMPLE	Text	7	Sample Available--Denotes if Sample Available or Not
SLABC1PHOT	Text	1	Core Photograph 1 Available--Denotes if Core Photograph Exists or Not
SLABC2PHOT	Text	1	Core Photograph 2 Available--Denotes if Core Photograph Exists or Not

LAT_DD	Double	15	Latitude, Decimal Degrees
LON_DD	Double	16	Longitude, Decimal Degrees
UTME	Double	9	Universal Transverse Mercator Easting, Meters
UTMN	Double	10	Universal Transverse Mercator Northing, Meters
QUAD75NM	Text	21	7.5' Quadrangle Name
TXDSTNM	Text	18	Tax District Name
LOCFLAGTR	Text	37	Location Flag--Describes Source or Type of Well Location Data
BEREA	Text	1	Berea Penetrated--Denotes if Berea Penetrated or Not
VENANGO	Text	1	Venango Penetrated--Denotes if Venango Penetrated or Not
BRADFORD	Text	1	Bradford Penetrated--Denotes if Bradford Penetrated or Not
ELK	Text	1	Elk Penetrated--Denotes if Elk Penetrated or Not
MEDINA	Text	1	Medina Penetrated--Denotes if Medina Penetrated or Not
TUSCARORA	Text	1	Tuscarora Penetrated--Denotes if Tuscarora Penetrated or Not

Wells that Penetrate, TCRR

TCRR_PPLAY_NAAEAC

WVGES, PGS



API	Double	19	API Number
COUNTYNAME	Text	10	County Name
PERMIT	Long	5	Permit Number
OPERNM	Text	55	Operator Name
CO_NUM	Text	15	Company Number
FARM	Text	40	Surface Owner
WELL_NUM	Text	6	Farm Number
MINERAL	Text	30	Oil and Gas Rights Owner
ELEV	Short	4	Elevation (Surface of the Well), Feet Above Mean Sea Level
DATUMTR	Text	15	Elevation Datum
TD	Long	5	Total Depth, Feet
DFMNM	Text	20	Deepest Formation Name
DFM	Text	3	Deepest Formation Code
DFMTNM	Text	20	Deepest Formation Tested Name
DFMT	Text	3	Deepest Formation Tested Code
LSDEEPPLAY	Text	3	Deepest Play (*Project Plays Only*)
FIELDNM	Text	15	Oil and Gas Field Name
WELLTYPETR	Text	15	Well Type
WELLTYPE	Text	1	Well Type Code
SUFFIXTR	Text	14	Suffix--Describes the Episode of Drilling/Deviated Drilling
STATUSTR	Text	9	Status--Describes the Status of the Drilling Permit
CMPMN	Short	2	Completion Month
CMPDY	Short	2	Completion Day
CMPYR	Short	4	Completion Year
LOGS_AVAIL	Text	14	Logs Available
LOG_TOP	Long	5	Log Top Depth (Gross Interval), Feet
LOG_BOT	Long	5	Log Bottom Depth (Gross Interval), Feet
SCAN	Text	1	Log Scanned--Denotes if Log Scanned or Not
DIGITIZED	Text	1	Log Digitized--Denotes if Log Digitized or Not
CORE1TOP	Long	5	Core 1 Top Depth, Feet
CORE1BTM	Long	5	Core 1 Bottom Depth, Feet
TOPFM1NM	Text	20	Core 1 Top Formation Name
TOPFM1	Text	3	Core 1 Top Formation Code
BTMFM1NM	Text	20	Core 1 Bottom Formation Name
BTMFM1	Text	3	Core 1 Bottom Formation Code
CORE2TOP	Long	5	Core 2 Top Depth, Feet
CORE2BTM	Long	5	Core 2 Bottom Depth, Feet
TOPFM2NM	Text	20	Core 2 Top Formation Name
TOPFM2	Text	3	Core 2 Top Formation Code
BTMFM2NM	Text	20	Core 2 Bottom Formation Name
BTMFM2	Text	3	Core 2 Bottom Formation Code
SAMPLE	Text	7	Sample Available--Denotes if Sample Available or Not
SLABC1PHOT	Text	1	Core Photograph 1 Available--Denotes if Core Photograph Exists or Not
SLABC2PHOT	Text	1	Core Photograph 2 Available--Denotes if Core Photograph Exists or Not

LAT_DD	Double	15	Latitude, Decimal Degrees
LON_DD	Double	16	Longitude, Decimal Degrees
UTME	Double	9	Universal Transverse Mercator Easting, Meters
UTMN	Double	10	Universal Transverse Mercator Northing, Meters
QUAD75NM	Text	21	7.5' Quadrangle Name
TXDSTNM	Text	18	Tax District Name
LOCFLAGTR	Text	37	Location Flag--Describes Source or Type of Well Location Data
BEREA	Text	1	Berea Penetrated--Denotes if Berea Penetrated or Not
VENANGO	Text	1	Venango Penetrated--Denotes if Venango Penetrated or Not
BRADFORD	Text	1	Bradford Penetrated--Denotes if Bradford Penetrated or Not
ELK	Text	1	Elk Penetrated--Denotes if Elk Penetrated or Not
MEDINA	Text	1	Medina Penetrated--Denotes if Medina Penetrated or Not
TUSCARORA	Text	1	Tuscarora Penetrated--Denotes if Tuscarora Penetrated or Not

Cross Sections

Gas Atlas Cross Sections (Sts-5,6,9,10)

StsFig-5-6-9-10_XSection_NAAEAC

WVGES

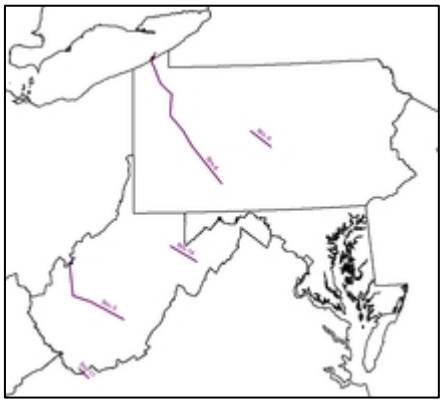


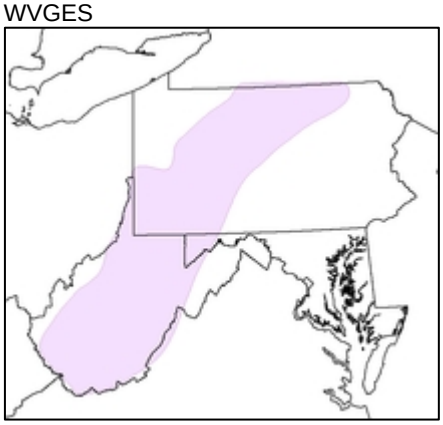
Figure	Text	15	Gas Atlas Figure Reference
XSection	Text	25	Cross Section Direction
Comment	Text	200	Comment
XSecFile	Text	50	Cross Section File Name (for Mapping Hyperlink to Cross Section Image)

General

Play Outline, TCRR

OGLAYERS_Tuscarora_polygon_NAAEAC

WVGES

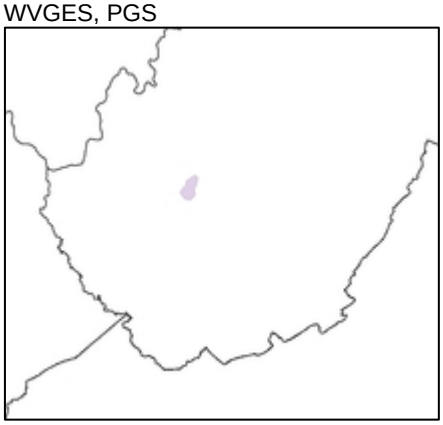


SHAPE_LENG	Double	19	Play Polygon Length
SHAPE_AREA	Double	19	Play Polygon Area

Gas Fields, TCRR

GASRES_Sts_NAAEAC

WVGES, PGS



ID	Double	12	Shape Identifier
FIELD_NAME	Text	35	Field Name
FIELD_ID	Double	12	Field Number
PLAY	Text	4	Play
FM	Text	5	Formation Name
FM_DETAILS	Text	66	Formation Name Details
PROD_TYPE	Text	26	Production Type

Gas Atlas: Fields and Pools (Sts-2)

Structural Provinces, Sts2

StsFig2_StructuralProvinces_NAAEAC

WVGES

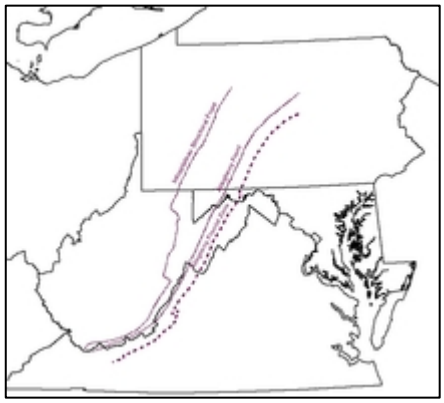


Figure	Text	15	Gas Atlas Figure Reference
TrendName	Text	60	Trend Name

Fields and Pools, Sts2

StsFig2_Fields_NAAEAC

WVGES

Figure	Text	15	Gas Atlas Figure Reference
FieldName	Text	50	Field Name

Gas Atlas: Penetrations, Nitrogen, and CO2 (Sts-3)

Wells, Sts3

StsFig3_Wells_NAAEAC

WVGES

Figure	Text	15	Gas Atlas Figure Reference
WellType	Text	20	Well Type

Inert Gas, Sts3

StsFig3_InertGas_NAAEAC

WVGES

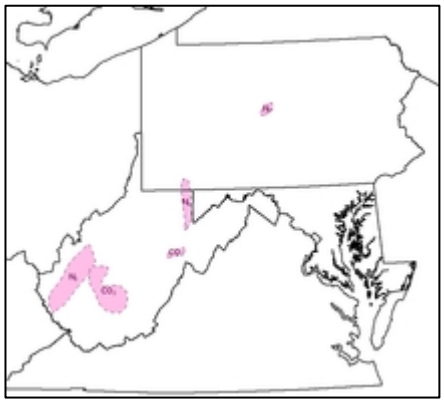


Figure	Text	15	Gas Atlas Figure Reference
Comment	Text	60	Comment
Label	Text	20	Gas Type

Gas Atlas: Isopach and Lithofacies, Lower Silurian, Regional (Sts-7)

Isopachs, Sts7

StsFig7_Isopachs_NAAEAC

WVGES

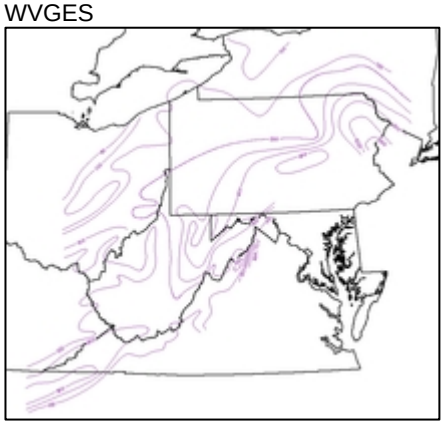


Figure	Text	15	Gas Atlas Figure Reference
Contour	Long	9	Contour Value, Feet
Comment	Text	254	Comment

Outcrop Limit, Sts7

StsFig7_OutcropLimit_NAAEAC

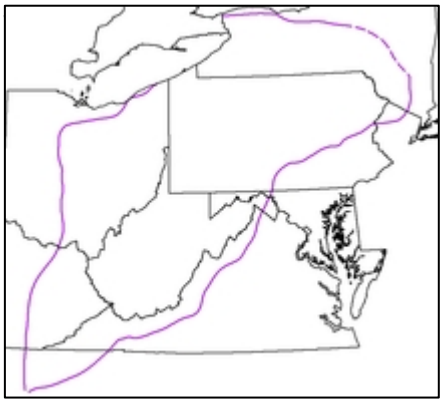


Figure	Text	15	Gas Atlas Figure Reference
Comment	Text	200	Comment

Lithofacies, Sts7

StsFig7_Lithofacies_NAAEAC

WVGES

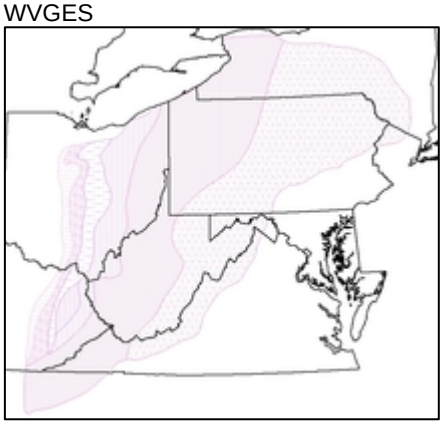


Figure	Text	15	Gas Atlas Figure Reference
Lithology	Text	100	Lithologic Description

Gas Atlas: Structure, Indian Creek Field, Kanawha County, WV (Sts-12)

Wells, Sts12

StsFig12_Wells_NAAEAC

Figure	Text	15	Gas Atlas Figure Reference
WellType	Text	25	Well Type

Structure Contours, Sts12

StsFig12_Contours_NAAEAC

WVGES

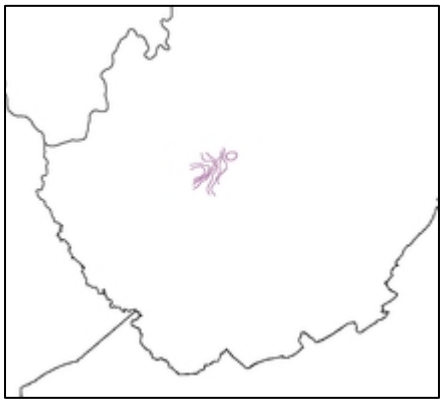


Figure	Text	15	Gas Atlas Figure Reference
Contour	Long	9	Contour Value, Feet
Comment	Text	200	Comment

Gas/Water Contact, Sts12

StsFig12_Contact_NAAEAC

WVGES

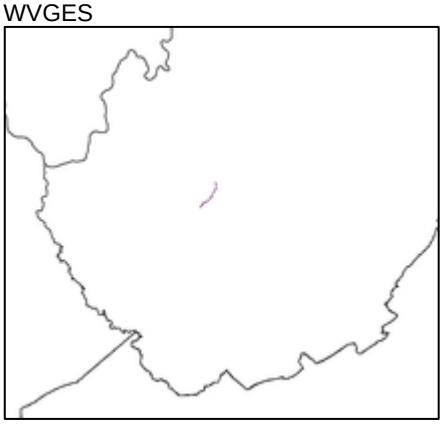


Figure	Text	15	Gas Atlas Figure Reference
TrendName	Text	25	Trend Name

Warfield Anticline, Sts12

StsFig12_WarfieldAnticline_NAAEAC

WVGES

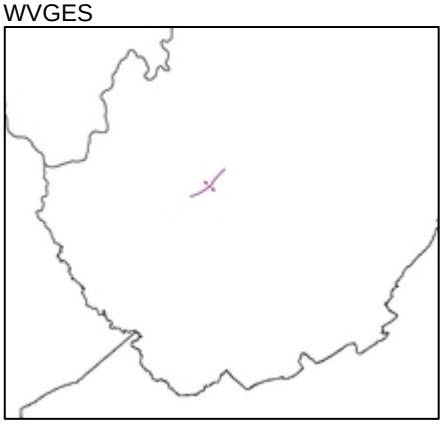


Figure	Text	15	Gas Atlas Figure Reference
TrendName	Text	25	Trend Name

Indian Creek Field, Sts12

StsFig12_IndianCreekField_NAAEAC

WVGES

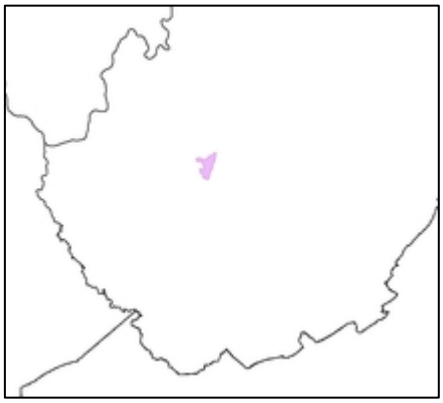


Figure	Text	15	Gas Atlas Figure Reference
FieldName	Text	50	Field Name

Gas Atlas: Well Location and Structure, Leadmine Field, Tucker and Preston Counties, WV (Sts-15)

Wells, Sts15

StsFig15_Wells_NAAEAC

WVGES

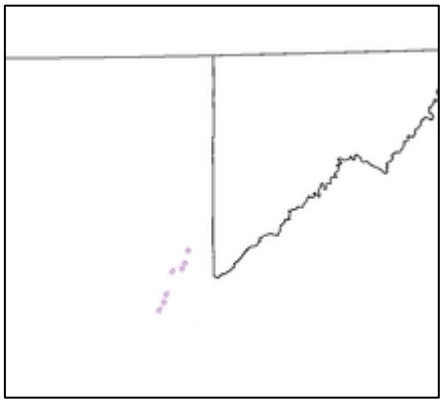


Figure	Text	15	Gas Atlas Figure Reference
WellType	Text	35	Well Type
WellName	Text	40	Well Name

Anticlines and Synclines, Sts15

tsFig15_AnticlinesSynclines_NAAEAC

WVGES

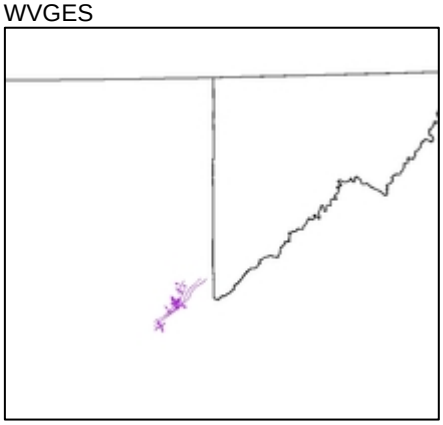


Figure	Text	15	Gas Atlas Figure Reference
TrendName	Text	50	Trend Name

Leadmine Field, Sts15

StsFig15_LeadmineField_NAAEAC

WVGES

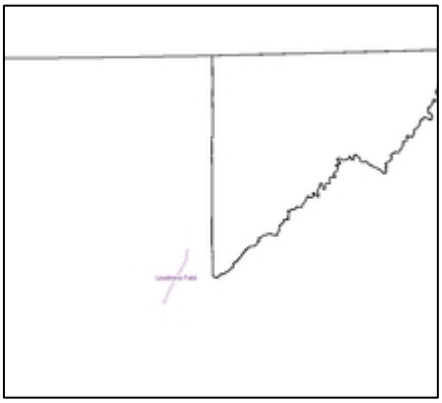


Figure	Text	15	Gas Atlas Figure Reference
FieldName	Text	50	Field Name

Gas Atlas: Well Location, Cucumber Creek Field, McDowell County, WV (Sts-17)

Wells, Sts17

StsFig17_Wells_NAAEAC

WVGES

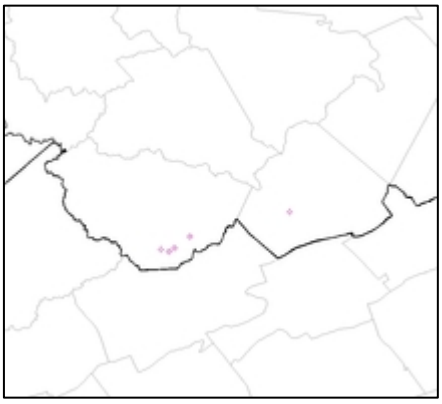


Figure	Text	15	Gas Atlas Figure Reference
WellType	Text	25	Well Type
WellName	Text	50	Well Name

Fault, Sts17

StsFig17_Fault_NAAEAC

WVGES

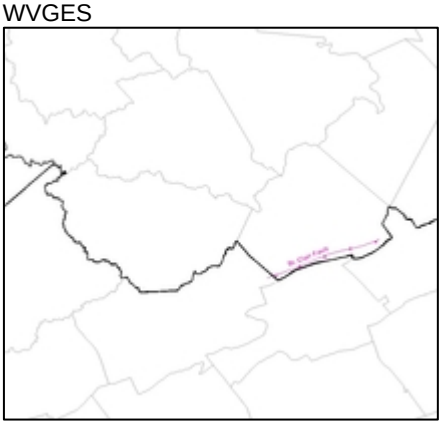


Figure	Text	15	Gas Atlas Figure Reference
TrendName	Text	50	Trend Name

Anticlines and Synclines, Sts17

StsFig17_AnticlinesSyclines_NAAEAC

WVGES

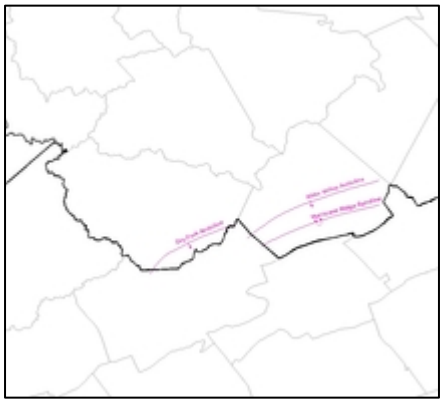


Figure	Text	15	Gas Atlas Figure Reference
TrendName	Text	50	Trend Name

Gas Atlas: Well Location, Centre County, PA (Sts-19)

Wells, Sts19

StsFig19_Wells_NAAEAC

WVGES

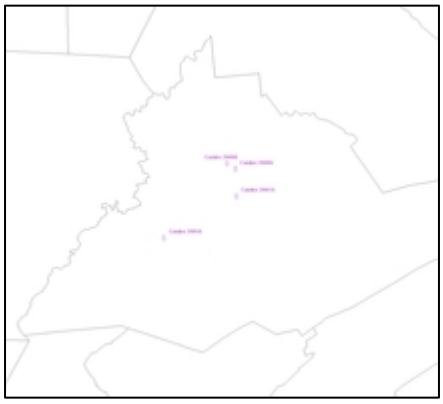


Figure	Text	15	Gas Atlas Figure Reference
WellName	Text	50	Well Name

Allegheny Front, Sts19

tsFig19_AlleghenyFront_NAAEAC

WVGES

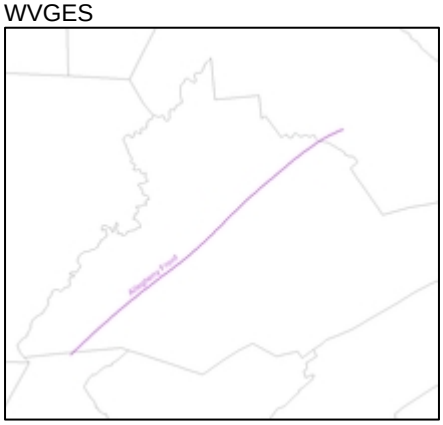


Figure	Text	15	Gas Atlas Figure Reference
TrendName	Text	25	Trend Name

Anticlines and Synclines, Sts19

StsFig19_AnticlinesSynclines_NAAEAC

WVGES

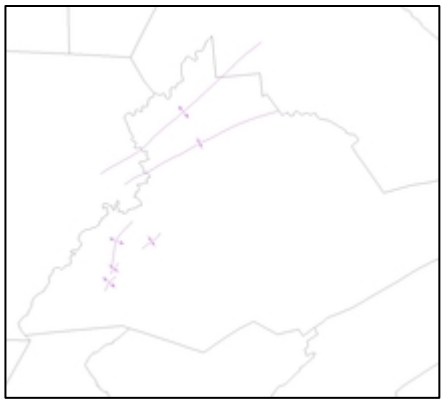


Figure	Text	15	Gas Atlas Figure Reference
TrendName	Text	50	Trend Name

Comments:

Color scheme for plays in the IMS application:

Berea/Murrysville (BERE)	
Venango (VNNG)	
Bradford (BDFD)	
Elk (ELK)	
Medina / "Clinton" (MDIN)	
Tuscarora (TCRR)	

Some shapefile names may change after the filing of this final report.

Some unnecessary attributes in compiled shapefiles, especially in the General and Geology Layers, may be eliminated. Many of these are noted with grey text.

Due to issues in the summer with Pennsylvania's data servers, Pennsylvania data arrived late and WVGES is still processing that data at the time of this writing. Therefore, most well-based and general gas/oil field layers show just information for West Virginia. Also, several general geography and geology layers are missing Pennsylvania data at this time.

Attributes and descriptions, as of 12/10/2008

Appendix B - Appalachian Basin Tight Gas Reservoirs: Screen Shots of the Web-Based Application

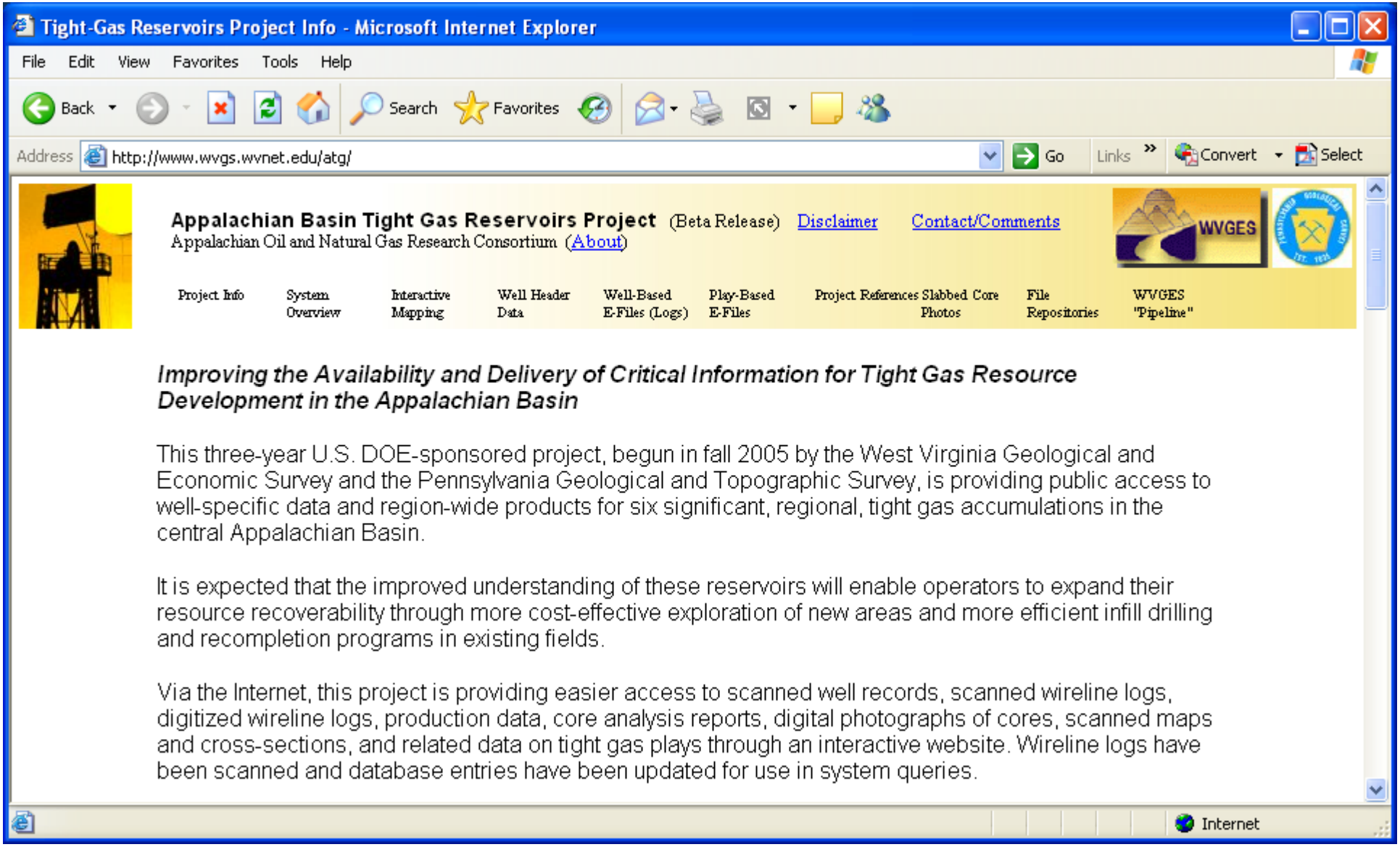


Figure B-1. The Appalachian Basin Tight Gas Reservoirs Project is formally titled, “Improving the Availability and Delivery of Critical Information for Tight Gas Resource Development in the Appalachian Basin”. The goal is to provide public access to well-specific and regional data for six tight or low-permeability gas plays to improve the understanding and recoverability of those resources.

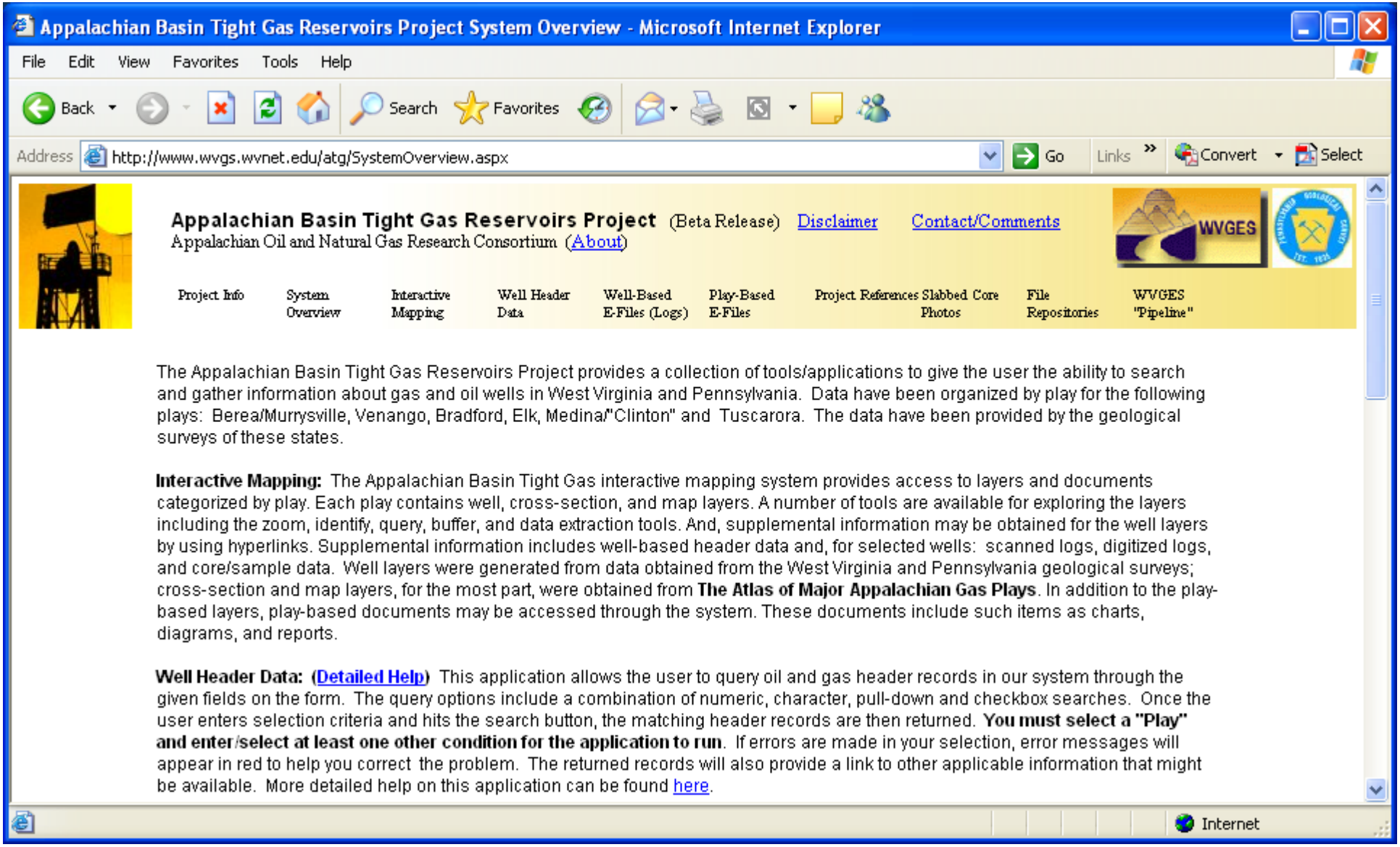


Figure B-2. The “System Overview” section provides basic information about each of the applications available through the Appalachian Basin Tight Gas Reservoirs Project. The applications are shown on the navigation bar and include: Interactive Mapping, Well Header Data search, Well-Based E-Files search, Play-Based E-Files search, Project References search, Slabbed Core Photos access, File Repositories access, and WVGES “Pipeline”.

Appendix B - Appalachian Basin Tight Gas Reservoirs: Screen Shots of the Web-Based Application

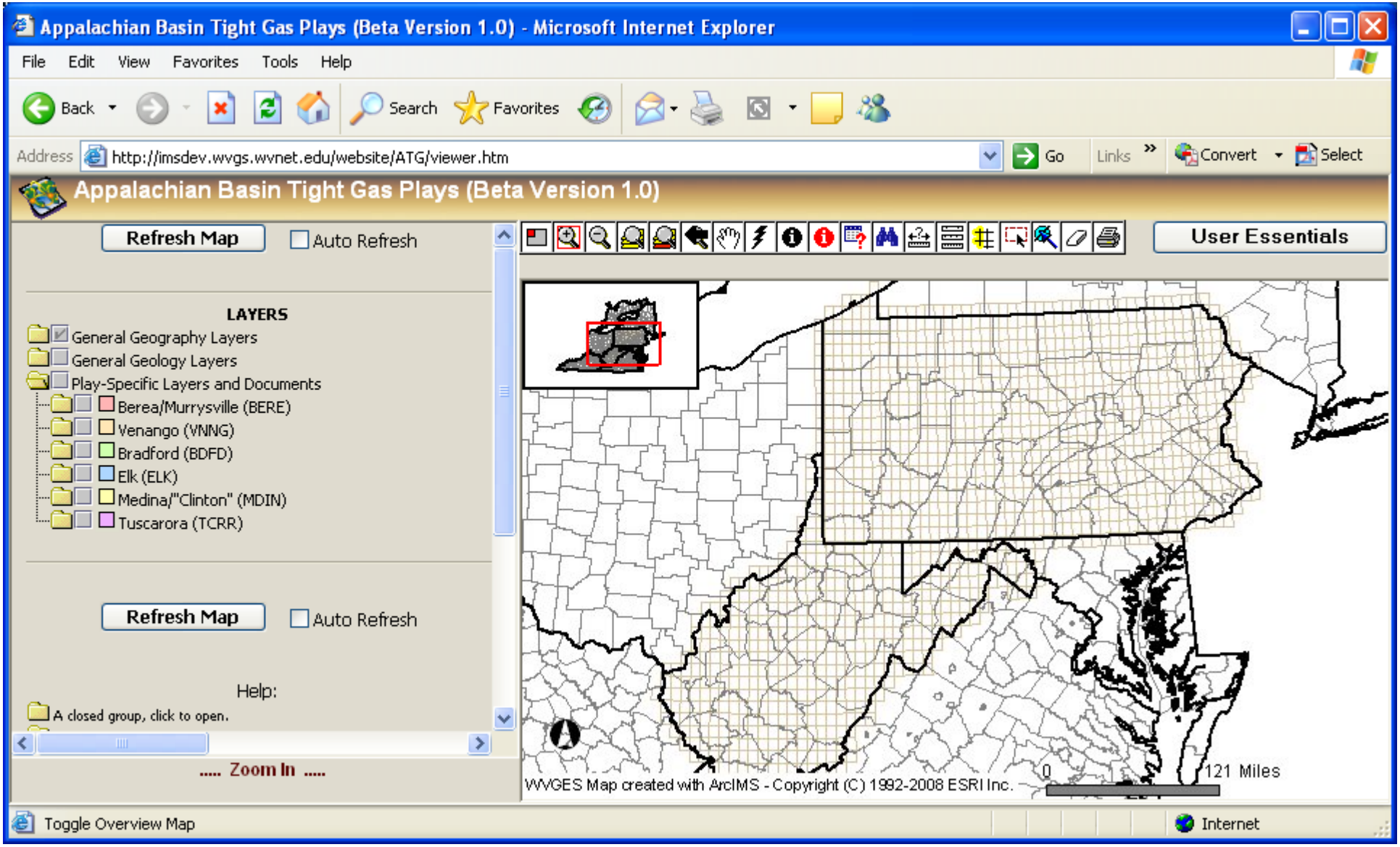


Figure B-3. One of the highlights of the Appalachian Basin Tight Gas Plays Project applications is the interactive mapping system. The system provides access to well data, cross sections, maps, and documents organized by play. In addition, a number of base layers are available to provide context.

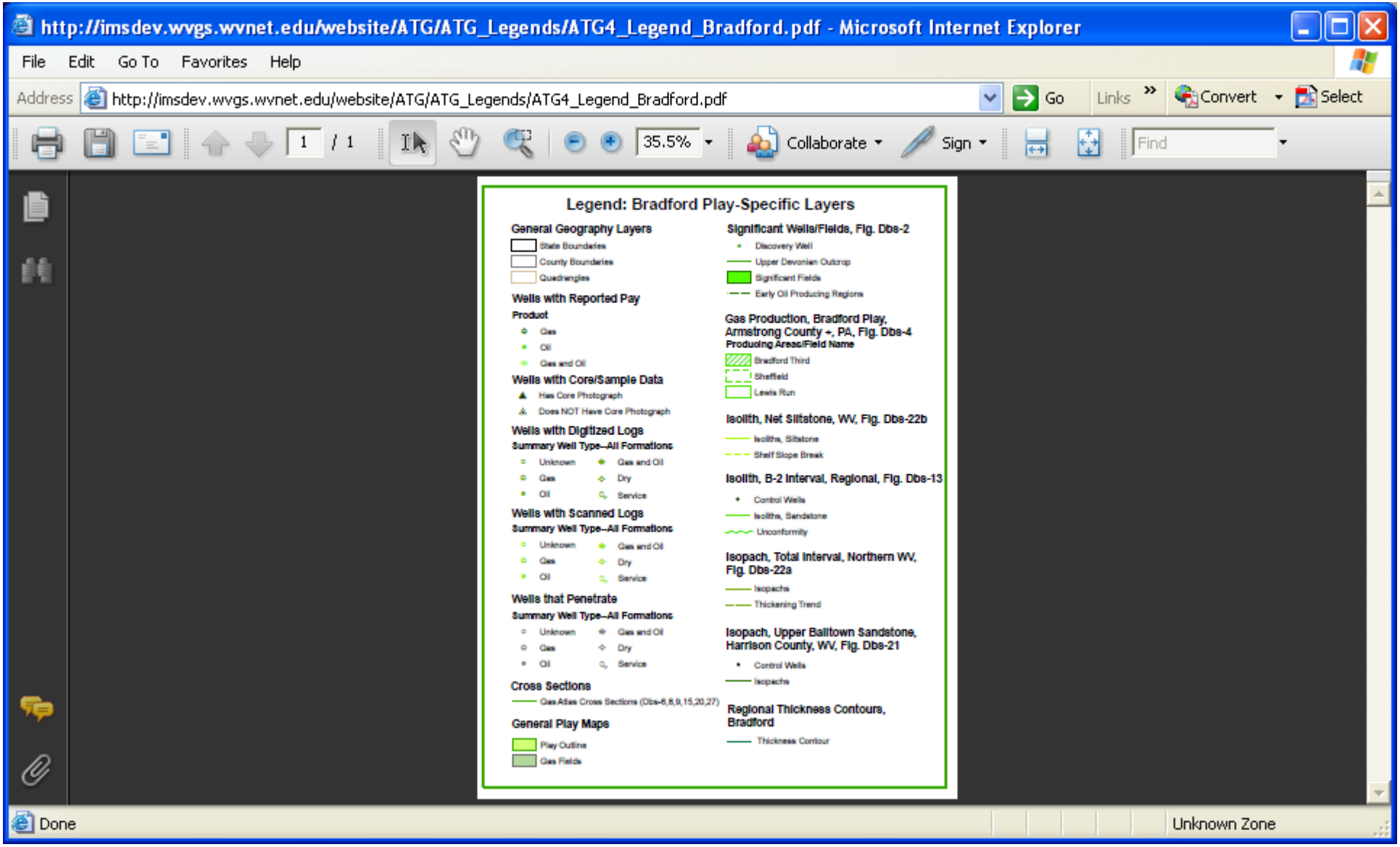


Figure B-4. A detailed legend is available for each major category associated with the interactive mapping system. This particular example shows the legend for the Bradford play-specific layers. Other legends include general geography and geology, the Berea play-specific layers, the Venango play-specific layers, the Elk play-specific layers, the Medina play-specific layers and the Tuscarora play-specific layers.

Appendix B - Appalachian Basin Tight Gas Reservoirs: Screen Shots of the Web-Based Application

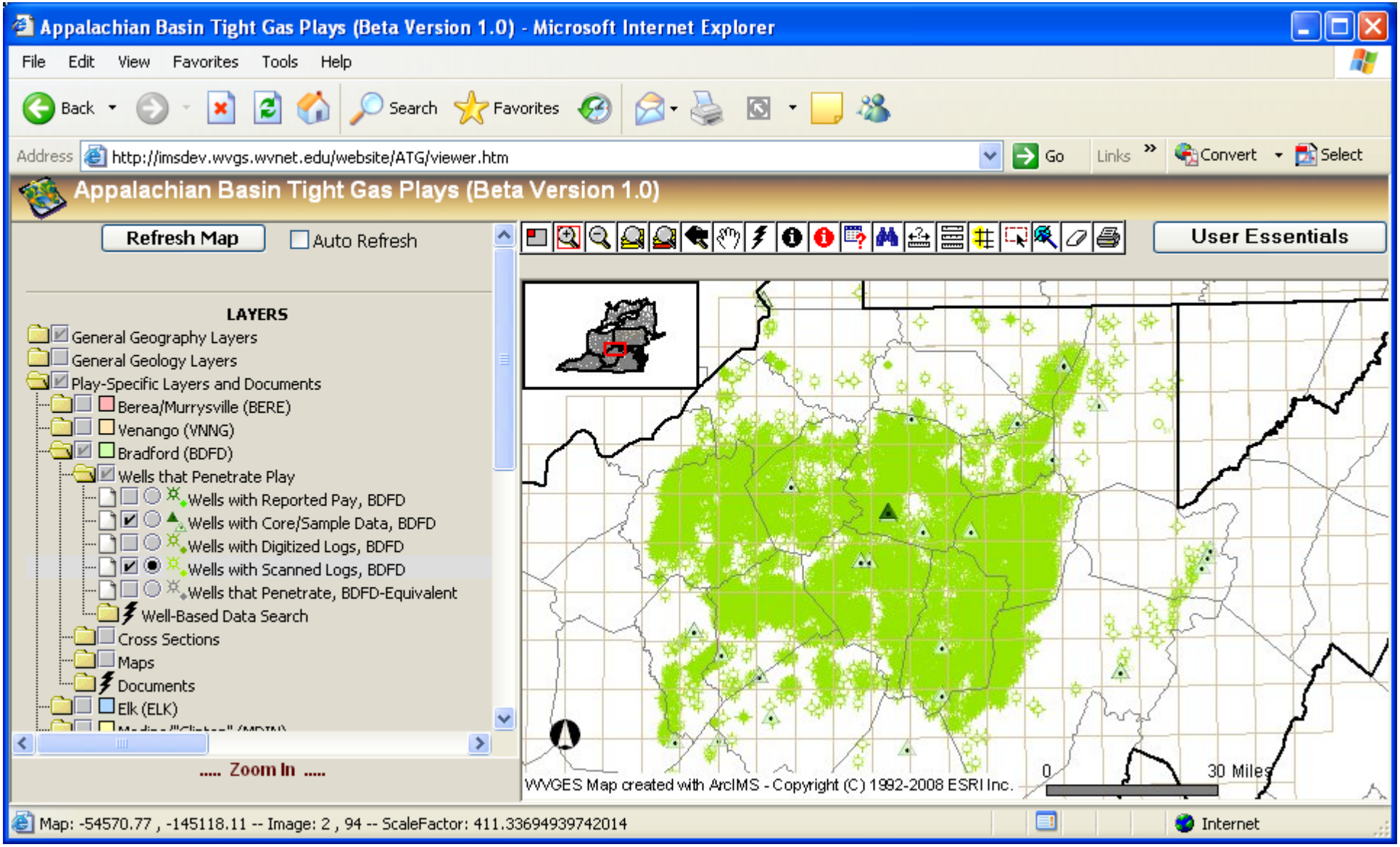


Figure B-5. Well-based data are available through the interactive mapping system. Five different well-based layers are available for each play. This map shows wells with core/sample data and wells with scanned logs for the Bradford Play in West Virginia.

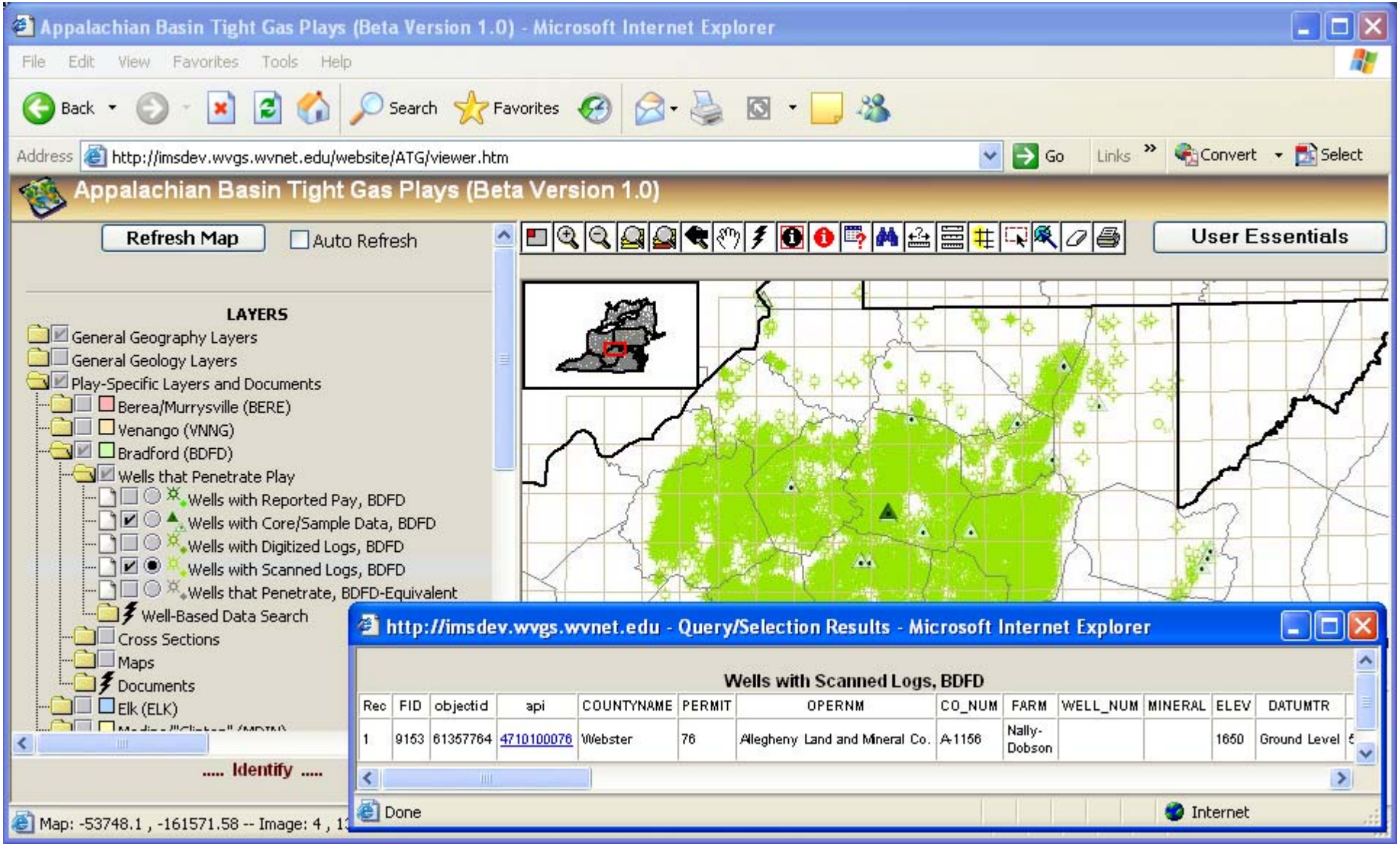


Figure B-6. Attribute data and additional data can be obtained for each well shown on the map by using the identify (i) tools. The black i tool shows data for the active layer while the red i tool shows data for all of the layers that are visible on the map. Additional data may be obtained by clicking on the API number which links the user to various materials including, for instance, any digitized or scanned logs

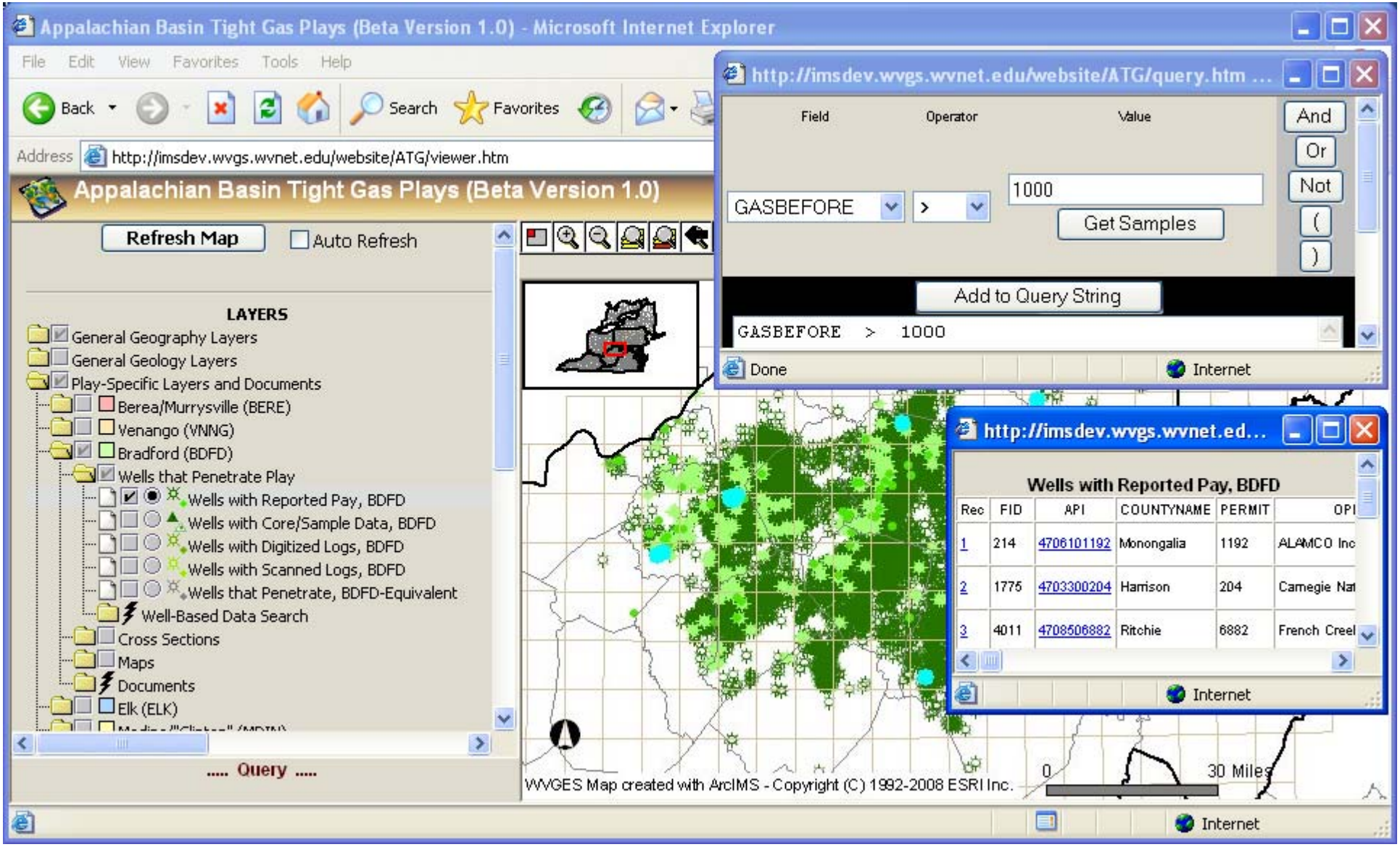


Figure B-7. Queries can be performed on the well data. In this example, all wells that have a gas volume before treatment greater than 1000 MCF (thousand cubic feet) are highlighted in light blue on the map. In addition, well-based attribute data can be displayed for all of the wells that meet the query criterion or criteria.

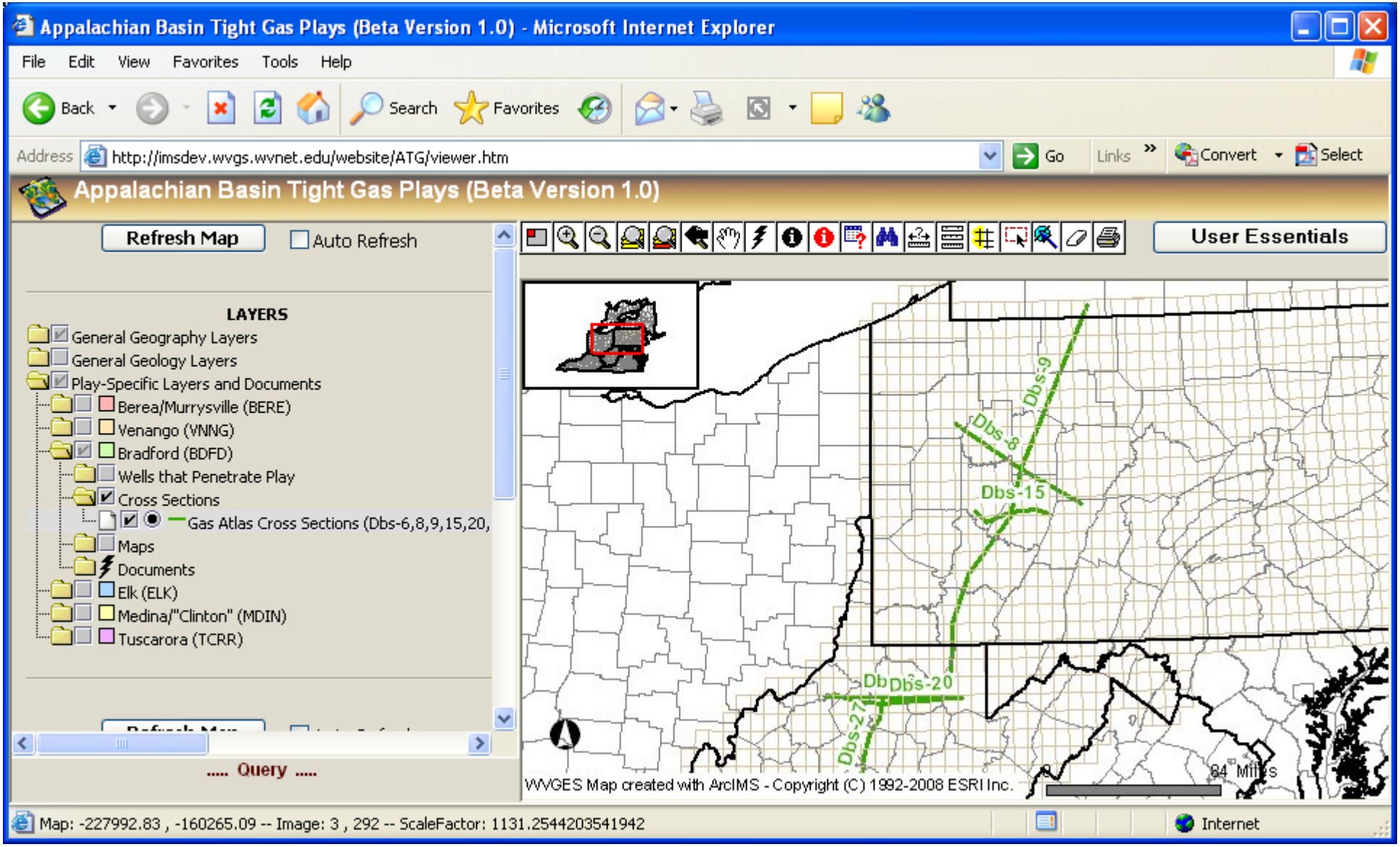


Figure B-8. Cross-sections lines and corresponding images are available for each of the tight gas plays. This example shows the cross-section lines that are available for the Bradford Play in Pennsylvania and West Virginia.

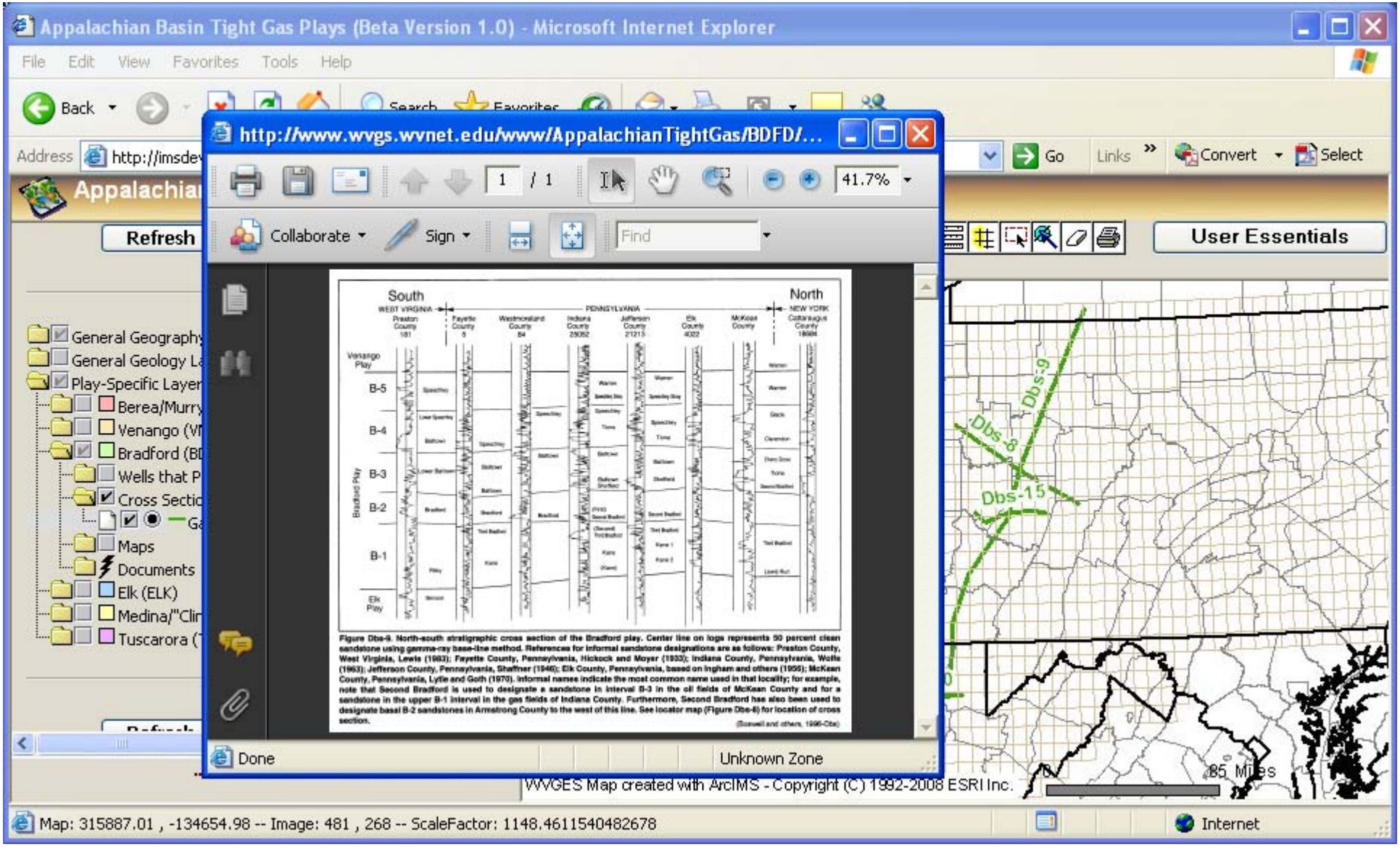


Figure B-9. Cross-sections are accessed by making the cross-section layer active and then by clicking on one of the cross-section lines with the hyperlink tool (lightening bolt). The cross-section image is then displayed in a new window.

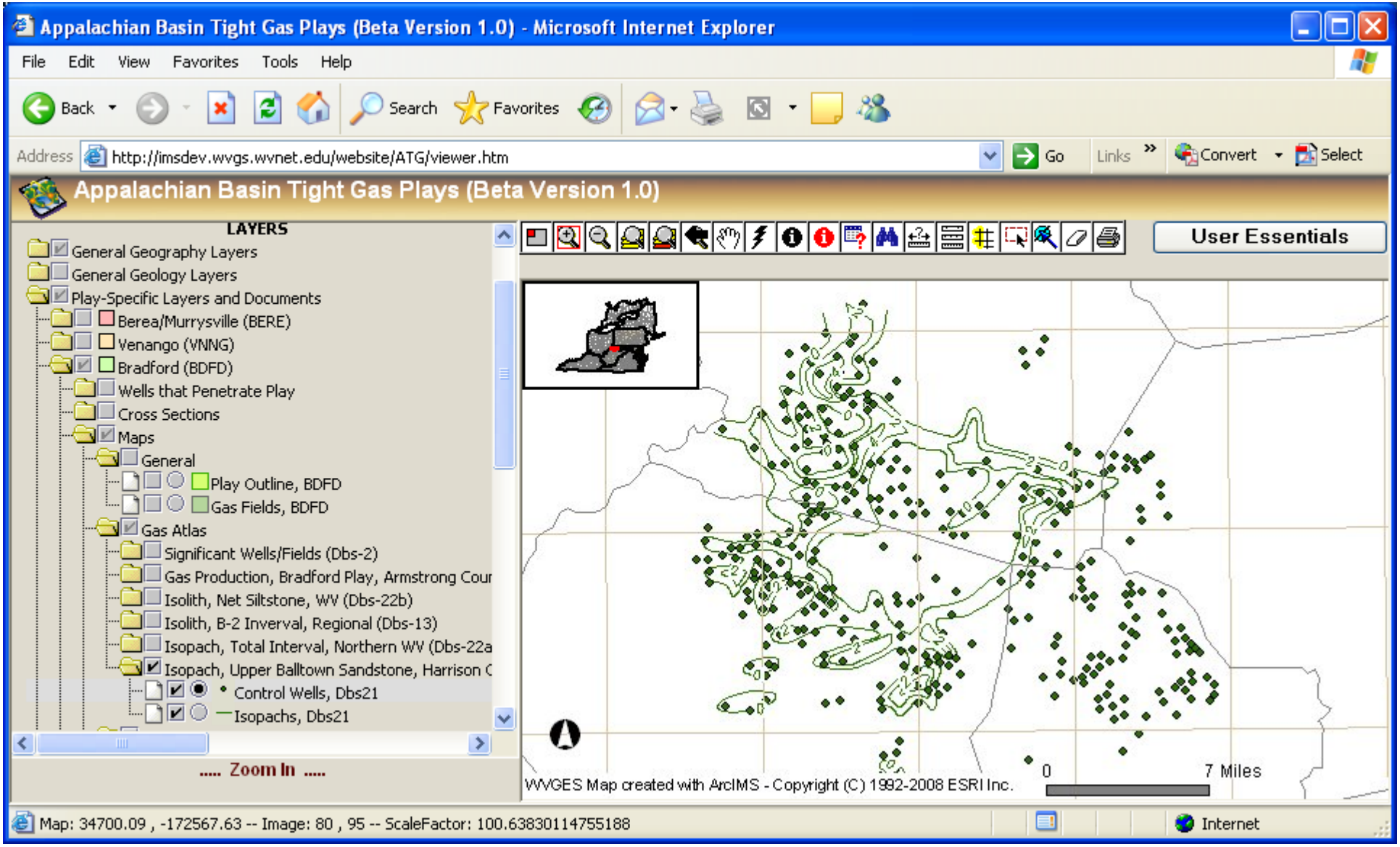


Figure B-10. Various types of maps are available from the interactive mapping system. This example shows one of the maps associated with the Bradford Play. Specifically, the example is an isopach map of the upper Balltown sandstone in Harrison County, West Virginia.

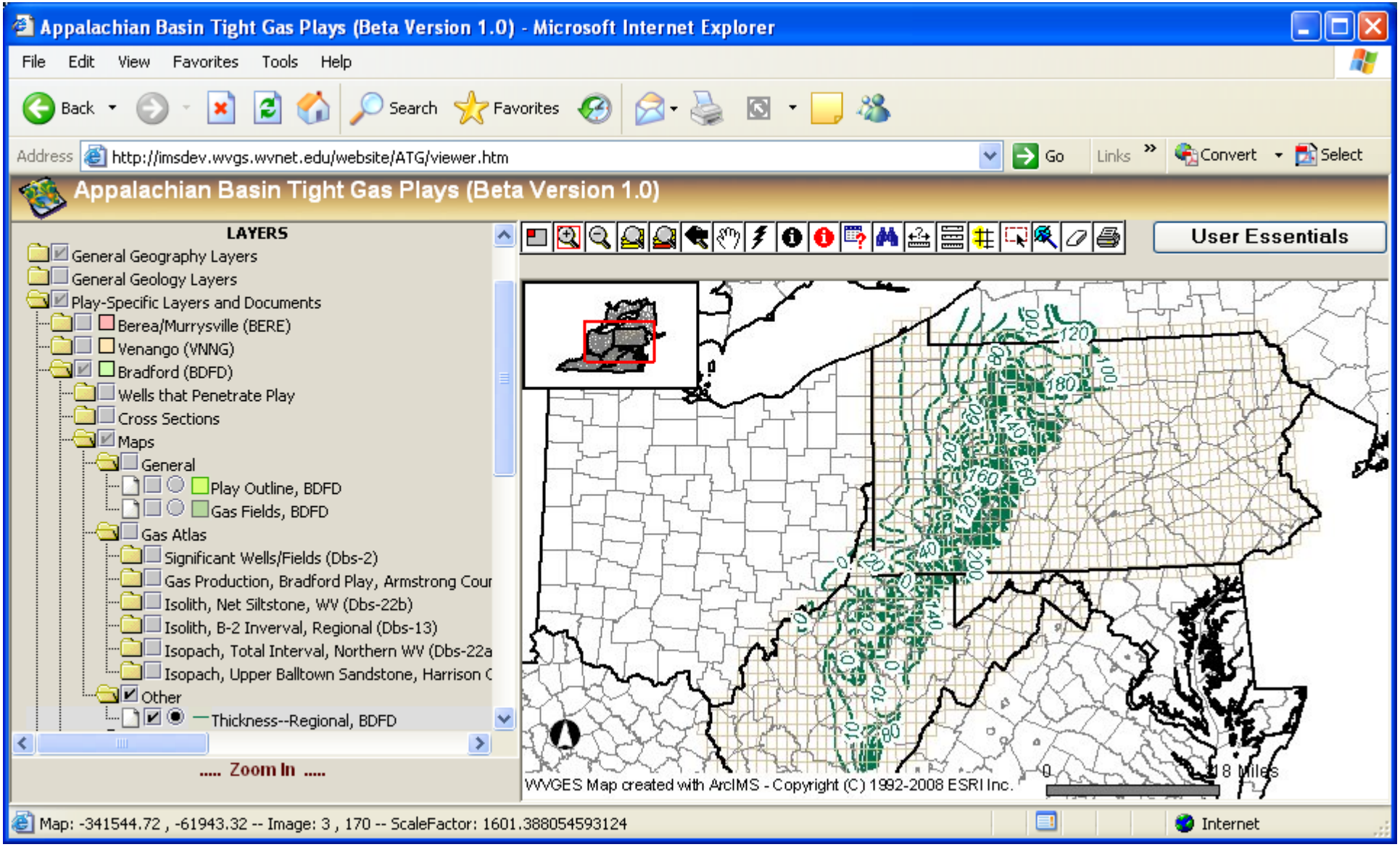


Figure B-11. This example shows yet another map associated with the Bradford Play. Specifically, the example shows a regional thickness map in Pennsylvania and West Virginia.

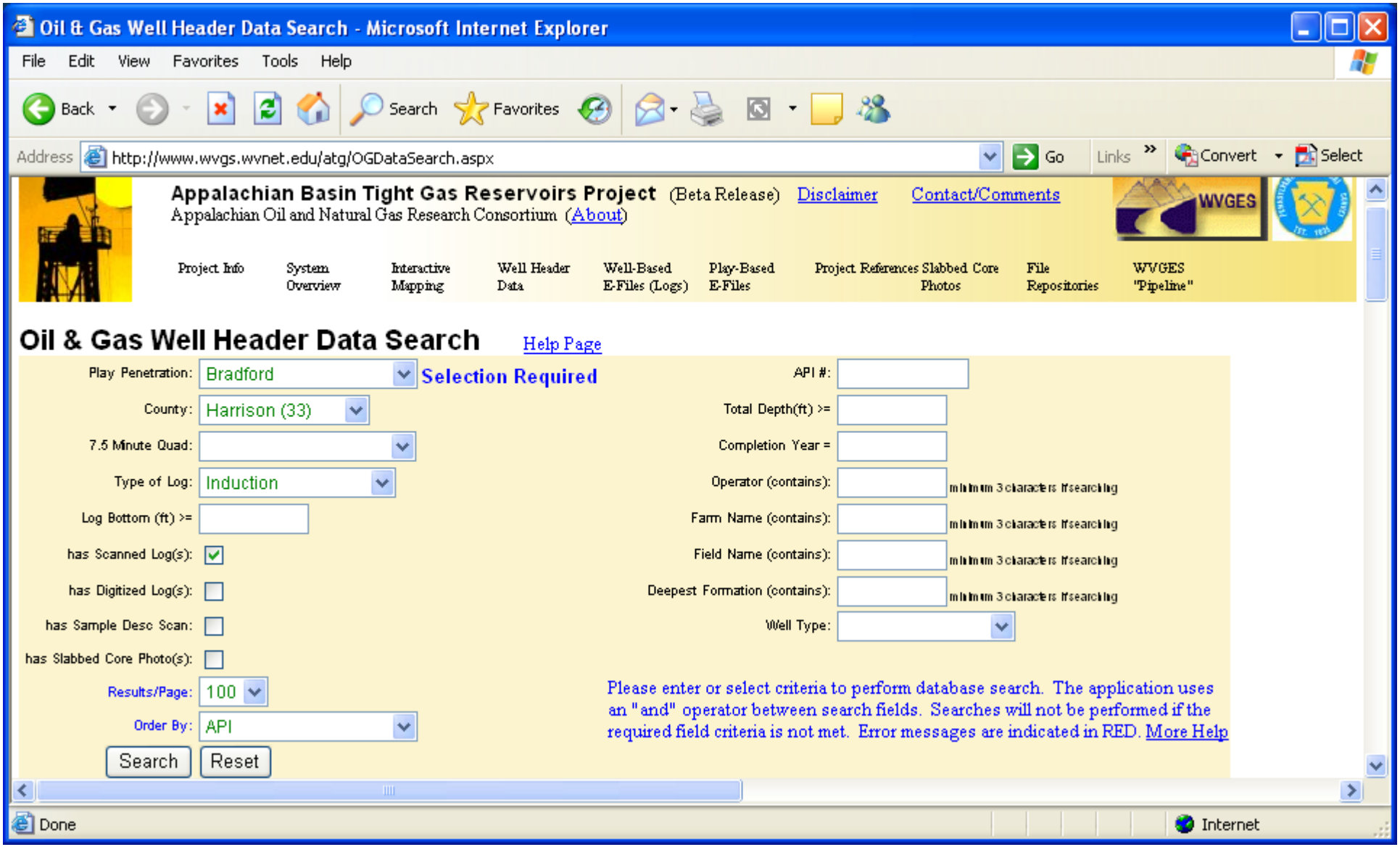
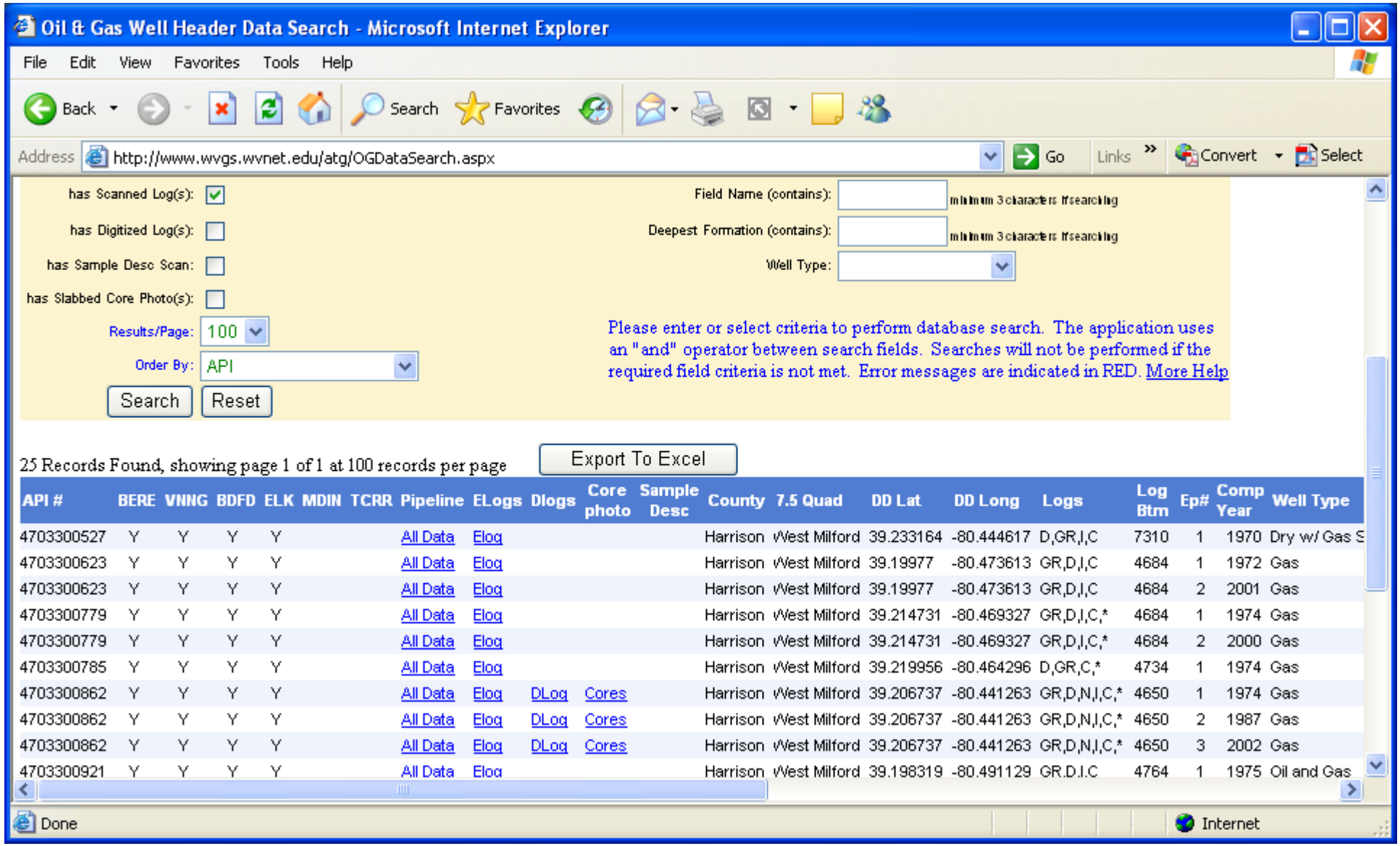


Figure B-12. Well header data are accessible through a search page. Several criteria are available to enable a user to create a collection of well data based on their specific interests or needs (please see above). Well header data includes well-specific data such as surface owner, operator name, total depth, and deepest formation.



API #	BERE	VNNG	BDFD	ELK	MDIN	TCRR	Pipeline	ELogs	DLogs	Core photo	Sample Desc	County	7.5 Quad	DD Lat	DD Long	Logs	Log Btm	Ep#	Comp Year	Well Type
4703300527	Y	Y	Y	Y			All Data	Elog				Harrison	West Milford	39.233164	-80.444617	D,GR,I,C	7310	1	1970	Dry w/ Gas S
4703300623	Y	Y	Y	Y			All Data	Elog				Harrison	West Milford	39.19977	-80.473613	GR,D,I,C	4684	1	1972	Gas
4703300623	Y	Y	Y	Y			All Data	Elog				Harrison	West Milford	39.19977	-80.473613	GR,D,I,C	4684	2	2001	Gas
4703300779	Y	Y	Y	Y			All Data	Elog				Harrison	West Milford	39.214731	-80.469327	GR,D,I,C,*	4684	1	1974	Gas
4703300779	Y	Y	Y	Y			All Data	Elog				Harrison	West Milford	39.214731	-80.469327	GR,D,I,C,*	4684	2	2000	Gas
4703300785	Y	Y	Y	Y			All Data	Elog				Harrison	West Milford	39.219956	-80.464296	D,GR,C,*	4734	1	1974	Gas
4703300862	Y	Y	Y	Y			All Data	Elog	DLog	Cores		Harrison	West Milford	39.206737	-80.441263	GR,D,N,I,C,*	4650	1	1974	Gas
4703300862	Y	Y	Y	Y			All Data	Elog	DLog	Cores		Harrison	West Milford	39.206737	-80.441263	GR,D,N,I,C,*	4650	2	1987	Gas
4703300862	Y	Y	Y	Y			All Data	Elog	DLog	Cores		Harrison	West Milford	39.206737	-80.441263	GR,D,N,I,C,*	4650	3	2002	Gas
4703300921	Y	Y	Y	Y			All Data	Elog				Harrison	West Milford	39.198319	-80.491129	GR,D,I,C	4764	1	1975	Oil and Gas

Figure B-13. The well header data search provides access to a wealth of well-based data. In addition, links to other sources of data are provided. Search results can be exported to Excel.

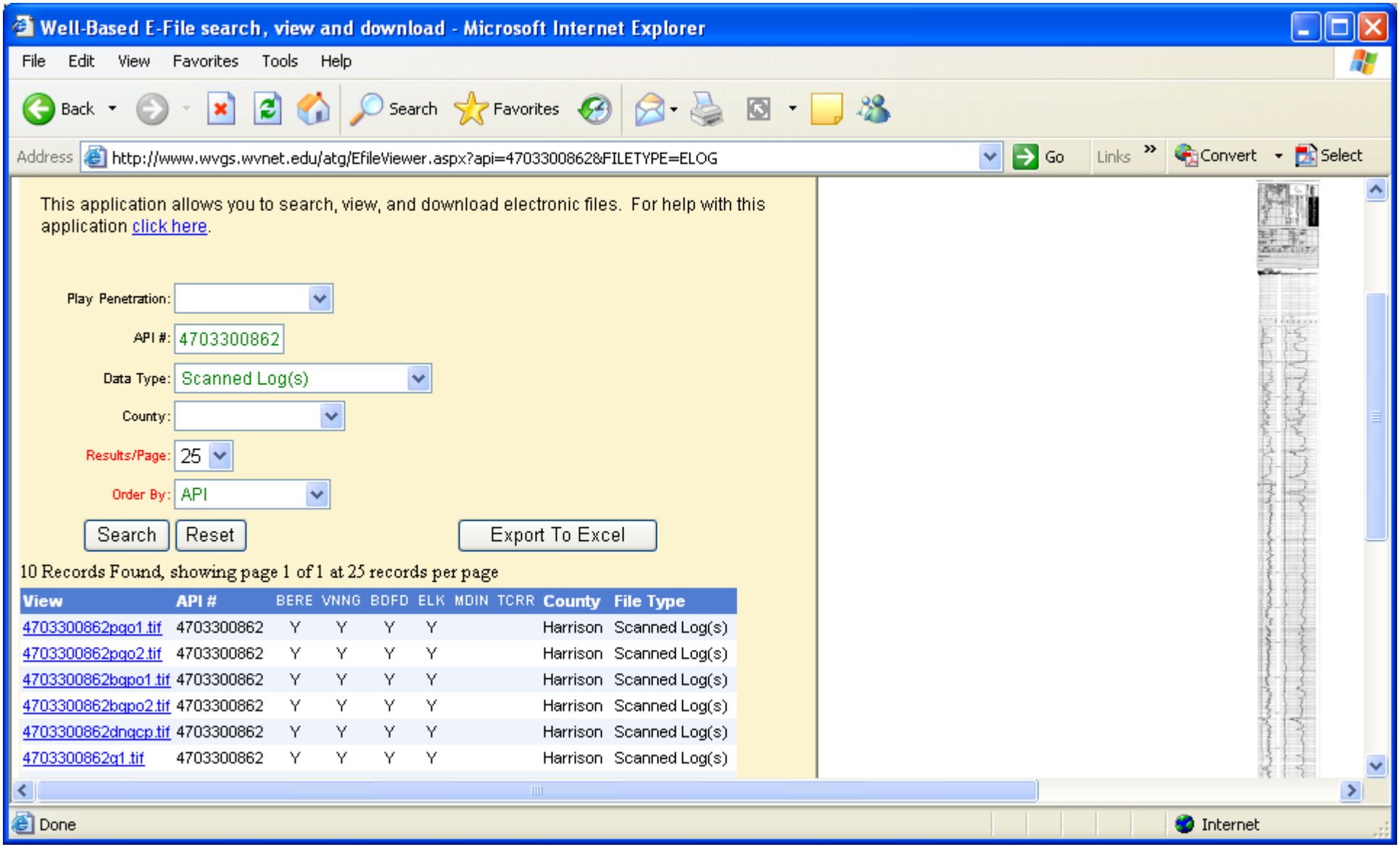


Figure B-14. A link to scanned logs is one of the link types available from the well header data search result. Scanned logs and other electronic documents can be searched, viewed, or downloaded. A scanned log for well 4703300862 is shown in the viewer on the right-hand side of the page. Users should be able to scroll down through the log image, zoom in, and zoom out.

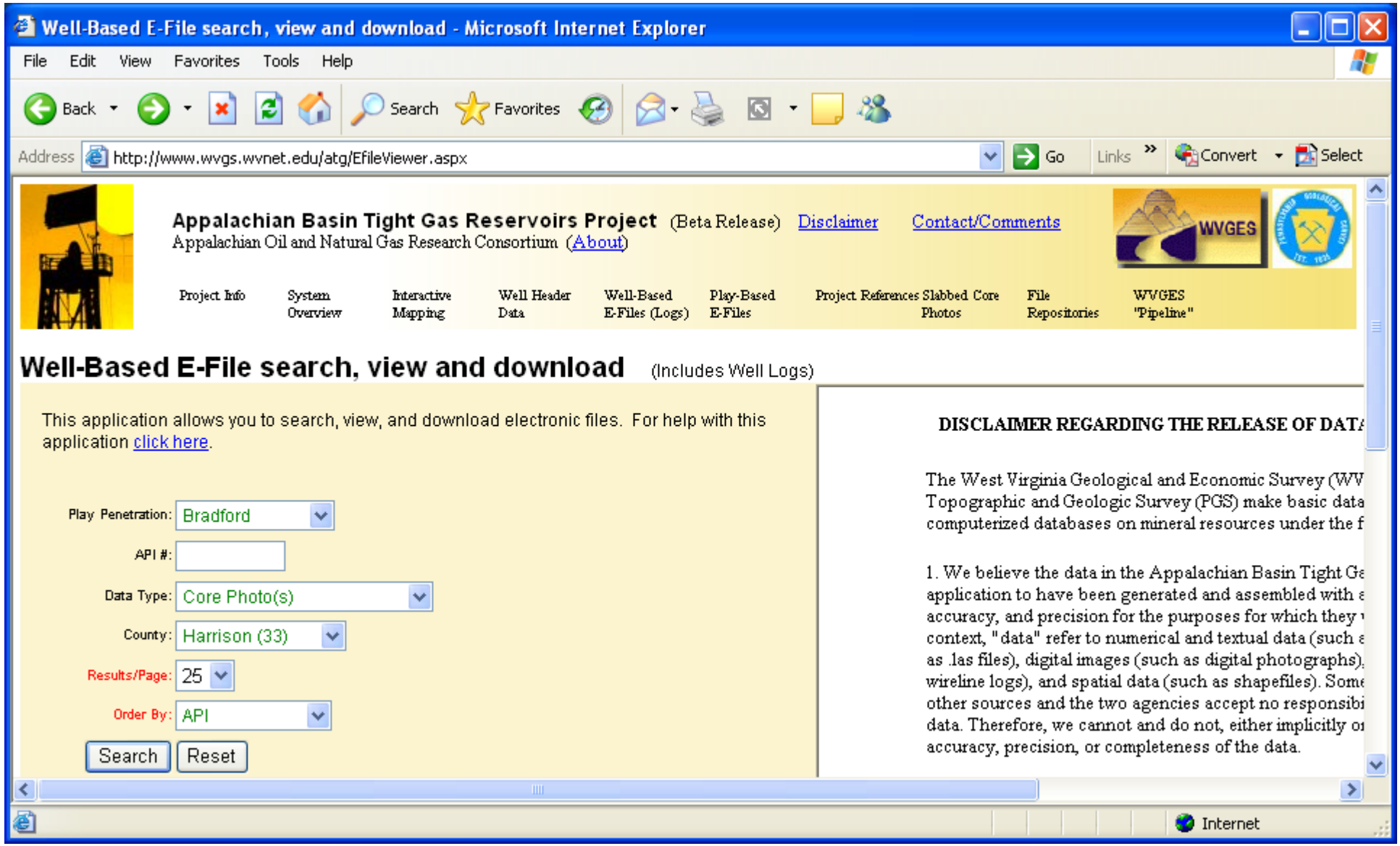


Figure B-15. Well-based e-files or documents (*as opposed to well header data*) are accessible through a search page. Several search criteria are available including play, API number, data type, and county. Well-based files would include such items as well plats, completion reports, scanned logs, core photographs, and core and sample descriptions.

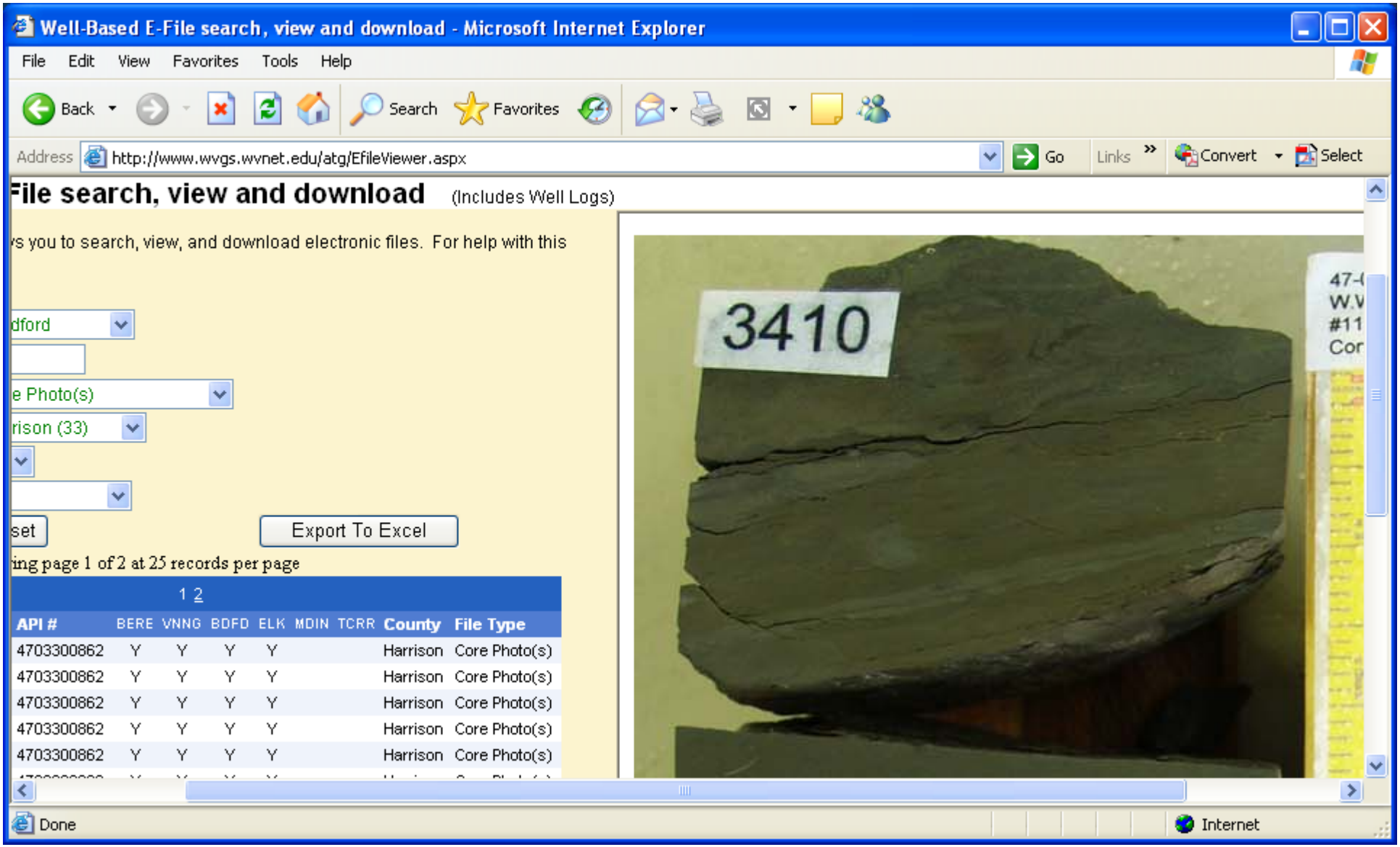


Figure B-16. The well-based e-file search provides basic data about and access to documents about a particular well. For example, as shown here, a core photograph for well 4703300862.

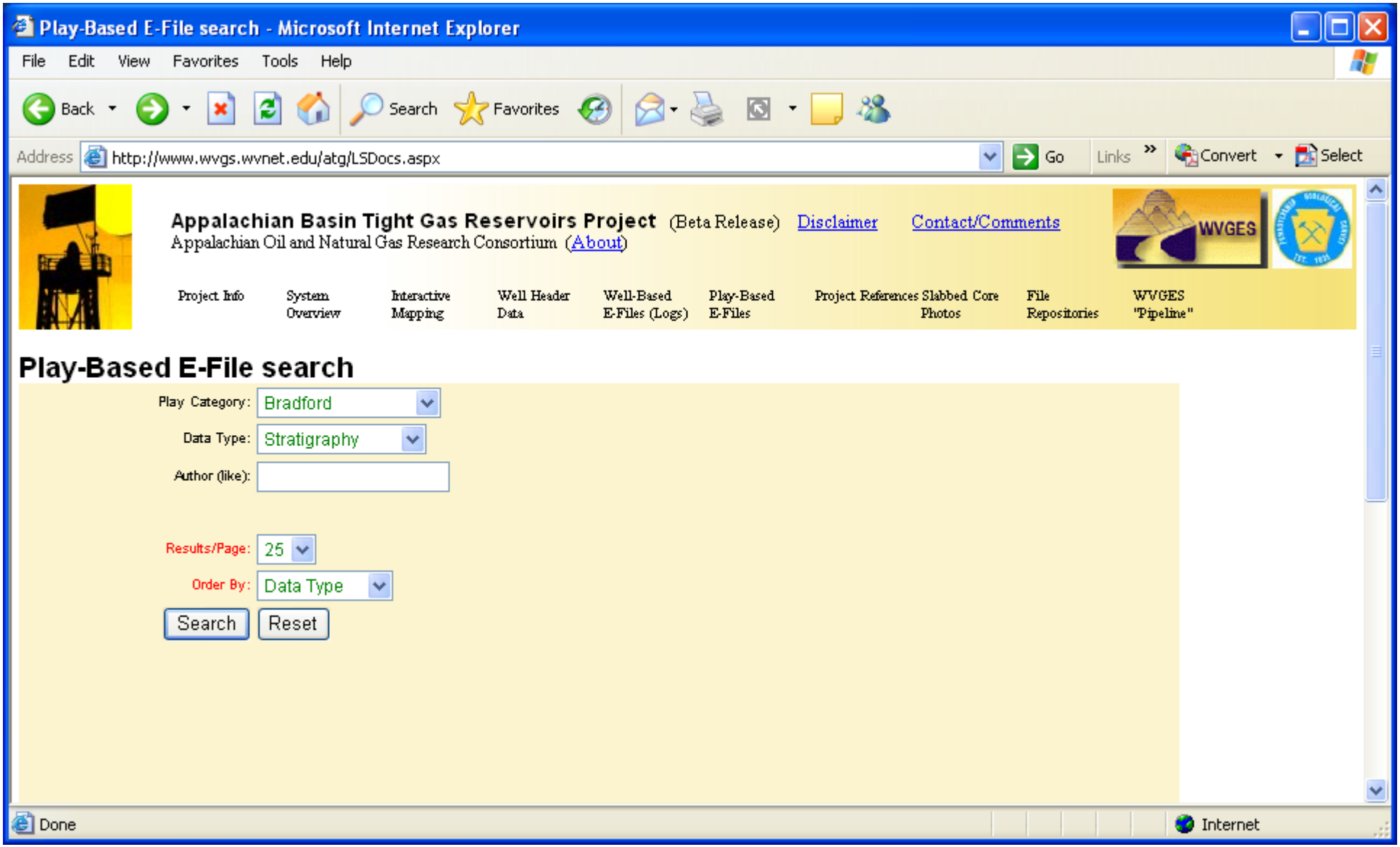


Figure B-17. Play-based e-files are accessible through a search page. Several search criteria are available including play category, data type, and author. Play-based files would include such items as abstracts, reports, cross sections, and maps.

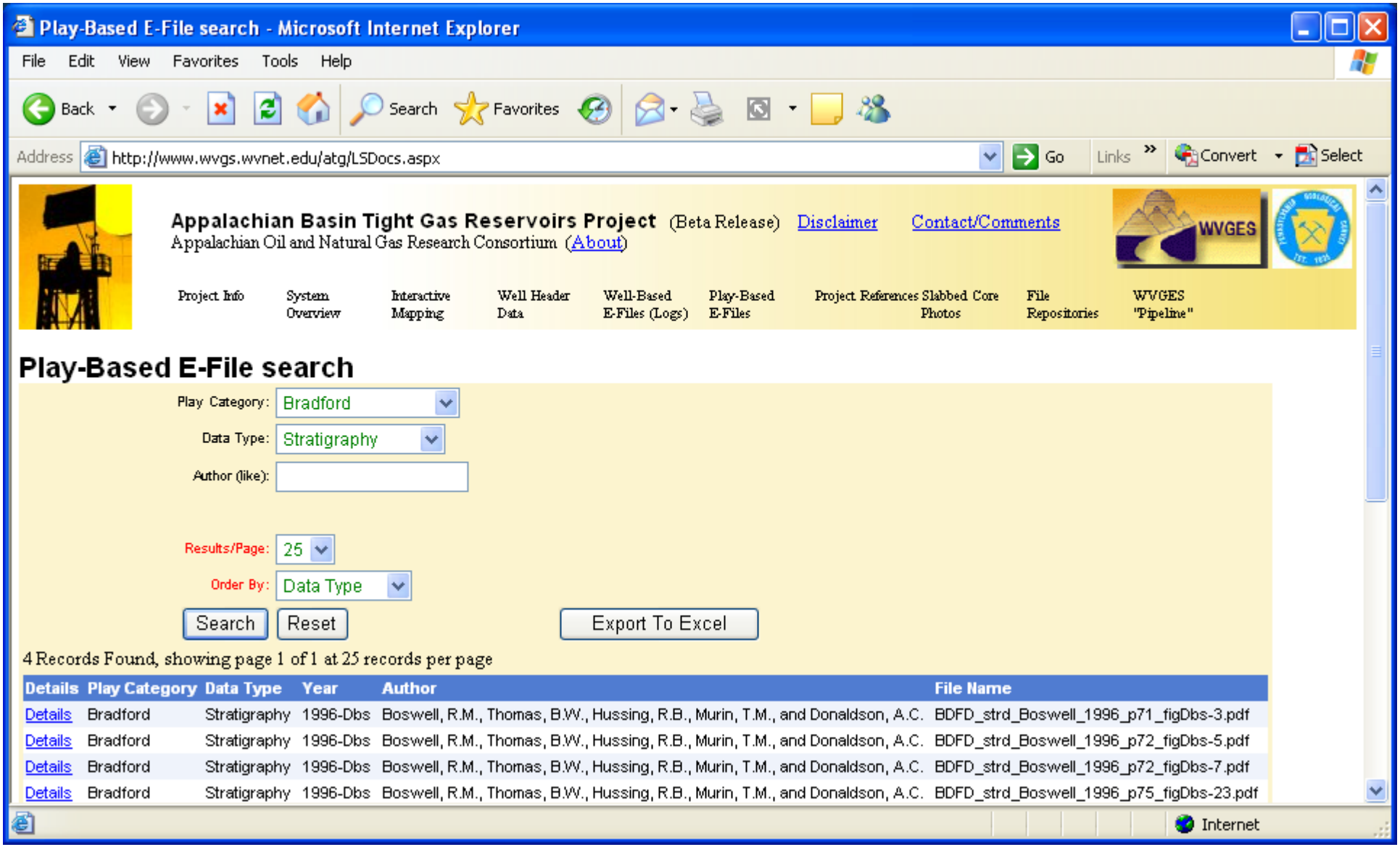


Figure B-18. The play-based e-file search provides basic data about and access to documents about a particular play.

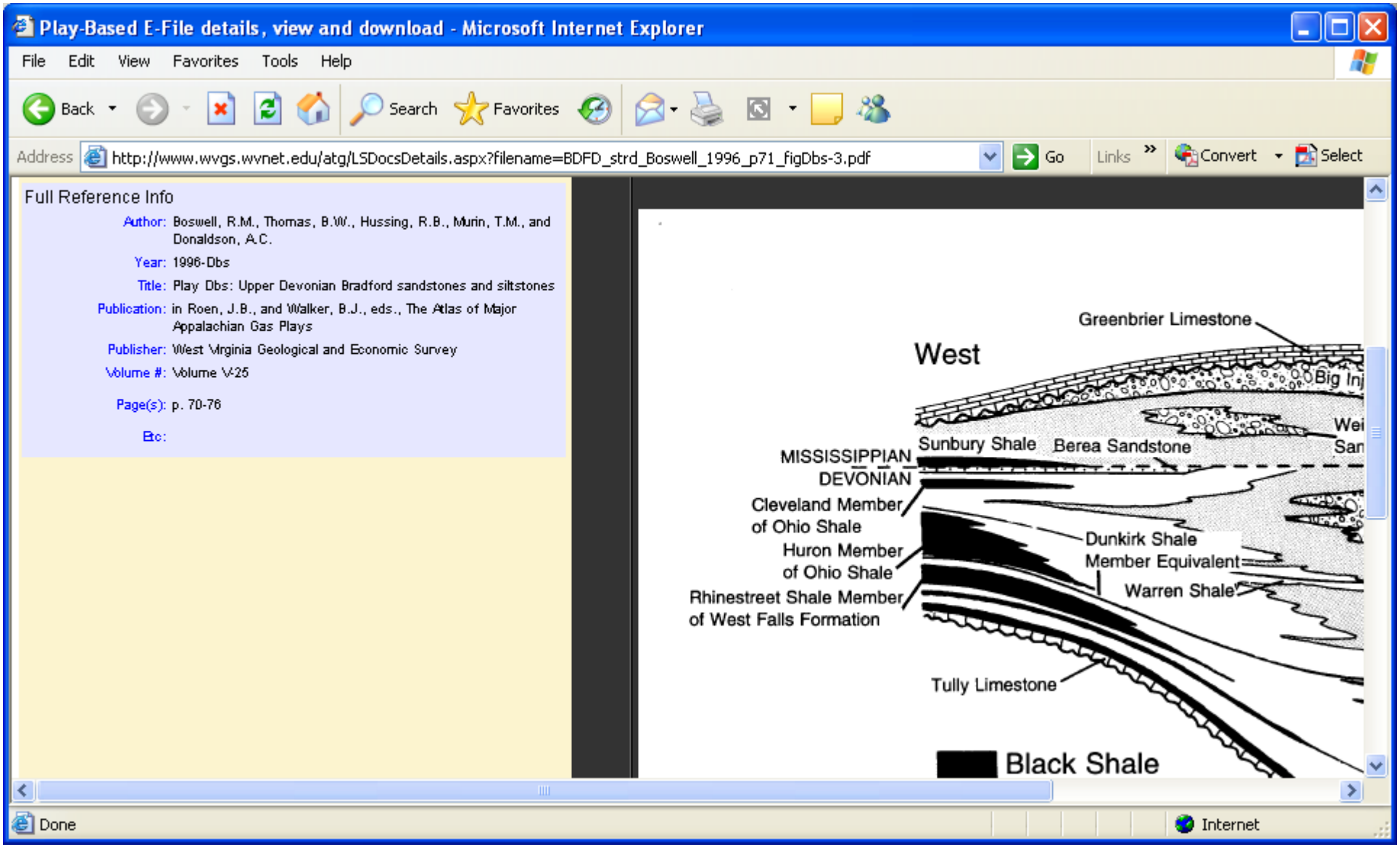


Figure B-19. A specific play-based document can be accessed by clicking on the “Details” link given the play-based e-files search result (see previous figure). The document is then shown in a viewer on the right-hand side of the Web browser page. The user should be able to change the size of the image, scroll, zoom in, and zoom out. Along with the image, full reference information and scanned document information is given.

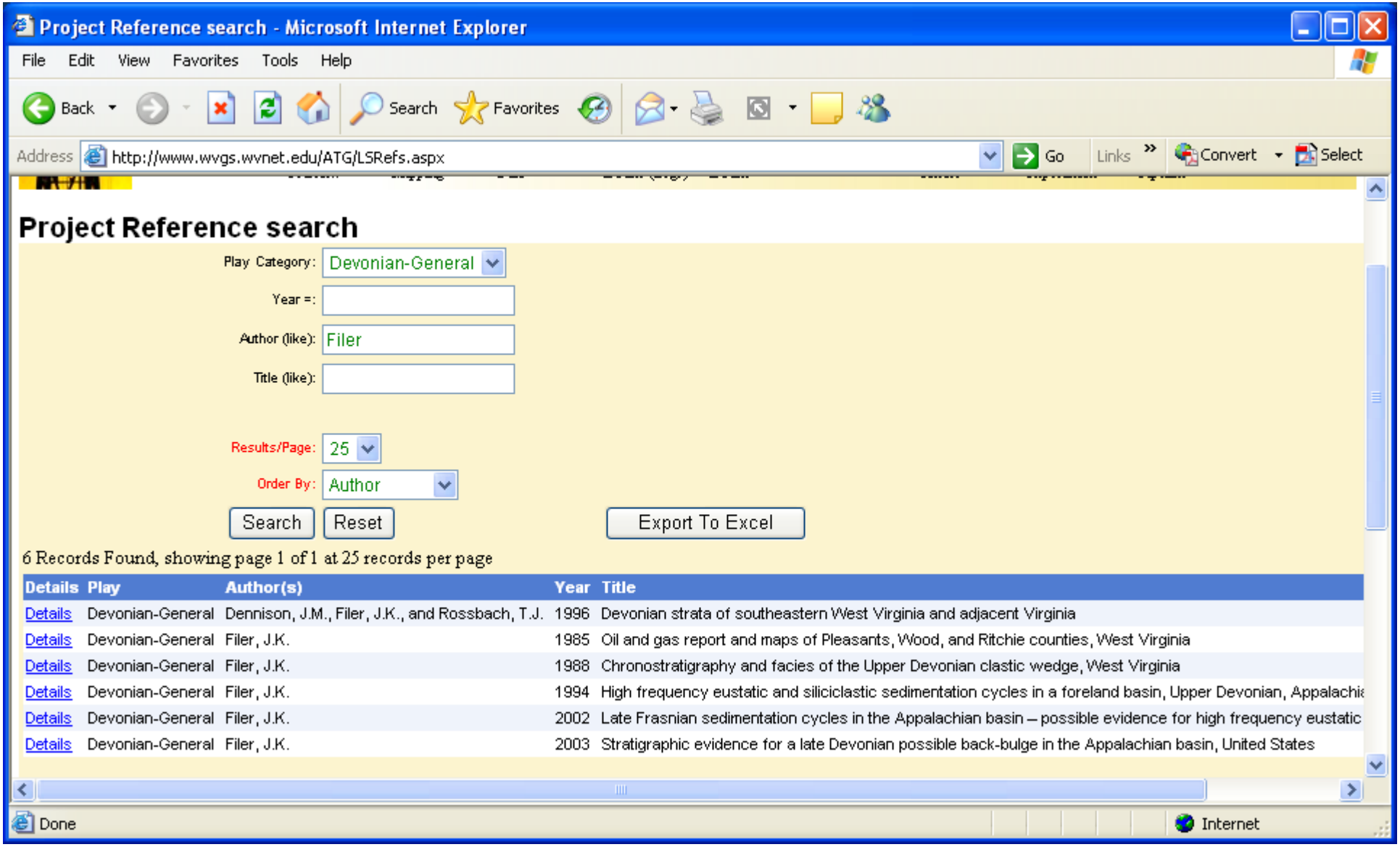


Figure B-20. Project references are available through a search page. Search criteria include play, year, author, and title.

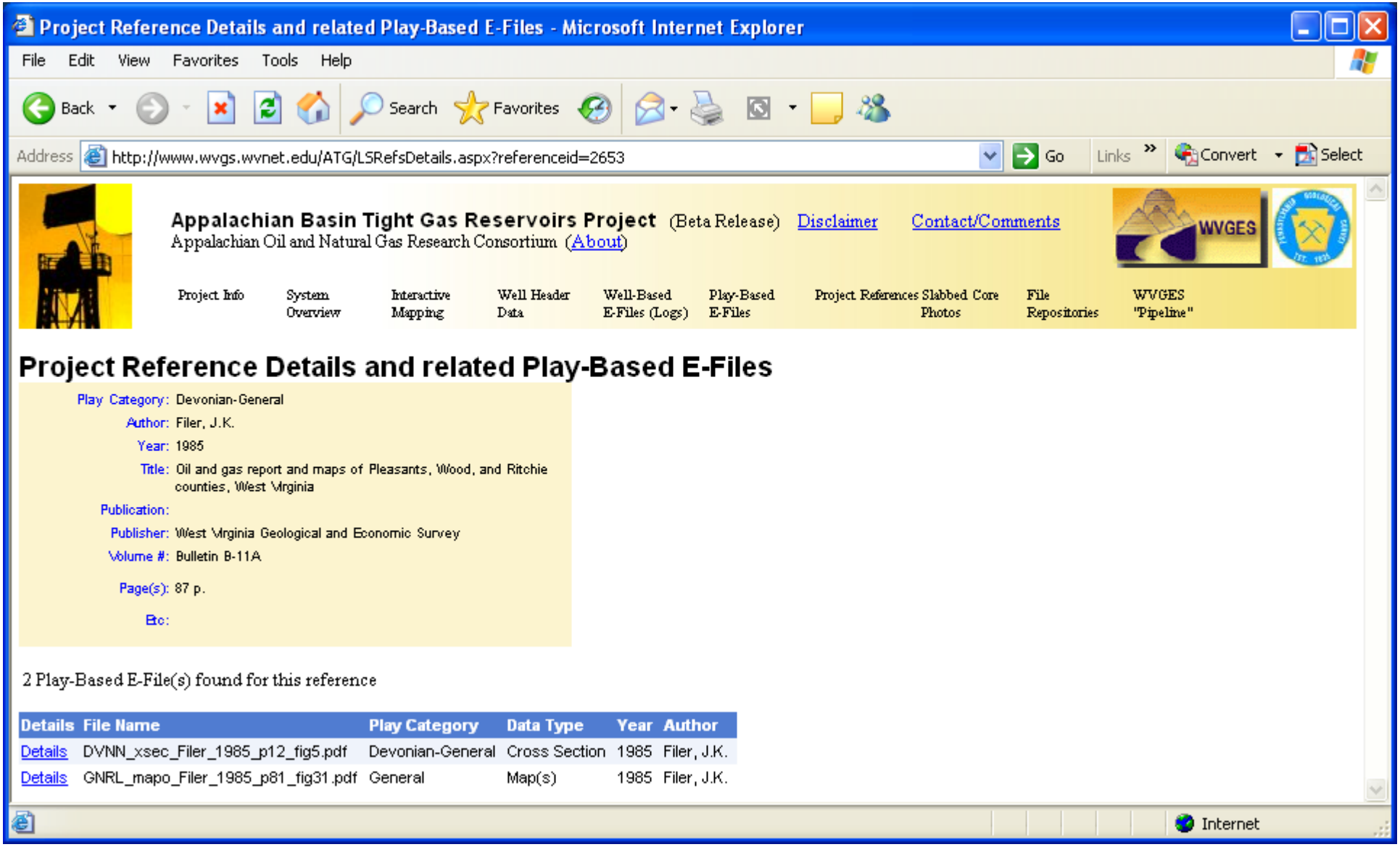


Figure B-21. The links from the project reference search provide additional details about the document that was selected.

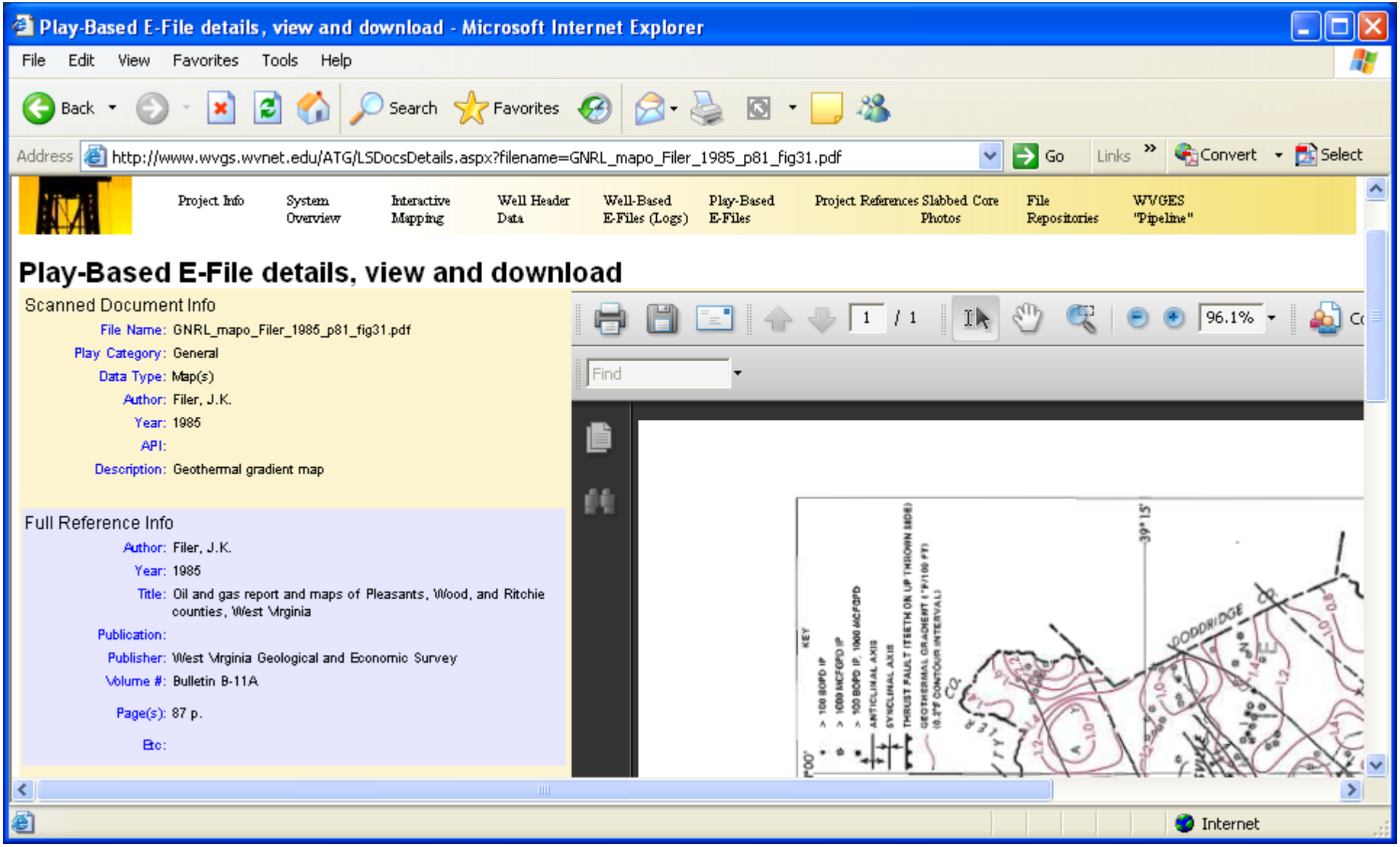


Figure B-22. Finally, links provide access to individual project reference documents that have been scanned. This example provides a scanned image of a geothermal gradient map from a West Virginia Geological & Economic Survey (WVGES) publication.

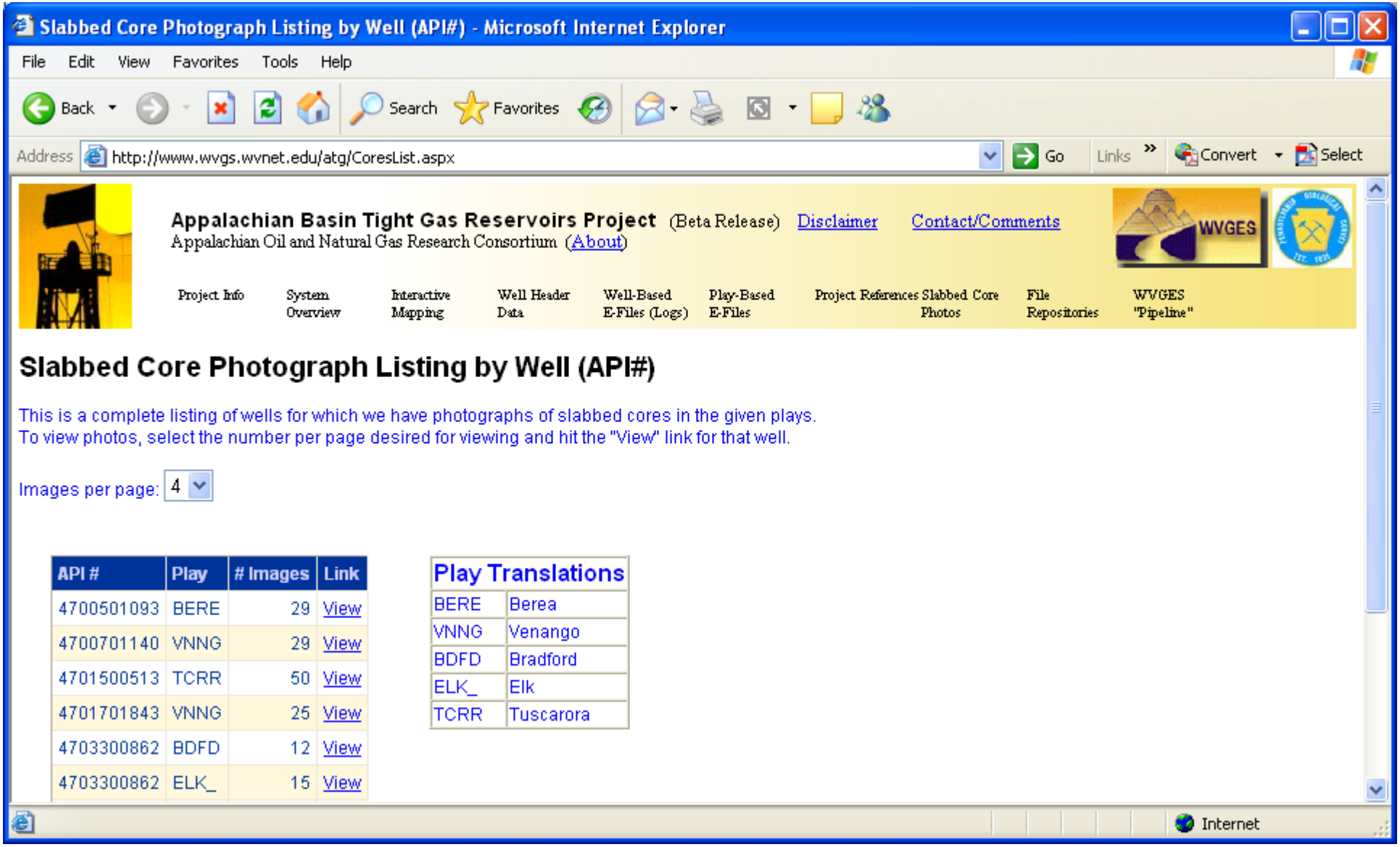


Figure B-23. Photographs for slabbed cores are available for about a dozen wells. Access to the photographs is available in a number of places in the Appalachian Basin Tight Gas Reservoirs Project system, including through a table of links.

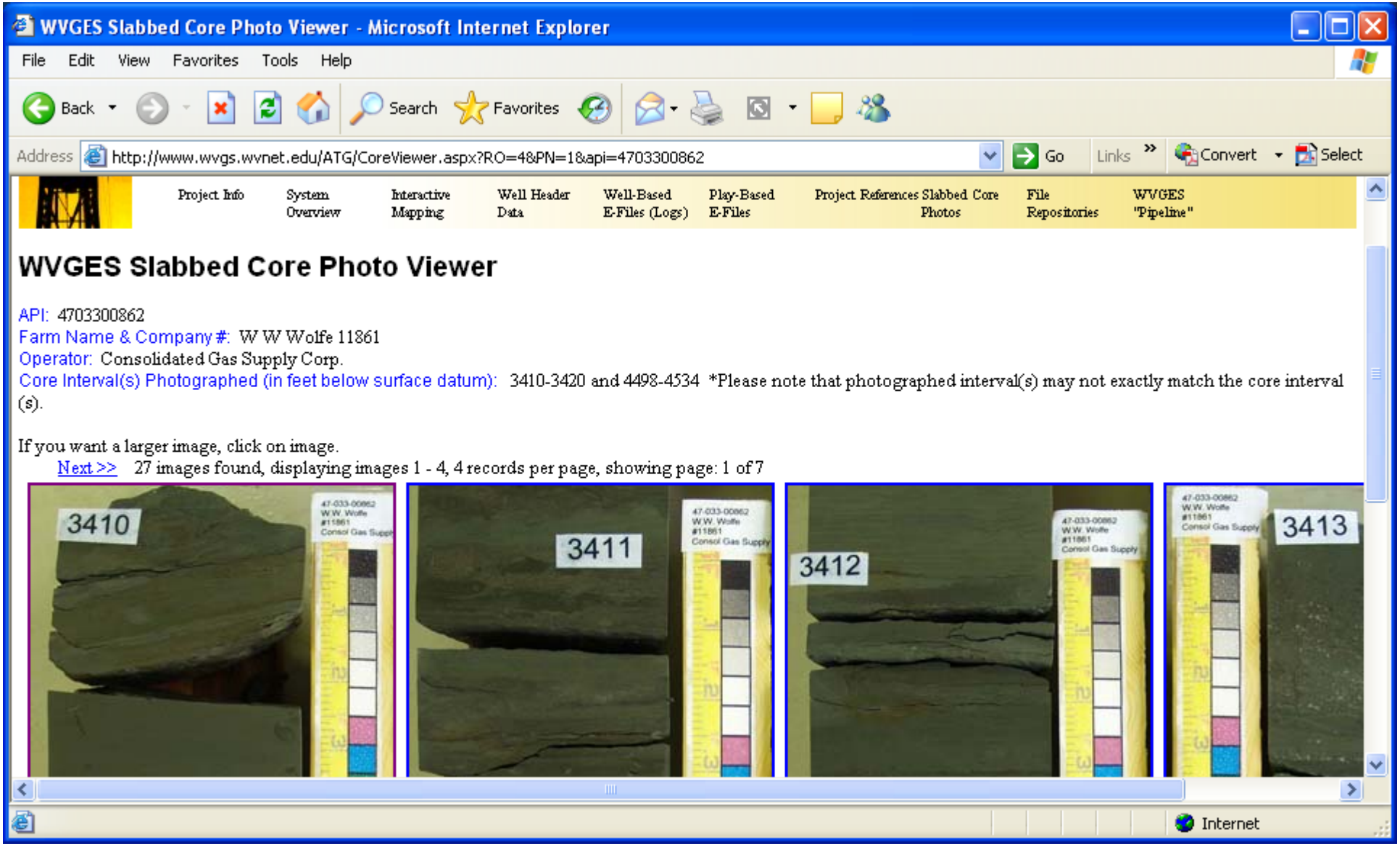


Figure B-24. Numerous photographs are typically available for any given well. The photographs are shown here in depth order with four images per page.

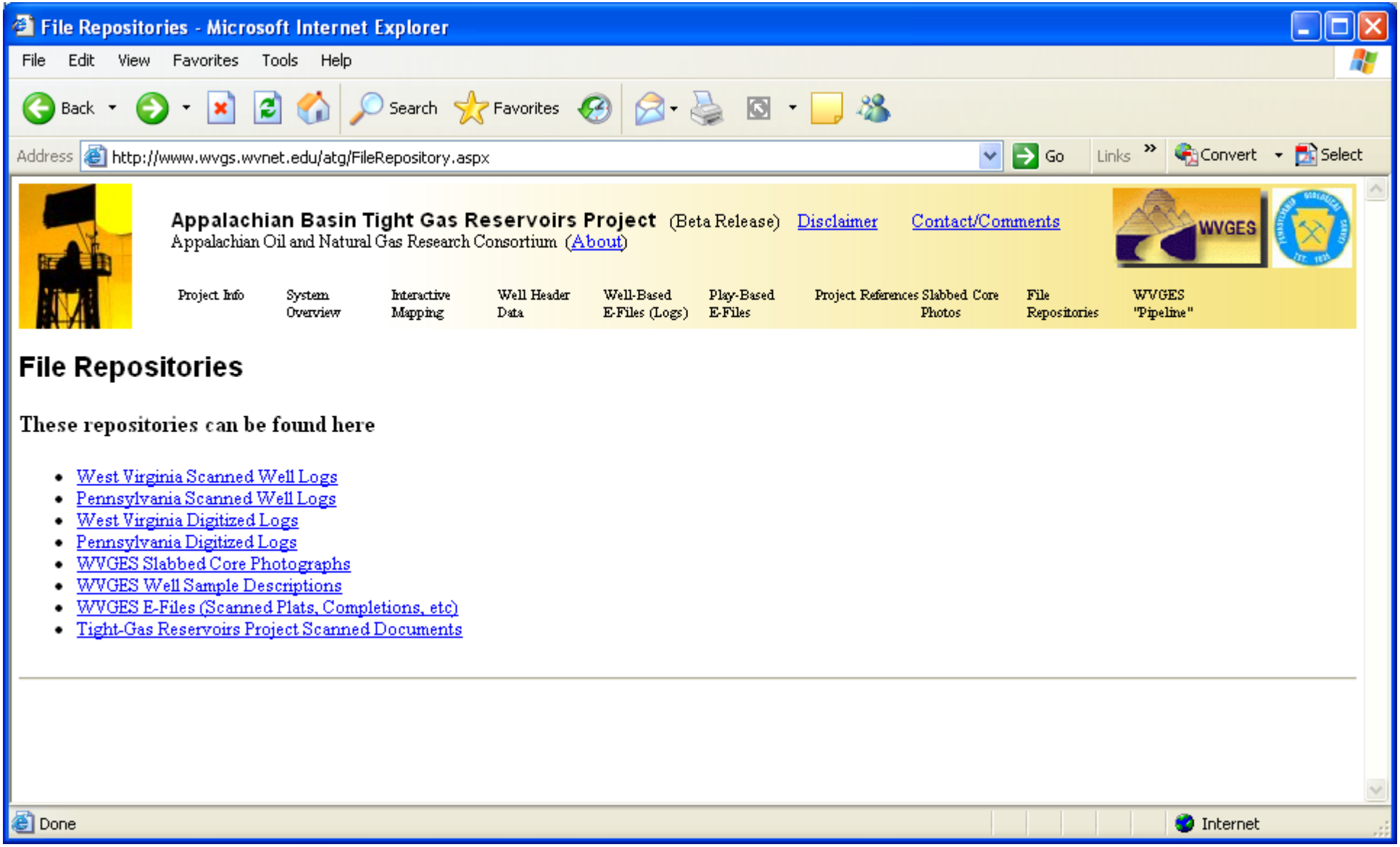


Figure B-25. Data can be accessed in various ways. For those who have already determined what they need, the “File Repository” section provides easy access to downloadable files. Data are organized by county within each data type.

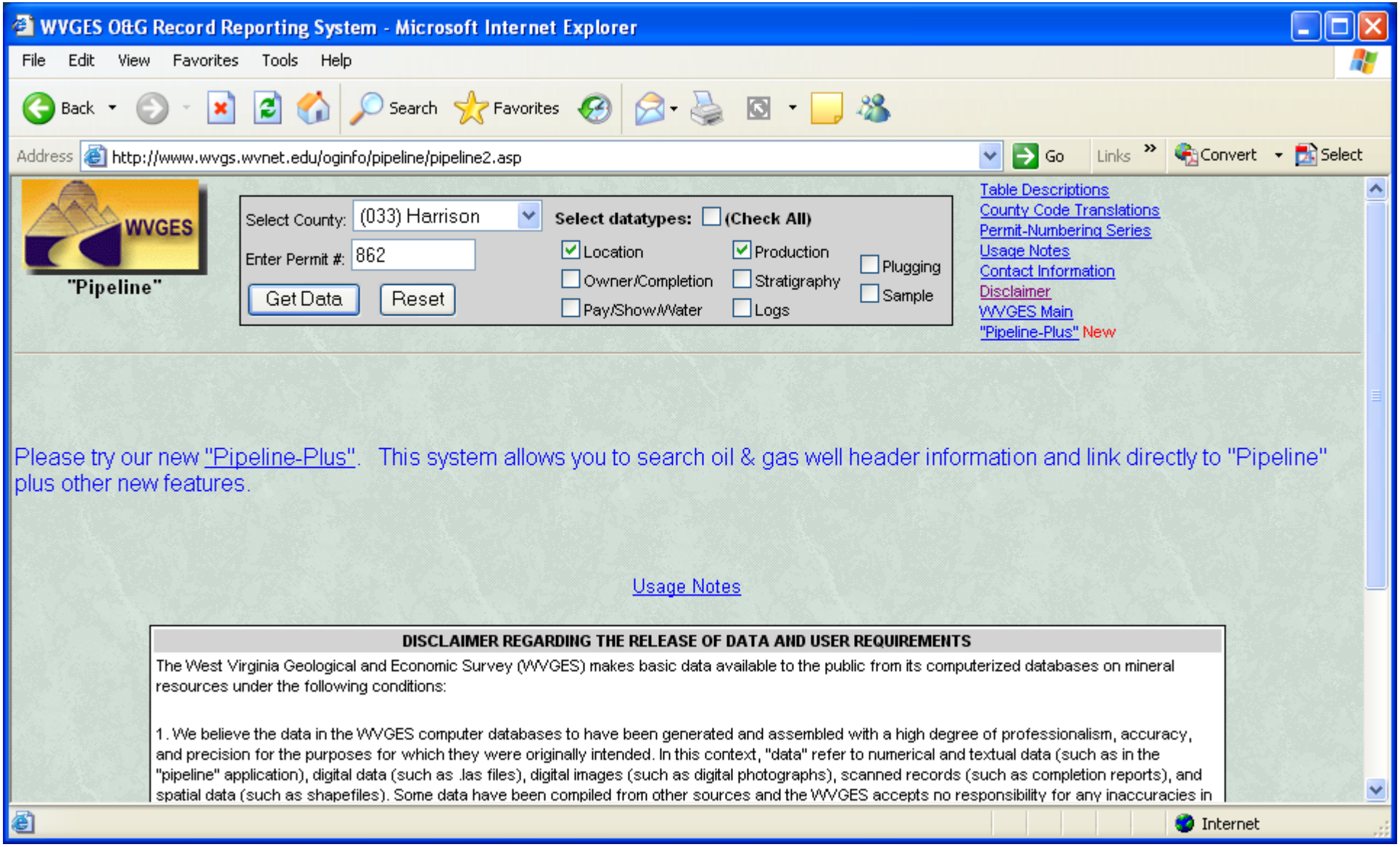
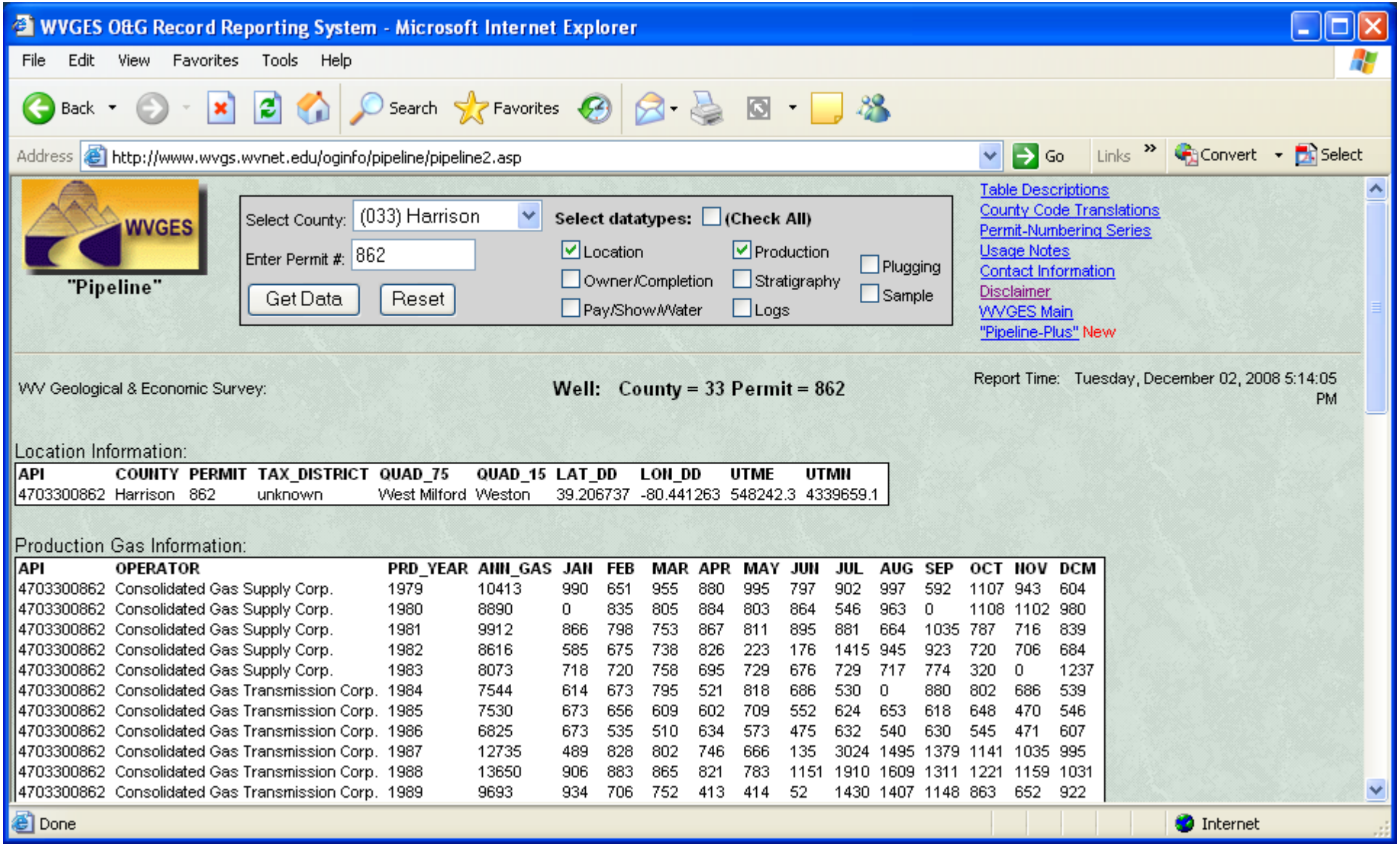


Figure B-26. "Pipeline" provides access to all of the well data that the West Virginia Geological & Economic Survey (WVGES) has for West Virginia wells. County, permit number, and the type of data can be selected.



API	COUNTY	PERMIT	TAX_DISTRICT	QUAD_75	QUAD_15	LAT_DD	LON_DD	UTME	UTMN
4703300862	Harrison	862	unknown	West Milford	Weston	39.206737	-80.441263	548242.3	4339659.1

API	OPERATOR	PRD_YEAR	ANN_GAS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DCM
4703300862	Consolidated Gas Supply Corp.	1979	10413	990	651	955	880	995	797	902	997	592	1107	943	604
4703300862	Consolidated Gas Supply Corp.	1980	8890	0	835	805	884	803	864	546	963	0	1108	1102	980
4703300862	Consolidated Gas Supply Corp.	1981	9912	866	798	753	867	811	895	881	664	1035	787	716	839
4703300862	Consolidated Gas Supply Corp.	1982	8616	585	675	738	826	223	176	1415	945	923	720	706	684
4703300862	Consolidated Gas Supply Corp.	1983	8073	718	720	758	695	729	676	729	717	774	320	0	1237
4703300862	Consolidated Gas Transmission Corp.	1984	7544	614	673	795	521	818	686	530	0	880	802	686	539
4703300862	Consolidated Gas Transmission Corp.	1985	7530	673	656	609	602	709	552	624	653	618	648	470	546
4703300862	Consolidated Gas Transmission Corp.	1986	6825	673	535	510	634	573	475	632	540	630	545	471	607
4703300862	Consolidated Gas Transmission Corp.	1987	12735	489	828	802	746	666	135	3024	1495	1379	1141	1035	995
4703300862	Consolidated Gas Transmission Corp.	1988	13650	906	883	865	821	783	1151	1910	1609	1311	1221	1159	1031
4703300862	Consolidated Gas Transmission Corp.	1989	9693	934	706	752	413	414	52	1430	1407	1148	863	652	922

Figure B-27. "Pipeline" results can show all of the data that the West Virginia Geological & Economic Survey has for a particular well. In this example, location and production data were selected for well 4703300862.

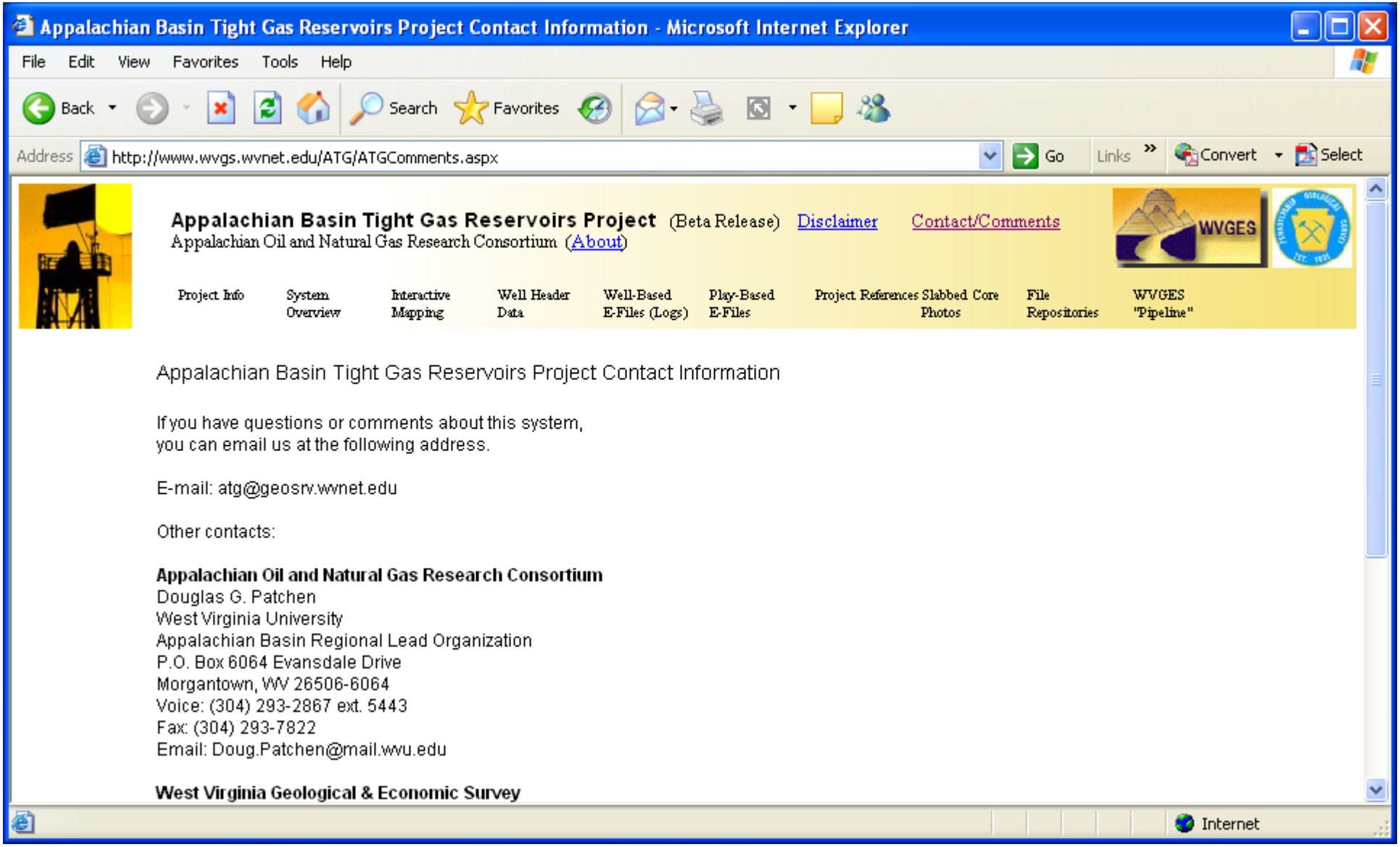


Figure B-28. Contact information has been provided for the Appalachian Oil and Natural Gas Research Consortium (AONGRC), the West Virginia Geological & Economic Survey (WVGES) and the Pennsylvania Geological Survey (PGS). The project was funded through AONGRC while WVGES and PGS completed the work including data gathering and application development.

Appendix C: Appalachian Basin Tight Gas Reservoirs: Interactive Mapping System Metadata

In keeping with FGDC guidelines regarding the development of GIS systems, metadata were prepared for the Appalachian Basin Tight Gas interactive mapping system datasets or layers. The format for the metadata include:

- Identification
  - General
    - Abstract
    - Purpose
    - Language
    - Access Constraints
    - Use Constraints
    - Native Dataset Environment
    - Native Dataset Format
  - Citation
    - Citation Title
    - Originator
    - Publication Date
    - Geospatial Data Presentation Form
    - Online Linkage
  - Time Period
    - Currentness Reference
    - Calendar Date
  - Status
    - Progress
    - Update Frequency
  - Spatial Domain
    - Bounding Coordinates
  - Keywords
    - Theme Keyword(s)
    - Theme Thesaurus
- Data Quality
  - Process Step(s)
- Data Organization
  - General
    - Spatial Reference
    - SDTS or VPF Terms
- Spatial Reference
  - General
    - Geographic Coordinate System Name
    - Projected Coordinate System Name
    - Horizontal Datum Name
    - Ellipsoid Name
    - Semi-major Axis
    - Denominator of Flattening Ratio
  - Horizontal Coordinate System
    - Type
    - Coordinate System Type

            - Abscissa Resolution
            - Ordinate Resolution
            - Units
            - Encoding Type
            - Standard Parallels
            - Longitude of Central Meridian
            - Latitude of Projection Origin
            - False Easting
            - False Northing
- Entity Attribute
    - Detailed Description
        - Entity Type
            - Label
            - Type
        - Attribute
            - General
                - Label
                - Type
                - Width
                - Precision
                - Definition
                - Definition Source
            - Attribute Domain Values
                - Type
                - Unrepresentable Domain
- Distribution
    - General
        - Resource Description
    - Standard Order Process
        - General
            - Format
            - Transfer Size
            - Dataset Size
    - Available Time Period
        - Timeframe
- Metadata Reference
    - General
        - Metadata Date
        - Language of Metadata
        - Metadata Standard Name
        - Metadata Standard Version
        - Metadata Time Convention
        - Contact
            - General
                - Person
                - Organization
                - Contact Voice Telephone
            - Address
                - Address Type
                - City

        - State or Province
        - Postal Code
- Extensions
    - Online Linkage
    - Profile Name