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Pennsylvania Groundwater Information System (PaGWIS) Documentation

Enter PaGWIS

INTRODUCTION

The Pennsylvania Ground Water Information System (PaGWIS) consists of two Microsoft Access databases, ESRI's ArcExplorer software, and a wealth of digital geographic data for use in ArcExplorer. The heart of the system is a large Access relational database containing data for wells, springs, and ground water quality throughout Pennsylvania. The latest version of this database consolidates and updates information that was distributed as four different Access files in previous versions of PaGWIS. Also new to version 3.0 is a separate Access database that serves solely as an interface to retrieve data from the data file on the CD-ROM. The interface provides easy-to-use forms that quickly retrieve well, spring, and/or water quality information on the basis of a county, a latitude-longitude rectangle, or an approximation of a radius around a point. Latitude/longitude values can be entered in either decimal degree or degree-minute-second format. Once this small database is copied and set up on the user's computer, it will retrieve data directly from the large database on the CD-ROM.

As with the previous version of this CD-ROM, ArcExplorer is provided along with geographic coverages that enable the user to visualize and query a static set of data from the database. ArcExplorer is a freeware program available from ESRI. It is promoted as a viewer for geographic data. As before, ArcExplorer is provided as a supplement to, not a replacement for, the Access databases. Similarly, ArcExplorer should not be looked at as a means of producing report quality hardcopy. The ground-water data accessible through ArcExplorer is very limited relative to that contained in the Access database. Users that want to extend the capability of ArcExplorer might want to look into ArcView, a comprehensive GIS (Geographic Information System) application sold by the same company. All coverages on the CD were prepared using ArcView and are in ArcView's native shape file format. ESRI's web site is at www.esri.com.

The user is expected to have a working knowledge of file management under the Windows operating system. Setup of PaGWIS requires that the user know how to navigate the Windows drive and directory system. Although PaGWIS provides an interface that makes it simple to retrieve data for ground water sites in user-defined areas of Pennsylvania, the PaGWIS database contains much more data than is retrieved by these canned queries. With a working knowledge of Microsoft Access the user can modify the canned queries in order to retrieve exactly the information desired.

SYSTEM REQUIREMENTS

PaGWIS requires an IBM compatible PC running Windows 95, Windows 98, or Windows NT. The Access file containing the PaGWIS data can be opened using either Microsoft Access 95 or Access

97. The PaGWIS Menu system **requires** Access 97.

All of the database objects, including the PaGWIS menu system are designed to fit a monitor running at a minimum resolution of 800 by 600, however, it is strongly recommended that resolution be set to 1024 by 768. Monitor resolution is set by right clicking on the desktop. Select Properties from the menu that opens.
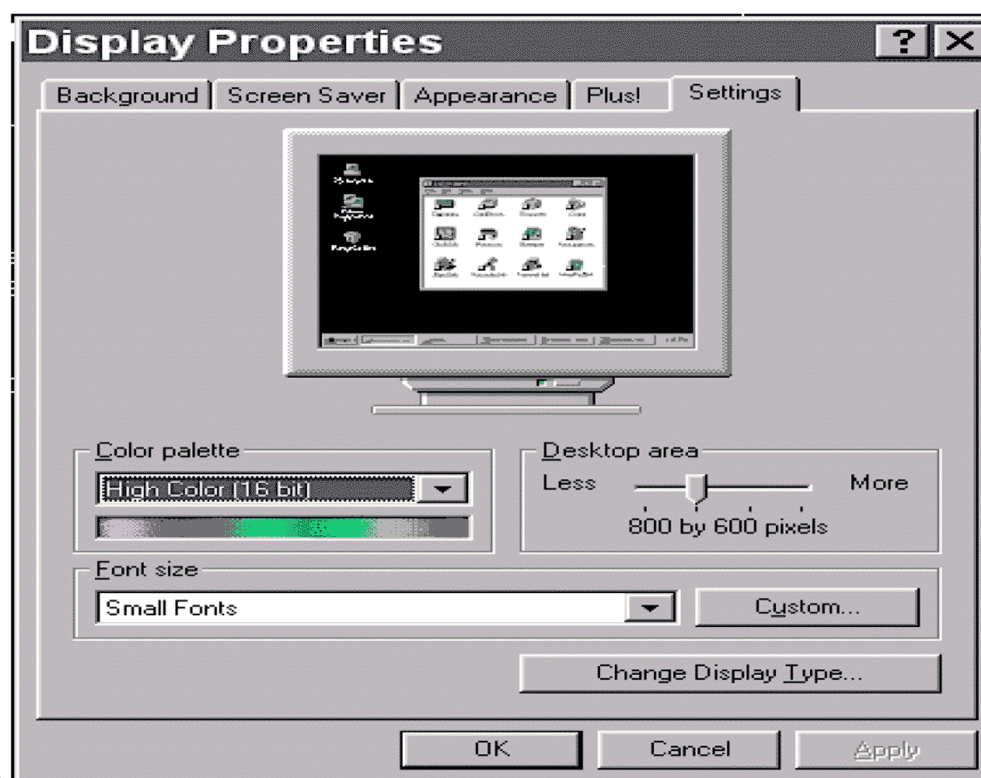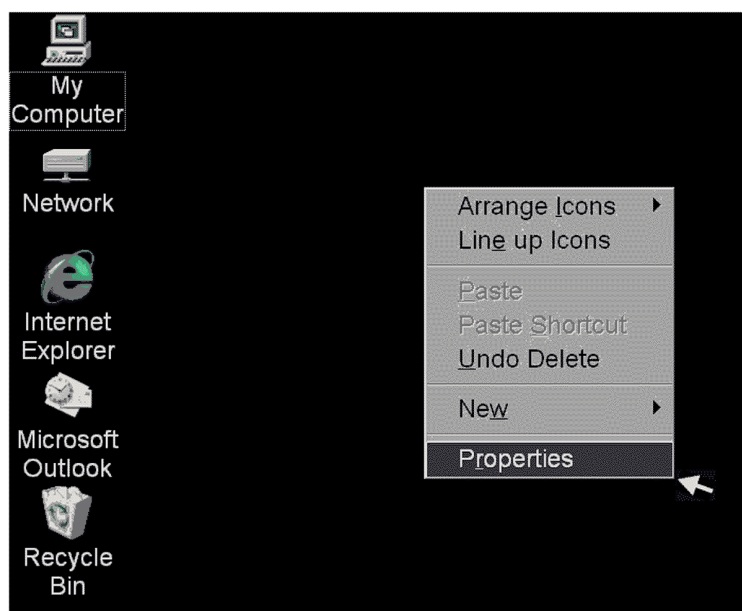
Finally, select the Settings tab.

Select the new resolution and press apply to verify that the system will function at the new settings. If everything works, select OK.

Use of a lower resolution than recommended may make it impossible to view the query grid for the predefined queries included in PaGWIS.

DATA SOURCES AND LIMITATIONS

Data in the PAGWIS database has been consolidated from numerous sources.
PaGWIS is designed around a comprehensive modification of the USGS's Ground Water Site Inventory national database. Definitions of the database fields also mirror GWSI where there is a one to one correspondence. In some cases the PaGWIS field sizes have been increased to allow for more detail. PaGWIS also uses data types, such as Date fields, available in Microsoft Access.

PaGWIS version 3.0 contains data from the following sources:

Water Well Inventory (WWI)

This database contains information regarding 165,827 wells, 123,351 of which have latitude and longitude values. This database was created by the Pennsylvania Geological Survey to manage data supplied to them by water well drillers. Data submission began in 1966 using paper forms. Latitude and longitude was determined in the office by interpreting both handwritten directions and a hand-drawn map supplied by the driller. Most of the location and data entry work has been done by temporary employees of the agency, so it is of varying reliability. Typically one county was worked on at a time. No data entry has been done since August of 1994, when York county was updated. Records submitted since the last update are filed by county and township in the Harrisburg offices of the Pa Geological Survey and can be examined by visiting that office. In 1999 the paper files were searched for records that could be located with minimum effort. Interns began assigning coordinates and entering the data for these selected wells. That data will be added to PaGWIS once it has been reviewed. The date of the last update for the Water Well Inventory in each county can be found in field *Last_WWI* of the table *tblCountyCodeLU*. Although since 1966 drillers have been obligated by law to submit a completion report for every water well constructed in the state, it is estimated that many thousands go unreported each year.

Ground Water Site Inventory (GWSI)

GWSI is part of the United States Geological Survey's WATSTORE system, a national database to manage water data. PaGWIS contains information on 44,411 wells and 1,538 springs from this database and is current through July, 1998. Locations for all GWSI sites have been determined through a field visit. Most of the data in GWSI resulted from water resource studies conducted by either the Pennsylvania or United States Geological Surveys. Much of this same data and the resulting interpretation, can be found in the published reports from these studies. Since 1966 the WWI data, discussed above, has provided the starting point for many of the sites in GWSI, so it is likely that there is some duplication in the two datasets. GWSI contains a wealth of historical data, some dating to the early 1900's.

Quality of Water (QWData)

This is the water quality portion of the United States Geological Survey's WATSTORE system. PaGWIS contains the results of more than 479,515 individual parameters conducted on 18,217 samples collected at 7,265 wells and 524 springs across Pennsylvania. The database uses standardized codes to identify the 10,419 different parameters the database is designed to store.

Public Water Supply Wells

Data on selected public water supply wells was provided by the Bureau of Water Supply Management in Pennsylvania's Department of Environmental Protection (DEP). PaGWIS contains information regarding 9,067 public water supply wells which were not present in either WWI or GWSI. Many of these wells were constructed prior to the Water Well Inventory. A higher percentage of public water supply wells go unreported to the WWI because drillers mistakenly believe the consultant overseeing the construction will submit the completion report.

Pesticide Survey

Data for 172 wells was supplied by The Pennsylvania Department of Agriculture as a result of a two-year study of pesticides in ground water. Generally the WWI provided base information for the field verification and sampling of these sites.

In addition to the sources listed above, data from several other sources are being worked on and will be added as they become available. These include data from the Internet-based collection of the Water Well Inventory data, and data from the files of the Ohio, Susquehanna, and Delaware River Basin Commissions. Some PaGWIS data tables (tblDrillersLogInfo for example) will have limited data until data from these other sources becomes available.

INSTALLATION AND SETUP

PaGWIS contains two different data systems. The first is a set of two Microsoft Access databases. The second is a rudimentary computer mapping application and related geographic data (called coverages) for Pennsylvania. Before proceeding we need to make sure that the Windows Explorer program on your system is set up to show complete file names and detailed file lists. All of the directions assume you are using the "standard" Windows Explorer and not the "Active Desktop". The same options under Active Desktop may be in slightly different locations. Anyway, start Windows
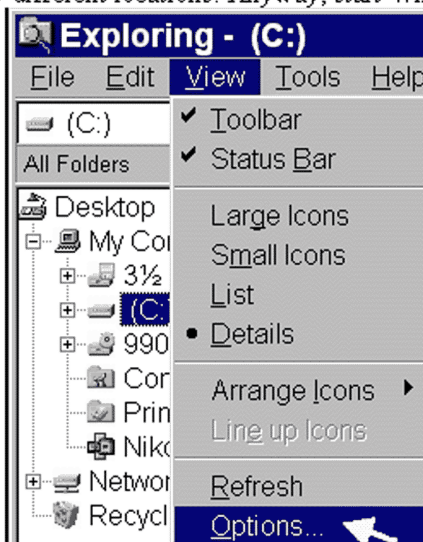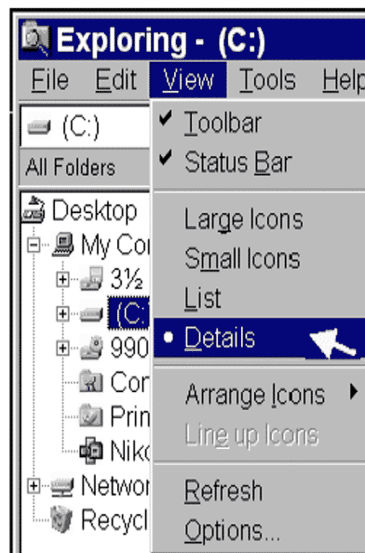

Explorer. From Explorer's menu select *View/Options*.

In the dialog box that opens check the *Show All Files* box, and un-check the *Hide file extensions for known file types* box.
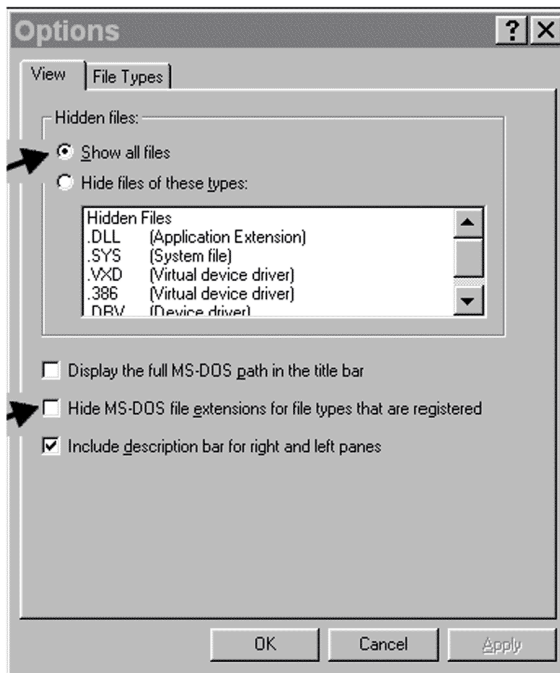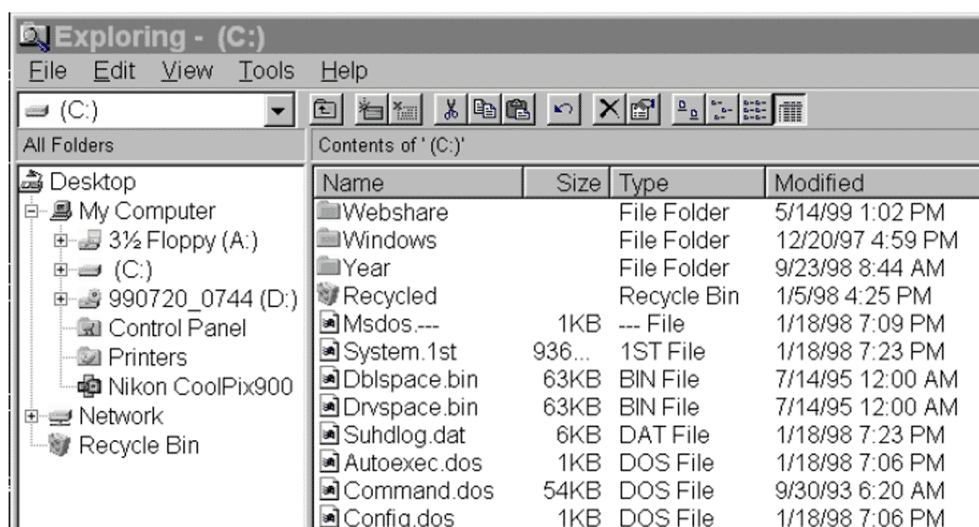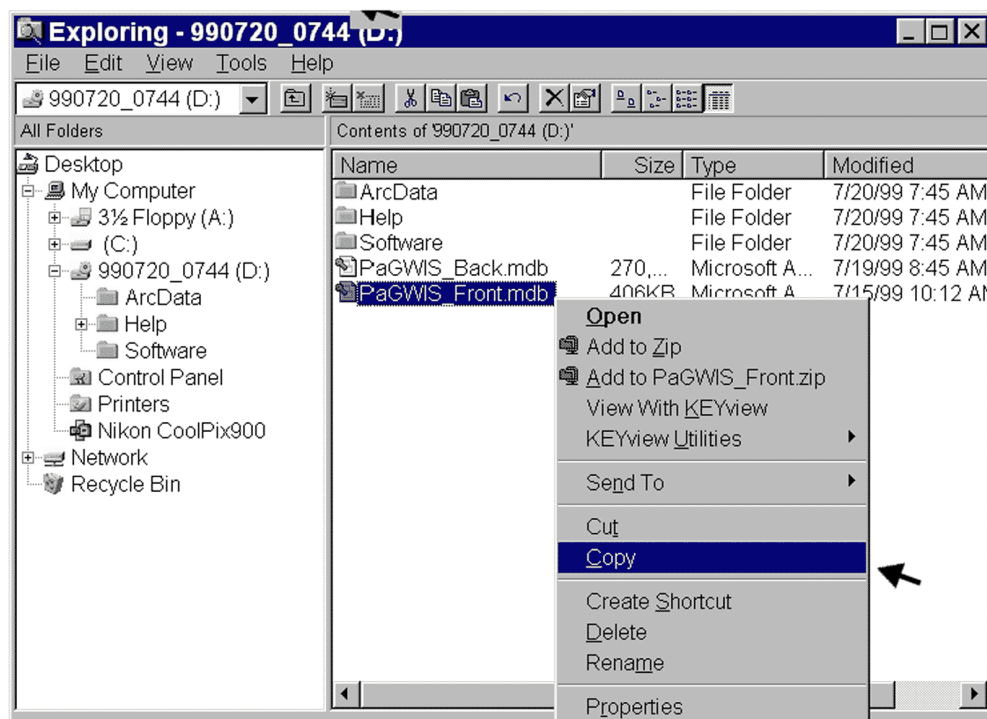
Click *OK*.

Finally, execute menu option *View/Details*.

The right pane of Windows Explorer should now display a running list of files with each name preceded by a small icon and ending in a three-character extension denoting the file type.

Unlike previous versions of PaGWIS, version 3.0 provides an interface which can be used to specify both the type of data (spring, well, or water quality) desired and the geographic boundaries of the search area. The interface is actually a separate Access database that must be installed on the users system and then linked to the data on the CD-ROM. To install the interface simply copy the file *PaGWIS_Front.mdb* to a directory on your hard drive.

Next you must remove the *Read-Only* attribute that was set when the file was copied from the CD. To remove the *Read-only* attribute, use Windows Explorer to navigate to the *PaGWIS_Front.mdb* file on your hard drive. Use the right mouse button to click on the file name. Select *Properties* from the menu that opens.
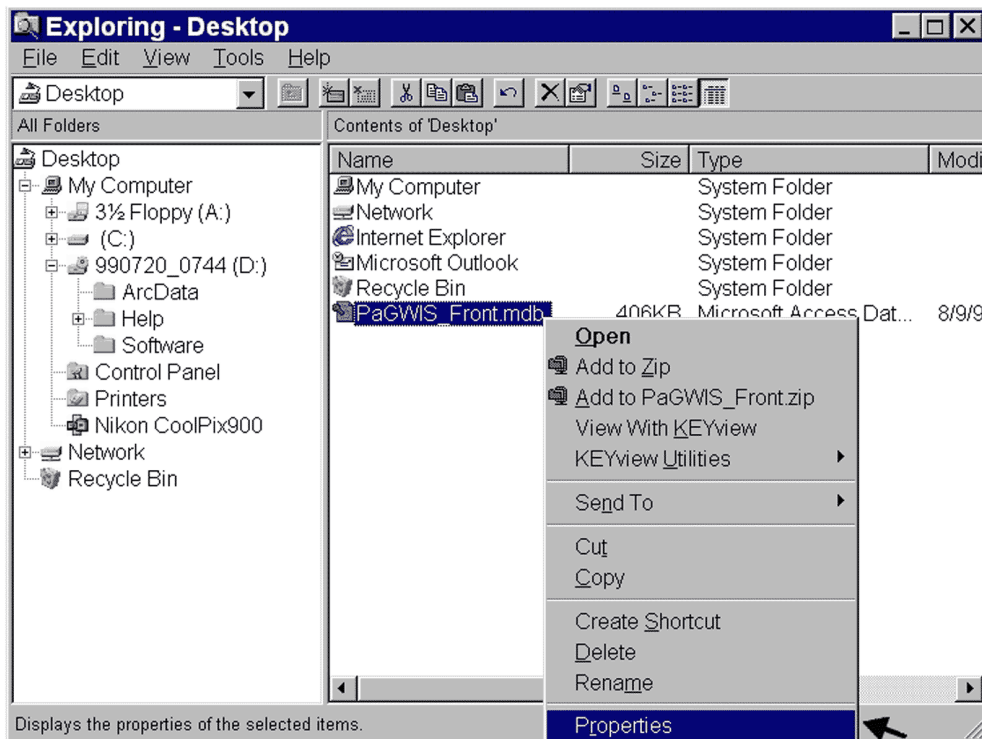
Un-check the *Read-Only* box in the dialog box that opens. Click *OK*.
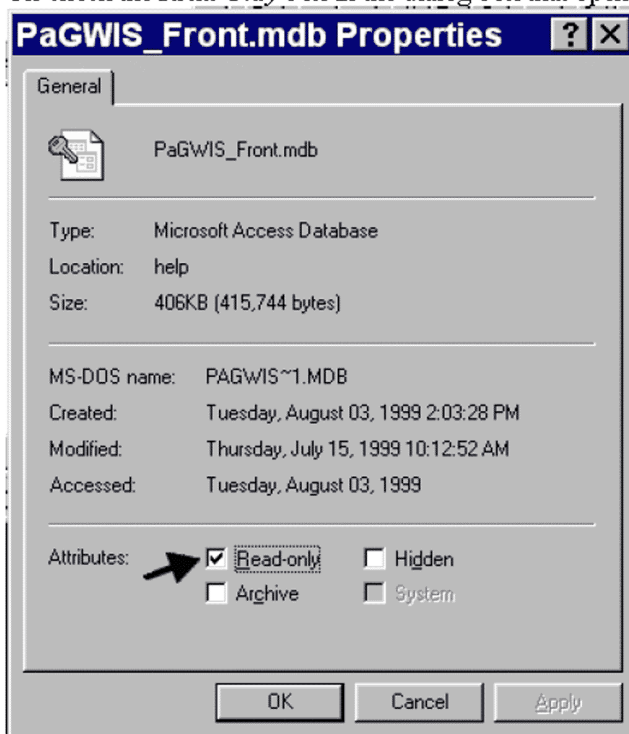
Now open the ***PaGWIS_Front.mdb*** in Access. This is most easily done by returning to Windows Explorer and double-clicking on the file name. The primary data retrieval form opens automatically when the database is opened.

PaGWIS_Front.mdb contains only the interface so it must be told where to find the data before a retrieval can be run. This is done be executing menu option *File/Get External Data/Link Tables*.
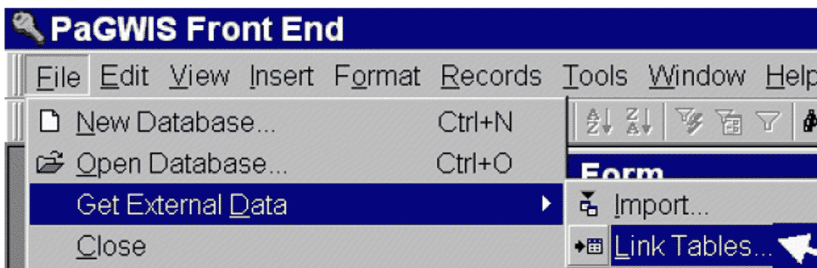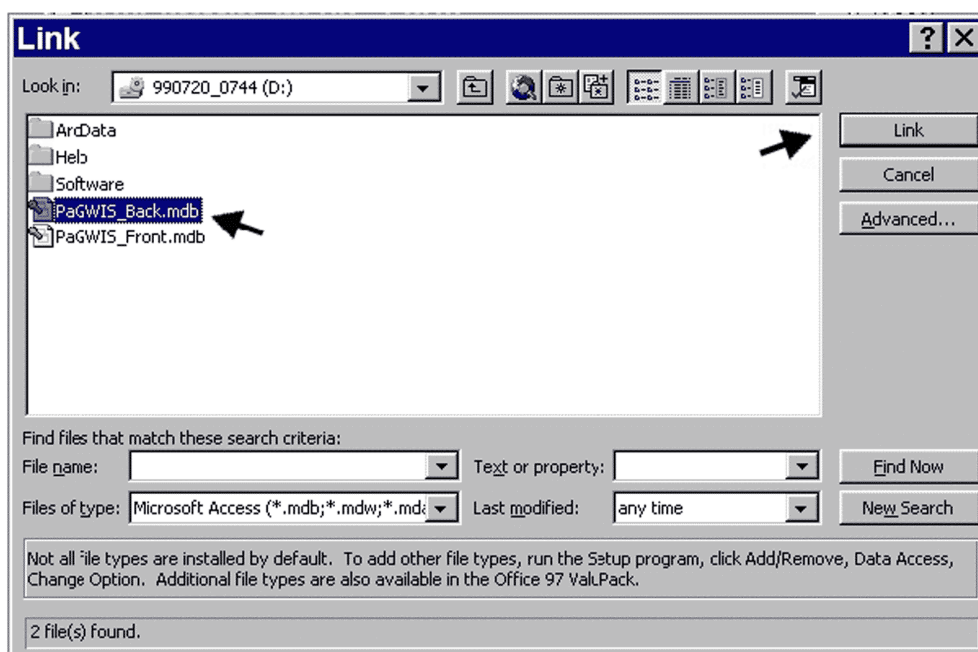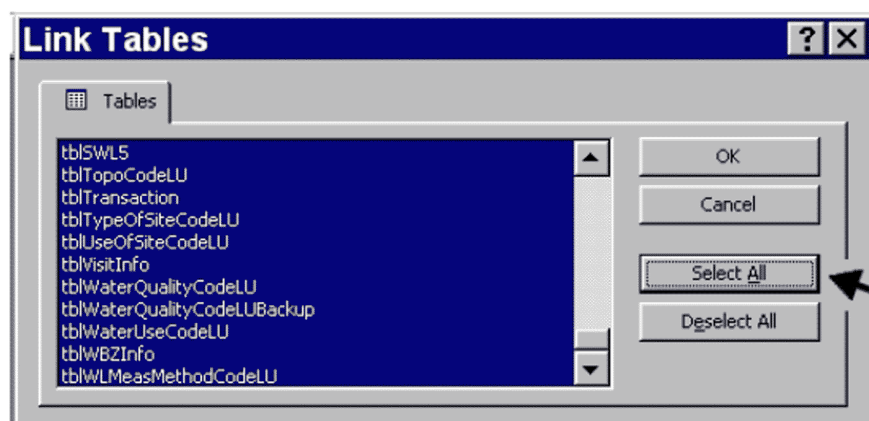

A file navigation window will open. Use it to navigate to file *PaGWIS_Back.mdb* on the CD-ROM drive of your PC.

Highlight the file and click the Link button.

The file dialog box will be replaced with the Link Tables dialog. Click on Select All and then OK.

The program will begin to work and after some time, you should receive a message that all tables have been successfully linked. PaGWIS is now ready for data retrieval. Each time *PaGWIS_Front.mdb* is started it will attempt to re-establish the links to the tables on the CD-ROM.

ArcExplorer

The mapping application consists of ESRI's ArcExplorer software and a wealth of geographic data, called coverages, which are usually read from the CD-ROM. To install ArcExplorer, simply use Windows Explorer to navigate to file *\Software\aesetup.exe* on the CD-ROM.
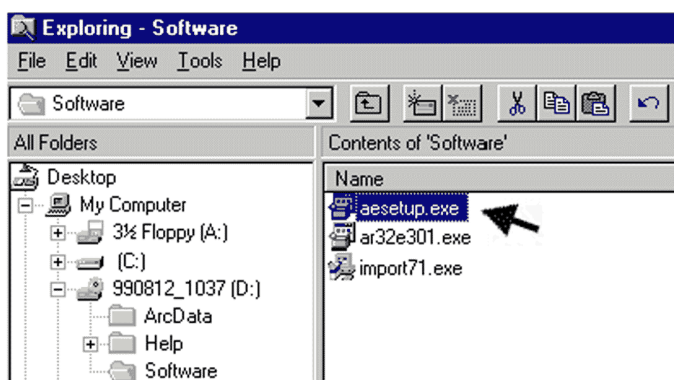
Double click on the file name to begin the setup program. The setup process is similar to most Windows programs. Generally it is advisable to allow setup to install the files in the directories it suggests. A rather comprehensive users guide is installed in the same directory with the software. This manual is in Adobe Acrobat format so it requires a free reader application in order to view it. The Acrobat Software can be installed from the CD if it is not currently on your system. If you are uncertain whether your system has Adobe Acrobat simply use Windows Explorer to navigate to the ArcExplorer directory (if you selected the default during installation then that would be C:\Program Files\ESRI\ArcExplorer). Look for a file named *arcexplorer.pdf*.
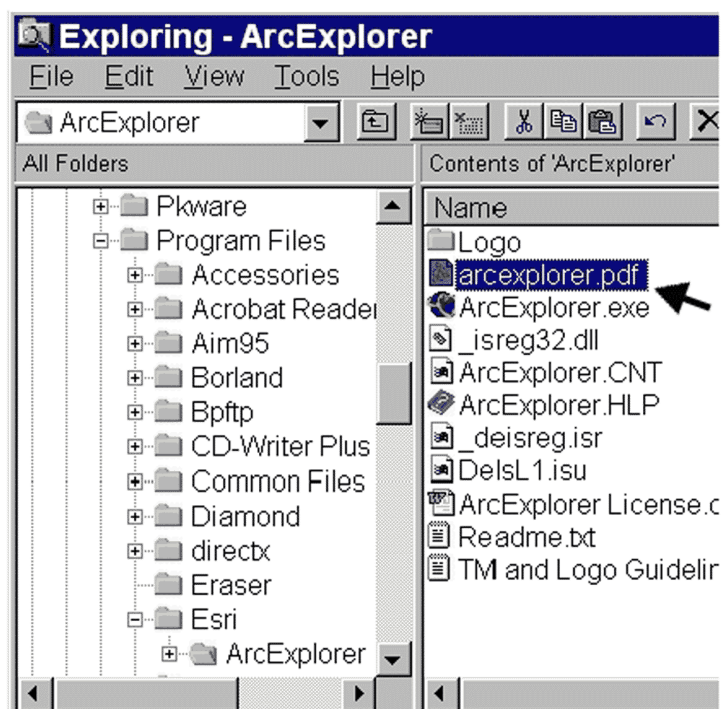
If Acrobat Reader is installed this file will have an icon that looks like a red triangle with loops at each apex. If Acrobat Reader is not installed the icon will be the Windows default, usually a white page with the flying Window logo.

ADOBE ACROBAT READER

Acrobat files are very common on the Internet, so it is advisable to install the Acrobat Reader software if it is not currently on your PC. Use Windows Explorer to navigate to the file *\Software\ar32e301.exe*.
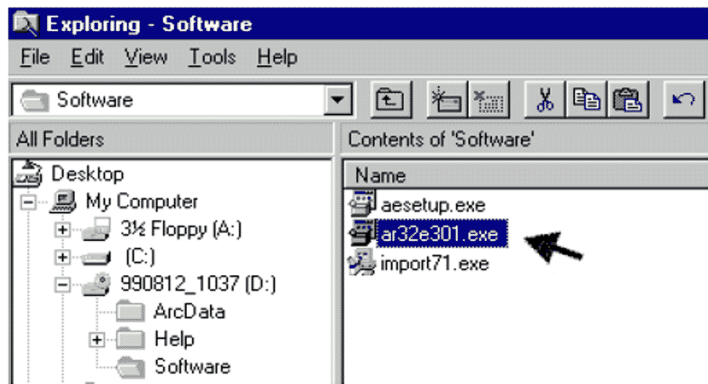
Double click on the file to start the setup program.

USING THE PAGWIS DATABASE

Microsoft Access uses the Database Window to keep track of the different objects in PaGWIS. Similar to Windows Explorer, the database window provides several different ways to list the elements in a database. Again, similar to Explorer, more information is provided by the "Details" view. You can select the Details view by pressing the "Details" button on the Access Toolbar.
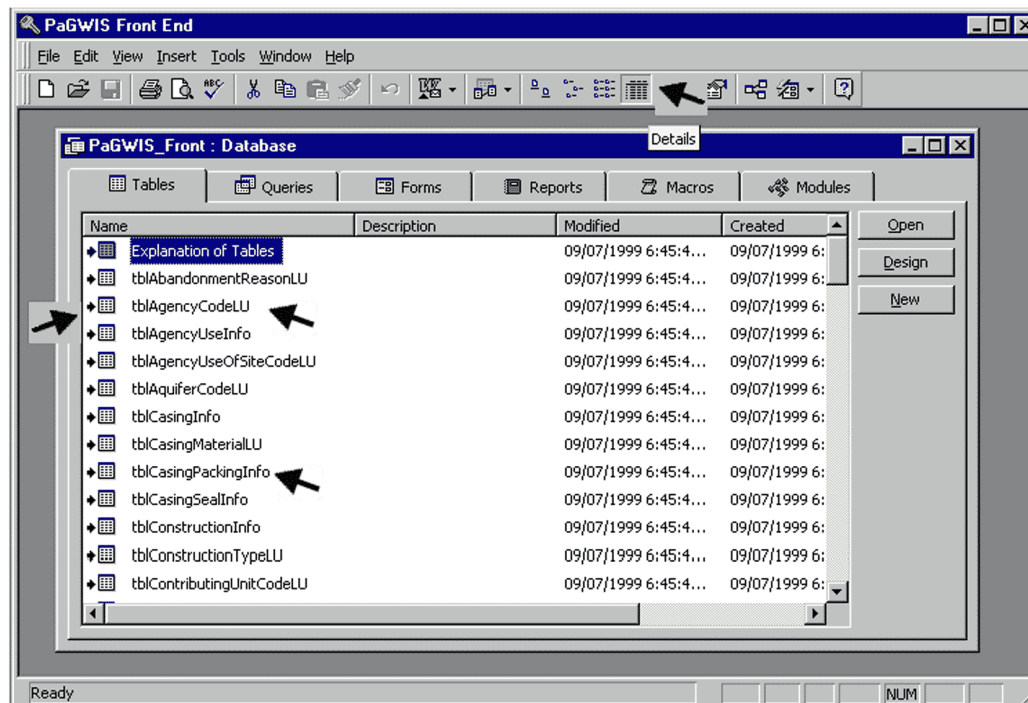
The tabs in the Database Window represent the different types of objects in an Access database. PaGWIS uses three types of objects: Tables, Queries, and Forms. Each object in PaGWIS has a name, which appears in the title bar of the window, when the object is opened. Object-naming conventions recommend that name of each object carry a prefix indicating the type of object. In PAGWIS table names begin with *tbl*, query names with *qry*, and form names with *frm*.

Click on the Tables tab to see a list of all of the tables used by the database. An arrow in front of the table name indicates that the table is linked to the database. All tables in PaGWIS are linked. There are two types of tables in PaGWIS, those that hold the data describing the wells, springs, and water quality, and those that are used to translate codes used to represent the data in the database. To efficiently utilize computing resources, codes are used to represent much of the data in PaGWIS. For

example, a water-use code of "H" is used to indicate that the water from the well is used for domestic purposes. Names for tables that contain information on the wells and springs carry an "Info" suffix. Names for tables that are used to translate codes carry an "LU" (for Look Up) suffix.

After the interface is set up, as described above, the PaGWIS database can be started by simply double clicking on the *PaGWIS_Front.mdb* file in Windows Explorer. This will start Access, load the interface file, and open the form that serves as the main menu.

The main data retrieval form is broken into two major areas. The top portion of the form is used to retrieve data for an entire county.

The bottom portion of the form is used when a latitude-longitude based query is desired.

**Define a Data Retrieval using
Latitude and Longitude**

	Decimal Degrees	**Degree-Minute-Second**
Rectangular Polygon		
Radius Around a Point		

Select the button that represents both the format of the coordinates to be
entered and the geometry of the search

For each retrieval scenario the user has four possible types of information to retrieve: Well Data, Spring Data, Well-Water Quality, and Spring-Water Quality. Each data type can be retrieved by pressing a button on each retrieval form.

PaGWIS is a huge database so retrievals from the CD-ROM can take considerable time. Once you have pushed one of the retrieval buttons please be patient. If you find it necessary to interrupt a retrieval that is running, hold down the Control key and press the Break key.

PaGWIS Front End ☒

You canceled the previous operation.

OK
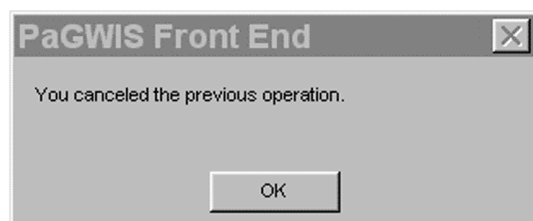
USING THE DEFAULT MENU

County-based retrievals can be run from the main menu simply by selecting the county name and pressing the button for the type of data desired. Note that the list of county names is read from the CD so it can take a little time to populate the list for the first time during each session. More than 40,000 wells from the Water Well Inventory have no coordinates so they will only show up in a county based retrieval.

frmPaGWIS_Menu : Form

Pennsylvania Ground Water Information System
Data Retrieval Menu

DO NOT PRESS   Due to the relational nature of this database, a retieval may contain more than one line per well

Retrieve Data for an entire County

| Well Data | Well-Water Quality |
| Spring Data | Spring-Water Quality |

ADAMS
ALLEGHENY
ARMSTRONG
BEAVER
BEDFORD
BERKS
BLAIR
BRADFORD

Results will be sorted by Municipality, Record Source, then Well ID

Results will be sorted by Record Source, Well ID, Date Sampled, and Analysis Code.

Queries defined by latitude and longitude can take two forms. The first is a rectangular area bounded by the latitudes and longitudes entered by the user. The second is an approximation of a radial search around a point. The radial search requires the entry of the latitude and longitude of the center and a radial distance in miles.

For either of these search methods the latitudes and longitudes can be entered in one of two different formats: Degree-Minute-Second or Decimal-Degree. The combination of search method and latitude longitude format results in four possible search scenarios, each of which is represented by a button on the bottom of the main-menu form. Pressing one of these buttons will open a form specific to the search geometry and coordinate format.

Define a Data Retrieval using
Latitude and Longitude

	Decimal Degrees	Degree-Minute-Second
Rectangular Polygon		
Radius Around a Point		

Select the button that represents both the format of the coordinates to be entered and the geometry of the search

frmDD_LAT_LON_Poly : Form

Polygon Search - Decimal-Degree Format

40.5
Latitude North

76.5
Longitude West

76.0
Longitude East

40.0
Latitude South

Well Data

Spring Data

Well-Water Quality

Spring-Water Quality

Enter coordinates as positive numbers in decimal-degree format. All fields must be filled before pressing a Query Button.

Results will be sorted by County, Municipality, Record Source, then Well ID

Results will be sorted by County, Record Source, Well ID, Date Sampled, and Analysis Code.

Define a Data Retrieval using Latitude and Longitude

	Decimal Degrees	Degree-Minute-Second
Rectangular Polygon		
Radius Around a Point		

Select the button that represents both the format of the coordinates to be entered and the geometry of the search

frmDMS_LAT_LON_Poly : Form

Polygon Search - Degree-Minute-Second Format

```
                            °      '      "
                          40 — 30 — 01
                           Latitude North
```

```
  °     '      "                                        °      '      "
 76   30   01                                          76   00   01
 Longitude West                                         Longitude East
```

```
                            °      '      "
                          40 — 00 — 01
                           Latitude South
```

Enter coordinates in degree-minute-second format. All Fields must be filled before pressing a Query button.

| Well Data | Well-Water Quality |
| Spring Data | Spring-Water Quality |

Results will be sorted by County, Municipality, Record Source, then Well ID

Results will be sorted by County, Record Source, Well ID, Date Sampled, and Analysis Code.

Define a Data Retrieval using Latitude and Longitude

	Decimal Degrees	Degree-Minute-Second
Rectangular Polygon		
Radius Around a Point		

Select the button that represents both the format of the coordinates to be entered and the geometry of the search

frmDD_Lat_Lon_Rad : Form

Radial Search – Decimal-Degree Format

This retrieval approximates a radial search around a fixed location. The results will include wells in the "corners" of this figure

76.000000
Longitude

40.000000
Latitude

.5
Radius in Miles

Enter the coordinates of the center as a positive number in decimal-degree format and the radius of the search in miles. All fields must be filled before pressing a Query Button.

Well Data

Spring Data

Results will be sorted by County, Municipality, Record Source, then Well ID

Well-Water Quality

Spring-Water Quality

Results will be sorted by County, Record Source, Well ID, Date Sampled, and Analysis Code.
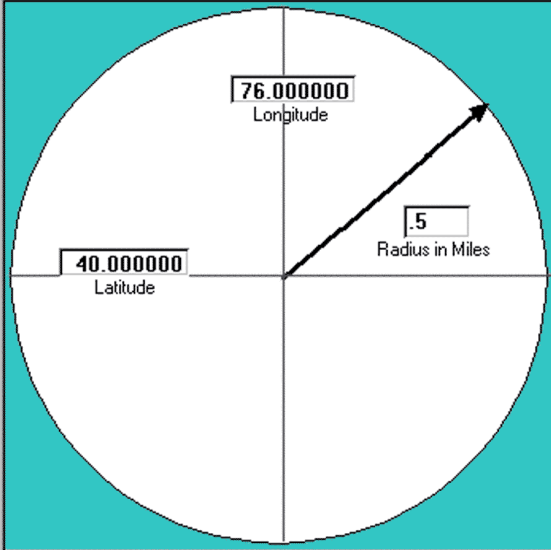
Define a Data Retrieval using Latitude and Longitude
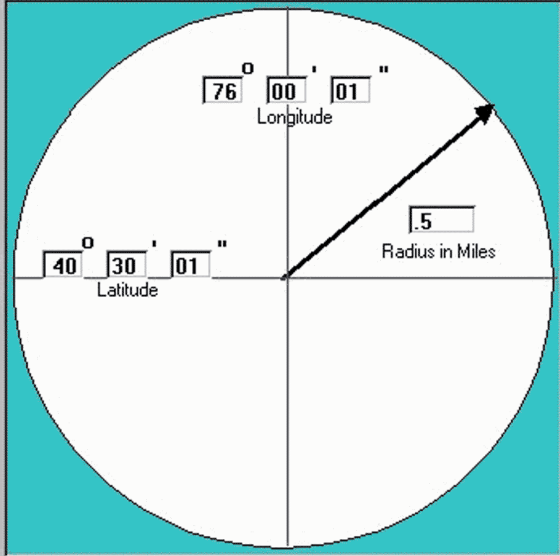
	Decimal Degrees	Degree-Minute-Second
Rectangular Polygon		
Radius Around a Point		

Select the button that represents both the format of the coordinates to be entered and the geometry of the search

frmDMS_Lat_Lon_Rad : Form

Radial Search - Degree-Minute-Second Format

This retrieval approximates a radial search around a fixed location. The results will include wells in the "corners" of this figure

76° 00' 01"
Longitude

40° 30' 01"
Latitude

.5
Radius in Miles

Enter the coordinates of the center in degree-minute-second format, the radius of the search in miles. All fields must be filled before pressing a Query Button.

Well Data

Spring Data

Results will be sorted by County, Municipality, Record Source, then Well ID

Well-Water Quality

Spring-Water Quality

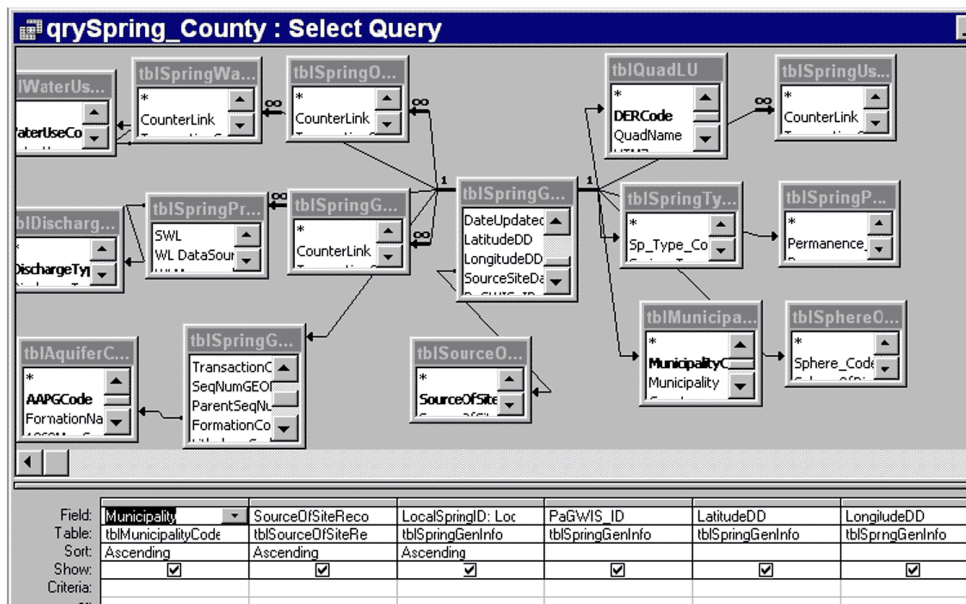Results will be sorted by County, Record Source, Well ID, Date Sampled, and Analysis Code.

The user can then enter the required information. Note that the forms using degree-minute-second format require two digits for each of the degree, minute, and second entries. Use a "0" before all minute or second entries that are less than 10. To simplify data entry the cursor moves to the next entry block as soon as the second number has been entered. There is no need to tab or "mouse" to each field. Also, coordinates should be entered as positive numbers. Be careful to get the correct geographic sense for each coordinate pair: largest longitude on the left, largest latitude on the top.

MODIFYING QUERIES TO GET THE DATA YOU WANT

Each button on the forms initiates an Access query that reads the data from the form and retrieves a predetermined set of fields. PaGWIS contains far more information than is offered by these elementary retrievals. With a working knowledge of Microsoft Access the queries provided as part of the menu system can be copied and modified to retrieve whatever the user desires. One easy way to start this process is to run a retrieval using a system query. Once the results are posted to the screen, change the query to design view by pressing the toolbar button on the left side of the toolbar. The button looks like pencil next to a turquoise drafting triangle.
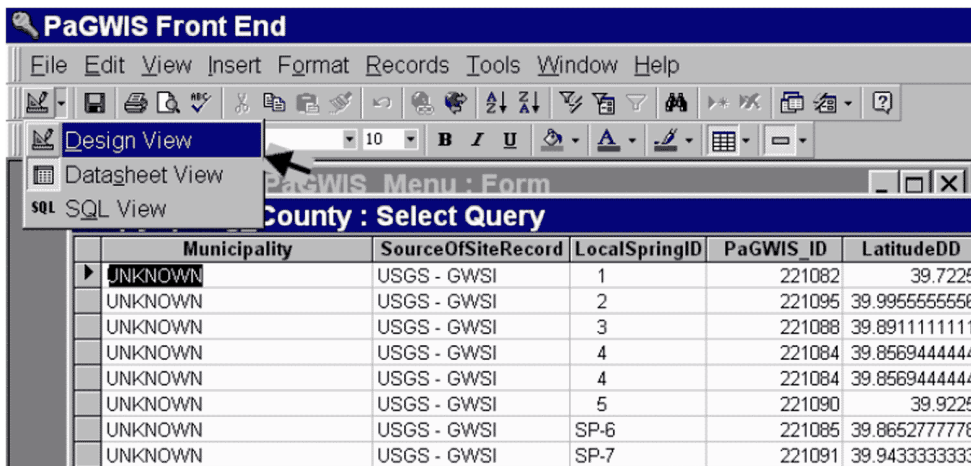
To avoid changing the system query, once the query is displayed in design mode

you should execute menu option *File/Save As/Export* and make a copy of the query.

PaGWIS Front End

File   Edit   View   Insert   Query   Tools   Wind

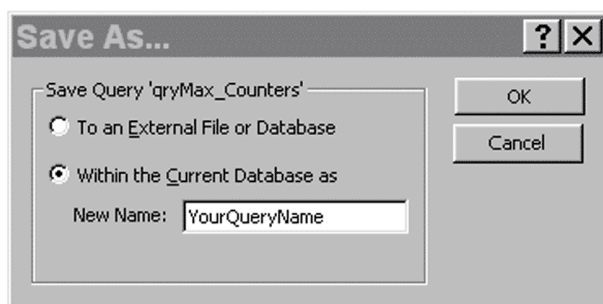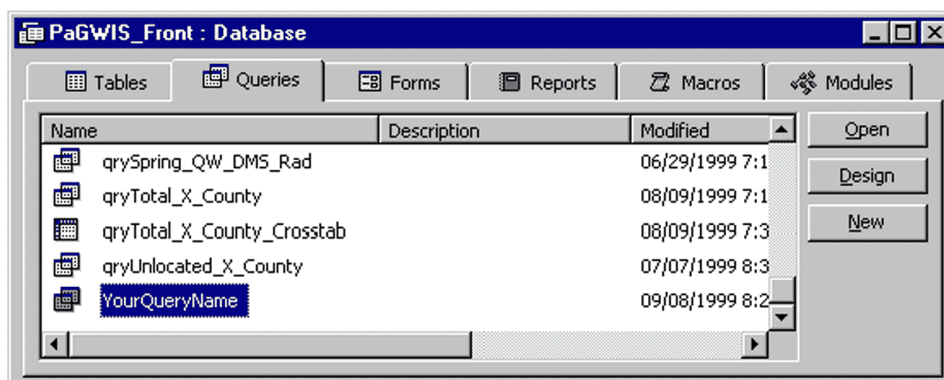|		
New Database...	Ctrl+N	
Open Database...	Ctrl+O	
Get External Data	▶	
Close		
Save	Ctrl+S	
Save As/Export...		
Save As HTML		
Page Setup...		
Print Preview		
Send...		
Database Properties		
1 C:\SHARED\HELP\PaGWIS_Front		
2 H:\PAGWISCD\PaGWIS_Front		
3 H:\PCInventory		
4 H:\software		
Exit		
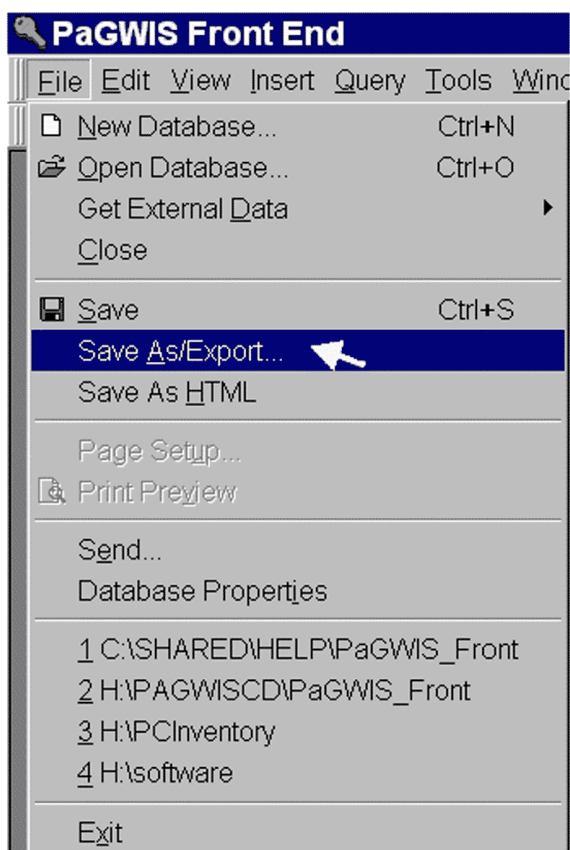
This will open a dialog that allows you create a copy of the query. Give it a name and select OK.

Save As...   ? X

Save Query 'qryMax_Counters'
○ To an External File or Database
● Within the Current Database as
   New Name: YourQueryName

[OK]
[Cancel]

You are now working on the copy so you can make any modifications without affecting the standard PaGWIS functionality. Because the queries read data from the forms, it is important that the form be opened and the fields populated before the query is run. Using the menu system this happens by default, however, when you create a new query that is not activated by the menu, it too will require the form to run correctly. We recommend that you proceed through the PaGWIS menu until you are ready to press a query button, then simply navigate to the Database Window, select the Queries tab, and double click on your new query to run it.

PaGWIS_Front : Database

| Tables | Queries | Forms | Reports | Macros | Modules |

| Name	Description	Modified	
qrySpring_QW_DMS_Rad		06/29/1999 7:1	Open
qryTotal_X_County		08/09/1999 7:1	Design
qryTotal_X_County_Crosstab		08/09/1999 7:3	
qryUnlocated_X_County		07/07/1999 8:3	New
YourQueryName		09/08/1999 8:2	

USING ARCEXPLORER

ArcExplorer 1.0 is offered under license from ESRI (www.esri.com) as a viewer for geographic data. Arc Explorer 1.1, a slightly enhanced version, is available for download from www.esri.com. Version 1.1 has specific system requirements. Please be sure to read the documentation before trying to install this version. Most of this data must be in the proprietary format of either their Arc/Info or ArcView software packages. The PAGWIS CD-ROM contains data in the Shape file format used by ESRI's ArcView program. ArcView and Arc/Info are known as Geographic Information Systems (GIS). GIS programs are sophisticated mapping applications that can manipulate and interpret the relationships between different types of geographic data. Each type of data is plotted as a separate layer (also called a coverage) by the GIS. ArcExplorer is a very rudimentary GIS, providing the layered display and limited querying of existing geographic data. It does not have the capability to conduct spatial analysis (relate one layer to another in space) or to create new geographic data.

After installing the program navigate to the ArcData directory of the CD and double click on the file **_Pa_Wells.aep_**.
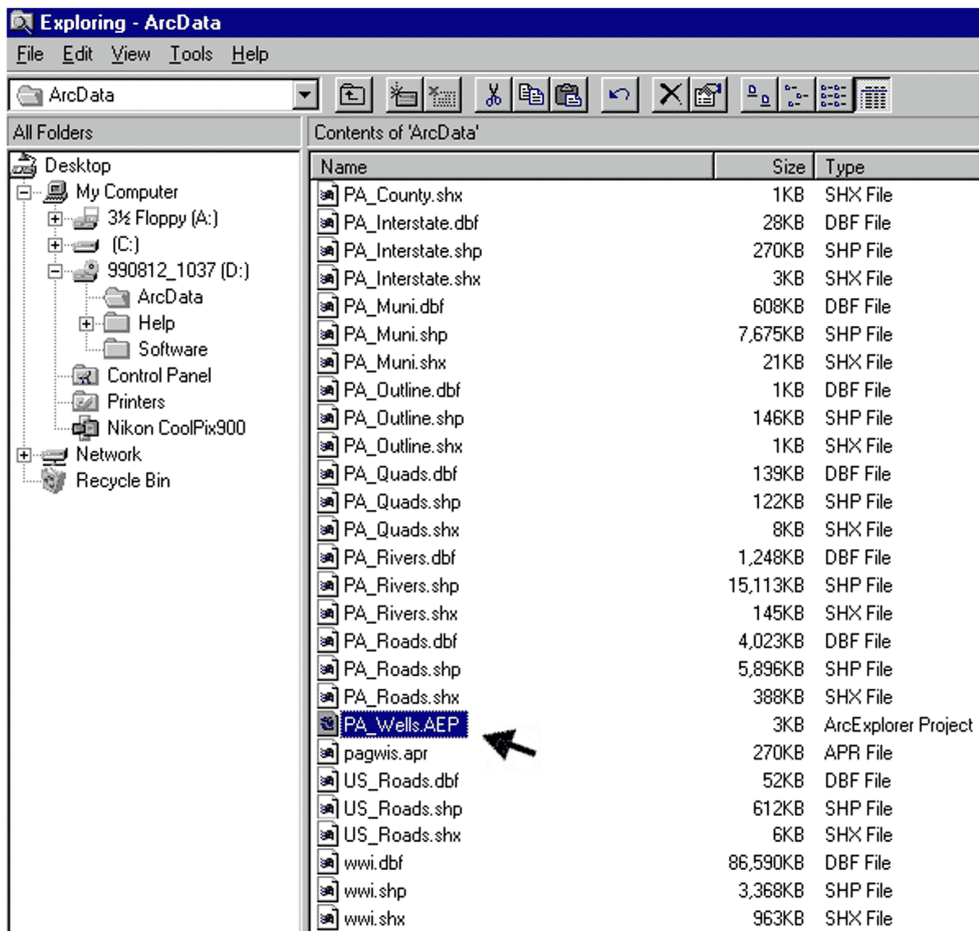
This will load a pre-configured map that accesses most of the geographic data on the CD-ROM. Once the display is complete, maximize the ArcExplorer window so it fills the entire screen. The ArcExplorer window consists of a list of the layers (called Themes) on the left and a map on the right.
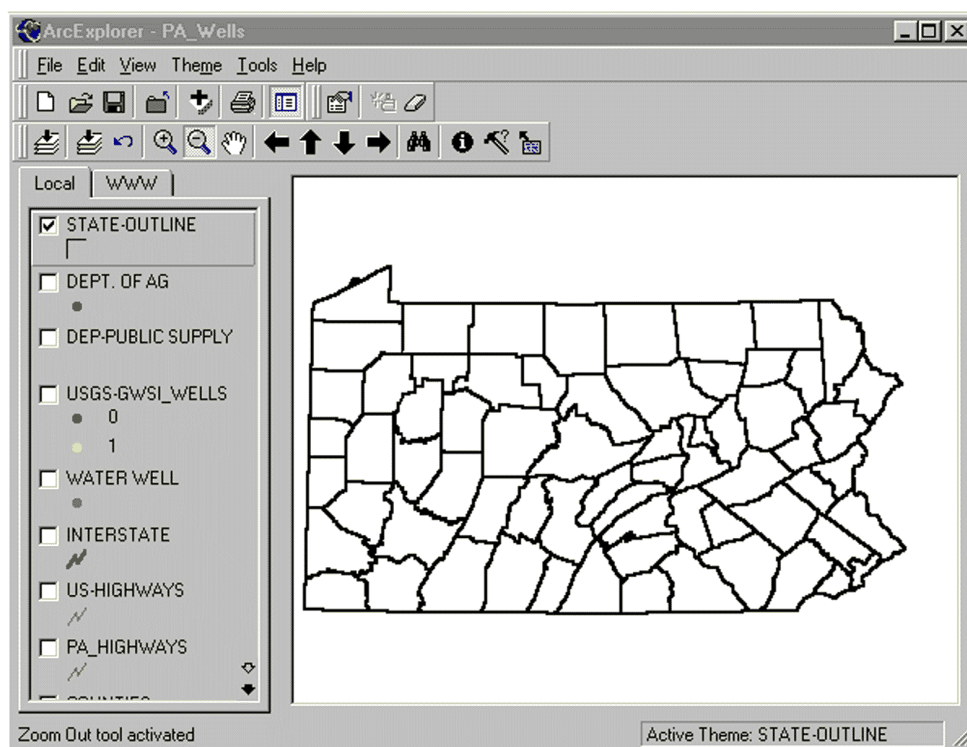
Each theme can be turned on or off by checking or un-checking the box next to the name. To speed the initial loading of the map, only the counties and state outline are turned on. Other layers can be turned on as desired, but keep in mind that it can take considerable time to post the data to the screen.

Themes on the bottom of the list are plotted to the screen first; those at the top plot last. The sequence can be changed by clicking on the theme name and dragging it up or down the list. Double clicking on a theme will open the theme properties dialog.
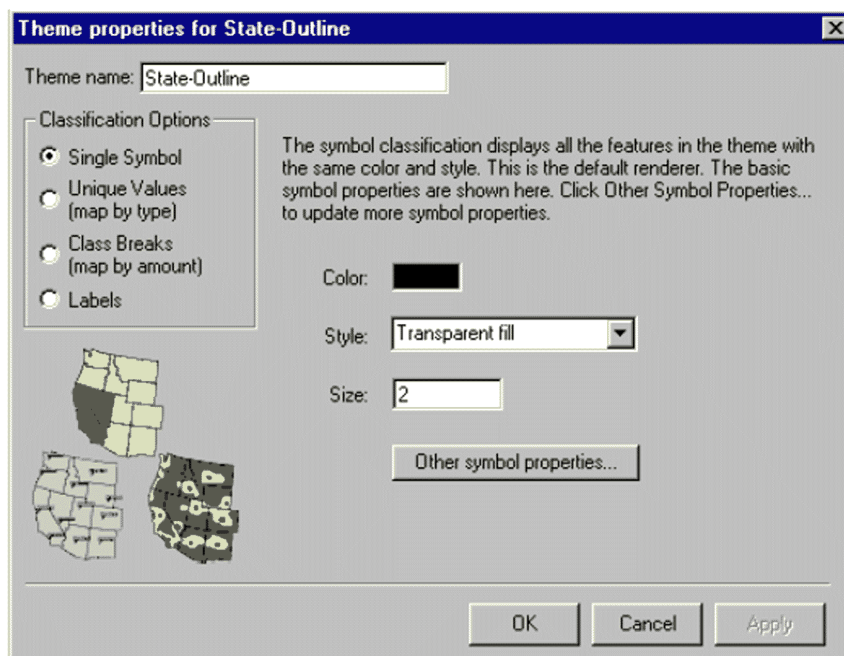
Properties control how the theme is displayed, whether a label is displayed, or whether the display is varied according to one of the theme's attributes (such as well yield). If you want to save the changes

you make to an ArcExplorer project you will need to save the file to your hard disk

LIMITATIONS

ArcExplorer and the included Pennsylvania geographic data provide the PaGWIS user with a quick means of determining whether there is PaGWIS data in a region of interest. The ArcExplorer coverages are not meant to serve as replacement to the Access Databases. ArcExplorer is not intended, and in fact, cannot produce subsets of the database for publication purposes. While maps can be printed, there is little flexibility in the process. We recommend that ArcExplorer be used merely to get an overview of what to expect from a PaGWIS retrieval. As discussed under the section on installing ArcExplorer, a good user's manual is provided in Adobe Acrobat format. All users should read this manual to become familiar with the capabilities of the software. We will not provide individualized instruction on ArcExplorer functionality.

ArcExplorer and its associated geographic coverages for Pennsylvania provide what can best be described as a frustratingly limited, yet fairly sophisticated, means of interacting with a subset of the PaGWIS data. Many of the limitations arise because PaGWIS is a relational database. This means that each well or spring can have multiple entries for many types of data. For instance, PaGWIS is designed to allow for the multiple entries for ownership of each well and spring. While this flexibility permits us to track changes in ownership, it causes problems when we want to extract only a single owner for each well or spring. Because the ArcExplorer coverages can only display one point for each well or spring, we can only display one value for each of these repeatable fields. In most cases we have chosen to display the most recent entry.

PROJECTION OF COVERAGES

In order for ArcExplorer to display Pennsylvania in the shape most users expect, it is necessary to project the data layers. This projection process is exactly the same as that used by map makers when preparing a printed map. In order to use data from other sources, it must be in the same projection as the data on the CD. The data on the CD-ROM has been projected according to the following parameters:

Projection: Albers Equal Area
Datum: NAD27
Units: Meters
Spheroid: Clark 1866
First standard parallel: 40 degrees
Second standard parallel: 42 degrees
Central Meridian: −78 degrees
Latitude of origin: 39 degrees

SOURCES FOR ADDITIONAL GEOGRAPHIC DATA

PASDA (Pennsylvania Spatial Data Access) is a publicly accessible web site at Penn State University that serves a clearinghouse for Pennsylvania GIS data. Many additional coverages are available at PASDA; many of them in the same projection as the data on the PaGWIS CD. Use the URLs below to access the data:

ftp://pasda.cac.psu.edu/pub/pasda/drg24k-c/ is a FTP directory of 7.5 minute quadrangles listed alphabetically by quad name. These quads are in the Albers projection compatible with the PaGWIS data. Each zip file is about 2 megabytes. Download the archive and unzip both files into a directory on your hard drive. Add these as image themes to the ArcExplorer display.

ftp://pasda.cac.psu.edu/pub/pasda/ is a listing of coverages available on the PASDA site. Not all of this data will be in a projection that is compatible with the data on the CD. Open the *metadata* file to read about the coverage, including the projection information.

Some geographical data may be in Arc/Info Export format. Files of this type carry a filename extension like .e00, or e01. These files must be processed before they can be used by ArcExplorer. To process these files you must first install the utility named **Import71.exe** located in the *Software*
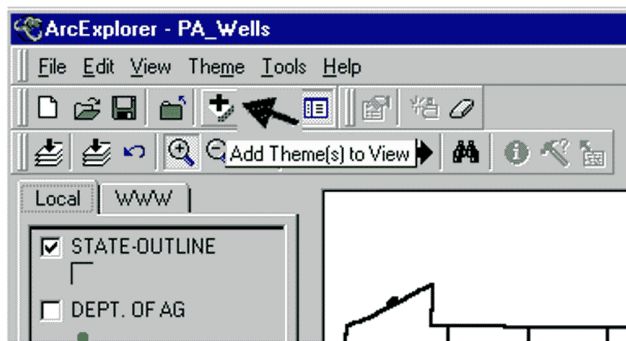
directory of the CD.
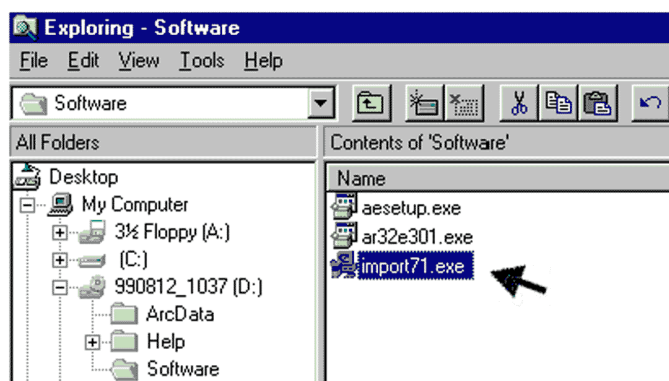
Once the utility is installed, simply start Import 71 and use the Browse button to navigate to the e00 file. Next type the directory where you want the data written and push *OK* to process the file.
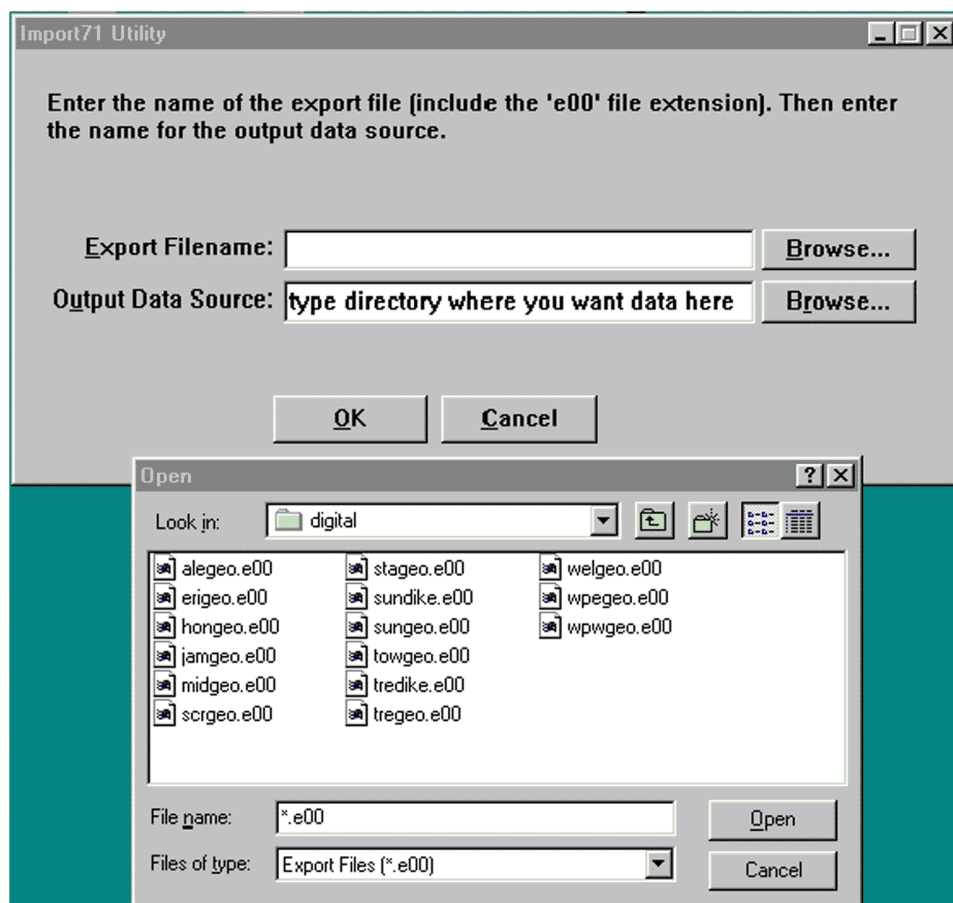
Use the *Add Theme* button on the ArcExplorer toolbar to add this coverage to the current ArcExplorer session.

For more information, email Gary Fleeger of the Pennsylvania Geological Survey.

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