KANSAS GEOLOGICAL SURVEY
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WISARD
Water Information Storage and Retrieval Database

by

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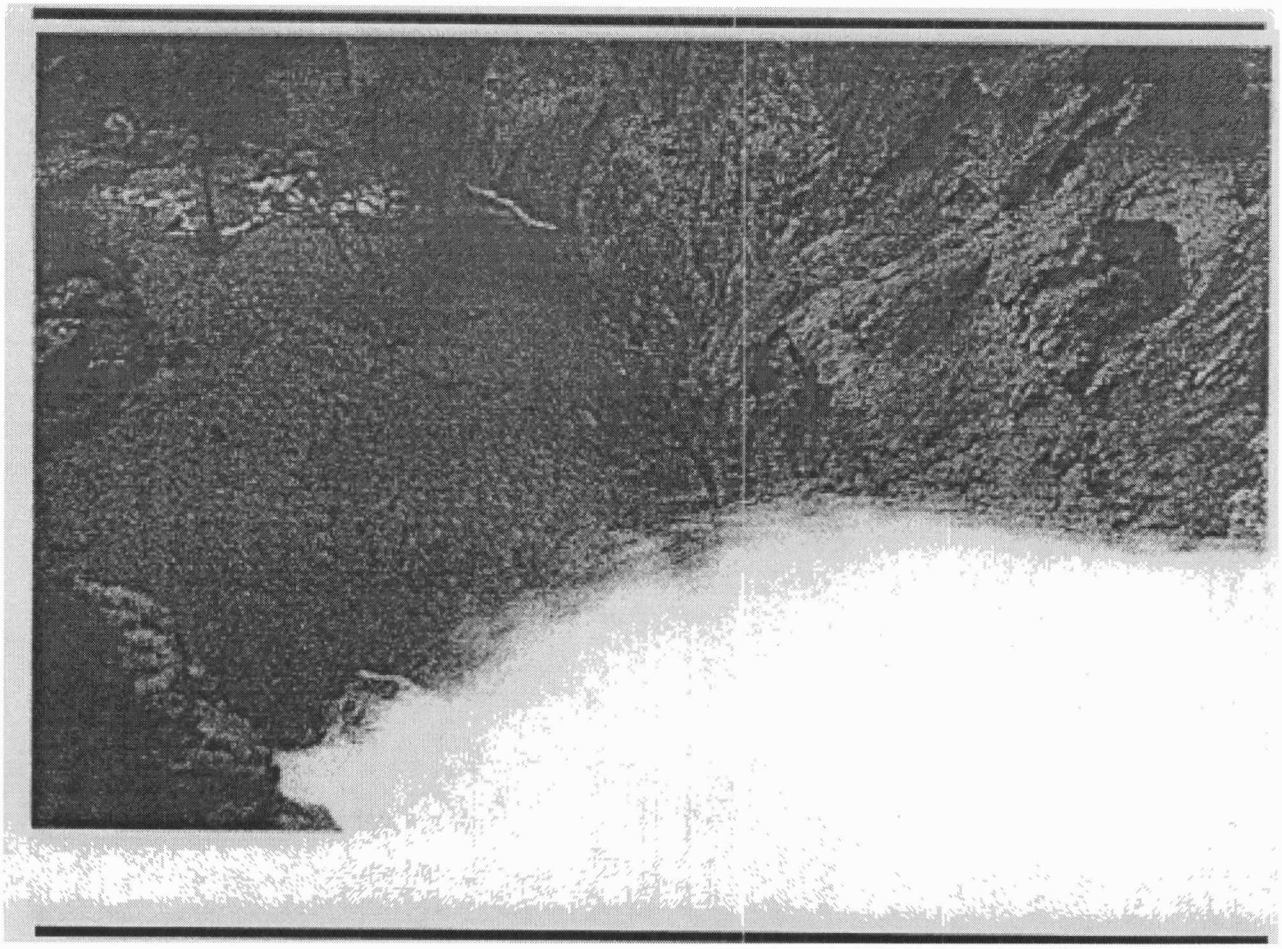

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WISARD

By

Günther Hausberger, John Davis, Rick Miller, Kurt Look, Dana Adkins-Heljeson, Gina Ross, Brett Bennett, Jeff Schloss, and Geoff Bohling

What is WISARD?

The name "WISARD" is an acronym for "Water Information Storage and Retrieval Database," a repository of information on fresh-water wells drilled into aquifers in Kansas. WISARD includes not only the data themselves, but also their arrangement and structure in a computer-accessible form that allows the information to be extracted easily and simply; the software tools needed to manage the information are included as well. WISARD resides physically as an ORACLE relational database on a computer at the Kansas Geological Survey (KGS) in Lawrence, Kansas. Water-level measurements and other information in WISARD can be accessed at the computer where the data are stored, or from any location in the world via the World Wide Web. WISARD consolidates information formerly maintained by several local, state and federal agencies. WISARD is owned and maintained by the Kansas Geological Survey for use by agencies of the State of Kansas and the citizens of Kansas. The data, with the exception of some information concerning personal ownership, are freely available to anyone*.

Water is the most precious natural resource in Kansas. Drinking water is required for urban and rural households and for livestock. Irrigation water is needed for crops and plantings. Wildlife cannot survive without water and water must be available for recreational and industrial purposes. Much of this water is taken from underground aquifers such as the High Plains Aquifer, the major source of ground water in central and

western Kansas. Over the past 50 years, irrigation pumping severely depleted parts of the High Plains Aquifer. In response, the Kansas Legislature passed the Kansas Groundwater Act of 1972, which authorizes local ground-water management districts (GMDs) to direct the equitable development and exploitation of ground-water resources. To do this, the GMDs need accurate, up-to-date information on the ground-water resources in their areas of responsibility. A variety of agencies are both generators of data and users of information on ground-water levels in Kansas. The Division of Water Resources (DWR) of the Kansas Department of Agriculture is responsible for statewide policy on water use and conservation and requires data on which to base their decisions. The Kansas Geological Survey uses information on water levels for its hydrologic research programs. The U.S. Geological Survey maintains a national database on water, relying upon information from individual states. WIZARD, the KGS's Water Information Storage and Retrieval Database, is designed to consolidate data from all of these sources and to serve as a unified provider of verified information for all potential customers of ground-water data in the State.

What is ORACLE?

ORACLE is a powerful computer database system, commercially developed and sold by Oracle Corporation of Redwood City, California. ORACLE is a registered trademark covering products that include not only the database software, but also the computer language and programming tools needed to develop and maintain the data and to generate reports and to interact with applications programs. ORACLE is probably the most widespread database system in use today for large applications. Versions of the software are available for most modern computing platforms. At the Kansas Geological Survey, ORACLE operates under the Solaris operating system on a Sun microcomputer server.

In a relational database, all data are organized in a number of tables which are connected, or related, to one another. ORACLE is a relational database; it maintains only a single copy of information and uses pointers that indicate where related information is located. In WIZARD, the primary table is SITES, which contains over 52,000 records consisting of geographic and other identifiers of specific water wells. Other WIZARD tables include AQUIFERS, CONSTRUCTION, GEOHYDROLOGIC_UNITS, OWNERS, WATER_LEVELS, and so forth.

The data in an ORACLE database can be accessed by writing special programs using a high-level computer language called SQL (Structured Query Language), or by using a utility program such as ORACLE Browser or Microsoft ACCESS. The following sections of this manual contain instructions for querying the WI2ARD database using specific application programs running on computers at the KGS, over the Internet, or via the World Wide Web.

An ORACLE database contains a number of accounts. Each account belongs to a user who has been assigned a username and password. To access WI2ARD (except over the Internet), a user must have an ORACLE account on the KGS server. Account holders can access ORACLE from any computer connected to the KGS server, including those within the University of Kansas campus network. Those beyond the campus can connect by ftp to any computer on the KU network on which they have a user's account, or can connect by modem to the KU dial-up server. Limited direct access to the KGS server is available through four modem ports that can be reached by dialing (785) 864-5765 through 5768. The Database Administrator allocates all user accounts and must be contacted to establish an Oracle account and to arrange for other access accounts that may be necessary.

What data are in WI2ARD?

WI2ARD contains information on the location and construction of Kansas wells drilled for water and water-related purposes. Except for locational information, data are not complete for all wells. Only data from wells used to monitor the water level as part of the Kansas water-level observation well network have been checked for accuracy and completeness.

For wells that are part of the statewide or local water-level observation well networks, WI2ARD contains an historic record of water levels measured at various times during the year. Most of these data consist of annual measurements of depth-to-water taken in the winter, but some wells are measured on a quarterly or monthly basis. For these wells, the data include information necessary to convert depth-to-water into water table elevation, including the height above ground level of the well access hole and the surface elevation of the well bore.

A subset of Kansas wells are measured by the Kansas Geological Survey. These data initially are captured using the WaterWitch data acquisition system and contain additional information unique to that system, including data for quality control and quality assurance.

Where do the data come from?

The information in WIZARD has been derived from several preexisting sources. Most of the information on well locations, well ID numbers, elevations, construction, and similar features has been taken from the U.S. Geological Survey's GWSI (Ground Water Site Inventory). With the exception of data for those wells which are included in the Kansas Geological Survey's observation well measurement program, none of this information has been verified. The GWSI database is also the source of historical measurement data on depth to water. Since 1996, the U.S. Geological Survey has obtained these depth-to-water measurements data directly from the State and local agencies that make the measurements. About two-thirds of the annual water-level data are now submitted by local GMDs and the Division of Water Resources; the other third is being updated on an annual basis with information collected by the KGS using WaterWitch. Water level and locational data from WaterWitch is subjected to automatic data verification and cross-checking by global positioning (GPS). Data received from other sources have undergone less extensive checking. The identification of aquifers being tapped by observation wells is taken from the KGS's KIWI database, supplemented by information provided by the Geohydrology Section of the KGS.

The Kansas Geological Survey has established and intends to maintain WIZARD as the authoritative repository for all information on ground water obtained through boreholes or wells in the State of Kansas. We anticipate that eventually other databases on related topics such as water quality will be incorporated into WIZARD, thus a query to a single source will suffice for any groundwater-related request for information. It also is the Survey's intent that all information in WIZARD be subject to continued checking, verification and correction, so that eventually the accuracy of all of the data will be confirmed.

Who can access WIZARD?

The information in WIZARD, with the exception of data on private ownership, is freely available to any interested persons. Local, state, and federal agencies and offices, as well as

qualified individuals, can apply for a user account that will allow direct access to WI2ARD. These groups, as well as members of the general public, can immediately access WI2ARD over the World Wide Web; but, because of the speed of data transfer over the Internet, such use is most appropriate for occasional queries about specific wells or small areas. Internet access to WI2ARD is strictly limited to read-only privileges. More extensive access, including the creation of special reports and large documents, requires the use of a user account.

The Kansas Geological Survey strives to ensure that data contained in WI2ARD are as accurate as possible, and encourages and appreciates the reporting of errors. However, to preserve the integrity of the database, write privileges are limited to authorized, selected individuals and members of the KGS staff. Please contact the database administrator for the latest information on how to report corrections and changes in the WI2ARD database and its contents.

How do you contact the WI2ARD administrator?

Members of the public and personnel in other agencies should contact Dan Suchy via e-mail at dsuchy@kgs.ukans.edu, by telephone at (785) 864-3965, or by fax at (785) 864-5317. Dan will route your query (to ask about ground water, to report an error in the data, for help with Oracle, or ask about the Survey's Web pages, etc.) to the proper specialist for reply.

Who are the wizards behind WI2ARD?

The WI2ARD database was developed in response to an edict from the Kansas Geological Survey's administration. It had become apparent that the existing method of preserving water-well observation measurements was incapable of supporting the requirements of the WaterWitch data collection system and the data enhancements resulting from its use. In December of 1997, a database management and analysis team was assembled under the supervision of Dipl.-Ing. Günther Hausberger from Geo- und Umweltinformatik of Leoben, Austria. Dipl.-Ing. Hausberger is a consultant on database construction with extensive experience in the design of information systems for the earth and environmental sciences. Project supervisor for the KGS was John Davis of the Mathematical Geology Section, in cooperation with Rick Miller of Exploration Services. KGS team members included Kurt Look, who was responsible for ORACLE database design and construction,

and coordinated input into the database; Dana Adkins-Heljeson, who developed the WIZARD WWW page and the Internet interface to WIZARD; Gina Ross, who produced the interface to ARC/INFO and the Survey's mapping packages; Jeff Schloss, who transferred information from KIWI and helped coordinate with the U.S. Geological Survey for transfer of information from GWSI; Brett Bennett, author of the WaterWitch system, who coordinated its interface with WIZARD; and Geoff Bohling, who created the interface with SAS and performed the initial statistical analyses of the database contents. Dan Suchy has been appointed the interface person to direct questions from the public to the proper specialist.

The initial working version of WIZARD was completed within two weeks of its official starting date on December 8, 1997, but the testing and correction of the structure and the transfer of data into the database continued through February of 1998. Indeed, the growth and expansion of WIZARD is ongoing and will continue into the future as new information is added and old data are corrected and revised. Although the team that created WIZARD has now returned to their normal responsibilities, they continue to participate in its maintenance and expansion—even from Austria.

A special note of appreciation is extended to Kristi Hansen of the U.S. Geological Survey, who worked far into the night helping the design team understand the structure of GWSI and transferring its contents for Kansas into WIZARD. The KGS also is grateful for the continuing computer and infrastructure support provided to Dipl.-Ing. Hausberger by the Joanneum Research Forschungsgesellschaft m.b.H., Leoben/Graz.

Disclaimer and Important Lawyer Stuff

The Kansas Geological Survey is not responsible for the quality or accuracy of data in the WIZARD database. The database contains unverified, provisional, and raw data that are made available solely for the convenience of interested parties with the understanding that not all data are reliable. Some information in the WIZARD database has been retrieved from provisional data maintained by the U.S. Geological Survey in the Ground Water Site Inventory (GWSI). The data contained in WIZARD may and almost certainly does contain errors both from the GWSI database and as a result of importing it into WIZARD. The Kansas Geological Survey is not liable in any way for the accuracy or completeness of these data, nor for the consequences of any decisions based thereon.

The Kansas Geological Survey makes no warranty or representation, either express or implied, with respect to the data, documentation, or interpretations or decisions based on the use of these data including the quality, performance, merchantability, or fitness for a particular purpose. In no event will the Kansas Geological Survey, its employees, contractors, or assigns be liable for direct, indirect, special, incidental, punitive, or consequential damages arising out of the use of or inability to use the WIZARD database or documentation whether as a result of contract, negligence, strict liability, or otherwise.

The WIZARD Database and ORACLE

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WIZARD Reports

No reports have been created from WIZARD. This task can easily be accomplished with report writer utilities like Crystal Reports.

Updates to the USGS database

This task is going to take a significant amount of work. This task has not yet been started. Bill Harrison is probably going to need to prioritize this task.

Access to WIZARD

WIZARD exists as an Oracle schema (WIZARD) in an Oracle 8.0.4 database. To see the WIZARD schema, connect to:

User	WEB_USER
Password	HELP
Connect String	ABYSS.KGS.UKANS.EDU
Port	1521
Host	polaris.kgs.ukans.edu
Protocol	TCP/IP

Once connected, you'll be presented with read only access to most of the KGS databases. You are interested in the WIZARD schema tables.

Normally, you are better off accessing the database using the ODBC protocol. With the proper driver installed on you Windows 95/NT machine, you are able to query the database easily using tools you are familiar with: Microsoft Access, FoxPro, Excel, Lotus, Report writers like Crystal Reports, etc. Any product that can communicate with an ODBC driver can access the WIZARD database. If you have an Apple MacIntosh or a Unix workstation, ODBC is still an option, but it will take an effort to locate the proper drivers.

Another connection possibility is to link your Oracle database directly with WIZARD's Oracle database, an option that is available as part of the Oracle Universal Server architecture.

If you are interested in access to WIZARD using any of the above methods, please contact Kurt Look and he'll be glad to help you.

WIZARD Data Structure

The primary table is SITES. The primary key of SITES is the USGS_ID. Every other table is related to the SITES table by either [USGS_ID, SEQUENCE_NUMBER] or by [USGS_ID, SEQUENCE_OF_PARENT, SEQUENCE_NUMBER].

WATER_LEVEL_RESAMPLES is the only non-USGS table. WATER_LEVEL_RESAMPLES contains re-sampling information on a given reading contained in WATER_LEVELS.

Warning: These tables are constantly evolving. The tables and record counts will differ on a daily basis as errors are corrected and additional records are added or deleted.

All changes to WIZARD are logged to the WIZARD_LOG schema. If you are interested in determining when a change was made, why it was made, and who made the change, you can query the WIZARD_LOG user.

Most columns in these tables come directly from the GWSI database and the naming convention follows GWSI. Jeff Schloss can help you with the GWSI component numbers.

WIZARD.SITES (51,744 records)

Name	Null?	Type
USGS_ID	NOT NULL	VARCHAR2(15)
SITE_TYPE		VARCHAR2(1)
RECORD_CLASSIFICATION		VARCHAR2(1)
SOURCE_AGENCY_CODE		VARCHAR2(5)
PROJECT_NUMBER		VARCHAR2(12)
STATE_CODE		NUMBER(2)
COUNTY_CODE		NUMBER(3)
LATITUDE		NUMBER(11,6)
LONGITUDE		NUMBER(11,6)
LAT_LONG_ACCURACY_CODE		VARCHAR2(1)
LAT_LONG_SOURCE		VARCHAR2(20)
LOCAL_WELL_NUMBER		VARCHAR2(24)
SPOT		VARCHAR2(8)
SECTION		NUMBER(2)
SUBDIVISION		VARCHAR2(4)
SUBDIVISION_WELL_NUMBER		NUMBER(2)
TOWNSHIP		NUMBER(2)
TOWNSHIP_DIRECTION		VARCHAR2(1)
RANGE		NUMBER(2)
RANGE_DIRECTION		VARCHAR2(1)
MERIDIAN		NUMBER(1)
LOCATION_MAP_NAME		VARCHAR2(20)
LAND_SURFACE_ALTITUDE		NUMBER(8,2)
LAND_SURFACE_ALTITUDE_METHOD		VARCHAR2(1)
LAND_SURFACE_ALTITUDE_ACCURACY		NUMBER(6,2)
HYDROLOGIC_UNIT_CODE		NUMBER(8)
WELL_CONSTRUCTION_DATE		DATE
USE_OF_SITE_PRIMARY		VARCHAR2(1)
USE_OF_WATER_PRIMARY		VARCHAR2(1)
USE_OF_WATER_SECONDARY		VARCHAR2(1)
USE_OF_WATER_TERTIARY		VARCHAR2(1)
DEPTH_OF_HOLE		NUMBER(8,2)
DEPTH_OF_WELL		NUMBER(8,2)
DEPTH_DATA_SOURCE		VARCHAR2(1)
INV_WATER_LEVEL		NUMBER(7,2)
INV_WATER_LEVEL_DATE		DATE

INV_WATER_LEVEL_SOURCE	VARCHAR2(1)
INV_WATER_LEVEL_METHOD	VARCHAR2(1)
INV_WATER_LEVEL_SITE_STATUS	VARCHAR2(1)
SITE_RECORD_CREATED_DATE	DATE
SITE_ESTABLISHED_INVENTORIED	DATE
OTHER_DATA_AVAILABILITY	VARCHAR2(20)
AQUIFER_TYPE_CODE	VARCHAR2(1)
AQUIFER_CODE	VARCHAR2(8)
STATION_TYPE_CODES	VARCHAR2(7)
SITE_CODE_AGENCY_USE	VARCHAR2(1)
FLAGS_DATA_COLLECTED_TYPE	VARCHAR2(16)
FLAGS_INSTRUMENTS_AT_SITE	VARCHAR2(16)
REMARKS	VARCHAR2(50)
RESTRICTION_NOTES	VARCHAR2(2000)
WELL_ACCESS	VARCHAR2(20)
DOWNHOLE_ACCESS	VARCHAR2(20)
GROUNDWATER_MGMT_DISTRICT	VARCHAR2(20)
GEOLOGICAL_UNIT1	VARCHAR2(2)
GEOLOGICAL_UNIT2	VARCHAR2(2)
GEOLOGICAL_UNIT3	VARCHAR2(2)
DEPTH_TO_BEDROCK	NUMBER(4)
DEPTH_TO_BEDROCK_SOURCE	VARCHAR2(20)
ANNUAL_WATER_LEVEL_REPORT	VARCHAR2(20)
WATER_LEVEL_REPORT_REGION	NUMBER(1)
UPDATE_INITIALS	VARCHAR2(3)
UPDATE_DATE	DATE

AQUIFERS (99 records)

Name	Null?	Type
USGS_ID	NOT NULL	VARCHAR2(15)
SEQUENCE_OF_PARENT	NOT NULL	NUMBER(3)
SEQUENCE_NUMBER	NOT NULL	NUMBER(3)
AQUIFER_DATE		DATE
AQUIFER_STATIC_LEVEL		NUMBER(7,2)
AQUIFER_CONTRIBUTION		NUMBER(3)
UPDATE_INITIALS		VARCHAR2(3)
UPDATE_DATE		DATE

CASINGS (27693 records)

Name	Null?	Type
USGS_ID	NOT NULL	VARCHAR2(15)
SEQUENCE_OF_PARENT	NOT NULL	NUMBER(3)
SEQUENCE_NUMBER	NOT NULL	NUMBER(3)
DEPTH_TOP		NUMBER(8,2)
DEPTH_BOTTOM		NUMBER(8,2)
DIAMETER		NUMBER(5,2)
MATERIAL		VARCHAR2(1)
WALL_THICKNESS		NUMBER(6,3)
UPDATE_INITIALS		VARCHAR2(3)
UPDATE_DATE		DATE

CONSTRUCTION (31289 records)

Name	Null?	Type
USGS_ID	NOT NULL	VARCHAR2(15)
SEQUENCE_NUMBER	NOT NULL	NUMBER(3)
CONSTRUCTION_DATE		DATE
CONTRACTOR_NAME		VARCHAR2(12)
CONSTRUCTION_DATA_SOURCE		VARCHAR2(1)
CONSTRUCTION_METHOD		VARCHAR2(1)
TYPE_OF_FINISH		VARCHAR2(1)
TYPE_OF_SURFACE_SEAL		VARCHAR2(1)
DEPTH_TO_BOTTOM_OF_SEAL		NUMBER(4)
DEVELOPMENT_METHOD		VARCHAR2(1)
DEVELOPMENT_HOURS		NUMBER(3)
DEVELOPMENT_SPECIAL_TREAT		VARCHAR2(1)
UPDATED_LAST		DATE
UPDATE_INITIALS		VARCHAR2(3)
UPDATE_DATE		DATE

GEOHYDROLOGIC_UNITS (37480 records)

Name	Null?	Type
USGS_ID	NOT NULL	VARCHAR2(15)
SEQUENCE_NUMBER	NOT NULL	NUMBER(3)
DEPTH_TOP		NUMBER(8,2)
DEPTH_BOTTOM		NUMBER(8,2)
AQUIFER_CODE		VARCHAR2(8)
CONTRIBUTING_UNIT		VARCHAR2(1)
LITHOLOGY_CODE		VARCHAR2(4)
MATERIAL		VARCHAR2(123)
UPDATE_INITIALS		VARCHAR2(3)
UPDATE_DATE		DATE

HOLES (462 records)

Name	Null?	Type
USGS_ID	NOT NULL	VARCHAR2(15)
SEQUENCE_OF_PARENT	NOT NULL	NUMBER(3)
SEQUENCE_NUMBER	NOT NULL	NUMBER(3)
DEPTH_TOP		NUMBER(8,2)
DEPTH_BOTTOM		NUMBER(8,2)
DIAMETER		NUMBER(5,2)
UPDATE_INITIALS		VARCHAR2(3)
UPDATE_DATE		DATE

HYDRAULICS (319 records)

Name	Null?	Type
USGS_ID	NOT NULL	VARCHAR2(15)
SEQUENCE_NUMBER	NOT NULL	NUMBER(3)
UNIT_ID		VARCHAR2(8)
UPDATE_INITIALS		VARCHAR2(3)
UPDATE_DATE		DATE

MEASURING_POINTS (6910 records)

Name	Null?	Type
USGS_ID	NOT NULL	VARCHAR2(15)
SEQUENCE_NUMBER	NOT NULL	NUMBER(3)
BEGIN_DATE		DATE
END_DATE		DATE
HEIGHT		NUMBER(6,2)
DESCRIPTION		VARCHAR2(250)
UPDATED_LAST		DATE
UPDATE_INITIALS		VARCHAR2(3)
UPDATE_DATE		DATE

MISC_VALUES (1785 records)

Name	Null?	Type
USGS_ID	NOT NULL	VARCHAR2(15)
SEQUENCE_NUMBER	NOT NULL	NUMBER(3)
VALUE_1		NUMBER(7,1)
VALUE_2		VARCHAR2(11)
VALUE_3		VARCHAR2(10)
UPDATED_LAST		DATE
UPDATE_INITIALS		VARCHAR2(3)
UPDATE_DATE		DATE

OBSERVATION_WELLS (11086 records)

Name	Null?	Type
USGS_ID	NOT NULL	VARCHAR2(15)
SEQUENCE_NUMBER	NOT NULL	NUMBER(3)
WELL_HEADING_LINE		VARCHAR2(115)
UPDATED_LAST		DATE
UPDATE_INITIALS		VARCHAR2(3)
UPDATE_DATE		DATE

OPENINGS (696 records)

Name	Null?	Type
USGS_ID	NOT NULL	VARCHAR2(15)
SEQUENCE_OF_PARENT	NOT NULL	NUMBER(3)
SEQUENCE_NUMBER	NOT NULL	NUMBER(3)
DEPTH_TOP		NUMBER(8,2)
DEPTH_BOTTOM		NUMBER(8,2)
OPENINGS_TYPE		VARCHAR2(1)
MATERIAL		VARCHAR2(1)
UPDATE_INITIALS		VARCHAR2(3)
UPDATE_DATE		DATE

OTHER_IDS (50815 records)

Name	Null?	Type
USGS_ID	NOT NULL	VARCHAR2(15)
SEQUENCE_NUMBER	NOT NULL	NUMBER(3)
OTHER_IDENTIFIER		VARCHAR2(15)
OTHER_IDENTIFIER_ASSIGNOR		VARCHAR2(15)
RESPONSIBLE_AGENCY		VARCHAR2(60)
UPDATE_INITIALS		VARCHAR2(3)
UPDATE_DATE		DATE

OWNERS (37934 records)

Name	Null?	Type
USGS_ID	NOT NULL	VARCHAR2(15)
SEQUENCE_NUMBER	NOT NULL	NUMBER(3)
OWNERSHIP_DATE		DATE
LAND_OWNER		VARCHAR2(2000)
LAND_OWNER_TELEPHONE		VARCHAR2(13)
UPDATED_LAST		DATE
UPDATE_INITIALS		VARCHAR2(3)
UPDATE_DATE		DATE

QUALITY_NETWORK (8012 records)

Name	Null?	Type
USGS_ID	NOT NULL	VARCHAR2(15)
SEQUENCE_NUMBER	NOT NULL	NUMBER(3)
NETWORK_DATA_TYPE		VARCHAR2(2)
DATA_COLLECTION_BEGIN_YEAR		NUMBER(4)
DATA_COLLECTION_END_YEAR		NUMBER(4)
SOURCE_AGENCY		VARCHAR2(5)
DATA_COLLECTION_FREQUENCY		VARCHAR2(1)
NETWORK_PRIMARY		VARCHAR2(1)
NETWORK_SECONDARY		VARCHAR2(1)
UPDATE_INITIALS		VARCHAR2(3)
UPDATE_DATE		DATE

REMARKS (26494 records)

Name	Null?	Type
USGS_ID	NOT NULL	VARCHAR2(15)
SEQUENCE_NUMBER	NOT NULL	NUMBER(3)
REMARKS_DATE		DATE
REMARKS		VARCHAR2(2000)
UPDATED_LAST		DATE
UPDATE_INITIALS		VARCHAR2(3)
UPDATE_DATE		DATE

VISITS (32737 records)

Name	Null?	Type
USGS_ID	NOT NULL	VARCHAR2(15)
SEQUENCE_NUMBER	NOT NULL	NUMBER(3)
VISIT_DATE		DATE
PERSON		VARCHAR2(100)
INITIALS		VARCHAR2(3)
AGENCY		VARCHAR2(4)
UPDATED_LAST		DATE
UPDATE_INITIALS		VARCHAR2(3)
UPDATE_DATE		DATE

WATER_LEVELS (363906 records)

Name	Null?	Type
USGS_ID	NOT NULL	VARCHAR2(15)
SEQUENCE_NUMBER	NOT NULL	NUMBER(8)
MEASUREMENT_DATE_AND_TIME		DATE
DEPTH_TO_WATER		NUMBER(8,3)
STATUS		VARCHAR2(1)
METHOD		VARCHAR2(1)
ACCURACY_CODE		NUMBER(1)
ATTEMPTS		NUMBER(3)
AGENCY		VARCHAR2(4)
TAG_NUMBER		NUMBER(8)
OIL_ON_WATER		VARCHAR2(12)
LATITUDE_GPS		NUMBER(11,6)
LONGITUDE_GPS		NUMBER(11,6)
TAPE_HOLD		NUMBER(6,2)
CHALK_CUT		NUMBER(4,2)
INITIALS		VARCHAR2(3)
CHALK_CUT_QUALITY		VARCHAR2(10)
WEIGHTED_TAPE		VARCHAR2(20)
UPDATE_INITIALS		VARCHAR2(3)
UPDATE_DATE		DATE

WATER_LEVELS_RESAMPLES (298 records)

Name	Null?	Type
USGS_ID	NOT NULL	VARCHAR2(15)
SEQUENCE_OF_PARENT	NOT NULL	NUMBER(8)
SEQUENCE_NUMBER	NOT NULL	NUMBER(1)
MEASUREMENT_DATE_AND_TIME		DATE
TAPE_HOLD		NUMBER(6,2)
CHALK_CUT		NUMBER(4,2)
DEPTH_TO_WATER		NUMBER(8,3)
INITIALS		VARCHAR2(3)
CHALK_CUT_QUALITY_CODE		NUMBER(3)
CHALK_CUT_QUALITY		VARCHAR2(10)
WEIGHTED_TAPE		VARCHAR2(20)
UPDATE_INITIALS		VARCHAR2(3)
UPDATE_DATE		DATE

The WIZARD Database and the Web

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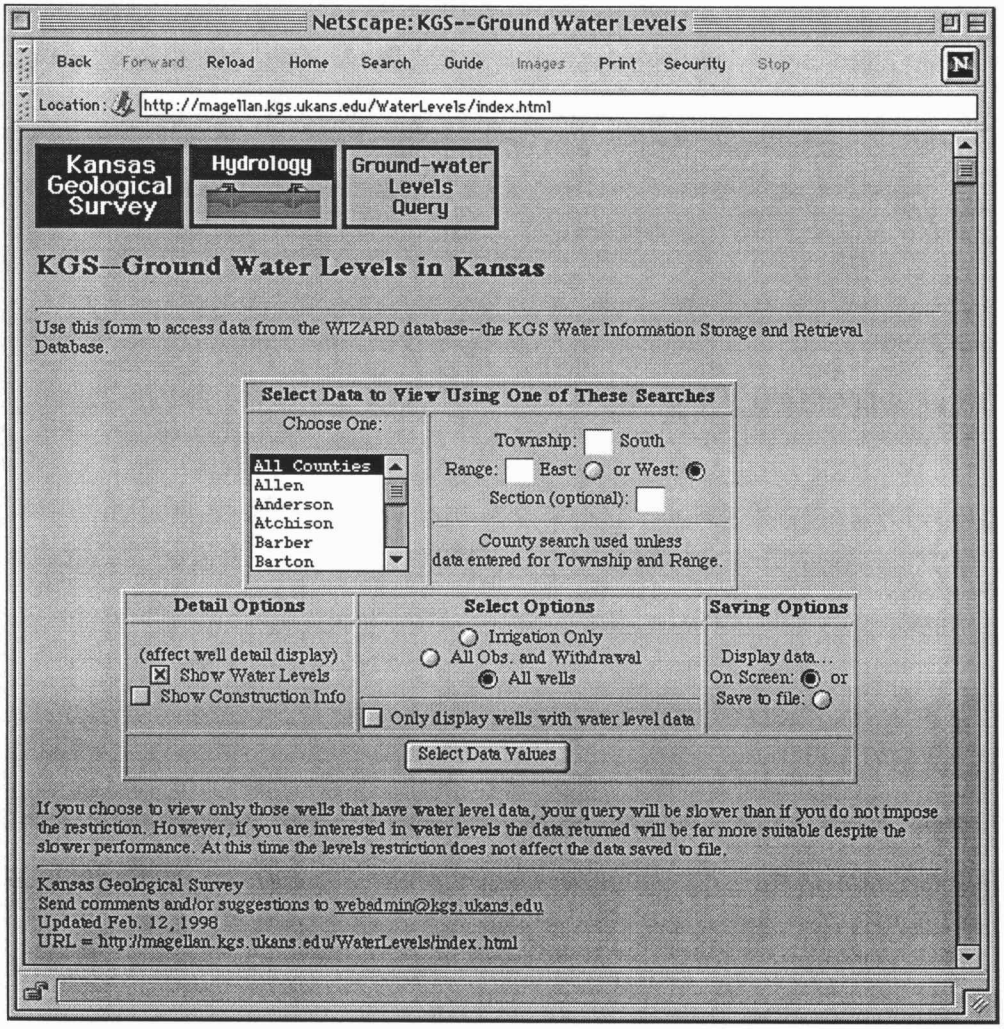
Online Access to The WIZARD Database

The WIZARD water information database can be accessed over the World Wide Web using Netscape Navigator, Microsoft Internet Explorer, or any other web browser. If you have an Internet connection, you can access the online version of Wizard using this URL:
http://magellan.kgs.ukans.edu/WaterLevels/index.html

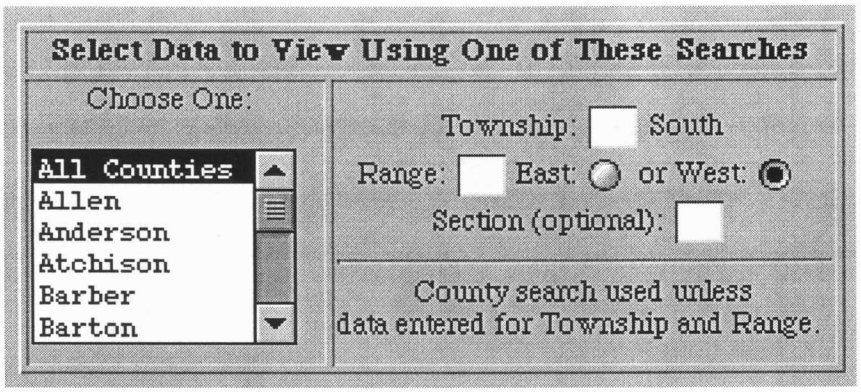
Users of WIZARD over the Web will see a screen similar to this:



This screen will change over time. New options, changes in KGS project goals, and changes in the database will cause adjustments to this screen.

Search Options

Two searches are available to select data from WIZARD. The first is a search by County Name. You can select any county, or you can select to retrieve data from all counties. The second search allows you to enter a Township and Range value and retrieve all data from that Township-Range area. You can further restrict the Township-Range search by specifying a Section Number, but that is optional.



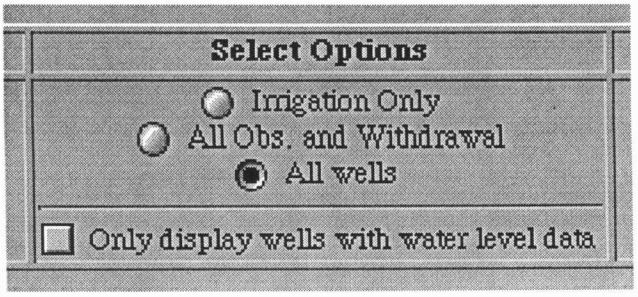
If **any** values are entered in the Township-Range area of this form, the database will assume that you are interested in a Township-Range search, even if you have selected a county. Make sure that if you have performed a Township-Range query but now wish to select data by county that you delete all the numbers from the Township, Range and Section boxes.

Please note that while "West" is the default for the Range value, that option has no affect on the County Search.

The default search of WIZARD is a County search that extracts data from all counties in Kansas.

Select Options

Because there are over 50,000 wells in the WIZARD database and thousands of wells for any county, there are some optional restrictions that can be placed on the WIZARD search to restrict the wells extracted.



The first restriction is based on the Use of Site and Use of Water fields in the database. Needs of the Kansas Geological Survey-Kansas Division of Water resources water level measurement program focused interest on Irrigation wells (specifically) and on Observation and Withdrawal wells (in general), so those restrictions were placed on the Query form.

The next restriction available tells WIZARD to retrieve only wells that have water level data in the database. The database does not know if the well is still capable of having water levels taken, only that water levels were measured in the past.

These two restrictions ("Use of Site" and "Water Levels") are separate. You can choose to...

View Irrigation wells that have water level measurements

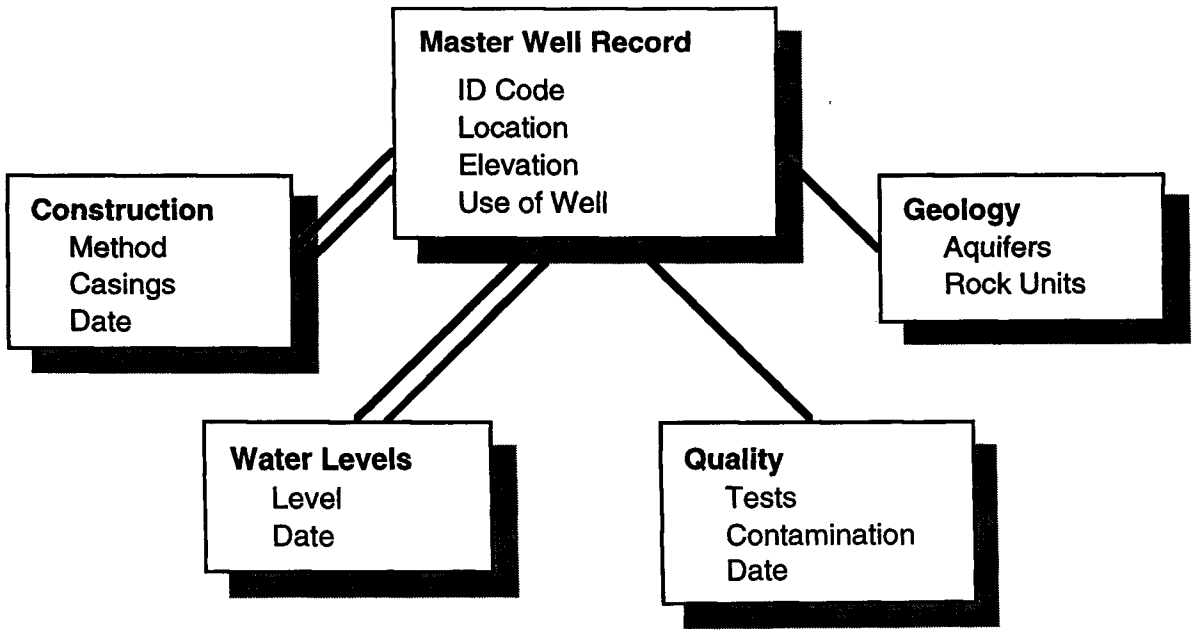
View Irrigation wells whether or not they've had level measurements

View wells of any type but only if they've had water level measurements and so on.

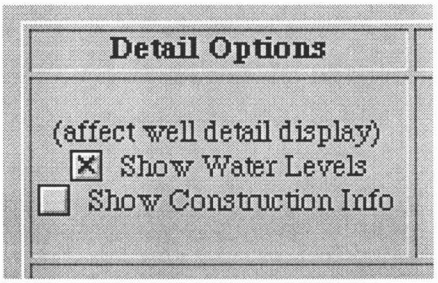
The default search of WIZARD is to select wells of **all types** whether or not they've had water levels measured in the past.

Well Detail

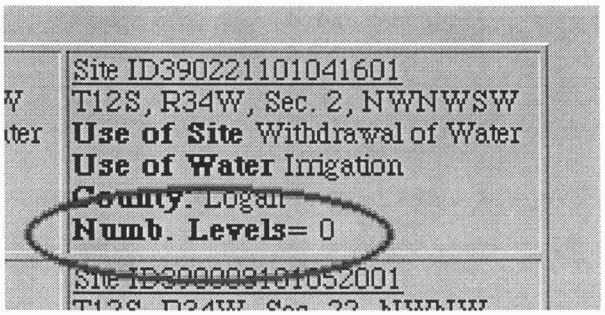
In addition to basic well information like location or and ID to keep track of the wells, the WIZARD database contains other information about the wells. This detail information describes additional attributes about the well. Users will be interested in certain kinds of information about a well based upon their particular projects. To use database terminology, we would call this "master-detail" organization.



Not all of these options are possible with the current version of Wizard, but you can select from two options for detail display. These are independent choices—you can select one or the other or both. You may see additional options added in future revisions.

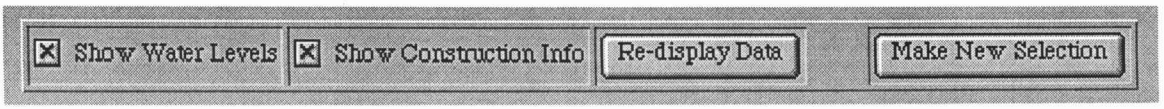


If you select "Show Water Levels," then the preliminary list of wells found will display the number of levels found for each well. If the "Levels" box is not checked, then this line of text will not be printed. There are no indicators for the "Show Construction Info" option on the preliminary well list.

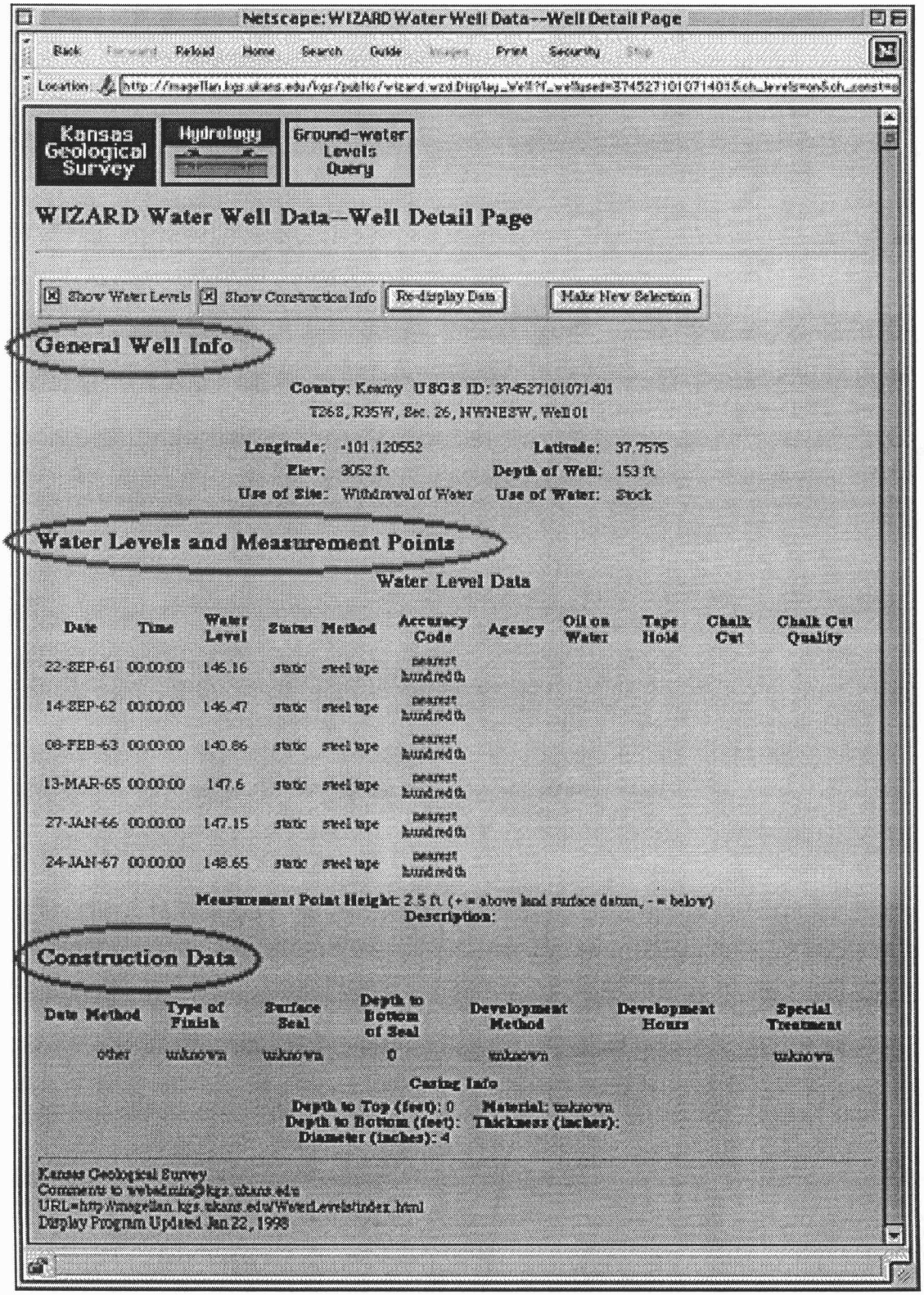


The true power of the Detail Options appears on the well detail sheets. On the next page is an example result page showing a well with both detail options checked. All data is displayed for this well.

If you select a well but did not chose to display Water Levels or Construction Details, you can re-display the well with the desired information. A set of options on the top of the well detail page allows you to add or subtract detail information and then re-display the well. In addition, you can choose to make a new selection.



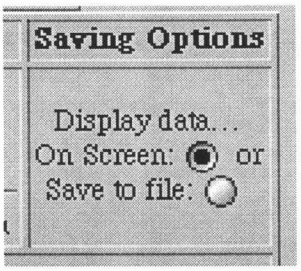
The default search of WIZARD is to show water levels but not to show construction detail.



Example well detail page

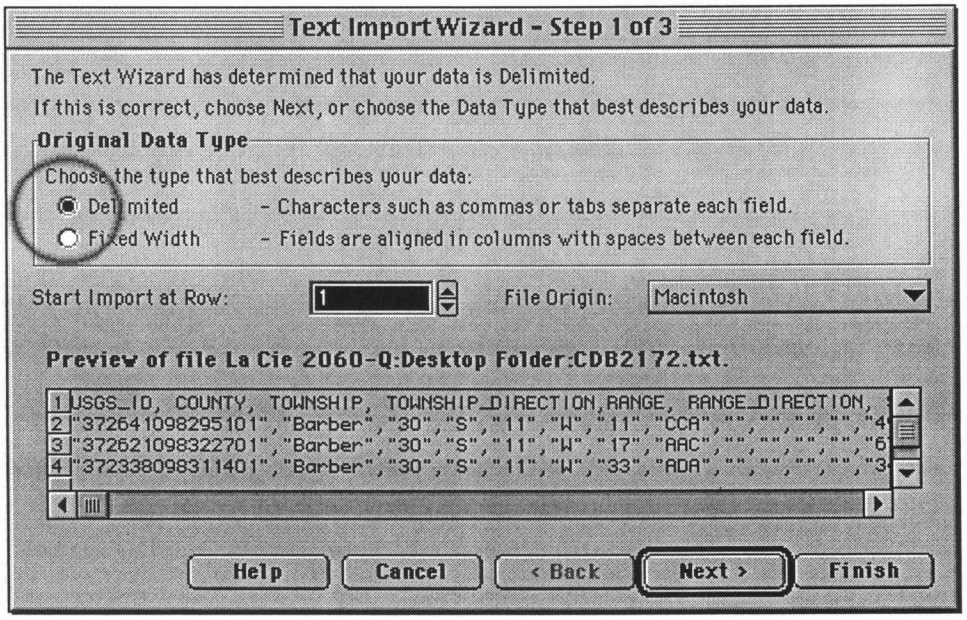
Save Options

Finally, the user has two options on viewing data—screen display or file access.

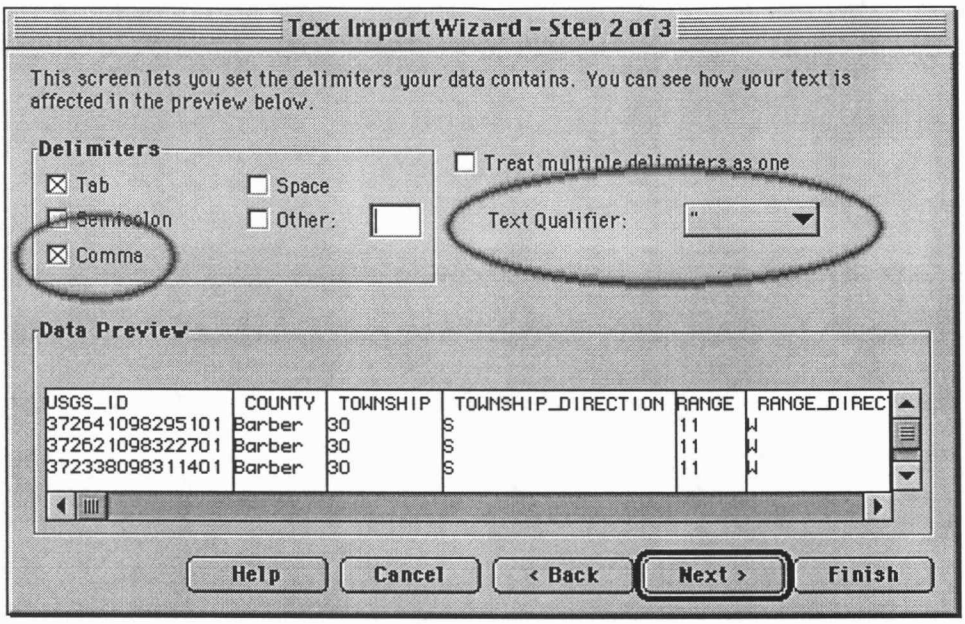


As shown earlier, screen display includes a preview of several wells, allowing the user to select a specific well to display. The "Save to File" option select all the data and writes it to a comma-delimited file. That file can be saved to the user's hard disk and imported into Excel, Access, Word, or other software. For example, the Import Wizard in Excel will lead you through importing the data.

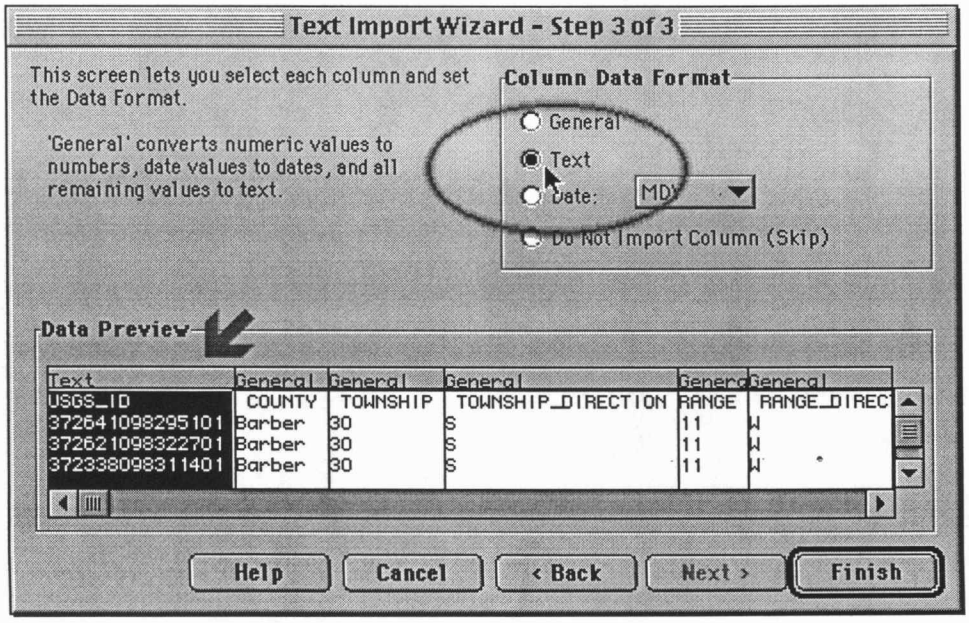
1. Excel will show you the first part of your file. Make sure that the "Delimited" button is checked.



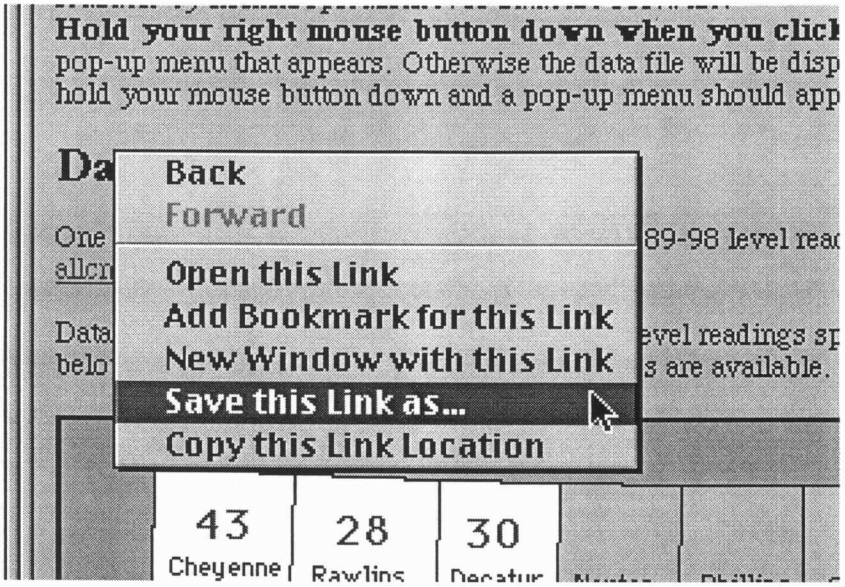
2. Check the "Comma" box in the "Delimiters" area. It will not matter if the "Tab" box is checked also. Make sure the " (double quotes) mark is selected as the Text Qualifier.



3. Finally, you may want to change the USGS-ID column to a Text field from a Number field. The ID is a large number, and it may be more convenient to view it as a character value.



If you click on a link to a web page or text file shown on your browser, that information will be displayed in your browser window. If you hold down your right mouse button (or normal mouse button on a Macintosh) a pop-up menu will appear. It will allow you to save the file to your hard disk.



The WIZARD Database and ARC/INFO

3

Procedures to query and display ORACLE databases using ARC/INFO

1. OPEN ARC: at the system prompt

```
pangaea% arc
Copyright (C) 1982-1997 Environmental Systems Research Institute, Inc.
All rights reserved.
ARC Version 7.1.1  (Thu Feb  6 23:26:50 PST 1997)

This software is provided with RESTRICTED AND LIMITED RIGHTS.  Use,
duplication, and disclosure by the U.S. Government are subject to
restrictions as set forth in FAR Section 52.227-14 Alternate III (g)(3)
(JUN 1987), FAR Section 52.227-19 (JUN 1987), and/or FAR Section
12.211/12.212 [Commercial Technical Data/Computer Software] and DFARS
Section 252.227-7015 (NOV 1995) [Technical Data] and/or DFARS Section
227.7202 [Computer Software], as applicable. Contractor/Manufacturer is
Environmental Systems Research Institute, Inc., 380 New York Street,
Redlands, CA 92373-8100, USA.

Arc:
```

2. CONNECT TO ORACLE: at the Arc prompt, use the CONNECT command

```
Arc: connect
Usage: CONNECT <database> {connect_info}
```

In the following example, a connection is established, using the Oracle database connection definition file, ORACLE1, and command line connection information form, user/password@database.address, where:

user = water_witch
password = help
Oracle database = kgs
address = kgs.ukans.edu

```
Arc: connect  oracle1  wizard/help@kgs.kgs.ukans.edu
```

When the connection is established, you should see the following message . . .

```
Connection to ORACLE1 successful.
```

NOTE: Any database connection in Arc may be terminated by the DISCONNECT command. Usage: DISCONNECT <database>

3. LIST CURRENT CONNECTIONS: use the SHOW command

Arc: **show**
Usage: SHOW <parameter> {argument . . . argument}

The SHOW command with CONNECTS parameter will list all current connections.

Arc: **show connects**
oracle1

The SHOW command with CONNECT parameter and specific connected database argument will return parameters associated with the particular connection (Oracle user passwords are always returned as 'xxx').

Arc: **show connect oracle1**
oracle1,$ARCHOME/bin/dbi_oracle,wizard/xxx@kgs.kgs.ukans.edu

4. SET UP THE RELATE ENVIRONMENT: use the RELATE command

Arc: relate
Usage: RELATE <ADD|DROP>

For external DBMS tables, only one RELATE TYPE option is valid. This option is called FIRST.

FIRST - if many records exist in the DBMS table with the same value for the Relate Column, only the first record of each value is matched (related) to the Relate Item. This means, only a one to one relation is established.

The access rights to the related file determines whether the related file can be modified, or only displayed.

RW - gives read and write access. RO - gives read only access.

The following responses are used to set up the relate environment:

Arc: **relate add**

Relate Name:	**REL2**	*(arbitrary name used for this relate)*
Table:	**sites**	*(ORACLE database name)*
Database:	**oracle1**	*(connection to oracle information file)*
Item:	**NWELLS-ID**	*(INFO item)*
Column:	**usgs_id**	*(ORACLE column)*
Relate Type:	**FIRST**	
Relate Access:	**RO**	
Relate Name:	*(if you have more relates to set repeat the procedure if not press the return key).*	

Arc:

5. *APPLICATIONS:*

For the purpose of this example we created a point coverage containing 519 well locations. The name of the coverage is NWELLS.

```
Arc:list  nwells.pat
Record          AREA     PERIMETER NWELLS# NWELLS-ID
     1         0.000         0.000      1       1
     2         0.000         0.000      2       2
     3         0.000         0.000      3       3
     4         0.000         0.000      4       4
     5         0.000         0.000      5       5
     6         0.000         0.000      6       6
     7         0.000         0.000      7       7
     8         0.000         0.000      8       8
     9         0.000         0.000      9       9
    10         0.000         0.000     10      10
Arc:
```

Related INFO file items or DBMS table column files can be used in ARC/INFO anywhere that an item name can be specified. The general form for using items and columns out of related files is:

<relate>//<item>

Where RELATE is the name of a defined relate and item is the name of an item or column on the related table. This can be used anywhere an item name can be given, such as, ARC, ARCEDIT, AND ARCPLOT. For example, in ARCPLOT, related items could be used in RESELECT command and displayed graphically, or use the LIST command and the data will be listed on the screen.

```
Arcplot: mape nwells
Arcplot: reselect nwells point rel2//tape_hold >= 200
NWELLS points : 99 of 519 selected
Arcplot: points nwells
Arcplot:
```

If you want to list the results of the relate . . .

```
Arcplot: list nwells points nwells-id rel2//tape_hold
Record  nwells-id rel2//tape_hold
    22     22         201.00
    24     24         225.00
    32     32         219.00
    37     37         218.00
    40     40         227.00
    46     46         220.00
    49     49         204.00
    50     50         238.00
    51     51         235.00
    52     52         225.00
    53     53         205.00
    54     54         225.00
    55     55         245.00
    56     56         230.00
    59     59         230.00
   127    130         208.00
   161    164         200.00
   Continue? n

Arcplot:
```

5. COPY AN EXTERNAL DBMS TABLE INTO AN INFO TABLE: use the COLUMNS and DBMSINFO commands

A connection to the oracle database must be established first with the CONNECT command, i.,e. (connect oracle1 water_witch/help@kgs.kgs.ukans.edu)

```
Arc: columns oracle1 sites
```

NAME	LENGTH	TYPE	NULL
USGS_ID		INTEGER	YES
TOWNSHIP		SMALLINT	YES
TOWNSHIP_DIRECTION	1	VARCHAR	YES
RANGE		SMALLINT	YES
RANGE_DIRECTION	1	VARCHAR	YES
SECTION		SMALLINT	YES
SUBDIVISION	4	VARCHAR	YES
WELL_NUMBER		SMALLINT	YES
USGS_ID_NUMBER	15	VARCHAR	NO
LATITUDE	9,5	DECIMAL	YES
LONGITUDE	9,5	DECIMAL	YES
FIPS_COUNTY_CODE		SMALLINT	YES
AQUIFER		SMALLINT	YES
BASIN		SMALLINT	YES
GROUNDWATER_MGMT_DISTRICT	20	VARCHAR	YES
LAND_OWNER	90	VARCHAR	YES
LAND_OWNER_TELEPHONE	10	VARCHAR	YES
KGS_TAG_NUMBER	17	VARCHAR	YES

```
DATE_OF_MEASURE                              ISODATETIME  YES
Continue? n

Arc: dbmsinfo oracle1 wells wells.dat
DBMS table copied to INFO table wells.dat
Items: 36, Records: 529
Arc: Arc: columns info wells.dat

COLUMN   ITEM NAME          WIDTH OUTPUT  TYPE N.DEC  ALTERNATE NAME
INDEXED?
    1  USGS_ID                4     10     B      -
    5  TOWNSHIP               2      5     B      -
    7  TOWNSHIP_DIRECTI       1      1     C      -
    8  RANGE                  2      5     B      -
   10  RANGE_DIRECTION        1      1     C      -
   11  SECTION                2      5     B      -
   13  SUBDIVISION            4      4     C      -
   17  WELL_NUMBER            2      5     B      -
   19  USGS_ID_NUMBER        15     15     C      -
   34  LATITUDE              11     11     N      5
   45  LONGITUDE             11     11     N      5
   56  FIPS_COUNTY_CODE       2      5     B      -
   58  AQUIFER                2      5     B      -
   60  BASIN                  2      5     B      -
   62  GROUNDWATER_MGMT      20     20     C      -
   82  LAND_OWNER            90     90     C      -
  172  LAND_OWNER_TELEP      10     10     C      -
  182  KGS_TAG_NUMBER        17     17     C      -
  199  DATE_OF_MEASURE       20     20     C      -
  219  TAPE_HOLD              8      8     N      2
Continue? n
```

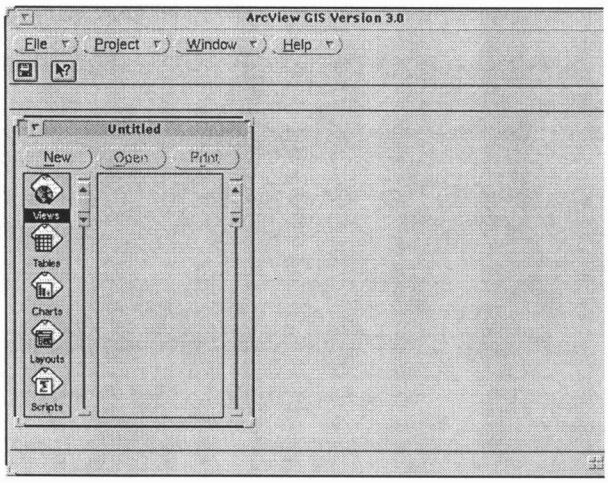
The WIZARD Database and ARCVIEW

4

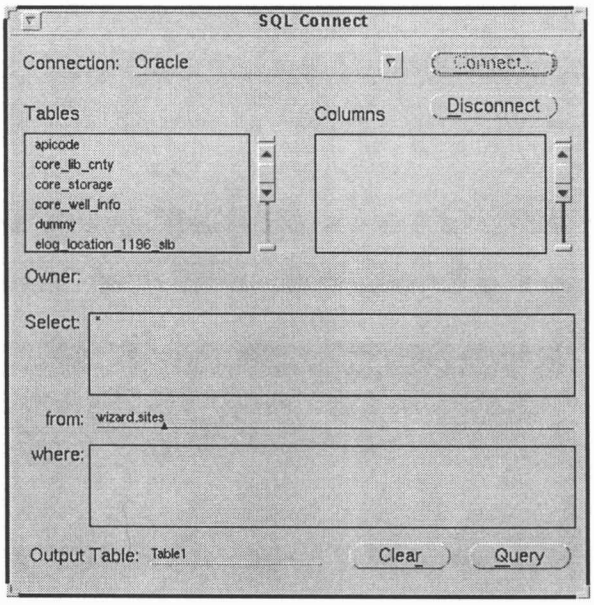
Procedures to query and display ORACLE databases using ARCVIEW

1. OPEN ARCVIEW: at the system prompt

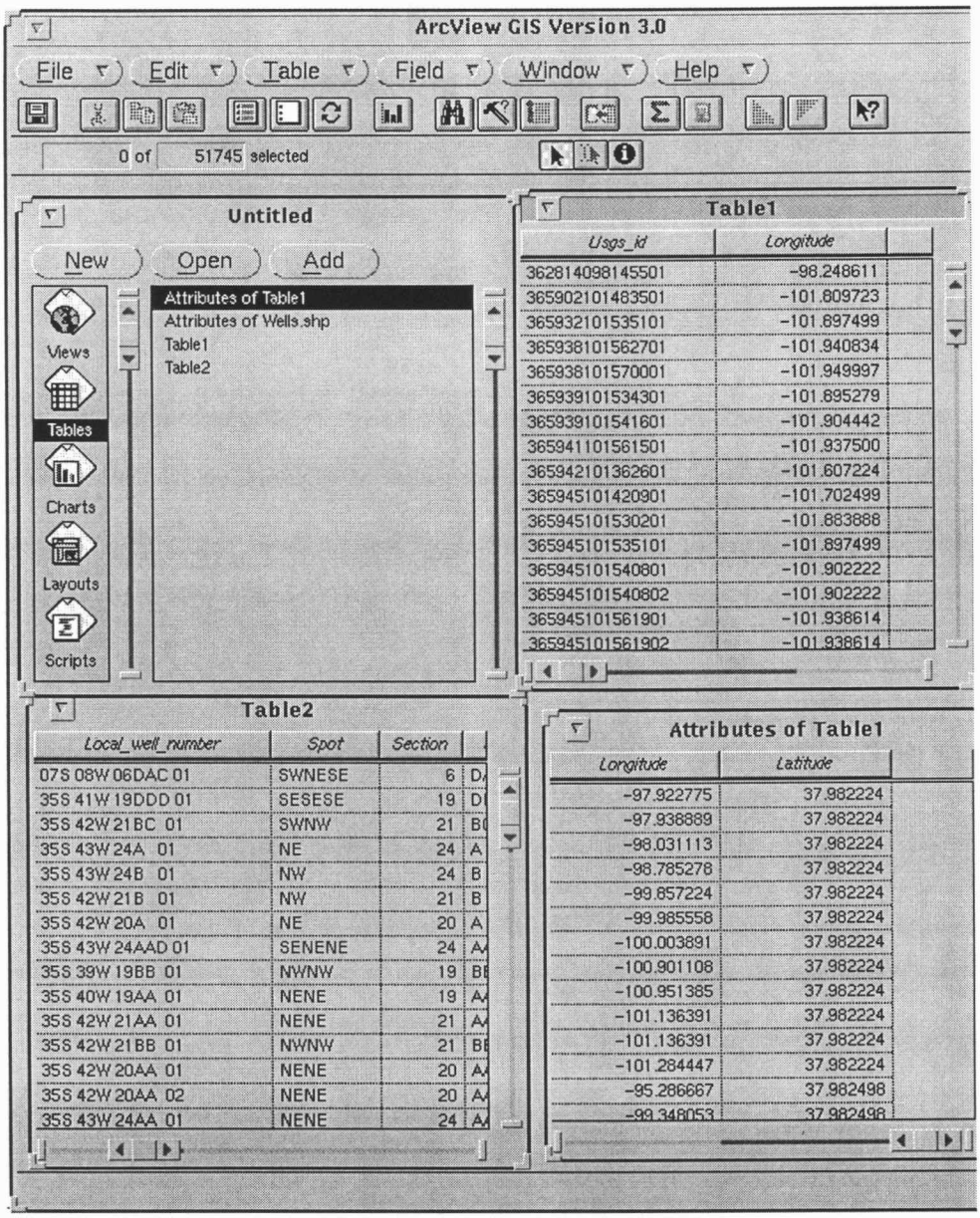
pangaea% **arcview**



Click on the "Project" buttom and pull down the menu down to the "SQL Connection".



At the "Select" window enter your sql statement, in this example * was entered to select all the columns from the database. Enter the Oracle username followed by the name of the table of view (to query) separated by a period. In the example above Wizard is the username and sites is the name of the table to be queried. If you wish to entered some conditions to the query, use the "Where" window. Click on "Query" buttom to execute the query.



These are examples of tables after successful queries.

Setting up a database connection with the DATABASE INTEGRATOR UNIX ArcView

In the UNIX version of ArcView, the databases that will be available in the Connection box are specified in the Database definition file, default.db. This file contains the parameters used to establish a connection between ArcView and an external DBMS. ArcView looks in its etc subdirectory in the install directory to find the default databse definitionn file. If you want to have more than one connection to the same database, you need to put that database in default.db twice.

The database definition file should be present in the path before connecting to a database. Also, the appropriate variables for each databse must be set. Each DBMS has different variables. For example, the variables that are set for Oracle are:

```
ORACLE_HOME=
ORACLE_SID=
Two_task=
```

NOTE: Only the variable ORACLE_HOME must be set as an environment variable in the user's .cshrc.

The Database definition file contains two or more lines of information for each database type. The format of the first two lines is the same for all DBMSs. The third line contains connection information that is specific to your DBMS. The default.db file can contain as many SQL connection sections as you like. The example of the structure below shows 3 sections, the first with default login and connection information, the second with no additional information, and the third with only connection information.

Structure of the default.db file at KGS looks as follows:

```
(SqlCon.1
Name:"Oracle"
Client:"$AVHOME/bin/dbi_oracle"
Login:"kgs/help@kgs.kgs.ukans.edu
Info:"ORACLE_HOME=/home/pangaea_6/oracle/app/oracle/product/7.3.2"
Info:"ORACLE_SID=KGS"
)

(SqlCon.2
Name:"Ingres"
Client:"$AVHOME/bin/dbi_ingres"
)
(SqlCon.3
Name:"Sybase"
Client:"$AVHOME/bin/dbi_sybase"
)
(SqlCon.4
```

```
Name:"Informix"
Client:"$AVHOME/bin/dbi_informix"
)
```

Connection information can include the user name, networking protocol, database node and instance. if you were usingOracle, the connection information is in the same format as that used in the ORACLE SQL*Plus facility.

NOTE: The default.db that comes with ArcView (in its etc subdirectory) follows this structure. No connection information is included in the default.db.

The WIZARD Database and SAS/ACCESS

5

Accessing the WIZARD Database from SAS

The SAS/ACCESS software may be used to establish a connection to the WIZARD database from SAS. Within SAS, you use **proc access** to establish a link to the desired Oracle table and to create a view into that table. This view can then be treated as if it were a SAS dataset, meaning it can be employed as the input data to any SAS procedure. The following example creates a view into the WIZARD table water_levels. This view represents the water level data for one particular well. The SAS procedure for general linear models, **proc glm**, is then used to compute a linear trend for the depth to water versus time. **Proc gplot** is then used to create a plot showing the depth data versus time along with the trend line. Additional details regarding the use of SAS/ACCESS can be found in the relevant SAS documentation, SAS/ACCESS Software for Relational Databases: Reference, Version 6, First Edition, along with the related Oracle Chapter, both available from SAS Institute Inc., SAS Campus Drive, Cary, North Carolina 27513.

The first step is to establish the fundamental link to Oracle using **proc access**. This involves specifying the Oracle username and password along with the name of the particular table we are interested in. The following code creates a link to the water_levels table. The link is identified by the name "wlevels":

```
proc access DBMS=ORACLE;
    create saslib.wlevels.access;  /* establish the link to Oracle */
    user=wizard;                   /* username */
    orapw=help;                    /* password */
    table=wizard.water_levels;     /* the table we are interested in */
    list all;                      /* list names of fields in table */
```

The final line creates a listing, in the SAS output, of all the variable names in the water levels table.

Next we must create a view into the table. This is done using code that also occurs within **proc access** (immediately following the code above). The following code creates a view named "onewell", representing the water level data for one particular well (identified by its USGS site id number):

```
    create saslib.onewell.view;  /* create view into Oracle table */
        select all;              /* include all variables */
        subset where USGS_ID = 370023100550801; /* select one well */
        format MEASUREMENT_DATE yymon5.;
        rename USGS_ID = siteid                 /* remap Oracle names */
               MEASUREMENT_DATE = msmtdate      /* to legal SAS names */
               MEASUREMENT_TIME = msmttime
               DEPTH_TO_WATER = watrdpth
               STATUS = status
```

```
METHOD = method
ACCURACY_CODE = acccode
ATTEMPTS = attempts
AGENCY = agency
TAG_NUMBER = tagno
OIL_ON_WATER = oilonh2o
LATITUDE_GPS = latgps
LONGITUDE_GPS = longps
TAPE_HOLD = tapehold
CHALK_CUT = chalkcut
INITIALS = initials
CHALK_CUT_QUALITY = cutqual
WEIGHTED_TAPE = wgtdtape
UPDATE_INITIALS = updtinit
UPDATE_DATE = updtdate;
```

Most of the lines of code above simply remap the names in the Oracle table into legal SAS variable names (which can only be eight characters long). We could have included only a certain subset of the variables in the view by listing the (original) variable names in the select statement, rather than using "select all".

At this point the view, onewell, can be treated as a SAS dataset. We can use **proc glm** to compute a linear trend of water depth versus time, as follows:

```
proc glm data=saslib.onewell;
    model watrdpth = msmtdate / solution;
    output out=lintrend p=predlev;
run;
```

The model is specified as a simple linear model of watrdpth versus msmtdate. An output dataset is created that includes the original variables along with the predicted water level, predlev. **Proc glm** produces various output, including the following parameter estimates:

Parameter	Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
INTERCEPT	96.61429213	70.89	0.0001	1.36294903
MSMTDATE	0.00316326	20.46	0.0001	0.00015464

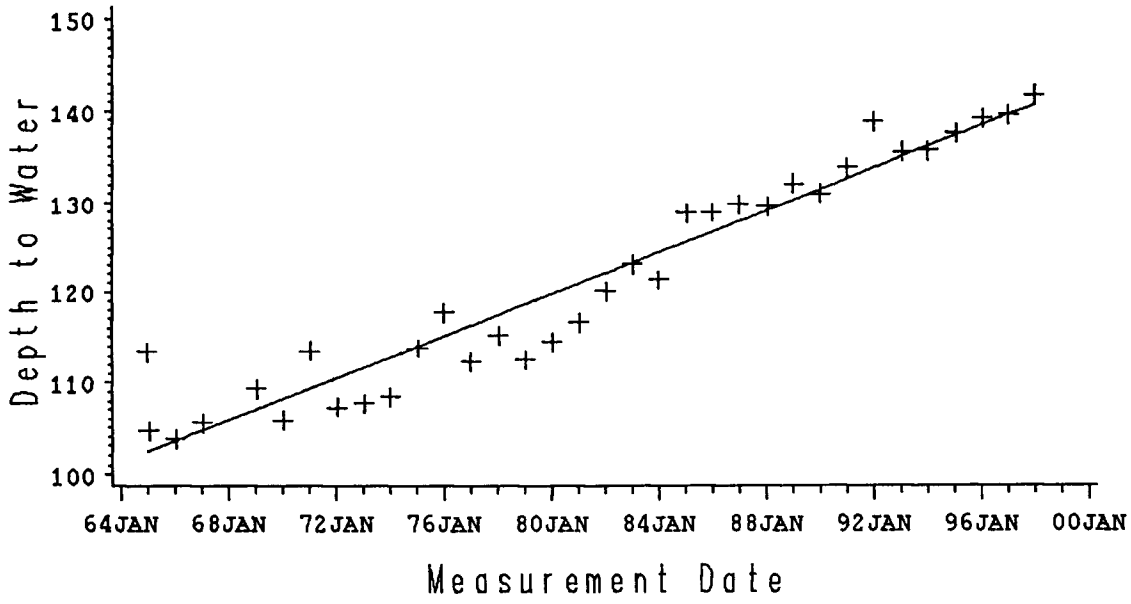
Since date variables actually represent days (since Jan. 1, 1960), the coefficient of MSMTDATE in this case represents .0032 feet/day, or 1.2 feet/year. The intercept value is the predicted water level for Jan. 1, 1960.

Finally, we can use **proc gplot** to create a plot of water depth versus time, along with the trend line, as follows:

```
proc gplot data=lintrend;
    plot watrdpth*msmtdate = 1
         predlev *msmtdate = 2
```

```
      / overlay haxis=axis1 vaxis=axis2 hminor=3;
    format watrdpth 3.;
    symbol1 h=1.5 c=green v=plus;
    symbol2 i=join v=none;
    axis1 order=(1461 to 14610 by 1461)
          label = (c=blue h=1.5 'Measurement Date');
    axis2 label = (c=blue h=1.5 a=90 r=0 'Depth to Water');
run;
```

This produces the following plot:



The example above represents major overkill. One would seldom use SAS to do something like create a plot for a single well. SAS is more appropriate for running lengthy analyses of large datasets. For example, SAS was used to produce the tables summarizing the contents of the WIZARD database included at the end of this report. The code on the following pages was used to summarize the contents of the Sites table in the WIZARD database. Most of the fields in the Sites table are from the GWSI database, although some have been added to accomodate Water Witch data along with additional information. (Some of these fields do not yet contain any information.) The formatting statements are used to translate the shorthand GWSI codes into more meaningful output values, based on the GWSI documentation. A number of variables are printed using a format ("$presabs." for character variables or "presabs." for numeric variables) that simply indicates the presence or absence of data, since a summary of the exact contents of these fields is not particularly useful.

File site_sum.sas, used to summarize contents of Sites table in WIZARD:

```
options linesize=75;

libname saslib 'sasbin';

proc access DBMS=ORACLE;
    create saslib.siteinfo.access;
    user=wizard;
    orapw=help;
    table=wizard.sites;

    create saslib.siteinfo.view;
        select all;
        format WELL_CONSTRUCTION_DATE date7.
               INV_WATER_LEVEL_DATE date7.
               SITE_RECORD_CREATED_DATE date7.
               SITE_ESTABLISHED_INVENTORIED date7.
               UPDATE_DATE date7.;
        rename USGS_ID = siteid
               SITE_TYPE = sitetype
               RECORD_CLASSIFICATION = recclass
               SOURCE_AGENCY_CODE = sagcode
               PROJECT_NUMBER = projno
               STATE_CODE = statcode
               COUNTY_CODE = cntycode
               LATITUDE = lat
               LONGITUDE = lon
               LAT_LONG_ACCURACY_CODE = locacc
               LAT_LONG_SOURCE = locsrc
               LOCAL_WELL_NUMBER = wellno
               SPOT = spot
               SECTION = section
               SUBDIVISION = subdiv
               SUBDIVISION_WELL_NUMBER = subwelno
               TOWNSHIP = twp
               TOWNSHIP_DIRECTION = twpdir
               RANGE = rng
               RANGE_DIRECTION = rngdir
               MERIDIAN = meridian
               LOCATION_MAP_NAME = mapname
               LAND_SURFACE_ALTITUDE = surfalt
               LAND_SURFACE_ALTITUDE_METHOD = surfmeth
               LAND_SURFACE_ALTITUDE_ACCURACY = surfacc
               HYDROLOGIC_UNIT_CODE = unitcode
               WELL_CONSTRUCTION_DATE = consdate
               USE_OF_SITE_PRIMARY = siteuse
               USE_OF_WATER_PRIMARY = watuse1
               USE_OF_WATER_SECONDARY = watuse2
               USE_OF_WATER_TERTIARY = watuse3
               DEPTH_OF_HOLE = holedpth
               DEPTH_OF_WELL = welldpth
               DEPTH_DATA_SOURCE = dpthsrc
               INV_WATER_LEVEL = wlev
               INV_WATER_LEVEL_DATE = wlevdate
               INV_WATER_LEVEL_SOURCE = wlevsrc
               INV_WATER_LEVEL_METHOD = wlevmeth
```

```
                INV_WATER_LEVEL_SITE_STATUS = wlevstat
                SITE_RECORD_CREATED_DATE = recdate
                SITE_ESTABLISHED_INVENTORIED = estdate
                OTHER_DATA_AVAILABILITY = othravl
                AQUIFER_TYPE_CODE = aqtype
                AQUIFER_CODE = aqcode
                STATION_TYPE_CODES = statyp
                SITE_CODE_AGENCY_USE = agncyuse
                FLAGS_DATA_COLLECTED_TYPE = colltype
                FLAGS_INSTRUMENTS_AT_SITE = siteinst
                REMARKS = remarks
                RESTRICTION_NOTES = restnote
                WELL_ACCESS = wellacc
                DOWNHOLE_ACCESS = holeacc
                GROUNDWATER_MGMT_DISTRICT = gmd
                GEOLOGICAL_UNIT1 = geounit1
                GEOLOGICAL_UNIT2 = geounit2
                GEOLOGICAL_UNIT3 = geounit3
                DEPTH_TO_BEDROCK = brdepth
                DEPTH_TO_BEDROCK_SOURCE = brsrc
                ANNUAL_WATER_LEVEL_REPORT = annrpt
                WATER_LEVEL_REPORT_REGION = rptrgn
                UPDATE_INITIALS = updtinit
                UPDATE_DATE = updtdate;
run;

proc format;
    value $sitetype 'C' = 'Collector'
                    'D' = 'Drain'
                    'E' = 'Excavation'
                    'H' = 'Sink hole'
                    'I' = 'Conn. wells'
                    'M' = 'Mult. wells'
                    'O' = 'Outcrop'
                    'P' = 'Pond (dug)'
                    'S' = 'Spring'
                    'T' = 'Tunnel'
                    'W' = 'Well'
                    'X' = 'Test hole';
    value $surfmeth 'A' = 'Altimeter'
                    'L' = 'Surveying'
                    'M' = 'Topo map';
    value $siteuse  'A' = 'Anode'
                    'C' = 'Standby'
                    'D' = 'Drain'
                    'E' = 'Geothermal'
                    'G' = 'Seismic'
                    'H' = 'Heat res.'
                    'M' = 'Mine'
                    'O' = 'Observation'
                    'P' = 'Oil or gas'
                    'R' = 'Recharge'
                    'S' = 'Repressurize'
                    'T' = 'Test'
                    'U' = 'Unused'
                    'W' = 'Withdrawal'
                    'X' = 'Waste disp.'
                    'Z' = 'Destroyed';
```

```
value $watuse    'A' = 'Air cond.'
                 'B' = 'Bottling'
                 'C' = 'Commercial'
                 'D' = 'Dewatering'
                 'E' = 'Power'
                 'F' = 'Fire'
                 'H' = 'Domestic'
                 'I' = 'Irrigation'
                 'J' = 'Cooling (Ind.)'
                 'K' = 'Mining'
                 'M' = 'Medicinal'
                 'N' = 'Industrial'
                 'P' = 'Public supply'
                 'Q' = 'Aquaculture'
                 'R' = 'Recreation'
                 'S' = 'Stock'
                 'T' = 'Institutional'
                 'U' = 'Unused'
                 'Y' = 'Desalination'
                 'Z' = 'Other';
value $datasrc   'A' = 'Other agency'
                 'D' = 'Drillers log'
                 'G' = 'Geologist'
                 'L' = 'Geophysical logs'
                 'M' = 'Memory'
                 'O' = 'Owner'
                 'R' = 'Other person'
                 'S' = 'Source agency'
                 'Z' = 'Other';
value $wlevmeth  'A' = 'Airline'
                 'B' = 'Analog recorder'
                 'C' = 'Cal. airline'
                 'E' = 'Estimated'
                 'G' = 'Press. gage'
                 'H' = 'Cal. Press. gage'
                 'L' = 'Gphscl logs'
                 'M' = 'Manometer'
                 'N' = 'Nonrec. gage'
                 'R' = 'Reported'
                 'S' = 'Steel tape'
                 'T' = 'Electric tape'
                 'V' = 'Cal. elec. tape'
                 'Z' = 'Other';
value $wlevstat  'D' = 'Dry'
                 'E' = 'Flowing recently'
                 'F' = 'Flowing, no meas.'
                 'P' = 'Being pumped'
                 'R' = 'Pumped recently'
                 'S' = 'Pumping nearby'
                 'W' = 'Well destroyed'
                 'X' = 'Inf. by SW Site'
                 'Z' = 'Other influence';
value $aqtype    'U' = 'Unconf. single'
                 'N' = 'Unconf. mult.'
                 'C' = 'Conf. single'
                 'M' = 'Conf. mult.'
                 'X' = 'Mixed';
value $agncyuse  'A' = 'Active'
```

```
                    'I' = 'Inactive'
                    'O' = 'Inventory';
    value state     08='Colorado'
                    20='Kansas'
                    29='Missouri'
                    31='Nebraska'
                    40='Oklahoma';
    value $locacc   'S' = ' 1 second'
                    'F' = ' 5 seconds'
                    'T' = '10 seconds'
                    'M' = '60 seconds';
    value $restnote ' '    = 'Missing'
                    'NONE' = 'No Restriction'
                    other  = 'Some Restriction';
    value $presabs ' ' = 'Missing' other = 'Present';
    value presabs . = 'Missing' other = 'Present';
run;

proc freq data=saslib.siteinfo order=freq;
    title 'Sites Table Summary';
    tables sitetype recclass sagcode projno
           statcode cntycode locsrc wellno
           spot section subdiv subwelno twp twpdir rng rngdir mapname
           surfmeth unitcode siteuse watuse1 watuse2 watuse3
           dpthsrc wlevsrc wlevmeth wlevstat othravl
           aqtype aqcode statyp agncyuse colltype siteinst
           remarks restnote wellacc holeacc gmd
           geounit1 geounit2 geounit3 brsrc annrpt rptrgn;
    format sitetype $sitetype. statcode state. cntycode presabs.
           spot subdiv wellno mapname  $presabs.
           subwelno section twp rng presabs.
           surfmeth $surfmeth. siteuse $siteuse. unitcode presabs.
           watuse1 watuse2 watuse3 $watuse.
           dpthsrc wlevsrc $datasrc. wlevmeth $wlevmeth. wlevstat $wlevstat.
           othravl statyp $presabs. aqtype $aqtype. aqcode $presabs.
           remarks $presabs. restnote $restnote.
           agncyuse $agncyuse. colltype $presabs. siteinst $presabs.;
run;

proc freq data=saslib.siteinfo order=formatted;
    tables locacc;
    format locacc $locacc.;
run;

proc means data=saslib.siteinfo maxdec=2 n mean min max;
   var lat lon meridian surfalt surfacc holedpth welldpth wlev brdepth;
run;

data yeardata (keep=consyear wlevyear recyear estyear updtyear);
   set saslib.siteinfo;
   consyear = year(consdate);
   label consyear='Well construction year';
   wlevyear = year(wlevdate);
   label wlevyear='Inventory msmt. year';
   recyear  = year(recdate);
   label recyear='Year record created';
   estyear  = year(estdate);
   label estyear='Year site established';
```

```
   updtyear = year(updtdate);
   label updtyear='Year record updated';
run;

proc means data=yeardata n mean min max;
   var consyear estyear wlevyear recyear updtyear;
run;
```

The WIZARD Database and WaterWitch

6

Wizard/Water-Witch interface

Water-Witch (WW) and Wizard can not read one another's native data file formats. To bridge this gap, a comma delimited ASCII file is used. This discussion deals with how WW software imports and exports these files. **Details on how Wizard imports and exports these files is discussed separately.**

The program WWMERGE.EXE is the data utility that handles the import/export of WW data sets. [WWMERGE contains a robust set of data reporting utilities and data manipulation capabilities. In our discussion we are only concerned with it's data import/export conversion tools.] WWMERGE is part of the standard Water-Witch installation, and is found in the WAT12 folder/directory on the target Windows-95 computer. Figure 1 shows WWMERGE after it has been started.

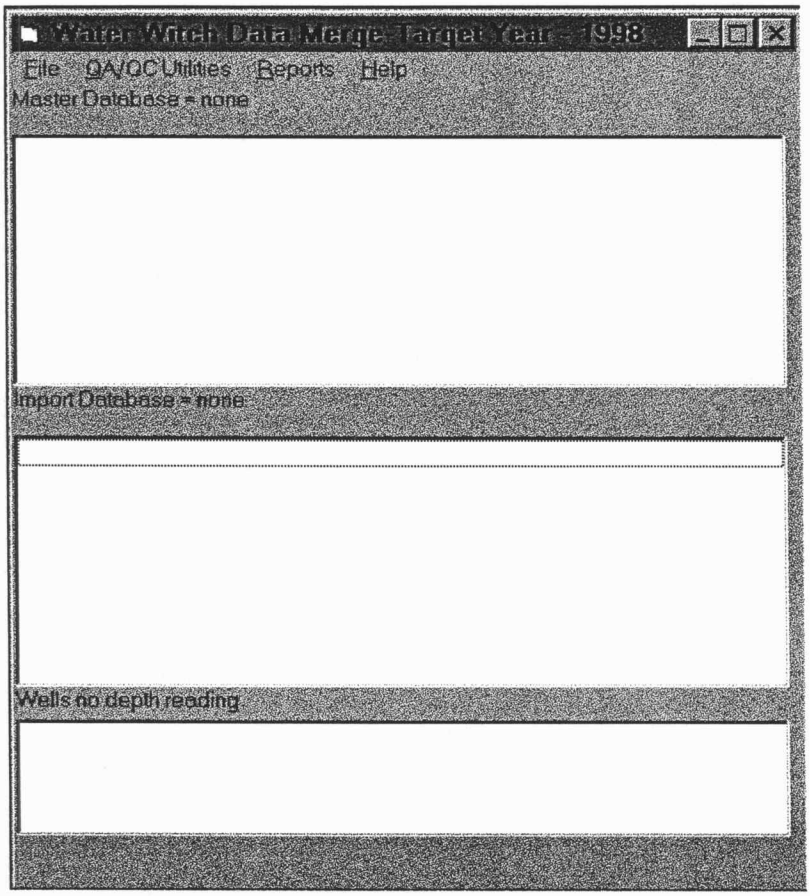


Figure 1

The WWMERGE window consists of several data frames. In our case we are interested in only the top frame. This frame is referered to as the master frame. WW compatible data files can be read into, and saved from this master frame.

Importing Wizard Data

Select the File drop-down menu item. This will expose the **Dbase Import/Export** item. Choose this item and click on **Import Wizard to Master** as shown in figure 2.

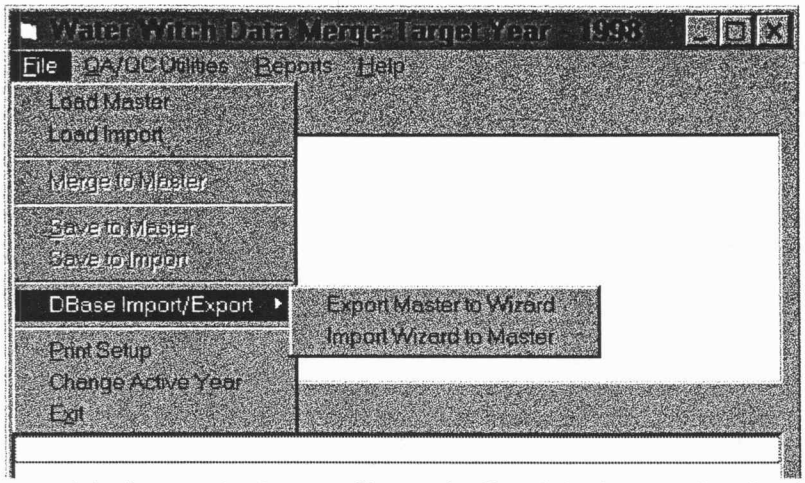


Figure 2

A message box will appear asking if the master frame should be cleared before importing. Normally the answer will be Yes. Answering no allows one to add on to a pre-existing data set. WWMERGE then displays a standard Windows-95 file dialog box. By default import files are assumed to have a .TXT extension. Select the file to import and click the OPEN button.

WWMERGE will begin the import. Progress of the conversion is show directly above the master frame. When the conversion is complete the master frame will reveal a list of the imported wells. An example is shown in figure 3.

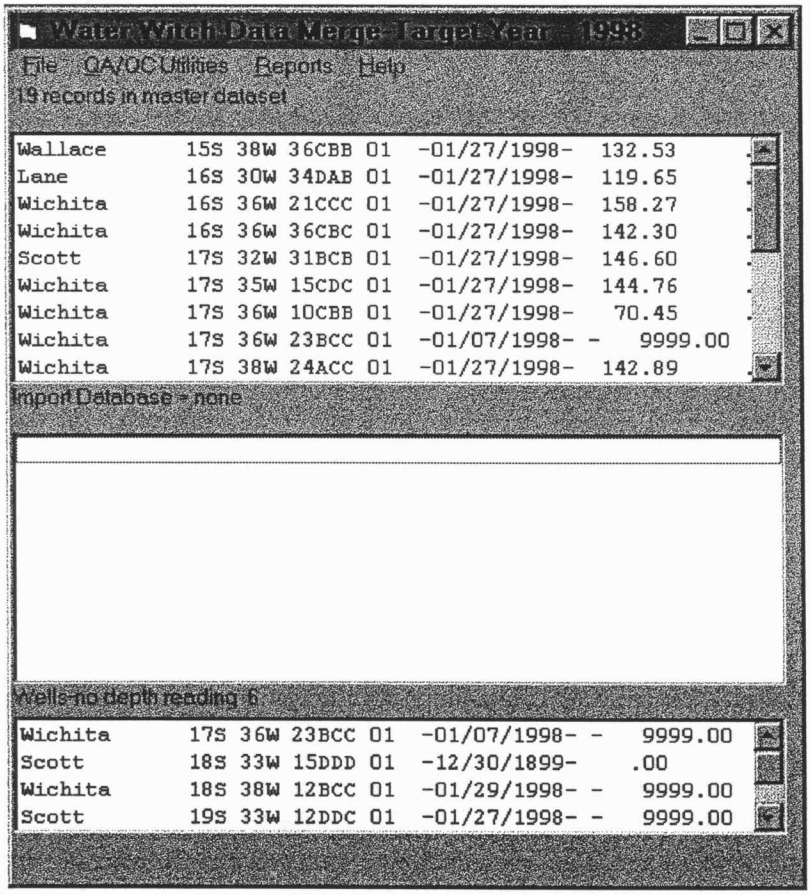


Figure 3

The data is now internally in WW format. This data must be saved to a file before WW can use the data for acquisition. Select the File drop-down menu item. Choose the **Save to Master** option. This will open a Windows-95 file dialog box. Enter the name of the output file, and click OPEN. By default WW files end with a .DAT extension. The Water-Witch program may now be started, and the file just saved used as its data file.

Exporting To Wizard.

Start WWMERGE and select the file drop-down menu. Choose the **Load Master** menu item. A Windows-95 file dialog will appear. Select the WW data file to export. WWMERGE will load and display the file in the upper frame of WWMERGE (master frame). Select the file drop-down menu again, and choose the **Dbase Import/Export** item. Then click on the **Export Master to Wizard** item. WMERGE will display a message box describing the action about to take place. Click OK on this message and a file dialog will appear. Type in a file name to call this exported data. By convention the file should end with a .TXT extension. WWMERGE will then begin the conversion. Progress is indicated just above the master frame. When conversion is complete a message appears indicating the total number of records converted as shown in figure 4.

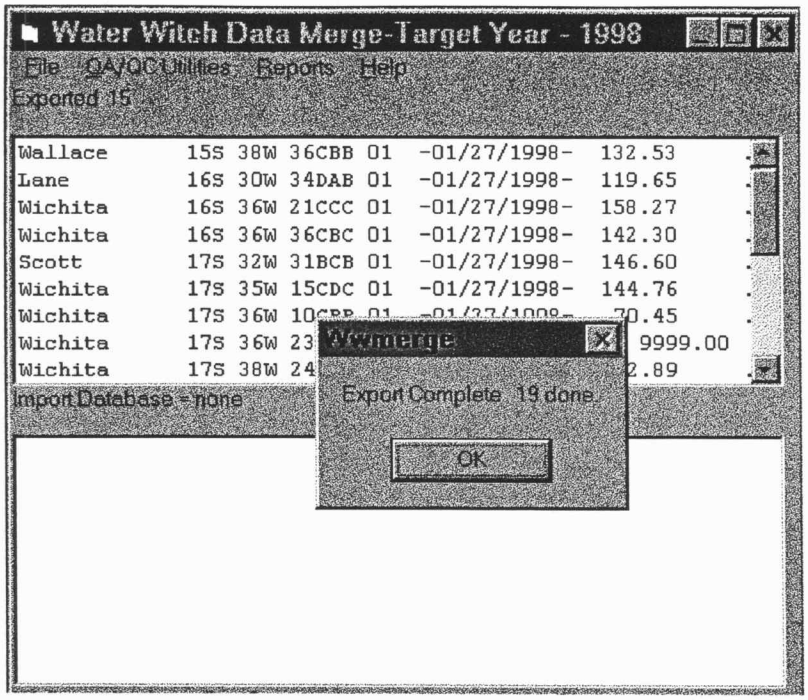


Figure 4

ASCII data file format

Each well record consists of a comma delimited ASCII text line ended by a carriage-return linefeed character (CR-LF). Each element in a line is separated by a comma. Strings maybe enclosed by double quotes ("). If a string has either a comma, single quote ('), CR-LF, or double quote (") it *MUST* be enclosed in double quotes. Strings that contain CR-LF pairs (and these two characters must only appear as pairs), must substitute a pair of || for the CR-LF. If a double quote is in a string it must have "" substituted for each occurrence of the double quote. Below are listed, in order, the values in a well record. All fields must be present. Fields that have no data my be left blank, except as noted below. Following the name of field is the Visual Basic definition for the field.

kgsid As String * 17 'KGS Identifier
usgsid As String * 15 'USGS Identifier
county As String * 13 'Kansas County name
fips As Integer 'county code
oldlat As Double 'usgs lat/lon
oldlon As Double
lat As Double 'gps lat/lon
lon As Double
measurement_type As String * 4 'Frequency of measure
elevation As Single 'ground elevation ft
measure_correction As Single 'Measurement point offset from ground level
land_owner As String * 90 'Land owner/operator information
owner_phone As String * 10 'land owner/operator phone number
mp_notes As String * 120 'measure point description notes
notes As String * 250 'general remarks about the well site-likely to contain CR-LF's and quote marks.
tape_hangs As String * 40 'depth of well problems
well_access As Byte 'flag 1=easy well access =0 not easy
down_access As Byte 'flag 1=easy downhole access
weighted As Byte 'flag 1=weighted tape,0=not weighted.
gmd As Byte 'district numbers 0=none,1-5, 255=uknown
flag As Integer '16bits worth of flags
well_depth As Integer 'drilled depth of well -9999 unknown
well_usage As String * 1 'usage code i=irr, u=ununsed
geo_unit As String * 6 'allows for 3 aqu types removed wat8

The following section is repeated 36 times. Each entry representing a different year. The first year is 1989, the last year is 2024. Null values should be 0 or blank. Null date should be 12/31/1899. Year should be expressed to 4 digits. Null time should be 0:0:0. All years must be represented even for those who's time as not yet come.
[
sample_times As Byte 'number of measurements attempted
sample_agency As Byte '1=usgs,2=dwr,3=kgs

```
sample_tagnum As Long   'tag number of this reading
sample_oil As Byte      'flag 255=oil on water
sample_lat As Single 'gps lat. stamp
sample_long As Single 'gps long stamp

sample_hold As Single  'hold point-primary sample
sample_cut As Single  'cut point  These two with MP value create _depth
sample_depth As Single 'depth of reading. mp corrected.
sample_date As string   'date of reading should be of form  mm/dd/yyyy
sample_time as string 'time  hh:mm:ss
sample_personal As String * 3 'initials of measurer
sample_chalk_cut As Byte  '0-2  0=fair, 1=good,2=excellent

hold As Single  ' hold point-resample 1
cut As Single  'cut point  These two with MP value create _depth
depth As Single 'depth of reading. mp corrected.
date As string   'date of reading
sample_time as string 'time  hh:mm:ss
personal As String * 3 'initials of measurer
chalk_cut As Byte '0-2 0=fair, 2=excel

hold As Single  ' hold point-resample 2
cut As Single  'cut point  These two with MP value create _depth
depth As Single 'depth of reading. mp corrected.
date As string   'date of reading
sample_time as string 'time  hh:mm:ss
personal As String * 3 'initials of measurer
chalk_cut As Byte '0-2 0=fair, 2=excel

hold As Single  ' hold point-resample 3
cut As Single  'cut point  These two with MP value create _depth
depth As Single 'depth of reading. mp corrected.
date As string   'date of reading
sample_time as string 'time  hh:mm:ss
personal As String * 3 'initials of measurer
chalk_cut As Byte '0-2 0=fair, 2=excel

]
```

Further discussion of variables:

gmd 1,2,3,4,5 or 0 (where 0 indicates no gmd) 255 unknown
chalk_quality 2 = excellent, 1 = good, 0 = fair 255 unknown
MP_access 1 = easy, 0 = difficult
downhole_access 1 = easy, 0 = difficult
tape_restrict depth(s) in feet, for example 235,260
oil_on_water 1 = yes, 0 = no 255=uknown
weighted_tape 1 = yes, 0 = no 255=unknown

Flag bit meanings:
Bit0=QA record flag-Set in QA file types
Bit1= trouble-measurement was out of trend when recorded
Bit2=gps reading out of range, or not active during measurement in 1998 the downhole access flag became unused.
Bit3=New note flag-the notes field has been changed
Bit4=New MP notes flag-the measure point notes have been changed
Bit5=New MP value-The measure point distance was changed
Bit6=Measure failed-1 or more attempts were made but failed to get a reading. The DTW is set to -9999
Bit7=New restrictions note-The restrictions of record were changed.

Byte count/data type are:

Type	Length
Byte	1
Integer	2
Single	4
Double	8
Long	4

The WIZARD Database table contents

7

Appendix: Contents of selected WIZARD tables

I. Contents of Sites table as of March 18, 1998:

SITE_TYPE

SITETYPE	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Well	49483	99.3	49483	99.3
Test hole	276	0.6	49759	99.9
Outcrop	27	0.1	49786	99.9
Spring	22	0.0	49808	100.0
Tunnel	7	0.0	49815	100.0
Collector	1	0.0	49816	100.0
Pond (dug)	1	0.0	49817	100.0

Frequency Missing = 1927

RECORD_CLASSIFICATION

RECCLASS	Frequency	Percent	Cumulative Frequency	Cumulative Percent
C	38967	78.8	38967	78.8
U	10495	21.2	49462	100.0
M	9	0.0	49471	100.0
L	1	0.0	49472	100.0

Frequency Missing = 2272

SOURCE_AGENCY_CODE

SAGCODE	Frequency	Percent	Cumulative Frequency	Cumulative Percent
USGS	51744	100.0	51744	100.0

PROJECT_NUMBER

PROJNO	Frequency	Percent	Cumulative Frequency	Cumulative Percent
462009400	13723	73.7	13723	73.7
N. CENTRAL	822	4.4	14545	78.2
CMRASA0254	776	4.2	15321	82.3
462010600	588	3.2	15909	85.5
462008200	556	3.0	16465	88.5
462011700	532	2.9	16997	91.3
462000200	492	2.6	17489	94.0
EQUUS BEDS	335	1.8	17824	95.8
EQUUS BEDS1	161	0.9	17985	96.6
462000701	132	0.7	18117	97.3
S. CENTRAL	92	0.5	18209	97.8
462000700	87	0.5	18296	98.3
462013500	76	0.4	18372	98.7
462008800	41	0.2	18413	98.9
462014700	37	0.2	18450	99.1
462008600	31	0.2	18481	99.3
KS-164	31	0.2	18512	99.5
462016400	22	0.1	18534	99.6
462019400	18	0.1	18552	99.7
462010900	16	0.1	18568	99.8
462007900	15	0.1	18583	99.8
462010700	10	0.1	18593	99.9
4620138	6	0.0	18599	99.9
KWRB	4	0.0	18603	100.0
462016700	2	0.0	18605	100.0
002	1	0.0	18606	100.0
4620007	1	0.0	18607	100.0
462006400	1	0.0	18608	100.0
462018200	1	0.0	18609	100.0
462088000	1	0.0	18610	100.0
CMRASA0245	1	0.0	18611	100.0

Frequency Missing = 33133

STATE_CODE

STATCODE	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Kansas	51730	100.0	51730	100.0
Colorado	9	0.0	51739	100.0
Nebraska	3	0.0	51742	100.0
Missouri	1	0.0	51743	100.0
Oklahoma	1	0.0	51744	100.0

COUNTY_CODE

CNTYCODE	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Present	51744	100.0	51744	100.0

LAT_LONG_SOURCE

LOCSRC	Frequency	Percent	Cumulative Frequency	Cumulative Percent
GWSI	51159	98.9	51159	98.9
GPS	585	1.1	51744	100.0

LOCAL_WELL_NUMBER

WELLNO	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Present	51744	100.0	51744	100.0

SPOT

SPOT	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Present	51571	100.0	51571	100.0

Frequency Missing = 173

SECTION

SECTION	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Present	51743	100.0	51743	100.0

Frequency Missing = 1

SUBDIVISION

SUBDIV	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Present	51573	100.0	51573	100.0

Frequency Missing = 171

SUBDIVISION_WELL_NUMBER

SUBWELNO	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Present	51723	100.0	51723	100.0

Frequency Missing = 21

TOWNSHIP

TWP	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Present	51742	100.0	51742	100.0

Frequency Missing = 2

TOWNSHIP_DIRECTION

TWPDIR	Frequency	Percent	Cumulative Frequency	Cumulative Percent
S	51720	100.0	51720	100.0
W	17	0.0	51737	100.0
N	5	0.0	51742	100.0

Frequency Missing = 2

RANGE

RNG	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Present	51743	100.0	51743	100.0

Frequency Missing = 1

RANGE_DIRECTION

RNGDIR	Frequency	Percent	Cumulative Frequency	Cumulative Percent
W	41479	80.2	41479	80.2
E	10262	19.8	51741	100.0
3	1	0.0	51742	100.0
S	1	0.0	51743	100.0

Frequency Missing = 1

LOCATION_MAP_NAME

MAPNAME	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Present	13337	100.0	13337	100.0

Frequency Missing = 38407

LAND_SURFACE_ALTITUDE_METHOD

SURFMETH	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Topo map	16852	51.7	16852	51.7
Surveying	15668	48.0	32520	99.7
Altimeter	101	0.3	32621	100.0

Frequency Missing = 19123

HYDROLOGIC_UNIT_CODE

UNITCODE	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Present	51716	100.0	51716	100.0

Frequency Missing = 28

USE_OF_SITE_PRIMARY

SITEUSE	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Withdrawal	36508	76.4	36508	76.4
Unused	3919	8.2	40427	84.6
Observation	3606	7.5	44033	92.2
Test	2952	6.2	46985	98.3
Oil or gas	415	0.9	47400	99.2
Destroyed	358	0.7	47758	100.0
Drain	8	0.0	47766	100.0
Anode	3	0.0	47769	100.0
Repressurize	3	0.0	47772	100.0
Heat res.	1	0.0	47773	100.0
Waste disp.	1	0.0	47774	100.0

Frequency Missing = 3970

USE_OF_WATER_PRIMARY

WATUSE1	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Irrigation	23587	50.2	23587	50.2
Unused	10158	21.6	33745	71.8
Domestic	6632	14.1	40377	85.9
Stock	4298	9.1	44675	95.0
Public supply	1610	3.4	46285	98.4
Industrial	662	1.4	46947	99.8
Commercial	39	0.1	46986	99.9
Other	22	0.0	47008	100.0
Dewatering	7	0.0	47015	100.0
Air cond.	3	0.0	47018	100.0
Fire	1	0.0	47019	100.0
Power	1	0.0	47020	100.0
Recreation	1	0.0	47021	100.0

Frequency Missing = 4723

USE_OF_WATER_SECONDARY

WATUSE2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Stock	4040	97.1	4040	97.1
Other	44	1.1	4084	98.2
Domestic	41	1.0	4125	99.2
Unused	17	0.4	4142	99.6
Industrial	13	0.3	4155	99.9
Public supply	2	0.0	4157	100.0
Air cond.	1	0.0	4158	100.0
Irrigation	1	0.0	4159	100.0

Frequency Missing = 47585

USE_OF_WATER_TERTIARY

WATUSE3	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Stock	23	54.8	23	54.8
Other	17	40.5	40	95.2
Domestic	1	2.4	41	97.6
Irrigation	1	2.4	42	100.0

Frequency Missing = 51702

DEPTH_DATA_SOURCE

DPTHSRC	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Memory	10720	95.3	10720	95.3
Source agency	173	1.5	10893	96.8
Other agency	162	1.4	11055	98.3
Drillers log	126	1.1	11181	99.4
Other person	34	0.3	11215	99.7
Owner	28	0.2	11243	99.9
Geologist	3	0.0	11246	100.0
Other	3	0.0	11249	100.0
Geophysical logs	1	0.0	11250	100.0

Frequency Missing = 40494

INV_WATER_LEVEL_SOURCE

WLEVSRC	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Source agency	22167	80.9	22167	80.9
Owner	3785	13.8	25952	94.7
Other person	963	3.5	26915	98.3
Drillers log	291	1.1	27206	99.3
Other agency	145	0.5	27351	99.8
Geologist	26	0.1	27377	99.9
Other	14	0.1	27391	100.0
Geophysical logs	2	0.0	27393	100.0

Frequency Missing = 24351

INV_WATER_LEVEL_METHOD

WLEVMETH	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Steel tape	22421	82.2	22421	82.2
Reported	4668	17.1	27089	99.3
Estimated	96	0.4	27185	99.6
Electric tape	83	0.3	27268	99.9
Other	10	0.0	27278	100.0
Press. gage	4	0.0	27282	100.0
Cal. elec. tape	3	0.0	27285	100.0
Manometer	1	0.0	27286	100.0

Frequency Missing = 24458

INV_WATER_LEVEL_SITE_STATUS

WLEVSTAT	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Dry	386	62.1	386	62.1
Other influence	186	29.9	572	92.0
Pumping nearby	15	2.4	587	94.4
Pumped recently	13	2.1	600	96.5
Being pumped	10	1.6	610	98.1
Inf. by SW Site	5	0.8	615	98.9
Flowing recently	3	0.5	618	99.4
Flowing, no meas.	2	0.3	620	99.7
Well destroyed	2	0.3	622	100.0

Frequency Missing = 51122

OTHER_DATA_AVAILABILITY

OTHRAVL	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Present	4018	100.0	4018	100.0

Frequency Missing = 47726

AQUIFER_TYPE_CODE

AQTYPE	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Unconf. mult.	161	68.5	161	68.5
Unconf. single	52	22.1	213	90.6
Conf. single	22	9.4	235	100.0

Frequency Missing = 51509

AQUIFER_CODE

AQCODE	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Present	7525	100.0	7525	100.0

Frequency Missing = 44219

STATION_TYPE_CODES

STATYP	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Present	51744	100.0	51744	100.0

SITE_CODE_AGENCY_USE

AGNCYUSE	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Inventory	37439	72.4	37439	72.4
Active	14068	27.2	51507	99.5
Inactive	237	0.5	51744	100.0

FLAGS_DATA_COLLECTED_TYPE

COLLTYPE	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Present	2611	100.0	2611	100.0

Frequency Missing = 49133

FLAGS_INSTRUMENTS_AT_SITE

SITEINST	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Present	1552	100.0	1552	100.0

Frequency Missing = 50192

REMARKS

REMARKS	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Present	49	100.0	49	100.0

Frequency Missing = 51695

RESTRICTION_NOTES

RESTNOTE	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Some Restriction	141	67.5	141	67.5
No Restriction	68	32.5	209	100.0

Frequency Missing = 51535

WELL_ACCESS

WELLACC	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Easy	1330	94.1	1330	94.1
Hard	83	5.9	1413	100.0

Frequency Missing = 50331

DOWNHOLE_ACCESS

HOLEACC	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Hard	926	65.5	926	65.5
Easy	487	34.5	1413	100.0

Frequency Missing = 50331

GROUNDWATER_MGMT_DISTRICT

GMD	Frequency	Percent	Cumulative Frequency	Cumulative Percent

Frequency Missing = 51744

GEOLOGICAL_UNIT1

GEOUNIT1	Frequency	Percent	Cumulative Frequency	Cumulative Percent
QU	606	44.3	606	44.3
TO	559	40.9	1165	85.2
QA	154	11.3	1319	96.4
KD	30	2.2	1349	98.6
KJ	15	1.1	1364	99.7
KN	2	0.1	1366	99.9
JM	1	0.1	1367	99.9
KU	1	0.1	1368	100.0

Frequency Missing = 50376

GEOLOGICAL_UNIT2

GEOUNIT2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
TO	306	90.8	306	90.8
QU	24	7.1	330	97.9
KD	5	1.5	335	99.4
KJ	1	0.3	336	99.7
QA	1	0.3	337	100.0

Frequency Missing = 51407

GEOLOGICAL_UNIT3

GEOUNIT3	Frequency	Percent	Cumulative Frequency	Cumulative Percent
KJ	27	69.2	27	69.2
KD	9	23.1	36	92.3
JM	2	5.1	38	97.4
TO	1	2.6	39	100.0

Frequency Missing = 51705

DEPTH_TO_BEDROCK_SOURCE

BRSRC	Frequency	Percent	Cumulative Frequency	Cumulative Percent

Frequency Missing = 51744

ANNUAL_WATER_LEVEL_REPORT

ANNRPT	Frequency	Percent	Cumulative Frequency	Cumulative Percent

Frequency Missing = 51744

WATER_LEVEL_REPORT_REGION

RPTRGN	Frequency	Percent	Cumulative Frequency	Cumulative Percent

Frequency Missing = 51744

LAT_LONG_ACCURACY_CODE

LOCACC	Frequency	Percent	Cumulative Frequency	Cumulative Percent
1 second	409	0.9	409	0.9
5 seconds	6629	13.8	7038	14.7
10 seconds	33180	69.3	40218	84.0
60 seconds	7657	16.0	47875	100.0

Frequency Missing = 3869

Variable	Label	N	Mean
LAT	LATITUDE	51744	38.35
LON	LONGITUDE	51744	-99.19
MERIDIAN	MERIDIAN	51743	6.00
SURFALT	LAND_SURFACE_ALTITUDE	32825	2182.74
SURFACC	LAND_SURFACE_ALTITUDE_ACCURACY	32346	3.04
HOLEDPTH	DEPTH_OF_HOLE	1084	1730.37
WELLDPTH	DEPTH_OF_WELL	32179	122.48
WLEV	INV_WATER_LEVEL	27591	51.23
BRDEPTH	DEPTH_TO_BEDROCK	0	.

Variable	Label	Minimum	Maximum
LAT	LATITUDE	36.98	40.00
LON	LONGITUDE	-102.95	-94.61
MERIDIAN	MERIDIAN	6.00	6.00
SURFALT	LAND_SURFACE_ALTITUDE	0.00	3999.00
SURFACC	LAND_SURFACE_ALTITUDE_ACCURACY	0.00	100.00
HOLEDPTH	DEPTH_OF_HOLE	0.00	8710.00
WELLDPTH	DEPTH_OF_WELL	0.00	6150.00
WLEV	INV_WATER_LEVEL	-35.40	830.00
BRDEPTH	DEPTH_TO_BEDROCK	.	.

Variable	Label	N	Mean	Minimum
CONSYEAR	Well construction year	0	.	.
ESTYEAR	Year site established	0	.	.
WLEVYEAR	Inventory msmt. year	0	.	.
RECYEAR	Year record created	0	.	.
UPDTYEAR	Year record updated	51744	1998.00	1998.00

Variable	Label	Maximum
CONSYEAR	Well construction year	.
ESTYEAR	Year site established	.
WLEVYEAR	Inventory msmt. year	.
RECYEAR	Year record created	.
UPDTYEAR	Year record updated	1998.00