

APPENDIX A

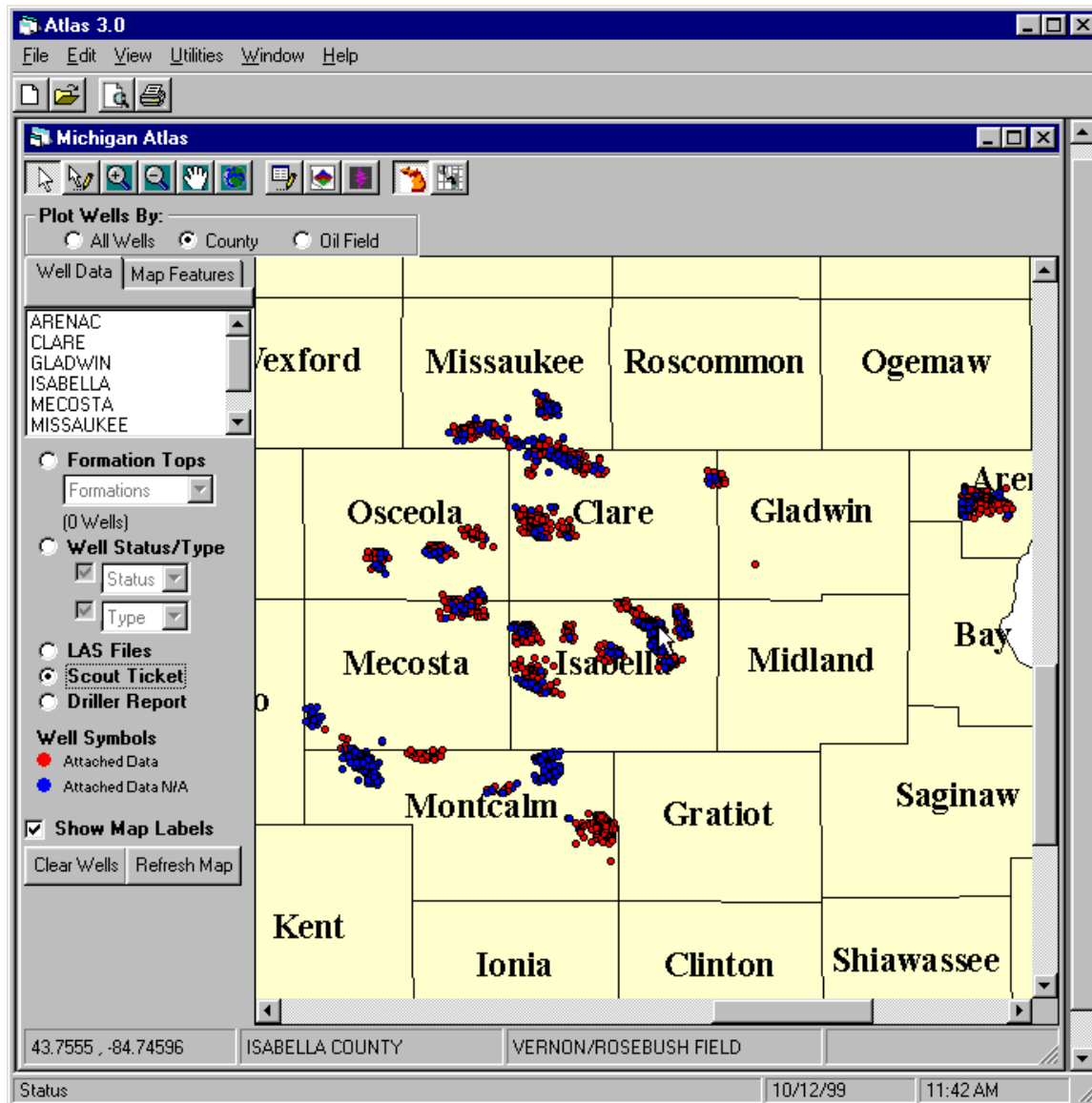
**HELP FILES FROM ATLAS 3.0
OCTOBER, 1999**

**ADVANCED CHARACTERIZATION OF FRACTURED RESERVOIRS IN
CARBONATE ROCKS: THE MICHIGAN BASIN**

DE-AC26-98BC15100

Atlas

Atlas maps Oil and Gas Wells by County, Oil Field, and by user-drawn areas. Program features include Database Editing, Formation Top and Well Status Displays, Document Image and LAS File Displays, Data Exporting for 3D plotting, Log Viewing, and the display of detailed Map Features by County through the use of the U.S. Census TIGER/Line® data.



Copyright Information

Atlas 3.0

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Subsurface Visualization Lab (SVL), Michigan Technological University, Houghton, MI.

J. R. Wood, Director of SVL, jrw@mtu.edu

C. J. Asiala, Programmer, cjasiala@mtu.edu

ImagN' for Windows

(Used for displaying document images.)

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Map Objects LT

(Used for displaying maps.)

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Defining a Project

A **Project** is defined to include all of the wells in a given database, along with the Map files of where the wells are located and any supporting document files, such as Scout Tickets or Driller Reports. When a project is loaded, the user must select a subset of the wells in the Project to plot, edit, or export.

The Selected Wells may be:

1. All wells in the project
2. All wells in one or more Counties
3. All wells in one or more Oil Fields
4. All wells located within a user-drawn rectangle

Project Information:

ProjectList.mdb is an MS-Access database, which is loaded into the install directory during Set Up. The table, **Projects**, is updated with the Form, **Project Information**, which is loaded when a user Opens a Project or adds a New Project to **Atlas**.

Project Information

Project Data

Project Name: Michigan Atlas

Project Database: C:\Data_Projects\atlas\data\mi_atlas.mdb [Browse...]

Formation Top Picks

Measured Depth Subsea Depth **Hole or Null Value:** -99999

Maps (Select one or more)

World Map (Country Borders): [Browse...]

Country Map (State Borders): [Browse...]

State Map (County Borders): C:\Data_Projects\atlas\data\co26names [Browse...]

Directory of Map Features: q:\tigerdata\ [Browse...]

Document Images (Optional)

	Document Type	Document Root Directory	
1.	Scout Ticket	q:\scouttickets\	[Browse...]
2.	Driller Report	q:\driller_reports\	[Browse...]
3.	LAS Files	Q:\atlas3\lasfiles\	[Browse...]

[Open] [Cancel] [Remove...] [Set Project Extents...]

Project Name

Open an existing Project: Select an existing project by clicking on a Project Name in the List Box.

Set up a New Project: Type the Project Name in the Text Box, and fill in the rest of the project information.

Project Path

Path of the Project Database.

The database included with the Atlas is **MI_Atlas.mdb** and will be installed in the "Data" subdirectory of the Installation Directory.

Formation Depth Option Buttons

The Measured Depth and Subsea Depth Option buttons describe the format of the Formation Depth in the Tops table. Measured Depth is the default.

Hole or Null Value

The value set to be the Formation Depth in the Export table for records, which have no value for the Selected Formation Top. The default value is -99999.

Maps

At least one of the map files (World, Country, or State) must be defined for the Project. In the path given, there must be 3 files associated with the Shape file selected (*.shp, *.dbf, *.shx).

The map files included with Atlas are the shape files needed for the State Map of Michigan. All of the Michigan counties are included in these files.

World Map contains outlines of all the countries in the world.

Country Map contains outlines of all the states in one or more countries.

State Map contains outlines of all counties in one or more states.

Directory of Map Features points to a directory, which holds shape files for individual map features, such as lakes, streams, roads, and township boundaries. These shape files (one per county, per feature) were downloaded from the U.S. Census TIGER/Line[®] 1995 Data set.

Document Images

Document Images are multiple-page TIFF Image Files, which were created by scanning paper documents associated with the Wells in the Project Database. Atlas allows for two different types of documents, which can be defined by the user.

Document Type is the name given to describe the document.

Document Path is the path of the Root Directory of where the TIFF Images are stored.

Document1 and *Document2* are fields in the Project Database that are set to true if a document of the given type is attached to the well. The **Document1** and **Document2** tables hold the subdirectories and file names of documents 1 and 2 respectively. These tables are connected to the header table through the permit number.

In the Michigan Atlas project, Document 1 refers to the Scout Tickets and Document 2 refers to the Driller Reports. All of the Scout Tickets available for the wells in the database are included with **Atlas** (subdirectory scouttickets), but not all of the Driller Reports are available. The Document Paths can be set to the directories on the CD-ROM and the Atlas program will display them from there.

Example for the Michigan Atlas Database: If the CD-ROM drive is E:\, then the Document1 Type is *Scout Ticket* and the Path is *E:\ScoutTickets*. The Scout Ticket TIF files are stored in Subdirectories under this directory on the CD-ROM. Each Subdirectory is a County Name, and there may be subdirectories under the Counties for the Township names.

Command Buttons

Open

Validate entries on the form and Load the Atlas Form that displays the Maps and Well Locations.

Cancel

Exit

Remove...

Remove the selected Project Definition from the ProjectList database, but do not delete any data files.

Set Project Extents...

Set the Top-Left and Bottom-Right Latitude/Longitude extents of the project.

Project Extents

Lat/Long Coordinates for Top Left Corner of Project Extent:

Top (Latitude)	Left (Longitude)
44.5	-86

Lat/Long Coordinates for Bottom Right Corner of Project Extent:

Bottom (Latitude)	Right (Longitude)
43	-84

Get Extents from Database OK Cancel

If the **Get Extents from Database** button is clicked, the Extent values are filled in by the maximum and minimum Latitudes and Longitudes in the Project Database. Otherwise, the values can be manually entered in. When **OK** is clicked, the values are stored in the **ProjectList.mdb** Database, and are used in the mapping program to zoom in to the extents of the project.

Project Database:

"**MI_Atlas.mdb**" is an MS-Access database, which is automatically installed in the "**data**" subdirectory of the install directory. It contains Well Header and Formation Tops data for 30 Oil Fields in 7 counties in central Michigan. This database can be substituted with similar data in a different MS-Access database as long as the required tables and fields are included. Data can be loaded into the **Atlas** program by:

5. Copying the structures of the tables in MI_Atlas.mdb to new empty tables within a new MS-Access database, and then appending records to the tables, or
6. Opening an existing MS-Access database and renaming the tables and fields to the same names in MI_Atlas.mdb.

Tables:

- **All_Well_Headers**
- **All_Well_Tops**
- **FormationNames**
- **OilFields**
- **Counties**
- **Document1**
- **Document2**
- **LASFiles**
- **DetailMapLayers**
- **UserMaps**

All_Well_Headers

This table holds the general information about each well in the database. Because **Atlas** allows the user to edit fields, all of the fields must be in the database. However, the ones marked with (*Required), must have valid data in order for the functions of **Atlas** to work correctly.

Index: OilField, ASC; Permit, ASC

All_Well_Headers : Table		
Field Name	Data Type	Description
Permit	Text	Unique Well Identifier (*Required)
OilField	Text	Oil Field Name (*Required)
Well_Status	Text	W.B. Harrison Status Code
Latitude	Number	Latitude (*Required)
Longitude	Number	Longitude (*Required)
KB	Number	Kelly Bushing (*Required)
IP-Before	Number	Initial Production Before Water Injection
IP-After	Number	Initial Production After Water Injection
IP-Water	Text	Initial Production of Water Out
Top_Porosity	Text	Dundee Top of Porosity
Subsea_TD	Number	Total Depth (Subsea Depth)
Comment	Text	
Document1	Yes/No	Indicates a Document1 (ex. Scout Ticket) is attached to Permit
Document2	Yes/No	Indicates a Document2 (ex. Driller Report) is attached to Permit
LASFile	Yes/No	Indicates a LAS file is attached to Permit in table LASFiles
Operator	Text	Oil Well Drilling Company
LeaseName	Text	Well Name
WellNbr	Text	Well Number
CountyCode	Number	County Code
CountyName	Text	County Name (*Required)

All_Well_Headers : Table		
Field Name	Data Type	Description
TWN	Text	Township
RNG	Text	Range
Section	Number	Section
QtrQtrQtr	Text	Civil Location within a 1/4 of a 1/4 of a section
QtrQtr	Text	Civil Location within a 1/4 of a section
Quarter	Text	Civil Location within a section
NSQtrDistance	Number	Feet from North or South quarter of a Section
NSDir	Text	North/South Direction of Footage Call
EWQtrDistance	Number	Feet from East or West quarter of a Section
EWDir	Text	East/West Direction of Footage Call
TD	Number	Total Depth (Measured Depth)
FormTD	Text	Formation at Total Depth
IssueDate	Date/Time	Permit Issue Date
DrillStartDate	Date/Time	Drill Start Date (SPUD)
DrillComplDate	Date/Time	Drill Completion Date
WellType	Text	DNR Well Type Code
WellStatus	Text	DNR Well Status Code
PlotFlag	Text	Used by Atlas program (*Required Field-No data needed)

All_Well_Tops

This table holds multiple records per Permit number, one record for each formation depth. Depth can be either Measured or Subsea Depth, but the user must define which depth is used on the **Project Information** form when setting up the project. **Atlas** assumes the depth is Measured Depth unless the user selects Subsea Depth.

Index: Permit, ASC; Depth, ASC

All_Well_Tops : Table			
Field Name	Data Type	Description	
Permit	Text	Unique Well Identifier (*Required)	
FormationCode	Text	Formation Code (*Required)	
FormationName	Text	Formation Description (*Required)	
Depth	Number	Depth of Formation (*Required - Measured Depth or Subsea Depth)	

FormationNames

List of Formation Codes used in the database and the corresponding descriptions.

Index: DepthSequence, ASC

FormationNames : Table			
Field Name	Data Type	Description	
DepthSequence	Number	Filled by User to show the Depth sequence of the Formations	
FormationCode	Text	Formation Code (*Required)	
FormationName	Text	Formation Description (*Required)	

OilFields

Stores the name of the Oil Field and the latitude/longitude coordinates for the Top Left and Bottom Right corners of the Oil Field boundaries. When the mouse is moved over an Oil Field, the code for determining the value in the Status Bar uses the Lat/Long ranges in the **OilFields** table to show which Oil Field is being passed over. Also, this table is used to fill the listbox on the Edit Screen for Oil Field. Users can pick an existing Oil Field or Type in a field that is not on the list.

Index: Name, ASC

OilFields : Table			
Field Name	Data Type	Description	
NAME	Text	Oil Field Name (*Required)	
Top	Number	Latitude of Top of Rectangle which bounds the Oil Field (*Required)	
Bottom	Number	Latitude of Bottom of Rectangle which bounds the Oil Field (*Required)	
Left	Number	Longitude of Left Side of Rectangle which bounds the Oil Field (*Required)	
Right	Number	Longitude of Right Side of Rectangle which bounds the Oil Field (*Required)	

Counties

Stores the Names and numeric codes of the counties in the scope of the project. This table is used to fill the list box on the Edit Screen for County Name so users will be consistent with

upper/lower case and spelling when entering the County Names. The county code will automatically be updated with the number in the CountyCode field. Because the counties in a state do not change, the list box does not allow new entries to be typed in. To make changes to this table, use Microsoft Access.

Index: County, ASC

Field Name	Data Type	Description
County	Text	County Name
FIPSCode	Text	County FIPS Code
CountyCode	Number	DNR County Code
StateAbbr	Text	2 Character State Abbreviation
StateFIPS	Text	State FIPS Code

Document1

For each well that has a Document1 (Scout Tickets for Michigan Atlas Example) type of TIFF file associated with it, the Permit and path to the Document file are stored in this table. For each permit in this table, the Document1 field is set to true in the All_Well_Headers table.

Field Name	Data Type	Description
Permit	Text	Unique Well ID
DocumentPath	Text	Path and File Name to Document1

Document2

For each well that has a Document2 (Driller Reports for Michigan Atlas Example) TIFF file associated with it, the Permit and path to the Document file are stored in this table. For each permit in this table, the Document2 field is set to true in the All_Well_Headers table.

Field Name	Data Type	Description
Permit	Text	Unique Well ID
DocumentPath	Text	Path and file Name to Document2

LASFiles

For each well that has a LAS file associated with it, the Permit and path to the LAS file are stored in this table. For each permit in this table, the LASFile field is set to true in the All_Well_Headers table.

LASFiles : Table			
	Field Name	Data Type	Description
	Permit	Text	Unique Well ID
	LASFile	Text	Path and File Name of LAS File

DetailMapLayers

Holds descriptions of each possible Map Feature included in the download from the Census TIGER/Line® 1995 Data. This table is used to construct the shape file name and set the display options for each map layer.

DetailMapLayers : Table			
	Field Name	Data Type	Description
	LayerName	Text	Map Feature Description
	Prefix	Text	3-character code to represent layer
	Color	Text	Color the feature will appear as on the map
	Order	Number	Order in which the layer will be drawn on the map

UserMaps

This table is created and updated by the **Atlas** program when the user selects the counties and Map Feature Layers to display. There is one record per county, per map feature. This table keeps a listing of the current shape files and attributes needed to display them.

UserMaps : Table			
	Field Name	Data Type	Description
	County	Text	County Name
	FIPSCode	Text	County FIPS Code
	LayerName	Text	Map Feature Name
	Prefix	Text	3-character code for Layer
	Color	Text	Color of Map Feature
	Order	Number	Order of drawing of Map Feature
	ShapeFile	Text	Shape file name of feature

Map Files:

The map files are shape files which hold the state and county boundaries, and also provide Latitude/Longitude coordinates for mouse movements over the map. The shape files can be created using software packages like ArcView[®] and ARC/INFO[®].

The shape files included in this application contain the counties within Michigan. They are loaded into the "Data" subdirectory of the Install Directory during Set Up. The set of Shape files for one map should include the Shape (*.shp), the Shape Index (*.shx), and the Shape Database (*.dbf) files.

Maps are referenced in the **Project Information** screen. The user must indicate which maps to use in a project. At least one of the **World**, **Country**, or **State** maps must be defined in order to plot points in a project. (The shape file name is entered without an extension.)

The **Directory of Map Features** refers to a directory containing shape files from the U.S. Census TIGER/Line[®] data, which are used to display map features like lakes, rivers, and streets. A set of feature shape files for each county in Michigan is included with **Atlas**. To display on the map, use the **Add Map Features** toolbar button to select counties and features.

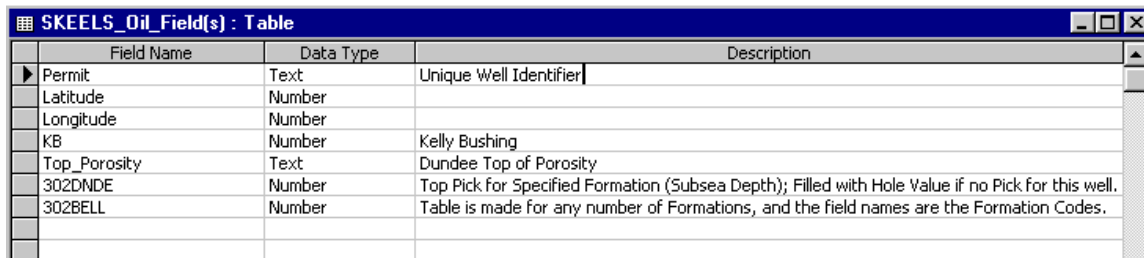
To add Map Features from other states to **Atlas**,

- Add records for any new features to **DetailMapLayers** table in project database.
- Add counties with County and State FIPS codes to **Counties** table.
- Move the new shape files to the directory listed in the **Project Information** Screen.

Export Databases:

After a group of wells has been selected and the points are drawn on the map, the Formation Tops data can be exported into a separate MS-Access database to be used in plotting programs. The user selects one or more formation tops to export. A new or existing Export Database is chosen, and a table is written to hold the exported data.

The table will be created with the description of the Prospect as its name unless the user overwrites the table name. The fields holding the **Subsea Depth** of each Formation Top will be named by the Formation Code.



Field Name	Data Type	Description
Permit	Text	Unique Well Identifier
Latitude	Number	
Longitude	Number	
KB	Number	Kelly Bushing
Top_Porosity	Text	Dundee Top of Porosity
302DNDE	Number	Top Pick for Specified Formation (Subsea Depth); Filled with Hole Value if no Pick for this well.
302BELL	Number	Table is made for any number of Formations, and the field names are the Formation Codes.

Notes about the Exported Data:

- The exported table will have one record for each well selected.
- If the well does not have a value for the formation tops chosen, the subsea depth value for that formation will be the hole (or null) value which is set in the **Project Information** screen. It is possible for an exported well to have no values for the chosen formations.
- If the Formation Picks are in Measured Depth (also set in the **Project Information** screen), and there is no valid KB (Kelly Bushing), then the record for that well will not be exported. It will be written to a log file in the same directory as the Export Database and will be named after the name given to describe the selected wells with an extension of ".log". The Kelly Bushing can then be entered into the database from the Edit Screen if it is available.
- If the Formation Picks are in Subsea Depth, the KB is still written to the file, but it is not checked for valid data.
- Top_Porosity is the Top of Porosity for the Dundee Formation.

New/Open Project

Atlas keeps a record of multiple projects that can be accessed by the users. The **Projects** table in the **ProjectList** database holds one record per project and tracks the following:

7. Paths and filenames for the database, map files, and document files.
8. Minimum and Maximum Latitude and Longitude coordinates of all the wells in the specified database for use as project extents.
9. Measured/Subsea Depth indicator for Formation Top Picks.
10. Hole (or Null) Value to be used when no Top Pick is found for a specified formation.

Separate projects may be needed for different geographical regions, and it may also be easier to work with a large database if it is divided into smaller databases and treated as several projects.

Menu Option: File, New

Displays a blank **Project Information** Screen. Type in the Project Name and fill in the rest of the project information. If a project name already exists in the **Projects** table, a message is displayed to inform the user a different project name must be chosen.

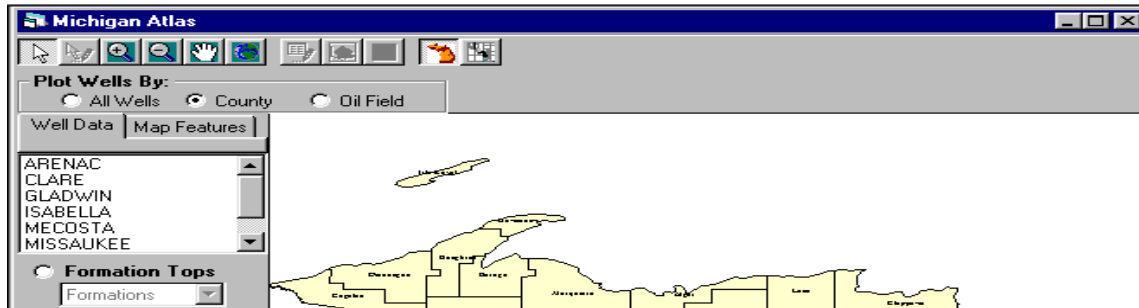
Menu Option: File, Open

Displays the first project in the **Projects** table, but the Project Name is shown as a list box so the user can choose another project. Settings may be updated in the **Project Information** screen, or the project can be opened directly.

Clicking on **Open** from the **Project Information** screen will load the defined map files and make the chosen database available to the Atlas program.

Plotting Wells

Once wells have been plotted on the map, they are available for Editing and Exporting. They can also be re-mapped showing symbols for the presence of attached documents, Formation Top Picks, and Well Status.



"Plot Wells By:"

- When the user clicks an option button, the list box is filled according to the option button clicked. The Counties and Oil Fields are queried from the All_Well_Headers table in the database. When one or more items are selected from the list box, all wells that satisfy the selection are plotted.
- When the All Wells option is clicked, the list box is cleared, and all of the wells in the database are plotted.
- The user can select multiple items from the list box by using the shift and control keys. When multiple items are selected, wells are plotted that satisfy at least one of the choices.

Selecting Wells by Clicking on the Map



- Click the Select button and move the mouse over the map until an Oil Field name appears in the 3rd frame of the Status Bar at the bottom of the screen. Click the mouse, and the wells from this Oil Field will be plotted.
- If the cursor is over a county, but not over an Oil Field, the whole county will be plotted when clicked. If there are no wells for the chosen county in the database, the clicked county will be zoomed in and displayed.
- Hold the shift key and click on additional Oil Fields or Counties, and all selected areas will be plotted. All of these wells will be included in the Edit and Export functions.

- Click the Select button and draw a rectangle over an area of interest to the user. The wells located within this latitude/longitude range will be plotted on the map.

Well Symbols

There are 5 types of data attached to each well - Formation Top Picks, Well Status and Type, LAS Files, Scout Tickets*, and Driller Reports*. Initially, all wells are plotted with blue circles. When one of the 5 options is selected, the well symbols change to red if data of that type exists.

When the option button for Formation Top Picks is clicked, a Formation Code must also be selected. All wells with a Top Pick for that formation will be symbolized in red. The number of wells with the selected formation is displayed beneath the list box.

When the Well Status/Type option is chosen, any combination of Status and Type can be selected, and all wells that meet the conditions will be plotted in red.

Once an option has been chosen, additional wells plotted will be coded with the same options.

* In the Michigan Atlas project, the 2 Documents are Scout Tickets and Driller Reports. The documents associated with the wells can be any type of document. The user defines a document description and root directory in the **Project Information** screen when a project is defined or opened. The remaining path information for individual documents are stored in separate tables (Document1 and Document2).

Map Tools

Zoom-In

Select the Zoom-In button and draw a rectangle around the area to enlarge.

Zoom-Out

When the Zoom-Out button is clicked, the map is scaled down by 2 times.

Pan

Select the Pan button and drag the mouse from one spot on the map to another to move the map in any direction.

Full Extent

Click the Full Extent button and the whole map will be drawn to a scale that fits on the screen.

Show Map Labels

When this box is unchecked, the labels are removed from the map. This may be necessary when viewing wells that are plotted where the labels are printed on the map.



Clicking on **Clear Wells** will remove all wells plotted on the map. Clicking on **Refresh** will redraw the current selection of wells and reset the list box items.

Status Bar Data

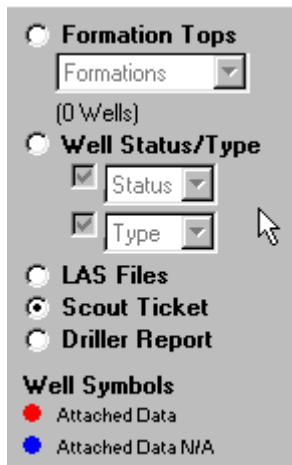
There are 4 frames in the Status Bar at the bottom of the map. The first frame is the Lat/Long coordinates of where the mouse is located. The second frame is the County that the mouse is over. The third frame contains the name of an Oil Field, if the mouse is over an Oil Field. Otherwise, it is empty.

The Fourth frame is used to display the name of a feature when Map Features have been added to the map. If the Map Features tab is clicked and the frame for Water Bodies is clicked, when the mouse passes over a lake, the name of the lake will appear in the 4th frame.

Plotting Formations

When a group of wells is selected and plotted on the map, the Formation List Box is filled with the Formation Codes of Top Picks that exist for the plotted wells. The user chooses to display wells by Formation Code, LAS Files, or Document. The names of the documents are filled by the Document Type, which is entered in the Project Information Screen. The well symbols are plotted in red if data exists for the chosen option type. All other wells are plotted in blue. (ex. Clicking on **LAS Files** changes the well symbols to red for all wells with a LAS file attached. Clicking on **Scout Tickets** changes the well symbols to red for all wells with a Scout Ticket.)

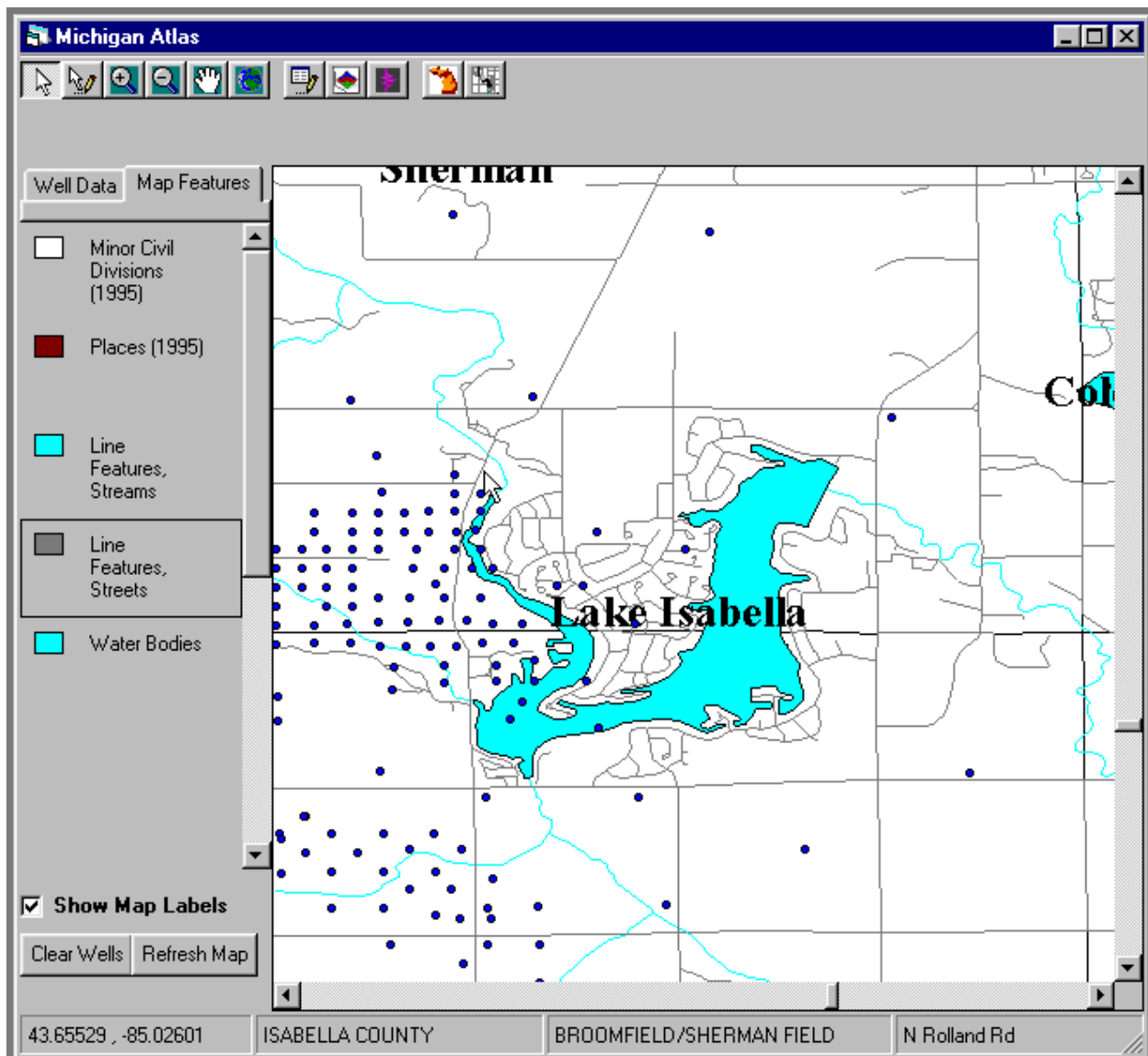
When the user clicks the Formation Top Picks option button, a Formation Code must also be selected. The wells are then re-plotted with red symbols indicating that the well has a pick for the chosen formation. The number of wells with a value for the chosen formation is displayed below the list box.



The next selection of plotted wells will be symbolized with the options of the current group of selected wells. For example, if one field is plotted for the Dundee formation, the next field or county chosen will be plotted for the Dundee formation also. If a county is plotted to show which wells have Scout Tickets, the next selection will be plotted showing Scout Tickets also.

U.S. Census TIGER/Line[®]; 1995 Data

Users can select Detail Map Layers to the area of the map they are working with. Detailed shape files for each county in Michigan were downloaded and stored in one directory on the Atlas CDROM. For each county, there are individual shape files for certain features such as township boundaries, roads, lakes, and streams. Atlas users can select which Counties and which detail maps they want to add to the Map of Michigan.



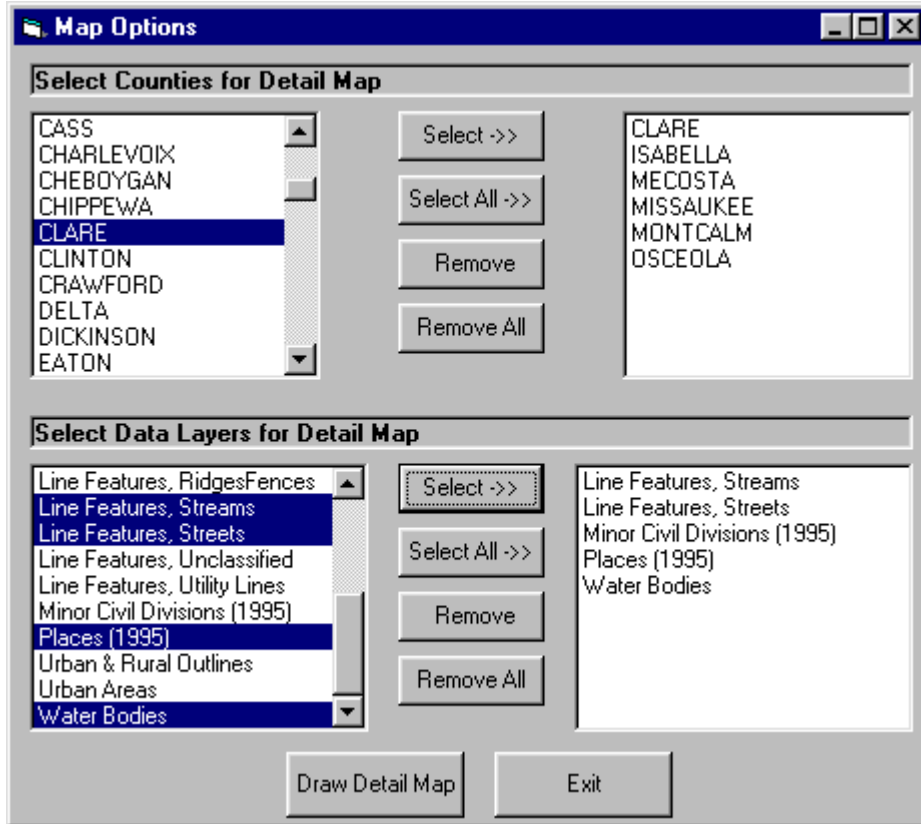
ShapeFile Naming Standards

xxxSSCCC.shp

Each shape file is identified by this format, where xxx is a 3-character code describing the type of detail layer, SS is the FIPS State Code, and CCC is the FIPS County code.

Database

The County FIPS code was added to the **Counties** table. The **DetailMapLayers** table was created to hold a record for each possible Layer Description, Prefix Code, Order, and Color. The **UserMaps** table is generated by **Atlas** to hold the user's current selection of Counties and Detail Layers. The shape file name is generated by the user selections and if it exists, a new layer is added to the map in **Atlas**.



Editing Well Data

Edit Plotted Wells

After a group of wells has been selected and plotted, the **Edit Plotted Wells** button is enabled. When clicked, the Edit Screen is activated and the fields of the Header and Tops tables can be edited. Only the plotted wells are available for editing and the Permits are listed in the Selected Wells list box near the bottom left of the Edit Screen.

Select Wells to Edit

This button is used when one or several wells need to be edited or viewed without changing the selection of plotted wells. Clicking on a point or drawing a rectangle around a well or group of wells will activate the Edit Screen just for these wells while keeping the wells previously plotted on the map. A blue rectangle is drawn around the wells being edited.

Edit Screen

The operations performed using this form will update the main database, but will involve only the records selected by the user.

EVART/PROSPER/PROSPER S FIELDS

Permit#: 34536 Lat*/Long*: 43.92299 -85.25983

Oil Field*: EVART Well Status Codes: OIL AB 1

Operator: DART OIL AND GAS CORPORATION * Required Entry

Well Name: MCCORMICK ET AL 2-27

KB*: 1055 Subsea TD: -9763 IP-Before: 0

Total Depth: 4918 Formation at TD: RCFD IP-After: 0

County Code/Name*: 67 OSCEOLA IP-Water: *****

SECT/TWN/RNG: 27 18N 8W Top of Porosity: *****

Quarters: SW SE NW No. Formation Tops: 25

Footage Calls: 330 FSL 848 FEL Issue Date: 4/20/81

Comment: Drill Start Date: 5/11/82

Drill Compl Date: 5/11/82

Selected Wells	Formation Tops			
	Permit	FormationCode	FormationName	Measured Depth
34400				
34459				
34536	34536	351CLDR	Coldwater Limestone	1607
34606	34536	351SNBR	Sunbury	2434
35163	34536	351BERE	Berea	2442
36786	34536	319ANRM	Antrim Shale	2908
41825	34536	302TRVR	Traverse Formation	3053

Click a Formation to Update the Current Formation Tops Record

Add Well Delete Well Refresh Update Close

Add Fm Top Delete Fm Top Scout Ticket Driller Report LAS File

Record: 129 of 133

Selected Wells

Click on a Permit number in this list box and the header information and formation tops data for this well will be displayed on the screen.

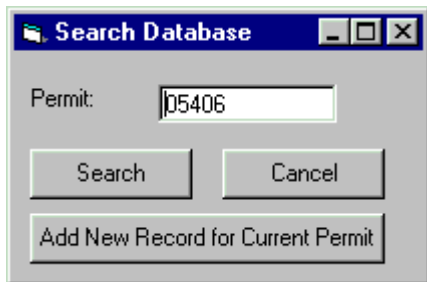
Oil Field

The Oil Field entry is a list box, which is filled from the Oil Field Table. When a new Oil Field is typed into the list, the new field is added to the Oil Field Table with the Top, Bottom, Left, and Right fields set to 0. The Oil Field extents can be updated by the user in MS-Access or by using the Utility, **Get Oil Field Extents**.

County

The County entry is a list box, which is filled from the Counties Table. The County list is set up so users cannot add new counties to the project. It is assumed that the Counties Table will hold all possible Counties for the project. The Counties Table can be filled by the user in MS-Access or by using the Utility, **Fill County Table**, which fills the County Table with the unique county names in the All_Well_Headers Table.

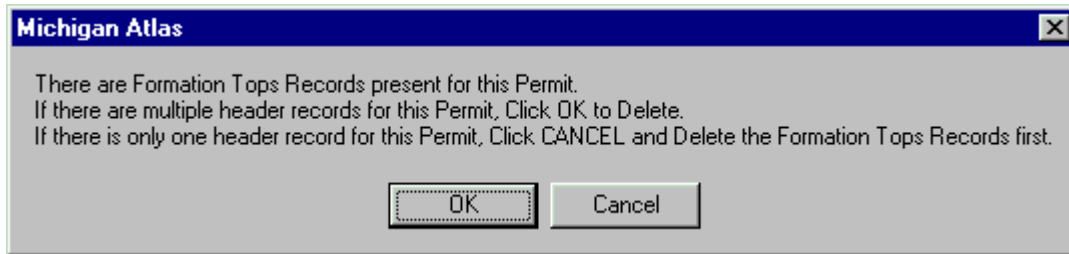
Add Well



- Brings up a Search Window with Permit number of current well.
- The user can search the database for a new Permit number, or add a new record for the current permit.
- **Search** button. If the Permit is found among the group of selected wells, then the data for that well is displayed and the user can edit the fields as needed, or add Formation Tops data. If the Permit is found in the database, but not in the current Selection of Wells, then a message is displayed to tell the user that the Permit entered already exists in the database. If the Permit is not found, then a blank display screen comes up where the user types in data for a new well.
- If **Add New Record for Current Permit** is clicked, an additional record for the current Permit number will be added to the database. All fields will be identical to the current record, and edits can be done from here. (This function may be useful to attach multiple types of image documents that cannot be combined into multi-page TIFF files.)
- **Permit, Lat/Long, KB, and County Name** must have values in order for the program to run properly. **Oil Field** is needed if the database is to be plotted by Oil Field.

Delete Well

Click on the **Permit** number to delete and then click on the **Delete Well** button. If there are formation tops present for this permit, the following message box appears:



Refresh

Refreshes the query, which was run to select the wells displayed on the **Edit Screen**.

Update

Must be clicked in order to save the edits and save the data in a new record. If the **Edit Screen** is closed before the **Update** is done, all entries for the newly added record will be lost, and the permit will not be added to the database.

Close

Closes the **Edit Screen**.

Editing Formation Tops

Add Formation

When this button is clicked, the **Permit** is automatically entered in the next Formation Tops record. Select a Formation from the list box at the bottom right of the screen. When an item is clicked from this list, the **Formation Code** and **Formation Name** are updated. Only the **Depth** needs to be entered manually.

Save changes to the Formation Top Record in the All_Well_Tops Table by clicking on another cell in the grid or clicking the **Update** button.

Delete Formation

Select a Formation Top record from the Formation Tops Grid, and click on **Delete Formation** to delete a formation depth from the database.

Scout Ticket and Driller Report

These 2 buttons correspond to the Documents defined for the project. In our example database, MI_Atlas.mdb, **Document1** references Scout Ticket TIFF files and **Document2** references Driller Report TIFF files. Document1 and Document2 are defined in the **Project Information Screen**. If they are left blank, it is assumed that there are no documents associated with the wells in the database. In this case, the Scout Ticket and Driller Report buttons will be disabled.

If there is a path and file name stored in the Document1 and/or Document2, the Document Name given in the **Project Information Screen** will be displayed on the corresponding button. When the button is clicked, a form is brought up to display the document. The information from the document can be used to fill in data in the database. The buttons are disabled if there is no file in the document fields.

LAS File

The LAS File button is activated if an LAS file is associated with the current well. When clicked, a viewing window displays the text of the LAS file with Next and Previous buttons allowing the user to view multiple LAS files for one well. The LASFiles table stores the permit and path of the LAS File, and the LASFile field in the All_Well_Headers table is set to true if an LAS File exists for a well.

Formation Codes

This list box in the lower right corner of the **Edit Screen** displays Formation Codes used in the database (Table, **FormationNames**). When a Formation Code is selected, the **Formation Code** and **Formation Name** of the current Formation Tops Record is changed to the selected item. In order to save the change, click another row in the grid or click the **Update** button.

Update the **FormationNames** Table from MS-Access or use the **Get Formation Codes** Utility to reset the table to hold all of the unique Formation Codes currently in use from the All_Well_Tops Table. To add new codes to the list, type in the new code and description in the Formation Tops grid when adding a new formation top to the table. Run the **Get Formation Codes** Utility to reset the Formation Code List and make the new formation code available for new entries.

Viewing Documents

When the **Document** buttons (**Scout Ticket** and **Driller Report** in the Michigan Atlas project) on the **Edit Screen** are enabled, there is a document image associated with the current well available for viewing. Clicking the button will display the TIFF image of the document. The image has zoom-in and zoom-out buttons, and next and previous buttons for multi-page images.

The image can remain open while entering data into the **Edit Screen**.

OPERATOR Gordon Oil Co.			PERMIT NO. 2399		
FARM George Prout			WELL NO. 1		
COUNTY Isabella			TWP. Denver		
NW	NW	NW	SEC. 18	TWP. 15N	RGE. 3W
NL 330	SL	EL	WL 330	CONT.	Gordon
	8" 954	SHOWS Gas 3695, Oil 3691-3-95			
14"	6" 1538				
10" 392	5" 3061				
NIP 180 bbls.			AIP. 3-2 bbls.		
ELEV. 754.7			T.D. 3700		
			COM. 4/17/35 COMP. 6/17/35		
Form	From - To	Datum	Form	From - To	Datum
Drift			Tr. Ls.		
Br. Ls.			Bell		
Stray #	1288-1300	-534	Dun.	3655slm	-2900
Mar.	1300	-625	D.R.		
Mar. R.R.	1442-1525		Syl.		
Cw. Ls.			B.I.		
Cw. R.R.			Sal.		
Sun.			Niag.		
Be-Bed.			Cat.		
Ant.	2475	-1720	Cinn.		
T.F.	3000	-2245	Trent.		

Background

Atlas displays multiple page TIFF images. When documents are scanned, they can be saved as TIF Group 4 compression and all pages for a document can be combined into one physical file. **Atlas** allows the user to define 2 different document types. For example, the Michigan Atlas project references Scout Ticket and Driller Report documents. TIF images for Well Logs could also have been defined. The document type description is entered in the Project Information Screen along with the root directory of where the documents are located. The description is displayed on the Command buttons on the Edit Screen that display the document for an individual well.

The ScoutTickets table (references for Document1) and DrillerReports table (references for

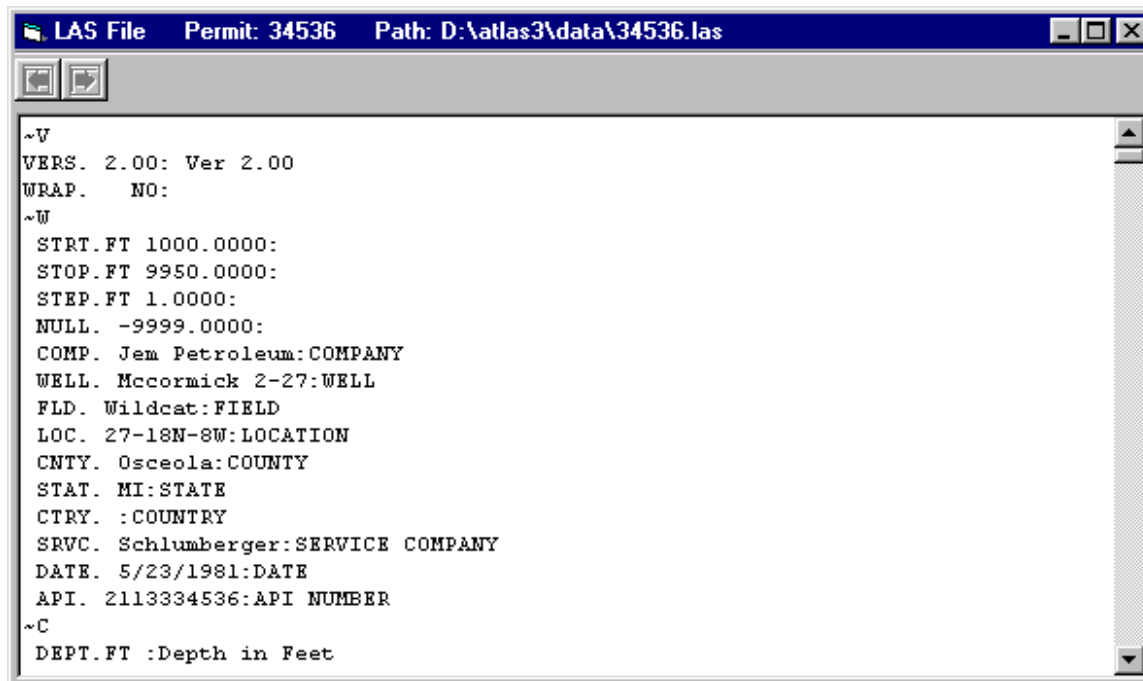
Document2) hold the Permit and path to each document. The fields Document1 and Document2 in the All_Well_Headers table are set to true if a TIF file exists for the well.

Even though Atlas defines only 2 document types, users can connect more documents to a well without adding additional pages to a multi-page TIFF file. For example, suppose the project already references Scout Tickets and Driller Reports and now the user wants to display Well Logs.

11. In the Scout Ticket root directory, make another folder. (ex. d:\scouttickets\WellLogs\)
12. Add Well Log files to this directory. (ex. D:\scouttickets\WellLogs\montcalm\02394.tif)
13. Add a record to the ScoutTickets table (Permit: 02394,DocumentPath: WellLogs\montcalm\02394.tif)
14. Set Document1 to true in the All_Well_Headers table. This can be done in an Access Query.
15. When the Scout Ticket button is clicked, the Next Document and Previous Document buttons will be enabled, and the user will be able to view all of the documents available for the well. The Next and Previous Page buttons will also work if each document has multiple pages.

Viewing LAS Files

When the **LAS File** button on the **Edit Screen** is enabled, there is a LAS File associated with the current well. Clicking the button will display the text of the LAS file. Next and Previous buttons are enabled if the well has more than one LAS File referenced.

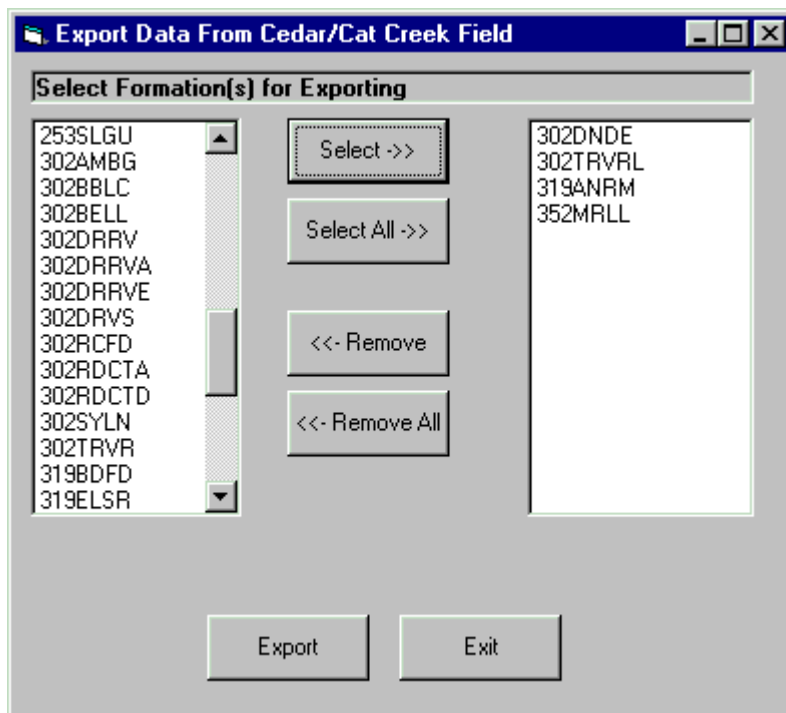


```
~V
VERS. 2.00: Ver 2.00
WRAP. NO:
~W
STRT.FT 1000.0000:
STOP.FT 9950.0000:
STEP.FT 1.0000:
NULL. -9999.0000:
COMP. Jem Petroleum:COMPANY
WELL. McCormick 2-27:WELL
FLD. Wildcat:FIELD
LOC. 27-18N-8W:LOCATION
CNTY. Osceola:COUNTY
STAT. MI:STATE
CTRY. :COUNTRY
SRVC. Schlumberger:SERVICE COMPANY
DATE. 5/23/1981:DATE
API. 2113334536:API NUMBER
~C
DEPT.FT :Depth in Feet
```

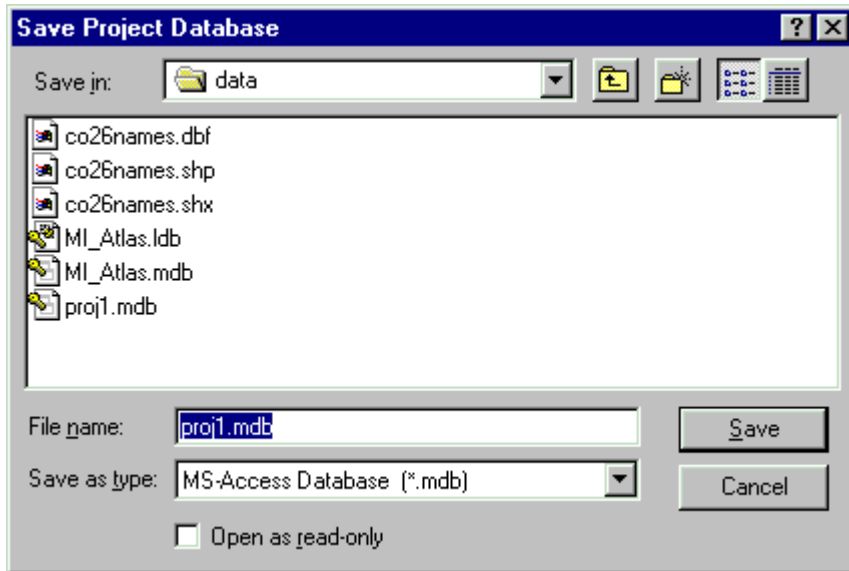
Export Formation Tops

The Export function saves Permit, Lat/Long, KB, Dundee Top of Porosity and formation depths selected by the user for the wells plotted on the map. This MS-Access database file can then be read into other programs for 2D and 3D plotting, isopach maps, etc.

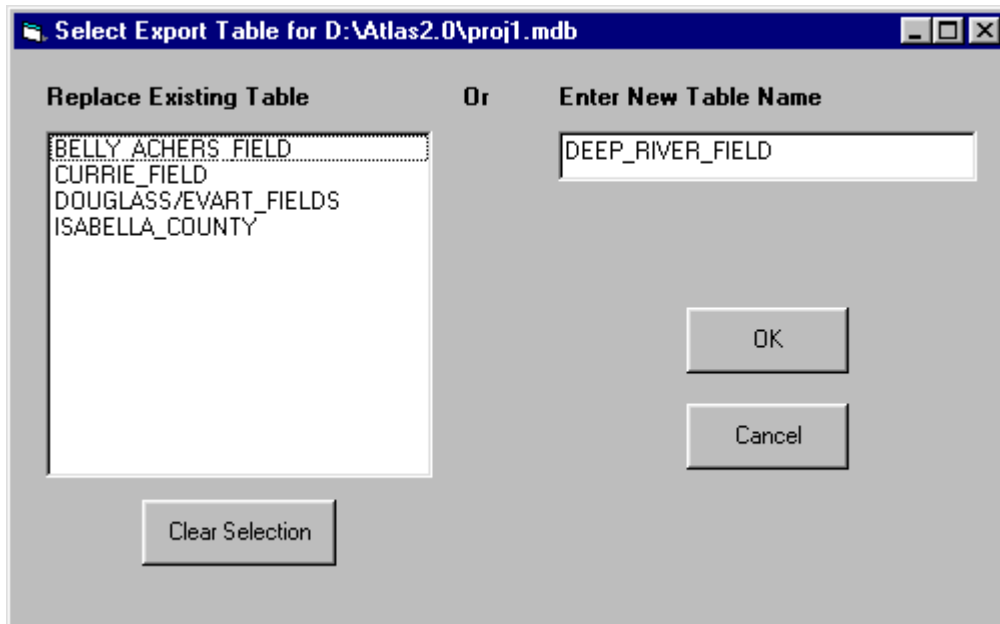
- Plot a selection of wells on the map.
- Click the **Export** button from the ToolBar.
- Choose the formation(s) to be included in the exported table. The shift and control keys can be used with mouse clicks to select Multiple formations. Use the Select and Remove buttons to move formation codes to and from the selection lists. The formations in the right-hand list will be used in the Exported Table.
- Click **Export**.



- Create a new project database or select an existing Project database (MS-Access database *.mdb) to store the exported table.
- If an existing database is selected, a message pops up to remind the user that the Exported table will be added to this database.



- Create a new Export Table or replace an existing Export Table within the project database. Existing Tables are listed on the left, and the name to be used for the new Export Table is on the right. When possible, the program provides a name that should describe the Wells Selected. The user can choose either of these, or type in a new table name.



- When **OK** is clicked, the table is created in the database and a Log file is written to the same directory as the Export Database to record the Export Results. If a Well is missing its KB (Kelly Bushing), and the Formation Picks are in Measured Depth, Atlas cannot calculate Subsea Depth. An Export Record is not output for these wells, but the Permit and Well Name are listed in the Log file so users can correct the data.



- The program is then returned to the **Export Data From...** screen, where the user can click **Exit** to return to the map, or make new formation selections and export another table.

Well Log Viewer

LogVu is a separate program for viewing log curves defined in an LAS file. **Atlas** activates LogVu and sends the LAS paths to LogVu to open the well logs.

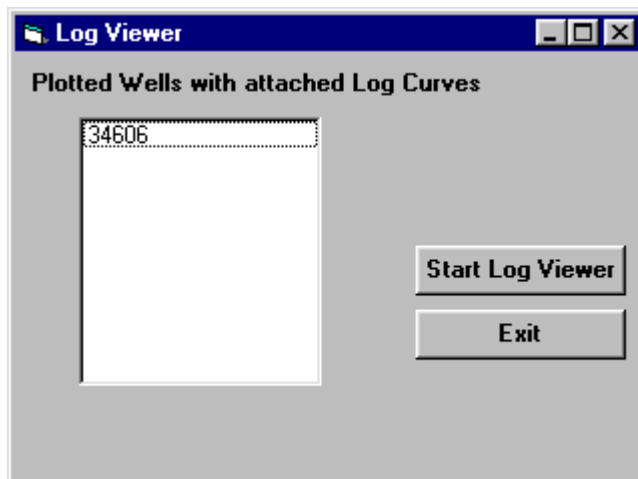
16. Plot a group of wells on the map.

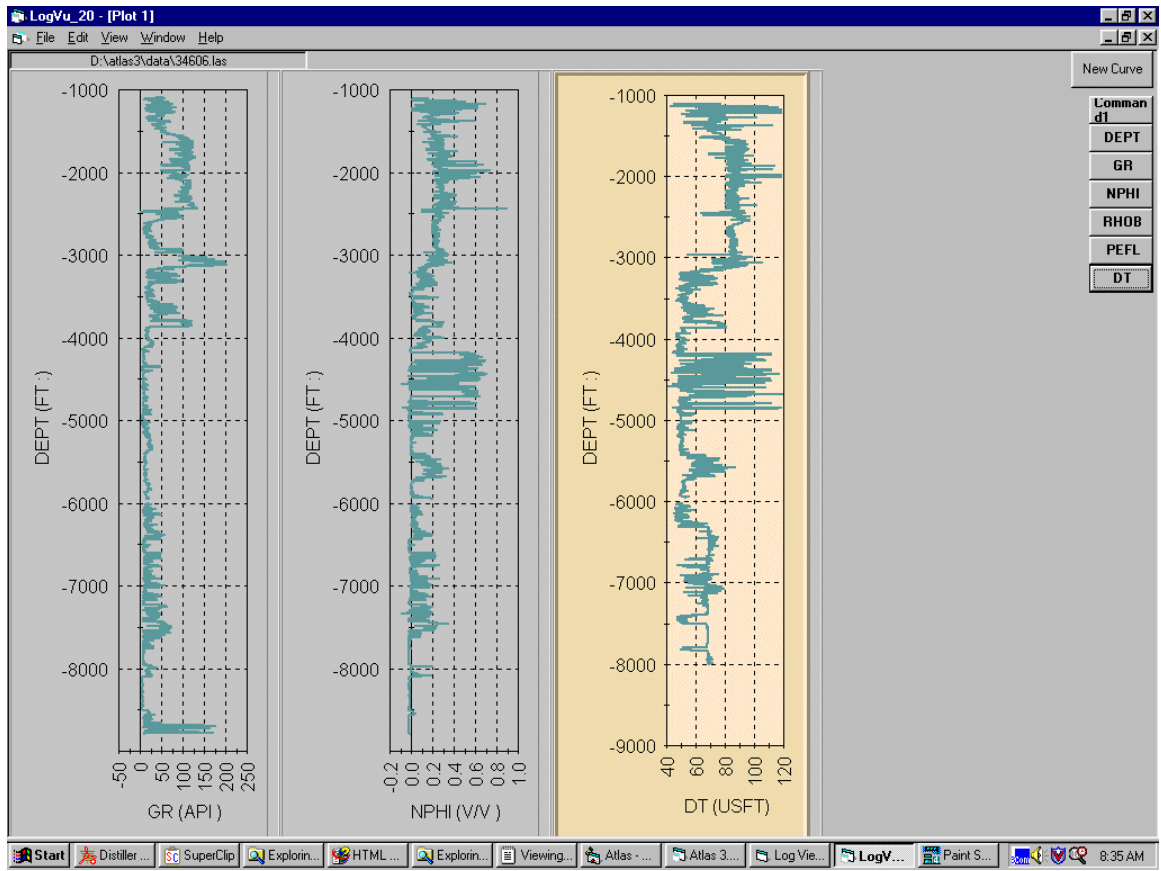
17. Click the **LAS Files** button to show which wells have LAS files. (optional)

18.  Click the **Log Viewer** button.

19. With the cursor changed to a crosshair, click on a well or draw a rectangle around a group of points to select wells for viewing well logs.

20. The selected wells that have LAS files attached will be displayed in the Log Viewer Screen. Select one Permit number and **Start Log Viewer**.





Get Oil Field Extents

This creates or updates the **OilFields** table in the project database. This table lists all defined Oil Fields in the database and holds lat/long coordinates for the top-left and bottom-right corner of the rectangle surrounding the Oil Field.

If the table does not exist in the user's database, the table is created with the fields NAME, Top, Bottom, Left, and Right. If the table does exist, the user can exit the utility or choose to have the table overwritten with updated data from the database.

A Totals Query appends the minimum and maximum latitudes and longitudes of each Oil Field in the **All_Well_Headers** table to the **OilFields** table. The Top (maximum Latitude) / Left (minimum Longitude) and Bottom (minimum Latitude) / Right (maximum Longitude) coordinates represent the rectangular extents of each Oil Field on the map.

Use of OilFields table:

When the mouse is moved over the map, the **OilFields** table is searched for the mouse location by comparing the mouse location with the extents of each field. When the mouse location is found to be within the range of the extents, the Oil Field name of that record is displayed in the Status Bar at the bottom of the map. The values of the extents in the **OilFields** table may need to be manually adjusted in MS-Access to account for the following:

21. Oil Field boundaries are not always a perfect rectangle and may overlap. Plot the Oil Field by selecting from the list. Then compare the lat/long coordinates shown on the Status Bar when the mouse is moved to the coordinates in the **OilFields** table. Make any necessary adjustments.
22. A well may have an incorrect Latitude/Longitude or be labeled as being in the wrong field. This will make the rectangle extents for the field much larger than what is correct. Fix the well or change the extents in the **OilFields** table to exclude the well in error.

The **OilFields** table is also used to fill the list box for the Oil Field field on the Edit Screen. When an Oil Field is chosen from the list, the **All_Well_Headers** table is updated (completed after the **Update** button is clicked). A new Oil Field can be added to the list by typing in the Oil Field name in the text part of the list box. This will add the new Oil Field to the **OilFields** table, but the Top, Left, Bottom, and Right coordinates will be set to zero. The **Get Oil Field Extents** utility can be run again to set the extents or they can be manually entered using MS-Access.

* Remember that any manual changes made to the OilFields Extents will be overwritten by the maximum and minimum longitude and latitude values found in the All_Well_Headers table if the **Get Oil Field Extents** utility is rerun.

Get Formation Names

This utility creates or updates the **FormationNames** table in the project database. Each formation beneath the earth's surface is referenced by a standard formation code for a particular area. This table stores the available codes and formation descriptions available for the current project.

If the table does not exist in the user's database, the table is created with the fields DepthSequence, FormationCode, and FormationName. If the table does exist, the user can exit the utility or choose to have the table overwritten with updated data from the database.

Unique Formation Codes and Formation Names are appended to the **FormationNames** table from the **All_Well_Tops** table. This table is then used to fill the list box on the Edit Screen that is used for filling in Formation Codes in the Formation Tops grid (Updates the All_Well_Tops table). It is important to choose the Formation Codes from the list when adding or updating Formation Picks, so the codes will be consistent within the database.

CRYSTAL FIELD

Permit*:	<input type="text" value="02406"/>	Lat*/Long*:	<input type="text" value="43.28284"/>	<input type="text" value="-84.87131"/>		
Oil Field*:	<input type="text" value="CRYSTAL"/>	Well Status Codes:	<input type="text" value="OIL"/>	<input type="text" value="AB"/>	<input type="text" value="3"/>	
Operator:	<input float:="" right;"="" type="text" value="THE DAILY CRUDE OIL CO. * Required Entry					
Well Name:	<input type="text" value="TOW, J."/>	<input type="text" value="1"/>				
KB*:	<input type="text" value="790"/>	Subsea TD:	<input type="text" value="-2408"/>	IP-Before:	<input type="text" value="739"/>	
Total Depth:	<input type="text" value="3198"/>	Formation at TD:	<input type="text" value="DUND"/>	IP-After:	<input type="text"/>	
County Code/Name*:	<input type="text" value="59"/>	<input type="text" value="MONTCALM"/>	IP-Water:	<input type="text" value="*****"/>		
SECT/TWN/RNG:	<input type="text" value="2"/>	<input type="text" value="10N"/>	<input type="text" value="5W"/>	Top of Porosity:	<input type="text" value="-3186"/>	
Quarters:	<input type="text" value="SE"/>	<input type="text" value="NW"/>	<input type="text" value="SW"/>	No. Formation Tops:	<input type="text" value="15"/>	
Footage Calls:	<input type="text" value="990"/>	<input type="text" value="FNL"/>	<input type="text" value="990"/>	<input type="text" value="FWL"/>	Issue Date:	<input type="text" value="4/11/35"/>
Comment:	<input type="text" value="-1495"/>				Drill Start Date:	<input type="text" value="4/19/35"/>
					Drill Compl Date:	<input type="text" value="5/29/35"/>

Selected Wells <input type="text" value="02238"/> <input type="text" value="02394"/> <input type="text" value="02395"/> <input type="text" value="02404"/> <input type="text" value="02405"/> <input style="background-color: #000080; color: white;" type="text" value="02406"/> <input type="text" value="02407"/>	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="5" style="text-align: left; padding: 2px;">Formation Tops</th> </tr> <tr> <th style="width: 10%;"></th> <th style="width: 15%;">Permit</th> <th style="width: 20%;">FormationCode</th> <th style="width: 40%;">FormationName</th> <th style="width: 15%;">Measured Depth</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">▶</td> <td>02406</td> <td>353MCGN</td> <td>Michigan</td> <td style="text-align: right;">335</td> </tr> <tr> <td></td> <td>02406</td> <td>701GCDF</td> <td>Base of Glacial Drift</td> <td style="text-align: right;">335</td> </tr> <tr> <td></td> <td>02406</td> <td>403SGNW</td> <td>Saginaw</td> <td style="text-align: right;">365</td> </tr> <tr> <td></td> <td>02406</td> <td>403PARM</td> <td>Parma Sandstone</td> <td style="text-align: right;">630</td> </tr> <tr> <td></td> <td>02406</td> <td>353MCGN</td> <td>Michigan</td> <td style="text-align: right;">728</td> </tr> </tbody> </table> <div style="margin-top: 5px; border: 1px solid black; padding: 2px;"> <p style="font-size: small; text-align: center;">Click a Formation to Update the Current Formation Tops Record</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;"></td> <td style="width: 20%;"><input type="text" value="353MCGN"/></td> <td style="width: 60%;"><input type="text" value="Michigan"/></td> </tr> <tr> <td></td> <td><input type="text" value="351CLDRR"/></td> <td><input type="text" value="Coldwater Redr"/></td> </tr> <tr> <td></td> <td><input type="text" value="351CLDR"/></td> <td><input type="text" value="Coldwater Lime"/></td> </tr> <tr> <td></td> <td><input type="text" value="351BERE"/></td> <td><input type="text" value="Berea"/></td> </tr> <tr> <td></td> <td><input type="text" value="319ELSR"/></td> <td><input type="text" value="Ellsworth Shal"/></td> </tr> <tr> <td></td> <td><input style="background-color: #000080; color: white;" type="text" value="319BDFD"/></td> <td><input style="background-color: #000080; color: white;" type="text" value="Bedford Shale"/></td> </tr> <tr> <td></td> <td><input type="text" value="319ANRMT"/></td> <td><input type="text" value="Light Antrim"/></td> </tr> </table> </div>	Formation Tops						Permit	FormationCode	FormationName	Measured Depth	▶	02406	353MCGN	Michigan	335		02406	701GCDF	Base of Glacial Drift	335		02406	403SGNW	Saginaw	365		02406	403PARM	Parma Sandstone	630		02406	353MCGN	Michigan	728		<input type="text" value="353MCGN"/>	<input type="text" value="Michigan"/>		<input type="text" value="351CLDRR"/>	<input type="text" value="Coldwater Redr"/>		<input type="text" value="351CLDR"/>	<input type="text" value="Coldwater Lime"/>		<input type="text" value="351BERE"/>	<input type="text" value="Berea"/>		<input type="text" value="319ELSR"/>	<input type="text" value="Ellsworth Shal"/>		<input style="background-color: #000080; color: white;" type="text" value="319BDFD"/>	<input style="background-color: #000080; color: white;" type="text" value="Bedford Shale"/>		<input type="text" value="319ANRMT"/>	<input type="text" value="Light Antrim"/>
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<input type="button" value="Add Well"/>	<input type="button" value="Delete Well"/>	<input type="button" value="Refresh"/>	<input type="button" value="Update"/>
<input type="button" value="Add Fm Top"/>	<input type="button" value="Delete Fm Top"/>	<input type="button" value="Scout Ticket"/>	<input type="button" value="Driller Report"/>

Record: 6 of 278

If a new code needs to be added to the list, it can be manually typed into the Formation Code and Formation Name columns in the Formation Tops grid on the Edit Screen. When the **Get Formation Names** Utility is run again, the **FormationNames** table will be updated with the new Formation Code and the new code will appear in the list box.

Connect LAS Files

This utility reads a directory file list and adds the path for each *.las file to the **LASFiles** table in the project database. The **LASFiles** table holds the permit number and path for a LAS file so the content of the LAS file can be displayed and the Log Curves can be charted using the LogVu program.

If the table does not exist in the user's database, the table is created with the fields **Permit** and **LASFile** (LAS File path). If the table does exist, the user can exit the utility or choose to have additional LAS files added to the table.

LAS File references are added just like the Document Images (Scout Tickets and Driller Reports). The root directory is stored in the ProjectList.mdb database associated with the Project Information Screen, and the subdirectories and file names are stored in the LASFiles table. It is assumed that the first 5 digits of the LAS File name is the permit number. This permit number and the path of all the LAS Files in the given directory are added to the **LASFiles** table. The **LASFile** Yes/No field is updated to true on the **All_Well_Headers** table for all permits added to the **LASFiles** table which are also in the **All_Well_Headers** table.

Multiple LAS files for each permit can be added. For example, if 12345.las holds 5 log curves, 12345Logs2.las may hold 5 more curves. If the Allow Duplicates check box is checked, two records are added to the LASFiles table:

```
12345 12345.las
12345 12345Logs2.las
```

