

Applied Petroleum Geology

GEOL 598

Sooner Field

**Introduction to Petra
Chapters 3 & 4**

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Modified from Jewel Wellborn (2007)

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Creating a Cross Section

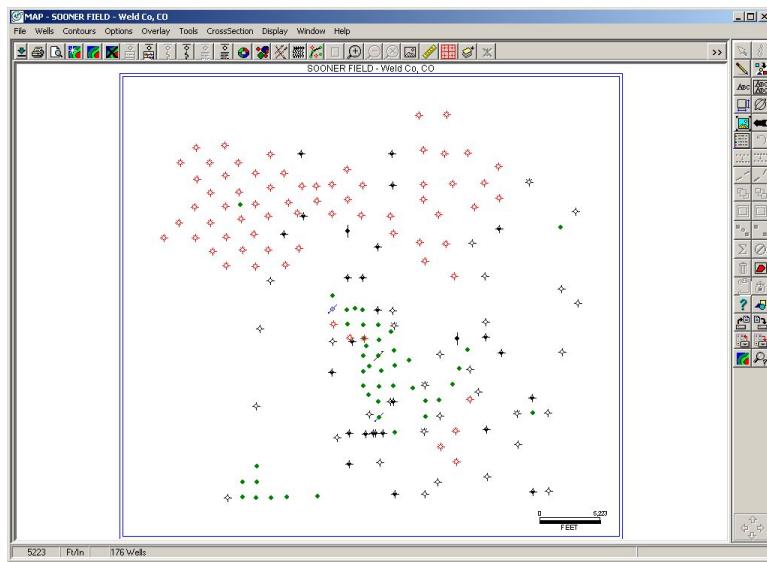
Picking Tops and Correlations

Raster Logs

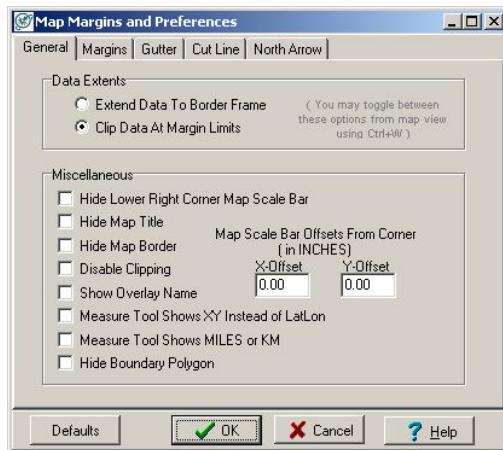
Adding Faults

Chapter 3. THE MAPPING MODULE

With the current set of 196 wells, we can display a basemap by clicking the “Mapping” icon or choosing the “Tools>Mapping”_menu option. You’ll get a map showing well spots for 176 wells. **The wells selected maintain the areal extents or limits for the map.** Wells are mapped using xy values. If you have loaded any wells that do not have a location, the well will not be selected for display in the map module.

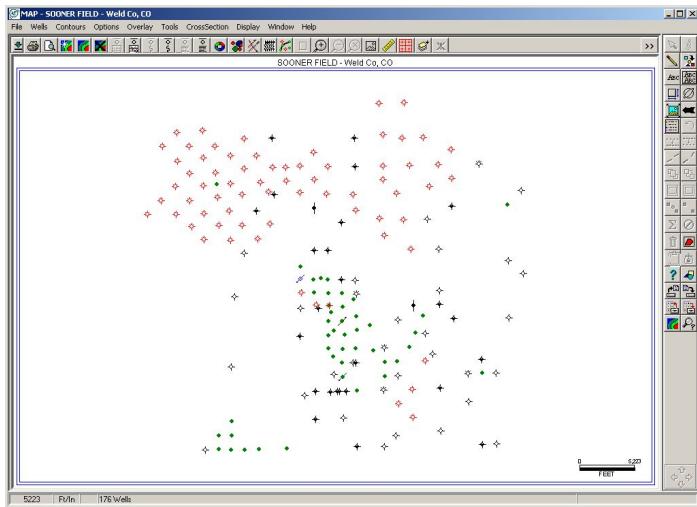


There are two modes for displaying your data in the map module. Select the Menu Item DISPLAY>OPTIONS menu. Select the “General” Tab.



The “Data Extents” option has two “Radio” button options. You may toggle using a **CTRL W** function to switch between the Extend Data to Border frame, or Clip Data At Margin Limits. The map above is displayed with the “Clip Data At Margin Limits”. This is the display that you will use prior to printing a map to view the selected limits of your printed map.

The map displayed below is using the “Extend Data To Border Frame”. During your daily work, you may choose to use this setting for the full screen view.



ZOOM and PAN FUNCTION



Zoom In - Click this icon then click-drag-release to define a zoom rectangle.



Zoom Out - Click to go back one zoom level.



Zoom Off – Click to display default scale.

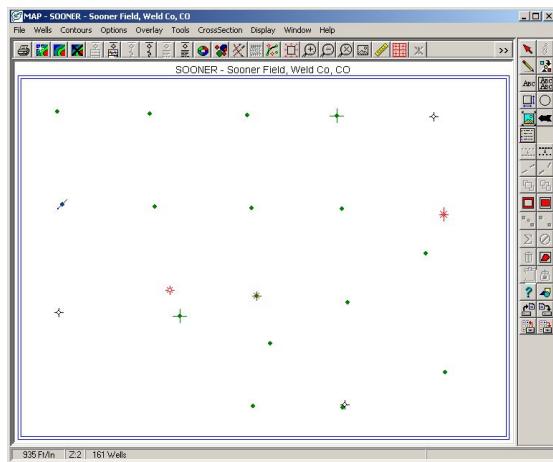


Pan – Click once to activate, click again or right-click mouse to disable the pan function. While in pan mode, click-drag-release to move the zoom window.



Redraw the Screen

This will be a favorite to refresh your screen after changes are made.



“Zoomed”

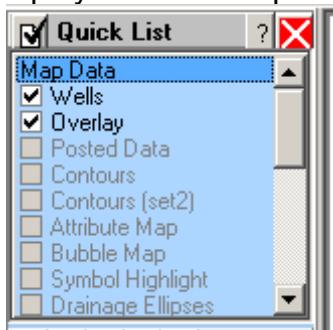
THE QUICK LIST OPTION

The PETRA mapping module provides a "Quick List" panel that can be used for quick access and control of many of the mapping features. The Quick List panel

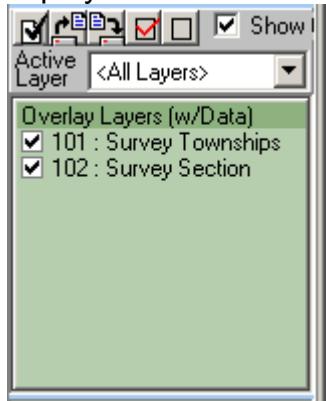


is activated using the small icon on the map tool bar just to the left of the printer icon.

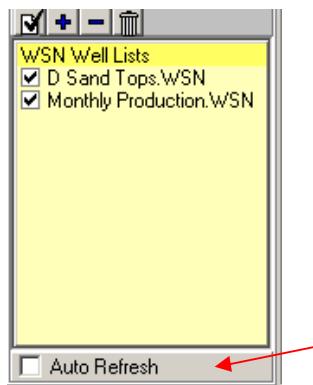
The "Blue" section is for map and database items you wish to view in the map display. Once the option has been activated a simple toggle switch can be used.



The "Green" section contains a listing of the available overlay layers and can also be a quick way to turn on and off the items the user wishes to see in the map display:

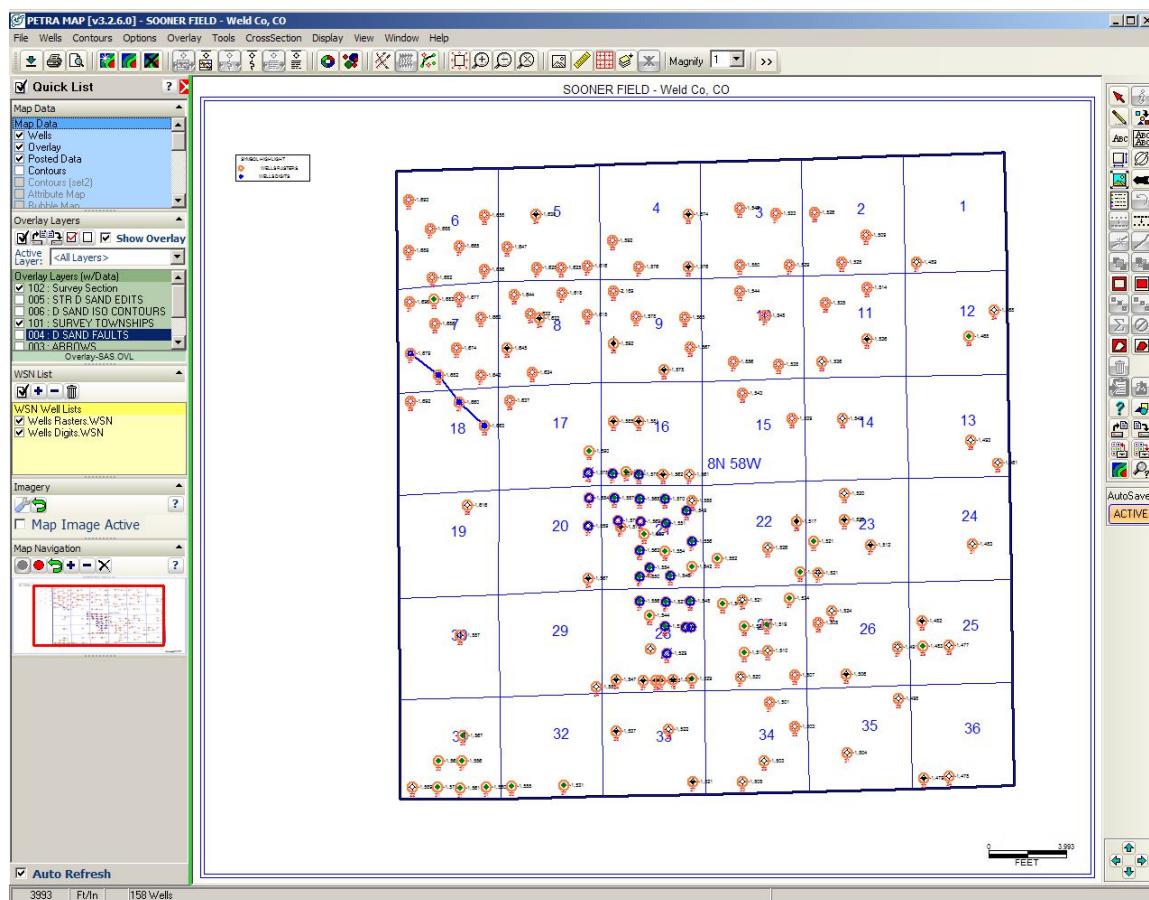


The "Yellow" section is reserved for WSN lists. The WSN files can be added for view using the blue "plus" sign. Multiple WSN lists can be seen at once with this option:



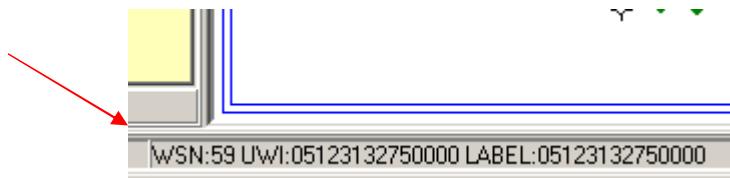
The Auto Refresh button is a useful option to view your selections.

Map Navigation allows you to quickly zoom in or out of an area on your map:

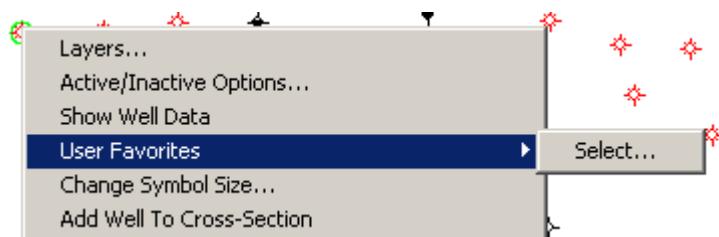


NAVIGATING BETWEEN THE MAP AND MAIN

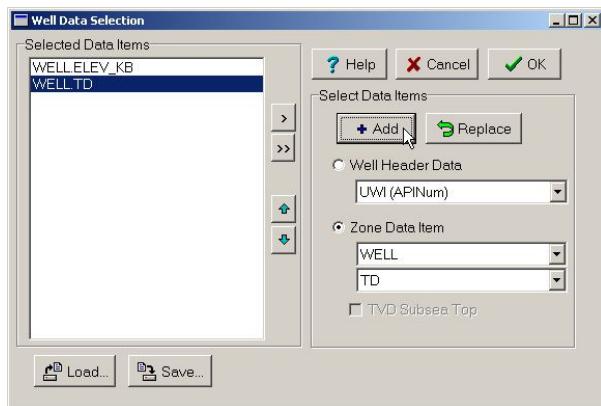
First, click once with the “Left Mouse” button on a well symbol and note the WSN, UWI, and Label for the selected well at the bottom left of the screen.



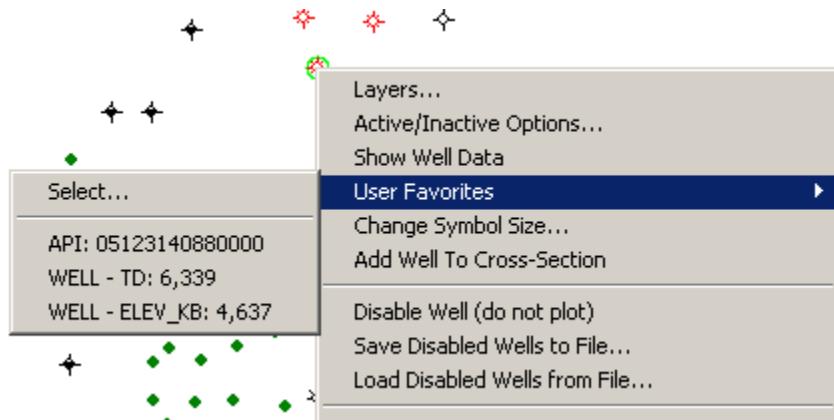
Next, click the “Right Mouse” button on the same well and note the “popup” menu showing more information for the well. Also note a special menu option called User Favorites>Select.



This option allows you to select your own database items that you wish to see when you right-click on a well. Select “Elev_KB” and “TD” from the “Well Zone Item” drop down list.

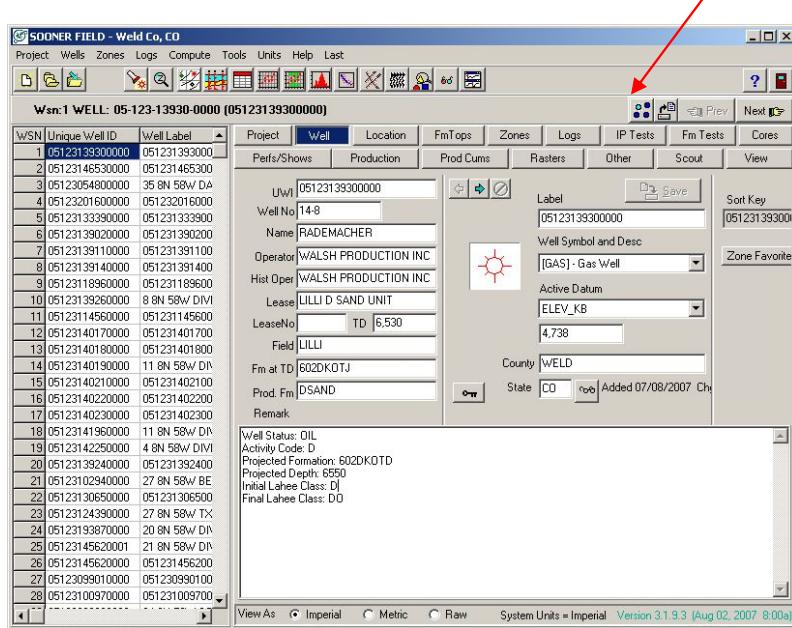


After making your selections, click the “Right Mouse” button on a well and click on the option for “User Favorites>Select” to see the options chosen:



Double click on the left mouse and you will be returned to the well in the Main module.

After locating a well in the “Main” module you can find where that well is located on the map by clicking the “Highlight Well On Map” button .



MAP OVERLAY

The overlay for this project comes pre-loaded. Please refer to the following if you were importing land grid:

LOADING LAND GRID DATA

To complete the look of our basemap, we need to load a land grid file, in this case we will load a Tobin section-township-range data file. The land grid will be loaded into a portion of the “Mapping” module referred to as the “Map Overlay”.

The map overlay provides storage for those graphical data elements that are not part of a well. These elements are sometimes referred to as “Culture” data. Examples are land grids like section lines, county outlines, rivers, shorelines, roads, hand-drawn contours, faults, etc. These data are stored as simple graphics data and they can be manually edited using the mouse. The overlay system of the “Mapping” module provides most of the “CAD”, (Cartographic Auto Display), functions required to complete most maps.

DEFINITIONS:

Graphics Element – A multi-point line, polygon, text or image.

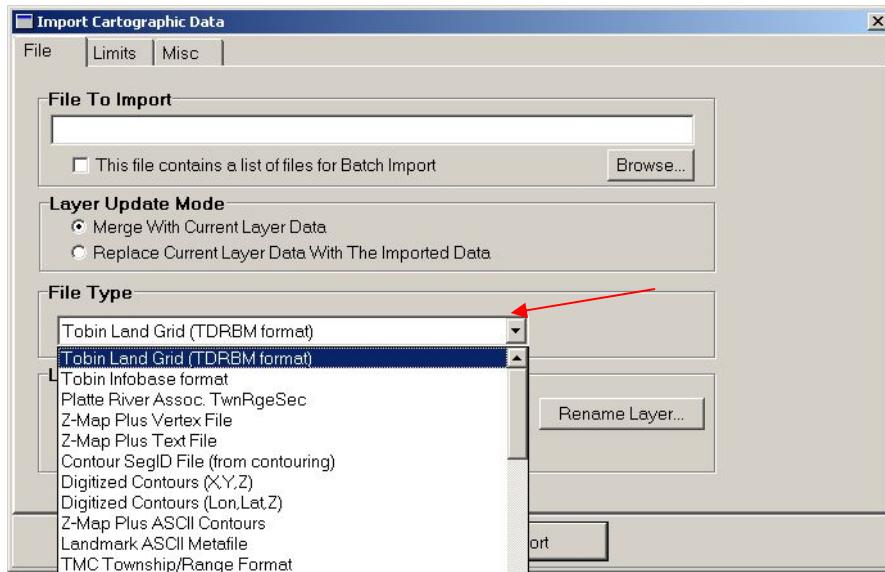
Overlay Layer - A grouping of graphics elements. Each layer has a user-defined name. Graphics elements are grouped into layers in such a way that desired map features could be displayed by making layers visible or invisible.

Overlay File (*.OVL) – A program file containing 256 overlay layers. An overlay file is maintained in the computer’s memory while working in the “Mapping” module. Changes to the overlay must be saved back to the overlay file on disk. It is highly recommended that you use **“One overlay per person per project”**. If you use more than one overlay file and have new data that you add to one overlay file and want that same data in the other files that you have created, you must update all of the other overlay files.

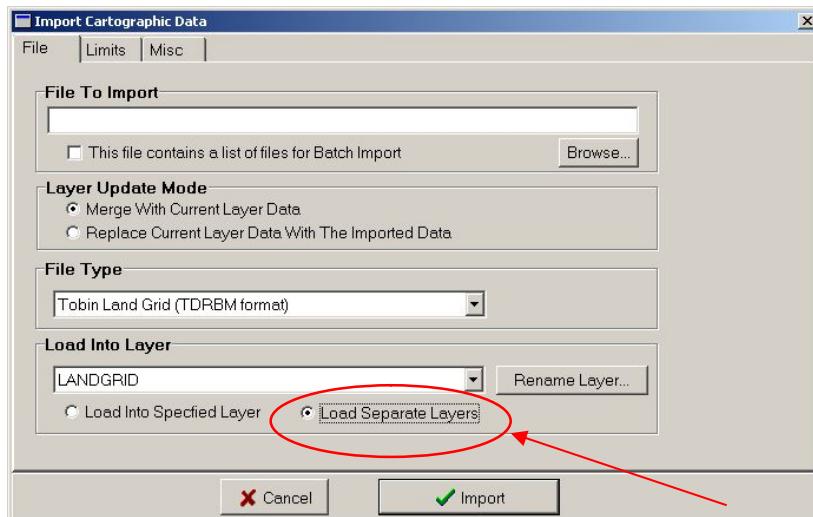
NOTE: Always save your overlay before exiting or leaving the project. Choose the “Import” icon from the overlay tool bar located on the right side of the “Map” screen  or use the “Overlay>Load>Import” menu.

Select the Langrid 4485CO.X file from the c:\geoPlus1\data\sooner folder. PETRA will automatically recognize the file as a Tobin Infobase Format.

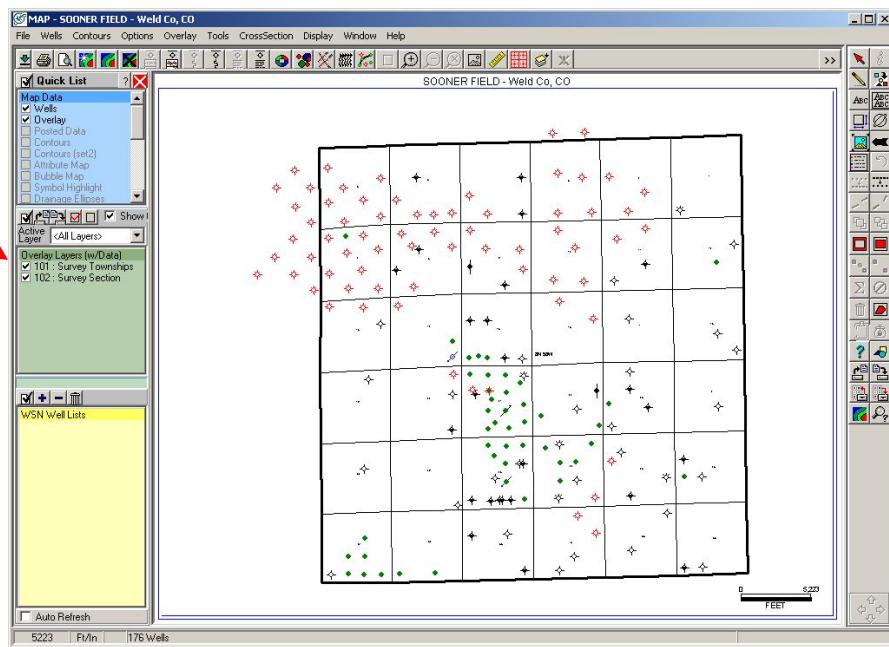
Several types of graphical formats may be loaded into the PETRA overlay. Let's review some of the options by selecting the File Type drop down menu:



Now choose the option to load the Tobin Infobase file and the "Load Separate Layers" option for the data. This layer option allows PETRA to parse the data into separate layers for Section, Townships and Ranges.



NOTE: The "Layer Update Mode" has two "Radio" buttons. When loading data into a layer that already had data in it you may want to use the option to "Merge With Current Layer Data".

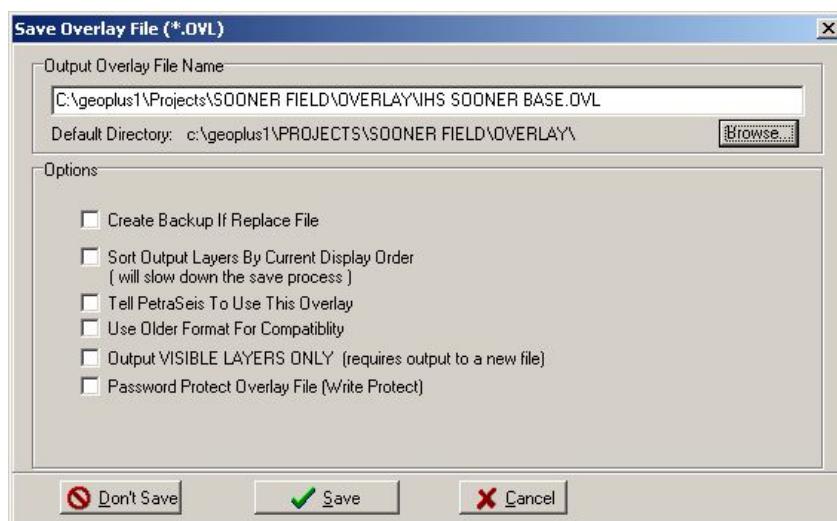


The map will redraw showing the township-range-section land grid. Two layers are now seen in the Overlay (Green) Quick List. The overlay is currently in memory only and must be saved to disk in order to be retained and redisplayed at a later date.

Your overlay has been preloaded however:

The overlay must now be saved to a file. A suggestion is to save with your initials and the area name: XX_Sooner Basemap.OVL

Select the “Save Overlay” icon from the Overlay tool bar or click on “Overlay>Save>Overlay File...” menu at the top of the “Map” module.



Click the “Save” button then enter a file name such as “Sooner Field Basemap”. Your overlay data will be saved to disk in the “Overlay” folder for the project.

RULE FOR USE OF OVERLAYS

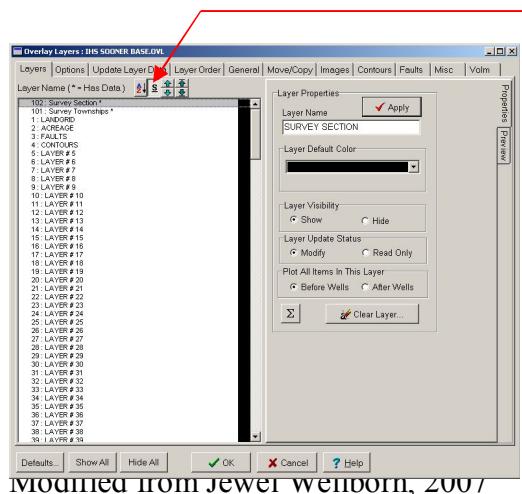
- 1.) **One Overlay Per Person per Project.** Saving the Overlay (*.ovl) does not save a specific display of a map. The Overlay is not connected to the database.
- 2.) **Save *.MAP settings** to save a display with the associated connections to the database, the grid, contours, color scheme, posting, wells, limits, bubbles and attributes. Map settings are stored as a *.MAP file. Save your map settings under File>Save Map Settings. Saving the Overlay only saves the “drafting” that you have done on the overlay, and does not save the “picture” of the map you are viewing.
- 3.) Do not allow multiple users to be working on the same overlay – it is best to have each person have their own OVL.
- 4.) Share Layers through the Layer transfer and Associated Read Layer Options.
- 5.) **Save your *.OVL often.**

Making “Global” Changes To The Overlay

Our overlay shows sections with a very small text size for the section numbers. The actual size was defined by the height parameter in the Tobin grid file. We can change all of the section numbers to a larger size.

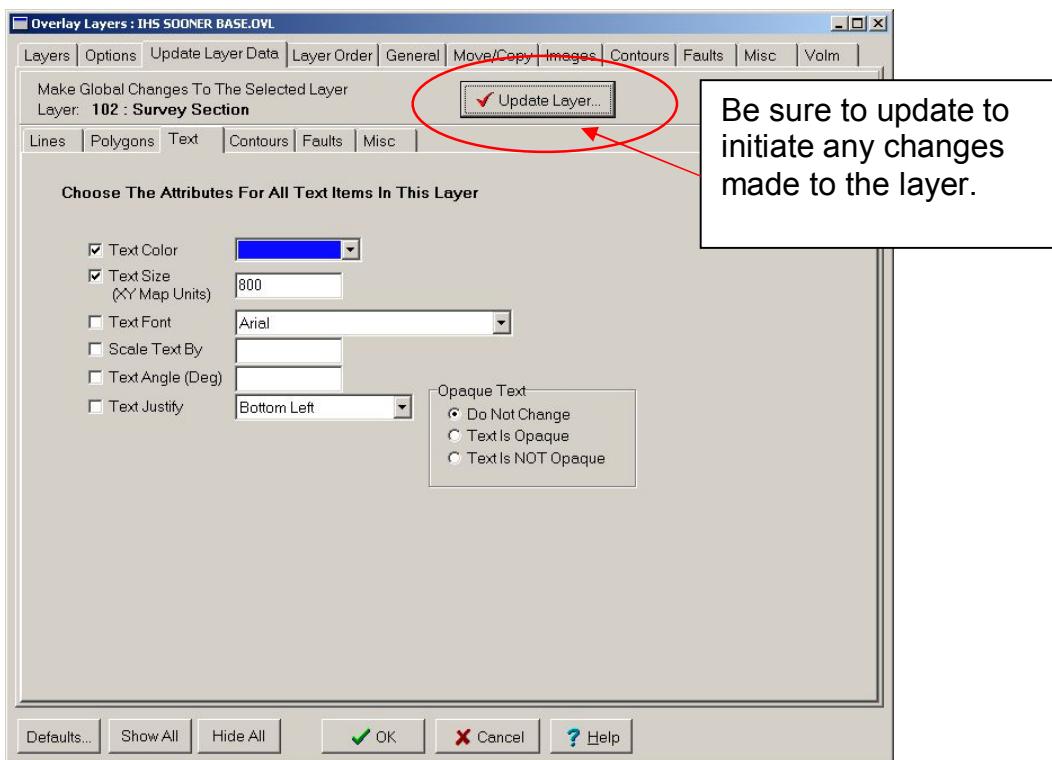
First, determine what size you would like the section numbers to be. Select one of the section numbers by holding down the shift key and double-clicking on the section number. You will see the “Overlay Text Attribute” dialog screen showing a text size of 197 feet. Change the value to 800 and click “OK”. You should now be able to read the section number at the default map scale.

Next, we can change all section numbers to have a size of 800 ft. using the “Overlay>Preferences” menu, a double click on the listing in the Quick list, or the “Layers” toolbar icon located on the lower right of the map. 



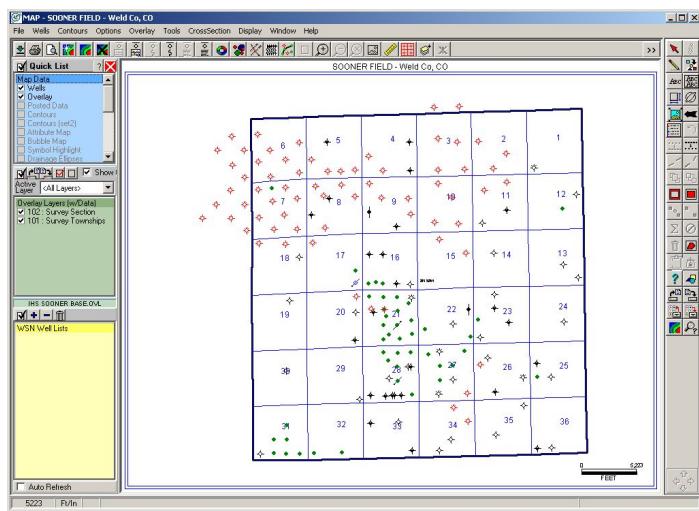
Click on the “S” button to sort the layer data by item count. The two layers that have data will be displayed at the top.

Select the “Survey Section” layer then the “Update Layer Data” Tab.



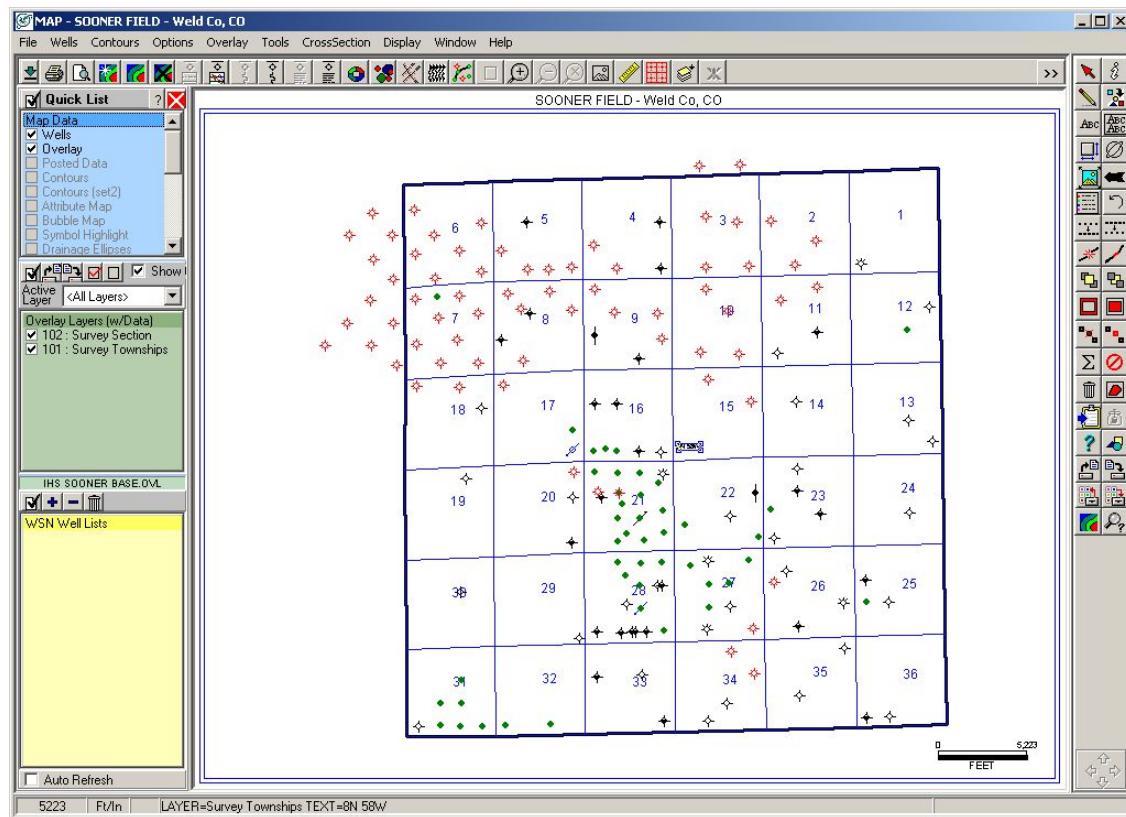
You may change the line colors and text colors, as well as size. Choose the tab labeled "Text" and enter 800 as the Text Size.

Click the "Update Layer" button to apply the changes to the text in the layer. Click "OK". The map will redraw showing the now larger section numbers.

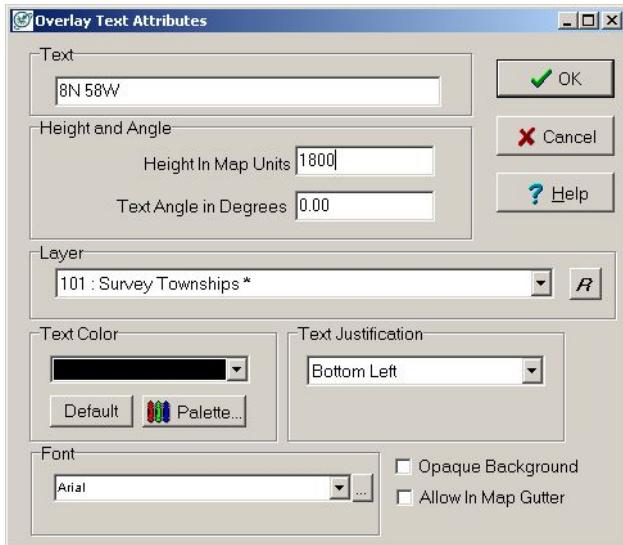


Now select the Township text from the map using the OVERLAY TOOL BAR.

By using the RED ARROW icon, , you may select any item from the overlay and make edits of the attributes of the item. The icon, , allows changes to the item.



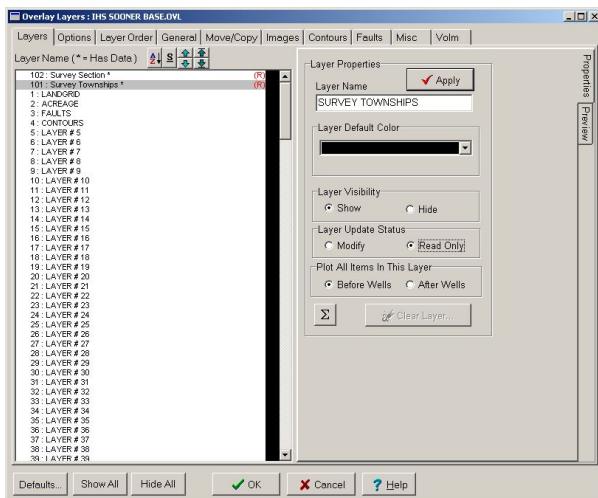
Locate the Township text and change the attribute to reflect a larger size, such as 1800.



You may make additional changes to the color, angle of text, justification, and font by using the Overlay Attribute function.

After loading and making our corrections to the township-range-section land grid data, we can set the layers to “**Read Only**”. This is done to make it easier to select an overlay item to make modifications to the item without disturbing the surveyed lines of the landgrid.

To set the layers to “Read Only” click on the “Overlay→Preferences & Layers” menu or the “Layers” icon on the “Overlay” tool bar, . When the dialog screen is displayed, click on the “S” button to sort the layers by item count, largest to smallest. Click on the layer that you want to make “Read Only”, in this case, “Survey Section”. Click the “Read Only” radio button. You will see the (R) appear to the right of the “Survey Section” layer. Repeat the process for the “Survey Townships” layer.



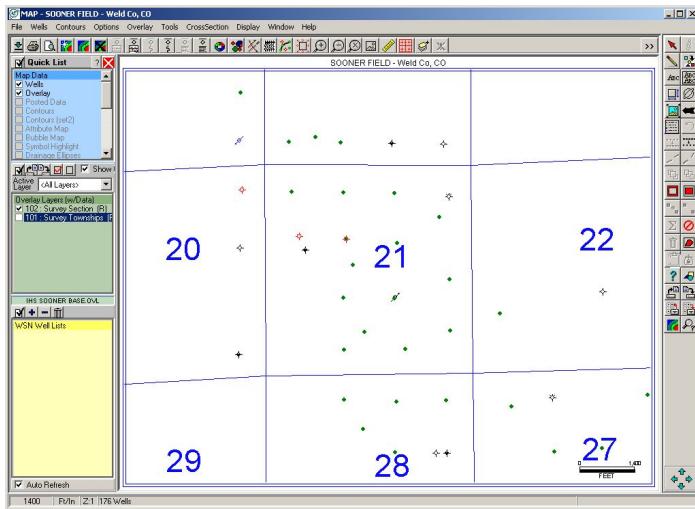
Since we have made changes to the overlay in memory, we must resave the overlay file. You may even want to activate the “Overlay>Set Auto Save” menu function.

SUGGESTION: Always set the landgrid and cultural layers to “Read Only”.

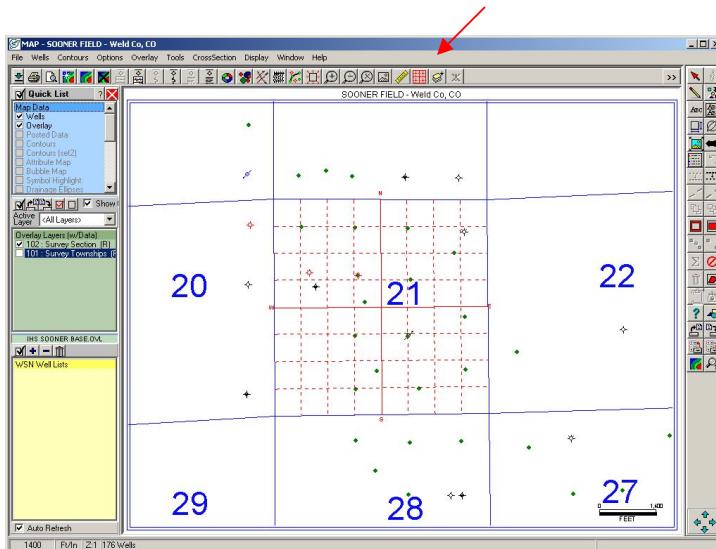
DRAWING A LEASE OUTLINE

To illustrate how you can hand-draw items in the overlay, we will draw an “L” shaped lease outline inside section 21. We will use this lease polygon later to compute net pay volumes.

To begin, zoom in on section 21 such that the section fills the entire screen but you can see all four corners of section 21.



Next, activate the “Quarter Section Grid” function that we will use to guide us while drawing the lease polygon. Click the icon then click in the center of section 21. You should see the quarter section grid in red.



We will use the overlay pencil tool  to draw in our L-shaped lease polygon that will cover three quarters of the section. We will also use a “snap” technique so that we get the lease to tie exactly with the section and quarter section grid.

There are three snap function keys:

F1 snaps to the nearest well.

F2 snaps to the nearest overlay line vertex.

F3 snaps to the nearest quarter section grid intersection.

F9 is a toggle that displays lat/long and x/y values.

We will use F3 to snap the points of the lease polygon.

THE “SNAP” PROCESS

First, locate the mouse near the point you wish to snap to and digitize. Using your mouse hand, press the F3 key followed by the Enter Key. The Enter Key actually records the value at which you snapped. It is the Lat-Long (or XY) coordinate of the item you snapped to, not merely the mouse location. Using your mouse hand guarantees you do not move the mouse between the time you press F3 and the time you press the Enter Key.

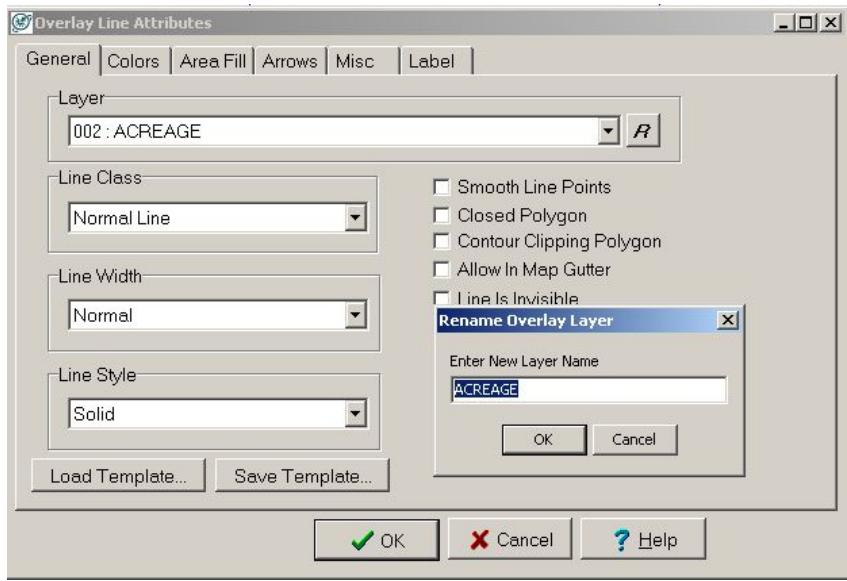
DRAWING THE LEASE POLYGON

To start digitizing the lease polygon, first click the overlay pencil tool  on the “Overlay Tool Bar” on the right hand side of the “Map” module. A crosshair cursor indicates you are in a digitizing mode. To cancel, simply press the “ESC” key. Locate the mouse near the upper-leftmost corner of section 21. With your mouse hand, press the F3 key and note that the cursor jumps to the section corner. Without touching the mouse, press the Enter Key. Now, move the mouse and note that a rubber-band line connects the section corner to the mouse cursor. Move the mouse to the center point along the north edge of the section. Snap (F3 and Enter) to pick this point. Continue by picking a point in the center of the section, then the center of the east edge, SE corner, and finally the SW corner. You need not repick the starting point.

Press the “Right Mouse” Button to End picking. The Overlay Line Attributes screen will be displayed.

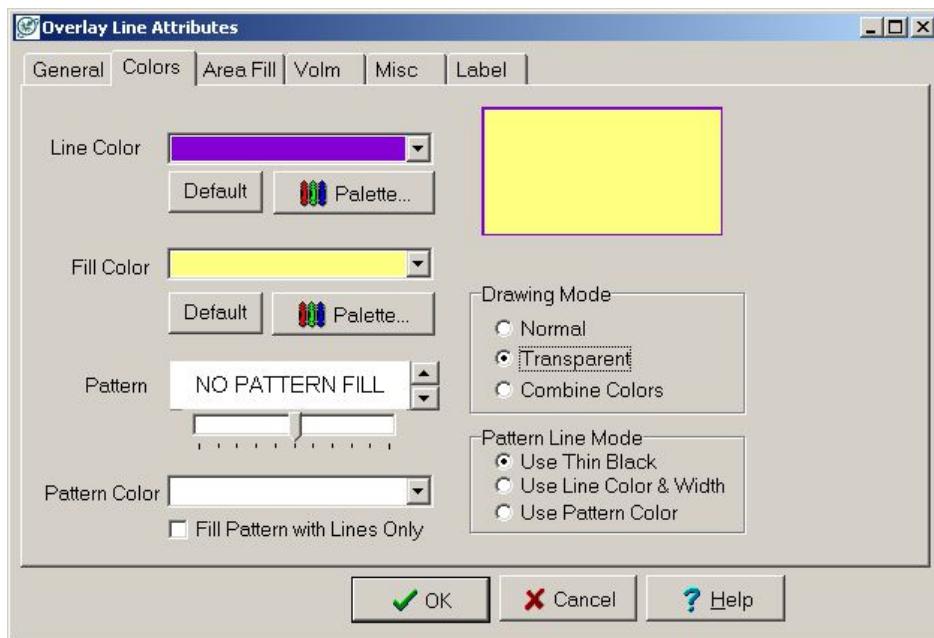
Choose the layer to be **ACREAGE**. You may wish to rename the layer. If so,

use the “R” Icon, , to rename your layer.

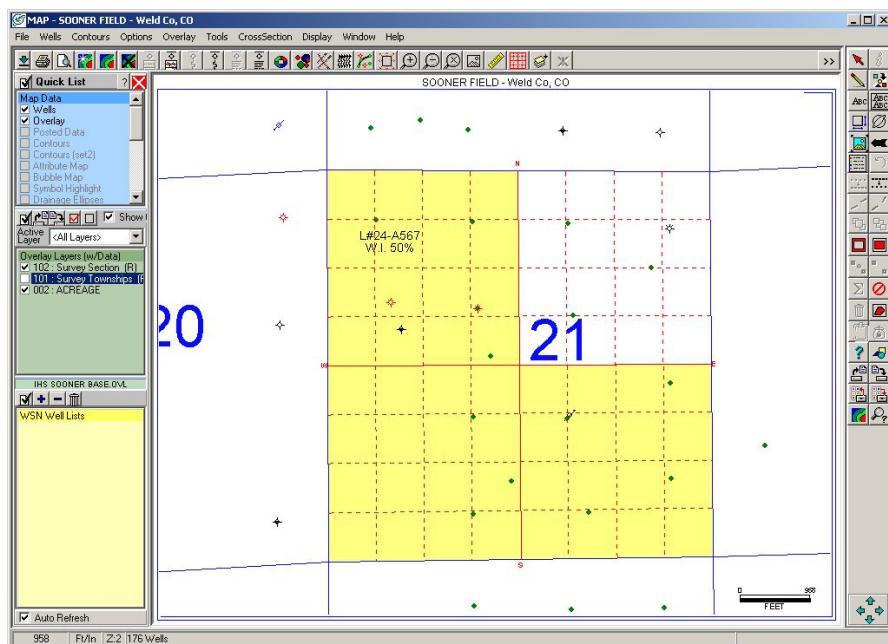
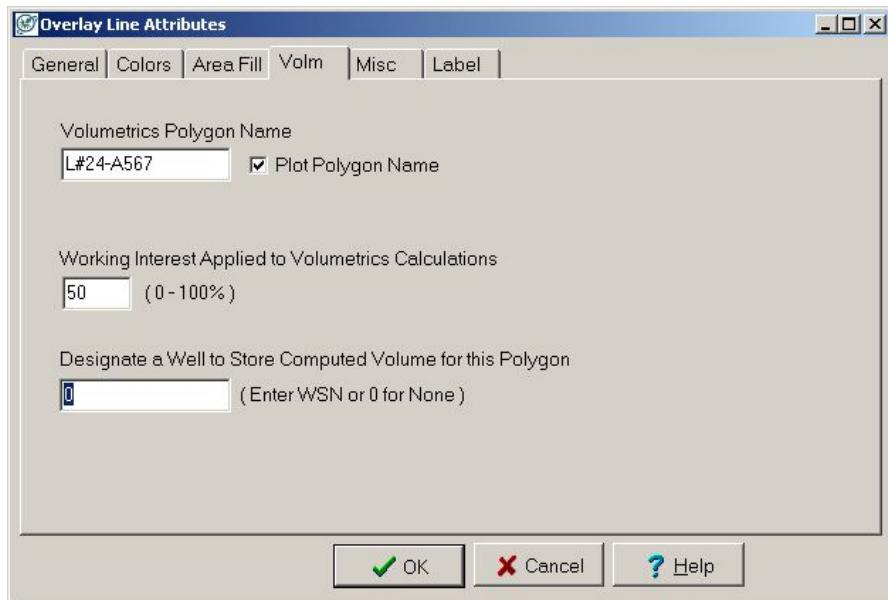


Next select the LINE CLASS as a Normal Line, and set the Closed Polygon switch.

Select the line color and fill color. The Area Fill tab will show the “Fill Interior” option selected.



You may wish to enter a Volumetric Polygon name and a working interest percentage. If you would like to use the polygon for volumetrics, consider placing your corporate lease ID, Name, or Number in the polygon name.



To remove the red quarter grid overlay, select ALT-Q.

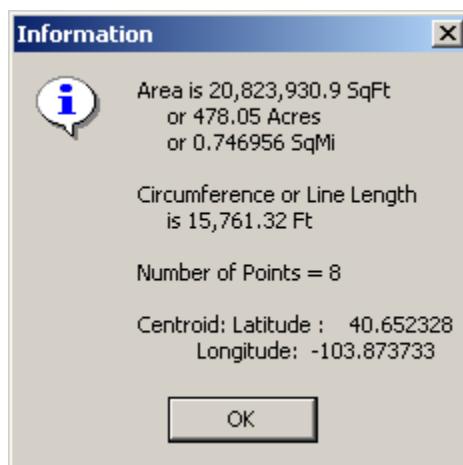
SELECTING THE POLYGON

Method 1 - There are two methods to select an overlay item. Click on the “Red Arrow” icon  on the “Overlay Tool Bar”. Then, click on the edge of one of the edge lines of the polygon to select it. The polygon vertices are highlighted showing it is selected.

Method 2 - Hold the shift key down and left-click once on an edge of the lease polygon. You will see the control nodes displayed for the selected lease polygon.

AREA OF THE LEASE

You can display the area of any closed polygon. After selecting the polygon (see above), click the overlay toolbar “Show Area” icon .



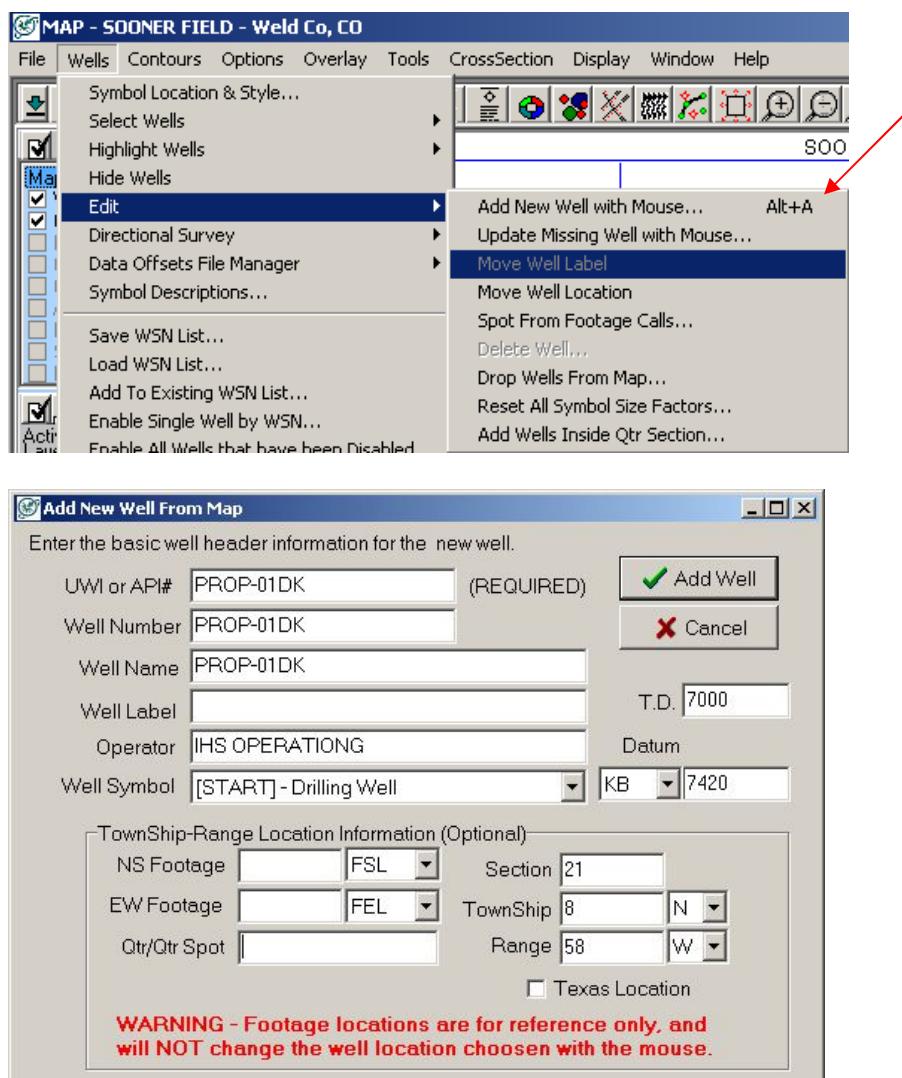
Resave the overlay file to retain the newly added lease polygon.

SPOTTING A NEW WELL FROM FOOTAGE CALLS

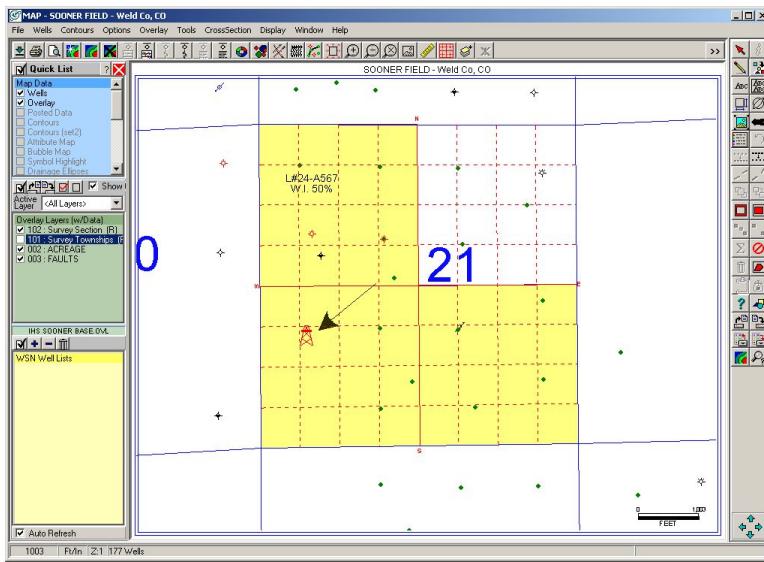
We will now add a new well to our database by spotting it on the map and providing the footages from the section. The new well will be added to the database using the mouse, then adjust the location by entering the exact footages.

NOTE: The quarter section grid must be active during this process.

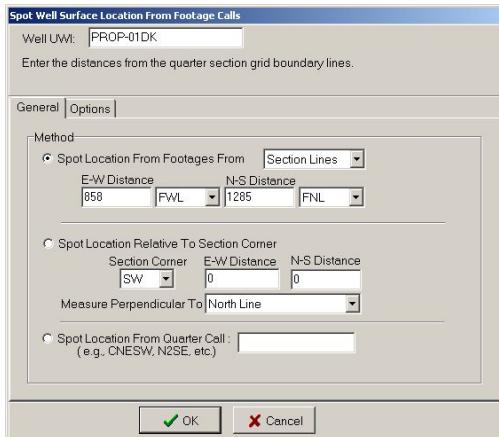
Spot the new well somewhere in the SW quarter of section 21. First, choose the "Wells>Edit>Add New Well with Mouse" menu item and click on the map at the desired new well location. Enter the UWI for the new well of **PROPOSED**. You can also enter any other information about the new well.



The new well will be added to the database, and will include Lat Long and XY values for the location.



To adjust the well's location using footage calls, or QTR section description, select the new well by clicking it once with the "Left Mouse" button. From the Well menu, choose "Wells>Edit>Spot from Footage Calls".

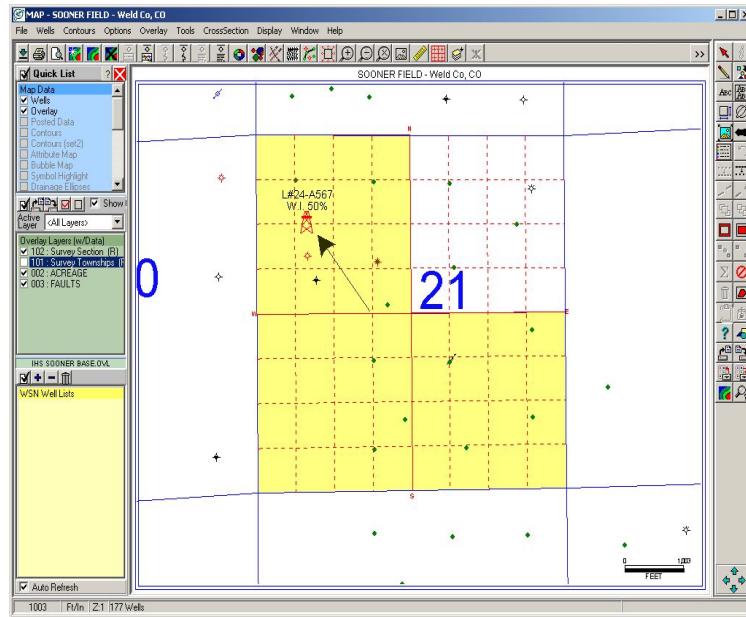


Note: You may adjust the well location either using footages or quarter calls.

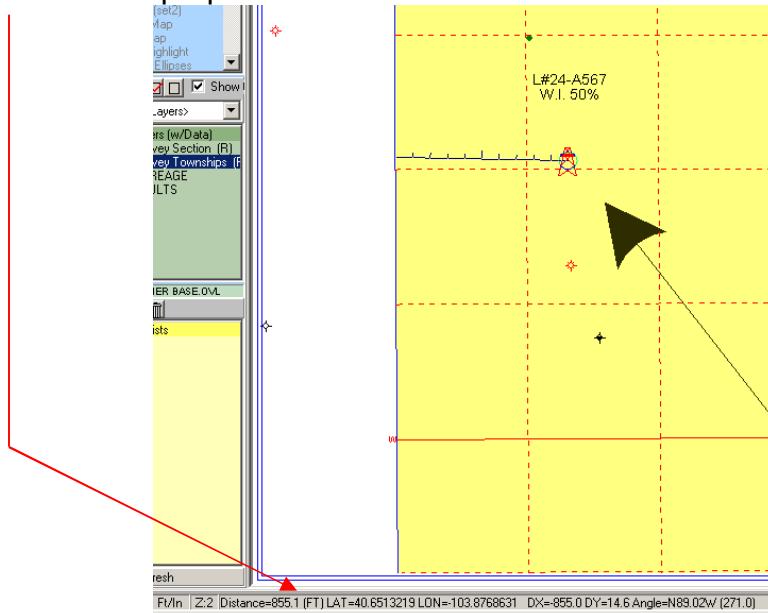
Note the new location of the **PROPOSED** well. Zoom in and check the location using the measure tool. The new well location will be locked in the database.

MEASURING DISTANCE

First, activate the measure tool . Snap the mouse to the new well by locating the mouse near the new well and press **F1** and then the Enter Key. You will get a rubber band measuring line connected to the well. Check the distance (displayed in the status line) of the well from the west line and the south line. The measured distance is approximated to the nearest screen pixel.



NOTE: This technique can also give you the proposed location XY, LatLon, and Horizontal for proposed directional wells from a surface location.



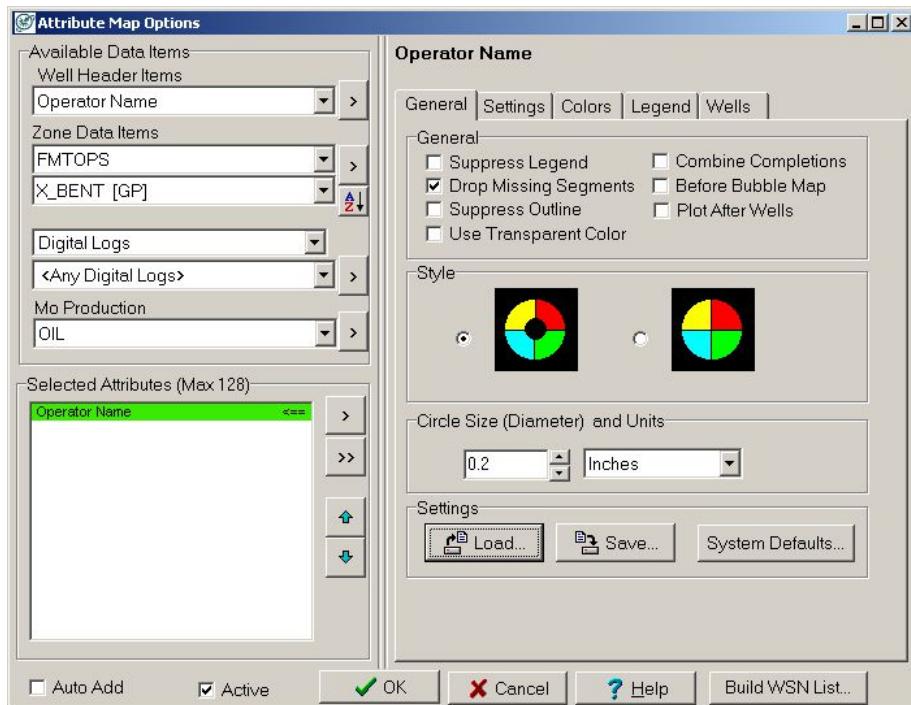
You may also use the “**F9**” key that is a toggle that displays lat/long and x/y values.

ATTRIBUTE MAPS

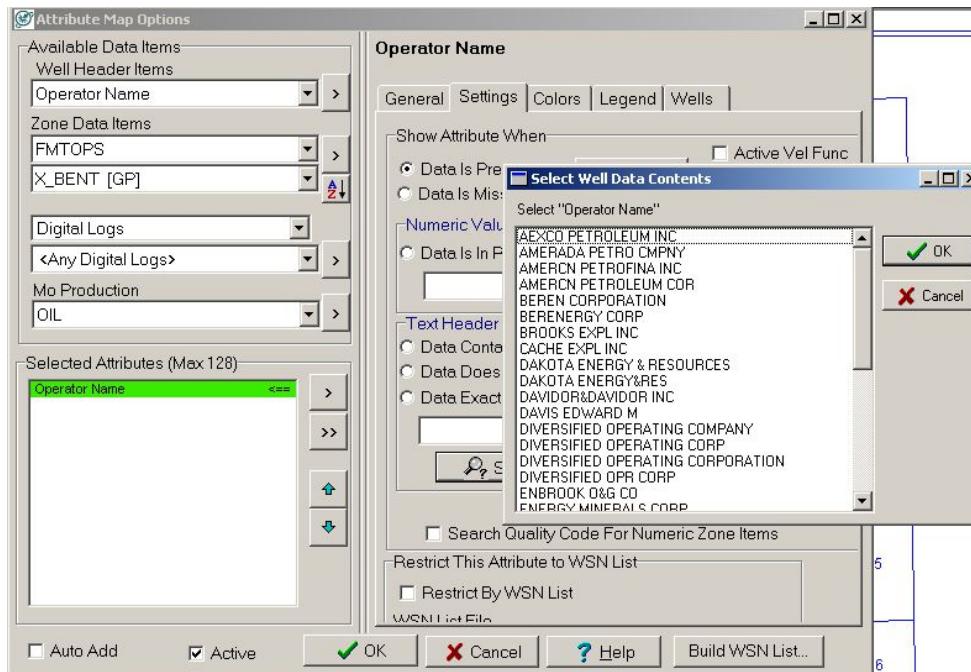
Displaying the Occurrences of Operators

We can display a map showing which wells contain certain Operators. This map type uses a feature called an Attribute Map.

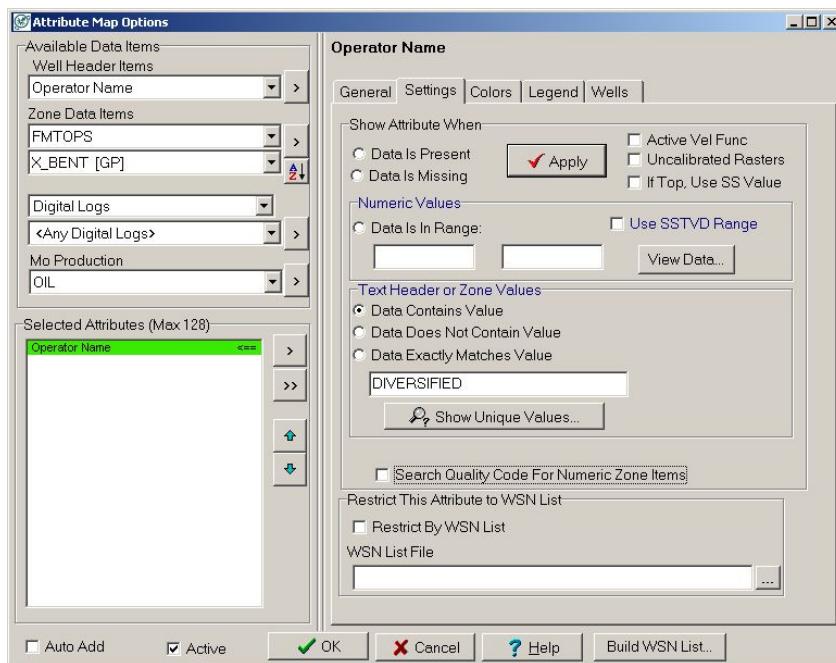
From the “Map” module, choose the “Options>Attribute Map” menu of the  icon located at the top of the map screen. The attribute map allows up to 128 different variables or conditions to be dynamically determined and displayed at each well. For this “operator map” we will look for wells that contain a specific Operator. Locate the drop-down list box under the Well Header Items, and select the Operator Name. Using the “>” button, bring the Operator name to the Selected Attribute list. Next, change the color to light green. Adjust the circle size parameter to 0.2 inches.



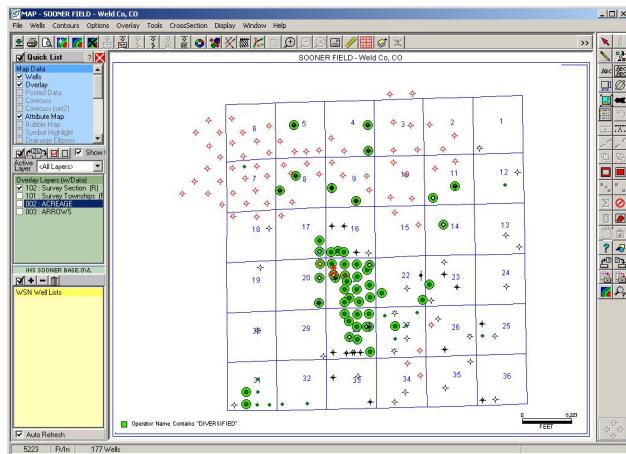
From the SETTINGS TAB, select the Text Header or Zone Value items and Show Unique Values:



Select the Operator –“Diversified” and use the “Data Contains Value” to bring all text strings which contain the value for display.



The following Attribute Map shows wells that have “Diversified” in the Operator name. In the Attribute function, you may add additional operator names, dates, and selected data items as the program will sample the database for your selections.



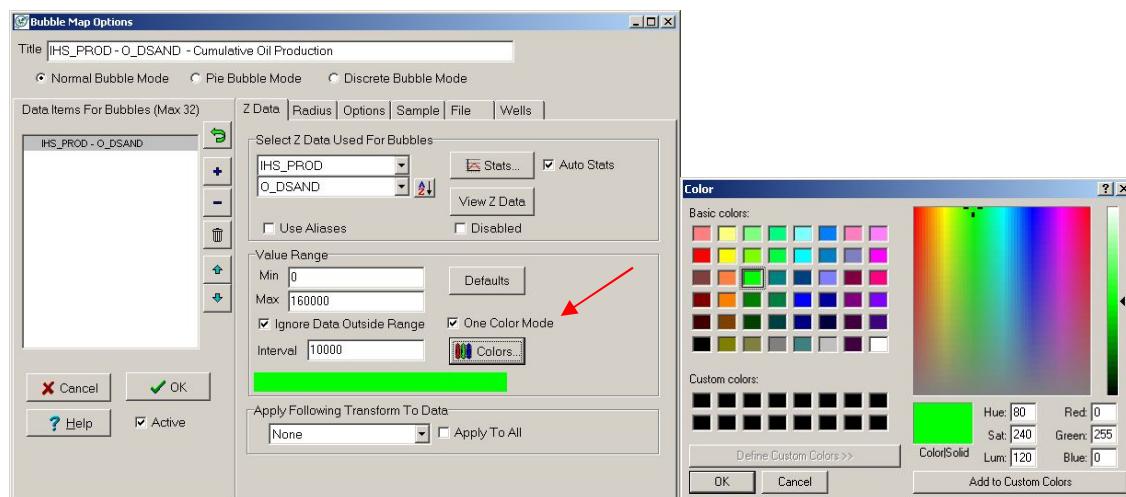
You can disable the attribute map by un-checking the “active” option at the bottom of the attribute map options screen, or from the Quick list option.

PRODUCTION BUBBLE MAPS

The classical method of displaying production data is through the use of a bubble map. Bubble maps are used to show variations in the amount of production from well to well using variable size “bubbles”. Each bubble is proportional to the amount of production in the well. Bubble maps make use of the cumulative production values that were computed during monthly production import. The values we are interested in showing are stored in the “Zone” or table called IHS PROD and include the O_DSAND, G_DSAND, and W_DSAND items.

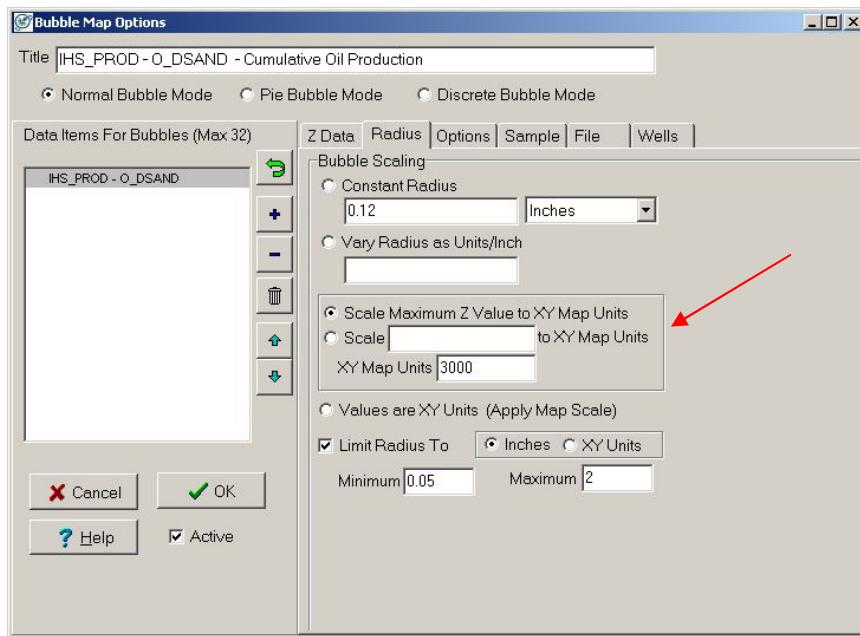
To start with we will make a simple, single valued bubble map with varying sized bubbles showing oil production for the “D” sand.

Choose the “Options>Bubble Map” menu or click the  icon. From the “Bubble Map” options screen, change the zone from FMTOPS to WELL and find the item called O_DSAND. Click the blue plus  icon to add the item to the data items list. We can either plot single or multi-colored bubbles. Choose the “One Color Mode” option and click the “Colors” button to set the color to light green.

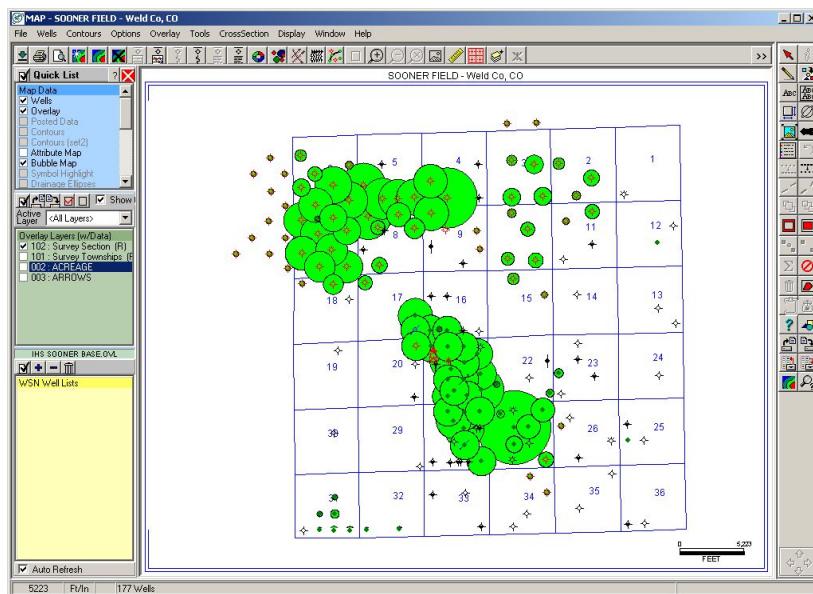


The variation in bubble size is controlled on the “Radius” Tab.

Choose the option that states “Scale Maximum Z Value To XY Map Units” and enter an “XY Map Units” value of 3000. This means we wish to have the largest production value, regardless of whether it is 100 BBLS or 100,000,000 BBLS to have a radius of 2500 (diameter of 5000) feet on the map. Limit the “Radius” to 0.05” Minimum and 2” Maximum so that even the smallest values show something.

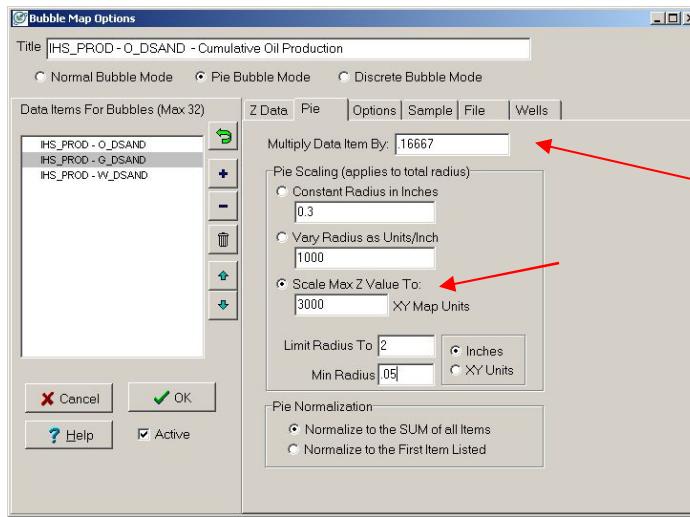


Click the “OK” button to display the bubble map.



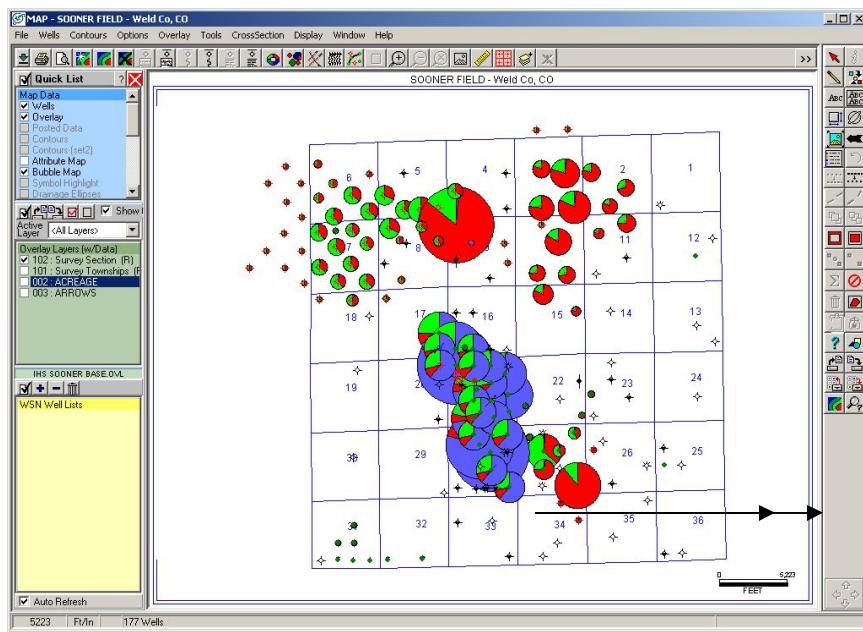
We can also combine several production values in a bubble map in a type of “pie chart” style bubble map called a “Pie Bubble” map. Return to the bubble map options and select and add G_DSAND and W_DSAND items to the data items list. Set the color for gas to red and water to blue.

Set the “Pie Bubble Mode” option located at the top of the screen. We must also set the “Pie Radius” option to control how the pie bubbles vary in size. The radius this time will be proportional to the summation of the three components. Set the “Scale Max Z Value To” option and enter a value of 3000 XY Map Units.



The size of each pie slice will be related to each item's magnitude in relation to the sum of all three. Since we are mixing BBLS and MCF values we must scale the pie bubble components to have similar units. Given the relationship **BOE=OIL+GAS/6**, we can multiply the gas components by 0.1667 to convert to MBOE. If you do not scale or “normalize” the values, it will appear that the wells are producing mostly gas and the oil and water slices will be subdued.

The Pie Bubbles will now show values for MBOE – Million Barrel Oil Equivalents

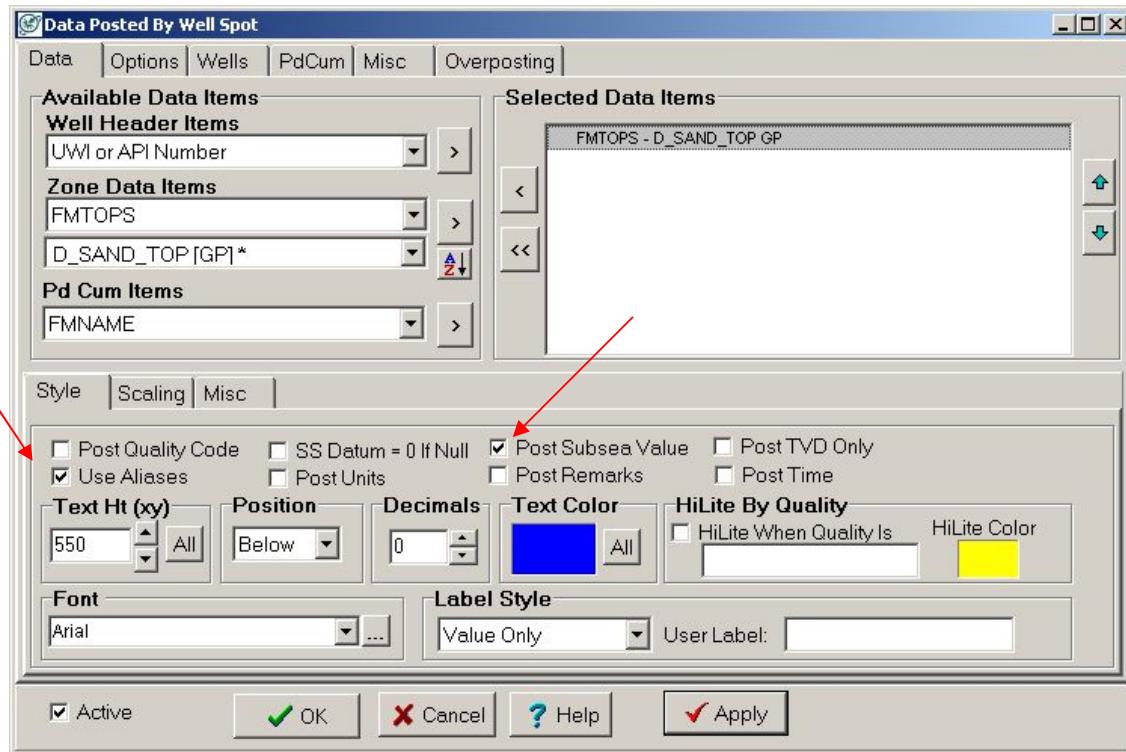


A third option is the Discrete Bubble Mode, which allows the user additional flexibility in setting the values, colors, and sizes of the bubbles for specialized displays. This option allows you to set the *low boundary*, *high boundary*, *radius* and *color* for up to 8 discrete bubble sizes. When a boundary cell is left blank, the associated range value is set to 1E30. If the radius is blank, the line is ignored during display.

You can disable the bubble map by un-checking the “Active” option at the bottom of the bubble map options screen, or by deselecting the Bubble Map in the Quick List.

POSTING WELL DATA

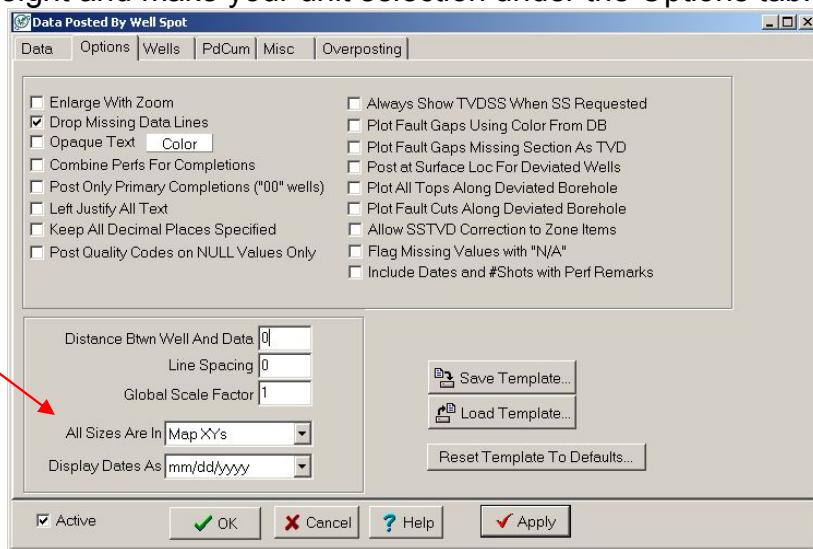
Data can be posted in 4 positions around the well spot using the “Options→Data Posting” “Mapping” menu or the  icon. We will post the structure value for the D_SAND_TOP formation top. We have previously aliased this top in the database so in addition, make the following selections:



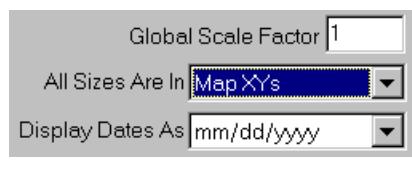
First, from the “Zone Data Items”, choose the FMTOPS and item D_SAND_TOP.

Next select the > button to add the item to the “Selected Data Items”. Click the option below for “Post Subsea Value” to insure the subsea structure value is posted and not the measured depth. **Note:** If a well has no datum, no value will be posted.

You may choose to post the data using either XY map units or Inches. Select the Text height and make your unit selection under the Options tab.



You may also choose additional options as we begin the mapping exercises.

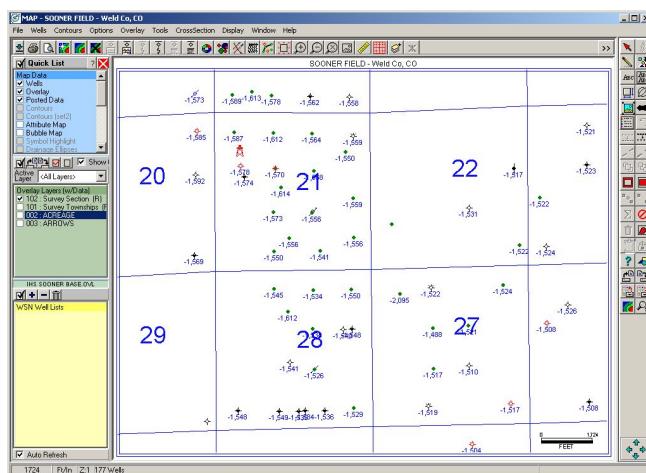


Note the default text height 575 XY units. This will be fine for a large area, but not for all map scales. Click the "OK" button and see how the data is posted and in particular the size relative to the map scale.



Change the “Text Height” to 250 and click the “All” button to set the text height for all selected items.

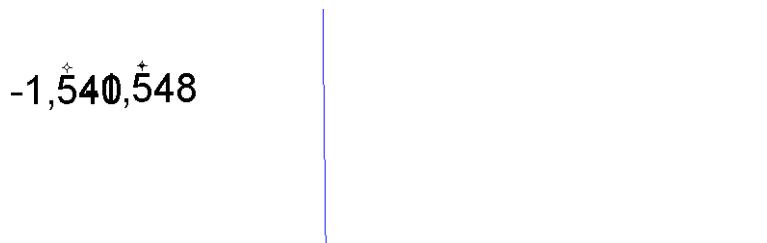
Now display the map and see how the posted text size changes with the map scale as you zoom in and out.



MOVING POSTED TEXT

Notice the two wells in the east half of section 28 and how their posted text overlaps. You can move the text so that it will not over post. There are 4 text positions around the well were multiple text lines could be posted. Each of these 4 positions or blocks of text can be repositioned. There are 4 steps to moving posted text.

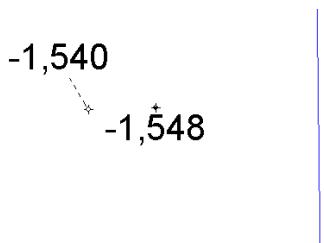
Step 1, select the well for which you wish to move text. Left mouse click on the well to highlight it.



Step 2, click the “Select and Move Data Label” icon  located on the upper tool bar.

Step 3, click the “Left Mouse” button on the text you want to move, and

Step 4, click the new position for the text.

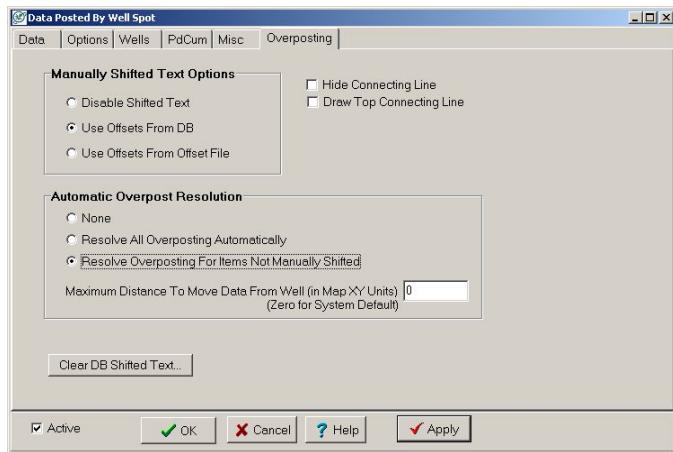


The shifted text offsets are stored in the well database so that others will see their text moved as well. An alternative to this shared text repositioning is available through the use of an “offset file”.

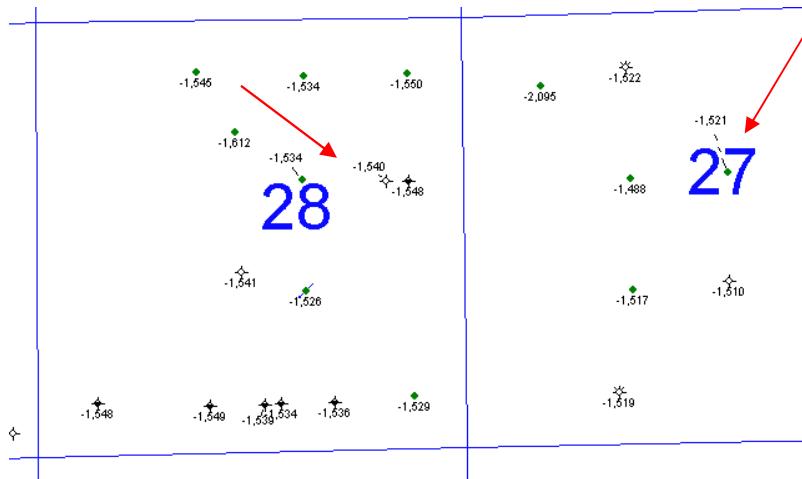
To set the position of the text back to the default position, click on the well that you want to reset the moved text for. Click on the “Select and Move Data Label” icon  located on the upper tool bar. Put the cross hairs over the selected well and right click. The moved text will be moved back to the default position.

Automatic Over Post Resolution

If you wish, PETRA can dynamically reposition the posted text to minimize over posting. Simply enable the option on the data posting options screen as shown below.



The resulting map is produced. Zoom in and note the dotted line connecting the repositioned text back to the well symbol.



CONTOUR MAPPING

There are two processes involved in producing a contour map. The first step, called gridding, is done to interpolate a regularly spaced dataset called a grid using the well or other project data. Gridding results in a grid file from which contours can be drawn. Grid files are **automatically saved** in the “Grids” folder of the project directory. The grid file will have an extension of *.GRD. The second step, contouring, uses the grid file and the user’s parameters such as the color scheme, contour interval, etc. to draw contours directly from the grid. A contour file is created for each grid and is automatically saved in the Grid folder with the extension of *.GDT.

There are three icons used for gridding and contouring.

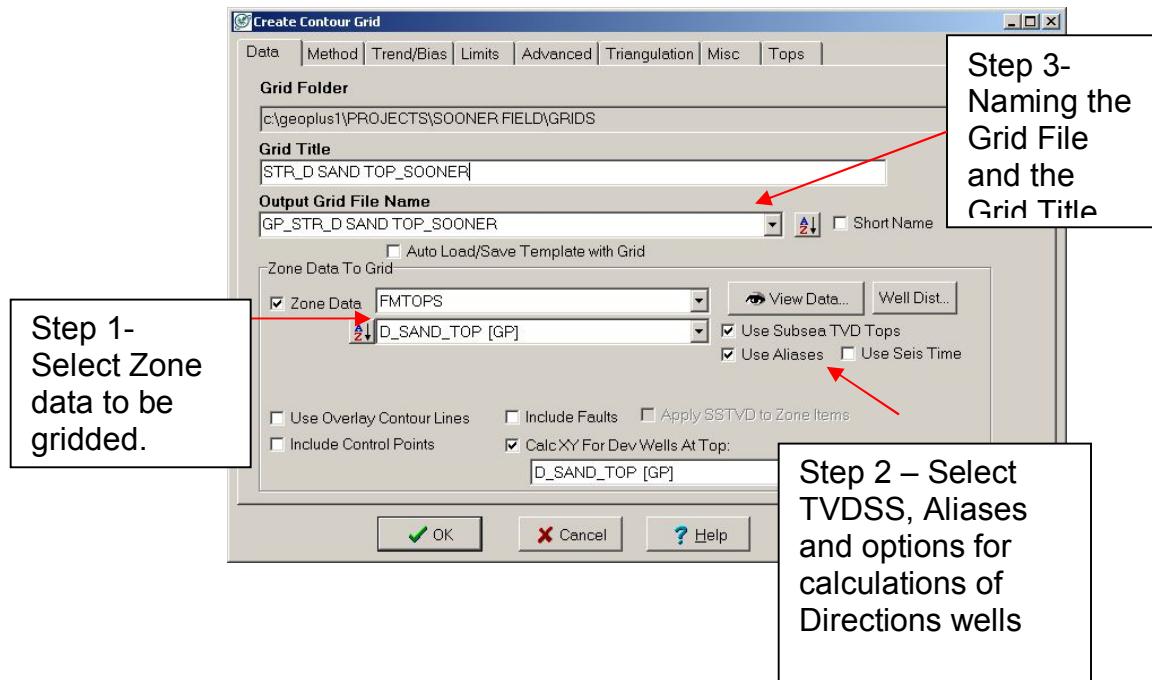


Select the “Contours>Create Grid...” menu or the  icon to generate a grid file. After the grid has been produced, select the “Contours>Display Contours” menu or the  icon to draw the contours from a grid. Use the “Contours>Hide Contours” menu or the  icon to turn off or hide the grid-based contours. Contours may also be turned off with the Quick List selection.

STRUCTURE CONTOUR MAPPING

DATA TAB

Select the “Contours>Create Grid...” menu or the  icon. Using the gridding options, shown below, first select the formation top called D_SAND_TOP. Note the selection of the option called “Use TVD Subsea Tops” in order to have subsea or “structure” tops used. Also select “USE ALIAS” as our D Sand Top was aliased to the IHS Formation Top, 602DKOTD.



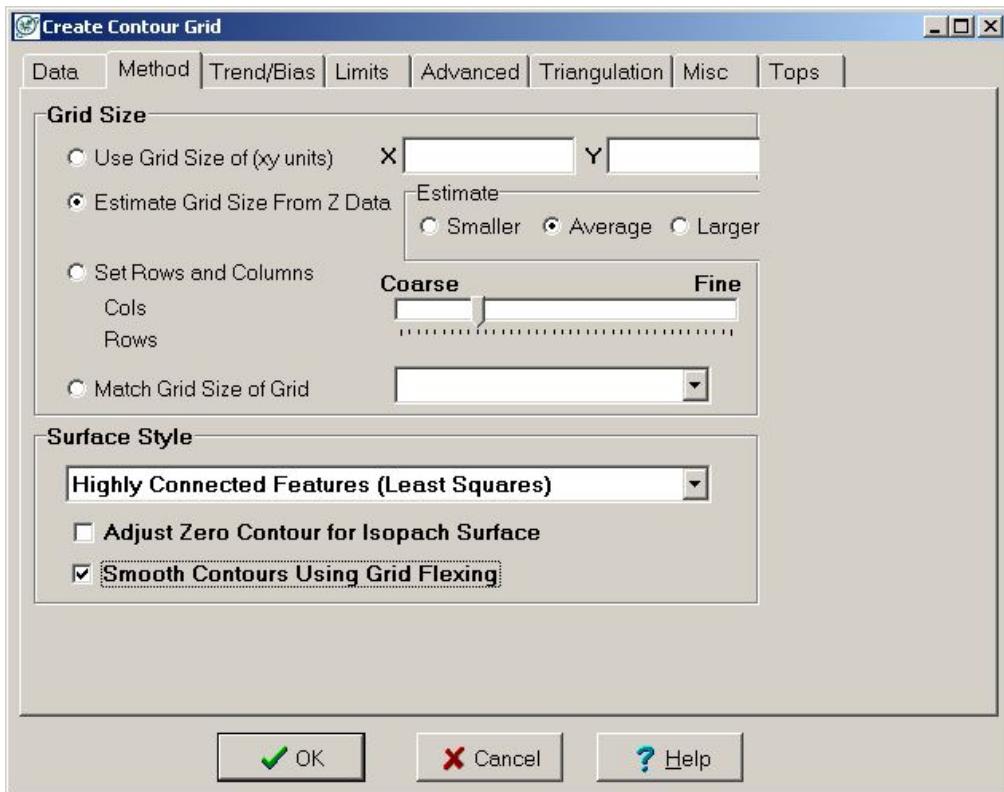
In naming the Grid file, a suggestion is to use the following procedure:

“Interpreters Initials_Type of Map (STR, ISO, NEP, etc)_Horizon_Area.GRD”

Using a standardized nomenclature of grid files will assist in locating the grid you have made, the type of map created, what horizon on which the grid is based, and the area of interpretation.

METHOD TAB

Select the “Methods” Tab to set the grid size and surface style options. Use the “Estimate Grid Size From Z Data” “Average” option.



The grid size determines just how fine or coarse the interpolation is done over the well data. It is important to have a **grid size that matches the well data spacing**. If the grid size is too large, the contours will not “honor” the well values. If too fine, then contours can have somewhat of a noisy signature in areas of sparse data control. PETRA will compute a grid size based on the well data distribution. The “larger” grid size is based on the mode of the distance between the wells that have the data. The “Average” grid size, is one-half the mode, and the “smaller” is one-quarter of the mode.

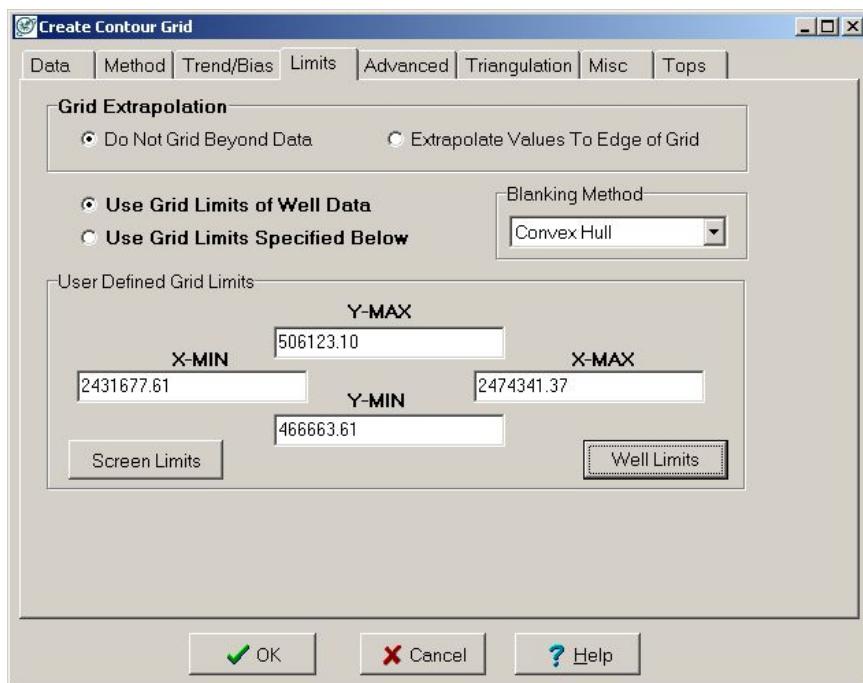
We will use the “average” default grid size and let PETRA determine the grid size from the data spacing. This is a good place to start, but always check to see what grid size is being used.

The “Surface Style” option determines the mathematical algorithm used to compute weighted averages at each grid node. We will select the default option of “Highly Connected Features” which produces a minimum of curvature surface. This style is good for structure maps and hand-drawn contours. A least squares algorithm is employed and tends to produce connected features as opposed to disconnected closures.

LIMIT TAB

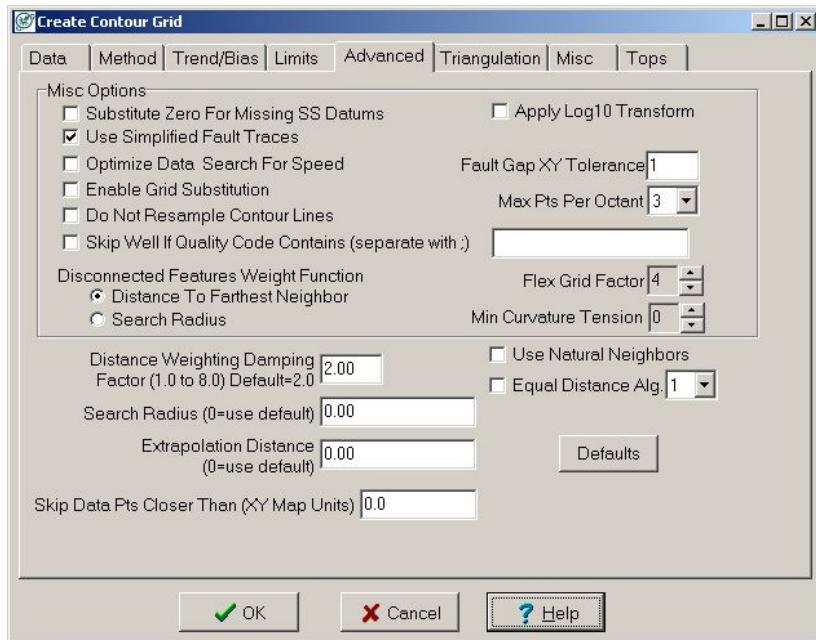
By default, the gridded surface extends only over the area of the map containing wells. Alternatively, you may have the grid values computed over the entire range of the grid limits. Extrapolating beyond the data control points can sometimes result in unreliable grid values. Additional options are available in the "Extrapolation Distance" selection in the Advanced section to control the amount of extrapolation produced.

User defined Grid Limits - Here you may enter your own grid area XY limits or use the default limits that are defined by the well data. Blanking methods, such as Convex Hull or Neighbor Search, give different edge effects to your maps. We will use the convex Hull method to provide a smoother edge effect for our map.

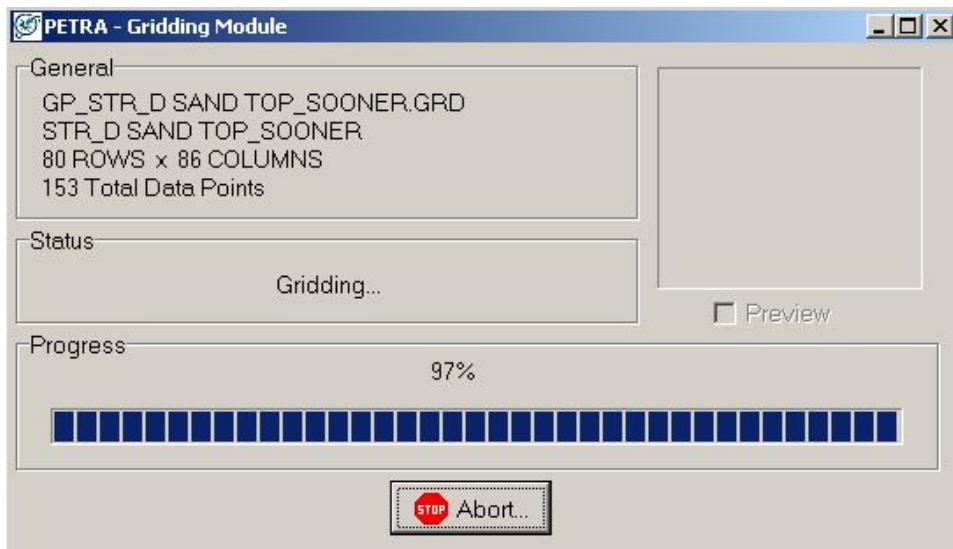


ADVANCED TAB

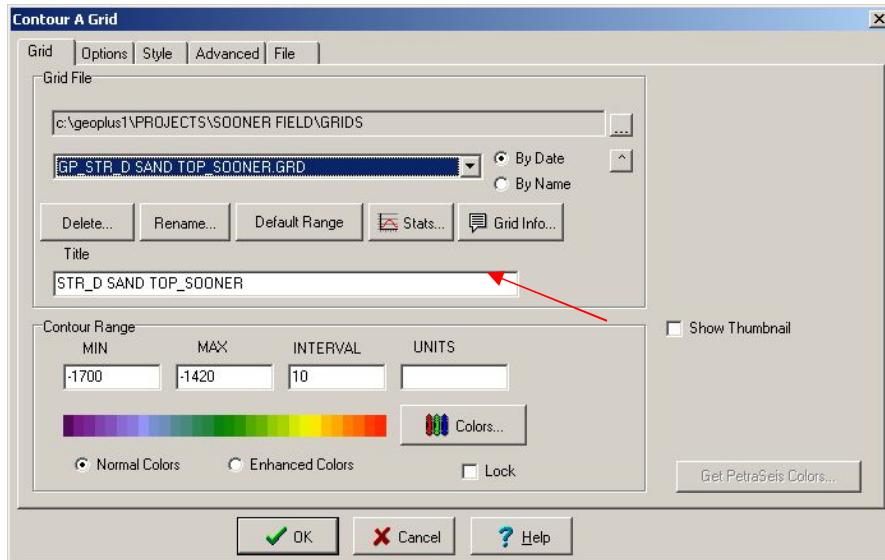
Advanced options contains many miscellaneous options for gridding. Many of these options are used where specialized applications are necessary or desired, and for such needs as skipping a well where a quality code has been entered for wells not to be used in the gridding process.



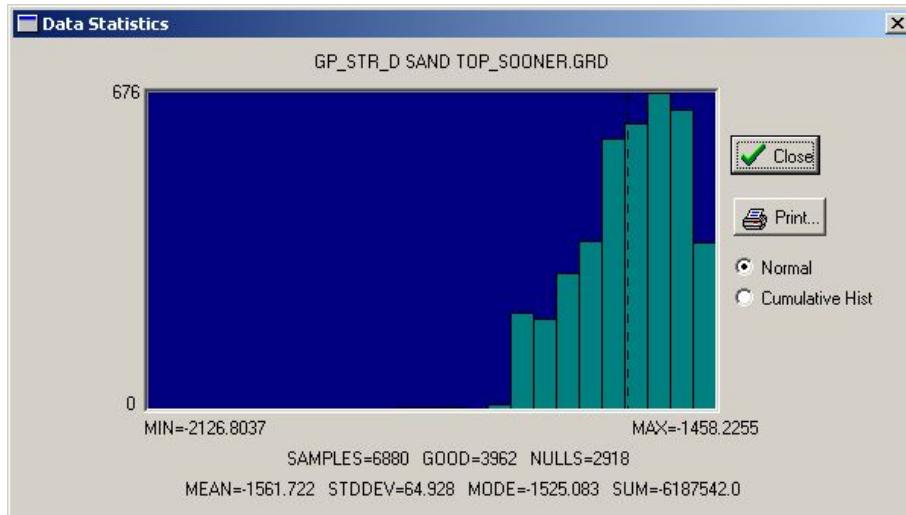
Click the “OK” button to start the gridding process. The screen will show the gas gauge of the process and will allow the user to monitor the gridding.



Once the gridding process has completed, select the “Contours>Display Contours” menu or the  icon to bring up the contouring options screen shown below.

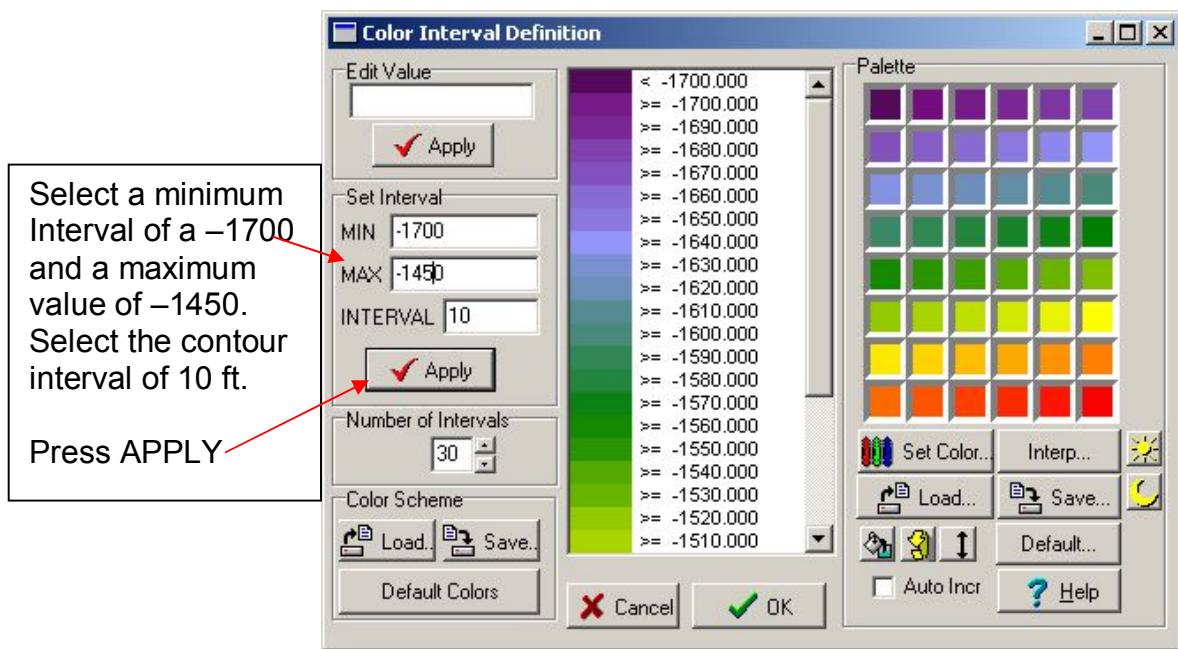


Check the “Stats” to determine the best minimum/maximum values and the contour interval.

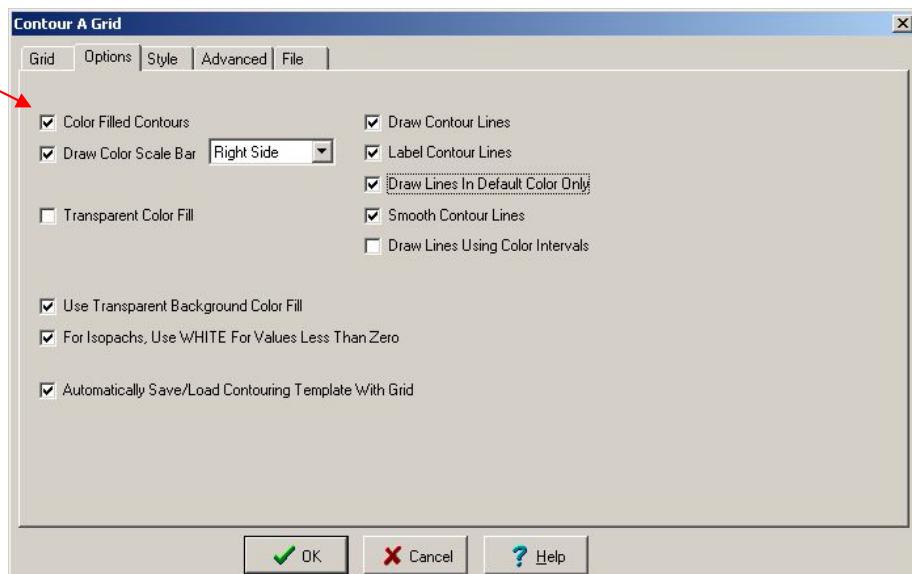


The histogram shows the statistics of the grid, including the min and max data for your contour interval. This histogram also show a problem with the data in the database- most likely a KB bust on one or more wells.

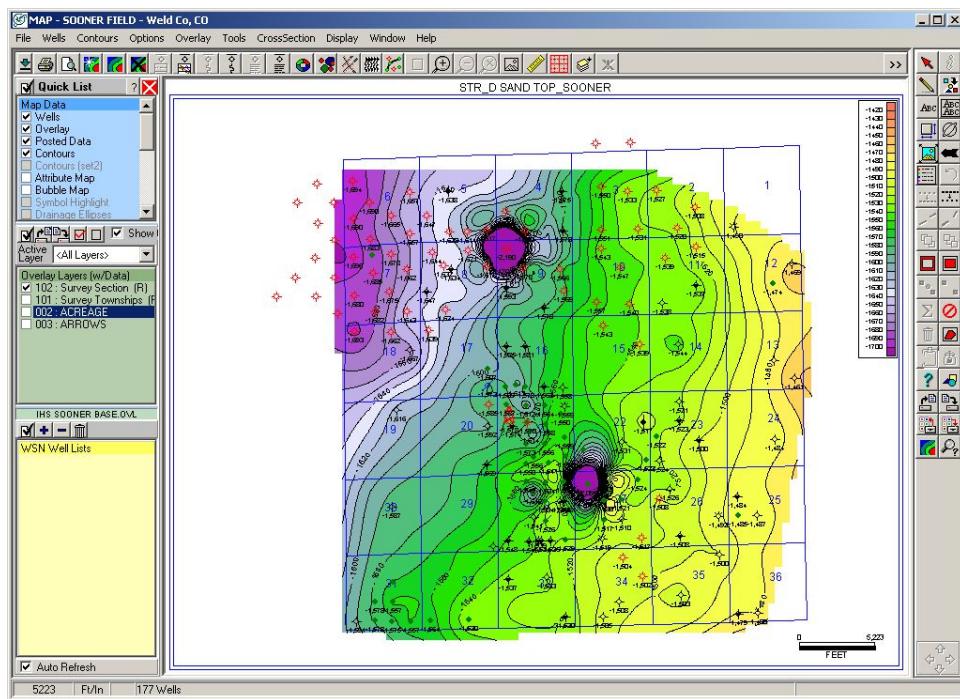
Click on the “Colors” button to utilize the full color palette within the interval you wish to show.



Click on the “Options” Tab and turn on the “Color Filled Contours” option. If you do not wish to see color filled contours deselect the color filled contour switch.



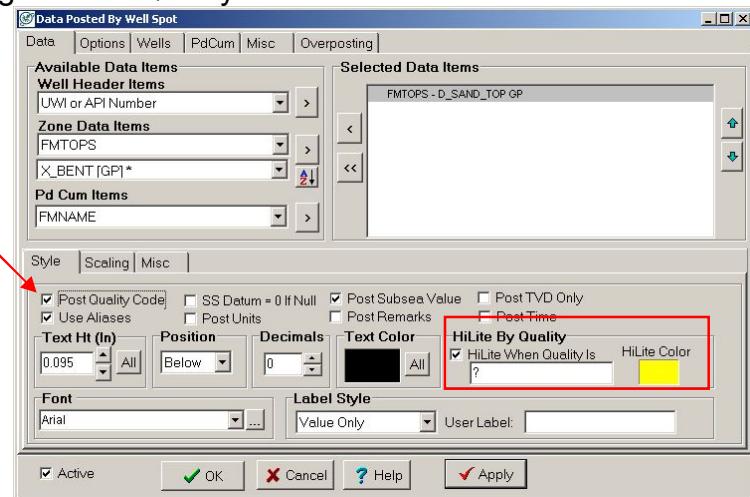
The following map shows the resulting D_SAND_TOP structure contours.



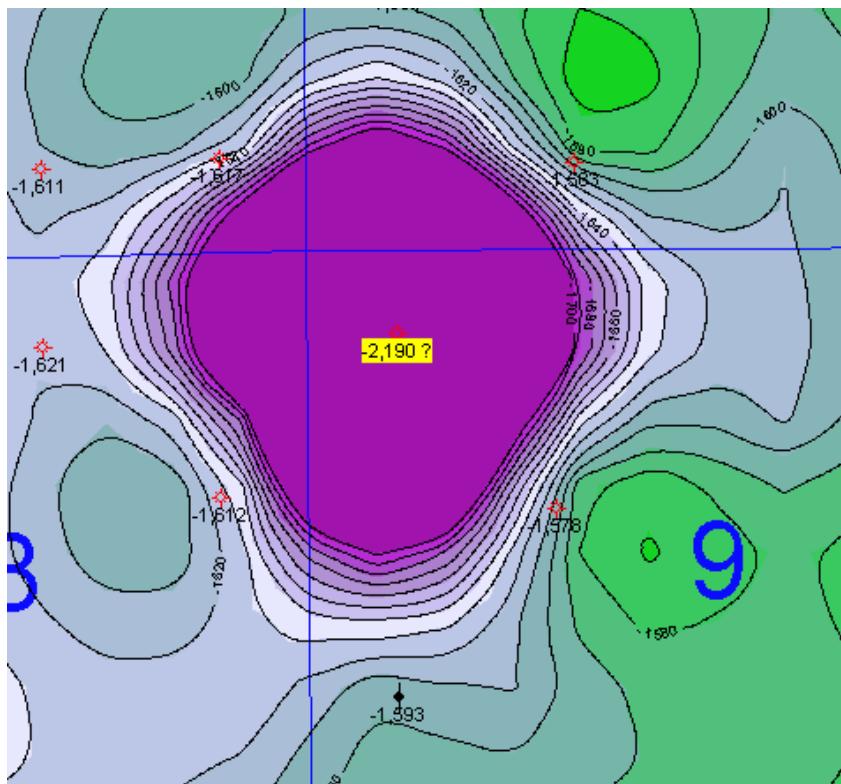
There are two obvious data points that are questionable. Return to the main module and place a “?” in the quality code of the 602DKOTD formation top for both wells.

Project	Well	Location	FmTops	Zones	Logs	IP Tests	Fm Tests	Scout
Rasters			Other					
ELEV_KB	=> 4,181	<input type="checkbox"/> Active Only	<input type="checkbox"/> Read Only	<input type="button" value="Save"/>	(*=Aliased)			
Fm Name	Src	MD	SS	TVD	QUAL	Time(ms)	Sy	
X_BENT *	GP						0	
603BMAK	3	6,175	-1,994	6,175			0	
D_SAND_TOP *	GP						0	
602DKOTD	3	6,276	-2,095	6,276	?		0	
BASE_D_SAND	GP						0	
602DKOTJ	3	6,357	-2,176	6,357			0	

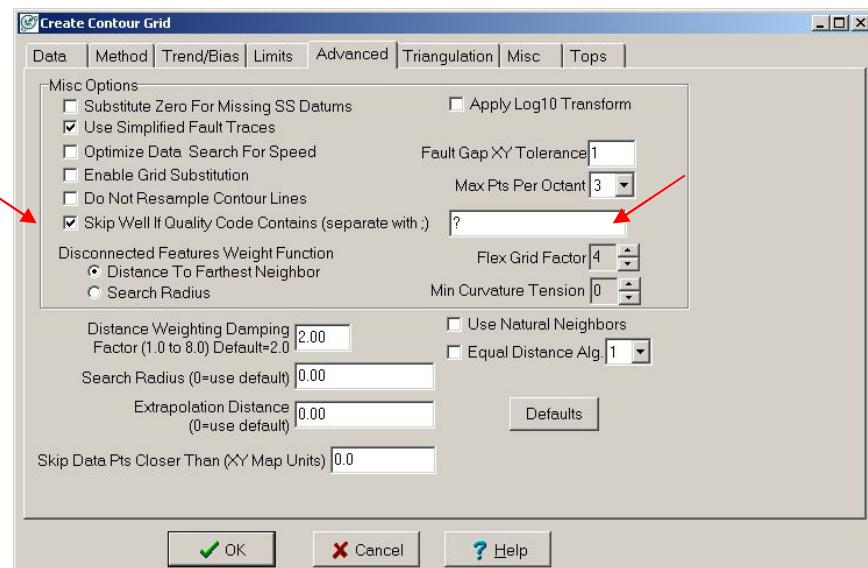
Return to the posting of the well data and add the “Post Quality Code” and Highlight when Quality Code is “?”.



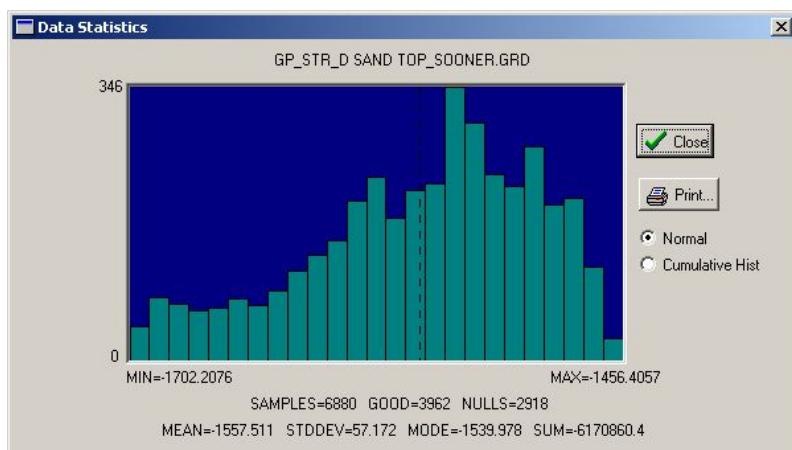
The problem wells will appear with their questionable pick highlighted.



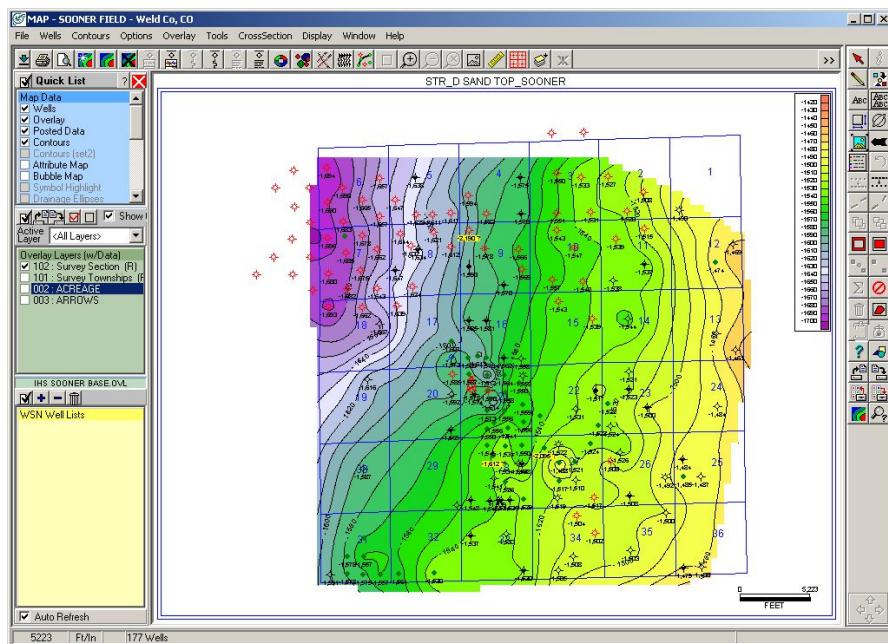
We will need to recreate our grid with these points removed.
Follow the same procedure, but on the Advanced tab, select the “Skip Well if Quality Code Contains...”?.



Select “OK”, and redisplay your grid. Check the statistics.

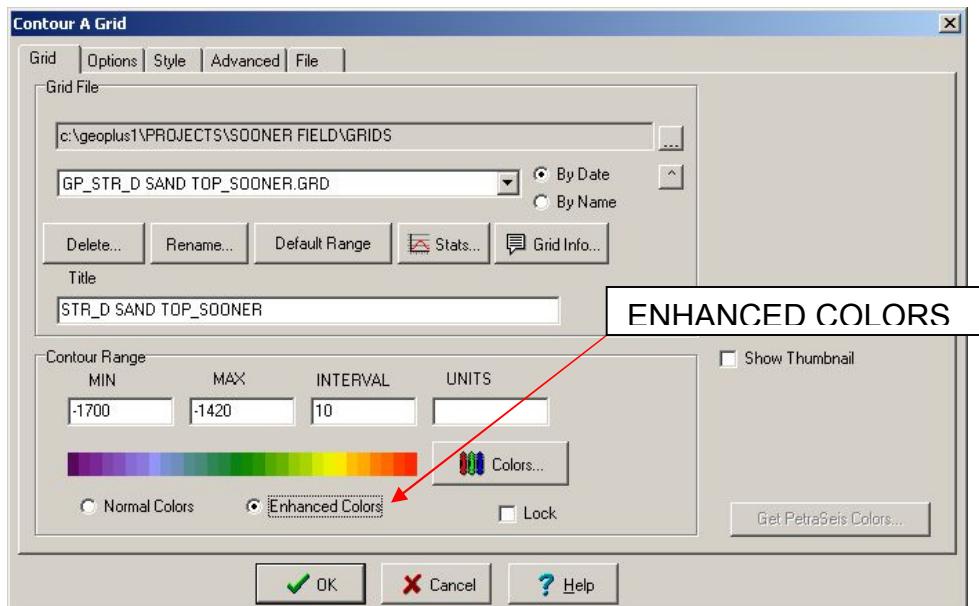


These grid statistics are more consistent and the points in question will need to be reviewed and corrected before using them in future grids.

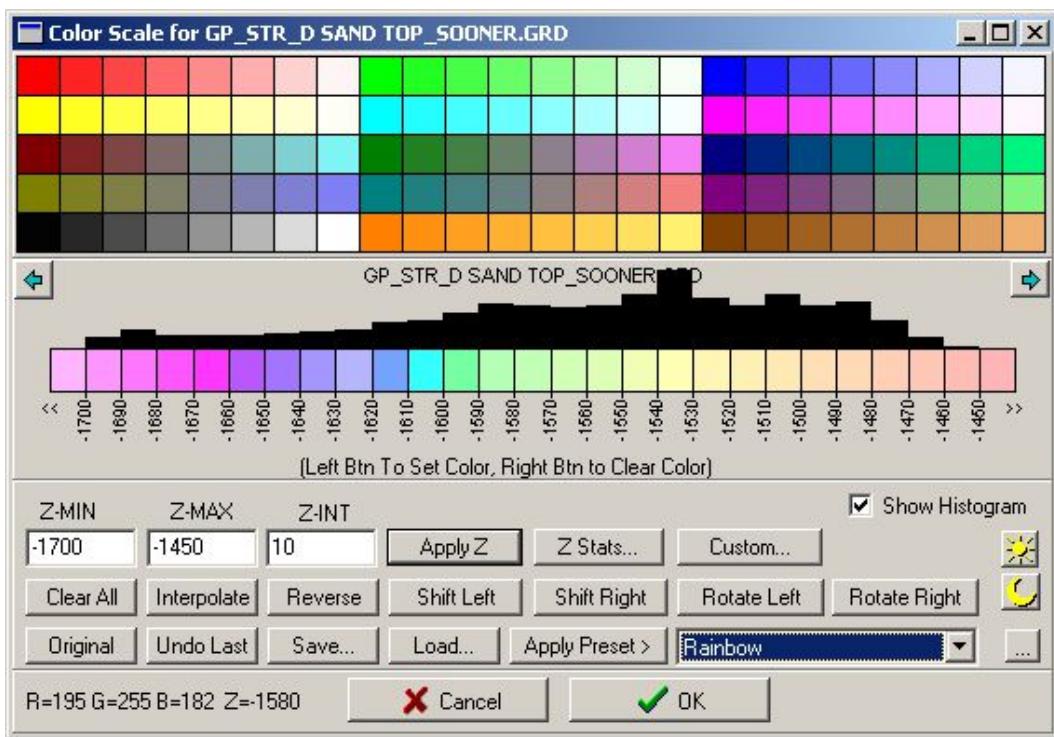


Our corrected and redisplayed structure map.

A second color option is available to us in the map module. Again select the Contour a grid option, and select the “Enhanced Colors”.



To change the color-fill colors, again select the “Contours>Display Contours” menu or the icon. Click the option for “Enhanced Colors” and then click the “Colors” button. Activate the data histogram using the “Show Histogram” option.

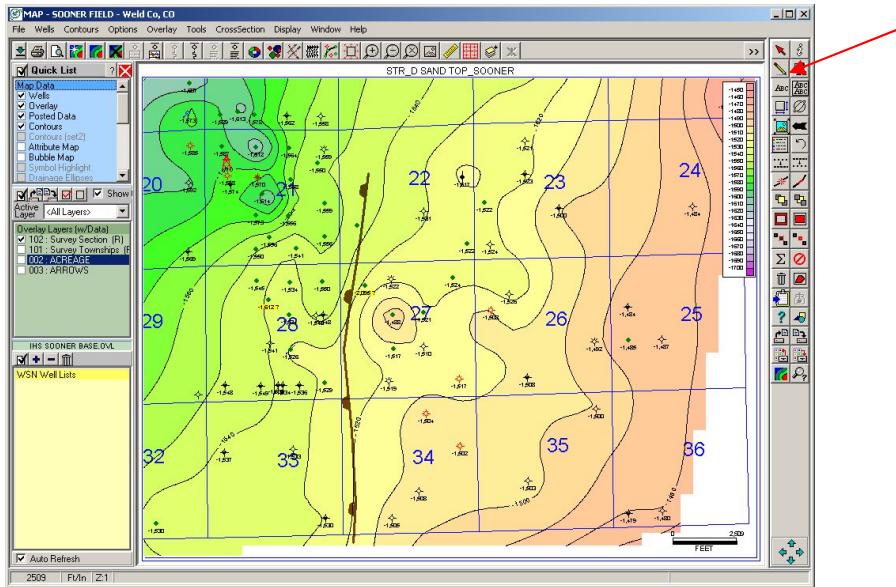


It is clear from the histogram data that the gridded data ranges from –1700 to around –1450. Change the values to match your values and select apply “Z”.

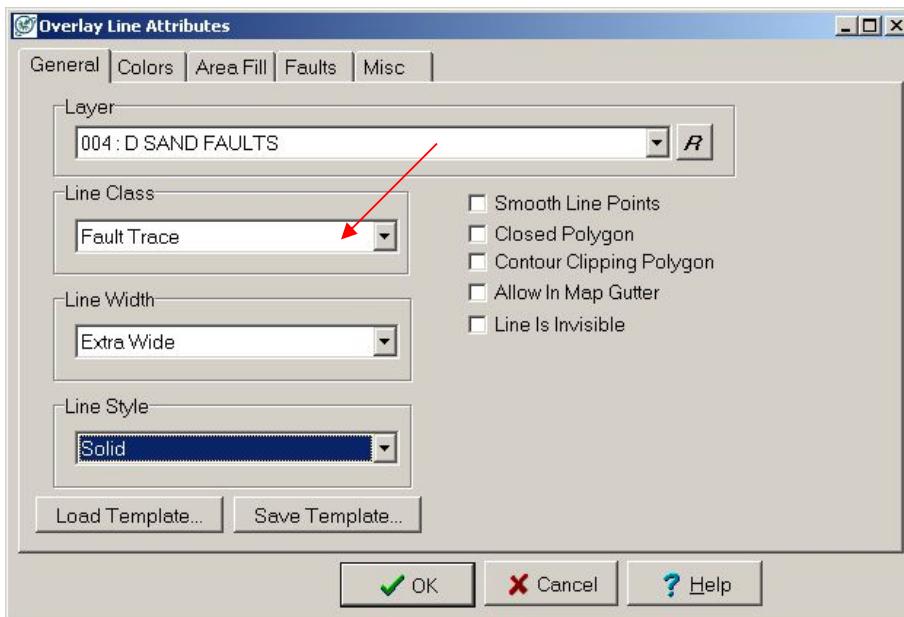
Click “OK”, then “Yes”, then “OK” again to redraw the map with the new color range. Now the entire color spectrum is utilized.

ADDING FAULTS TO THE STRUCTURE MAP

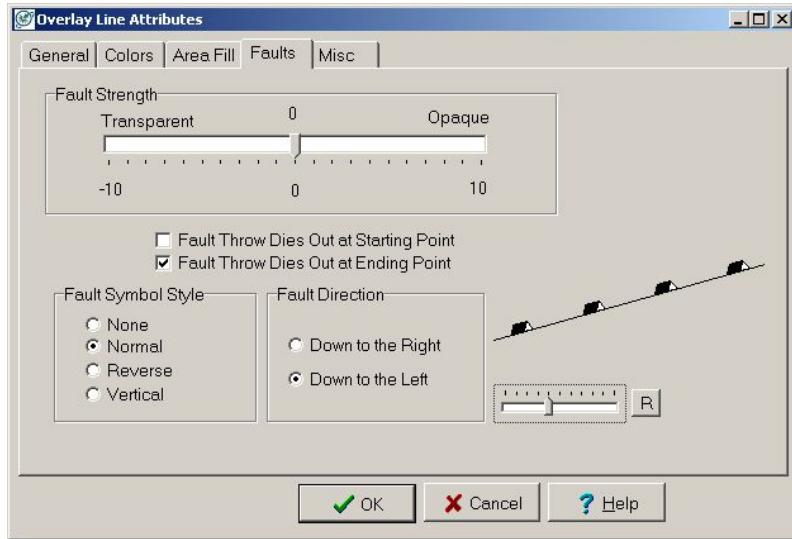
We can add a hand-drawn fault to the map using the overlay pencil tool.



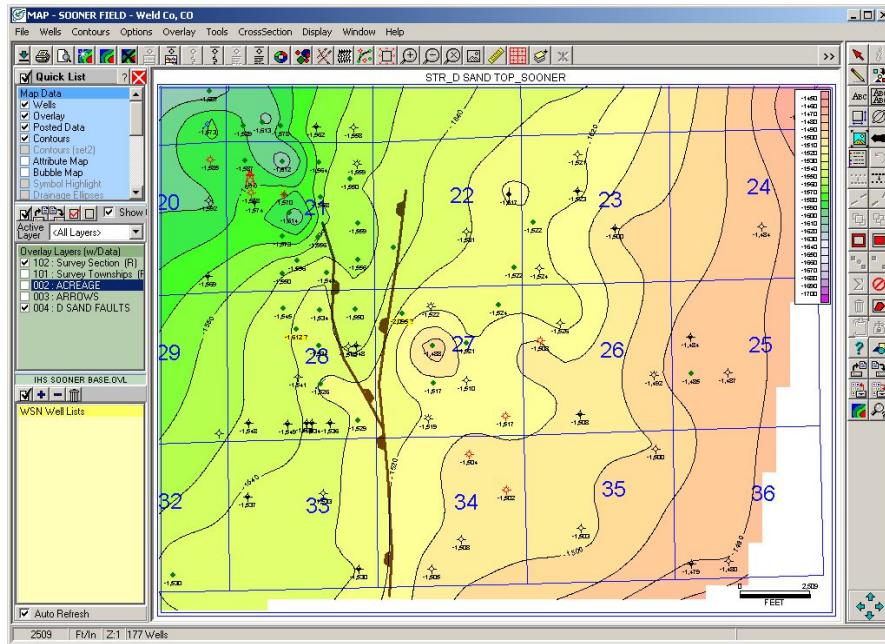
Click the pencil and draw a fault line as shown in the map below. Put the fault in the layer called D SAND FAULTS and set the Line Class to Fault Trace.



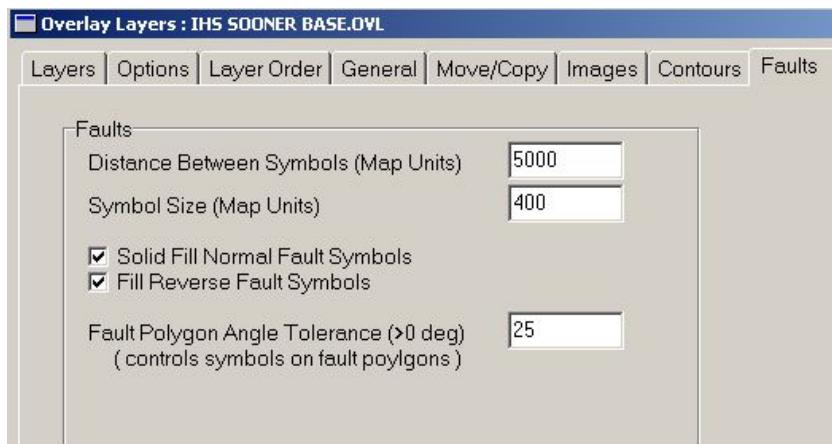
On the “Fault” Tab, select the “Normal Fault” option and “Down To The Left”.



Add a second to the map and place the fault line in the same overlay layer as before.

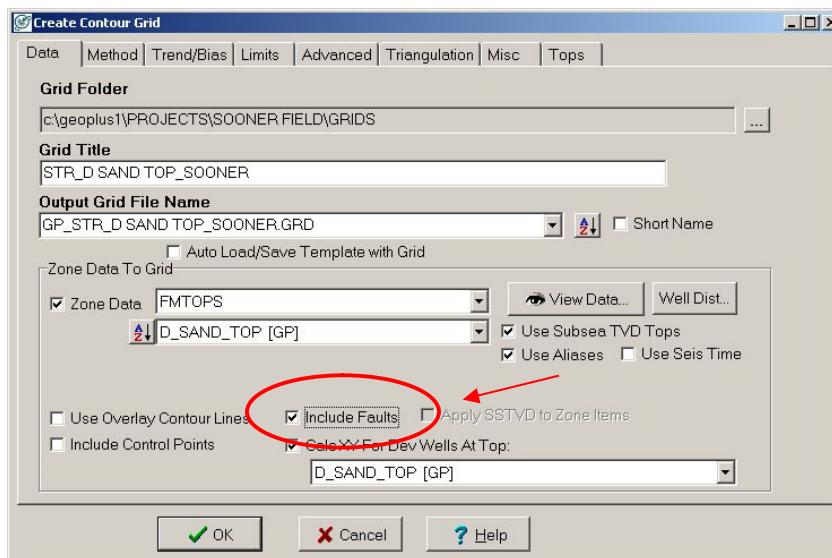


The distances between the fault symbols and the sizes of the symbol can be controlled through the overlay line attribute, or through the Overlay > Preferences and Layers:

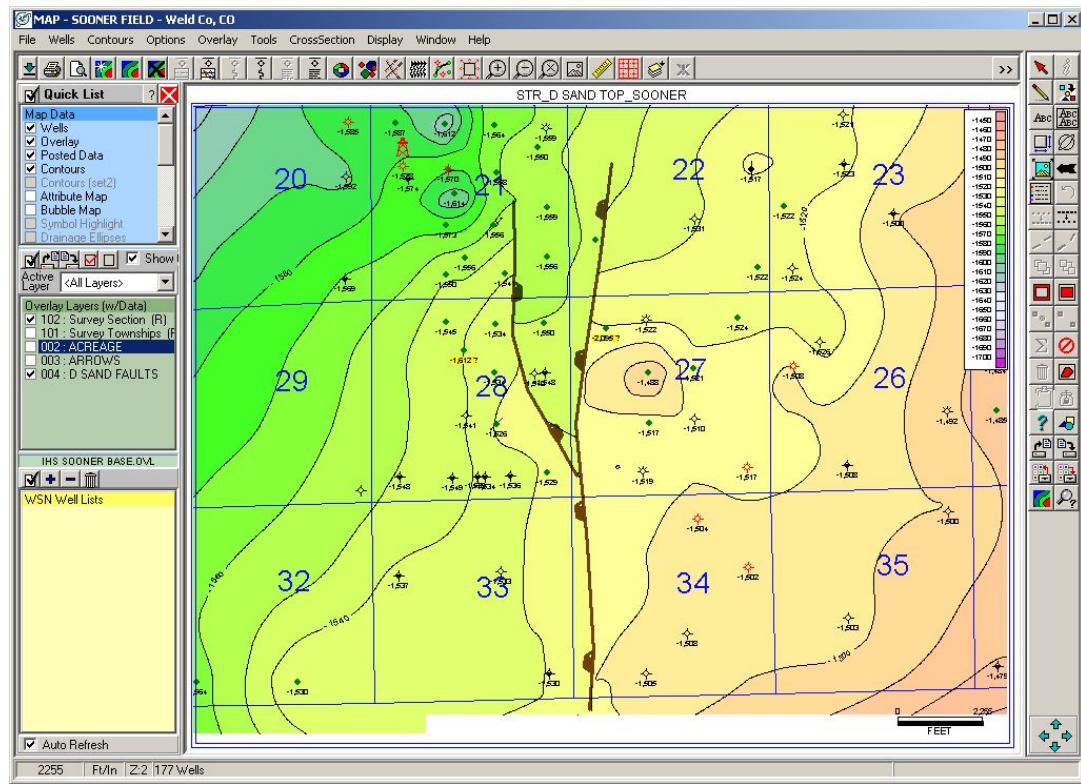


Now we can regrid the map using the faults and then we will add some hand editing of the contours to engage our interpretation of the structure.

Select the Create a Grid Menu, and select “Include Faults” – everything else will remain the same.



After regridding the map, refresh the screen see the new structural contours. Note how the contours are broken at the fault boundary. The program has used the faults as boundary conditions and assigned a throw across the fault based on the well data on the up and down thrown sides, and the associated grid nodes.



Now we will need to add some interpretive contouring.

ADJUSTING CONTOURS WITH GEOLOGIC INTERPRETATION Using the “Guide Contours”

There is nothing like a “Hand-Drawn” map. The hand editing of contours within the program allows the interpreter to influence the gridding process and create an interpretive, yet accurate, map using the geologist’s knowledge and observations for the best interpretations. There are a number of options for adding and editing contours. The use of the Overlay “pencil” to draw the interpretation is the most useful. Digitizing contours and importing them into the overlay is a more time consuming process, but is used in many instances, and the last option would be to capture the computer generated contours from the grid, edit the nodes of the computer contours, and then regrid using only the contour layer.

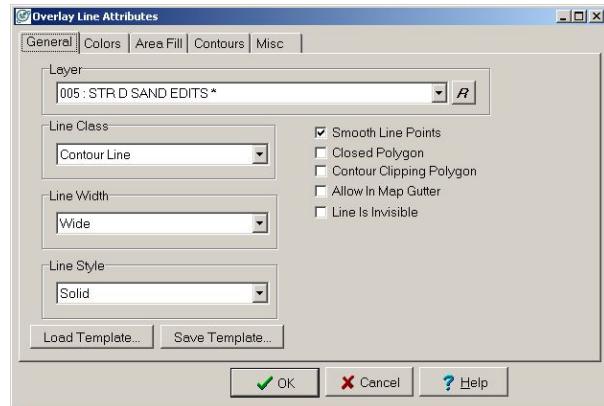
Select the pencil tool from the overlay tool bar. Using the pencil, digitize a contour line as shown below:

Step 1 – Digitize the line with several “nodes” .

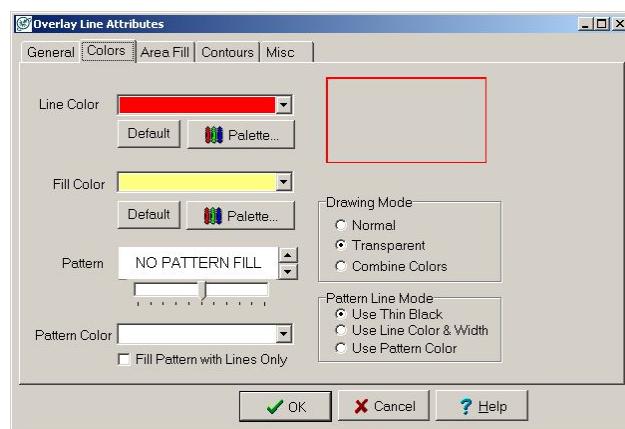
Step 2 – Select a new layer for the hand edited contours.

-Select the LINE CLASS as Contours line

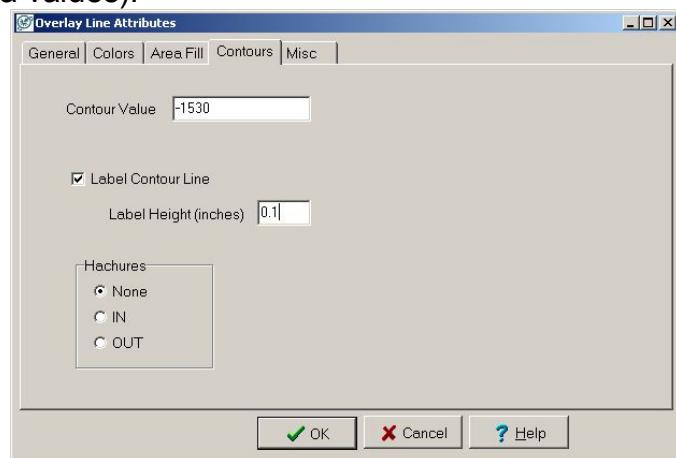
-Select a Line Width



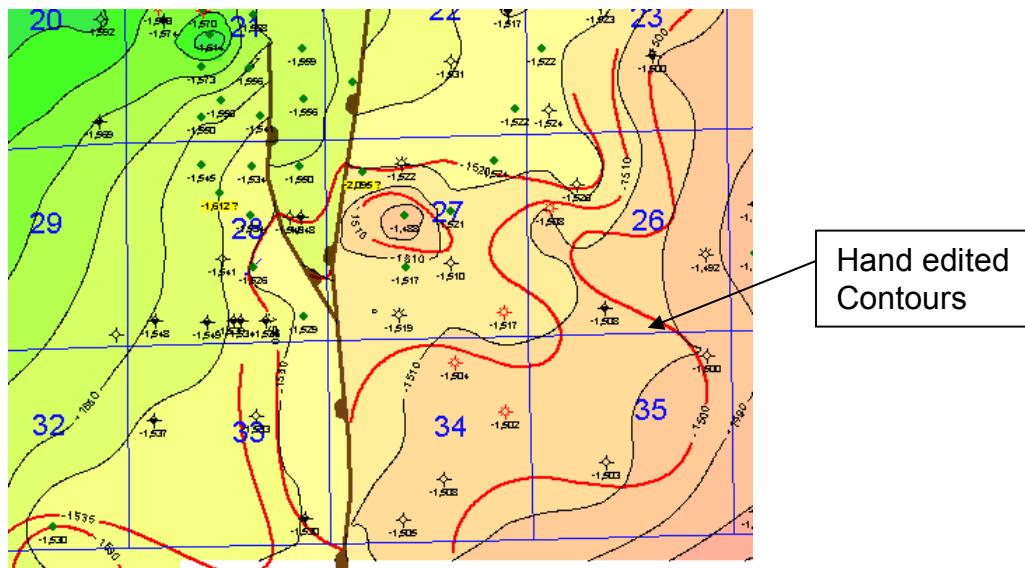
Step 3 -Select a Color for your edited contour lines



Step 4 – Select the CONTOUR VALUE (remember to add a negative sign for subsea values).



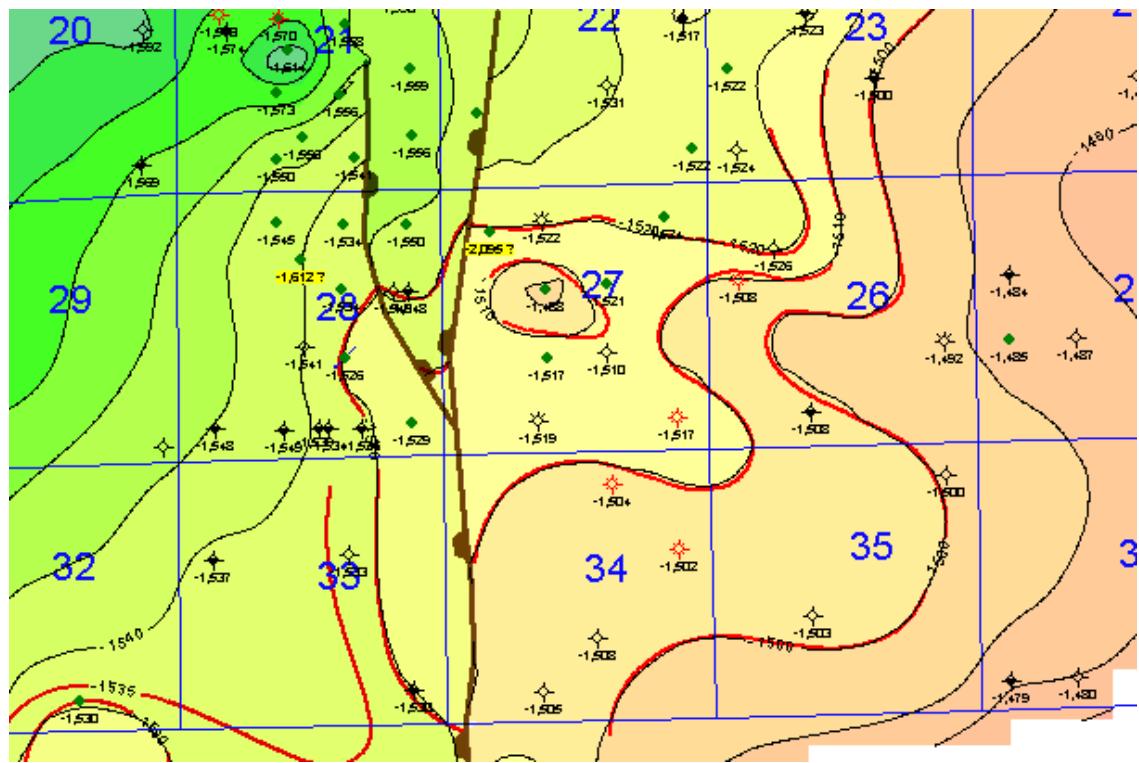
Review your contours, making sure that you are honoring the values in the database. To provide a more interpretive contour map, we can provide additional control to the gridding process in the form of hand drawn contour line segments in addition to the well data. As an example, in the map below, hand edited contours (those in red) and faults have been added to the map by the interpreter.



Following the contour edits, select the option to re-grid, and this time select Use Overlay Contour Lines, and Include Faults.

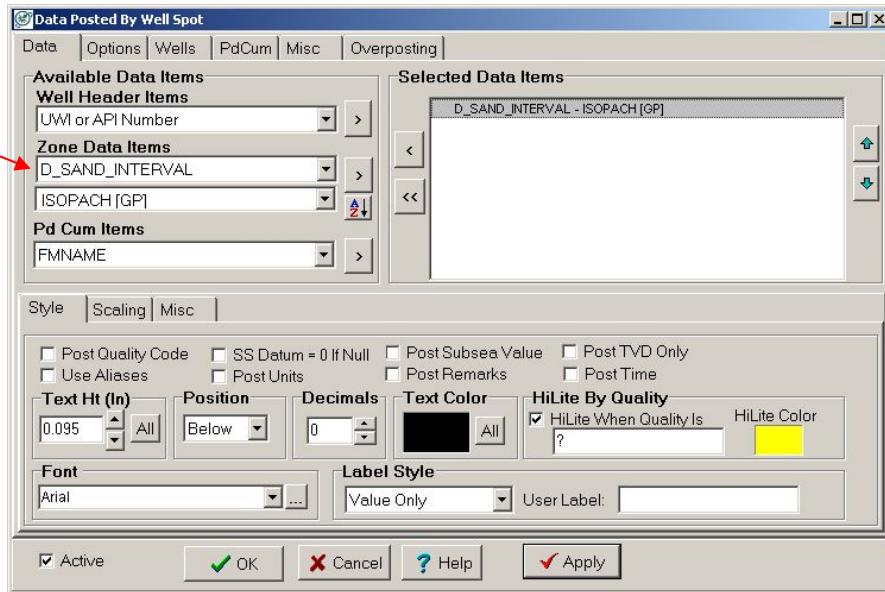


After regridding and displaying the map, the computer-generated contours have now been adjusted to the interpreter's hand drawn interpretation.

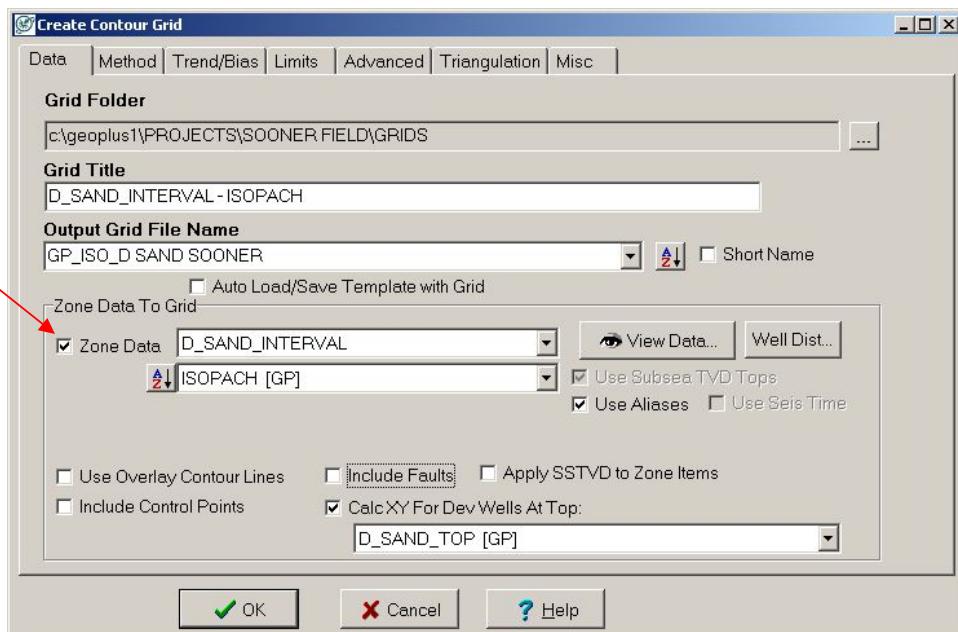


ISOPACH CONTOUR MAP

Next post the D SAND ISOPACH values from the database.



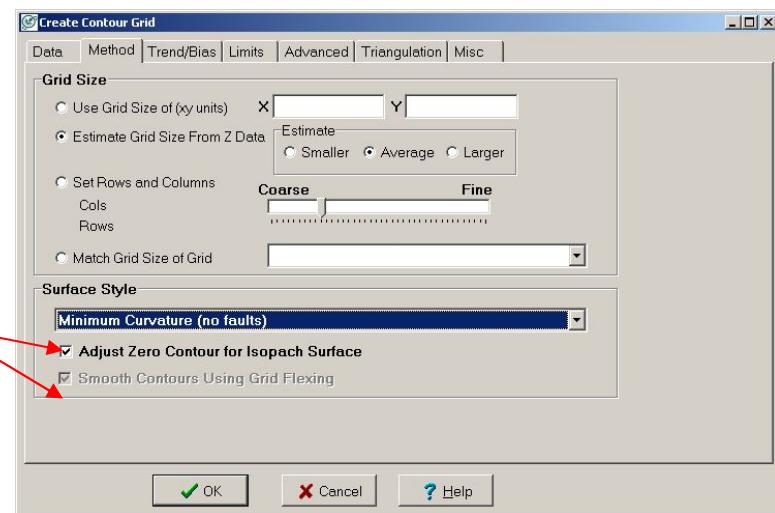
Select the “Contour>Create Grid” menu and choose the D SAND_INTERVAL zone and ISOPACH item. Turn off the overlay contours and fault options from the structure map.



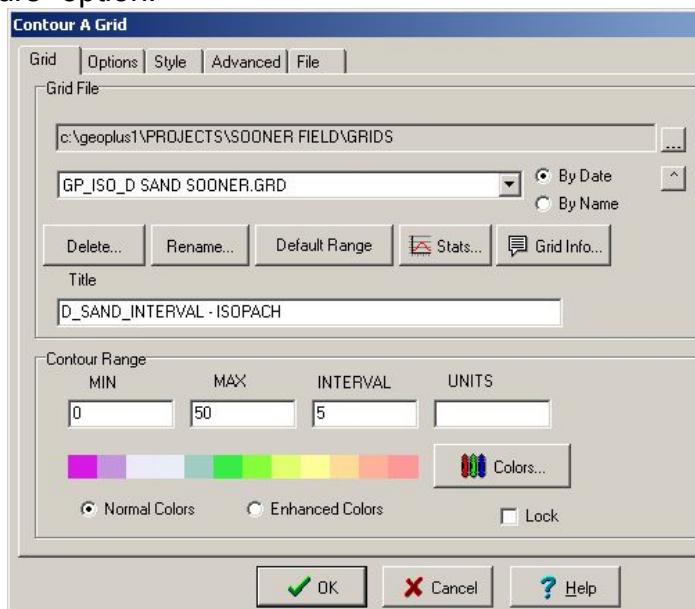
Rename the grid using the suggested naming convention – “Initials_Type_Horizon_Area”.

Typically, we can have isopach values with positive values and several zero thickness values. Since gridding attempts to “honor” all data values, including the zero values, we could possibly end up with a zero contour line that wanders unnaturally around the outer portions of the map. Instead, zero data values can be treated differently from other values to force a zero contour that conforms more naturally around the isopach features.

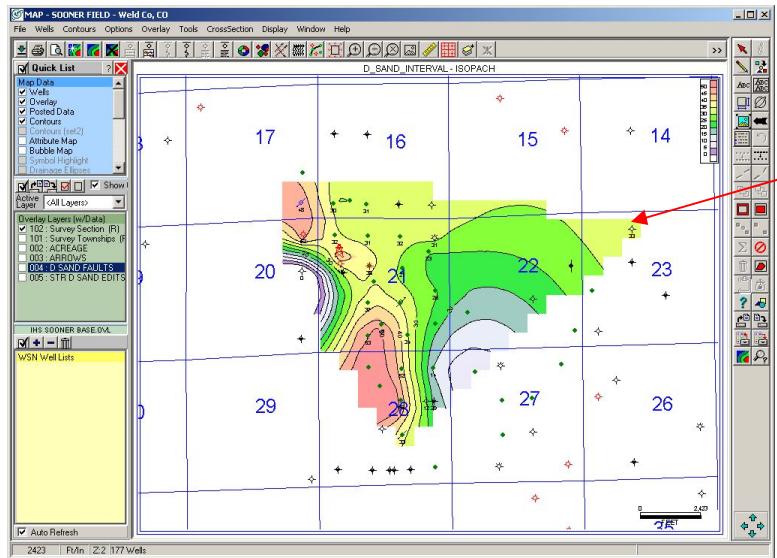
This option is called “Adjust Zero Contour for Isopach Surface” on the “Method” Tab. Use the Minimum Curvature surface Style, and select OK to begin the gridding process.



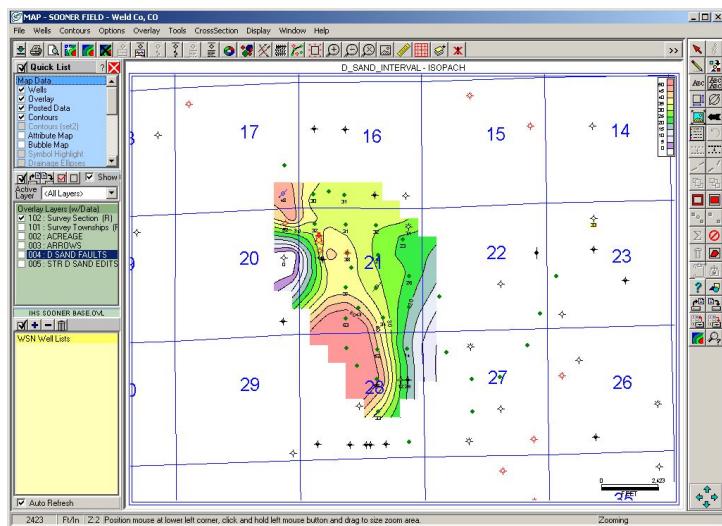
Select the Contour file to view from the drop down menu on the “Display Contours” option.



Check the statistics and set the contour values for your isopach.



There is a well in section 23 which is a different sand body, place a question mark on the data for that well and regrid using the advanced function to remove the wells with the “?” quality code.



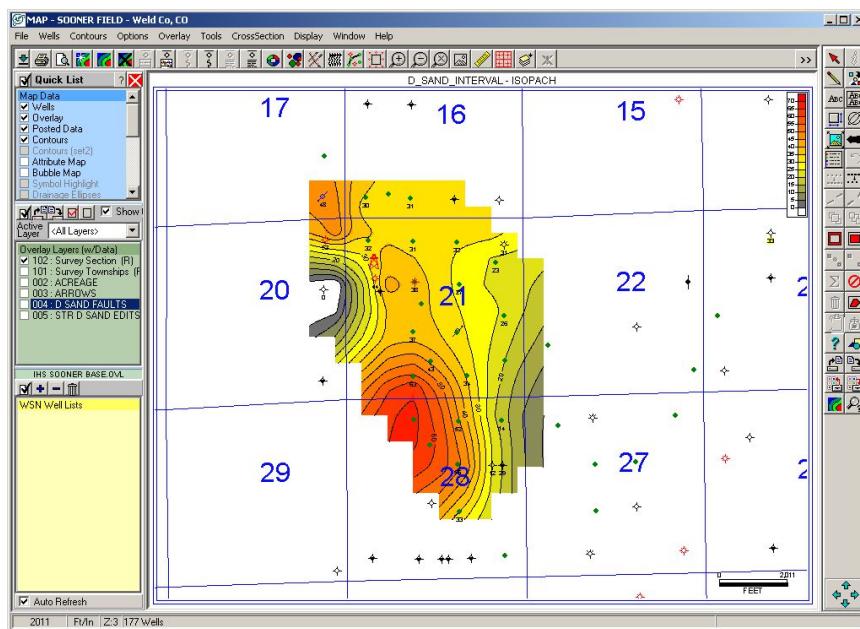
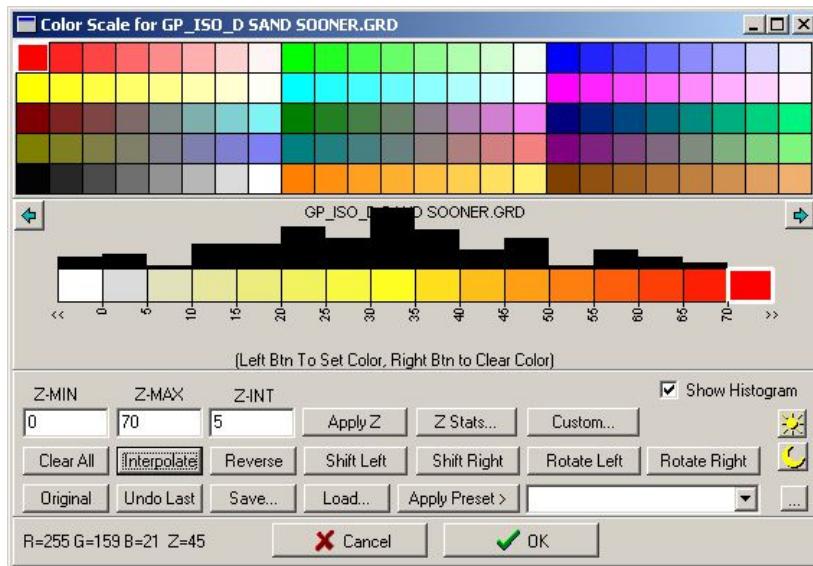
Select the Contour→Display Contours. Choose the D SAND Interval ISOPACH.GRD. Set the colors using the “Enhanced Colors” as shown below.

Setting the Enhanced Colors Scheme

Select the Contour a Grid and the Enhanced Colors options.

Select the Show Histogram option and change the min and max to 0 and 70 with a 5 foot contour interval.

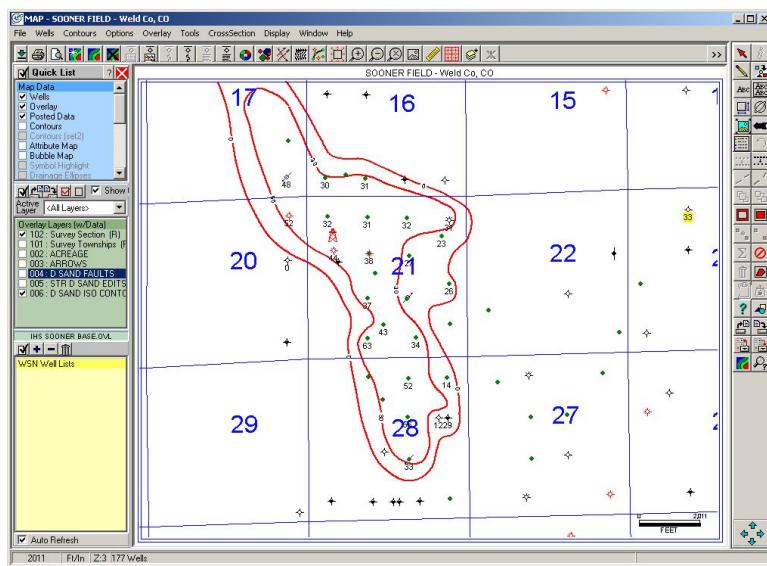
Select “CLEAR ALL”. Build a grey-yellow-red color scheme by adding the grey on the far left, yellow in the middle, and red on the far right. Then click the “Interpolate” button. You can save this scheme using the “Save” button.



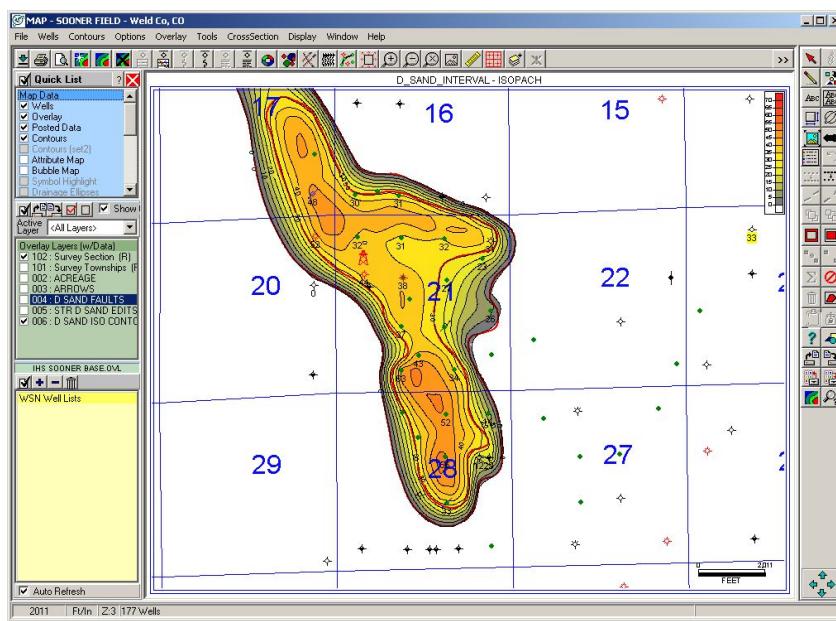
The resulting isopach map used a “minimum curvature” style of gridding with an average grid cell size.

Notice how the contours form more of a channeling effect in the thickest parts of the sand. You may now wish to add some zero edge contours to better control the channel appearance.

Add a Zero line and a 30 Ft contour by hand editing through the overlay. Select the HIGHLY CONNECTED algorithm, with flexing applied. Remember to place your new Isopach edits in a new layer for this map.



Regrid using the zero edge and 30 ft hand edited contours. Redisplay your map with 5 foot contours.



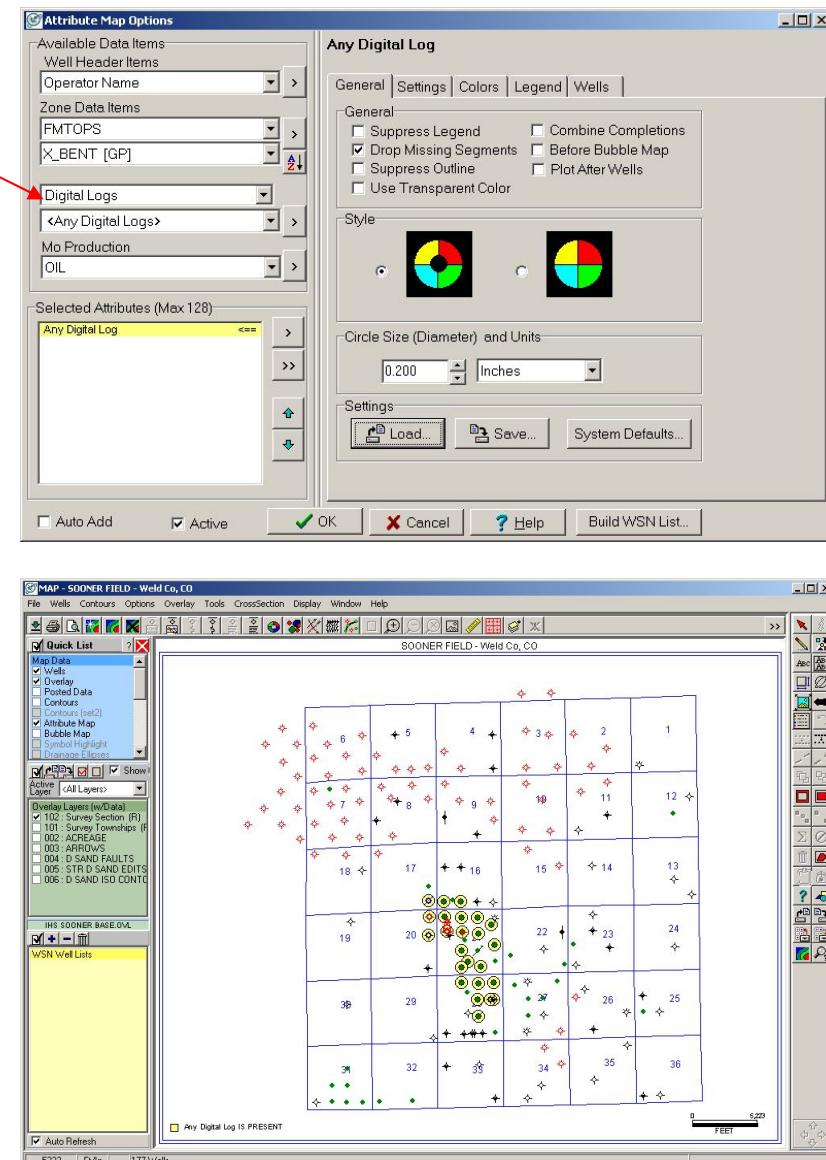
As you can tell, the program will adjust the computer-generated contours to represent the hand-edited interpretation. However, the program will not allow your edits to override the data in the database.

Chapter 4. CROSS SECTION MODULE

SELECTING THE WELLS

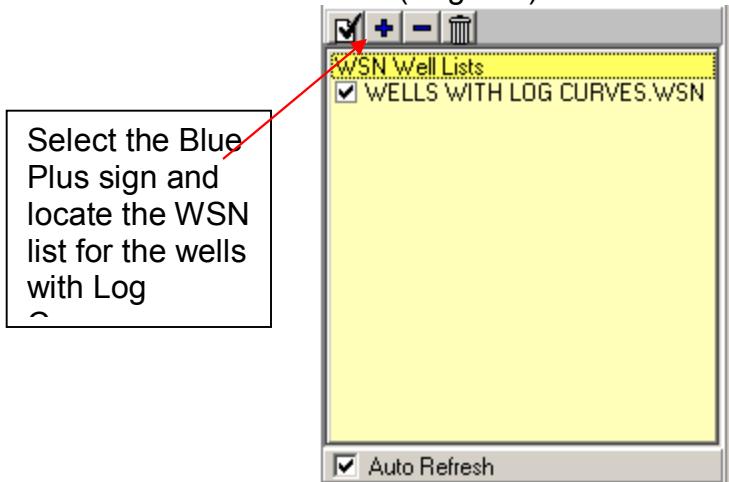
The Cross Section Module can be initiated from either the Main or the Map Modules.

From the map, we first we need to determine which wells have digital log curves. Return to the Attribute map to see which wells have digital logs.



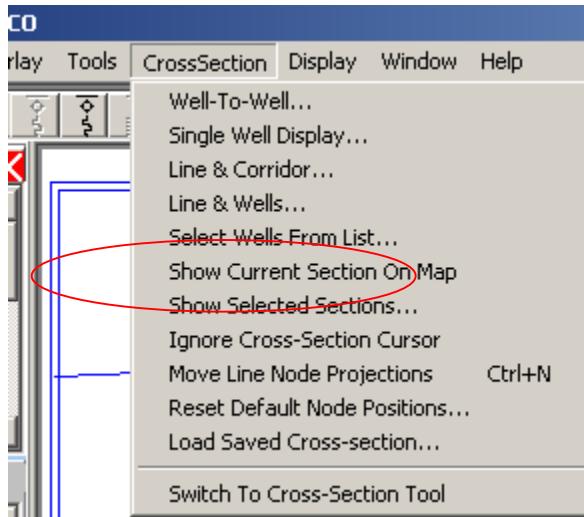
We can choose the wells we wish to use a variety of ways. One option is to select wells by data criteria, another would be to select wells in a rectangle or prospect area, and another is to select wells from a WSN list. We will use the Quick list and WSN list for the wells we selected with digital logs.

Using the Yellow –WSN List function from the Quick list, select the Blue Plus sign and find the “Wells with Log Curves.WSN” which was created after the LAS files were loaded in the Main module (Page 36).

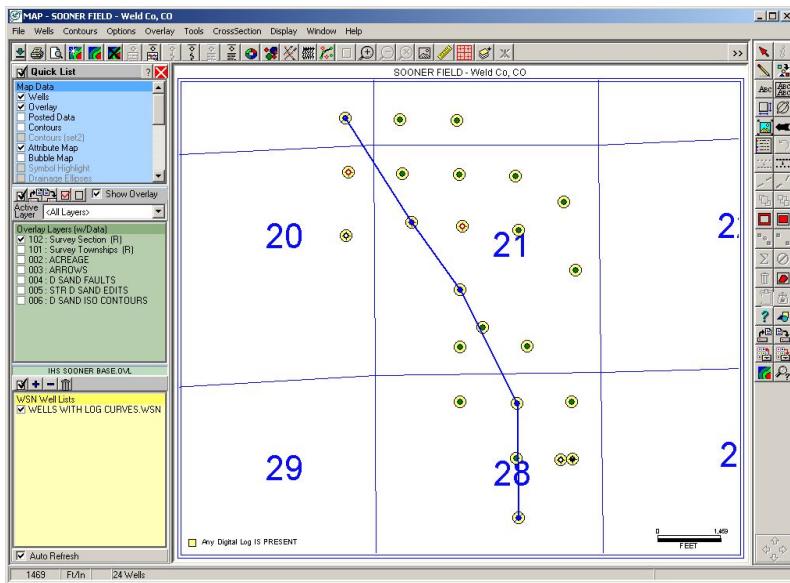


When the map refreshes, you will see only the wells contained in the WSN list.

Select the wells for the cross section using the “Well-To-Well Cross-Section”,  icon or the “Cross Section>Well-To-Well...” menu. You may wish to toggle the “Show Current Section on Map” to locate the selected section and wells.

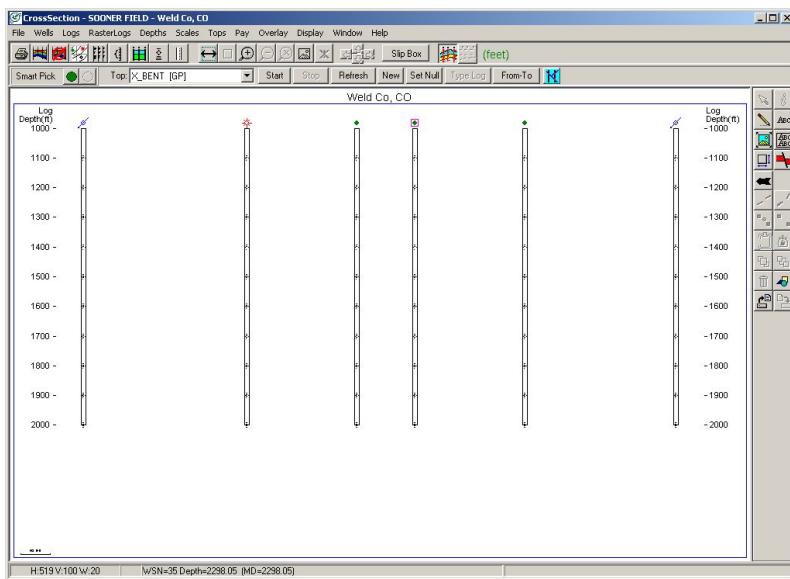


Construct a section from NW to SE through those wells that have log curves.



Position the mouse cross hair on the first (left-most) well you want on the section and click the “Left Mouse” button. Next, click the second well, third well, and so on until you have selected all the wells for the cross-section. Click the “Right Mouse” button to end. The “Cross-Section” module will start and display the selected wells.

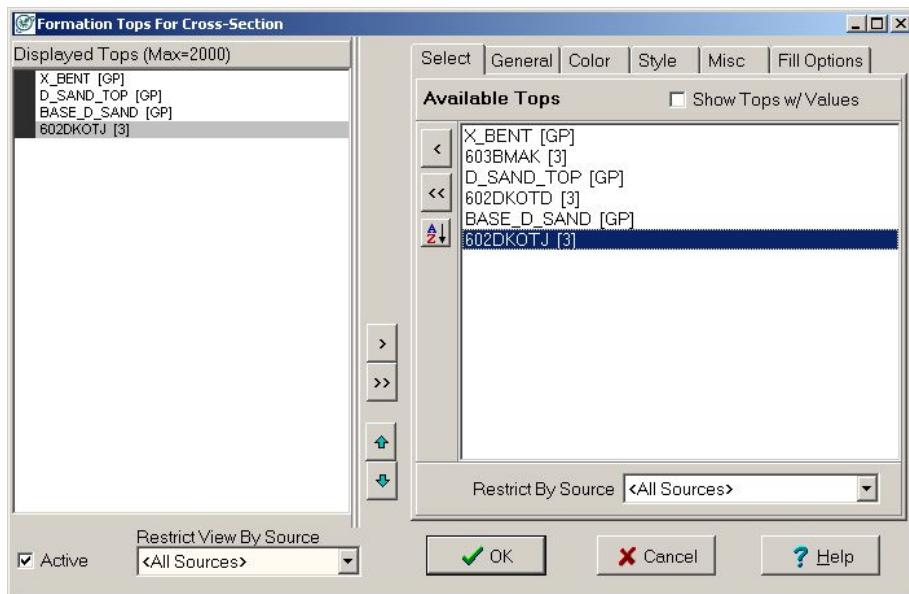
The very first cross-section you make in a project will appear with only the wells. We must then define the “style” of the display by setting the depths, tops, log curves and other information we want plotted. Once the cross-section style is defined, successive cross-sections will have the same style.



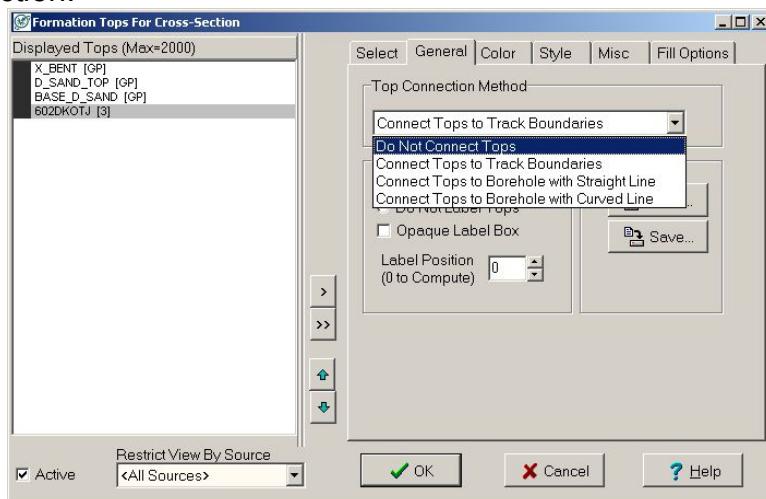
SETTING THE FORMATION TOP DISPLAY

PETRA has the ability to set the depth range using formation tops or log curves. If we define which tops we are going to display, then we can compute the depth range from those tops. However, if you already know the depth range you can simply specify it. First, select the “Tops>Display Options” menu or the  icon.

Choose all four tops to be displayed by clicking the  button and then click the “OK” button. This will define which tops we wish to see plotted.

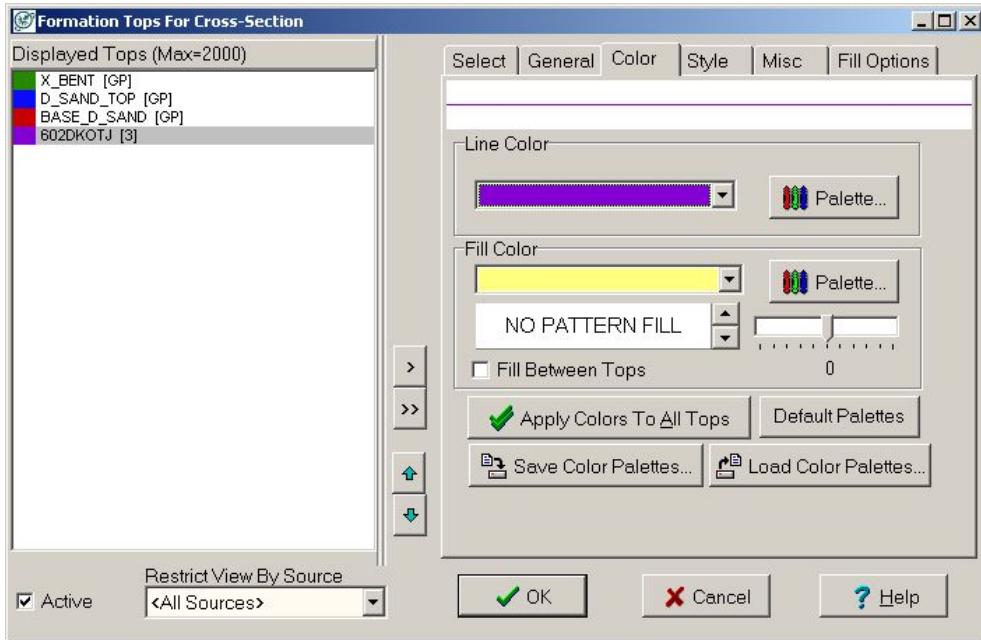


From the Tops Display, select the General Tab, and determine the style of Top connection:

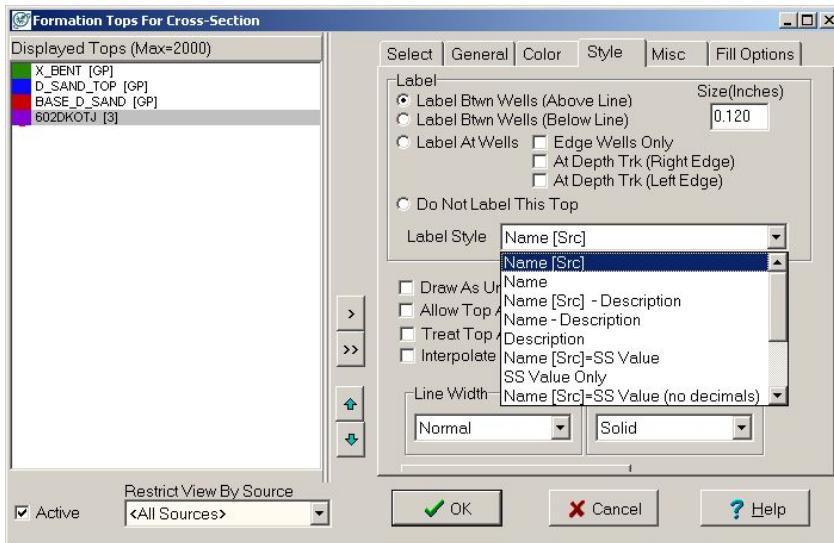


We will connect the tops to the track edges for the exercise.

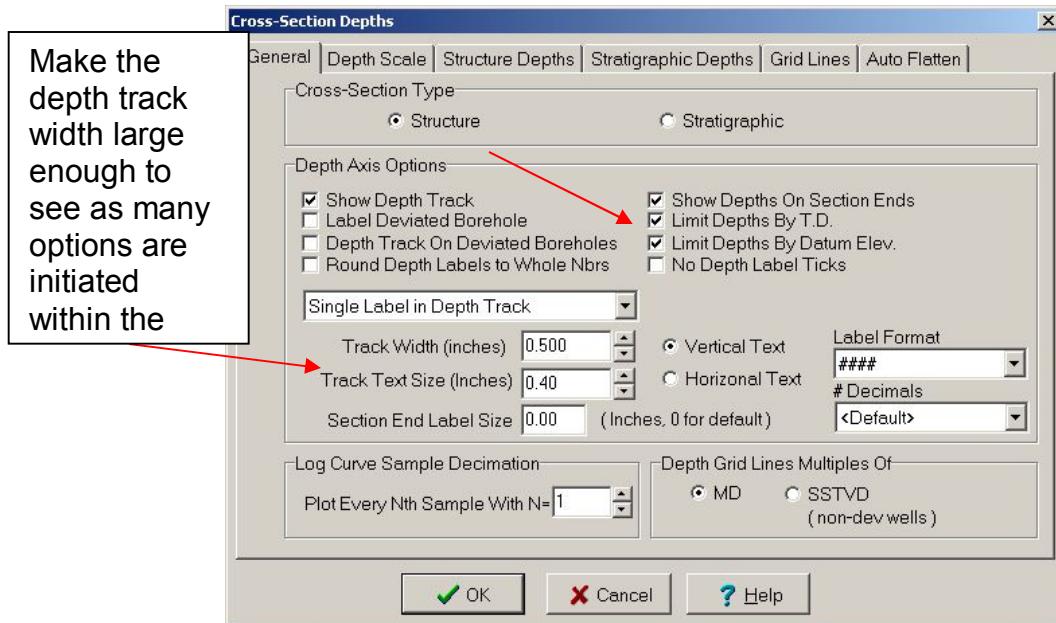
Next select the color scheme you wish to see for the connecting lines. You may choose a different color for each of the formation tops. At this time do not select to fill between tops.



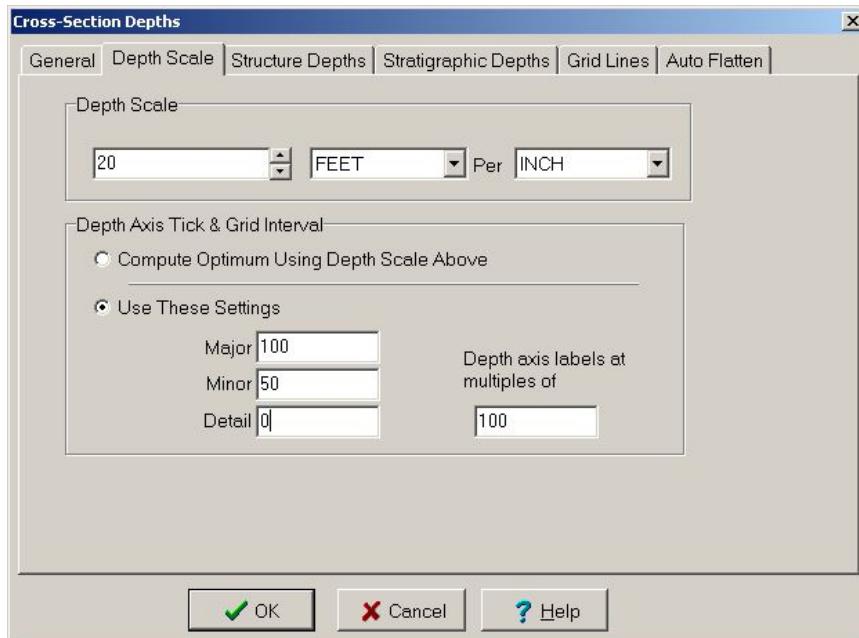
The Style Tab allows the user to determine how each of the tops will be labeled – above the line, below the line, at the well, in the depth track, etc. The options for the use of the alias, interpolation of the missing tops, the line style and line thickness are available for selection.



Select the “Depths→Depth Scale” menu or the  icon. The General tab is designed for the set-up of the well depth track. Options include the track width, limit on depths and datum elevations, and labeling. Select the following options:

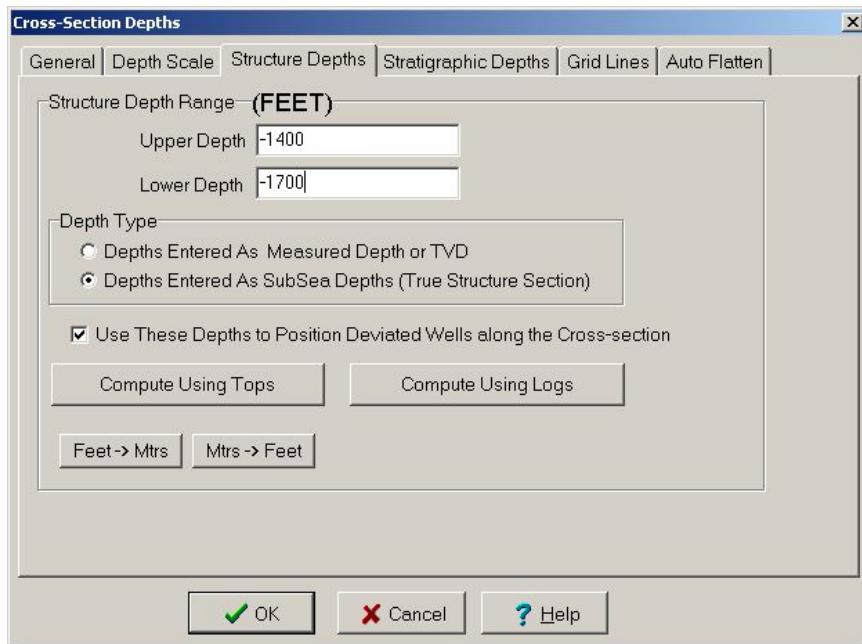


Set the Depth Scale tab to show the depth scale at 20 feet per inch, and Grid Interval settings to represent Major Interval at 100 feet, Minor at 50 feet and detail at 0 (zero).



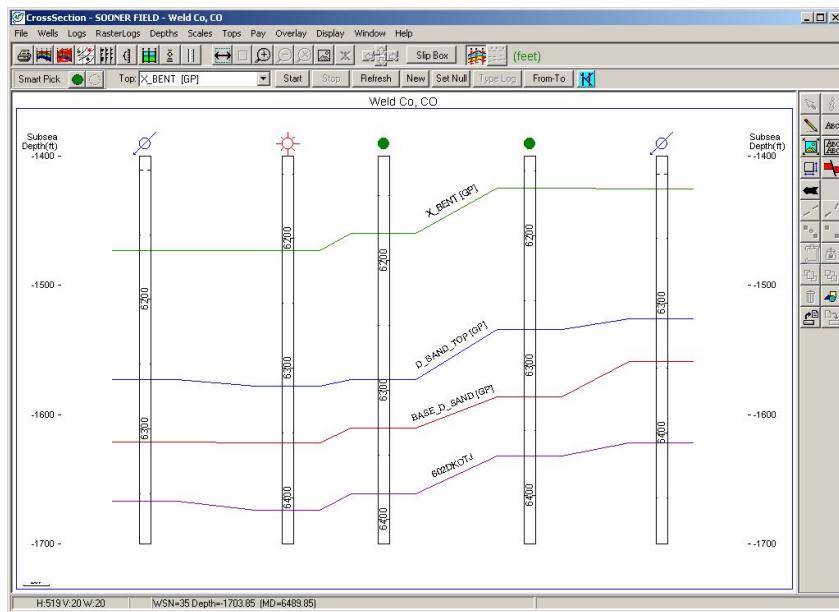
We want to set the structure depths so that all tops will appear, and the section depths will be shown in Subsea Structure.

Finally, select the “Compute Using Tops” option to set the depth range to show the selected tops for the specified wells in the cross-section.



STRUCTURAL CROSS SECTION

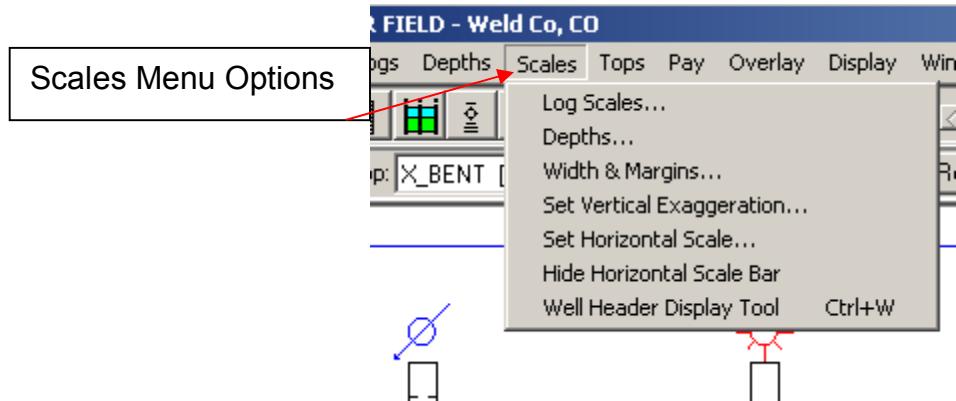
The following Structural cross-section is displayed:



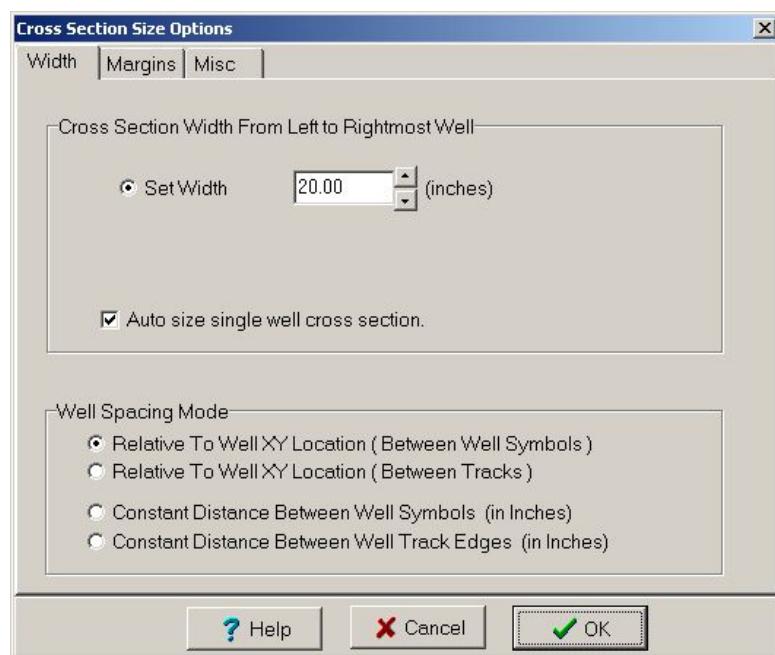
The lower left corner of the screen denotes the horizontal scale as H, the vertical scale in feet /inch as V, and the width of the cross-section in inches as W. The width is measured from the center of the leftmost well to the center of the rightmost well.

The display of the cross section is a relative ratio of Horizontal, Vertical, and Width between the left and right most wells. The default width is 20 inches.

Selection of an appropriate Horizontal and Vertical scales will assist in display manipulation. Vertical exaggeration and horizontal scaling can be set automatically, as well as chosen for specific purposes by the interpreter.

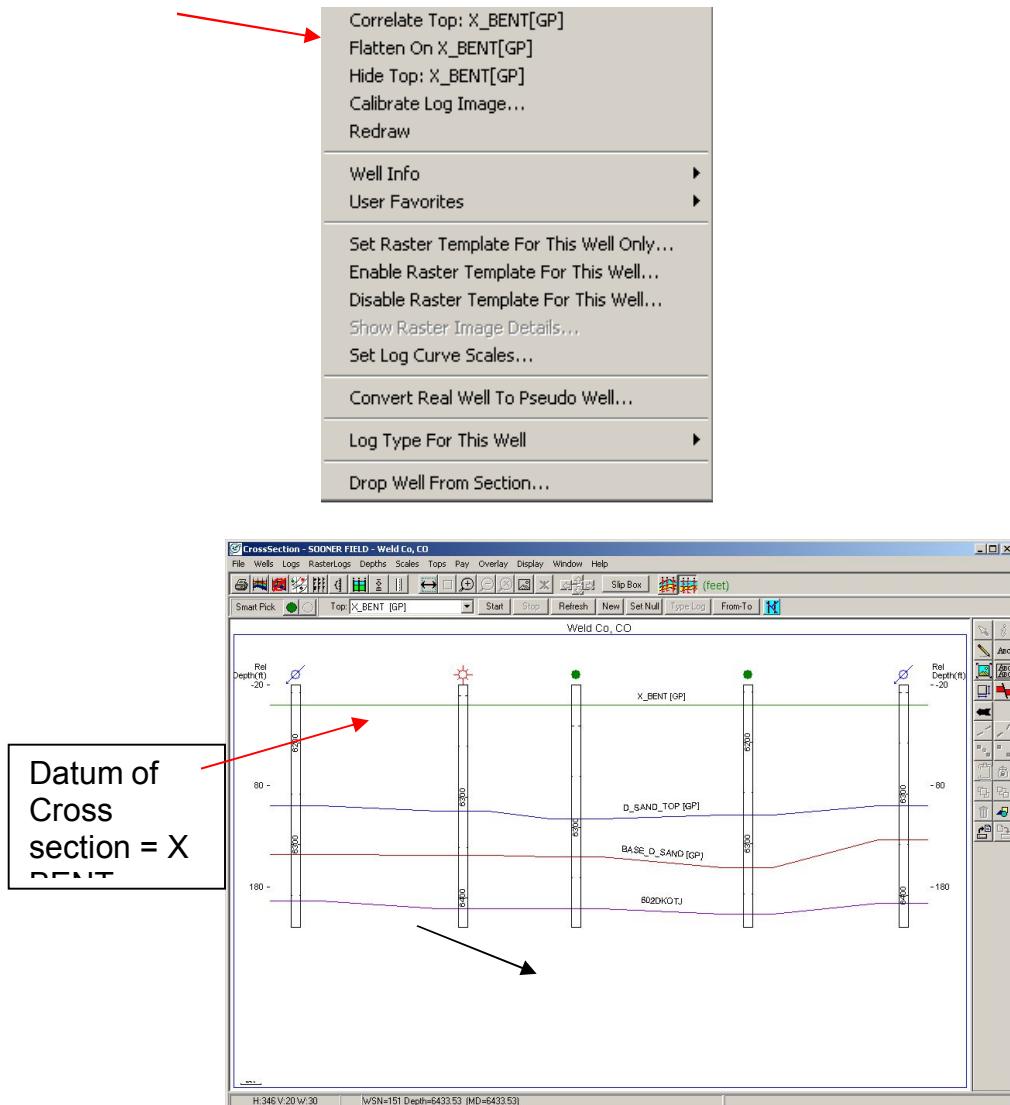


The Width may be selected relative to the XY positions of the wells, or a constant distance between wells.



STRATIGRAPHIC CROSS SECTION

We change to a stratigraphic cross-section by “flattening” the section on a particular formation top such as the XBENT. To do this, position the mouse at the intersection of the XBENT and a well, and click the “Right Mouse” button in the depth track. Choose the “Flatten On...” menu item to create the flattened section shown below.

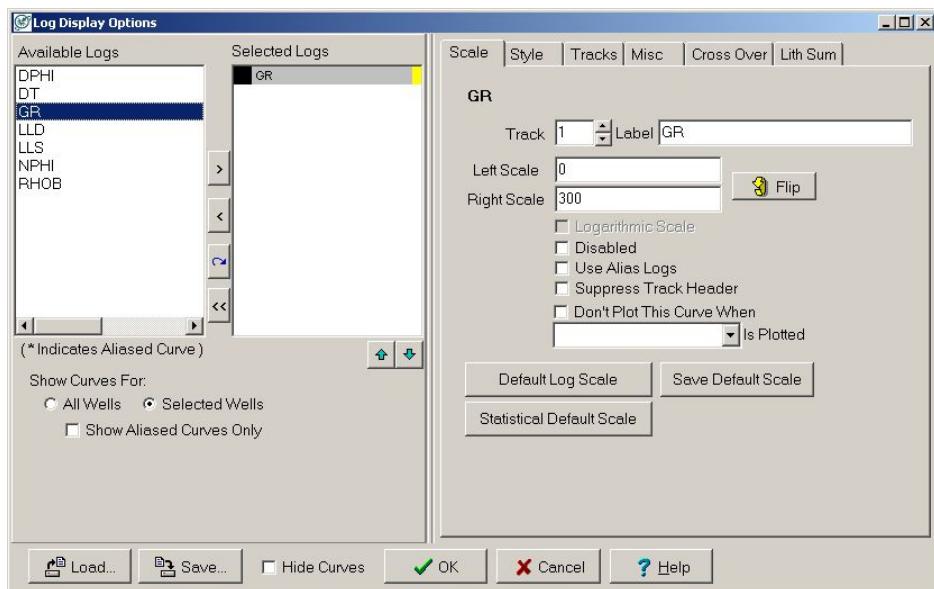


You can toggle between the structure and stratigraphic cross-sections using the   icons.

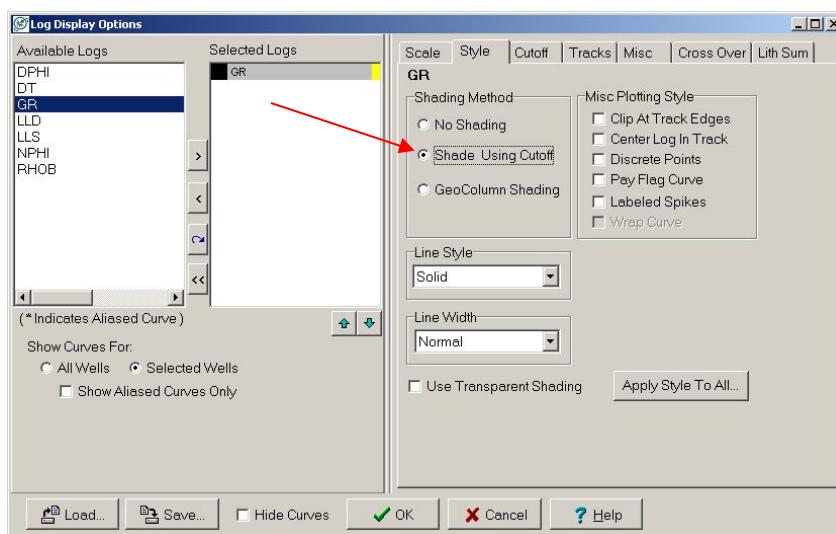
ADDING DIGITAL LOG CURVES

Choose the Logs>Scales and Display Options or the  icon. Click the “Selected Wells” option to reduce the curve list to only those that are available for this cross-section.

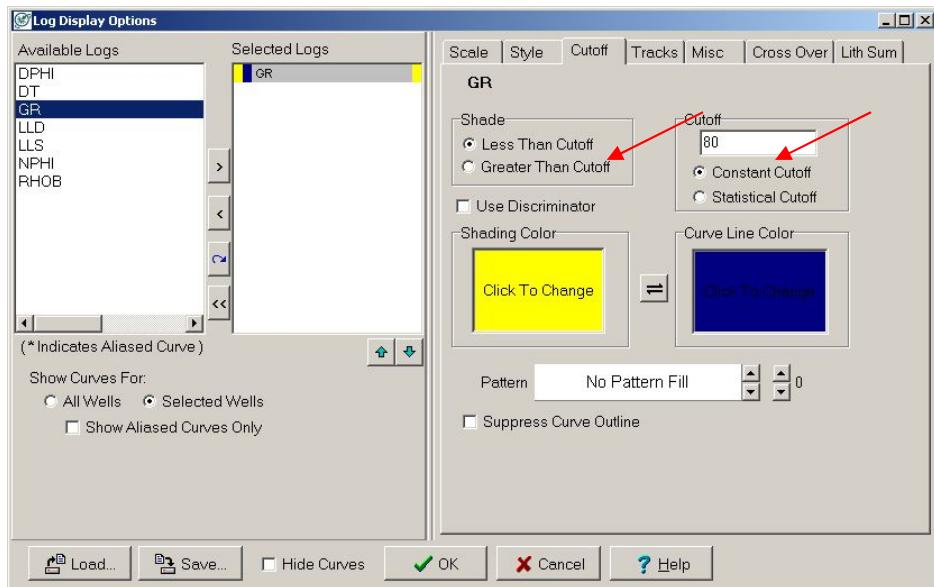
Add the GR curve to the Selected Logs by double-clicking the GR name in the leftmost list. Change the min-max scale to 0 to 300. The default scale was determined from the statistical analysis of the GR curves.



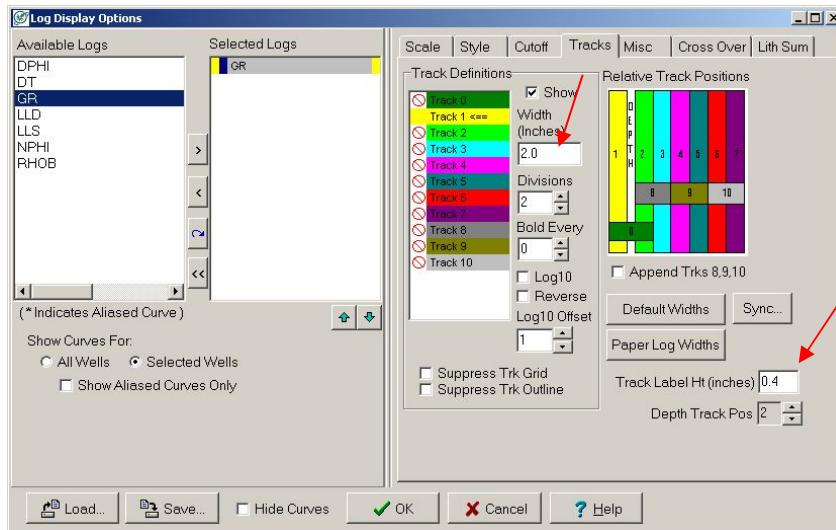
The GR curve will be in log track number 1. Select the Shade Using Cutoff style for the GR Curve.



We will use a cutoff value of 80 API units and shade in yellow. You may choose a different color for the GR Curve. The type of shading being shown uses a single "cutoff" value. It is common to have the GR curve shaded below a cutoff to indicate sands (shaded) and shales (unshaded). Set the cutoff to 80 and select "Shade Less Than Cutoff". Change the shade color to yellow by clicking the color cell.

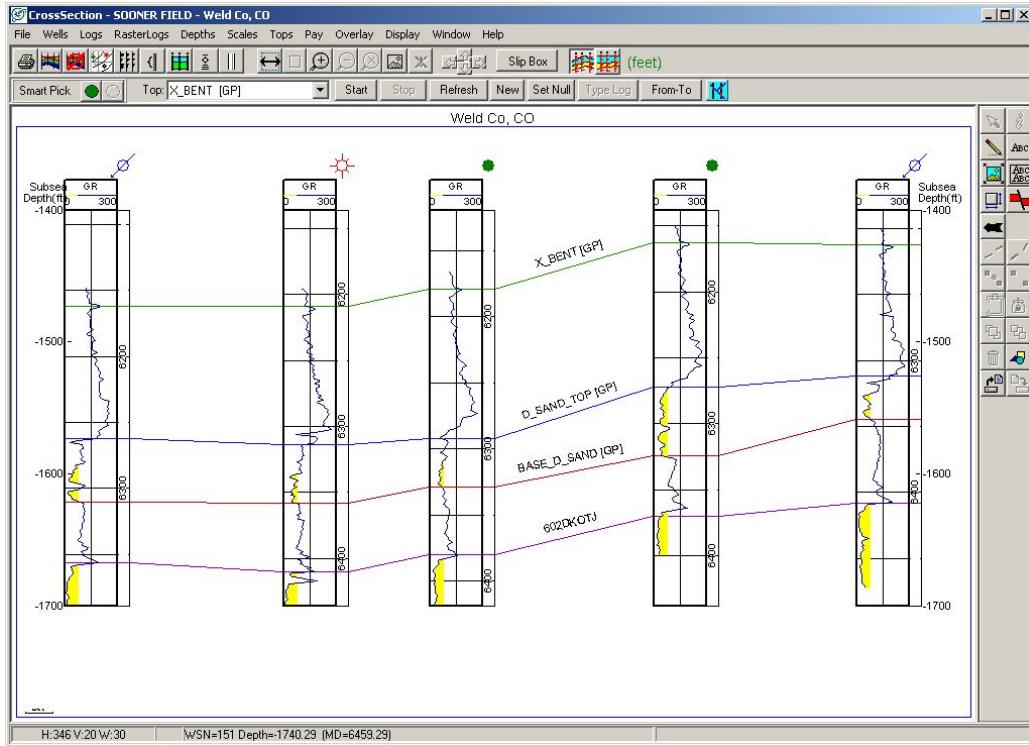


Next select the tracks option for the GR. You may wish to widen the GR track from 1 inch to 2inches, and select the Track label height to be 0.4 inches.



Track 1, as shown above, is selected to be shown. The remaining other tracks are currently hidden. There are 11 tracks that can be used in the display, and each one can be set separately for specific purposes of display.

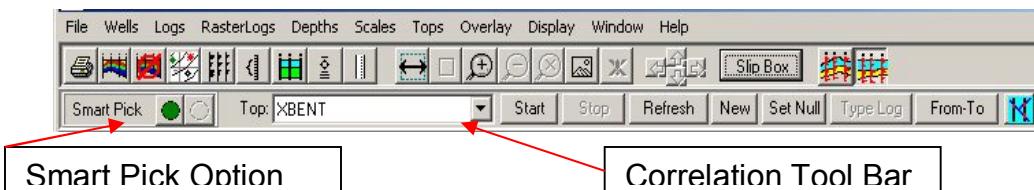
The tracks are the graph paper behind the curves. **Tracks have no scale, only the curves have scales. It is up to you to see that the track options, such as number of divisions or logarithmic match the curves that are plotted in them.



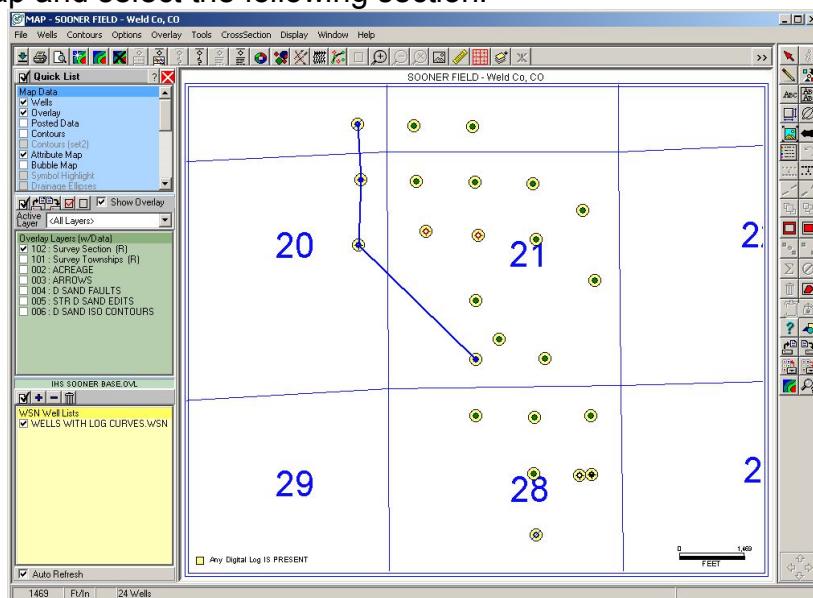
The curve shading in the cross-section above makes the differences in lithology easier to see.

PICKING AND CORRELATING TOPS

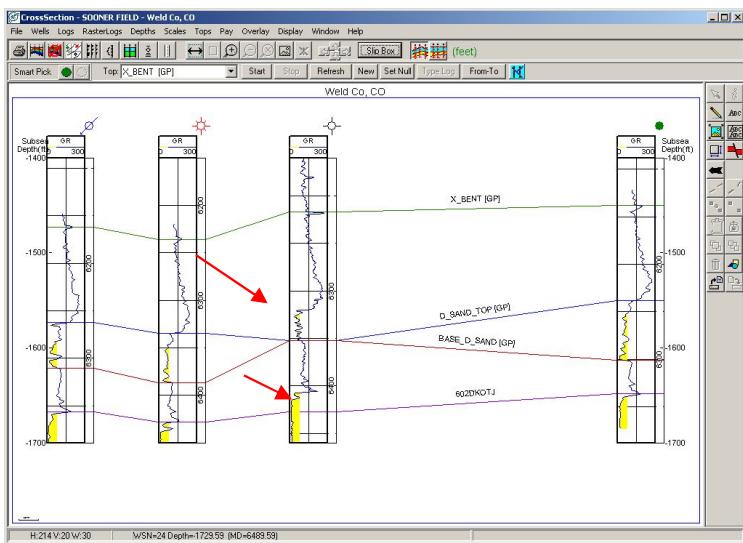
It is easy to interactively pick formation tops in the cross-section. First, activate the tops correlation tool bar found under Tops>Correlation Tool Bar. There are three ways to correlate formation tops in the cross section – the correlation tool bar with drop down menu, right mouse in depth track to activate top, and the “smart” pick which allows more detail



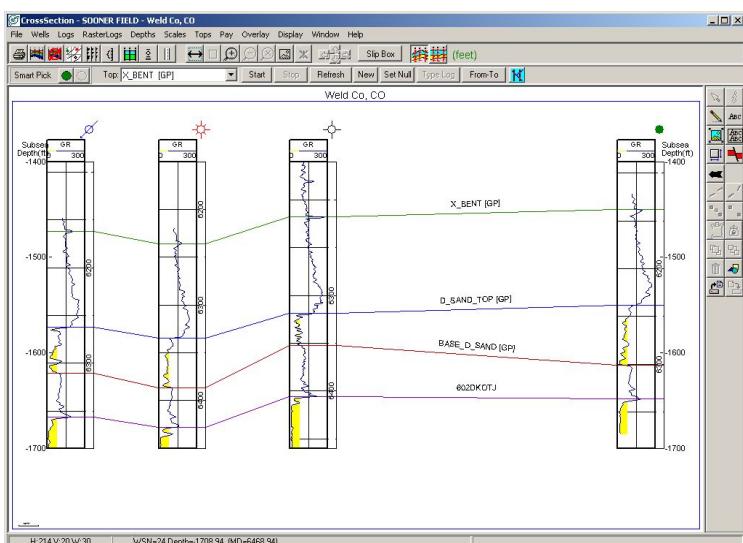
The tool bar shows a drop-down list containing our current top names. Return to the map and select the following section:



The selected section has several formation tops that will need adjusting.



Using the drop down tops menu, choose the Top of the D Sand and correct the correlations through the section.



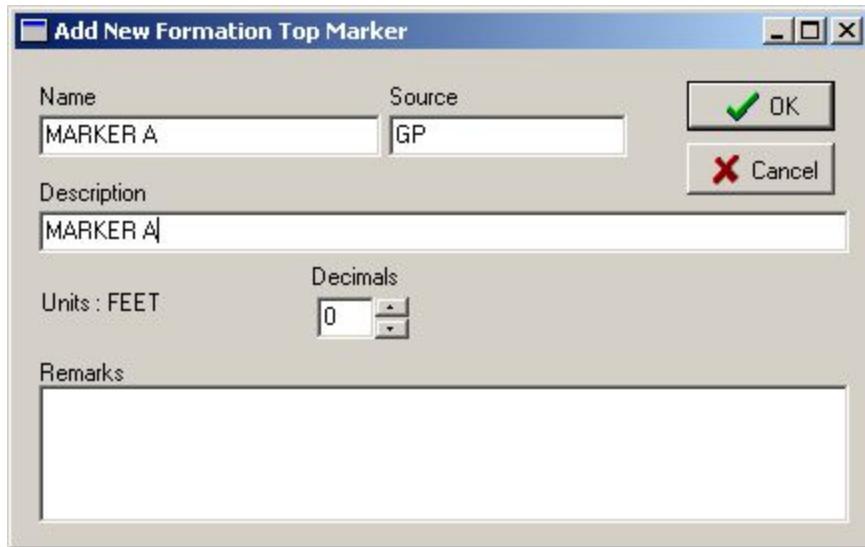
Now we will add a new formation top, Marker A, and bring the correlation through the selected wells.

ADDING NEW TOPS

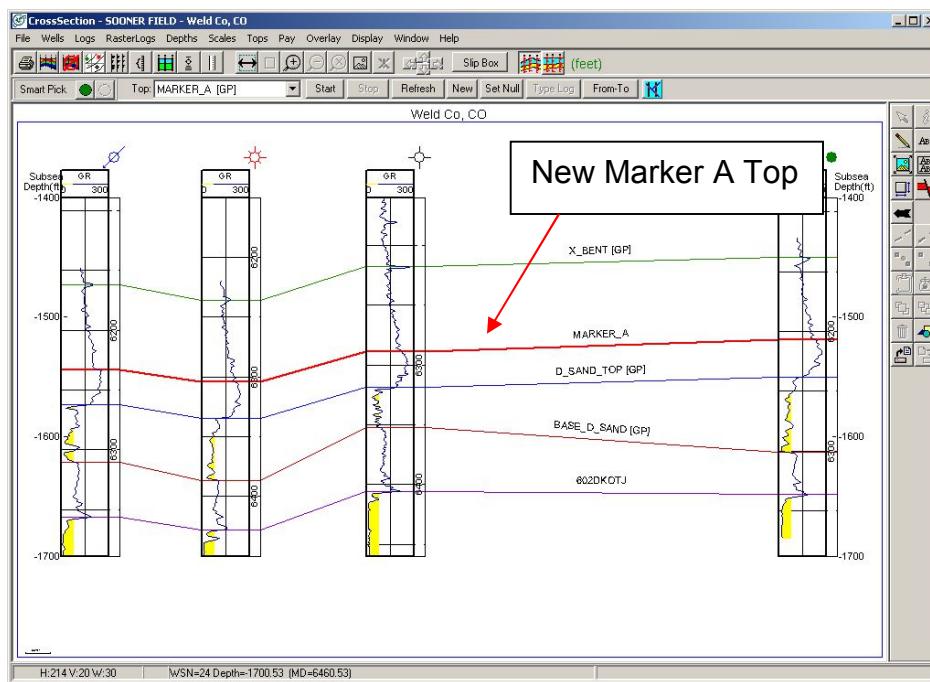
From the correlation tool bar, locate the button “NEW”.



The description screen allows the user to name, source, and describe the top being added to the database.



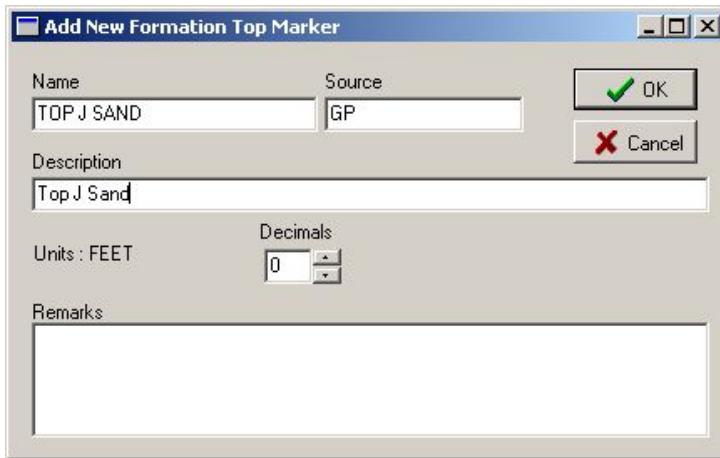
The new top, Marker A, will now be seen in the correlation list. Select the top and correlate through the section.



Return to the map and select a new section. You may wish to add an attribute for the Marker A top so that you can mark your progress with the correlations. Continue to correlate all tops through the selected wells.

Note the correlation line of the 602DKOTJ[3] or IHS top. There are miss-picked values in several wells. We can correct the IHS pick or pick our own version of this top. If you change the IHS pick, you run the risk of someone reloading the bad values back in during a future import update process. So, we will pick out our top of the J sand and “alias” it to the 603DKOTJ top.

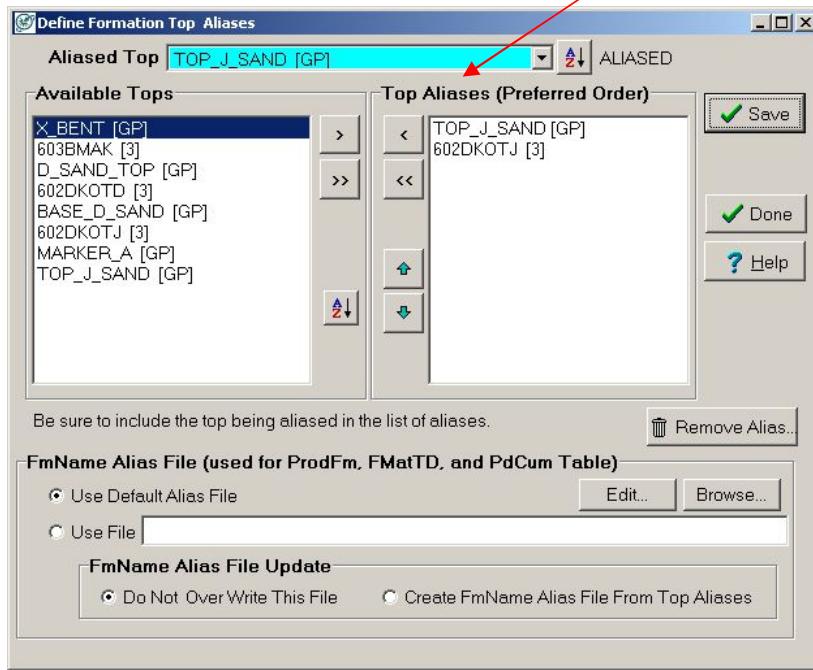
Create your new top by clicking the **New** button located on the tops correlation tool bar. Use the name Top J Sand as the top name. Please source the formation tops you add to the database with your initials.



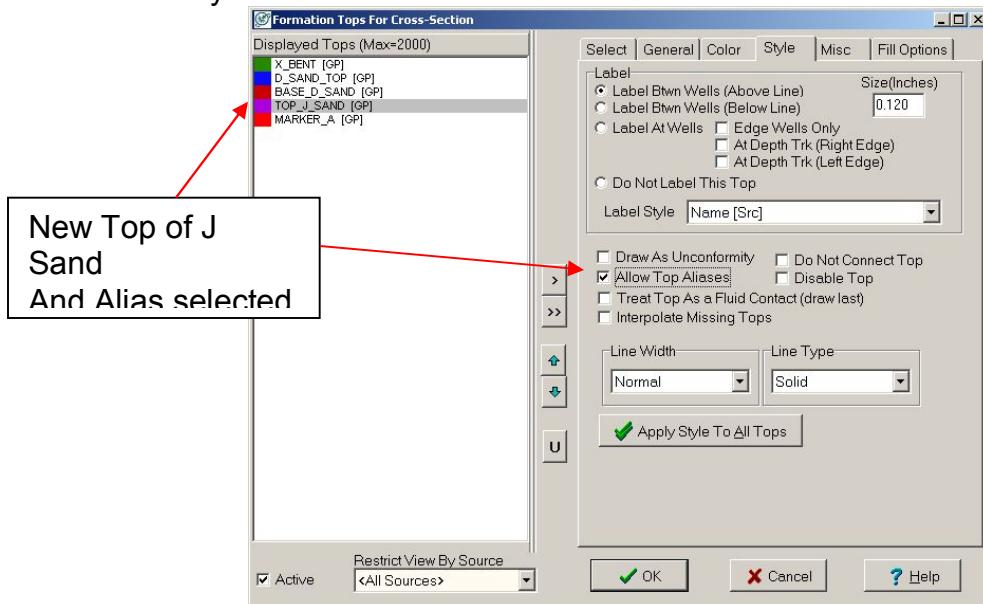
Return to the Main module and locate the Formation Tops lists to add the alias for the Top of the J sand.

WSN	Unique Well ID	Well Label
22	05123130650000	05123130650000
24	05123139370000	20 8N 58W DIVEF
26	05123145620000	05123145620000
35	05123106370000	05123106370000
62	05123131330000	05123131330000
95	05123136550000	05123136550000
121	05123187700000	05123187700000
130	05123135050000	05123135050000
136	05123135970000	05123135970000
139	05123148500000	05123148500000
140	05123153140000	05123153140000
144	05123159600000	05123159600000
149	05123130450000	05123130450000
150	05123130820000	28 8N 58W DIVEF
151	05123130900000	05123130900000
153	05123131380000	05123131380000
154	05123134520000	05123134520000
155	05123132490000	05123132490000
156	05123132590000	05123132590000
157	05123132760000	05123132760000
158	05123133300000	05123133300000
159	05123133310000	05123133310000
161	05123134290000	28 8N 58W SKAEI
162	05123130920000	05123130920000

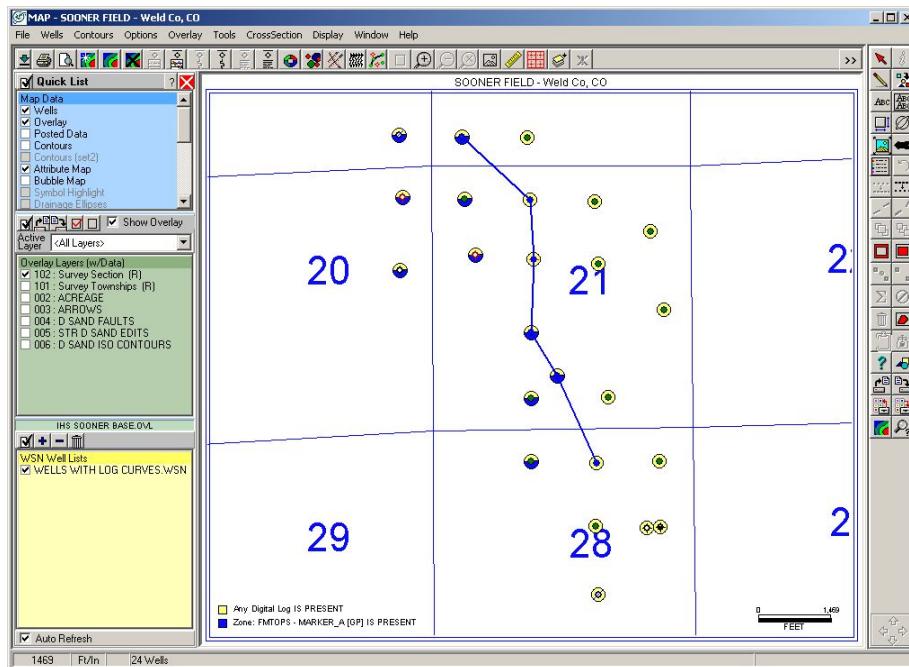
Select the alias function and alias the Top of J Sand to the 603DKOTJ top. Once aliased, you will see the color change for the top.



Return to the cross section and activate the Tops>Display option. Remove the 602DKOTJ[3] top from the Displayed Tops list by selecting it and clicking the “>” button. Check the order of display and style of the Top of J Sand. Be sure to include the “Use Alias” on the Style tab. We must activate the top as it will not be used automatically.

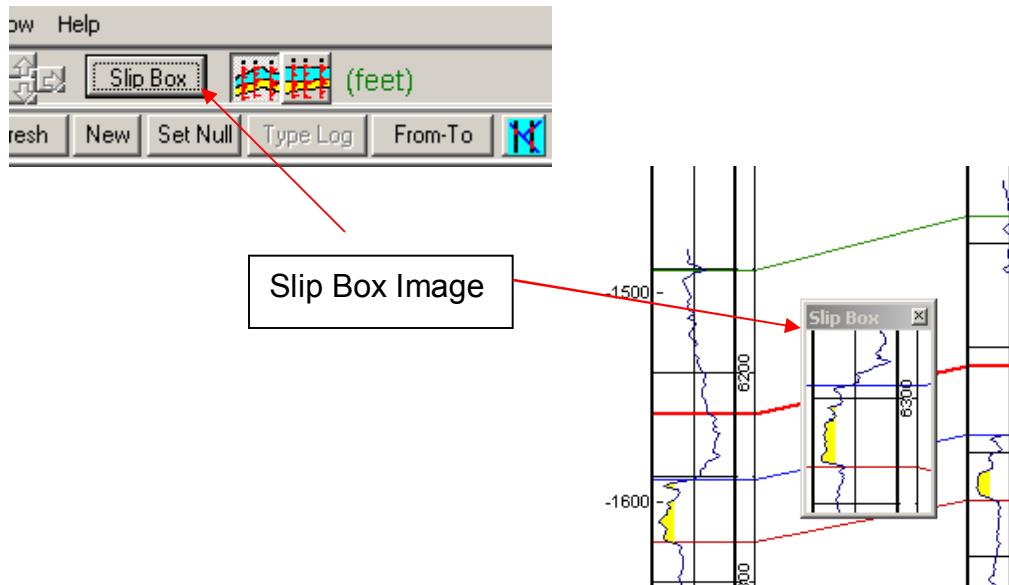


Now we can return to the map and select new cross sections for correlations. You may wish to place an attribute for the Marker A top to show your progress in your correlations. The map below shows a blue attribute for those wells that now have the Marker A top.

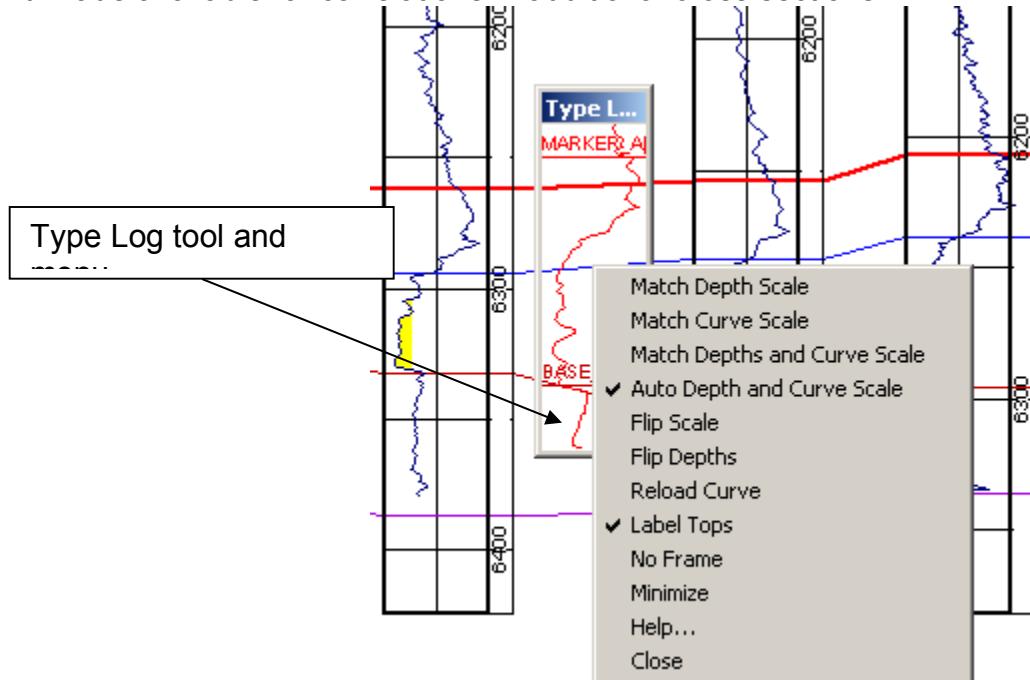


USING THE SLIP BOX AND TYPE LOG TOOLS

The Slip Box provides a temporary bmp image for correlations across the cross section. The Slip Box may be used with either Raster or Digital log data.



The Type Log Curve Tool provides a floating, re-sizeable window containing a selected portion of the log curve. The tool is primarily useful during the correlation process. A portion of a particular log curve can be move about the cross section for comparison with other wells. The Type Log may be minimized and made available for correlations in additional cross sections.

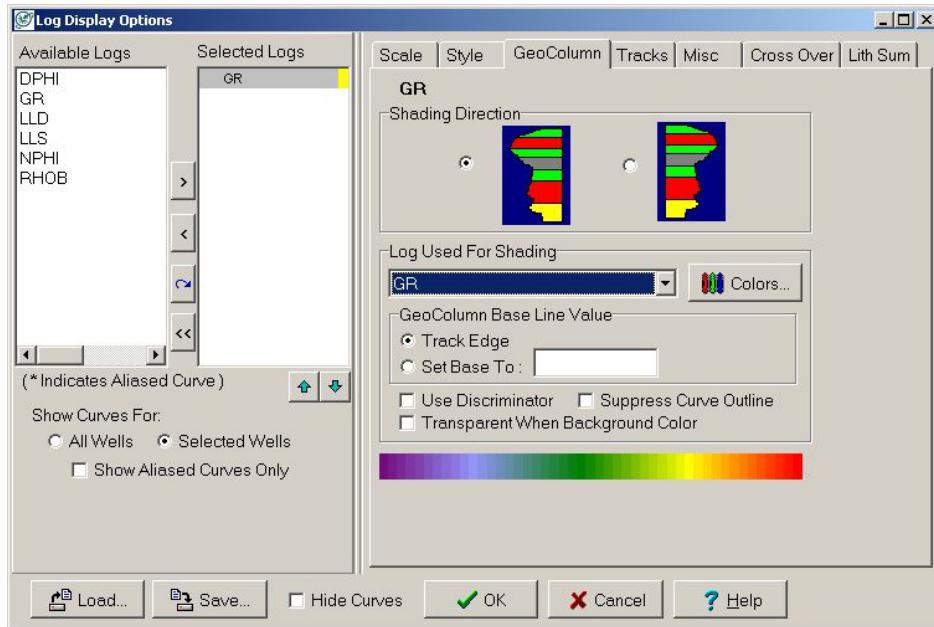


Use the "Logs>Select Log Curve" menu to choose the type log curve. Next, select the "Logs>Start Picking From-To Pairs" to define the depth range. You only need to choose 1 from-to pair, then click the right mouse button to end the picking mode. Finally, select the "Logs>Type Log Curve Tool>Set Type Curve" menu. The type curve will appear in a floating window. Resize the window as desired.

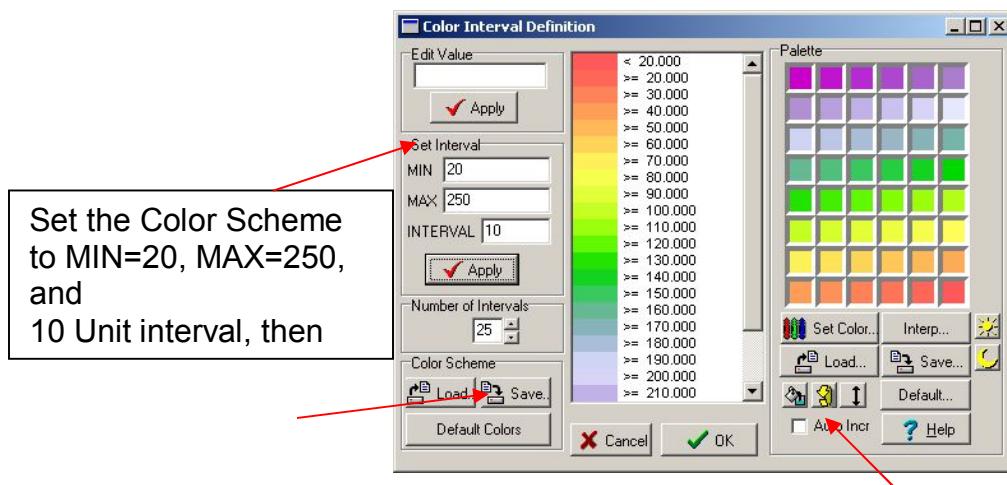
GEOCOLUMN SHADING

One of the options available in the cross section is the ability to interpretively color fill the section using LAS curve values and a color palette.

We can further differentiate lithologies by shading with more colors over more intervals. Select the Digital Log Display option under LOGS>SCALES AND DISPLAY OPTIONS. Select the STYLE tab, and change to “GeoColumn Shading”.

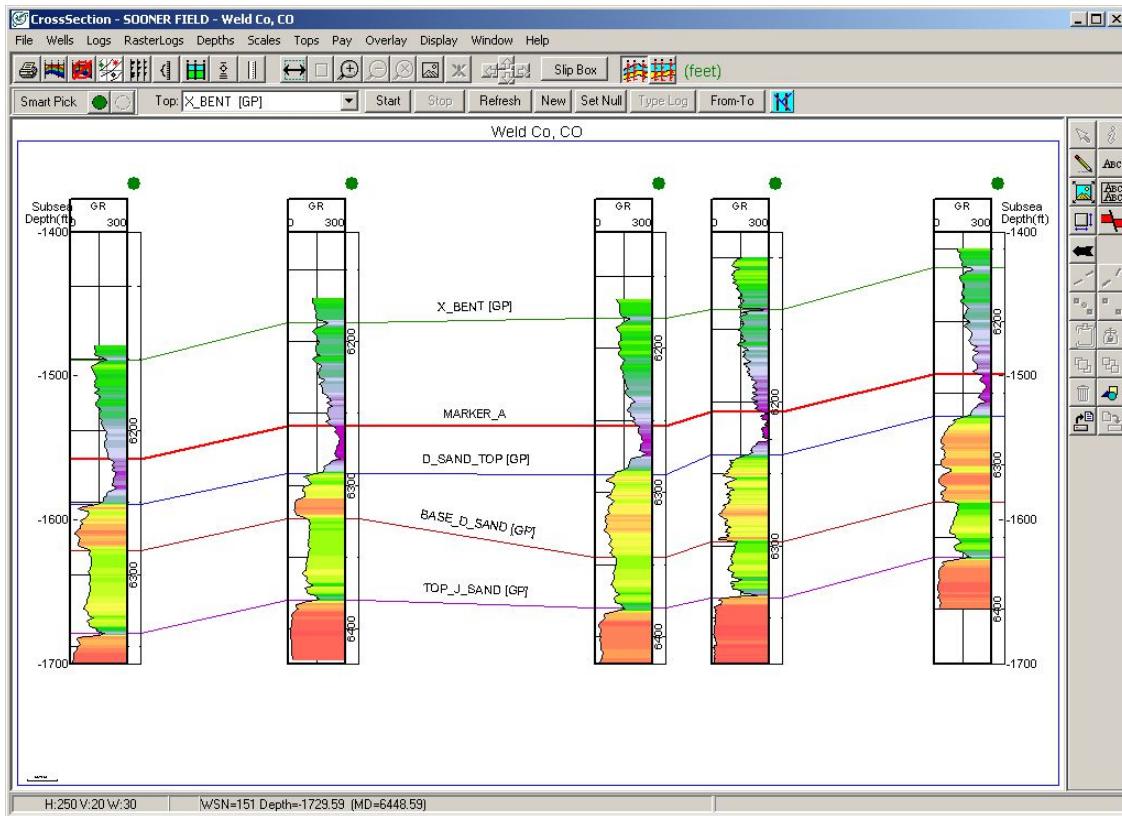


Select the GR Curve for display and the COLORS icon to assign the color scheme.



You will need to reverse the colors for the GR curve, and then SAVE the color scheme.

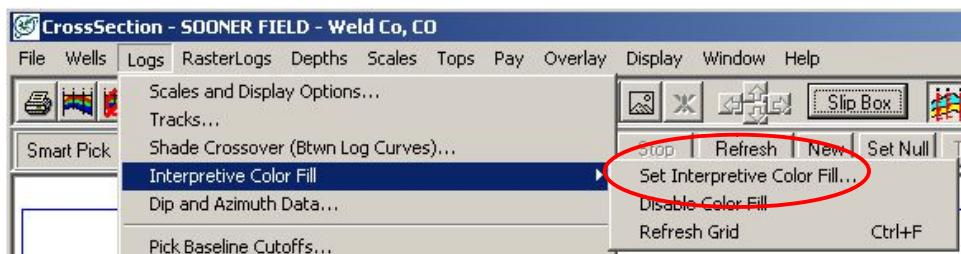
Your Cross section will now show color schemes which represent the GR values of the curves.



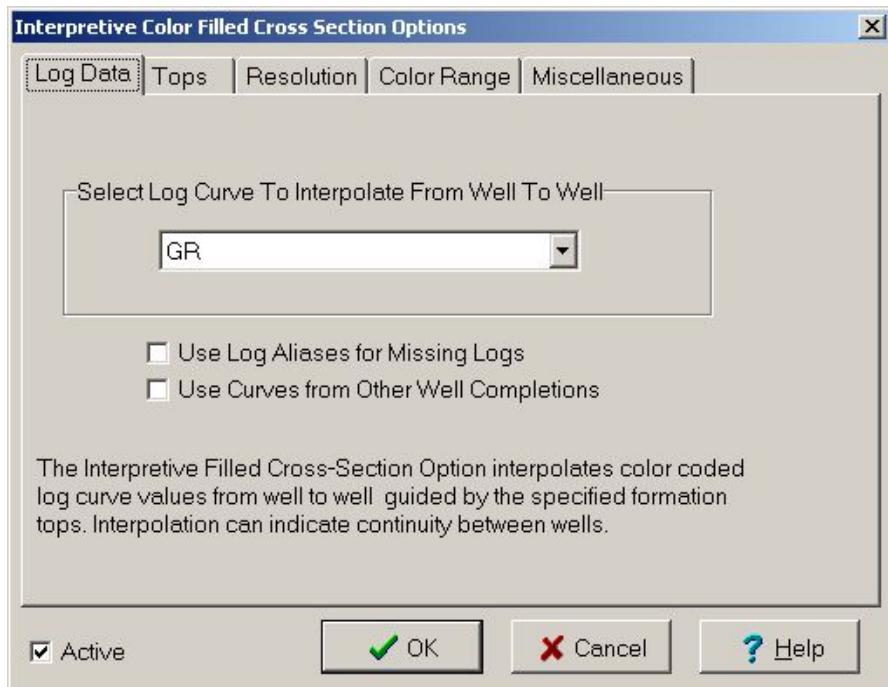
INTERPRETIVE COLOR FILL

PETRA can also interpolate any curve between wells to show the section as if we had continuous values across the section. We will again use the GR curve.

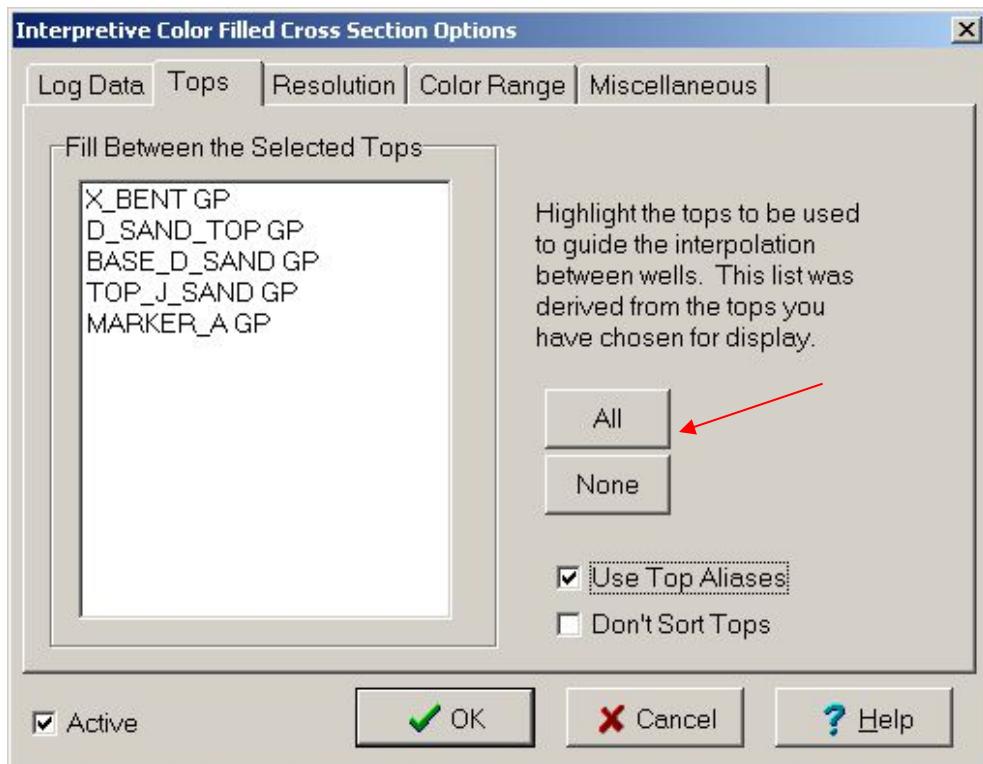
Click the interpretive fill icon or the “Logs>Interpretive Color Fill>Set Interpretive Color Fill” menu option.



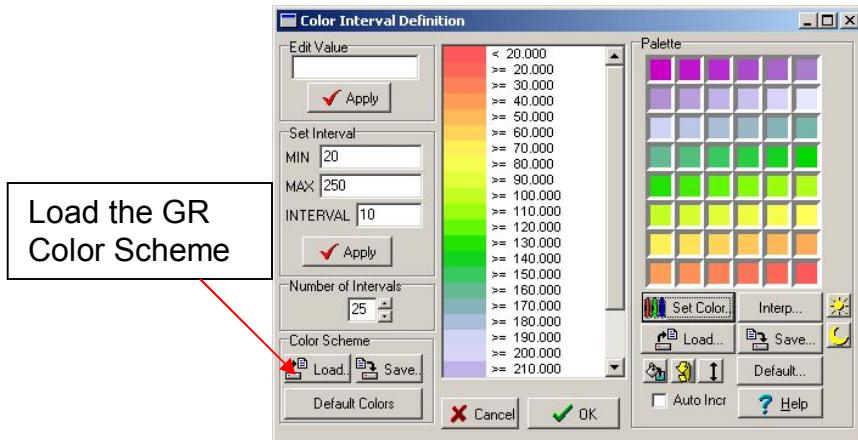
Choose the GR curve:



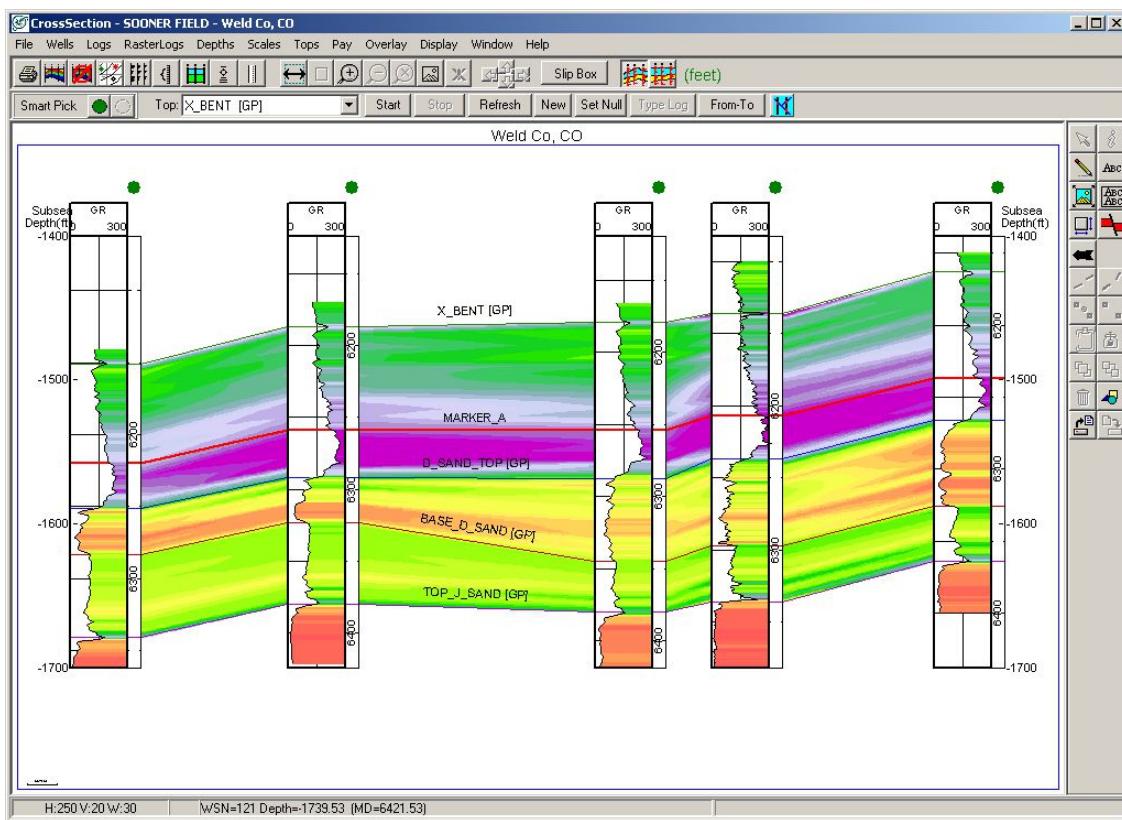
Select all of the following tops:



Select the “Set Colors” button on the “Color Range” Tab and load the color scheme you just saved for the GeoColumn shading.



Press the OK button and view the color filled cross section.

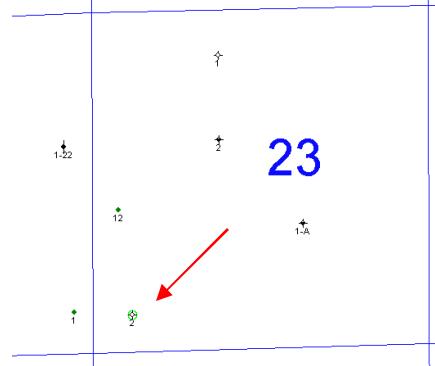


To turn off the interpretive color fill, click the icon.

RASTER LOGS

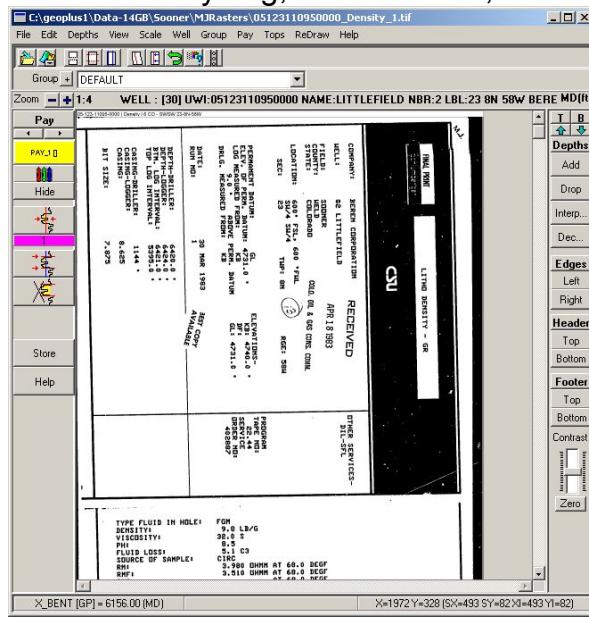
Raster log images, typically in the form of TIF files can be displayed on a cross-section just like digital log curves. Raster images must be depth registered or "calibrated" to know where they should be plotted relative to depth.

There are generally two methods of depth registering raster logs images in PETRA. You can batch import depth registered rasters from IHS, MJ Systems or A2D or you can register images inside PETRA. For this class, we will manually depth calibrate a single TIF image for well WSN 30, Beren Littlefield #2



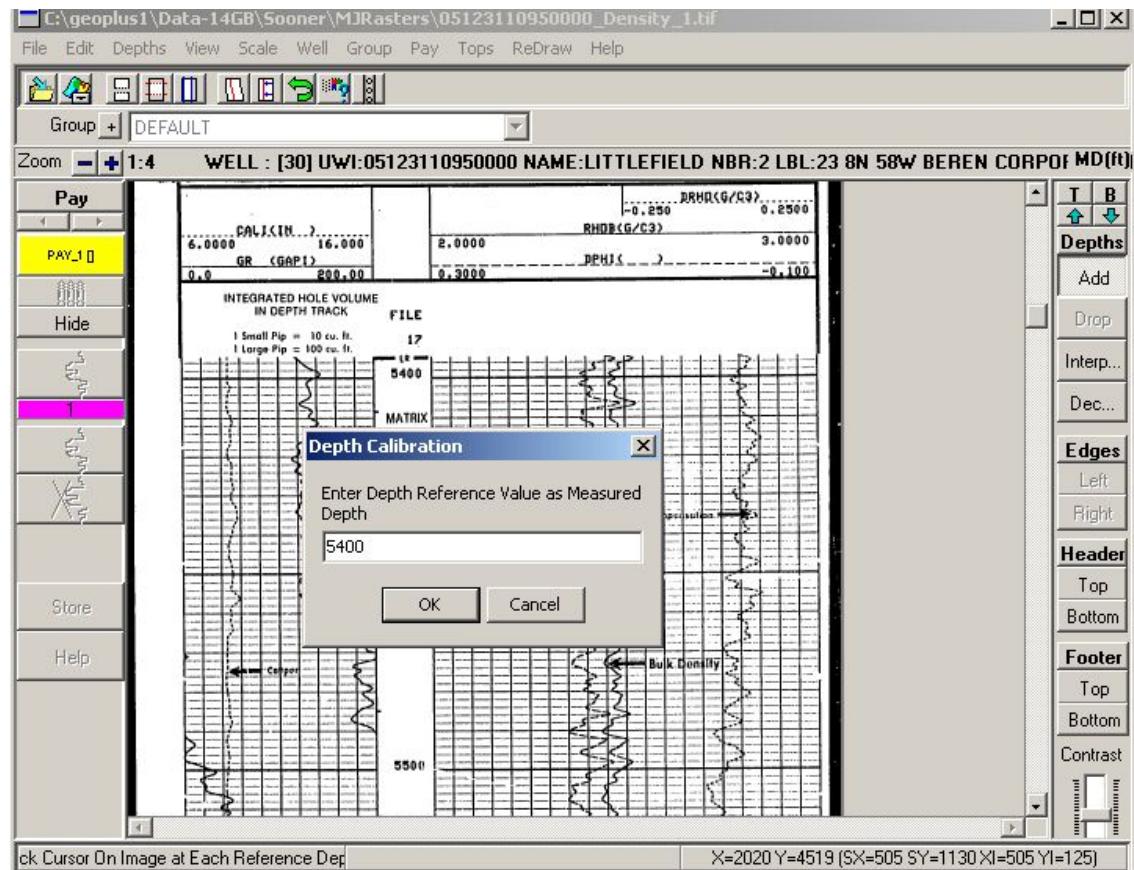
Return to the "Map" module and find well WSN 30 located in the SWSW of section 23. Double-click it to jump to the "Main" module. From the "Rasters" Tab, click the button to activate the calibration screen.

Select the "File>Open Image" menu and choose the file 5123110950000_Density_1.tif from the Sooner Data folder. There will be two TIF images, one the Density Log, and the other, the Induction log.



CALIBRATING DEPTHS

Click on the “Add” button located under the Depths tool bar located on the right side of the screen. Click the blue horizontal cursor on the image depth labeled 5400, then type in 5400.



Scroll the image to the bottom and click on the depth labeled 6400 and enter 6400. Now, as you scroll through the image you will see thin black lines every 100 feet. These are interpreted depths. If any of these black lines are “off depth”, then click at the appropriate depth and enter the depth value.

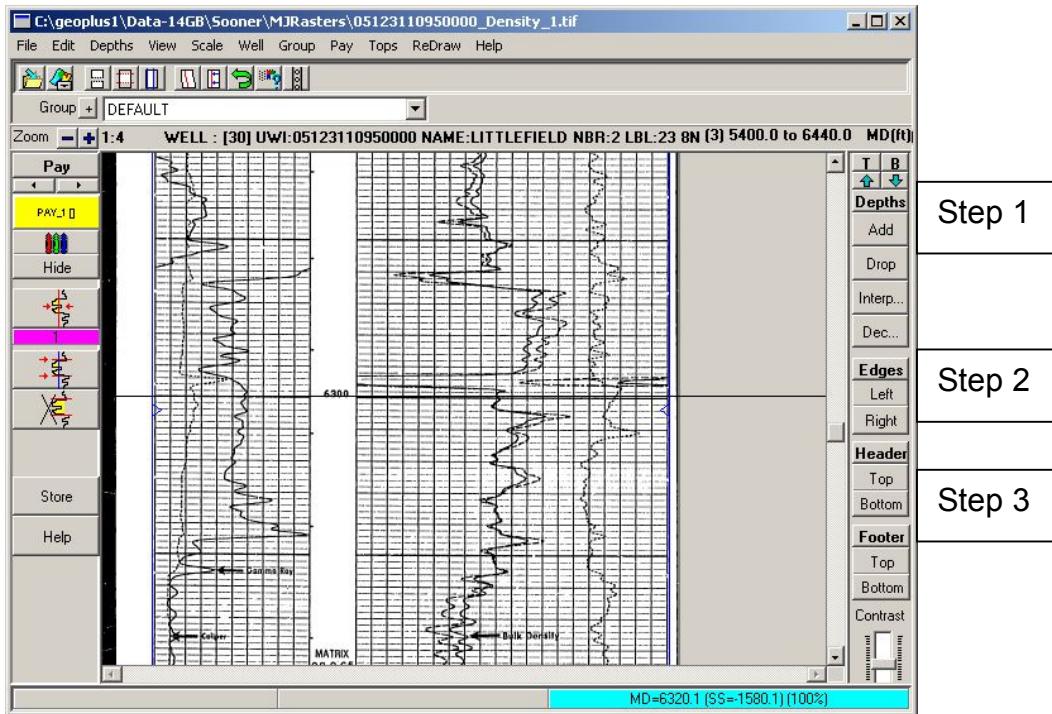
NOTE: – You only need as many intermediate depth points as necessary to correct for paper stretch.

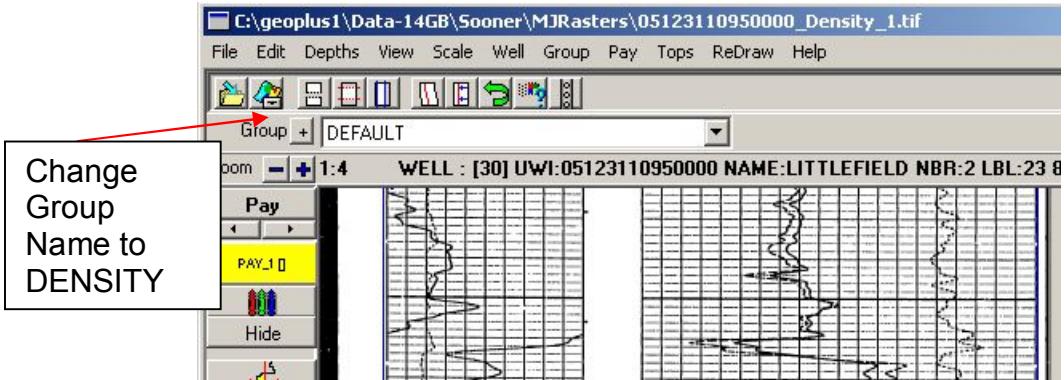
Scroll to the bottom of the image and click on the last grid line that should be 6440.

Click the “Add” button again to deactivate the depth-picking mode or just “Right Click” to deactivate the depth-picking mode.

REMOVING UNWANTED EDGES

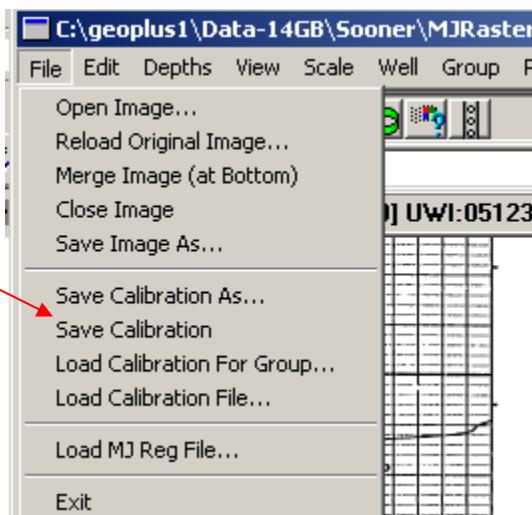
You can use the “Edge” buttons and click on the Left and Right edge of your image. Those portions of the image outside these boundaries are clipped during display.





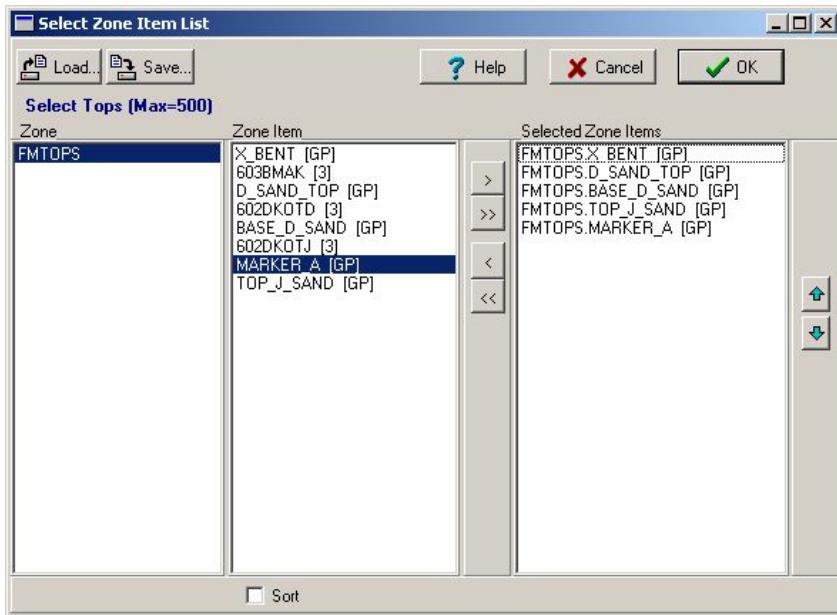
Now we will save the Calibration to the database and connect the Raster Tif with the LIC – Log Image Calibration file, as well as the Group name.

Select the “File>Save Calibration As...” menu and save your image calibration. The calibration file (*.LIC) will be stored in the Images folder of the project.

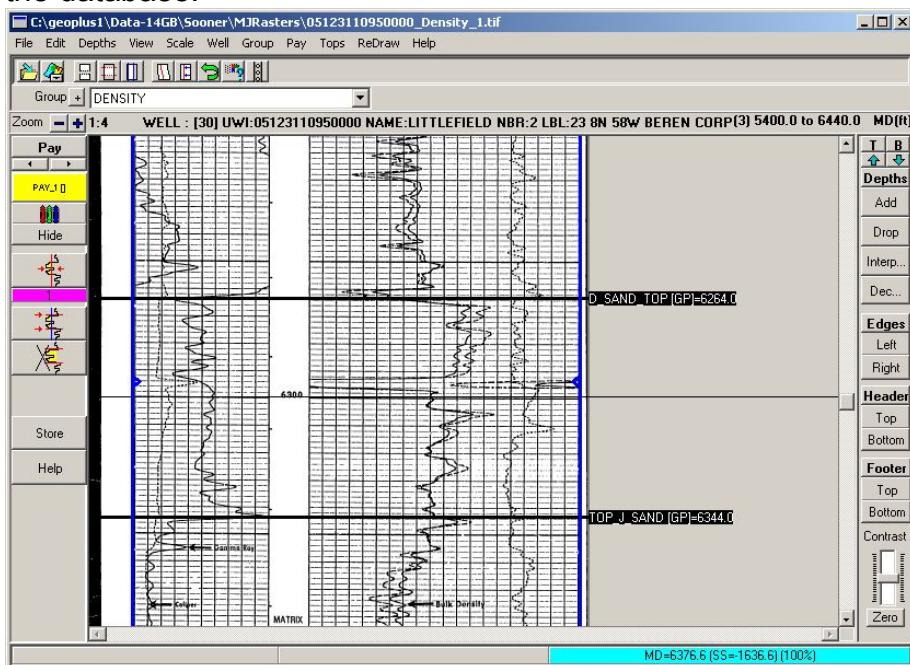


SETTING THE TOPS DISPLAY ON RASTER LOGS

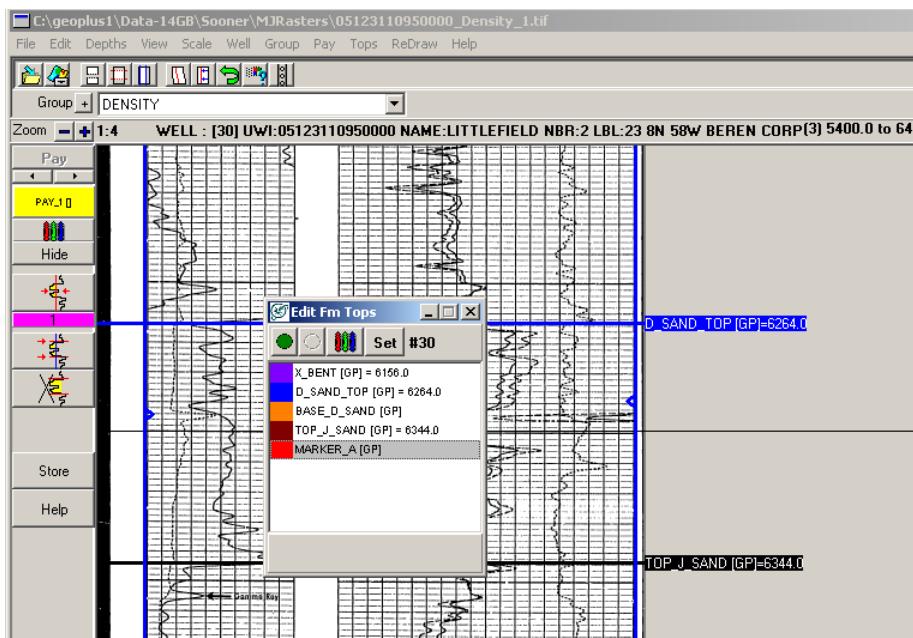
Now that we have depth calibrated the log, we can select the tops to be displayed or correlated through the Raster file. Find the “Tops>Select Tops” in the menu.



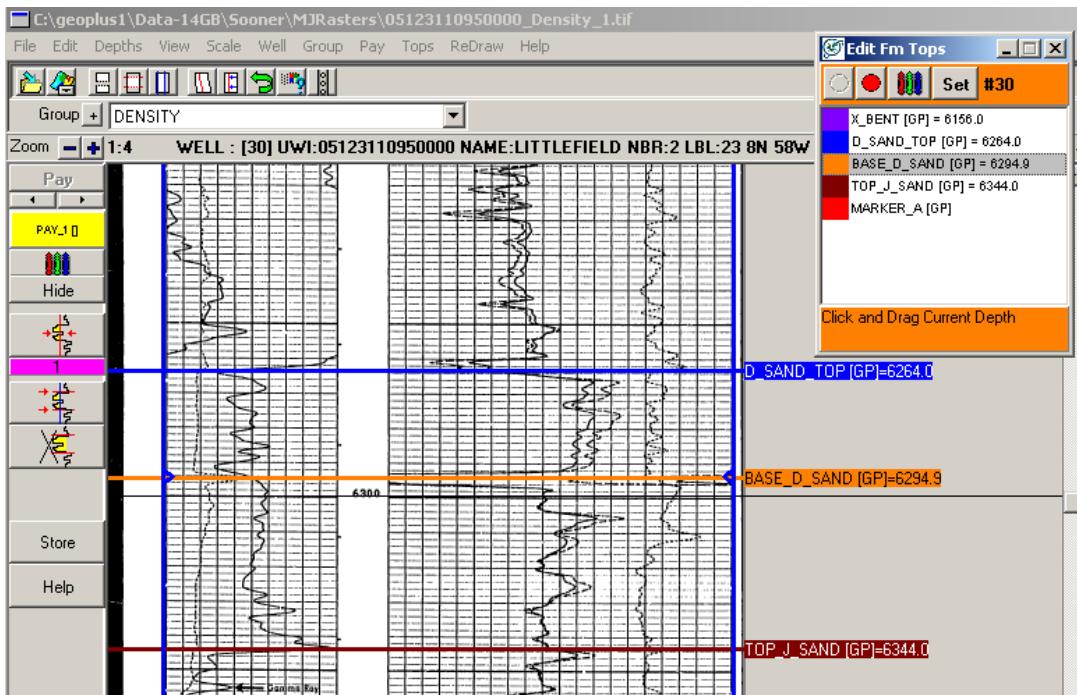
Once selected for view, the tops can be shown and edited by the user. Using a “CTRL T”, or “Tops>Edit Mode Active”, you will now see the tops displayed from the database.



Activate the Tops edit mode and change the color and correct the depth of the correlations.



There is no Base of D Sand present, so select the top and add to the log in an appropriate location.



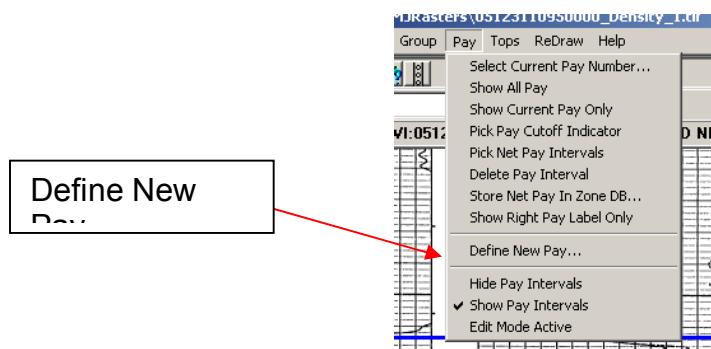
PICKING “PAY” ON A RASTER IMAGE

One very useful tool is to select “pay” on the raster log. If we had Digital logs we would calculate pay from the curves, but without the digits, we will need to select a cutoff line and a top and base of the “pay” zone for our pay maps and processes.

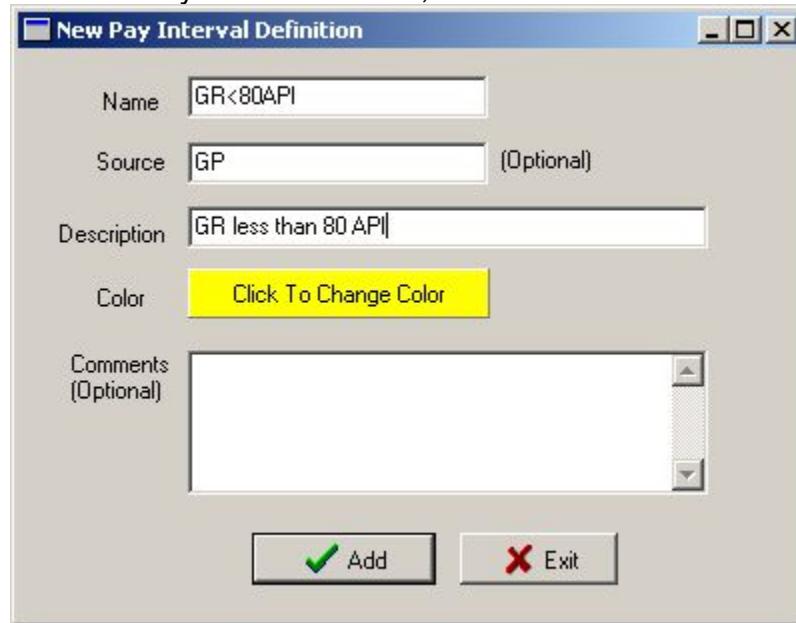
“Pay” can be used for net sand, porosity cutoffs, resistivity cutoffs, etc. The values chosen then can be added to the database to be used in mapping and calculations.

First we will define a new “Pay”. Ours will be GR less than 80 API units (Net Sand).

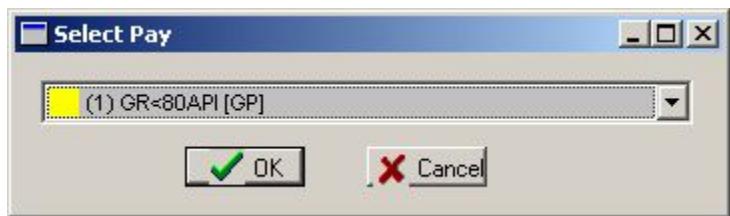
Select from the Pay Menu, the Define New Pay option.



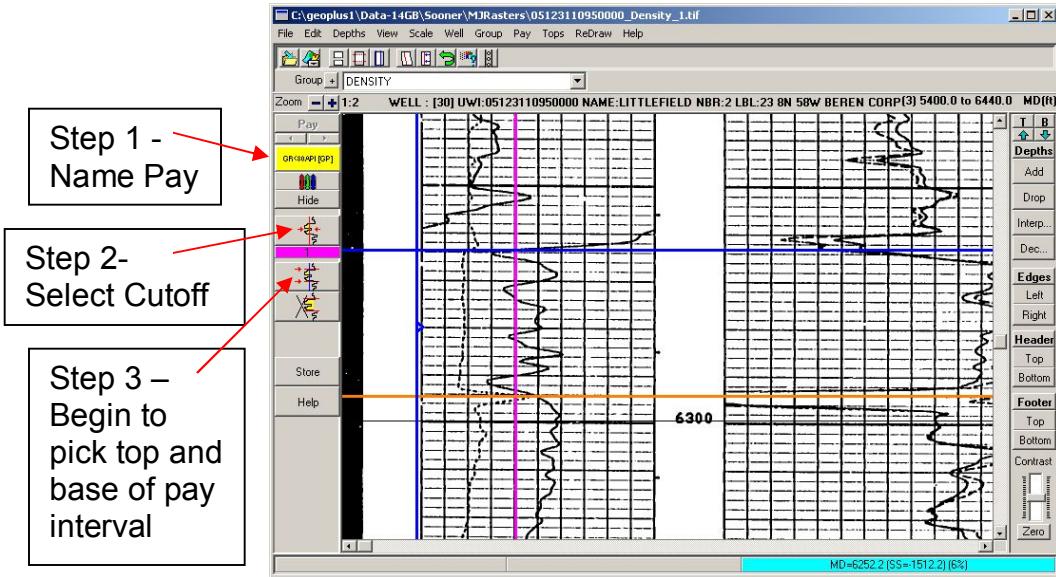
Name the new “Pay” as GR<80 API, and source the new item.



After adding the “Pay”, select from the menu “Select Current Pay Number”:

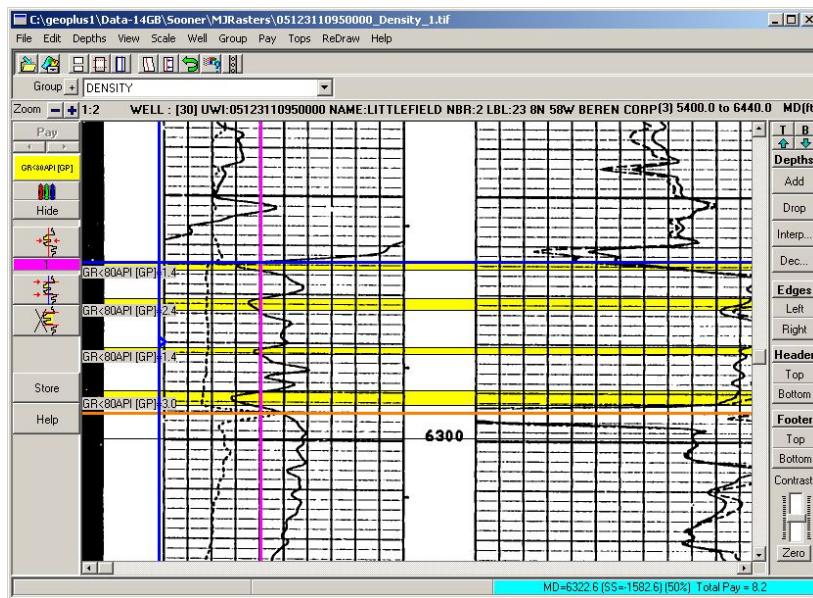


From the “Pay” tool bar, select the cutoff line option and place on the Raster at the 80 API unit value:



You may choose more than one “Pay Cutoff Indicator Line” .

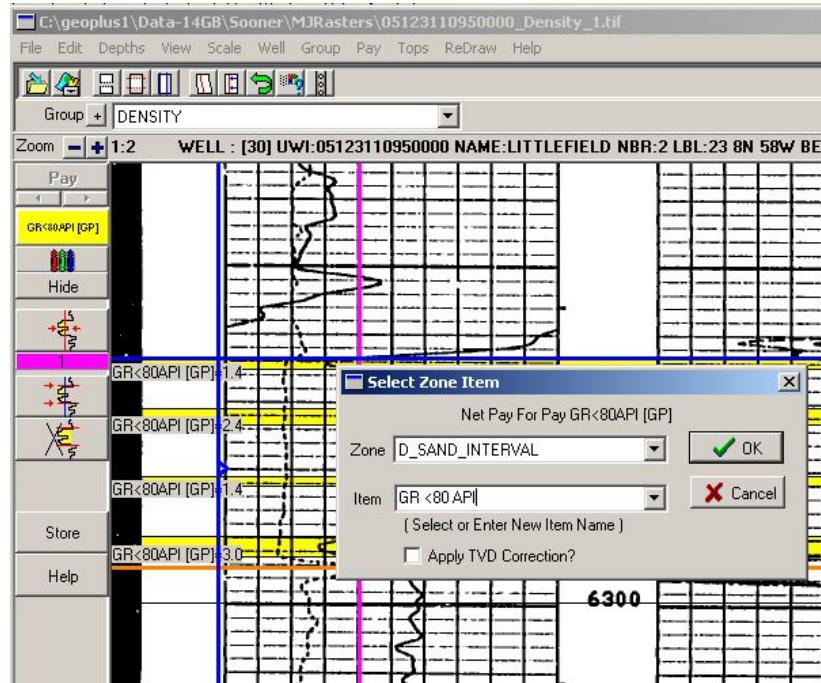
Now begin to select the top and base of the intervals matching your criteria.



The program calculates each interval, and the sum of the combined intervals for the individual pay name.

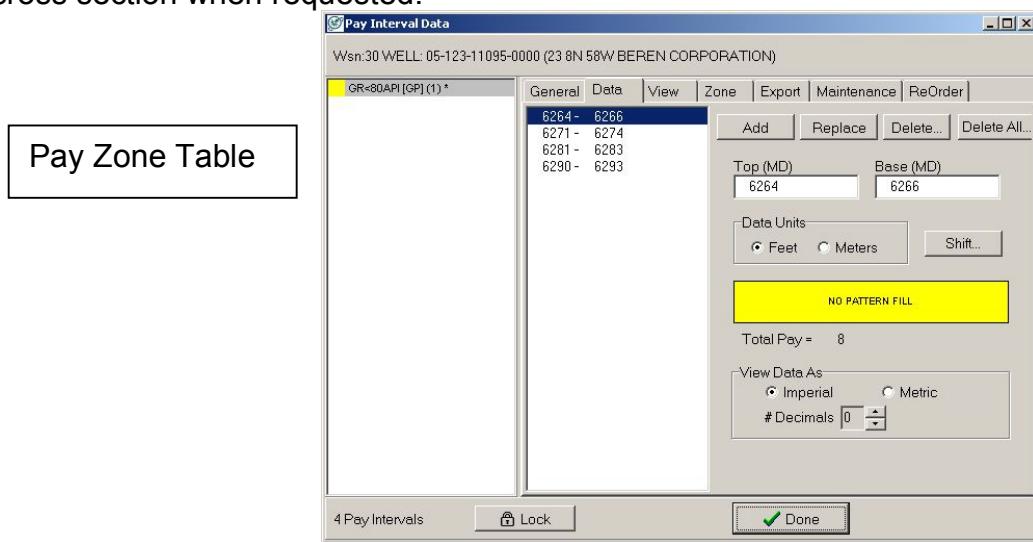
You may wish to place the values into the Pay Zone Tables, and store the cumulative values into a Zone.

Select the STORE option on the Pay Tool bar, and store the value into an appropriate zone.



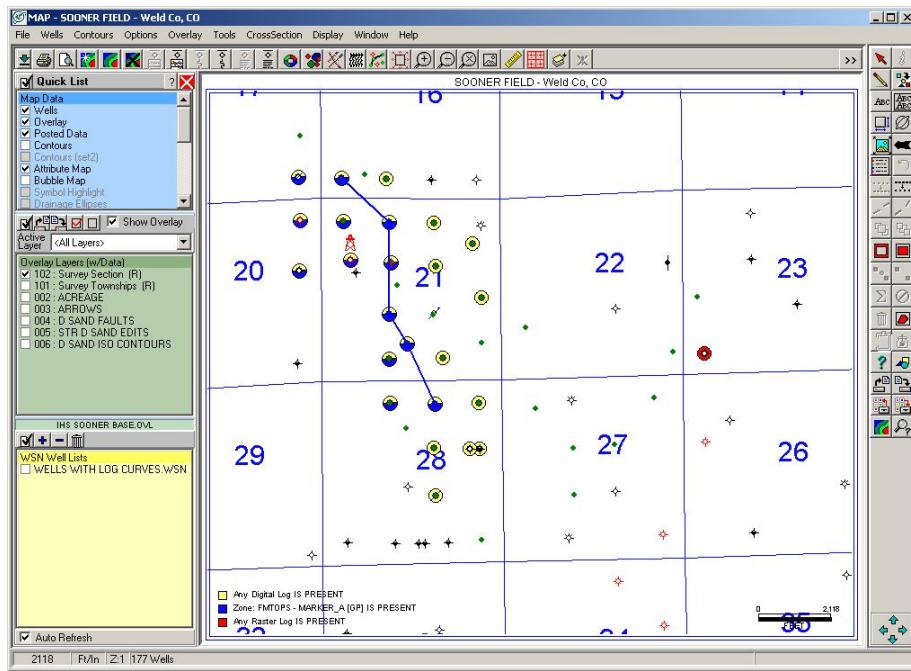
You will be asked to source the new item and select its description. Now resave your calibration. When you exit the Raster module you will also be asked to save any changes to the formation tops, and any changes or additions to the "Pay" counts.

The pay, as described is held in the Database table which can be accessed from the Raster Tab or the "Other" tab in the Main Module. These pay will appear in the cross section when requested.

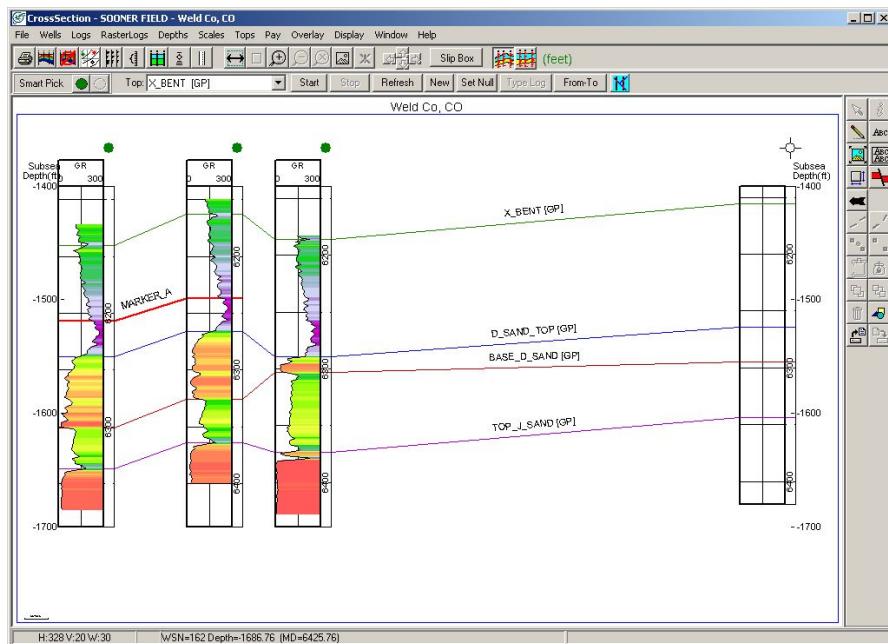


DISPLAY OF RASTER LOGS ON CROSS SECTION

From the map, select an attribute showing the Digital logs, Raster logs, and Marker A.



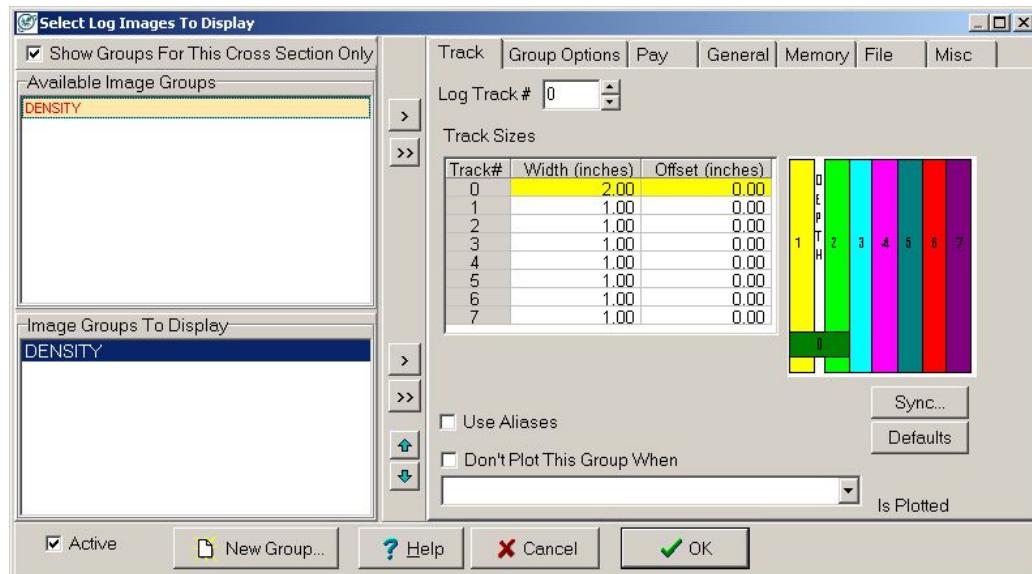
Create a new cross section using the Digital and Raster log files.



Display the section as a structural cross-section. The Raster log tops appear because we have saved them into the database.

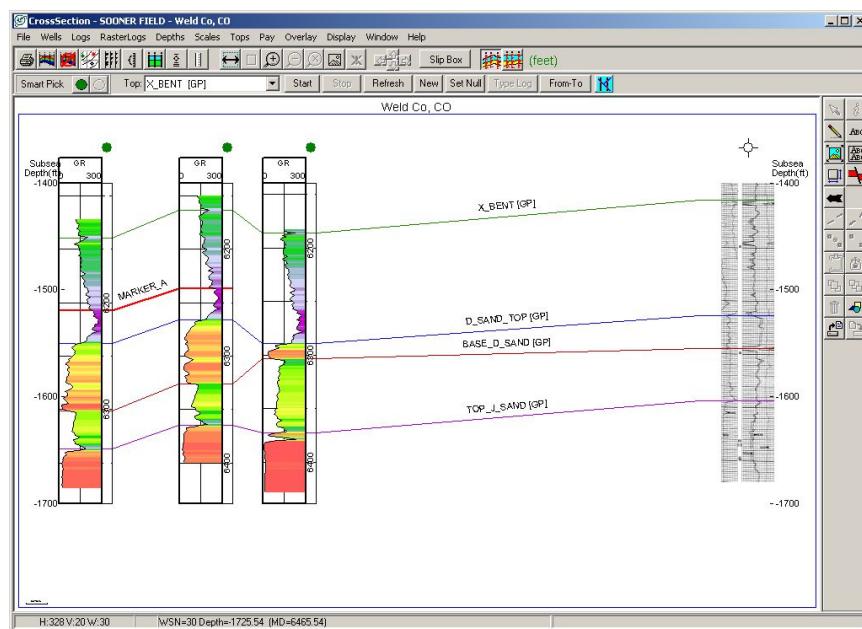
The raster log will not show until we select the “RasterLog>Raster Log Display Options” menu.

Select the “Show Groups for this Section Only” and select the Density Group to be shown in the section.



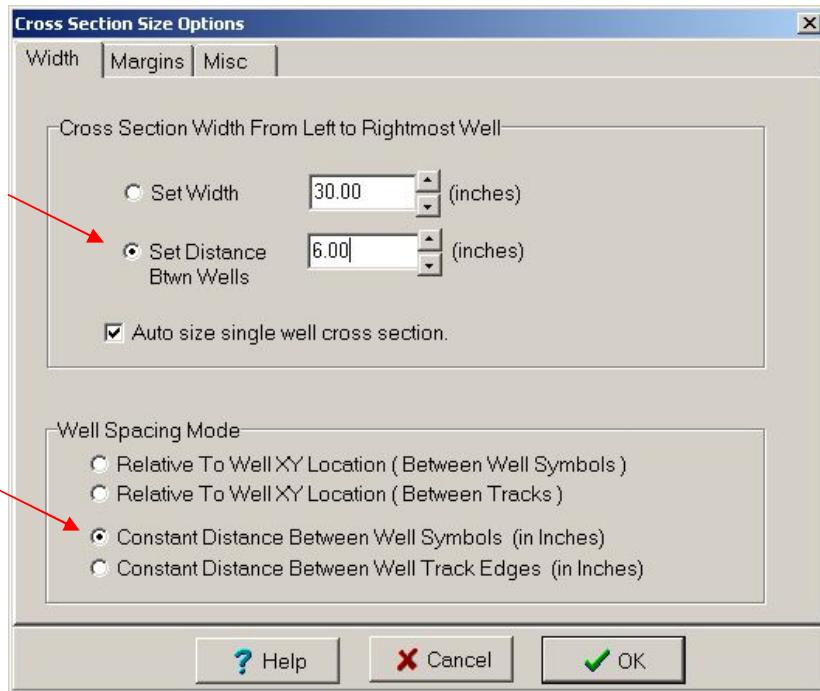
Place the Density in Track “0”, and set the track width to 2 inches.

Click “OK” to display the following cross-section.

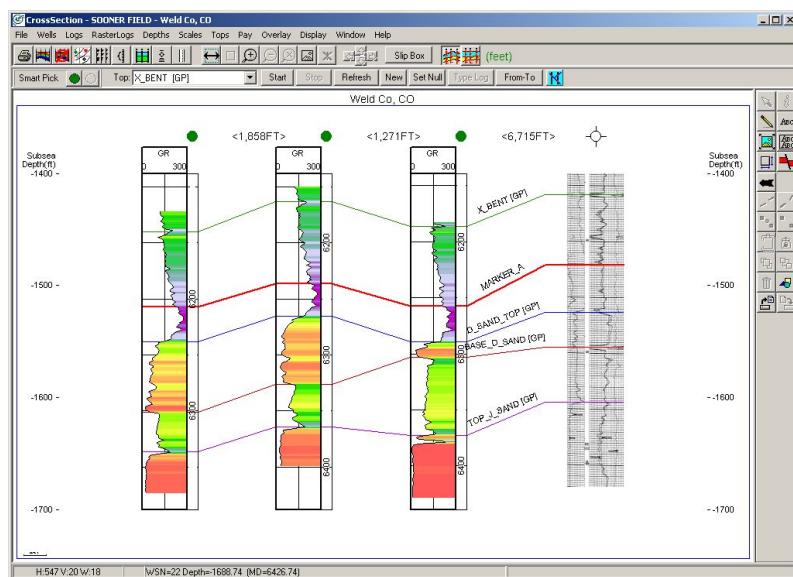


Pick any additional formation tops in the raster well using the same technique as with digital logs.

You may wish to use the Scaling of “Constant distance between wells for your correlation process. Select the Scales>Widths and Margins menu, the Well spacing mode, and distance between wells.



The following cross section will appear:



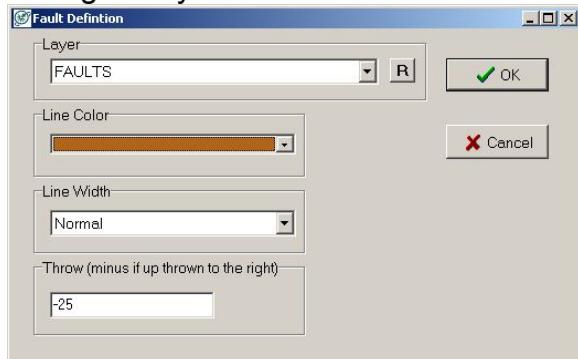
Distances between wells can be shown by selecting Wells>Symbol Location and Style>Options>Label Distance Between Wells.

ADDING FAULTS TO THE CROSS SECTION

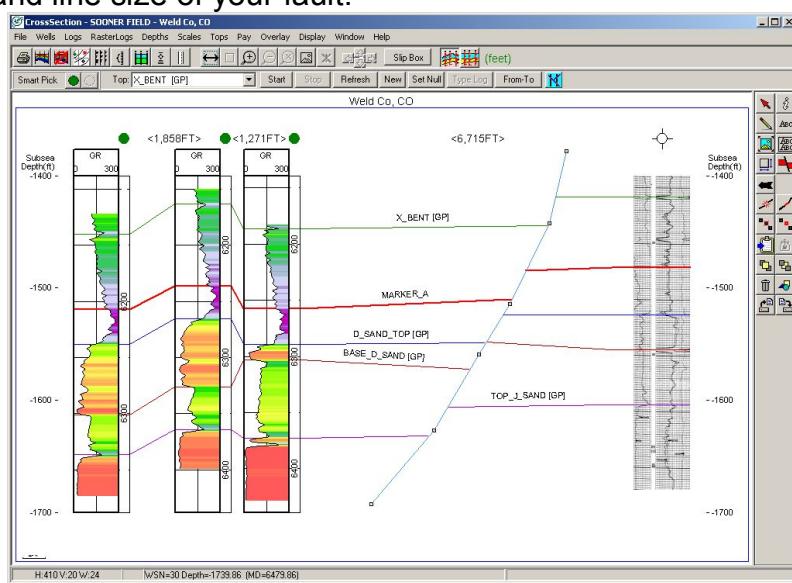
Faults can be added graphically through the overlay options, added to the fault database table, or added to the cross section as a gridded profile, using a gridded fault plane.

Return to Scales>Widths and Margins Option and select the XY relative positioning of the wells. Set the Width of display at 24 inches. To display the “Overlay” tool bar, click on the “Overlay>>Show Tool Bar”. The tool bar will be displayed on the right hand side of the cross section as shown in the cross section below.

We will use the overlay tool first. Select the “Add Fault” icon  on the overlay tool bar. Draw the fault between the wells from top to bottom. Add the control nodes similar to the ones displayed below. Use a throw of 25 to duplicate the fault that is shown below. You will be asked to add a (-) minus sign if the fault is upthrown to your right as you view the screen.

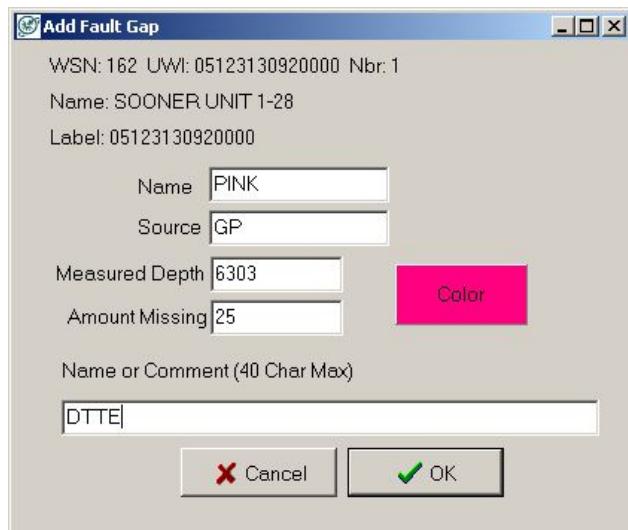


Rename the overlay layer on the Cross section overlay (*.XSO), and choose a color and line size of your fault.

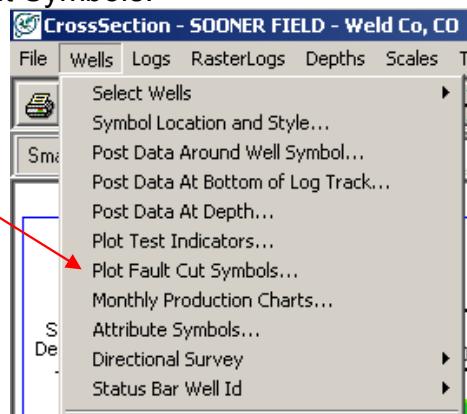


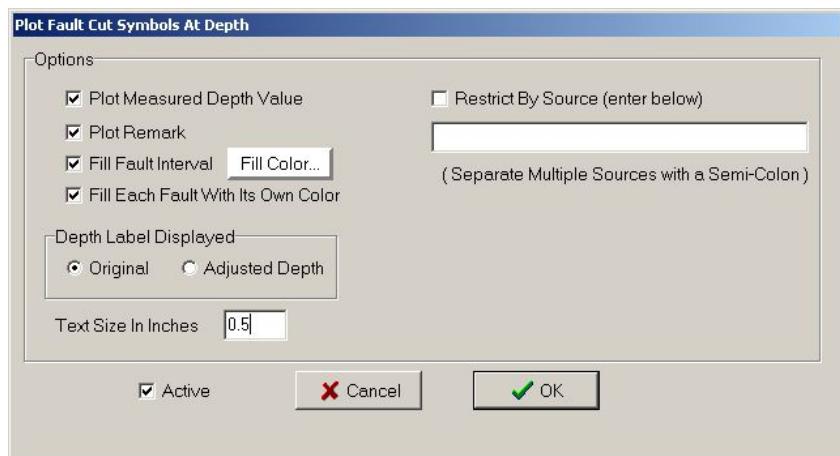
The fault selection above is a graphical display, and is not yet entered into the database.

The second way to select and show a fault is from the fault icon, . This icon adds the fault cut to the well and into the database.

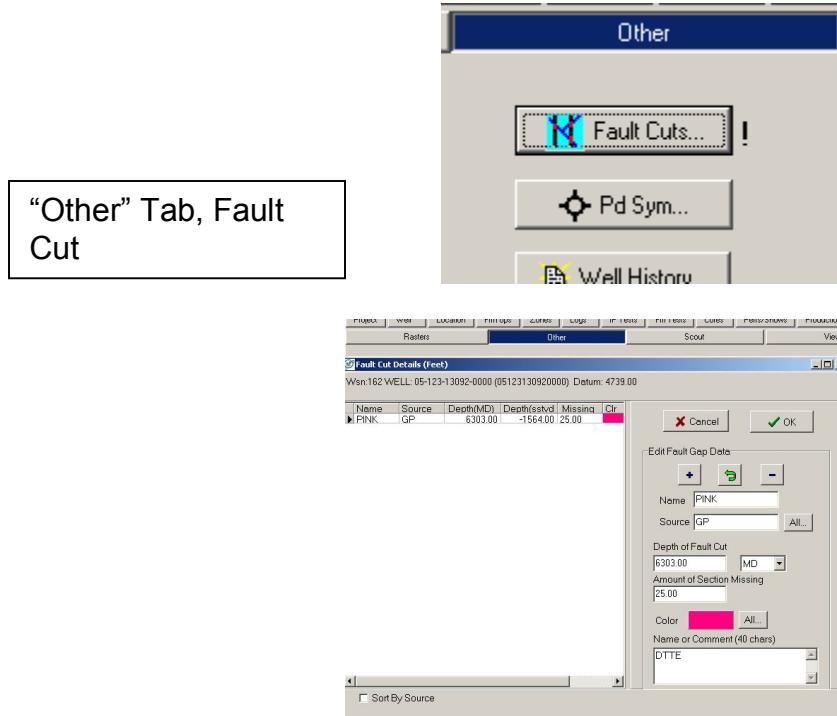


Once added, the fault will display on the cross section after selecting the Wells>Plot Fault Cut Symbols.

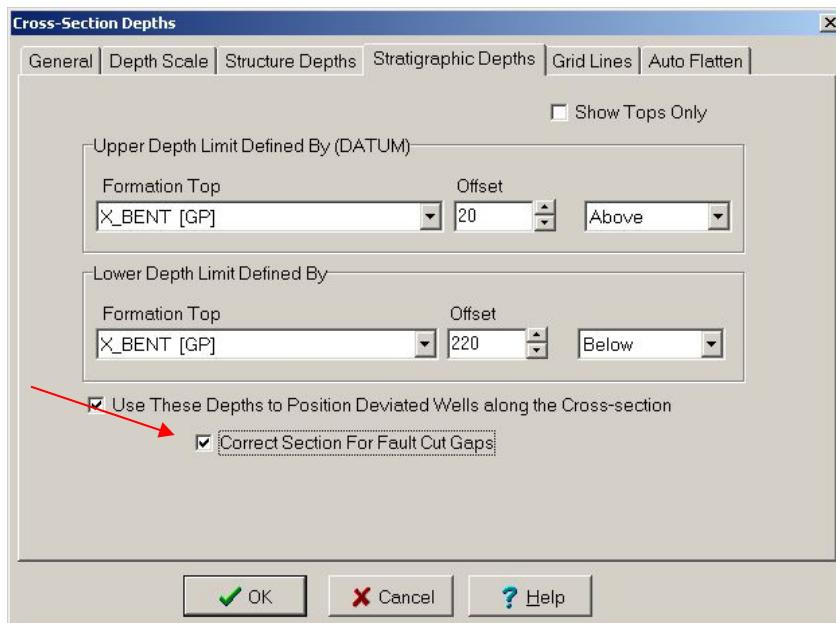




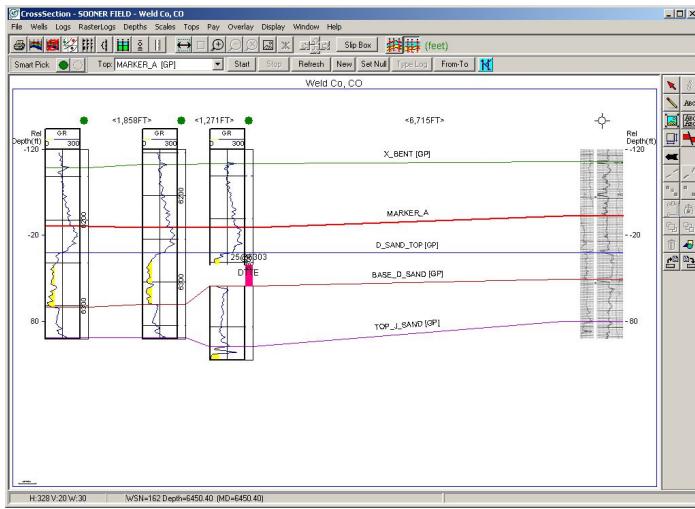
You may also view the fault in the well database in the main module. The Fault tables are stored under the “Other” tab.



Petra allows the restoration of the missing section through the Stratigraphic datum display. Select the Depth>Depth Scale>Stratigraphic Depths, and choose the toggle for Correct Section for Fault Cut Gaps.



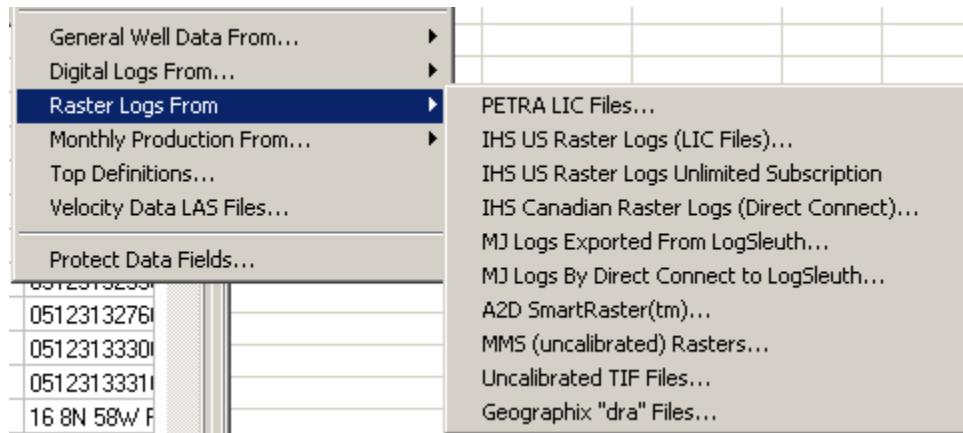
Display the cross section as a flattened section on the Top of the D Sand.



Notice the color fill and labeling of the fault.

RASTER LOG LOADING OPTIONS

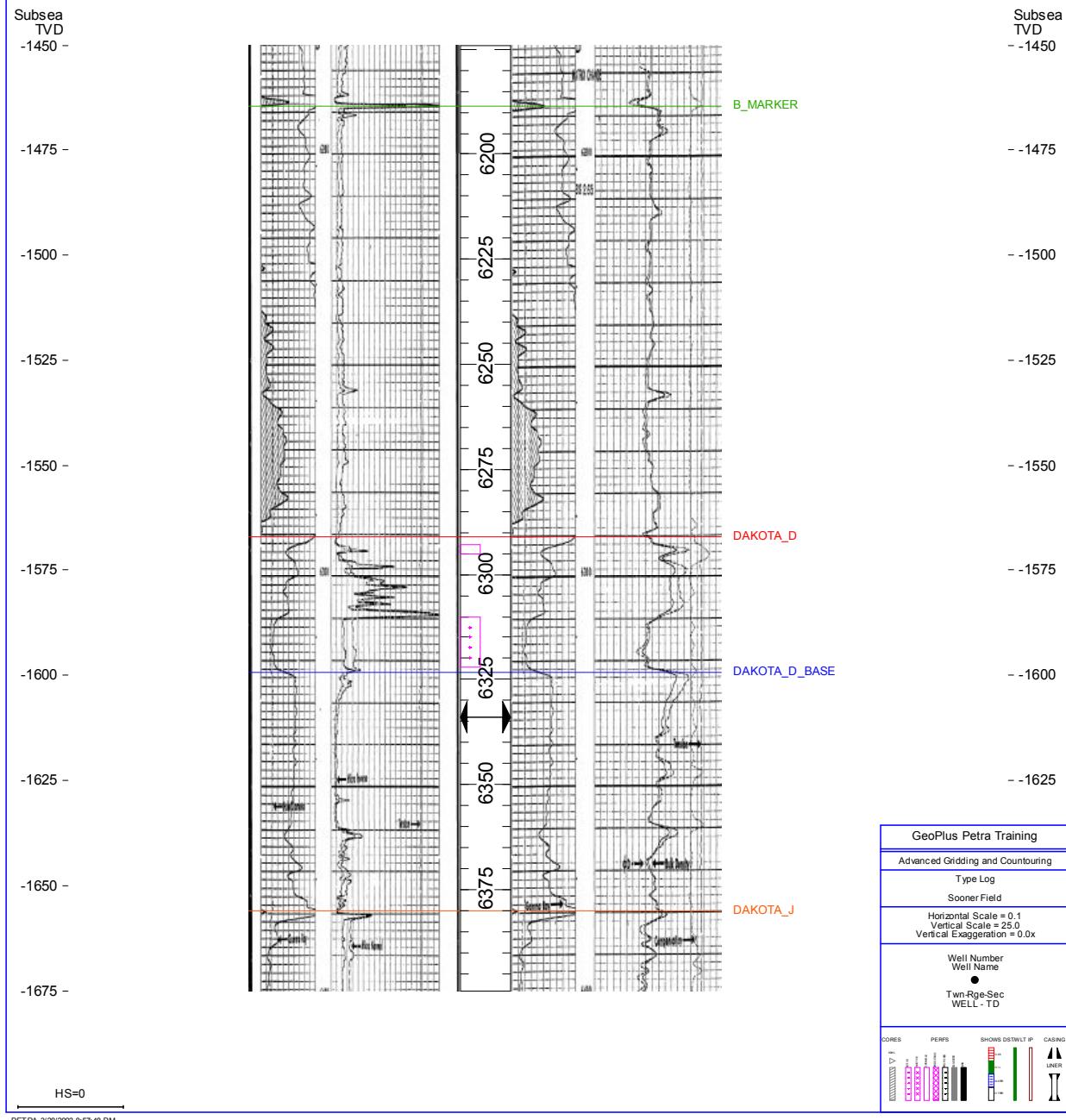
There are many vendor options for acquiring raster logs. Petra can easily load rasters through the Main module under Project>Import>Raster Logs From>



Many vendors offer their Rasters with depth calibrations which makes them easy to load and use within the program. After you have loaded your Rasters, there are options in Petra to digitize the raster, and display perfs, tests, cores, and casing which are covered in our intermediate and advanced training courses.

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*Type Log -
Sooner Project*



Congratulations! You have now completed the PETRA introductory training material. On behalf of IHS ENERGY Corporation, Hydrocarbon Exploration and Development, Inc., and our staff of experts, I want to take this opportunity to express our sincere appreciation for your business. We are certain that PETRA will provide you with a superior set of geological tools to simplify your daily activities.