XSect

with the coordinate grid and trace utilities

Version 1.50

XSect is an ArcView 3.x extension that creates a vertically exaggerated cross-sectional view from any theme containing a numeric depth or elevation field. This document describes version 1.50 of the software. Recent upgrades are described at the end.

If you are reading this for the first time and want to see what ***XSect*** can do, then skip directly to the Case Study and look at the pictures.

The ***coordinate grid utility*** is provided with ***XSect*** to make it easy to enhance a cross-section view (or any view, for that matter) with a background grid of coordinate lines. These lines are saved in a shapefile and displayed as a theme. They also have attributes that enable you to label the lines and easily select the X (vertical) or Y (horizontal) ones for separate labeling or display.

The ***trace*** utility creates outlines of cross-section features. Using it can enhance the presentation of a cross-section and is even a useful analytical tool for interpreting cross-sections. Combined with the coordinate grid utility, it can also create rectangular backgrounds to enhance coordinate grids.

All three software programs, once loaded, are accessible in ArcView's **View|Themes** menu as the "**Cross-sections…**", "**Make grid…**", and "**Make trace…**" items.

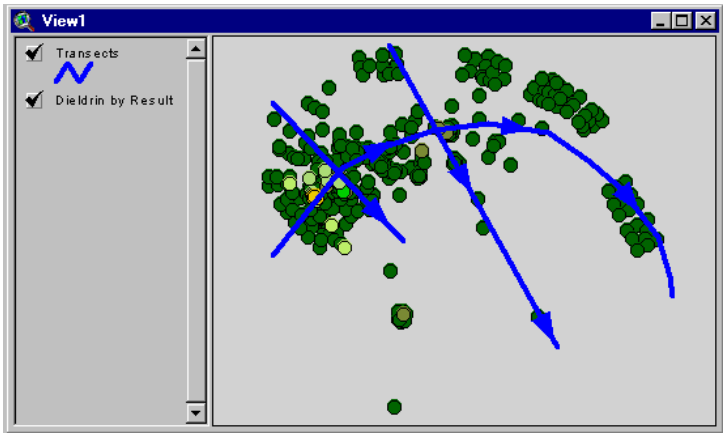
Operation

XSect

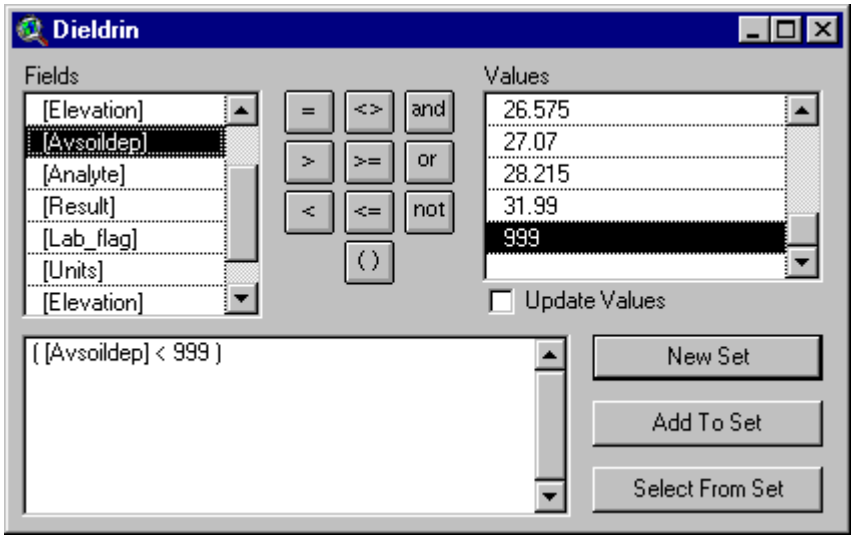
The software requires three forms of input:

1. **A point theme** containing a depth or elevation attribute.
2. **A polyline theme** containing one or more transects (in plan view).
3. **User-supplied information** to control the process.

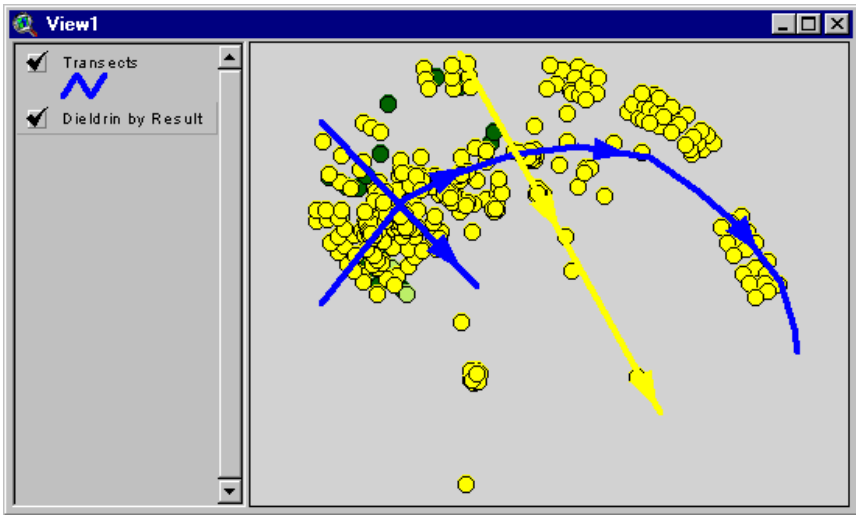
The point theme ("values") and polyline theme ("transects") must appear in the same view. You can name them anything. Here they are called "Dieldrin" and "Transects".



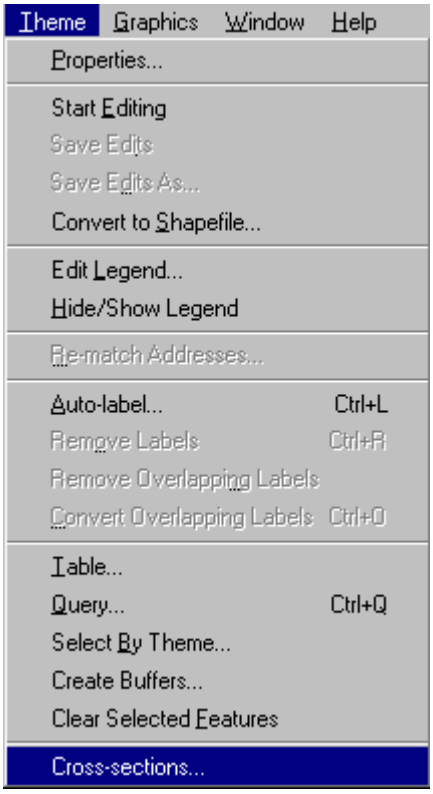
The first step is to prepare the themes by *selecting* their elements and *activating* the values theme. In this example, only points with reasonable depth values are being selected.



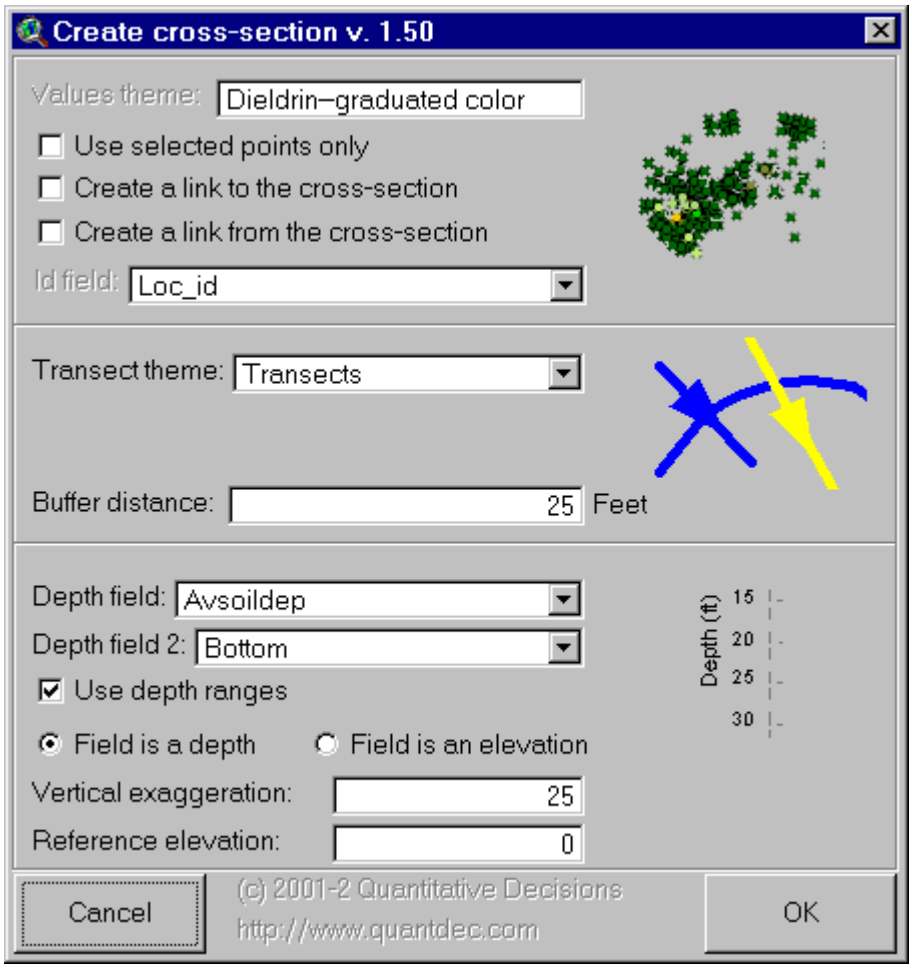
The selected transects will be processed. By default, only the selected points will be used. (As usual in ArcView, if no features are selected, they will be treated as if all had been selected.) The yellow features in this view are the selected ones.



After this preparation, request the cross sections using a new item in the **View|Themes** menu. This item is created when the cross-sections extension is loaded.



Selecting the cross-sections item raises the **Create cross-section** dialog.



The **values theme** simply confirms the values theme selection: it cannot be changed. (The cross-section extension uses the uppermost active point theme in the view.)

Check **use selected points only** when you want ***XSect*** to process just the points currently selected in the values theme. Leave it unchecked to make sure all points are processed. (In either case, if no points are selected then all points will be processed.)

Check **create a link *to* the cross-section** to have ***XSect*** link the features in the values theme to the new features in the cross section. "Linking" means that selecting features in the values theme will automatically cause corresponding features to be selected in the cross-section theme. The corresponding features will be the ones having matching values of the **id field**.

Check **create a link *from* the cross-section** to have ***XSect*** automatically link the features in the new cross-section theme to the values theme. This means that selecting features in the cross-section will cause corresponding features in the original values theme automatically to be selected, too.

The **id field** is the one that will be used in any links. If possible, select a field that uniquely identifies each feature.

Transect theme lets you select among the polyline themes that may be present in the view. It defaults to the last theme used by the dialog, or the topmost polyline theme in the view otherwise.

Buffer distance determines the points that will be selected: all points within this distance of each transect will be used in making cross-sections.

Depth field offers a selection of numeric fields in the values theme attribute table. It lets you choose the attribute to use for displaying depths in the cross-sections (or the tops of depth ranges when making "depth range" cross sections). It defaults to the last field used by the dialog, or the first numeric field in the table otherwise. (When the values theme contains 3D points ("pointZ"), the shape field will appear as an option. Choosing it causes ArcView to use the Z-values of the points for the depths or elevations.)

Depth field 2 offers the same selection of numeric fields in the values theme attribute table. Use it to choose the attribute to use for displaying bottom depths when making "depth range" cross-sections.

Check the **use depth ranges** box to create a "depth range" cross-section. This is one in which each point will be depicted by a vertical line spanning the two depth values.

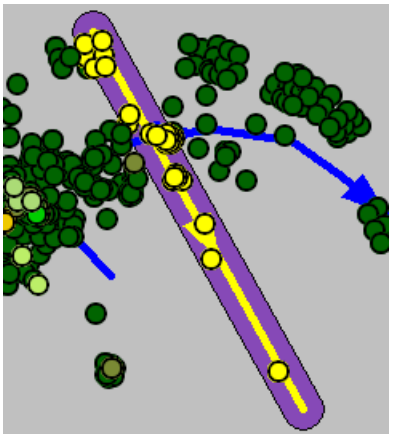
The radio buttons (**Field is a depth** and **Field is an elevation**) indicate whether the depth field contains depths (below a reference surface, usually the ground surface) or elevations. When the field is a depth, higher values will plot *lower* on the cross-section; when the field is an elevation, higher values will plot *higher* on the cross-section.

Vertical exaggeration is the amount to scale depths (or elevations) before plotting. (Specifying a negative value does nothing: only the absolute value is used. The direction of plotting—down or up—is determined solely by the radio button selection.) Even the reference elevation, if any, is scaled.

Reference elevation is a quantity that will be added to all depth (or elevation) values before applying the vertical exaggeration. For example, suppose the depths range from 0 to 20 meters and were obtained relative to a ground surface at 637 meters. If you want the cross-section to be plotted at the absolute elevations, rather than as depths (elevations relative to zero), then (a) continue to specify that the field is a depth but (b) set the reference elevation to 637.

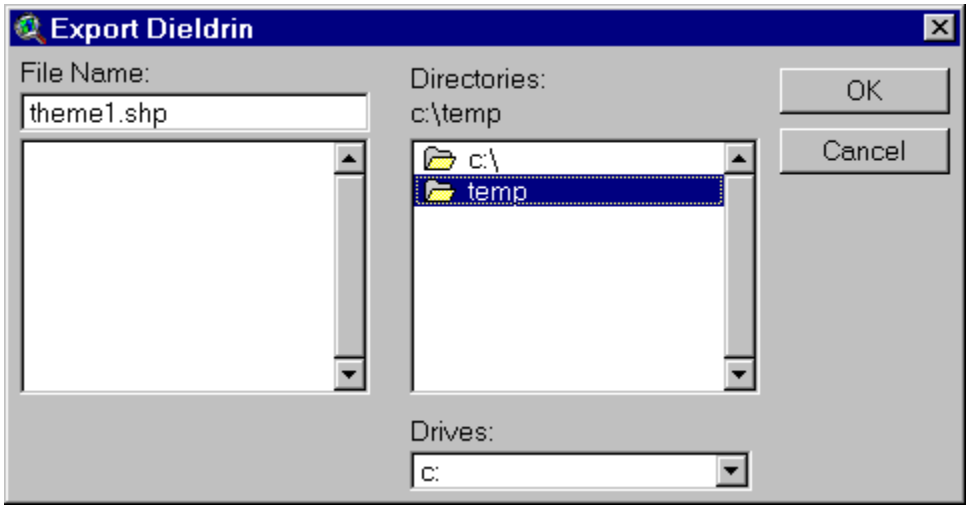
After you press the OK button, the software goes through three operations *for each selected transect feature*:

1. It selects the points falling within the buffer distance of the transect.

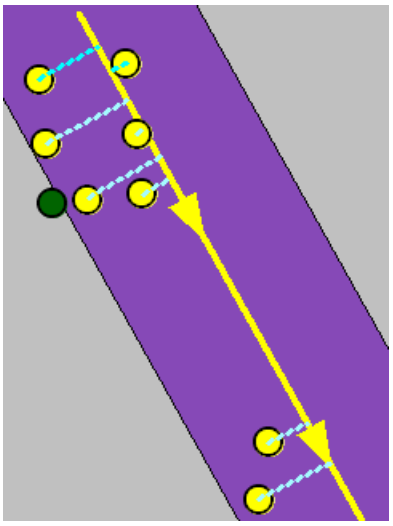


(This figure displays the 200-foot buffer around the selected transect to help you see how the points are selected. ArcView will not actually create such a buffer.)

2. It exports the selected records to a new shapefile. You will be asked to specify where this shapefile will be created:

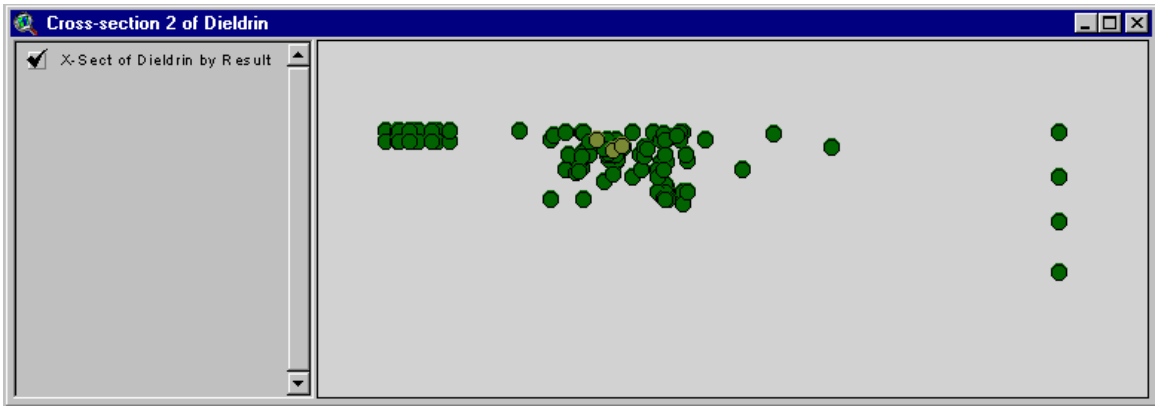


3. It places the exported points at their proper places in the cross-section. The horizontal coordinate is determined by projecting each point to the nearest point on the transect and measuring the distance of the projection to the beginning of the transect. (Notice that this distance therefore depends on the *orientation* of the transect.) The vertical coordinate is determined by multiplying the depth value by the vertical exaggeration. (This is negated when the depth value is to be treated as a depth and otherwise is left as is.) Then, if there is a reference elevation, that is also vertically exaggerated and added to the vertical coordinate.

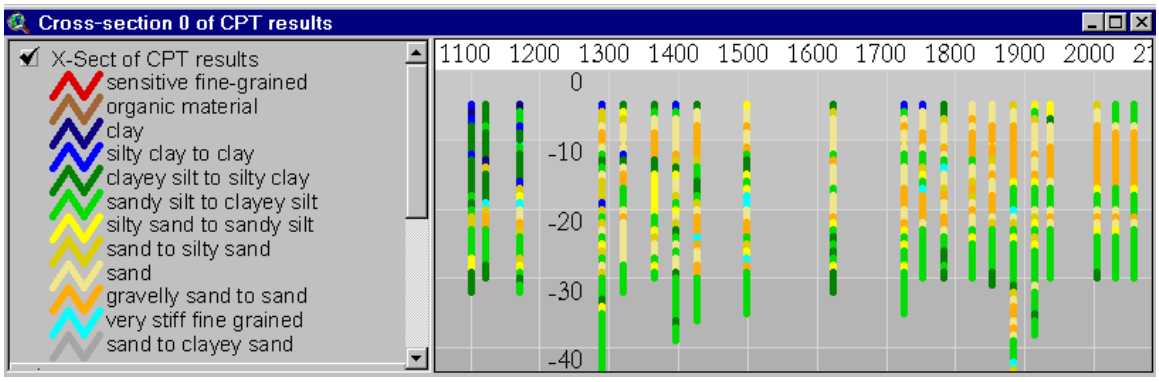


This figure shows how selected points are projected onto the transect. Dotted lines connect the points to their projections.

The software will create a new view to display the resulting shapefile. Arcview's horizontal coordinate shows distance along the transect, from left to right, and the vertical coordinate shows the exaggerated elevation.



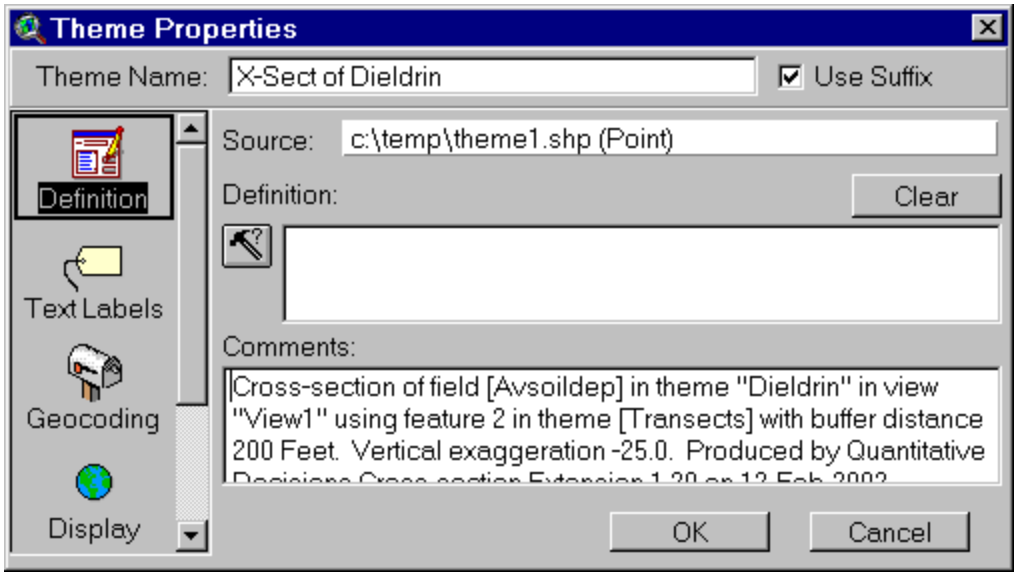
Tip: Cross-sections may exhibit many overlapping points. You can determine which points are drawn on top by using the ***Sort and Promote*** scripts available for free download at http://www.quantdec.com/arcview1.htm#Legends. This enhances your ability to display prominent points, such as those of singularly high or low values of the legend theme.



This figure shows a "depth range" cross-section. The original points were symbolized with a graduated color legend. ***XSect*** automatically uses the same technique—graduated colors—to show the depth ranges. Here, each line extends vertically from the top to the bottom depth given in the feature table and is shown with the appropriate color. (Because no reference elevation was given, all depths are relative to zero, and therefore are negative values.)

The new view inherits many of its properties from the original view, including background color and units of measurement. The view is named for the values theme. Its number ("2" in the illustration) is derived from the transect's record number; numbering begins with zero and proceeds in the physical order of the base file for the transect theme.

The new cross-section theme inherits many of its properties from the values theme, including the legend and its visibility. Comments and a descriptive name are added to document how it was created. This is useful if the theme is later copied into another view.



After completing these operations for each selected transect feature, the software returns the input themes to their original states and redraws all views.

Coordinate grid utility

This utility works independently of ***XSect***. It is intended for use within any cross-section view created by ***XSect***. It can be used multiple times to create overlapping "major" and "minor" coordinate grids.

You provide the utility's input through a dialog, but for your convenience the dialog obtains initial settings from three additional sources:

1. The view itself. Views created by ***XSect*** contain information (within their comment field) about the vertical exaggeration.

2. The view's display and its themes. These can be used to determine the extent of the coordinate grid.

3. Previous input to the dialog. Most values previously input are retained with each new use of the dialog, making it fast and easy to experiment or produce large numbers of similar grids.

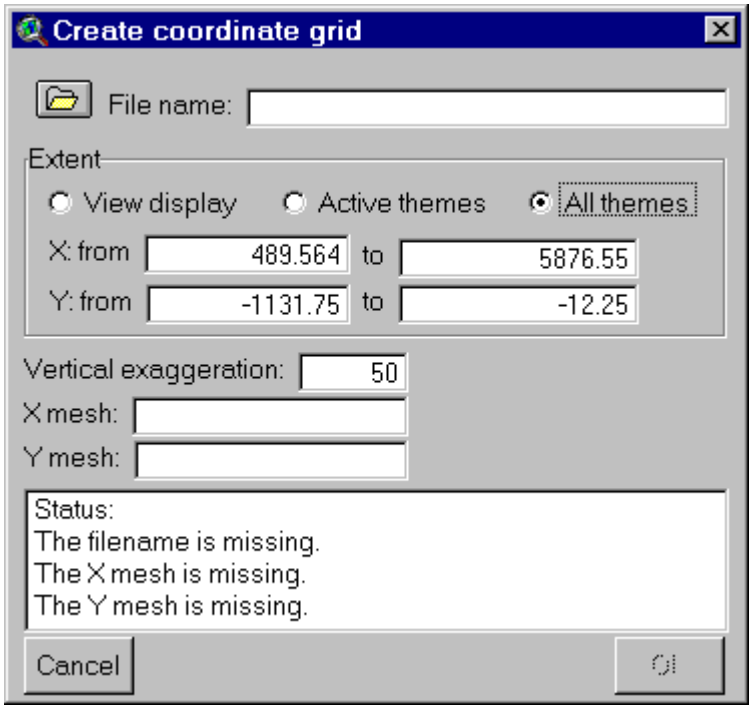
Therefore, the preparation needed for using this utility will normally consist of either setting the view to cover exactly the region you want to grid, or selecting a theme (or themes) in the view to be covered exactly by the grid. The rest is done through the dialog.

Invoke the dialog through the **View|Theme|Make grid…** item:

To the right is the dialog as it normally appears when first used in a cross-section view.

It is designed to be filled out from top to bottom. At each step, the status box will remind you of what yet needs to be specified and of any errors that need to be corrected.

(Resize the dialog to see any status lines that do not fit in the status box.)



The **file name** is the full name of the shapefile that will contain the grid lines. (It will therefore be a *polyline* shapefile.) You may either type in any valid name or use the **file browser** button to navigate the file system. *To prevent damage to existing shapefiles, the utility will require this to be a new file.*

The **extent** determines where grid lines will be drawn. It is specified in one of four possible ways:

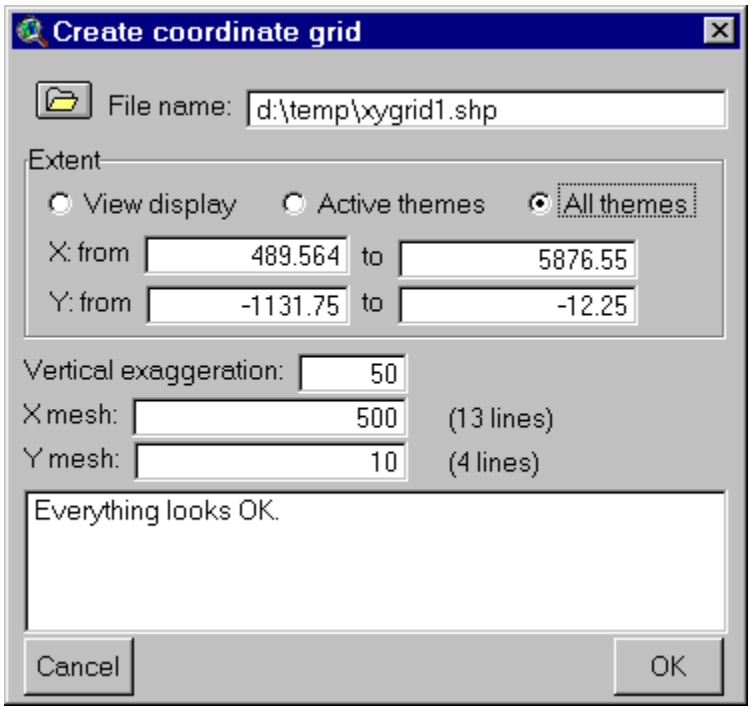
- Clicking the **view display** button will copy the extent of the visible part of the view into the dialog.
- Clicking the **active themes** button will copy the mutual extent of all active themes. (If no themes are active, this button will be disabled.)
- Clicking the **all themes** button will copy the mutual extent of all themes. This is the default and is appropriate when the view contains a single cross-section theme.
- You can override any of the extent parameters by typing them directly.

The **vertical exaggeration** should exactly match the vertical exaggeration used by ***XSect***. The grid utility will automatically divide all Y coordinates by this value when doing its computations. For instance, a horizontal grid line at a true elevation of Y = 10 will have Y coordinates of 500 = 50*10 in the view when the vertical exaggeration is 50. If no vertical exaggeration is desired, use a value of 1.0 here.

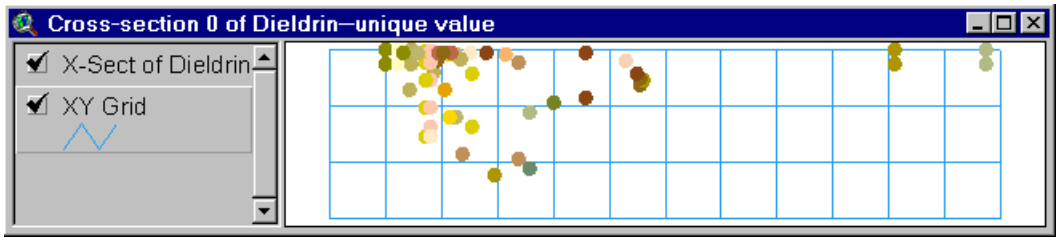
The **X mesh** and **Y mesh** are the spacings between grid lines. When you type these in, the numbers of grid lines will be computed and shown on the dialog, to help you anticipate what the grid will look like. These values are also used to determine the start and stop points for the grid: the extent is expanded, if necessary, to ensure that its X coordinates are whole multiples of the X mesh and its Y coordinates are whole multiples of the Y mesh.

This is the dialog, appropriately filled in.

The extent parameters are in the view's coordinates: no vertical exaggeration has yet been applied to them. Because the vertical exaggeration is set to 50 in this illustration, the grid extent in real coordinates, where Y is depth or elevation, will be from -1131.75/50 to -12.25/50 .



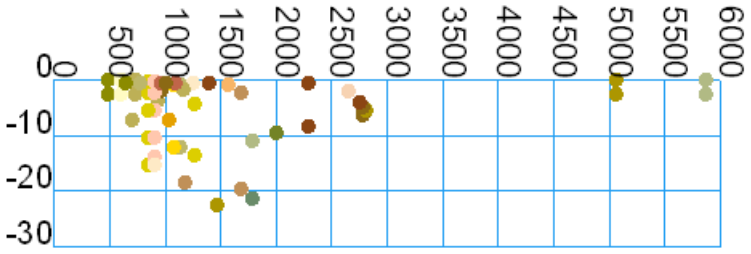
Pressing OK will create a grid shapefile and display it in the view.



The color of the grid lines is randomly set by ArcView. Modify them with the Legend Editor. Pale, light colors are good choices, because the grid should not intrude on the display of the cross-section data.

The grid theme will already be set up for quick labeling. Use the **Theme|Auto-Label…** item or its **Ctrl-L** shortcut. When the labeler dialog appears, choose "Use Theme's Text Label Placement Property" and press OK.

Adjust the text, if necessary, by selecting it and opening ArcView's palette (**Ctrl-P**) to modify the font, size, and color.

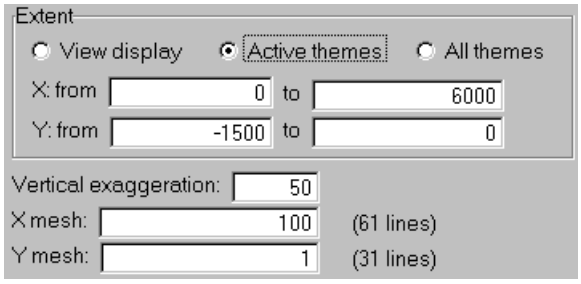


Note how the utility rounded the grid extent parameters to produce grid lines

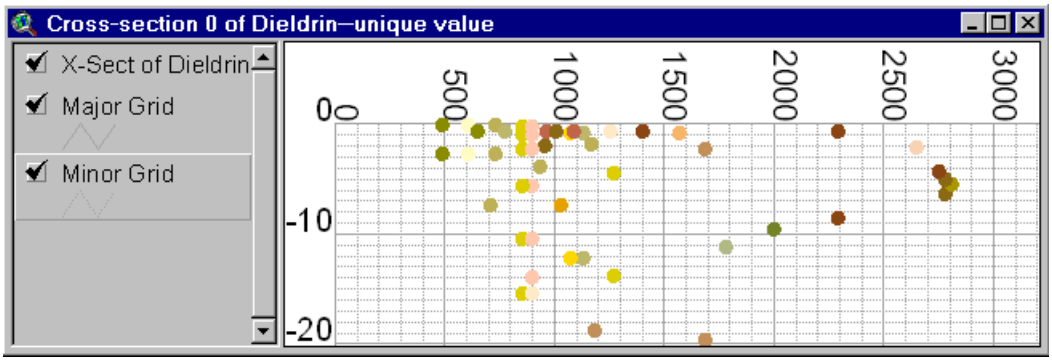
with nice coordinate values. It also determines the right number of decimal places to use (in this case, none).

These examples produced a coarse, or "major," grid with wide meshes. Doing this first establishes a framework for creating more refined, or "minor," grids with narrower meshes. Prepare for these by activating the new major grid theme, then re-run the grid utility dialog.

This time, by choosing the **Active themes** button, the extent has been set to that of the active theme (the major grid). This ensures that the minor grid lines will fill in the major grid exactly.



After symbolizing the grids with the Legend Editor and moving the minor grid beneath the major grid in the View's Table of Contents, the cross-section is complete.



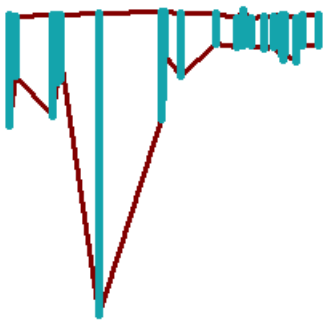
Refer to the "Fine Points" section below for more tips on using this utility.

Trace utility

This utility is a stand-alone tool that outlines the upper and lower extents of any collection of points or polylines shown as themes in a view. The outlines can be represented as polylines or filled in as polygons.

The utility creates such outlines, or "traces," for all selected features in every active theme in a view. These will all be put into a common theme for display.

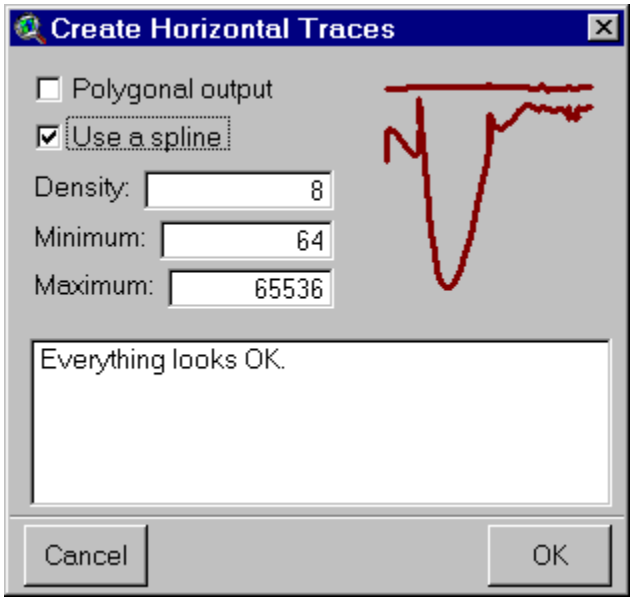
Here is a simple pair of traces, represented as two dark red polylines. The original cross-section is a series of vertical blue lines (representing the vertical extents of borings, perhaps). The trace utility has automatically traced out their tops and bottoms.



Prepare to use the trace utility by selecting features in one or more themes (of point or polyline type), then simultaneously activating those themes. Then run the dialog.

Just like the coordinate grid dialog, the trace dialog includes a status box to help you fill in the dialog accurately and quickly. This figure shows how the dialog typically looks.

(Unlike the coordinate grid dialog, you do not specify the output shapefile directly. Instead, after pressing **OK**, you will be prompted for the output filename.)



Polygonal output means that the upper and lower traces will be separate polylines.

Use a spline means to create a smoothly curved trace instead of using straight line segments between features. The curved trace is an "interpolating B-spline." It will look good except when features are close together horizontally but differ a lot in the vertical direction; then, it can create loops and whorls that are sometimes unwanted.

When the spline option is chosen, you can modify three parameters that affect its appearance:

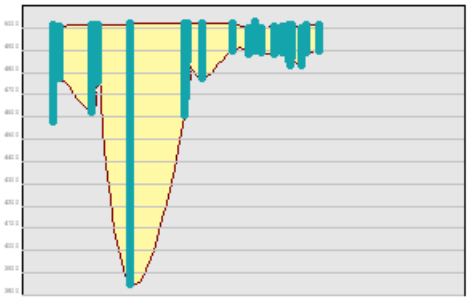
- **Density** is the average number of vertices to create per input vertex in the trace. When the trace might contain sharp changes of direction or long smooth curves, use higher values. Values between 2 and 10 are good to start with.

- **Minimum and maximum** prevent the utility from using two few vertices in any trace or too many (which might needlessly inflate the size of the trace shapefile).

The resulting trace shapefile will have [Id] and [Type] attributes. [Id] names the theme that has been traced. [Type] will be one of "U", "L", or "P", for "upper", "lower", and "polygonal" trace, respectively. This can help you select individual traces after creating a large number in one operation.

Creating a trace typically takes very little time, unless there are many input features to process (more than a few thousand). Since most cross-sections have only a few dozen or few hundred features, this should not be a problem. If you find the operation taking too much time, you can interrupt it by pressing ArcView's **stop** button.

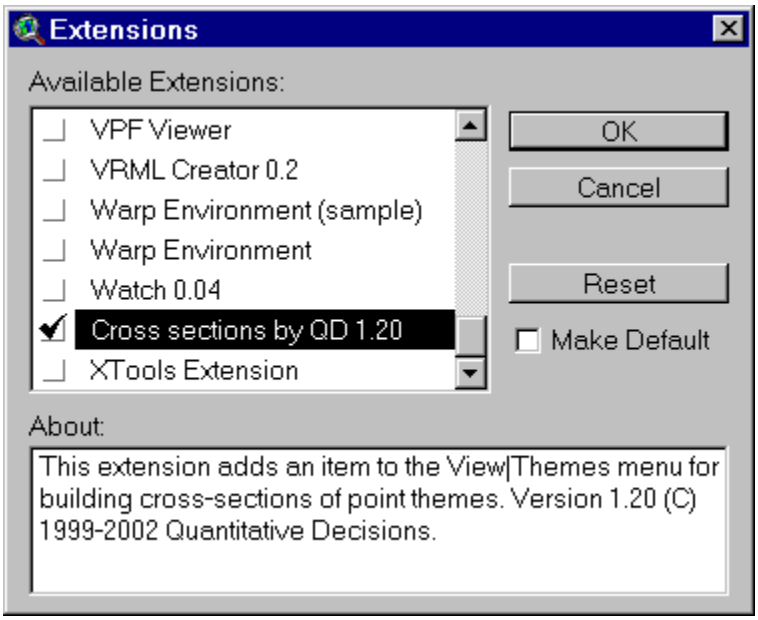
This figure shows a depth-range cross section (vertical blue lines), a labeled coordinate grid, and three traces: a splined trace outlined in red, a polygonal splined trace in yellow, and a trace of the coordinate lines in pale blue, to serve as background for the coordinate lines.



Installation

To install this extension, copy it into ArcView's EXT32 or USEREXT directory. This is usually C:\ESRI\AV_GIS30\ArcView\Ext32, but may depend on how ArcView was installed on your computer.

To load this extension, select the "Cross-sections" extension in ArcView's extension dialog. The order in which it appears depends on the name you give to the extension file. By default, the file's name is "XSECT.avx". This name will place it near the bottom of the ArcView extension dialog, which presents extensions in the alphabetic order of their file names.



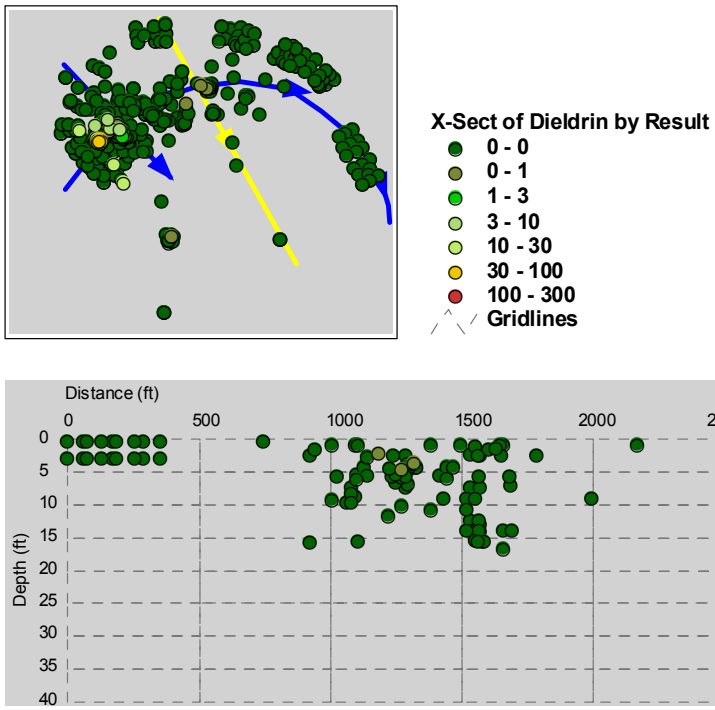
Installation requires the presence of the **Dialog Designer** extension for ArcView. This extension comes with ArcView 3.2 and is available for earlier versions of AV 3.x via download from http://www.esri.com/.

The extension introduces additional "system scripts" into ArcView. The new script names all begin with "XSECT." to avoid conflicts with any other scripts or extensions in your project. It also introduces two new dialogs, "XSECT.Dialog" and "XSECT.Grid".

Final Touches

Cross-sections are more useful when accompanied by axes and labels. These are readily supplied by preparing a standard shapefile adapted to your site, as illustrated below, or by using the coordinate grid utility as described previously. Of course you can use any of ArcView's tools to symbolize and label elements of the cross-section theme and to lay out the relevant views for printing.

Cross-section 2 of Dieldrin



The grid lines in this figure were created with the grid utility. The numeric values were auto-labeled. The axis labels ("Depth (ft)" and "Distance (ft)") were manually entered using ArcView's text tool in the view.

Fine Points

Units of measurement

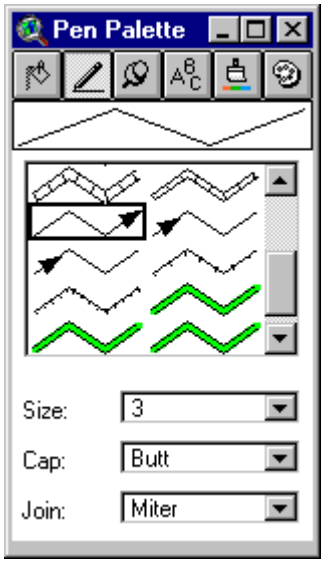
The coordinates in the cross-section shapefiles are in the original view's *distance units*. The distance units can differ from the underlying units. For instance, the original point location coordinates might be in meters, but the view's distance units (set by the user) could be in feet. All cross-section shapefiles derived from this view will then have coordinates in feet.

Z- and M-values

This software also works with 3D and measured themes. If the values theme is 3D or measured, then the output cross-section themes are also 3D or measured, respectively. The software will not change the z-values or the measures of the points. When the values theme is a 3D point theme, you can elect to use the point Z values for the depths or elevations. (Regardless of the theme types, however, distances between points and transects will always be computed horizontally, never in three dimensions.)

Controlling transect orientation

To see how a transect is oriented, symbolize it with one of the arrow symbols provided by ArcView.



You can flip the orientation of any feature using the free ***Flip lines*** extension available at http://www.quantdec.com/arcview1.htm#Creation. It is easy to use and fast in execution.

Adjusting vertical exaggeration

Sometimes you will get everything right, but then will want to change the vertical exaggeration, or perhaps shift cross-section themes vertically or horizontally in order to include many within the same view. An easy way to rescale and shift themes is by means of the ***Transform Shapes*** extension (available for ArcView 3.2 and later only), free for download at http://www.quantdec.com/arcview1.htm#Analysis. This extension will transform all active themes in a view at once, so if you have already created coordinate grids, activate their themes along with the cross-section theme when running ***Transform Shapes***.

Linking

The linking options (new in version 1.30) help you quickly understand which figures in the cross section correspond to the original points. Linking can be very inefficient when many links originate from one theme (such as the original point theme), because each change in that one theme causes changes in many other themes. Therefore linking *to* the cross-section should be chosen with caution, and rarely. Linking *from* the cross-section theme is usually much more efficient. (Should you find that changing selections in a values theme or a cross-section theme is taking an unusually long time, you can remove the links by opening the theme's attribute table and selecting **Table|Remove All Links**.)

It can be useful at times to create both links, so that any change of selection made in either a cross-section theme or the original theme causes both to change. If you have multiple links from the original theme, a change of selection in it or in any of the related

cross-section themes will cause all these themes to change simultaneously. This is a powerful way to explore spatial relationships within your data.

If your values theme does not have an identifier field, you can easily create one. First, if your values theme is not editable (such as when its source is a CAD file or ODBC connection), save it as a shapefile using the **Theme|Convert to shapefile** item. At the same time, save its legend (use the **Save** button in the Legend Editor). Add the new shapefile as a theme to the view and load the saved legend (use the **Load** button in the Legend Editor). Open its feature table, begin editing it, and add a numeric identifier field. Clear any selected records, open the Field Calculator, and type

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in its text box. Press OK. This will number the records sequentially beginning with zero. Stop editing and save the edits. The theme now has an identifier field useful for linking to and from the cross-sections you produce.

When to choose depth range cross sections

Consider using the depth range option (new in version 1.40) to display objects that span a range of depths, such as well screens, geologic strata, or sample cores. To do so, you will need to have (or to create) two numeric fields in the original feature table: one with the minimum depth (or elevation) and the other with the maximum depth (or elevation).

Legends

XSect goes to great lengths to use the original theme's legend to depict the cross-section features, especially when the cross-section is a depth range that uses lines rather than points to show the data. It pays, then, to put the original values theme legend in as good a shape as possible *before* creating any cross-sections, so that you do not have to repeat your work. (ArcView itself does not allow the user to use legends created for point themes in non-point themes, but ***XSect*** does!)

The **Advanced** button in the Legend Editor lets you change feature size automatically as the view's scale changes. If you are using this feature in the values theme, and you request a large vertical exaggeration, the new view may have a much different apparent scale. The automatic scaling will then cause the cross-section features to appear much larger or smaller than intended. The solution is either (a) to disable the automatic scaling in the cross-section legend or (b) to change the sizes of all symbols in the cross-section legend.

Coordinate grids

Here are some tips on getting the most out of the coordinate grid utility.

- Start with a coarse grid. It will take no time to produce and will establish a common extent for any finer grids you might want to create.

- Symbolize grid lines with light colors and unobtrusive line styles: they are for visual reference and should not intrude on the cross-section itself.

- To symbolize horizontal and vertical grid lines differently, create a unique-value legend and select [Type] as the values field. A feature with a [Type] of "H" is a **H**orizontal line and a feature with a [Type] of "V" is a **V**ertical line.

- To display just an X grid (vertical lines) or just a Y grid (horizontal lines), set the grid theme's definition (in the **Theme**|**Properties** dialog) to the expression

  [Type] = "V"

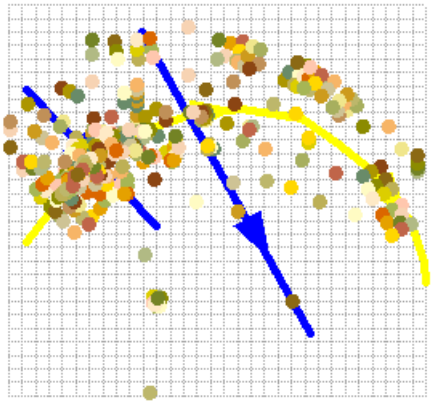
  or

  [Type] = "H"

  respectively.

- You can create coordinate grids even in views not produced by ***XSect***. For instance, you might find it useful to have a coordinate grid for the original view of your points. In this case, specify a vertical exaggeration of 1.

  Here is a fifty foot square grid covering the original point theme.



- Use the ***Transform2D*** extension to rotate and translate coordinate grids, if you like.

- See the coordinate grid theme's comments for information on its vertical exaggeration, x mesh, and y mesh.

- Consider saving some of your favorite grid legends (use the Save button in the Legend Editor) and loading them into any new grids you create.

- You can label grids in different ways, such as along the bottom and right hand sides, by modifying the grid theme's labeling properties (**Theme|Properties** dialog).

Traces

Traces enhance portions of a cross-section by outlining or framing them. Consider also using them as analytical tools. For example, a trace of one part of a cross-section can be used, via ArcView's theme-on-theme selection, to select corresponding portions of an overlapping cross-section.

Traces usually take very little time to generate. So, if you're not sure what kind is best for you—polygonal or polyline, splined or not—then try each combination.

Remember that traces of subsets of your data can be made. Just select a portion of a cross-section or grid, then run the trace utility.

As with the coordinate grid maker, you can run the trace utility in any view, not just a cross-section view. Its results are most useful for point themes or polyline themes whose features are horizontal or vertical line segments.

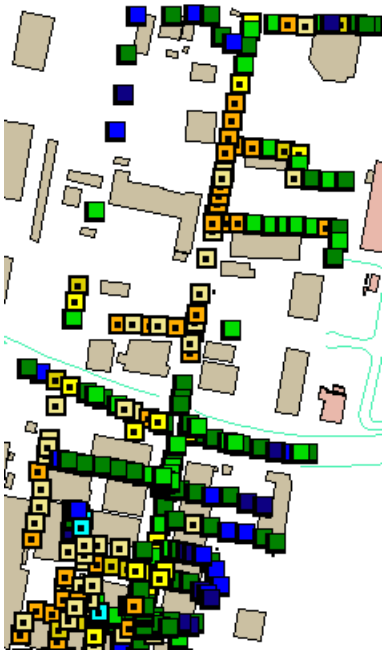
Case Study

This tiny case study demonstrates the illustrative and analytical power of ***XSect*** with ArcView. Although your application is likely to differ, perhaps this study will indicate how ***XSect*** and its utilities might best serve your needs.

The objective was to understand and document complex subsurface conditions that control the movement of groundwater contaminants near an old toxic chemical spill site. To this end, an investigation obtained 500 borings. Each extended down to ten meters or more (about 30 feet). They were placed in lines along the expected groundwater flow direction and across that direction.

A CPT (Cone Penetrometer Test) instrument followed the boring auger, measuring pressure and side (sleeve) friction every two to five centimeters. This resulted in almost 90,000 readings. ArcView scripts post-processed these using the Robertson & Campanella method to characterize the soils in one-foot vertical intervals within the borings. This reduced the number of data to about 14,000 values. Each value consists of an elevation and a coded soil type.

A table of boring location coordinates was joined to the data table, then added to a view as an XY point event theme. Here is a portion of the map, showing a simplified background of roads and buildings for reference. The borings appear as dotted squares. Their colors correspond to soil type.
Unfortunately, only one of the thirty or so results in each boring is shown: all the others lie beneath the topmost one.



(The image covers an area of about 1200 by 2000 feet. Maybe we should have used the trace utility to put a reference grid in it…)

This case study explores the "gravelly sand" data along one transect. These data indicate where the subsurface is most permeable to groundwater flow, which is along the paths that contaminated groundwater might take. A full study would explore all the data along all the transects. (In fact such a study was originally performed, but without the benefit of the ***XSect*** software, it took a very long time to do.)

The next few pages outline the steps taken using ***XSect*** and its utilities.

XSect created an elevation cross section.

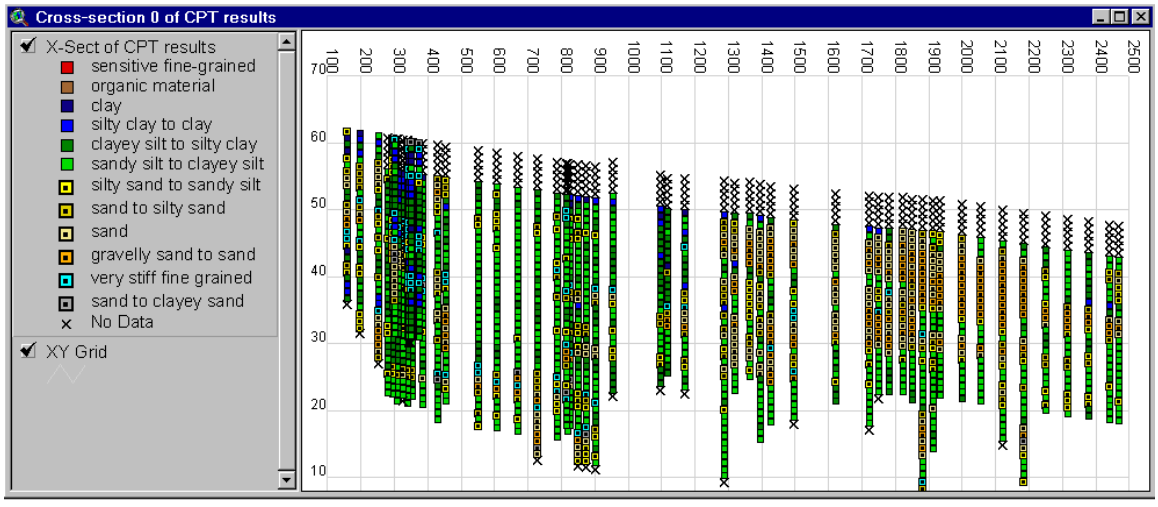
The first task was to review data along the boring transects. To this end, the transects were quickly digitized into a polyline theme.

The transects do not have to be very accurate: ***XSect's*** ability to collect sample locations within a buffer will take care of that.

The transects are shown here in red with directional symbols to show their orientation. The transect to be studied below is shown in yellow, just after it had been selected in ArcView.

This was all the preparation needed. ***XSect*** did the rest. The investigator simply requested a cross-section of all data within ten feet of the selected transect.

The cross section, as it goes from left to right, advances from south to north along the orientation of the transect.



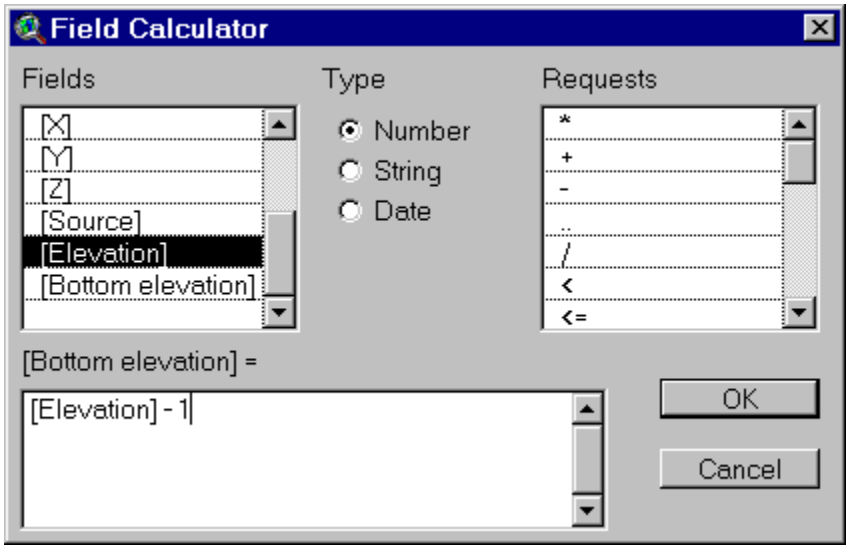
The coordinate grid utility created a reference grid.

A quick application of the coordinate grid utility created the reference grid, shown faintly behind the cross section. It was rapidly labeled using the Ctrl-L shortcut to produce this image. The vertical exaggeration is 20:1. All labels are in feet.

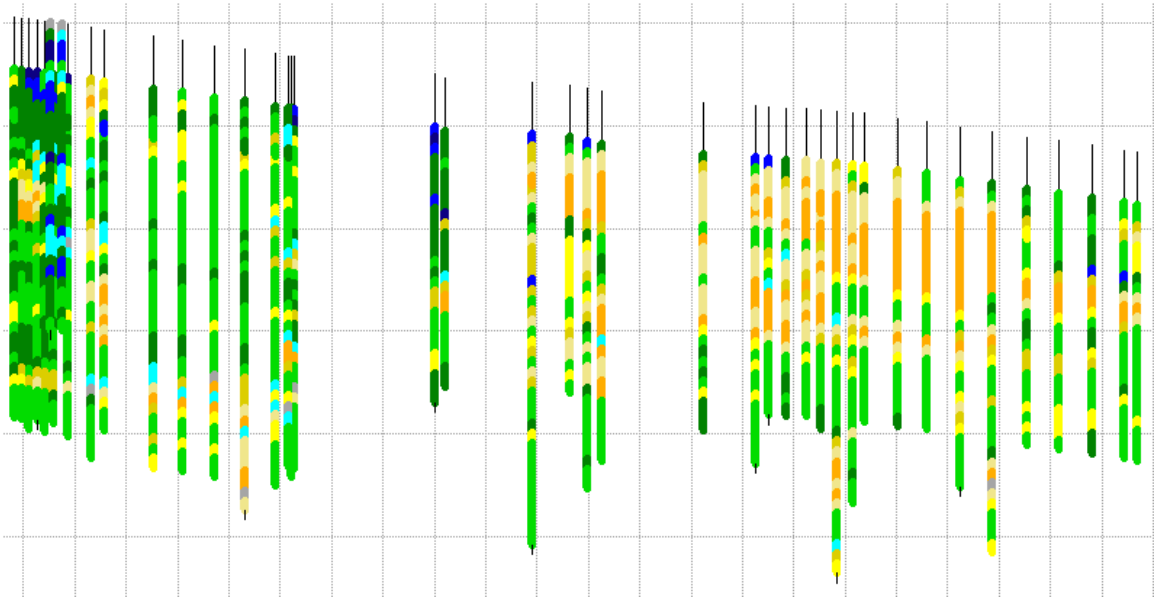
ArcView's data-processing capabilities helped to create an elevation-range cross-section.

The data of interest, "gravelly sand to sand," appear as dotted orange squares. Evidently there is a mass of them to the right: downgradient and to the north on the maps. To the left, the situation looks more complex. It is difficult to make out a pattern.

To improve the visualization, an elevation range cross-section was produced. This was made possible by using ArcView's field calculator to generate a top and bottom elevation from the original (top) elevation.



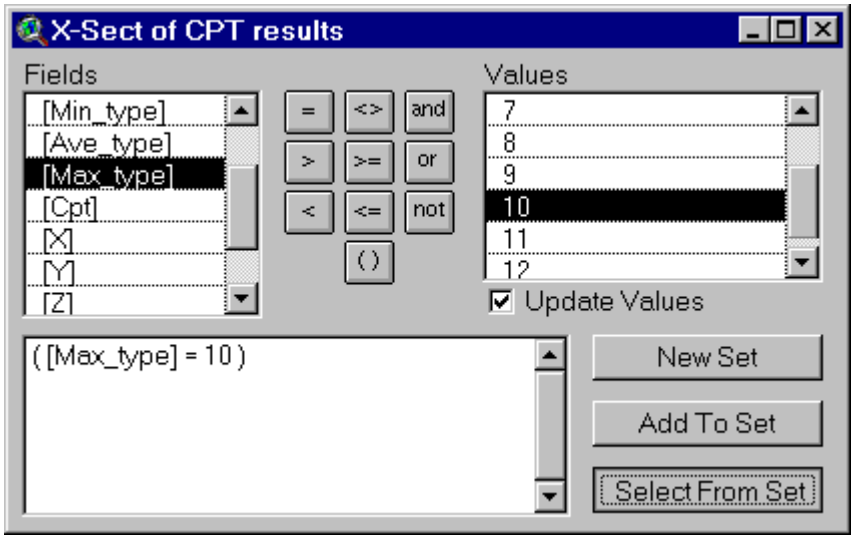
The elevation-range cross section uses the same color scheme to symbolize the data, even though it is a polyline theme, rather than a point theme. But because it is a polyline theme, it is easier to control the thickness of the borings, helping to reveal the data patterns.



The trace utility produced visual summaries of the relevant data.

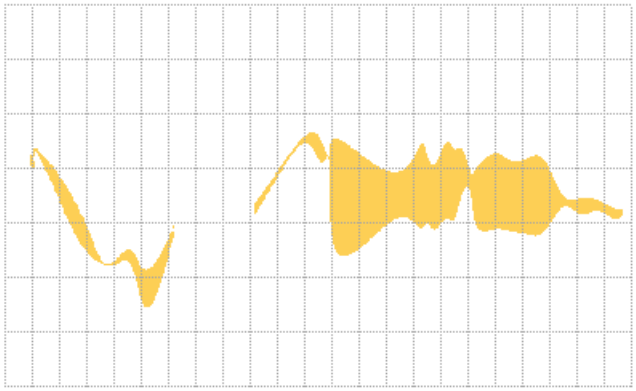
There is a gap in the data, about a third of the way from the left. This occurred because a busy highway intercepts the study area. There appears to be a geological change at this location, too: to the right (north), there is a preponderance of sand and gravel. To the left (south), there is very little.

To help visualize this better, two traces were made. To make the first, all data to the right of the break (and above an elevation of 20 feet) were selected manually. From this selection only those data with a value of 10 (the code for gravelly sand) were selected using ArcView's query tool.



The trace utility was asked to produce a polygonal spline. As usual with ArcView operations, it used *the selected data only*.

This process was repeated for the left-hand data, resulting in the two traces shown here. They outline the highest and lowest elevations where gravelly sand was found in the CPT logs. The difference in the two portions of the data is graphically clear: the sand unit is very thin and discontinuous to the left, thick and continuous to the right.

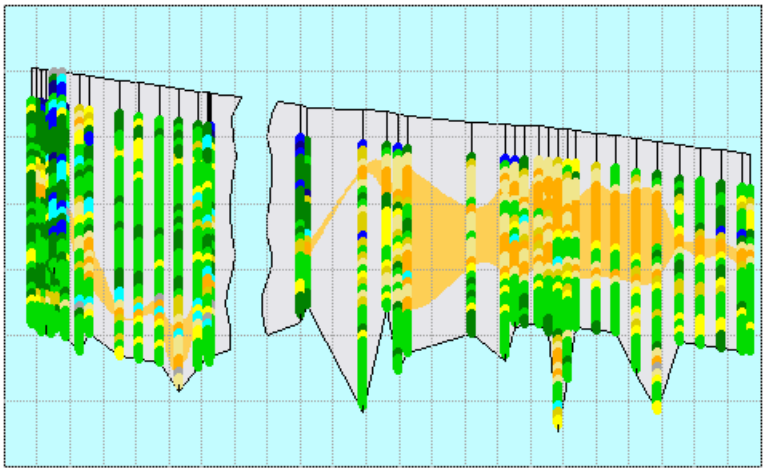


(This difference was neither apparent to nor readily accepted by previous investigators, who maintained that the thick sand unit extended southward—to the left—without any break.)

The trace utility also improved the visual quality of the cross-section.

The trace utility was used to enhance these analytical results by creating a background for the CPT logs (showing what portion of the subsurface had been investigated) and a background for the grid (as a visual frame).

The light blue frame is a polygonal, unsplined trace of the coordinate grid. The broken white background region is a polygonal, unsplined trace of the entire cross-section. Its top marks the ground surface while its bottom shows the vertical extent of the investigation.



ArcView's "split polygon" tool was used to manually cut out a section in the middle of the white trace to show the data gap. This is the only part of the image that was not automatically generated.

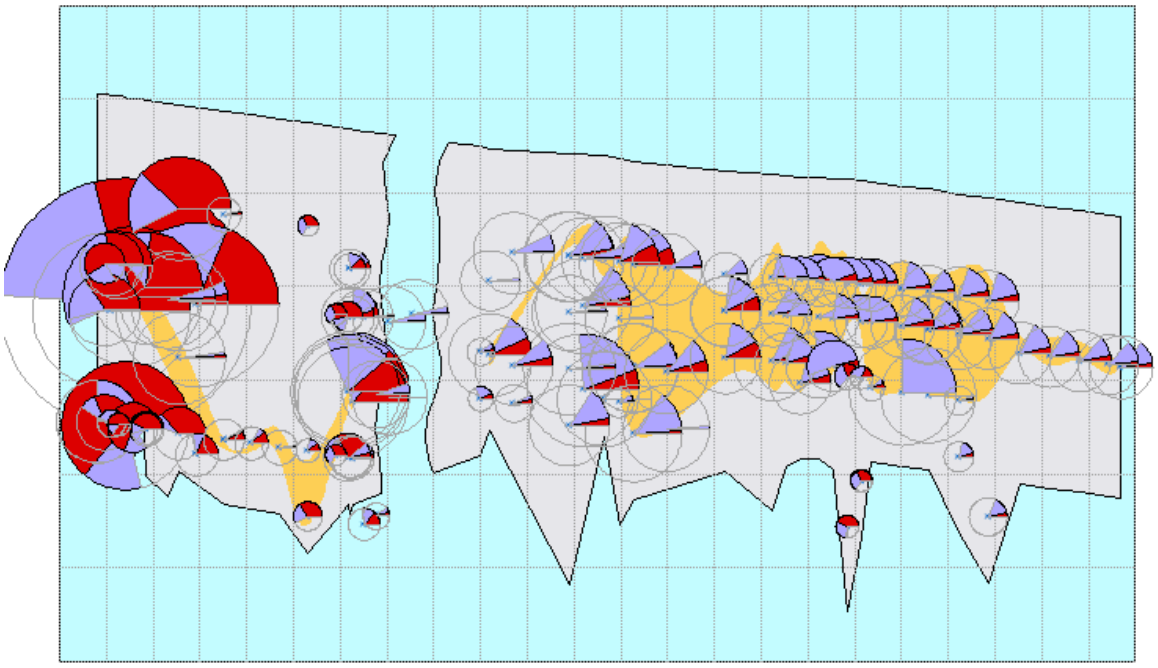
(A close look at this image shows some clay—green—sections within the sands at the right. This superposition of data and its trace presents the simple message of the interpretation—the trace alone—while preserving the full complexity of the raw data.)

Of course, you can use any of ArcView's other capabilities to enhance your cross-sections with labels, additional shapes, legends, scale bars, and much more.

XSect produced a chemical analysis cross-section for overlay on the soil boring cross-section.

After the CPT borings were completed, groundwater samples were obtained, usually in sandy locations (where enough groundwater could flow into the sampler). These samples were analyzed for chemicals characteristic of the contaminant source. The results were displayed on the original map using a pie chart legend. This was ineffective as a visualization tool because of the vertical overlap of many of the samples.

XSect quickly converted this conventional display into a cross-sectional display using the same legend. It would be too confusing to show it along with the CPT cross-section: there is much going on. Instead, the CPT data have been suppressed, leaving only the gravelly sand traces to indicate where most of the groundwater will flow.



The areas of the pie charts are proportional to total contaminant concentration. The pie slices show relative concentrations of the three chemicals: PCE (red), TCE (blue), and cis-DCE (transparent).

(PCE is a known contaminant in the south (at the left). This is evident from the large sizes of the red slices at the left. TCE is a possible contaminant further downgradient (right). Cis-DCE results from biochemical breakdown of PCE and TCE. Groundwater flows from left to right.)

Conclusions: XSect plus ArcView has excellent analytical and visualization powers for cross-sectional data.

The sizes and colors of the pie charts, superimposed on the trace of gravelly sand, reveal much about the possible sources, transport, and changes in contamination.

This image, combined with similar images from the other transects, provides a detailed three-dimensional picture of subsurface conditions at this site. By using simple and automatic tools, combined with ArcView's flexibility in selecting and editing data, this study was able to progress very quickly toward a better understanding of conditions and an effective way of presenting that information.

Recent Changes

Version 1.50 introduces the coordinate grid and trace utilities. To support the coordinate grid maker, ***XSect*** now places vertical exaggeration information in the comments field of each cross-section view.

The **reference elevation** option was introduced in this version.

This version also addresses a problem that had occurred when long field names were used by ***XSect***. During some computations, ArcView truncates long field names. A work-around has been implemented.

Version 1.41 works around a problem with graduated-symbol legends. These do not work correctly in ArcView 3.2a: the Legend Editor unilaterally undoes any changes made to symbol colors. (The ESRI tracking number for this problem is CQ00006324.) Now, ***XSect*** detects graduated-symbol legends that use more than one color and converts them automatically to graduated-color legends that use more than one symbol.

XSect now sets the thickness of lines in a depth range cross section to be the same as the width of the original symbols. In this way it can preserve graduations in symbol size. However, in many cases this can produce unusually thick lines. In the Legend Editor you can modify all symbols by clicking on the top symbol, holding the shift key and clicking on the bottom symbol, then (still holding the shift key) double-clicking the bottom symbol. Changes you make in the palette, such as reducing the line thickness, will apply to all selected symbols at once.

Contact

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Index

B

C

D

E

F

G

H

I

J

K

L

M

T

U

V

W

X

Z

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