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# **SiteView™ 1.0**

Environmental Visualization Software

## User Guide

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# How To Use This Manual

This manual has the following chapters:

Chapter 1, "Introduction," provides an overview of SiteView functionality and of this manual.

Chapter 2, "Getting Started," introduces the major SiteView components.

Chapter 3, "Objects, and Attributes," introduces the concepts of SiteView's classes, objects, and data types.

Chapter 4, "Creating, Importing, and Viewing Objects," describes how to create and list objects in a SiteView site.

Chapter 5, "Selecting Objects," describes how to select objects graphically, perform selections (queries) with the Select window, Selection History window, and Registers.

Chapter 6, "Potatoes in space (iso-shells)," describes how to create, combine, modify, edit, and change the appearance of iso-shells in three-dimensional space.

Chapter 7, "Surfaces," describes how SiteView creates 2-1/2 dimensional surfaces from your data.

Chapter 8, "Stratigraphy," describes how to import, model, and visualize stratigraphic information in cuts, fence diagrams, and as solids.

Chapter 9, "Printing," describes how to print views, the various printing options, and how to save views to file for transfer to other applications such as word processing.

Chapter 10, "SiteView Classes and Attributes," lists SiteView's default object classes and their attributes.

# Table of Contents

How To Use This Manual	iii
Table of Contents	iv
Introduction	1
<b>What is SiteView?</b> .....	<b>1</b>
<b>What is a VirtualSite?</b> .....	<b>1</b>
Getting Started	4
<b>Installing SiteView</b> .....	<b>4</b>
<b>Installing SiteView</b> .....	<b>4</b>
<b>The Keyboard and Mouse</b> .....	<b>6</b>
<b>Mudville Airport</b> .....	<b>7</b>
<b>3D Views</b> .....	<b>10</b>
Objects and Attributes	16
<b>Objects and Classes</b> .....	<b>16</b>
<b>Attributes and Attribute Values</b> .....	<b>17</b>
<b>Data Types and Units</b> .....	<b>17</b>
<b>Sources, samples, and measurements</b> .....	<b>18</b>
<b>Coordinate Systems</b> .....	<b>19</b>
Creating, Importing, and Viewing Objects	21
<b>Creating objects</b> .....	<b>21</b>
<b>Creating objects with palette tools</b> .....	<b>21</b>
<b>Creating Derived Objects</b> .....	<b>22</b>
<b>Deleting Objects</b> .....	<b>23</b>
<b>Moving Objects</b> .....	<b>23</b>
<b>Importing from a spreadsheet</b> .....	<b>24</b>
<b>Importing from a DXF File</b> .....	<b>28</b>
Selecting Objects	29
<b>Select objects</b> .....	<b>30</b>
<b>Selection History</b> .....	<b>32</b>
<b>Store/recall selection</b> .....	<b>35</b>
Potatoes in space (iso-shells)	36
<b>Iso-shell Modeling</b> .....	<b>37</b>
<b>Creating iso-shells</b> .....	<b>40</b>
<b>Iso-shell properties</b> .....	<b>41</b>
Surfaces	46
<b>Surface Modeling</b> .....	<b>46</b>
<b>Surface display properties</b> .....	<b>47</b>
Stratigraphy	53
<b>Stratigraphic Modeling</b> .....	<b>53</b>
<b>Importing and viewing stratigraphic information</b> .....	<b>53</b>
<b>Stratigraphic Modeling</b> .....	<b>54</b>

<b>Fence diagrams in 3D views.....</b>	<b>54</b>
<b>Selection properties.....</b>	<b>55</b>
Printing	57
<b>Printing to a Windows supported printer.....</b>	<b>57</b>
<b>Printing to file.....</b>	<b>57</b>
SiteView Classes and Attributes	59
<b>Annotation.....</b>	<b>59</b>
<b>Boring.....</b>	<b>59</b>
<b>DXF layer.....</b>	<b>60</b>
<b>Monitoring Well.....</b>	<b>60</b>
<b>Sample.....</b>	<b>60</b>
<b>Measurement.....</b>	<b>60</b>
<b>Stratigraphy Sample.....</b>	<b>61</b>
<b>Value Point.....</b>	<b>62</b>
<b>Water Level.....</b>	<b>62</b>
Index	63

## Chapter 1

# Introduction

This chapter introduces you to

- ¥ SiteView<sup>a</sup> data visualization, and
- ¥ VirtualSite<sup>a</sup> data manipulation.

## What is SiteView?

SiteView is a computer software tool that helps engineers, scientists, and managers visualize environmental information. It combines VirtualSite object-oriented data manipulation with features that allow you to integrate, analyze, and view environmental data. SiteView helps you visualize and communicate soil, groundwater, air quality, water body, and other natural conditions at real-world sites.

## What is a VirtualSite?

When you assess a site whether to rank its hazard potential, to ascertain the feasibility of alternative remediation measures, or to map the distributions of air pollutants, you build a conceptual model of the site in your mind. This conceptual model describes the site and reflects any hypotheses regarding natural or man-made conditions in a geographic and geometric rendering.

As you continue collecting different data, the conceptual model changes to reflect these incoming data. At times, the model can become unwieldy due to the sheer volume of data required for an accurate site assessment. Often, this mental picture blurs because it must be revised so frequently.

The VirtualSite data model computerizes the conceptual model of an environmental site in a compelling three-

dimensional picture or visualization. The result of this computerization is a spatial model which contains all the data from the site.

Part of the power of the VirtualSite data model lies in the fact that SiteView treats data as objects. Objects have values for location, contaminant or pollution data, stratigraphy, and any other information that characterizes the site.

Most objects are represented by symbols that you can handle directly. For example, you can display a stratigraphic profile based on a series of borings simply by selecting the symbols for borings with the mouse in any view then choosing a command to create a Section Line.

With SiteView, you can

- integrate data which have been recorded in different formats,
- visualize the site in a variety of ways,
- manipulate and analyze the site data, and
- prepare presentations about the site.

## Data Integration

Environmental site assessments require data that are recorded in a variety of formats. Just a few of the data you collect are survey data, geologic borings, historical affidavits, and soil, air, and surface samples. The data come in every form from handwritten boring logs and photographs to spreadsheet files and electronically transmitted lab data. The consolidation of these data is a large task.

SiteView helps you integrate data from these different sources. You can take data in spreadsheet or AutoCAD™ drawing interchange file format (DXF) and populate a VirtualSite. As more data are collected, you simply repeat the import process and the VirtualSite is revised, reflecting the new data that have been merged.

With SiteView, you can combine data collected at different times and from disparate sources to form a single, consistent picture of the site. This model is refined as you visualize and analyze the VirtualSite data.

## Site Visualization

Although SiteView provides a central, consistent representation of site data, you can view these data in a variety of ways. SiteView views are dynamic snapshots of data.

When you first use the system, you can create a terrain contour map on which field samples are represented by symbols. You can delve into the details of a site by displaying data objects' attribute values, or you can build a better conceptual picture of the site by displaying different views such as analyte contours and color maps, 3D solid models, and stratigraphic profiles.

After you've displayed a view, you can adjust it to suit your needs. For example, you can specify the grid size on which plumes are interpolated and the interval between 3D contours showing thresholds of pollution concentration.

## Presentation

An important part of your job is showing the results of your site assessment to colleagues, clients, and the public. All of the graphics in SiteView can be printed. In minutes, you can produce maps, profiles, and 3D views suitable for presentation.. You can also save all these views to file and use them as inserts for reports or slide shows.



## Chapter 2

# Getting Started

This chapter introduces the ways you can use SiteView's environmental visualization capabilities to explore your 3D spatial data. In this chapter we describe:

- How to install SiteView,
- The Mudville Airport data shipped with your copy of SiteView,
- How to view and move around a 3D site visualization,
- How to select and change the display of objects at the site, and
- How to work with multiple views of your data.

## Installing SiteView

This section describes how to install SiteView on your computer, and the minimum hardware and software requirements you need to use SiteView.

## Installing SiteView

To install SiteView, first check to see that the hardware and operating system configuration on the PC on which you want to install SiteView is adequate to support the SiteView application.

### **Minimum PC configuration**

Your PC should have at least the following hardware and operating system configuration,

Hardware: 486 or Pentium PC running at 33MHz or faster  
5MB of free space on your hard disk for  
SiteView  
20MB of swap space on your hard disk  
VGA monitor

Software: Microsoft Windows 3.1 or higher

Win 32S enhancement to Windows (provided with SiteView)

Installation procedure SiteView is delivered on five 3-1/4 inch diskettes. Two of these diskettes contain the SiteView application and sample files. Two contain the Win 32S enhancement for Microsoft Windows 3.1 which is required to run SiteView's graphics. The final diskette contains an electronic version of the SiteView User's Guide in Microsoft Word for Windows format.

Before installing SiteView, first install Win 32 S by following the instructions on the diskettes. Next, install SiteView.

### **Intallation of Microsoft Win32S™ 1.15.111.0**

1. Start Microsoft Windows
2. Insert Disk 1 of Microsoft Win32S
3. From Program Manager, select File menu, and choose Run
4. Type a:\setup and press Enter

### **5. Follow Directions**

### **Intallation of SiteView™ 1.0**

1. Return to DOS prompt c:\
2. Type mkdir siteview and press Enter
3. Type cd\siteview and press Enter
4. Insert Disk 2 of SiteView
5. Type a:pkunzip -d a:siteview and press Enter
6. Follow Directions

### **Viewing or Printing This Document**

1. Start Microsoft WORD™ for Windows or compatible word processor software
2. Insert DOCUMENTATION DISK
3. Open a:siteview.doc
4. View or Print



pointer moves. SiteView supports a two-button mouse, which allows you three selection alternatives: Left (Select), Control-Left (Adjust Selection), and Right. When your system is installed with a three-button mouse, SiteView ignores the middle button.

As you use this manual, you'll be asked to perform the following mouse operations.

<b>This</b>	<b>Means</b>
<b>Press</b>	<i>Push the mouse button and hold it down.</i>
<b>Release</b>	<i>Let go of a pressed mouse button.</i>
<b>Click on</b>	<i>Press and release the left mouse button quickly before you move the pointer.</i>
<b>Click-left</b>	<i>Press and release the left mouse button quickly before you move the pointer.</i>
<b>Control-click-left</b>	<i>Press and release the control button while pressing the left mouse button quickly before you move the pointer.</i>
<b>Click-right</b>	<i>Press and release the right mouse button quickly before you move the pointer.</i>
<b>Double-click</b>	<i>Quickly press and release the mouse button twice before moving the pointer.</i>
<b>Move the pointer</b>	<i>Slide the mouse with no buttons pressed.</i>
<b>Drag the pointer</b>	<i>Slide the mouse with one or more buttons pressed.</i>
<b>Graphically select objects</b>	<p><i>Move the pointer over the object and click-left. To adjust your selection, move the pointer over an object and control-click-left. If the object is selected, it becomes unselected; if the object is unselected, it becomes selected.</i></p> <p><i>You can also select objects by pressing the left mouse button and dragging the pointer to create a rectangle around the area that you'd like displayed in the window. Release the button and all the objects enclosed by the square are selected.</i></p>
<b>Display menus and choose commands</b>	<i>Click-right on a menu to display it. Click-left on a command to choose it. To choose a menu's default command, click-left on the menu.</i>

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## **Mudville Airport**

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The hypothetical Mudville Airport site is a 500-acre regional airport bordered by light industry and residential areas. Approximately 30 borings and monitoring wells lie within a 4000-foot radius of the site. Chemical samples

taken in these wells have been used to characterize the extent of groundwater contamination in the environs. A small river lies some distance from the site but is not used for public water supply.

All of the data for the Mudville site are, in fact, real, although they have been combined from different projects and renamed. All the data are in the public domain and may be used for demonstrations and presentations of SiteView's environmental visualization capabilities.

## Mudville data set

The data set that was shipped with SiteView contains the following files:

mudville.sws	This is a SiteView workspace of the Mudville Airport, into which have already been imported the mudville.dxf CAD drawings, borings.tsv geotechnical boring locations, chem.tsv chemical samples taken in the borings, and the gwl.tsv groundwater levels.
mudville.dxf	CAD drawings of the Mudville Airport and surrounding areas saved in AutoCAD DXF format (these have already been imported into the workspace, but are saved in a pointer file with the workspace; when you open a saved site, SiteView searches for the DXF files and automatically re-imports them; if you delete or move DXF files, SiteView will not be able to reimport them).
borings.tsv	Tab-separated-value (TSV) ascii file containing the original soil borings and their locations (already imported into the workspace).
chem.tsv	TSV file of chemical analyte values (already imported into the workspace).
gwl.tsv	TSV file of groundwater levels across the site (already imported into the workspace).

measure.tsv	TSV file of chemical measurements.
strat.tsv	TSV file of stratigraphic interval observations for the monitoring well data in the wells.tsv file, consists of well name, from-depth, to-depth, and material type data (not yet imported).
wells.tsv	TSV file of monitoring well names, locations, and depths (not imported into the workspace yet)

## Viewing Mudville

### Starting SiteView

To start SiteView:

- Start or login to your computer.
- Start Windows by typing `win` at the prompt.
- Double-click-left on the icon for SiteView in the Program Manager.

### Opening the Mudville Site

- From SiteView's File menu, click on Open.
- In the file browser, double click on the `mudville.sws` file.
- SiteView will open the Mudville site and reconstruct the saved view.

**Note:** To conserve hard disk space so that you can store large amounts of site information, when you save a workspace with SiteView only the imported data and instructions for recreating the VirtualSite are saved. When you open a site, SiteView recalculates the various surfaces, iso-shells, and other objects that have been specified. SiteView also recreates the lighting, smoothing, and other conditions of the site. On a typical 486-PC, this rebuilding may last for as long as one or two minutes. Be patient. Remind yourself, this is much cheaper than buying a fancy graphics workstation.

## What's in the Mudville workspace

When you open the Mudville workspace, you will see that a number of objects have already been created. The idea is

that you can use these already created features to explore SiteView's environmental visualization capabilities before you need to learn more detailed topics such as how to import raw data or how to create iso-shells and surfaces.

The original Mudville workspace contains, among other things,

- Planimetric maps of the Mudville Airport and environs, lying on top of a 3D bounding box which circumscribes the subsurface space.
- A set of borings shown by their locations and centerlines. Along the length of the borings, triangle symbols show the locations of chemical samples.
- A 3D groundwater plume of chemical concentrations based on downhole samples in the set of borings.
- Groundwater surface.

The various files of data for monitoring wells, stratigraphy, and other information about the site will be used later in this manual to illustrate importing new data and creating new site features.

## 3D Views

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The principal way most people want to view their data is in full three dimensions. In SiteView, this is called the 3D view. When you opened the Mudville workspace, a single 3D view was present. You can create a new 3D view of your workspace by selecting New 3D View from the Window menu. Within the hardware limits of your computer, there is no limitation to the number of simultaneous views you can have of your workspace.

**Note:** Because all of the views by necessity share the same set of colors that Windows supports, usually only the active window has the correct colors you have chosen from the object properties dialog box. The inactive views often do not keep their correct colors when another window has been made active. For the time being, this is a system limitation and there is little SiteView can do about it.



## **Viewpoint**

A 3D view allows to see your data in three dimensions. Depending on where in space the observer is, this picture will appear differently. You can “look down” on your site from above, “look up” from below, or “look across” from some oblique angle. Also, you can look at the site from different azimuth directions. You control the point in space from which you see the workspace by using the Viewpoint... window which is found under the View menu. The Viewpoint... window allows you to set or increment the azimuth, inclination, and perspective of a view. It allows you to move the observation point in to (closer) or out of (further away from) the site.

### **Bounding box**

The Bounding Box... command found within the Options... window under the View menu allows you to put a box around your site. You can change the color and size of this box, and mark its edges with scales. Most people find it easier to perceive three dimensional objects rendered on the monitor screen when a bounding box surrounds the image.

The command Fit Bbox Around Selection makes the bounding box just circumscribe the selected objects. If all objects are selected, Fit To Selection puts a box around the entire site. If only a few objects are selected, Fit To Selection can be used to highlight those objects.

Clip View causes SiteView to trim the image at the faces of the box. This allows you to isolate one part of the site and “cut away” everything outside the box which surrounds it.

### **Rotate**

You can rotate the site clockwise away from the observer or counter-clockwise toward the observer using the up and down arrow buttons on the Viewpoint... window. These same buttons appear on the tool bar at the top of the view. Each time you click on one of these buttons, SiteView rotates the image by the increment shown on the Viewpoint... window. You can change this angular increment by typing over the number in the window between the arrows.

Similarly, you can rotate the site to the left or right by clicking on the left and right arrows either on the Viewpoint... window or on the toolbar. SiteView rotates the view by the increment shown on the Viewpoint... window.

### **Moving in and out**

You can move the viewpoint in toward or out away from the site objects using the In/Out buttons. Moving the viewpoint in toward the site has the effect of moving the observer closer toward the image, and finally inside the set of objects that make up the workspace. Moving out has the opposite effect. In/out is the same as “walking through the site,” as is often done in architectural graphics.

**Note:** Moving the viewpoint in and out is not equivalent to zooming-in and zooming-out of the view. Zooming magnifies the image on the screen ( that is, blows up a part of the picture so that all the features are larger); it does not change the angles of view among the elements of the picture. Moving in or out changes the relative angles of different site objects within the view.

### **Zoom, pan, and scaling to fit**

You can zoom in on (magnify) or out of the site display in any view.

#### **Zoom**

To enlarge (zoom in on) a view:

- Choose the Zoom tool in the window pallet (magnifying glass).
- Click-left in the area that you’d like in the center of the display. The view is redrawn, magnified at 1.2 times the original.
- Or, drag-left and pull the pointer to create a rectangle around an area. Release the button and the view is redrawn so that the area in the rectangle fills the window.

To reduce (zoom out of) a view:

- Choose the Zoom tool.

- Control-click-left in the area that you'd like in the center of the display. The view is redrawn, reduced 1.2 times the original.
- Or, control-drag-left and pull the pointer to create a rectangle around an area. Release the button and the view is redrawn so that the site display is reduced to the size of the rectangle.

### **Pan**

You can move the site display in a window using the Pan tool or using the Center on Selection command under the View menu. To move the site display with the Pan tool:

- Choose the Pan tool (the hand).
- Drag-left on the desired location; as you drag the mouse, a line appears.
- Drag the pointer to a new location, the line is drawn from the original to the new location.
- Release the button and the display moves toward the new location.

To center the site display on the current selection: Choose the Center on Selection command from the View menu.

### **Scaling to fit**

You can display the entire site so it all appears in the Plan view window. To resize the site to fill the window: Choose the Scale to Fit All command from the View menu. The site display is resized so it appears in the window completely.

You can display the site so all the currently selected objects appear in the Plan view window. To resize the site to display all currently selected objects: Choose the Scale to Fit Selection command from the View menu. The site display is resized so the objects appear in the window completely.

You can adjust the display of the site in the window by zooming in or out on the site, sizing the site to fit the window, or moving the site within the window.

## **Lighting**

3D views with iso-shells and surfaces can be lighted to enhance the degree of discrimination you perceive in visualizing a site. SiteView can apply a light source at any

direction and in any color, and can smooth the reflectance of shells and surfaces in a variety of ways.

### **Light direction**

You can set the direction toward which the light source strikes the images by clicking on the respective button in the lighting window. Clicking on North means that the light shines toward the north, and so forth. The positive y-axis points north; the positive x-axis points east. U, C, and D mean that the light shines from the top (upper), center, or bottom (down) direction.

### **Light color**

The Light Color selection allow you to change the color of the light that illuminates the image. SiteView provides a set of 30 default colors. You can also select custom colors by clicking on Custom at the end of the list. Colored light has little effect when color ramps are turned on, and have maximum effect when the color ramps are turned off (i.e., index interpolation is turned off) and the surface edge color is set to a neutral value such as white or light gray.

### **Lighting algorithm**

SiteView provides three lighting algorithms:

- Flat--reflects light at the angle of incidence off each planar facet of the surface.
- Gouraud--linearly smoothes the reflectance of the light off the facets of the surface.
- Phong--Non-linearly smoothes the reflectance of the light off the facets of the surface.

Flat lighting calculates faster than Gouraud or Phong lighting, but shows the edges of the surface facets more readily. Phone lighting provides the most smoothing, but takes the longest to calculate.

## **Plan views or “maps”**

SiteView uses a 3D view of your site data. To see a plan view similar to a standard map or GIS picture, you can set the Viewpoint to look down on the site (Top Down View), turn off Perspective, and turn off hidden surfaces in the View menu, Options... window. This give you a Planimetric map of the site, and also allows you to render 3D iso-shells

or surfaces in the same picture. In the plan view, Send to Front and Send to Back change the drawing order of objects at the site to enhance the view you want to achieve.

## Fence diagrams

A fence diagram is a projected view of stratigraphic panels in three-dimensions. SiteView supports arbitrary fence diagrams passing through borings, wells, or other vertical sets of stratigraphic data. Fence diagrams can be cross-cutting (e.g., a figure-eight section line), multiplicative (i.e., more than one sequence of borings), and can intersect iso-shells. You can use colors and/or stipples categorized by geological material type to represent the different strata in a fence diagram, and can make fences opaque or transparent to illustrate the attribute levels in an iso-shell figure.

To create a Fence Diagram:

- Select the borings or the section line for which you want to make a Fence Diagram.
- Choose Create..., Section Line from the Edit menu.

To change the way a fence diagram looks, choose Selection Properties... from the Edit menu, and change the properties of interest.

## Working with fence diagrams

A Fence Diagram provides an oblique, three-dimensional view of the site.

You can manipulate the Fence Diagram in the same ways you manipulate any other 3D view. For example you can:

- Change the area of the Fence Diagram display by zooming in and out, panning, centering on the selection, scaling to fit the entire Fence Diagram, or scaling to fit the current selection within the Fence Diagram.
- Create annotations within the Fence Diagram.
- Change the appearance of individual site objects displayed within the Fence Diagram..

## Working with multiple views

You can create multiple SiteView views and display them simultaneously. For example, you can display different parts of a site in two separate views. You can display a plan surface in one 3D view, and examine the same attribute with a profile surface in a Fence Diagram, and see iso-shells in another 3D view all simultaneously.

As before, Windows allows SiteView to use only a single color ramp. Usually, only the active window has the “true” colors that you selected. Inactive windows may have colors that change when the window is made inactive. When the window is again made active, the “true” colors reappear. This is a limitation of the PC hardware and operating system and cannot be avoided.

## Chapter 3

# Objects and Attributes

Working with objects is the fundamental way of manipulating data in SiteView. This chapter describes how objects are organized and used by SiteView; it describes

- objects and object classes,
- attributes and attribute values,
- data types, and
- samples and sources.

## Objects and Classes

Objects are organized groups of data values that are the basis of all data management, analysis, and visualization in SiteView. Classes organize the data associated with an object. Classes can be thought of as a template for objects. The objects themselves are instances of a class, created from these templates. Classes and objects consist of groups of attributes which organize the data values. In an object, at least some values for the attributes are filled in.

The following table gives examples of classes and objects.

<b><i>Class</i></b>	<b><i>Objects</i></b>
<i>Boring</i>	<i>B1, B5, B3</i>
<i>Surface</i>	<i>terrain, groundwater level</i>
<i>Sample</i>	<i>sample SO-4, SO-3, Sample-2</i>

There are two kinds of classes in SiteView:

- default classes in SiteView are defined in the object dictionary and can be grouped into subclasses by the naming convention you use.
- derived classes are special classes SiteView creates for such things as surfaces, iso-shells, and DXF layers.

Some classes have special meaning in SiteView and are used to create the various views or new objects of derived classes. SiteView looks for specific attributes in the objects created from these classes to find the values from which to compute views or derived objects. For example, to create Profile views and Fence Diagrams, SiteView looks for the material attribute in a stratigraphy sample object which is associated with a boring.

## **Attributes and Attribute Values**

Classes and the objects defined by them contain attributes. Attributes hold the object's data values; attributes have names and data types. Attribute names allow you to refer to specific attributes. In an object created from a class template, attributes can be filled with data values that correspond to their attribute's data type. These values are called attribute values.

The following table gives a few examples of attributes and their data type.

<i>Attribute Name</i>	<i>Data Type/Description</i>
<i>Source</i>	<i>References to boring or sample location.</i>
<i>Elevation x</i>	<i>Floating point number</i>
<i>Comments</i>	<i>String. Allows users to associate text with an object.</i>

The following table shows the attributes for the Boring Class and the attribute values for a specific boring, named B-100.

<i>Class Attributes</i>	<i>Attribute Values</i>
<i>Name</i>	<i>B-100</i>
<i>X</i>	<i>22620 ft</i>
<i>Y</i>	<i>36280 ft</i>
<i>Z</i>	<i>603 ft</i>

If you created a new boring object, you would specify values for the same attributes.

## **Data Types and Units**

Data types determine the valid values for a attribute. SiteView supports the following data types:

- integer



- floating point
- string

Valid values for strings are any sequence of alphanumeric characters. For integers and floating point numbers valid values are numeric quantities. SiteView does not associate units with the data types. Examples of string, integer, and floating point values are shown below.

Data Type	Valid Values
<i>String</i>	<i>ABCDEF</i> <i>Cadmium Surface</i> <i>Boring log</i>
<i>Integer</i>	<i>12345</i> <i>-37</i>
<i>Floating Point</i>	<i>+0.5</i> <i>+.576</i> <i>-1.3 e 2</i>

SiteView recognizes not-specified (blank) as a valid value for all types. Not-specified values have meaning during data import and are otherwise ignored. Importing a specified value into a attribute which was previously not-specified overwrites the attribute value; otherwise a conflict is reported. Blanks indicate a value is not-specified for import.

## **Sources, samples, and measurements**

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Objects can be

- ¥ sources
- ¥ samples, or
- ¥ measurements.

Sources are the spatially referenced objects or locations such as borings at which samples and measurements have been taken. Samples are the spatially referenced objects such as a soil sample or groundwater sample which observations have been made. Measurements are the non-spatially referenced pairs of measurement-type and measurement-result which constitute the analytical result of sampling. For example, one related set of source, sample, measurement could be:

Source: Boring B-1, x=1000, y=1521, z=345

Sample: Water sample at depth 10 feet

Measurement: pH, 7.2

The relationship of source to sample and of sample to measurement are parametric ones in which some of the sample's attribute values are determined in relationship to its source, and some of the measurement's attribute values are determined in relationship to its sample.

In the example above, a water sample with a boring as its source has an associated pH measurement of 7.2. The soil sample has a "depth" attribute of 10 feet which describes its distance down hole relative to the top of the boring. The sample also has an elevation attribute Z that is parametrically determined from the top of the boring elevation and the sample depth:  $z(\text{sample}) = z(\text{boring}) - \text{depth}(\text{sample}) = 345 - 10 = 245$ . The x and y locations of the sample are directly inherited from those of the boring. The measurement of pH has x, y, and z locations that are inherited from those of the sample, so that  $x=1000$ ,  $y=1521$ , and  $z=245$ .

The connections between sample objects and source objects and between measurement and sample objects are created during import by specifying the name of the source object in the sample data or the name of the sample object in the measurement data. If a sample object is imported before its source object, or the measurement before the sample object, the data will reside within SiteView's data set but the object will not be able to be visualized. Once the source object is imported, the sample can inherit data from it, and consequently be shown in spatial views. Similarly for the sample and measurement.

## **Water level samples**

Water levels are a particular class of sample in SiteView. Water level samples have five attributes: Name, Source, Depth, Water Elevation. The depth is the depth at which the measurements was made. Water Elevation is the piezometric potential of the water measurement value, expressed as elevation head. Graphically, water level samples show the piezometric potential as an inverted triangle along the boring or well depth.

## **Coordinate Systems**

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Survey data and other site objects specify their position with respect to a coordinate system. SiteView uses a reference coordinate system that it constructs from the xyz values of objects you import or create. The data you import or manually enter into SiteView must have consistent coordinate values. SiteView is not a cartographic system and does not internally support coordinate transformation. However, objects in SiteView can be translated, scaled, and rotated with the pallet tools and mouse.

## Chapter 4

# Creating, Importing, and Viewing Objects

You can create, edit, and delete objects using commands from the File and Edit menus. This chapter describes how to

- create new objects by importing data from spreadsheets,
- delete objects already in the VirtualSite,
- import CAD layers from DXF files,
- create derived objects, and
- move objects.

## Creating objects

There are several ways of creating objects in SiteView. You can

- create points, polylines, squares, and polygons with the palette tools,
- import objects from a spreadsheet,
- create derived objects using the CreateÉ commands, and
- import layers from a DXF file.

This section describes how to create and import basic objects. Later chapters describe how to create derived objects, and how to import stratigraphic data.

## Creating objects with palette tools

You can create points, surface points, polylines, and polygons using the Palette tools.

## Creating points

To create a point:

1. Click on the Point tool along the left hand side of any view.
2. Click on a location in the view, and a point is created.

**Note**, SiteView attempts to interpret all three x,y, and z coordinates of the point. However, because any spot on the 2D monitor window corresponds to an infinite number of collinear points in the 3D VirtualSite, SiteView needs to make assumptions about where the new point is to be located. It does so by fitting a plane perpendicular to the line of view at the mid-point of the current selection, and placing the newly defined point on that plane. This may not be the point in xyz space that you have in mind. SiteView shows the point coordinates in the selection box at the top of the view. If these coordinates are not what you want, you can move the newly created point using the Move tool.

## Creating polylines, polygons, and squares

To create a polyline or polygon:

- Click on the Polygon tool.
- Click-left on the appropriate locations in the diagram to create vertices. You can click-right to remove the last vertex.
- Control-click-left, or close the polygon, to finish drawing the object.

Again, the note above applies to the xyz coordinates that SiteView interprets from your graphical input.

## Creating Derived Objects

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SiteView creates three types of geometric objects that it derives from other objects and attribute data:

- ¥ Iso-Shells of 3D data fields in xyz,
  - Attribute surfaces over x,y space, and
- ¥ Section lines for fence diagrams.

Objects of each of these classes are based on other data in the VirtualSite, and they may not be imported.

Iso-shells of 3D data fields are mathematical representations of the relationships between a chosen attribute value and the xyz locations of those values in space. An iso-shell is the locus of points of constant

attribute value in 3D space. Examples of iso-shells are the threshold value of a groundwater contaminant plume having come from downhole samples, or a specified value of pollutant concentration in the air having come from the results of an air dispersion calculation. Details on creating iso-shells are found in the chapter entitled, "Iso-Shells."

Surfaces are mathematical representations of the relationship between a chosen attribute value and the x,y locations of those values in space. Examples of surfaces are terrain elevation, depth to groundwater, and concentration of some chemical contaminant on the ground surface. Details on creating surfaces are found in the chapter entitled, "Surfaces."

Section lines are the polylines on the ground surface connecting borings that are used in constructing a geologic profile or fence (i.e., traverse lines). A section line shows the cutting (poly-)plane used to display geology in a fence diagram. Details on section lines are found in the chapter entitled, "Stratigraphy."

## **Deleting Objects**

---

To delete an object or group of objects:

- Make sure the object or group is the first element on the stack.
- Choose the Delete command from the Edit menu. A dialog box appears asking you to confirm the Delete operation.
- Choose the Yes button to delete the object or group.

**Note:** Deleting an object is permanent. You may not undelete once the operation has been executed. If you only want to hide an object from view but not delete it, select the object or group in question and choose Hide from the Edit menu.

## **Moving Objects**

---

You can move or adjust the location or scale of objects in the VirtualSite using a set of pallet tools. These include the move tool, horizontal scale tool, vertical scale tool, and rotation tool.

## Move tool

You can move selected objects on the Plan view with the Move tool. To move an object:

1. Click on the Move tool.
2. Select an object by clicking left on it.
3. Drag-right the object to the new location.

The next time you select that object, its location coordinates will reflect the move.

## Horizontal scale tool

The Horizontal scale selection tool allows you to change the horizontal scale of an object or group. Clicking-left on the object selects, control-left adjusts the selection, and dragging-right changes the horizontal (xy) scale of the object. Dragging to the left makes the horizontal extent of the object smaller, dragging to the right makes the horizontal extent larger.

The Restore Position command under the Edit menu allows you to restore the original scale and position if no other action has been executed since the change scale.

## Vertical scale tool

The Vertical scale selection tool allows you to change the vertical scale of an object or group. Clicking-left on the object selects, control-left adjusts the selection, and dragging-right in the up/down direction changes the vertical scale of the object. Dragging toward the top makes the vertical exaggeration of the object larger, dragging toward the bottom makes the vertical exaggeration smaller.

The Restore Position command under the Edit menu allows you to restore the original scale and position.

## Rotation tool

The Rotation tool allows you to rotate the angular position of a selected object or group. Clicking-left on the object selects, control-left adjusts the selection, and dragging-right changes the angular position of the object. Dragging to the left rotates the object counter-clockwise, dragging to the right rotates the object clockwise.

The Restore Position command under the Edit menu allows you to restore the original scale and position.

## Importing from a spreadsheet

---

SiteView allows you to integrate different types of data from various sources into a single VirtualSite. You can import site data from spreadsheets, databases, or other applications by storing your data in a tab-separated-value (.tsv) array file. The order in which attributes appear in the array is unimportant. SiteView allows you to map the relationship between incoming data columns or rows and corresponding SiteView objects or attributes.

After importing, the data become VirtualSite objects. You can then use SiteView's features to manipulate, analyze, and visualize your site data.

The data you import from spreadsheets describes site objects and their attribute values. For example, the following spreadsheet data describe three monitoring wells in the VirtualSite: MW-3, MW-3A, and MW-4.

*Monitoring Wells*

<i>X</i>	<i>Y</i>	<i>Z</i>	<i>Name</i>
7850	10200	233.03	MW-3
7530	10350	193.18	MW-3A
7300	10275	190.29	MW-4

For each object you import from the spreadsheet, SiteView creates a temporary object, then searches the VirtualSite for a previously existing object with the same name. If SiteView finds such an object, it merges the newly imported attribute values into the existing object's attribute values. If SiteView does not find such an existing object, it creates a new object using the attribute values (including the value of the Name attribute) you provided on the spreadsheet.

**Not:** You need not include the Name attribute for all site objects imported from the spreadsheet. SiteView checks for an existing object only if you do provide a name for the incoming object.

When you import one or more samples from the spreadsheet, you can include for each sample the name of the associated source object, thereby establishing the relationship between the imported sample and its source.



(Recall that each source can have many samples, but that each sample has at most one source.)

For example, the following spreadsheet data are chemistry samples related to the three monitoring wells.

<i>Sample</i>	<i>Source</i>	<i>Depth</i>
A	B-1	10
B	B-1	20

The following spreadsheet data are the analyte measurements made in the three chemistry samples.

<i>Measurement</i>	<i>Sample</i>	<i>Value</i>
METHYLENE CHLORIDE	A	6000
TRANS-1, 2-DICHLOROETHENE	A	6500
TRICHLOROETHENE	A	20000
TETRACHLOROETHENE	A	3000
METHYLENE CHLORIDE	B	6521
TRANS-1, 2-DICHLOROETHENE	B	6043
TRICHLOROETHENE	B	9034
TETRACHLOROETHENE	B	2300
METHYLENE CHLORIDE	C	6100
TRANS-1, 2-DICHLOROETHENE	C	6498
TRICHLOROETHENE	C	21657
TETRACHLOROETHENE	C	3000

You should arrange the data on your spreadsheet so that each row or column of an imported range represents a single site object. Within such a row or column, individual cells represent values for the objects' attributes.

## Preparing Data for Import

Before importing spreadsheet data into SiteView, you should prepare your data according to the following guidelines:

- Group data of similar class together. For example, keep monitoring wells together on the spreadsheet.
- Remember that objects with no associated x-, y-, and z-coordinate data do not appear in views.
- Store your data in an ASCII file that is tab delimited (.tsv).

- Make sure that your data use the same coordinate system as the virtual site into which they are being imported.

## Importing Data

The Import process has the following steps:

1. Specify the .tsv file to import.
2. Specify the import format (columns or rows).
3. Specify the class of object to import in the scrolling list.
4. Map the data layout to the list of attributes.
5. Select ranges of rows to be imported.
6. Click OK or Apply.

### Specifying the File

To begin the import process, choose the Import → Import Spreadsheet command from the File menu. The Import Spreadsheet dialog box appears when you first choose the Import Spreadsheet → command. It allows you to specify the name of the spreadsheet file.

There are two ways of specifying a file in this dialog box:

- ¥ Type the file path in the File Name field.
- ¥ Click on a file in the scrolling list.

After you specify the file name and click on the OK button, the Import Spreadsheet dialog box appears with the data from the file to be imported.

### Specifying the Class of Object

To specify the class of object to import, click on it in the pull-down list of object classes. The list beneath displays the class's attributes and changes according to the object class you select. Note that the class list excludes derived classes such as surfaces, iso-shells, and section lines because you cannot import derived objects.

### Describing the Spreadsheet's Layout

Next, you need to describe the spreadsheet's layout to SiteView. That is, tell SiteView which attributes you are importing and where on the spreadsheet the values of those attributes are located.

Along the top of the data table is a set of blank fields. Each blank field corresponds to a column of data in the table. In each blank field, one of the attribute names listed in the scrolling list will be mapped. This tells SiteView that the data in that column correspond to whatever attribute name is mapped there.

To make the mapping, select the appropriate blank field above a column. Click on the corresponding attribute in the scrolling list to the left. That attribute name will appear in the blank field, and the selection will move to the right. If you want to pass over a column, click on Skip Column.

When you have finished mapping the attributes to data columns, highlight the rows of data that you want to import. Then click OK or Apply and the data will be imported, and new objects will be created in SiteView.

**Note:** Unmapped rows or columns are not imported.

## **Importing from a DXF File**

---

You can import two- and three-dimensional DXF layers as SiteView graphic overlay objects. Graphic objects are represented as overlays on the 3D view; they do not have attributes. SiteView can import the following DXF entity types:

- points,
- lines,
- polylines,
- arcs,
- circles,
- 3-dimensional objects,
- solid (entity),
- blocks/inserts, and
- text (with scale and rotation)

SiteView's import capability does not include the following:

- binary DXF files,
- shape (entity),
- trace (entity),
- extended entity data,
- line attributes (e.g., width, style), and

Because each DXF layer is imported as a static graphic object, the contents of an imported layer cannot be edited or converted to SiteView objects. To ensure maximum performance of SiteView, import as few layers as possible, or hide layers that do not need to be visible all the time. To make this as easy as possible, group in one layer all entities that you want to hide or reveal as a unit.

To import DXF files:

1. Choose the Import DXF command from the Import... command under the File menu. The Import DXF dialog box appears.
2. Specify the path and file name of the DXF file in the Import DXF dialog box and click on the OK button. The Import DXF Layers dialog box appears.
3. Choose layers from the scrolling list.
4. Click on the OK button. SiteView imports the layers as editable graphic objects.

## Chapter 5

# Selecting Objects

Many SiteView operations require single objects, groups of objects, or attribute values as functional arguments. When SiteView operations require this input, SiteView gets the input from whatever is currently selected. The current selection and selection history is a scratch pad for arguments-to and results-from operations.

When you perform an operation that requires input from the selection history, the first element is used. Some operations require more than one input in which case the first, second, third, and so on elements are used.

Operations that require input remove the elements (arguments) from the selection history and place the operation results as the final<sup>N</sup>most recent<sup>N</sup>element(s) in the history. For example, suppose that the selection history contained the elements on the left, below, with a group of 20 groundwater elevation points as the last selection. You can ask SiteView to create a groundwater elevation surface from the 20 points by choosing Create... Surface from the Edit menu. After doing so, the selection history would contain the elements on the right.

<i>List order</i>	<i>Selection history:</i>	<i>Selection history:</i>
-4		Object 1 (1)
-3	Object 1 (1)	Object 2 (1)
-2	Object 2 (1)	Object 3 (1)
-1	Object 3 (1)	Points (20)
0	Points (20)	Surface (1)

This chapter describes how to,

- select objects,
- manipulate groups of objects,
- work with the selection history,

- store objects and groups in registers, and
- query for attribute values.

## Select objects

---

You can select objects by

- graphically selecting in views,
- using the SelectÉ window under the Edit menu,
- or using the Selection HistoryÉ window under the Select... window.

### Selecting objects graphically

You can select objects graphically in any view. To select objects, move the pointer over the object and click-left. You can also select objects by pressing the left mouse button and dragging the pointer to create a rectangle to surround the objects, then release the button and all the objects enclosed by the rectangle are selected.

To adjust a selection, move the pointer over an object and control-click-left. If the object is selected, it becomes unselected; if the object is unselected, it becomes selected. If you already had selected other objects, control-click-left adds or removes the new object from the group.

### SelectÉ window

The SelectÉ window is found under the Edit menu. The SelectÉ dialog window has three boxes within it: a Choose From box at the top, a list of object classes along the left, and a list of individual objects along the right. What you choose in each of these boxes affects what appears in the other boxes.

### Select by class

In the Choose From box you can choose either from

- ¥ All, or
- ¥ Current Selection.

All, means that you are selecting from the entire VirtualSite, and all of the objects and data that have been imported or entered into the site. Current Selection, means

that you are selecting only from those objects that occupy the current selection.

When you choose All, a scrolling list of all object classes that exist in the entire VirtualSite appears in the object list on the left hand side. The respective number of objects of each class is shown in parentheses next to the class name. When you choose Current Selection, the object list contains only those object classes and numbers that exist in the then current selection. You can toggle back and forth between All and Current Selection, and the left hand side list will change.

Clicking on one of the object classes in the left hand side list, and then clicking on OK or on Apply, tells SiteView to select all the objects that are of the class you have just highlighted. You may aggregate different types of objects by adjusting the selection (using control-click-left with the mouse) in the left hand side. Clicking on OK or Apply tells SiteView to select the group of all objects of all the classes that were simultaneously highlighted in the left hand side list.

When you highlight a class of object in the left hand side list, all the individual instances of that object class(es) appear in the scrolling list to the right. Toggling between All and Current Selection in the Choose From box causes the list of individual instances of objects in the right hand side list to change. When you highlight individual objects in the right hand side list, and then click on OK or Apply, SiteView selects the group of individual objects that you have highlighted.

## Select by value

You can also select objects by the values of attributes associated with them. Beneath the scrolling list of object classes and object instances is a query bar entitled, "Where," that allows you to select an attribute to query on and to set a logical query relationship. Clicking Filter causes this query to be executed on whatever set of objects has been chosen in the select class or object scrolling lists.

For example, say that you have selected all measurement objects in the scrolling list at the top of the Selection window. Now set the query attribute to "Name," the logical relation to "=", and the value to "TCE." SiteView will find

all of the measurements of TCE within the group you have selected. Now setting the query attribute to "value," the logical relation to ">," and the value to "100," and SiteView will find the subset of all TCE measurements for which the measured value is greater than 100. In this way you can sequentially query the data in the VirtualSite to find only those objects that you want to analyze or visualize.

## **Selection History**

---

The Selection History button under the Select... window displays an expanded window showing the complete history of selections in the current SiteView session. The current selection is at the bottom of the list, and earlier selections are shown in sequential order moving upward. The Selection History window allows you to retrieve earlier selections, and to perform Boolean operations on those selections (i.e., on groups of objects). Boolean operations are powerful aids in manipulating sets of objects because they allow you to combine and compare groups of objects, and allow you to subselect only the set you want to deal with.

## **Manipulating Groups of Objects**

The Boolean operations that you can execute from the Selection History window are,

- ¥ Union—combining two groups into an aggregate which includes all of the objects in either or both of the groups;
- ¥ Intersection—finding the set of objects which are common to two groups (i.e., the overlap); and
- ¥ Difference—finding the set of objects which are in one group but not in another.

### **Finding the Union of Two Groups**

You can combine the contents of two groups into one group using the Union function from the Selection History window. The following example shows the union of two groups of objects.



**First Element:**

**\*Group (4)\***  
\*Boring B-1\*  
\*Boring B-2\*  
\*Boring B-3\*  
\*SampleSO-3\*

**Second Element:**

**\*Sample (4)\***  
\*SampleSO-3\*  
\*SampleSO-4\*  
\*SampleSO-5\*  
\*SampleSO-6\*

**First Element:**

**\*Group (8)\***  
\*Boring B-1\*  
\*Boring B-2\*  
\*Boring B-3\*  
\*SampleSO-3\*  
\*SampleSO-4\*  
\*SampleSO-5\*  
\*SampleSO-6\*

### Finding the Intersection of Two Groups

You can find the objects that are common to two groups and place them as a single object or group using the Intersection function from the Selection HistoryÉ window. The following example shows the intersection of two groups of objects.

**First Element:**

**\*Group (4)\***  
\*Boring B-1\*  
\*Boring B-2\*  
\*Boring B-3\*  
\*SampleSO-3\*

**Second Element:**

**\*Sample: Soil (4)\***  
\*SampleSO-3\*  
\*SampleSO-4\*  
\*SampleSO-5\*  
\*SampleSO-6\*

**First Element:**

**\*SampleSO-3\***

### Finding the Difference between Two Groups

You can subtract the objects in the first group from those in the second using the Difference function from the Main keypad. The following example shows the difference between two groups of objects.

**First Element:**

**\*Group (4)\***  
\*Boring B-1\*  
\*Boring B-2\*  
\*Boring B-3\*  
\*Sample SO-3\*

**Second Element:**

**\*Sample: Soil (4)\***  
\*Sample SO-3\*  
\*Sample SO-4\*  
\*Sample SO-5\*  
\*Sample SO-6\*

**First Element:**

**\*Sample: Soil(3)\***

*\*Sample SO-4\**

*\*Sample SO-5\**

*\*Sample SO-6\**

## **Separating the Contents of an Group**

You can separate the objects that make up the group by selecting the group of objects, and then from the Edit menu choosing SelectÉ. In the Choose From window elect From Selection, and click on the object class(es) in the left hand list. The group of individual objects constituting the selection is show in the right hand list.

## **Manipulating the Selection History**

The Selection HistoryÉ window allows you to

- ¥ change the order of selection elements,
- ¥ move elements from to the beginning of the stack,
- ¥ duplicate stack elements, and

You can change the stack positions of elements easily. To move an element to the first stack position, display the element in the Selection HistoryÉ scrolling list and click on it. The selected element is moved to the first position; the first element is moved to the second position; the second element to the third position, and so on.

## **Find related**

For any group of objects that you highlight in the scrolling lists of the Select... window, you can find all the related sources, samples, and measurements. The group for which you find related objects can be all of the same object type, or can be a mixed group.

You can find the objects related to a group in the Selection... window, by using the "Find Related" option in the Selection History... window. Highlight in the scrolling lists the group of objects for which you want to find related objects. In the Find Related pull-down window choose the class of related object you want to find. Click on the Apply button to find the related objects.

For example, in the last section you found all the TCE measurements with values greater than 100. To find the

borings those measurements came from, leave those TCE measurements highlighted in the scrolling lists, and choose "borings" in the Find Related window. Click on Apply and the related borings are selected. To find, in turn, all the samples related to these borings—whether of TCE or not—choose "samples" in the Find Related window and click on Apply.

## **Store/recall selection**

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When you use a group, object, or value often, you can store it in a register to use again. Registers are stored stack elements. Using the Store/Recall Selection window, you can perform the following operations:

- ¥ store objects or groups in registers you define on-the-fly,
- ¥ recall objects or groups from registers, and
- ¥ delete a specific stored register.

To open the Store/Recall Selection window, choose the Store/Recall... command from the Edit menu.

To store stack elements in a register, type the name with which you would like to store the first stack element in the Name text line and click the Store button. To recall stored registers, choose the register name to recall by clicking it in the scrolling list or typing it in the Name text line and click the Recall button.

To delete a specific register, choose the register name by clicking it in the scrolling list or typing it in the Name text line and click the Delete button.

## Chapter 6

# Potatoes in space (iso-shells)

SiteView allows you to create and visualize iso-shells of three-dimensional continuous and discrete fields. At ConSolve, we jokingly call these things, "Potatoes in space," because that's what they look like. Some other people call them "Onions" or "Blobs." More prosaic people call them "iso-shells" or "iso-surfaces." You can call them whatever makes you happiest.

A 3D field is a spatial distribution of an attribute or attributes which has a value at every xyz point with some spatial domain of interest. For example, the concentration of TCE within the 3D subsurface underlying a site is a field. So is the NO<sub>x</sub> concentration in the air above the site. Every point in the domain has a concentration value associated with it, although many of these may be zero. An iso-shell of this TCE field is the locus of xyz points at which the concentration of TCE equals some fixed value, for example, 100 ppb.

An iso-shell is the 3D analog of an iso-line (i.e., contour) on an xy-attribute surface in two-dimensions. Just as contour lines can be set at any value, iso-shells can be set at any value. SiteView calls this value an "iso-value." Just as contours form a nested set of closed loops on a 2D map, iso-shells form a nested set of closed boundaries in a 3D visualization. These nested boundaries appear much like the layers of an onion.

Using SiteView, you can start from a set of arbitrarily located measurements points, interpolate a 3D grid of points within an attribute field, and then generate iso-shells of that field at any iso-value. You can slice these iso-shells along planes parallel to your axes, and visualize the results in many ways.

This Chapter discusses the following topics:

- ¥ SiteView's algorithms for creating iso-shells
- ¥ How you can create iso-shells
- ¥ Iso-shell selection properties.

## Iso-shell Modeling

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SiteView creates an iso-shell by starting with a set of attribute measurements located in three-dimensional space. These measurements need not be regularly positioned in xyz. From this set of measurements, SiteView creates a 3D grid and interpolates values of the attribute at all of the grid points, using a set of measurements. Once the gridded values are obtained, SiteView interpolates linearly within each grid cell to fit small planar facets of constant attribute value those data. These small planar facets are connected to build an iso-shell. You can choose the way these shells are visualized by changing their iso-values, there colors, the way light shines on and is reflected from them, where they are sliced, whether they are made to look solid, and in many other ways.

### Data Requirements

To create an iso-shell, SiteView requires a group of attribute measurements located in xyz space. As with any interpolation scheme, there is no minimum number of required measurements, but the more measurements you have, the more accurately the interpolation will reflect site conditions. Typical attributes you may want to interpolate could include,

- ¥ Total volatile organics in soil and groundwater,
- ¥ Mercury concentration in lake waters, or
- ¥ NO<sub>x</sub> concentration in the air.

### Gridding

When you import objects and attribute data into SiteView, they are usually positioned irregularly in space. To regularize the data, SiteView creates a spatial grid of attribute values from the irregular points. A grid is a 3D regularly spaced lattice of points. SiteView creates a uniform grid parallel to the axes of the site. This grid has the same spacing between points in each principal direction.

#### Grid spacing

The default grid generated automatically when you create a new iso-shell has ten (10) grid points in the largest dimension, or 1000 or fewer in total. Depending on the complexity of your data, more grid points may be required to provide a realistic representation of your data. You can change the number of

grid points by adjusting the MaxGridDimension option in the Selection Properties window.

### **Grid location**

It is sometimes convenient to move the principal axes of the grid used to interpolate data to a different region of the site. You can change the location of the window that the grid uses to interpolate within to create iso-shells by using the move tool on the view tool pallet. To move the grid, first orient the viewpoint from which you are looking at the iso-shell to be perpendicular to the plane in which you want the movement to occur. Select the iso-shell, and click on the Move pallet tool. You can move the iso-shell grid by dragging the mouse. When you release the mouse, the grid will be relocated, and the iso-shell will be reinterpolated.

## **Interpolation**

SiteView interpolates attribute data for iso-shells using a gravity weighted sum approach. For the sparse data sets typical of most environmental visualization problems, gravity weighting is generally thought to provide interpolations reasonably similar to other weighted sum algorithms, including Kriging. Gravity interpolation is reasonably fast and does not require user intervention in estimating complex model coefficients.

### **Formulas**

All weighted sum interpolation algorithms are based on an equation of the form:

$$z_0 = \sum_{i=1}^n w_i z_i \quad \text{such that, } 0 \leq w_i \leq 1$$

in which  $z_0$  is the interpolated value of the attribute at some grid point,  $w_i$  is a set of weights corresponding to each of the  $i=1, \dots, n$  measured attribute values, and  $z_i$  is the set of measured values. SiteView uses all of the measurement points for interpolation.

SiteView's gravity interpolation model assigns weights to the measured values in proportion to the inverse of the square of the distance between the measurement location in 3D and the location of the grid point to be interpolated. That is,

$$w_i = \text{constant}/(\text{distance})^2$$

in which distance is the three-dimensional distance between the interpolated grid point  $z_0$  and the measurement point  $z_i$ , and the constant normalizes the sum of weights to be 1.0.

### **Anisotropy**

When SiteView creates a new iso-shell it defaults to isotropic weights. That is, the weight assigned to a measurement in interpolating a grid point depends on the distance from the measurement to the grid point but not on the direction of the distance.

You can add vertical anisotropy to the interpolation by adjusting the Anisotropy factor in the Selection Properties window. Factors greater than zero increase the influence of measurements in the horizontal direction and decrease the influence of measurements in the vertical direction. Factors less than zero increase the influence of measurements in the vertical direction and decrease the influence of measurements in the horizontal direction. Setting the anisotropy factor to the value  $k$  changes the directional influences by an amount proportional to  $2^k$ .

### **Iso-shell construction**

Once SiteView has created a 3D grid of interpolated attribute values, it sequentially looks at each grid cell and finds those whose vertex attribute values bound the current iso-value in the Selection Preferences window. These are the grid cells through which the iso-shell passes.

In each of these grid cells, SiteView linearly interpolates between the grid points and calculates triangular surface patches of constant iso-value. Several such triangular patches may be required in a single grid cell. The group of all such surface patches throughout the gridded domain is connected together into a continuous surface to create the iso-shell. You can see these surface patches by choosing Edges Visible with the Selection Properties window.

When you visualize a shell in a 3D view, you can make the shell appear either solid or hollow. When you slice a solid shell, the plane of the slice shows a continuous interpolation of

attribute value, as if you were slicing a solid object which was colored according to attribute value.

When you slice a hollow shell, the shell appears as a manifold with an empty inside. To see multiple hollow shells at different iso-values, create as many shells as you wish with the same attribute data set, and then give each iso-shell the same Selection Properties, but with different iso-values.

**Note:** The time it takes your computer to paint the screen depends on the number of polygons that it has to render. Adding multiple iso-shells multiplies this number of polygons and causes the computer to take longer to paint a view.

## **Creating iso-shells**

---

An iso-shell is created in SiteView using a four step process:

1. Import the objects and attribute data you want to use to create an iso-shell.
2. Select those objects whose attributes you want to create a shell form.
3. Tell SiteView to create an iso-shell from the selected groups of objects.
4. Use the Selection Properties window to adjust the visual properties of the iso-shell as desired.

### **Import data**

SiteView can create iso-shells from any attribute data. These data are imported into SiteView using normal spreadsheet import. They can be imported either as attributes associated with samples or other objects, or as plain value points. A value point is a measurement that has only (x,y,z,value) information.

### **Select group of objects**

To create an iso-shell, first you must select the group of objects whose attributes you want to use to create the iso-shell. You can select these objects by clicking on them with the mouse, or by using the Select command from the View menu. At this stage you need only select the objects you are



interested in; SiteView will later ask you what attributes you want to use.

## Create iso-shell

Once you have the objects of interest selected, from the Edit menu choose Create and pull-right to see the sub-menu of derived objects that you can create. Choose Iso-shell.

When you choose Iso-shell from the Create sub-menu, a dialog box appears which shows a scrolling list of all the attributes associated with the current selection of objects. From this list, click on the attribute of which you want to create an iso-shell. Then click on OK. SiteView creates an iso-shell of the attribute data using a set of default properties which you can later adjust to suit your tastes.

## Adjust properties

When SiteView creates an iso-shell it uses a set of default parameters for grid size, color ramp, anisotropy, and other properties. Usually, you will want to adjust at least some of these properties to obtain the visualization that you think best reflects true field conditions. You should pay particular attention to grid size and anisotropy as these can have important influence on your final result.

**Note:** When adjusting Selection Properties, it is always a good idea to put your view in Quick mode. Rendering a complex visualization with many features on a PC takes time. Drawing a wire frame figure is much quicker. Therefore, make all the changes you want with the view in quick mode, and then when you want to see a fully rendered version, switch to normal mode.

## Iso-shell properties

### Shell model

This section discusses those Selection Properties which pertain to the way SiteView constructs its mathematical model of a 3D field for constructing iso-shells.

### **Iso-Value**

The iso-value is the value of the 3D attribute field at which you want to visualize the iso-shell. The iso-value is analogous to contour value in an xy-attribute surface model.

### **Max grid dimension**

The maximum grid dimension is the maximum number of grid intervals in any principal direction. SiteView sets the number of grid intervals in the longest principal direction to equal this number and adjusts the number of grid intervals in the other two principal directions accordingly. The amount of time it takes SiteView to numerically interpolate a grid is proportional to the cube of the grid dimension.

### **Anisotropy factor**

In the natural world many processes are inherently anisotropic. That is, their extent or behavior in one principal direction, say one axis in the horizontal plane, is different from their behavior in other directions. This difference is captured by anisotropy in the way SiteView interpolates attribute values on a grid. SiteView accommodates anisotropy between the horizontal plane and the vertical axis using an anisotropy factor. For no anisotropy (i.e., isotropic interpolation) SiteView sets this factor to zero (0). Positive values of the anisotropy factor give increasing importance to horizontal neighbors; negative factors give increasing importance to vertical neighbors.

### **Solid value below**

An iso-shell divides space into two (not necessarily continuous) regions: that region in which attribute values are greater than the iso-value, and that region in which attribute values are less than the iso-value. Toggling-on Solid Value Below causes SiteView to display the region in which the attribute values are less than the iso-value. Toggling-off Solid Value Below causes SiteView to display the region in which the attribute values are greater than the iso-value.

### **Min/Max Planes**

The minimum and maximum planes in each of the x, y, and z directions set the bounds within which SiteView displays an iso-shell. These can be thought of as cutting planes

### **Min/Max Caps**

You can make the shell appear either solid or hollow. When you slice a solid shell, the plane of the slice shows a continuous interpolation of attribute value, as if you were slicing a solid object which was colored according to attribute value. Toggling-on the minimum or maximum cap causes the corresponding cutting plane to show a solid interpolation of attribute value as if the shell were a solid body. Toggling-off causes the corresponding cutting plane to be transparent so the shell appears hollow.

### **Visualization**

This section discusses those Selection Properties of iso-shells which pertain to the way iso-shells can be visualized

#### **Hidden**

Toggling-on Hidden causes the iso-shell not to be seen in the view. Toggling-off causes the iso-shell to show.

#### **Color-Shading**

The various Color-Shading options allow you to change the way the iso-shell coloring is graded to reflect attribute value.

#### Color Map

The Color Map chooser allows you to select one of four color ramps: Standard, gray, rainbow, and cyan/yellow. Standard is a continuous ramp (purple to yellow) which many people find a pleasing and visually compelling gradation for visualizing contaminant distributions. Gray is a continuous gradation (white to black) through the gray tones. Rainbow is a banded ramp of six colors (royal blue, cyan, green, yellow, orange, red) which can be used to show step-wise gradations of attribute value. Cyan-to-Yellow is a two band ramp.

#### Color interpolation

The Color Interpolation option allows you to smooth any of the color maps. For example, choosing color interpolation with the Cyan-to-Yellow color map yields a smooth transition of colors between cyan and yellow.

#### Color shading auto

Color Shading Auto automatically adjusts the minimum and maximum values of a color ramp to be the same as the minimum and maximum attribute values in the attribute field. Toggling-off Color Shading Auto causes SiteView to look for the values in the Color Shading Min and Color Shading Max options.

### Color shading min and max

Color Shading Min and Color Shading Max allow you to fix the minimum and maximum attribute values for the color map in the case where Color Shading Auto is turned off. You can set the minimum and maximum to have any value you want. This provides flexibility to choose exactly which parts of the chosen color ramp you want to use to visualize an iso-shell. SiteView will uniformly grade the color ramp over the interval between the minimum and maximum color shading values.

### Color shading factor

The color shading factor provides a way of compressing or expanding intervals of the color map.

### Index Interpolation

Index Interpolation is a toggle which allows you to choose between color interpolations of an attribute field according to the color map as opposed to a constant coloring of the faces of the iso-shell. When Index Interpolation is turned on, SiteView uses the color map to visualize a shell. When Index Interpolation is turned off, SiteView colors the shell according to the selection under Face Color. Turning Index Interpolation off, and setting the face color to white, allows you to experiment with light colors and reflectivity.

### **Color legend visible**

The Color Legend Visible option allows you to place an automatic color legend on any view. The legend shows whatever color map is chosen, the range of attribute values, and smoothes the color map is Color Interpolation is turned on. The legend can be moved or scaled using the pallet tools. To bring the legend back to its original position and shape, used Reset Position from the Edit menu.

## **Faces, edges, and lines**

This section discusses those Selection Properties of iso-shells which pertain to the ways faces, edges, and lines of shells can be visualized.

### **Color**

The color option provides a color chooser from which you can set the color of the faces, edges, and lines of an iso-shell. The color choose provides 30 assorted colors. At the bottom you can choose a custom pallet of colors. Custom colors can also be added to the standard list from the pallet.

### **Visible**

The Visible toggle allows you to hide or show faces, edges, and lines.

### **Width**

The Width toggle allows you to change the width of faces, edges, and lines. The default is one (1). Higher integers increase edge or line width.

### **Perimeter edges only**

Each surface patch in an iso-shell has an edge and face color. Toggling-on Perimeter Edges Only causes the edges of all the faces except those on the perimeter of the iso-shell to be hidden. Toggling-off Perimeter Edges Only causes the faces of all the edges to be visible.

## Chapter 7

# Surfaces

Surfaces provide an easy means of visualizing large quantities of data; they show the values of attributes as they change based on their location. SiteView allows you to create surfaces in 3D views. Surfaces show the values of attributes as they change with x,y location. They provide an easy means of visualizing large quantities of data and of estimating values at points where no value is known. This chapter describes the methods by which SiteView creates surfaces.

## Surface Modeling

---

The following sections describe how (x,y, attribute)-surfaces are generated. Three steps are necessary to create surfaces:

1. You specify a group of data points or samples (by selecting it) and a dependent variable (in a dialog box).
2. SiteView triangulates the corresponding x,y location data.
3. SiteView creates a continuous surface by piecing together the triangles.
4. To smooth the surface, SiteView interpolates values of the surface on a regular grid, and then contours the interpolated values.

## Data Requirements

To create a plan surface, SiteView requires an group of objects that have both location and attribute data. Location data are x- and y-coordinates that indicate the objects' placement in the xy plane.

Attribute data are the dependent variable values, the data that you'd like to visualize. These data correspond to object attribute values that are numeric, or NS (not specified). Some examples of attributes that contain

attribute data include: z (the elevation or depth of an object), total volatile organics, and the concentration of cadmium.

## Triangulation

After SiteView verifies that its data requirements are met, it creates a triangulated irregular network (TIN) of the location data using the Delaunay triangulation method. That is, SiteView creates nearly-equilateral triangles whose vertices are the location points, such that the circumscribing circle of each triangle contains no other points. Triangles form the basis for the interpolation of attribute data unless the surface is smoothed.

## Interpolation

To create a smooth surface, SiteView interpolates attribute data among the points at which the attributes are known. It does this using Natural Neighbor interpolation. Surfaces are created using Natural Neighbor interpolation on the grid spacing that the user specifies, and then contour lines linearly interpolated on the surfaces.

## Surface display properties

---

You can select surfaces by clicking on them or using the SelectÉ dialog box. When a surface is selected, SiteView displays a polygon surrounding the surface (i.e., the convex hull of the surface defining points).

After surfaces are created and selected, you can change their appearance. SiteView supports the following surface display properties:

- contours are lines along which the dependent values of the surface are equal.
- color-shading helps you visualize the dependent values of a surface by mapping ranges of values to colors and coloring the surface accordingly.

The following sections describe the options you can set in the Selection PropertiesÉ dialog box when displaying surfaces. You can choose more than one style for a surface.

## **Hidden**

Hidden is an on/off setting which shows or hides the surface in its entirety.

## **Contours**

You can arbitrarily set a number of visualizations for contours. These are each separate options within the Selection PropertiesÉ. dialog box.

### **Contours visible**

On/off toggle to make the contours visible in the view.

### **Contour color**

Provides a color chooser from which to select a color for the contours.

### **Contour linear spacing**

Toggles between linear and logarithmic spacing for the contours. Linear calculates contour lines for the base value and any value differing from the base value by a multiple of the interval. For example, if you specify 0 for the Base Value and 5 for the Interval, the first value in the series is 0; the adjacent contours are 5 and -5. Subsequent contours are 10 and -10, 15 and -15, and so on.

Logarithmic calculates contour lines for the base value and any value that equals the base value multiplied by an integer power of the factor. For example, if you specify 1 for the Base Value and 2 for the Factor, the base contour in the series is 1; the adjacent contours are 2 ( $2^1$ ) and 0.5 ( $2^{-1}$ ). Subsequent contours are 4 ( $2^2$ ) and 0.25 ( $2^{-2}$ ), 8 ( $2^3$ ) and 0.125 ( $2^{-3}$ ), and so on.

### **Contour base**

Sets the base attribute value from which contour spacings are calculated.

### **Contour interval**

Sets the numerical interval between contour values.



### **Contour below base**

Yes/no toggle to hide or display contour lines whose values are below the base value.

### **Smooth**

Yes/no toggle allowing you to choose smooth or angular contours. If you choose Yes for smooth contours, SiteView connects the points on the interpolated grid to construct contours. If you choose No, SiteView uses the Delaunay triangulation to construct contours.

### **Contour emphasis**

Yes/no toggle allowing you to emphasize certain contours. Choose Yes, indicate how frequently to color, and choose the emphasis color.

#### Contour emphasis every

Lets you set the frequency of highlighting contours. To emphasize every fifth contour, enter 5 in the field and press on return.

#### Contour emphasis color

Provides a color pallet for selecting the color of the emphasized contour.

#### Contour emphasis width

Lets you set the line width of the emphasized contours. A line width of one (1) is default.

## **Text**

The text options refer to contour labels, their color, frequency, position, and so on.

### **Text visible**

Allows you to choose to label values for all, none, or only color-emphasized contours.

### **Text color**

Provides a color pallet for changing the color of the contour labels.

### **Contour label placement**

Choose where the labels are placed (right, lower-right, bottom, lower-left, left) for each labeled contour. Click pull-down list to choose the location.

### **Contour label frequency**

Allows you to set the spacing of the contour labels.

## **Cells**

Every surface is made up of both of triangular cells which are defined by the Delaunay triangulation of the data points and of grid cells that are generated by SiteView when smoothing a surface. Normally, these cells are not visible in the 3D views, but are part of the underlying mathematics of the surface model. Using the Cell properties you can make the cells visible and change the way they look.

### **Cells visible**

This is a yes/no toggle which makes the cell boundaries visible or invisible.

### **Face color**

Provides a color chooser with which to select the color cell faces.

### **Cell color**

Provides a color pallet with which to color the cell lines.

### **Cell index interpolation**

Yes/no toggle that turns on and off the attribute-driven color shading of the cell lines.

### **Cell quads only**

Yes/no toggle that shows only the square cell elements making up the surface (i.e., hides the diagonal segments).

Quad-cells-only often provides a more visually appealing surface net than the full triangles do. This property is only applicable to smooth surfaces.

## Color-Shading

The color shading options allow you to color a surface with a gradient or color ramp, where the color of the surface at any point corresponds to the interpolated attribute value at that point. For presentation purposes, you may also place a color legend on any view, which shows the scale of the attribute vs. color.

### Color map

Note that you can choose among four color ramps for color shaded surfaces. These are found under the `Color Map` property. The four choices are:

- ¥ StandardÑSmooth ramp, dark blue through red to yellow.
- ¥ GrayÑSmooth ramp, dark through light gray,
- ¥ RainbowÑBanded ramp from ... through ...
- ¥ Cyan to YellowÑStepped ramp, cyan-yellow

### Color interpolation

Turning color interpolation on sometimes creates a much smoother gradation of colors on a surface, but also increases the rendering time.

### Color shading automatic

This is a yes/no toggle which sets the scale of the attribute surface to run from the minimum attribute value in the data set to the maximum attribute value in the data set. If you turn Color Shading Automatic off, then the surface scale is set to run between the Color Shading Minimum and Color Shading Maximum (below).

### Color shading minimum/maximum

These two properties allow you to specify the minimum and maximum values for the color shading. For example, using the standard color ramp, minimum values are drawn in deep purple, maximum in yellow. Dramatic effects can

sometimes be obtained by altering minimum and maximum values.

### **Color shading factor**

The color shading factor is a number between centered on zero that allows you to exaggerate or compress the color ramp. At zero, the color ramp is the default gradient of colors. As the color shading factor becomes larger, the color ramp is shifted toward higher colors; as the color shading factor becomes smaller, the color ramp is shifted toward lighter colors.

### **Color shading index interpolation**

Yes/no toggle that turns on and off the color shading ramp on the surface. Turning index interpolation off makes the surface all the same face color.

### **Legend**

Check the Show Color Legend box if you want the view to include a legend for the surface's color ramp. As you make changes in the surface color ramp, the legend automatically updates to reflect them.

## **Z from attribute**

An x,y-attribute surface forms a mathematical model for the attribute value over space and colors the surface corresponding to the attribute value. The spatial location or elevation of the surface, however, corresponds to the elevation values (z-values) of the objects used to form the surface. Z-from-attribute causes the surface elevation to follow the attribute value, normalized to appear within the bounding box of the surface.

## Chapter 8

# Stratigraphy

This chapter describes how to import geologic information and build stratigraphic representations in SiteView

## Stratigraphic Modeling

SiteView displays site stratigraphy as stratigraphic panels in both 3D and Profile views using data from the borings' stratigraphic samples. Stratigraphy can also be depicted using colored solid models (iso-shells) in 3D views.

In 3D views, stratigraphic panels have a three-dimensional, oblique projections, and thus behave as fence diagrams. Iso-shell solid modeling can also be used in 3D views to give a more visually compelling, if slightly less accurate, depiction of stratigraphy.

## Importing and viewing stratigraphic information

SiteView represents stratigraphic information in borings, monitoring wells, or other downhole observations as a set of from-to samples of material type. To import stratigraphic samples, you should first enter the source, from-value, to-value, and material type in rows or columns of a spreadsheet. You may also name each stratigraphic sample if you wish. Save the information as a .tsv file, and open the file in SiteView by choosing the Import Spreadsheet' command from the File menu.

The stratigraphy samples are represented by from-to boxes along the borings from which they come. These representations have edges, the color and thickness of which can be varied, and faces the background color of which can be varied. On the faces you can show stipple

patterns keyed to the material type represented by the stratigraphy sample.

## **Stratigraphic Modeling**

---

SiteView uses linear stratigraphic modeling to construct stratigraphic panels. SiteView builds a stratigraphic model by matching stratigraphic samples that are of the same material and either are in borings that are adjacent in the section line, or are in non-adjacent borings but that are deeper than the bottoms of all intervening borings.

SiteView uses the following conventions when interpolating stratigraphy in fence diagrams:

- For the stratigraphic modeling of two borings with the same sequence of materials, the top and bottom of each material are joined by straight lines.
- For the stratigraphic modeling of two borings when one boring contains a material that does not exist in the other boring, the material is pinched out half way between the borings.
- For the stratigraphic modeling of three or more borings when the two extreme borings are deeper than an interlying boring and have strata at deeper levels, these deeper strata are interpolated beneath the intervening borings.
- When two borings have materials that are not in the same sequence, SiteView interprets the materials as lenses, and pinches these out half way between the two borings.
- SiteView fills in concave regions beneath a shallow boring if the adjacent deep borings suggest this case.
- SiteView ends a stratum part way between two borings when there is no data to suggest how the stratum is resolved.

## **Fence diagrams in 3D views**

---

In 3D views you can create a fence diagram by

- ¥ selecting the borings through which the fence diagram will run, and
- ¥ choosing Create Section Line from the Create... window of the Edit menu.

This will create a fence diagram which interpolates the stratigraphy among the borings you have selected. In the plan map a new section line is created, whose properties can be modified by using the Selection PropertiesÉ. window.

## **Selection properties**

---

Stratigraphy samples and thus the fence diagrams they are part of have the following adjustable properties in the Selection PropertiesÉ. window.

### **Hidden**

Yes/no toggle that hides or shows the stratigraphy sample.

### **Pixel width**

Allows you to set the width of the stratigraphic sample bounding boxes

### **Edges**

#### **Edges visible**

Yes/no toggle that shows or hides the edges of the stratigraphic sample bounding boxes.

#### **Edge color**

Provides a color chooser for the edge bounding box of the sample.

#### **Edge width**

Allows you to set the width of the edge line.

### **Faces**

#### **Faces visible**

Yes/no toggle that shows or hides the flat faces of the stratigraphic sample bounding boxes.

**Face color**

Provides a color chooser for the background color of the face of the stratigraphy sample

**Face pattern**

Allows you to show or hide the stipple pattern for the stratigraphic sample.

**Transparent**

If face pattern is ON, then transparent makes the background invisible; if face pattern is not ON, then transparent has no affect.

**Pattern color**

Provides a color chooser for the stratigraphic stipple pattern.



## Chapter 9

# Printing

You can print any SiteView view to a color or monochrome printer that is supported by Windows, and you can save a view to file to be later incorporated in a report, slide presentation or some other application.

This chapter describes how to

- ¥ print to a printer and
- ¥ same to file.

## Printing to a Windows supported printer

---

When you print a SiteView view, the printed image is identical to the one displayed on your screen. To print a view to a printer:

1. Choose Page Setup... from the File menu. The Page Setup dialog box appears. Choose the margins you want.
2. Choose Print... from the File menu. The Print dialog box appears.
3. Adjust the options in the Print dialog box as desired, and click OK.

## Printing to file

---

SiteView produces graphics files in a number of common formats when you use the Print to File command. You can use the file with text processing or drawing applications that can import encapsulated PostScript files, to save specific figures that might appear in reports or presentations, or to create a file to be passed to other computers or users.

To create a graphics file of a view, under the File menu choose Print to File... , and specify the file path and graphics format you want in the dialog box. The Print to file option supports the following graphics formats:

- Postscript,
- Encapsulated Postscript,
- CGM,
- HPGL, and
- PICT.

## Chapter 10

# SiteView Classes and Attributes

SiteView provides an object dictionary that contains the definitions of the classes discussed in this chapter. This Chapter describes

- ¥ SiteView classes and attributes, and
- ¥ descriptions of SiteView data types.

SiteView supports the following default object classes--in addition to the iso-shell, surface, and section line derived classes--for handling environmental data.

## Annotation

Annotations are created using the Annotation tool. The following table lists the Annotation class's attributes.

<i>Attribute</i>	<i>Type/Description</i>
Name	String.

## Boring

Boring is based on the Proto Boring class. SiteView allows you to create Fence Diagrams from Boring class objects. The following table lists the Boring class's attributes.

<i>Attribute</i>	<i>Type/Description</i>
Name	String.
X	Distance.
Y	Distance.
Z	Distance.

## **DXF layer**

---

Layers are created when importing or exporting DXF files. The following table lists the Layer class's attributes.

<b>Attribute</b>	<b>Type/Description</b>
Name	String. Each object can have a name.
Source File	String. The DXF file from which the layer comes.
Name in File	String. The name of the layer in the DXF file.

## **Monitoring Well**

---

Monitoring Well is based on the Boring class. SiteView allows you to create Fence Diagrams from Monitoring Well class objects. The following table lists the Monitoring Well class's attributes.

<b>Attribute</b>	<b>Type/Description</b>
Name	String.
X	Distance.
Y	Distance.
Z	Distance.

## **Sample**

---

The following table lists the Sample class's attributes.

<b>Attribute</b>	<b>Type/Description</b>
Name	String. Each object can have a name.
Source	Reference to source object.
X	Distance.
Y	Distance.
Z	Distance.

## **Measurement**

---

The following table lists the Measurement class's attributes. Parametric attributes are noted with *P*; they are attributes whose values are derived by SiteView rather than specified by you.

<b>Attribute</b>	<b>Type/Description</b>
Name	String. Each object can have a name.
Source	Reference to source object.
Attribute	String.

Value                      Float in point number.

## **Stratigraphy Sample**

---

The following table lists the Stratigraphy Sample class attributes. Parametric attributes are noted with ; they are attributes whose values are derived by SiteView rather than specified by you.

<b>Attribute</b>	<b>Type/Description</b>
Name	String. Each object can have a name.
Source	Reference to source object.
From	Distance.
To	Distance.
X	Distance. The stratigraphic sample's x-coordinate is taken from its source.
Y	Distance. The stratigraphic samples y-coordinate is taken from its source.
Z-From	Distance. Z-From is calculated by subtracting the stratigraphic sample's From value from its source's z-coordinate.
Z-To	Distance. Z-To is calculated by subtracting the stratigraphic sample's To value from its source's z-coordinate.
Attribute/ Material	Type/Description

The stratigraphic materials list, for which SiteView associates distinct stipple patterns, includes:

Soil Categories		Rock/Engineering Geology Types	
SC	Clayey sand	Andesite	Hornfels
SM	Silty sand	Anthracite	Lignite
SP	Poorly graded sand	Basalt	Limestone
SW	Well graded sand	Breccia	Marble
GC	Clayey gravel	Chalk	Peat
GM	Silty gravel	Clay	Porphyrite
GP	Poorly graded gravel	Coal	Quartzite
GW	Well graded gravel	Conglomerate	Rhyolite
MH	Inorganic silt of high plasticity	Crystalline Rock	Rock Sand
ML	Inorganic silt of low plasticity	Diorite	Sandstone
CH	Inorganic clay of high plasticity	Dirty Sand	Schist
CL	Inorganic clay of low plasticity	Dolomite	Serpentine
OH	Organic clay of high plasticity	Evaporite	Shale
OL	Organic clay of low plasticity	Felsite	Silt
PT	Peat, muck	Gabbro	Siltstone
		Gneiss	Slate
		Granite	Talc
		Gravel	Till
		Greenstone	

## Value Point

Value Point is an independent Sample. The following table lists the class's attributes.

<b>Attribute</b>	<b>Type/Description</b>
Name	String. Each object can have a name.
X	Distance.
Y	Distance.
Z	Distance.
Sampled Value	Attribute Value

## Water Level

The following table lists the Water Level class's attributes.

<b>Attribute</b>	<b>Type/Description</b>
Name	String. Each object can have a name.
Source	Reference to source object.
X	Distance.

Y  
Z

Distance.  
Distance.

# Index

## 3

3D data fields • 22  
3D field • 36, 41  
3D view • 3, 13, 46, 50, 53, 54  
3D Views • 10

## A

algorithms • 14, 36, 38  
analyte • 3, 8, 26  
Anisotropy • 39, 42  
Annotation • 59  
Attribute • iii, 16, 17, 59  
AutoCAD™ • 2

## B

Blobs • 36  
Boolean • 32  
Boring • 59  
Bounding box • 11

## C

CAD • 8, 21  
Cell color • 50  
Cell index interpolation • 50  
Cell quads only • 50  
Cells • 50  
Cells visible • 50  
CGM • 58  
Classes • iii  
Clip • 11  
Color • 13, 43, 44, 50, 51, 52  
Color interpolation • 43, 51  
Color legend visible • 44  
Color Map • 43, 51  
Color shading auto • 43  
Color shading factor • 44, 51  
Color shading min and max • 43  
Color-Shading • 43, 50  
Contour base • 48  
Contour below base • 48  
Contour color • 48  
Contour emphasis • 49

Contour emphasis color • 49  
Contour emphasis every • 49  
Contour emphasis width • 49  
Contour interval • 48  
Contour label frequency • 50  
Contour label placement • 49  
Contour linear spacing • 48  
Contours • 48  
Contours visible • 48  
Coordinate Systems • 19  
Creating object • iii, 21, 22, 40

## D

Data Requirements • 37, 46  
Data Types • 17  
default classes • 16  
Deleting • 23  
derived classes • 16, 17, 27, 59  
Difference • 32, 33  
DXF • 2, 8, 16, 21, 28, 60

## E

Edge color • 55  
Edge width • 55  
Edges visible • 55  
Encapsulated Postscript • 58

## F

Face color • 50, 55  
Face pattern • 55  
Faces visible • 55  
Fence diagram • 14, 54  
Filter • 31  
Find related • 34  
Flat • 14

## G

Gouraud • 14  
Graphic objects • 28  
graphics file • 57  
gravity interpolation • 38  
Grid spacing • 37

Gridding • 37

## H

hardware • 4, 10, 15  
Hidden • 43, 47, 55  
Horizontal scale tool • 24  
HPGL • 58

## I

Import • 26, 27, 28, 40, 53  
Importing • iii, 18, 21, 24, 26, 28, 53  
install • 4, 5  
Installation • 5  
interpolating stratigraphy • 54  
Interpolation • 38, 43, 44, 47  
Intersection • 32, 33  
iso-shell • iii, 9, 13, 14, 15, 16, 22, 23, 27, 36, 38, 40,  
41, 42, 44, 53  
iso-surfaces • 36  
Iso-Value • 41

## K

keyboard • 6

## L

lattice • 37  
Light color • 13  
Light direction • 13  
Lighting • 13, 14  
logarithmic • 48

## M

Max grid dimension • 41  
measurement • 8, 18, 19, 26, 31, 34, 36, 37, 39, 60  
Microsoft Word • 5  
Min/Max Caps • 42  
Min/Max Planes • 42  
Monitoring Well • 60  
mouse • 6  
Move tool • 22, 23  
Moving in and out • 11  
Moving Objects • 23  
Mudville • 4, 7, 8, 9, 10

## O

Object • iii, 2, 16, 18, 21, 22, 23, 29, 32  
object-oriented • 1  
Onions • 36  
operating system • 4, 15  
overlay • 28

## P

Page Setup • 57  
Palette • 21  
pan • 12  
Pattern color • 56  
Perimeter edges only • 45  
Phong • 14  
PICT • 58  
Pixel width • 55  
Plan view • 14  
Planimetric • 10, 14  
plumes • 3  
Point tool • 22  
Polygon tool • 22  
Postscript • 58  
Potatoes in space • iii, 36  
Preparing Data • 26  
Print to File • 57  
Printing • iii, 57  
properties • 10, 14, 36, 40, 41, 47, 50, 51, 54, 55

## R

*Rock/Engineering Geology Types* • 62  
Rotate • 11  
Rotation tool • 24

## S

sample • 2, 3, 7, 8, 10, 16, 18, 19, 23, 25, 26, 34, 35,  
40, 46, 53, 54, 55, 61  
scaling • 12, 15  
Select... window • 30  
Select by class • 30  
Select by value • 31  
Select objects • 30  
Selecting • iii, 29, 30  
Selection History • iii, 30, 32, 33, 34  
site assessments • 2  
Smooth • 49  
*Soil Categories* • 62  
Solid value below • 42  
Source • 18  
spreadsheet • 2, 21, 24, 25, 26, 27, 40, 53  
Store/recall selection • 35  
Stratigraphic Modeling • 53  
Stratigraphy • iii, 23, 53, 55, 61  
Surfaces • iii, 23, 46, 47

## T

Text • 49  
Text color • 49  
Transparent • 56  
Triangulation • 47

## U

Union • 32



## V

Value Point • 62  
Vertical scale tool • 24  
Viewpoint • 10, 11, 14  
VirtualSite • 1, 2, 9, 21, 22, 23, 24, 25, 30, 31  
visualization • 1, 4, 8, 9, 16, 36, 38, 41

## W

Water level • 19, 62  
weighted sum • 38  
workspace • 8, 9, 10, 11

## Z

Z from attribute • 52  
Zoom • 12