GeoCue

User Guide Version 2020

22 December 2020

Before attempting to install and use GeoCue, please very carefully read the ***GeoCue Installation Guide***. This guide tells you how to install the product suite, how to add GeoCue Client and GeoCue Web users and how to migrate a previously created database. You will not be able to access GeoCue until you have *carefully* followed the steps in the ***Installation*** guide!

The default GeoCue Admin password is “geocueadmin” (case sensitive) unless it has been previously changed.

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Getting Help

This guide is a replacement to all previous GeoCue guides.

Please note that the GeoCue documents are now supplied in separate volumes. The various CuePacs are documented in a separate user guides.

The Command Dispatch System (CDS) is described, from the user's perspective, in this guide. A separate Administrator's Guide is available for advanced management tasks.

Please also note that Environment Builder is separately documented although it is included with all versions of GeoCue Server.

We are sure that you will experience different problems with GeoCue that range from installation issues to defects that made it through our testing undetected. We hope that you will immediately contact us with any problems or questions and have the patience to work with us through a successful GeoCue deployment.

Please contact us via email for assistance with or comments about GeoCue or our various CuePacs.

email:

support@geocue.com

Phone:

1-256-461-8289

Just ask for GeoCue Support and you will get connected with someone who can assist you. There is usually someone in the office between the hours of 0600 and 1800 CDT, USA on weekdays. Weekends are sort of hit or miss.

Fax (always on):

1-256-461-8249

About this Document

Welcome to the GeoCue Release 2020.1 User Guide. Please note that CuePacs are documented in separate user guides.

Throughout this document we use the following conventions to highlight information:

Boxes outlined in ***black*** contain general production information and hints.

NOTE: Figures in this document may not exactly represent the view that you have in the current version of the software. If items in a graphic are not important to the topic being discussed, then that graphic may not have been updated in this release of the User Guide.

Contents

1 Introduction

Process Management is the art of organizing and monitoring a workflow with the goals of improving efficiency and quality while simultaneously reducing production costs. Process management can be performed with tools as simple as pen and paper or as complex as automated systems that control chemical plants. The important thing, of course, is that it is *done*. Like a control system with no feedback loops, production performed without constant monitoring and tweaking generally runs at very low efficiency. In this day of ubiquitous computing, companies who are not implementing rigorous Process Management will have great difficulty in competing with those companies who do constantly improve their processes.

A fundamental belief that we kept in mind in the design of our process management system is that most companies have fairly efficient workflow procedures and tools in place today. Thus an approach of taking on the domain expertise of our customers and asking them to completely retool their approach to production would not make sense. We perceive the major problem not as workflow *definition* but rather managing and controlling the existing workflows. Therefore, our design approach is to build a collection of *framework* tools that can envelope existing workflow procedures and tools with a minimum of perturbation of operations and user training.

The GeoCue Group geospatial process management system (*GeoCue*) is a generic suite of framework tools that are easily tailored to manage a variety of geospatial production scenarios such as LIDAR production, digital orthophoto production, traditional photogrammetric production, digital camera post-processing and etc. In fact, *GeoCue* is applicable to just about any production or task management scenario that follows the paradigm of input of data, dividing the data into production "segments" and then processing the data into products. Here we use the term *products* somewhat loosely since products could simply imply a report. For example, we think *GeoCue* is a viable tool for parceling up a task such as intelligence review of image data among analysts.

<XXX>

Most geospatial processing operations can be managed through geospatial and temporal "slicing." Geospatial slicing involves dividing the project area into manageable subunits that can be parceled out to "production operators." Temporal slicing is the process of dividing the overall workflow into well defined *process steps*. *GeoCue* contains intrinsic capabilities to accommodate both of these aspects of process management.

The obvious view of process management is typically that of *processing* data into a deliverable product. An example of this is ingesting raw LIDAR data, processing these data through a sequence of production steps and then creating some final delivery product such as contour files. One could come up with a similar scenario for orthophoto production, digital feature extraction and other types of geospatial production. However, the same data management issues occur in scenarios that involve only "intellectual" production such as intelligence review of data. Here the task sequencing is quite similar to geospatial production with steps such as preparing the data for inspection, parceling it up among analysts, providing data specific tools for review, including tools to provide management a synoptic view of the current state of the process and so forth.

We strongly believe that the *GeoCue* product family will be a very valuable addition to many organizations who manage medium to large projects that have a combined spatial and temporal nature. As we realized the value of a general data production environment, we began to carefully architect *GeoCue* to allow it to accommodate a wide variety of tasks rather than focusing on our initial technology area of elevation data processing. An example of the result of this focus has been the inclusion of a variety of technologies within *GeoCue* to allow either end-users or systems integrators to field-extend the system.

An additional important element of *GeoCue* is the inclusion of a web viewing and annotation tool. This viewer can be used to allow remote users to obtain a *filtered*, read-only view of the project. By filtered we mean that a *GeoCue* system administrator can establish the elements that will be included in a remote view by criteria such as the user's login identity. In addition to serving the obvious role of allowing trusted users remote view access to projects, it also serves as a tool to allow ultimate end-use customers real time access to the production project. In addition, the web system includes the ability to create 'annotations' related to a project. This is essentially a web-hosted red-lining system that allows a web user to attach comments to *GeoCue* 'entities' as well as assign resolution 'steps'.

While we believe that many users will be able to deploy GeoCue "out-of-the-box" by using GeoCue Group and third party developed application *Environments*, the true value of GeoCue will be realized by tight integration into workflow practices. To facilitate this deep deployment integration, GeoCue is designed as a workflow management *development platform.* As will be described in this document, nearly all functions within GeoCue are implemented within a

GeoCue Repository Services architecture that is accessible via a GeoCue Application Programmer's Interface (API). To enforce this development philosophy, the developers of GeoCue have implemented the GeoCue Client using the GeoCue Repository API. Thus we are truly eating our own cooking!

This document is intended as introduction to the GeoCue process management system as well as the Environments provided by the LIDAR 1 CuePac. However, you are strongly encouraged to play around with GeoCue outside of these examples.

2 An Overview of GeoCue

GeoCue is a run-time configurable geospatial process management system. By run-time configurable, we mean that a user can select a desired production workflow from a pull-down menu within a GeoCue Client and that user's instance of GeoCue will immediately reconfigure to the selected *Environment.* For example, a user may be using an *Orthophoto* production *Environment* for a project area labeled Madison Country. The user may wish to dynamically switch to an *Elevation* modeling environment with the same Madison County project data. The user would effect this change by simply selecting the desired *Environment* from a GeoCue pull-down environment selector menu.

GeoCue is a robust, multiuser client-server system. *Multiuser* means that the GeoCue system includes an extensive set of *entity* locking mechanisms to ensure that when more than one user is working on the same project from different workstations that they do not corrupt one another's data. In addition to providing various locking mechanisms, GeoCue provides graphical feedback of entities that are in use by a Client as well as information about who is using the entity and for what processing task. This means that a production supervisor can immediately view the status of a project and quickly see what each production operator is doing.

Client-Server means that GeoCue is designed as a multi-tier architecture with so-called "thick" clients running on each production desktop but with the actual work occurring in the centrally located GeoCue Server (we often call this the Repository or Repository Services). GeoCue Server uses a conventional database (we currently support both Microsoft SQL Server and Oracle) for the storage of project *metadata* and disk-based files for the storage of large data types such as imagery, elevation data, laser point data and so forth. The storage and management of project data is a critically important aspect of a process management system. Each of these subjects is discussed in relevant chapters of this document.

Customers may be concerned about the reliance of a production system on a central server. However, this is a necessary element of a robust enterprise system for several reasons. The central reason was our desire to have a system that provided instantly accurate views of the status of a project to all users logged into the same project. This requirement is met in GeoCue with an *event driven notification system.* When one user performs an operation such as locking a data entity for editing, an event is sent to all GeoCue clients that are currently logged onto the same project. This event causes the client displays to reflect the locked status of the object.

There are many of these events supported in GeoCue, all using the Repository to notify connected clients. A second and perhaps more compelling reason for our architectural choice is data reliability and security. Hosting data via a Repository gateway allowed us to build GeoCue as a *transaction*-based system. Each data manipulation operation within GeoCue causes a transaction to be performed in the database. This design means that GeoCue Clients do not have a "Save" button since each operation is incrementally saved via transaction processing against the database. An additional benefit of database storage of all operations is the ability of the system to protect data from unauthorized access. Having project metadata stored on open disks at the production workstation makes data security a tough proposition.

An added benefit to our Server-based architecture is the ability to instantly publish project data to Internet hosted browsers via a GeoCue Web Server. This allows customers who deploy GeoCue Web Server to pull their customers into the production loop by providing web based status views of projects as well as a powerful red-lining capability (see the Annotation Subsystem chapter for details).

GeoCue is customized to particular data types and workflow definitions through collections of configuration menus, command tables, data type definitions and so forth that are contained in packages of database tables. These personality *Environments* are loaded interactively by GeoCue users as they move around through various workflows. GeoCue Group will deliver standard packages of workflows in bundles that we call *CuePacs*. Our first commercially released workflow Environment is the LIDAR 1 CuePac, a collection of LIDAR production workflow definitions. We expect to engage third party companies in the development of CuePacs in different disciplines to give GeoCue a very broad application base. Most importantly, GeoCue has been specifically designed to allow end-users to easily define their own production environments.

The top level architecture of the GeoCue system is depicted in Figure 2-1

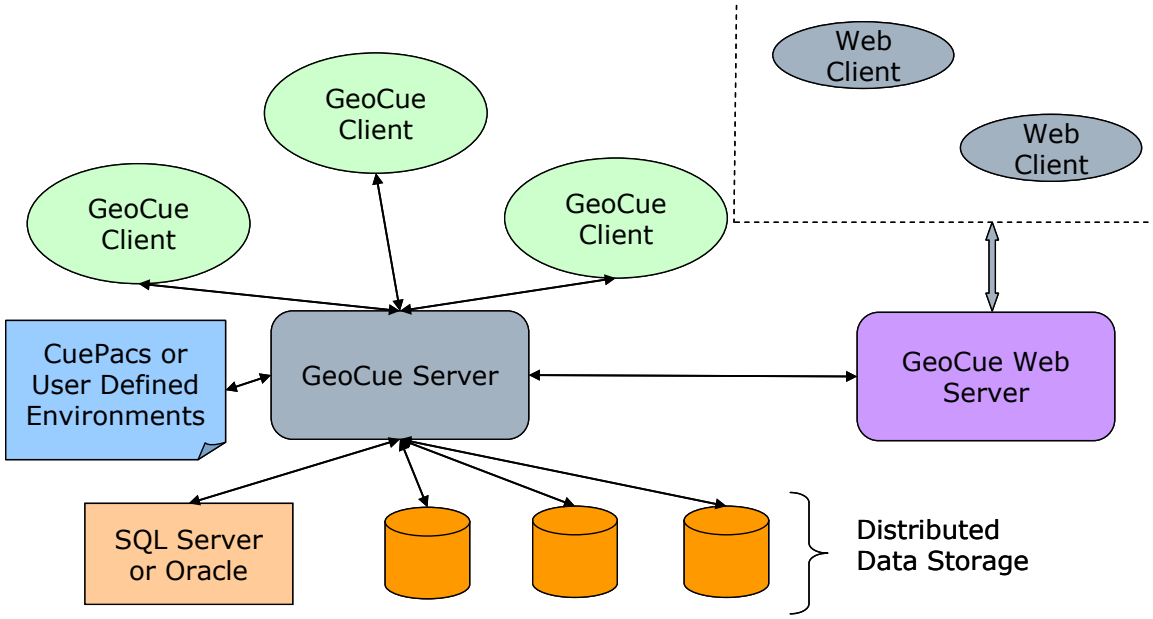


Figure 2-1 GeoCue System Architecture

GeoCue Server is the heart of the system, providing the central control and management functions. GeoCue uses a database for storage of project metadata (data about data), project data and the configuration information that define a workflow environment. High density data such as image and elevation data are stored in flat files anywhere within the network connected file system. GeoCue maintains references to these externally stored data, primarily in *file collection* objects. These file collection objects are also stored within the database and are *dereferenced* when needed by the system. GeoCue can also be configured to store high density data directly in the database although we have found the performance of databases to be inadequate for large projects when configured in this manner. The GeoCue Server and database can be hosted on the same machine or on separate, network connected machines.

GeoCue Client is a graphical view into the GeoCue Server. A copy of GeoCue Client is hosted on each production workstation[1]. The clients provide the graphical view into the project set hosted on the Repository as well as the user interface tools for interacting with the project. All actual project data manipulation routines are encoded within GeoCue Server routines (*Repository Services)* rather than in GeoCue Client code. This design choice was made to allow tools other

[1] GeoCue Corporation licenses GeoCue under both node-locked and floating license models.

than GeoCue Clients to have full access to project management tools via an Application Programmer's Interface into Repository Services. The current version of GeoCue Client uses the MapObjects development kit from ESRI for the map view, coordinate transformations and graphic symbology.

GeoCue Web Server is an optional component of GeoCue that is used to dynamically publish elements of projects for viewing by remote clients connected to a web server either via the Internet or Intranets. GeoCue Web Server is a collection of services hosted within Microsoft's Internet Information Server.

2.1 GeoCue Functions

The GeoCue system provides an extensive set of functions for setting up and managing geospatially oriented processes. The interaction philosophy of GeoCue is that all project work, either managerial or production, is performed from within the graphical view of GeoCue Clients. In the analysis of workflow efficiencies that we have studied and modeled over the past 25 years, we have found the most productive systems to be those in which you can graphically view and manipulate data. The general functions provided by GeoCue include[2]:

- Project Definition
- Project Planning (time, user, etc.)
- Data management
- Metadata manipulation
- Multiuser access and control
- Dispatched/Distributed Processing (Departmental version only)
- Coordinate System transformations and management
- Production control (who does what with which data)

[2] This is just an example list. See the GeoCue help documents for a full listing of the functional areas provided by GeoCue.

- Project status tracking and reporting
- Web-based Project annotation ("red lining")[3]
- Web Viewing

2.2 GeoCue Interface

The GeoCue Client provides the primary interface into the GeoCue system for project planners, project technicians and project managers. This interface is depicted in F**igure 2-2**.

[3] Web functions require the optional GeoCue Web Server.

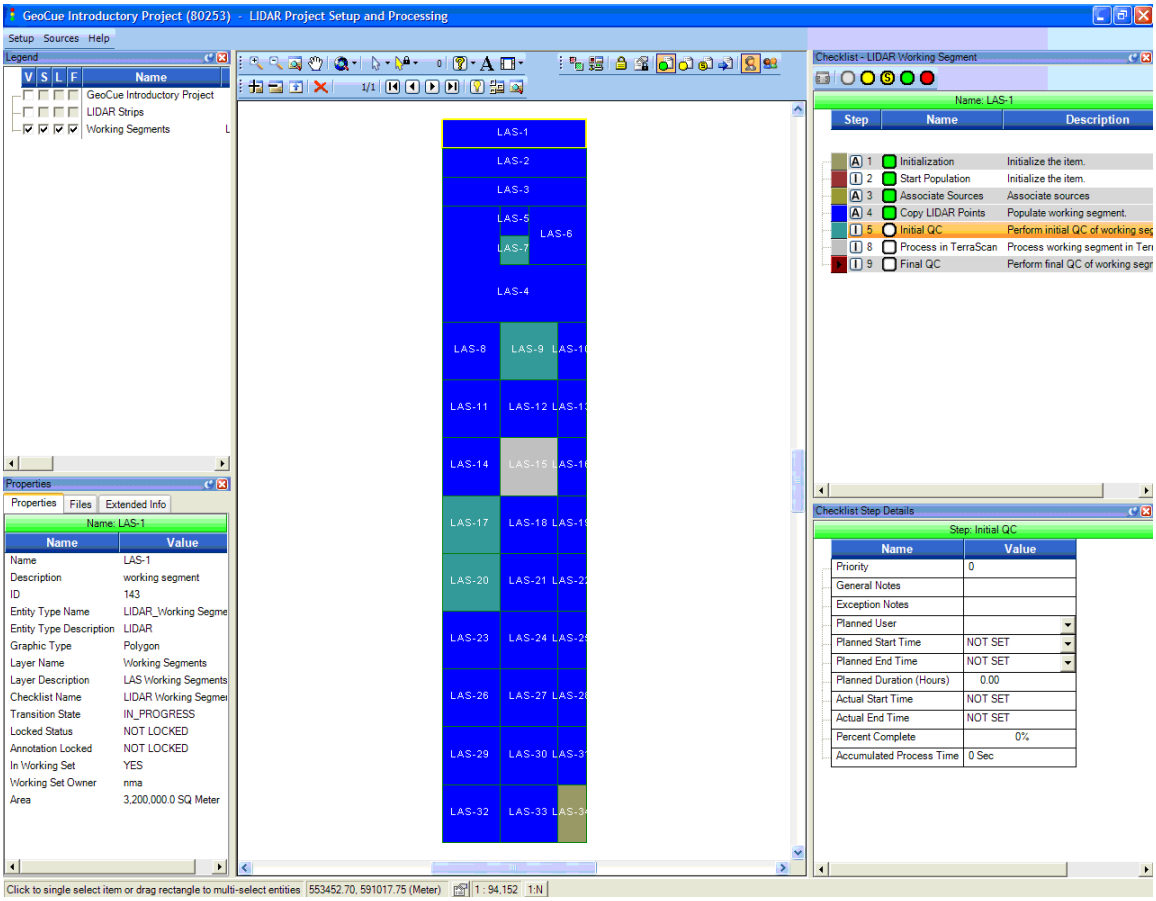


Figure 2-2 GeoCue Interface

The central pane is the "map" view of the project (GeoCue Map View). This view is controlled by the "legend" on the left side of the interface. This legend controls the display of data "layers" within the project. The layers that are available depend on the state of the project (how much data has been read into the project and where, in the processing timeline, the project is currently located) as well as the loaded *Environment*. For example, if the current environment were Orthophoto processing, then a LIDAR source layer would probably not be included in the legend. An example GeoCue legend is depicted in Figure 2-3. The legend allows the user to selectively enable or disable Visibility (V) of the layer, Selectability (S) of the entities that reside on the layer, the display of Labels (L) for entities on the layer and the current production status Fill (F) of entities on the layer.

Layers in GeoCue are assigned a *type.* The layer type is used for several purposes. The first is as a category used by processing environments. For example, a custom executable within GeoCue would know that the *entity* "Project Boundary" will always be located on the layer of type GC_PROJECT. An additional use of layer type is to *filter* the possible entities that can reside on a layer. Each layer within GeoCue has a (potentially different) coordinate system. All entity graphics on a particular layer will be in the coordinate system of that layer. The coordinate system of a layer is defined when the layer is created and is displayed with the legend. GeoCue automatically ensures that the display is correct when layers containing different coordinate systems are mixed within the same project.

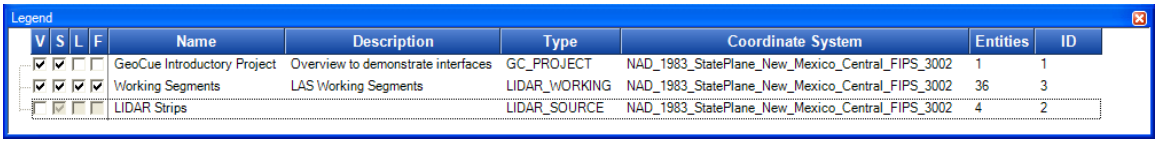


Figure 2-3 GeoCue Legend

GeoCue performs most process and data management tasks through the manipulation of graphical representations of project information. The generic name for a processing element within GeoCue is an *entity.* Entities reside on GeoCue layers. Layers have an associated graphical type which is one of Point, Line, Polygon or Raster. Graphic entities on the same layer therefore have the same graphic type and coordinate system. This imposes no limitation on workflow design since as many layers as are necessary can be added to a project.

Entities have symbology to visually identify both their type and their current production status. An example of symbology is depicted in Figure 2-4.

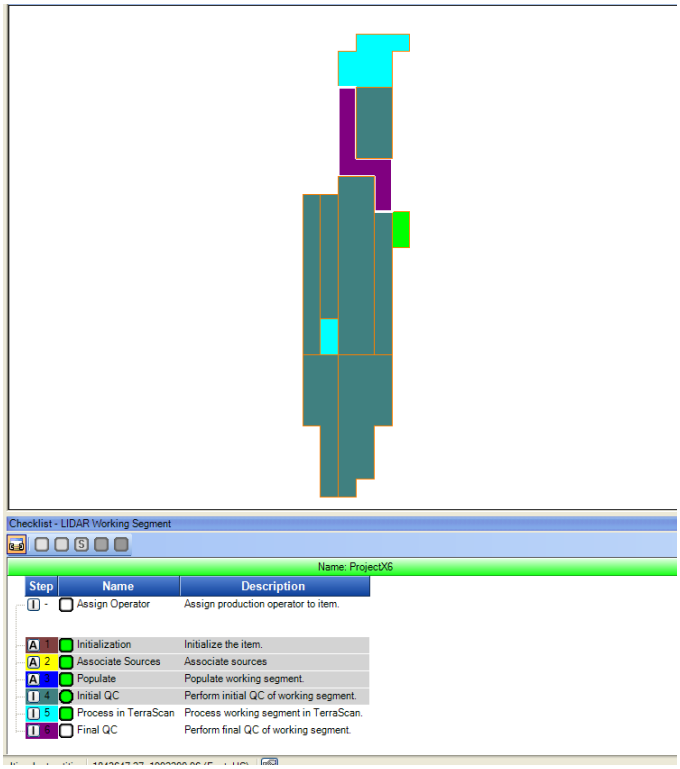


Figure 2-4 Entity Symbology

The outline color of the entities indicates the type (in this example, the type is *LIDAR Working Segment)* and the fill color indicates either the last completed production step or the currently in-progress step (this is user selectable). The color key is shown in the checklist.

The panes on the right are dedicated to project status/tracking and metadata management. The upper right pane contains the processing checklist. In general, every processing entity within GeoCue can have a separate checklist. These checklists form the *Cue* in GeoCue since they provide the prompts to users as to the next production step that is to be performed. Figure 2-5 depicts a close-up of a sample checklist. As is detailed in a later chapter in this document, the checklists actually are the graphical user interface to a *State Machine.* Each step within a checklist can be programmed to fire an executable program and to send a notification message. This interface concept makes it very easy for production operators to carry out production in the correct sequence using the right tools.

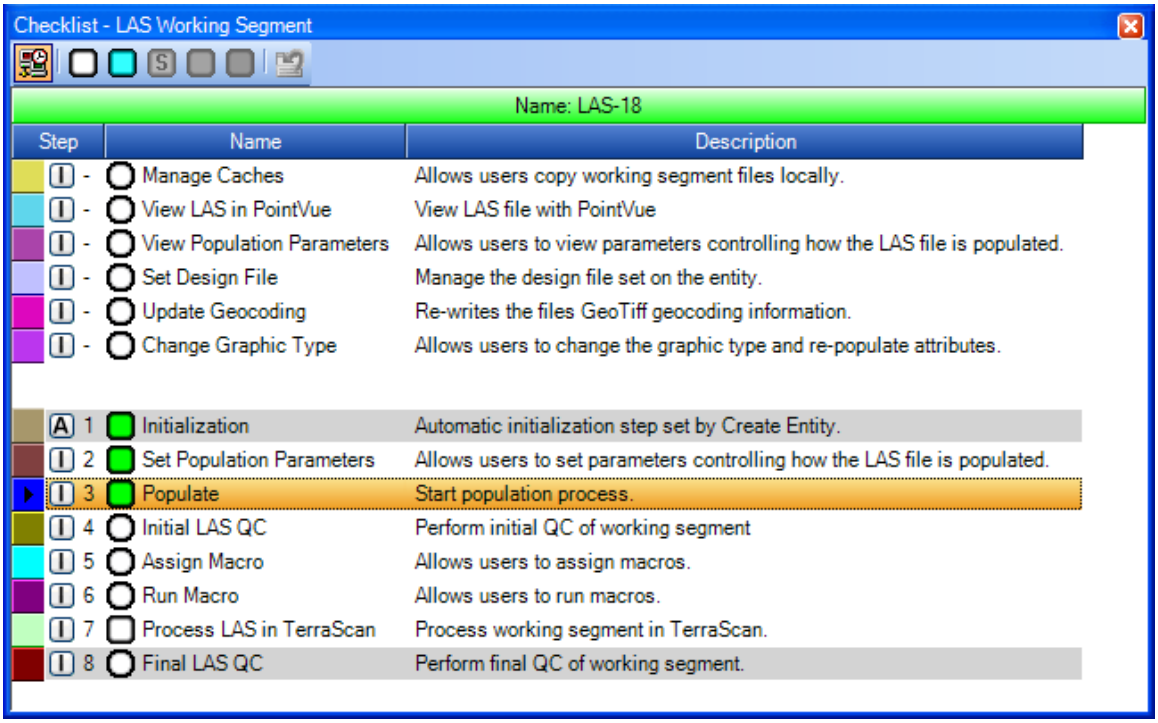


Figure 2-5 Production Checklist

In addition to providing "Cues" as to the next step in production, the checklist also maintains the processing history. This planning and tracking information is maintained for each step in a checklist. The tracking pane is accessible by either selecting a checklist entry and then selecting the "Checklist Step Details" tab or by double clicking a checklist step (if the pane or tab is not present). An example of planning/history tracking is depicted in Figure 2-6.

The project planning information allows the user to set information regarding planned production on a step-by-step basis. This information includes such items as the planned production operator, the start and stop dates/times, the planned actual production time, planning notes and so forth. As the production operator carries out checklist steps, GeoCue automatically records the session information (see the checklist chapter for details).

> ***Note*** –GeoCue allows you to set the planning data for a project via the individual checklist entries and to view the production status in the same way. We recognized the need for bulk loaders and project reports. The optional *Project Manager* **CuePac**

is now available and provides extensive project planning and analysis tools in addition to the standard tools available within the base GeoCue product.

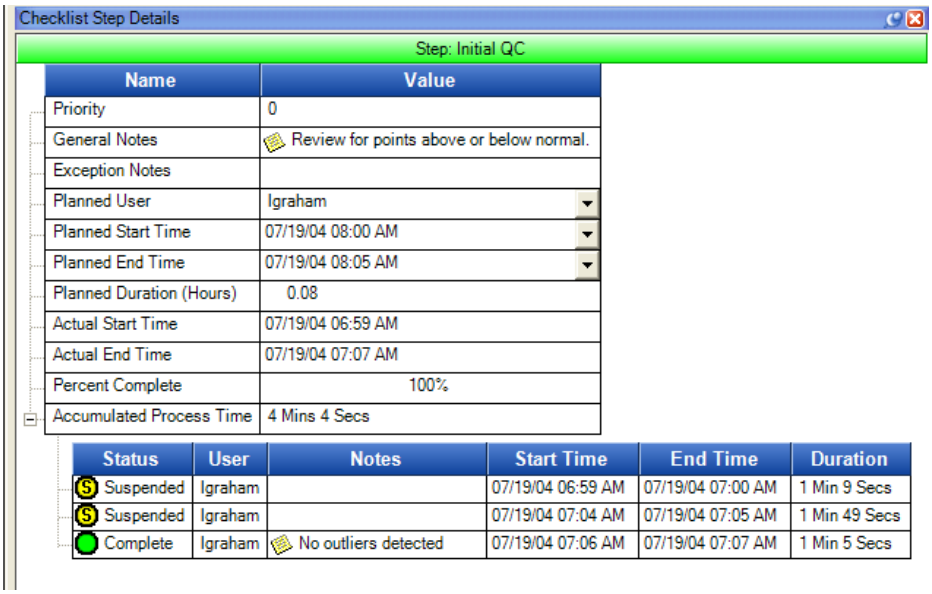


Figure 2-6 Process Step Planning/Tracking

A major design goal in GeoCue is to record actual project statistics as an automatic by-product of production. We feel that this is the most accurate method of collecting actual project data. Thus rather than requiring an operator to fill in production data such as their start and stop times, GeoCue automatically collects this information as production progresses.

The lower right pane of the GeoCue interface is devoted to entity metadata. An example of the metadata values display (the *Properties Pane)* is depicted in Figure 2-7. These data include items such as the type of production entity, the name, general properties, the list of file information for entities that track file-based data and finally a tab that displays any user defined data associated with an object. GeoCue supports the concept of tracking ad-hoc data associated with production. For example, a user may read in control point information as part of a production project. The user may need to add a note to a control point. If the project definition for control points did not include a note field, the user can add a "String" field to the control point and populate this field with the note. GeoCue supports many ad hoc actions of this

nature, making it very flexible in handling the normal workflow perturbations associated with day to day production.

Often the actual processing data that are associated with a production entity are not stored with the entity itself (i.e. in database tables) but rather as files on a disk somewhere in the network in which GeoCue resides. Any entity within GeoCue can track file based data via a *file collection* associated with the entity. An example of file based data is depicted in Figure 2-8, a screen shot of the *files* tab of the property pane.

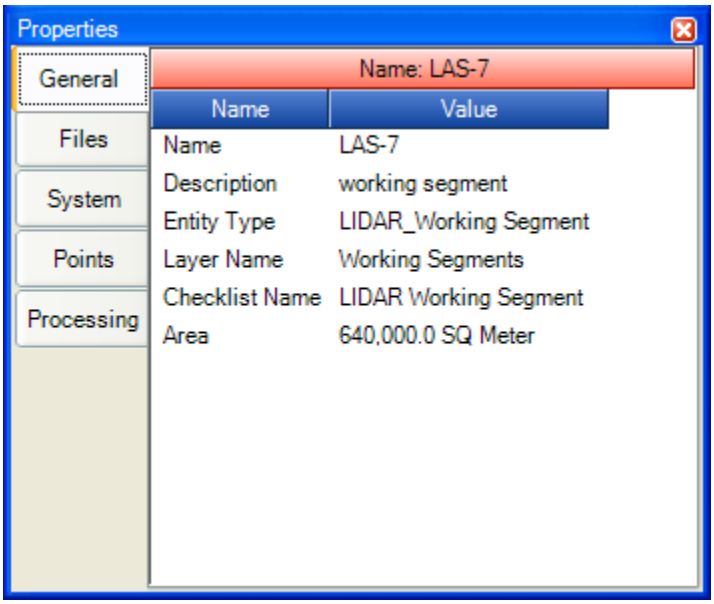


Figure 2-7 Properties Pane

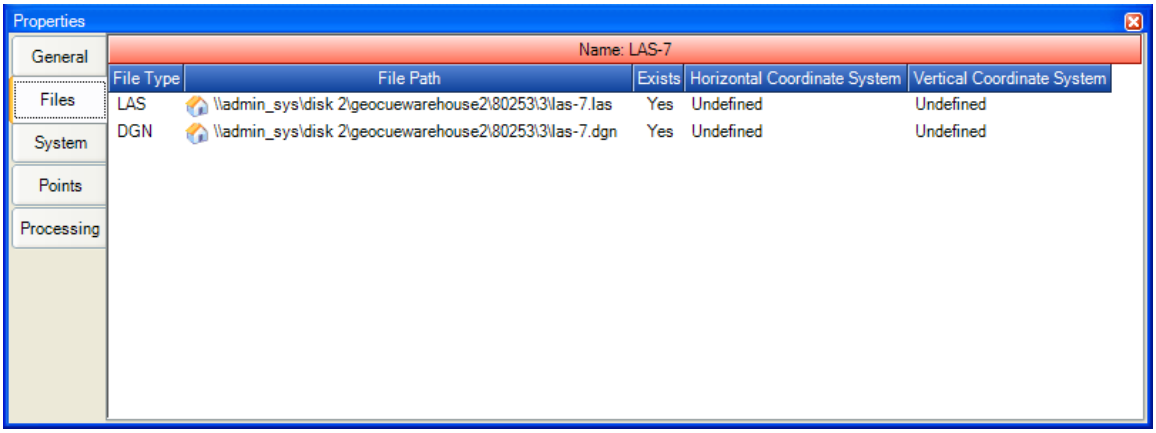


Figure 2-8 File Properties Pane

3 User Manager

GeoCue should already be installed on your machine(s). If not, refer to the GeoCue Installation Guide and install the products. You should see the GeoCue Client icon on your desktop:

Double click this icon to start up the GeoCue Client application (alternatively you can right click the icon and select 'open' from the drop down menu).

If the GeoCue icon does not appear on your desktop then you probably did not select this option during installation. Browse to your GeoCue directory (normally at C:\Program Files\GeoCue\GeoCue Client) and start up GeoCue.exe. You can create a shortcut on your desktop by right-clicking the program name and selecting Create Shortcut.

Note – If a domain user other than the person who did the installation of GeoCue Client on a particular machine intends to use GeoCue on that machine, you must select the option to make GeoCue available to Everyone during the installation process (this is the default setting). If you do not do this, you will receive an error when you invoke GeoCue.

You should see a window as in Figure 3-1 below. Your layout of the various panes may differ depending on how you had these windows arranged the last time you closed the client[4].

NOTE: Effective with Release 5.0, Machine Manager (if you have the Departmental version of GeoCue) has been moved to Dispatch Manager.

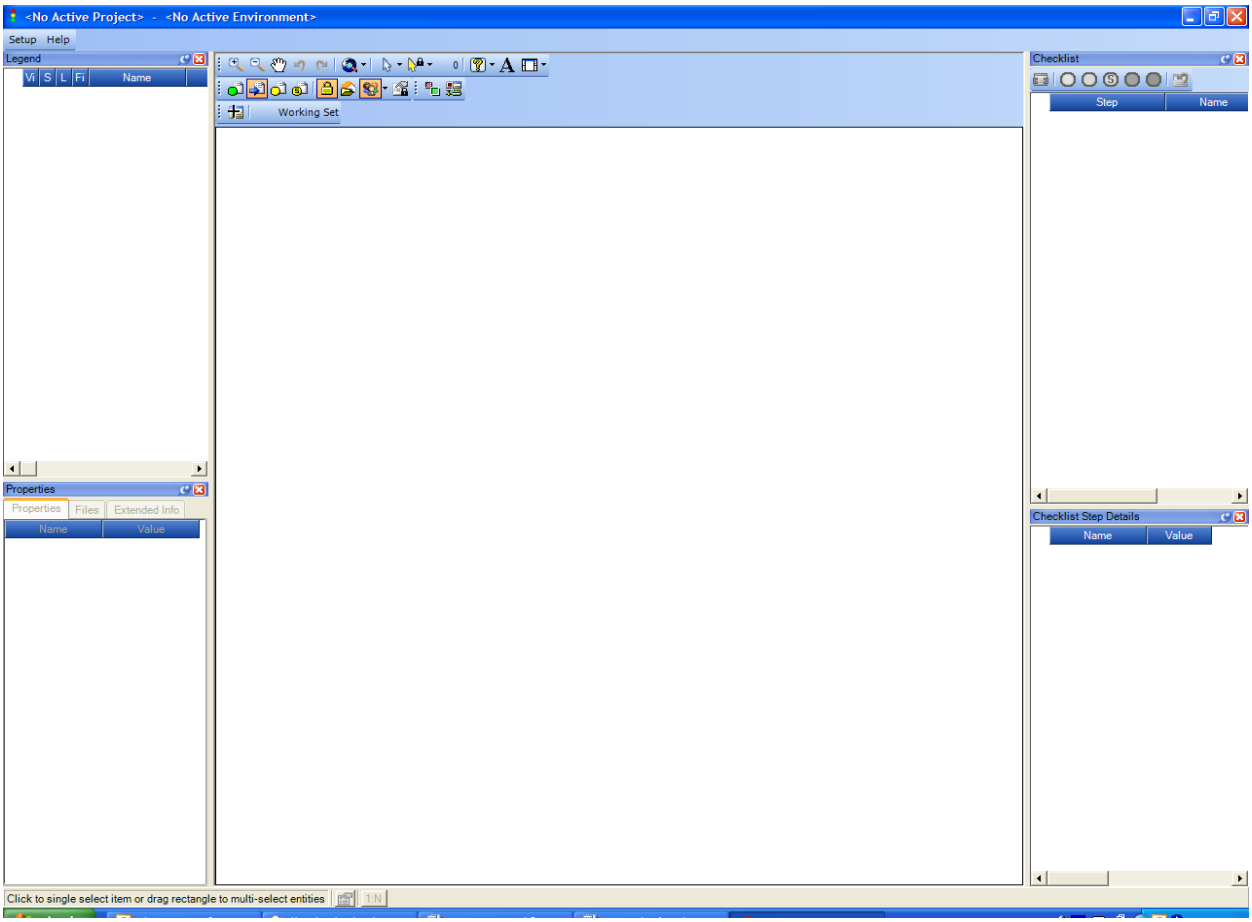


Figure 3-1 The GeoCue Opening Window

[4] The background color that you see in the map view in your version of GeoCue will be black. We have changed the color in this document for printing purposes.

Note – If you have not yet been added to GeoCue as a *User,* you will receive the error dialog of Figure 3-2.

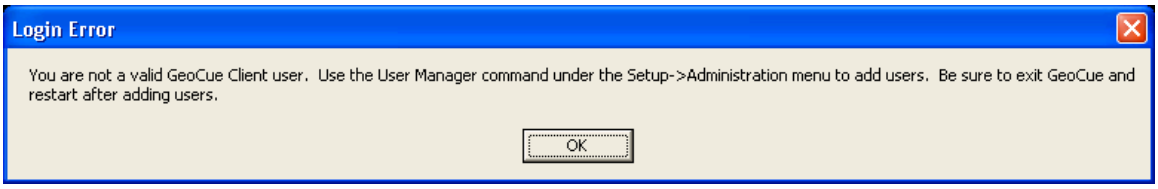


Figure 3-2 Unknown User error message

3.1 Starting User Manager

User Manager allows you to control access to GeoCue based on user name or user group affiliation. The management of access to projects is a two step process. The first step is to set up potential GeoCue users via the User Manager. The second step is to set the access permissions on a project by project basis.

Note that if you attempt to bring up the *Setup* ▶ *Project* dialog and you have not been added as a user to GeoCue, you will receive the error message depicted in Figure 3-3. This error is corrected by adding the user as described in the following subsection.

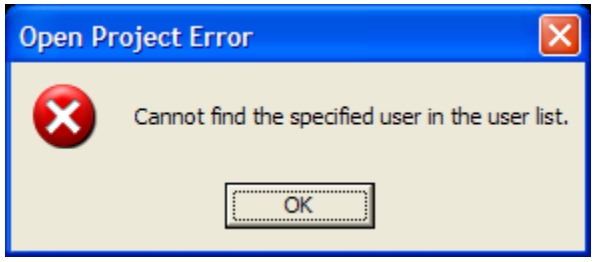


Figure 3-3 User Access Error

The default login for the GeoCue User Manager is:

User Name: Admin

Password: geocueadmin

Prior to first using GeoCue, it is necessary to add users to the system. Bring up GeoCue and select ***User Manager*** from the ***Setup*** drop-down menu (Figure 3-4).

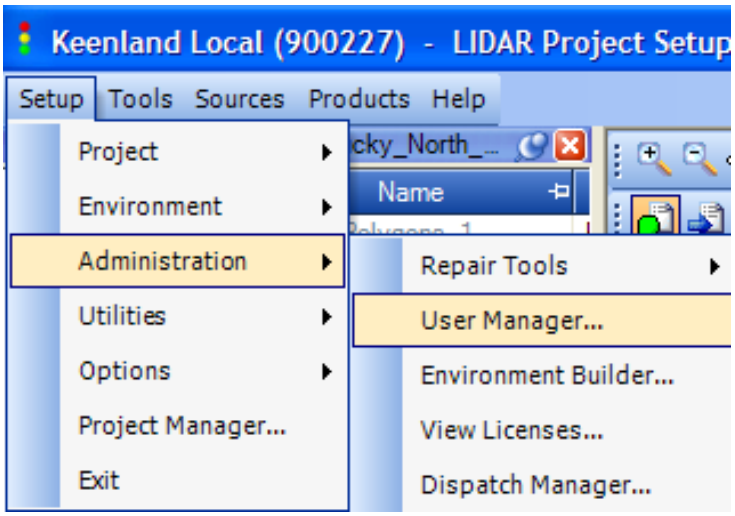


Figure 3-4 Accessing User Manager

If your domain login has not been added to GeoCue as an Administrator, you will be presented the dialog of Figure 3-5. The default Password is geocueadmin (note that the password is case sensitive) and the Username is Admin.

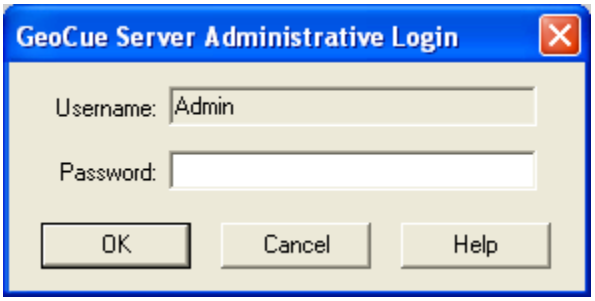


Figure 3-5 - User Manager Login

After logging in, you will be presented with the interface depicted in Figure 3-6 (although your entries will differ depending on who has already been added to GeoCue as well as your domain logins).

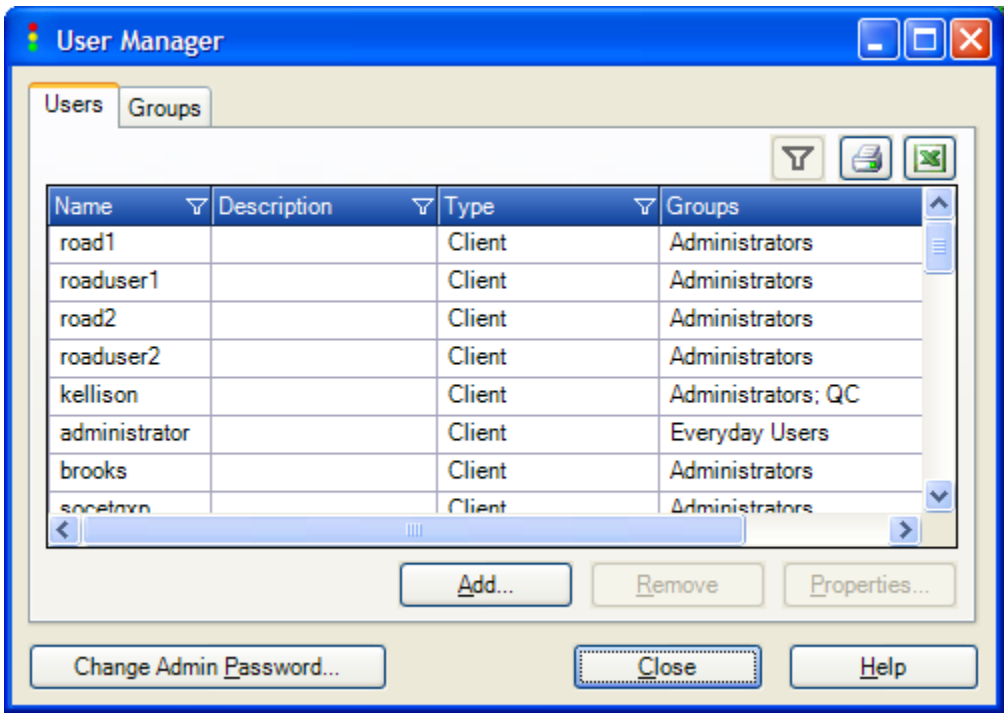


Figure 3-6 User Manager

A new install (where no users have previously been added to the system) will have two web users pre-assigned:

User Name	*Password*	*Group*
guest	guest	External Web Users
iguest	iguest	Internal Web Users

Note that user names are not case sensitive whereas passwords are.

NOTE – In most list dialogs you can sort the entries by clicking on the column heading.

GeoCue differentiates between normal users (and internal web users) and external web users because domain logins are used for access verification for internal users. Users and internal web users must be domain users (or they would not have access to GeoCue). Web users access GeoCue projects via the GeoCue Web Server and therefore are *foreign* users.

Groups allow you to segment GeoCue users into different categories. These categories are used for project-wide access as well as controlling access to checklist commands (for example, you could establish a group called "QC" and then restrict access to certain Quality Check commands to members of this group).

3.2 Changing the Administrator Password

To change the Administrator password, select the ***Change Admin Password…*** button on the main user manager dialog. You will be presented the dialog of Figure 3-7.

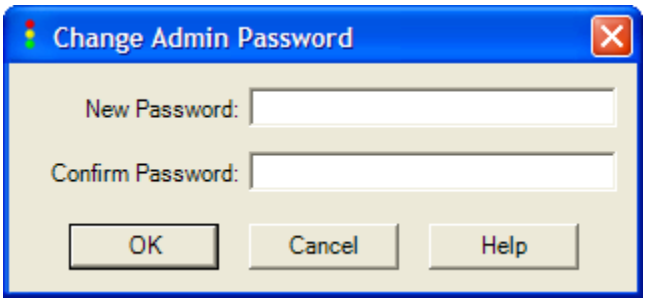


Figure 3-7 Change Admin Password dialog

To change the administrator password, simply key in the new password in both fields.

NOTE: Be certain to keep track of your password!!!

3.3 Adding New Users

To add a new user to GeoCue, select the ***Add*** button from Users tab of the *User* dialog. This will bring up the dialog depicted in Figure 3-8. Enter the name of the user exactly the same as their domain login. You can add an optional description as well. Select the type of user; either GeoCue Client User or Web User. The same user name cannot be a member of both groups (if you want to add users to both groups, chose an alias for their web user login such as appending Web to their normal login name. Select the group(s) that this user is a member of by selecting the groups in the group section of the dialog and pressing the ***Add*** button. Select as you would in any windows application by holding down the *Shift* key to select all entries from the first selected to the current selected or by holding down the *Ctrl* key while individually selecting.

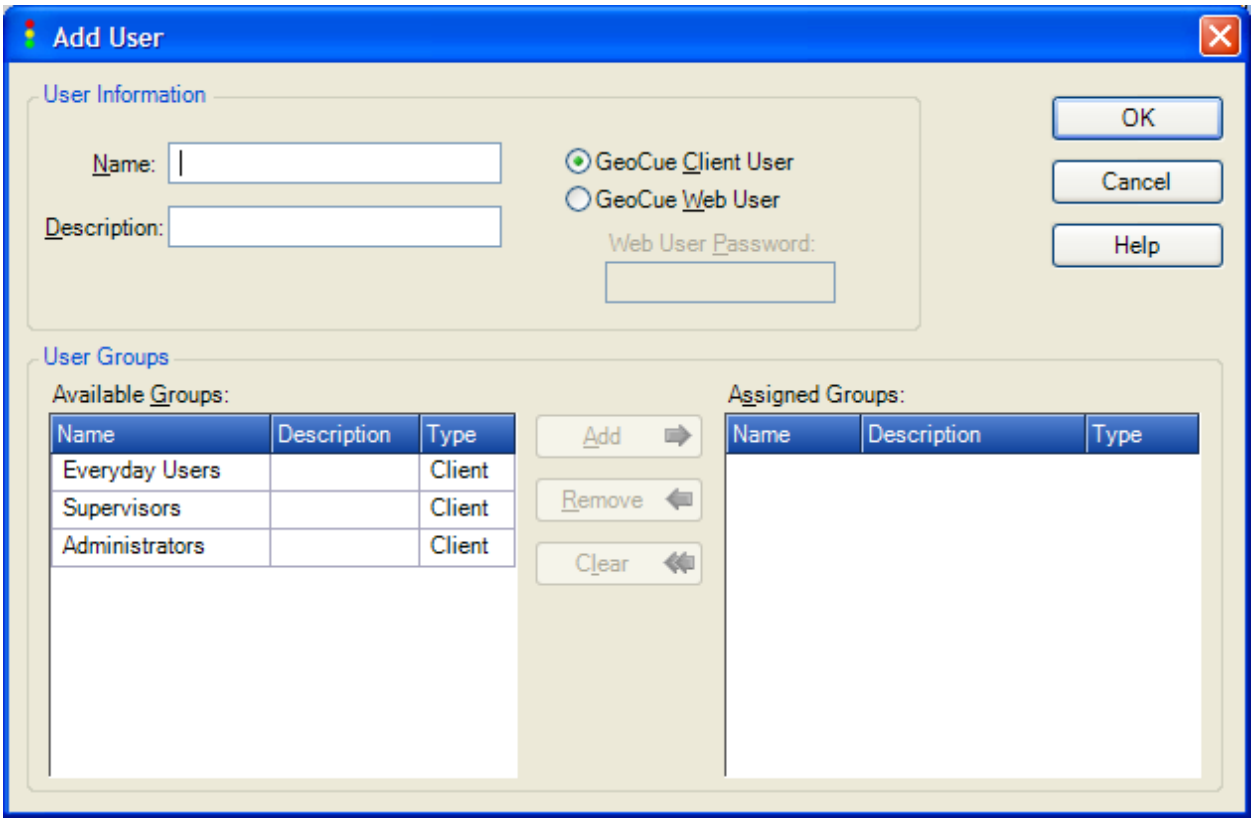


Figure 3-8 Add User Dialog

3.4 Adding New Groups

You can add new groups by selecting the *Groups…* tab on the User Manager dialog. Upon selecting *Groups…*, you will be presented with the dialog of Figure 3-9. The *Group Manager* dialog provides a listing of all the current groups and who is a member of each. To create a new group, select the *Add* option. This will invoke the dialog of Figure 3-10. You can use any name you chose to denote a group

(except for the pre-existing group names). For example, you might choose “LIDAR Editors” as a group. Chose the group type (Client or Web) and then add the users that you wish to make members of the group (you can always add additional users at a later time).

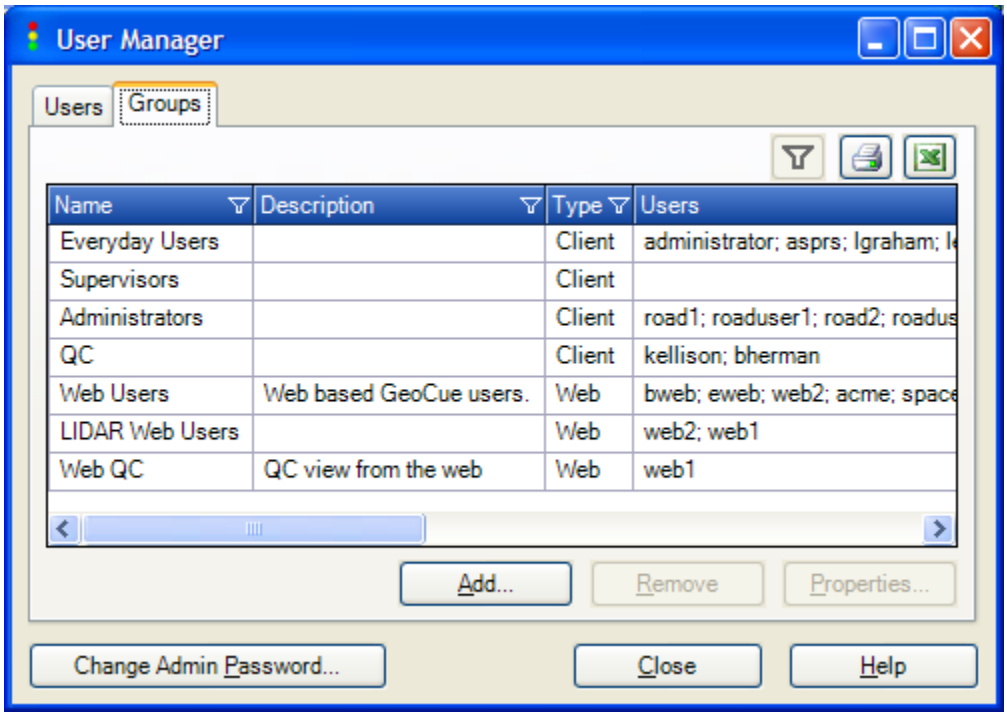


Figure 3-9 Group Manager tab

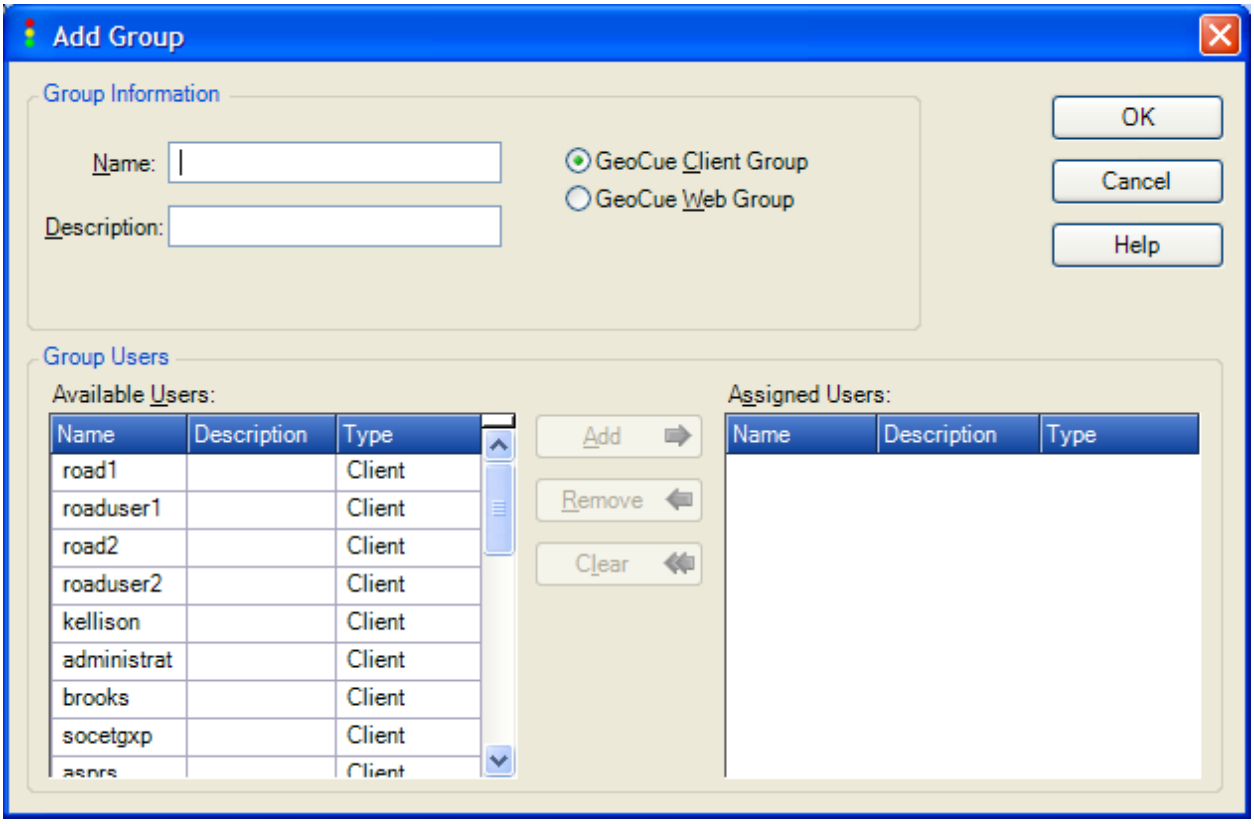


Figure 3-10 Add Group Dialog

4 License Manager

GeoCue Server includes a License Manager that manages licensing for your GeoCue constellation. You can view the status of GeoCue licenses by navigating from the top-level GeoCue Client menu: ***Setup*** ► ***Administration*** ►***View Licenses …*** This will invoke the dialog of Figure 4-1.

> GeoCue Client and CuePacs are licensed to *Nodes* where a node is a physical computer. GeoCue version 2.0 and later allow the same user to log in to GeoCue on different nodes simultaneously. Each login will consume a separate license.

4.1 License Serial Numbers

Our License Serial Numbers are a six column series of groupings of letters and numbers:

GCC-S-N-P-02000000-00000006

The meanings of these numbers are described in Table 4-1 below:

Table 4-1 License Serial Number scheme

Column	***Name***	***Description***
1	Product Code	A code that identifies the application (e.g. GCC is GeoCue Client)
2	Embedded/Standalone flag	Some software is bundled (embedded) with other software. E=embedded, S=Standalone (e.g. a copy of Map Core is always embedded with a copy of GeoCue Client)
3	Node Locked or Floating flag	N = Node Locked License F = Floating License

4	Owner Type	E = Evaluation P = Purchased L = Leased
5	Version Number	8 digit number to be interpreted as xx.yy.ww.zz where xx is the major release number, yy is the minor release number, ww is the Build number and zz is used for Service Pack identification
6	ID Number (also called Serial Number)	A unique integer that identifies the software. This number is never the same for two different software items.

4.2 GeoCue Client Licenses

The top section of the View Licenses dialog lists licenses that are currently checked out by your instance of GeoCue Client. The lower section of the dialog lists licenses that are checked out by executable modules (we call these XCs) that have been invoked by various actions you have taken in GeoCue.

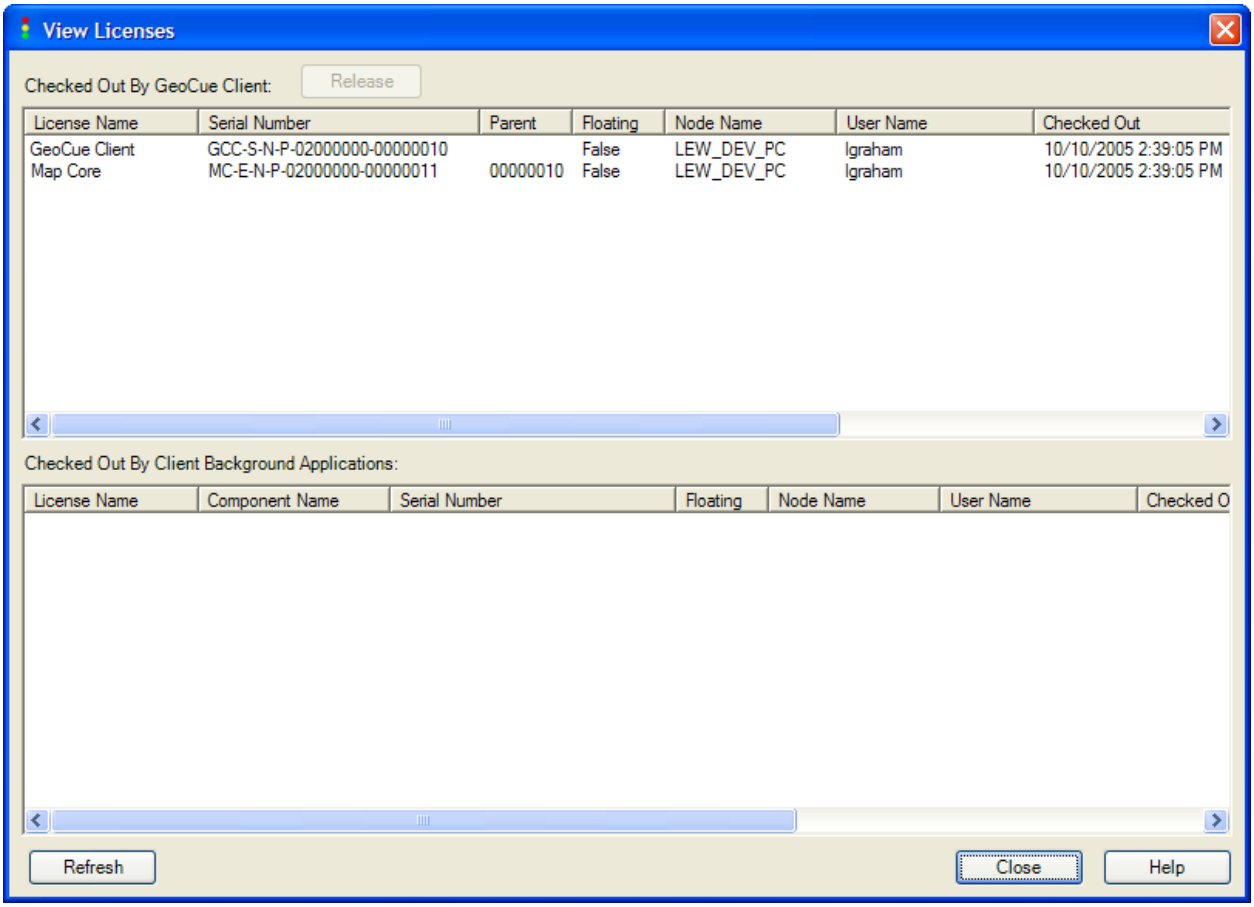


Figure 4-1 License Viewer

The top section of this display will always list two licenses:

- GeoCue Client – Your interface to GeoCue
- Map Core – A set of mapping utilities that include technology that we license from ESRI. When you purchase a copy of GeoCue Client, a license of Map Core is included. You can look at a Map Core license to see if it was bundled with a different software item. In the dialog of Figure 4-1 License Viewer, notice that the "Parent" column for Map Core lists the GeoCue Client serial number.

4.3 Module Licenses

Components that you execute via GeoCue commands (menus and checklist steps) may require a license. If so, the executed component will request the appropriate license "Just in Time" from the GeoCue Server License Manager. If a license is available, it will be *checked out* to your GeoCue Client. The license will appear in the top section of your License View dialog. In addition, the module that required the license will be displayed in the lower section of the dialog *as long as the module is actually running*. For example, we have started an image generation operation on a project using a checklist step provided by LIDAR 1 CuePac. Review the display of Figure 4-2. Note the LIDAR 1 CuePac license that is listed in the *Checked Out By GeoCue Client* section of the dialog. Notice that this same license is listed in the lower section of the dialog with a Component Name of "GEN_STEREO." GEN_STEREO is the *key* of the module that contains the code used by LIDAR 1 CuePac to generate all image types (even non-stereo LIDAR Orthos).

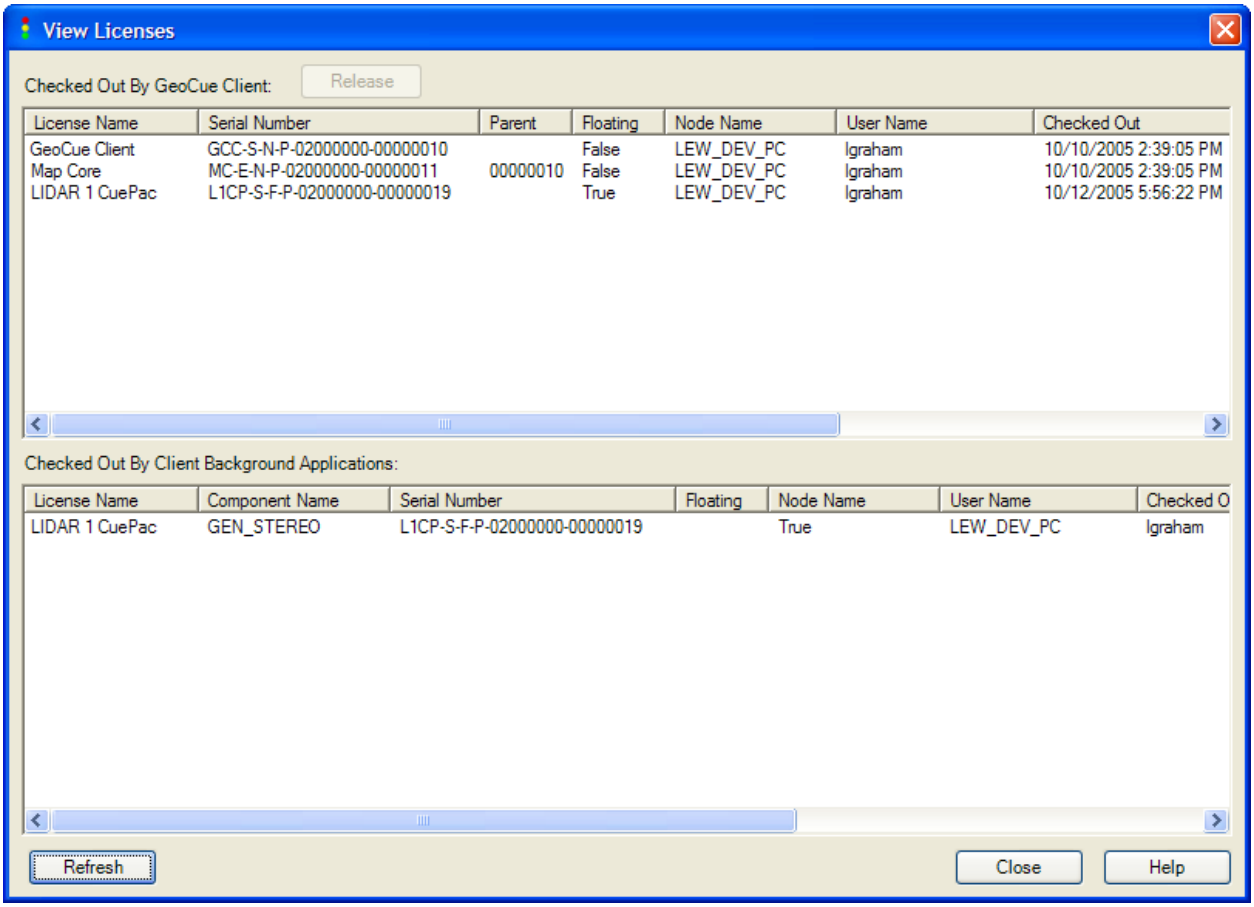


Figure 4-2 A LIDAR CuePac module using a license

GeoCue uses an *Acquire and Hold* license strategy. This means that as soon as a module requires a license, that license must be obtained (or the module cannot run). Once acquired, the license will be retained on behalf of the client until one of the following conditions occurs:

- GeoCue Client exits and no module on the workstation is using the license
- GeoCue Client exists and some later time a running module terminates (remember, operations such as generating images continue to process even if you exit GeoCue Client)
- GeoCue Client is running, no module is using a license and you force a return of the license to the license pool via the ***Release*** button on the View Licenses dialog.

For our current example, the LIDAR 1 CuePac will remain checked out even after the image generation completes and the GEN_STEREO module terminates. We use this strategy to prevent license "thrashing." Imagine a situation in which your license configuration has two GeoCue Clients and only one LIDAR 1 CuePac license. You begin a LIDAR processing session and someone on the other GeoCue Client machine also begins a LIDAR session. If the other person started a process such as Generate Ortho, your client would fail when it attempted an operation requiring a LIDAR 1 CuePac license (such as *Import Sources).* We prevent this sort of thrashing by retaining a license once it is checked out, even if your Client is not actively using the license.

4.4 Forced License Release

You can force the release of a module license (licenses displayed in the lower pane of the License Viewer dialog) by selecting the license you wish to release and pressing the **Release** button at the top of the View Licenses dialog. If no module that requires the selected license is currently executing on behalf of your client, the license will be retuned to the license pool maintained by your GeoCue Server.

This scenario might be useful if you are working on a project in one environment such as LIDAR and then wish to switch to a different environment such as DEM without exiting GeoCue Client. You can force the release of your LIDAR 1 CuePac license, making it available to other users.

5 License Monitor

GeoCue includes a License Monitor that allows you to view both the dynamic use of floating licenses in your GeoCue system as well as monitor the occurrences in which licenses become depleted. These tools are designed to allow you to cost effectively plan your license pool.

License Monitor is accessed ether from the Administrative drop-down menu of a GeoCue Client or from the GeoCue program group.

5.1 License Usage

The first tab of license monitor is used to view the dynamic (over time) use of licenses in your GeoCue constellation (Figure 5-1). Select the license that you wish to view from the ***License*** drop-down list to display the usage profile for that license type. The profile is the percent of total licenses in your license pool of the selected type versus time.

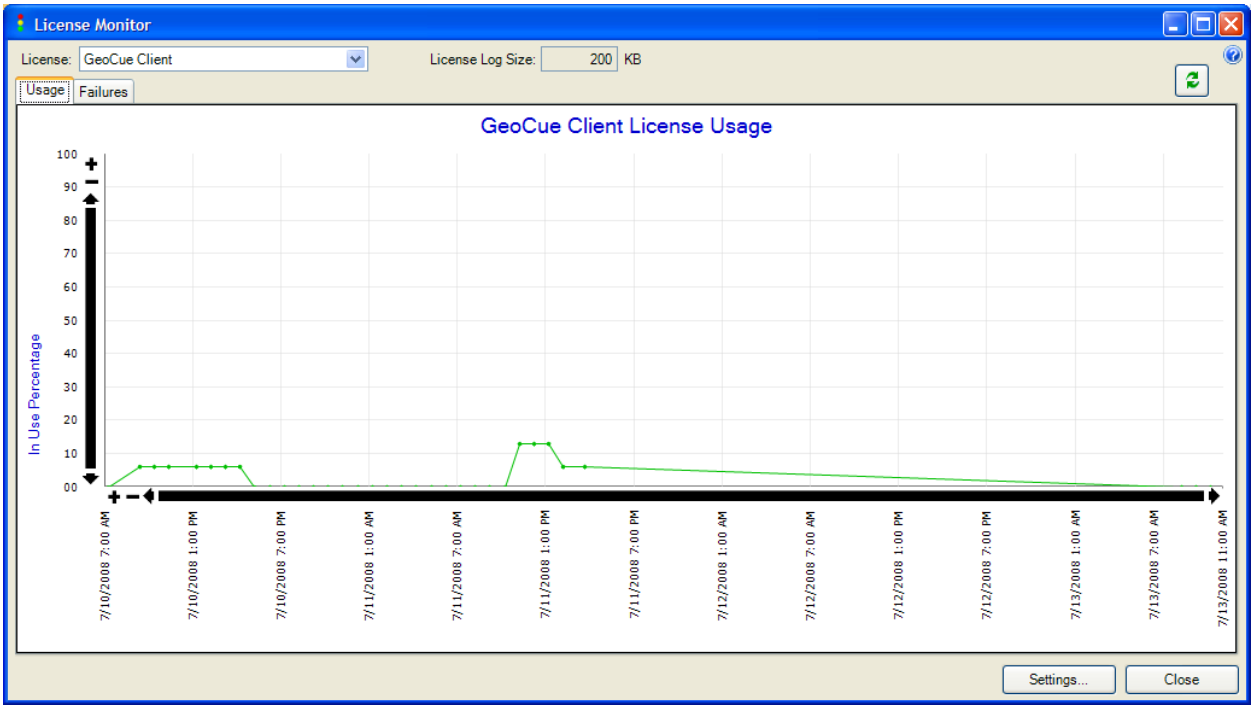


Figure 5-1: License Monitor, Usage tab

A license type whose name appears in red in the drop-down list has experienced an access error. This generally means that you do not have sufficient copies of this license type.

You can view the number of times your systems failed to retrieve a license as well as when these failures occurred using the Failures tab of License Monitor.

6 Exploring GeoCue

In this chapter we will explore some of the general features of GeoCue.

6.1 Setting the Environment

The first thing that we will do is load the LIDAR Production Environment supplied as one of the Environments included in the LIDAR 1 CuePac. Starting with the "Setup" drop down menu item, select the ***Setup ►Environment*** as depicted in Figure 6-1 and select ***Project Setup and Processing***. After selection of this Environment, GeoCue will configure its menu system as depicted in Figure 6-2. Note that the loaded *Environment* is displayed in the GeoCue title bar right after the Project name (which current displays *No Active Project* because we have not yet loaded or created a project).

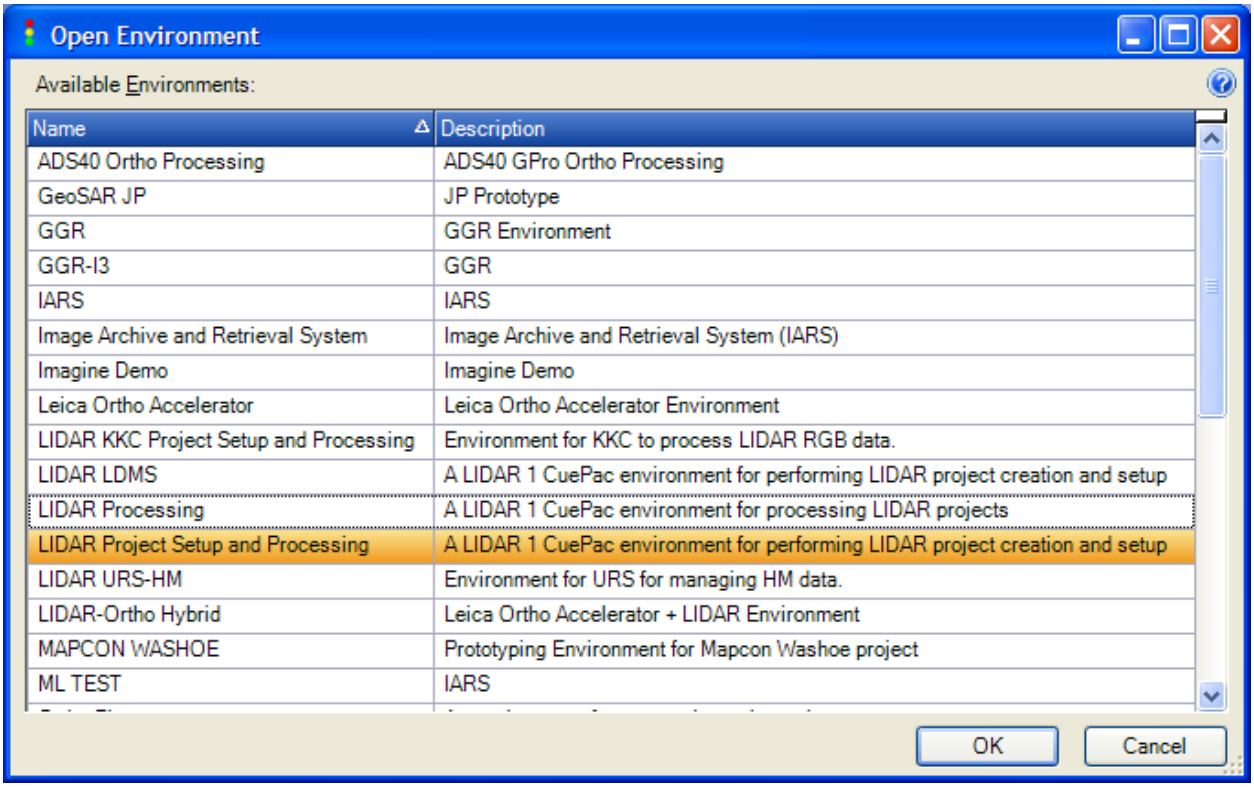


Figure 6-1 Selecting an Environment

Figure 6-2 The Project Setup Environment

Select S***ources*** from the drop down menus and observe the selections. An example is depicted in Figure 6-3. Note that your menus may be different if you have different environments loaded on your client (e.g. DEM CuePac).

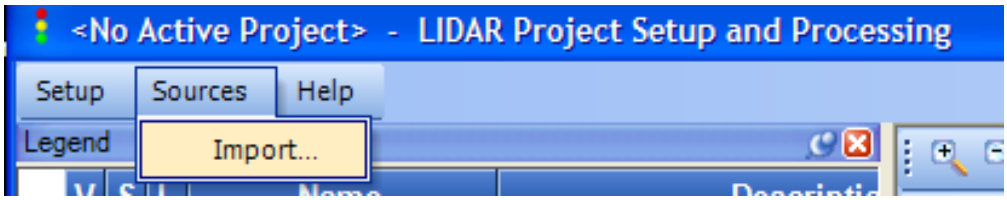


Figure 6-3 Sources dropdown menu

Now repeat the Environment selection process but now select *Processing* rather than *Project Setup and Processing.* Observe (see Figure 6-4) that there are no specific dropdown menus for this processing environment. This is because we chose to design this particular environment such that all processing commands are invoked from *Checklists* (you will learn about checklists in a subsequent exercise). This exercise illustrates how *sub-environments* can be used to restrict the access of selected users to certain commands. Using Environment Builder, you can tie sub-environments to specific user logins. This is useful for situations such as allowing a project supervisor full access to configuration items such as defining the project and importing sources but limiting production users to editing operations. You can extend the use of sub-environments in any manner you choose. You can create as many sub-environments as are necessary to segment project operational access.

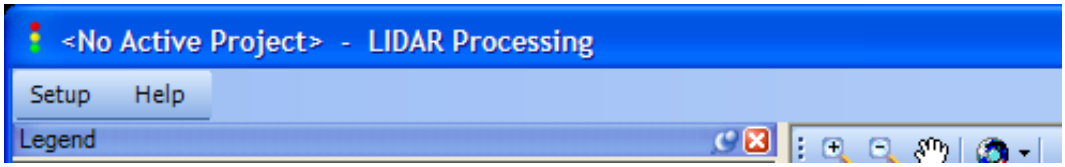


Figure 6-4 Dropdown menus selections in *Processing* Environment

Exit GeoCue by either clicking the  in the upper right of the GeoCue window or by selecting *Setup* ►*Exit* from the drop down menu.

NOTE – It is never necessary to ***Save*** your work in GeoCue. In fact, GeoCue does not have a ***Save*** option! GeoCue is a multiuser, transaction-based system that transacts against the Repository each time you perform an action. Thus your work is constantly updated in the database.

6.2 Loading a Project

In this exercise we will load an example project that is included with the GeoCue sample data. Start GeoCue as described in the previous exercise. Now select ***Setup*** ►***Project*** ►***Open*** from the drop down menus as illustrated in Figure 6-5 below.

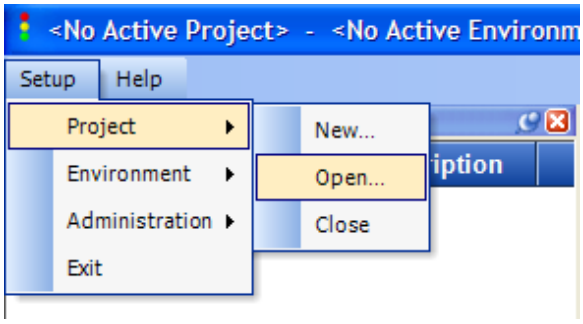


Figure 6-5 Accessing the Project Open dialog

This will bring up the *Open Project* dialog as depicted in Figure 6-6 (your dialog may not reflect the same content as this example, depending on the number of projects you have already created and/or deleted).

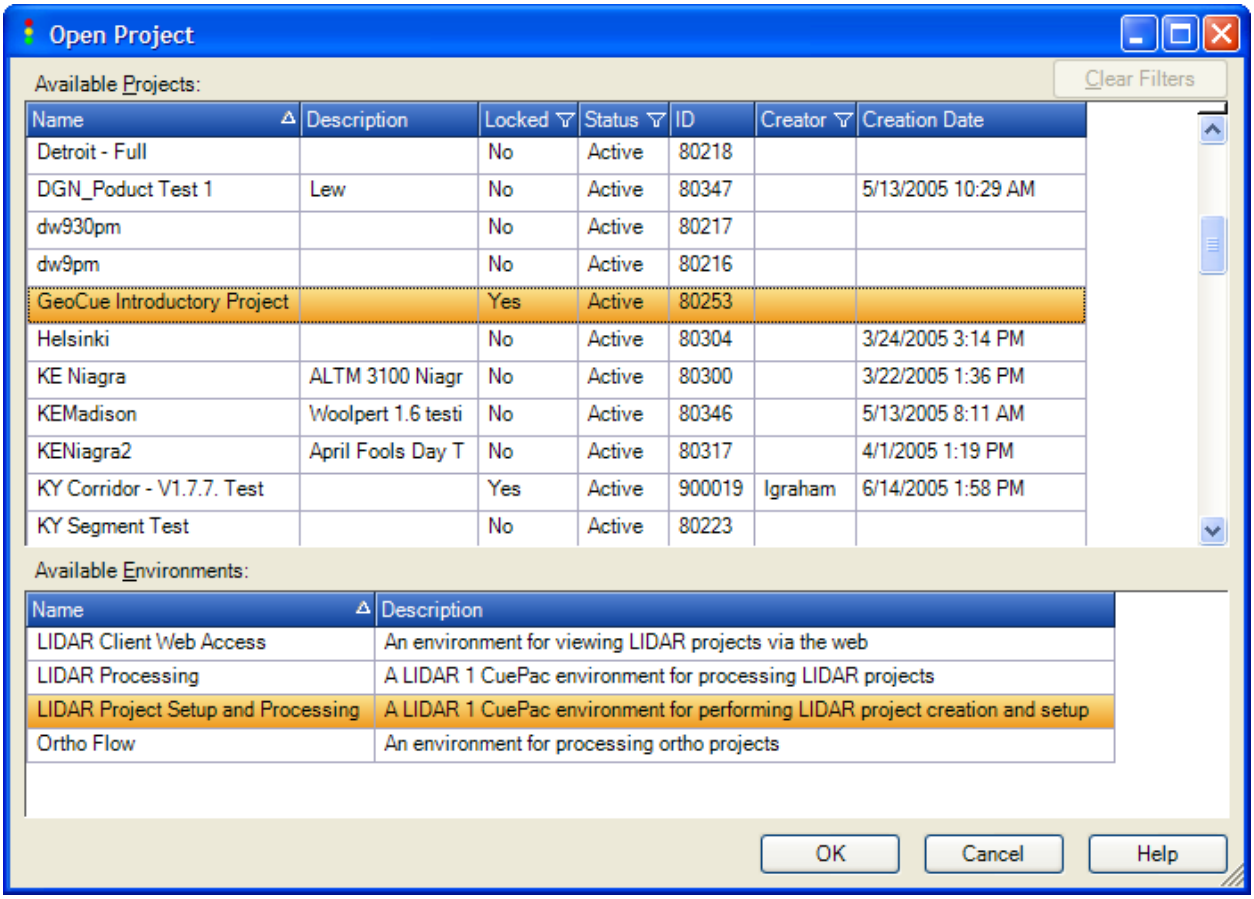


Figure 6-6 Open Project Dialog

The top pane of the *Open Project* dialog is used to select the **Project** whereas the lower pane is used to select the **Environment**. The column labeled **Locked** indicates if the project has been *Locked* against deletion (this lock is set and reset via the Project Properties dialog, described in a separate section of this document). The **Creation Date** indicates when the project was originally created.

You can sort any column in the Open Project dialog by clicking on the *triangle* symbol. You can *filter* any column that has a *funnel* symbol by clicking on the funnel. You can construct Custom Filters by selecting *Custom* in the drop-down list of filter selections.

Select the Project entitled *GeoCue Introductory Project* in the upper pane and the Environment entitled *LIDAR Project Setup and Processing* in the lower pane (*Selections* are made by hovering the cursor over the item you wish to select and single clicking the left mouse button). Now press the OK button at the bottom of the dialog. This will cause the "GeoCue Introductory Project" project to be opened in the "LIDAR Project Setup and Processing" environment. An alternative method to perform these same actions is to select either the *Project* or the *Environment* and then double clicking the other selection. Thus in the example above you could single click *GeoCue Introductory Project* in the project pane to cause it to be selected and then double-click the "LIDAR Project Setup and Processing" line in the environment pane.

After selecting the OK button (or using the double click method) the dialog will be dismissed and the project/environment will be loaded. Your display should now resemble Figure 6-7 except that the *map view* background color of your application will be set to whatever color you have chosen (we have made it grey or white in most figures in this diagram to facilitate printing on paper). You may need to turn on the visibility of layers by selecting the "V" column in the legend the first time you open a project.

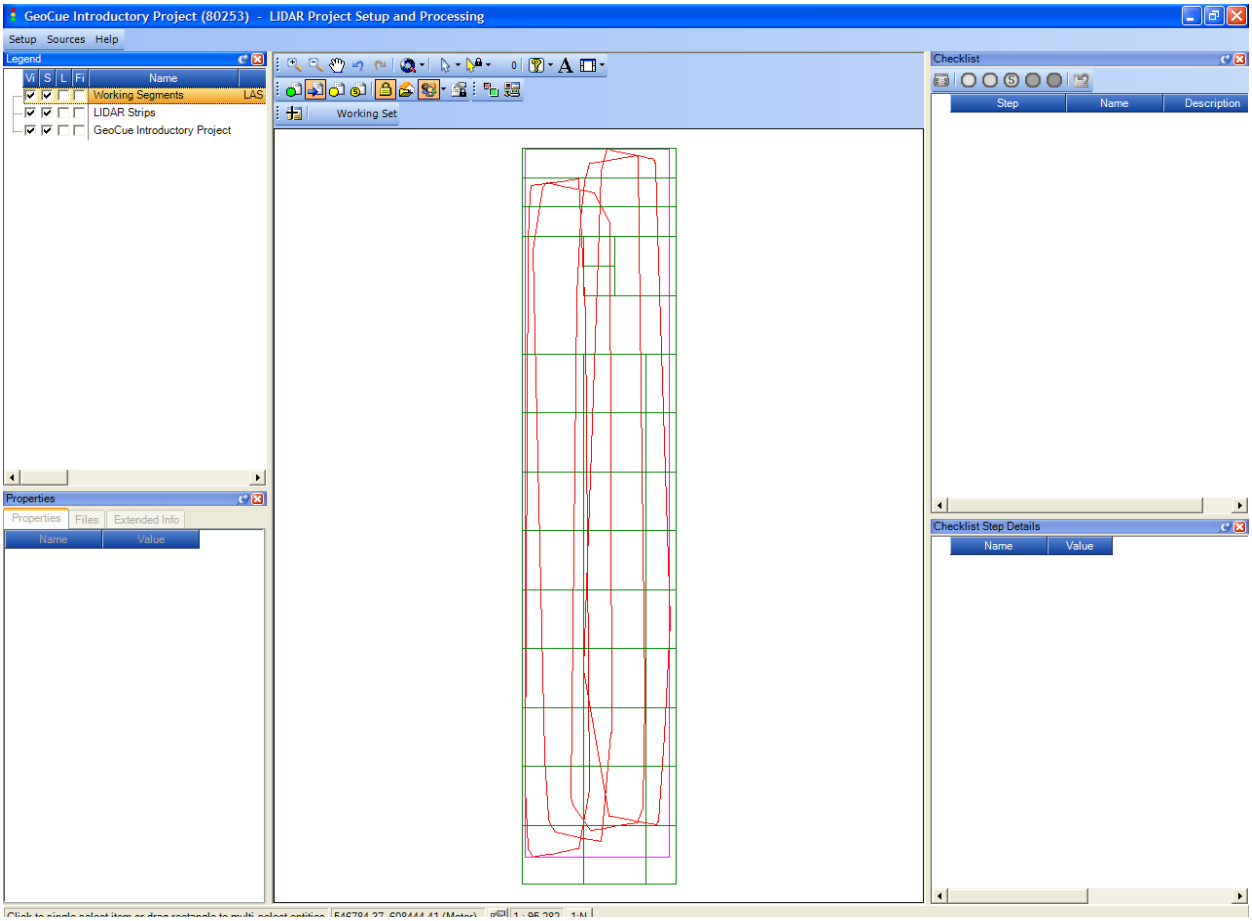


Figure 6-7 The GeoCue Introductory Project

You may now ***Exit*** the project as described in section 4.2

6.3 Elements of the GeoCue Interface

It is not necessary to open a project for this section of the tutorial although you are certainly encouraged to do so if desired.

The opening view of GeoCue is displayed Figure 6-8 with all components of the GeoCue Client interface labeled and explained in the subsections below. These subsections give a qualitative explanation of the function of each group of tools. GeoCue includes a robust, on-line help system that is current with the state of the release. Use this help system to read the details of each of the GeoCue tools.

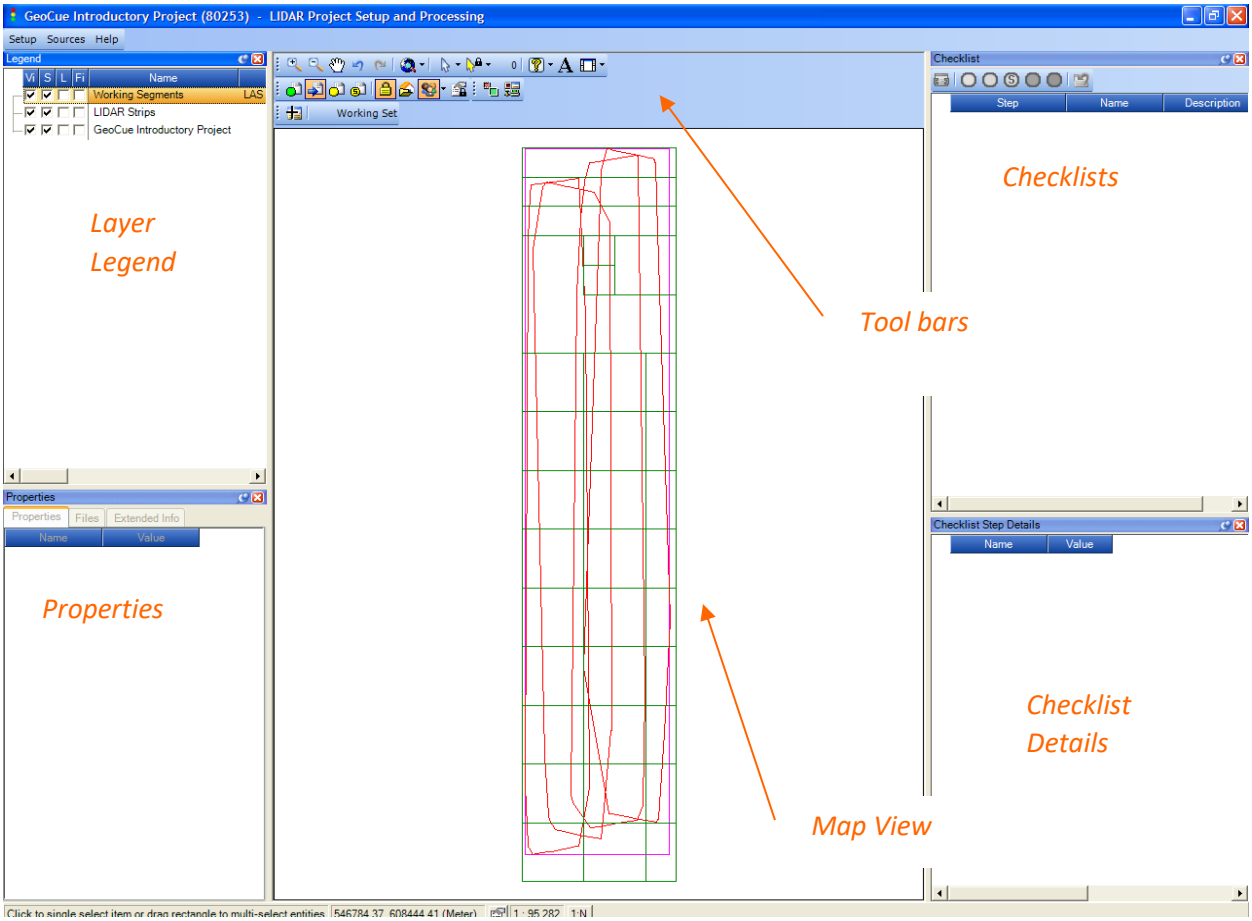
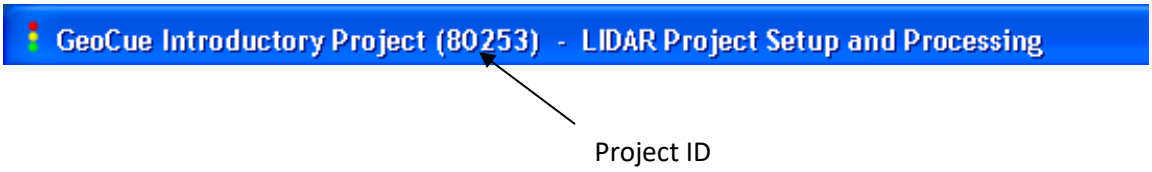


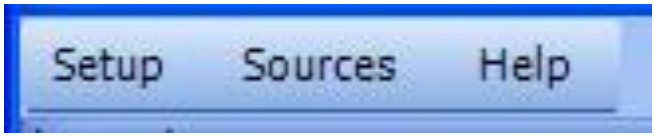
Figure 6-8 Typical View Layout for GeoCue Client

6.3.1 The Project ID

The *Project ID* is displayed in the GeoCue title bar immediately following the project name. The Project ID is a globally unique integer that GeoCue uses to identify projects. This number is useful to you in locating files that reside in a GeoCue Warehouse. GeoCue creates a project level folder with the name set to the Project ID number in the root directory of the current GeoCue Warehouse Folder that was selected when the layer was created. Each layer in a GeoCue project has an associated unique ID (an integer). If GeoCue needs to store external files (external with respect to database information), then a folder with the Layer ID is created directly beneath the Project folder. This folder will then contain any files associated with the Layer.



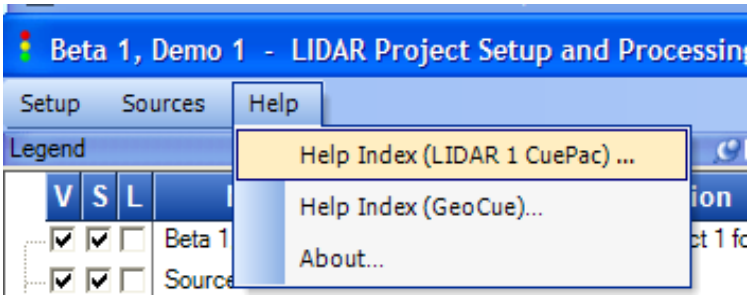
6.3.2 The Menu Bar



The menu bar is established by the selected environment. Every environment (including the system when no environment is loaded) includes the ***Setup*** and ***Help*** menu bar selections. Items on the menu bar are typically used for operations that are utility in nature or for *inter-entity* operations. By *inter-entity*, we mean operations that typically involve one or more source entities and that create one or more different output (or result) entities. Intra-entity operations, on the other hand, are operations that operate on a group of entities and change them in-place. We will discuss both of these types of operations in the exercises of the workflow.

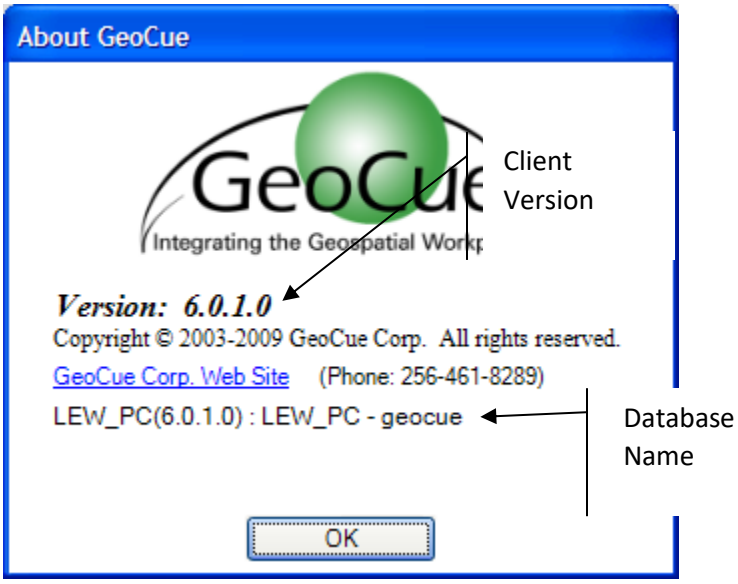
6.3.3 Accessing the Help System

GeoCue has a base help system that contains information about the features of GeoCue that are generally available regardless of the *Environment*. In addition, a separate help file will appear in the Help dropdown menu when you load a specific environment.



6.3.4 Finding Version Numbers

When you call GeoCue Group for support or questions, please be prepared to provide the version number of your software. This is available by selecting ***About***… from the Help dropdown menu:



You can also locate version numbers for individual GeoCue components by opening the readme files located in the "Start->All Programs->GeoCue->Documentation" program group.

6.3.5 Setting GeoCue Options

You can access the GeoCue Options setting dialog via Setup ► Options ► GeoCue (you may have other option choices listed depending on the Environments and/or CuePacs you have on your particular system). This will invoke the dialog of Figure 6-9

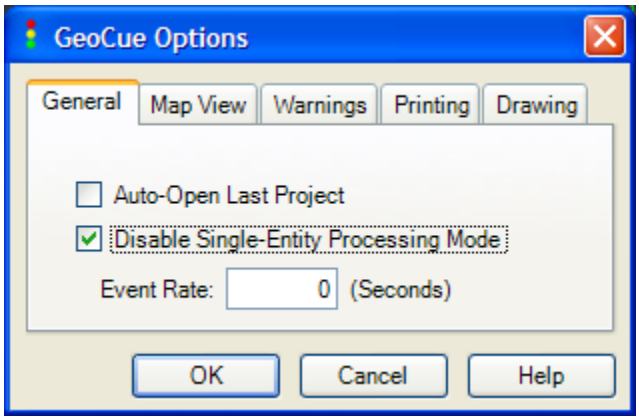


Figure 6-9 The GeoCue Options dialog

6.3.6 The Layer Legend

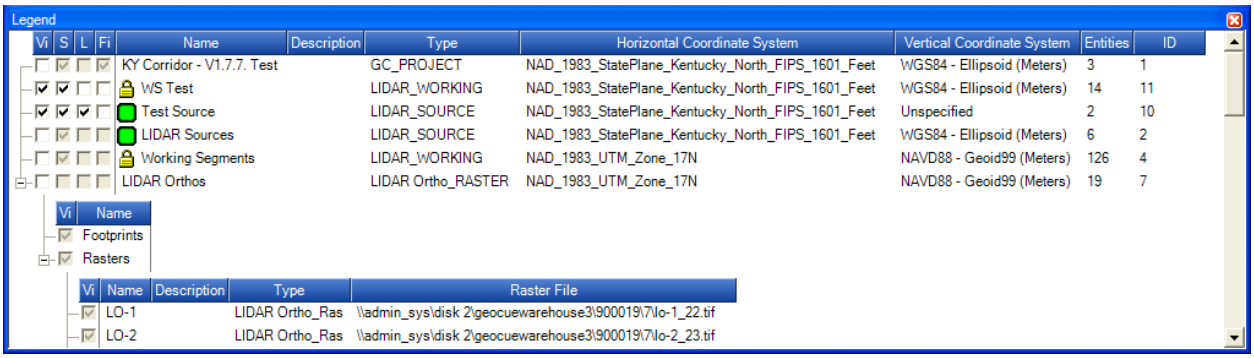


Figure 6-10 The Layer Legend

The layer legend provides information regarding each layer that is present in a GeoCue project. All projects have, as a minimum, a *Project* layer (of type GC_PROJECT). This project layer is created at the time of a *New* project creation. All layers in GeoCue have two coordinate systems – a Horizontal system and a Vertical system. Once the coordinate system is assigned, it cannot be changed (short of deleting and recreating the Project!).

Note - GeoCue includes, under ***Setup*** ► ***Administration*** ► ***Repair Tools*** a utility that can change the coordinate system of a Layer. This can be a very dangerous tool. Make sure you read the chapter "Repairing Projects" in this manual before attempting to use this command.

GeoCue supports mixed coordinate systems and thus the coordinate system of each layer can be different. GeoCue automatically takes care of converting coordinate systems for geometry and display operations. The coordinate system of the *Project* layer becomes the *default* project coordinate system. This is the coordinate system that will be displayed automatically when a coordinate system choice must be made. In nearly all cases, you can change from the default to whatever system you desire.

Right-clicking in the layer legend area displays a legend right click menu that provides a number of functions related to layer manipulation. See the on-line help for details.

NOTE – Many commands for adding and removing project information are accessed through the *Legend.* There are two ways to access these commands; via the legend right-click menu or by creating a legend toolbar. To create a legend toolbar, perform the following steps:

- ***Right-click*** anywhere in the *Legend* (the pane where the layer information is displayed)
- Grab the right-click menu and drag it to the map view (grab it by the dots that appear at the top of the menu)

- The menu will now convert to a tool bar. You can dock the toolbar in the Legend pane.
- To remove the toolbar, just click the “x” in the upper right corner.

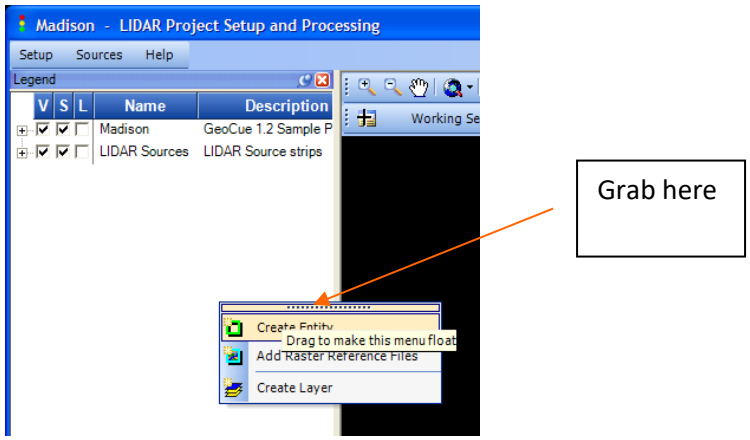


Figure 6-11 Grabbing the right-click menu

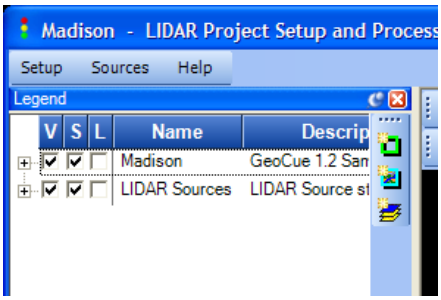


Figure 6-12 Toolbar docked on right side of legend pane

6.3.7 The GeoCue Toolbars

Many operations within GeoCue are available via toolbars. You can turn the display of toolbars off and on by right clicking in the toolbar area of the main GeoCue frame. This will cause a right click menu to be displayed. Just check the toolbars you wish to be displayed and uncheck the ones you wish hidden.

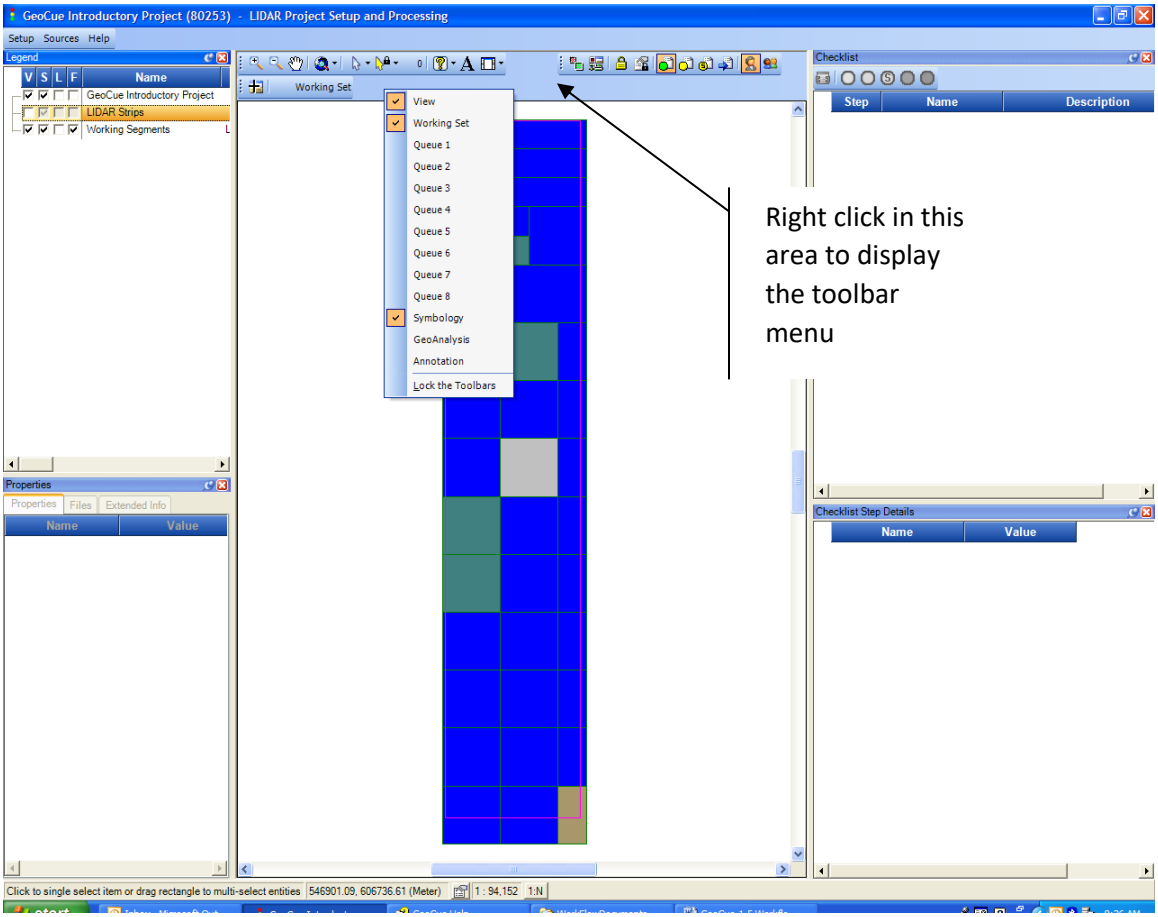


Figure 6-13 Controlling the Tool Bars

Toolbars are *dockable* and *floatable* in GeoCue. See the on-line help to learn how to customize the location and appearance of toolbars. Some toolbar buttons present multiple options. This is visually evident by the appearance of a down arrow on the right of the toolbar. See the example of the *Selection* toolbar dropdown in Figure 6-14.

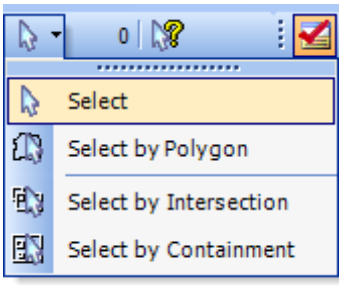
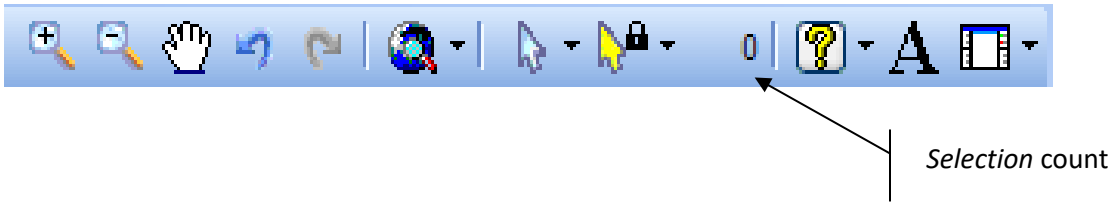


Figure 6-14 The *Selection* button dropdown options

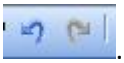
> ***Hint*** – All of the toolbar buttons in GeoCue have "tool tip" help. Just hover the mouse cursor over a toolbar button and a tool tip will appear. If the tool tip does not appear after a second or so, click the title bar of GeoCue and hover again (this step makes GeoCue the active window. Tool tips only display for the active window).

6.3.7.1 The View Toolbar

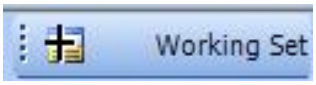
The view toolbar is used to manipulate the map view and to set the options for the map view during queue (either *Named* or *Working Set*) navigation. The number on the toolbar indicates the number of entities that are currently *Selected.* The *Fit* icon fits all entities on all layers in the legend for which the layer legend Visible (V) toggle is checked.



Hint – If you have a completely empty project and are importing data into the project, creating entities from the imported data (we will do an example of this when we import LIDAR data into an empty project), you may not see anything in the map view. This is because GeoCue cannot determine a data extent for the view if there are no data in the view. Click the *Fit World* button  several times

during the data load and GeoCue will fit the newly loaded data. If you want to return to a previous view, you can traverse the view stack using the Previous and Next view buttons on the toolbar.  .

6.3.7.2 The Working Set (Queue) Toolbar



The Queue toolbars are *collapsed* when the associated queue is empty. There are three types of Queues in GeoCue; the Working Set Queue (usually called simply the *Working Set*), *Named Queues* and the *Selection Queue* (which we often refer to as the *Selection Set).*

The Selection Set Queue is apparent to you simply as the currently selected entities in the GeoCue view. Entities in the *Selection Set* are highlighted in white. There is no queue tool bar available for the Selection Set.

The Working Set is a fundamental tool within GeoCue. In most instances, it is desirable to place a multiuser lock on an entity prior to making a change to the entity. This lock prevents other users from trying to modify the same entity at the time that you are modifying the entity and it also prevents other users from attempting to use an entity before it is completely ready for use. Adding entities to the Working Set of a GeoCue Client places a Working Set lock on those entities. This Working Set lock prevents any other user from adding the same entities to their Working Set. Entities within your Working Set are always visually identifiable by their bright yellow outline color.

A collapsed Working Set toolbar immediately indicates to you that there are no entities currently in your Working Set. As soon as one or more entities are added, the Working Set toolbar extends to reveal all of the Working Set manipulation tools (see the help system for details).

It is important to understand that Queues contain *References* to entities, not the entities themselves. For example, if you put slips of paper with the names of people written on the slips into a hat, the hat can be thought of as a *Queue* of names. Adding and removing slips of paper from the hat is

manipulating the references to the people, not the people themselves (to directly manipulate the people, you would have to put *them* in the hat!).

Caution – Be careful in deleting entities using the delete tool of the Working Set toolbar  . Entities deleted using this selection are actually deleted from the project and cannot be recovered! Technically, this button *dereferences* the pointers to entities and then deletes the entities.

You can "short circuit" the process of adding to the Working Set by the *Select to Working Set* selection arrow (shown below). When active, selections are placed directly into your Working Set.

The *Select to Working Set* mode remains active until you press one of the *Selection* mode arrows. Note that the Map View cursor color is white when you are in the normal *Selection* mode and yellow when you are in the *Select to Working Set* mode.

6.3.7.3 The Named Queue Toolbar

Named Queues are general purpose queues that can be used in a wide variety of applications. The Named Queue paradigm is another standard ("canonical") form within GeoCue and thus you will see these employed in many different ways within GeoCue Group produced *Environments*. Named Queues function in a manner analogous to the Working Set Queue with the major differences being that entities in a named queue are not automatically locked and that named queues can be shared with other users. Again, see the on-line help for details.

Hint: Named Queue toolbars contain a tool that allows you to directly transfer the content of the named queue to the Working Set Queue. This provides you with a convenient mechanism for performing repeated operations on a collection of entities that need to be processed from the Working Set. Just add the entities to a Named Queue and press the "Add to Working Set" tool.

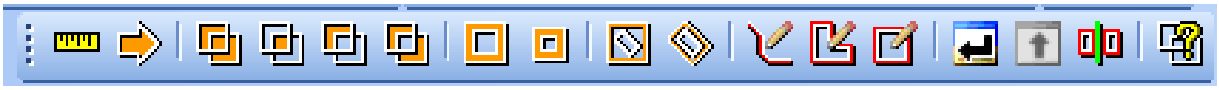
The number of named queues that can be created by a GeoCue user is virtually unlimited. A Queue toolbar is set to a particular named queue by selecting the name of the queue in the dropdown name field of the toolbar. Up to 8 named queue toolbars can be simultaneously displayed in GeoCue. The display of these toolbars is turned off and on from the toolbar options right click menu described at the beginning of this section.

Multiuser – A named queue can be *Published.* Publishing a named queue has two actions:

1. A published named queue will automatically become available in everyone's named queue dropdown list who is accessing the same project (even if they are in different Environments
2. A published named queue will persist when you exit your instance of GeoCue (unpublished named queues are deleted).

Thus the Published queue is a very powerful tool for persisting transient project data and for communicating exact entity information to uses of the project.

6.3.7.4 The GeoAnalysis and GeoDraw Toolbar



When we were developing algorithms to detect the absence of LIDAR strip coverage using vector analysis techniques, we realized that vector analysis of entities within GeoCue would be very useful in a wide range of applications. Therefore we moved this specialized capability from ***LIDAR 1 CuePac*** and included it within GeoCue as a generalized set of functions. The GeoAnalysis tools always accept *Selected* items as input and create new GeoAnalysis entities on specialized GeoAnalysis output layers as their result. For this reason, you can use any entity for input regardless of its current lock state. These commands never modify their source entities.

Hint – It is quite useful to use the results of GeoAnalysis as the input to some later operation. We will work an example of using the UNION of LIDAR strips as the input to form a *Project Boundary* entity.

It is fairly typical to delete the GeoAnalysis layers after use by right clicking the GeoAnalysis layer legend entry and selecting *Delete Layer* from the right click menu.

The GeoAnalysis functions are described in the GeoAnalysis chapter of this document.

CAUTION – Be very careful when deleting a layer. This action causes all entities on the layer to be deleted as well as the layer itself. The deleted information cannot be recovered.

We strongly recommend that you *Lock* layers to prevent the inadvertent deletion of entities on the layer or of the layer itself. To lock a layer, *select* the layer and then bring up the layer properties either via the right-click layer menu or the layer properties tool on the layer toolbar. On the properties dialog, check the **Delete Lock** option.

6.3.7.5 The Symbology Toolbar

The *Symbology* toolbar allows you to view entities using a variety of symbologies. For example, by turning on the option to view the Working Sets of Others, you can immediately see what entities have a transient lock placed on them by other users. This avoids the frustration of selecting an item and attempting to add it to your Working Set, only to receive an error message that the entity is currently locked by another user.

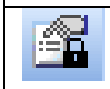
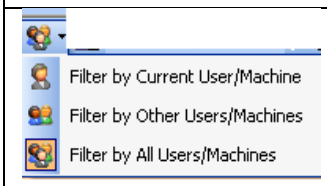
The details are described in the following table:

Symbol	***Name***	***Description***
	Production State Complete	Fills the entity with the color of the last completed checklist step. Transparent if no completed steps. Lime green fill if the entire checklist is complete. AFFECT OF USER OPTION: Takes into account who completed the last step. Transparent if you chose "Filter by Current User/Machine" and you were not the one who completed the last step. If the current user did not set the last completed step to Complete, the "Filter by Other Users/Machines" or "Filter by All

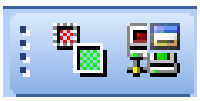
Symbol	***Name***	***Description***
		Users/Machines" option must be used to see the completion state. If the entire checklist is complete, the user filter has no affect.
	Production State Next	Fills the entity with the color of the next non-completed step in the checklist. Transparent if the checklist is complete *or* if the **Planned User** fields in the checklist are blank. AFFECT OF USER OPTION: Looks at the "Planned User" for the checklist step and applies the user filter. So if a step has no planned user or is assigned to someone else, and you turn on "Filter by Current User", the entity will be transparent.
	Production State In Progress	Fills the entity with the color of the in-progress step for a checklist. Transparent if no step in progress. AFFECT OF USER FILTER: Considers the user that put the step in progress and filters the fill based on the selected user filter option. If you choose "Filter by Current User/Machine", you will only see steps that you have in progress.
	Production State Suspended	Fills the entity with the color of the suspended step for a checklist. Transparent if no step suspended. AFFECT OF USER FILTER: Considers the user that put the step suspended and filters the fill based on the selected user filter option. If you choose "Filter by Current

Symbol	***Name***	***Description***
		User/Machine", you will only see steps that you have suspended.
	Production State Suspended	Fills the entity with the color of a production step that has been queued by the Task Manger for execution. For example, if you select multiple segments to be *Populated*, they will be in a *Pending* state until processing for the particular entity actually starts. Transparent if no step is pending. AFFECT OF USER FILTER: Considers the user that put the step *In-Progress* and filters the fill based on the selected user filter option. If you choose "Filter by Current User/Machine", you will only see steps that you have initiated.
	Locks (Read, Write, Annotation)	Turns on/off the display of locks which outlines the entity in a color signifying the type of lock on the entity. If there are no locks on the entity, the outline is not colored. The user can choose which types of locks to display based on the "Locks" options of the "Symbology Settings" dialog box. AFFECT OF USER FILTER: Considers who owns the locks when deciding whether or not to color the entity outline for both Write and Read Locks. Annotation Locks are not tied to a specific user.
	Cache	Turns on/off the display of the cache status for warehouse-based files for an entity. The outline color of the entity is based on the state of any cached files. If the entity is not cached, the entity outline is not affected.

Symbol	*Name*	*Description*
		The user can choose which types of cache status to display based on the "Cache" options of the "Symbology Settings" dialog box. AFFECT OF USER/MACHINE FILTER : Considers the machine name when deciding whether or not to color the entity outline.  "Warehouse Up-to-Date": If the entity is cached and the warehouse is up-to-date, it means that no action is needed to update the warehouse. Selecting this option will display entity outlines in green that meet this test. "Warehouse Out-of-Date": If the entity is cached and the warehouse is out-of-date, it means that the valid copy of the file is somewhere else. Selecting this option will display entity outlines in orange if it meet this criteria. Both of these options take into account the current machine. For example, of the User Filter is set to Current User/Machine and the files are not cached on the local machine, the outline will not be colored.

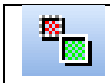
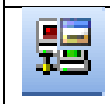
Symbol	*Name*	*Description*
	Symbology Settings	Brings up the symbology settings dialog where the user can select which types of locks and which cache states to display.
	User/Machine Filter	 Not selected: Disables all symbology options controlled from this toolbar. (Note that the icon is not depressed like the next image).  Filter by Current User/Machine: Filters the symbology based on the current user and current machine.  Filter by Other Users/Machines : Filters the symbology based on any user other than the current user and any machine other than the current machine.  Filter by All Users/Machines: Essentially combines the output from the previous two options.

6.3.7.6 The Transition Toolbar

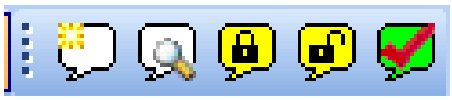


This toolbar contains tools to allow you to visualize the Working Sets of other users as well as Transition State.

Symbol	*Name*	*Description*

	Transition state	A pattern fill symbology used by GeoCue Environments to indicate the overall status of an entity. Examples of states that might be used by an Environment are Created, Initialized, and Complete.
	Working sets of others	Shows the Working Sets of other users in bold yellow outline. You can discover who has an entity in their Working Set by selecting the entity and viewing the Working Set information in the property pane

6.3.7.7 The Annotation Toolbar



The ***Annotation*** tools provide a mechanism to make annotations about entities or reference layers, to review the annotations and to resolve the annotations. The Annotation system is primarily intended as a set of tools to allow GeoCue Web users to make comments about project entities.

6.3.8 The Checklist and Checklist Details Panes

The *Checklist* is the core element of GeoCue. In fact, it is the Checklist from which the *Cue* in GeoCue is derived. The Checklists serve as the Cues to users as to the next step in production and to supervisors as Cues to production status.

6.3.8.1 Checklists

An example of a Checklist is depicted in Figure 6-15. In general, each entity within GeoCue could have a different checklist. In practice, entities that require identical processing typically have the same checklist entries (although the actual instance information of a checklist is always unique to an entity).

The Checklist in GeoCue is a very robust *State Engine* that can be used to *fire* actions on the entity referenced by the checklist. In simple terms, this means that each entry in a checklist (there are seven entries in the example of Figure 6-15) can cause a different action (such as invoking a user defined executable program) to be carried out when the checklist state is modified.

The type of entity to which the checklist applies is listed as the window pane title ("LIDAR Working Segment" in our example). The particular entity that is selected is listed between the state action toolbar and the actual checklist (ProjectX4 in our example). The state toolbar is depicted in Figure 6-16. The entries on this toolbar are used to change the state of the entity checklist and to fire any associated actions.

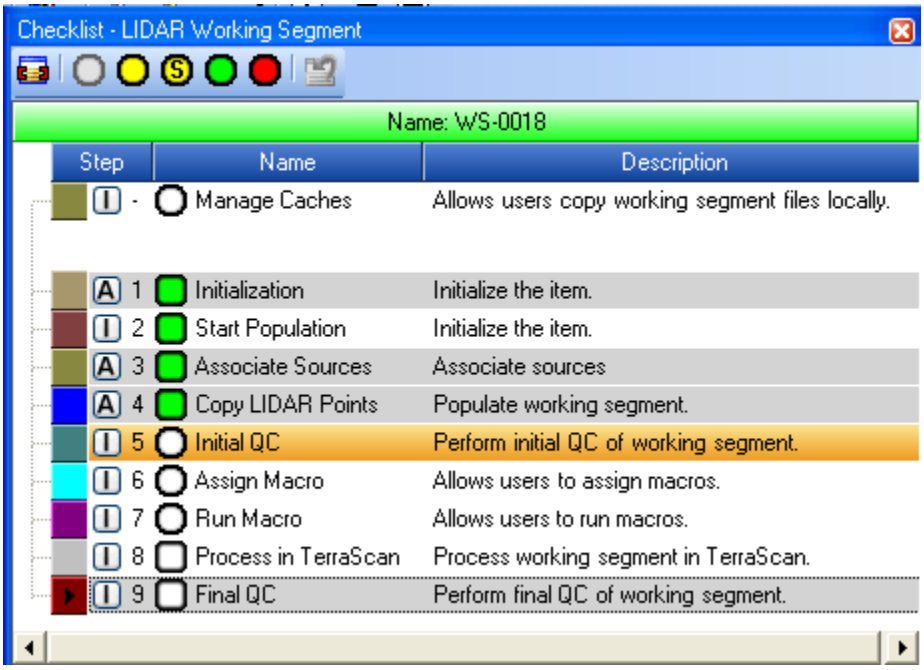


Figure 6-15 A GeoCue Checklist

In the example of Figure 6-15, if the "Process in TerraScan" checklist entry were selected and the "In Progress" toolbar button depressed on the State Selector toolbar (Figure 6-16), GeoCue would build a TerraScan project with the selected entity as the target for editing and then invoke TerraScan. The status of the checklist would change to "In Progress" for all users who were viewing this entity in this project.

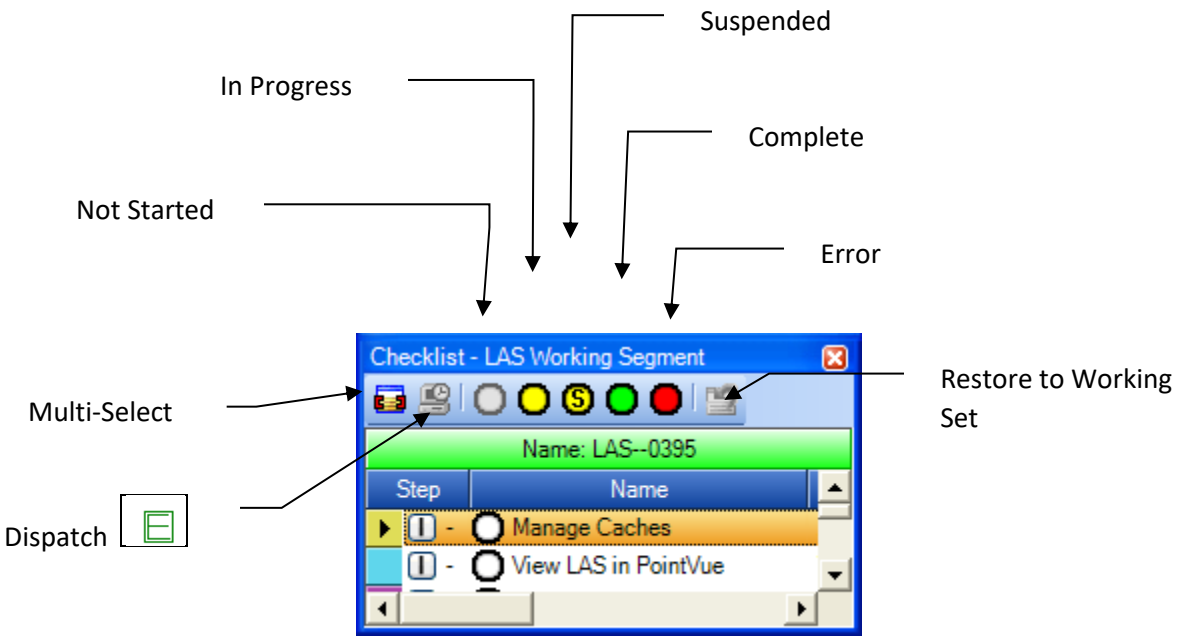


Figure 6-16 State Selector Toolbar

The Checklist State Engine is quite comprehensive, providing actions for each possible transition state as well as possible *undo* states. Programming the Checklist is beyond the scope of this document but will be covered in the GeoCue Environment Builder document, a version of which will be available in GeoCue Version 2.0 and above.

In order to change the *State* of an entity via a checklist action, the entity must first be placed in the Working Set. This action ensures that you have exclusive access to the entity. To review the current state of an entity, simply *select* the entity.

When an entity is the current item within the Working Set, the checklist bar immediately below the state buttons will be displayed with a green background color. This is an indicator that the checklist is *active* and that you can potentially manipulate the entity via the checklist state buttons. Checklist entries that can be manipulated will be displayed with a white background whereas those that cannot will display with a grey background. The states and their actions are listed below:

Symbol	*Name*	*Action*
	Not Started	This checklist item has not been started. Either the step has never started or it has been "undone" back to a *not started* condition.
	In Progress	For interactive steps, this is the button that starts processing. This fires the action associated with performing the step and starts production time logging.
	Suspended	This indicates that production is not complete for the step but that it has been suspended. GeoCue automatically takes all interactive production steps that are "In Progress" to this state if you exit GeoCue. You can also manually set an *Interactive* processing step to Suspended. Production step timing is paused when a step enters the suspended state.
	Complete	The process step has been successfully completed. The production timer is stopped.
	Error	The process step state is set to Error. This causes the symbology of the associated entity/entities to change to red, even if fill symbology is disabled. The production time logging is stopped.

The possible transitions are programmed by the environment designer. Each of the states listed in the table above can have an associated *action.* The action is to start an executable program to potentially operate on the associated entity. As you navigate a checklist for an entity within a specific environment, the state selector buttons on the state toolbar will enable and disable based on the possible actions that you could take. For example, if the current state of a checklist item is green (meaning it is complete) and no other toolbar buttons are enabled, then this step cannot be "unwound."

The **Restore To Working** Set button can restore entities to the Working Set that were previously removed due to setting a Checklist Step In Progress. This button is especially useful for repetitive processes, such as setting parameters and then initiating processing.

The **Multi-Select** button (see Figure 6-16) can potentially be used if you have more than one entity in the Working Set. Activating this button indicates that the checklist action should be applied to all entities in the Working Set, not just the current entity. An action can be applied to the entire Working Set only under the following conditions:

- Each entity in the Working Set must have an identical checklist
- Each entity must be at the same point in its checklist

We will go through an example of the multi-select capability when we *Populate* working segments in a LIDAR processing example. We noted that a common error is to place multiple entities in the Working Set but forget to press the Multi-Entity Mode button prior to pressing a state transition button. In anticipation of this error, we present the dialog of Figure 6-17. Pressing *Process All* at this point will cause GeoCue to behave as if you had actually remembered to activate Multi-Entity Mode prior to pressing the state transition button. If presentation of this dialog is not desired, it can be deactivated via the *Setup* ►*GeoCue* ►*Options* dialog.

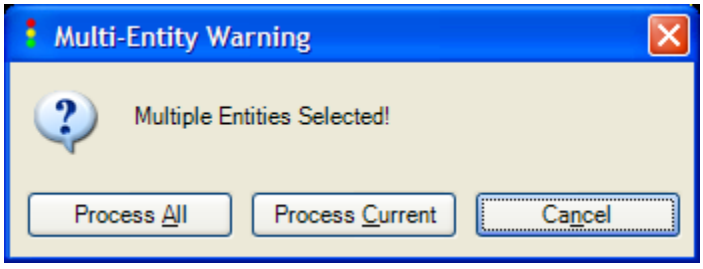
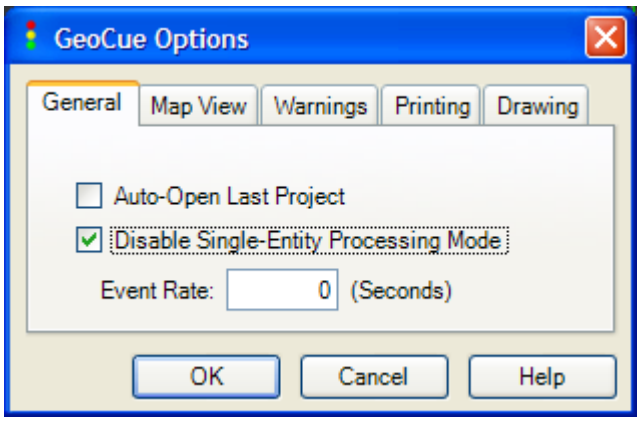


Figure 6-17 Multi-Select Reminder dialog

NOTE – You can set GeoCue such that it is *always* in multi-entity mode via the ***Setup -> Options -> GeoCue*** dialog. Check the Disable Single –Entity Processing Mode option. This will remove the Multi-Entity button from the checklist processing toolbar. With the option checked, GeoCue assumes that you always want to apply the action to all entities in the Working Set.



The **Dispatch** button (see Figure 6-16) is available only if you have the Departmental version of GeoCue. This button will activate if the current checklist step is *dispatch enabled.* If you leave the **Dispatch** button enabled (it defaults to enabled for dispatchable commands) then rather than immediately starting the command associated with the checklist step, the Dispatch dialog will be invoked. The operations of dispatching are detailed in the Command Dispatch System chapter of this guide.

Hint – The GeoCue Checklist system is very sophisticated and, as such, may appear overly complex for certain projects. However, GeoCue is set up such that checklists are not required on entities and, if checklists are present, they can be set to *no action* which means that they will simply record user information when activated. Thus the reality is that the Checklist system will satisfy all needs for entity actions from the most elementary to quite complex.

6.3.8.2 Production Logging

A second major function of the Checklist system within GeoCue is the recording of production status. The primary storage association within GeoCue for production status information is a *details* log associated with *each step* of a checklist. The details pane can initially be displayed within a GeoCue session by double clicking the step in a checklist that you wish to inspect. If the checklist details pane is already displayed, single or double clicking an entry in the checklist will set the details pane to the selected entry. An exemplar details pane for the checklist of Figure 6-15 is depicted in Figure 6-18.

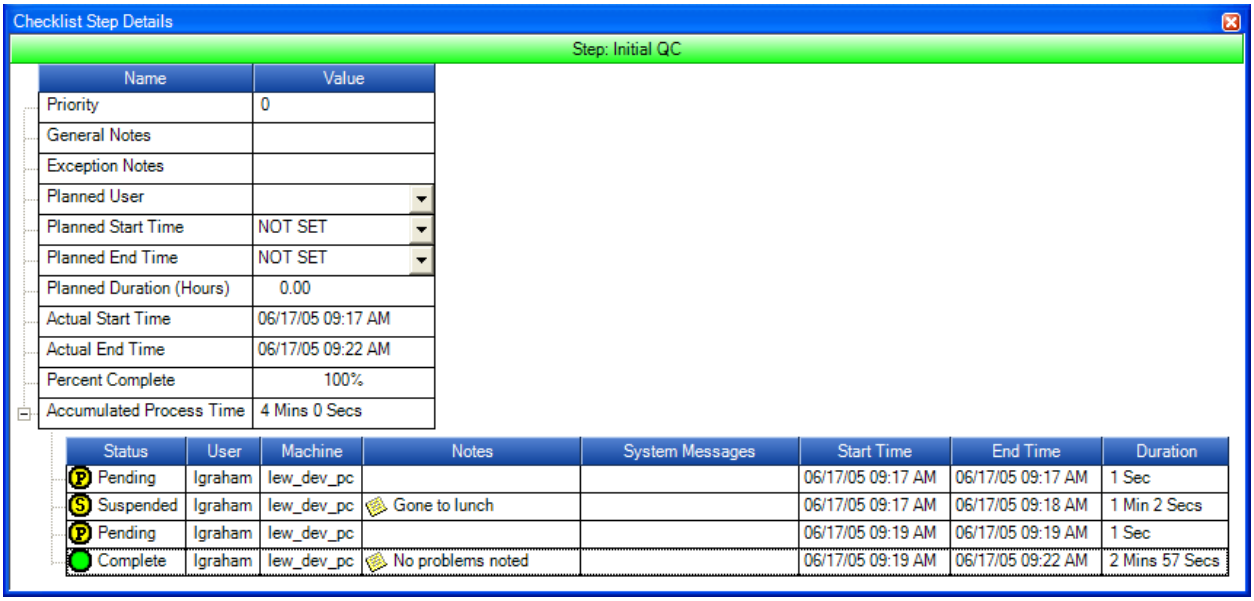
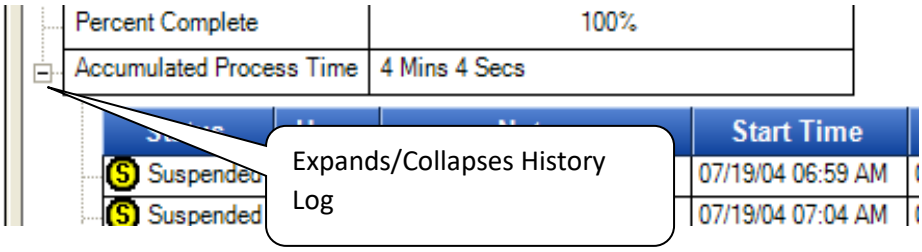


Figure 6-18 The Checklist Details Pane

Note that the step being inspected is listed in the panel at the top of the pane (in our example, "Initial QC"). As with the checklist itself, a green name panel means that the entity to which this checklist is associated is in the Working Set and thus edits are permitted. If the panel were red, the details could still be inspected but they could not be modified.

In general the details log provides planning data and accumulated actual statistics in the top section of the pane. In the bottom of the pane is a detailed history of the processing that has occurred for this step of this checklist.

Hint – The [+] symbol beside the **Accumulated Process Time** expands and collapses the history log:



If your history log does not appear, either this button is collapsing its display or you have not yet accumulated the first history log entry (the step has never been moved from the NOT STARTED state).

See the On-Line help guide for details of the information maintained in the checklist logs.

Note – The time spent in the ***Pending*** state is not counted in the Accumulated Process time.

6.3.9 The Property Pane

GeoCue provides information about *entities* in a *Property Pane*. An example property pane is depicted in Figure 6-19. You can think of *Entities* in GeoCue as data containers. The properties and data contained by entities are displayed in the Property Pane. Property Panes may have one or more active tabs depending on the type and state of the entity. For example, the Entity represented by the example of Figure 6-19 references external storage files (the *Files* tab) and also contains extended data grouped under three other tabs.

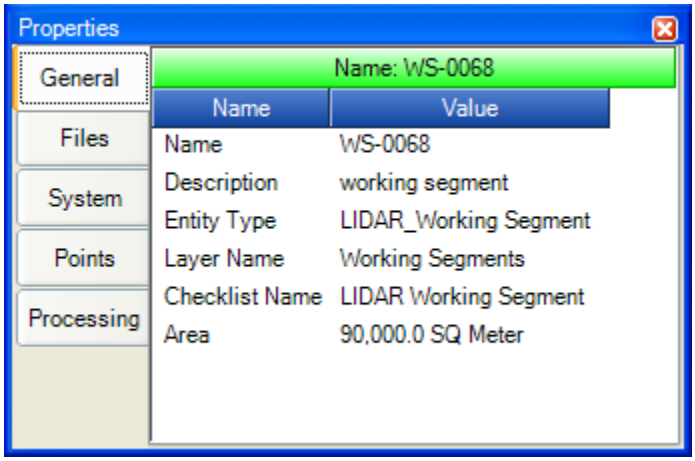


Figure 6-19 Property Pane

Note – If you have multiple entities selected, the properties pane will indicate the number of selected entities but will not display properties. This is because properties are, in general, unique to each entity.

7 Data Storage and GeoCue

NOTE – If you are a GeoCue user and are not responsible for GeoCue data management, you can skip this entire chapter. It is intended primarily for GeoCue Administrators.

One of the most important aspects of managing a production process is the management of project data. Data management is an integral element of GeoCue and thus you need to have a good overall understanding of how we have implemented this capability.

GeoCue manages three general classes of data. These classes are explained in the following table:

Table 7-1 GeoCue Data Elements

Data Type	***Description***	***Example***	***GeoCue Storage Scheme***
Metadata	Data about data.	GeoCue entities	Stored directly in the GeoCue database
GeoCue file-based data	Data created by GeoCue but managed outside the database	LIDAR points or raster data associated with LIDAR Working Segments, LIDAR Orthos, LIDAR Stereo Pairs, etc.	These data are stored in one or more file-based folders (*Warehouses)* established by your GeoCue system administrator.
GeoCue reference files	External files pointed by GeoCue entities but not managed by GeoCue	LIDAR source strips, reference rasters	Entities within GeoCue point to these external files.

7.1 A Discussion of Data Types

GeoCue, like many systems that maintain large data repositories, uses a hybrid storage scheme in which "compact" data are stored in a database (a part of the GeoCue Server) and large data items are stored directly in the distributed file system of the GeoCue constellation. There are several reasons for this scheme. The first (and perhaps most important) is performance. While database vendors are close to achieving the performance levels necessary to rapidly store and retrieve high volume data such as imagery and LIDAR, they are not quite there. We have yet to encounter a customer who has been willing to trade production performance for storing large data elements in the database!

However, a more compelling reason to externally store data such as LIDAR and Imagery in file storage is the nature of the workflow. Production projects are normally transient. That is, the project has a definite start and completion point with respect to time. Project data such as imagery and LIDAR consume vast quantities of repository space (for example, a typical county-wide LIDAR project might involve 100 GB of data and a large format digital camera might collect 1 TB or more in a single day). From both a management and cost perspective, it is necessary to "off-line" these data as quickly as possible to make room for new projects. However, it is very useful to maintain metadata regarding the project in an on-line status. This allows you to perform complete queries on completed projects (via the on-line metadata) without the need to maintain voluminous data such as imagery on-line. A third and final important issue is the impracticality of backing up multi-terabyte databases on a daily basis. A project off-lining capability is much more practical.

We categorize data into three types for management in GeoCue. These types are discussed in the following subsections.

7.1.1 Metadata

Metadata is the general term that we use for project data that is stored in the GeoCue Server database (SQL Server or Oracle database). Examples include the basic data type of *Entity* in GeoCue. For example, if you *Select* an entity in GeoCue and examine the properties of the entity in the *Property Pane*, that information is stored in and retrieved from the database.

7.1.2 GeoCue Internal File-based Data

GeoCue internal file-based data is created each time GeoCue creates LIDAR, Raster or other file resident data items. These files are *always* associated with an *Entity* in GeoCue and referenced by that entity's *Files* pointers. These file storage locations can be viewed by selecting the entity and viewing the *Files* tab of its properties dialog.

Data in this category is stored in the data *Warehouse* locations set up by your GeoCue system administrator. In GeoCue version 1.4 and later, multiple warehouse locations are supported. You can choose the desired warehouse when you *Create* a layer. A *Warehouse* in GeoCue is simply a Universal Naming Convention (UNC) accessible network shared folder on any physical storage device. A UNC file path is of the form \\Machine\Path as opposed to "X:Path".

It is important to note that the GeoCue Server cannot prevent anyone from bypassing GeoCue and directly accessing UNC shares dedicated as GeoCue Warehouses. In fact, it is often desirable to do just this to export certain data files from GeoCue. However, you should establish a general policy of allowing only system administrators to directly access the warehouses.

WARINING - It is imperative that you *never* delete, rename or add files to a UNC shared folder that has been designated a GeoCue Warehouse. It is permissible to *copy* (not *move)* files from a GeoCue Warehouse. GeoCue maintains metadata references to all files in the GeoCue Warehouses. If you directly rename a file or delete a file, the metadata-warehouse relationship becomes corrupt. This generally results in serious project access problems.

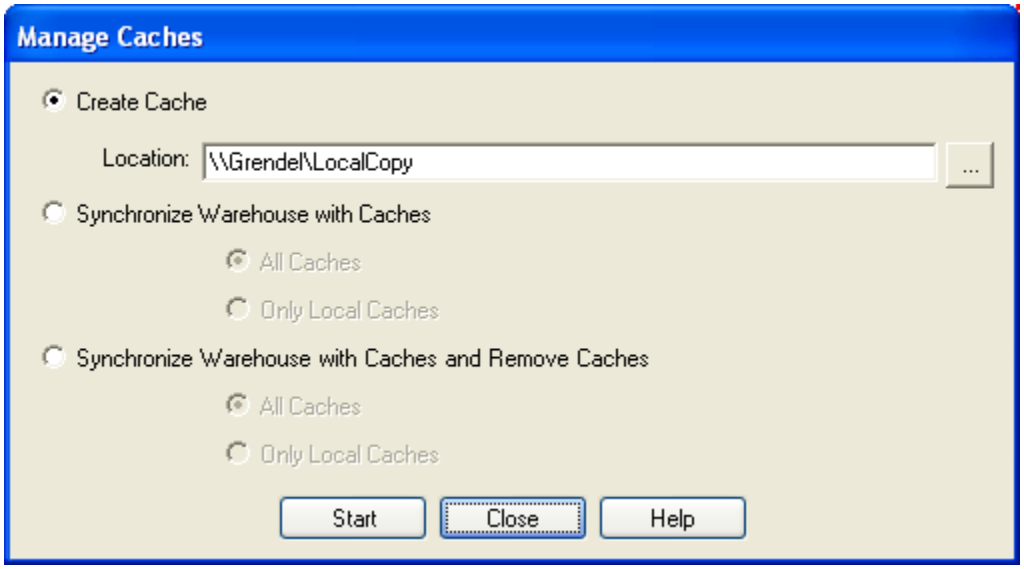
NEVER directly attempt to *Clean Up* a GeoCue Warehouse. GeoCue may be maintaining data of which you are not aware within Warehouse folders, even for deleted or off-lined projects. If you feel that you have a Warehouse that is collecting extraneous data, please contact us at support@geocue..com.

The creation and deletion of files in GeoCue Warehouses is indirectly performed by GeoCue Client interactions. For example, if you create LIDAR Working Segments using LIDAR 1 CuePac functions, a folder is created in a GeoCue Warehouse that correlates 1 to 1 with the layer. Several files will be created in this folder for each working segment entity created on the GeoCue Working Segment Layer. If you delete an entity (i.e. by selecting a working segment into the Working Set queue and deleting the entity), GeoCue automatically deletes the associated files from the GeoCue Warehouse. If you delete all of the Working Sets, GeoCue does *not* delete the folder assigned to the layer. This is because GeoCue often creates *hidden* entities that are used for internal system operations. Generally if you delete an entire layer, GeoCue will delete the associated folder (but not always!). The general message here is that you must never attempt to bypass GeoCue and perform your own operations within folders designated as GeoCue Warehouses.

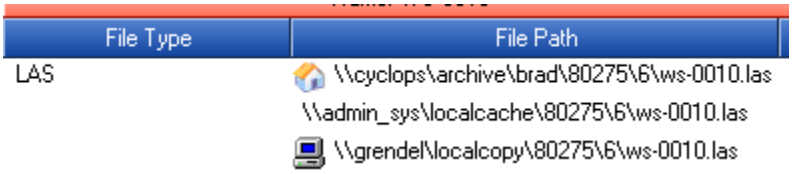
7.1.3 GeoCue Caches

Data that resides in a GeoCue Warehouse is always accessed via Universal Naming Convention (UNC[5]) paths. Starting with Version 1.6 of GeoCue, this warehouse managed data can also reside in locally stored caches for performance purposes. Again, all data files are always accessed via UNC paths, so even locally stored data must be in a designated shared folder with full read/write access, just like a standard Warehouse. For certain entity types, an unordered checklist step called "Manage Caches" will be displayed. This is the interface for both creating and cleaning up locally managed data. Once this step is invoked by putting an entity into the Working Set and setting its state to In Progress, the Manage Caches dialog box will appear.

[5] A UNC path is the full location of a data file, including the unique machine name. For example, a UNC path might appear as "TURBO_1\GC_Dats\Madison\ST01.LAS". The other common method of accessing folders is via "mapped" drive. The above path using a mapped drive access method could appear as "Z:GC_DATA\Madison\ST01.LAS". GeoCue ***cannot*** used the mapped drive technique because drive mapping is unique only to the particular machine that has the mapping.



To create a local cache, select the *Create Cache* option, browse to a UNC folder with read/write permissions, then select Start. Copies of the warehouse managed files will be created in the specified location. The cache folder structure is identical to the project/layer folder structure of a standard GeoCue Warehouse. Once caches are created, their status can be visualized with the "Cache" symbology option on the Symbology toolbar. The multiple filenames can also be seen in the *Files* tab of the *Properties* pane.



Once cached files have been edited, the invalid files are indicated by a red text color.

To return edited cache files to the warehouse, select the Manage Caches step again and select either of the Synchronize options. These will return modified data to the warehouse for the selected caches and optionally delete the caches after the operation.

> Caching is not a bypass of the robust multi-user locking in the GeoCue system. In order for users to modify data, they must still gain a Write Lock on the specified entity.
>
> It should be noted that if a user tries to access a file that is not cached locally and for which the warehouse is out-of-date, GeoCue will automatically update the warehouse.

7.1.4 GeoCue Reference Data

The third general category of data managed by GeoCue is *Reference* data. Reference data are file-based data referred to by GeoCue entities but not stored or maintained in a GeoCue Warehouse. An example might be Reference Rasters that have not been *imported* into GeoCue. In general, reference files contain data that are Read-Only with respect to GeoCue.

Note that in all versions of GeoCue, LIDAR source data mapped to a project via the *Import Sources* command of LIDAR 1 CuePac are actually Reference file data in GeoCue (in spite of our misnomer on the assignment command!). Thus if you delete a LIDAR strip entity in GeoCue, the referenced LIDAR file on disk is *not* deleted.

Reference data are usually data that will remain static for the duration of a project and are not modified in GeoCue.

7.2 GeoCue Physical Files

Files that are to be referenced from GeoCue must be stored on network shared drives such that the user of the GeoCue Client has direct access to the share without the need to enter a password. This means that the permissions of the share must be established such that all GeoCue Client users who have project data referenced on the share have local permissions. You system administrator will know how to establish these permissions.

All data shares accessed by GeoCue must be on physical devices that are network shared. This is because GeoCue uses Universal Naming Convention (UNC) to access all data, even if that data is located on the same physical machine as a GeoCue Client.

7.3 GeoCue Warehouses

We refer to a network share designated as a location for the storage of GeoCue managed file data as a GeoCue *Warehouse*. Starting with Version 1.4, GeoCue has the ability to maintain

multiple warehouses. An initial warehouse is assigned when the GeoCue Server is installed. Additional Warehouses can be added at any time following the installation of GeoCue Server.

Our philosophy as of Version 1.7 of GeoCue is Simple Data Management, Level 1 (SDM1). SDM1 offers advantages and disadvantages. These are tabulated in Table 7-2.

Table 7-2 Simple Data Management, Level 1 (SDM1)

Advantages	***Disadvantages***
Simple to manage	Generally oblivious to unmanaged access to data warehouses
Allows users to specify storage locations at the time of creation of a GeoCue Layer	No automatic storage distribution
Warehouses can be added or removed at any time	

The biggest weakness of SDM1 is that it does not attempt to monitor activities on a physical storage device outside the GeoCue system. This means that if you set up a share on a physical disk drive as a GeoCue Warehouse and allocated 200 GB to GeoCue, SMD1 expects there to *always* be 200 GB available exclusively to GeoCue. Thus if you set up this example warehouse on a disk drive with a total capacity of 250 GB and then allow users to store files on this drive outside the GeoCue system, you could experience “out of disk” problems if the unmanaged storage is allowed to exceed 50 GB. This leads us to recommend a practice of either monitoring disk space usage on a frequent basis or, much more preferably, dedicate physical disk drives to the exclusive use of GeoCue.

Why SDM1? – Attempting to monitor the use of disk space by foreign applications (foreign with respect to GeoCue, that is) is more complex than initially meets the eye. For example, many applications can use a great deal of disk space that is gradually allocated during a single run of the application. A good example of this is an orthorectification process. Such an application may begin running with 0 bytes consumed for output imagery on a disk drive. As the process runs (often over a time span of many, many hours), it may have a data accumulation rate of perhaps 10 GB per hour. Now imagine another process (such as GeoCue) attempting to do a similar storage operation to the same physical disk. A good example would be GeoCue LIDAR 1 CuePac populating LIDAR working segments. There is no current protocol that would allow GeoCue to say to the Rectifier "Hey, how much disk space are you planning to use?" Thus the best GeoCue could do is measure the space. However, this space is rapidly shrinking and thus the snapshot of free space is not useful. Rather than building a very complex system that attempts to address this (and a wide range of variations), we elected to use SDM1. The general rule of SDM1 is that the application constellation using SDM1 has to manage its disk resources but foreign applications cannot be allowed to eat into the SDM1 allocated space.

7.3.1 Accessing the GeoCue Warehouses Management Dialog

When your GeoCue constellation is installed (or when your GeoCue Server software is upgraded from a previous installation) an initial set of warehouses will be established by the System Administrator as part of the install process. GeoCue requires that at least one warehouse be designated at installation time so you are guaranteed to have at least one existing warehouse.

To modify your warehouse configuration, you must access the GeoCue Server Database Manager. This program is located on the machine that is used as the GeoCue Server host. Either physically log on to this machine or access it via the Windows Remote Desktop Connection. The Database Manager is located under (depicted in Figure 7-1) :

All Programs ► GeoCue ► GeoCue Server ► Database Manager

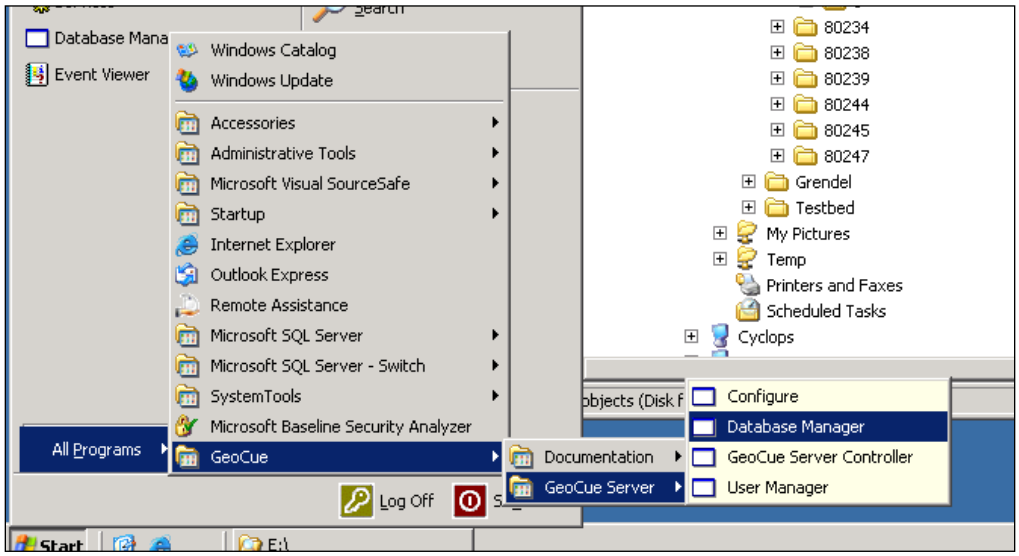


Figure 7-1 Accessing GeoCue Database Manager

Selecting this program will result in the dialog displayed in Figure 7-2. The first tab on this dialog (***Update)*** is documented in the GeoCue Installation Guide. It is used to update a previous version of a GeoCue Database and is not associated with the Warehouse management functions. The ***Update*** button should be disabled.

Select the Warehouses tab. This will result in a dialog similar to Figure 7-3.

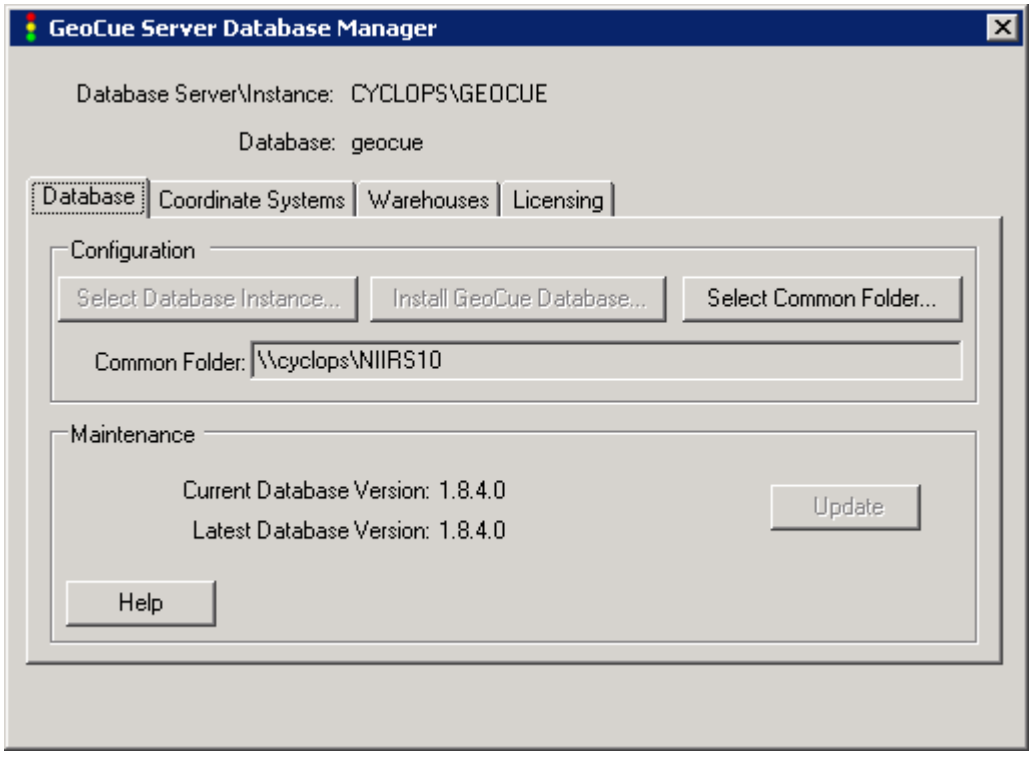


Figure 7-2 GeoCue Database Manager opening dialog

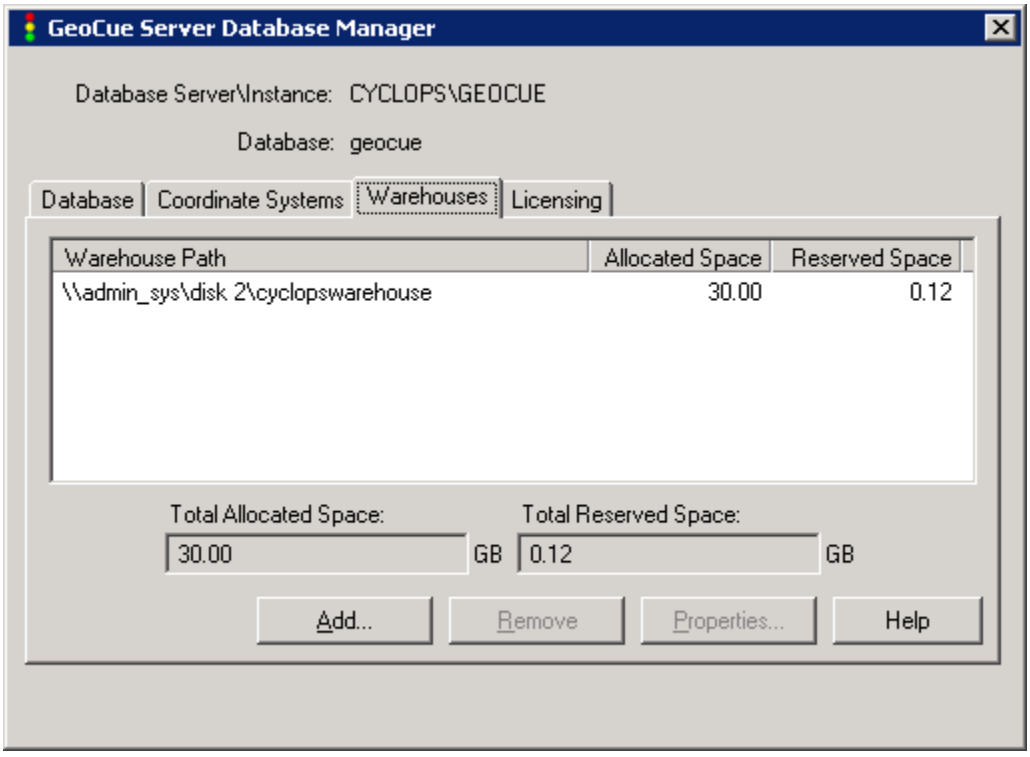


Figure 7-3 The Warehouse management tab

Shown on the *Warehouses* tab are the currently assigned Warehouses, the space that has been allocated to each warehouse and the amount of space that has been *reserved* by project layers that are using the warehouse. The definitions of terms used in the Simple Data Management protocol are contained in Table 7-3.

Table 7-3 SDM1 terms used in GeoCue

Term	***Definition***
Partition Size	The total amount of available storage on a newly formatted NTFS physical device partition.
Free Space	The current number of bytes on a Partition that are unused and available for storage.

Term	*Definition*
Allocated Space	The amount of space that should remain available in a Warehouse for GeoCue. It is important to note that allocations are made for each Warehouse. If more than one warehouse resides on the same physical partition (e.g. disk drive partition) then the allocated space is the sum for each warehouse on that partition.
Reserved Space	In GeoCue, a user can *reserve* space for use by a Layer. In general, reserved space is storage set aside for use by a layer that may or may not yet be used.

7.3.2 Adding a Warehouse

To add a Warehouse, press the ***Add*** button to display the dialog of Figure 7-4. To add a new warehouse, simply browse to the network share (this must be a shared folder on an NTFS file system to which GeoCue Clients have permissions). Set the space (in Gigabytes) that you are allocating to GeoCue and press OK. The share will be added to the Warehouses dialog.

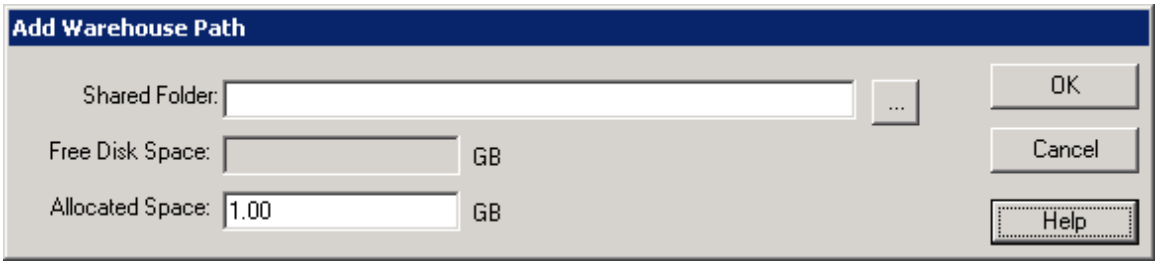


Figure 7-4 Add Warehouse dialog

You may receive an error message, an example of which is depicted in Figure 7-5. This message means that the GeoCue Server could not resolve the assigned folder to a Universal Naming Convention path. This error can be caused by any combinations of the following:

- The Partition on which the folder is located is not formatted as an NTFS file system
- The folder is not network shared. Note that being able to browse to a folder does not mean that the folder is network shared. If you are using a file folder on the machine on which you are working, the folder must still be network shared. This is because GeoCue is a multiuser system and all clients must have access to all shares.
- You do not have appropriate access permissions for the network share.

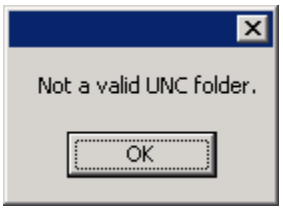


Figure 7-5 Add Warehouse error message

7.3.3 Removing a Warehouse

Removing a GeoCue Warehouse means that the share will no longer be available for assignment as the warehouse used by a GeoCue layer. It does not mean that the warehouse becomes disconnected from layers to which it has already been assigned! This is an important point. For example, if you have assigned a warehouse to a Working Segment layer in LIDAR 1 CuePac but have not yet created working segments, the originally assigned warehouse will be used by GeoCue even if it has been *Removed.*

WARNING - Removing a GeoCue Warehouse via the GeoCue Database Manager tools does not mean that the Warehouse is no longer used by GeoCue. It only means that the warehouse will not be available for assignment to layers that are created

following removal of the warehouse. Deleting the warehouse (by bypassing GeoCue and directly modifying the warehouse folder) will corrupt all GeoCue projects that contain layers that were originally assigned to the warehouse!

To remove a warehouse, select the desired warehouse in the Database Manager *Warehouses* pane and press ***Remove.*** You will receive a confirmation dialog similar to the one shown in Figure 7-6. Press *Yes* if you are sure you want to remove the Warehouse.

Figure 7-6 Remove Warehouse confirmation dialog

Note that *Removing* a warehouse from GeoCue is a benign action. If you unintentionally remove a warehouse, simply use the *Add* command to restore the warehouse.

Note – GeoCue must have at least one defined Warehouse. If you attempt to remove the only Warehouse, you will receive the error dialog of Figure 7-7.

Figure 7-7 Attempting to remove the only Warehouse

We are continuing to add data management tools to GeoCue based on our internal designs and feedback from you, our customers. Future capabilities that are planned include:

- Project Off-lining – Moving data out of GeoCue warehouses into NT Backup sets.
- Project On-Lining – Restoring an off-lined project.
- Warehouse Move – This utility will move the contents of an existing warehouse to a new warehouse.

7.3.4 Viewing/Changing Warehouse Allocations

You can view the current properties of a GeoCue Warehouse and change the storage allocation by selecting the desired warehouse from the Database Manager *Warehouses* tab and pressing the *Properties* button. This will invoke a dialog similar to that depicted in Figure 7-8.

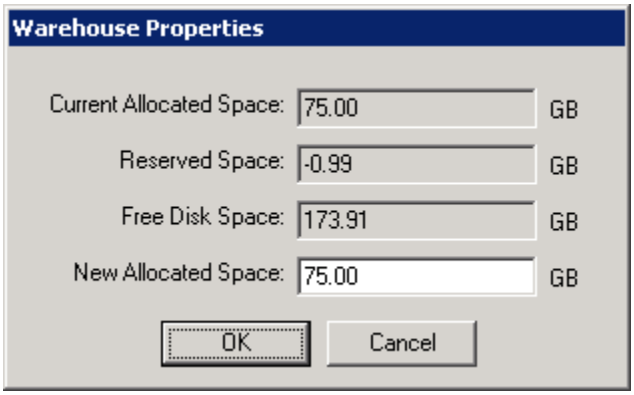


Figure 7-8 Warehouse Properties

Note that the Free Space is computed at the time that you invoke the dialog and thus indicates the current space available for storage on the *Partition* on which the selected warehouse is located. This is not a reflection of the space available for storage allocation because more than one warehouse can be assigned to the same physical partition. Thus decisions regarding the

amount of space that can be allocated to a GeoCue warehouse depend on a number of factors, among which are:

- Are programs other than GeoCue using space on the partition?
- Do you have more than one GeoCue Warehouse allocated to the same partition?
- Is the space currently reserved for layers smaller than the anticipated actual physical storage that will be needed for a layer?

To change the *Allocated* space, key in a new size (in Gigabytes) and press *OK*.

7.4 How GeoCue Stores Project File-based Data

GeoCue stores managed (as opposed to GeoCue Referenced) file-based data created in the GeoCue Warehouses based on the following scheme:

When a *Project* is created in GeoCue, it is assigned a unique Project ID (an integer). This Project ID is displayed in the GeoCue Client dialog following the Project Name (an example is depicted in Figure 7-9 Project ID).

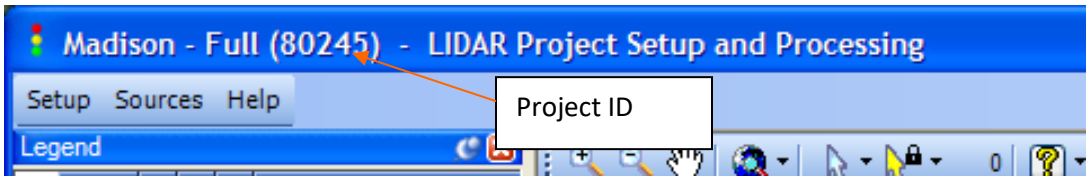


Figure 7-9 Project ID

When a layer is created, it is assigned a GeoCue Warehouse from a drop-down list of the currently configured warehouses. The layer is assigned a *Layer ID* (a project unique integer) that is displayed in the Legend.

When the first data element requiring file-based storage is created on a layer, GeoCue Server creates (if it does not already exist), a Project Folder in the Warehouse folder named <*Project ID*>. It then creates a subfolder within this project folder named <*Layer ID*>. All files created by GeoCue associated with entities on the layer will be stored in this folder.

The warehouse mapped to a layer cannot be changed once the layer has been created. Thus the files associated with a single layer never span more than one GeoCue warehouse.

7.5 Warehouse Configuration Recommendations

The following guidelines are provided for setting up GeoCue warehouses. These are not rules that must be followed but simply points to help make your GeoCue installation efficient.

1. When creating GeoCue Warehouses, try to use physical disk partitions exclusively for the warehouse. For example, dedicate physical partitions on your GeoCue Server to GeoCue and do not allow their use for any other purpose.

2. In general, assign only a single GeoCue Warehouse to a physical partition. This means that you should dedicate a physical partition to GeoCue and then create a single top level shared folder on this drive. Now create a single GeoCue warehouse on this newly created folder (note – GeoCue will allow you to assign as many warehouses as you desire to a single physical partition. It only requires that the folder to which a warehouse is assigned be unique)

3. When creating layers (discussed in other sections of this document), try to set the warehouse *Reserved* space value as close to the actual space that will be required as possible. It is always best to slightly overestimate this requirement than to under estimate.

4. After a layer has become relatively static in terms of data storage (e.g. after a working segment layer has been populated, after the LIDAR orthos have been generated at the desired ground resolution and etcetera), bring up the layer properties dialog and set the *Reserved* space to a value slightly larger than the true physical space used by the layer (e.g. 5% larger than is actually being used).

5. If you are going to do a majority of processing on a single machine (e.g. you have a project for which a single production technician will be doing all of the LIDAR classification on her local workstation), set up a warehouse on this production machine. Assign the production intensive layers (in our example, the working segment layer) to this warehouse. This technique minimizes network traffic during production.

8 Basic GeoCue Concepts

In this section of the tutorial we will work through some basic functions within GeoCue. In each example, we will use the project ***GeoCue Introductory Project*** and the Environment *LIDAR Project Setup and Processing.* You can open and close this project and environment at will. In each section below, it is assumed that you have the project open. See section 4.3 for a refresher on opening projects and environments.

In all of the examples that follow, we will typically not explore all of the different ways of carrying out an operation. See the on-line help (or alternatively, print the help manual included on the distribution DVD) for detailed information on all of the methods available for carrying out a particular action.

8.1 Multiuser Aspects

For all of the examples of this user guide, we suggest that you have access to an additional workstation running GeoCue and LIDAR 1 CuePac. This will allow you to visualize the actions that occur when more than one user assesses the same project. This multiuser project status and access control is one of the strongest and most productive features of GeoCue.

The most convenient way to carry out the exercises is to have the two workstations side-by-side. If this is physically not realizable, try using the Remote Desktop Connection of Windows XP to bring up the second workstation on your current workstation desktop:

> ***Remote Desktop Connection*** – Bring up the Microsoft Windows XP dialog for Remote Desktop Connection. You will find this under:
>
> ***All Programs ►Accessories ►Communications ►Remote Desktop Connection***

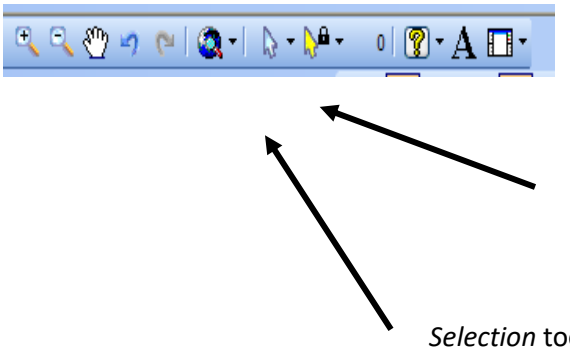
Fill in the name of the computer to which you wish to connect. Press the ***Options>>*** button and fill in the login information under the ***general*** tab. If you successfully connect, you will be presented a view of the remote desktop on your current machine. Just start up GeoCue on the remote machine and load the same project.

Note – If you do not have access to two machines running GeoCue, don't worry. It is not mandatory for the workflow exercises.

8.2 Selecting in GeoCue

Selecting in GeoCue is similar to selecting within a Microsoft product or the Windows operating system. The selection indicator in GeoCue is a white outline. As discussed in the previous chapter, you cannot, in general, perform operations on an entity that modify that entity unless the entity is in your Working Set. Thus *Selecting* is typically done to inspect entities or as the first step in adding an entity to the Working Set. In the following examples, we will practice several of the selection techniques available in GeoCue.

The *Selection* tools are contained on the *View* toolbar. A drop-down list of tools are available:



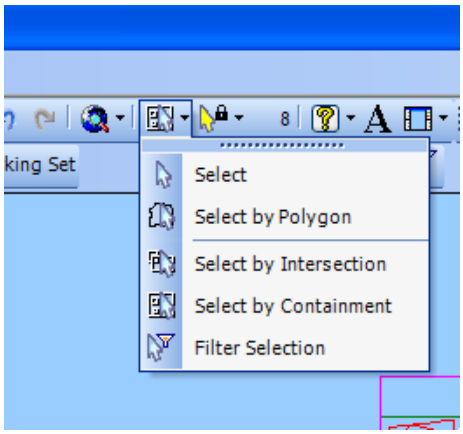


Figure 8-1 GeoCue's Selection Tools

Hint – You can create a *Selection* toolbar by either choosing *Select* from the list of available toolbars (just right-click in the toolbar area of the GeoCue Map View to display a pick list of available toolbars) or by dragging the drop-down list by left-clicking and holding on the series of dots displayed at the top of the drop-down list.

8.2.1 Activating/Deactivating Selectability

Every *entity* in GeoCue is contained on a *Layer*. Each Layer has a *Selectability* toggle in the legend. If this toggle is checked then entities on the layer can be selected. If it is not checked, entities on the layer will not be selectable.

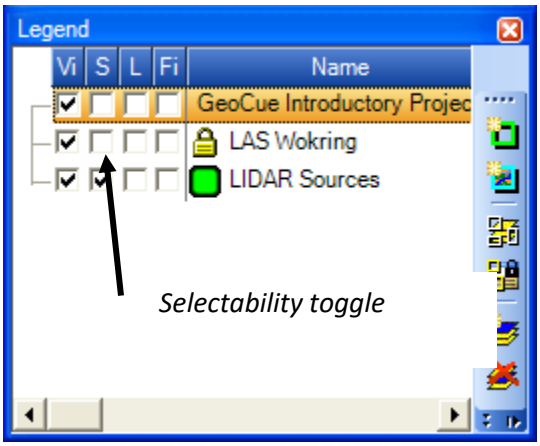


Figure 8-2 Selectability toggle

8.2.2 Single Entity Selection

Ensure that you are in *Select* mode by pressing the *Select* tool on the view toolbar (not the *Working Set Select* tool):

Click on the top edge of the top-most small square Working Segment:

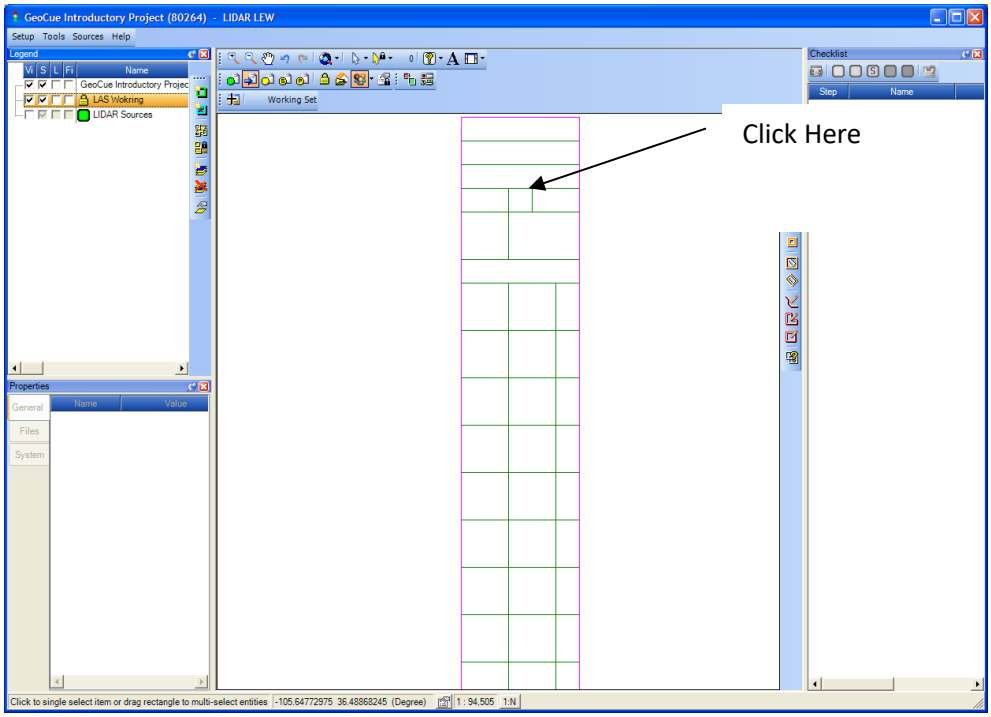


Figure 8-3 Selecting on an edge

You should see the dialog of Figure 8-4:

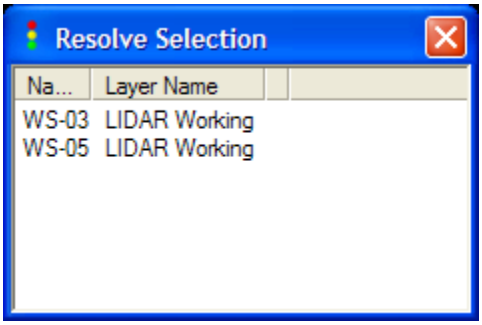


Figure 8-4 Resolving an ambiguous selection

Hover the selection cursor over each item on this list and observe the display. You will see the corresponding graphic element flash. This dialog is an *ambiguity revolver* that is displayed any time a selection is ambiguous. Select the entry with entity *name* "LAS-5" from this list. You should see the top-most square working segment highlight. There are three indicators of the selection. The first is the highlight (white border around the entity) of the entity, the second is the name of the entity in the title bar of the *Properties* pane and the third is the entity name in the name section of the *Checklist* pane.

> ***Note*** - In GeoCue *all* entities have properties and thus will display values in the property pane when *Single Selected* or when the entity is the *Current* entity in the Working Set. However, Checklists are optional in GeoCue so it is possible that you will not see a checklist for a particular entity. You can determine if an entity has a checklist by selecting the entity and inspecting the "Checklist Name" field in the properties of the entity.

Now click somewhere within the map view away from any entities. The highlight will disappear from the previously selected entity and the property and checklist panes will blank out.

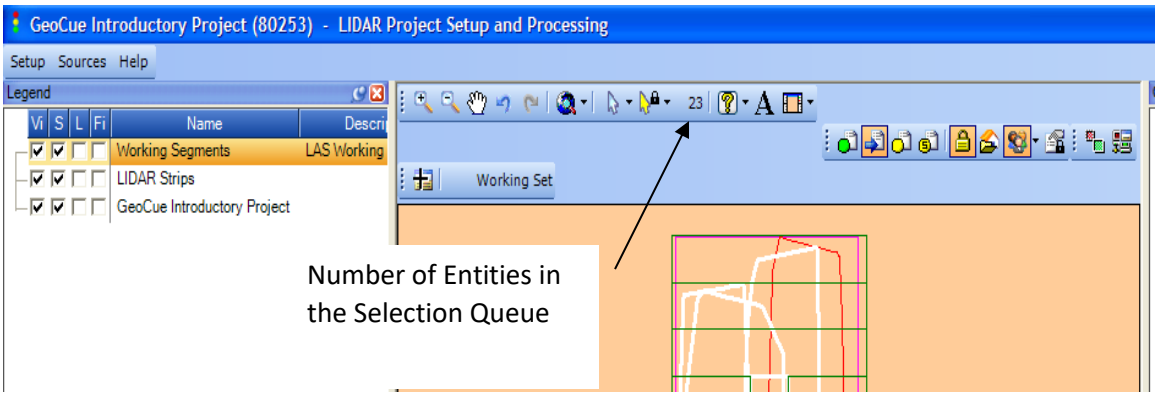
8.2.3 Selecting by Dragging a Rectangle

Next we will select this same entity by dragging a selection box. Place the cursor just above and to the left of LAS-5 (the entity we selected in the previous step). Press and hold the left mouse button. As you drag the mouse (while keeping the left button depressed), you will form a rectangle whose origin is at the location where you first pressed the left mouse button and whose diagonally opposite corner is at the current cursor location. Drag a rectangle such that it totally encloses LAS-5 but does not totally enclose any other entities. Release the left mouse button. If you correctly performed this operation, the result should be the same as the previous selection.

You can select multiple entities using the "drag" selection technique. All entities that are totally enclosed within the rectangle that you drag will be selected.

Note that when you have multiple entities selected, they will all be highlighted in white. However, the property and checklist panes will be blank. This is because it is not possible to show information about more than one entity at a time in the property and checklist panes. The property and checklist title bars will reflect the number of selected entities (e.g. *3 Items Selected)* to remind you that you are not seeing the properties due to a multi-select condition.

GeoCue maintains a *Selection Queue* of entities that you have selected. You can add and remove items from this queue by use of the ***Control*** key on your keyboard (the **Ctrl** key). If you hold this key down during selection, entities that you select will be added to the selection queue. If you select an entity that is already selected while holding down the **Ctrl** key, the entity will be deselected (removed from the selection queue). The selection paradigm employed within GeoCue using the **Ctrl** key combinations is the same as the use of **Ctrl** in making selections within Windows (for example, when selecting files within Windows Explorer). Experiment with selecting and deselecting entities in the map view. The number of currently selected entities (the number of entities in the Selection Queue) is indicated on the *View* toolbar next to the selection arrow.



8.2.4 Select by Polygon

The second entry on the Selection tool dropdown list allows you to draw a *Selection Polygon.* Activate this tool and move the cursor over the Map View. You will notice that the *Selection Cursor* has changed to a cross hair with a polygon symbol. This indicates that you are in the *Select by Polygon* mode. Begin the selection operation by pressing the data button on the mouse. Each time you press the data button, you will add a vertex to the selection polygon. Double click the data button to complete (close) the polygon.

8.2.5 Selecting from the legend

Sometimes you need to select every entity on a particular layer (or layers). This can be quickly accomplished by selecting the layer(s) and then choosing the ***Select Layer Entities*** command from the Legend right click menu or Legend toolbar button. All entities on the selected layers will be added to the selection set. This is indicated in Figure 8-5.

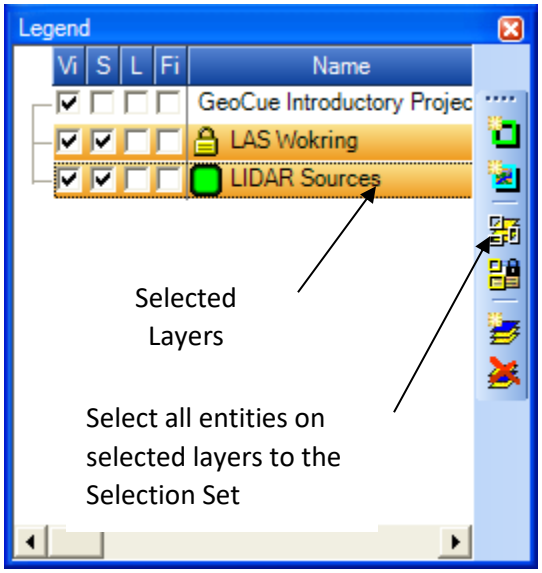


Figure 8-5 Select from Layer

8.2.6 Select by Intersection or Containment

Two tools are provided on the Selection toolbar for selecting by *intersection* and selecting by *containment*. Use these tools by following the below steps:

1. Select the entity (or entities) that will be the source for containment or intersection
2. Activate/deactivate selectability for the layers to achieve the desired selection results
3. Press the selection mode toolbar button

For example, to select all of the LAS Working Segments wholly contained within LIDAR source strip "LS-0004", first select this source strip (see Figure 8-6). Next toggle off selectability on all layers except the LAS Working layer. Finally, press the *Select by Containment* tool. Your result should resemble Figure 8-7.

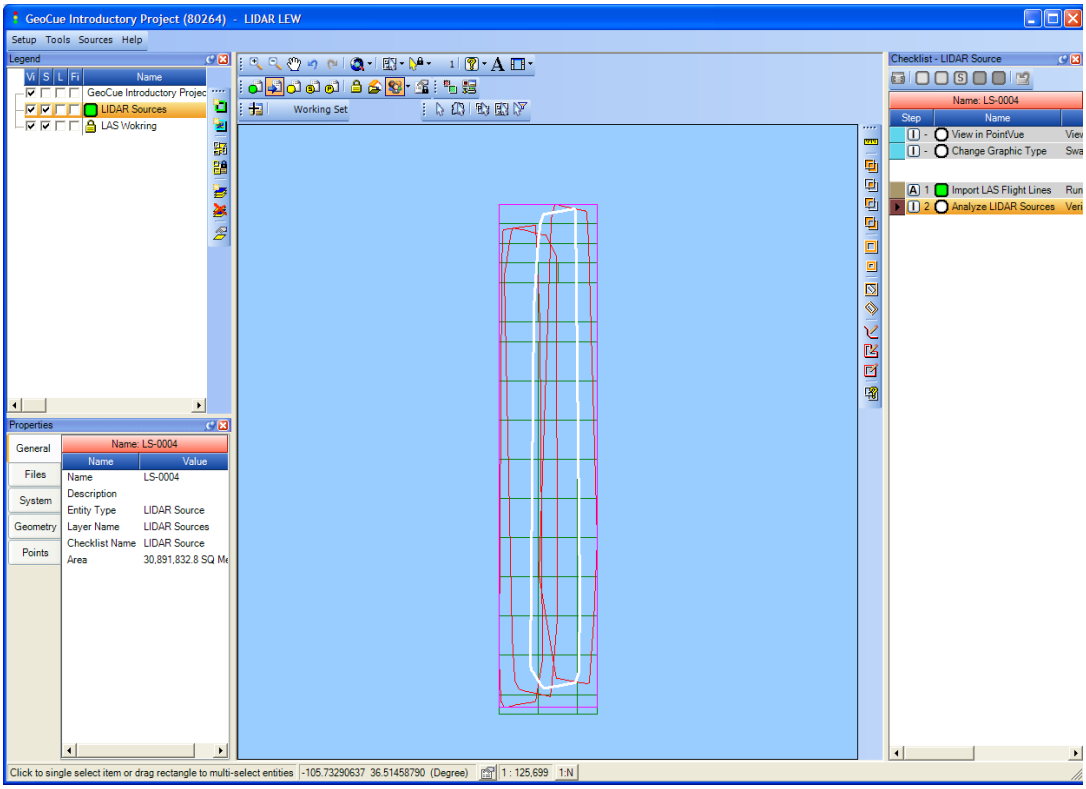


Figure 8-6 Source strip LS-0004 *Selected*

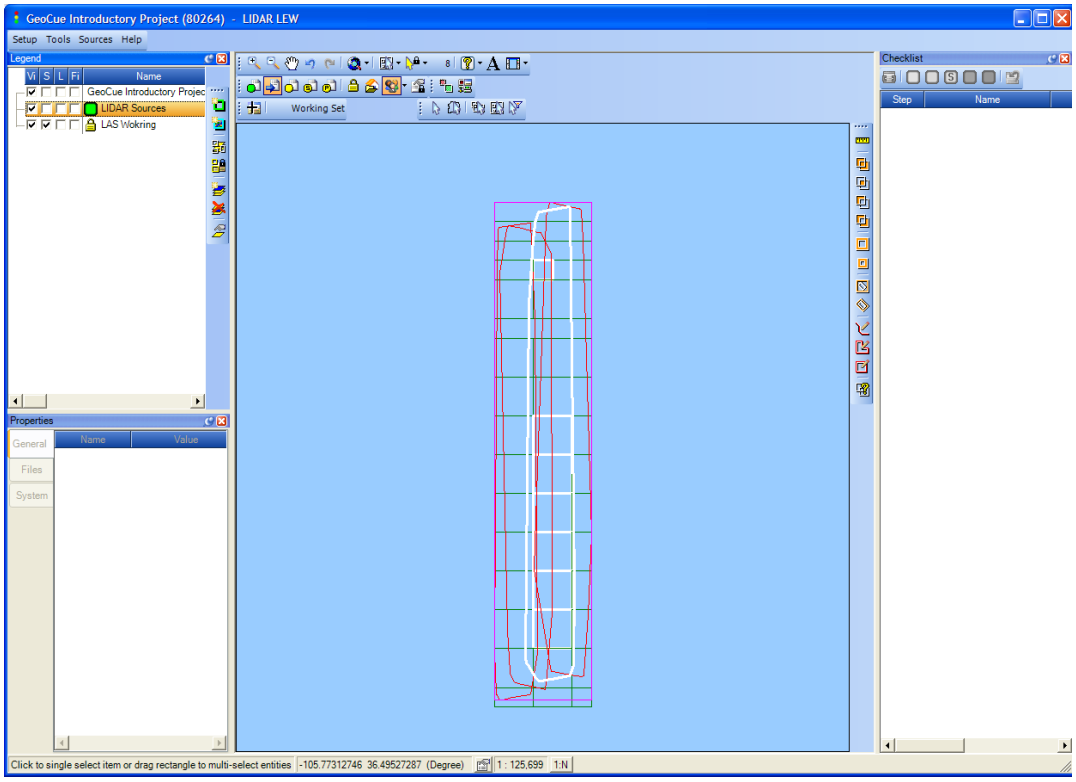


Figure 8-7 LAS Working segments selected by Containment in LS-0004

8.2.7 Filtering Selection Sets

GeoCue provides a tool to *thin* a selection set based on entity type. This allows you to select multiple entities types and then remove those entities (by type) that are not desired. The *Filter Selection* tool invokes a dialog that allows you to specify the entity types to remove and retain.

Repeat the example of the previous section by selecting LS-0004 and then, without toggling off selectability of the LIDAR Sources layer, select by *containment* the LAS Working Segments. Your display should resemble Figure 8-7 of the previous example. Now press the *Filter Selection* tool. You will be presented with the dialog of Figure 8-8.

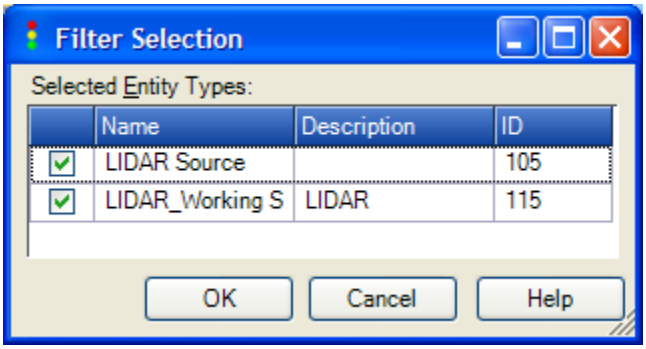


Figure 8-8 *Filter Selection* dialog

Deselect the entity types that you do not want to remain selected and press OK. In this example, uncheck LIDAR Source and press OK. Only the LIDAR Working Segments will remain selected.

This command is particularly useful when you cannot filter by Layer because a single layer contains more than one type of entity.

8.3 The Working Set Queue

As discussed in Chapter 4 of this guide, it is usually necessary to add an entity (or entities) to the Working Set Queue (which we usually shorten to Working Set) prior to being able to perform an action on that entity. The reason for this is that GeoCue is a transaction-based, multi-user system. To ensure that you are the only person performing an operation on a given entity at a particular time, it is necessary that you *lock* the entity for your exclusive use. We accomplish this operation within GeoCue by placing the entity in a special queue. Not only does this perform the multiuser locking but it also provides a number of convenient navigation tools. In this exercise we will add entities to the Working Set and perform some Working Set navigation operations.

Select LAS-5 as discussed in the previous exercise. LAS-5 should be highlighted and the property pane dialog title should reflect LAS-5. If you do not see anything in the property pane title bar, then you probably have more than one entity selected. Look at the selection count and ensure that its value is 1.

Your Working Set toolbar should be *collapsed* and appear as follows:

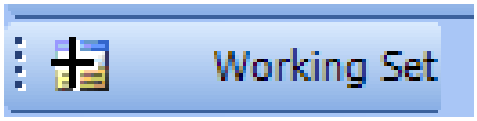
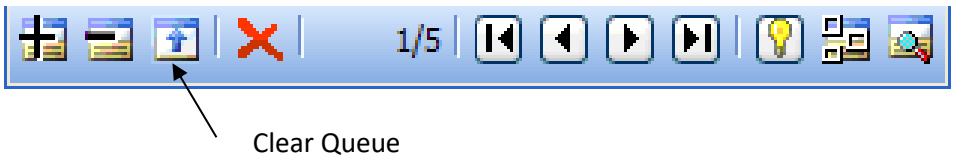


Figure 8-9 Empty Working Set

Note - If your Working Set toolbar is expanded, then you have one or more entities in the Working Set. An expanded Working Set toolbar will appear similar to:



If your Working Set queue is not empty, clear it by pressing the *Clear Queue* button.

Add the selected entity (LAS-5) to your Working Set queue by pressing the "+" button on the tool bar. This will cause the toolbar to expand and display an item count of "1 of 1" as depicted in Figure 8-10.

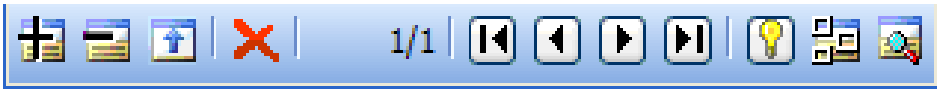


Figure 8-10 Working Set with one contained *Entity*

Now select another LAS Working Segment and add it to the Working Set. Continue this process until you have added five segments. Your toolbar will now appear as:

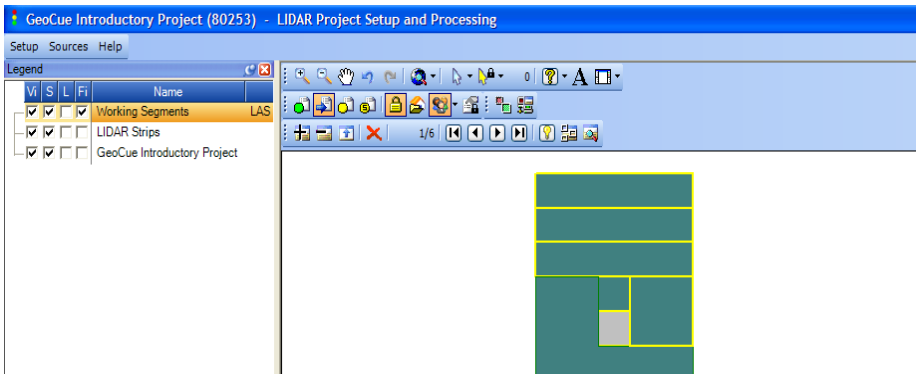
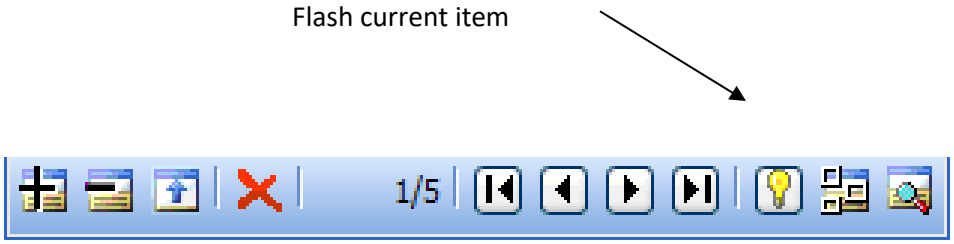


Figure 8-11 Entities in the Working Set Queue

Notice that the entities that you selected and added to your Working Set are now highlighted in yellow (the entities that appear on your screen will be different from this screen shot unless you happened to select exactly the same entities).

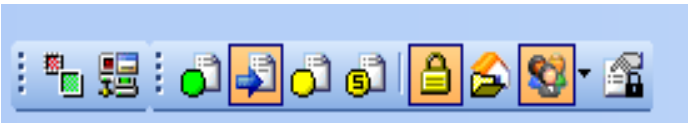
We maintain the notion of the "current" entity in the Working Set queue. You can visualize the current entity by pressing the "Flash current entity" button on the Working Set toolbar.



Pressing this button will cause the current item in the queue to flash on the display. You can change the *Current* entity by pressing the various arrow keys on the Working Set toolbar. Experiment with these and see how the current item shifts in response to your input. You should observe that as the current entity is changed, both the property and checklist panes update to reflect the current entity. The concept of the current item in a queue is quite important in

GeoCue. First of all, the current item in the Working Set is usually the entity for which the checklist and property panes list information. More importantly, if you perform an action on a single entity by pressing an action on the checklist state transition toolbar, the operation will apply to the *current* entity in the Working Set.

Multiuser – You can observe multiuser locking by logging in to a separate workstation[6] running GeoCue under a different domain login than the one you are using on your primary workstation. Bring up the same project and turn on the symbology of "Working Sets of Others".



Working sets of other users

This will result in a display of the Working Set that you have selected on your original login being displayed in bold yellow. Try to select one of these entities into the Working Set on the second workstation. You will receive an error message informing you that the entities are in the Working Set of another user. Note that you can select these entities but you cannot add them to a Working Set. We allow *selection* to enable other users to view the checklist status and properties of entities while they are locked by other users. You will also note that when you select an entity that is in your Working Set, the property pane lists the fact that the entity is in a Working Set and also the login of the user who has the entity in their Working Set. The display that will be observed by other users for the Working Set depicted in Figure 8-11 is depicted in Figure 8-12.

[6] If you are running XP on your desktop you can log into the second machine using *Remote Desktop Connection.*

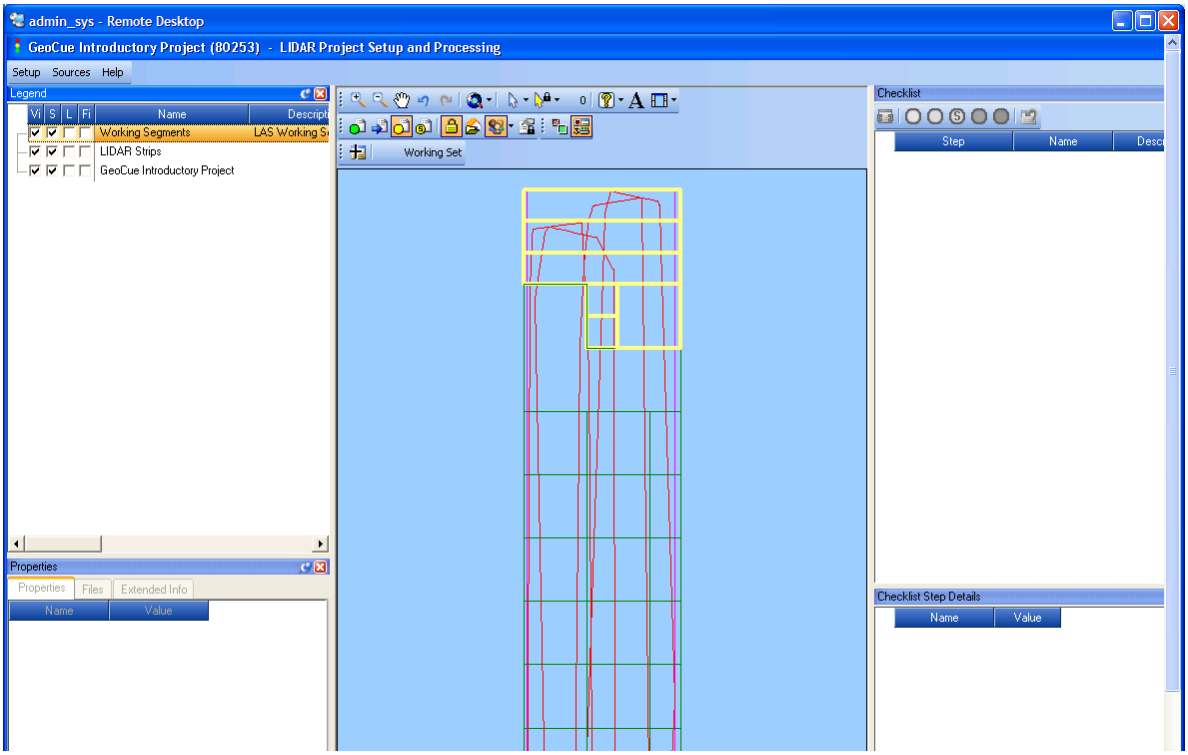


Figure 8-12 Working Sets of Other Users

You can remove an entity from a Working Set by selecting the entity and pressing the "-" button on the Working Set toolbar. The Working Set queue contains pointers to entities, not the entities themselves. Thus removing an entity from a Working Set queue has no effect on the entity itself.

> ***Warning*** – Selecting the *delete* tool on the Working Set toolbar will cause *all* entities in the Working Set to be permanently deleted from the project. Technically the delete tool *dereferences* the pointers to entities in the Working Set to cause an action to be directly taken on these entities. You will be prompted with a confirmation prior to the action being completed.

You can select several display options to assist you in navigating entities in a queue. These options are on the dropdown queue display mode tool on the view toolbar.

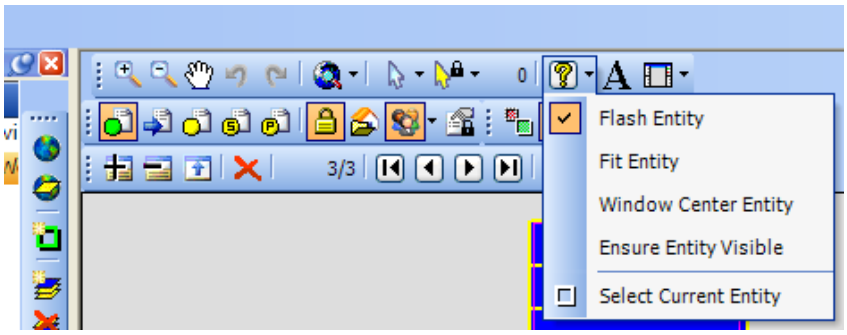


Figure 8-13 Queue Current Item Display Options

These selections apply to all queues and cause the display to perform the indicated action as you navigate the queue with the arrow functions. Try selecting various options on the display mode tool and navigating the Working Set (the Working Set should still contain the 5 entities you added previously in this exercise). You may want to "zoom in" the map view to observe the effect of selecting the various modes. We find "Ensure Entity Visible" to be the best choice for situations where you do not want GeoCue to change the magnification of the map view but you want to ensure that you can always see the current item in a queue.

Beginning with release 3.1, you can activate *Select Current Entity* as an option in the queue display mode settings. This will cause the current item to become *Selected* as you navigate through a queue (or the Working Set).

Play around a bit with different view options and queue navigation modes. When you are finished, clear the Working Set as described in the inset box near the beginning of this exercise.

Note – If you exit GeoCue with entities still in your Working Set, GeoCue will automatically remove these entities from your Working Set during its exit processing. This is by design since if we allowed these entities to remain in your Working Set on exit, they would be locked for all other system users.

For this reason, we call the Working Set locks a "short term transaction lock." GeoCue also supports long term locks that do remain in place after you exit your instance of GeoCue. These long term locks are accessible to environment designers and are typically activated as part of a processing command.

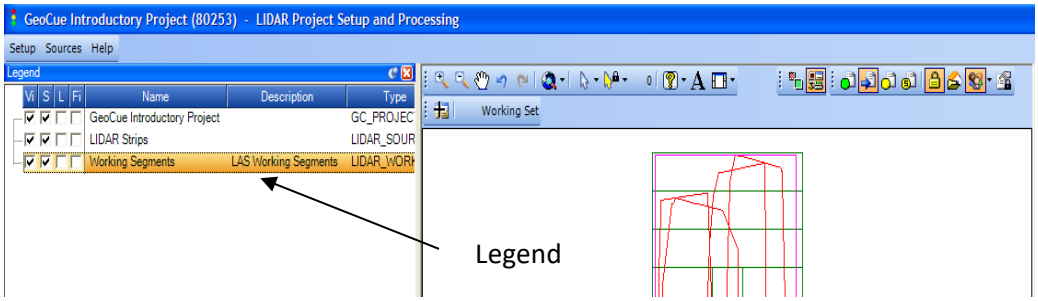
You can also select entities directly into the Working Set queue by toggling the *Working Set Select Mode* tool on the View Toolbar. When active, all selections will move directly into your Working Set. Use the Control key to perform multiple select and deselect operations just as you would for manipulating the select queue. Note that the cursor in the Map View displays in Yellow when you are in the *Select to Working Set* mode and White when you are in the normal *Select* mode.

Note – Items in your Working Set are locked out of other users Working Sets. Therefore you should avoid placing items in your Working Set unless you really require a multiuser lock on those entities. Thus use the *Select to Working Set* tool with prudence if you have multiple persons working in the same project.

8.4 Manipulating Layers

Open the *GeoCue Introductory Project* project in the *LIDAR Setup and Processing* environment. Deactivate all of the buttons on the *Symbology* toolbar. This should result in your project entities being displayed in outline form (non-filled outlines).

Your project contains three layers. The layers are displayed in the legend:



Scroll the legend by manipulating the scroll bar at the bottom of the legend pane. Note that the legend provides a variety of information about a layer. This information is described in detail in the GeoCue help documents (and, of course, the on-line help).

NOTE- As of GeoCue release 3.0, the legend symbology has been augmented to provide additional information regarding coordinate systems and datum transformation status. This new symbology is described in the Coordinate System chapter of this manual. The screen shots that you see in this chapter have not been updated to show this new symbology since it is not germane to this topic.

Note – One of the entries in the Legend is a column called “Entities.” This is a count of the current number of entities on the layer. This number may not agree with the number of visible entities that you observe on a layer. The reason for this is that GeoCue can support “non-graphic” entities. An example of a non-graphic entity is a sorting structure called a Quad Tree. We maintain a Quad Tree on the Segment layer for rapidly sorting LIDAR points into and out of working segments. Thus the number of entities that you can select on a layer may be smaller than the number of entities displayed in the layer information.

Select layers by clicking anywhere on the row for the legend entry. You can multi-select by using the Control and Shift keys in a manner analogous with selecting in Microsoft Windows Explorer.

The order in which layers are “stacked” can be manipulated by selecting layers and performing a drag/drop operation. A small arrow will appear as the layers are moved up/down in the legend

indicating whether the layer will be dropped above or below the current layer. The stacking order is remembered from session to session on both a project level and user level. The first entry in the legend is the top layer of the display, the second is the next layer from the top and so forth. Thus the last entry in the legend is the bottom-most display layer.

You can turn off the display of a layer by deselecting the "V" (Visibility) option in the layer checklist options. Experiment by selecting and deselecting various combinations of the "V" options on the legend.

The second option on the legend is the *Selectability* ("S") options. When deselected, this option prevents entities on the associated layer from being selectable. This is useful for disabling the selection of entities that are not involved in the current operation. Experiment with this by selecting Working Segments near LIDAR source strips with all layers selectable and then with all layers except the working segment layer set to not selectable.

The third option enables the display of labels. Activating the label display option ("L") in the legend turns on the display of labels for the entities on the layer for which you have enabled the option. Figure 8-14 is the display you will observe with visibility enabled only for the Working Segment layer and with the Label option enabled.

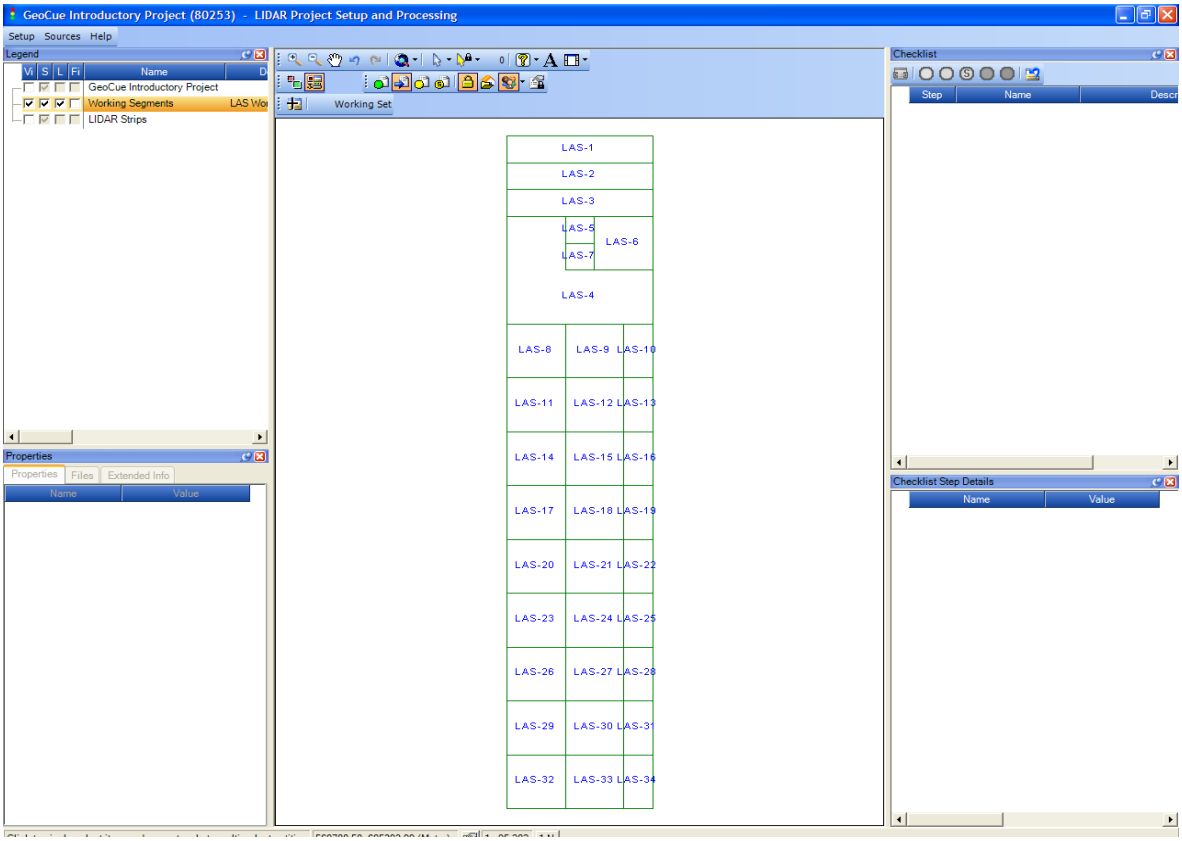


Figure 8-14 Label Display

The final option is (F)ill Symbology. When you activate the fill symbology toggles on the Symbology toolbar, only layers with the (F)ill option selected will display the symbology.

> You can toggle multiple layers at once by selecting the layers you wish to toggle and then selecting the appropriate check box in any of the selected layers.

8.5 Quick Zoom and Pan

Zooming and panning are such common operations that we have added short-cut access to these tools (you must have a mouse with a click-wheel button to make full use of these tools). These commands work in the map view, even if you have command pending (such as the right-click menu displayed). The operations are described in the following table:

Action	***Result***
Roll mouse wheel 'toward' yourself	Zoom-in
Roll mouse wheel 'away' from yourself	Zoom-out
Press and hold wheel.	Pan 'hand' appears. Pan display until you release the wheel.

NOTE – If you are in the zoom-in command (using the  tool, you can escape the command prior to releasing the left mouse button by pressing the escape (Esc) key.

Hint: Previous views are saved in a view stack that can be traversed via the Previous and Next View buttons. 

8.6 Map View Background Color

You can change the map view background color using the new color tool on the *View* toolbar:

Background Color Tool

8.7 Changing the View Stacking Order

You can now change the order of display in the Map View via the legend. Layers in the Legend Pane can now be drag/dropped. A layer is moved by selecting the layer and then dragging / dropping it to the new position. A blue arrow indicates the direction that you are moving to (remember, the upper-most entry in the legend represents the top-most layer in the Map View).

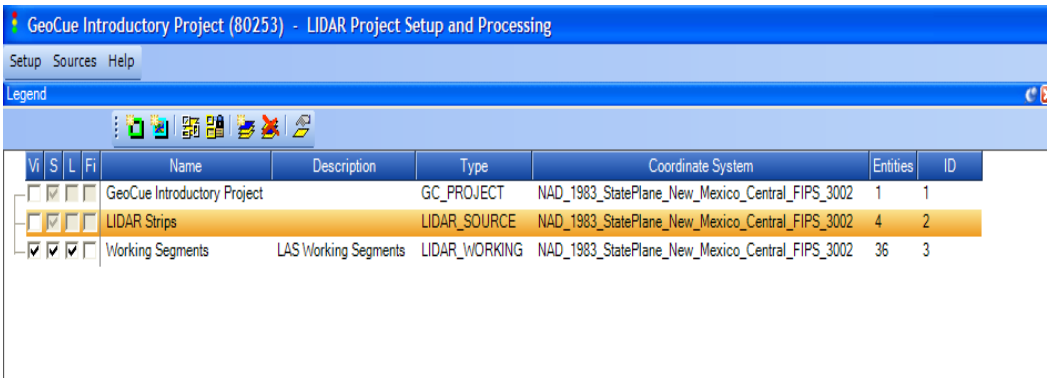


Figure 8-15 Legend with new Toolbar

Note – You can now move more than one entry at a time in this version of GeoCue. Use the standard multi-select operations (CTRL and SHIFT Keys) to select more than one layer to move.

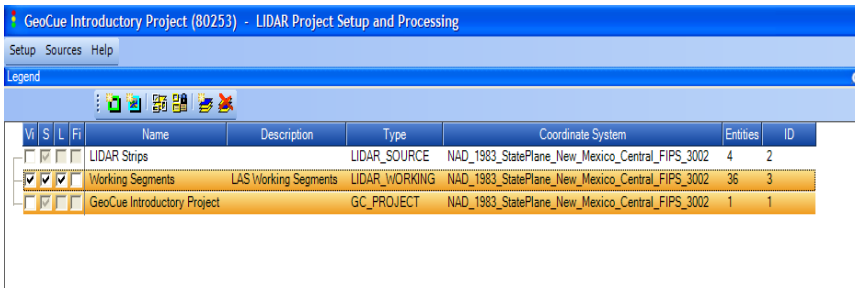


Figure 8-16 Legend toolbar with multiple layers selected

8.8 Entity Properties and States

All entities have an associated set of *properties* and *states*. We refer to these collectively as *properties.* Properties include basic metadata about an entity such as its geometry type as well as state conditions such as whether or not it is in a Working Set or locked.

8.8.1 Properties

Using the GeoCue Introductory Project project and the LIDAR Setup and Processing Environment, select the working segment LAS-5. You can quickly locate this segment by turning off the visibility of the Sources and the project layers (the project layer is called "GeoCue Introductory Project) and turning on labels for the Working Segment layer. The property pane should display as in Figure 8-17. Note that the *title* of the pane is *Properties.* Next in the pane are tabs to select the various pages of information about the entity. Next is the *Name* bar. In this bar is displayed the name of the entity to which the properties apply. If the background of the bar is red, the entity is read-only (which typically means that it is not in your Working Set). If the bar is green, the entity is the current item in your Working Set.

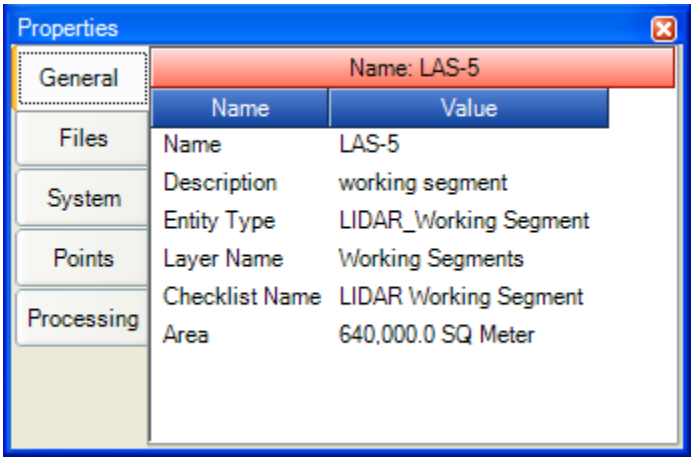
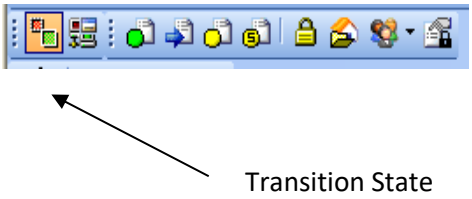


Figure 8-17 LAS-5 Properties

The properties displayed in this pane (which are subject to change in subsequent releases) are described in the following table:

Property Name	***Description***
Name	The name of the entity. This is also what is in the Name bar of the properties pane and also the text that becomes displayed when *labels* are turned on.
Description	An optional field that can be used to provide a more detailed description of the entity.
ID	A unique integer value that we use within GeoCue to uniquely identify entities. This is primarily of use if you design your own environments and are doing debugging.
Entity Type Name	The *Type* of the entity. This is a *class* of entity such as Working Segment.
Entity Type Description	This is an (optional) description of the Entity Type. It is the same for all entities of the same sub-class (type).
Layer Name	The name of the layer on which this entity resides. This is the same name that appears in the layer legend.
Layer Description	The (optional) description of the layer on which this entity resides. This is the same description that appears in the layer legend.

Property Name	***Description***
Checklist Name	The name of the (optional) checklist that is associated with this entity. You will note that this name appears in the title bar of the checklist pane. Each individual entity could have a different checklist although in most environments the checklists associated with entities of the same general class tend to be the same.
Transition State	Transition State is used by an environment designer to designate the gross state of an entity (whereas checklist state signifies the more granular state of an entity). You can view the transition state of an entity by activating the Transition State symbology button on the Symbology toolbar:  Transition state is graphically indicated by the *fill pattern* of an entity.
Locked Status	Indicates if the entity is under a long term transaction lock. If so, the user who owns the lock will be displayed.
Annotation Locked	This field indicates if the entity is being locked by an *Annotation.* This capability of GeoCue is discussed in a later section. It is generally used during red-lining when a problem is severe enough to warrant stopping production on an entity until the annotated problem is resolved.

Property Name	***Description***
In Working Set	This field indicates if the entity is in a Working Set Queue (recall that this places a short-term lock on the entity). If true, the user who has the entity in a Working Set will be displayed.

8.8.2 File Collections

Some entities can reference files stored somewhere in the networked file system. The entity file referencing system allows you to manage the data associated with production in an organized manner. This is the case with the LIDAR working segment entities used in LIDAR 1 CuePac.

Ensure that the segment LAS-5 is still *selected*. Select the ***Files*** tab on the properties pane and you will see a display similar to Figure 8-18. Note that your display will show different file paths than that in the figure.

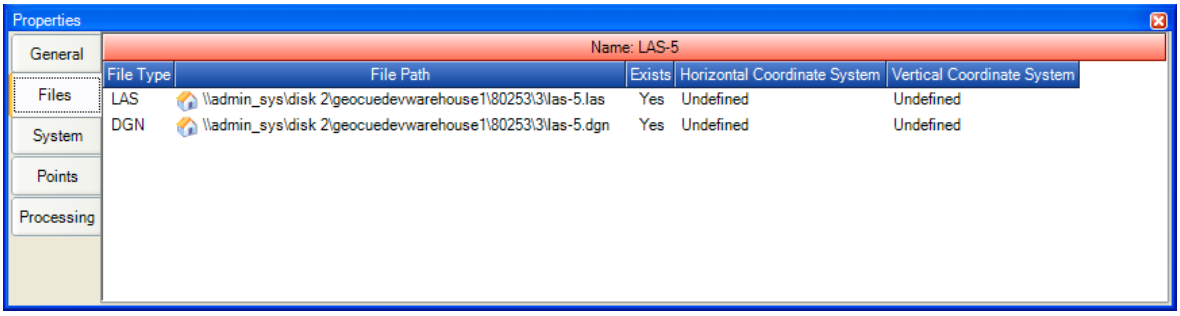


Figure 8-18 Files Tab

This tab of the properties pane indicates if and where ancillary physical files associated with the currently selected entity are located. In this example, there are two files associated with the LAS-5 working segment. The first is a file containing the LIDAR points. The type is LAS which indicates that this is a file of LIDAR points in the ASPRS LAS format. The second file is a MicroStation design

file (indicated by a type of DGN). Our workflow is set up for TerraScan which requires a MicroStation seed file.

The second column of the display indicates the full physical path (in Universal Naming Convention format) to the associated file. The icon preceding the file path indicates the *caching* state of the file (See the Data Management chapter of this document for details on GeoCue's caching operations).

The third column (***Exists***) indicates if a file physically exists at the specified location. Occasionally in production a place-holder is established for a file prior to the actual creation of the file. In this case, the ***Exists*** field will read "**No**".

The fourth and fifth columns indicate the coordinate systems of the data within the physical file. Note that the coordinate system of the data referenced by a file can be different from the coordinate system of the layer on which the entity that references the file resides. It is not always possible for GeoCue to determine the coordinate system of the data in a file (or the file may not be geocoded). In this case the coordinate system will be listed as *Undefined.*

8.8.3 Extended Information

An entity can contain additional information that is stored in the GeoCue repository. This information can be added by an environment designer and programmatically accessed. The extended information is visible by selecting the desired tab on the properties pane. This is shown for the *Points* tab of the LAS-5 entity in Figure 8-19. Note that LAS-5 has several items of extended info that have not been populated.

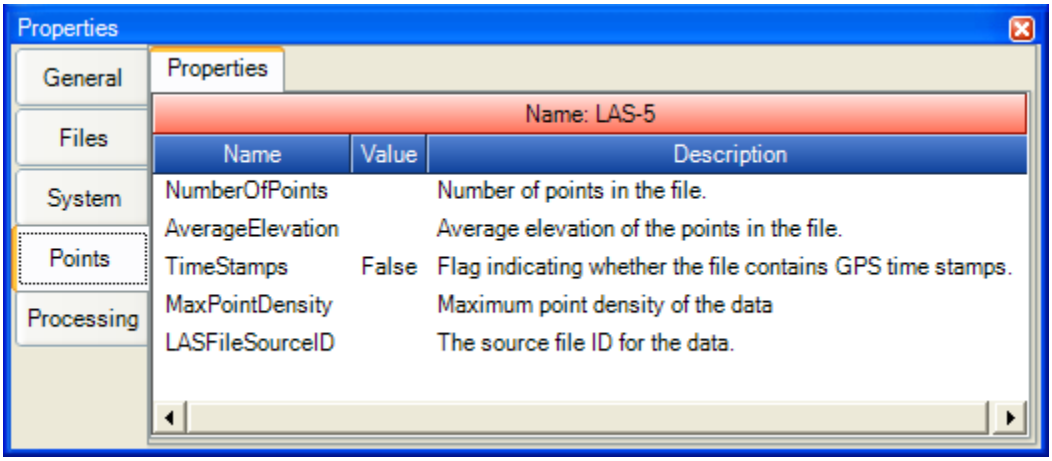


Figure 8-19 Extended Info

8.9 Checklists and Status

One of the most powerful features of GeoCue are Checklists. In fact, the name of the product is derived from this capability since the checklist facility is used to *Cue* operators as to the next step in processing.

Turn on the symbology for "Production Step, Complete" by pressing the appropriate button on the Symbology toolbar. If it is not already selected, select working segment LAS-5. You should see a checklist in the checklist display pane similar to Figure 8-20 (you can adjust the size of the window by stretching the edges to get a complete view of the checklist pane).

Let's review the items that are currently visible in the checklist pane. First of all, the *checklist name* is displayed in the title bar of the checklist. In our case, it is "Checklist – LIDAR Working Segment."

Just below the checklist title bar is the State Selection toolbar. This toolbar is currently deactivated (as indicated by its grayed-out display) because a segment must be in the Working Set

before state actions can occur. Currently we have *Selected* LAS-5 but we have not placed it in our Working Set. We will discuss this toolbar in detail a bit later.

The next item is the "Activation Bar" that is just under the State toolbar. This activation bar indicates the name of the entity to which the checklist is associated (in our case you should see "LAS-5" in this bar) and the modification state indicated by the color of the bar – red (the current state) indicating that the entity is in a "read-only" mode and green indicating that the entity is in your Working Set and can be modified.

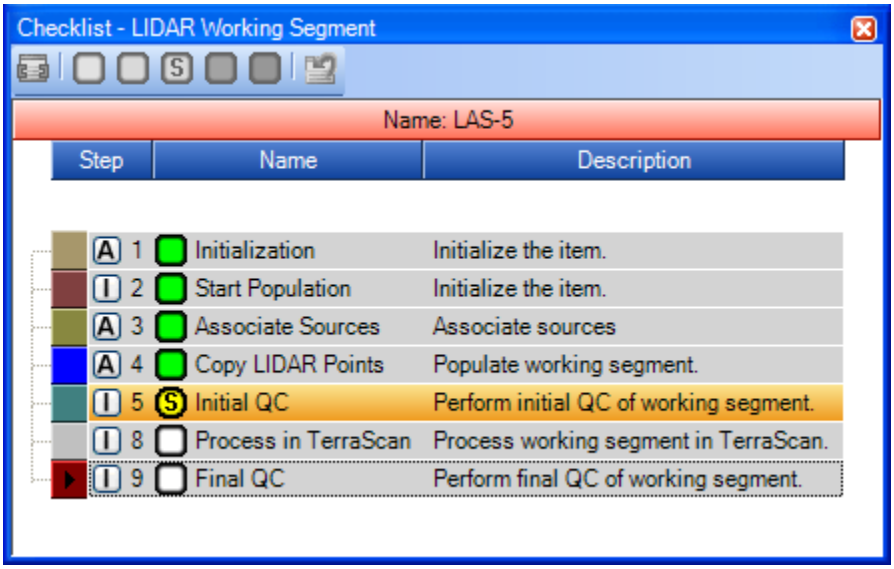


Figure 8-20 LAS-5 Checklist

Finally there is the checklist proper. In the example of Figure 8-20, there are 7 processing steps associated with entity LAS-5. Examine the first entry in this list ("Initialization"). The icon on the far left indicates if this is a step that is Automatic ("A") or Interactive ("I"). An automatic step is one that is invoked by some element within a GeoCue environment that is not directly available via the state toolbar tools. In our example, "Initialization" is an automatic step and thus you would not invoke this step from the checklist tools.

The second indicator on the list is the step number. Notice in the list of Figure 8-20 that these are consecutively numbered from 1 to 7. This number is useful in communicating status (for example, LAS-5 is complete up to step 4).

The background color on the left section of the list is a legend that maps to the process step fill symbology. For our example, the fill symbology of LAS-5 is shown in Figure 8-21 (make sure you have selected "Production Step Complete" on the Symbology toolbar). Note that the fill color of LAS-5 corresponds to step 4 of its checklist. This color coding of production step provides you a quick, synoptic view of the overall state of production of a layer. Production State Complete tells you the last processing step in an entity's checklist that is complete.

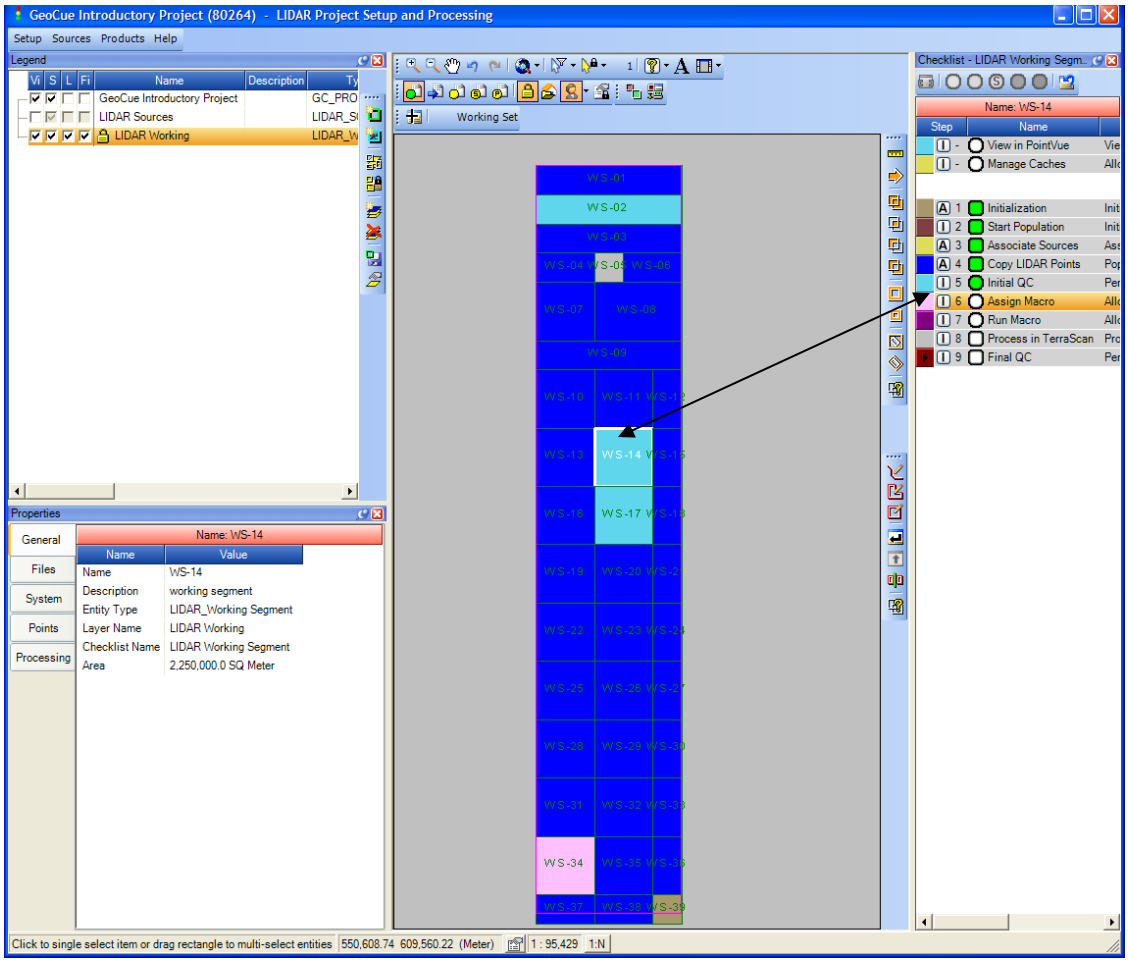


Figure 8-21 Fill symbology, Production Step Complete

An alternative view is “Production State Next.” You can view this by selecting “Production Step Next” on the Symbology toolbar. Make sure that you have the User Filter set *to Filter by All Users/Machines*. The result is depicted in Figure 8-22. Note that the *Next Production Step* is not necessarily one that has not yet been started. In the example of LAS-5, the next production step (Step 5) is one that has been started and is now in a suspended state (discussed below).

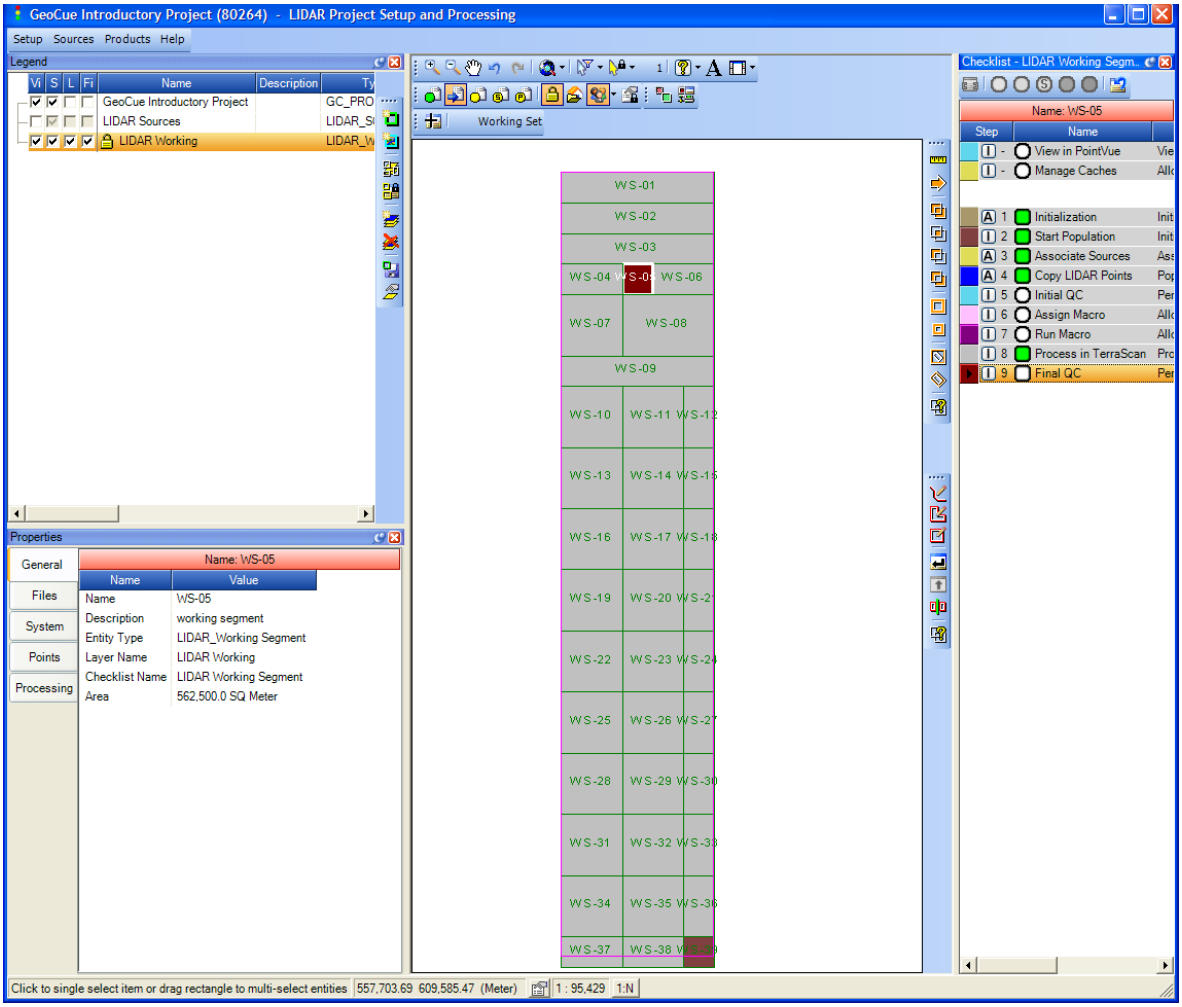


Figure 8-22 Fill Symbology, Production Step Next

The next item as you scan across a checklist row entry is the *State* of the production step. This is indicated by a colored icon, the meaning of which was described in section 4 and is repeated below for convenience.

Symbol	***Name***	***Action***
	Not Started	This checklist item has not been started. Either the step has never started or it has been "undone" back to a *not started* condition.
	In Progress	For interactive steps, this is the button that starts processing. This fires the action associated with performing the step and starts production time logging.
	Suspended	This indicates that production is not complete for the step but that it has been suspended. GeoCue automatically takes all interactive production steps that are "In Progress" to this state if you exit GeoCue. You can also manually set an *Interactive* processing step to Suspended. Production step timing is paused when a step enters the suspended state.
	Complete	The production step has been successfully completed. The production timer is stopped.
	Error	The production step state is set to Error. This causes the symbology of the associated entity/entities to change to red, even if fill symbology is disabled. The production time logging is stopped.

An additional concept with a checklist action is the idea of *Optional* or *Mandatory.* In an ordered checklist, mandatory steps must be successfully complete before you can begin to process the next step. Optional steps, on the other hand, can be omitted. However, if you choose to start an optional step, it must then be completed before the next step can be started. Optional versus mandatory steps are indicated by the shape of the state icon. A round icon indicates an optional step whereas a square icon indicates a mandatory step. Notice that for LAS-5, step 5 ("Initial QC") is the only optional step.

8.10 Checklists and Processing History

The checklist facility in GeoCue is also used for maintaining the production history. Double click on the checklist entry for LAS-5, Step 8 ("Process in TerraScan"). This will cause the history pane to activate and to populate with information from the selected state. An enlarged view is shown in Figure 8-23.

Note – The display panes in GeoCue are fully configurable. You can drag panes to different locations within the GeoCue frame and even "stack" panes as tabbed dialogs. Just grab the pane by its title bar or by its tab and drag it around in the GeoCue frame. GeoCue remembers your layout from session to session so once you have established a layout that you like, it will be restored each time you invoke GeoCue. In all of our examples, we show the default GeoCue layout.

Note – If you close a pane in GeoCue by clicking the "X" icon in the upper right of the title bar of the pane, it can be recovered. Right click in the Map View. From the right click menu, select *Views*. Check the views you would like to activate.

Hint – We find the most useful arrangement for the Checklist Step Details pane is to float it over the GeoCue window (just grab its title bar and drag it where you desire) and resize it to a nice, large size that shows all fields.

Now as you click through the steps in the Checklist pane, the details pane will automatically change to reflect the current step (the current step is always displayed in the Step bar at the top of the details pane, just under the title bar).

When you are through examining the details, click the "X" in the upper right of the dialog. This will dismiss the details dialog. The next time you double click a checklist step, the details pane will reappear in the configuration you set during this process.

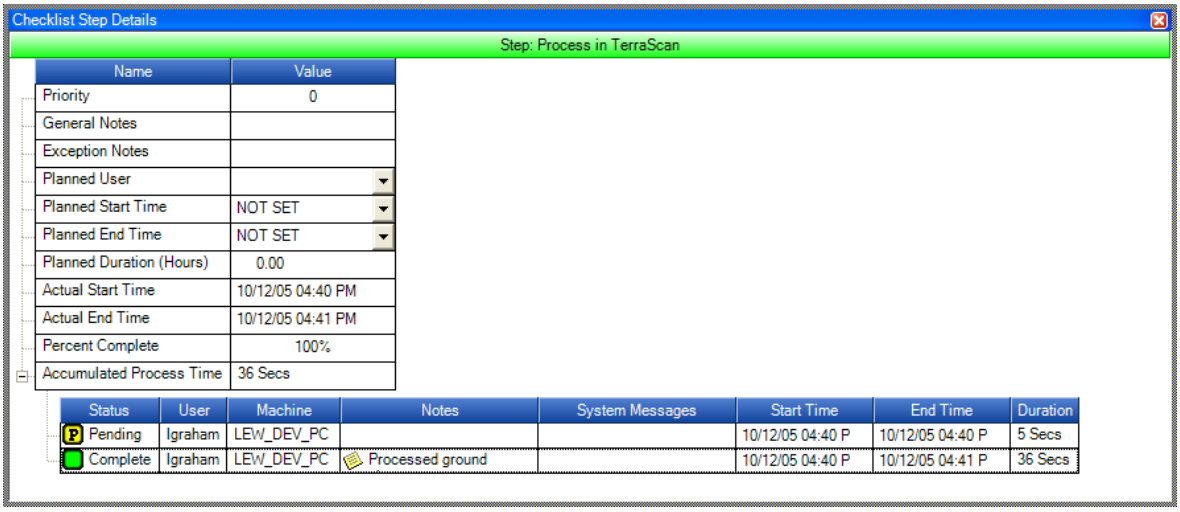


Figure 8-23 Details for Step 5 of LAS-5

8.10.1 Planning Data

There are three general sections of the Process Step Details pane. The top section is planning data. This includes fields for planning the user, the start and stop times, the overall planned processing time and production notes. Note that the start and stop times are "calendar" times and thus the difference between these two does not necessarily represent the actual production time. This is why we provide a separate field for this.

> Note – You must have an entity as the current entity in your Working Set to enter and edit planning or history data in the Checklist details pane. Click in the field you with to edit. When you have completed your edit, press the **Tab** key, *not* the ***Return*** key (this is standard Microsoft – we don't like it either!!)

8.10.2 Actual Production Statistics

The next four fields are the actual summary production data for the process step. These fields cannot be edited but instead are automatically populated by GeoCue. These fields are described below:

Field	***Description***
Actual Start Time	This field is populated with the date and time the first time the status of a checklist step changes from Not Started to some other state.
Actual End Time	This field is populated with the date and time when the process step state changes to Complete.
Percent Complete	We are still designing this. For now it is populated with the ratio of actual processing time divided by planned processing time x 100. Obviously this is the percent complete only in those very rare cases in which you were able to accurately predict how long a step would actually take!
Accumulated Process Time	We automatically track time during which the entity is undergoing some sort of processing on a step by step basis. This field contains the sum of this time.

8.10.3 Processing History

The final section of the Process Step details pane contains the processing history for this particular step. This field for step 8 of LAS-5 is enlarged in Figure 8-24. The *Status* field indicates the final action that was taken by the user recorded on the line. In the example of Figure 8-24, the user suspended the process step on both occasions (this is why the status for this step is not yet complete). There is an area in each history line where the user can enter a Note. The sum of the *Duration* times is accumulated in the *Accumulated Process Time* discussed in the previous section.

Status	User	Machine	Notes	System Messages	Start Time	End Time	Duration
Pending	lgraham	LEW_DEV_PC			10/12/05 04:40 P	10/12/05 04:40 P	5 Secs
Complete	lgraham	LEW_DEV_PC	Processed ground		10/12/05 04:40 P	10/12/05 04:41 P	36 Secs

Figure 8-24 History for Step 8, LAS-5

8.11 Checklists and Processing

GeoCue provides several interfaces for invoking processing actions. One of these is via the drop down menu system. This interface is typically used for global actions that are not necessarily tied to a particular production entity or for bringing data into the system for the first time. An example is reading in LIDAR strips at the start of a LIDAR processing project. A second method of invoking processing is via *Checklist* actions.

We will review this feature by once again working with LAS-5. It is only possible to invoke checklist actions on an entity (or to edit the fields in the *details* pane) if the entity has been placed in your Working Set. Thus for this exercise, add LAS-5 to your Working Set. Ensure you add only this one segment to your Working Set. You can tell how many segments are in the Working Set by observing the count on the Working Set toolbar. It should read "1 of 1." Now click on processing step 9, "Final QC" in the checklist.

The Entity tag under the state toolbar in the checklist pane should be green and should list WS-05 in the text field. This is depicted in Figure 8-25. Single click the 9 different steps in the checklist. You should see state transition buttons become active only for states with white backgrounds. Now select step 9 again.

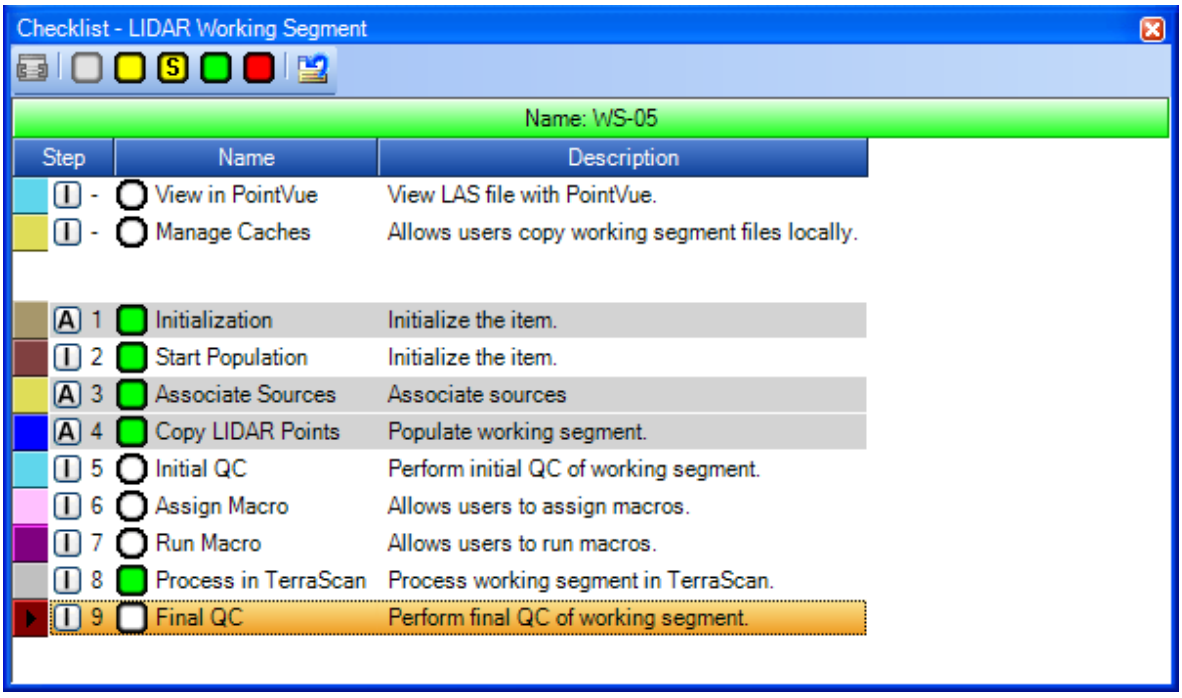


Figure 8-25 LAS-5 Ready for Checklist Processing

The available state buttons for step 9 are Not Started, In Progress, Complete and Error. The Suspended state is not available because this is the current state of step 9. The actions that will be invoked when you press the different state buttons are programmed into the environment. For the Environment "LIDAR Project Setup and Processing" for this checklist, the following actions will be invoked:

State	***Action***
Not Started	Sets the status of this entity back to Not Started. Causes no other action.
In Progress	Starts up the LIDAR 1 CuePac default LAS viewer, PointVue, with this working segment (LAS-5) loaded. This viewer can be used for performing the Initial QC.

State	*Action*
Complete	Sets the status of this step to successfully completed without taking any other action.
Error	Flags this step as an error. Causes the fill symbology of LAS-5 to change to red, even if symbology is turned off.

Press the In Progress state tool (the yellow state button). This should cause PointVue to start up with this working segment loaded. Note that the name of the segment is displayed in the title bar of PointVue (see Figure 8-26).

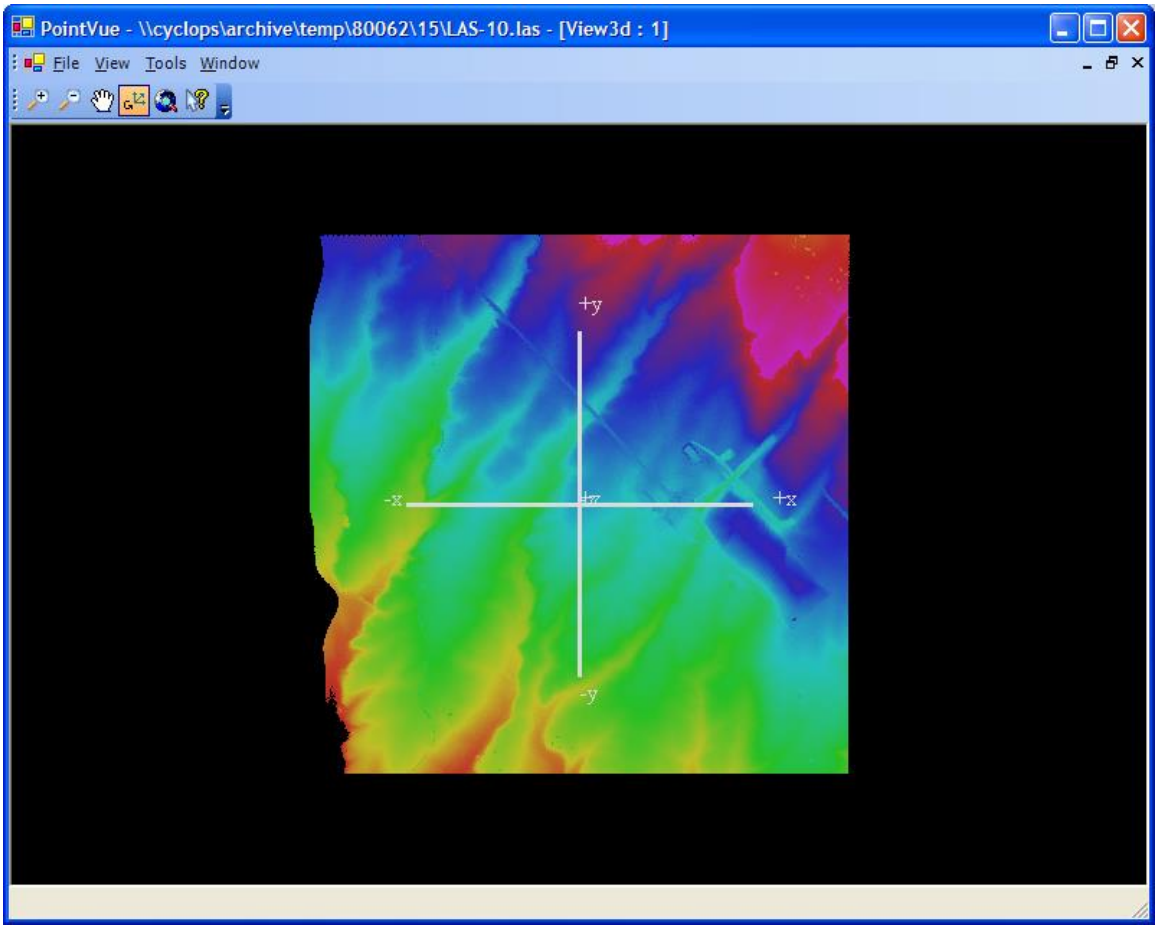


Figure 8-26 The In-Progress action for LAS-5, Step 5

Feel free to play around in PointVue (see the PointVue on-line help for details on the features of the viewer). When you are ready to exit, either click the "X" in the upper right of the PointVue window or select *File* ►*Exit* from the PointVue pull-down menu. You will be presented with the dialog of Figure 8-27. You can enter a comment in this dialog that will be inserted into the history log of the process step. The selection you make from this dialog sets the exit status of the process step.

Add a note such as "Going to lunch" and choose "Suspended" in this dialog. You will notice that a line has been added to the processing history of step 9 of LAS-5 with *your* login name and the start and stop times that correspond to the time you entered PointVue and the time you exited, respectively.

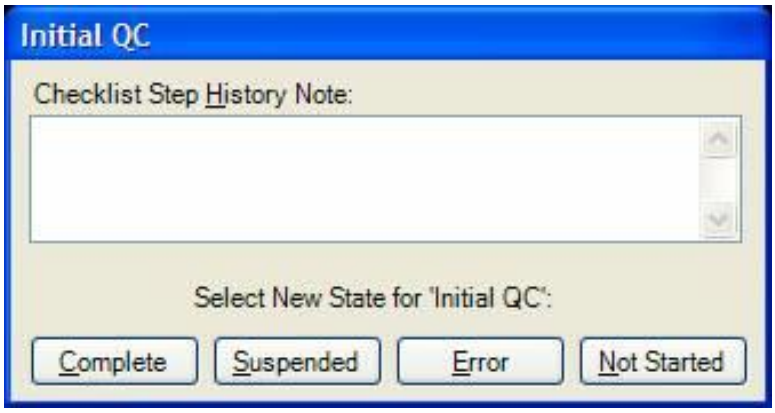


Figure 8-27 Process Step Exit Dialog

You can also add a *History Note* to the history by adding LAS-5 to your Working Set, selecting the Notes box in your history entry and typing in a note. Make sure you exit the note field by pressing the Tab key.

Multiuser – You can observe the changes you make to the process step status of an entity in real time. Bring up this same project on a second workstation under a different user login. Select LAS-5 (do not add it to the Working Set). As you enter and exit PointVue via the checklist processing functions on your

original workstation, observe how the history updates on the second workstation. If you select “Filter by Others” and “Working Sets of Others” on the *Symbology* toolbar, you will also observe the transitions of LAS-5 in and out of your Working Set. If you turn on the symbology for “Locks” on the secondary workstation, you will observe that LAS-5 transitions from your Working Set to being in a long term transaction lock when PointVue is invoked. When you exit PointVue, the long term lock is released (long term locks are symbolized by a bold, purple entity outline).

9 Queues and Annotations

Queues are a fundamental tool in GeoCue. A queue allows you to control and manipulate a group of GeoCue *entities.* Queues are essentially lists of GeoCue entities that provide you with navigation methods such as *next, previous* and so forth. Queues can also modify the display behavior of the GeoCue Map View as you navigate the queue. For example, you can set an option on a queue that tells GeoCue to center the Map View on the current entity as you navigate the elements of the queue. This type of navigation is very useful for QC operations.

Named Queues have an integral *Annotation* system. This allows you to denote issues as you navigate the entities within a queue.

There are three fundamental queue types in GeoCue:

- The Selection Set
- The Working Set
- Named Queues

The selection set are entities within GeoCue that have been *Selected*. These entities usually highlight in white. The Selection Set queue cannot be directly manipulated by the user.

The Working Set Queue (also referred to simply as the Working Set or the WSQ) is a named queue with two additional features:

- Entities in the Working Set can be deleted
- Entities in the Working Set have a transient lock applied and thus checklist steps can be executed against these entities (if applicable).

The use of the WSQ for executing checklist steps has been discussed in a previous chapter. Thus, for the purposes of this chapter, the Working Set is the same as an ordinary named queue.

10 GeoCue Layers

Layers and Entities are the basic units of construction within GeoCue. Every *entity* within GeoCue must be associated with a *layer*. The manipulation of layers has been reviewed in previous chapters. In this chapter we will review the methods used to create and delete layers. Inherent to layers is the concept of Coordinate Systems. This topic is presented in detail in the Coordinate System chapter of this document.

10.1 An Overview of Layers

You can think of *layers* in GeoCue as vertically stacked, transparent pages in a book, essentially the same as in GIS systems such as ArcView. Every *entity* in GeoCue is contained by a layer, even if the entity is non-graphic (i.e. not visible in the Map View).

The current release of GeoCue supports the following layer types:

- Point Graphic
- Line Graphic
- Polygon (simple) Graphic
- Raster
- Non-Graphic

A layer has two associated coordinate systems; a horizontal system and a vertical system. The coordinate systems are assigned at the time of creation of the layer. Once created, the type of a layer and the coordinate systems cannot be changed.

Note – In the current release of GeoCue, the coordinate system of a layer, once assigned, cannot be changed. The reason for this design is that the entities that reside on a layer are in the coordinate system of the layer. If the coordinate system of a layer were to be modified, then the coordinate systems of the data of each entity resident on a layer would also have to change. Changing the coordinate system of an entity is not a generic operation since it typically requires intimate knowledge of the entity type and permissible operations. This design does not present a limitation in GeoCue since coordinate changing operations typically involve copying entities from one layer to another, accomplishing the desired coordinate system transformation.

The GeoCue display system automatically manages mixed coordinate systems (much like a modern GIS). Thus layer types and coordinate systems can be freely mixed without concern for correct superimposition of data elements. Thus, for example, you can have line entities in one horizontal coordinate system and control points in a different coordinate system yet they will correctly superimpose. This support for arbitrarily mixed coordinate systems makes using GeoCue very seamless and easy.

NOTE – Most GIS systems with which you are familiar support only a horizontal coordinate system. GeoCue supports both horizontal *and* vertical coordinate systems.

10.2 GC_PROJECT

Every GeoCue project, regardless of the processing *Environment*, will have a single layer of type GC_PROJECT. This layer is automatically created with the creation of a ***New*** project and it cannot be removed, short of deleting the project.

In the current version of GeoCue, the project layer, GC_PROJECT, is always of type *Polygon*. In a future version of GeoCue, we will add support for layer *collections.* At that time, the GC_PROJECT will become a layer collection capable of containing any number and type of layers.

NOTE – The Project Layer in GeoCue defines the Project Coordinate System. This coordinate system defines the *Universal Graphic* coordinate system used in GeoCue. GeoCue requires that a datum transformation be defined between every layer created in a project and the Project Coordinate System. If you are going to work in a single datum (such as NAD83) then just set the Project Coordinate System to the most prevalent data (perhaps a NAD83 State Plane System). On the other hand, if your project contains a mixture of data from a variety of datums, choosing WGS84 as the Project Coordinate System will usually ensure that you can always define datum transformations between all layers and the Project Coordinate System. For more details on this topic, see the Coordinate Systems chapter of this guide.

10.3 Creating and Deleting Layers in GeoCue

In most cases, layers are created interactively in GeoCue as part of a production setup or processing scenario. It is possible, however, for applications to automatically create layers as part of their programmed operation.

A layer can be programmatically deleted as part of the encoding of a processing environment or it can be interactively deleted via the ***Delete Layer*** command. The delete layer command is accessed via either the legend right-click command or via the ***Delete Layer*** tool (Figure 10-1) on the legend toolbar.

WARNING – The ***Delete Layer*** command is a *deeply recursive* deletion. This means that the command causes each entity on the layer to be inspected. If the entity references external data located in the GeoCue Warehouse and if the entity property is set to "delete files on entity deletion" then the associated files are deleted. Next the entities themselves are deleted (meaning all table information related to the

entity that is stored in the GeoCue database is deleted). Finally the layer itself is deleted.

GeoCue does ***not*** have an undo command. Thus once you confirm deletion of a layer (and assuming the layer is not ***locked***), you cannot recover the deleted data!

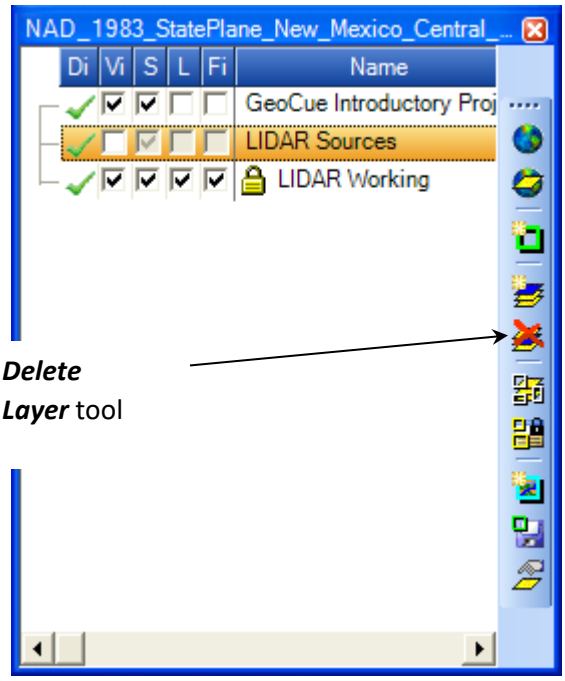


Figure 10-1 The Delete Layer tool

10.4 The Create Layer Dialog

The *Create Layer* dialog is invoked either from the right-click menu of the *Legend* or via the legend *Create Layer* toolbar button. The *Create Layer* tool button is shown in Figure 10-2 and the Legend Right-Click menu is depicted in Figure 10-3. Upon selecting the *Create Layer* command using either of these methods, you will be presented the dialog of Figure 10-4. The entries associated with this dialog are described in Table 10-1.

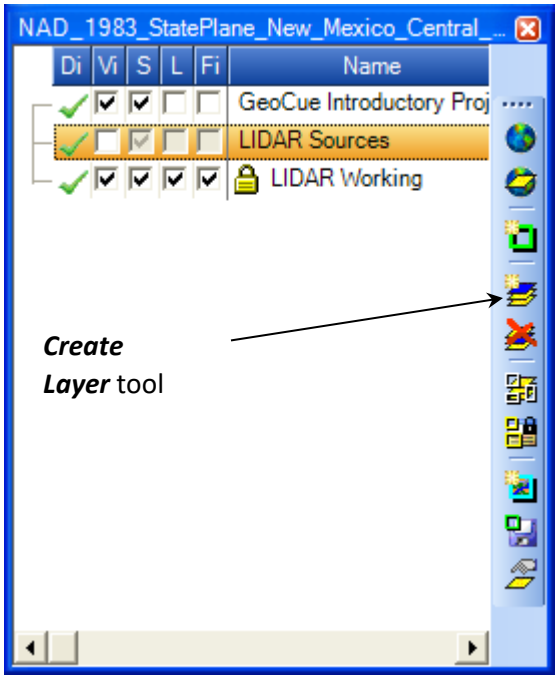


Figure 10-2 Create Layer tool

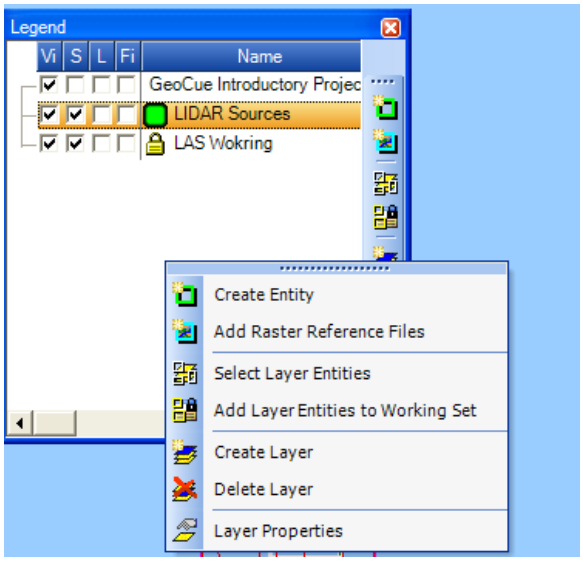


Figure 10-3 Legend Right-Click menu with *Create Layer* and Create *Entity*

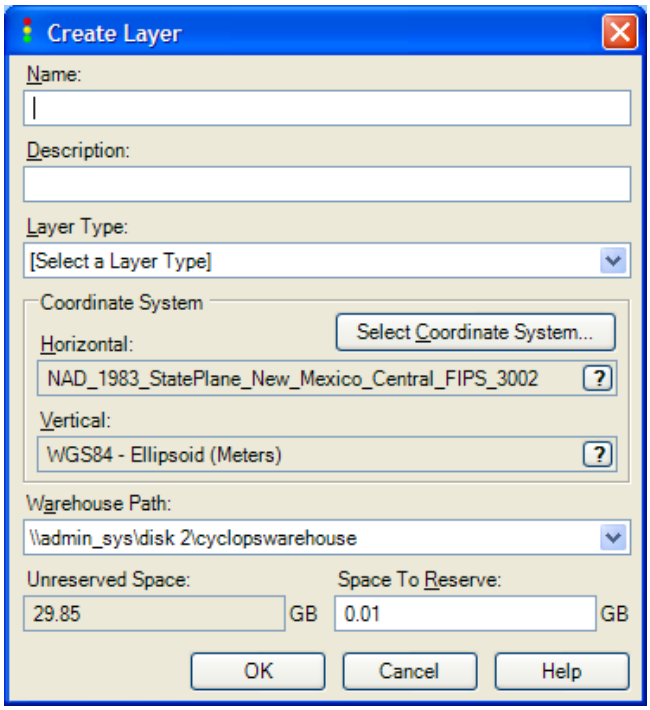


Figure 10-4 The Create Layer dialog

Table 10-1 Create Layer fields

Field	***Description***	***Notes***
Name	Any alphanumeric name (spaces are allowed)	Layer names must be unique within a project. The name is not case sensitive when testing for uniqueness.
Description	Any alphanumeric string.	No restrictions
Layer Type	Select the *type* for the layer	The type list is governed by the selected *Environment.* Selecting different *Environments* for the same project can result in the display of different layers.
Coordinate System	The Coordinate System for the layer. All entities on the layer will be in the layer's coordinate system.	See *Coordinate System* chapter of this document.
Warehouse Path	Specifies where data associated with the layer (typically via *File Collections)* will be stored. See the *Data Storage* chapter of this document.	A layer that does not reference file resident data will leave this field non-selectable.
Unreserved Space	Amount of space on the selected Warehouse that has not been reserved for data storage.	See Data Storage chapter.
Space to Reserve	Amount of space to reserve for future storage needs for this layer.	See Data Storage chapter.

10.5 Export Layer Geometry

You can export the geometry of entities on a layer (in ESRI Shape format) via the Export Geometry tool (Figure 10-5). Selecting a layer (or layers) and pressing the Export Geometry tool (or right-clicking the layer and selecting the command from the right-click menu) invokes the Export Geometry dialog. An example is shown in Figure 10-6. The action of each field on this dialog is explained in Table 10-2

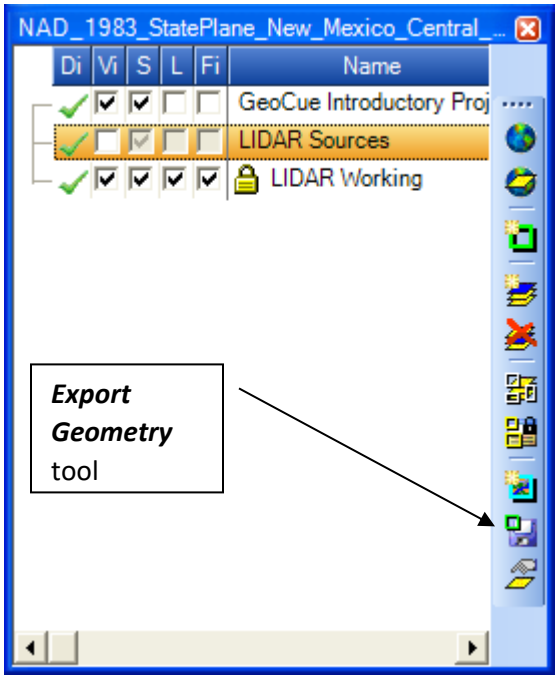


Figure 10-5 Export Geometry tool

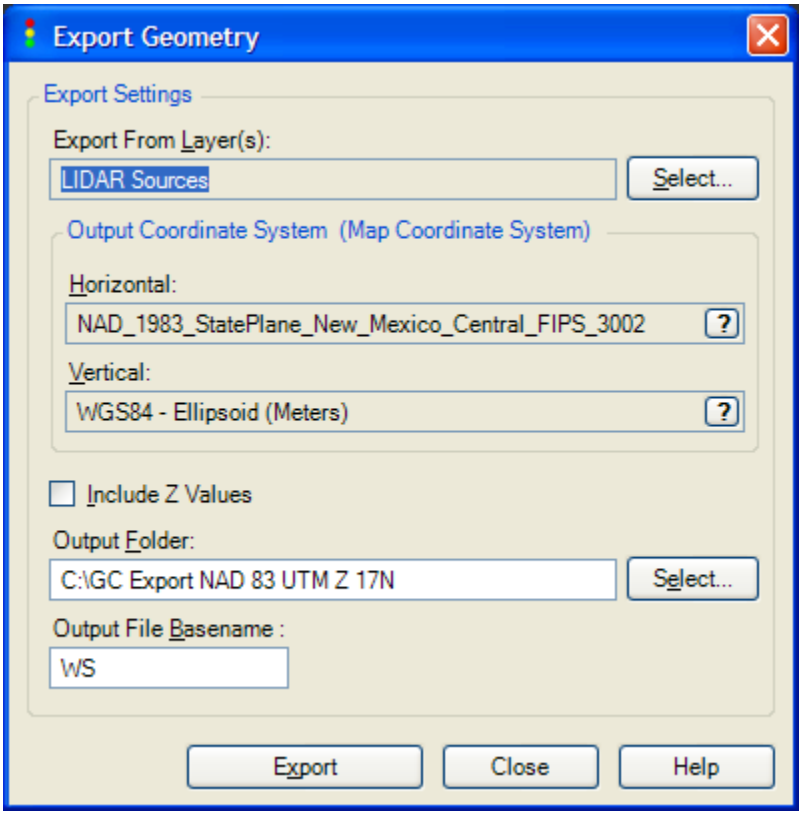


Figure 10-6 Export Geometry dialog

Table 10-2 Export Geometry dialog fields

Field	***Action/Function***
Export from Layer	Allows you to select a layer (or layers) different from the one selected when the dialog was invoked. The layers need not be in the same coordinate system.

Field	***Action/Function***
Output Coordinate System	All entities will be exported in the *active* Map Coordinate System. If you need to export to a coordinate system that is not in the current list of Map Coordinate Systems, simple add a new Map Coordinate System and select this new system as the *active* Map Coordinate System.
Include Z Values	If the data are 3 dimensional and you check this option, the Z value will be included in the output. If you do not check this option or the data are 2D, the Z values will not be output.
Output folder	The directory (folder) where you would like the output placed.
Output file base name	The export command generates a collection of ESRI compatible files as per the Shape specification. *Baesname* is the root file name of the output collection.

10.6 Layer Properties

You can examine the properties of a layer by selecting a single layer and then pressing the layer properties toolbar button (Figure 10-7) on the legend toolbar (or by selecting a layer and then choosing Layer Properties from the legend right-click menu). The layer properties dialog will be displayed. This dialog has three tabs as explained in the following subsections:

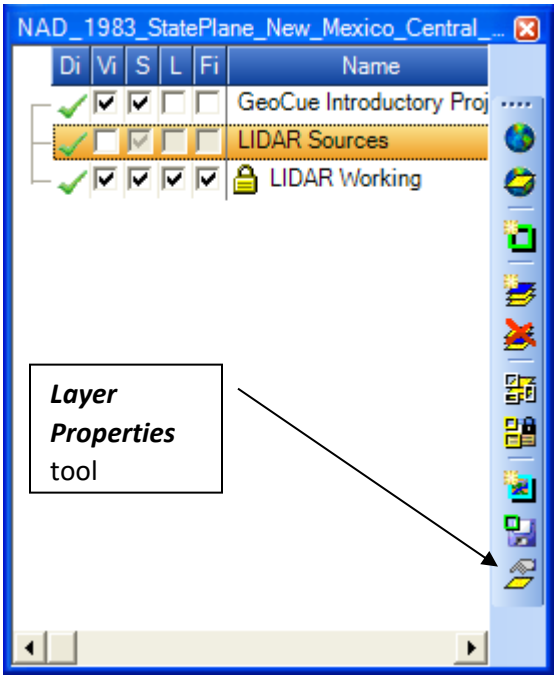


Figure 10-7 Layer Properties tool

10.6.1 General

An example of a *General* tab is depicted in Figure 10-8. The properties were previously described (see Table 10-1). You can change the name and description of a layer by keying in new values in the Layer Properties dialog. You cannot modify any other fields except the *Space to Reserve* if the layer references external files.

> NOTE – You can *Rename* a project by changing the layer name of the GC_PROJECT layer.

You can compute the amount of space that entities are using for GeoCue Warehouse storage by pressing the ***Calculate*** button (this button will not be active for layers that do not reference

GeoCue Warehouse storage space). This field defaults to *Unknown* because computing actual space can be time consuming and we did not want to slow down the display of the dialog.

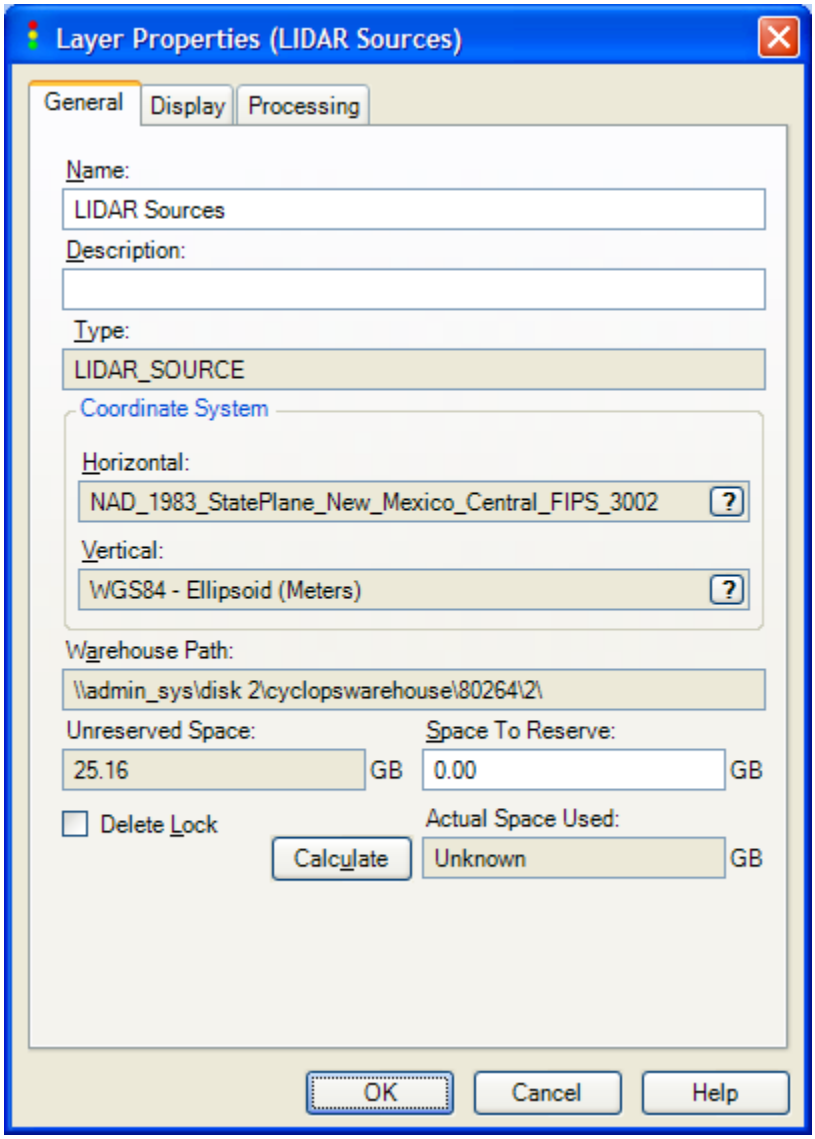


Figure 10-8 Example Layer Properties dialog

You can *lock* a layer by checking the *Delete Lock* option on the Layer Properties dialog. The *Delete Lock* option will cause the ***Delete Layer*** command to fail. It is a good idea to keep *Delete Lock* active for a layer to prevent accidental deletions. You can immediately ascertain the lock status of a layer from the legend. A locked layer will contain a lock icon to the left of the layer name (Figure 10-9).

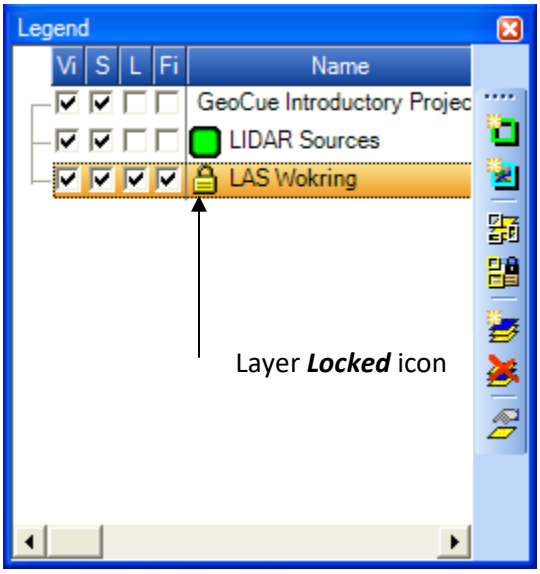


Figure 10-9 Layer *Locked* icon

Hint: You can specify that layers of a particular type should default to *locked* when they are created by setting this property for the layer type using Environment Builder.

Change the space to reserve for data associated with the layer (file-based data) by keying a new value into the *Space to Reserve* field (See the *Data Management* chapter of this guide). You can compute the current total size of file data associated with this layer by pressing the ***Calculate*** button.

10.6.2 Display

The second tab of the Layer Properties dialog (Figure 10-10) allows you to set "zoom toggles" for the graphics and/or rasters of a layer. This feature allows you to turn graphics on and off based on the current display scale ("zoom level") of the layer. This feature is very useful for:

- Decluttering a layer – Often it is not useful to view large scale data in a small scale view (e.g. you would not want city streets turned on if you were zoomed out to a county view).
- Enhancing display performance – Displaying a large amount of raster data will significantly degrade display performance. Thus it is useful to turn off raster layers when the map scale is such that raster detail is no longer discernable.

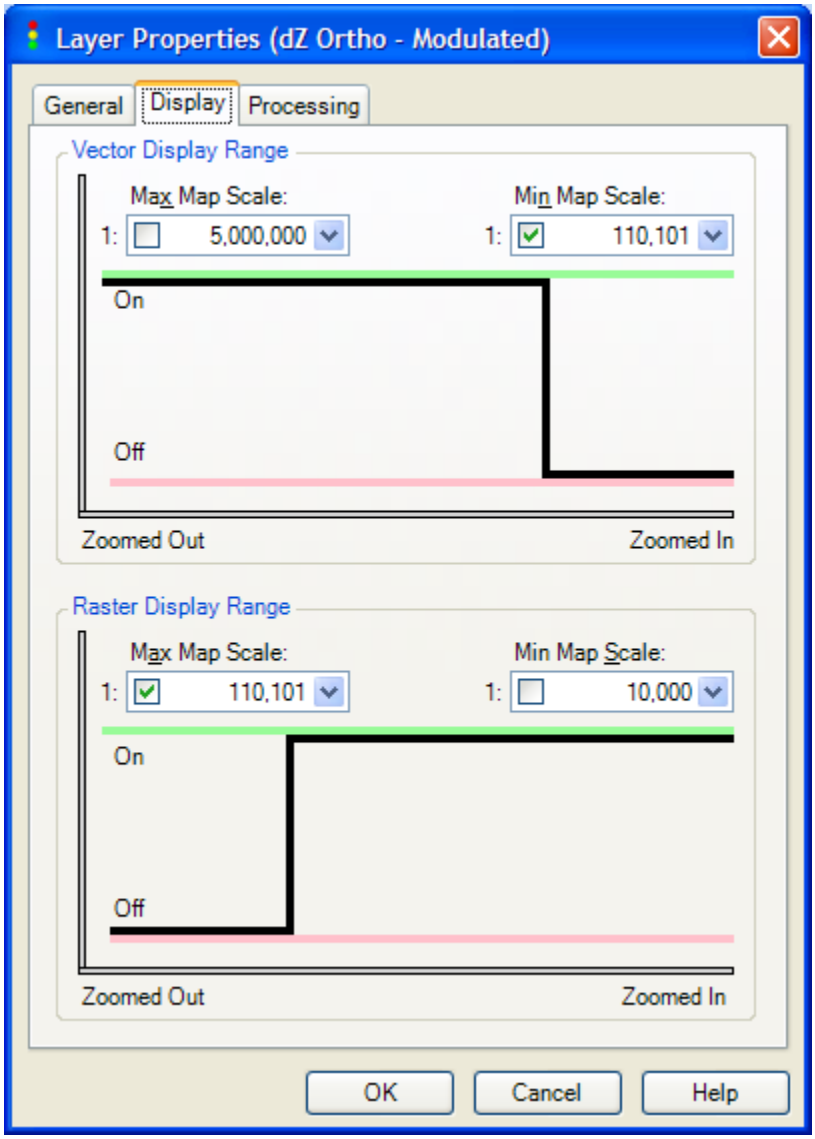


Figure 10-10 The Display tab of the Layer Properties dialog

Layers default to always on. GeoCue allows you to set two zoom toggles per layer. The first (left side of the dialog of Figure 10-10) sets the map scale at which you wish turn off the layer while zooming *out*. The right side control sets the zoom level at which you wish to turn the layer *off* while zooming in. Note that you can set both toggles such that the display of the layer is *on* for an intermediate range of magnifications. This type of setting is very useful for raster layers where the display is not very useful when zoomed out or in to extreme levels.

To enable a zoom toggle, check the box of the desired toggle. You can then either key in a map scale or set the desired scale to the current map scale. Pressing the drop-down arrow in the display toggle box provides the following choices:

- **Apply to Map** - This will immediately zoom the map display to the scale that you have keyed into the zoom toggle box. This option is useful for previewing your scale choice.

- **Retrieve from Map** – This selection enters the current map scale into the zoom toggle setting. We find this selection technique most useful since you can zoom the map to the desired toggle scale (while the Layer Properties dialog is displayed) and simply set the toggle scale.

10.6.3 Processing

We usually indicate processing status by the fill color of entities. However, if an entity does not yet exist, then it is not possible to use this technique. An example of this situation is when importing data into a GeoCue project or when initially creating entities. If the operation occurs quickly then this is not really a problem. However, if the operation will span multiple minutes or even hours, a status display is mandatory.

We use the concept of a *Layer Processing Status* system for indicating processing where using entity fill status is either not possible or not practical. An example from the LIDAR 1 CuePac is importing LIDAR strips. When processing is in progress on a layer, a processing icon will appear to the right of the layer name in the legend display. An example is shown in Figure 10-11. These icons are the same ones used on the production status toolbar (see the GeoCue overview chapter).

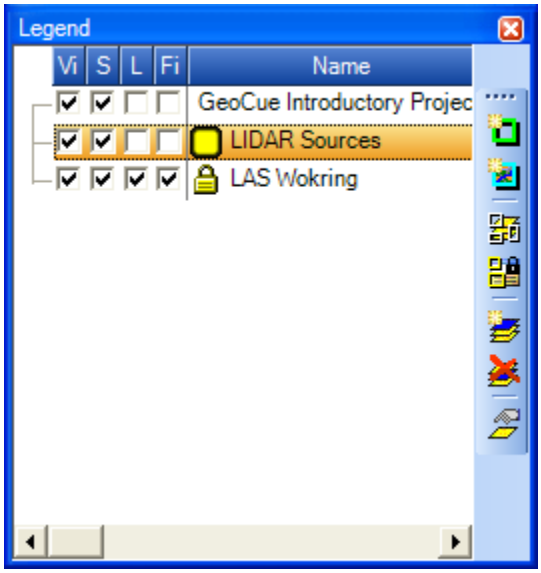


Figure 10-11 Layer processing icon

The third tab of the Layer Properties dialog (Figure 10-12) provides detailed information about processing that is occurring on the layer if the processing application uses this technique for providing status.

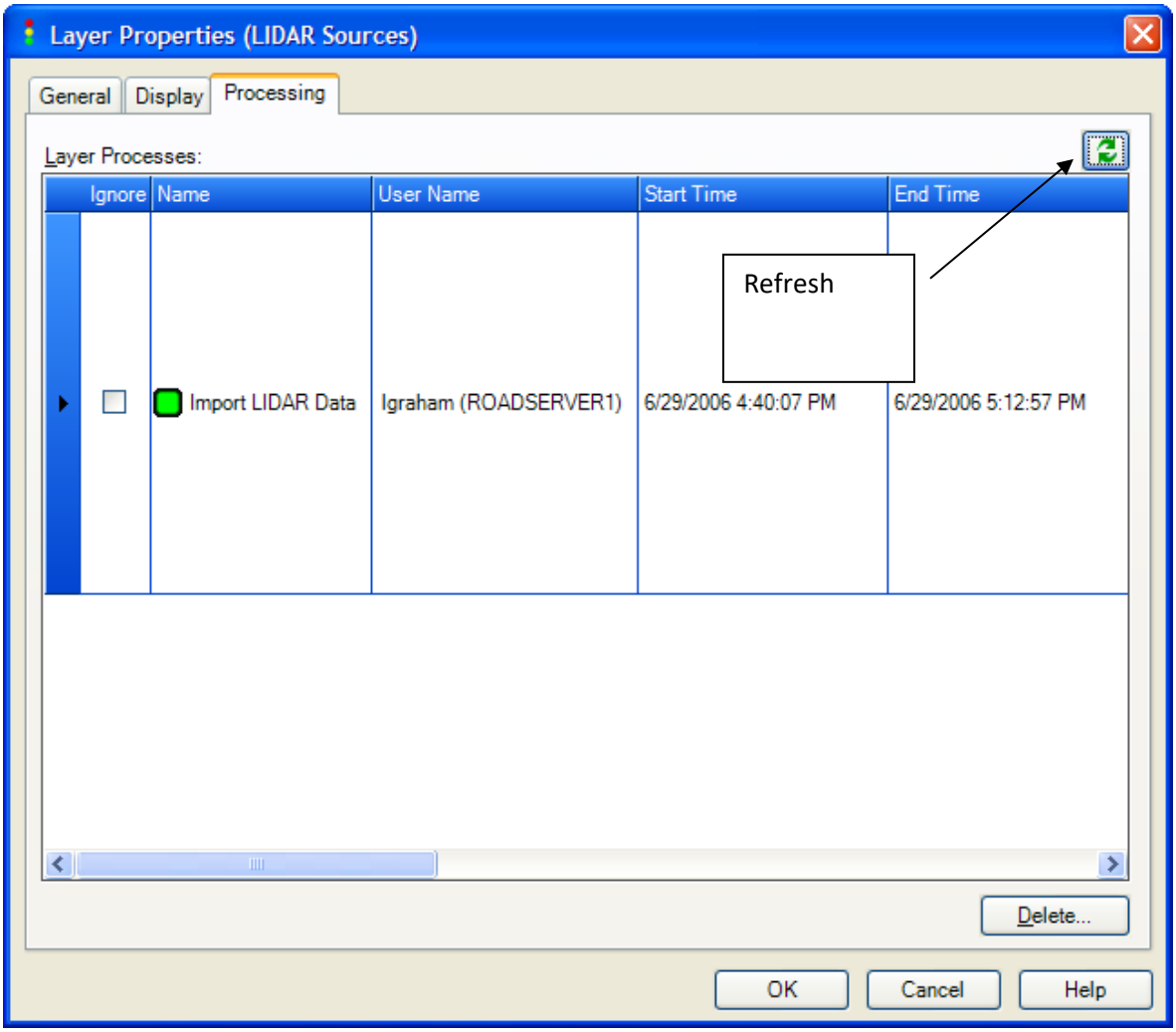


Figure 10-12 Processing tab of the Layer dialog (Import LIDAR example)

This dialog provides detailed information about processing that is either in progress (yellow layer processing icon), complete (green layer processing icon) or error (red layer processing icon). In general, if an error occurs during processing, the layer processing icon will change to red. Even if the processing icon has turned to red, processing may continue. An example might be that an error occurred on the 3 source of an import of 50 sources. You can generally determine the nature of the error by examining the detailed information in the Layer Processing Status dialog.

If a process is *in progress*, you will need to press the ***Refresh*** button on the *Layer Processing Status* dialog to cause a refresh of the most up-to-date status.

The *Layer Processing Status* dialog continue to accumulate processing history until you delete the history records by selecting the rows you wish to delete and then pressing the ***Delete..*** button.

If you wish to maintain the processing history for a layer but would like the layer status icon (Figure 10-11) to ignore previous errors of the layer, check the *Ignore* flag on the rows that are to be ignored when computing layer status. Note that a processing row that includes an error condition will override a subsequent success condition and thus you must use the *Ignore* option to override this case.

11 GeoCue Coordinate Systems[7]

WARNING – You should *always* carefully declare the **Vertical** Datum for Layers that contain elevation data such as LIDAR data (Source, LAS Working Segments), Control points and so forth. Elevation data definitely have a Z component and you will not be able to correctly transform this component if you do not correctly declare the Vertical datum.

NOTE – Effective with release 3.0 of GeoCue (and further refined in version 3.1), the coordinate system management system has undergone a major upgrade. We encourage you to thoroughly review this chapter, particularly when using coordinate systems that span multiple datums (e.g. a project containing a collection of layers in WGS 84, NAD 83 and NAD 27).

GeoCue uses the ESRI Coordinate System engine for all transformations except Orthometric. If you need to research datum transforms or general coordinate system information, use the ESRI ARC reference information.

GeoCue provides extensive support for coordinate systems and coordinate transformations, both horizontal and vertical as well as user definable datum transformations.

11.1 The Project Coordinate System

[7] If you need to review projections and datums, we recommend "Datums and Map Projections for Remote Sensing, GIS and Surveying", J. C. Iliffe, 2000, ISBN 1-870325-28-1

When you first create a new project in GeoCue, you are required to define a Project Coordinate System (PCS). The Project Coordinate System is used for several operations in GeoCue.

We store two definitions of coordinates for every entity in GeoCue – one in the layer coordinate system and the other in a project common coordinate system[8]. This common coordinate system is called the Project Coordinate System. For this reason, you should always set the Project Coordinate System to a system that is commonly supported for datum transformations.

> Effective with GeoCue 3.0, you must be able to define a datum transform (two-way) between every layer you add to GeoCue and the Project Coordinate System[9]. For this reason, avoid esoteric coordinate systems as the Project Coordinate System (they can still be used as individual layer coordinate systems).

Note – Previous to GeoCue 3.0, the Project Coordinate System was used as the default coordinate system each time you created a new layer in a project. Starting in GeoCue 3.0, you can set a coordinate system to be used as the default that is different from the Project Coordinate System. Thus the primary consideration in setting a Project Coordinate System is to choose one for which to/from datum transformations will exist for each layer that you intend to create within the project.

11.2 Map Coordinate Systems

Map Coordinate Systems are the coordinate systems that can be used for display in the Map View of GeoCue Client. There is always at least one Map Coordinate System – the Project Coordinate System. Map Coordinate Systems (and datum transformations, discussed later) are set from the Map Coordinate Systems dialog (Figure 11-1).

[8] Developers – we call this the Universal Graphics and use it to normalize data for all computational geometry operations.

[9] This is *always* possible because GeoCue allows you to define custom datum transformations.

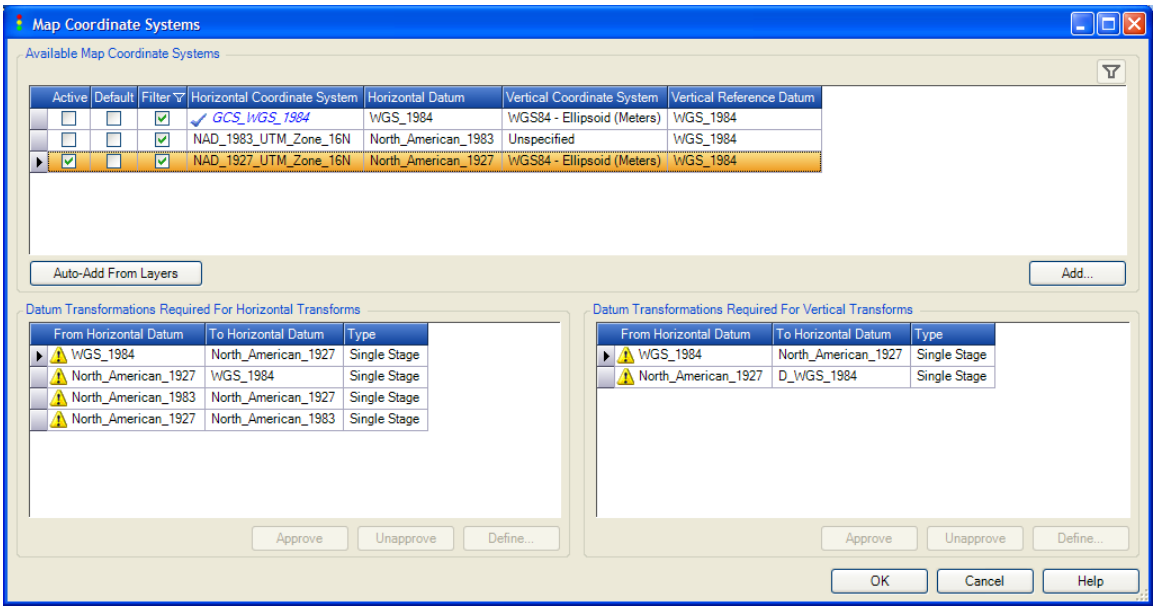


Figure 11-1 The Map Coordinate System dialog

This dialog is invoked by either right-clicking in a blank spot in the Legend and choosing *Map Coordinate Systems* from the drop down list (Figure 11-2) or by selecting the Map Coordinate Systems icon () from the Legend toolbar.

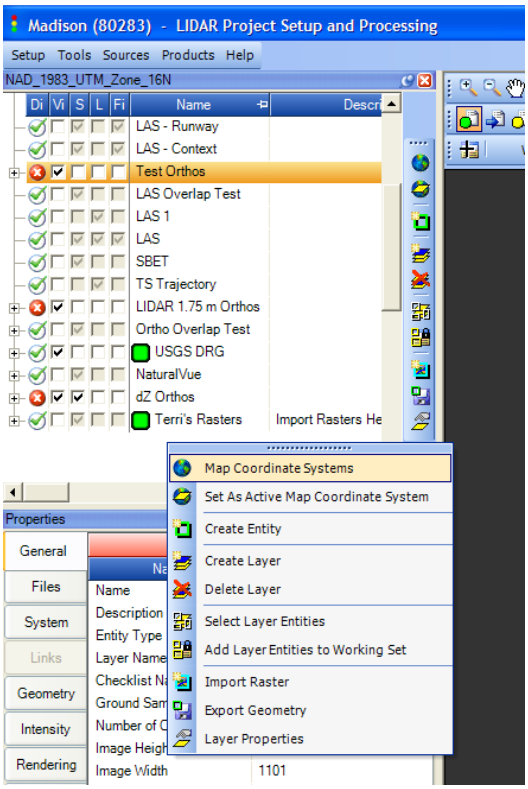


Figure 11-2 Selecting the Map Coordinate Systems dialog by right-clicking in the legend

11.2.1 Setting the Active Map Coordinate System

The GeoCue Map View will be set to the coordinate system for which you check the *Active* option. Note that the selectors in the *Active* column act like radio buttons in that when you select one, the previously selected choice becomes deselected.

You can quickly activate a new Active Map Coordinate System without invoking the Map Coordinate Systems dialog. This is done by right-clicking a Layer in the Legend that has the coordinate system you wish to activate and selecting *Set as Active Map Coordinate System* from the right-click menu. Alternatively, select the layer and press the Set as Active Map Coordinate System () legend toolbar button.

NOTE: There are three primary reasons for your choice in setting a Map Coordinate System.

1. Raster Layers will only display if the Map Coordinate System is the same as the coordinate system of the Raster layer.
2. The Coordinate Readout is in the Map Coordinate System. Thus if you want, for example, to read out latitude and longitude, then set the Map Coordinate System to a geographic system such as WGS-84.
3. GeoAnalysis tool specifications are in the units of the current Map Coordinate System. Thus if you have the Map Coordinate System set to WGS-84, options such as buffer zones will have to be set in degrees. This is usually inconvenient so if you set the Map Coordinate System to something such as State Plane, feet, you will be able to enter these parameters in the more convenient units of feet.

11.2.2 Adding to the list of Map Coordinate Systems

You can add new coordinate systems to the list of available map coordinate systems via the ***Add…*** button to the lower right of the list of coordinate systems (Figure 11-1). This will invoke the normal GeoCue Coordinate System selection dialog.

You can quickly add all coordinate systems that have been defined on layers within the project by pressing the "***Auto-Add from Layers***" button.

11.2.3 Setting the Default Coordinate System for New Layers

The *Default* column of the Map Coordinate Systems dialog allows you to select the coordinate system that will be the default each time you enter the *Create Layer* dialog. This is for

convenience only since you can normally override the default choice by pressing the ***Coordinate System…*** button on the *Create Layer* dialog. Again, this option has radio button action since you can have only one selected default.

11.2.4 Filtering the Coordinate System List

The final column is a *Filter* option. This option is used to allow filtering of Map Coordinate Systems from the list that you do not want to use or are no longer applicable to the project. For technical reasons you can never delete a Map Coordinate System once it has been defined so by unchecking the *Filter* option and setting the column filter to True, only those rows with the *Filter* field set will display.

The currently active Map Coordinate System is displayed in the title bar of the legend.

11.2.5 Data Export and the Active Map Coordinate System

When you export *transformable* data from GeoCue (for example, layer geometries and control points), these data are transformed to the Active Map Coordinate System as they are being exported. Thus you can transform on export to virtually any desired coordinate system by adding the system to the list of available Map Coordinate Systems and then setting this new system as the *Map Coordinate System*.

11.3 Datum Transformations

If you use layers and/or Map Coordinate Systems that are on different datums with respect to one another, you will need to define the transformations between the various datums. These transformations are defined using the lower section of the Map Coordinate Systems dialog (Figure 11-1) or in a Just-in-Time (JIT) manner when creating layers.

11.3.1 System Default Datum Transformations

GeoCue is delivered such that it will automatically set several default transformations for common North American datums (WGS84, NAD83, NAD27). These default transformations are automatically assigned when you open a project for which a datum transformation has not previously been defined. Once you define a transformation yourself, the default action will be disabled. This action was added to the system simply as a matter of convenience; you can always override the defaults.

When a default transformation is being used to transform a layer(s) to the active Map Coordinate System, a warning triangle is displayed at the left side of the layer's entry in the Legend (Figure 11-3). This warning is displayed to remind you that you should ensure (*Approve)* that the correct datum transformation is being used.

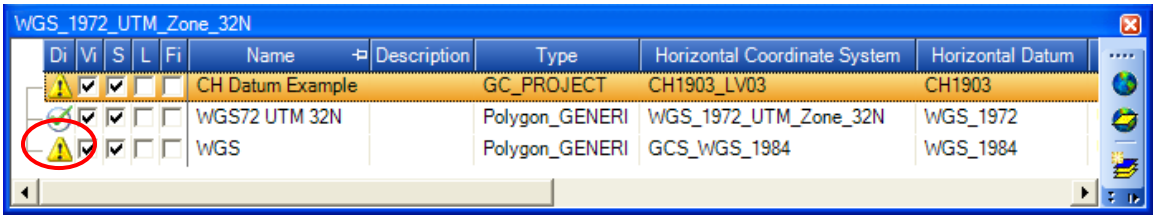


Figure 11-3 Default Datum Transformation Warning Symbol

WARNING – It is always recommended that you *Approve* datum transformations since the default selected by GeoCue may not necessarily be the desired transformation for your particular project. A classic example is that the datum we select automatically for conversions to/from NAD27 and WGS84 are for the conterminous United States and thus would not be appropriate for a project based in Alaska.

NOTE – In GeoCue 3.1, default transformations are on a project by project basis and can not be modified by the user. A future release of GeoCue will allow you to set default transformations on a system level.

11.3.2 Accessing the Datum Transformations Definition Dialog

Datum Transformations are set (and *Approved*) in the lower section of the Map Coordinate Systems dialog. Figure 11-4 depicts an example of a project in which two coordinate systems have been defined; WGS-84 and Swiss national grid CH1903 with vertical datum EGM96. Notice that the lower left section of the dialog (*Datum Transformations Required for Horizontal Transforms)* indicates (via the circled red X) that datum transforms have not been defined to covert between the two systems.

The transformations are set by the following procedures:

1. *Select* the row in the *Available Map Coordinate Systems* list (in the upper section of the dialog) for which you wish to set datum transformations (the row will highlight in orange when it is *selected*). The lower sections (horizontal, vertical) of the dialog will be automatically populated with all datums that could be defined between all layers in the project and the selected Map Coordinate System.
2. *Select* the row in either the Horizontal or Vertical Datum Transformation section of the dialog. The ***Define…*** button below the datum list will activate (note: only one datum can

be defined at a time so if you select more than one row, the ***Define…*** button will not activate).

3. You will be presented with the dialog depicted in Figure 11-5.

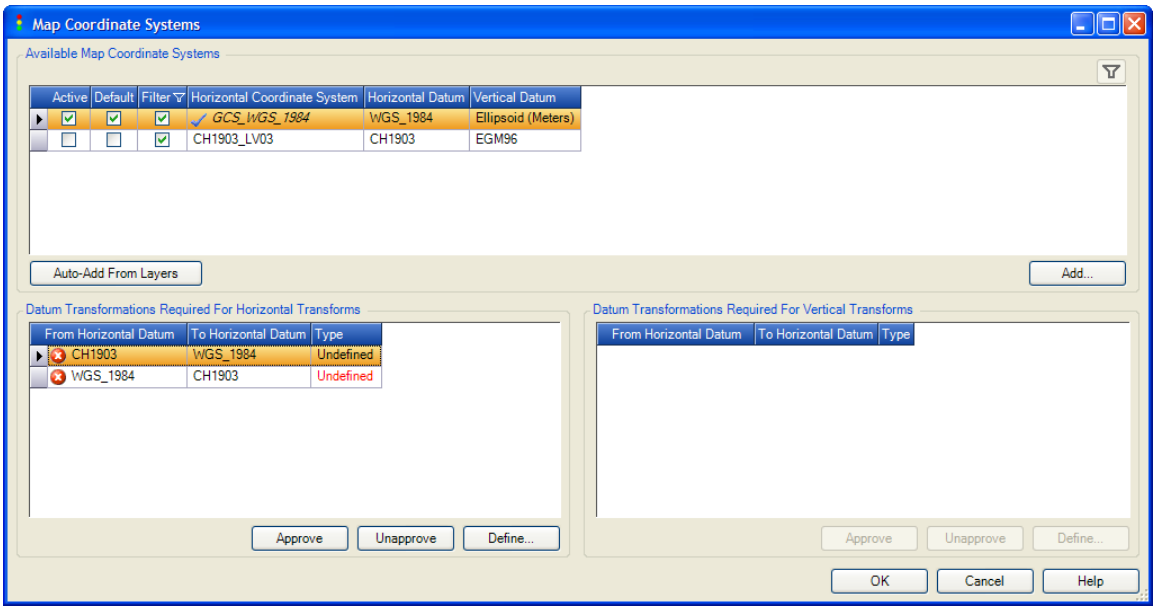


Figure 11-4 Preparing to define datum transformations

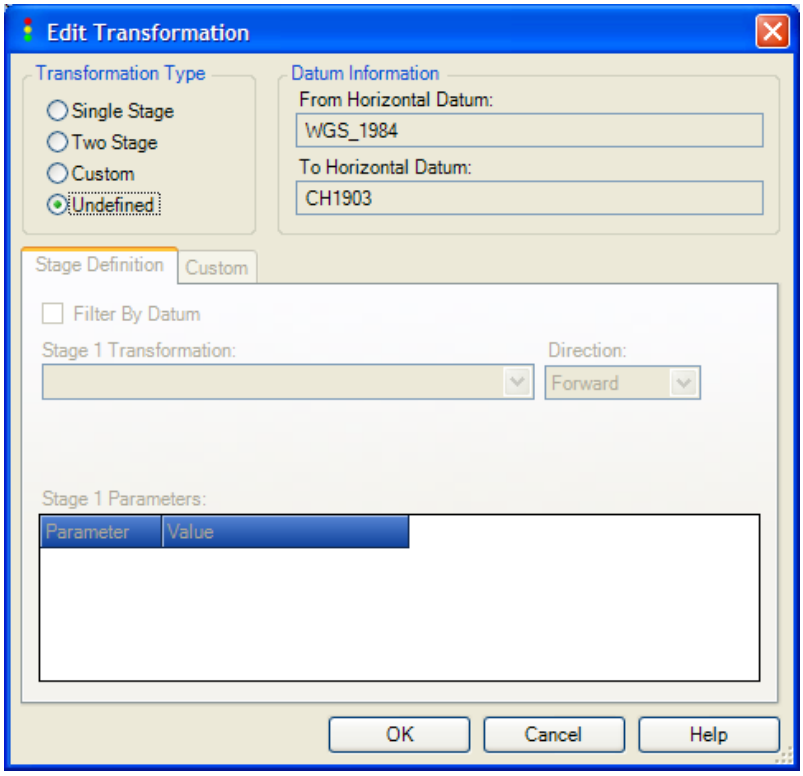


Figure 11-5 The Define Transformation dialog

11.3.3 Defining Datum Transformations

The Datum Transformations are defined using the dialog of Figure 11-5 (see previous section). The current datums for which the transformation will be defined are displayed in the Datum Information section of the dialog.

If the transform that you are working on is *undefined*, the radio button in the Transformation Type section of the dialog will be set to Undefined. You have three choices for defining the transformation:

1. Single Stage
2. Two Stage
3. Custom

Each option is discussed in the following subsections:

11.3.3.1 Single Stage Transformation

When you select the *Single Stage* radio button in the *Define Transformation* dialog, the dialog will change as depicted in Figure 11-6 (your display will vary from this based on the particular datums selected).

The *Filter by Datum* option filters all of the available datum transformations down to only those that could be candidates for the current *from*/*to* datums. If you deselect this check, you will be presented with all available GeoCue datum transformations in the drop-down list.

Select the desired transformation from the *Stage 1 Transformation:* drop-down list. The lower section of the dialog will be populated with all of the parameters of the selected transformation. Note that these parameters are read-only; if you need to edit parameters, you must choose *Custom* as the desired transformation.

Note that the *Direction* drop-down is a read-only selection if GeoCue can determine the appropriate transformation direction. If this is not the case, you can set the direction of the transformation to either *Forward* or *Reverse.* This is usually only necessary when you are using a transformation that you know will properly work for reasons unknown to GeoCue (for example, by knowing equivalent ellipsoids).

> WARNING – If you are selecting transformations with *Filter by Datum* deselected, you must know a lot about datum transformations!!! This option is for advanced users only who can determine from the displayed transformation parameters the correctness of the transform.

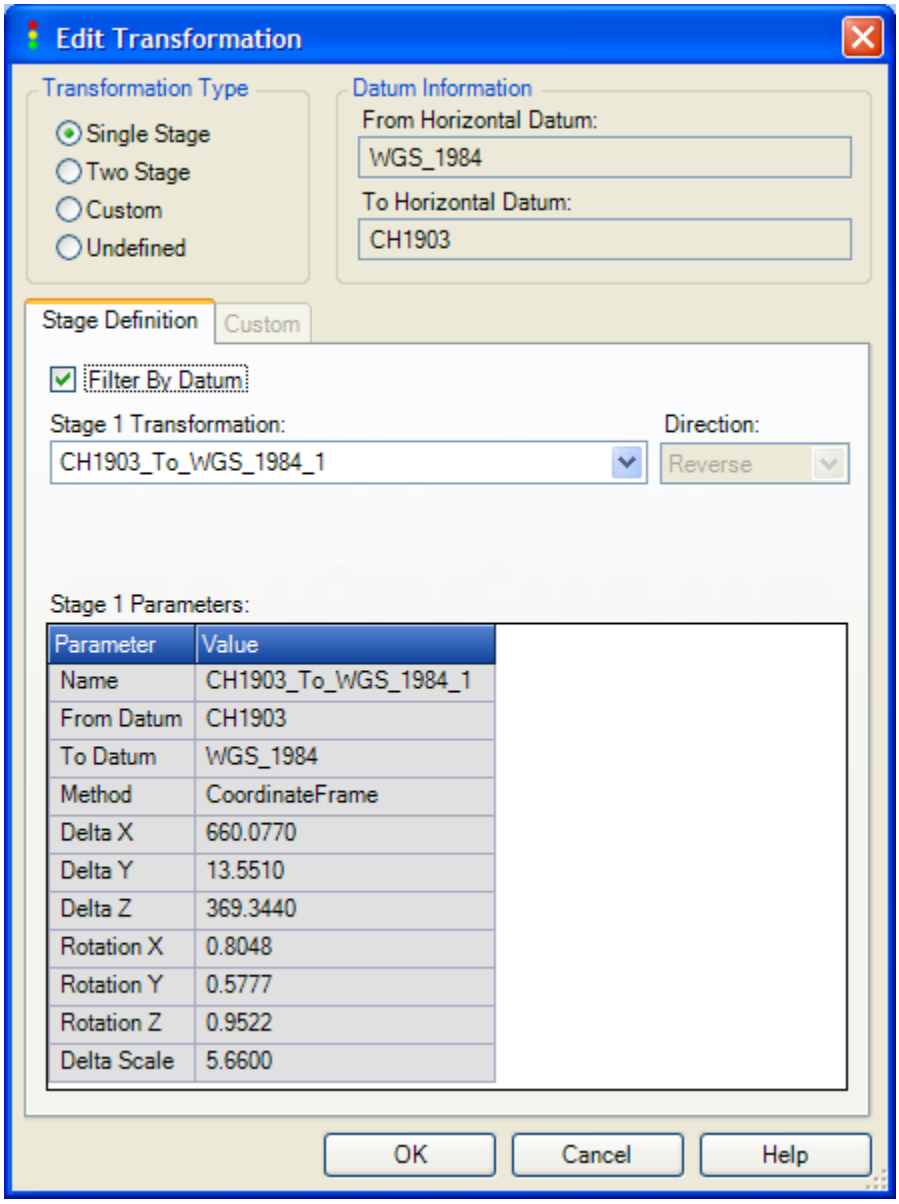


Figure 11-6 Defining a Single Stage Transform

11.3.3.2 Two Stage Transformation

A Two Stage datum transformation is typically constructed when there is not an available single stage transformation available in the GeoCue Datum Transformation library to accomplish the transformation. We illustrate this with a layer in the Swiss National Grid (CH1903) and a desired Map Coordinate System of WGS 1972, UTM Zone 32N (which is a proper coordinate system for Switzerland). For this case, GeoCue does not have a single stage transformation.

Selecting the Two Stage Transformation Type option from the *Define Transformation* dialog results in the dialog of Figure 11-7. Note that the dialog defaults to *Filter by Datum* and the first available two stage transformations that will accomplish the From/To mapping are pre-selected. Again, you can review the detailed transformation types and parameters in the *Parameters* section of the dialog.

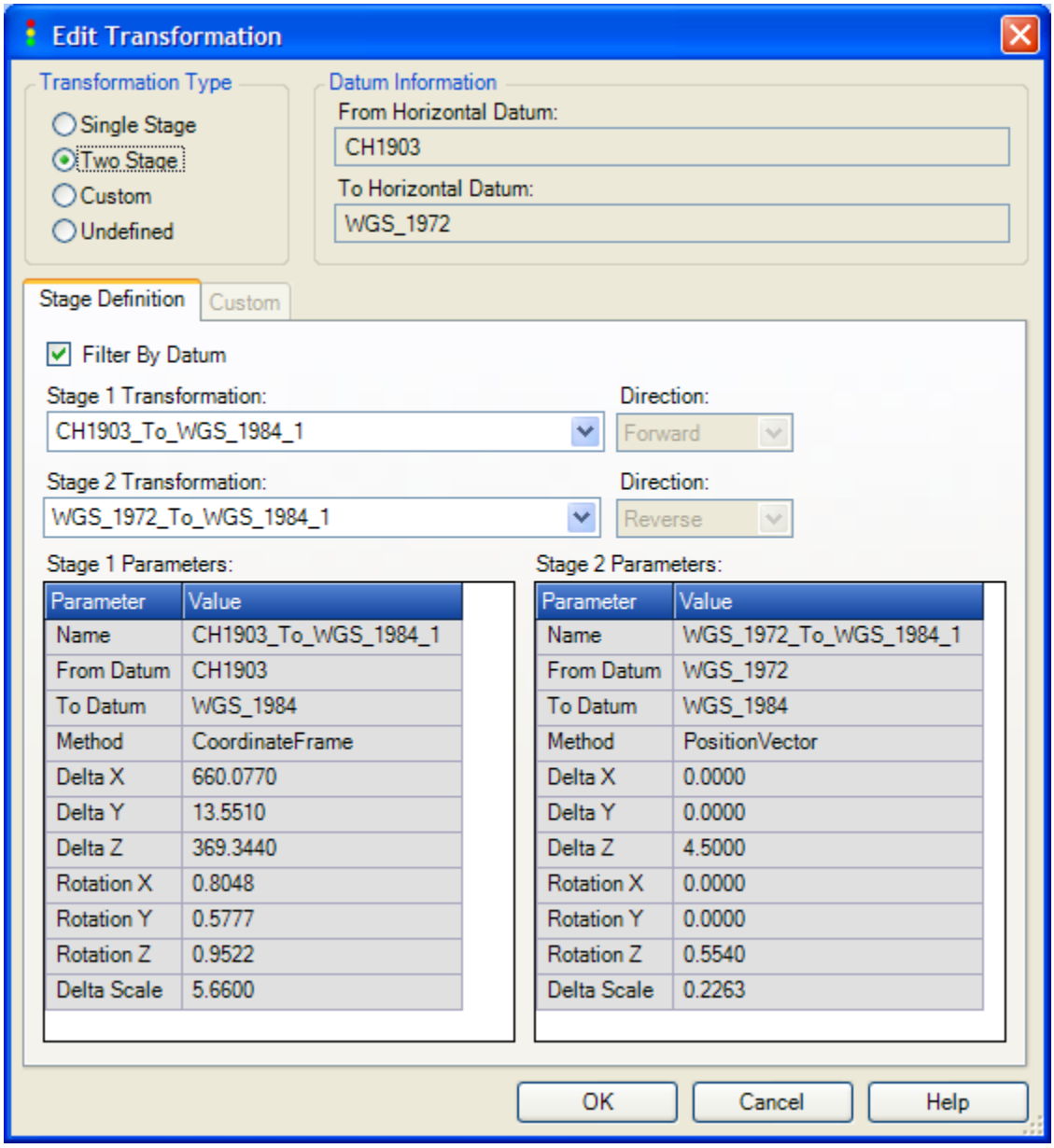


Figure 11-7 A Two Stage Datum Transformation

In the example of this section, we are trying to go from the CH1903 datum to the WGS_72 datum. Since no direct transformation for this is available in the GeoCue Datum Transformation library, we have set up a two stage conversion. The first stage goes from CH1903 to WGS 1984. For the second stage, we need to go from WGS 1984 to WGS 1972. This transformation is not available. However, a transform from WGS 72 to WGS 84 is available. Thus we can use this with the direction reversed. Note that all of this was preset for you by GeoCue.

11.3.3.3 Custom Transformation

To define a Custom Transformation, select the *Custom* radio button under Transformation Type on the Define Transformations dialog. Next select the desired method from the *Transformation Method:* drop-down list. Finally, edit the desired parameters in the *Parameters:* section of the dialog (Figure 11-8).

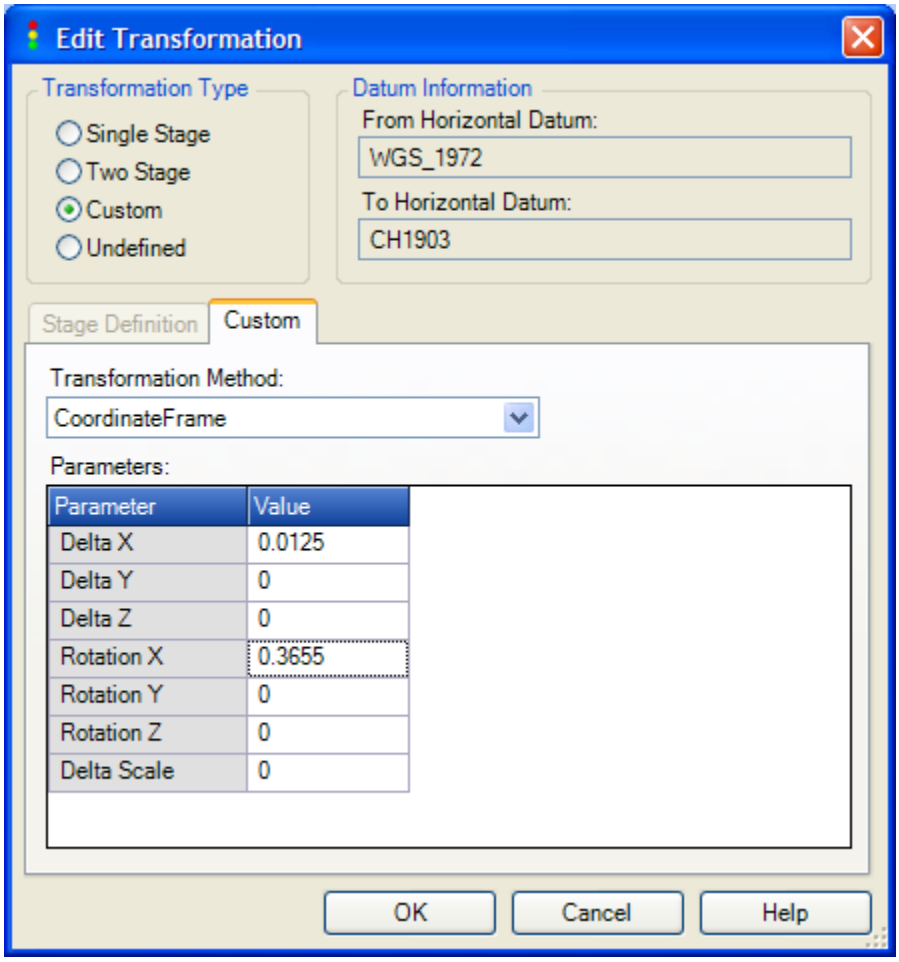


Figure 11-8 Defining a Custom Datum Transformation

NOTE – We do not create a library of custom transformations in GeoCue Version 3.1. Therefore, you will have to define these each time you need them in a project. Saved ("persisted") custom transformations will be added to a future version of GeoCue.

11.3.4 Just-in-Time Datum Transformation Definition

Effective with GeoCue Version 3.0, every layer in a GeoCue project must have a "to" and "from" datum transformation defined between the layer and the Project Coordinate System. To enforce this rule, you will be presented with the Just-in-Time (JIT) Datum Transformation definition dialog when exiting the Layer creation dialog if a datum transformation to/from the Project Coordinate System has not yet been defined.

This dialog (Figure 11-9) functions exactly as described in the previous sub-sections. Note that once a datum transformation has been defined for a project, it does not have to be redefined.

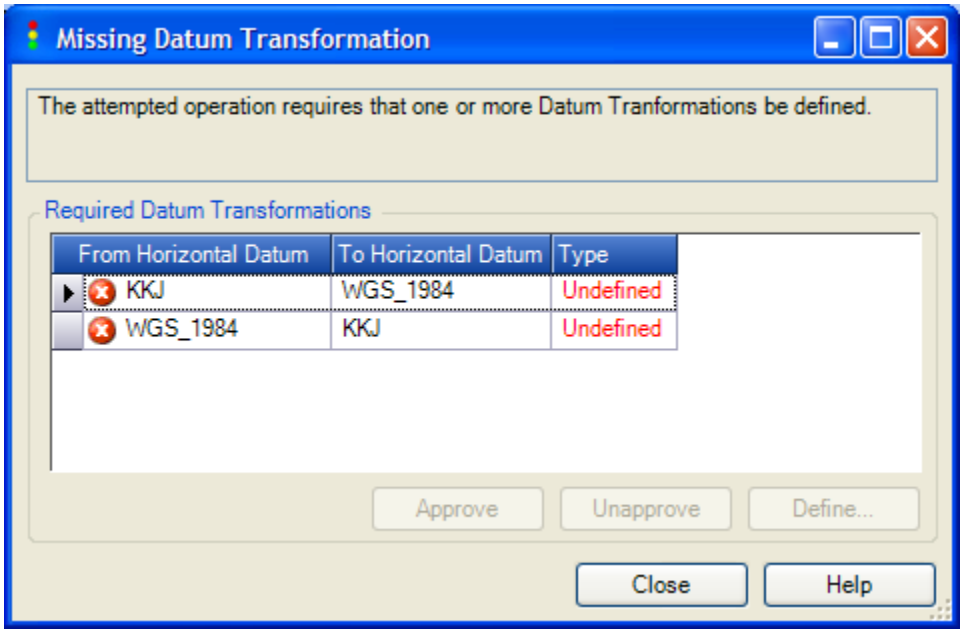


Figure 11-9 The JIT Datum Transformation Definition dialog

11.3.5 Approving/Disapproving Datum Transformations

GeoCue allows you to graphically indicate on the Legend the status of a Datum Transformation. As previously discussed, a transformation that has not been *Approved* is marked with a yellow warning triangle (see Figure 11-3). You can mark a transformation as Approved or to Unapproved by using the lower section of the Map Coordinate Systems dialog (Figure 11-1).

Note that when GeoCue automatically sets a default datum transformation, layers that use this transformation will display the *Unapproved* caution triangle.

To set the approval status of datum transformations, select one or more rows in the Horizontal or Vertical section of the Map Coordinate Systems dialog. Next press the ***Approve*** or ***Disapprove*** button based on your desired action. Figure 11-10 depicts multiple horizontal transforms in the process of being *Approved.*

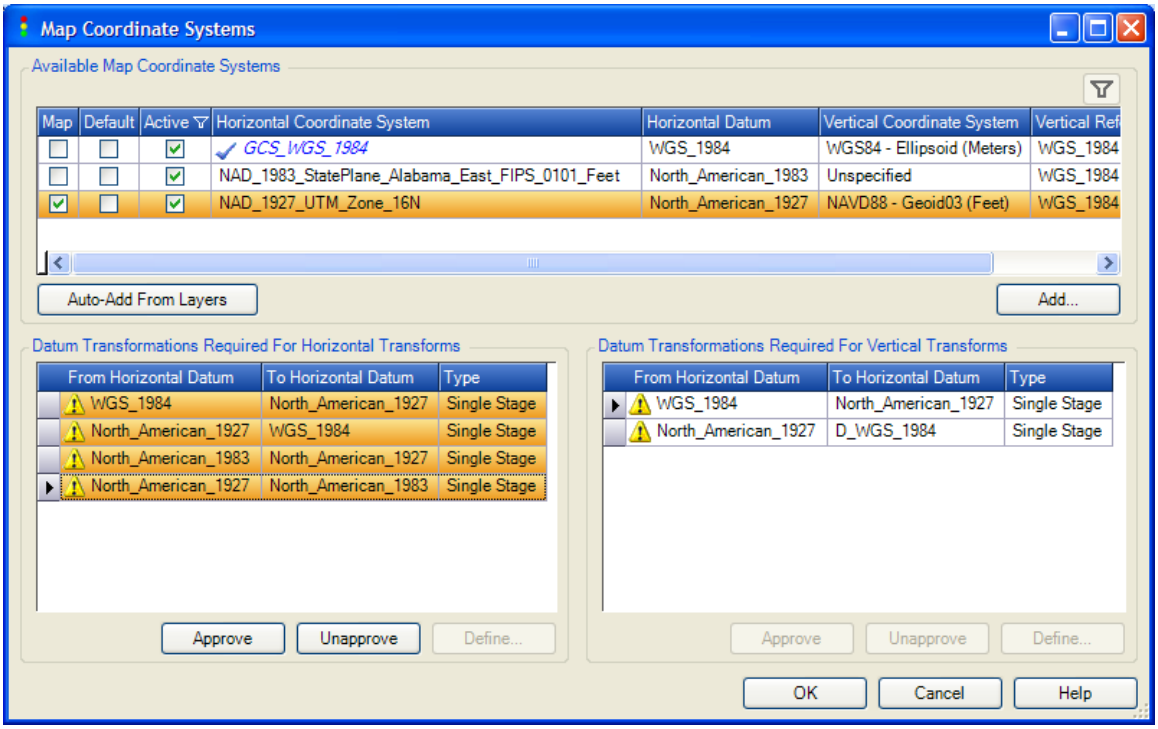


Figure 11-10 Approving/Disapproving Transformations

NOTE – Approving or Disapproving datum transformations has no effect on the operations within GeoCue. This function serves simply as a graphical reminder that a transformation should be verified. It is particularly useful when GeoCue is automatically applying a default transformation. We strongly recommend that you *Approve* all of your transformations ***prior*** to performing any operations that transform data (such as Populate Working Segments in LIDAR processing).

11.3.6 Vertical Systems and Datum Transformations

GeoCue supports a subset of vertical coordinate system transformations. These transformations are *always* performed through the WGS84 datum (although you can add your own vertical datums and these additional datums need not be based on WGS-84 lookup tables).. Therefore, each layer that specifies a vertical system must have a defined transform to/from its horizontal system and WGS-84. These transformations are set and approved exactly as defined in the previous sub-sections.

11.4 Layer Coordinate Systems

The horizontal coordinate system for each Layer is displayed in the layer Legend (Figure 11-11). Each layer also displays the corresponding horizontal and vertical datum. Note that the current map display coordinate system is shown in the title bar of the Layer legend.

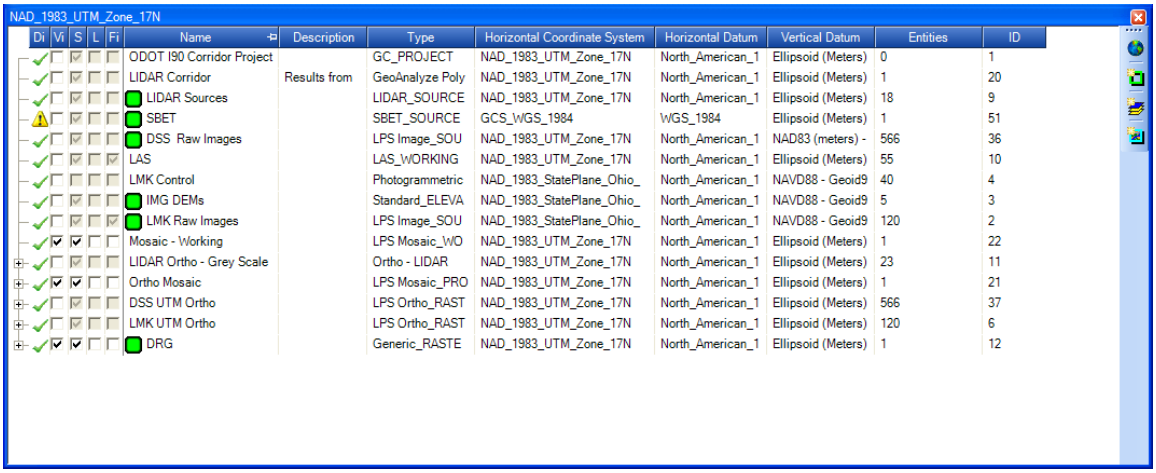


Figure 11-11 Layer Legend showing both horizontal and vertical coordinate systems

NOTE – All layers must have a specified Horizontal coordinate system. This is necessary because we could not co-register entities if their horizontal coordinate system were unknown.

In GeoCue, a Vertical datum set to ***Unspecified*** means that the system has not been specified or that it is irrelevant. It does *not* imply that the data resident on the layer is two dimensional. It simply means that if Z values exist, they will not be able to be transformed by GeoCue functions.

Effective with GeoCue Version 3.1, a new layer type of 2 Dimensional has been added to the system. We now require that certain layers such as raster be defined as 2 Dimensional. The definition of a layer as 2D or 3D is part of the Environment so users will not need to know this distinction when creating projects.

Distinct coordinate systems can be maintained for both entities and file-based data that are referenced by those entities (if any). An example of this case is depicted in Figure 11-12 and Figure 11-13 Notice that the LIDAR Source whose *File* properties are depicted in Figure 11-13 has horizontal and vertical coordinates of Earth Center, Earth Fixed (ECEF). However, the graphic that represents this strip resides on a layer whose Horizontal coordinates are NAD 1983, UTM, Zone 16N.

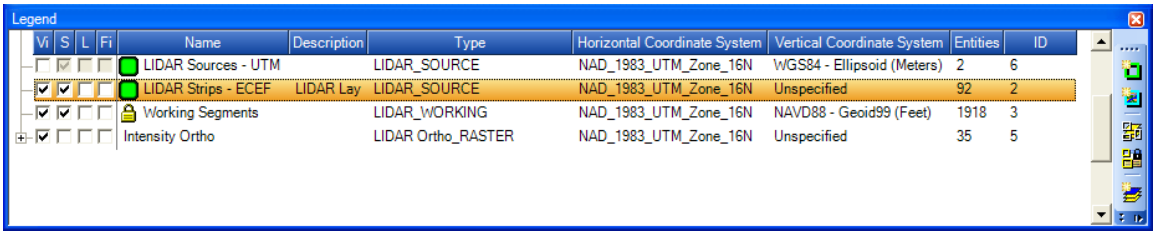


Figure 11-12 LIDAR Source Layer with unspecified Vertical Datum

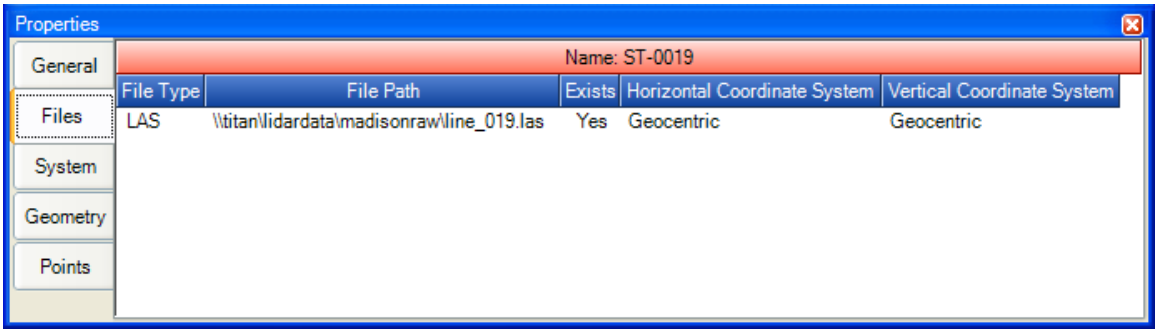


Figure 11-13 The File associated with a LIDAR Source on the ECEF Layer

In most cases, the transformation of coordinate systems occurs automatically in GeoCue. The most common case is that in which graphic representations of processing entities are on layers of differing coordinate systems. GeoCue transforms these graphics, on-the-fly, and displays the co-registered composite in the coordinate system of current Map Coordinate System.

11.4.1 Defining the Coordinate System of a Layer

The coordinate system of a layer is defined when the layer is created. Once created, a layer's coordinate system cannot be changed so be especially careful to check for proper horizontal and vertical system prior to adding data to a layer.

The default coordinate system for newly created layers can be set using the Map Coordinate Systems dialog. Open this dialog (Figure 11-1) and check the *default* option of the Map Coordinate System that you would like to use as your default system when creating new layers. Note that you can always override this choice when creating a new layer so it serves as a convenience only.

When creating a layer, you will be presented with the dialog of Figure 11-14. This dialog will be populated with your current selection of default coordinate system from the Map Coordinate Systems dialog (note – if you have not set a default system, GeoCue will use the Project Coordinate System). You can examine details of both the horizontal and vertical systems by

pressing the "?" beside the coordinate system name. If this is the system you need for the layer (be sure to examine both horizontal and vertical!), then do nothing. Otherwise, press the Select Coordinate System… button and you will be presented the dialog of Figure 11-15.

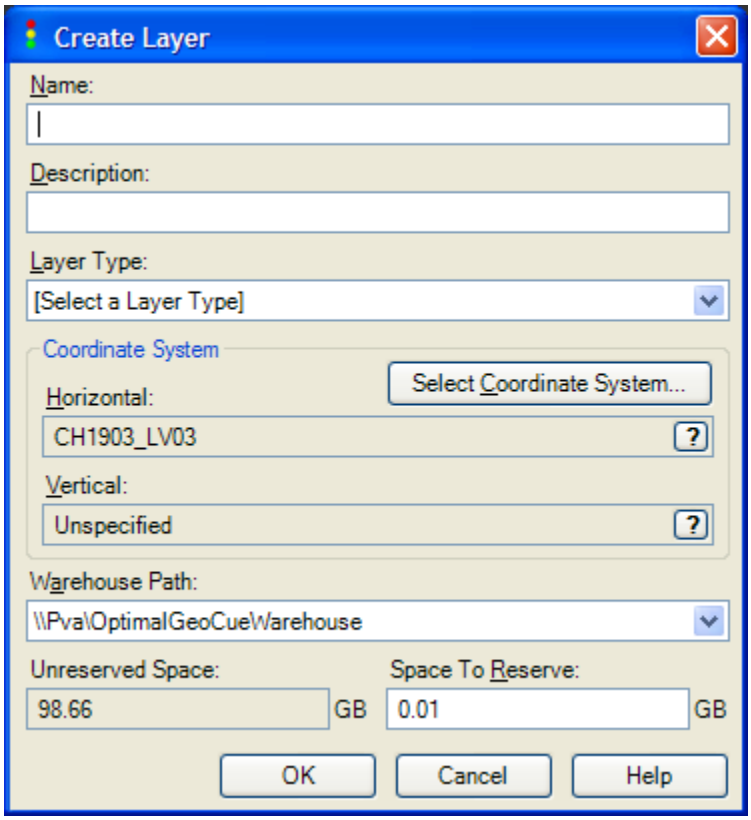


Figure 11-14 The Create Layer dialog

Using the coordinate system selection dialog, you can choose from an extensive selection of predefined horizontal coordinate systems. If the system you desire is not in the list, you can create a coordinate system in ESRI Well-Known-Text (WKT) format and import this file by selecting the *Select from File* radio button option.

Note that the full parameters of the coordinate system are displayed in the information panes on the left side of the dialog. It is a good idea to review these prior to pressing OK.

WARNING – One of the most common errors in setting a coordinate system is to choose the wrong units (Survey feet, International feet, meters). Be very careful to ensure that you have not committed this error since you cannot change the units of an existing layer.

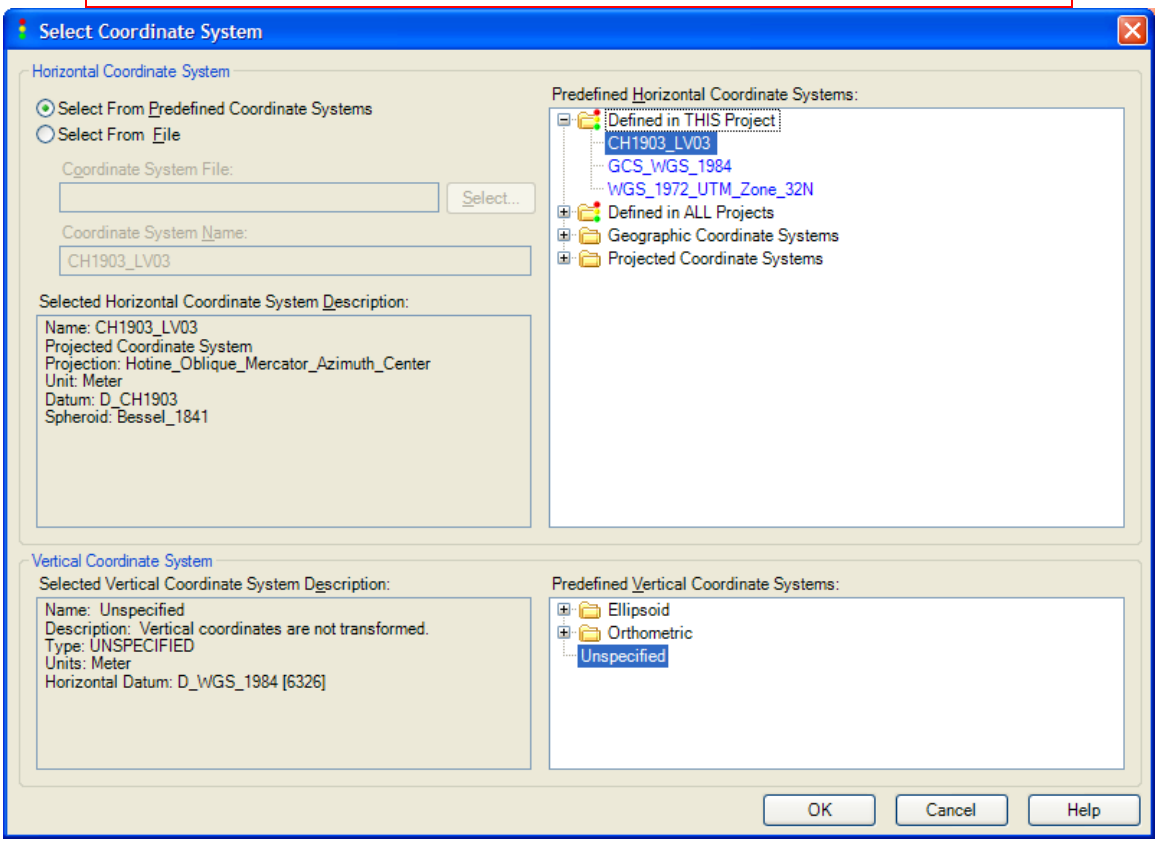


Figure 11-15 The Coordinate System Selection dialog

When you are satisfied with your selections for horizontal and vertical systems, press OK. As noted earlier, if a transformation has not been defined between the selected coordinate system's datum and the Project Coordinate System's datum, you will be presented with the Just-In-Time Datum Transformation Definition dialog.

11.4.2 Layer Coordinate System Symbology

Layers in your GeoCue project can display several icons that are used to inform you of a potential transformation issue. These are defined in the following table:

icon	***Meaning***
	A Datum Transformation is defined and being used to transform this Layer's coordinate system to the currently active Map Coordinate System but it has not been *Approved.* In general, you should always review transformations and mark them as approved. This symbol will always appear if GeoCue has selected a default datum transformation.
	This layer is using the same datum as the current Map Coordinate System and therefore no transformation is in effect.
	A datum transformation is required between this layer and the current Map Coordinate System. The datum is defined and approved.
	A Datum Transformation has not been defined between the coordinate system of this layer and the currently active Map Coordinate System. Data contained on this layer will not display. You can correct this by either switching the active Map Coordinate System to the coordinate system of this layer or by defining a datum transformation to/from the active Map Coordinate System.

NOTE: Effective with GeoCue 3.1, the Transformation warning symbol,  is no longer a multipurpose icon. A separate notation is now used to indicate that a raster is not being displayed.

11.5 Changing the Coordinate Readout

As you move the selection cursor in the Map View, the coordinates of the selection cross-hair are displayed in the readout area at the bottom of the GeoCue frame (Figure 11-16).

You can set the coordinate readout to be that of the current system of the Map View (the Active Map Coordinate System) or to any coordinate system in the project's Map Coordinate System list. To change the current readout, press the Readout Options tool button and you will be presented with the dialog of Figure 11-17. The coordinate readout will display the *Unapproved* datum transform option if the transform between the *Active* Map Coordinate System and the selected readout coordinate system has not been Approved.

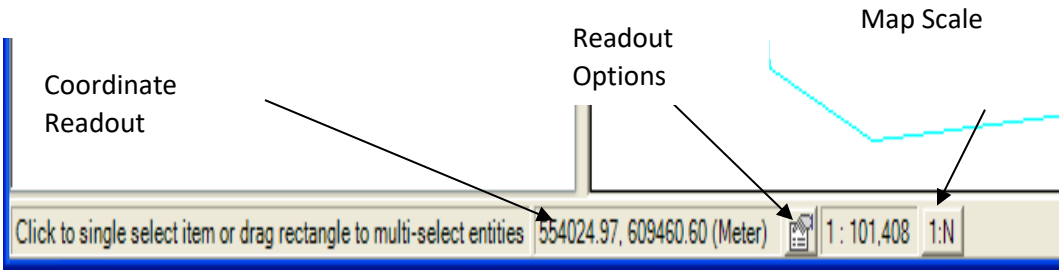


Figure 11-16 Coordinate Readout and Options button

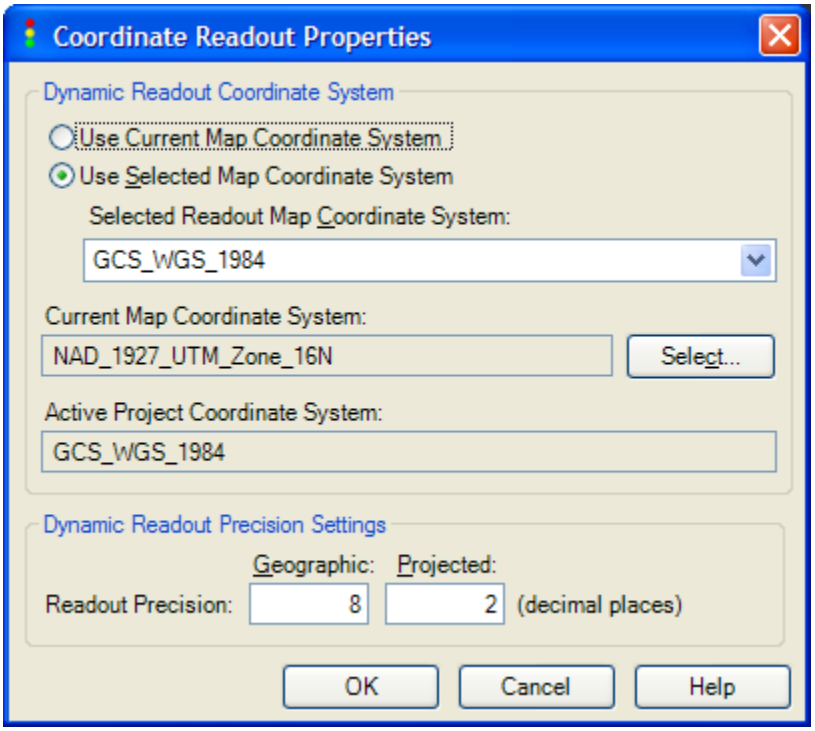


Figure 11-17 Coordinate Readout Properties dialog

Selecting *Use Current Map Coordinate System* sets the readout to the *Active* map coordinate system (recall that this is the system displayed in the title bar of the Layer Legend). Choosing *Use Selected Map Coordinate System* allows you to select one of the available Map Coordinate Systems from the drop-down list.

The ***Select…*** button invokes the Map Coordinate System dialog. Choose this option if you need to add a new Map Coordinate System to the list of available systems in the project.

11.6 Two-Dimensional Coordinate Systems

GeoCue now supports the concept of a two dimensional (2D) coordinate system. This was added to remove ambiguities when transforming coordinates to layers that did not really support the concept of a Z dimension such as raster layers.

An Environment builder can specify that a layer is required to be two dimensional using a new field in Environment Builder for defining layers. Users who are not building custom environments need not be concerned with this feature.

Beginning with GeoCue 3.1, certain layer types for packaged workflows (such as LIDAR 1 CuePac and Leica Ortho Accelerator) have layers that are 2D. This simply means that when you create a layer of this type, you cannot select a vertical datum. The most common 2D layer is a raster layer. When creating a layer that is defined as a 2D type, the Create Layer dialog will automatically set the vertical system to 2 Dimensional (see Figure 11-18).

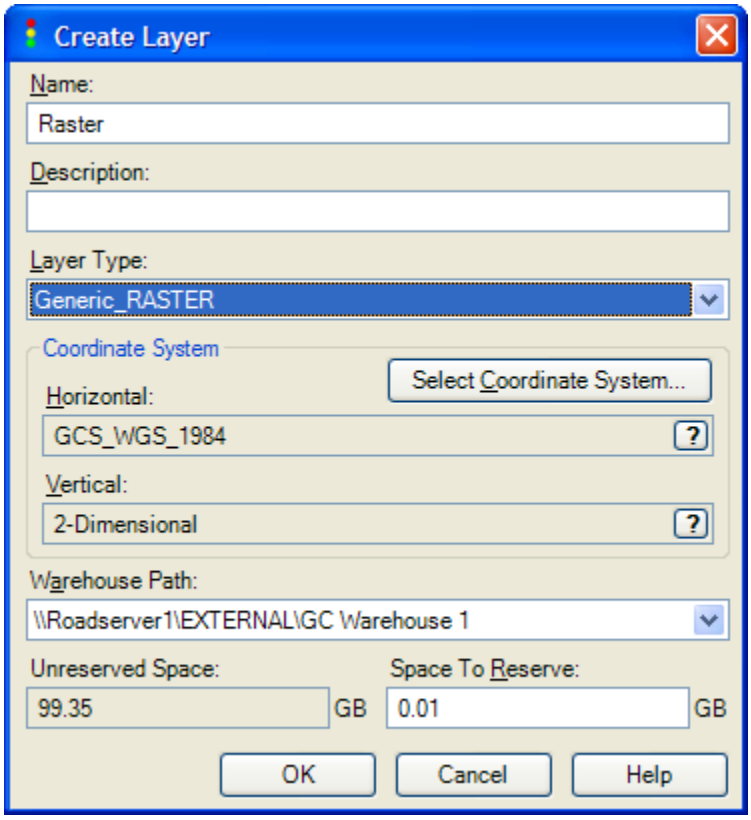


Figure 11-18 The new 2D layer type

You can change the horizontal system by pressing ***Select Coordinate System*** which presents the familiar *Select Coordinate System* dialog. However, you will now note that the vertical system has been set to "2-Dimensional" and the selection section for vertical has been disabled (see Figure 11-19).

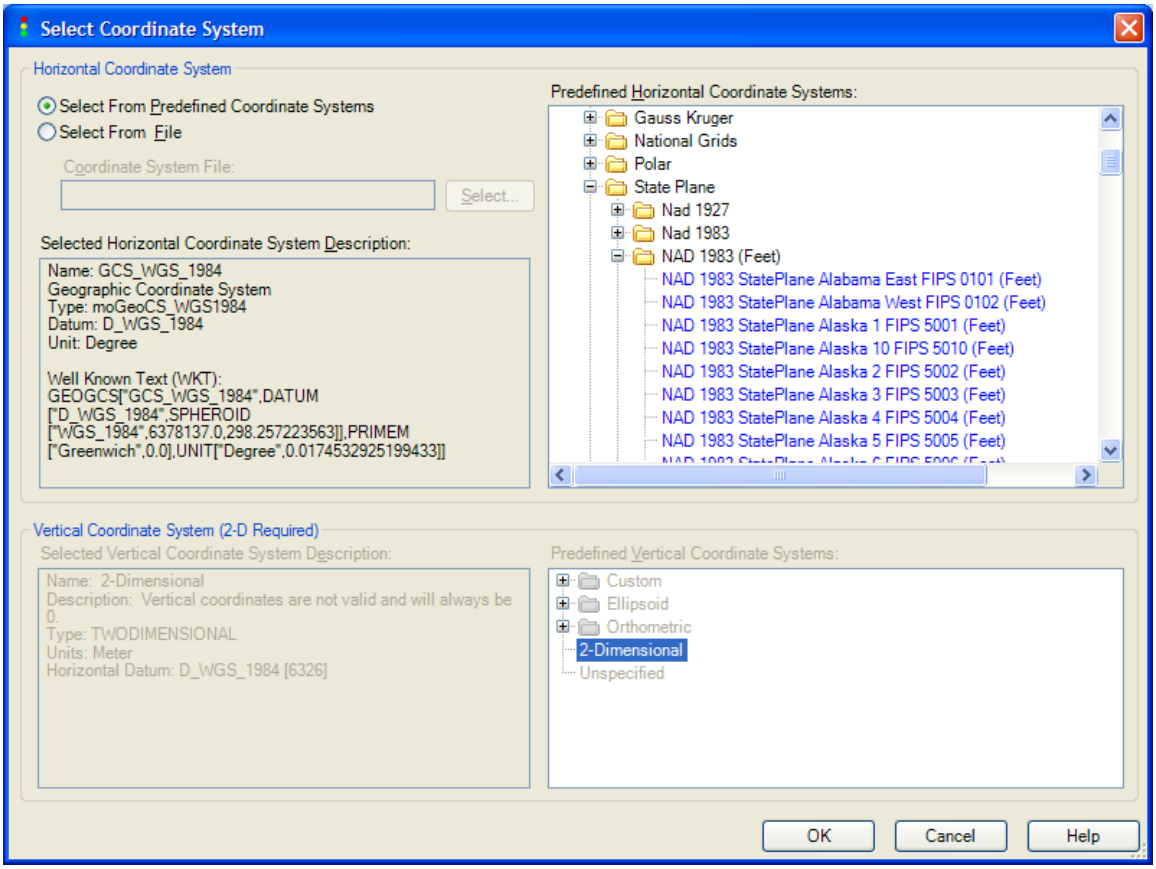


Figure 11-19 Select Coordinate System for a 2 Dimensional layer

11.7 Setting a Map Scale

You can set a specific Map Scale by selecting the Map Scale options button. This button is next to the coordinate readout options button. Note that the current map scale is displayed between the two buttons. The Map Scale dialog is depicted in Figure 11-20. Of course, as soon as you perform any sort of operation that changes magnification, the map scale will change.

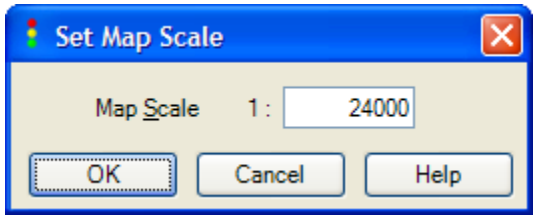


Figure 11-20 Map Scale Options dialog

11.8 Vertical Transformations in GeoCue

The possible vertical transformations that can occur between a source and destination layer in GeoCue are shown in Table 11-1:

Table 11-1 Possible Transformations in GeoCue

Source		*Working Segment Layer*		*Resultant Transform*	
Horizontal	***Vertical***	***Horizontal***	***Vertical***	***Horizontal***	***Vertical***
H1	V1	H2	V2	H1 ▶ H2	V1 ▶ V2
H1	2D[10]	H2	V2	H1 ▶ H2	Z set to zero
H1	V1	H2	2D	H1 ▶ H2	Z dropped
H1	Unspecified	H2	Unspecified	H1 ▶ H2	Z copied without change
H1	V1	H2	Unspecified	H1 ▶ H2	Z copied without change but no subsequent Z transforms possible
H1	Unspecified	H2	V2	*Error declared* – attempt to transform unknown Z to know coordinate system.	

[10] 2D = Two dimensional coordinate system

11.9 Adjust to Geoid

GeoCue includes an advanced system for declaring and using interpolation schemes for vertically adjusting the coordinates of three dimensional objects such as LIDAR points. This is the type of scheme that is used to apply gravity models to points (orthometric correction).

We deliver GeoCue with native support for the North American Vertical Datum of 1988 (NAVD88) with geoid models 1999 (Geoid 99) and 2008 (Geoid 03) as well as the Earth Gravity Model of 1996 (EGM96). These models are applied simply by selecting the desired Orthometric model from the Vertical Datum Selection section of the Coordinate Selection dialog. The United States National Geodetic Survey (NGS) geoid models are delivered with GeoCue Server and these are the models used in the orthometric adjustment.

GeoCue Server now incorporates the ability for you to build your own orthometric model. This means that GeoCue supports any orthometric model for which an interpolation grid is available. Please contact us for a Technical Note on installing Orthometric Models if you need this feature.

12 GeoCue Entities

The fundamental unit of processing within GeoCue is the *Entity*. An *entity* usually represents some physical processing element such as a LIDAR flight line, an aerial photograph, an elevation model and so forth.

An entity comprises:

- A graphical representation (there are also non-graphical entities in GeoCue).
- A collection of entity *Properties* (data definitions and values)
- A *Files* collection (optional)
- An associated processing checklist (optional)

The general processing paradigm within GeoCue is to change the state of entities via processing actions (e.g. convert a source image to an ortho by processing).

Entities can be created in a variety of ways in GeoCue ranging from automatic creation by processing routines (for example, in LIDAR 1 CuePac, LIDAR strips are automatically created by the *import sources* command) to direct interactive creation by a user.

12.1 Preparing for the Examples

In the exercises of this chapter, we will be using the *GeoCue Introductory Project*. Load this project via the *Setup* ►*Project* ►*Open* command.

We will be creating test entities of type "Polygon_GENERIC" and thus will require a layer on which to place these entities. Create a new layer by pressing the ***Create Layer*** tool in the Legend toolbar. Fill out the Layer Creation dialog as depicted in Figure 12-1. Press **OK** to create

the layer. This will create a layer in the GeoCue Introductory Project on which you can place entities.

We will practice entity creation using the LIDAR strip footprints on the LIDAR Sources layer. Turn off visibility of the other layers by unchecking their "V" toggle in the legend. You should have "V"isibility turned on for the LIDAR Source layer and the newly created "Practice Layer."

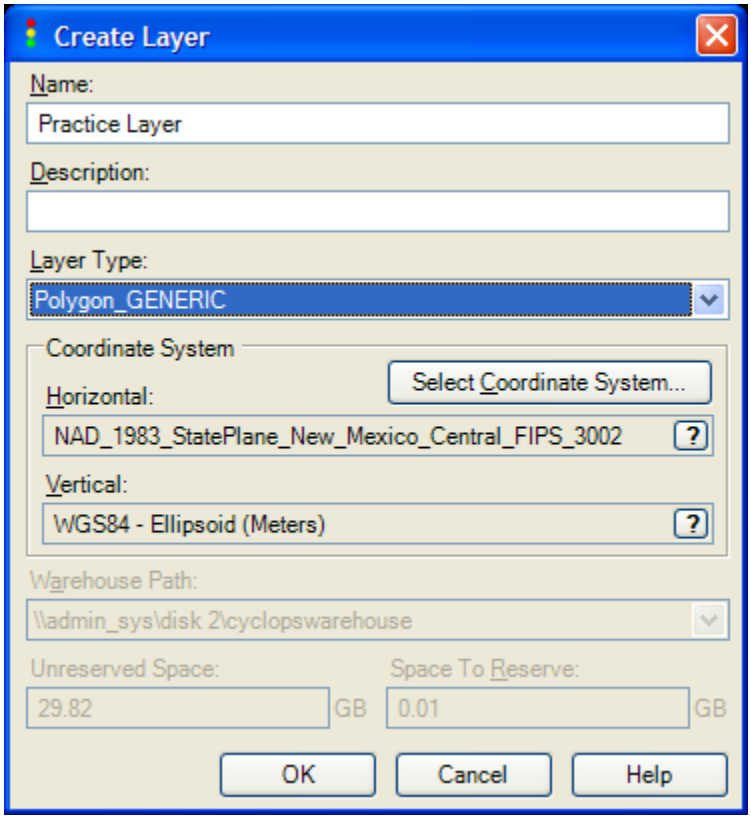


Figure 12-1 Creating the Practice Layer

12.2 The Create Entity Dialog

The *Create Entity* dialog is invoked from the *Legend* toolbar (Figure 12-2) or right-click menu (Figure 12-3). If you *Select* a layer in the legend prior to invoking the *Create Entity* command, the selected layer will be pre-populated in the Create Entity dialog. If the selected layer does not support any interactively creatable entities, you will receive the warning message of Figure

12-4. If you inadvertently selected the wrong layer, you will have the opportunity to set the correct layer in the Create Entity dialog.

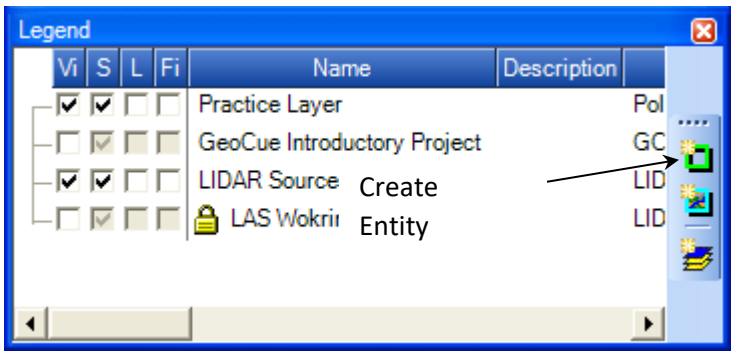


Figure 12-2 Create Entity tool

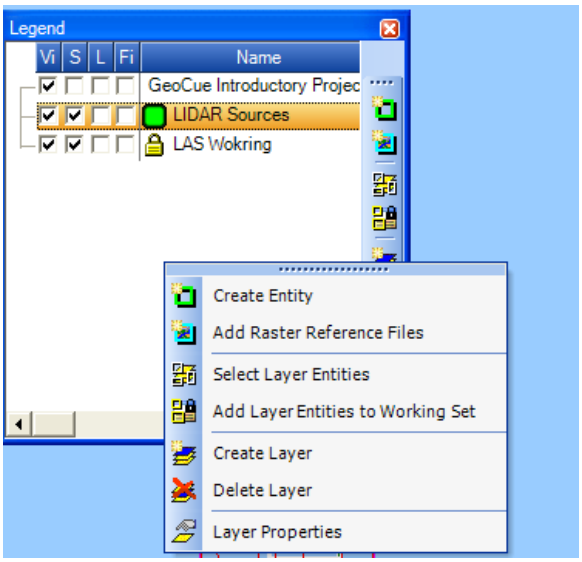


Figure 12-3 Legend Rick-Click menu with *Create Layer* and Create *Entity*

Figure 12-4 Create Entity warning when layer does not support interactive creation

When you select the command, you will be presented with the dialog of Figure 12-5.

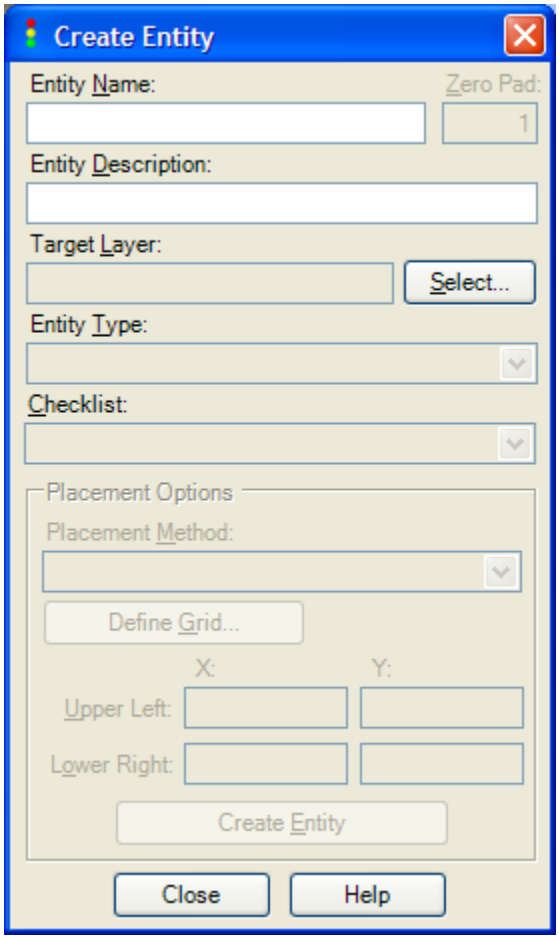


Figure 12-5 The Create Entity dialog

HINT – If you *Select* the layer on which you intend to place a new entity prior to invoking the ***Create Entity*** command, the dialog will be pre-populated with the desired layer.

Enter the name "Test Entity 1" into the *Entity Name* field of the ***Create Entity*** dialog. Since we did not highlight a layer in the legend when we invoked the ***Create Entity*** dialog, it is now

necessary to specify the desired layer on which GeoCue will place our entity. Press the *Select…* button beside the *Target Layer* entry on the ***Create Entity*** dialog. This will present the ***Select Layer*** dialog (Figure 12-6). Select the *Practice Layer* entry and press OK.

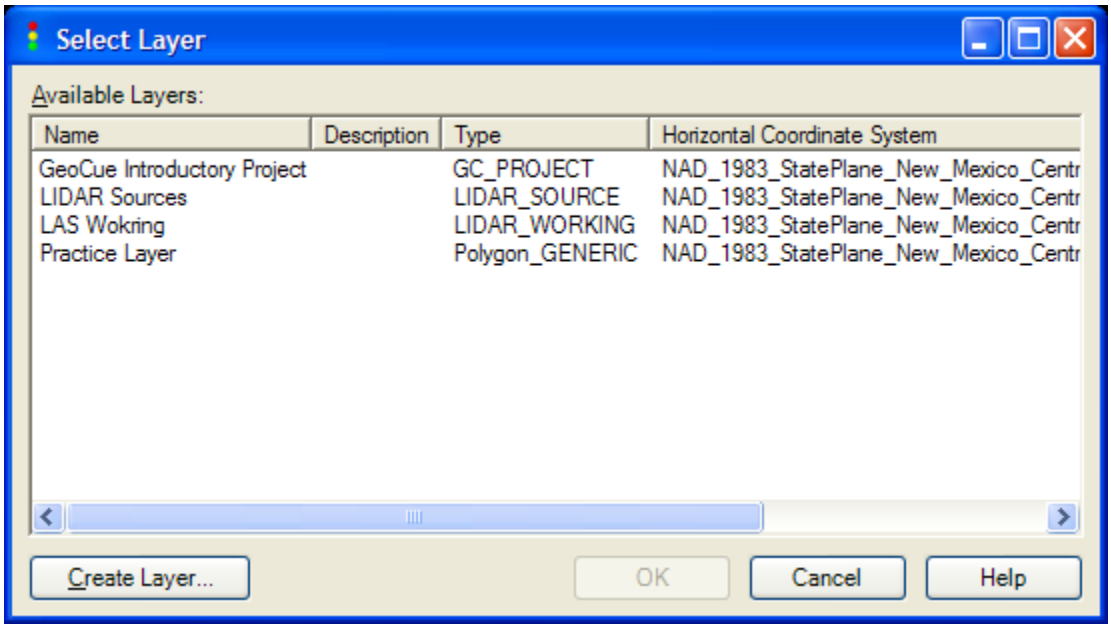


Figure 12-6 The *Select Layer* dialog

NOTE – Notice that the ***Select Layer*** dialog has a *Create Layer…* button. This allows you to create a layer "on-the-fly" as you create a new entity. Thus in our current example, we could have gone directly to ***Create Entity*** without first creating the Practice Layer and simply created this layer from the *Select Layer* command path.

Examine the options under the *Placement Method* dropdown list. These options are outlined in

Table 12-1 Entity Placement Methods

Placement Method	***Description***	***Common Uses***
Digitize Polygon	Free-form digitizing of a polygon	Hand digitizing a project boundary. Hand digitizing areas of interest (AOI)
Digitize Rectangle	Direct drawing of a rectangle	Drawing a rectangular entity such as a project boundary or an image footprint
Selected Entities' Geometry	Allows you to use some other entity or group of entities as a construction template for the current entities' creation.	Primarily of use with the GeoAnalysis tools (described in a separate chapter).or as a quick way to 'clone' other entities (e.g. multiple layers of images)
MBR of selected entities	Allows you to quickly draw a rectangle that is the Minimum Bounding Rectangle (MBR) of *selected* entities.	Useful for defining boundaries that need to fully encompass other entities (e.g. a boundary for a collection of LIDAR flight lines).
Key-in Rectangle	Creates a rectangular entity based on user supplied keyed in coordinates.	Useful for placing a precision rectangle.
Place Grid of Entities	Allows you to place gridded arrays of entities. Quite a few definition options are available in the Create Grid submenu.	Very useful for a number of entity types where breaking up the entities is useful for performance, delivery or multiuser reasons. Examples include LIDAR ortho coverage, product definitions, LIDAR processing segments.

Placement Method	***Description***	***Common Uses***
Import Geometry from CAD/SHP file	Allows you to define entities based on data contained in a CAD or ESRI Shape file.	Very useful for externally defined project entities. For example, your customers may have defined project delivery tiles in a MicroStation design file. Using this entity creation technique, you can directly import these definitions.

12.3 Digitize Polygon

In the ***Create Entity*** dialog, select the *Digitize Polygon* placement method. In the Map View, begin a polygon around the displayed LIDAR flight lines by placing the cursor at the desired starting location and pressing the left mouse button. Move the cursor to the next desired vertex location and again press the left mouse button. Continue creating the polygon until you have digitized the last desired point. Complete the polygon by double-clicking the left mouse button. When you complete the polygon, the ***Create Entity*** dialog will dismiss and the newly created entity will appear in the Map View. You can examine the *properties* of your new entity by *selecting* the entity and viewing the entries in the property pane (Figure 12-7).

> NOTE – You can cancel the polygon construction any time prior to double clicking the final vertex by pressing the **Esc** (Escape) key. Once you have completed the polygon, it cannot be edited. You must delete the entity and then recreate a new entity.

Note that when you are in the digitize polygon mode, the cursor changes to a cross-hair with a small polygon icon in the lower right of the cross-hair.

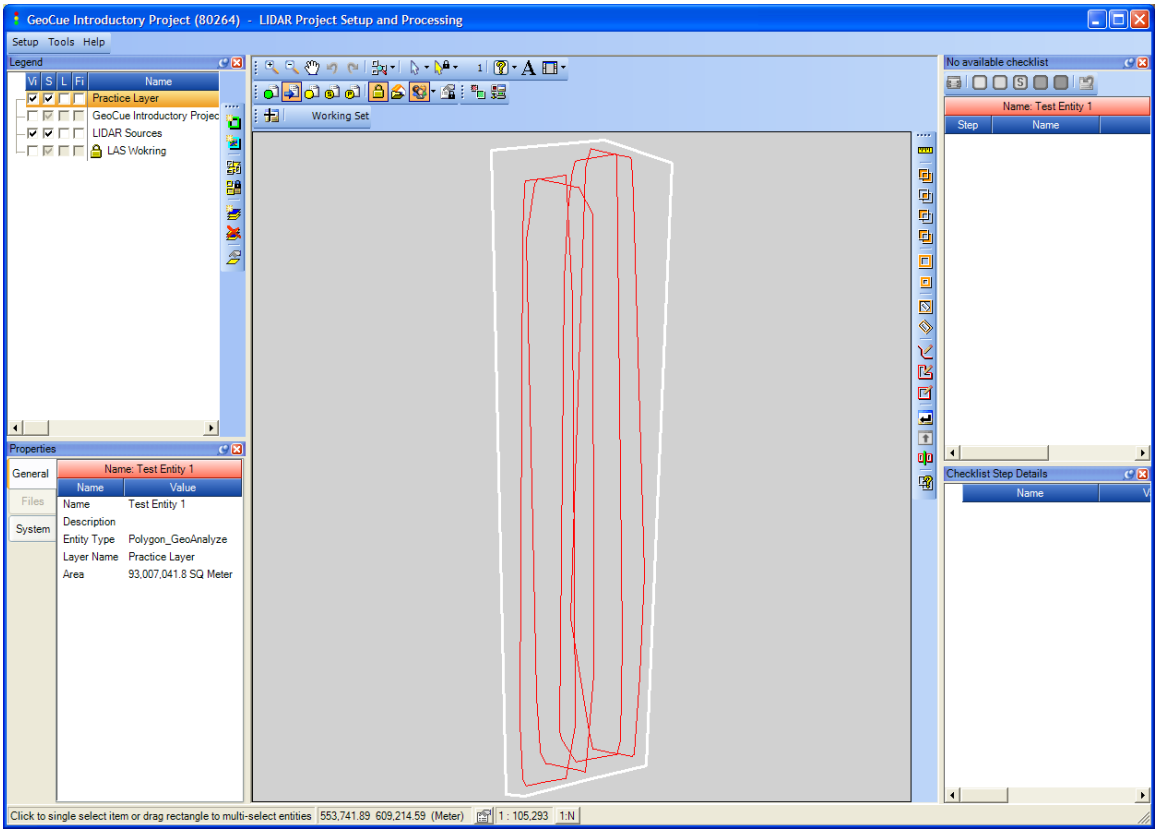
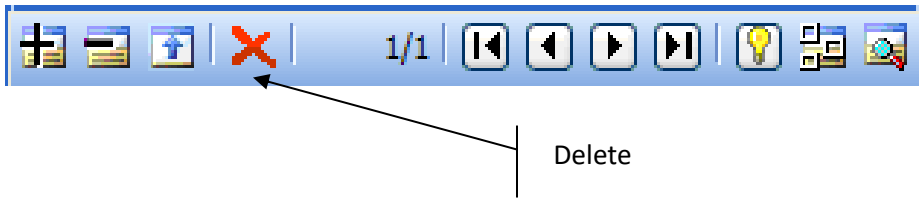


Figure 12-7 Polygon Entity in *Selected* mode

Now delete this newly created entity by:

1. Select the entity “Test Entity 1”
2. Add to the Working Set by pressing the “+” button on the Working Set queue toolbar. The entity will change color to yellow.
3. Press the delete button on the Working Set queue toolbar



CAUTION – GeoCue does not have an "undo" command. When you delete an entity (or layer or project) it cannot be recovered. Thus use extreme caution when making deletions in GeoCue.

4. You will be presented the confirmation dialog of Figure 12-8. Always very carefully read this dialog to ensure that you are only deleted the entities that you meant to delete! When sure, press **Yes**. The entity is deleted.

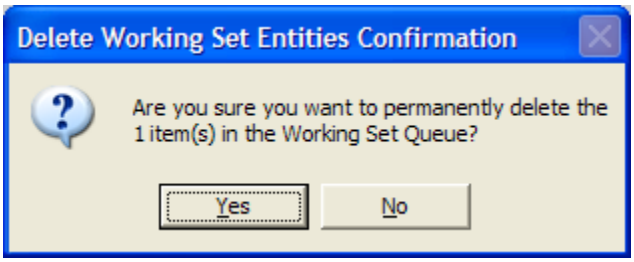


Figure 12-8 Deletion confirmation dialog

12.4 Key-in Rectangle

This technique of creating an entity is used when you know the coordinates of a rectangle that defines an entity.

Select the "Practice Layer" by left-clicking the entry in the legend. Select ***Create Entity*** by the legend toolbar tool or from the legend right-click menu. This will bring up the ***Create Entity*** dialog. Fill in the dialog to create a "Test Entity 2." Select the *Key-in Rectangle* placement method. Your ***Create Entity*** dialog should appear similar to Figure 12-9.

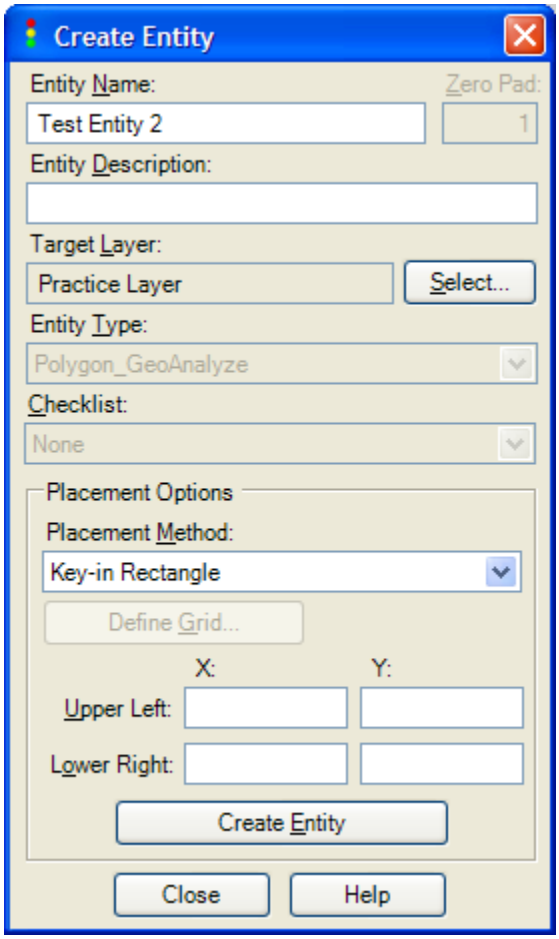


Figure 12-9 Create Entity via Key-in Rectangle

We assume that we have been supplied the coordinates of a rectangle as specified in Table 12-2.

Table 12-2 Provided rectangle coordinates

	X	***Y***
Upper Left	552,560	608,794
Lower Right	556,398	589,580

Key-in the coordinates into the dialog. Your ***Create Entity*** dialog should appear as shown in of Figure 12-10. After you have verified that all fields are correctly set, press ***Create Entity***. The dialog will dismiss and a new entity will appear that encompasses the LIDAR source strips.

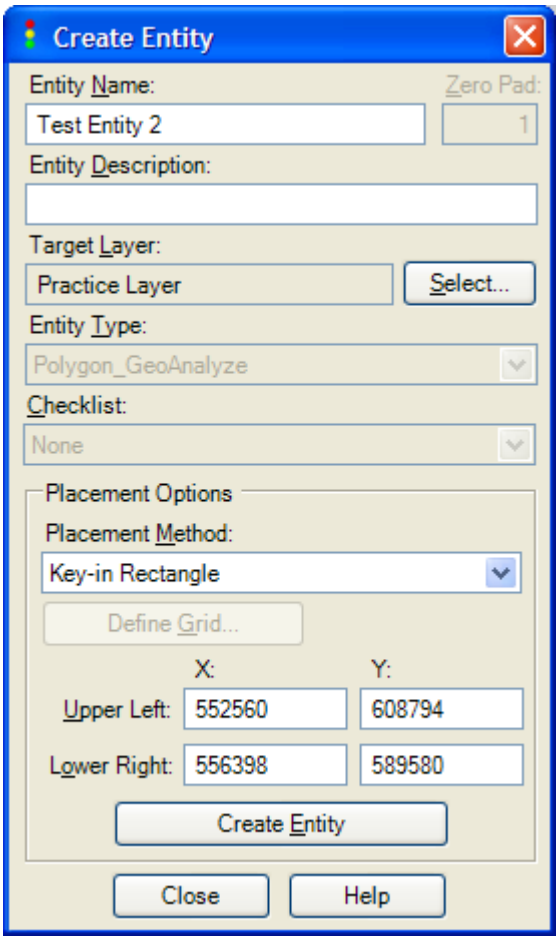


Figure 12-10 Creating the Project Boundary by Key-in

Hint – If you need to delete an entity (for example, if you make a mistake in creating the Project Boundary), clear the Working Set, ***Select*** the entity that you wish to delete, add the selected entity to the Working Set and press the ***delete*** tool on the Working Set toolbar. Answer yes to the confirmation box.

Warning – When you press the delete tool on the Working Set toolbar, all entities in the Working Set are deleted, not just the current entity. The confirmation dialog will inform you as to the number of entities that are to be deleted. It is a good idea to ensure that this number agrees with your expectation.

Be *very* careful with deleting entities (and layers). Once you confirm the action on the deletion confirmation dialog, the entities (or layers) *cannot* be recovered.

Hint – When you key-in the coordinates of an entity in the ***Create Entity*** dialog, the coordinates must be in the coordinates of the layer that you have selected for the entity placement. In our example above, we are using State Plane, NAD 83, New Mexico, Central. The units of measure are meters for NAD 83. Thus our key-in values were the northing and easting in meters.

Now delete the *Test Entity 2* entity.

12.5 Creating a Project Boundary based on an entity

Project Boundary

You can create an entity based on the geometry of a diff[illegible]y useful in conjunction with the GeoAnalysis tools. In this exercise we will use the GeoAnalysis tools to create a variety of geometries and then the *Create Entity* function to use one of the GeoAnalysis results to create a project boundary.

If you have any GeoAnalysis layers in the project, delete them.

Select the four source strips and use the ***Union*** tool on the GeoAnalysis toolbar to create the union of the four sources. The result should be a newly created layer called "GeoAnalysis_1" that contains 2 entities (one of the entities is the small gap between strips that we observed in the previous chapter).

Select the GeoAnalysis entity that represents the outline of the four source strips. This is probably named "Union_0."

> Hint – Use the Visibility ("V") and Selectability ("S") options on the legend to make visualizing and selecting entities easier. For example, you can turn off selectability of the source layer to filter out the sources when selecting entities from the GeoAnalysis layer.

Bring up the ***Create Entity*** dialog by either right clicking the "Project 1" layer in the layer legend or by selecting the "Project 1" layer and clicking the ***Create Entity*** tool on the legend toolbar.

Set the fields in the dialog as shown in Figure 12-11. Note that the Placement Method is set to "Selected Entities Geometry." Press ***Create Entity*** button. Now set just the Project 1 layer to visible and observe the result.

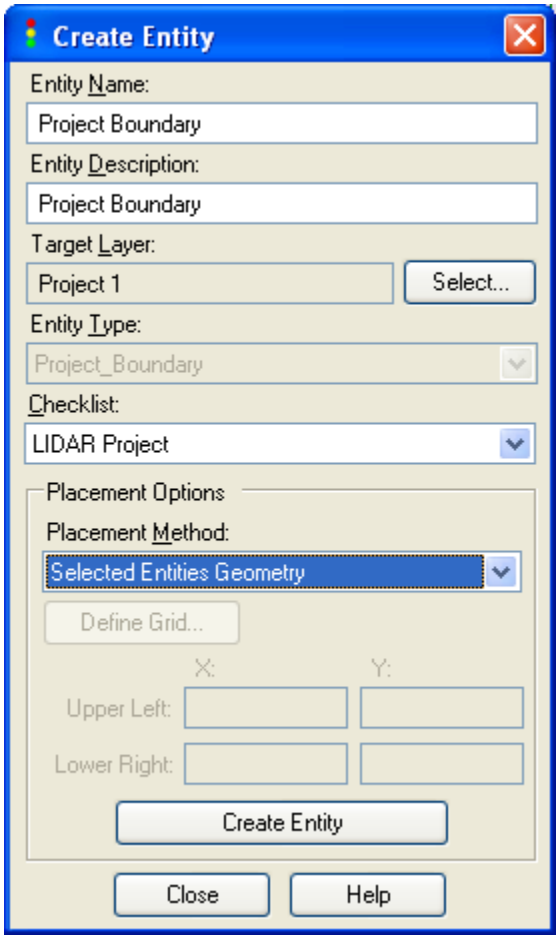


Figure 12-11 Creating a Project Boundary based on an Entity

You should see the result depicted in Figure 12-12.

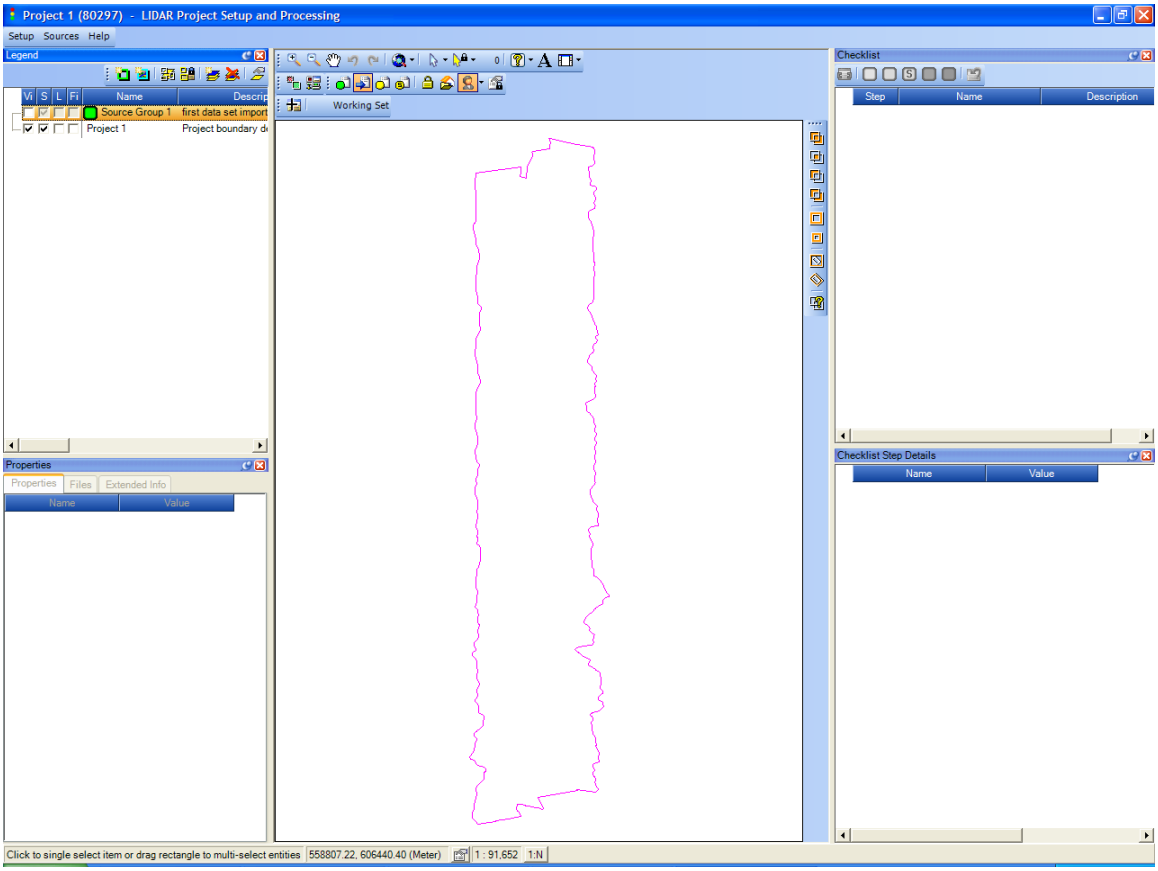


Figure 12-12 Project Boundary based on Source Boundary

Delete this project boundary and experiment with creating different geometries using the GeoAnalysis tools and repeating the above process.

When you are finished experimenting in this section, delete the Project Boundary entity as well as all of the GeoAnalysis layers.

12.6 Creating a Project Boundary based on Selection Set MBR

Creating an entity such as a project boundary based on the Minimum Bounding Rectangle (MBR) of other entities is such a common operation that we included it as one of the methods in the ***Create Entity*** dialog.

> Note – You probably accomplished this in the previous exercise by using the MBR tool in the GeoAnalysis toolbar and then creating an entity from the geometry of the selected entity. What is presented in this section is a faster method of accomplishing the same result.

Select the four sources and bring up the ***Create Entity*** dialog with the "Project 1" layer as the target layer. Set the fields of the dialog as shown in Figure 12-13. Notice that the Placement Method is set to "MBR of Selected Entities." Create the entity by pressing *Create Entity.*

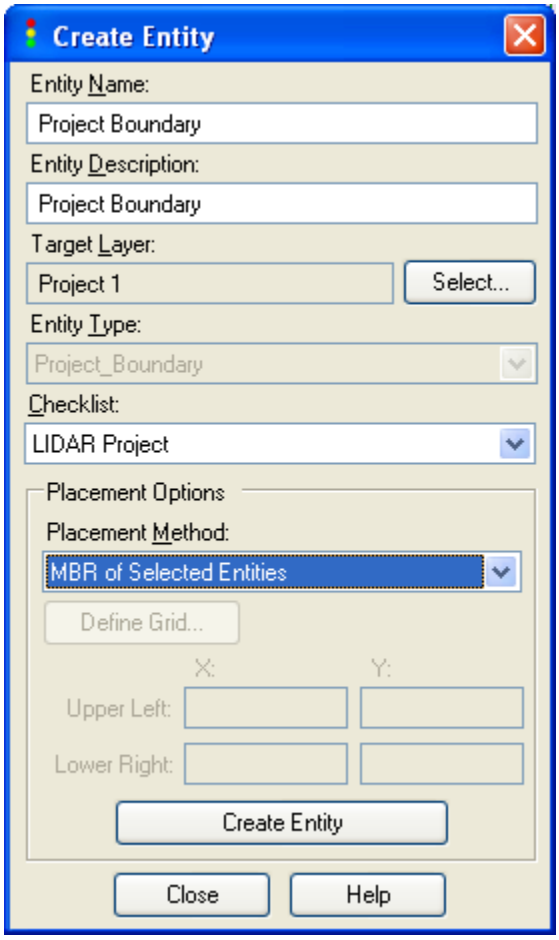


Figure 12-13 Entity based on selection set MBR

Your display should now show a new project boundary as depicted in Figure 12-14.

Delete the newly created Project Boundary.

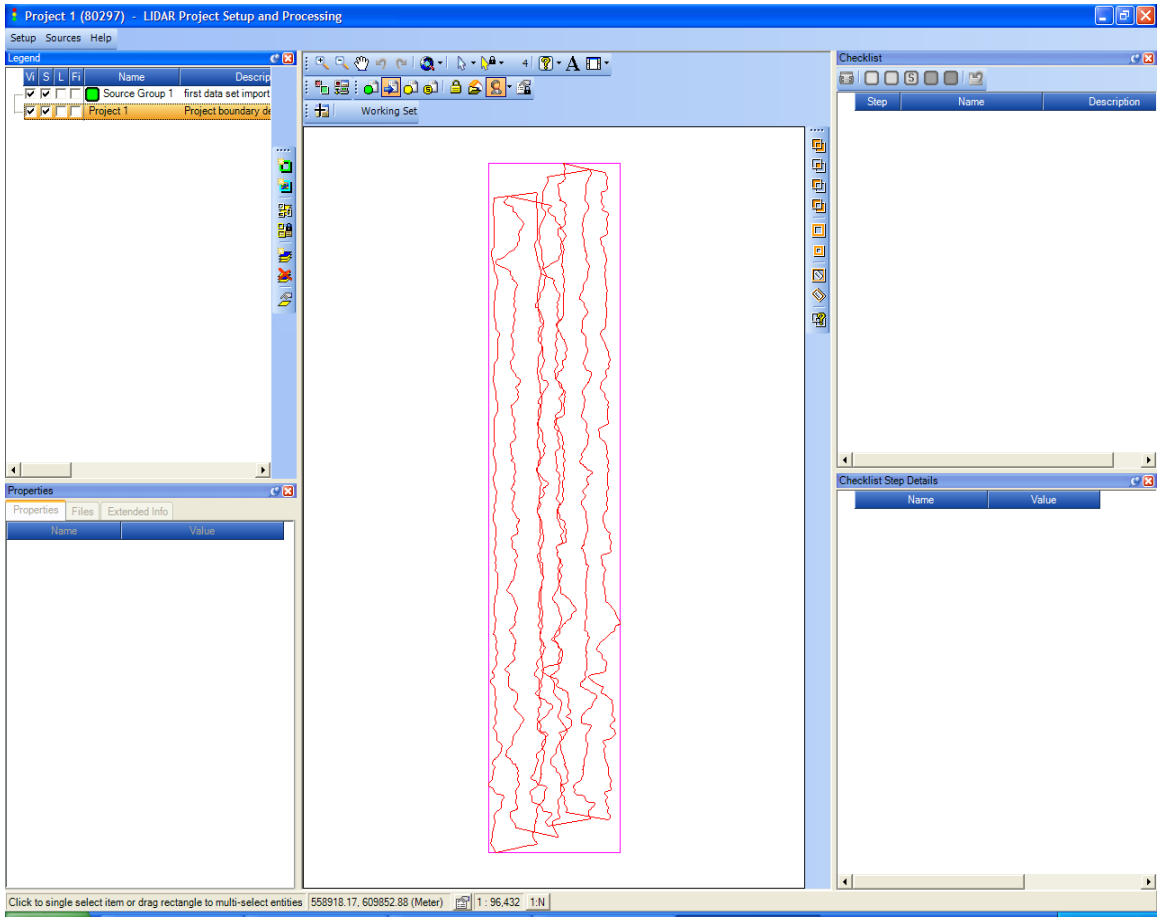


Figure 12-14 Project Boundary based on Sources MBR

12.7 Digitizing a Project Boundary

The next method of creating an entity is to directly digitize from the ***Create Entity*** dialog.

Select the ***Create Entity*** dialog from the Project 1 source layer. Populate the fields in the dialog as depicted in Figure 12-15. Note that the Placement Method is set to "Digitize Polygon." Now with the dialog still up (if it is in your way, you can drag it around by grabbing the title bar), digitize a polygonal boundary.

Digitizing a polygon in GeoCue – Left click where you want the origin. Move the mouse cursor to the position of the next point and left click. Continue this process until you have digitized the next to last point. Close the polygon by double clicking the last point. The shape of the polygon is constantly "rubber-banded" as you digitize. You can "back up" one point at a time by pressing the right mouse button.

Double-clicking the last point to close the polygon will automatically close the ***Create Entity*** dialog box. Notice that the ***Create Entity*** button is not active when you are creating an entity by digitizing. This is because the entity is created when you complete the drawing action.

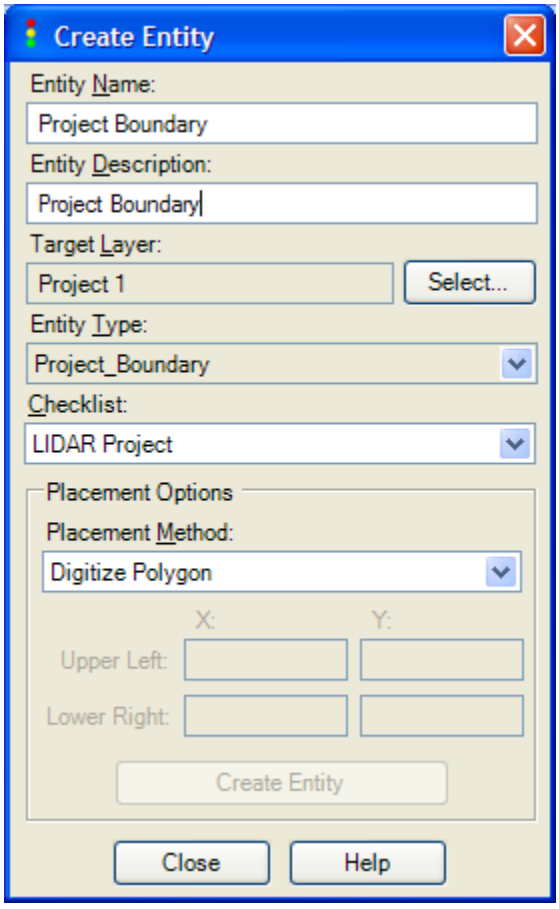


Figure 12-15 Digitizing an Entity

Upon closing the polygon and dismissing the dialog box you should see the digitized Project Boundary. An example is depicted in Figure 12-16 (of course your boundary will not be the same shape as ours).

You can also use this method to digitize a rectangle. Delete the newly created polygonal Project Boundary and repeat the above steps except this time select "Digitize Rectangle" as the Placement Method.

Digitizing a rectangle in GeoCue – Press and hold down the left mouse button where you want the origin of the rectangle placed. Drag the mouse cursor to the position of the terminal point of the rectangle. Release the mouse button. The shape of the rectangle is constantly "rubber-banded" as you digitize. The entity is created when you release the mouse button.

Hint – If, after you start to place a rectangle, you realize that you do not have the origin where you want it placed, press **Esc** (the Escape key) ***before*** you release the left mouse button. Now release the button. You will be able to restart the digitizing command at this point.

- When you finish experimenting in this section, delete the Project Boundary.

About Editing Entities – The current version of GeoCue does not allow you to edit the geometry of an entity. If you make a mistake in digitizing, you must delete the entity and start again. However, it is not necessary to exit the ***Create Entity*** dialog. You can delete the newly created entity with this dialog in place and fully populated. Thus recreating an entity does not require resetting all of the dialog input.

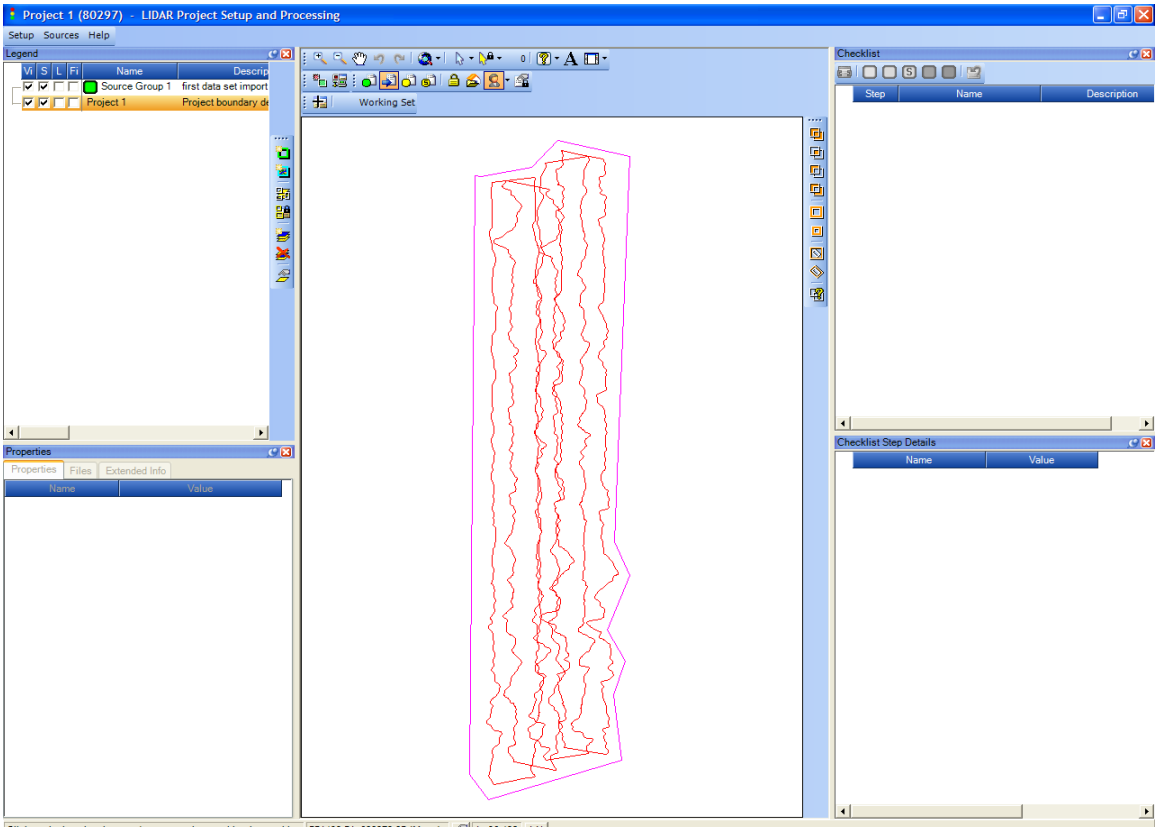


Figure 12-16 Free-form digitized boundary

12.8 Key-in of non-project coordinates

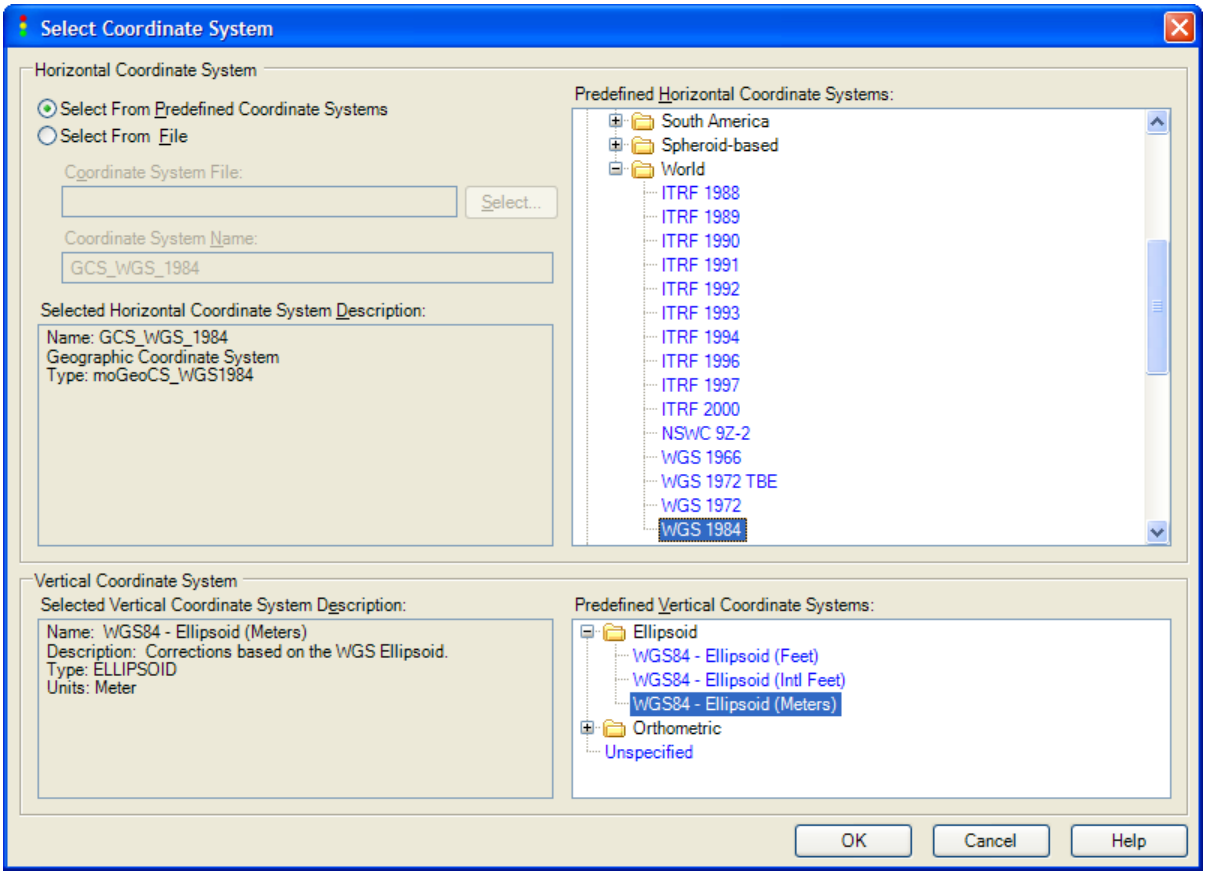
You may run in to a situation in which you need to key-in a rectangular entity in a coordinate system different from the layer on which you need to place the entity. For example, our current project layer is in NAD 83 coordinates. Suppose we wish to create a project boundary by key-in but our coordinate system of the project boundary is given to us in WGS-84 coordinates. In GeoCue, all entities on a layer must be in the coordinate system of the layer. Additionally, the key-in coordinates of an entity during ***Create Entity*** are interpreted in the coordinate system of the target layer. Since our Project Layer is NAD 83 and the Project Boundary must be on the Project Layer, we will have to coerce our input coordinates to NAD 83.

One way to do this is to convert the given WGS-84 project boundary coordinates to NAD-83 using a coordinate conversion tool and then create the project boundary as described in section 9.2.

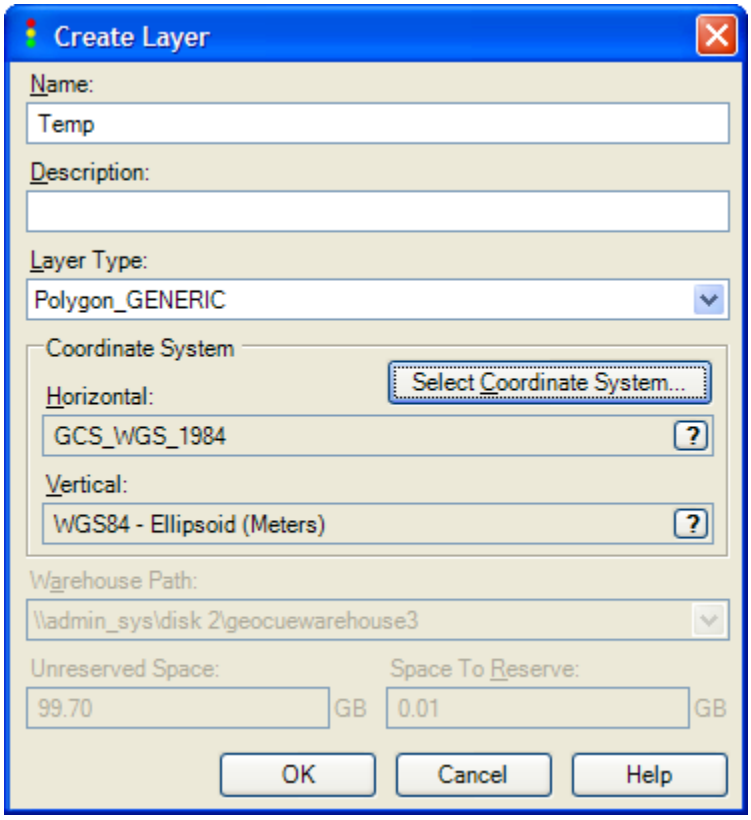
An alternative method involves creating a temporary layer in the desired key-in coordinate system and then using the entity on this layer as the template for the eventual target layer.

To demonstrate this exercise, we will assume that we have been supplied the Project Boundary MBR in WGS-84 coordinates.

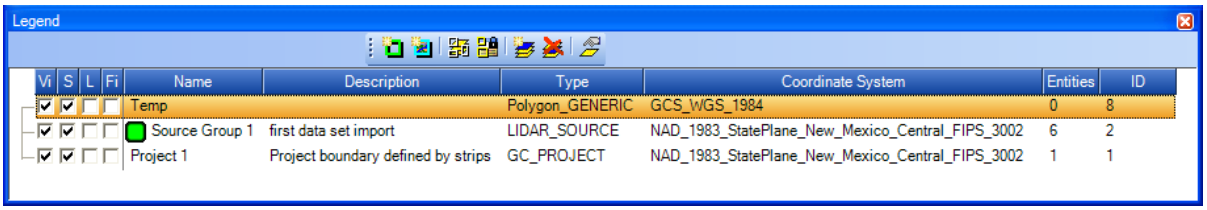
First, create a temporary layer by selecting ***Create Layer*** from the layer legend right-click menu (or from the create layer tool if you created a legend toolbar). Set the layer name to Temp and the layer type to "Polygon_GENERIC". Next select the coordinate system option and select the GCS_WGS_1984 coordinate system (you must choose "Display All Geographic Coordinate Systems" in the Selection Mode options section). The coordinate dialog should show:



Choose ***OK*** on the ***Select Coordinate System*** dialog and you will return to the ***Create Layer*** dialog. It should now appear as:



Click ***OK*** and the new layer called Temp will be created. Ensure that you have the correct coordinate system by observing this field in the layer legend:



Next we will create an MBR by key-in on this new Temp layer. Since we created this layer with a coordinate system of WGS-84, it will interpret key-in data in this same coordinate system. Create an entity on this layer by coordinate key-in as described in section 9.2. Use the WGS-84 coordinates displayed in the dialog of Figure 12-17. Notice that since the defined units of the WGS-84 coordinate system are decimal degrees, the key-in values in the dialog are entered in

this standard with a negative value indicated west longitude. Notice that we are just naming the entity "Temp" and using a "Polygon_GeoAnalyze" geometry because we intend to simply use this entity as a template for the Project Boundary.

Create the temporary entity by pressing ***Create Entity***. You should see a rectangle appear on the Temp layer. If it does not approximately enclose the LIDAR Source strips, verify that you have not made a key-in error.

Now, select the newly created Temp entity. Next open the ***Create Entity*** dialog by selecting the project layer and right-clicking in the Legend pane. Repopulate all of the fields in the ***Create Entity*** dialog as depicted in Figure 9-10. Be sure to note that every field in the dialog has been changed, including the destination layer (which has been set to the project layer) and the Placement Method.

Press ***Create Entity*** to dismiss the dialog. Turn off visibility of the Temp layer and you should see the new project boundary on the Project Layer, again approximately enclosing the LIDAR Source strips.

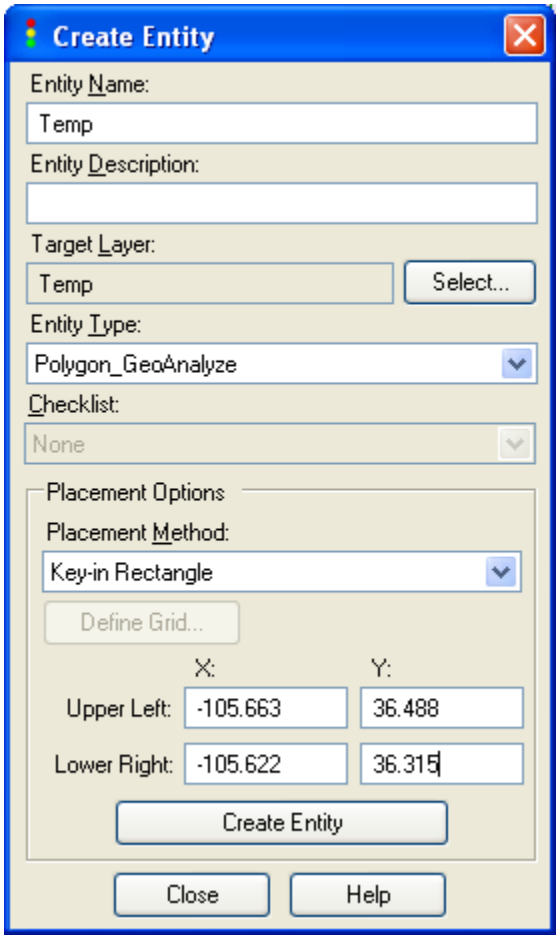


Figure 12-17 Key-in of a rectangle in WGS-84 Coordinates

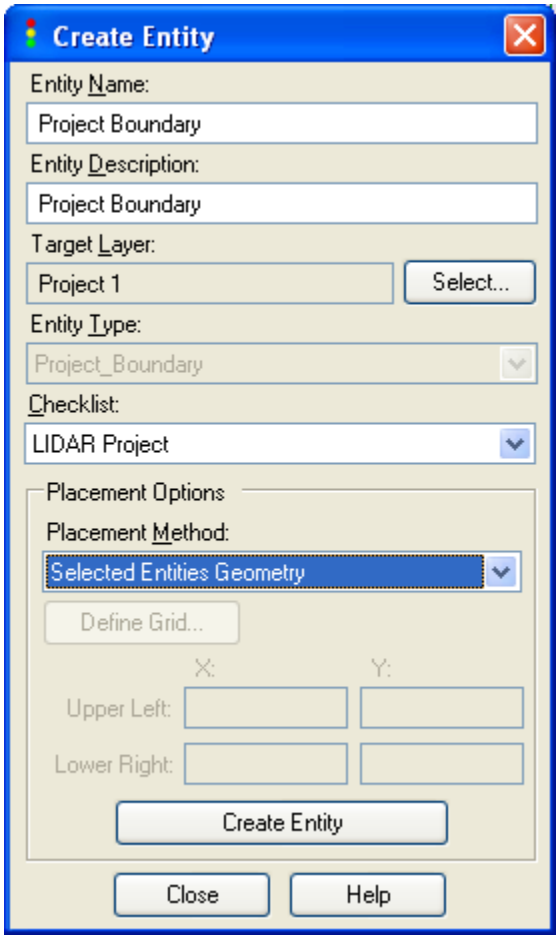


Figure 12-18 Repopulated Create Entity Dialog

The final step in this process is to delete the Temp layer (right-click the Temp layer and select Delete Layer).

The summary of this process is:

1. Create a temporary layer in the coordinate system for which you have input data
2. Create a temporary entity on the temporary layer using the input information
3. Use this entity as a template for forming the ultimate entity on the desired GeoCue layer

4. Delete the temporary layer

The above process takes advantage of the fact that GeoCue supports arbitrary mixing of coordinates systems and automatically does coordinate transformations between layers.

- When you complete this section, delete the Project Boundary.

12.9 The Gridding Tool

A very powerful entity creation tool in GeoCue is the gridding tool. Note that you can use this tool to created grids for use in products not related to a GeoCue workflow by creating a grid in GeoCue and then exporting this as a Shape file using the Export Geometry command.

To access this tool, select the placement method, “Place Grid of Entities” on the Create Entity dialog. This will invoke the gridding tool (Figure 12-19).

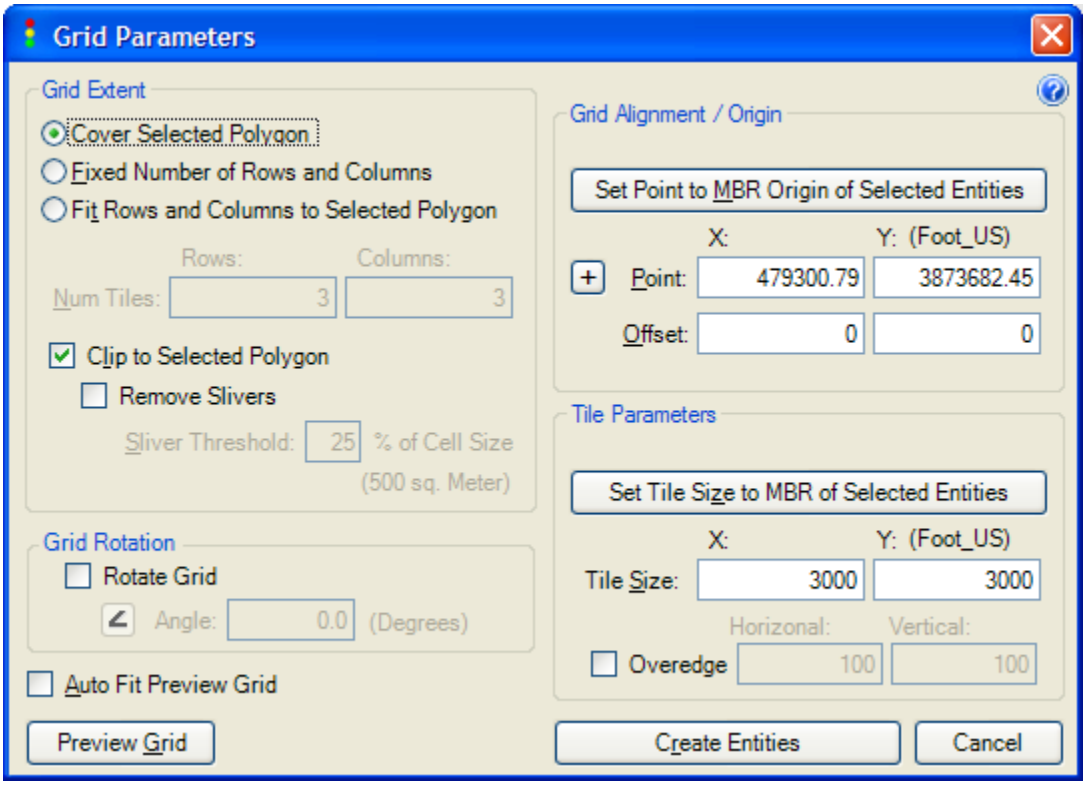


Figure 12-19 The Gridding Tool

The options on this dialog are highly interdependent.

12.9.1 Grid Extent

The first section (Grid Extent) defines the extent of the grid you wish to construct. The radio button selections perform the functions described in Table 12-3.

> NOTE: Each time you change an option, press the ***Preview Grid*** button to observe the result.

Table 12-3 Extent Options

Selection	***Description of use***
Cover Selected Polygon	*Select* an entity in the Map View. The grid defined by the parameters set on the right of the dialog will be defined such that it covers the selected polygon. The grid tile sizes will be those in the Tile Size boxes. The grid origin will be as defined in the Grid Alignment/Origin box.
Fixed number of rows and Columns	This choice will create the number of rows and columns of tiles as set in the "Num Tiles" boxes. They will be of the size specified in the Tile Parameters section of the dialog with origin as specified in the Grid Alignment/Origin section.
Fit Rows and Columns to Selected Polygon	This choice will fit the number of rows and columns set in the Num Tiles boxes to the selected polygon. Their size will be computed and displayed as read-only values in the Tile Parameters section of the dialog. Grid Alignment/Origin has no effect.

12.9.2 Clip to Selected Polygon

The *Clip to Selected Polygon* section allows you to force the grid to be truncated where it intersects a polygon that has been *selected* in the Map View. This means that the edge tiles will take on the shape of the enclosing polygon.

The *Remove Slivers* option will aggregate small entities that can result when clipping to a polygon. The removal algorithm functions based on the area of the entities. The percent threshold is based on the size of an unclipped tile (cell). For example, if you set the Threshold parameter to 25% then any clipped tile with an area 25% or less of an unclipped tile will be aggregated into the adjacent tiles. ***Sliver removal cannot be previewed.***

HINT: It is often most useful to create grids of GeoAnalysis polygons. You can then manipulate the resultant entities with the GeoAnalysis and GeoDraw tools. Finally, you can use the GeoAnalysis entities to create the desired entity type by selecting all of the GeoAnalysis entities and using the Create Entity with a placement method of *Selected Entities Geometries.* This is our recommended technique for any complex construction.

12.9.3 Grid Rotation

You can rotate the generated grid by enabling this option. Key in the desired rotation angle (counter-clockwise with respect to the positive X axis) or click the angle icon and draw a line along the axis of rotation in the Map View. Remember to press the ***Preview Grid*** button to preview the result.

12.9.4 Grid Alignment/Origin

Sometimes it is necessary that your tiles have a specific alignment to an origin. This section of the dialog is used to achieve these alignments.

The first option is to set the alignment to a selected object in the Map View. *Select* the object and press the ***Set Point to MBR Origin of Selected Entities*** button. The upper left corner of the Minimum Bounding Rectangle (MBR) of the *selected* object(s) is used as the origin. Note that the coordinates of this origin will be populated in the X, Y point section of the dialog.

The second option is to key in coordinates into the X and Y sections of the dialog

Finally, you can press the "**+**" icon to the left of the X, Y coordinate section of the dialog and digitize a point in the Map View for the desired origin.

You can key in an offset from the selected origin in the offset section. The units are the units of the layer on which the entities will be placed. Note that these offsets can be negative.

12.9.5 Tile Parameters

The *Tile Parameters* section of the dialog allows you to set parameters related to the tiles.

You can set the tile size based on one or more selected entities in the Map View by selecting the entities and pressing the ***Set Tile Size to MBR of Selected Entities*** button. Note that this will also enter the X and Y size in the **Tile Size:** fields of the dialog.

You can also set the tile size by keying in the desired X and Y sizes.

You can construct overlapping tiles by checking the ***Overedge*** option. Key in the amount of horizontal and vertical overedge desired.

12.10 Creating Entities from Imported Files

You can create entities on a layer based on the geometries contained in external CAD or GIS files. GeoCue currently supports:

- DXF
- MicroStation Version 7 and earlier
- ESRI Shape Files

To import geometries from a file, select the placement method “Import Geometry From CAD/SHP File on the Create Entity” dialog. This will bring up the import dialog (Figure 12-20). Browse for the desired file on which you wish to base your entities’ geometry. GeoCue will automatically recognize the file type and enable the appropriate sections of the dialog (our dialog is enabled for MicroStation design file import).

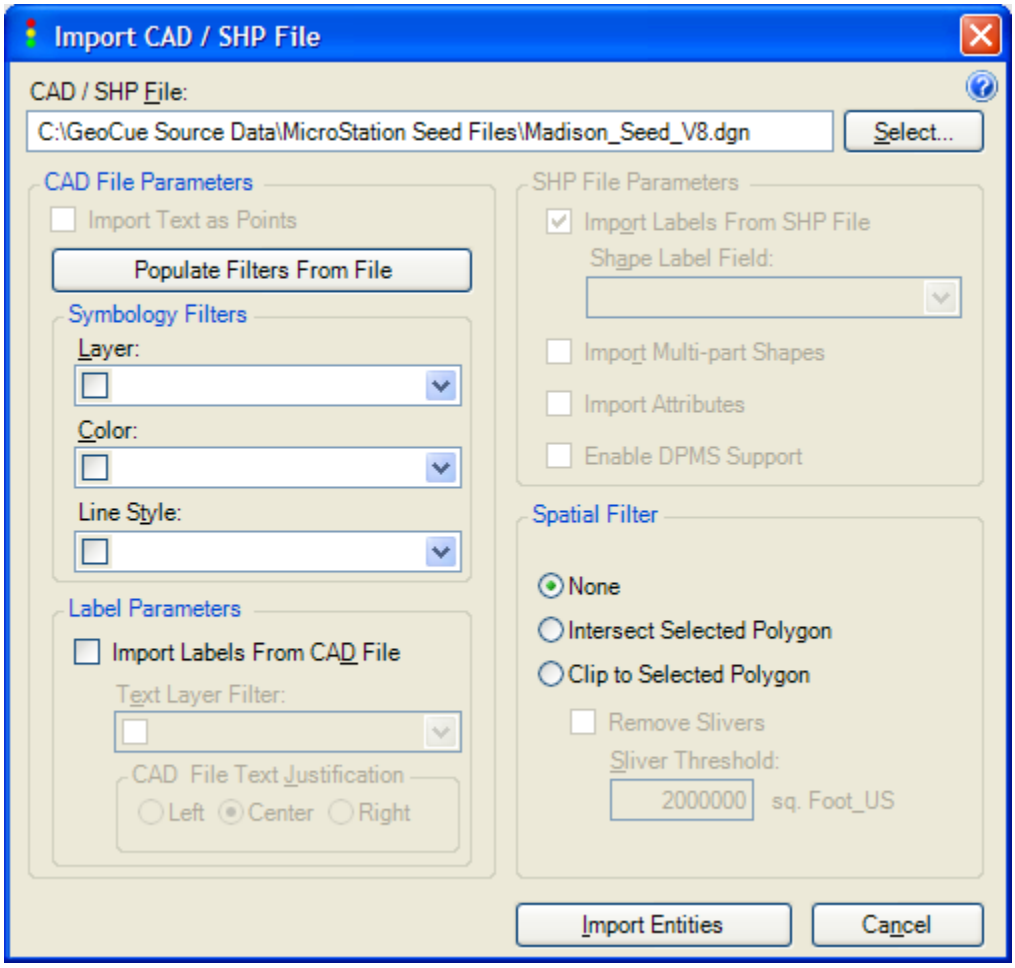


Figure 12-20 Import CAD/SHP File dialog

12.10.1 CAD Import

The CAD File Parameters section of the dialog allows you to filter based on Layer, Color and Line Style. If you do *not* check a box on a filter then elements will not be filtered out based on that criteria. For example, if you check the Layer box and set the field to "12" and check the Line Style box with its value set to "1", then all elements in the design file on layer 12 with line style 1 will be imported.

You can elect to name your entities based on labels from the CAD/SHP file by checking the Import Labels option. Unlike GIS files, the labels in a CAD file are not associated with CAD elements. Thus an intersection routine in GeoCue is used to make this association. The CAD File Text Justification option provides you flexibility in how the intersection between the imported CAD elements and the Labels is performed.

12.10.2 Shape File Import

The importation of Shape files is controlled by the right section of the dialog. Note that this section is used for importing Distributed Project Management System (DPMS files.

Import Labels from Shape File allows you to chose one of the shape file attributes as the GeoCue Entity label. Select the desired field from the drop-down list.

Import Multipart Shapes will cause GeoCue to create a separate entity for each part of a multi-part shape file (GeoCue does not natively support multipart shape files and hence the relationship between parts is lost). Thus, for example, if you import a multipart shape for a state boundary you will create multiple entities with the same name.

Import Attributes will import attributes from the shape file and populate the corresponding entity attributes with these values. The lookup table (access and modified in Environment Builder is used to establish this mapping table) for the GeoCue entity attribute group is used to perform this mapping.

Enable DMPS Support is set if you are imported shape files from a DPMS external project. Note that you will receive a warning on import if your shape file contains DMPS definitions but you have not checked this option.

You can spatially filter the elements in the import by selecting the filter option in the filter section of the Shape file import.

You can also apply the sliver removal tool to the resultant clipped entities.

12.11 Summary

We have reviewed a variety of different ways to create entities in GeoCue. The system has been designed with a great deal of flexibility in terms of being able to use entities created in one process (such as GeoAnalyze) as templates for another process.

Before you leave this chapter, create a Project Boundary on the Project Layer using the MBR of the source strips (as described in section 9.5). We will use this in a later chapter.

13 Associativity (Linking)

GeoCue includes the ability to establish relationships between *Entities* and provides GeoCue programmers facilities for manipulating entities via these relationships. This general capability is called *associativity* and the technology within GeoCue Server used to manage these relationships is called an *Associativity Engine*. In general, we refer to the overall system with the more familiar term, *Linking*[11].

Links (associations) are quite useful when two or more objects are related to one another in a programmatically dependent manner. Examples include:

- In DEM CuePac and LIDAR 1 CuePac, an LAS Boundary can be linked to LAS Working Segments. The relationship is that the boundary applies specifically to its associated (linked) working segments[12].
- In the Leica Ortho Accelerator CuePac, links are used to relate *Ortho* entities to their associated *Raw Image* entities and *Elevation* entities.

13.1 Defining Links

Links will be predefined by a system/Environment designer (using Environment Builder) for GeoCue workflows. Therefore it is never necessary (or desired!) for a GeoCue User to define a link. This section is provided for informational purposes only. The details on Link definition apply to Environment Designers and are available in the programmer guides to GeoCue.

[11] Programmers: All references to *Linking* in this chapter are synonymous to the *associativity* lexicon with which you may be more familiar. GeoCue implements a full Associativity engine that manages the integrate of relationships. You can establish ad hoc links interactively via Environment Builder.

[12] In versions of GeoCue prior to 3.0, this relationship was maintained by special metadata on the entity.

Links can be defined programmatically or on an *ad hoc* basis using Environment Builder. Environment Builder includes a new tab called Links (Figure 13-1) that is used for defining link objects. It is important to note that Links are separate objects in GeoCue that are not tied to a specific *Entity.* Thus the sequence is to *define* a link object via the Link tab of Environment Builder and then associate that link type to an *Entity* via the Entity tab of Environment Builder. The details of how this is performed are contained in the Environment Builder guide.

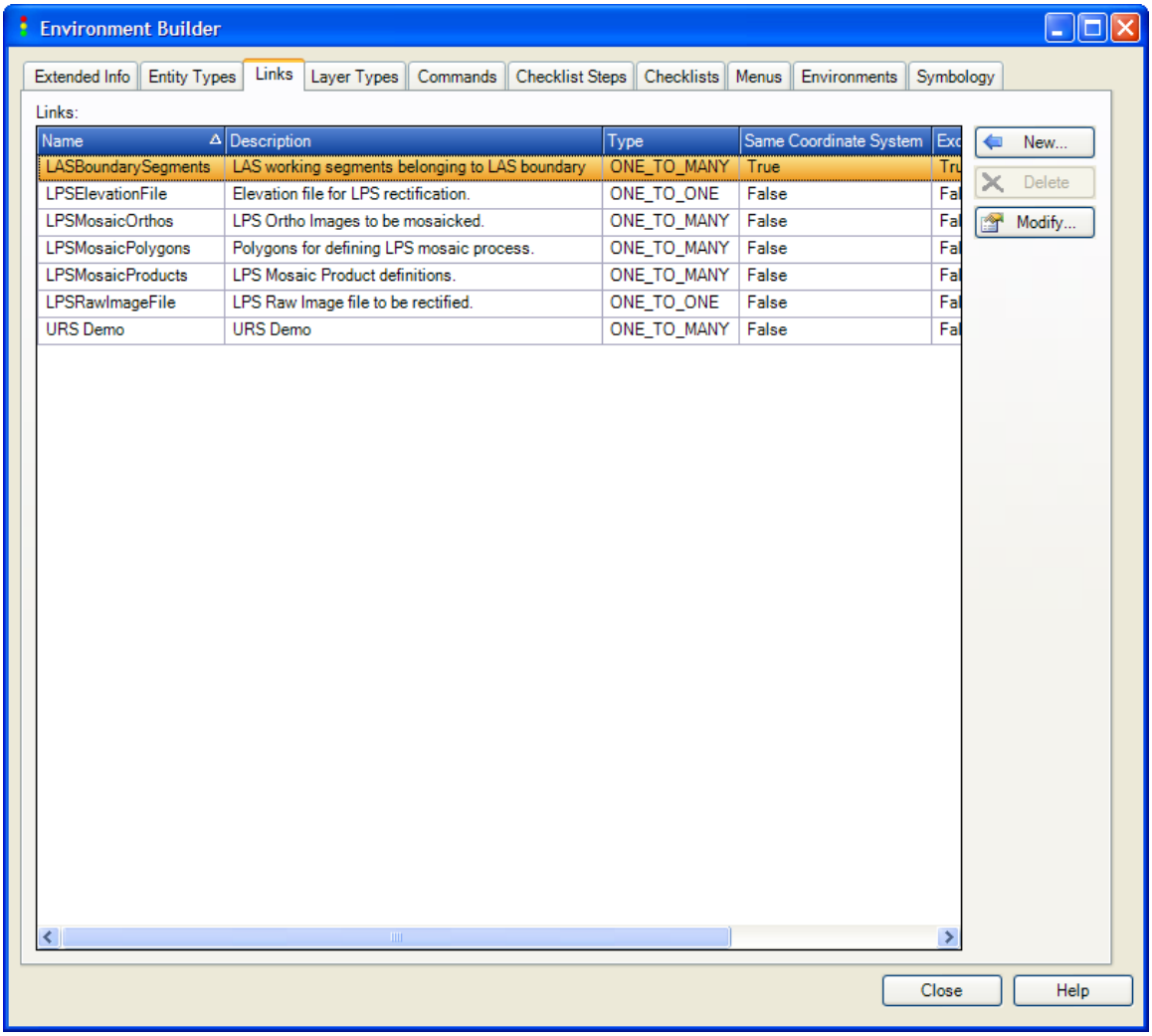


Figure 13-1 The Link tab in Environment Builder

13.2 The Link Toolbar

Links are manipulated via the new Link toolbar in GeoCue. This toolbar is depicted in Figure 13-2.

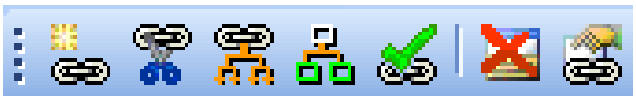


Figure 13-2 The Link toolbar

If this toolbar is not displayed in your instance of GeoCue, right-click in the toolbar docking area (above the Map View) and select **Link** (see Figure 13-3).

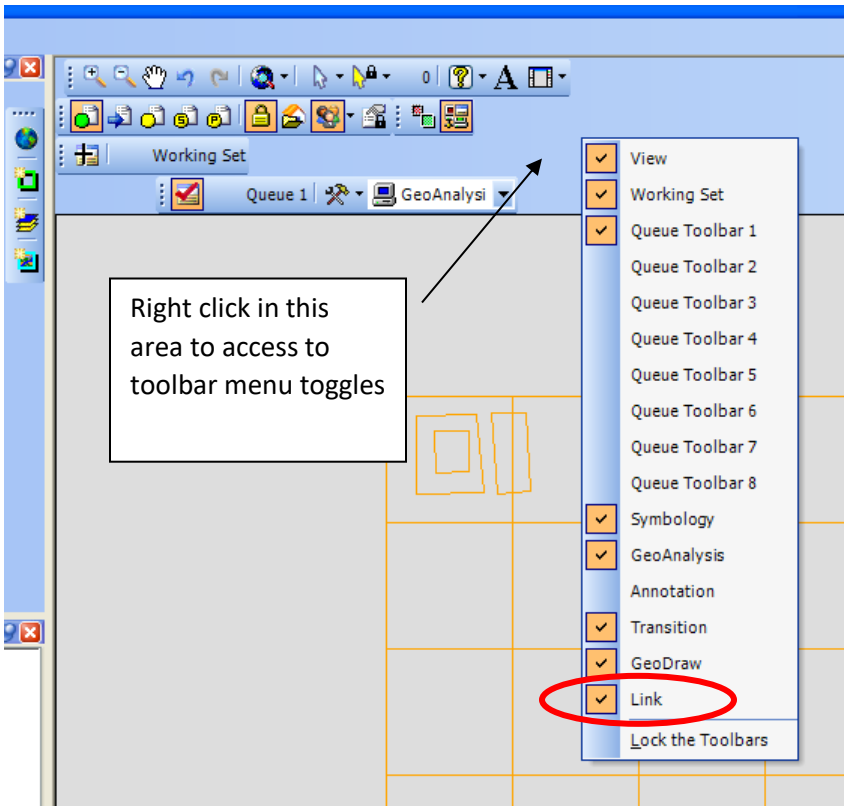


Figure 13-3 Displaying the Link Toolbar

The function of each button is described in the following subsections (the name of each tool is displayed as you hover the cursor over the tool).

13.3 Make Link

The *Make Link* tool establishes a link between *Source* entities (sometimes referred to as "Parents") and *Target* entities (sometimes referred to as "Children"). Establishing a Link adds a data field to the *source* entities and thus you must have a multi-user lock on the sources. This is accomplished, of course, by placing the source entities in the Working Set queue.

After placing the desired sources (e.g. Rectification Entities) in the Working Set, press the Make Link tool on the Link Toolbar. This will invoke the link dialog of Figure 13-4.

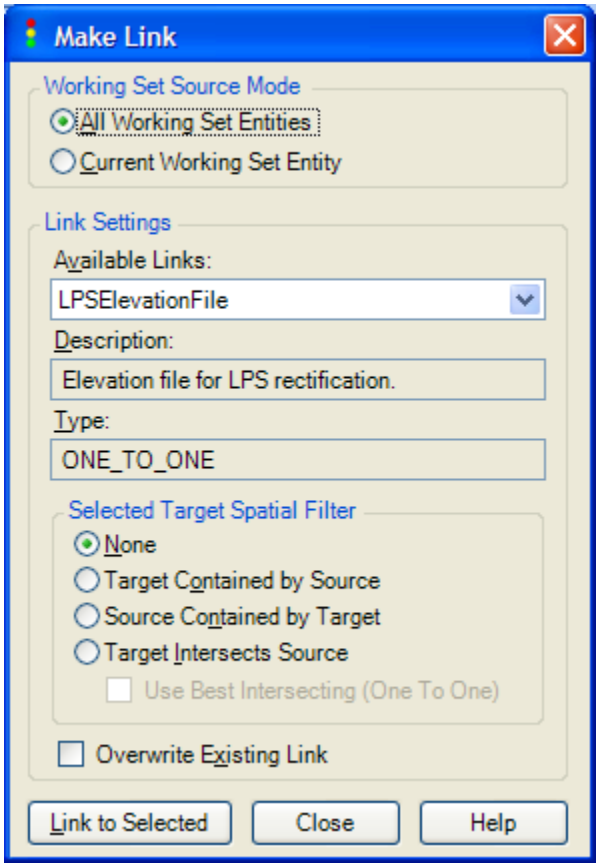


Figure 13-4 The *Make Link* dialog

The *Working Set Source Mode* option of the dialog allows you to establish a link for *All* entities in the working or only the *Current* entity. The *Current…* option is handy if you have a collection of entities that you wish to link in a single session but need to individually specify the target for each entity as you navigate the Working Set.

The Link Settings section of the dialog allows you to select the link from the Source entity link collection that will be used in this linking session. In the example of Figure 13-4 above, we have selected the LPSElevationFile link. This is a standard link in the Leica Ortho Accelerator CuePac that links a Rectification entity to the elevation file that will be used in the rectification process. If more than one link has been defined for the current entity(s), the choices will be available in the drop-down list.

NOTE: If you have selected heterogeneous entities into the Working Set and selected the *All Working Set Entities* as the link mode, only links that are common across the entities in the Working Set will appear in the drop-down list. If there are no common links, the drop-down will be blank.

After selecting the link, the Environment Builder defined link *Description* and *Link Type* will be displayed as read-only informational fields on the dialog. The Link Types are defined in the table below.

Table 13-1 Link Type definitions

Link Type	***Description***
One-to-one	The Source will link to a single target
One-to-many	The Source can be linked to one or more targets

NOTE: Both types of links may be defined as *Exclusive* in Environment Builder. This means that a Target can be *linked* by only one source (e.g. a Child can have only one Parent).

The *Sources* contained in the Working Set will be linked to the entities that are *Selected.* To assist with narrowing down the selection of the link Target, a spatial filter can be optionally applied to the entities in the selection set.

The next section of the dialog, *Selected Target Spatial Filter*, allows you to specify *filters* to be applied by the system in choosing the targets of the link from the target candidates current in the *Selection Set*. The actions of the filter options are described in Table 13-2.

Table 13-2 Link Filter Options

Filter Type	***Description***	***Action***
None	No filter applied	The source(s) will be linked to all elements in the *Selection Set.*
Target Contained by Source	Filter to targets that are fully contained by the source	For each source the filter attempts to narrow the selection set to targets fully contained by the source. If the link type can be satisfied after the filter, the link is made. An example of a failure would be a one-to-one link but 2 or more targets meet the filter criteria.
Source Contained by Target	Filter to sources that are fully contained by the target(s)	For each source the filter attempts to narrow the selection set to targets that fully contain the source. If the link type can be satisfied after the filter, the link is made. An example of a failure would be a one-to-one link but 2 or more targets meet the filter criteria.
Target Intersects Source (Use best intersecting not checked)	Filter to targets that are intersected by the source	For each source, select targets (from the current Selection set) that intersect (or are contained by) the source. If the link criteria can be satisfied (for example, if the link is one-to-one, only one target intersects the source) the link is established.

Filter Type	***Description***	***Action***
Target Intersects Source (Use best intersecting is checked)	Filter to targets that are intersected by the source. If the link is one-to-one, narrow down the selection to the single source that best (in a percent of intersection area sense) meets the intersection criteria.	For each source, select targets (from the current Selection set) that intersect (or are contained by) the source. If the link type is one-to-one, finds the best intersecting target based on the area of overlap between the source and the target.

The option *Overwrite Existing Link* will cause an existing link to be replaced by the new link, if a link can be established. This saves you from needing to *Delete* the existing link prior to relinking.

When you press **Link to Selected**, the linking action begins. All successful link *targets* will be placed in a queue called "Target_Linked_Entities" and the queue will be made *active.* This will cause the linked targets to highlight in green. An example is depicted in Figure 13-5 where the Source is shown in yellow (since it is still in the Working Set and the Target of the link is shown in the green, the active queue color.

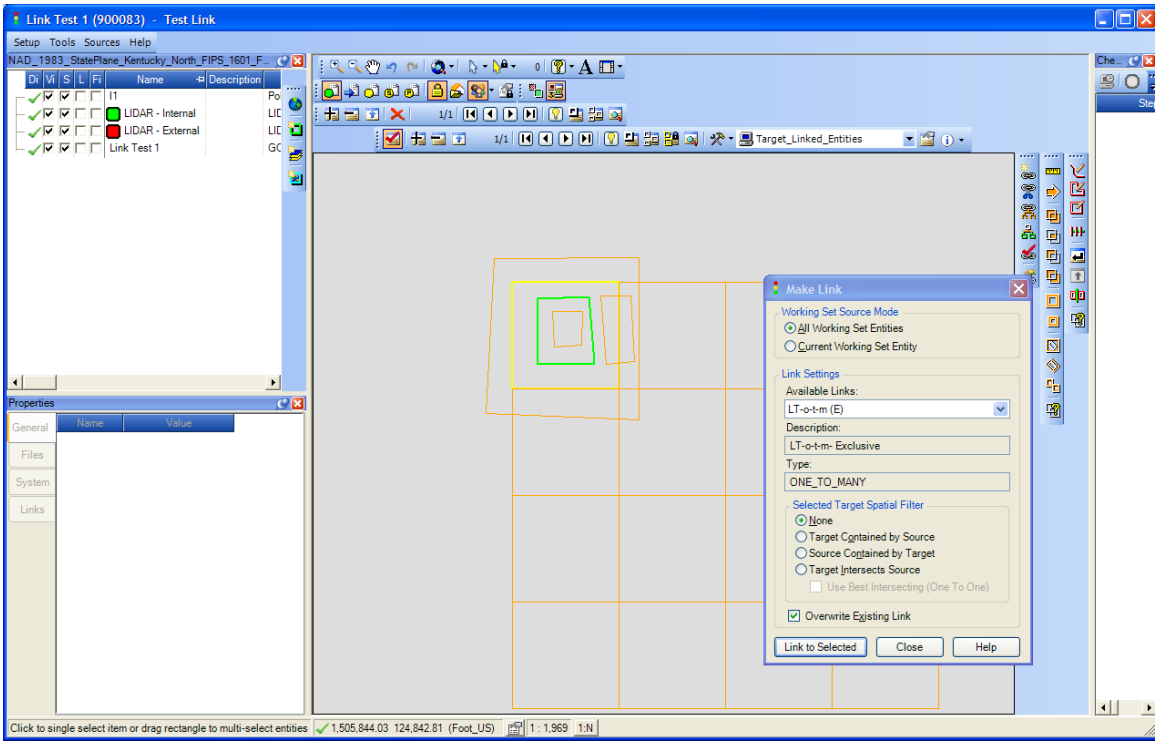


Figure 13-5 Source (yellow) and Target (green)

If no links can be established, nothing is added to the "Target_Linked_Entities" queue. If an error or ambiguity occurs, the error is displayed in a warning dialog such as that depicted in Figure 13-6

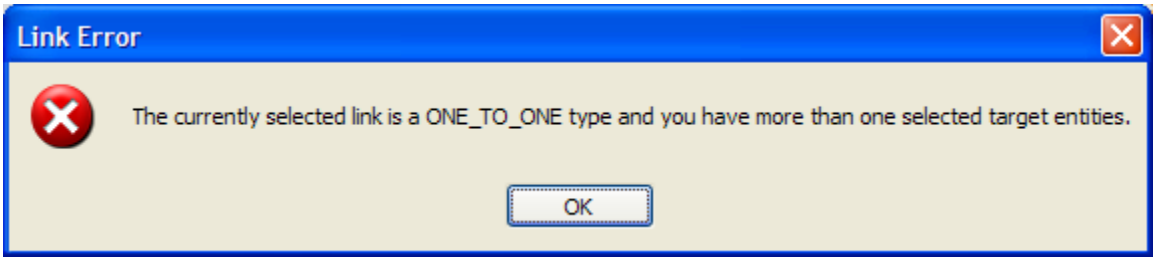


Figure 13-6 Example of a Linking error

If a group of entities are in the Working Set as link Sources and some of the Sources cannot be linked for some reason, the unlinkable sources are added to a queue named "Link_Error_Entities." As you advance through this queue, an informational message will be displayed telling you the reason why the link could not be achieved. An example of the queue message is shown in Figure 13-7.

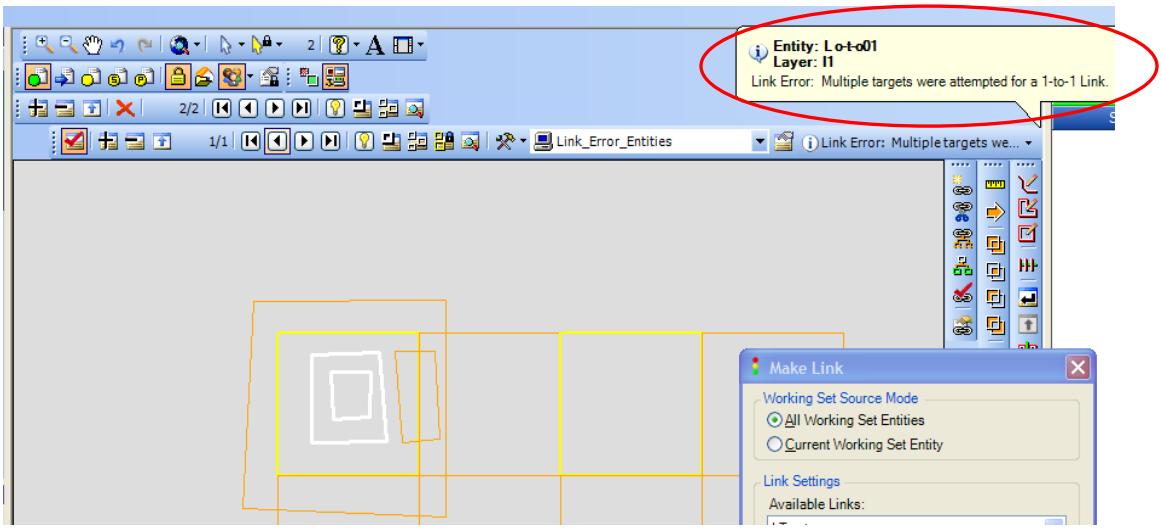


Figure 13-7 Link Error Queue message

NOTE: It is not necessary to exit the Linking dialogs to add or remove *Sources* from the Working Set. Thus you can invoke any linking dialog prior to adding Sources to the Working Set.

13.4 Break Link

The ***Break Link*** command is used to disconnect one or more links from entities placed in the Working Set. Note that if you have incorrectly linked an entity during a ***Make Link*** session, it is

not necessary to exit that command to redo the link. Simply choose the selection to *overwrite existing links* in the Make Link dialog.

To disconnect the links (one or more) from entities, first place them in the Working Set. Next press the Break Link tool on the linking toolbar. This will cause the dialog of Figure 13-8 to display. The actions of each section of this dialog are detailed in the following subparagraphs.

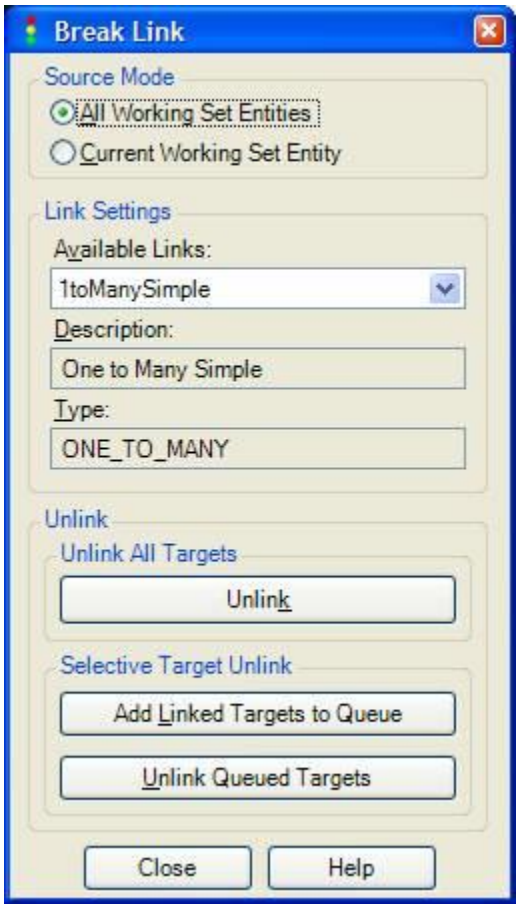


Figure 13-8The Break Link dialog

13.4.1 Source Mode

The ***Source Mode*** options allow you to work on *All Working Set Entities* or to process them one at a time (the Current Working Set Entity selection). Choose the desired setting. The default is All Working Set Entities.

13.4.2 Link Settings

The Link Settings section of the dialog allows you to choose the *Source* links that you wish to disconnect (break). This section of the dialog works in two modes, depending on your selection of Source Mode above

13.4.2.1 Source Mode set to All Working Set Entities

The first option in the displayed drop-down list is ALL Links, which will cause all links of all entities of the Working Set to be unlinked. Below the ALL Links selection will be listed all links of all entities of the Working Set, even if each link is not present on all Working Set entities. For example, if you have a link called ElevationLink on one entity in the Working Set and a different link called RawImageLink the second entity in the Working Set, both of these links will appear in the drop-down list. If you wish to break a specific Link, select it from the drop-down list.

13.4.2.2 Source Mode set to Current Working Set Entity

The first option in the displayed drop-down list is ALL Links, which will cause all links of the *Current* entity of the Working Set to be unlinked. Below the ALL Links selection will be listed all links of the *Current* entity of the Working Set. If you navigate through different entities of the Working Set (thus changing the *Current* entity) this drop-down list will change to reflect the links of the *Current* entity. If you wish to break a specific Link, select it from the drop-down list.

NOTE: If an Entity has a Link defined in Environment Builder but is not currently linked to any Targets, that link will *not* be displayed in the Link drop-down list.

13.4.3 Unlink

The ***Unlink*** section of the dialog contains several options for selectively unlinking particular Targets from the Sources contained in the Working Set.

13.4.4 Unlink all Targets

This section contains a single button, ***Unlink.*** Pressing this button will apply the previously selected options to the Entities (All source mode set) or *Current* (Current source mode set) Entity of the Working Set and unlink all Target entities from these sources.

13.4.5 Selective Target Unlink

The ***Selective Target Unlink*** section of the dialog allows you to selectively unlink particular Targets from the Sources in the Working Set by added the Targets to a named queue and then (when you press the Unlink button) unlinking only those Targets that you leave in this queue.

Pressing the ***Add Linked Targets to Queue*** will cause a *Link Trace* to occur. In a *Link Trace*, the GeoCue Associativity Engine (the portion of the GeoCue Server responsible for managing the linking system) will trace all of the Source Entity links based on the previous selections for Source Mode and Link Settings to their Targets. It will then place these linked Targets into a Queue named "Target_Linked_Entities." The linking system will make this the Active queue. Activating the queue will cause all of the entities pointed by the queue to highlight in green.

You can now manipulate this queue by stepping through it using the forward and back buttons on the queue toolbar. If you have Targets in this queue that you do not want to become

unlinked from their sources, press the ***Remove from Queue*** tool on the queue toolbar and the Current entity of the queue will be removed. For details of manipulating queues, see the Queue section of this document.

When you are satisfied with your selections, press the ***Unlink Queued Targets*** button on the Unlink dialog. This will cause the Links specified by the Link Settings section of the dialog of the Sources specified by the Source Mode section of the dialog to be unlinked from the Targets left in the "Target_Linked_Entities" queue.

> Note that the Break Link command allows you to do very specific unlinking operations and hence may seem a bit complex on first reading. In most cases, this command is never needed. For example, if you find that you have inadvertently linked the wrong elevation entity to a ortho entity, simply set the option to overwrite the existing link in the Make Link tool and relink link to the appropriate Target.
>
> Break Link is most typically useful for advanced users of custom Environments.

13.5 Trace Link

Trace Link allows you to visualize the Targets linked to Sources. Pressing the ***Trace Link*** tool displays the dialog of Figure 13-9. The actions of each section are described in the following subparagraphs.

Unlink ***Making*** or ***Breaking*** links, the Trace Link function only reads information from the linking fields of Entities. Thus the Entities that you wish to Trace are *Selected* rather than placed in the Working Set. You can *Select* the entities that you desire to Trace either prior to or after invoking the Trace tool.

If you are only interested in tracing the immediate Targets of the Sources (i.e. one level deep), it is more convenient to use the ***Quick Trace*** tool (described in the next section).

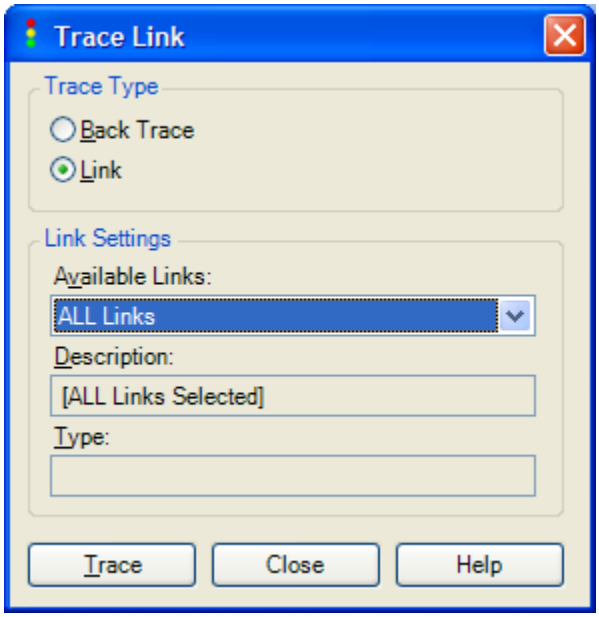


Figure 13-9 The Trace Link dialog

13.5.1 Trace Type

Normally, you should accept the default, Link, for this setting. This will cause the Trace action to follow the Source Entities to the Target entities ("Parent" to "Child"). GeoCue also allows you to perform a "Back Trace." A back trace treats the selected entity/entities as if they were Sources ("Children") and traces back to any Targets ("Parents") that are linked to these entities. This mode is useful for diagnostics. For example, in the Leica Ortho Accelerator CuePac, you might want to find out which orthos are linked to a particular elevation file. In Leica Ortho Accelerator, Orthos contain a One-To-One link that can be linked to an Elevation entity. Since the Orthos are the Source ("Parent") and the Elevation Entity is the Target ("Child"), the Elevation Entity will not show a Link if you place it in the Selection set to perform a trace. However, by selecting ***Back Trace,*** the Link Settings drop-down (described in the next section) will display these "back links."

13.5.2 Link Settings

The Link Settings option functions the same as it does for ***Make*** and ***Break*** link except the Source entities must be in the *Selection* set rather than in the Working Set.

Note that if you have **Back Trace** selected as the Trace Type, the displayed link types will be those of the Sources that are linked to the *Selected* Targets.

13.5.3 Trace (button)

Pressing the ***Trace*** button executes the trace. The Targets of the entities in the *Selection* set (the Sources) that are connected to the Sources via the selected link types are placed in named queues called "Trace_Gen_*n*" where n = 1, 2, 3, etc (you can change the name of the trace generation queues via the Link Options dialog, discussed later).

The first generation of Targets are placed into the queue, Trace_Gen_1. These entities are now treated as Sources and a second trace is executed. The results of this trace are placed in a queue named Trace_Gen_2. This process continues iteratively until either there are no more links or the number of generations exceeds the depth set in the Trace Options setting (the default depth is 3 generations).

NOTE: For most work, the Quick Trace tool suffices. The full trace tool is useful for in-depth diagnostics such as back-tracing or for advanced custom Environments that use multi-depth linking.

13.6 Quick Trace

The ***Quick Trace*** tool performs an immediate trace of *all* links on the *Selected* entities. It does not display a dialog. The Targets ("Children") of the *Selected* entities (the Sources or "Parents") are placed in a named queue called "Trace_Gen_1." The queue is set to the active queue and thus the Targets highlight in green.

13.7 Delete Link Queues

This tool provides a quick way to delete all of the queues (three in version 3.1) associated with the linking system. Pressing the *Delete Link Queues* causes the Source, Target and Error queues to be emptied and then deleted. This tool is useful when you are performing multiple link operations and want to ensure that previous results are cleaned up.

13.8 Validate Link

Validate Link checks the integrity of all links on the *Selected* entities. If any errors are found, a diagnostic will be displayed. You normally should not need to use this tool.

> NOTE: We used the Validate system while we were designing GeoCue's Associativity Engine. The engine is now robust and you should not encounter linking integrity issues (for example, in early versions of the Engine we did not prevent the occurrence of circular links and hence a tool was needed to diagnose this sort of issue. We left the tool in case there are some situations we overlooked!

13.9 Link Options

Pressing the ***Link Options*** tool displays the dialog of Figure 13-10. Each tab of this dialog is explained in the following subparagraphs.

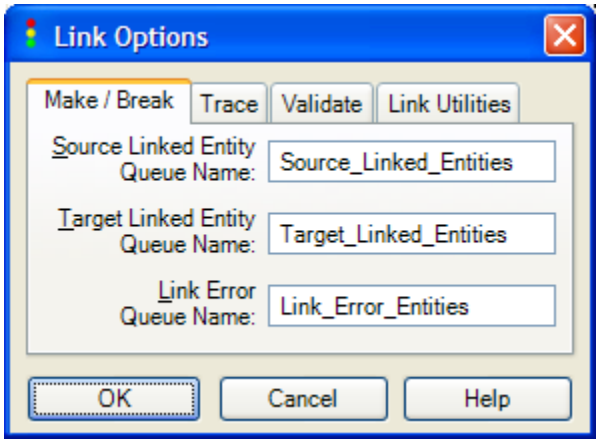


Figure 13-10 Link options dialog

13.9.1 Make/Break Tab

This tab (Figure 13-10) allows you to change the names of the queues that the linking system create when you make and break links.

13.9.2 Trace Tab

The Trace tab (Figure 13-11) allows you to modify several parameters associated with tracing links.

The ***Trace Generation Queue Name*** allows you to set a different base name for the queues used in tracing. Whatever name you set will be appended with the generation number thus is useful to provide a separator at the end of the name such as an underscore ("_").

Note: Queue names in GeoCue can contain spaces such as "Trace Generation "(there is a single blank after "Generation." This will yield easy to read names such as "Trace Generation 1." We seem to jam our names together or add underscores out of old habits from the "no spaces, 8.3" file name days!

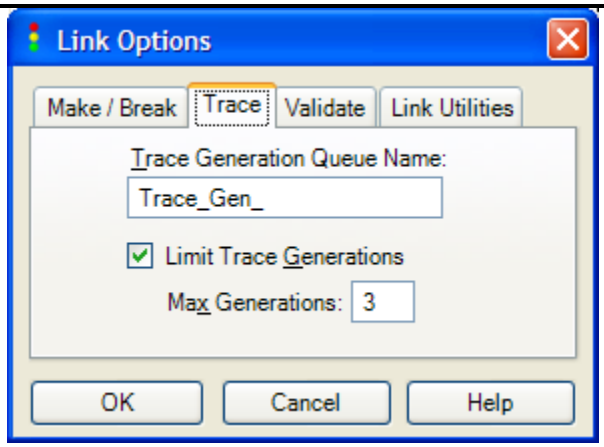


Figure 13-11 The Trace tab of the Link Options dialog

The Limit Trace Generations option restricts the number of generations that GeoCue will traverse when performing a full link trace (as opposed to a Quick Trace). The default is 3.

13.9.3 Validate Tab

When making or breaking links, any problem Sources are added to a named queue.. The Validate Options tab (Figure 13-12) allows you to change the default name of this queue. Simply type in a new name (spaces are permitted) and press OK.

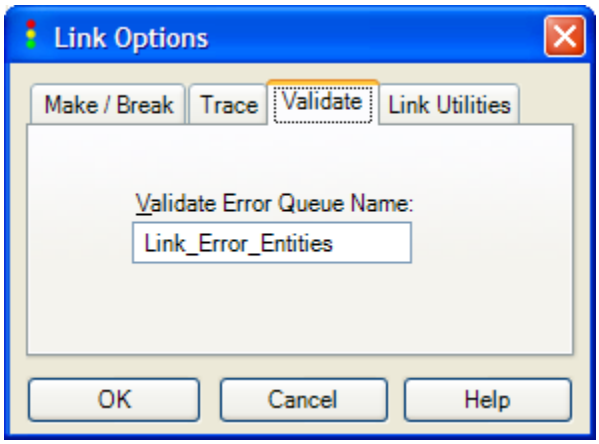


Figure 13-12 The Validate tab of the Link Options dialog

13.9.4 Link Utilities Tab

The Link Utilities tab (Figure 13-13) of the Link Options dialog contains utility functions for managing your linking tools. Currently this tab provides a quick way to clean up after using the link tools by providing a single button to delete the various queues used in the linking system. Simply check the queues you wish to delete and press the ***Remove Selected Link Queues*** button. Remember, this is always perfectly safe since deleting a queue does not delete the entities pointed by the queue (not to be confused with the Delete Entity button on the Working Set toolbar!).

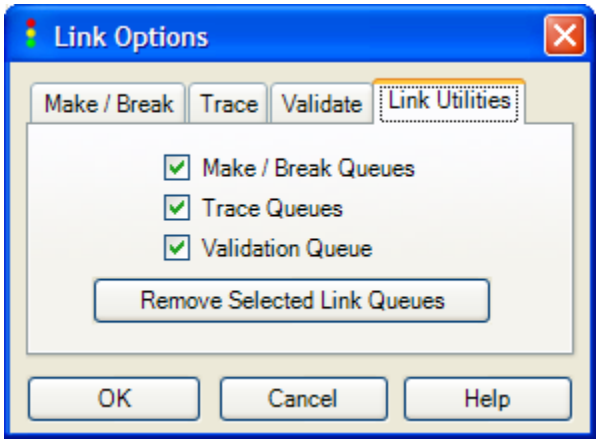


Figure 13-13The Link Utilities tab of the Link Options dialog

13.10Common Linking Problems

Don't worry too much about making mistakes while linking or unlinking entities; generally you can simply remove the link and start over. Some common linking problems are discussed below.

13.10.1 Link Restriction Violations

The most common linking problems are associated with restrictions that have been placed on the link by the Environment designer. You can examine the link restrictions by bringing up Environment Builder (via Setup, Admin) and examine the link from the Link tab.

An example is attempting to link a Source to more than one Target via a one-to-one link. An example of this would be trying to link an Ortho in Leica Ortho Accelerator to more than one elevation entity.

GeoCue allows the Link designer (again, via Environment Builder) to restrict the types of entities that can be linked as Targets. For example, the link on LAS Boundaries in LIDAR 1 and DEM CuePacs restricts the Target entity type to "LAS Working Segment."

Another type of restriction is a link with *exclusivity* set. This means that a Target (as opposed to the source) can only have one instance of a Source link of a particular type linked to it. Again, an example is the LAS Working Segment. The LAS Boundary link called "LASBoundarySegemnts" is used to link an LAS Boundary (the Source or Parent) to its associated LAS Working Segments (the Targets or Children). This link is a one-to-many meaning that one Boundary can be linked to many Segments. However, it is also *Exclusive* which means that if Boundary A is linked to Segment P, Boundary B cannot be linked to the same segment P.

All of these sorts of violations are flagged by the linking system when you attempt to create a link. The problem Sources or Targets are placed in the Link Error queue with a clearly stated definition of the problem for each entry in the queue.

13.10.2 Circular Links

GeoCue (by design) does not permit *Circular* links. For example, suppose you have a link called "Link to another entity" defined on an entity type of My Entity. You now create two "My Entities" named A and B. You next link A to B using your "Link to another entity" link. If you now attempt to link B to A using the "Link to another entity" link, you will receive the error "Create Link Error: The specified link would result in a circular dependency." The offending Sources will be placed in the Link Error queue.

13.11 Summary

Linking provides a very powerful feature in GeoCue. While it will be extensively used by us, the developers of GeoCue, it is available on an ad hoc and interactive basis for any user of GeoCue. As we release new versions of GeoCue, look for significant new capabilities in this area.

14 GeoAnalysis and GeoDraw Tools

GeoCue contains a rich collection of *GeoAnalysis* tools for both analysis and entity construction. The GeoAnalysis and GeoDraw toolbars are depicted in Figure 14-1. If either toolbar is not present in the toolbar area of the Map View, you can restore it by right-clicking in the toolbar docking area and selecting ***GeoAnalysis*** or ***GeoDraw.***

Figure 14-1 The GeoAnalysis Toolbar

14.1 Basic Entity Construction Techniques

In many cases, the most flexible way to create new entities is to build a *template* entity using the GeoAnalysis tools and then *Create Entity* using the placement method *Selected Entities Geometry* (see the Entity chapter).

14.1.1 Direct Drawing

There are three direct drawing tools supplied on the GeoDraw toolbar; Line, Polygon and Rectangle. There three tools allow you to directly draw, on a layer of type *GeoAnalyze_Line, or GeoAnalyze_Polygon*, lines, polygons and rectangles. These shapes can then be used as building blocks for more complex geometry types or as templates for creating entities.

We have reduced the number of key clicks required in drawing by enabling these tools to directly create a new layer, if necessary. The layer creation behavior is controlled by the GeoAnalysis *Options* settings (the GeoAnalysis Options tool button is on both the GeoAnalysis and GeoDraw toolbars). The options are accessed by selecting the  button on the

GeoAnalysis toolbar. This will invoke the dialog of Figure 14-2. The first tab, *Result Layer,* establishes the behavior for the placement of new GeoAnalysis entities. If the check box, Auto Create New GeoAnalysis Layers, is set then a new layer will be created *each time* a new GeoAnalysis entity is created. For example, if you drew three lines, a new layer would be created for each line. These layers will be named with a *prefix_N* scheme where *prefix* is entered into the Auto Layer Prefix portion of the dialog and *N* is a sequential number automatically assigned by GeoCue. If Auto Create New GeoAnalysis Layer is not selected, all entities will be added to the layer whose name you can supply in the *Fixed Layer Name* section of the dialog. The Auto Create option is useful for making it easy to segregate GeoAnalysis entities by layer placement.

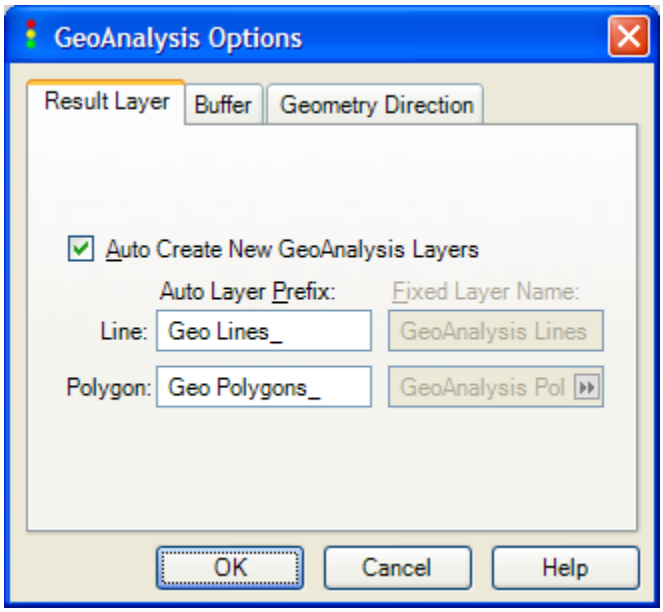


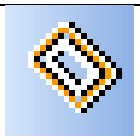
Figure 14-2 GeoAnalysis Options dialog

Try these commands by drawing lines, polygons and rectangles in GeoCue. You can delete the layers when you are finished experimenting.

NOTE: The three direct draw GeoDraw tools (line, polygon and rectangle) are all 'sticky' buttons similar to the drawing tools in Word. If you press the button once, you get a one-time tool (e.g. as soon as you complete a line, the mode reverts to *Select*). If you double-click the tool, the draw mode will remain active between drawing objects.

14.1.2 Minimum Bounding Rectangle tools

There are three Minimum Bounding Rectangle (MBR) tools provided in the GeoAnalysis toolbox. These are described in

Tool	***Icon***	***Action***
Minimum Bounding Rectangle (MBR)		Draws a rectangle around all *Selected* entities such that the rectangle is orthogonal to the project coordinate system and is the minimum size necessary to enclose all selected entities.
Minimum Area Bounding Rectangle (MABR)		Draws a rectangle around all *Selected* entities such that the rectangle can be rotated relative to the project coordinate system and is the minimum size necessary to enclose all selected entities. The rotation angle is that which minimizing the area of the enclosing rectangle.
MBR per Entity		Draw an individual MBR around each selected entity. The MRB can be expanded or contracted by setting the MBR per Entity buffer size in the GeoAnalysis options dialog (see Figure 14-3)

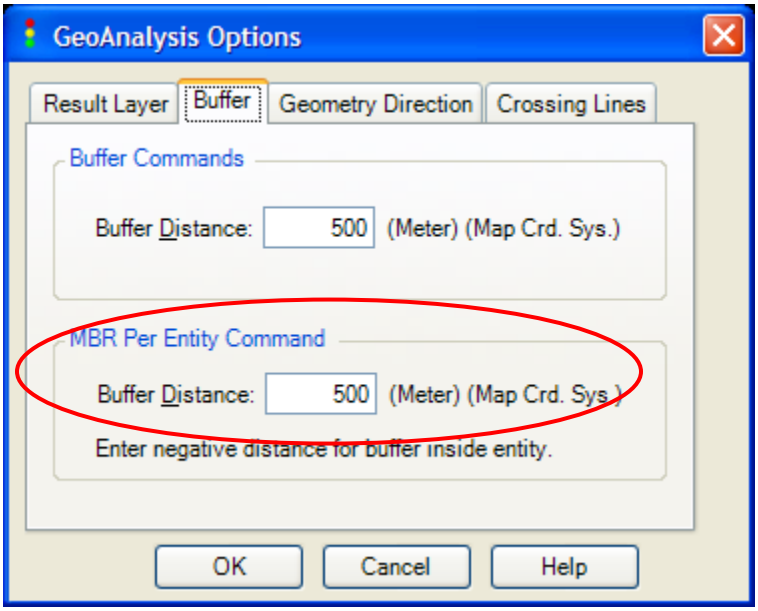


Figure 14-3 Setting the MBR per Entity Buffer zone

14.1.3 Polygon Geometry Operators

A number of *Geometry Operators* are available for both analysis and construction when using polygons. The operations provided are listed in Table 14-1.

Table 14-1 Polygon Geometry Operators

Operator	***Tool***	***Action***
Union		Creates a single entity that is the Union of all selected entities
Intersect		Creates a single entity that is the intersection of *all* of the selected entities. Note that if a single entity is outside the intersection, no entity is created.

Difference		Subtracts the second selected entity from the first selected entity, then the third selected entity from the previous result and so forth.
Exclusive Or		Computes the exclusive *OR* of two selected entities.

The usefulness of these tools will be demonstrated in a later section.

14.1.4 Buffer Zones

Buffer Zones are very useful for:

- Enlarging or shrinking a polygon by a fixed amount
- As an intermediate step in merging tiles to ensure that no slivers are created
- As a component for building corridors

Buffering operates on both lines and polygons. The size of a buffer is set from the *Options* dialog of the GeoAnalysis toolbar. The buffer units are in the units of the project coordinate system.

14.1.4.1 Growing or Shrinking a Polygon

We will illustrate growing and shrinking a polygon via an example. In the GeoCue Introductory Project, create an LAS Working layer. On this layer create a LAS Working segment by creating an entity using the Rectangle placement method (see the *Entity* chapter if you have difficulty with this). Our example is depicted in Figure 14-4.

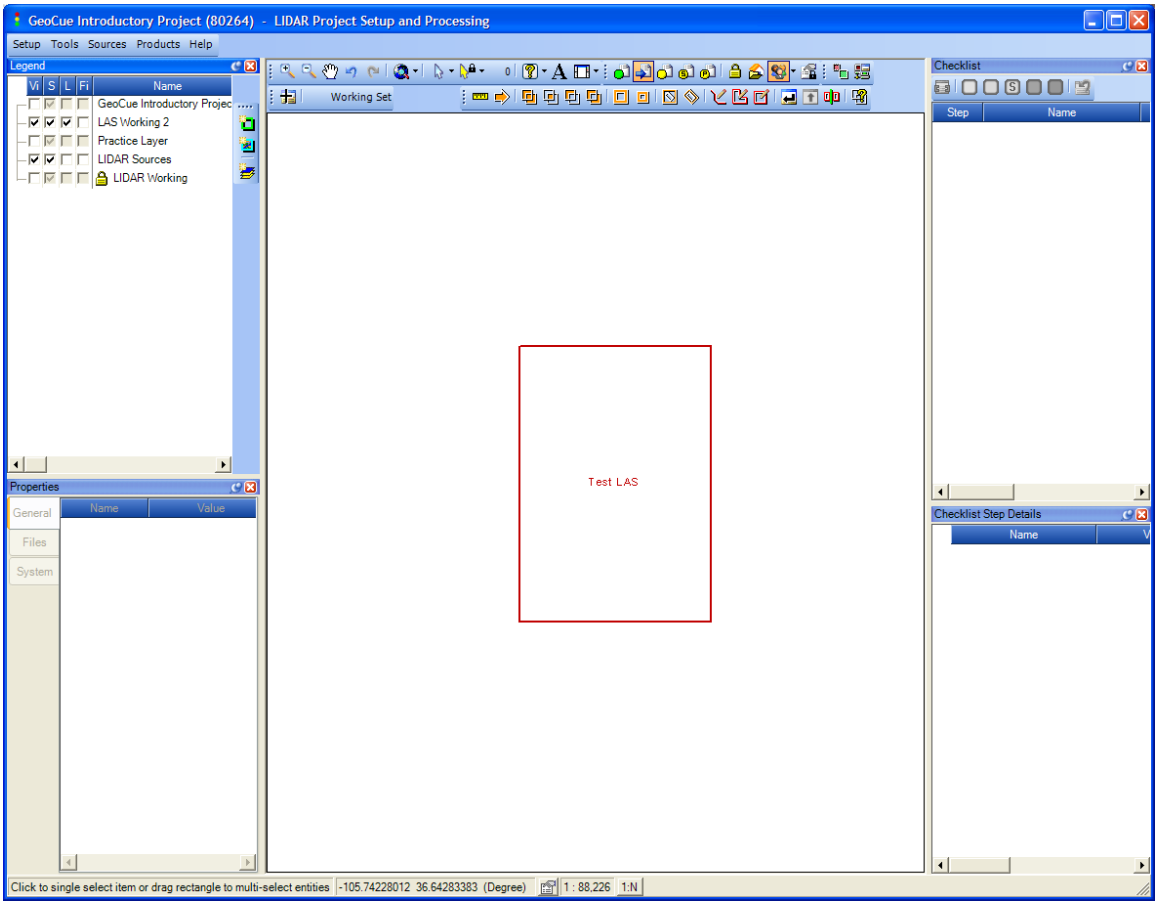


Figure 14-4 A LAS Working entity used in the buffer example

Open the GeoAnalysis options dialog. Check the Auto Create New GeoAnalysis Layer option and switch to the Buffer tab. Set the Buffer Distance to 200 meters (Figure 14-5). Dismiss the dialog.

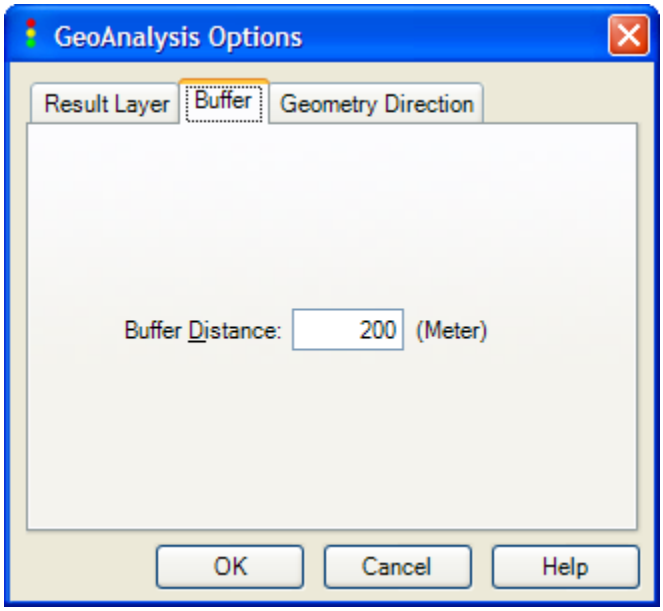


Figure 14-5 Buffer option setting

Now *select* the LAS Working Segment that you created and click the buffer grow tool on the GeoAnalysis toolbar. This should cause a new GeoAnalysis layer to be created with a GeoAnalysis polygon 200 meters larger than the LAS Working Segment. Our result is depicted in Figure 14-6. Note that the GeoAnalysis polygon has rounded edges. This is a result of the construction of a buffer that is everywhere 200 m greater than the selected geometry.

You can see that this command is very useful for providing exact amounts of overedge. For example, if a customer were to provide you with a set of objects defined in a CAD or Shape file and needed the objects buffered by a set distance, you could create the desired entities by importing the CAD/Shape file onto a GeoAnalysis layer, use the buffer command to enlarge the entities and then create the actual type of GeoCue entity desired by using the Create Entity command with the *Selected Entities Geometry* placement option.

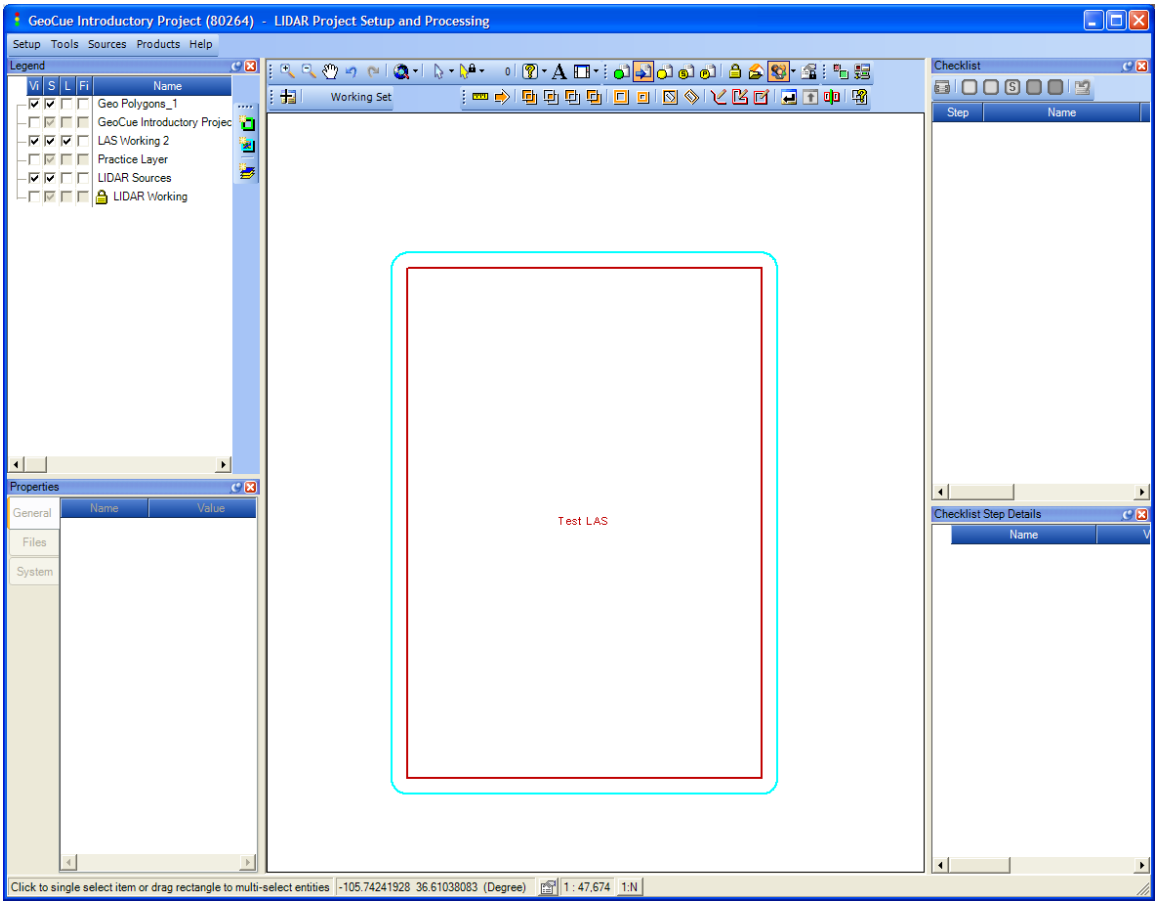


Figure 14-6 The LAS Working Segment along with the GeoAnalysis buffer polygon

14.1.4.2 Preventing Slivers when Merging Entities

It is often the case that polygon appear to touch but in reality have a small gap at their edges. If you use the Union command to merge these polygons, they will not aggregate into a single unit because of the lack of overlap. An example is depicted in Figure 14-7. Selecting these four LAS segments and applying the Union GeoAnalysis command results in the construction of Figure 14-8. Notice that rather than obtaining a single merged entity, we end up with four duplicates of the original entities.

This problem can be addressed by first expanding the entities with the Grow Buffer command. First zoom in on the junction between the elements and measure the widest gap using the GeoAnalysis Measure tool (see Figure 14-9). In our example this is about 42 meters. Use this value to set a buffer large enough to close the gap. Since each entity will be grown by a buffer amount, the buffer needs to be ½ the size of the gap. For our example, we will use 25 meters (we rounded up the maximum gap size to 50 meters and then divided that by 2). Set the buffer size to this value in the GeoAnalysis options dialog. Next select the 4 entities and select Grow Buffer. Finally, select the results of this operation and apply the Union tool. The result for our example is depicted in Figure 14-10.

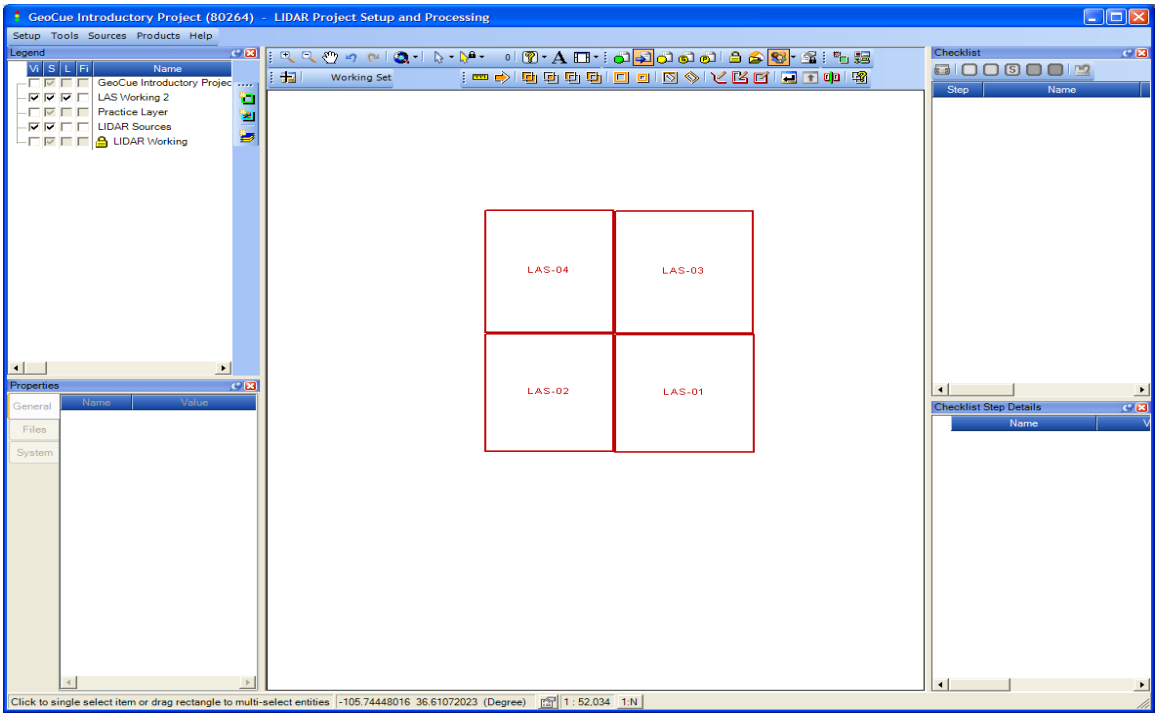


Figure 14-7 Four LAS segments with small gaps

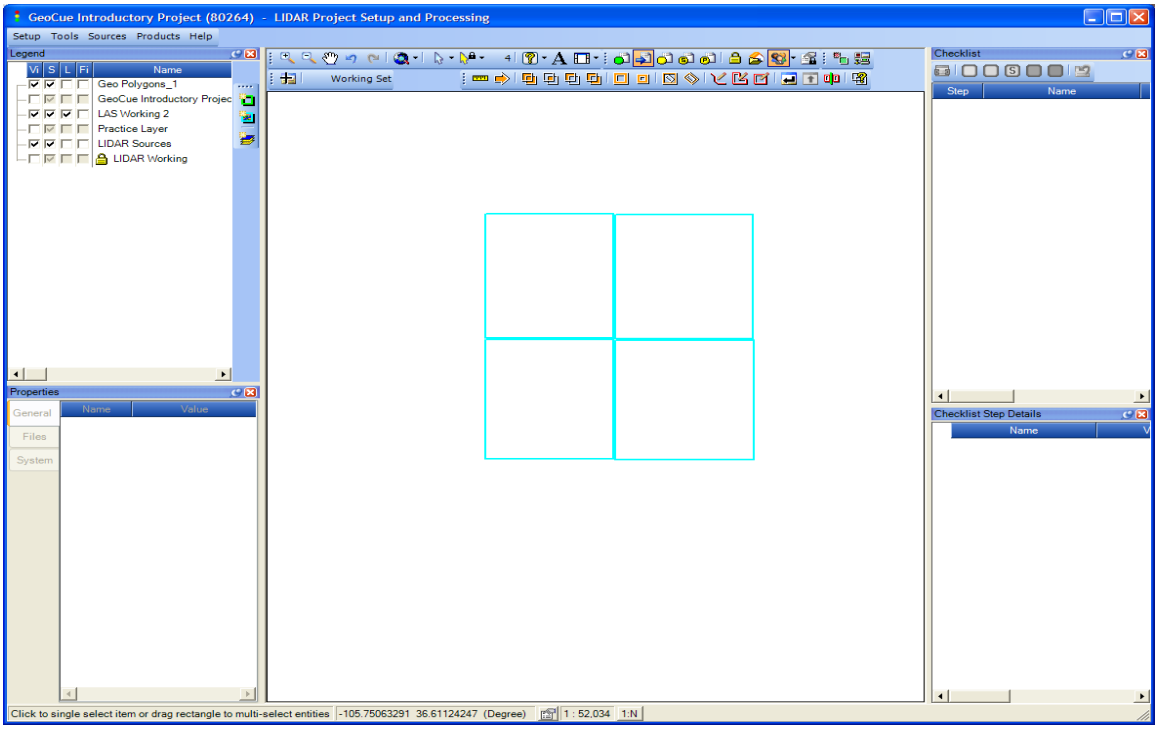


Figure 14-8 Result of the Union of entities that do not overlap

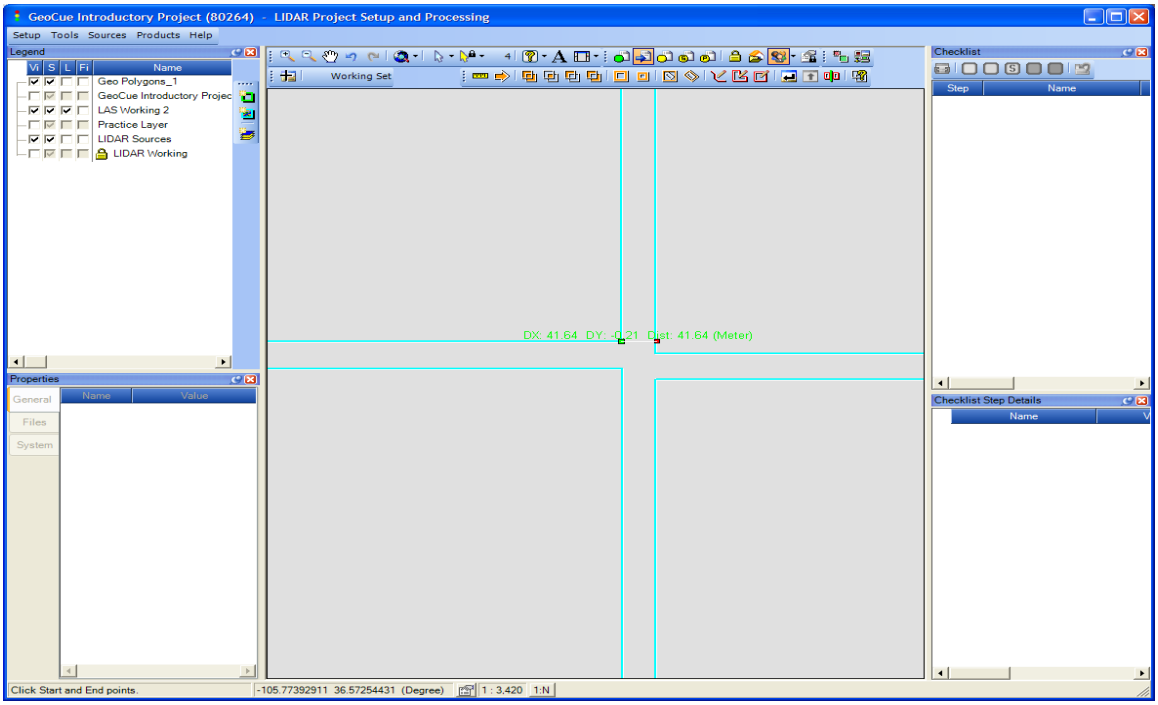


Figure 14-9 Measuring the gap

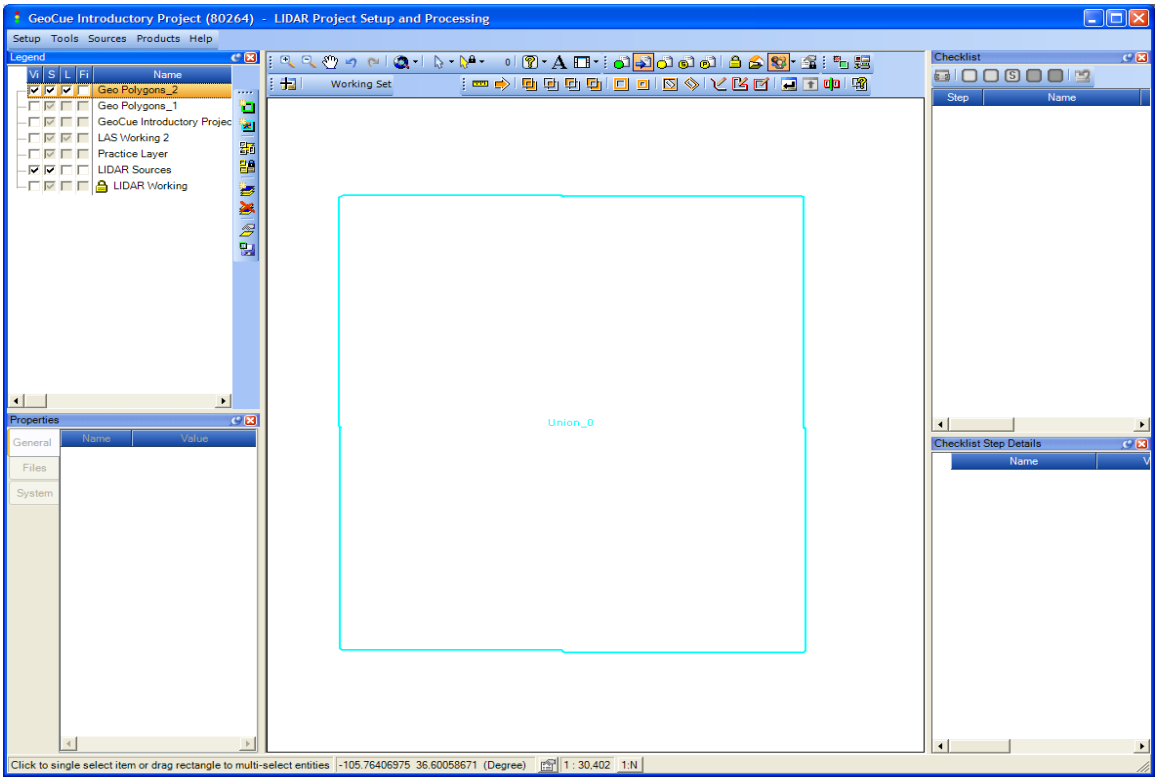


Figure 14-10 Union following buffer grow

Note that in our example, the final merged entity will be 25 meters (the buffer size) larger than the original outside edges of the merged entities. If this is not desired, the final entity can be selected and the Buffer Shrink tool can be applied. It is not necessary to set the buffer size since you want to subtract the same amount as was previously added (25 meters, in our example).

The final step would be to create the desired type of entity. This is accomplished by selecting the GeoAnalysis entity that will serve as the final construction template and then creating the actual type of entity desired using the Create Entity dialog and the *Selected Entities Geometry* placement method.

14.2 Building Composite Templates

There are a number of techniques that can be employed using the GeoAnalysis/GeoDraw tools to build more complex construction templates. We will investigate a few in this section. You are encouraged to experiment with these tools; the possibilities are limitless.

14.2.1 Building a simple corridor

We will use an example of building a road corridor. For this exercise, we have created a new project in the NAD 83, Zone 16 N meters horizontal coordinate system and ellipsoid, meters for the vertical system. To this project we added a reference raster layer and imported the Madison County Composite USGS Digital Raster Graphic that is located on your GeoCue Sample Data disk. This is depicted in Figure 14-11 (we named our project "Road Design").

Notice that we have zoomed in a bit on the Interstate spar running from the lower left of the raster toward the center (this is the I-565 corridor that links I-65 to Huntsville, Alabama).

The first step in designing the corridor is to sketch a GeoDraw line along the center of the Interstate spar. Simply select the GeoDraw Line command and draw a line. Our digitized road is shown in Figure 14-12. Next we will build a polygonal corridor using the buffer command. Set the buffer size to the desired half width of your corridor. For our example, we will wish to construct a corridor 200 meters wide (100 meters to each side of the road line). Thus the Buffer Distance in the GeoAnalysis Options dialog is set to 100 meters. Now *Select* the line and press the Grow Buffer tool. This will construct a polygon whose center line is the digitized road and whose width is 200 meters. Our corridor is depicted in Figure 14-13. The final step of construction is to use this GeoAnalysis polygon as the template for constructing the final desired type of entity. This is accomplished by *Selecting* the corridor template and using the *Create Entity* command to create the desired type of GeoCue entity, using the placement method *Selected Entities Geometry.*

NOTE: You can zoom in, zoom out and pan while digitizing by using the mouse wheel.

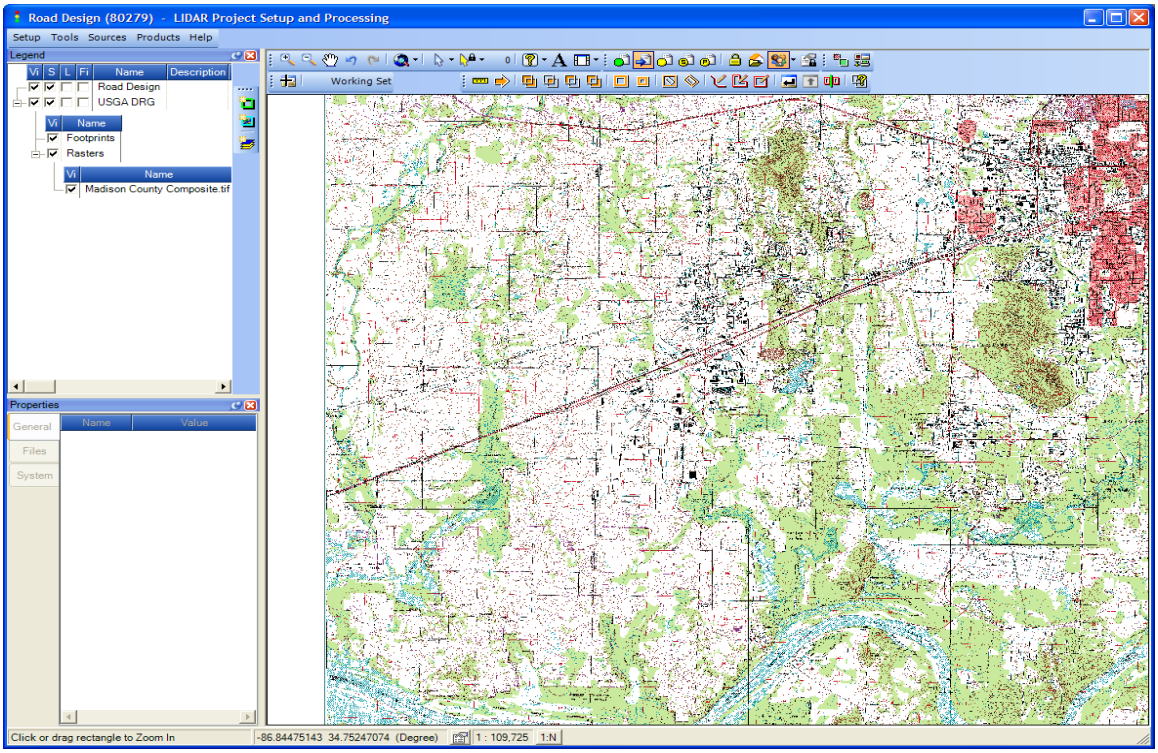


Figure 14-11 The Road Design Project with imported DRG raster backdrop

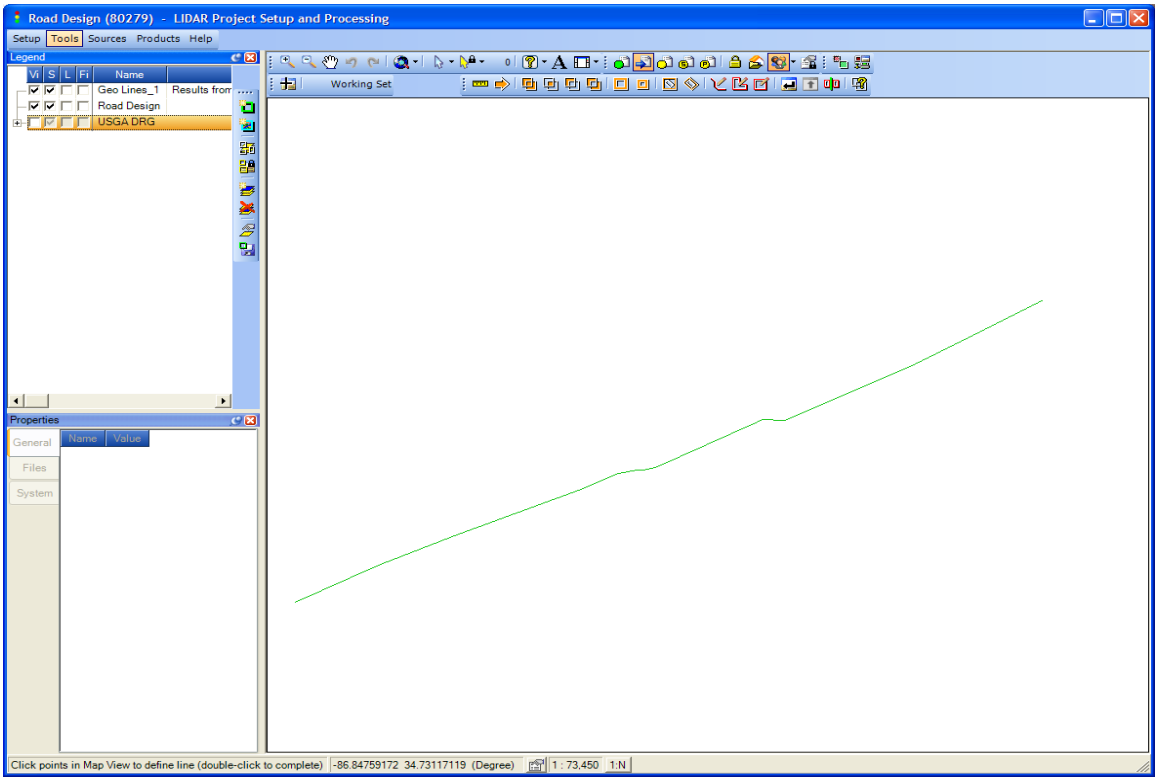


Figure 14-12 Digitized Road

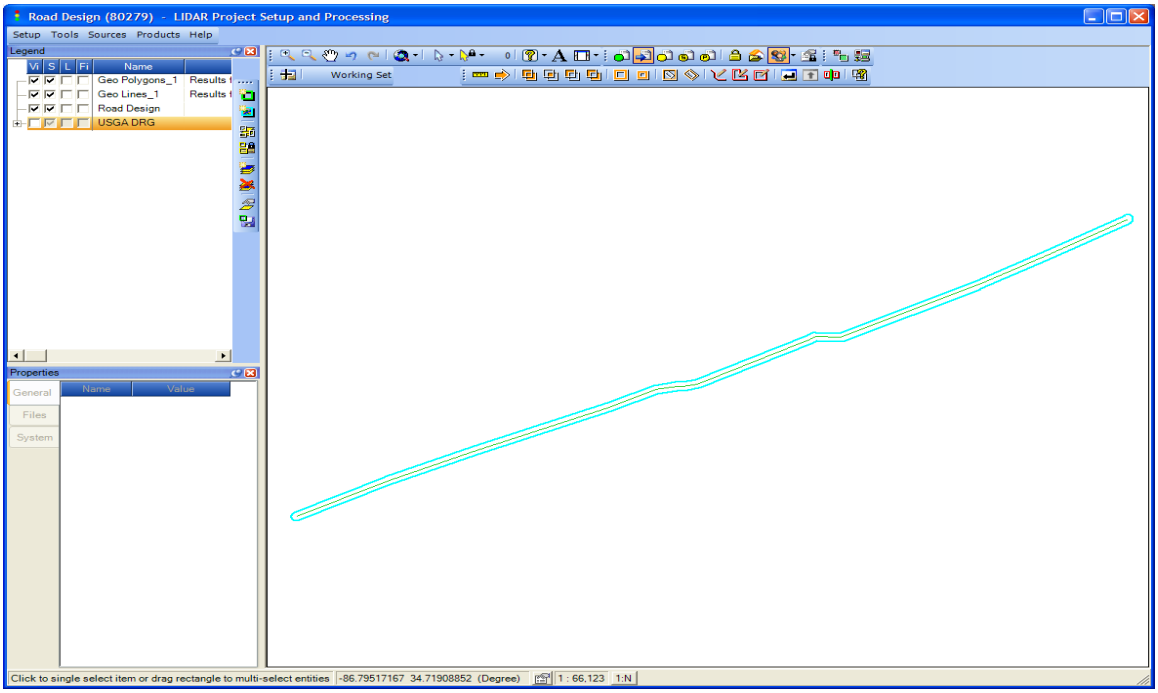


Figure 14-13 The constructed corridor

14.2.2 Partitioning a Polygon

It is often necessary to partition an entity to reduce it to workable sized elements. An example might be partitioning a corridor project into LAS (elevation) segments for editing.

GeoCue provides a number of tools that can be used to subdivide polygons. In this section we will investigate the "segment" tool on the GeoAnalysis toolbar. The segment tool allows you to place entities that will act at the segmentor (knife, if you will) on a GeoAnalysis queue and use these entities to segment all selected entities. The result is a new set of GeoAnalysis entities (the items to be segments act simply as a template; they are not actually changed).

We will use the road corridor GeoAnalysis entity of the previous section in this example. Draw a series of GeoAnalysis lines that cross the corridor at the locations where you want the segment boundaries to occur. Our example is depicted in Figure 14-14. Next *Select* the items that are to act as the Segmentors (the knife blades). In our example, these are the line segments that we

just drew. Now add these to the GeoAnalysis Input Queue by pressing the *Input Queue Enter* button on the GeoAnalysis toolbar ( ). This action will create a named queue (the name of which is GeoAnalysis Input Queue) and place all entities that were in a *Selected* state at the time the tool is pressed onto the queue.

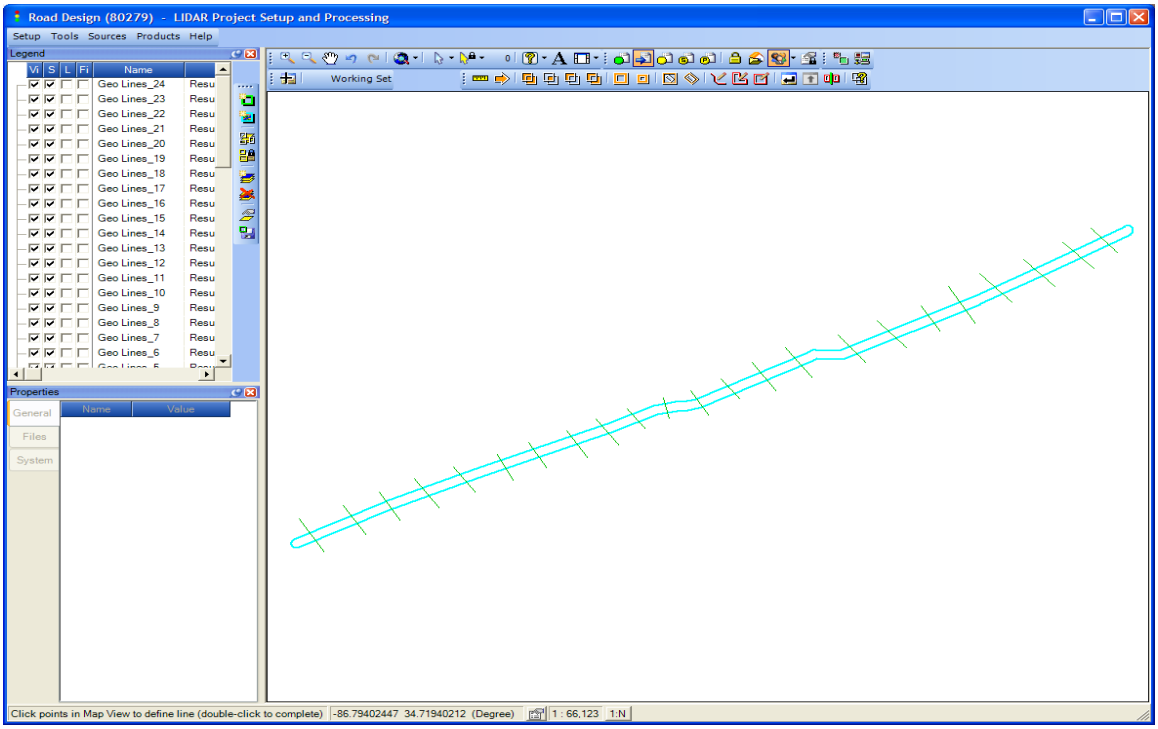


Figure 14-14 Preparing to segment the corridor

HINT – The GeoAnalysis Input Queue functions the same as any named queue within GeoCue. Thus you can manipulate this queue using the normal queue techniques described in a previous chapter. The Input Queue Enter tool on the GeoAnalysis toolbar is simply a short cut that:

- Creates the queue if it does not already exist
- Clears the queue if it exists and is not empty
- Adds all *Selected* entities to the queue

- Displays the Queue toolbar (if it is not already displayed)

Next *Select* the entity that is to be segmented by the entities in the queue. Finally, press the *Segment* () tool on the GeoAnalysis toolbar. The setup just prior to segmenting is depicted in Figure 14-15. Note that it is a good idea to set the GeoAnalysis options to create a new layer. This makes it easier to segregate the results. Following successful segmentation, an informational dialog similar to Figure 14-16 will be displayed. Make note of the results layer name displayed in this dialog to locate the segments. The results of our example segmentation are displayed in Figure 14-17.

You can clear the GeoAnalysis Input Queue by either selecting the Clear Queue button on the Queue toolbar or by pressing the Input Queue Clear () button on the GeoAnalysis toolbar. The only difference between these two options is that the Input Queue Clear button will hide the GeoAnalysis Input Queue toolbar after clearing all entities from the queue.

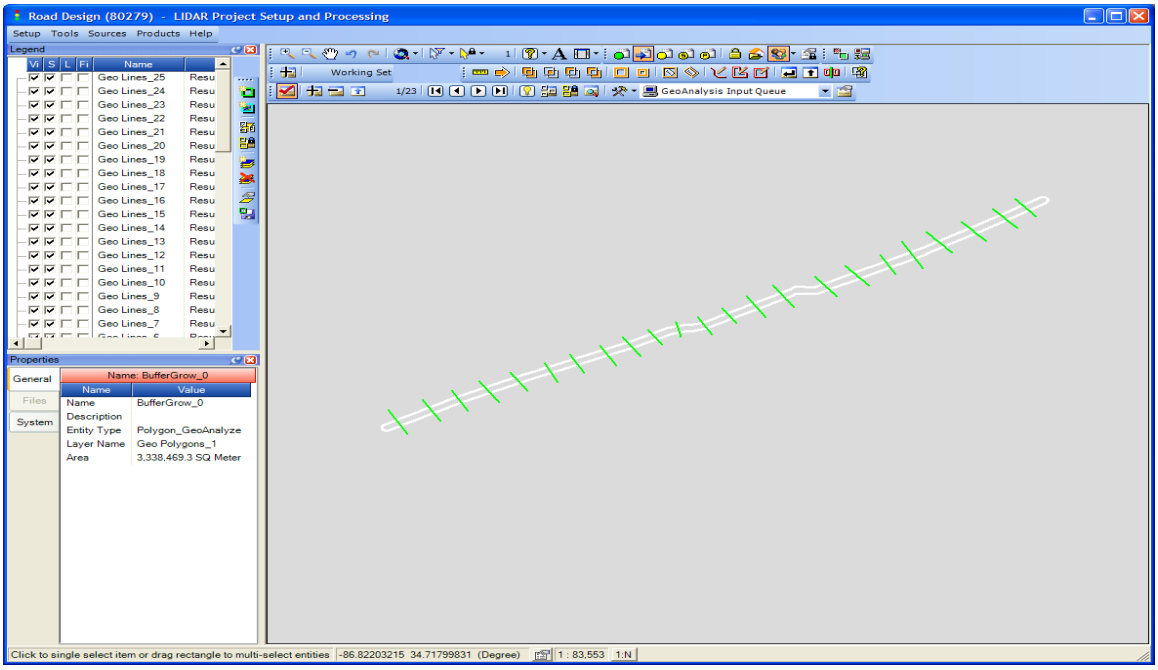


Figure 14-15 Setup just prior to segmenting

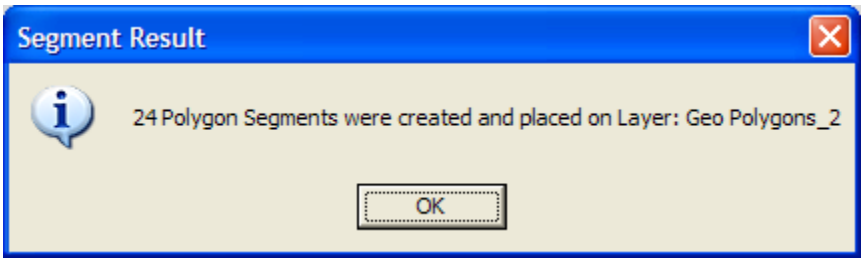


Figure 14-16 Segmentation information dialog

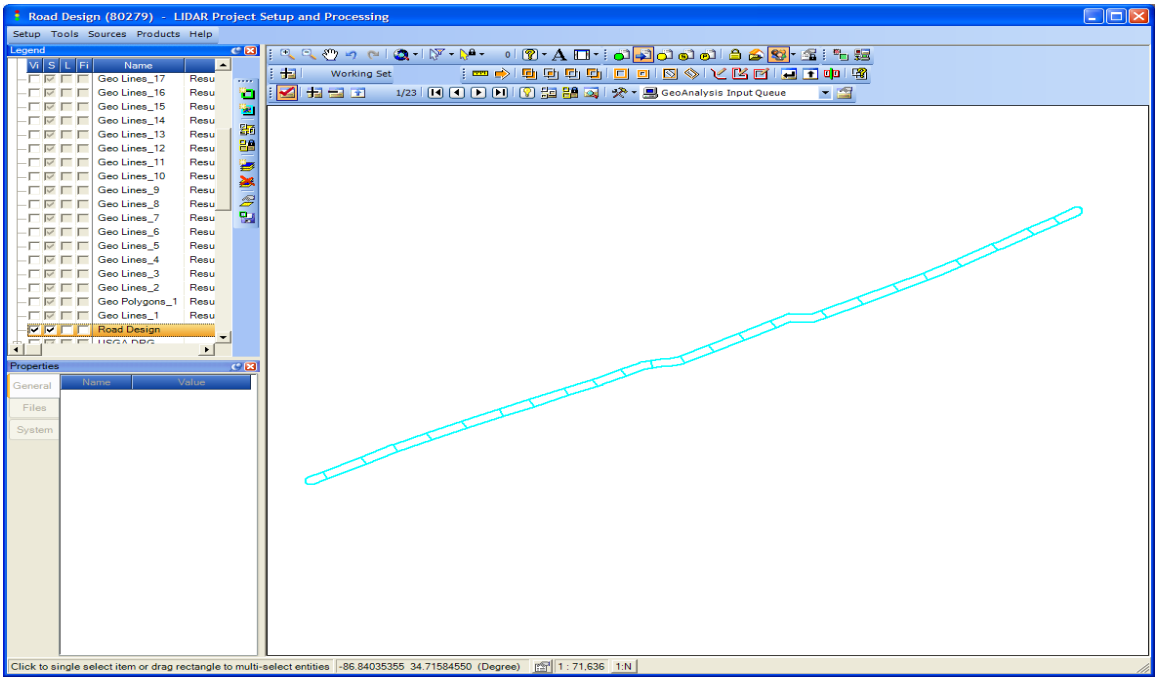


Figure 14-17 Segments resulting from the Segment command

14.2.3 Gridding a Polygon

Gridded layouts are ubiquitous in geospatial production. GeoCue provides a wide range of gridding tools that are accessed via the Create Entity dialog[13]. It is often very useful to first create a grid of GeoAnalysis polygons and then use these polygons as a template for creating the final desired entity. The reason for this approach is that the GeoAnalysis entities can serve as building blocks that can be manipulated to create the final desired layout prior to committing to an entity. Note that in the current version of GeoCue, an entity of any type cannot be geometrically modified once it has been created.

To explore the grid creation methods, create an arbitrary GeoAnalysis polygon by using the polygon drawing tool on the GeoAnalysis toolbar. Either create a new project or use an existing project that has units of meters (we used NAD83, UTM Zone 16N, meters in our example). Our

[13] Certain CuePacs such as LIDAR 1 and DEM provide additional application specific gridding tools.

example polygon is depicted in Figure 14-18. With no layers selected in the legend, click (or select from the layer right click menu) the *Create Entity* command (note – if your dialog has any fields populated, then you had a layer selected when you pressed the *Create Entity* tool).

Set the entity name to "C-"and enter a description, if desired. Create a new layer of type GeoAnalysis_Polygon_GENERIC named Grid Template. Choose the Placement Method "Place Grid of Entities" Your dialog should resemble Figure 14-19.

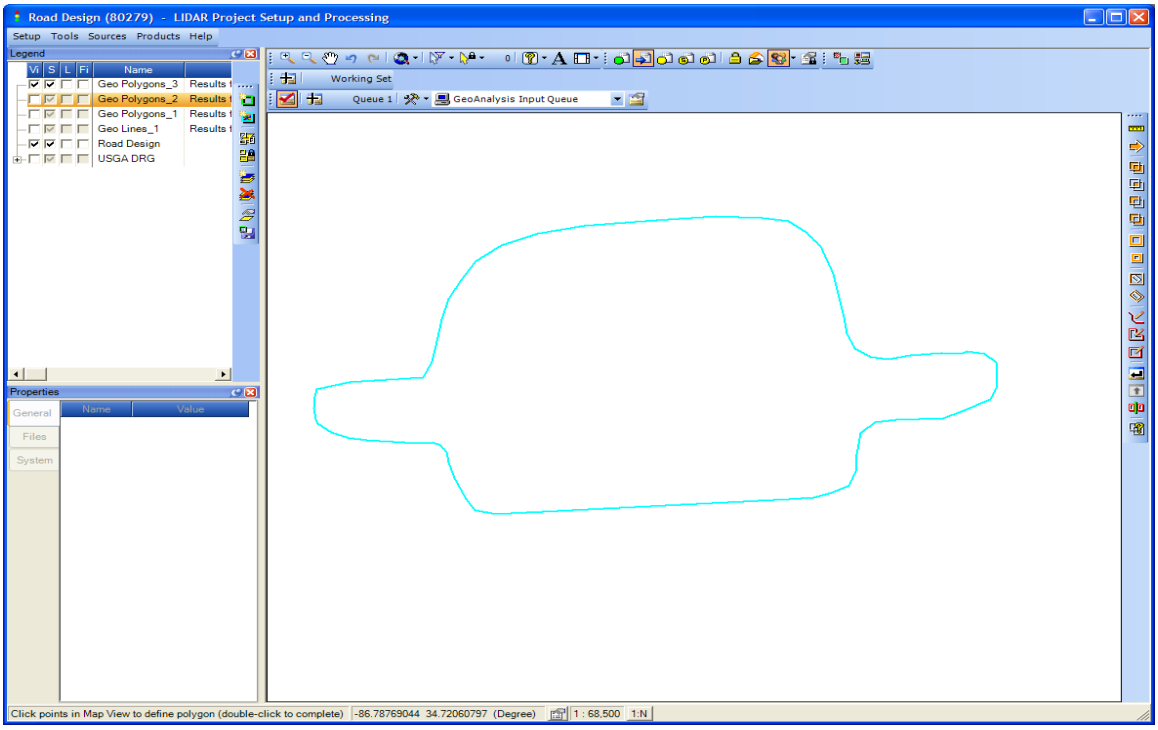


Figure 14-18 An arbitrary polygon for grid construction

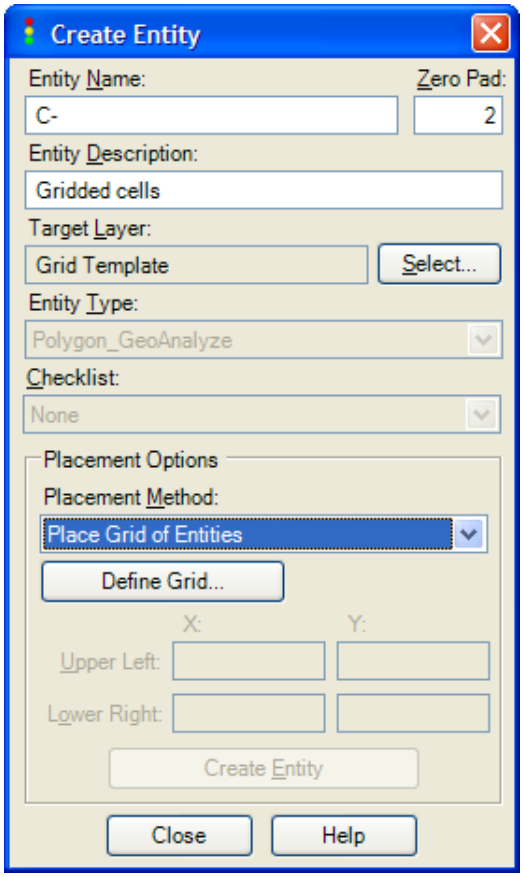


Figure 14-19 Create Entity dialog

Press the Define Grid button on the Create Entity dialog and you will be presented the dialog of Figure 14-20. Creating entities using the gridding tool was explained in detail in the Entities chapter of this document. Create a grid of entities clipped to your GeoAnalysis polygon (your settings will vary from ours depending on your polygon).

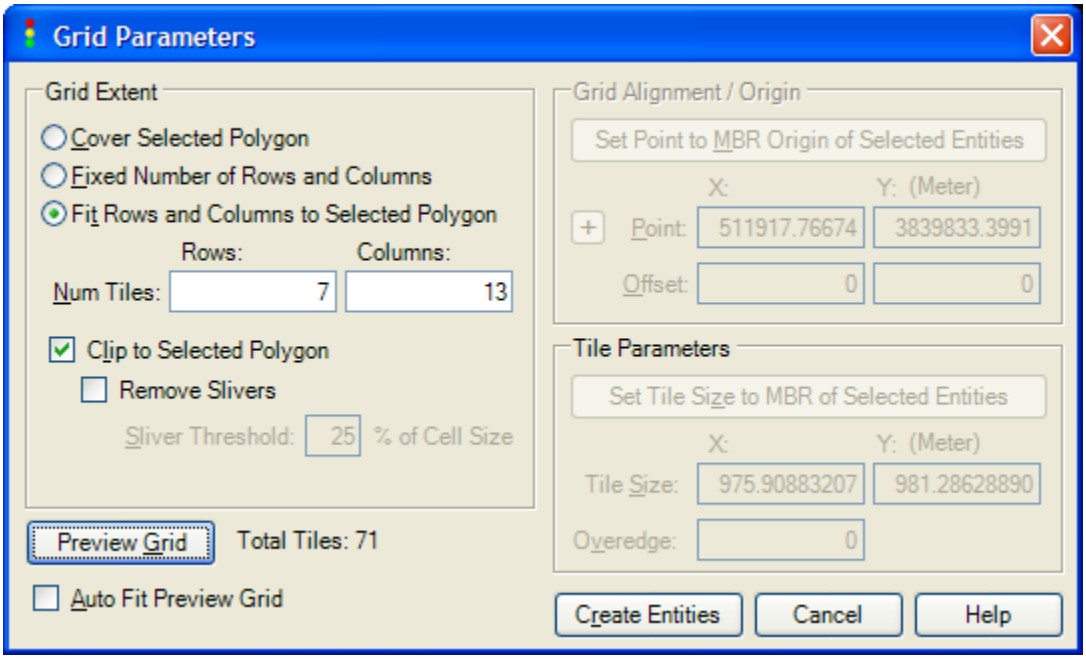


Figure 14-20 Grid Parameters Dialog

Our grid is shown in Figure 14-21.

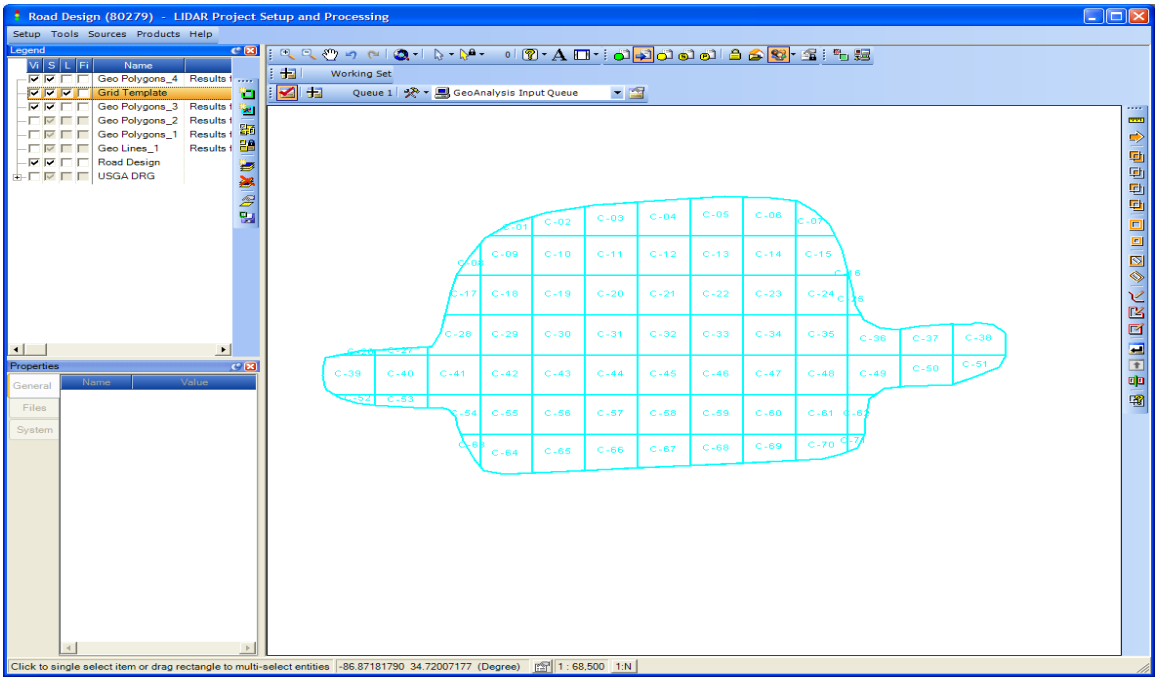


Figure 14-21 Grid of GeoAnalysis entities

Now use the various GeoAnalysis tools to remove unwanted slivers from the cells. You can:

- Use the Union command to merge two cells
- Use a GeoAnalysis line in conjunction with the Segment tool to split cells
- Use Intersect, difference and XOR where appropriate (building up and resolving more complex constructions)

Hint: If you set the GeoAnalysis Options to place results on a fixed polygon layer and then make that destination *Non-Selectable* (by un-checking the Select option in the Legend), you can more easily manipulate components of the construction.

Hint: When aggregating entities using the Union tool, it is often useful to immediately place the selected entities into a Named Queue. This is useful for later deleting the source entities that formed the Union.

We Unioned the small entities together and, just after pressing Union, pressed the "+" button on our named queue to add these entities to the queue. This is shown in Figure 14-22.

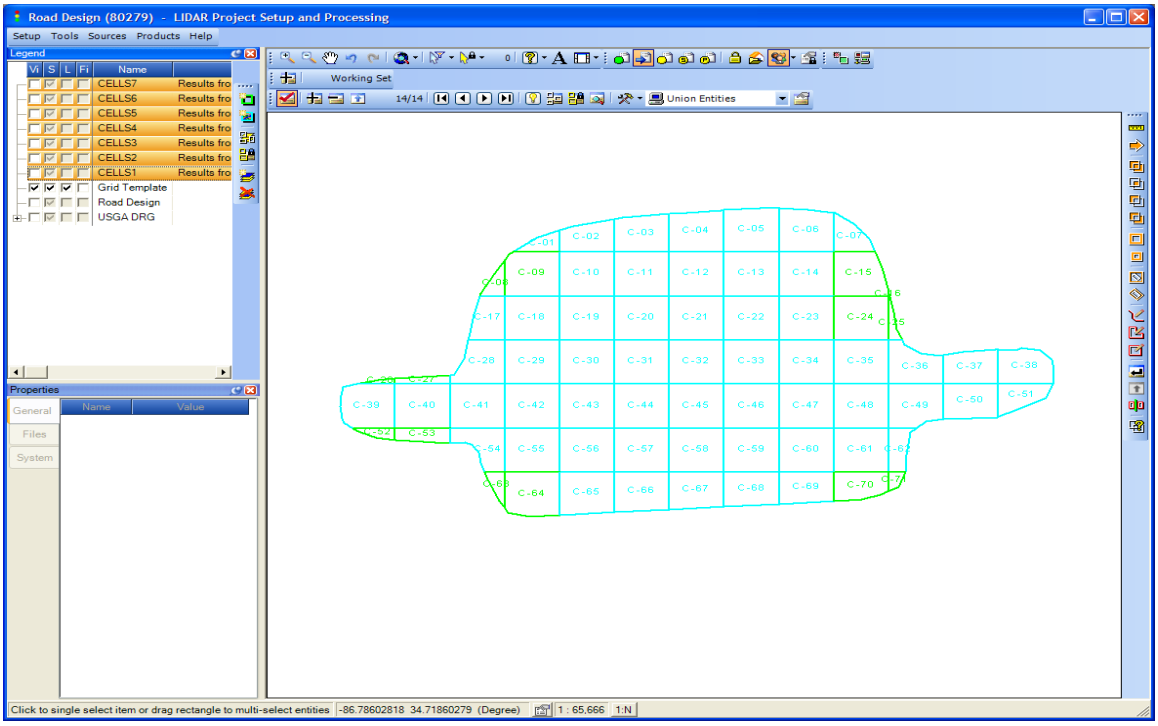


Figure 14-22 Entities used in Unions shown in a named queue (in Green)

The Union results are on a collection of layers named (in our example) CELLS1, CELLS2, etc. since we had the GeoAnalysis Options set to "Create new layer..". The result of the union operations is depicted in Figure 14-23. The trick now is to delete the original entities that were used to create the union entities and use the result to create the final desired entities.

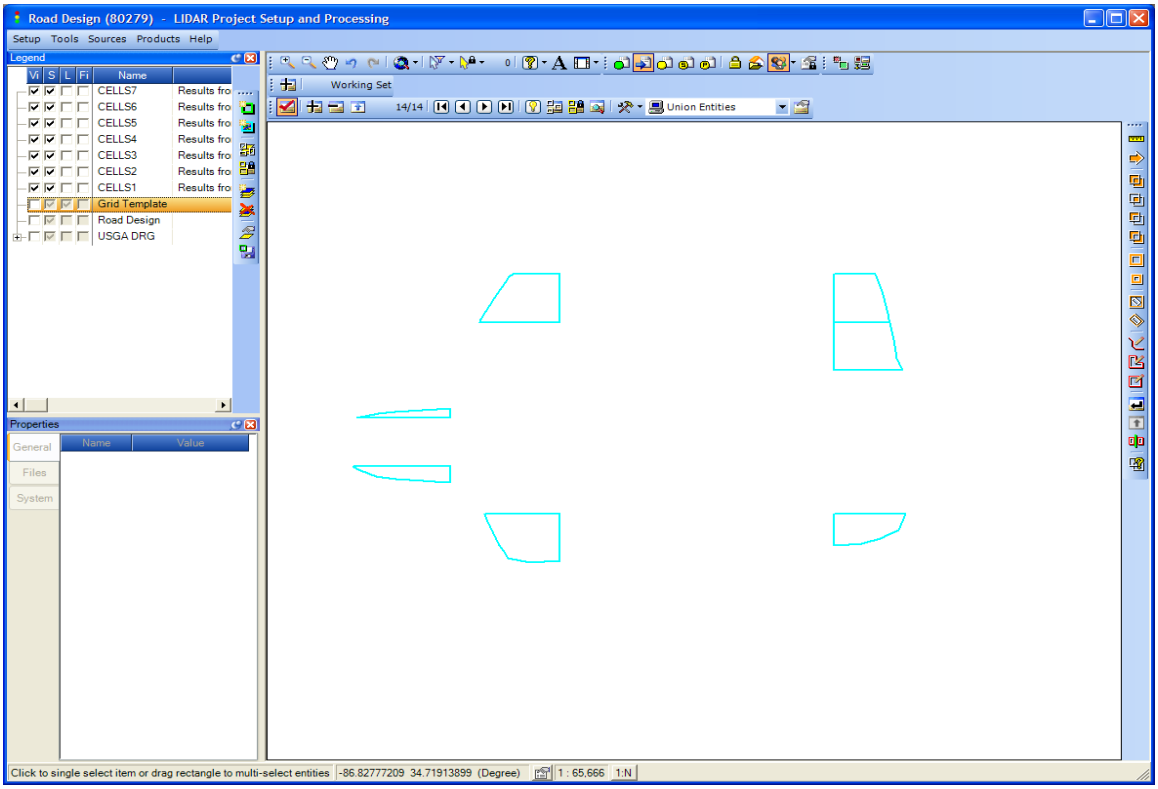


Figure 14-23 Result of Union operations

We have made the deletion easy by adding the entities used in each union operation to a named queue prior to those entities becoming "deselected." Thus we simply press the "Add to Working Set" button on the named queue and then delete the items in the Working Set (Figure 14-24).

Finally, all remaining entities on this layer as well as all of the entities that resulted from the Union operations are used to create new entities by using the Create Entity command with a placement method of *Selected Entities Geometries."* We used our template to create LAS Working segments. The result is shown in Figure 14-25.

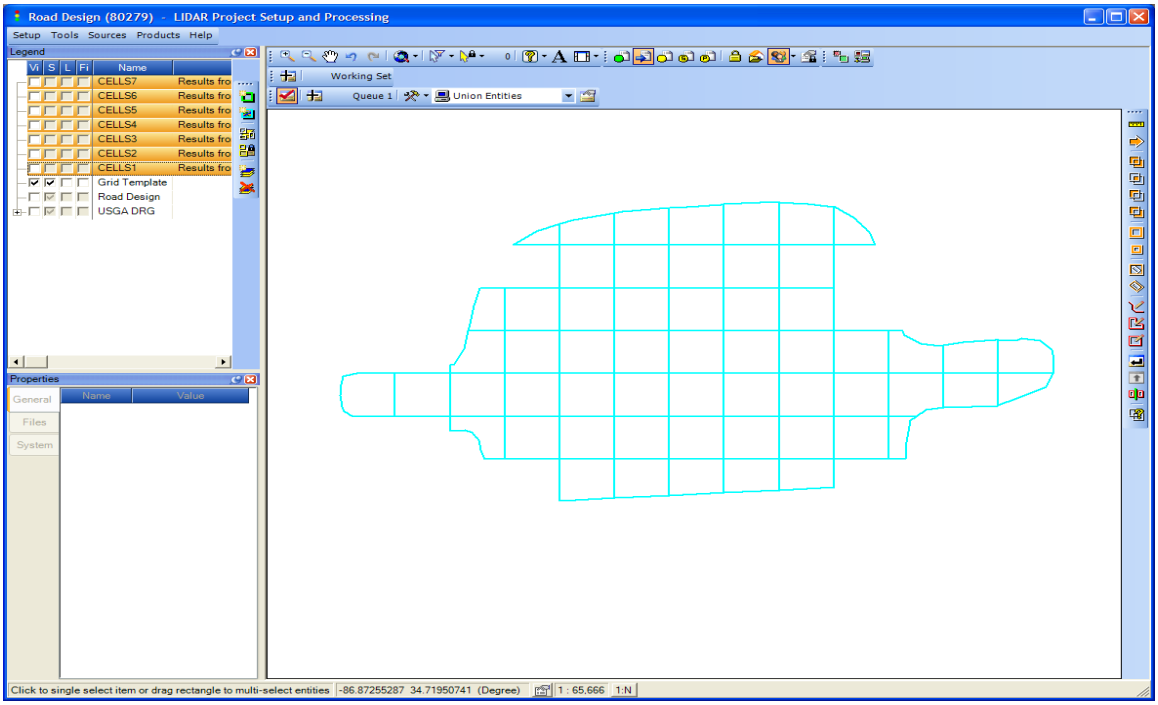


Figure 14-24 Original entity layer with entities used in the Union deleted

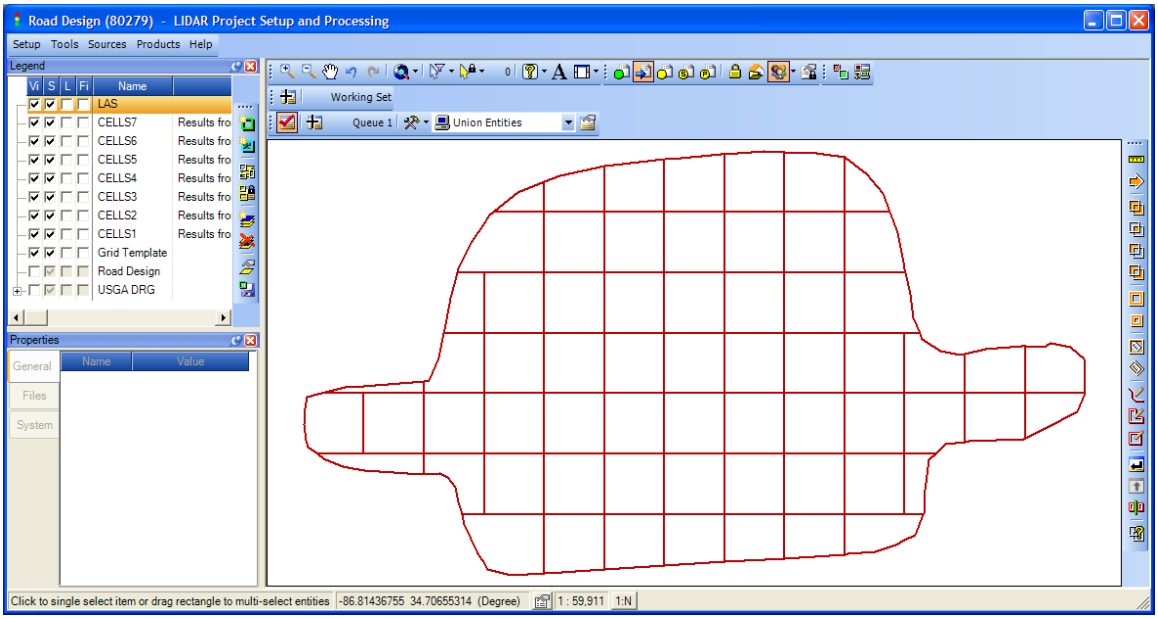


Figure 14-25 LAS Entities created from the GeoAnalysis process

14.3 Direction Arrows

One of the GeoAnalysis tools is the *Show Geometry Direction* ( ) tool. By selecting an entity, multiple entities or a layer, you can display temporary arrows superimposed on the entity edges that indicate the geometry *direction* of the entity. This can provide information such as the direction of a GPS/IMU Trajectory or the *sense* of direction of a polygon. To use this tool, select the entities (and/or layers containing entities) for which you wish to see direction arrows and then press the *Show Geometry Direction* tool. You will see temporary arrows such as those of

Figure 14-26. Note that the directional arrows are *transient* and thus will disappear as soon as you execute another command such as zoom in or zoom out.

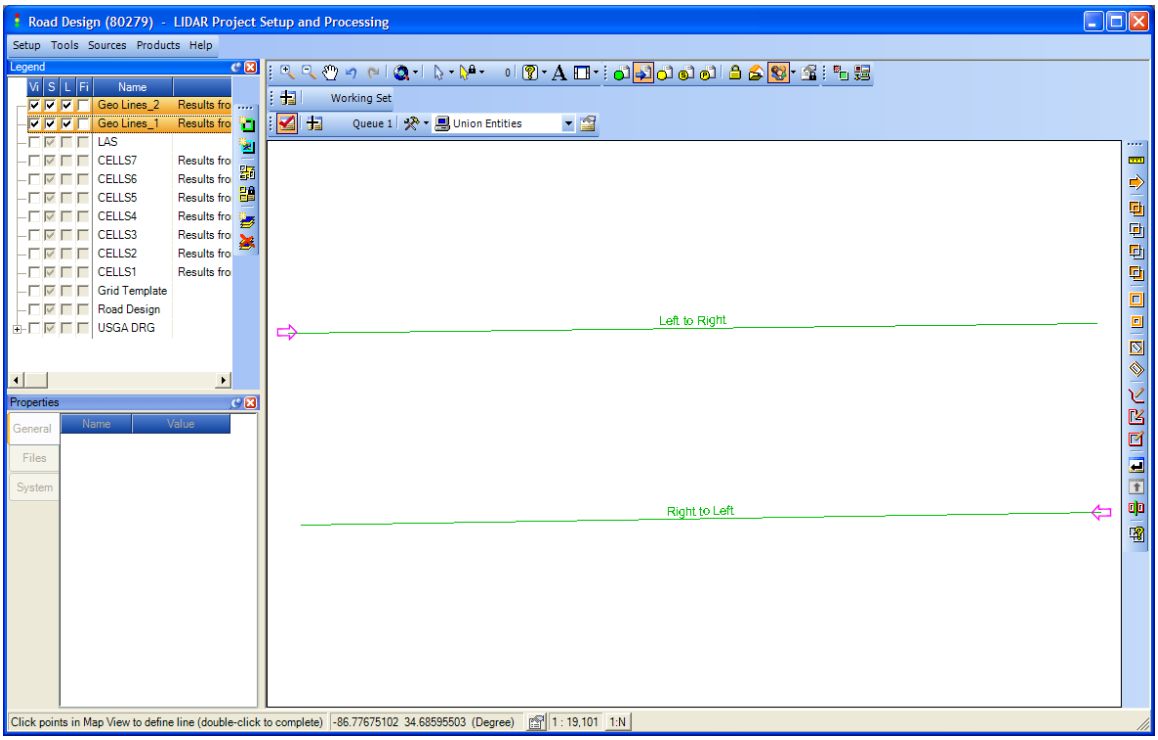


Figure 14-26 Directional Arrow Display

You can adjust a number of attributes of the directional arrows by setting parameters on the Geometry Direction tab of the GeoAnalysis Options dialog. Note that setting arrow placement to *Every Vertex* provides the added feature of showing you where each vertex is located for a particular entity.

14.4 Summary

The GeoAnalysis tools and commands provide a powerful set of features for analyzing and constructing entities within GeoCue. A standard (or *canonical*) method of creating entities in GeoCue is to construct original GeoAnalysis entities (by using the Create Entity command or using the GeoDraw tools), performing various operations on these GeoAnalysis entities to form the desired final entity geometry and then using these as templates in the Create Entity command.

15 Command Dispatch System[14] (D)

Since the first release of GeoCue, users have asked for three fairly difficult to implement enterprise features:

- Running commands on a machine (node) other than the one from which the command is invoked
- Scheduling a command to run at a later time
- Distributing commands that operate on multiple objects across multiple machines.

Running commands on a remote machine (remote execution or *remoting*) is valuable in a number of circumstances. One obvious case is when a user would like to set up a task on a workstation using a Graphical User Interface (GUI) but would like for the "grinding" part of the command to run on a different machine, freeing up her workstation for the next task. A concrete example might be to set up an import of LIDAR flight lines into a project using a client workstation but instruct the command to run on a remote server.

Scheduling commands extends the value of remote (or local) execution by allowing a user to specify a date and time when the command is to start. An example might be to set up the "macros" that are to run to ground classify LIDAR data but specify that the actual processing of these macros is not to start until everyone has gone home for the evening, thus preventing overloading workstations when other tasks need to be done.

The final concept is spreading tasks that can be split up across multiple computers. A classic example of *distributed processing* is to spread the rectification of 100 images across 10 computers and do this from a single GUI interface on a project management machine.

[14] Available only in the Departmental version of GeoCue

This collection of capabilities moves geospatial production from workstation to enterprise in ways that can have tremendous positive impacts on productivity and, ultimately, job profit.

NOTE: The Command Dispatch System is described in detail in the separate Command Dispatch System Administrator's Guide. This chapter covers the portions of the CDS related to using the system in production.

15.1 The Command Dispatch System in GeoCue Departmental Server

We have included the above capabilities into the Departmental version of GeoCue Server. We collectively refer to these features as the *Command Dispatch System*. The Command Dispatch System brings an exciting new level of productivity enhancements to GeoCue. Its basic capabilities include:

- Scheduling a task to run at a later time on the user's workstation
- Scheduling a task to run now or later on a remote workstation
- Splitting a task (it must be a *distributable* task, discussed later) across multiple machines
- Configuring groups of machines as processing *clusters*
- Setting resource limits for machines and clusters
- Setting machine and cluster schedules to dynamically reallocate resources or take machines offline and online for administrative purposes
- Setting processing priorities on objects and projects
- Monitoring the progress of dispatched tasks
- Rescheduling or terminating tasks that have been dispatched

GeoCue is an enterprise *framework* that can be extended by GeoCue Group (generally via CuePacs), by third party developers/OEM partners and by you, the end user. We have designed and implemented the Command Dispatch System to comply with this philosophy by building interfaces into Environment Builder (the workflow definition tool included with GeoCue) that allow you to set up commands for the Command Dispatch System. This means, for example, that if you have a super duper secret orthorectification executable program, chances are you can fairly easily integrate it into the GeoCue Command Dispatch System.

15.2 Dispatch Invocation

Tasks (that are capable of being dispatched) can be vectored to the Command Dispatch System via three different mechanisms:

1. by enabling *Dispatch* from the checklist toolbar controls (this is the most common mechanism)
2. by enabling *Dispatch* on dialogs that support dispatching (such as the Import LIDAR sources dialog of the LIDAR 1 CuePac)
3. Programmatically (some GeoCue commands make direct access to the Command Dispatch System. End-users can access the Command Dispatch System in this manner by using the GeoCue Software Developer's Kit – SDK)

15.3 The Dispatch Dialog

Following invocation by one of the methods described in the previous section, the Dispatch dialog (Figure 15-1) is displayed. Each of the sections of this dialog is discussed in the following subsections.

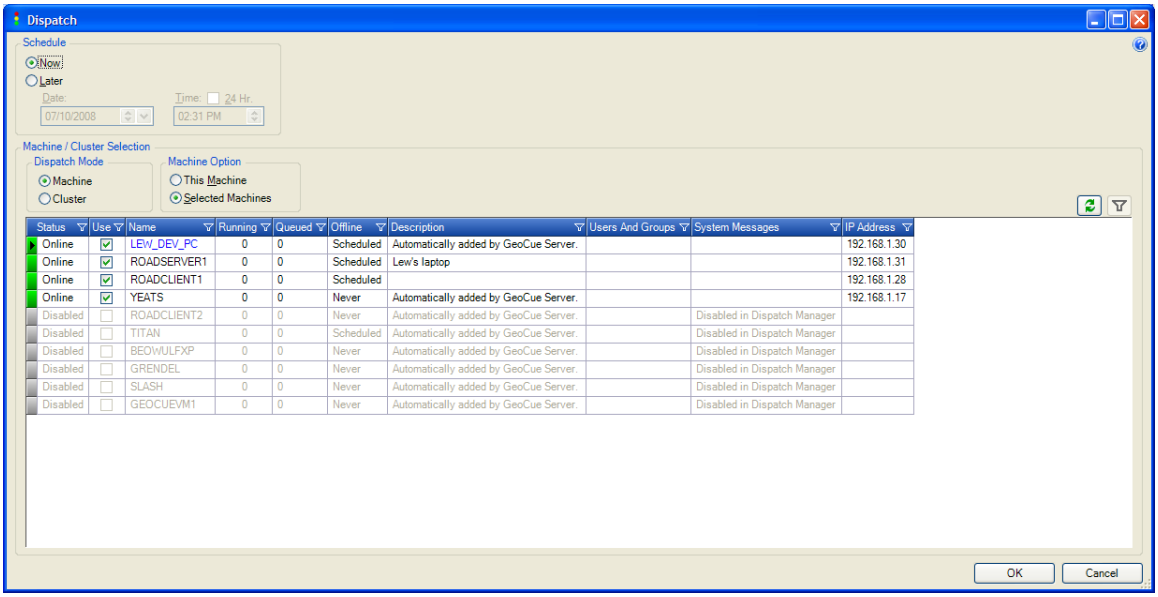


Figure 15-1: The GeoCue Dispatch dialog

15.3.1 Schedule

The default is Now which means that the Task will be submitted to the dispatch queue for immediate execution. Of course, when the Task actually executes is determined by the ultimate subtask priority, the number of other subtasks in the dispatch queue and the available of machines on which this Task can execute.

If you select *Later* in the Schedule radio button control, you can set a date and a time for processing this Task. Again, the exact time of execution will depend on the overall constellation status at the schedule time. However, you will be assured that the Task will not execute prior to the scheduled date/time.

15.3.2 Machine Mode

This is the default for launching tasks. When this mode is active, you can select either "this Machine" or "Selected Machines" in the Machine Option section of the dialog. If Selected Machines is enabled, you can select the desired machines from the Machine list table (Figure 15-2). Note that machines may not be selectable for several different reasons:

1. The machine has failed a Command Dispatch System validity check (it may be shut down or off the network)
2. The machine is Disabled because it has been set to "Disabled for Dispatched Processing" either via Dispatch Manager or via the tool tray icon on the disabled machine's desktop (see the Configuring Machines chapter)
3. The Command that is associated with the Task being dispatched is not configured to run on the machine (see the Configuring Commands chapter).

If a Task can be dispatched to a remote machine but cannot be distributed across multiple machines (e.g. Populate LAS Working Segments in the LIDAR 1 CuePac), the machine selection checkboxes will exhibit "radio button" behavior (meaning you can select only one machine).

To dispatch the Task, select the desired machine(s) and press the OK button.

> NOTE: Effective with GeoCue Version 6.0, you can *dispatch* to machines that are *off-line*. These machines will pick up subtasks for processing if they come back on-line while subtasks are still pending.

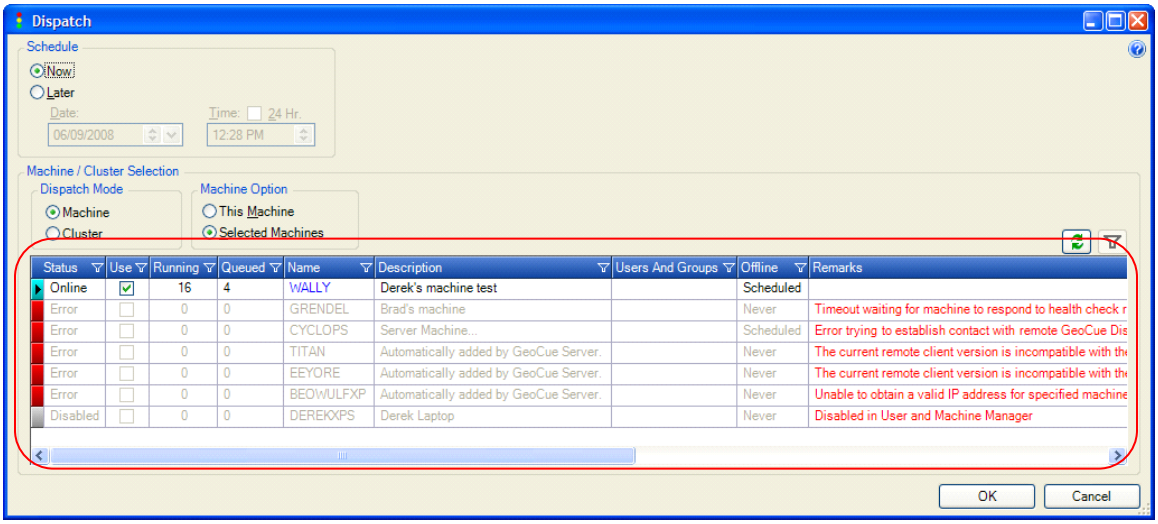


Figure 15-2: The Machine table

15.3.3 Cluster Mode

NOTE: You must have "Clustering" enabled on the Options sub-tab of the Configuration tab of Dispatch Manager to be able to select the Cluster mode during dispatch. The Cluster table will be empty if you have not defined Clusters using the Group/Cluster tab of the Dispatch Manager.

If Cluster mode is selected in the Dispatch Mode section of the Dispatch dialog, the Machine Options section of the dialog becomes disabled and the Cluster Table is displayed in the lower section of the dialog. An example of two configured clusters is shown in Figure 15-3.

Note that Cluster selection always has *radio button* behavior – that is, you can select only one Cluster as the target for the Task.

NOTE: Only Clusters that include machines that can support the command associated with the Task being dispatched will be listed in the Cluster table.

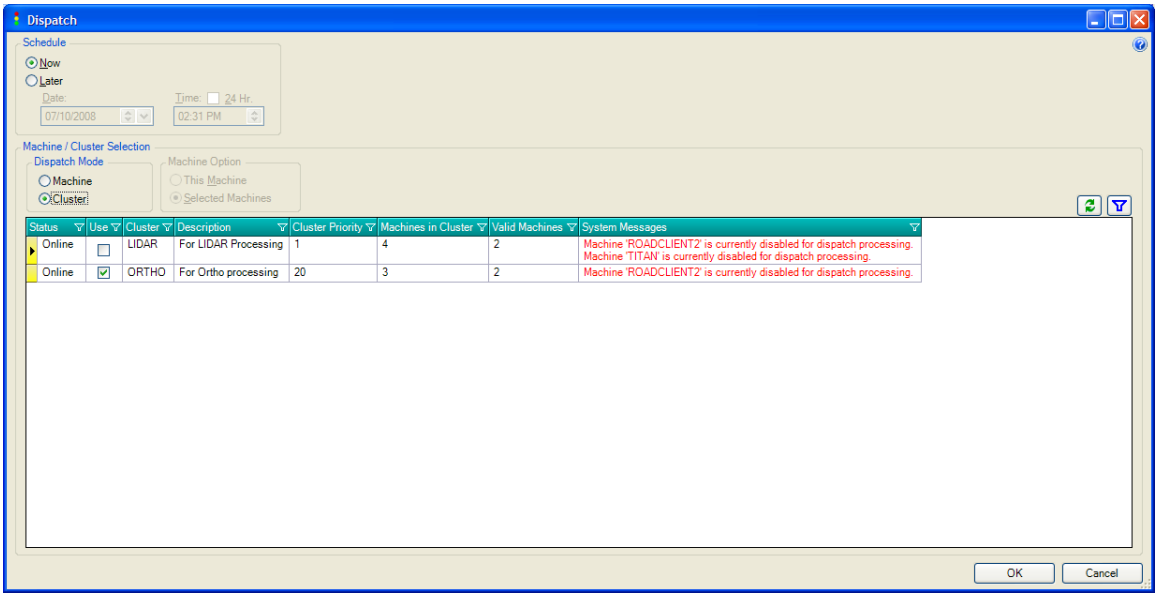


Figure 15-3: The Dispatch dialog displaying a Cluster table

To Dispatch the Task, select the desired Cluster and press OK.

15.4 Machine/Cluster Tables

The machine and cluster tables provide a variety of diagnostic information. An overview of the fields is provided in the follow subsections.

15.4.1 Machine Table Fields

The fields of the Machine table and their descriptions are listed in Table 15-1: Machine Dispatch Table.

Table 15-1: Machine Dispatch Table

Field	*Description*	*Notes*
Status	Idle (Green) Processing (Cyan) Disabled (Grey) Offline (Yellow) Error (Red)	The System Messages section of the dialog lists the reason for Errors. You can dispatch to machines in the states: • Idle • Processing • Offline
Use	Selector field for choosing machines	If the Task can be Dispatched but not Distributed, this field behaves in radio button fashion
Name	The name of the machine	This corresponds to the Machine name in the Machine tab of the Dispatch Manager
Running	This is the number of subtasks that are currently running on the machine	

Field	*Description*	*Notes*
Queued	This is the number of subtasks that are queued that could potentially run on this machine	The actual machine on which a subtask will be hosted is not known until the subtask is actually dispatched.
Offline	Indicates if the machine has an offline schedule set (this is set in the Machine tab of Dispatch Manager)	"Never" means a schedule has not be set for this machine. If the field indicates "scheduled", you can hover the cursor over the field to see a tool tip of the scheduled offline times.
Description	The description for the machine as entered in the Machine tab of Dispatch Manager	
Users and Groups	This lists the Users/Groups who can access this machine	
System Messages	This is system added information. It is usually a detailed message that relates to the reason for error conditions.	
Address	The Internet Protocol (IP) address of the machine	This is useful diagnostic information. If this IP address differs from the true IP address of the machine, CDS will not be able to communicate with this node.

15.4.2 Cluster Table Fields

Table 15-2: Cluster Dispatch Table

Field	*Description*	*Notes*
Status	Ready (Green, Yellow if not all machines are available) Offline (yellow) Error (Red)	The Remarks section of the dialog listed the reason for Errors or non-available machines.
Use	Selector field for choosing Clusters	This field *always* behaves in radio button mode (you can dispatch only to a single cluster)
Cluster	The cluster name as defined in the Groups/Clusters tab of Dispatch Manager	
Description	The cluster description as defined in the Groups/Clusters tab of Dispatch Manager	
Cluster Priority	The cluster priority as defined in the Groups/Clusters tab of Dispatch Manager	
Machines in Cluster	The total number of machines that are members of this cluster	A machine is a member of a cluster if it has SPU resources assigned in the Group/Cluster resource allocation tables of Dispatch Manager

Field	*Description*	*Notes*
Valid Machines	The number of machines in the cluster that could process the current Task	A machine that is a member of a cluster may not be able to process the current command because: • It is offline • It is not configured for the command associated with the Task (this definition performed using the Command tab of Environment Builder)
System Messages	This field contains detailed system status messages	Examine this field for information about why not all machines are valid.

15.5 Command Dispatch System Tool Tray Tool

Workstations on which GeoCue Client has been installed display a Command Dispatch System icon in the system tray (the lower right area of your desktop) – see Figure 15-4. The primary purpose of this tool is to allow a user to easily block their machine from being used by the Command Dispatch System. This is useful if you run a large dispatch job that includes a user's workstation and they need the full resources of their machine. Note that effective with the Version 6.0 release of CDS, this tool sets a machine to "offline" rather than "disabled."

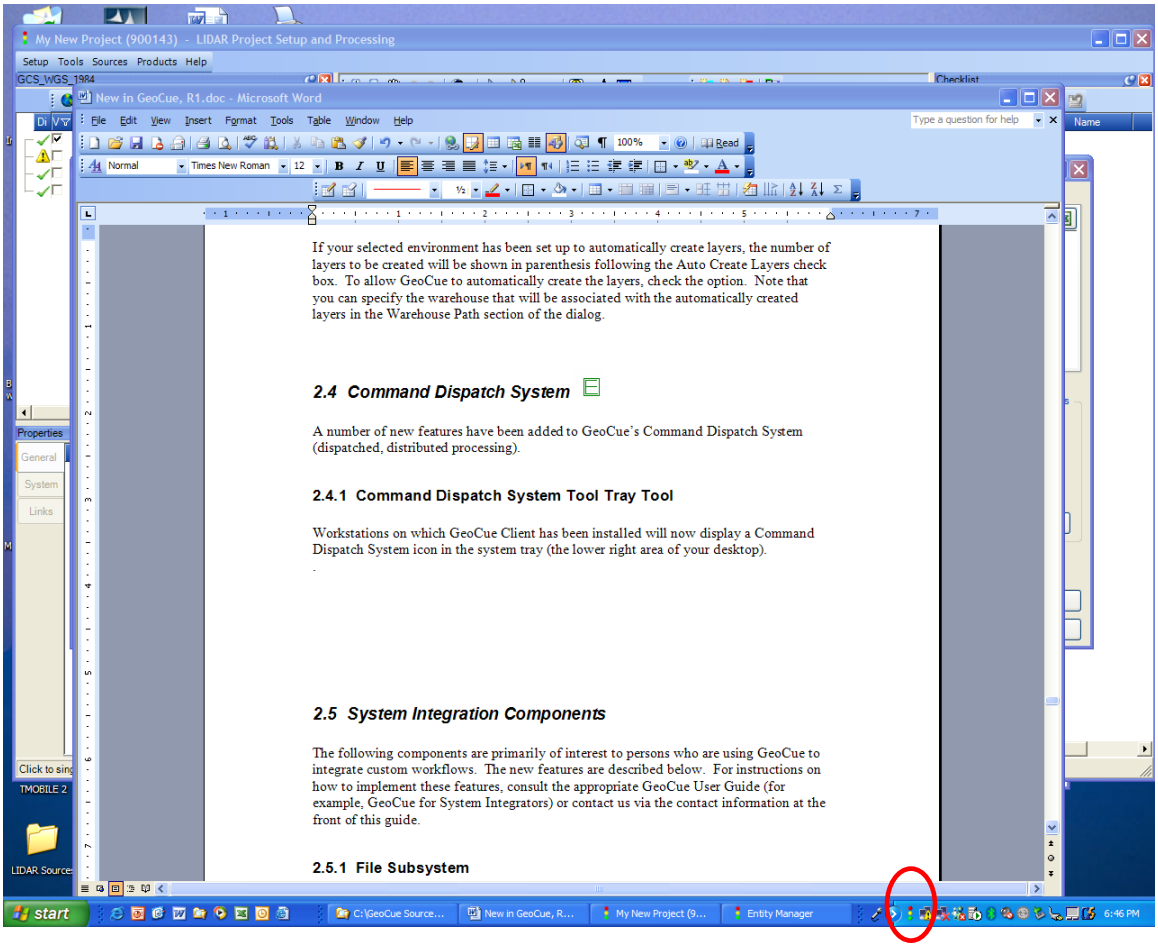


Figure 15-4 GeoCue Command Dispatch System tool

Hovering your cursor over this icon will tell you the status of any dispatch jobs that happen to be running on your Client machine as a tool tip (Figure 15-5). If your client is running a dispatch job in the background, this tip will inform you of the number of current tasks running on your node. If the Dispatch tool tip indicates "Idle", this is only for your machine; Command Dispatch System may be running tasks on other machines. You can always examine the full status by using Dispatch Monitor.

Figure 15-5 Dispatch tool tip

When GeoCue is processing a task on your node, the icon will change as indicated in Figure 15-6.

Figure 15-6 Dispatch In Progress icon

Hovering your cursor over the icon during dispatch processing will provide a tool tip status (Figure 15-7) as to the number of tasks currently executing on your node. This is typically the product of Cores X Processors as set up for your machine in User/Machine manager.

Figure 15-7 Tool Tip for a dispatch task In-Progress

Right Clicking the tool will provide you a menu with three selections:

1. Dispatch Monitor…
2. Set Offline/Online
3. Exit

Select ***Take Offline*** to block your workstation from accepting Dispatched commands. A machine that is offline for dispatch will display the icon of Figure 15-8.

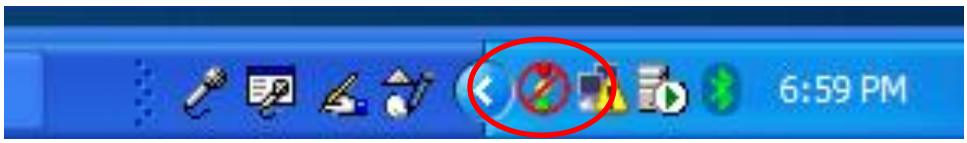


Figure 15-8 GeoCue Dispatch disabled for this node

If you have taken your machine offile, the selection on the tool changes to "Bring Online." Simply press this selection to re-enable this node for dispatching.

Selecting ***Exit*** removes the tool from your tool tray. To restore the tool, simply exit and restart GeoCue Client.

NOTE: Setting a machine to "offline" using the tool tray Dispatch tool will not cause the machine to immediately cease processing any currently executing subtasks. The current subtasks will always complete. This is necessary in order to maintain project integrity. For example, if a set of LIDAR Stereo models have been dispatched to a number of machines for processing and you take your machine offline, the model that is currently being generated on your machine will complete prior to your machine being removed from the list of eligible processing nodes.

15.6 Monitoring Dispatched Tasks

Running or queued tasks are monitored using the Tasks tab of Dispatch Manager. Dispatch Manager can be invoked either from the GeoCue tool tray icon on a desktop workstation, from the Tools menu of a GeoCue Client or from the Windows Start menu, GeoCue program group. Figure 15-9 shows the Task tab of Dispatch Manager. There are three major informational sections on this tab of the Dispatch Manager.

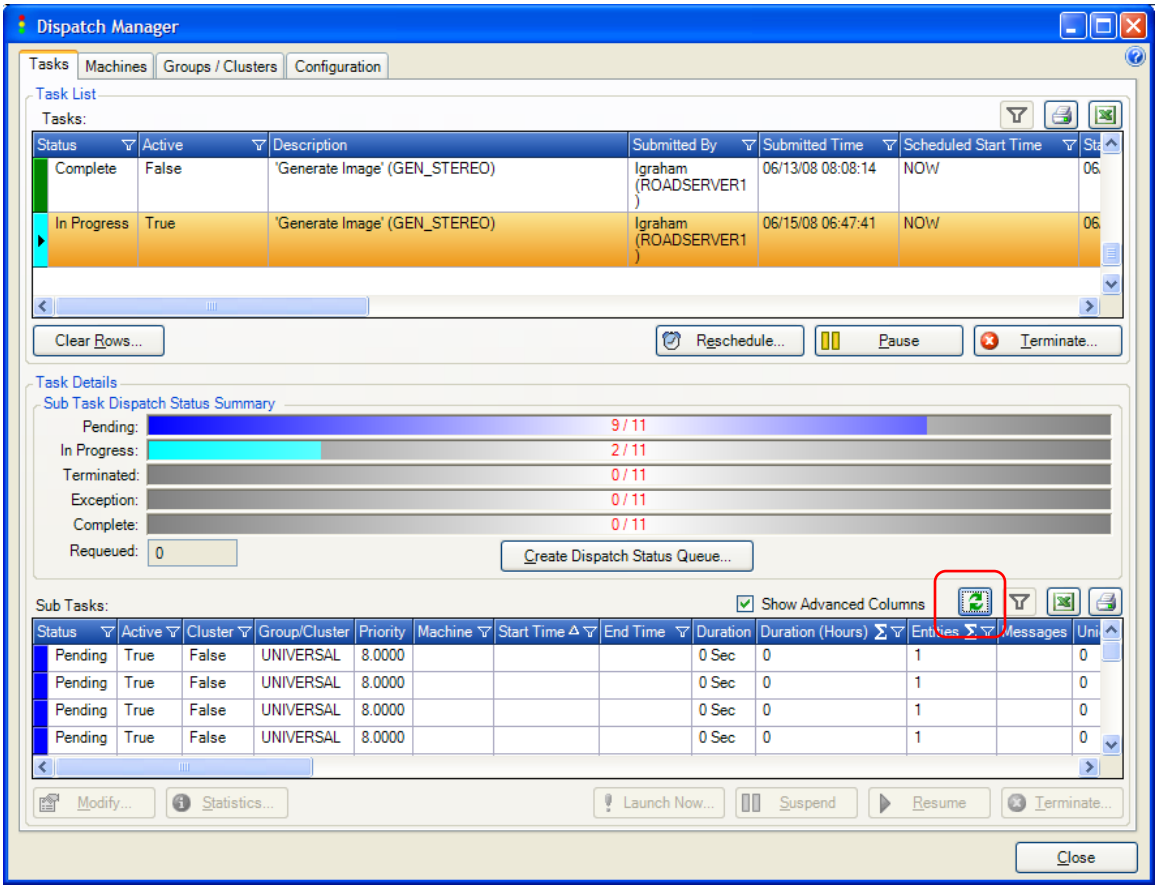


Figure 15-9: The Task tab of Dispatch Manager

15.6.1 Tasks Table

The upper section of the dialog shows dispatched tasks. You can filter this list to show only *Active* tasks (tasks in the Pending or Running state) by setting the filter on the Active column to True. You can delete rows by *selecting* the row and pressing the *Clear Rows…* button. Note that you cannot clear rows of Pending or In Progress Tasks.

The information contained in the Task table is detailed in

Table 15-3: Task Table

Item	***Description***	***Notes***
Status	The current status of this Dispatch Task	One of: Pending In Progress Exception Terminated (meaning a user explicitly terminated the command)
Active	True for Pending and In-Progress Tasks	Use this column to filter the Task dialog to show only active/pending tasks
Description	This is the Checklist Step name with the actual command from Environment Builder parenthetically indicated.	
Submitted by	The User: Machine that submitted this Task	
Submitted Time	Date/Time the Task was submitted	

Item	***Description***	***Notes***
Scheduled Start Time	Date/Time the Task is scheduled to start if the user elected Scheduling from the Dispatch dialog	NOW indicates the Task was submitted for immediate execution.
Start Time	The Date/Time the first subtask was dispatched to a machine	
End Time	The Date/Time the last subtask completed	For *dispatched* tasks there will be only one subtask
Duration	The time, in hours, minutes and seconds that the subtasks associated with the Task spent in execution.	
Duration (Hours)	The same as Duration but in decimal hours	Use this field to sort on time
Machines	The machines to which this Task could be dispatched	
Cluster	True if the dispatch mode was Cluster	
Group/Cluster	The name of the Group (or Cluster if the previous field was True) for this Task.	If you have not set any advanced dispatch modes, this field will indicate the UNIVERSAL group.
Project	The Project from which this Task was dispatched	
Environment	The Environment that was set in the Project from which this Task was dispatched	
Entities	The number of entities associated with this Task	
Messages	System messages (if any) are displayed in this column	

Item	*Description*	*Notes*
Group Access Code	This is a system code used by the *stochastic* re-queuing system	This is used for diagnostic purposes by GeoCue technical staff
User Params	Any additional parameters entered by the user in the Checklist Step configuration dialog	
Override Working Directory	If not blank, the target machine's working directory will be set to this path.	Primarily used on UNIX systems
ID	A unique integer ID associated with this Task	

15.6.2 Sub Task Dispatch Status Summary

The progress bars provide a visual indication of activity in the overall dispatch system. These bars reflect the information listed in Table 15-4.

Table 15-4: Task monitor progress bars

Bar	***Description***	***Notes***
Pending	This is the total number of currently pending subtasks in the CDS.	A Dispatched task results in a single subtask (such as Populate Working Segments). A distributable task results in *n* subtasks where n is typically the number of entities associated with the command.
In-Progress	The number of subtasks that are currently dispatched to machines and running	
Terminated	The number of subtasks that have been terminated by a user.	
Exception	The number of subtasks that have caused an error condition	
Complete	The number of completed subtasks	

The Requeued field indicates the number of Subtasks that have been Requeued. This occurs when one subtask needs the resources of another subtask but the other subtask is currently processing (an example is processing TerraScan macros with an over edge requirement). In this case, the subtask will be aborted and placed back in to the Pending queue.

You can create a GeoCue Name Queue associated with the various statuses of subtasks. Select the Task and then press the Create Dispatch Status Queue. This feature is very useful for actions such as locating all of the subtask entities that resulted in an error in the GeoCue Map View.

15.6.3 Subtasks Table

The lower section of the dialog shows Subtasks. The lower section is populated by selecting one or more tasks in the upper section of the dialog and pressing the Refresh button at the upper right of the Sub Task pane. Note that you must press the refresh button each time you want to review the list – it is not automatically updated.

Recall that if a Task will be *distributed,* it will spawn *n* subtasks where *n* is generally the number of entities associated with the Task. If a Task cannot be distributed but only *dispatched* it will result in the creation of a single subtask.

The various fields of the Subtask Table are described in Table 15-5. The fields highlighted in light blue display only when the "Show Advanced Columns" box is checked.

Table 15-5: Subtask Table

Item	***Description***	***Notes***
Status	This is the total number of currently pending subtasks in the CDS.	A Dispatched task results in a single subtask (such as Populate Working Segments). A distributable task results in *n* subtasks where n is typically the number of entities associated with the command.

Item	***Description***	***Notes***
Active	True for Pending and In-Progress Subtasks	Use this column to filter the Subtask table to show only active/pending tasks
Cluster	True if the dispatch mode was Cluster	
Group/Cluster	The name of the Group (or Cluster if the previous field was True) for this Task.	If you have not set any advanced dispatch modes, this field will indicate the UNIVERSAL group.
Priority	The subtask priority	See the section on the Priority Computation Algorithm (PCA)
Machine	The machine to which the subtask was dispatched	Blank if a subtask is pending since, in general, the machine on which a subtask will run is not known until it is actually dispatched
Start Time	The Date/Time the subtask was dispatched to a machine	
End Time	The Date/Time the subtask completed	
Duration	The time, in hours, minutes and seconds that the subtask spent in execution.	
Duration (Hours)	The same as Duration but in decimal hours	Use this field to sort on time
Entities	The number of entities associated with this subtask	Generally one for *Distributable* commands and *n* for *Dispatched* commands
Messages	System generated status messages	
Unique Processing ID	This is a system ID used by the stochastic processing subsystem	

Item	*Description*	*Notes*
Task Description	A description of the Task associated with this subtask	This description is formed by combining the name of the processing step used to launch this subtask with the name of the command from the command table – Example: “Generate Image (GEN_STEREO)”
Task ID	The ID of the Task to which this subtask belongs	The same as the Task ID in the Task table
Subtask ID	A unique integrate ID associated with this subtask	
Command	The command associated with this Task/subtask	The command from the Command table of Environment Builder associated with this subtask
Machine Process ID	This is the Process ID (PID) of the actual process on the machine that is running this command. For example, this is the Process ID that you would see in Windows Task Manager for this subtask execution.	This value is only displayed for processing machines equipped with a Dynamic Resource Interrogation Module (DRIM)
Accumulated CPU Time	The amount of CPU time used by this subtask on the target machine	DRIM only
Command Line Arguments	The command line arguments passed with the subtask	This field is only populated after the subtask is dispatched (it is blank for *pending* commands)
Messages	System messages (if any) are displayed in this column	

Item	*Description*	*Notes*
Priority Override	"True" if a user has overridden the priority using Dispatch Manager.	Priority override can only be performed by a GeoCue Administrator.
Size	The current amount of memory being used by this subtask	DRIM only
Predicted Size	The predicted amount of memory this subtask will use	Set in Environment Builder
Size Equilibrium Time	The time from the start of the subtask until its memory usage reached the predicted size	Set in Environment Builder
Auto Kill Size	The amount of memory usage that will trigger the autokill system.	DRIM only
CPU Usage	The percent of the host machine's CPU resources that are being used by this subtask	DRIM only
Predicted CPU Usage	The predicted percentage of CPU resources that will be consumed by this subtask	Set in Environment Builder
CPU Usage Equilibrium Time	The length of time from the start of the subtask until it is consuming the predicted CPU percentage	Set in Environment Builder
Reserve Resources	The Command associated with this Task has Reserved Resources	
Statistics Sampling	The frequency with which the DRIM for this subtask will gather statistics	DRIM Only

15.7 Clearing Rows from the Tasks Pane

You can clear rows from the Tasks pane of the Tasks tab of Dispatch Manager by selecting the rows that you wish to clear and pressing the ***Clear Rows…*** button at the lower left of the pane. Note that once a row(s) is cleared, it cannot be restored. Clearing a row has no affect on the processing history of the entity or entities associated with the Task.

Note that you cannot clear a Pending Task.

15.8 Rescheduling a Task

You can reschedule a task by selecting the row of the Task in the Tasks pane of the Tasks tab of Dispatch Manager and pressing the ***Reschedule…*** button. Note that you cannot reschedule a task that has already started, completed or that has been terminated.

15.9 Pausing a Task

You can *pause* a task by selecting the row of the Task in the Tasks pane of the Tasks tab of Dispatch Manager and pressing the ***Pause…*** button. Note that you cannot pause a task that is scheduled, completed or that has been terminated.

15.10 Terminating a Task

You can *terminate* a task by selecting the row of the Task in the Tasks pane of the Tasks tab of Dispatch Manager and pressing the ***Terminate…*** button. Note that you cannot terminate a task that is complete. If you terminate a task that is in progress, the subtasks that are currently executing will complete; only the subtasks that have not yet started will be terminated. Note that since a Dispatched task executes all subtasks on the same machine, a Dispatched task cannot be terminated once it has started.

15.11 Modifying a Subtask (GeoCue Administrators Only)

You can modify a subtask(s) by selecting the subtask rows in the Subtask pane of the Task tab of Dispatch Manager and pressing the ***Modify…*** button. You must be a GeoCue Administrator to access the Modify dialog). This will invoke the dialog of Figure 15-10.

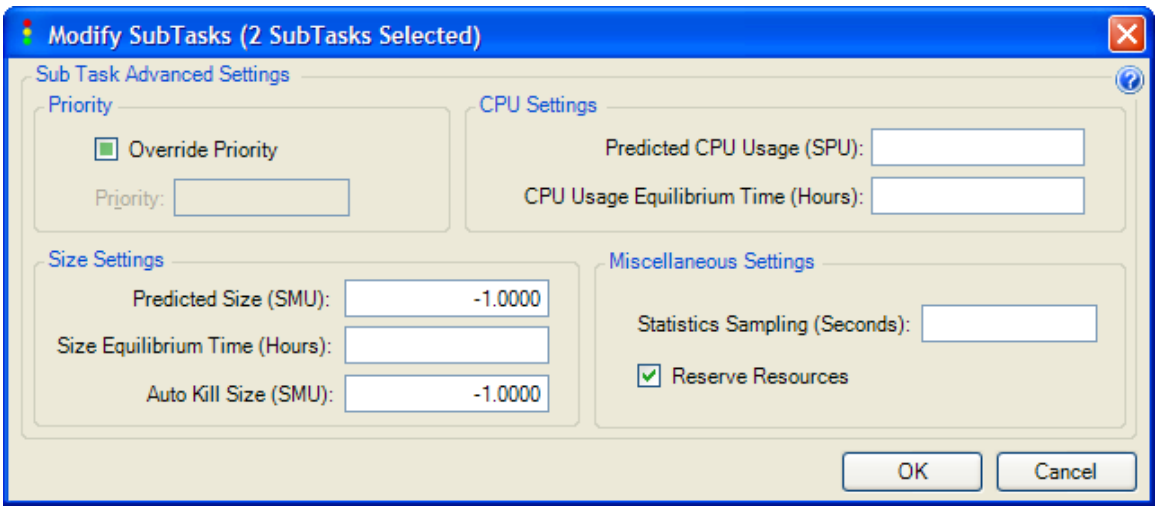


Figure 15-10: Modify Subtask dialog

As with all multi-select dialogs in GeoCue, if a field is blank, the selected objects do not currently share a common value.

The most common use of the override is to modify the subtask(s) priority.

15.12 Creating Entity Queues

You can create *queues* of entities associated with a Task. This is very useful for operations such as adding *failed* subtasks back to the working set for reprocessing or for examining the error status code for these entities.

The queue creation commands are on the Task tab of Dispatch Manager under the Sub Task Dispatch Status Summary progress bars.

Select the row of the Task for which you wish to create a queue (you cannot create queues for multiple Tasks simultaneously). Press the ***Create Dispatch Status Queue…*** button. This displays the dialog of Figure 15-11. Fill in a name for the queue and select the type of status using the Entity Dispatch Status drop-down selector. In the example of Figure 15-11 we are creating a queue of the subtasks that caused an exception. Press OK to create the queue.

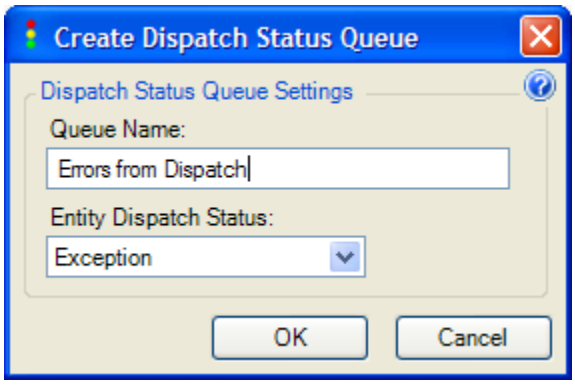


Figure 15-11: Create Dispatch Status Queue dialog

This queue will now be available in GeoCue Clients that are accessing the *project* from which this Task was dispatched. The example queue is depicted in Figure 15-12.

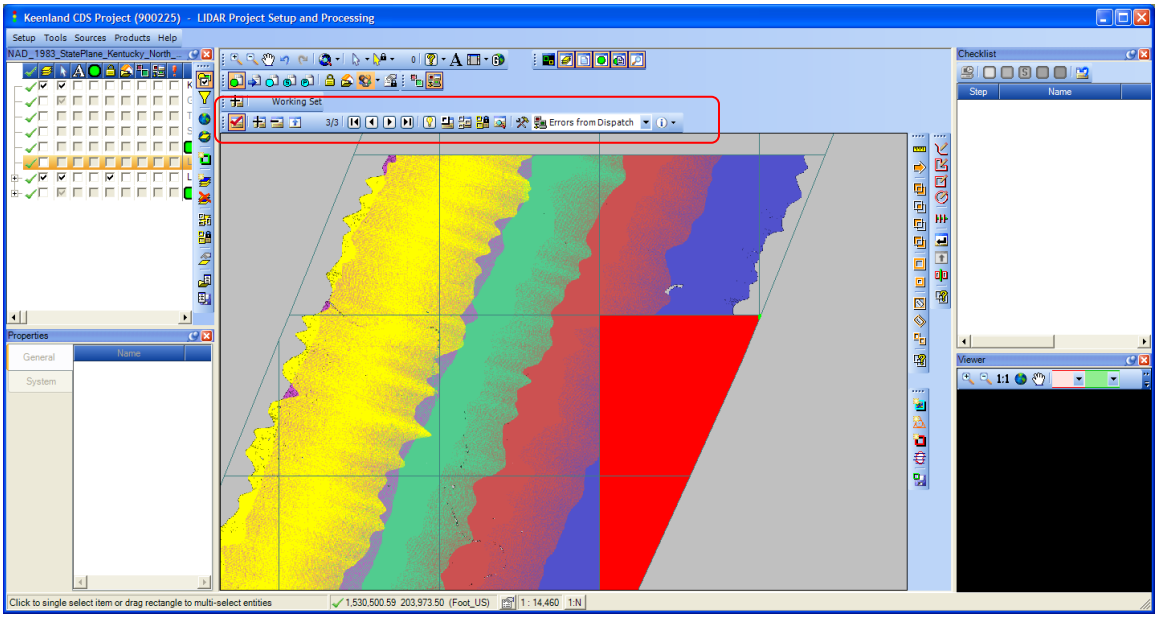


Figure 15-12: The Named Queue accessed from GeoCue Client

15.13 Monitoring Machine Activity

You can monitor machine activity using the Machine tab of Dispatch Manager.

> NOTE: If you are not a GeoCue Administrator (set in the GeoCue User Manager dialogs), the Groups/ Clusters and Configuration tabs of Dispatch Manager will be disabled. Additionally, all of the modification capabilities of the Machines tab will be disabled.

Figure 15-13 depicts the Available Dispatch Machines pane of the Machines tab of Dispatch Manager. Note that you must press the *refresh* button to see the latest status of Machines.

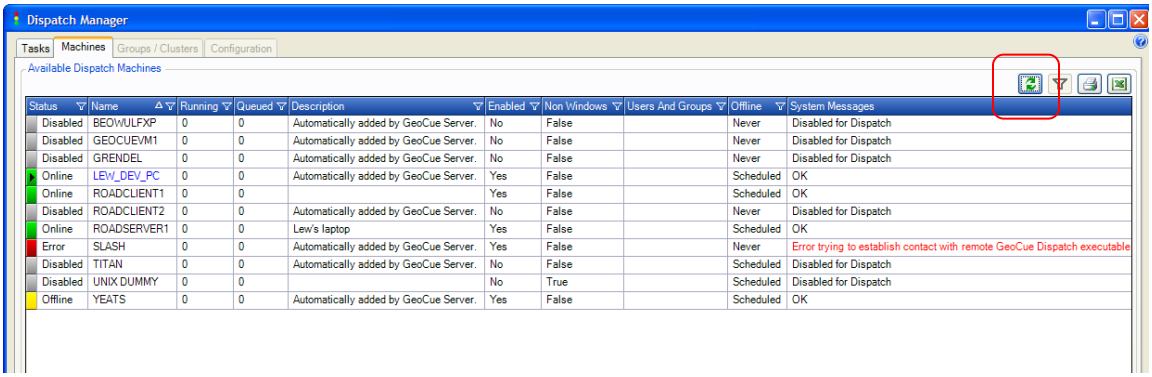


Figure 15-13: Available Dispatch Machines pane of Machines tab of Dispatch Manager

The fields germane to machine monitoring as well as their descriptions are listed in Table 15-6.

Table 15-6: Machine Monitoring Fields

Field	***Description***	***Notes***
Status	Idle (Green) Processing (Cyan) Disabled (Grey) Offline (Yellow) Error (Red)	The System Messages section of the dialog lists the reason for Errors.
Name	The name of the machine	This corresponds to the Machine name in the Machine tab of the Dispatch Manager
Running	This is the number of subtasks that are currently running on the machine	This is an instantaneous snap-shot so it can momentarily fluctuate.

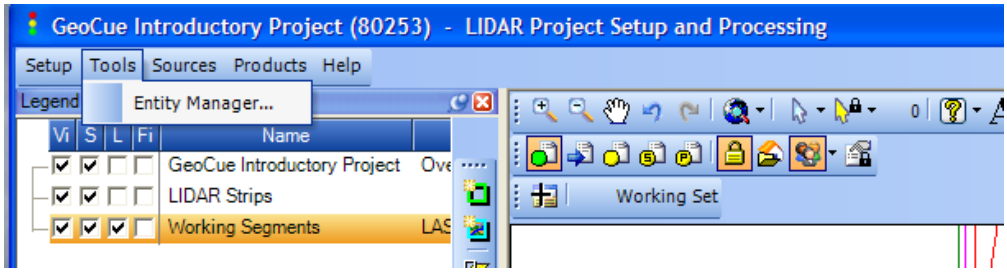
Field	***Description***	***Notes***
Queued	This is the number of subtasks that are queued that could potentially run on this machine	The actual machine on which a subtask will be hosted is not known until the subtask is actually dispatched.
Description	The description for the machine as entered in the Machine tab of Dispatch Manager	
Enabled	Indicates if the machine has been disabled	A machine can be disabled via this tab of Dispatch Manager (by a GeoCue Administrator) or via the tool tray icon on the machine itself.
Non-Windows	True if this is a LINUX/UNIX machine	
Users and Groups	This lists the Users/Groups who can access this machine	
Offline	"Never" of "Scheduled"	Hover the mouse cursor over "scheduled" fields to display the schedule as a tool tip.
System Messages	This is system added information. It is usually a detailed message that relates to the reason for error conditions.	
Address	The Internet Protocol (IP) address of the machine	This is useful diagnostic information. If this IP address differs from the true IP address of the machine, CDS will not be able to communicate with this node.

16 Entity Manager

Entity Manager is the tool for list manipulation of *Entities.* Entity Manager allows you to locate entities via a list view that is dynamically linked to the Map View. Once in the list view, you can use a number of commands to manage and change the attributes of entities including Entity naming, editing Extended Information and Querying Extended Info and Checklist Status. Entity Manager is a "non-modal" dialog. This means that Entity Manager can remain displayed and active while you are using other GeoCue commands.

16.1 Invoking Entity Manager

The examples of this section will continue to use the GeoCue Introductory Project. With this project open, invoke Entity Manager from the Tools menu:



This will bring up the ***Entity Manager*** dialog (Figure 16-1).

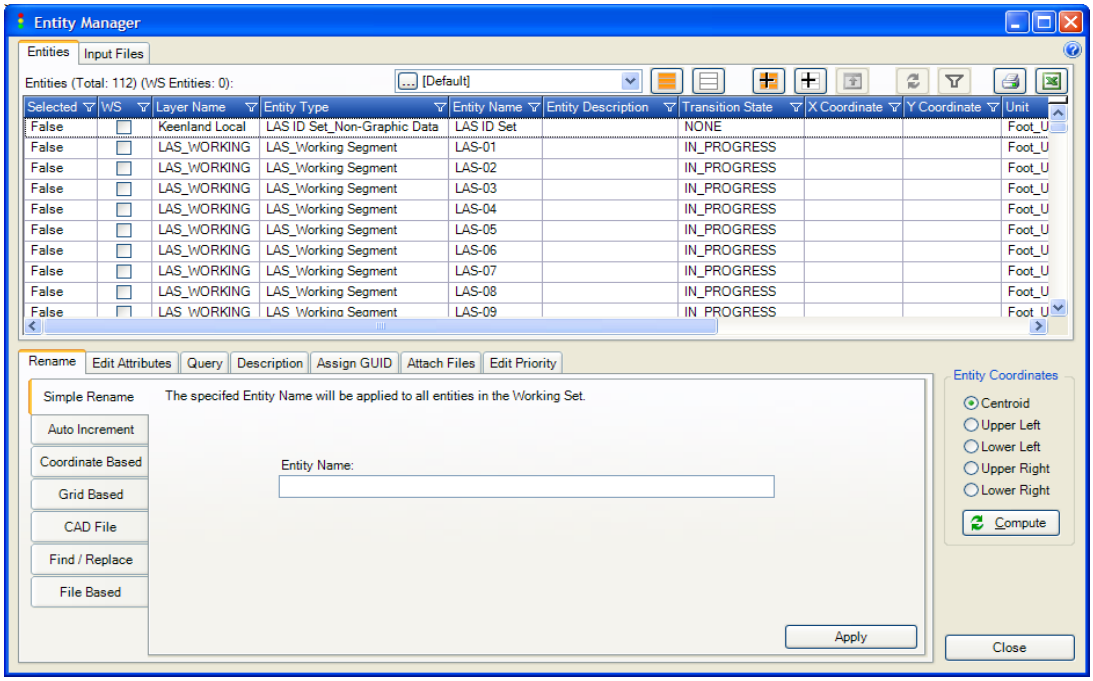


Figure 16-1 Entity Manager dialog

Entity Manager comprises a top pane which is effectively a list view of all (assuming no *filters* are active) entities in the project. The lower section of Entity Manager changes, based on the tab that you have selected (such as Rename, Edit Extended Info and Query).

NOTE: You must be logged in as a GeoCue System Administrator to access the "Attach Files" and "Edit Priority" tabs of Entity Manager.

16.2 Selecting In Entity Manager - Overview

The list in the Entities table is synchronized with the Map View of GeoCue. Thus if you select in Entity Manager, the corresponding entities will *select* in the Map View (and display in the *selected* color). Conversely, if you *select* one or more entities in the Map View, their corresponding rows in Entity Manager will become *selected.*

16.3 The Entity Manager Toolbar

The top right section of Entity Manager contains a tool bar as shown in Figure 16-2. These tools are described in Table 16-1.

Figure 16-2 Entity Manager Toolbar

Table 16-1 Entity Manager Main Toolbar

Icon	***Name***	***Description***
	Select all rows	Selects all currently displayed rows into the *Selection Set (*any rows that are not displaying due to filters will *not* be added to the selection set)
	Unselect all rows	Removes all current rows from the *Selection Set.*
	Clear Working Set	This button has the same affect as the Clear Working Set tool on the Working Set Toolbar – it removes all entities from the Working Set. It is repeated here for convenience.
	Refresh Query Columns	This tool causes the Entity List to be refreshed based on the current selections in the Query tab (lower section of the Entity Manager dialog)
	Clear All Filters	Removes all filters from the Entity table of Entity Manager
	Print	Prints the current list of the Entity list section of Entity Manager
	Export to Excel	Exports the current Entity list to Microsoft Excel

16.4 Sorting and Filtering

Sorting and *Filtering* behave the same in Entity Manager as in all user interfaces in GeoCue. You can sort the various columns of the Entity List by clicking the column heading of the column you wish to use as the sort key. You can also *Filter* based on the contents of the column(s). If you filter more than one column, the result set is the AND of the applied filters. A column can be filtered if a "funnel" icon appears in the column heading (you may need to expend the column header to see the filter icon). Click on this icon to invoke the filter drop-down list (Figure 16-3). Select the filter that you wish to apply to the column.

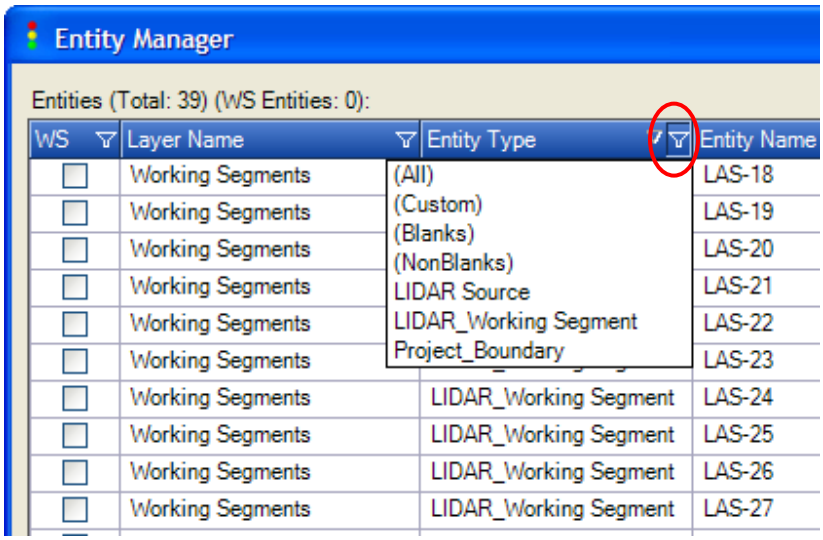


Figure 16-3 Filtering the Entity Type column

You can apply regular expressions to filters. Select *Custom* from the list of filters to set a conditional filter. An example of looking for working segments whose name ends in the digit one is depicted in Figure 16-4 with the results of the filter displayed in Figure 16-5.

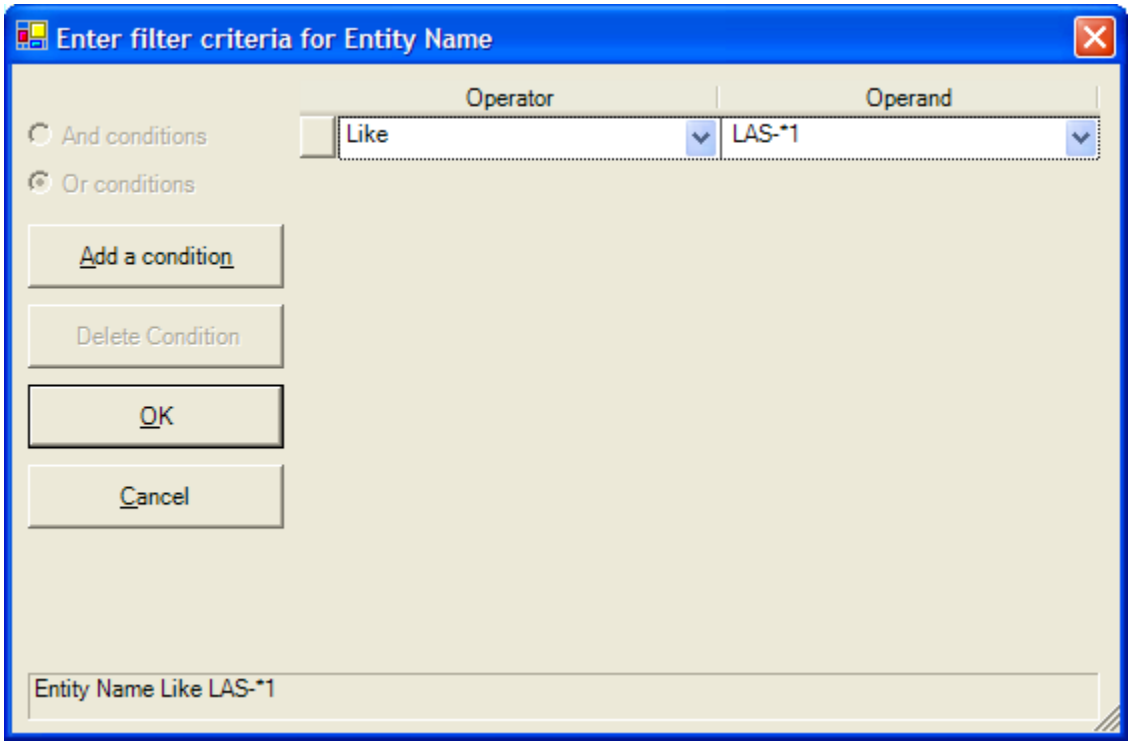


Figure 16-4 Setting a filter to find names that start with LAS- and end with the digit "1"

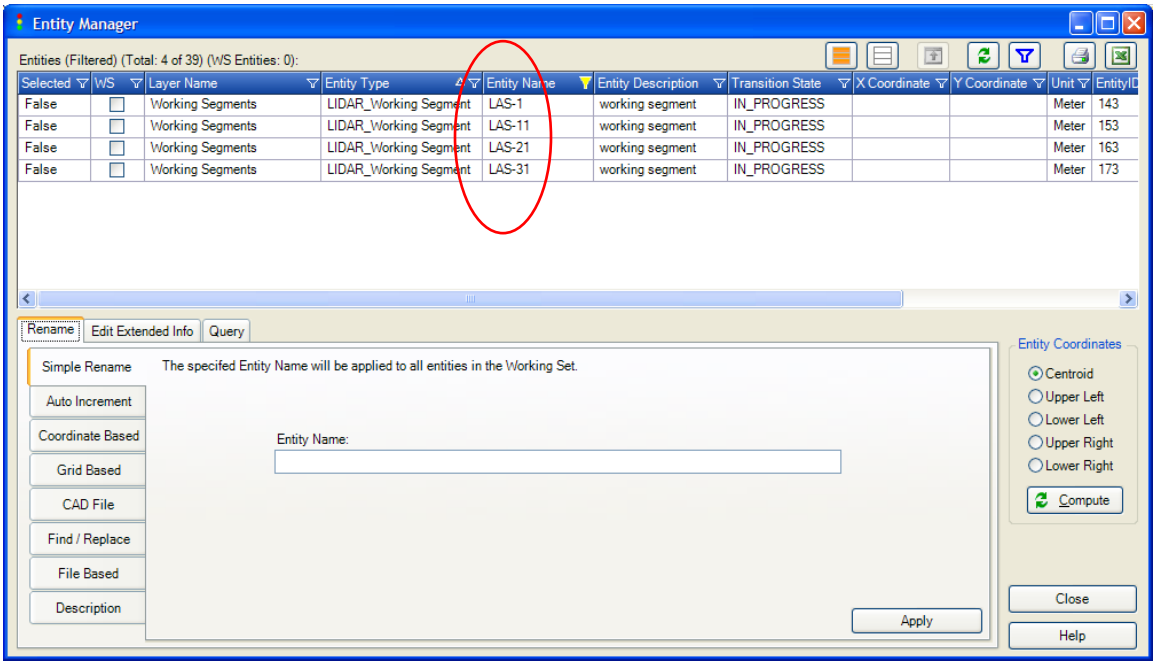


Figure 16-5 The result of the custom filter

Notice that when any type of filter is being applied to a column, the filter icon turns a different color. You can quickly clear all filters from all columns by pressing the *Clear Filters* button in the main toolbar of the Entity Manager dialog.

NOTE: **Transition State** is one of the standard columns in Entity Manager. Transition State is internally used by GeoCue for certain tracking operations and thus its value is non-deterministic from the user point of view. However, an entity in an error state will *always* have a Transition State of **EXCEPTION.** This fact allows you to very easily locate all entities within your project that are in an error checklist state. Simple set the Transition State filter to "EXCEPTION."

16.5 Selecting Entities

You can *Select* entities in the Map View by selecting anywhere in the Entity Manager list view (List View) other than the Working Set (WS) checkbox column. You can multi-select using the same familiar Windows multi-select methods as are used throughout GeoCue (Ctrl select to select and deselect individual entries, Shift select to multi-select, Ctrl A will select everything in the list view if the list view itself has the focus). The easiest way to *Select All* is to press the Select All tool on the Entity Manager main toolbar.

Notice the linked selection in Figure 16-6 (this is a great application to use to convince the bean counters that you need a dual screen workstation!!). Entity Manager has two-way dynamic linkage meaning that if you select in the Map View, the corresponding entries in the List View will become *Selected* and vice versa.

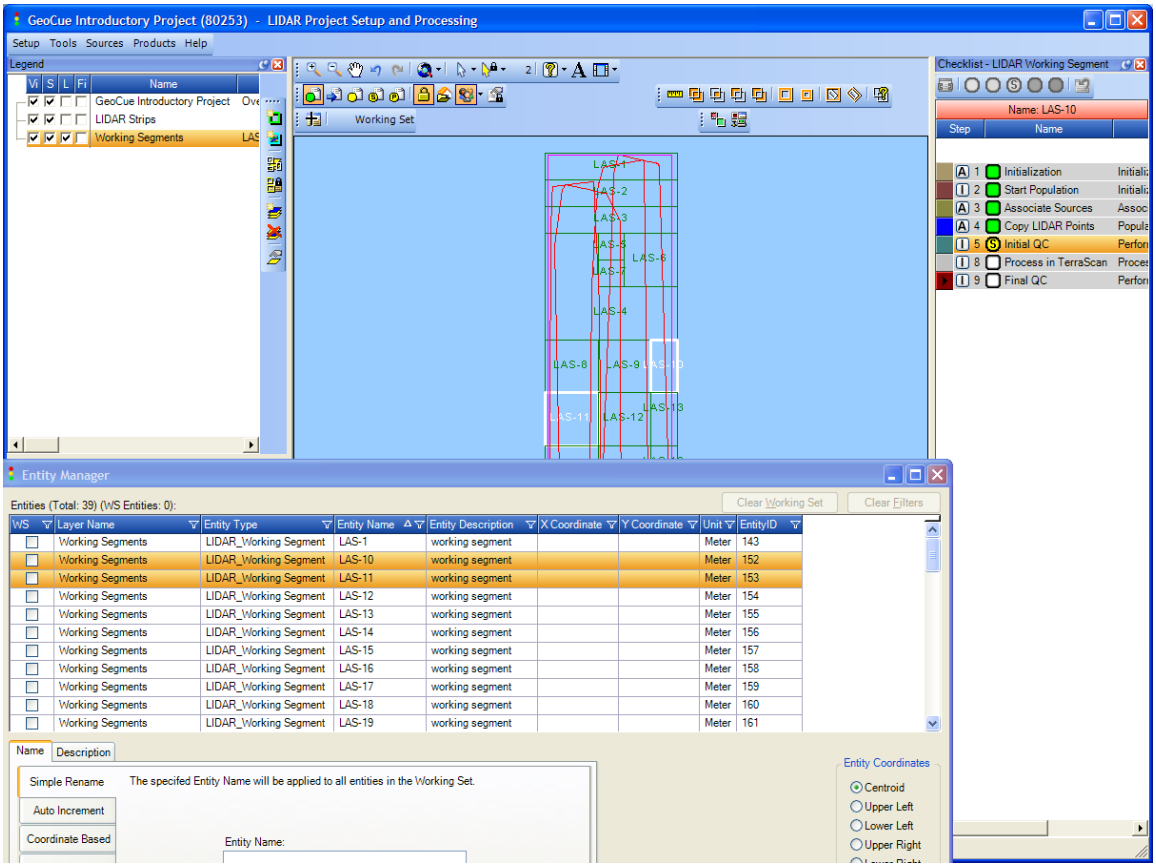


Figure 16-6 Linked Selection between the Map View and the List View

NOTE: Entity Manager always clears entities that become filtered out of the Entity List from both the Working Set and the selection set. Hence if you initially select all entities and then filter down to a subset, the filtered out entities will be removed from the Selection set. If you had placed these entities in the Working Set, the entities that were filtered out would be removed from the Working Set.

16.6 Computing the Planimetric (X, Y) Coordinates of Entities

The Entity Coordinates section (Figure 16-7) of the Entity Manager dialog allows you to probe the planimetric (X, Y) coordinates of all of the entities that are currently in the List View (coordinates will not be computed for entities that you are currently filtering from view).

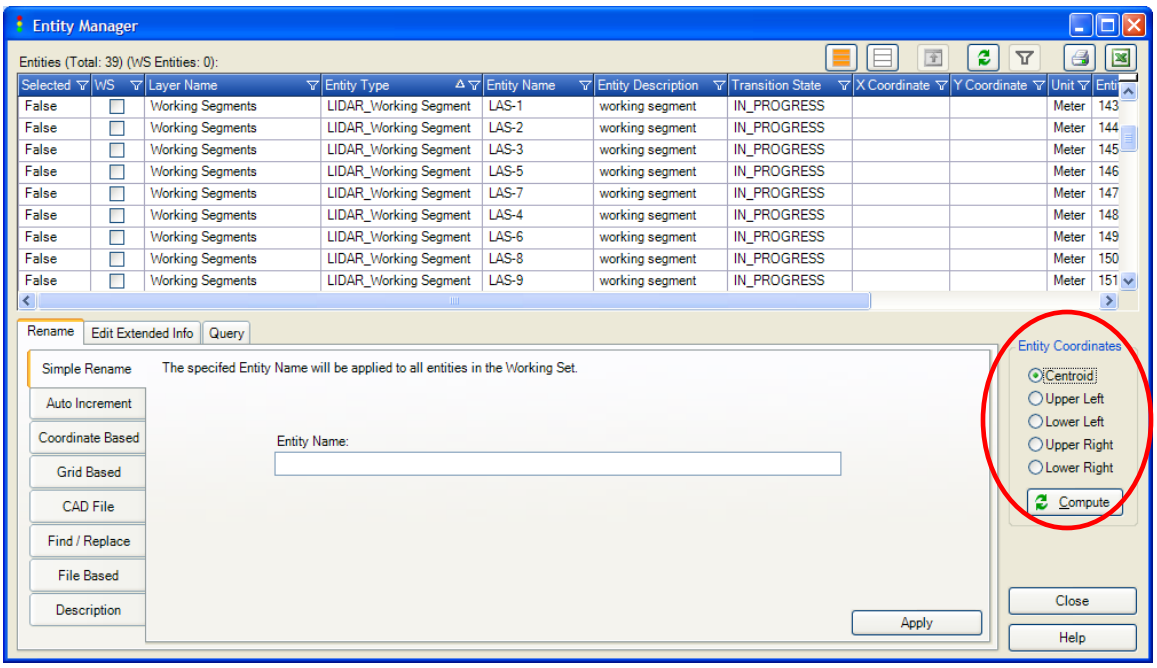


Figure 16-7 Coordinate Computation Section of Entity Manager

The coordinates are computed based on the Minimum Bounding Rectangle (MBR) of the entity regardless of its geometry type (Point, Line, Polygon) except for the special case of Centroid when the geometry type is Polygon. You can set the point in the MBR from which to measure the coordinate via the radio buttons.

In the unique case of computing the centroid of a polygon, a full topological centroid computation is performed.

The displayed coordinates are always in the Horizontal coordinate system of the layer on which the entity resides. Thus if you have some entities on a Geographic layer and others on a NAD83 UTM layer, you will see degrees and (Easting, Northing), respectively.

The Coordinate Computations are useful for spatially locating entities (simply compute their coordinates and then filter down to the entities that you desire) and for renaming the entity based on its coordinates (e.g. Easting, Northing naming schemes).

16.7 Adding and Removing Entities to/from the Working Set

You can add to and remove entities from the Working Set by checking the "WS" checkbox at the second left-most side of the List View. Just as in the Layer Legend, you can multiple select entities prior to checking or unchecking any of the selected Entities in the List View and the operation will apply to all items.

If you add Entities to the Working Set from the Map View, they will become checked in the List View.

> WARNING – It is good practice to *CLEAR* the Working Set prior to applying changes. This is because adding entities to the Working Set via the check box in List View is analogous to added entities via the "+" button on the Working Set toolbar. That is, entities already in the Working Set are not removed.

You can quickly clear the entire Working Set by pressing the *Clear Working Set* button in the upper right of the List View. Alternatively, you can press the *Clear Working Set* icon on the Working Set toolbar.

There are two visual cues as to the contents of the Working Set provided in List View. The first is the Status Line at the upper left of the List View. This contains an entry that reads "(WS Entities:

x) where *x* is the current count of entities in the Working Set. The second cue is the Clear Working Set button in the upper right of the List View. If this button is *Enabled* then there are entities in the Working Set. Conversely, if the button is *Disabled*, the Working Set is empty.

16.8 Renaming Entities and/or Changing Entity Descriptions

The first tab in the lower section of Entity Manager is used for renaming entities or changing the description of an entity (as can be seen in the **General** tab of the Properties Pane).

The standard method for editing entities (whether name, description or Extended Info) is to select the entities on which you desire to operate using ether the Entity Manager List View or GeoCue Map View. Next use filters in the List View to filter down to those entities you wish to manipulate. Finally, place these entities in the Working Set by either manually selecting via the Map View or by *Selecting* all entities in the list view (assuming you have filtered down to what you want) and then checking the "WS" check on one of the selected entities. The "Working Set" operation will be carried out on all entities that are current selected. The Entity Manager list view will be synchronized with the Map View and hence you will see these entities highlight in yellow.

16.8.1 Renaming Entities

Entity Manager includes a powerful collection of tools for renaming entities. The methods are described in the following subsections. In all cases, the procedure follows that for changing any attribute of an Entity. The Entity or Entities is/are added to the Working Set, the change applied and the Working Set cleared. It is assumed in the following subsections that you have added the entities whose names are to be changed to the Working Set.

The various renaming options are located along the vertical tab section when "Rename" is selected as the horizontal tab in the lower section of Entity Manager (Figure 16-8).

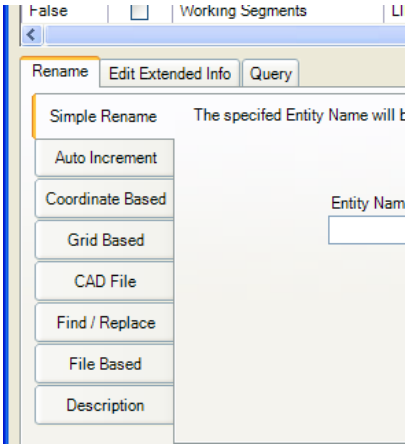


Figure 16-8 Rename (and Change Description) Section of Entity Manager

16.8.1.1 Simple Rename

Simple Rename replaces the current entity names with the entry in the Entity Name box. Note that GeoCue does not require that entity names be unique since the Name is not used for uniqueness testing (Entity ID is used for this purpose).

16.8.1.2 Auto Increment

Auto Increment renames the entities in the Working Set according to the pattern established by the various parameters in the order in which the Entities occur in the List View.

It is important to note that you have a lot of flexibility in how items are ordered in List View. For example, if you sort based on the Y coordinate, then the order will be “Row Major”. You can farther modify this by reverse ordering, you can set numbering to start at the top or bottom of the Working Set.

Auto increment starts numbering with the Start Number and adds the increment sequentially to the entities in the List View that are in the Working Set. A variety of options are available for prefix and postfix strings as well as “padding”

16.8.1.3 Coordinate Based

Coordinate Based allows you to use the computed coordinates of entities to form the entity name. Thus for example, you can name entities based on their Easting, Northing coordinates.

Specify the digits from the coordinates that you want to include in the name by checking the box above each digit to be included. An example is depicted in Figure 16-9.

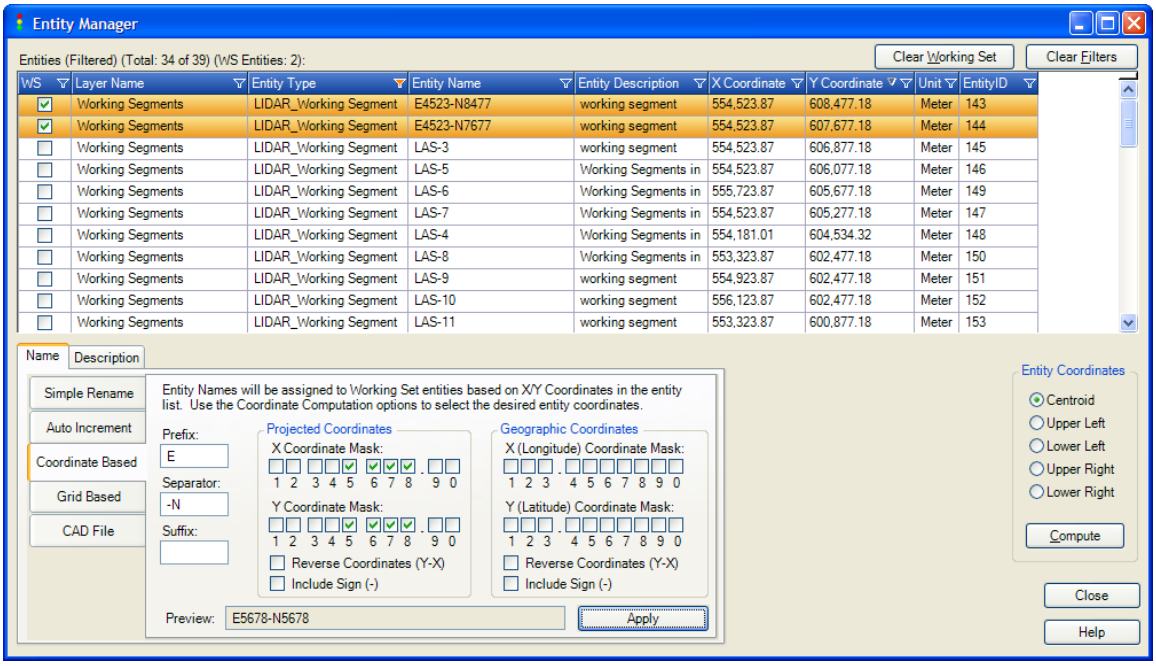


Figure 16-9 Coordinate based renaming

Hint – To insert a prefix for the second coordinate, add the desired prefix to the end of the separator. Notice that we have done this to generate the “N” for Northing in Figure 16-9.

16.8.1.4 Grid Based

Grid based renaming superimposes a virtual grid (this grid is not visible to you in the Map View) over the entities in the Working Set such that the granularity of the grid matches the smallest entity in the Working Set. The grid is then "walked through", intersecting entities and applying the names according to the parameters that you supply.

The origin and "sense' of the grid can be set to any of the four corners. If the origin corner is to the right, number proceeds from right to left rather than left to right.

16.8.1.5 CAD File

Labeling from a CAD file allows you to assigning labels to entities that are in the Working Set by intersecting labels imported from an external CAD file. This command is useful for operations such as defining working segments within LIDAR 1 according to a customer supplied scheme and then using the customer supplied CAD file to rename the resultant working segments (this twisted path will become unnecessary when we introduce arbitrary working segment in the second half of 2005).

If the labels originate in a CAD file, you can specify a specific layer from which to extract the text. If you do not check the Level Number option, text will be ingested from all levels in the CAD file.

If you import labels from a shape file, you can select from the Shape attributes the one that you wish to use as a label.

Note that the text imported from a shape or CAD file may result in one of two conditions that you might want to resolve:

1. An entity is in the Working Set but none of the text intersected. This is called a Missing Label.
2. More than one label intersected the same entity. This is called a Duplicate label.

These problems can be difficult to see in a very dense or scattered renaming operation. Therefore, GeoCue will Cue each problem entity by adding it to a named queue called "RENAME_PROBLEM". Each entity within this queue will have a new name of either MISSING or DUPLCATE. You can simply step through the named queue and inspect each problem entity. Fix the problem by either using a different renaming tool or by using the Simple Name function.

16.8.1.6 Find/Replace

The Find/Replace option attempts to replace all occurrences of the "Find What" substring with the "Replace With" substring. Below is presented an example of replacing the string "LAS" with the string "Block" for the working segments in the GeoCue Introductory Project.

First filter out all entities except the LAS working segments by setting the filter on the "Entity Type" column to "LIDAR Working Segment" (see Figure 16-10). Add the filtered selection to the Working Set by first selecting all visible (non-filtered) entities by pressing the *Select All Rows* tool. Next add these selected entities to the Working Set by checking the "WS" column of any of the currently highlighted rows (be careful not to *deselect* the row during this operation).

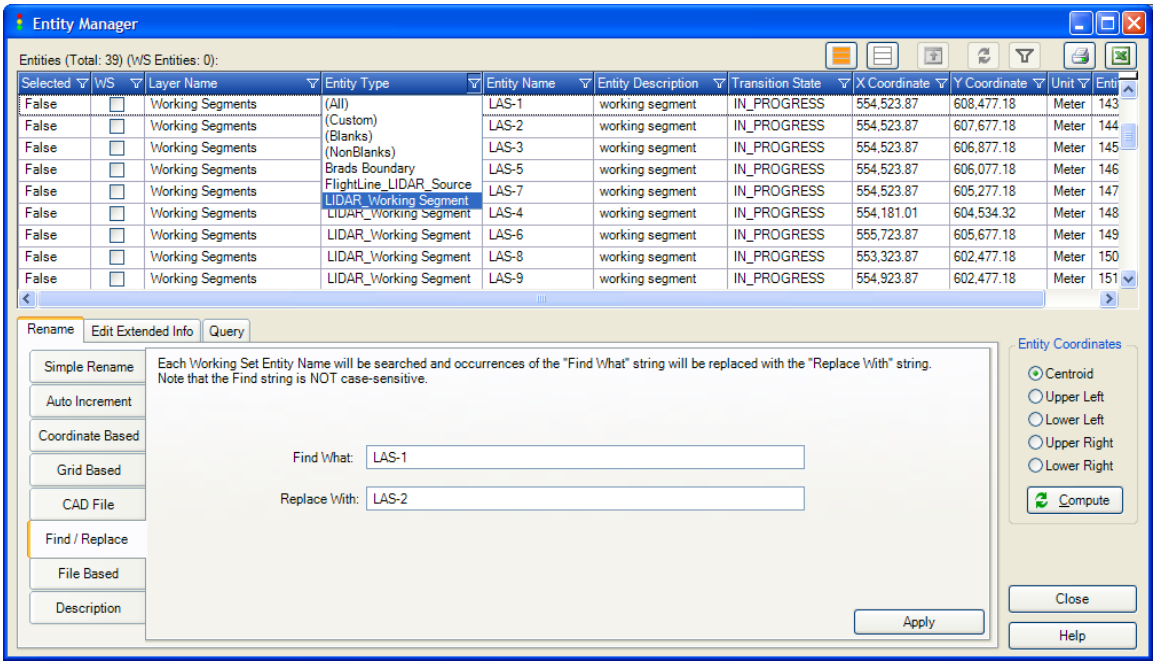


Figure 16-10 Filtering Entity Type to "LIDAR Working Segment"

Next select the Find/Replace tab in the lower section of the dialog. Type “LAS” in the Find What field and “Block” in the Replace With field. At this point, your Entity Manager dialog should resemble Figure 16-11.

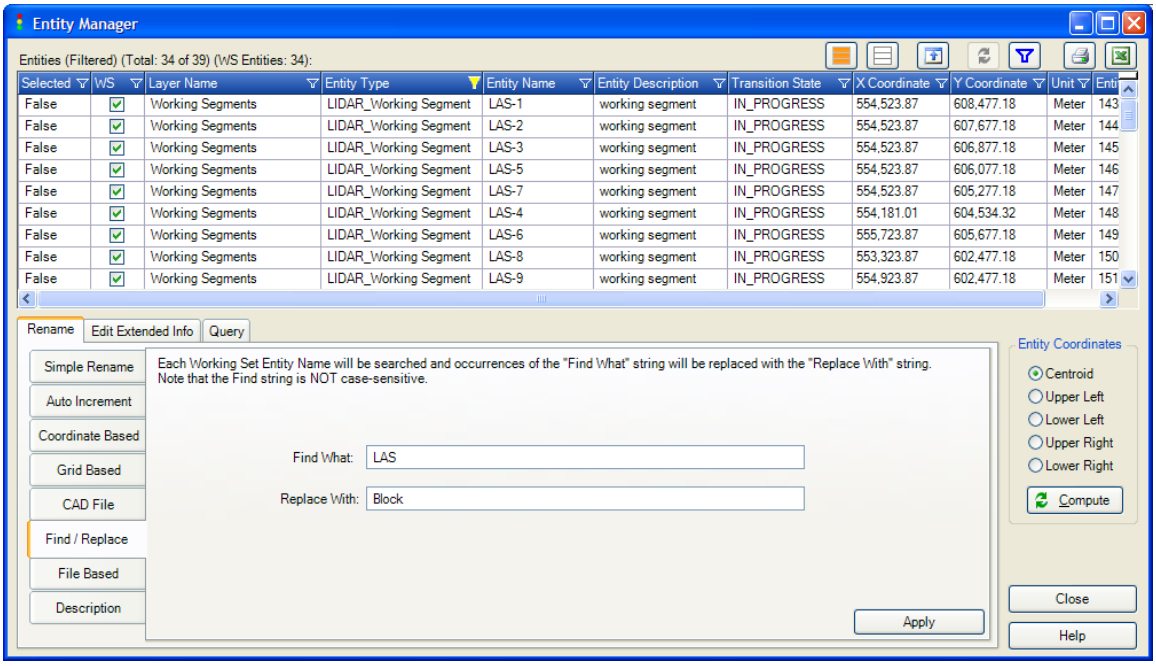


Figure 16-11 Filtered Entities added to the Working Set

Press the ***Apply*** button in the lower, right section of the dialog. The LIDAR Working Segment names will be changed from a prefix of "LAS" to a prefix of "Block." You can restore the original "LAS" names by repeating the Find and Replace operation but with "LAS" and "Block" in opposite dialog fields.

When you are satisfied with your changes, you can quickly clear the entities from the Working Set by pressing the ***Clear Working Set*** tool at the top of the Entity Manager dialog.

16.8.1.7 File Based

The File Based rename method will attempt to replace the current entity name of entities in the Working Set with the base name of the file selected in the Available File Types drop-down list. Note that if a particular entity does not support the selected file type, its name will not be changed.

16.8.2 Changing Entity Descriptions

To change the description field(s) of entities, select them into the Working Set (using either List View or Map View) and key-in the desired new description in the Entity Description field. Press the Apply button and the set description will be applied to all entities in the Working Set.

16.9 Query

The Entity Query system (a component of Entity Manager) provides the ability to query both Extended Information fields as well as Entity Checklist Status fields for individual processing steps. The operations of this system are described in the following subsections.

16.9.1 Pre-Filtering

The best approach to using the Query system is to first use the top-level filtering system of Entity Manager to narrow down the list of entities to those in which you are interested and then query for specific data using the query function. This technique is not required by GeoCue; it simply makes the query a bit easier.

Pre-filtering was described in the initial section on Entity Manager. Simply use the filters in the top section of Entity Manager to narrow down your selection to the desired entity types. For example, if you were interested in sorting LAS Working Segments based on the number of points in a segment, you might first filter based on the Layer Name that contains the entities of interest or the Entity Type.

After pre-filtering, move on to the Query subsystem.

16.9.2 Query Extended Info

To query Extended Information (Extended Info or Entity Metadata), select the horizontal Query tab in the lower pane of Entity Manager and then select the Extended Info vertical tab. This will result in the dialog arrangement of Figure 16-12 (note that we are still using the GeoCue Introductory Project data as our example).

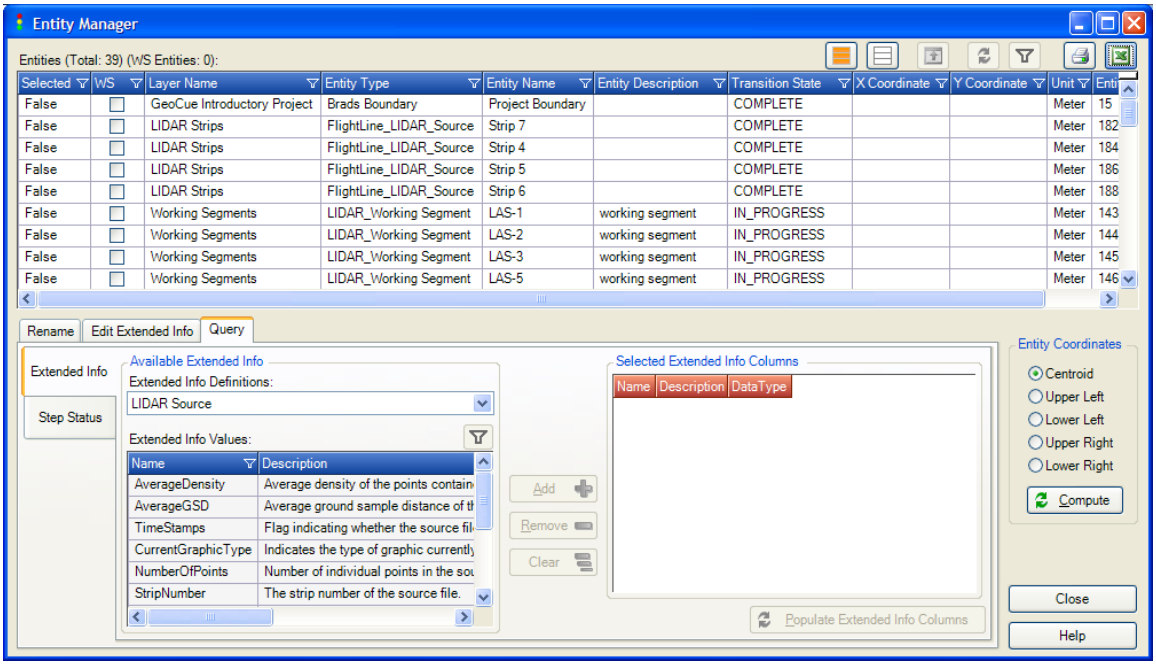


Figure 16-12 Entity Manager set to Query Extended Info

The “Extended Info Definitions” drop-down list contains all Extended Info definitions (these definitions can be inspected in Environment Builder) for all currently visible entities in the upper section of the Entity Manager dialog. Extended Info query functions by allowing you to add particular Extended Info fields to the top section of the Entity Manager dialog.

To add a query column to the Entity Manager *Entities* table, first select the Extended Info definition that contains the field you wish to add by choosing it in the Extended Info Definitions

drop-down selector. In Figure 16-12 above, we have selected "LIDAR Source." Now scroll through the Extended Info Values table and select the field(s) that you wish to query. This will cause the selected fields to highlight. Next press the **Add** button that is to the right of the Extended Info Values table. This will add the selected field(s) to the **Selected Extended Info Columns** table in the lower right of the Entity Manager dialog. Figure 16-13 depicts two Extended Info descriptions selected and Figure 16-14 shows the selections just after pressing the ***Add*** button.

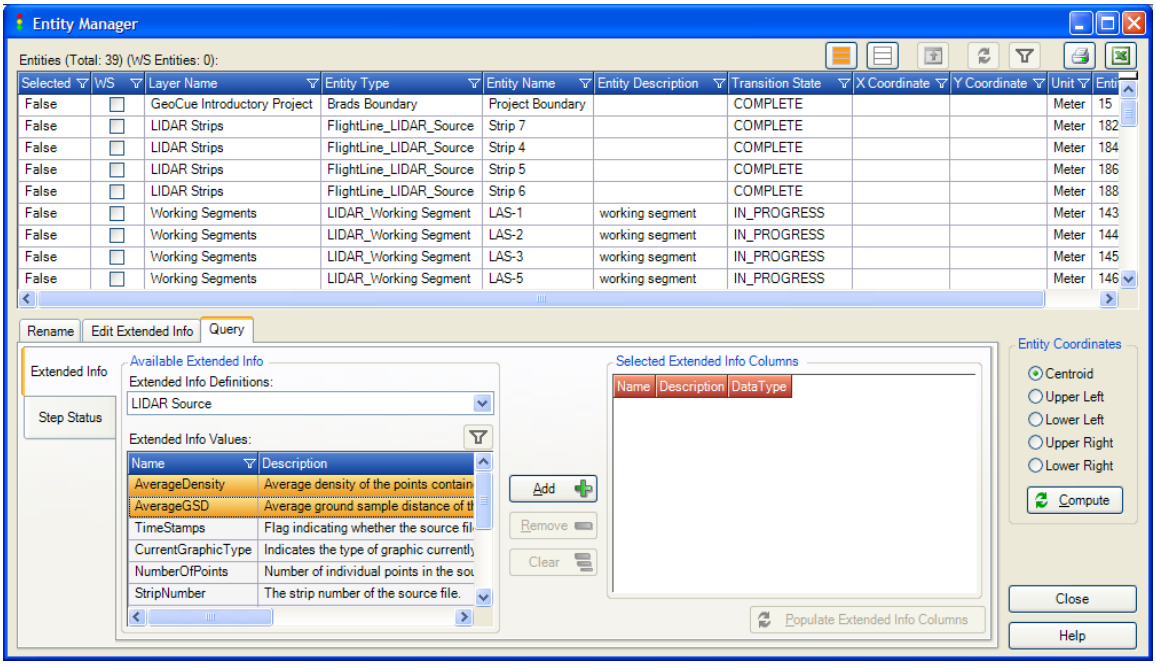


Figure 16-13 Two Extended Info fields Selected

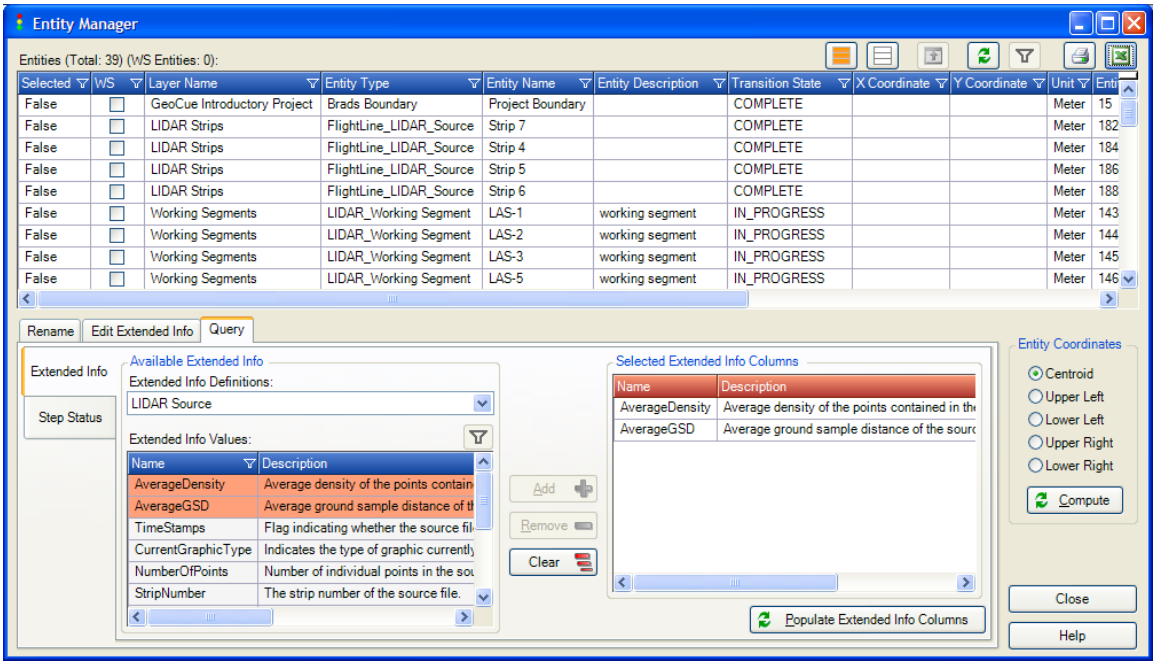


Figure 16-14 The Selected Fields added to the Entity columns

You will notice that the new columns have been added to the Entities section at the top of the dialog (be sure to scroll the dialog pane to the right so that the new columns are visible). The example shown above with the new columns added is depicted in Figure 16-15

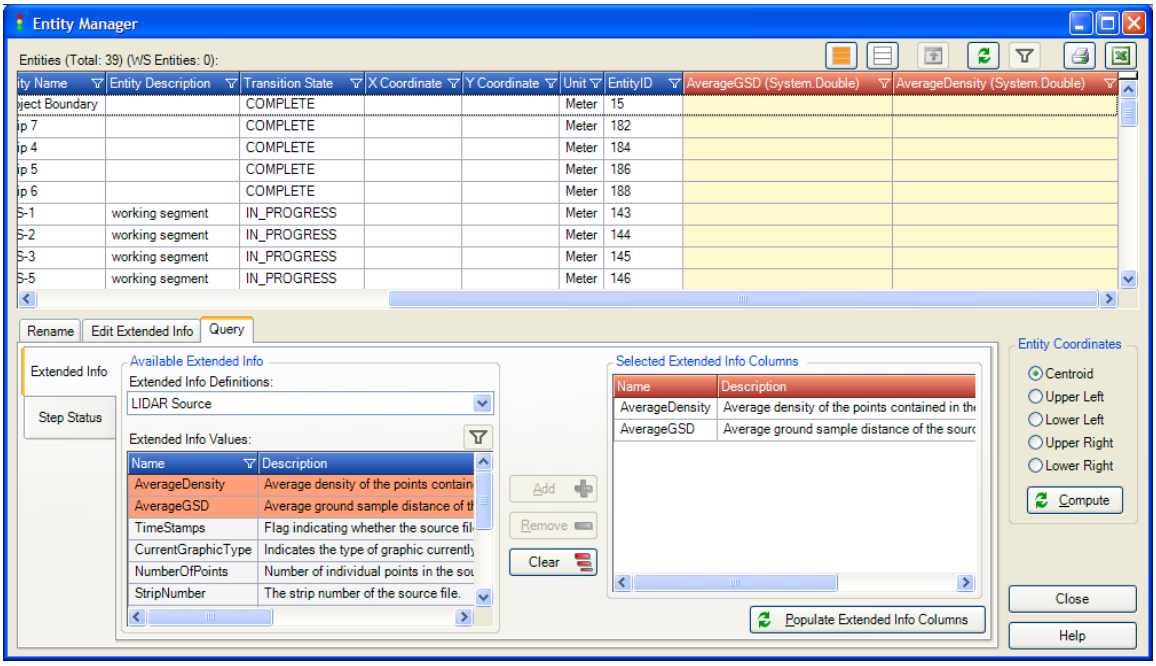


Figure 16-15 New Extended Info columns added to the Entity section

You will note that these newly added columns have not yet been populated with data and hence are displayed in yellow highlight. To populate these new columns, press the ***Populate Extended Info Columns*** button at the lower right of the Entity Manager dialog or press the ***Refresh Query Columns*** tool at the top of the Entity Manager dialog. After pressing one of these buttons, the newly added columns will populate as depicted in Figure 16-16.

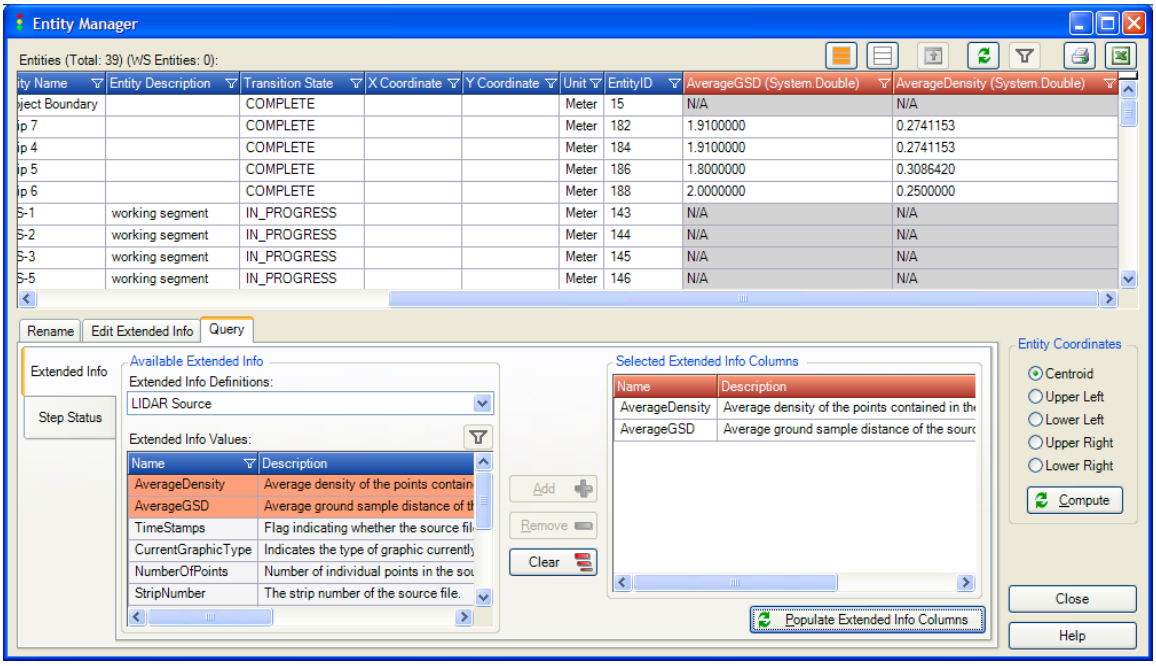


Figure 16-16 Populated Query Columns

You will note that if a field does not apply to a particular entity, the column entry reads "N/A" for Not Applicable. Once a column has been added to the Entity section of the dialog, you can filter that column just as any other column.

You can remove query columns by selecting one or more entries in the ***Selected Extended Info Columns*** section of the Entity Manager dialog and pressing the ***Remove*** button. You can remove all query columns at once by pressing the ***Clear*** button.

16.9.3 Query Step Status

The Query Step Status function within Entity Manager allows you to query the status of any checklist step on any entity. This was primarily added to allow easier access to entities based on a particular status for production operators. For example, if you left 12 entities of type LAS Working Segment in a Quality Check *Suspended* state and want to quickly add this group to the

Working Set, use this new Query Step Status tool. Other types of queries such as who did a particular step or how long that step required can be accessed via the (optional) Project Manager CuePac.

To query Step Status, select the horizontal Query tab in the lower pane of Entity Manager and then select the Step Status vertical tab. This will result in the dialog arrangement of Figure 16-17 (note that we are still using the GeoCue Introductory Project data as our example).

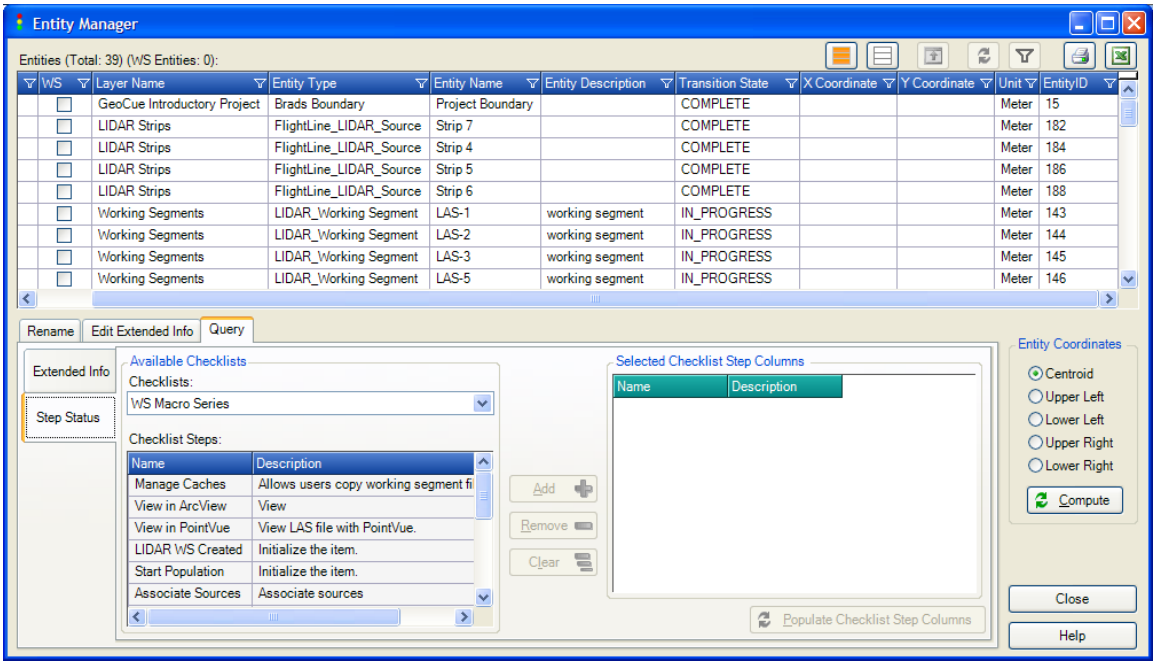


Figure 16-17 The Query Step Status interface

Notice that this query system behaves in a fashion similar to query Extended Info. Select the desired Checklist from the ***Checklists:*** drop-down selector. Next add the step(s) to the ***Selected Checklist Step Columns*** section of the dialog by selecting the desired step(s) in the ***Checklist Steps:*** section of the dialog and pressing the ***Add*** button. After adding the desired columns, populate them by pressing either the ***Populate Checklist Step Columns*** button or the ***Refresh Query Columns*** button.

An example of querying the checklist step of *Initial QC* for LIDAR Working Segments is depicted in Figure 16-18. Note that we *pre-filtered* the Entity Type column simply to eliminate entities not of the type we were interested in inspecting. In our example, we have several working segments with the Initial QC step in a suspended state. We can quickly add these to the Working Set by:

1. Filtering the Initial QC step to SUSPENDED
2. Pressing the ***Select All Rows*** tool
3. Clicking in the WS box of any of the currently selected entities

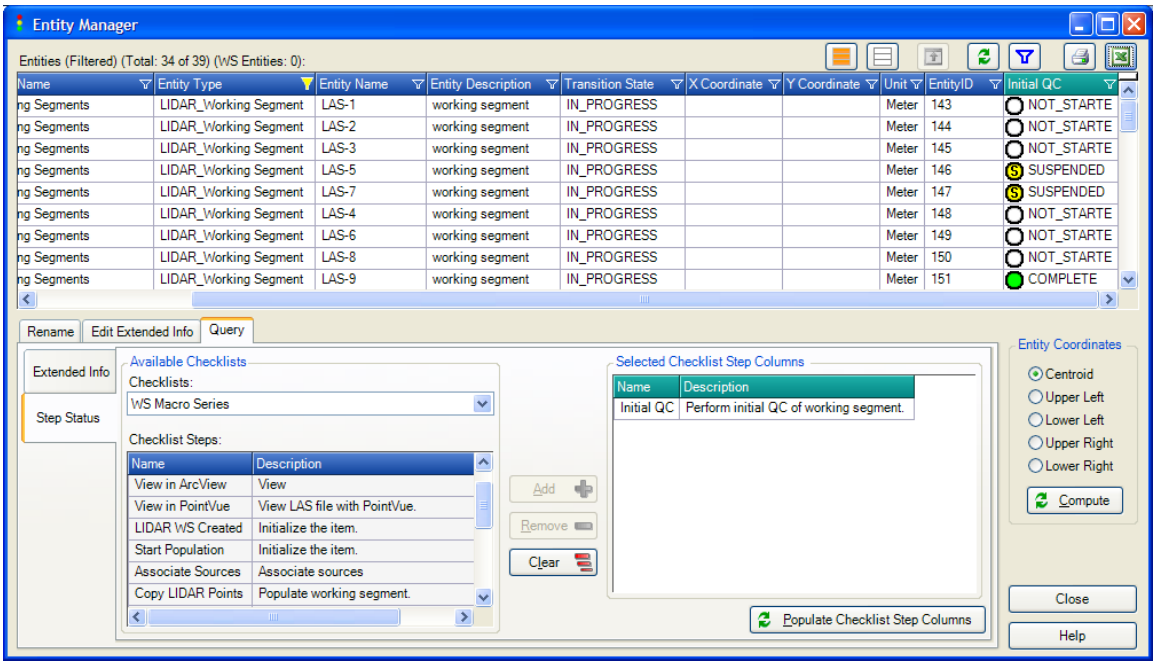


Figure 16-18 Query result for the Initial QC step of LIDAR Working Segments

16.10 Edit Extended Info

Edit Extended Info provides the capability to *Modify or Initialize* Extended Info fields on entities. Note that this is considered an advanced function that is typically only useful for customized Environments.

You cannot *Edit* Extended Info fields unless those fields have been designated as "Editable" within Environment Builder. Nearly all Extended Info fields of data provided in standard CuePacs has been set with Editable = FALSE.

If you wish to experiment with these functions, create a sample set of Extended Info and assign this info to a test entity using Environment Builder (GeoAnalysis type entities are useful for experimentation). You can then brings these entities into the Edit system of Entity Manager.

For our examples below, we created a simple entity with a few Extended Info fields that we designated as Editable.

16.10.1 Preparing to Edit Fields

Unlike the query system, you cannot edit an Extended Info field until the entity or entities are in the Working Set. Thus the best procedure is to either filter down the top pane of Entity Manager to the subset of entities that you wish to edit or directly select these target entities using tools in the Map View. Note in Figure 16-19 we have filtered our entities down to a type called "Macon Float" and have added these to the working set (using the procedure outlined at the end of the Query subsection discussed in the previous section).

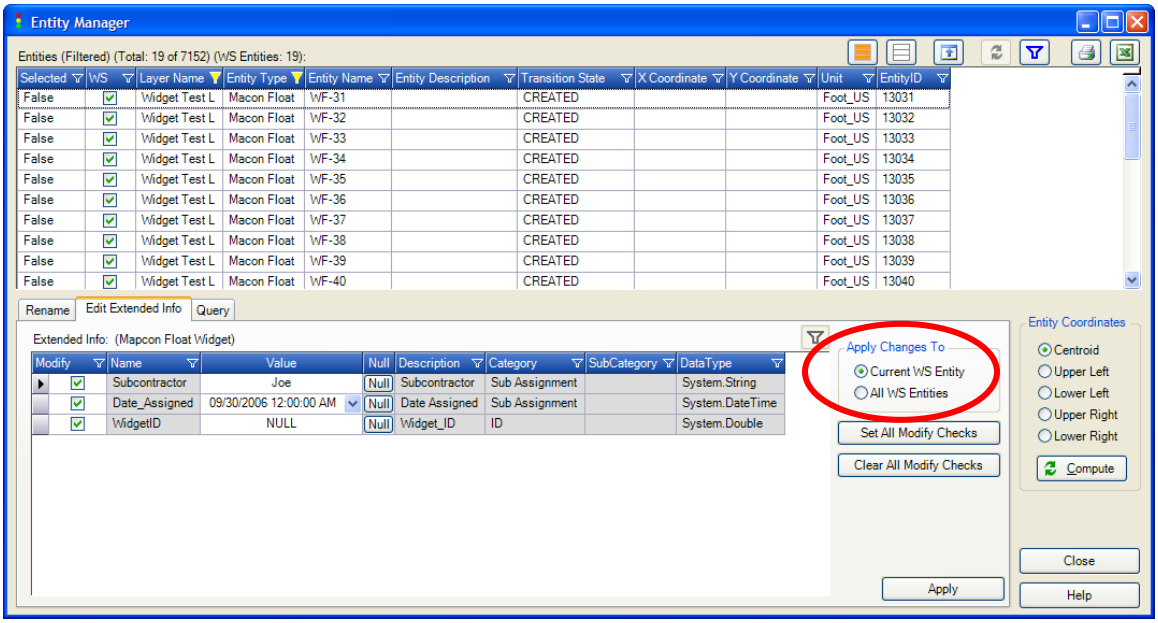


Figure 16-19 Preparing to edit Extended Info fields

The Extended Info section of the dialog then displays data as follows:

If the ***Apply Changes To:*** section of the dialog (circled in Figure 16-19) is set to *Current WS Entity*, the Extended Info section will display any editable Extended Info associated with the Current Working Set Entity. Note that if no fields display, this can mean either the current Working Set entity either has no Extended Info or it has no Extended Info set at Editable.

If the ***Apply Changes To:*** section of the dialog (circled in Figure 16-19) is set to *All WS Entities*, the Extended Info section will display any editable Extended Info that is common to all entities in the Working Set. Note that if no fields display, this can mean either the Working Set entities have no common Extended Info or it has no Extended Info set at Editable.

16.10.2 Modifying Fields

Once you have the desired fields displayed, you can edit the fields by setting the ***Modify*** checks in the Extended Info table of the field(s) you wish to edit and then keying in or selecting (depending on the field type) the new value(s). When you are satisfied with the edited values, press the ***Apply*** button in the lower right of the Entity Manager dialog (see Figure 16-20).

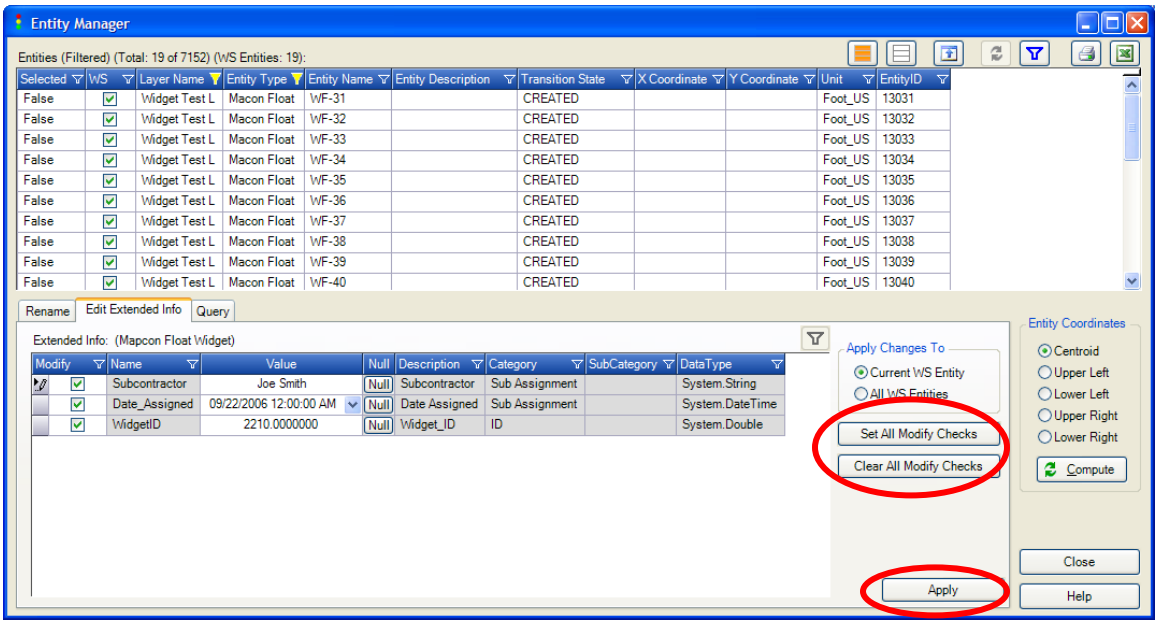


Figure 16-20 Editing Extended Info Fields

Note that you can quickly set or clear all of the Modify checks using the buttons in the ***Apply Changes To*** section of the dialog (circled in Figure 16-20).

> HINT: There is a new navigation mode provided for the Working Set (or any queue, for that matter) that automatically *Selects* the *Current* queue entry. To set this mode, set the *Select Current Entity* option under the drop-down tools of the Queue Navigation Mode tools in the main view toolbar (see Figure 16-21). Enabling this mode will cause the Current entity in the Working Set to become *Selected*. This will caused the current entity to

highlight in white in the Map View and also to become *Selected* in the upper pane of the Entity Manager dialog. An example of navigating in this mode is depicted in Figure 16-22.

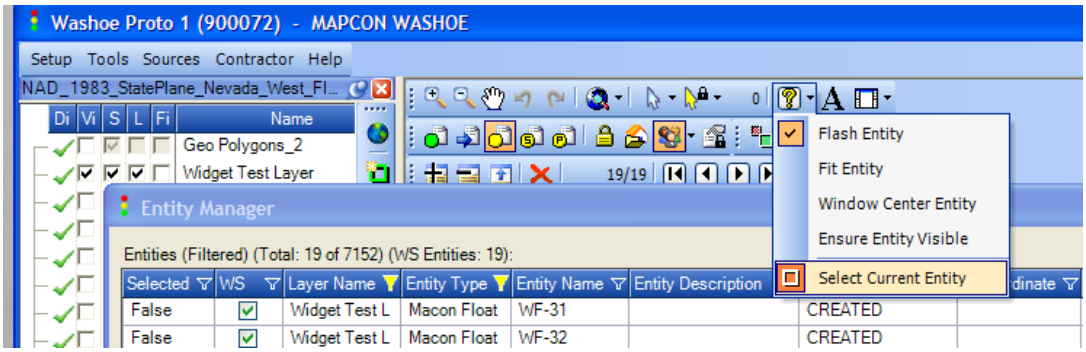


Figure 16-21 Setting the Select Current Entity queue navigation mode

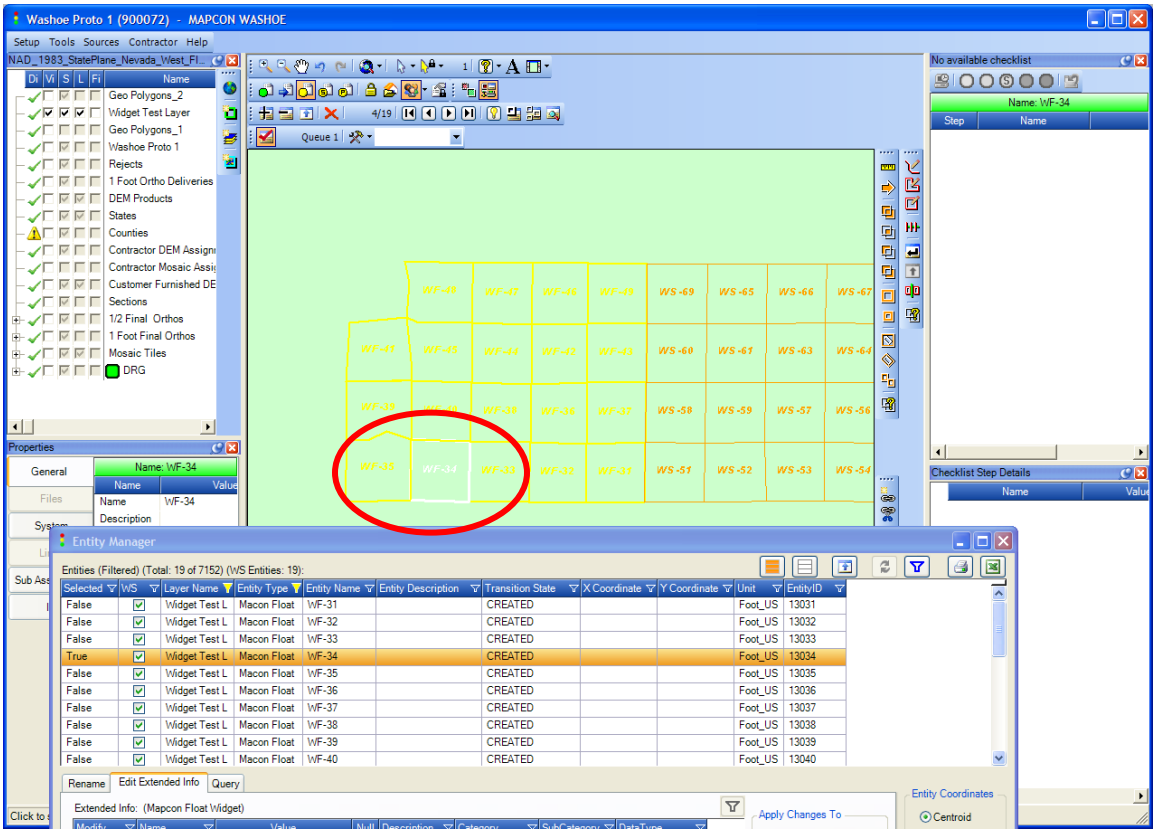


Figure 16-22 Synchronized "Current Entity" mode

NOTE: When an Extended Info field is initially created by GeoCue but prior to assignment of a value, it is set to a special value called DB_NULL (Database NULL). You can restore any field to this value in the Extended Info editor by setting the Edit check for that value and then pressing the NULL button to the right of the value field.

As you change Extended Info values via the editor, the new values will be reflected in real time in the Properties Pane for the entity (if the Extended Info field has been set to *visible*) in Environment Builder.

16.11 Entity Manager Summary

Entity Manager is very powerful tool that can be used in a wide variety of situations. We recommend that you set up a test project and spend some time in experimentation. By appropriately selecting Extended Info and using column filters, you can usually get to any subset of information desired.

17 Project Properties and Access Privileges

Project properties and access privileges are reviewed and modified from the Project Properties dialog or the Project Utilities dialog.

With the GeoCue Introductory Project open, select the Project Properties:

From the pull-down menu system, select *Project Properties* (Figure 17-1).

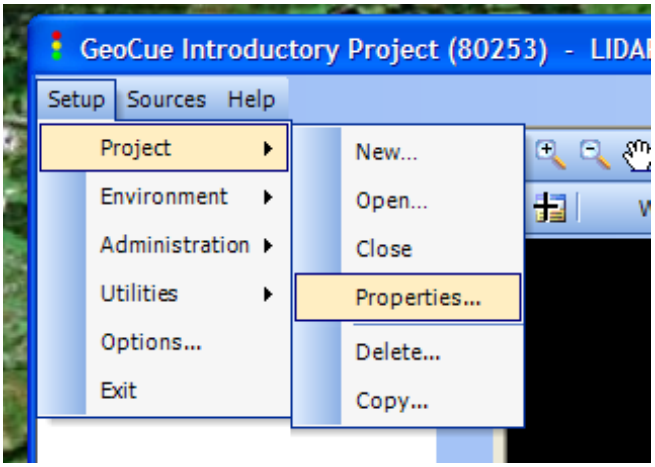


Figure 17-1 Selecting Project Properties

This will bring up a dialog box similar to the one displayed in Figure 17-2.

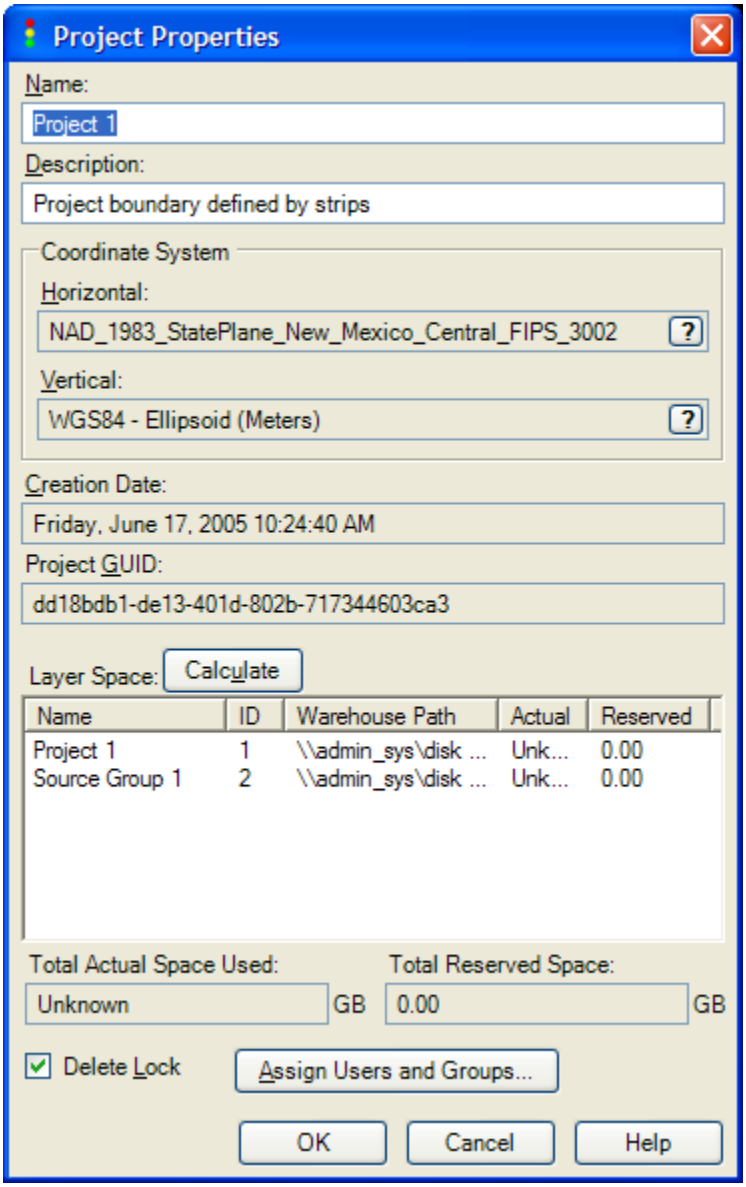


Figure 17-2 Project Properties dialog

The Project Properties provides a summary of information about the project, some of which can be edited. You can change the *Name* of the project and the project *Description* by editing these fields in the dialog. The *Coordinate System* field is a read-only property since, once a project is created, its coordinate system cannot be modified. The *Creation Date* shows when you create a

project. The *Project GUID* ("***G****lobally* ***U****nique* ***Id****entifier*") is an automatically generated 128 bit number that uniquely identifies a project for use in writing version 1.1 LAS files.

17.1 Project File Storage

The *Calculate* button causes GeoCue to compute the actual amount of disk storage space being used for storing GeoCue created file-based data (see Chapter 5 for details). We elected to use a calculate button rather than automatically computing this information because it can take time to compute for large projects.

The scrolling window provides information about the data storage associated with each layer in the project. The descriptions of these fields are contained in the following table:

Table 17-1 Properties Window Field descriptions

Field	***Description***	***Notes***
Name	Name of the GeoCue Layer	Corresponds to the layer name in the Legend
ID	The numeric ID of the layer	This will be the folder name under which this layer's files are stored.
Warehouse Path	The full UNC path to the top level folder of storage for this layer.	All file data for this layer is stored in this Warehouse. It is located at Warehouse\<*Project ID*>\<*Layer ID*>
Actual	Storage consumed by this layer in GB	Will say *Unknown* until the *Calculate* button is pressed.
Reserved	Space (in GB) reserved in the associated Warehouse for storage by this layer.	This value can be modified via the *Layer* ► *Property* dialog.

Listed near the bottom of the dialog are the total actual file space used by the project (it will indicate *Unknown* until you press the *Calculate* button) and the total space reserved by all of the project layers.

The Delete Lock option will prevent this project from being deleted via the *Setup* ►*Project* ►*Delete* dialog.

Finally, the *Assign Users and Groups…* button invokes the dialogs used for assigning access permissions to the project.

17.2 Assign Users and Groups

To add users or groups to the permission set of the project press the *Assign Users and Groups….* button on the Project Properties dialog. This will result in the display of the dialog of Figure 17-3.

> NOTE – The default access to a project is all users. Thus an empty assignment section on a project permissions dialog implies that *all* users will have access to the project. We may change this default behavior in the next release to the project *creator.*

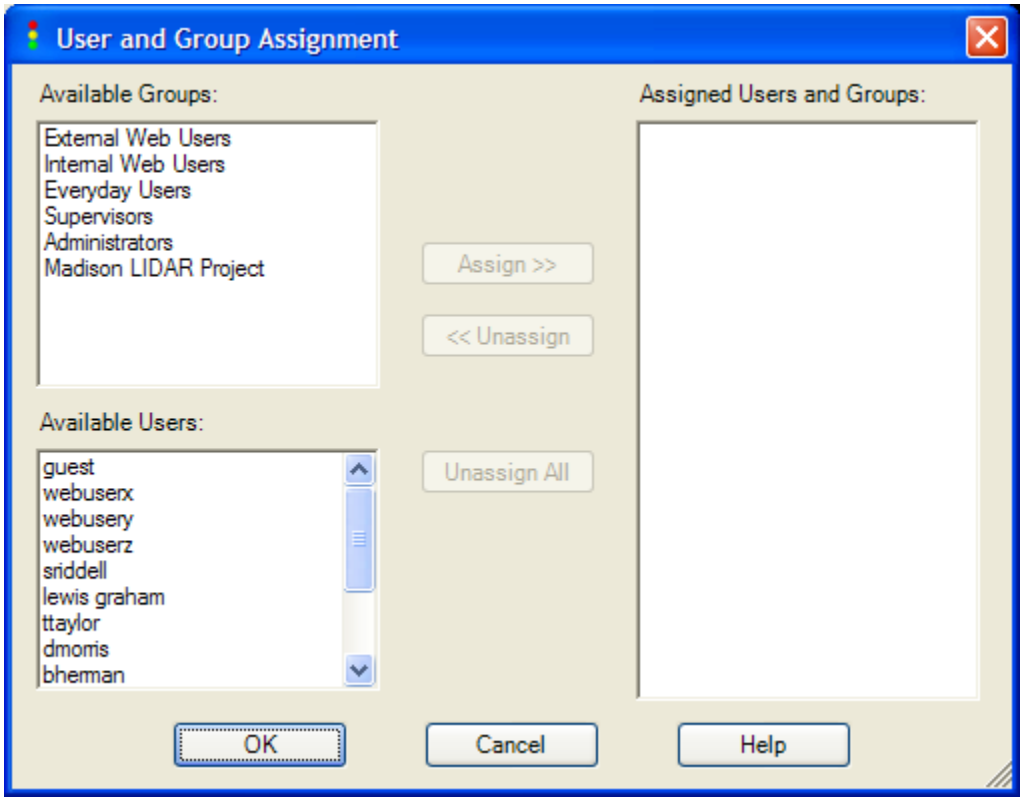


Figure 17-3 User and Group Assignment dialog

To add users or groups to the project, select the user or group name and press the Assign >> button. To remove a member, select the name in the *Assigned Users and Groups* section and press the << Unassign button.

If a user does not have access to a project (meaning that some users and or groups have been assigned access permission to the project but the particular user is not included in this set) then the project name simply will not appear in that user's *Open Project* dialog. This provides a convenient way to filter a particular user's open dialog to only those projects that a user needs to see.

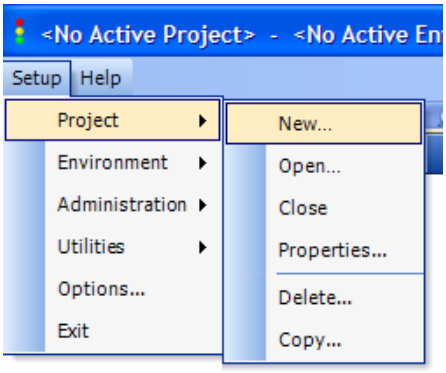
NOTE – Users who are added to the Administrator group will always have access to *all* projects. The Administrator group cannot be removed from the system. Thus, if for some reason you lose access to a project(s), simply add your login name to the Administrator group and then access the project.

18 The Madison Project

To perform the examples of the next several chapters, you will need to create a new project. This project is explored in great detail in the LIDAR 1 CuePac. However, several aspects are inherent to GeoCue without requiring the LIDAR 1 CuePac.

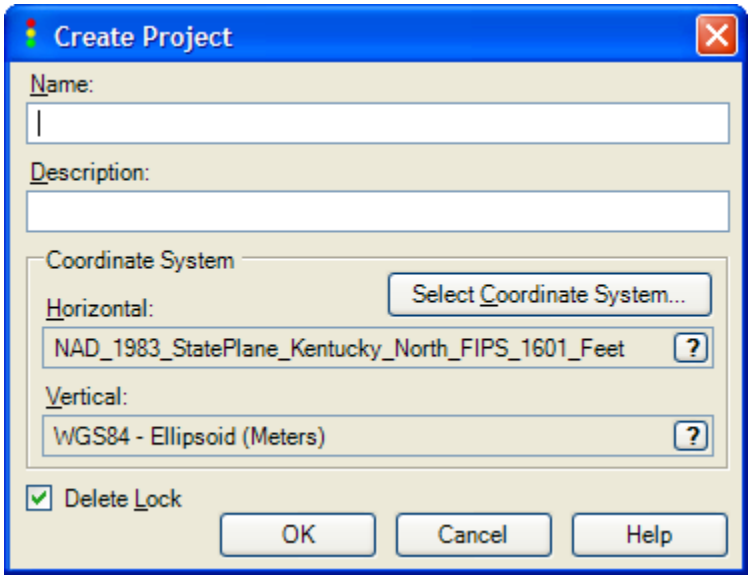
18.1 Creating a Project

Start up GeoCue and select the option to create a new project from the ***Setup*** menu:

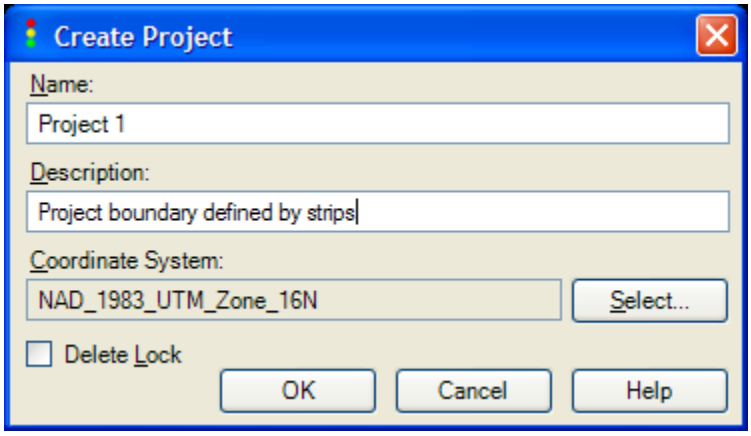


This will bring up the ***Create Project*** dialog[15]:

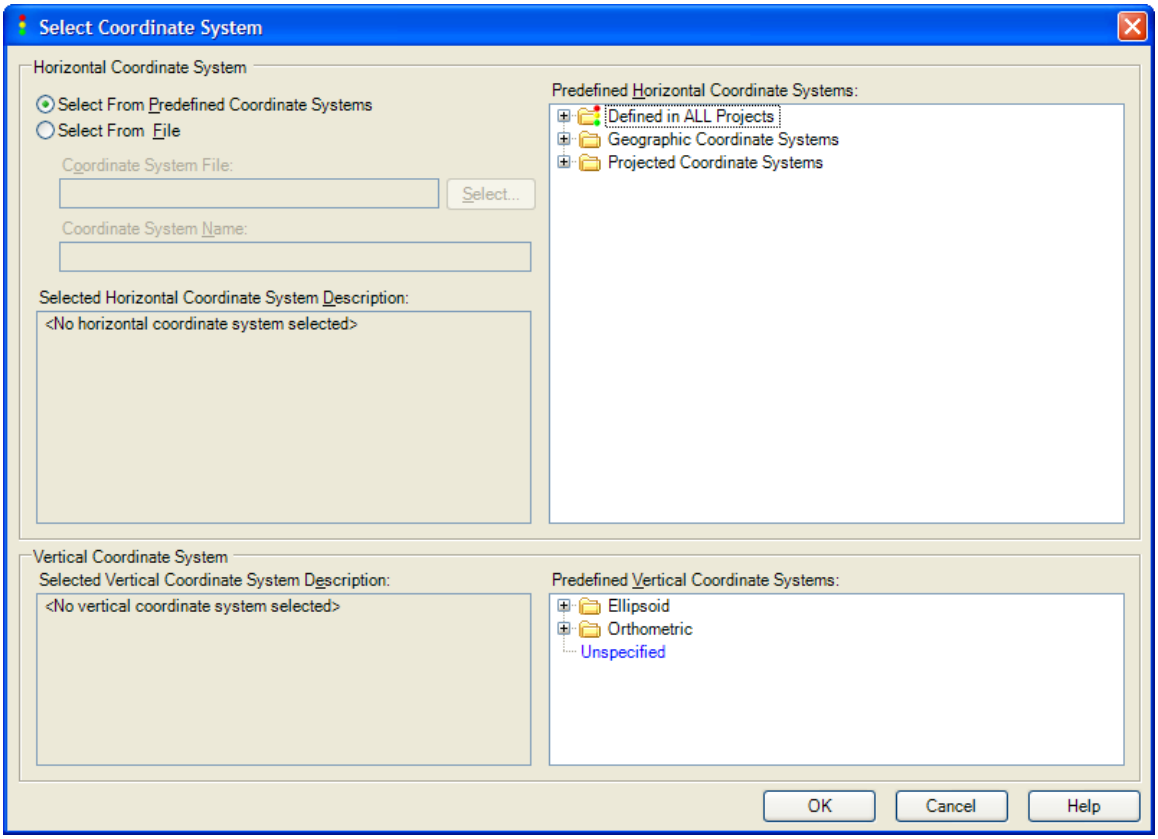
[15] The default coordinate system displayed will not necessarily be the same on your dialog.



Enter “Madison” as the project name (do not enter the quotation marks) and “Project boundary defined by strips” as the description.



Press the ***Select Coordinate System…*** button to bring up the coordinate system selection dialog:



18.1.1 Selecting the Horizontal System

Under the Horizontal Coordinate System, select the radio button for ***Select From Predefined Coordinate Systems*** (note – the Madison sample LIDAR data are in the NAD 1983, UTM, Zone 16N coordinate system).

Now browse to the selection for “NAD 1983 UTM Zone 16N” (Figure 18-1).

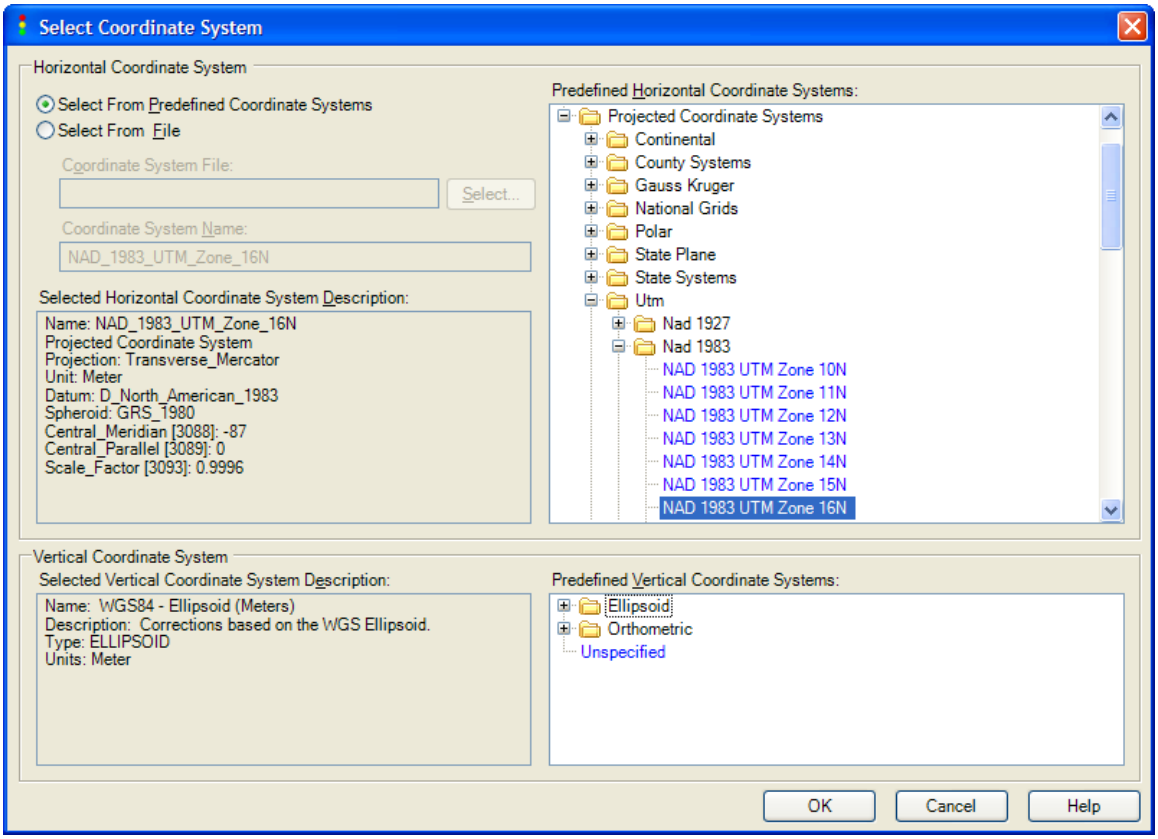


Figure 18-1 Browsing into the NAD83 UTM folder

18.1.2 Selecting the Vertical System

Under the Vertical Coordinate System section of the dialog, browse to the selection for WGS84 – Ellipsoid (Meters) – See Figure 18-2.

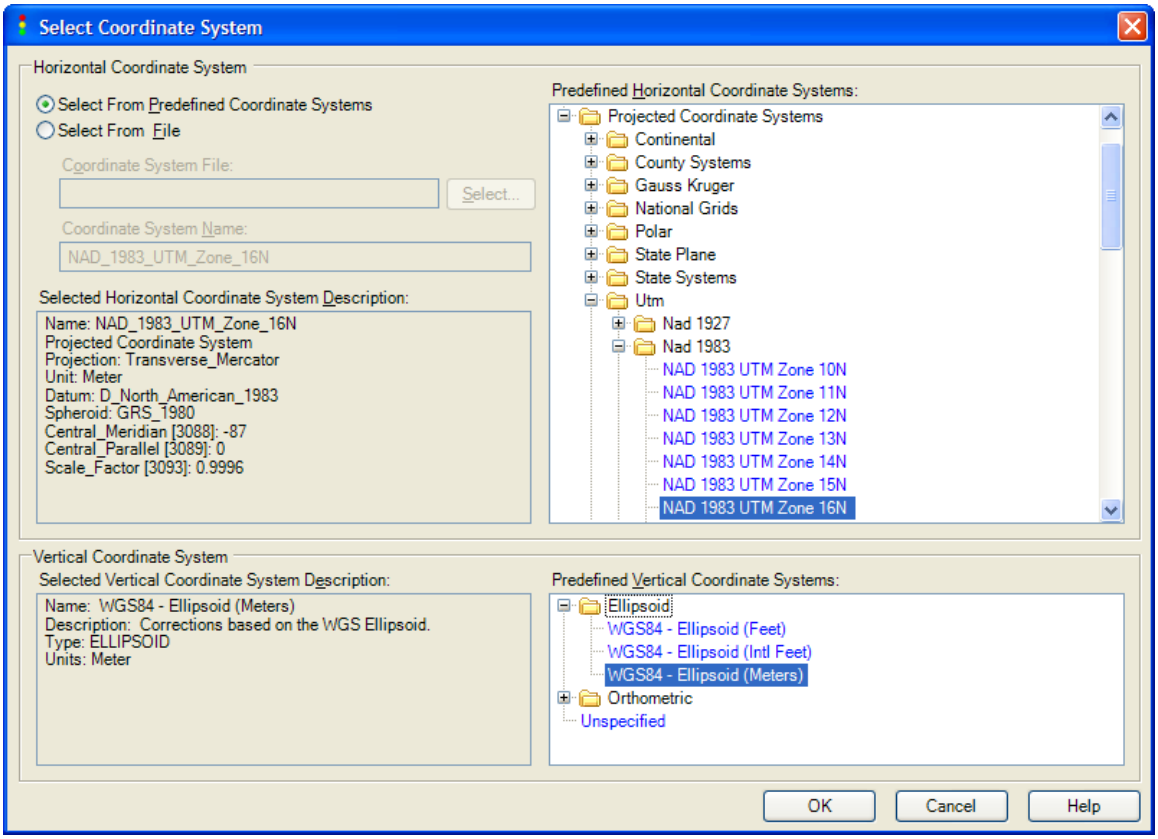


Figure 18-2 Selecting the Vertical System

After selecting the coordinate systems, press ***OK*** to dismiss the dialog. This will return you to the ***Create Project*** dialog with the selected coordinate systems**.**

18.1.3 Completing the Project Creation

This will result in the dialog being filled in as in Figure 18-3. Press the ***OK*** button to dismiss the ***Create Project*** dialog.

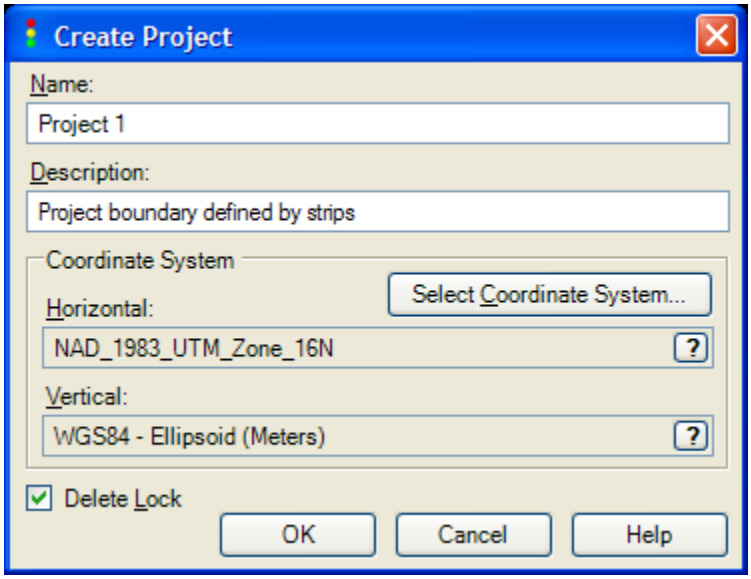
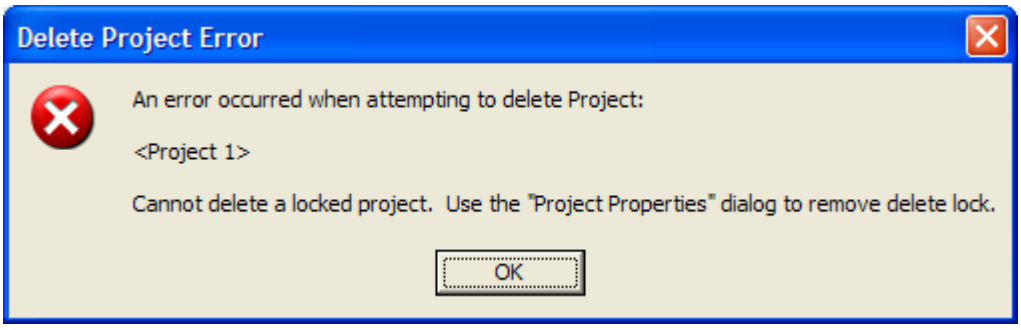


Figure 18-3 Completed Project dialog

NOTE – The Delete Lock option on the Create Project dialog allows you to lock the project with respect to deletion. Setting this option causes two events to occur:

- The LOCK column will indicate YES in the Project Open dialog
- Attempting to delete a project that is locked will result in the following error message:



You will notice that a layer has been added to the project with the name "Madison." At this point we have created a new project and assigned the project coordinate system (we chose this particular coordinate system because the LIDAR data we supplied with the project is in this projection). Note that you can see the coordinate system of a layer by scrolling the layer legend.

> Note – The Project Coordinate system will be the default coordinate system that is selected each time you ***Create*** a new layer. You can always override this default and select the coordinate system of your choosing when you create new layers.
>
> GeoCue has virtually no restrictions on mixing multiple coordinate systems in the same project. It is probably most useful to choose the Project coordinate system as the coordinate system associated with the bulk of your project data.

18.2 Setting the Environment

Ensure that your current ***Environment*** is set to ***LIDAR Project Setup and Processing*.** Recall that the current ***Environment*** is displayed in the title bar of GeoCue to the right of the project name. Recall that you can select the current ***Environment*** through the dropdown menus ***Setup*** ► ***Environment.***

> NOTE: GeoCue does not require you to have a CuePac license in order to open an *Environment* associated with that license. Thus you can select a LIDAR environment even if you do not have access to a LIDAR x CuePac license. This feature allows anyone to view project status with only a GeoCue Client license.

19 Control Points

GeoCue has the ability to import files of control points. This version of GeoCue supports the import of control point files in the following formats:

- Generic ASCII
- DAT/EM
- Z/I Imaging

A description of the points is contained in the following table:

Point Type	*ASCII*	*DAT/EM*	*Z/I Imaging*	*Symbol*
Full Control	HV	HV	/pc=XYZ /pt=CONTROL	=
Planimetric Control	H	H	/pc=XY /pt=CONTROL	N
Vertical Control	V	V	/pc=Z /pt=CONTROL	V
Full Check	CP	CP	/pc=XYZ /pt=CHECK	*
Planimetric Check	PCP	Not Supported	/pc=XY /pt=CHECK	Q
Vertical Check	VCP	Not Supported	/pc=Z /pt= CHECK	M
Tie / Pass	PP	PP	Not Supported	P

19.1 The Generic ASCII Format

The ASCII format allows you to input general control points. The format is a Comma Separated File (CSV). Thus the separator between fields can be white space, a tab or a comma. The fields are specified in the following table:

Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Field 7	Field 8
Name	Symbol	X	Y	Z	Sigma X	Sigma Y	Sigma Z

The name must be a continuous string with no blanks or special characters. The Symbol is defined in the table of the previous section. The coordinates of the X and Y value must be in the same system. GeoCue simply reads in the remaining fields and stores them in the Control Point Entity.

19.2 Loading a Control Point File

Under *Setup* ►*Utilities* invoke the Import Control… command. You will be presented with the dialog shown in Figure 19-1. We have included a sample file that is in ASCII format so ensure the ASCII radio button is checked.

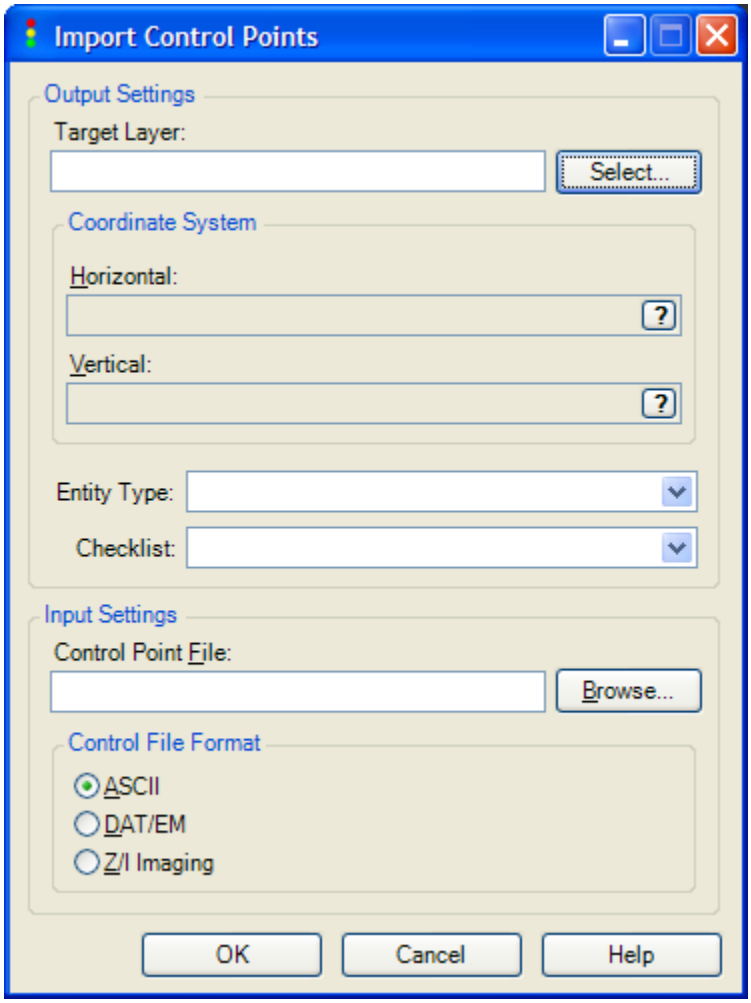


Figure 19-1 The Import Control dialog

Control points are placed on layers of type **Photogrammetric_POINT**. This point layer must be in the coordinate system of the control points (recall that all points in a file must be in the same coordinate system). The sample control point file provided is in geocentric WGS84 longitude, latitude. Navigate through the Select Layer… and create a new layer called "Control Points" and ensure that it is in GCS_WGS_1984 coordinates (Horizontal and Vertical). Figure 19-2 depicts the Import Control Points dialog just prior to selecting the file containing the points. Note that the dialog includes drop-down selections for Entity Type and Checklist. You will only have default selections in these drop-downs unless you have extended GeoCue via Environment Builder.

The final step is to browse for the control point file. The sample file is in the Sample data directory in the folder called “Control Points”. The file is named “Madison Test Points.dat” (you will need to ensure that the “Files of Type” filter is set to “all files (*.*)). The completed dialog is shown in Figure 19-3. Press *OK* to initiate the import and dismiss the dialog.

You should now see the control points in the Map View (they will be easier to see if you turn visibility of the LIDAR sources off). Control points are selected just like any other entity in GeoCue. Select one of the control points and examine its properties pane. You will note that the coordinates are stored on the main tab of the properties pane and the sigma values are stored on the Extended Info tab.

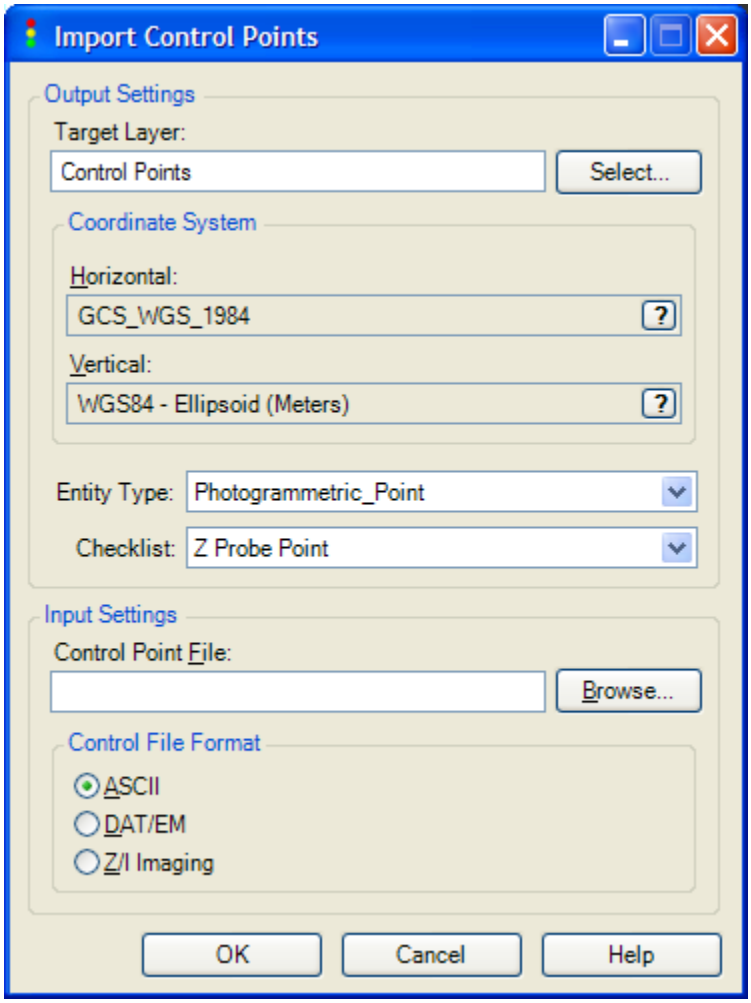


Figure 19-2 Selecting the WGS84 coordinate system

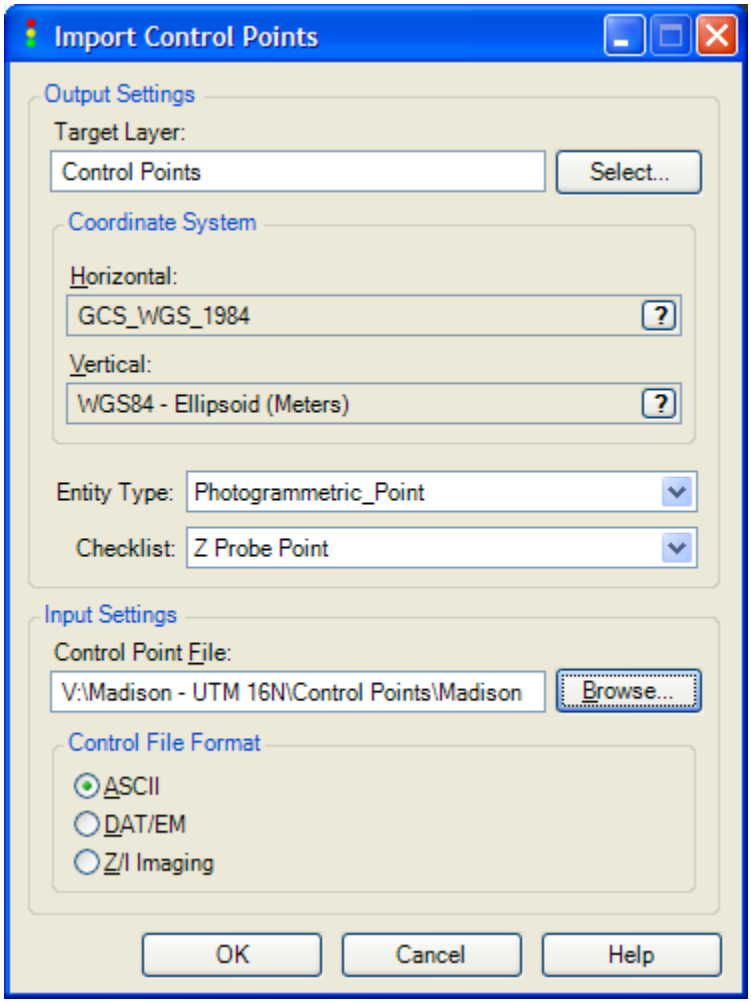


Figure 19-3 The completed Import Control dialog

19.3 Navigating through Control Points

You can easily visit all of your control points by adding them to either the Working Set or to a named queue.

Create a named queue called “Control Points” by:

Right-click in the tool bar area of GeoCue and check *Queue 1.* This is depicted in Figure 19-4. Click the drop-down tool in the Queue 1 toolbar and pick *New Queue* (see Figure 19-5).

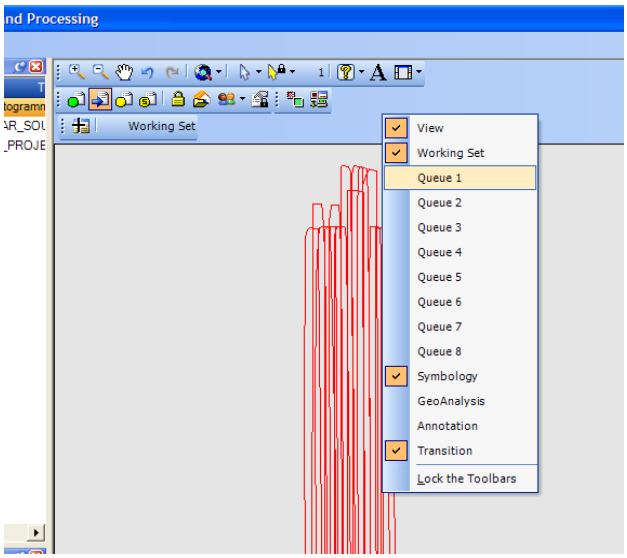


Figure 19-4 Turning on a Queue

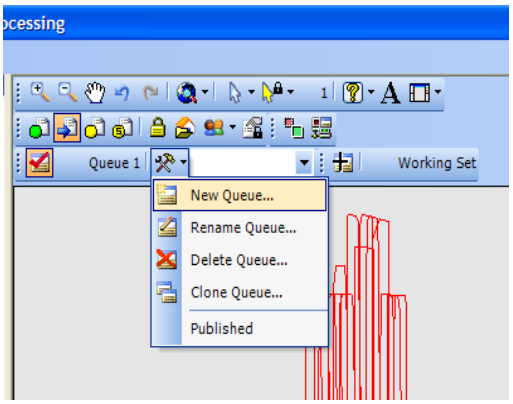


Figure 19-5 Selecting "New Queue"

This action will result in the display of the *Create New Queue* dialog (Figure 19-6). Name the queue "Control Points". If you select the *Publish New Queue* option, the queue named "Control

Points" will appear in the queue dropdown list of all users and they will be able to navigate the queue.

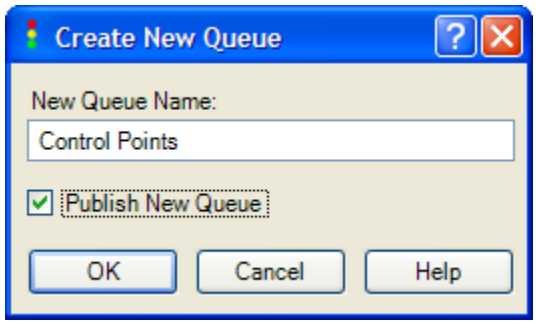


Figure 19-6 Create New Queue dialog

Add the control points to the Control Point queue by selecting them and pressing the "+" button on the Control Point queue toolbar (manipulating a named queue is the same as manipulating the Working Set Queue except that you cannot delete[16] items from a named queue). Recall that you can easily select all items on a layer by selecting the layer and then the *Select All Entities* tool on the legend toolbar (or the legend right-click menu).

Set the navigate mode for queues to *Window Center* (recall that this setting is the "?" icon dropdown tool on the *View* toolbar. Now set the display to a zoom level that fits a small part of the view. As you press the forward and back navigation buttons on the Control Points queue, note that the Map View centers on the point. Also notice that the properties pane reflects the metadata of the *current* queue member.

We will visit the control points again in the raster chapter to indicate the automatic changing of coordinate system feature of GeoCue.

[16] Remember that removing items from a queue (an operation you can perform on any queue that you own) is markedly different from deleting items referenced by a queue.

19.4 Control Point Summary

Unlike *reference files,* control points are imported into GeoCue. This means that GeoCue is taking a snapshot of the file rather than remaining attached. Thus if you modify a control point file after importing into GeoCue, the changes will not be reflected unless you import the file again. You should be aware that we have not tried to add logic to GeoCue to prevent duplicate control points (although we can if you feel this is important). Therefore we suggest having a one-to-one relationship between control point files and layers if you will be updating the values. Updating then is simply a matter of selecting all entities on the layer to be updated, adding them to the Working Set, deleting them and then re-importing the file to the same layer. If you are not concerned with updating, then you can import all files that have control points in the same projection/datum to a single layer.

Note that you can have multiple control point layers and those layers can be any mix of projections/datums. GeoCue reprojects all of the layers to the Map View coordinate system on-the-fly. You can ascertain the current Map View coordinate system by hovering the mouse pointer over the coordinate readout area at the bottom of the GeoCue frame.

NOTE – The Currently displayed coordinates in the coordinate readout are not necessarily in the coordinate system that you established for the project. The coordinate readout is always in the coordinate system of the currently displayed raster(s). This is discussed in more detail in the raster chapter of this document.

NOTE – We have just started on the inclusion of Control Points (and other point graphic capabilities) in GeoCue. You can expect to see rapid development of new features in this area to include:

- Interactive placement
- Changing symbology and attributes of points
- Inclusion of sigma symbology that scales with sigma
- Other features as we hear from you.

20 Reference Rasters

In this section we will add some reference raster to the project and examine clipping rasters to the size needed for a proper display.

> "Reference" data in GeoCue is treated differently from project created data in two major ways:
>
> - Reference data is never Write locked since the assumption is that a reference source should not be modified. This means that multiple projects can safely reference these data simultaneously.
> - The data referenced by a Reference type entity is never deleted when the referring entity or containing project is deleted.

A number of reference rasters have been included in the Madison data set. These reference rasters are described in the following table.

Directory (relative to top level data)	***File name(s) – Excluding overview and tiff world files***	***Description***
DRG - NAD27-UTM-N16	Madison County Composite.tif	A composite of 12 USGS DRGs of the Madison County project area in NAD27 – UTM Zone 16N
DRG - NAD83-UTM-N16-Uncropped	NAD83-Greenbrier-Uncropped.TIF NAD83-Madison-Uncropped.TIF	Two Individual USGS DRGs of the SE Madison County project area in NAD83, UTM Zone 16N with collars intact. These were created by reprojecting NAD27 DRGs

Directory (relative to top level data)	*File name(s) – Excluding overview and tiff world files*	*Description*
DRG - NAD83-UTM-N16	Madison County Composite.tif	A composite of 12 USGS DRGs of the Madison County project area in NAD83 – UTM Zone 16N
DRG - NAD83-UTM-N16	Ardmore.tif Capshaw.tif Farley.tif Fisk.tif Greenbrier.tif Huntsville.tif Jeff.tif Madison.tif Mason.tif Meridianville.tif Toney.tif Triana.tif	Individual USGS DRGs of the Madison County project area in NAD83, UTM Zone 16N with collars removed. These were created by removing the collars and reprojecting NAD27 DRGs
NaturalVue[17]	NaturalVue_NEAL.tif and a collection of overview and TIFF World files.	A clip of NaturalVue imagery that covers the project area (North-East Alabama). This image is in NAD83, UTM, Zone 16N

[17] *NaturalVue* is a trademark of Earth Satellite Corporation. This image was provided for evaluation purposes by Earth Satellite Corporation.

20.1 Raster that requires cropping

You will sometimes want to crop a raster either to remove marginalia or simply to limit the extent of a large raster to the area of interest. In this section we will attach two USGS Digitized Raster Graphics (DRG) files that require cropping (removal of the marginalia 'collar') to the project.

NOTE – Many commands for adding and removing project information are accessed through the *Legend.* There are two ways to access these commands; via the legend right-click menu or by creating a legend toolbar. To create a legend toolbar, perform the following steps:

- ***Right-click*** anywhere in the *Legend* (the pane where the layer information is displayed)
- Grab the right-click menu and drag it to the map view (grab it by the dots that appear at the top of the menu)
- The menu will now convert to a tool bar. You can dock the toolbar in the Legend pane.
- To remove the toolbar, just click the "x" in the upper right corner.

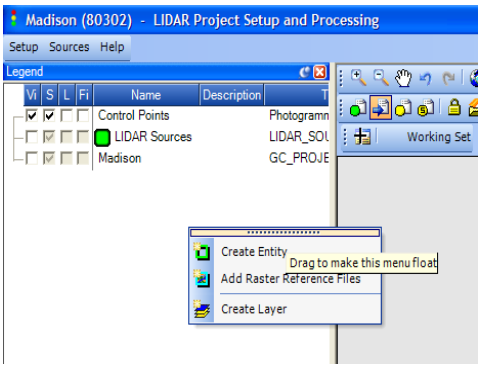


Figure 20-1 Grabbing the Right-click menu

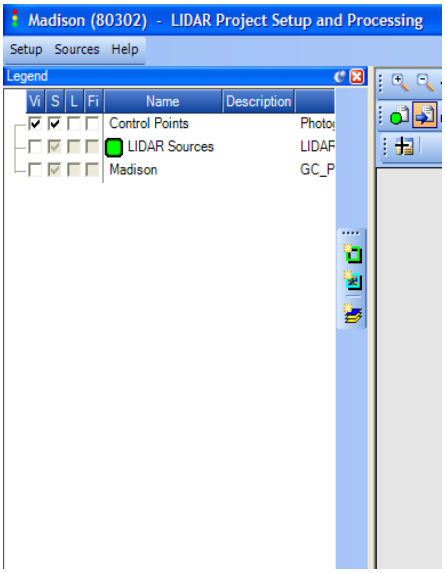


Figure 20-2 Toolbar docked on right side of legend pane

20.1.1 Loading the Raster

Select the *Import Raster* command by either right-clicking in the Layer Legend or by selecting the toolbar button from the legend toolbar (see the inset box above for instructions on creating the legend toolbar). You will be presented with the dialog of Figure 20-3.

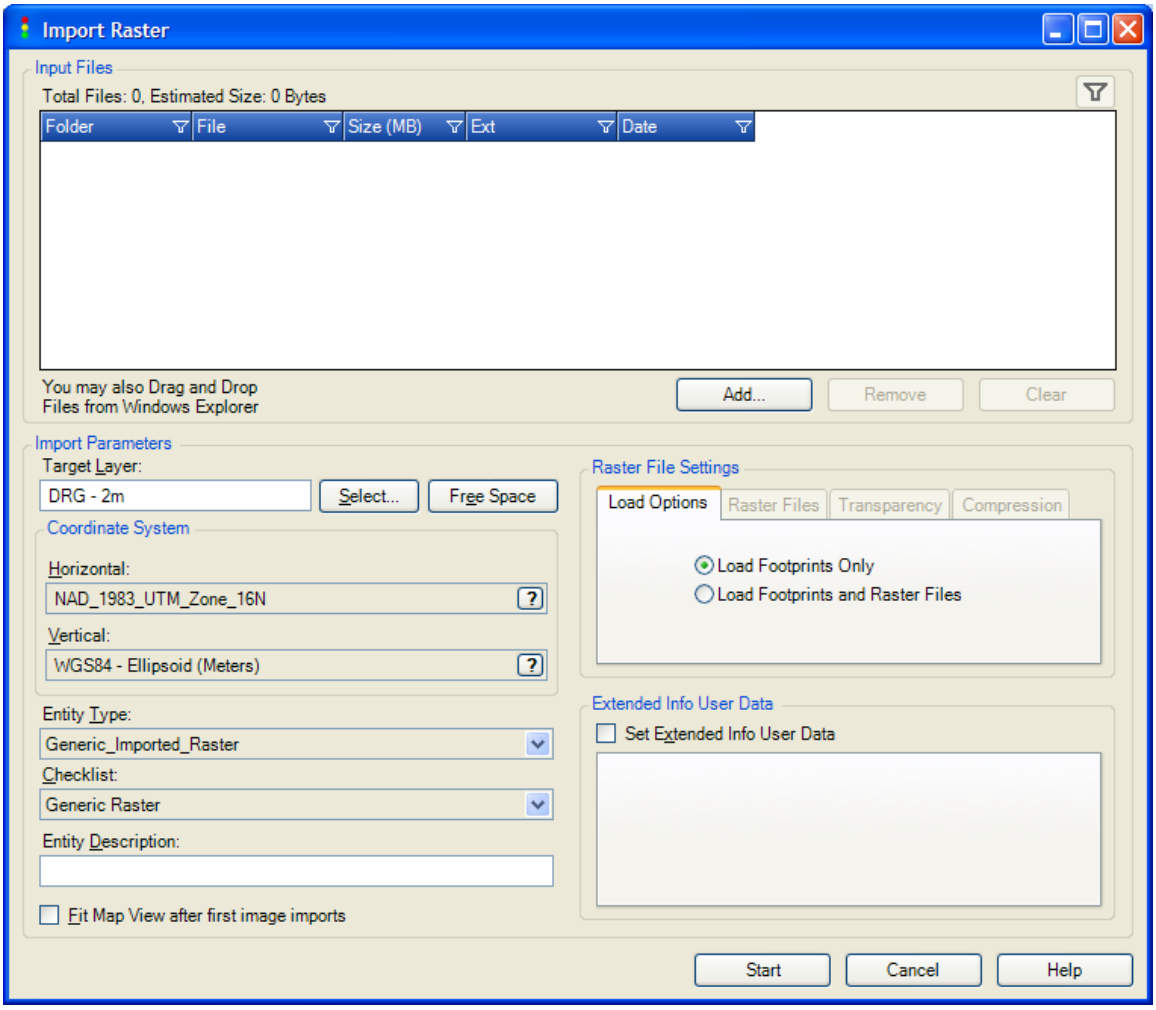


Figure 20-3 Add Raster Reference Files dialog

First choose the ***Add*** … button from the dialog. Browse to the directory where you have placed the GeoCue 1.2 Sample Data and select the directory containing the NAD 83 DRG data with collars (this directory was named "DRG - NAD83-UTM-N16-Uncropped" on the Sample DVD). Select both files in the directory (Madison… and Greenbrier…).

NOTE – Previous versions of GeoCue required that you create external overviews to enhance display performance. This is no longer necessary in that GeoCue now produces these automatically.

Next select a layer on which to place the raster. Since we have not yet created a layer, you will need to browse to the ***Create Layer…*** dialog via the ***Select…*** button. A Raster Reference must be placed on a layer of type **Generic_RASTER** and thus the layer selection of the dialog is blank. Create a layer of type **Generic_RASTER** by navigating through the *Select…* button on the dialog. This reference layer must have a coordinate system of NAD_1983_UTM_Zone_16N Name the layer "Uncropped DRG".

NOTE – Rasters are two dimensional entities and hence the Vertical system in not material. You can set this to *unspecified* if you desire.

Note that the Import Raster dialog includes drop-down selectors for the Entity Type and Checklist. This is available for users who extend GeoCue via Environment Builder. If your installation of GeoCue has not been extended, you will not be able to select in these fields.

You can optionally add a description for the raster data. Note that if you are importing more than one entity, the same description will be applied to all.

The Raster File Settings section of the dialog allows you to set various options for the method that will be employed in importing the raster as well as provides an option for loading only footprints (you can load the associated rasters at a later time via the checklist that will be attached to the imported footprints.

Select the radio button labeled *Load Footprints and Raster Files*. This will cause a complete load to occur after you press the **Start** button. Your dialog should appear as Figure 20-4 at this point.

Next select the Raster Files tab of the Raster Files Settings section of the dialog. This will display the options depicted in Figure 20-5. The available options and their affects are listed in Table 20-1.

Table 20-1 Raster Files options

Option	***Action***
Reference External Files	Causes GeoCue to reference the raster files at their current location. Use this option if the files are in an optimal display format and you will not need to disconnect the source drive or recover the space. Note that if you choose this option, external overviews will **not** be produced for the raster and hence display performance could suffer.
Copy Files to Warehouse	This option copies the raster files to the GeoCue Warehouse associated with the selected layer. The files are left in their original format. This option should be used when you need to recover (or disconnect the source drive) the source space.
Import Files to Warehouse	This option copies the raster files to the GeoCue Warehouse associated with the raster layer and creates an optimal format for performance within GeoCue. Choose this option whenever possible since it will provide the best response. Choose the Create Internal Overviews sub-option if the imported rasters will be used within a tool that uses internal overviews.

Option	***Action***
Include Metadata File	This option will cause GeoCue to attach a file (located in the same directory as the images) having the base name of the image but an extension of XML to the Raster Entity created during import. This option allows you to associated an auxiliary file such as a Federal Geographic Data Committee (FGDC) metadata file with the image. You can ignore this option if you do not understand this statement!

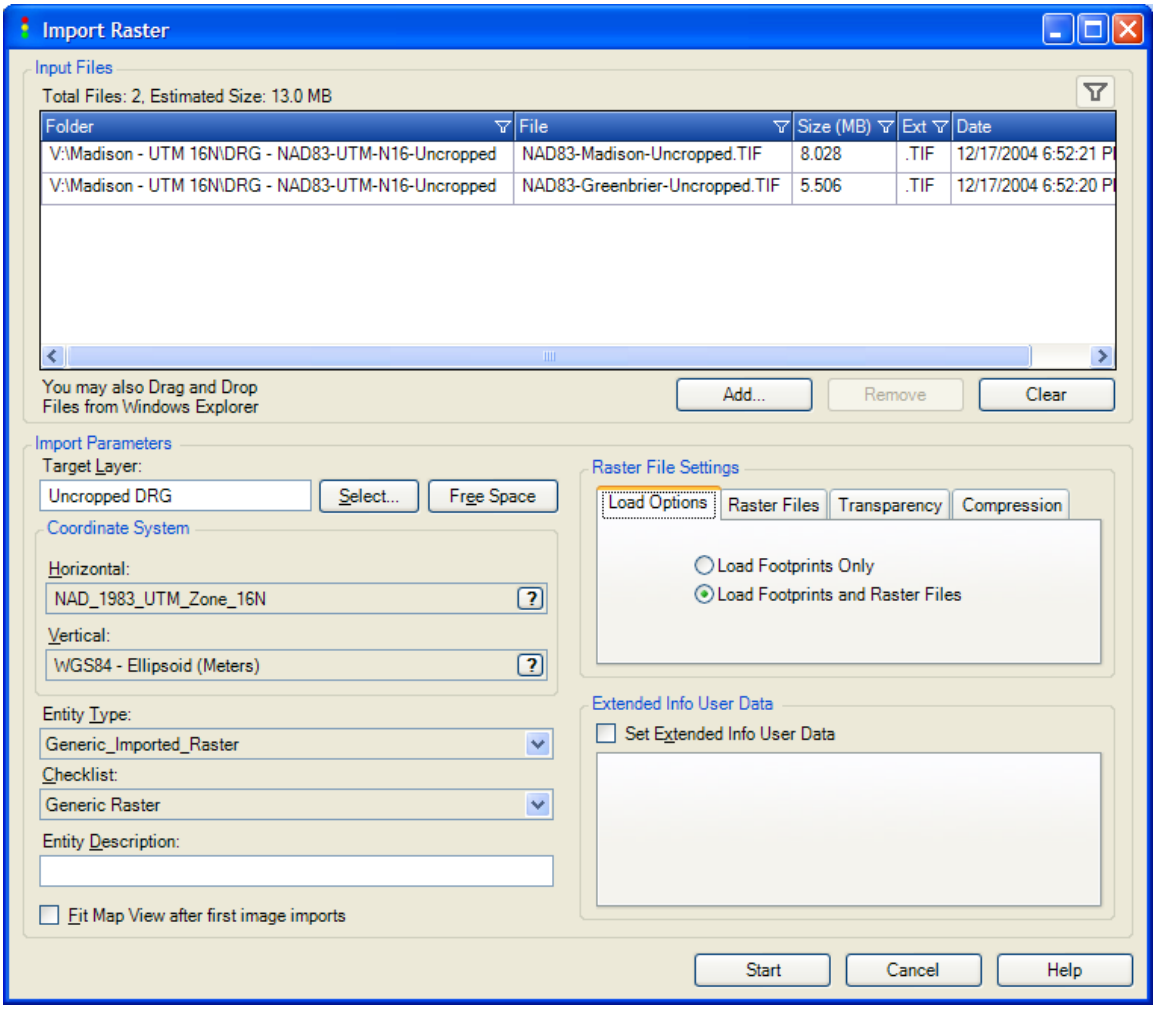


Figure 20-4 Import Raster prior to setting raster options

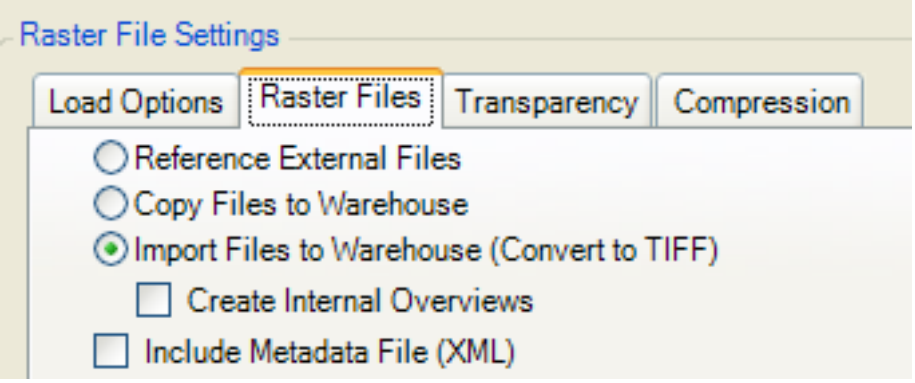


Figure 20-5 Raster Files tab

The ***Transparency*** tab allows you to set an RGB value that will be treated as transparent for all images in the import. This is very useful for images such as orthos where a particular color value (usually zero) has been used to mark invalid image areas.

The ***Compression*** tab allows you to apply JPEG compression to images that are being imported and converted. This tab is disabled for all other import choices.

For this example, chose the options depicted in Figure 20-5 and press the ***Start*** button. The raster import will begin. You should see two new footprints in your map view. These footprints represent the outline of the DRGs.

Notice that the layer name in the layer legend[18] has a "+" sign to the left (see Figure 20-6). Click the "+" on the main layer and sub-layers (as they expand) to fully expand the legend entry. Your legend should resemble Figure 20-7 after you have it expanded.

[18] Notice that we have set up our legend with the legend toolbar docked at the right.

The topmost entry of the Raster layer controls the **V**isibility, **S**electability and **L**abels for all sub-layers. Thus these function the same as any layer in GeoCue. We refer to this as the ***Primary*** layer.

Immediately under the topmost layer are two intermediate entries; one for footprints of the rasters and the other for the raster displays themselves. We refer to this as the ***Intermediate*** layer. This intermediate layer provides separate control over the display of the raster footprints and the actual raster data. Notice that if you toggle the **V**isibility option on the footprint layer that the footprints turn off and on. Toggling the **V**isibility option on the Raster entry turns on/off *all* raster entities that have their visibility toggle checked. By default, the Footprint **V**isibility toggle is on and the Raster **V**isibility is off when a new raster layer is created and when a project is first loaded. We default to this combination to improve load performance.

The final sub-layer provides individual control of the display of each raster file that you have associated with the top-most layer. This collection is referred to as the ***Raster Entities***. By default, the rasters are switched on at this level but off at the Intermediate level when a Raster Layer is first added to a project and each time the project is opened. This improves the load performance while allowing you to turn on the entire raster display by manipulating the single toggle at the Intermediate level. Note that the entities at this level of a composite raster layer behave similar to Entities rather than layers. You will note that if you select a raster entity at this level, the ***Delete Layer*** tool disappears from the legend toolbar. To delete at this level, add the entity(ies) to the Working Set and delete using the Working Set delete tool.

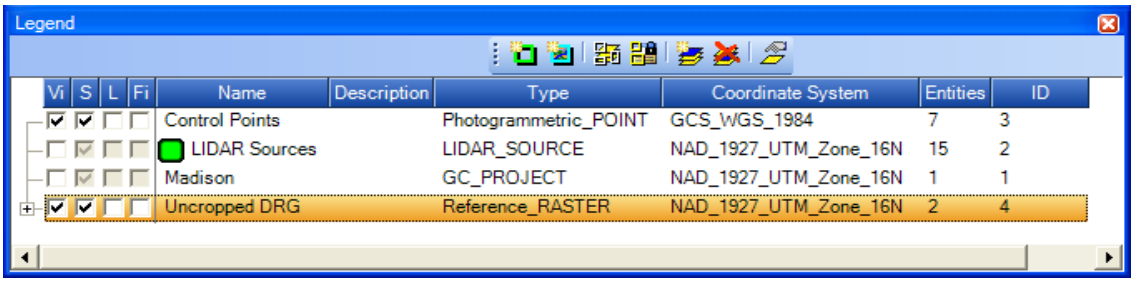


Figure 20-6 Legend after adding Raster Layer

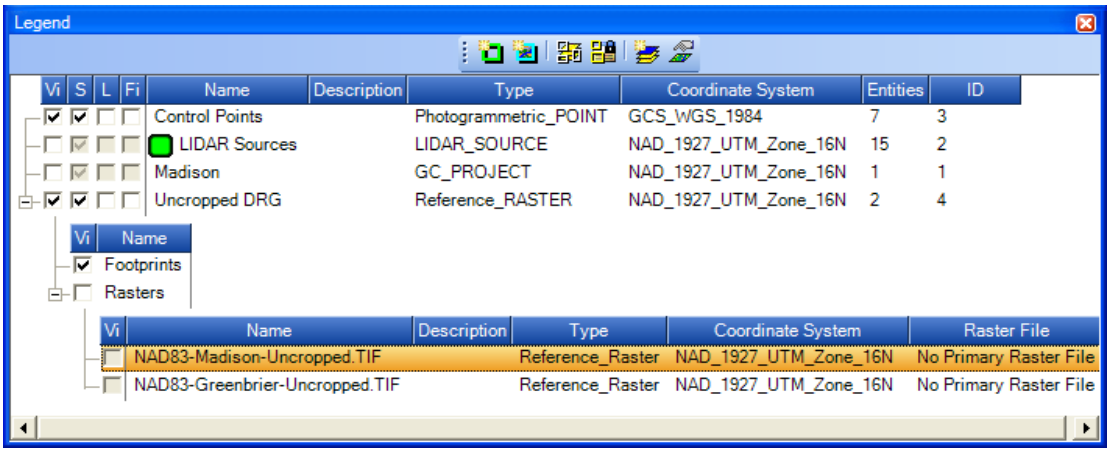


Figure 20-7 Legend with Raster layer fully expanded

20.1.2 Manipulating Rasters, Legend Display

Raster Entities are *Selected* by selecting the footprint of the entity or by selecting the raster entity in the legend (the lowest tier of a raster Composite layer) and choosing the Select Entities tool from the legend toolbar. Thus you must have the **S**electability option toggled at the topmost layer of the raster collection (the *primary* layer) and the Footprints set to **V**isible on the intermediate layer.

You can trace a raster back to the legend by *selecting* the raster footprint(s), right-clicking in the Map View and choosing *Select in Legend*. This will cause the rasters whose footprints are currently *Selected* to become selected in the legend (the legend will automatically expand and scroll to display the top-most selected raster). This tool is convenient if you want to turn a raster on or off in the legend but are not sure which entry corresponds to which raster.

You can delete a raster by adding it to the Working Set Queue (Working Set or WSQ) and selecting the delete button on the WSQ toolbar.

CAUTION – Pressing the delete icon on the Working Set Queue toolbar deletes ALL items in the Working Set Queue, not just the current item. You cannot undo a WSQ delete operation!!

20.1.3 Setting a Clipping Region

If you zoom in on a region between the two raster files that you have just added to the project, you will notice a lack of continuity due to the inclusion of marginalia in the data (see Figure 20-8). GeoCue provides a mechanism to indicate a rectangular area within a raster for display.

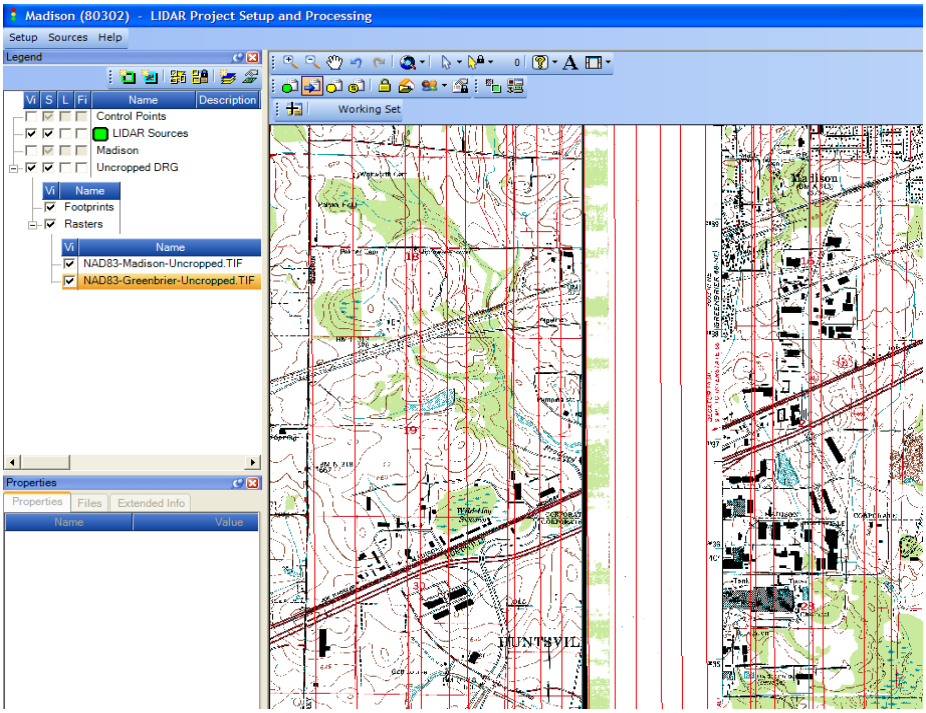


Figure 20-8 Break in raster due to marginalia

Turn off the display of all entities except the left raster ("Greenbrier"). Fit the left raster to the display (you can do this by selecting the left raster and click *Fit Selected Entities* on the view toolbar.

Select the left raster in the Legend and click *Raster Properties* in the Legend toolbar (or right-click the raster entry in the legend and select *Raster Properties* from the right-click menu). You will see the dialog of Figure 20-9. Note that you can change the Name of the raster as well as the description. Recall that the name of an entity is the value that is displayed for the entity when you enable **L**abels in the legend. The Layer and Coordinate System are displayed for reference – these values cannot be changed.

HINT – You can quickly locate the corresponding entry in the legend for a raster by selecting the raster in the map view (remember, you have to select a raster by selecting its footprint) and then right-clicking. One of the right-click menu options will be *Select in Legend*. Left-click this option and the corresponding entry in the Legend will be selected (you may need to scroll the legend or expand the corresponding raster entry to see the legend entry).

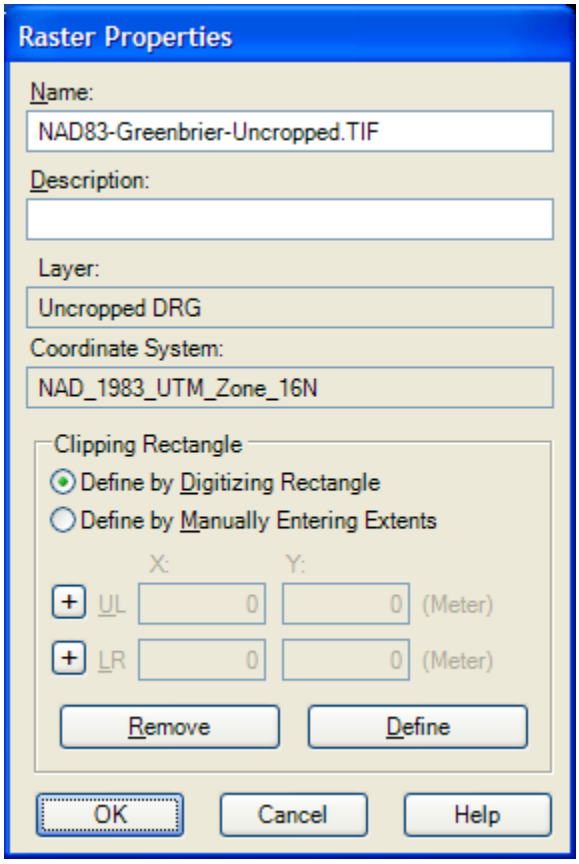


Figure 20-9 Raster Properties dialog

There are two methods of defining a clipping rectangle for the raster. The first method is to 'drag' a rectangle over the raster. Make sure the radio button is selected for *Define by Digitizing Rectangle* and press the *Define* button. Drag a rectangle over the raster by pressing and holding the left mouse button over the point of origin of your rectangle then, while continuing to hold down the left mouse button, drag the cursor to the point of termination of your rectangle. When you release the left mouse button, the rectangle (and hence clipping region) will be defined. You should see the raster clip to your newly defined rectangle.

For a large raster such as the DRG on which we are working, dragging a rectangle over the entire raster does not provide sufficient accuracy. If you magnify the display then you cannot drag the rectangle to the opposite corner. For these situations we have provided a precision point selection.

Zoom in on the upper right corner such that you can easily discern the corner edge of marginalia. Set the radio button selection in the **Raster Properties** dialog to *Define by Manually Entering Extents*. This option allows you to key-in the coordinates of the clipping region. We are adding to most dialogs in GeoCue that permit key-ins of values a digitize point selector facility. This is indicated by the presence of a "+" button next to the key-in field (see Figure 20-10). When this button is present, you can press the button and then digitize the value by moving the cursor to the location of the desired point and clicking the left mouse button.

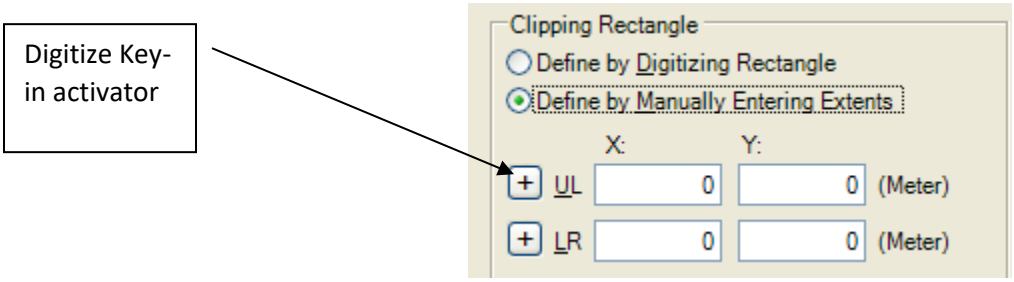


Figure 20-10 Digitize Key-in indicator

Try this feature now by digitizing the upper left corner of the raster, using view commands to zoom in on the lower right corner and digitize that corner. When you entered the two sets of coordinates, press the *Define* button to create the clipping boundary.

If you are not satisfied with the clipping boundary that you create, press *Remove* to restore the original boundary and perform the operation again.

When you have completed this for both rasters, you should be able to reduce the boundary discontinuity to a minimum (the quality of the join is, of course, a function of the quality of the geocoding of the original rasters).

20.2 Deleting Rasters

Delete individual rasters the same as you would any other GeoCue entity. Select the raster (recall that you select rasters by selecting their footprints) and add the entity to the Working Set Queue. Select the delete icon from the Working Set Queue toolbar and click *Yes* in response to the confirmation dialog.

You can also delete the top-level raster layer by selecting the layer and then choosing the *Delete Selected Layer* command from either the legend toolbar or from the legend right-click menu.

20.3 Mixed Projection Rasters

While GeoCue supports the mixing of any combination of projections and datums in the same project, there is a restriction that all data entities on the same layer must be in the same projection/datum. Recall that the Primary Layer of a raster composite is considered the layer. Therefore, all rasters within a raster composite must be in the same projection/datum.

GeoCue reprojects vector data on-the-fly. Therefore, any combination of multiple layers of vector data will properly display, regardless of the projection/datum of the individual layers.

GeoCue does ***not*** reproject raster data. Therefore, the Map Display automatically turns off the display of raster layers that are in a horizontal project that is different from the Active Map Coordinate System. The top-most layer Display check will change to a red "√" icon on raster layers that are not currently being displayed because of zoom toggles or incompatible coordinate systems. Hover the mouse over the icon to view a message on the reason for the non-display.

20.4 Experimenting with a Mixed Raster Project

In this section we will load up a composite DRG in two different coordinate systems and observe the behavior.

Remove the raster layers that you have added to the project in this section by selecting the primary layer (recall that this is the top level of a multi-tier raster layer) and press the *Delete Layer* tool on the legend toolbar (or right-click the layer you wish to delete and select *Delete Layer* from the right-click menu).

Add the NAD 27 DRG to the project by choosing the *Add Raster Reference Layer* from the legend toolbar. You will need to create a layer in the appropriate coordinate system. Browse to the NAD 27 DRG folder in your Sample Data direction and load the file called "Madison County Composite.tif" (it should be the only .tif file in the folder). Remember that raster files are loaded in the "Off" state by default to improve load performance.

Repeat the steps above but this time create a raster reference layer in NAD 83, UTM Zone 16N. Browse to the NAD 83 DRG folder of sample data and load the file called Madison Country Composite.tif (there are also individual DRGs in this folder). At this point you should have two new raster reference layers, one in NAD27 and the other in NAD83.

Delete any control point layers that you might have added in the previous sections and import the control point file called Huntsville Airport.txt from the Control Point directory of the sample data. This file is in WGS84 Geographic and thus must be imported to a Layer of type Photogrammetric_POINT in WGS84 coordinates. Name this new layer HSV Airport Control.

Create a named queue called "Control" and add the points that you just imported (there should be 4 members in the set). Set the queue navigation mode to Window Center. If the HSV Airport Control is not above the two DRG layers, move it above these raster layers by selecting it in the legend and pressing the "Up" tool in the legend toolbar.

Now navigate to the first control point in the Control queue by pressing the "Start of Queue" button on the named queue toolbar. Expand both DRG layers in the legend such that you have access to the raster control on the Intermediate Layer. Turn on the NAD 83 DRG rasters (depicted in Figure 16-10). Zoom the display to a suitable viewing magnification. You should see a control point superimposed over the end of a runway symbol (if the symbol is difficult to see, you can enlarge it via the *Layer Properties*, accessed by selecting the layer and then pressing the *Layer Properties* tool).

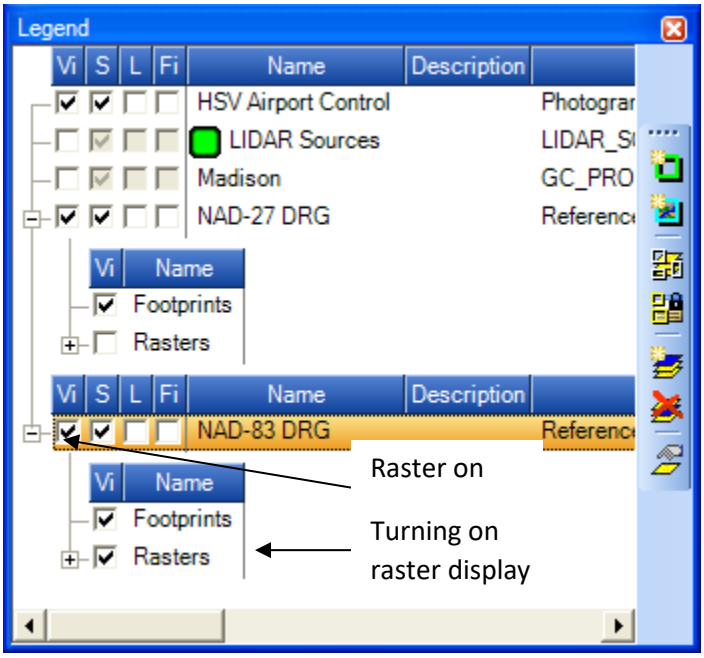


Figure 20-11 Manipulating the Legend

Now turn on the raster layer on the Intermediate layer of the NAD 27 DRG and set the current Map Coordinate System to this layer by pressing the Set Active Map Coordinate System tool on the legend toolbar. Note that the NAD83 DRG raster layer has been automatically turned off. The control point is still superimposed in the correct location.

Thus you can see that as long as you place entities on layers in the correct coordinate system GeoCue automatically manages the correct superimpositions.

NOTE – As you navigate through the 4 Huntsville Airport control points, you may notice that one of the points does not appear over the end of a runway. This is because one of the runways has been extended since the DRGs were last updated. We will see this when we examine the orthos made from the LIDAR data.

21 General Notes about Rasters and GeoCue

The GeoCue Client Map View is based on the ESRI MapObjects software development kit (GeoCue Server is not). There are several restrictions in the most recent release of MapObjects (Version 2.4) that relate to the processing of raster data. Some of these restrictions we accept in GeoCue client and others we have worked around. It is important that you understand the management of raster data in GeoCue so that you can plan projects accordingly and appreciate some of the display behaviors of the system.

21.1 GeoCue does not Support Raster Reprojection

While GeoCue fully supports on-the-fly coordinate system reprojection for point, line and polygon (in general, vector) data, it does not support the transform of coordinate systems for raster data.

We handle this limitation by automatically turning off raster layers whose horizontal coordinate system does not match the *Active Map Coordinate System*

It is important to note that vectors whose **V**isibility toggle is set will *always* display and will be automatically projected to the coordinate system of the Map Display.

21.2 Tiled TIFF, External Overviews

The optimal raster format for rapid display in GeoCue is tiled TIFF (Tagged Image File Format) with external image pyramids (also called overviews, reduced resolutions data sets, resolution layers or R Sets).

For internally generated raster data such as the LIDAR Orthos generated in LIDAR 1 CuePac, we automatically create these overviews.

For reference rasters, you can generate the overviews during import by selecting the Import Files to Warehouse (Convert to TIFF) option. This option will optimize raster files by converting them to TIFF and generating external overviews.

GeoCue supports either GoeTIFF packets in the raster file (in which case a TIFF World File, tfw) is not required or external TIFF World Files. Make sure that the tfw is appropriately scaled for each reduction in resolution (multiply the scale values by a factor of two for each factor of two reduction in scale).

When you add an external reference raster to GeoCue, we examine the directory to see if overviews are present. If so, they are mapped into the *files* collection of the raster entity. Thus you can tell if overviews are in use by examining the *files* collection.

Note that you can freely mix and match reference rasters on the same layer with the only restriction being that the layer must be in the exact coordinate system of the rasters and that all rasters that are to reside on the same layer must be in the same coordinate system.

WARNING – GeoCue is not intended to be a precision mapping system. You should never use coordinates derived from GeoCue for precision purposes.

WARNING – Our experience shows that USGS Digitized Paper Quad sheets are fairly inaccurate. The primary cause of this inaccuracy is rotation of the raster with respect to the grid. You can expect to see seams between DRGs as a result of this.

We strongly recommend against using scanned quad sheets for deriving coordinates!!!

21.3 Collections of Raster vs. Single Rasters

As you saw in the previous sections, GeoCue can manage multiple raster entities on a single composite layer. In addition, GeoCue provides separated control over footprints and the actual rasters. One of our primary design considerations in treating rasters in this manner was to allow them to participate in computational geometry operations. This means that you can, for example, select a raster and compute its intersection with a LIDAR strip.

Because of the granularity that we provide, the decision of using a single raster that comprises a mosaic of rasters or the individual rasters becomes one of operational efficiency.

We have tried to summarize the considerations in the table below (we are considering how you build up a single collection):

Collection Type	***Tiled?***	***Overviews?***	***Pros***	***Cons***
Separate Rasters	Y	Y	Can individually turn off and on subsections	Slower display than a single tiled image with overviews
	N	Y	"	Slow panning
	N	N	"	Slow Zooming, Slow Panning

Collection Type	*Tiled?*	*Overviews?*	*Pros*	*Cons*
Single Composite	Y	Y	Fastest display	Cannot control turning off and on individual sections Cannot build hybrid images (different types and resolutions on the same composite layer
	N	Y		Slow panning
	N	N		Slowest configuration. Use only with sparse files such as DRG

You can see from the table above that a single composite with tiled overviews provides the fastest display (and it is typically even faster if the imagery is compressed). This is the best choice if you are simply using the imagery for a backdrop (such as DRG or low resolution satellite imagery).

NOTE – We highly recommend Global Mapper (www.globalmapper.com) as a general purpose tool for preparing imagery for use in GeoCue. This tool is less than USD 400 and can perform most of the operations you will want for raster preparation including:

- Reprojection
- Cutting out Regions of Interest
- Cropping the collars from DRGs
- Many other related operations

22 The Annotation Subsystem

GeoCue provides an advanced annotation system that can be used for a variety of purposes. While this system was designed to allow customers with Web access to your projects to make comments on project activities (a form of project redlining), it can also be used independently of the Web. This chapter provides an overview of the use of the annotation system. The section on *Resolution* applies to annotations regardless of their method of creation (Web or GeoCue Client).

22.1 What are Annotations?

Annotations are comments that are added to a project. These comments can be linked to project entities or they can be non-linked (*free-form* or simply *free*) annotations. The use of a linked annotation is to make some production comment about an entity or a group of entities. For example, a production supervisor might want to flag a set of LIDAR working segments with a note that instructs a production operator that the data do not meet quality standards. A free-form annotation, on the other hand, is not associated with an entity. When we designed the free-form style of annotation, we envisioned it as the mechanism to make comments about *Raster* or *Reference* layers.

22.2 Annotation Locks

An annotation lock allows you to place a special type of lock on the entity or entities that you are annotating. This is useful when processing on the entity/entities must be stopped until the noted annotation (typically a problem) must be resolved.

When an entity is under an annotation lock, it cannot be added to a Working Set Queue via the normal procedure of selection followed by the ***Add to Queue*** command on the Working Set. If we were to allow this operation then anyone could still continue to process the entity. Instead, the *Annotation Entity* that has the lock on the referenced entity must be ***Resolved*** by a special annotation resolution command.

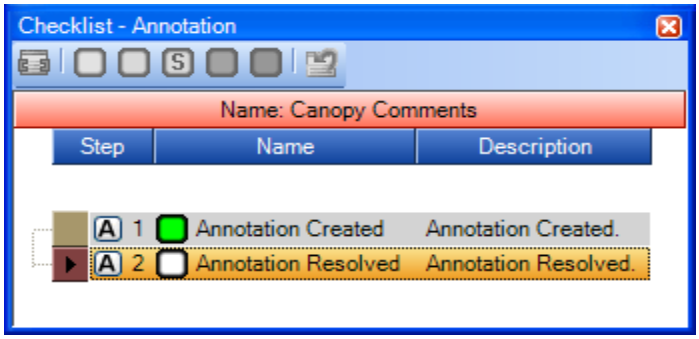
22.3 Annotation Types

GeoCue supports three general classes of annotation. The types of annotations and their descriptions include:

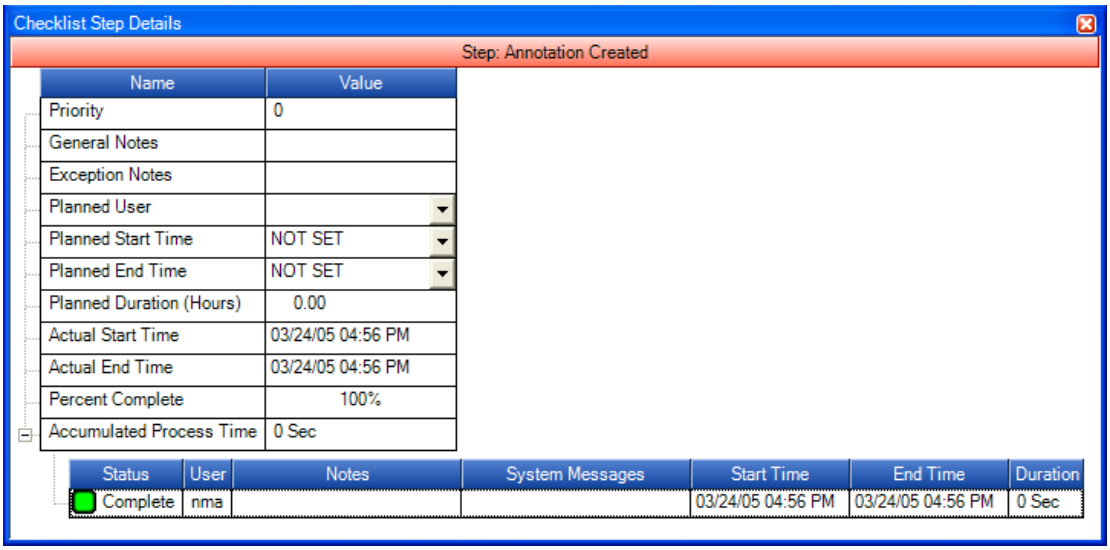
Type	***Description***	***Support Entity Locking?***
One-to-one	There is one entity referenced by the annotation.	YES
Group	A single annotation references a group of entities. The entities that are referenced by the annotation need not be of the same class (for example, a single annotation could be applied to a group containing both a LIDAR strip and a DTED elevation entity).	YES
Free	The annotation does not apply to an entity. It is geocoded and thus can be superimposed over a layer that does not have entities (such as a *Reference* layer) and maintain its relative position.	NO

22.4 The Annotation Checklist

In the current version of GeoCue, annotations have a checklist with two entries. An example is:

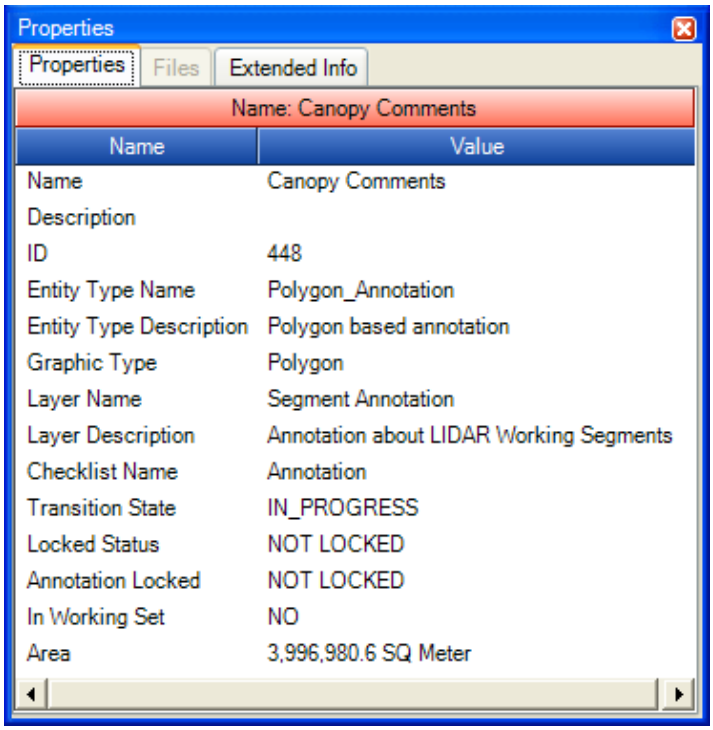


The first step is automatically populated by GeoCue when the annotation is created. The annotation itself (the note being created, either about entities or free form) is encoded in the checklist step details. Examining this for the *Annotations Created* step above:



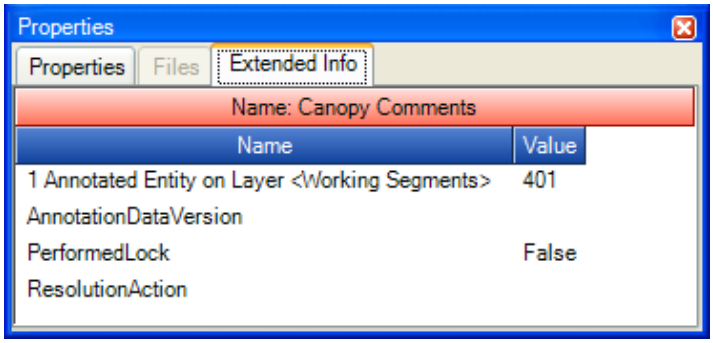
Notice the annotation comment "Check the low points on this segment" that appears in the checklist step General Notes field. You can also see who created the annotation and the time of creation by examining the history log at the bottom of the pane.

As with all entities, you can find out the details regarding an annotation by examining its property pane. Here is the ***Properties*** tab for the sample annotation above:



You can see that the **Entity Type Name** is a *Polygon_Annotation.* This information immediately informs you that this entity is an annotation. Of course, the quickest way to observe the general class of any entity is to observe the type of layer on which the entity resides. Annotations can only be hosted by Annotation type layers.

If you examine the ***Extended Info*** tab of the ***Properties*** pane, you can note the entities that are referenced by this annotation entity:



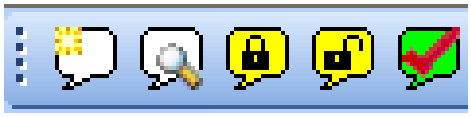
The first line(s) tell you the GeoCue entities that are referenced by this particular annotation entity and the layer on which they reside. In the example above, the annotation references a single entity with Entity ID = 401 on the Working Segments layer.

The field **PerformedLock** in the properties pane tells you if this annotation has an entity under an annotation lock. The field has a value of **False** which indicates that this annotation entity has not ***Annotation Locked*** entity 401.

Do not be concerned if you did not follow some of the detail above. It is not really necessary in the creation and resolution of annotations since most of the indicators are graphical.

22.5 The Annotation Tools

Annotations are created, reviewed and resolved via tool buttons from the Annotation toolbar. You can turn the display of the annotation toolbar off and on just like any other toolbar in GeoCue (see section 4.3.5).



The function of each of these tools is described in the table below:

icon	*Tool*	*Function*
	Toolbar "grab" area[19].	Grab this area to drag the toolbar off the toolbar section and convert to a floating menu.
	Create Annotation	Used to create a new annotation.
	Review Annotations	Use this function when you want to review the *Entities* to which an annotation refers but you do not intend to resolve the annotation. This command does not apply to ***free*** annotations (since a free annotation does not reference entities). The entities referenced by the annotation are placed in a queue named "ENTITY_REVIEW." The annotation checklist is not modified.
	Resolve via Working Set Queue	Use this function when you want to ***Resolve*** the *Annotation* by placing the referenced entities in the Working Set queue. This command sets the annotation checklist step *Annotation Resolved* to ***In Progress*** and places the referenced entities in the Working Set queue. Note that the Annotation Lock (if present) will remain set on these entities until you press ***Finalize.*** This means that you can safely exit annotation resolution prior to completion and resume at a later time.
	Resolve via Entity Review Queue	Use this function when you want to ***Resolve*** the *Annotation* and you can resolve the annotation without the need of placing the entities in your Working Set[20]. This command sets the annotation checklist step *Annotation Resolved* to ***In Progress*** and places the referenced entities in a named queue called **ANNOTATION_REVIEW.** Note that if these entities are under an annotation lock, they cannot be added

[19] This is the same on all GeoCue toolbars.

[20] An example could be that a supervisor made a note such as "The next time you process segments like these, use the FFT filter with parameter L = 2.1." Thus she is not saying to do anything with the current entities that would require exclusive locking.

		to the Working Set via this route. You must use the ***Resolve via Working Set Queue*** to move the entities into the Working Set.
	Finalize Annotation	Press this button when you have resolved all elements of the annotation. This causes the annotation process step *Annotation Resolved* to be set to complete and, if the annotation has a lock on the entities referenced, the lock is removed.

22.6 Creating Annotation Example

In this example we will create one each of the different types of annotations supported by GeoCue.

22.6.1 One-to-one Annotation

- Again bring up Project 1 in the environment LIDAR Project Setup and Processing.
- Select WS-1 (do not place it in your Working Set)
- Press the ***Create Annotation*** tool on the annotation toolbar. You will be presented the dialog of Figure 22-1.

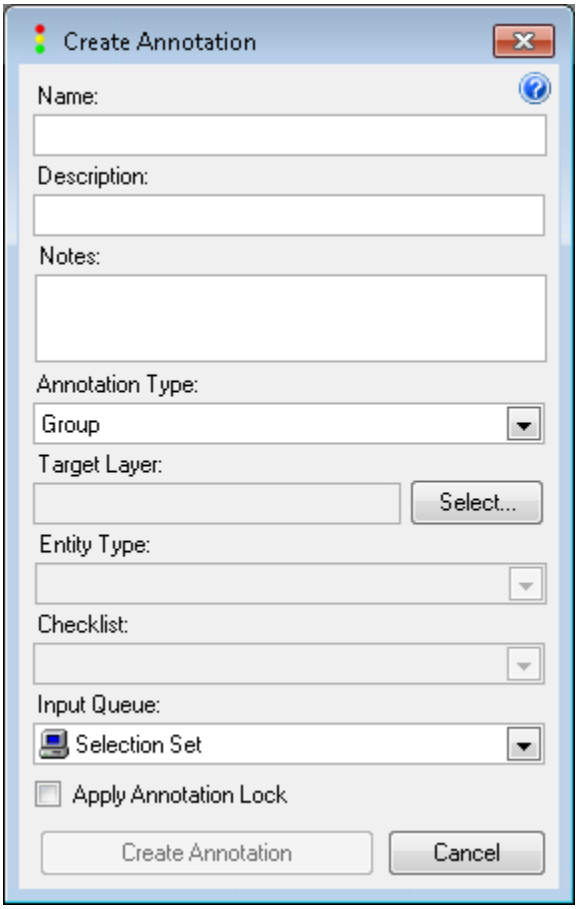


Figure 22-1 The Create Annotation dialog

The *Name* is the entity name for the annotation. It is the name that will be displayed when you activate labels for the annotation layer in the legend. It is also the name that will be displayed in the Property Pane and Checklist Pane when you *Select* the annotation entity.

- Enter "Canopy Comments" as the *Entity Name* and leave the description field blank.

The *Annotation Note* is the comment that will be filled in as the *General Note* in the details of the Annotation checklist step, *Annotation Created*. In effect, this **is** the annotation.

- Enter the comment “Canopy removal less than perfect in this segment but it meets the requirements.” in the Annotation Notes field.

- Select *One-to-one* in the Annotation Type: field

Press ***Select…*** under Target Layer: The ***Select Layer*** dialog will not offer any choices since there are currently no layers of class ANNOTATION in this project. Select ***Create Layer…*** and populate the layer creation dialog as in Figure 22-2.

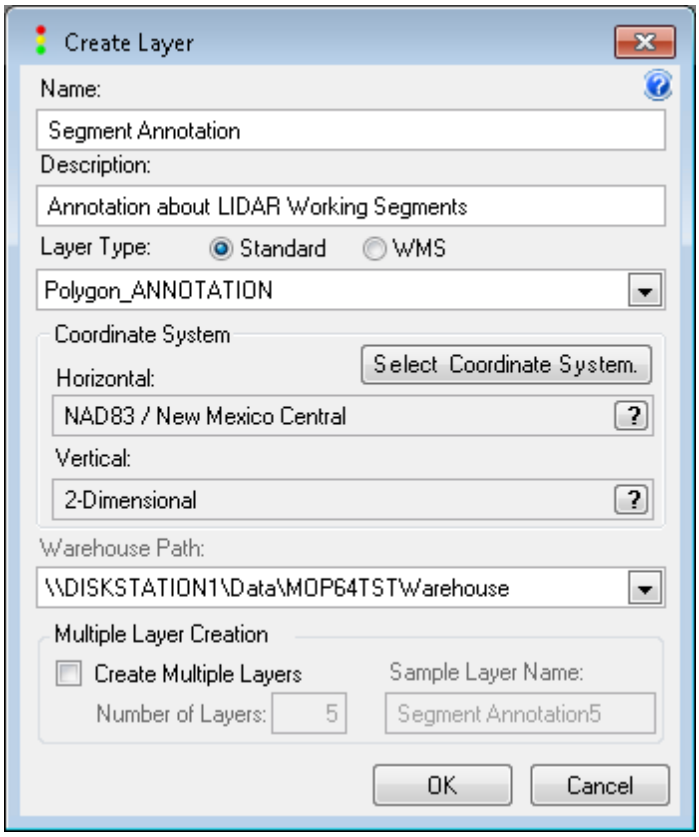


Figure 22-2 The populated Create Layer dialog for the Annotation layer

You will notice that there were three choices for the Layer Type: in the dialog – Polygon, Line and Point. We will use only polygon annotation layers in this version of GeoCue when we create annotations from within GeoCue.

- Click OK on the ***Create Layer*** dialog and on the ***Select Layer*** dialog to return to the ***Create Annotation*** dialog. Leave the Checklist set to *Annotation***.** It will now appear populated with the layer you just created (Figure 22-3).

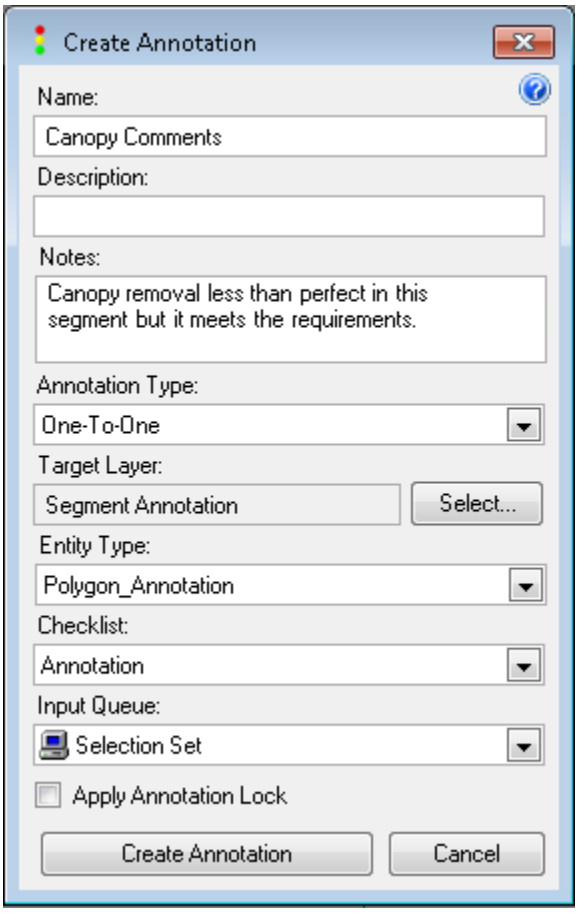


Figure 22-3 The populated Create Annotations dialog

The ***Create Annotation*** dialog will allow you to specify any queue as containing the list of entities to which the annotation(s) are to apply (except when the Annotation Type is *free* since *free* annotations do not reference entities). Note that in GeoCue, entities that you ***Select*** are in a (usually) hidden queue called the ***Selection Set***. The ***Selection Set*** is the default queue selected for annotations but you can also choose the Working Set or any named queue.

- For our example, leave Input Queue: set to ***Selection Set.***

- Make sure that the option to *Apply Annotation Lock* remains unchecked and press ***Create Annotation.*** The new annotation entity has now been created.

22.6.2 Group Annotation

In this example we will annotate a group of disparate entities and apply an annotation lock. We will recreate the LIDAR data "hole" as the problem that we are annotating. You can reproduce this following the abbreviated steps here:

- Select all four source strips (your selection queue count should read "4")

- Press **Union** on the GeoAnalysis toolbar

- Delete the large resultant entity on the GeoAnalysis layer and retain the small one that represents the hole in the LIDAR data.

> ***Hint*** – Use Layer and Symbology settings to make visualization and selection easier. For example, turning on the fill symbology makes visualizing the project status easy but obscures entities when attempting to select. Remember also that you can leave entities visible (by keeping the "V" option selected on the host layer) but turn off selectability (by un-checking the "S" option on the host layer).
>
> Note that entities can reside directly on top of one another. Sometimes you may select an entity and not see an associated checklist or properties appear. This is caused by selecting more than one entity and is typically because two or more entities are directly "stacked." For example, your project currently has an annotation entity directly stacked on top of the working segment WS-1. If you

want to select WS-1, turn off selectability of the annotation layer or, alternatively, select by clicking on the edge of the entity rather than dragging a rectangle over the entities. This will cause the "Smart Pick" dialog to display if there is an ambiguity.

We will annotate this hole and the associated working segment.

- Select the GeoAnalysis entity that represents the hole (it is most likely named Union_1).

- Turn on the selectability flag for the Working Segment layer and turn it off for all other layers (ensure that the GeoAnalysis entity remains selected)

- Chose ***Select by Intersection*** from the dropdown icon by the selection arrow. This will result in the Working Segment(s) in which the LIDAR hole is located being selected.

At this point your display should resemble Figure 22-4 (of course your display will differ depending on how your defined your segments and the state of visibility of your layers). Your selection queue should indicate that you have two objects selected (or perhaps more if your LIDAR hole intersects more that one Working Segment).

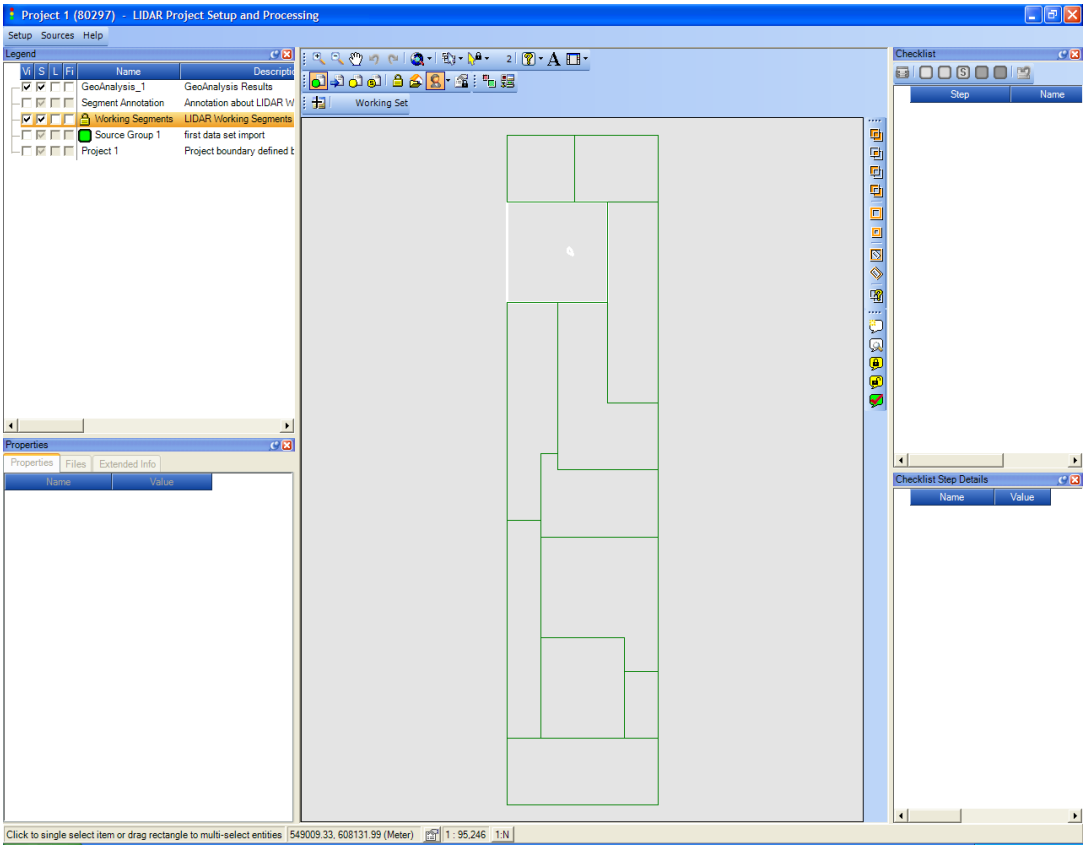


Figure 22-4 Project 1 with Segment containing "hole" selected

We will now create the annotation (ensure that you keep the selected entities *Selected).*

- Press ***Create Annotation*** on the Annotation toolbar

- Populate the dialog as shown in Figure 22-5 (the note "LIDAR coverage problem. Check severity and decide if we need to refly." pertains to the resolution of the LIDAR strip gap). Notice that we are using the Annotation layer that was created in the previous example. This is not required – you could create a new layer if you wanted to sort different types of annotations by layer. However, it must be a polygonal annotation

layer. Note the annotation type is **Group** and that we have set the **Apply Annotation Lock**

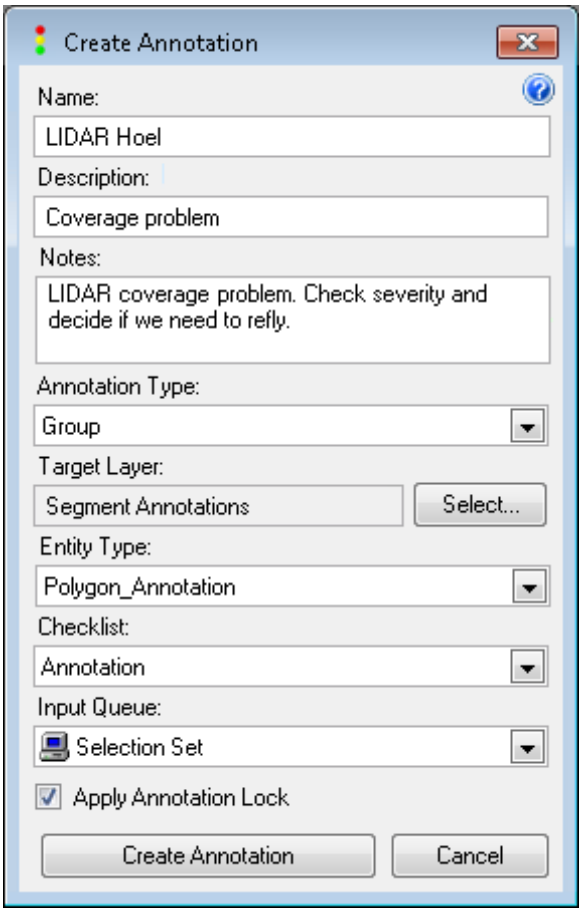


Figure 22-5 The annotation values for the "LIDAR Hole"

- Press ***Create Annotation.*** The annotation is created and the dialog dismisses.

It is instructional to select the newly created annotation and examine its ***Properties***, ***Extended Info*** tab (Figure 22-6).

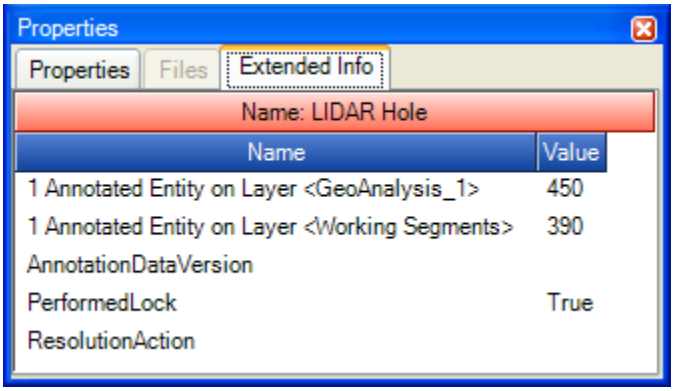
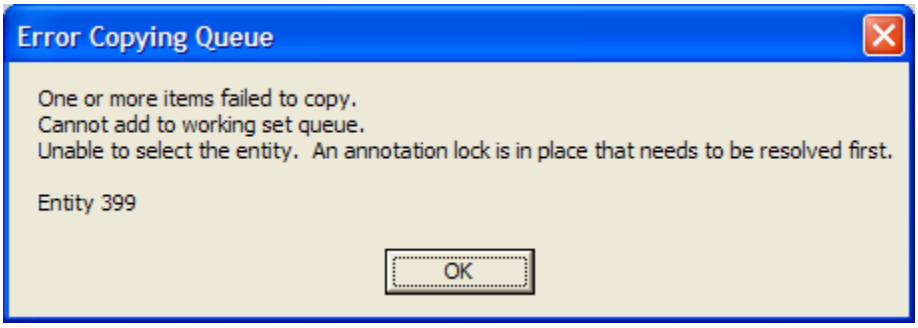


Figure 22-6 The Group Annotation Properties

In our example, we have annotated two entities – the GeoAnalysis entity (in our case Union_1) and the Working Segment that contains Union_1 (you will have more than one working segment if your Union_1 intersected more than one working segment). Notice that the **PerformedLock** field is set to True, indicating that this annotation entity has placed *Annotation Locks* on the entities that it references. If you examine the properties of either of these entities you will note that the **Annotation Locked** property is set to True.

To observe the effect of the annotation lock, ***Select*** the entity Union_1 and attempt to add it to your Working Set. You should receive the message box:



22.6.3 Free-form Annotations

As the final example of annotations, we will create a free-form annotation. Recall that this is an annotation that is not associated with a reference (or *annotated*) entity.

Invoke the Create Annotation dialog via the annotation toolbar and populate the dialog as shown below:

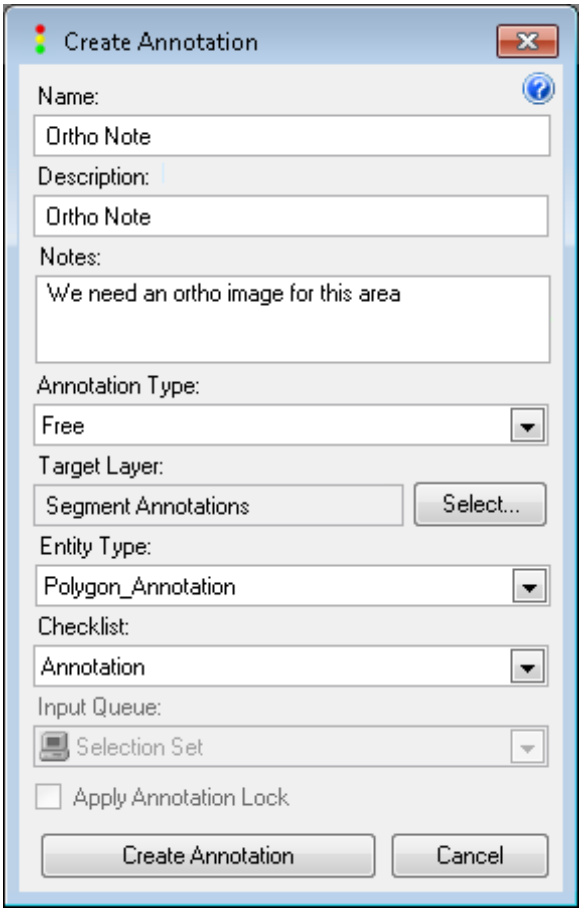


Figure 22-7 Free Form Annotation inputs

Note that we have selected ***Free*** as the *Annotation Type:* and that we are again using the same annotation layer. Notice that both the *Input Queue* and *Apply Annotation Lock* fields are deactivated. This is because a ***free*** annotation is not associated with a reference entity.

Press the ***Create Annotation*** button. This time the Create Entity dialog is invoked with all fields pre-populated (Figure 22-8).

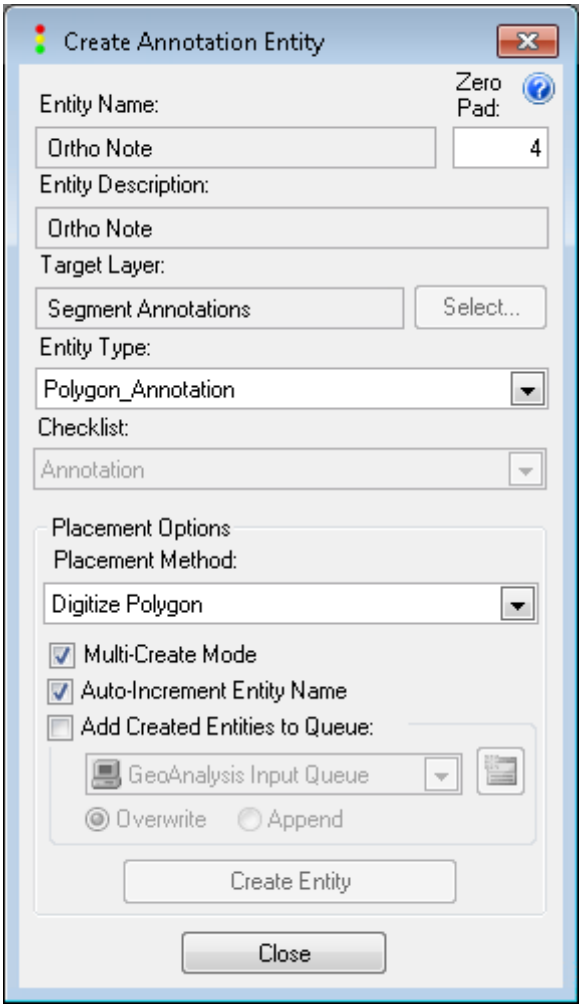


Figure 22-8 The Create Entity dialog used in Free Form annotations

Notice that you can use any *Placement Method* to create the annotation. For a review of the different placement methods, refer back to the Create Project chapter where we explored all of these methods in the creation of a Project Boundary. For this example, we will digitize a polygon.

Digitize an arbitrary polygon in the lower half of the project. When you complete the polygon, this dialog will close. See Figure 22-9 for an example of the ***free*** annotation that we digitized. We have ***Selected*** this annotation so that we can see its properties. Notice in the ***Extended Info*** fields of its property pane that there are no referenced entities. Also note that the

PerformedLock field is set to False. This, of course, must be the case since the annotation entity does not reference any entities!

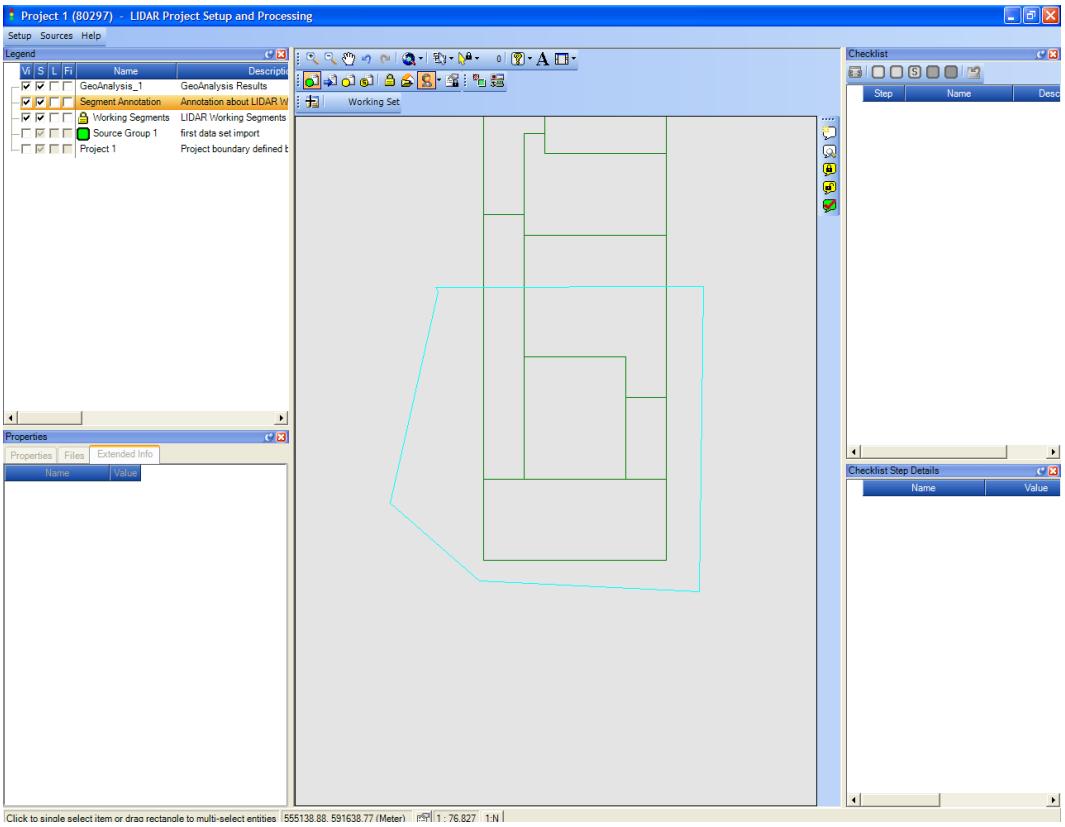


Figure 22-9 Our *free form* Ortho annotation

22.7 Reviewing Annotations

There are two levels of reviewing an annotation. The first is to simply examine the annotation entity itself. To do this, just select the annotation entity as you would any other entity and view its checklist and properties. The annotation note itself is the **General** comment in the checklist details box for the *Annotation Created* checklist step. Just double click on the checklist state to activate the details pane.

Remember, you never need to add an entity to your Working Set to review its checklist state, checklist details or properties pane.

> Multiuser note – We intentionally designed GeoCue to logically separate ***edit*** operations from ***review*** operations. With this design, anyone (with appropriate permissions) can review any entity in the system, even if the entity is locked for processing by another user. This means that you can observe the status of the project changing in real time as operators work on entities. This design provides *real time* visualization of project state, a key factor in high productivity.

The second type of review that you might want to do is to look at the entities that are referenced by an annotation (this applies to the two types of annotations that reference entities – Group and One-to-one). This capability is provided via the ***Review Entities*** tool on the ***Annotation*** toolbar.

In this exercise, we will review the Annotations that we have created in the previous exercises.

- ***Select*** the annotation named Canopy Comment (recall that this is a One-to-one annotation that is referencing working segment WS-1).

> ***Hint*** – If you select by dragging a selection rectangle (our favorite selection method), you will select at least two entities if you have selectability on for all layers and you are selecting an annotation that references an entity. This is because (in the case of a one-to-one annotation) the annotation either directly covers its referenced entity or it encloses (the case of group) the referenced entities. Remember that the number of ***Selected*** entities is always displayed as the count by the selection arrow tool. Solve this problem by either turning off selection on all layers except the one from which you are selecting or by point selecting at the edge of an entity and choosing the entity you want from the ***Smart Pick*** dialog.

- Press the ***Review Entities*** button on the ***Annotation*** toolbar. This will cause the referenced entity (entities in the case of a group annotation) to be placed in a queue

called ENTITY_REVIEW. This is a normal named queue and thus the entities placed in this queue are not locked. This implies that you can perform entity review for the entities referenced by an annotation, even if they are annotation locked.

You can inspect the referenced entity (entities) by the usual queue navigation tools. When you are finished, you can delete the REVIEW_ENTITIES queue.

22.8 Resolving Annotations

Resolving an annotation when that annotation references entities is a two part process. The first step is to begin the resolution process. The second step is to mark the annotation as being resolved (we call this ***Finalizing*** the annotation). For example, if the annotation indicated that a working segment needed additional editing, the resolution of the annotation would begin when you started the edit process and it would complete when the edit on the working segment was complete.

Resolving an annotation that has placed an annotation lock on the entities that it references proceeds a bit differently than resolving a non-locking annotation. We will demonstrate both of these types of resolutions.

22.8.1 Resolving a Non-locking Annotation

A *non-locking* annotation is generally applied to entities where work on that entity does not need to stop prior to resolution of the annotation. We created such an annotation when we created our *Canopy Comment* annotation.

- ***Select*** the *Canopy Comment* annotation

- Press ***Resolve via Entity Review Queue*** on the Annotation toolbar

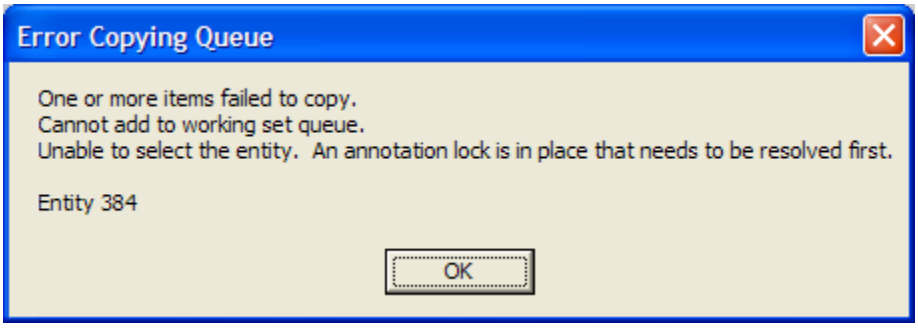
This will cause two actions to occur. First of all, all entities referenced by the annotation will be placed in the named queue ENTITY_REVIEW. The second is that it will set the state of the annotation checklist entry *Annotation Resolved* to ***In Progress.*** You can delete the ENTITY_REVIEW queue when you are through using it for managing the annotated entities.

> ***Hint*** – It is never necessary to delete named queues that GeoCue creates during annotations or problem resolutions. GeoCue will automatically clean up these queues when you exit your instance of GeoCue Client. In addition, GeoCue looks for the named queue before creating a new one. If one is found, it is first cleared and then the new entities are copied in. Thus you also need not worry about creating duplicate queues.

22.8.2 Resolving a Locking Annotation

A *locking* annotation is generally applied to entities where work on that entity cannot proceed prior to resolution of the annotation. We created such an annotation when we created our *LIDAR Hole* annotation.

An entity that is locked by an Annotation cannot be added to the Working Set, even by the creator of the annotation, via the ***Add to Working Set*** button on the Working Set toolbar. To demonstrate this, select the Union_1 entity and press the Add to Working Set toolbar button. You will receive a message similar to the following:



The locked entities must be added to the Working Set via the ***Resolve via Working Set Queue*** tool on the annotation toolbar.

- ***Select*** the *LIDAR Hole* annotation

- Press ***Resolve via Working Set*** on the Annotation toolbar

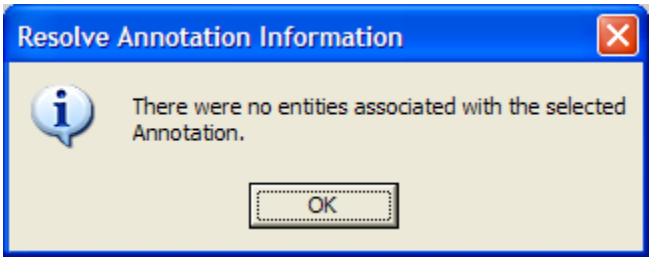
This will cause two actions. The first is that it will add all the entities referenced by the annotation entity to the Working Set Queue. The second is that it will set the state of the annotation checklist entry *Annotation Resolved* to ***In Progress.***

You can now do whatever processing is required to resolve the annotation by working on the entities. Note that if you remove these entities from the Working Set, they can only be placed back in the Working Set via the ***Resolve via Working Set*** button on the ***Annotation*** toolbar.

Note that you can also start the resolution of Locked annotations via the ***Resolve via Entity Review Queue*** tool on the Annotation toolbar. In this case the *Annotation Resolved* checklist step is set to ***In Progress*** and the referenced entities are placed in the ENTITY_REVIEW queue. However, you will not be able to add these entities to your Working Set via the ***Add to Working Set*** tool on the Working Set toolbar. You must use the ***Resolve via Entity Review Queue*** tool on the Annotation toolbar. You might want to use this mode if you want to start the clock on the annotation resolution but you are not yet ready (or do not need) to add the referenced entities to the Working Set.

22.8.3 Resolving a Free Annotation

You can begin the resolution of a free entity by selecting either Resolve Annotation button on the Annotation toolbar. You will receive the following benign message:



This is normal since a free annotation does not reference an entity.

- Select the *Ortho Note* annotation

- Press ***Resolve via Entity Review Queue*** and press ***OK*** on the message box

This will cause the Annotation Resolved checklist step to transition to ***In Progress.***

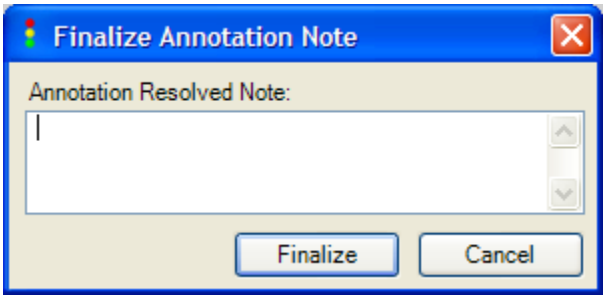
22.9 Finalizing the Annotation Resolution

The final step in resolving a resolution is to mark the annotation as ***Complete*** and to remove any locks the annotation entity has placed on entities. For all annotation types, this proceeds as follows:

- Select the annotation (ensure you have only a single annotation selected).

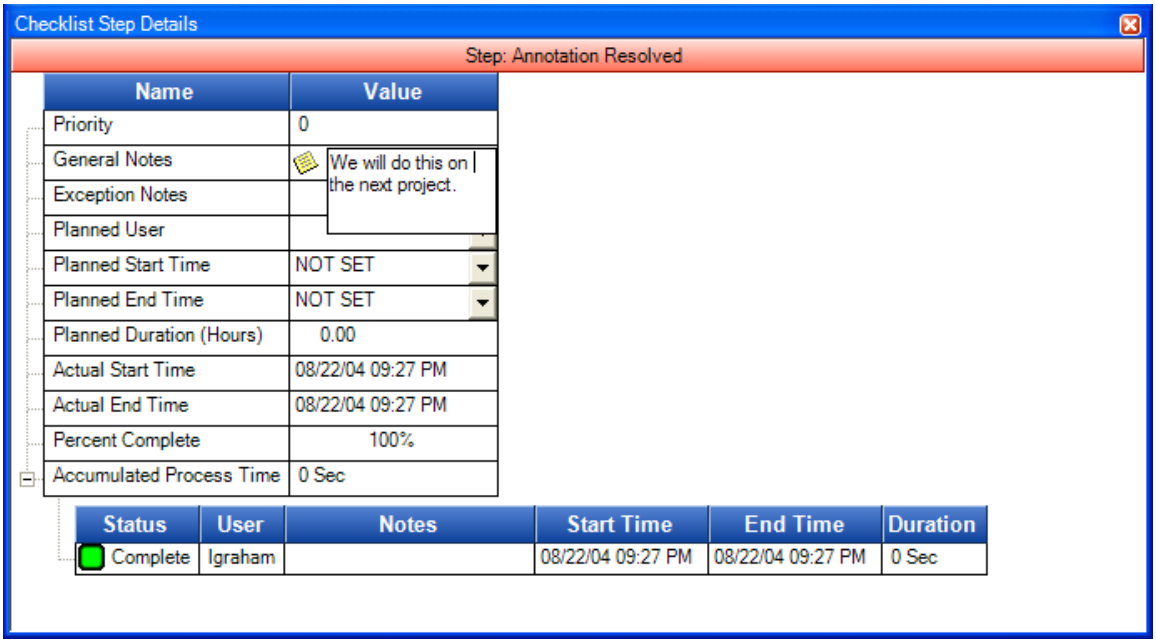
- Press the ***Finalize*** button on the Annotation toolbar

This action will result in the following dialog:



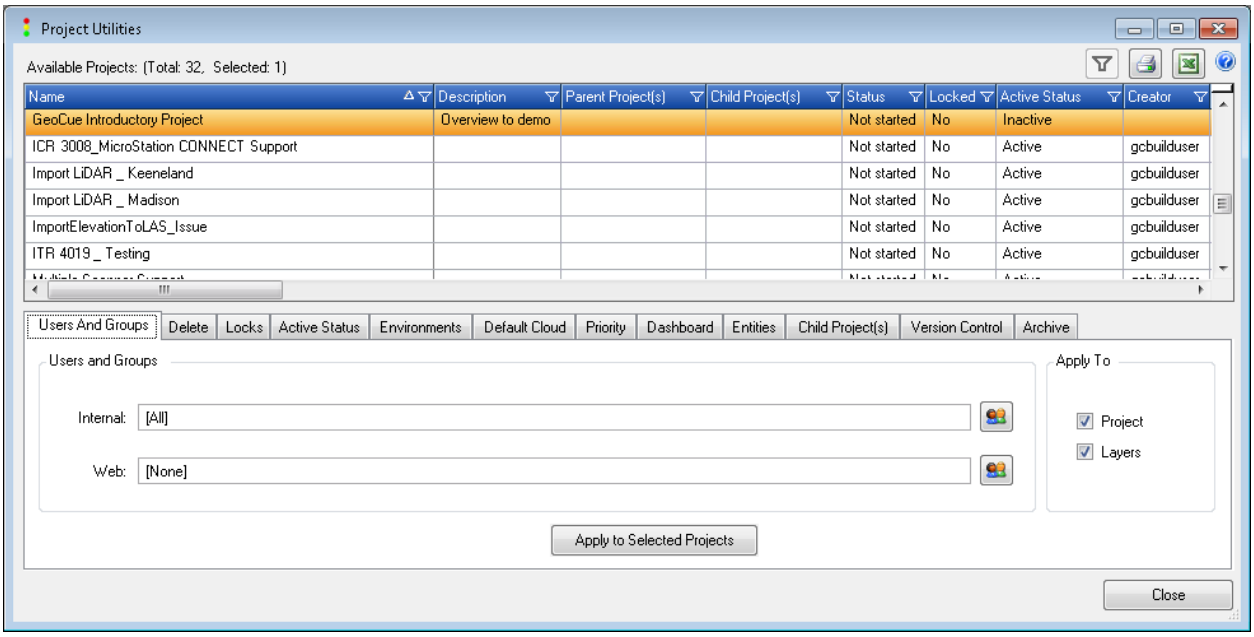
Enter a note regarding the resolution of the annotation in this dialog. It will be added as the General note for the *Annotation Resolved* checklist step of the annotation. If you press Cancel, the ***Finalization*** action will be aborted. If the annotation entity is locking referenced entities they will not be unlocked until you press ***Finalize.***

Below is our details pane for the *Annotation Resolved* checklist step of our Canopy Comment annotation.



23 Project Utilities

Versions of GeoCue prior to 4.0 had a *Project Delete* tool available from the *Setup* menu. This had been enhanced in GeoCue version 4.0 to a 'Project Utilities' menu



This dialog contains tabs that allow you to modify the selected projects. Note that the columns of the dialog contain standard GeoCue filters so these can be used to narrow your selection based on one or more filtering criteria (such as all projects created prior to a certain date, etc.).

The operations available via the tabs are listed in the following table:

Users and Groups	From this tab the user can change the Users and Groups that have permission to access the projects. Permissions may be set for internal network users as well as access through the web using Project Portal. Users and Groups may be

	assigned at the "Project" level or assigned to all layers within the selected projects using the "Apply To" checkboxes.
Delete	Allows the user to delete the selected projects while optionally deleting all "warehouse" managed folders associated with the selected projects. "Locked" projects may not be deleted. Projects may be unlocked from the "Locks" tab.
Locks	From this tab the user may turn On/Off the Project Delete Lock. Multiple projects may be selected to unlock/lock groups of projects at once.
Active Status	Allows you to set the active status of a project or group of projects. Active simply means that a project will appear in the 'Open Project' dialog. This flag provides a convenient way to hide projects that are complete.
Environments	Allows you to set valid work environments for specific projects. This is reflected on the Open Project dialog. When selecting a project, only Valid Environments are displayed in the Environments list to select from when opening the project.
Default Cloud	Sets the Processing Cloud that dispatched tasks will be processed by when using Command Dispatch System.
Priority	Allows you set a projects priority level. This setting is useful for sorting in the "Open Project" dialog.
Dashboard	Allows you to enable a project for use withinProject Dashboard. You may also set the permissions for Viewers/Workers/Managers within Project Dashboard.
Entities	Flush Entities allows a user to immediately remove entities from memory in a recently open project at the GeoCue Server machine. Flushing Entities from server memory will not affect the entities stored in the repository. It simply frees up memory for other project entities immediately instead of waiting for them to be cleared in the normal cache processing method.
Child Project(s)	Allows you to set the "Child" projects for the selected project. Once child projects are set, you may use the buttons on the "Project Navigator" toolbar to navigate between Parent and Child projects.
Version Control	Allows you to restore data files while a project is still in production.
Archive	Allows you to archive your off-line projects when they are completed.

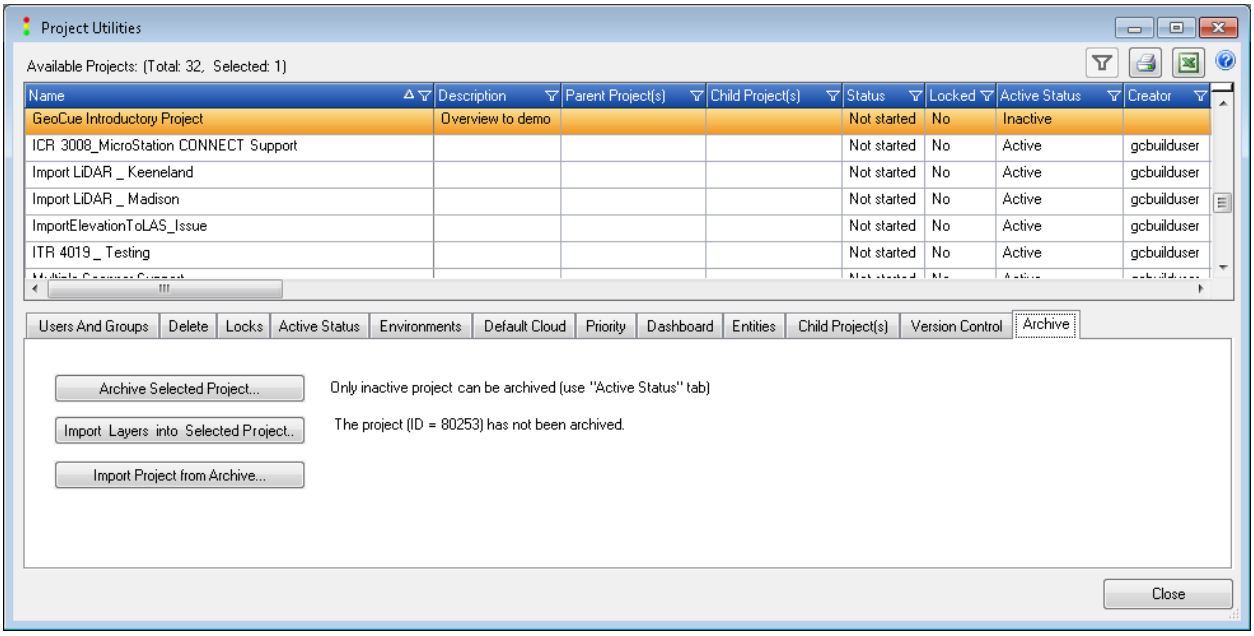
23.1 Archiving

Beginning with GeoCue 2017.1, we now provide the ability for the user to archive off-line projects when they are completed.

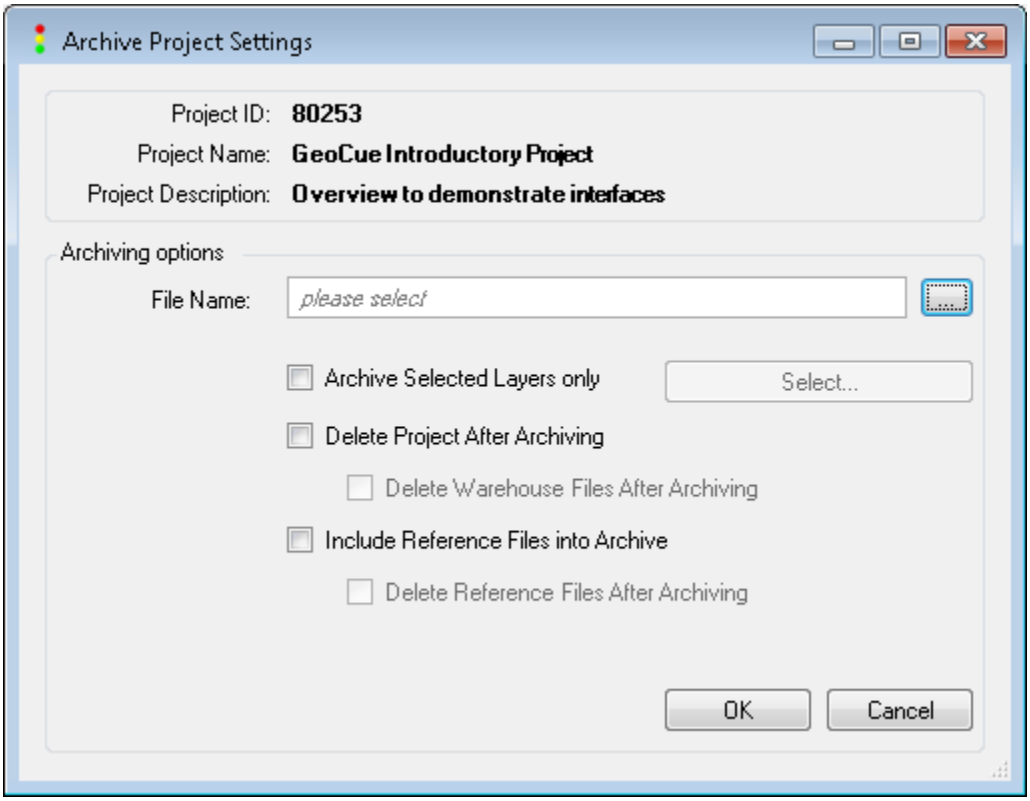
Archiving a completed project frees critical IT resources such as primary disk storage and simplifies operational back-up processes while providing an auditable compliance trail for any corporate or customer-required data retention policies. It also reduces the burden on on-going production staff of having to maintain and track historical projects, often for years after they are completed, in your live production database. Archiving can also reduce your overall business risk by adding another layer of data loss prevention by archiving to an off-site facility or to the cloud.

It is important to note that "archiving" is not the same as "backup" and archiving not intended to be used to replace a robust production data back-up and versioning policy. GeoCue already has automatic file backup and file versioning tools built-in to the GeoCue architecture. These existing backup tools are intended to provide short-term data recovery or rollback capabilities for live production projects. They are essentially error recovery tools for restoring data files while a project is still in production. Archiving or off-lining is intended to be used only at the end of a projects production life cycle as part of your data retention policy. As such, the new archiving tool in GeoCue extends the existing back-up and versioning tools already available, it does not replace them. Using both as part of your enterprise data management strategy will be of significant benefit.

Once you have upgraded to GeoCue 2017.1, the project archiving tool can be found under the Project Utilities menu on a new "Archive" tab. To archive a project, you should first flag the project as Inactive in Project Utilities; GeoCue will not allow you to archive Active projects.



Select the project you want to archive, verify it is flagged Inactive and click Archive Selected Project. This will bring-up the main archive settings dialog.



In the GeoCue 2017.1 release, you will be able to archive to a local network location. Typically, this will be to a designated location for transfer to your main enterprise data archive, either a local repository such as a tape backup or to off-site storage. Browse to and select the folder location and name for the archive file. A single GeoCue archive file will be created at this location. Note that you have options to delete the project completely from GeoCue after archiving, to only archive certain layers in a project and to include reference data in the archive if necessary. A significant benefit, should you chose to delete the project after archiving, is that the associated database records for that project will also be archived and then deleted from your production database, reducing the size of the database. Previously it was not possible to reduce the database size, even by deleting a project, so this capability adds significant convenience when you need to reduce the size of your database.

The archiving process itself will run in the background on the machine from which it is initiated - through GeoCue's Command Dispatch System (CDS) of course - once you click OK. If you need to recover a project in the future, you can re-import an archived project back to your live production database using the Import Project and Import Layers buttons. Again, please remember archiving is not intended to be used for backup or version control on a live project; only use it when you want to retire a project at

completion. Keep in mind that if you are archiving data layers, the archive will have a corresponding file size since it will contain all your geospatial data.

In the 2017.1 release, GeoCue Archiving supports local archives only. However, we are adding cloud-based archiving to Amazon Web Services (AWS) later in 2017. This will add more robust cloud-based off-site capabilities to your data archiving procedures. Since data archiving is essentially used for long-term retention of data that is no longer actively used, it makes sense that a cloud-based repository will be the most cost-effective way to go in the future. Cloud-based archiving will be available as a subscription service directly through GeoCue, so you won't have to worry about configuring your own AWS archive or using a third-party provider.

24 Concluding Remarks

We hope that you have enjoyed working with the GeoCue product family. Hopefully you have not discovered too many software defects (bugs).

The primary idea that we would like for you to recognize in working with GeoCue is that it is a general purpose production management system that, when encoded with the appropriate *Environment*, is suitable to a very wide variety of process management problems. As time moves forward, we and third party companies will be releasing a number of different CuePacs for different production workflows and disciplines. Our ultimate goal is that you employ GeoCue on every production workstation in your company. We have a singular focus on improving your bottom-line profitability through enterprise process management.