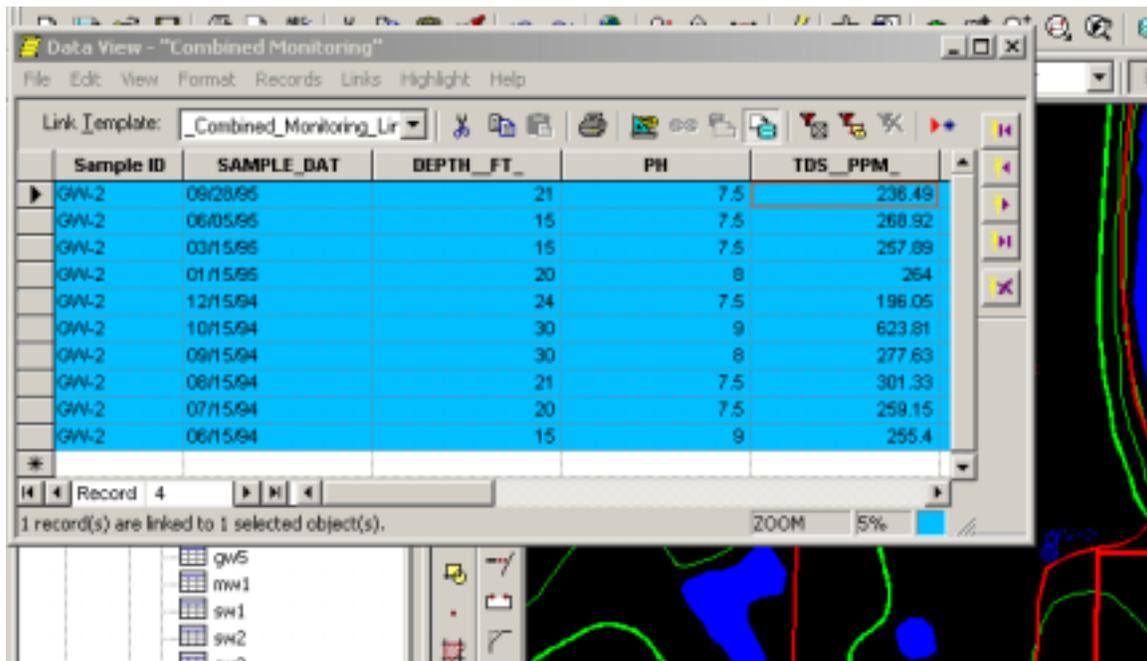


## XIX. AutoCAD Map 2000

AutoCAD  
Map 2000

### Lesson 1: GIS Defined

*A computer based system to capture, store, edit, manipulate, analyze, synthesize and display geographically referenced information. The key word being referenced, meaning tied to a real world coordinate system – to an actual place.*



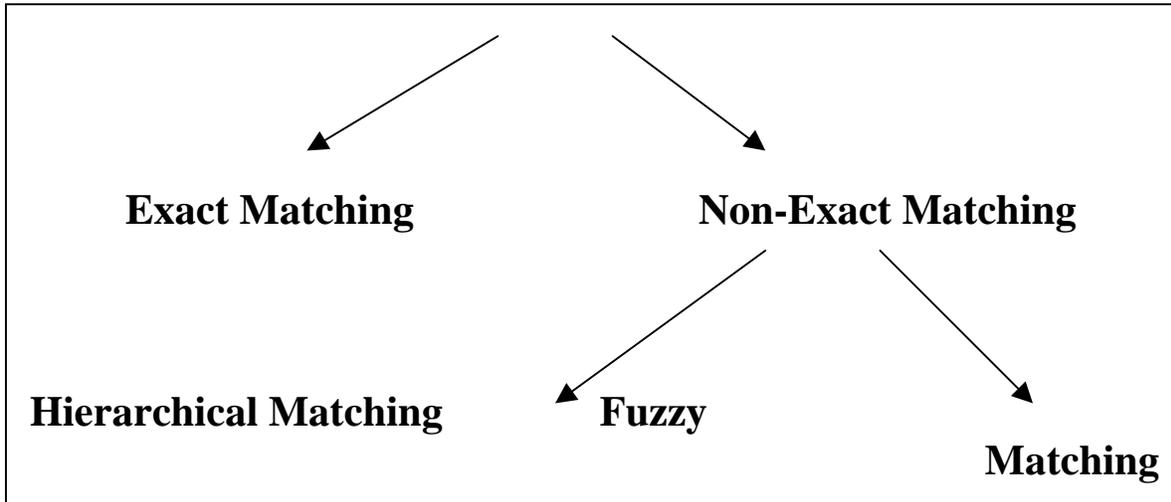
The screenshot shows the 'Data View - "Combined Monitoring"' window in AutoCAD Map 2000. The window displays a table with the following columns: Sample ID, SAMPLE\_DAT, DEPTH\_FT\_, PH, and TDS\_PPM\_. The table contains 11 rows of data for 'GW-2' samples. The table is linked to a map view on the right, which shows a geographical area with various features and a zoom level of 5%.

Sample ID	SAMPLE_DAT	DEPTH_FT_	PH	TDS_PPM_
GW-2	09/25/95	21	7.5	238.49
GW-2	06/05/95	15	7.5	268.92
GW-2	03/15/95	15	7.5	257.89
GW-2	01/15/95	20	8	264
GW-2	12/15/94	24	7.5	196.05
GW-2	10/15/94	30	9	623.81
GW-2	09/15/94	30	8	277.83
GW-2	08/15/94	21	7.5	301.33
GW-2	07/15/94	20	7.5	259.15
GW-2	06/15/94	15	9	255.4

A GIS database contains coordinates of features on the earth's surface and tabular information describing what the feature represents and its relationships to other features.

## Data Linkage

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## Components of a GIS

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- *Data and Information*
- *Modeling the Real World*
- *Hardware/Software*
- *Results and Application*

## GIS Functions

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*Data Entry*

*Data Display*

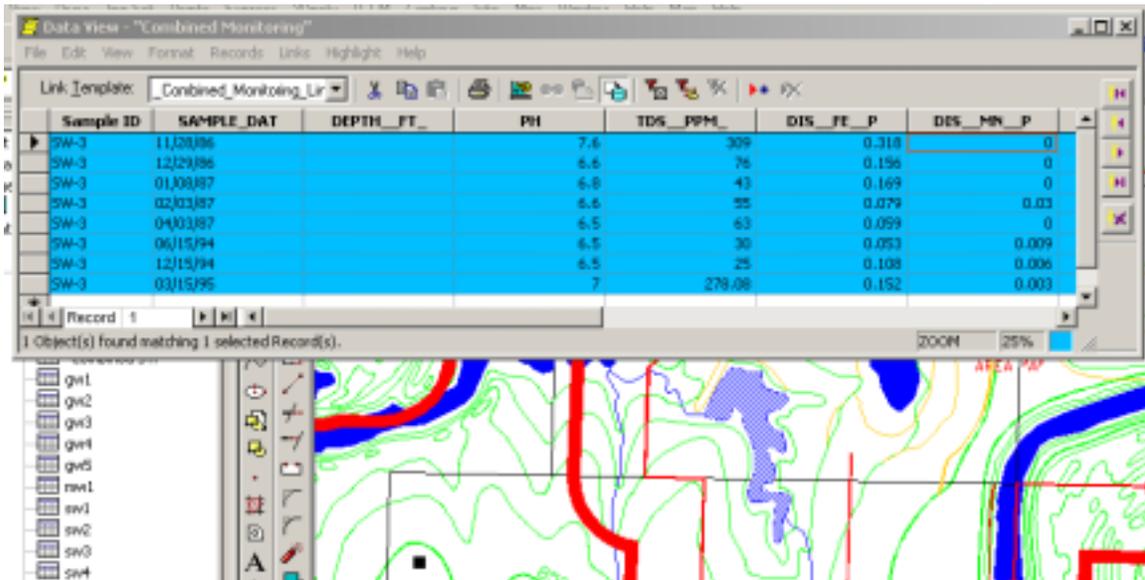
*Manipulation and Analysis*

*Data Management*

## Spatial Operations

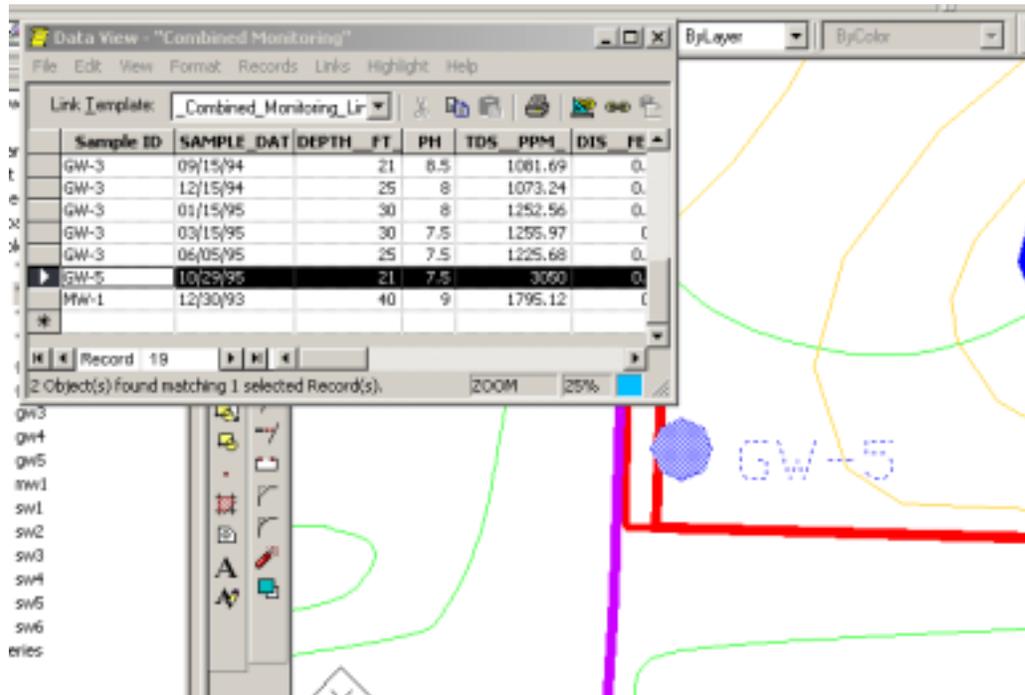
### Locational

What data is available for the selected Impoundment?



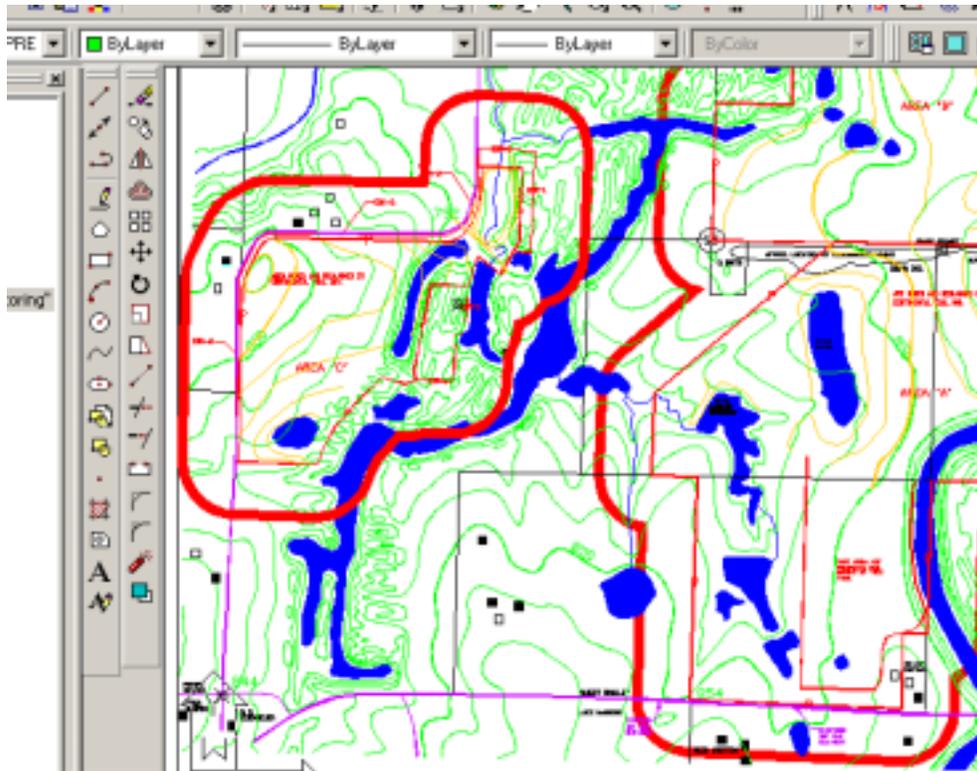
### Conditional

Where is TDS > 1000 ppm?



## Patterns

Which structures are within 300 feet of the active permit?



## Spatial Data Components

---

### **Two basic types of map information:**

- spatial information, which describes the location and shape of geographic features and their spatial relationships to other features, and
- descriptive information about the features

## CAD and GIS – complementary technologies

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### AutoCAD

*Graphics with properties*

*Properties describe how graphics are drawn*

*Focus on automation, storage, and retrieval*

### AutoCAD Map 2000

*Graphics with attributes*

*Attributes describe what the graphics represent*

*Attributes stored in a relational database*

*Focus on display, query, and analysis*

## **Lesson 2: IMPORTING and EXPORTING**

---

AutoCAD Map lets you import data from several external file formats including the following:

- **ArcView Shapefile (SHP)**
- **ESRI Arc/INFO Coverage**
- **MapInfo MIF/MID**
- **Intergraph (Microstation DGN)**
- **AutoDesk MapGuide (SDF)**

You can also export data from AutoCAD Map to these same file formats.

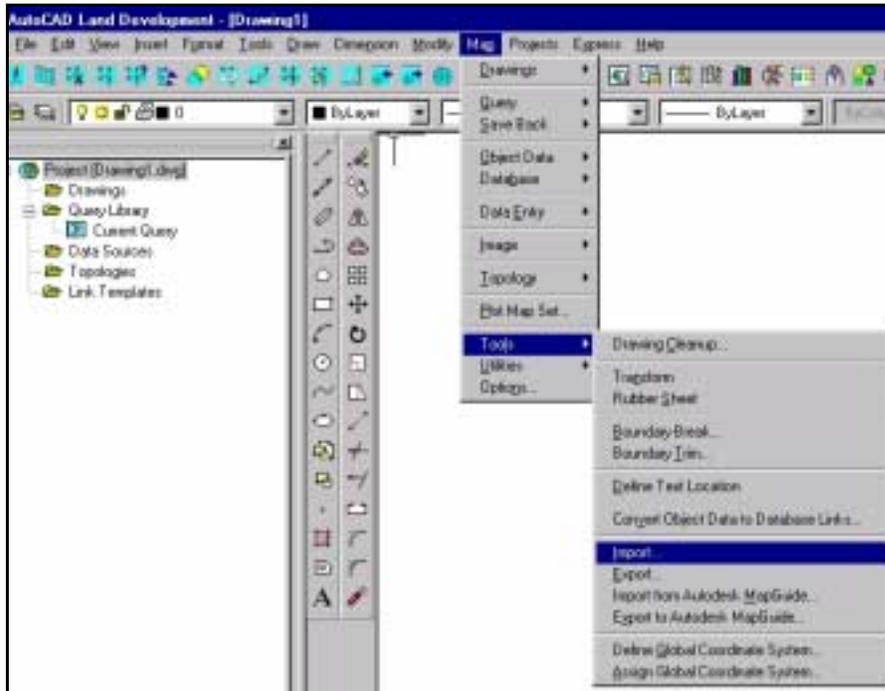
*The import and export commands allows the user to:*

- 1.) Specify a change in a file's coordinate system**
- 2.) Which layers data is placed on**
- 3.) How to manipulate blocks**
- 4.) Mapping of data elements to object data and external databases**

However, you must import all the data in an external file; AutoCAD Map does not allow for selective import.

## Steps for the Import Process:

### 1. Initiate the Import Command



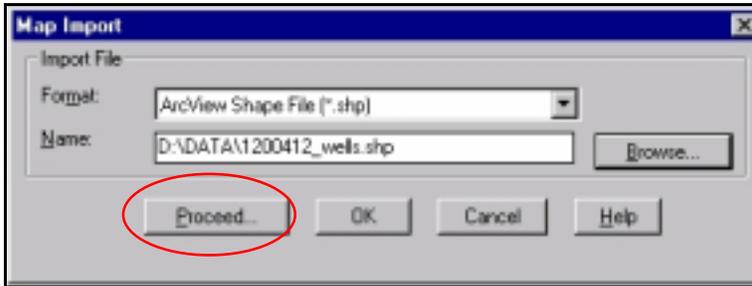
### 2. Specify the file type



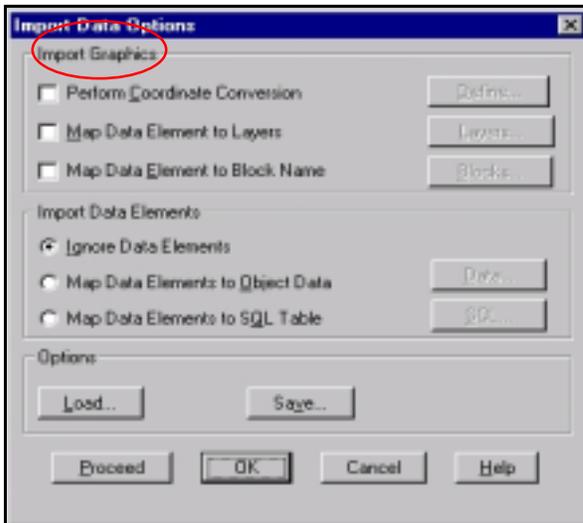
### 3. Specify the file



#### 4. Choose Proceed to continue

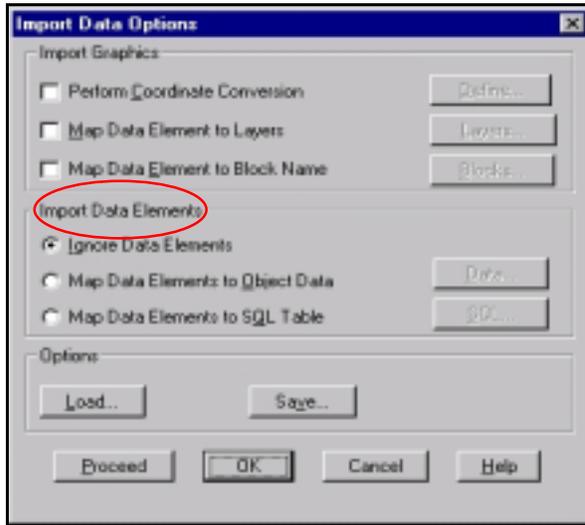


#### 5. Choose data translation options for importing graphical information (vectors)



The Import Graphics section of the dialog box allows mapping of the external file features to AutoCAD Map layers and blocks, as well as performing coordinate conversion. If Mapping for a set of data has already been defined and saved, you can load these settings with the Load button in the Options area.

## 6. Choose data translation options for importing attribute data



The Import Data Elements of the dialog box lets you map data stored in attribute tables to AutoCAD Map Object Data tables or external database tables. You can map to object data or an external database table, but not both

Object Data tables can be predefined in the current drawing, but the existing object data tables must contain the exact same field definitions as the items to be mapped /joined.

Data associated with polygons is mapped to a point (centroid) for that polygon, while data associated with arcs and points remains with the arcs and points respectively.

In order to Map Data Elements to an SQL table you must already be connected to a database driver.

**When importing data treat it like newly digitized data.**

## **Imported Data Needs**

- ❖ *Verification*
- ❖ *Cleanup*
- ❖ *Possibly Edge Matching*
- ❖ *Rubbersheeting to Match Existing Maps*

## Exporting Data

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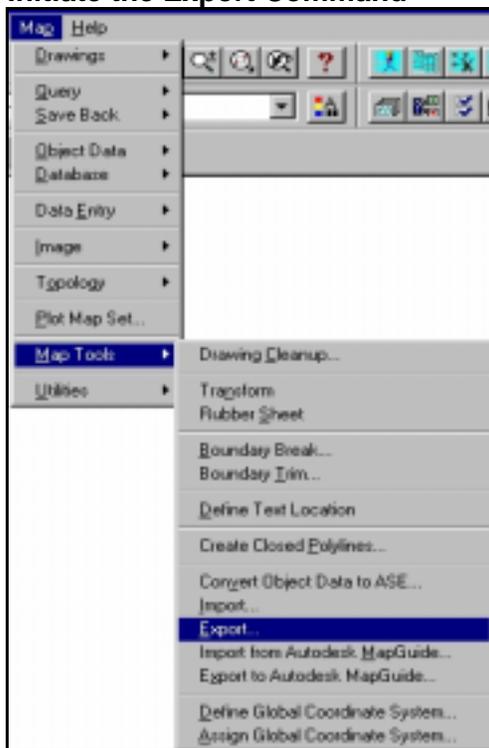
You use the SAVE and WBLOCK commands to maintain the data from a work session in DWG file.

There are other ways to export data from AutoCAD Map.

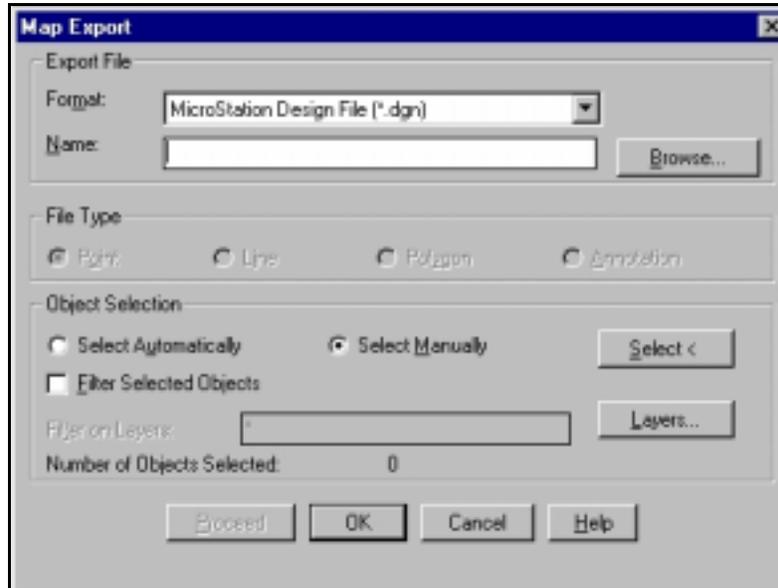
The external file formats that AutoCAD Map supports for export have already been discussed in this Lesson, however AutoCAD Map also allows ASCII and database files, created by Report queries, to be exported.

### Steps for the Export Process:

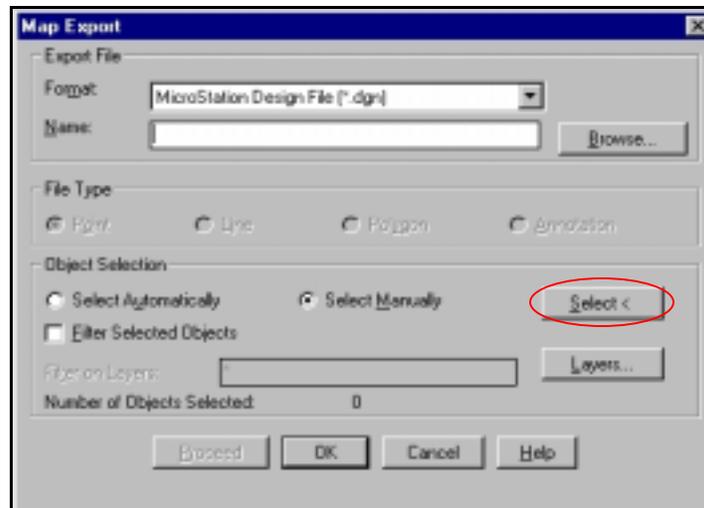
#### 1. Initiate the Export Command



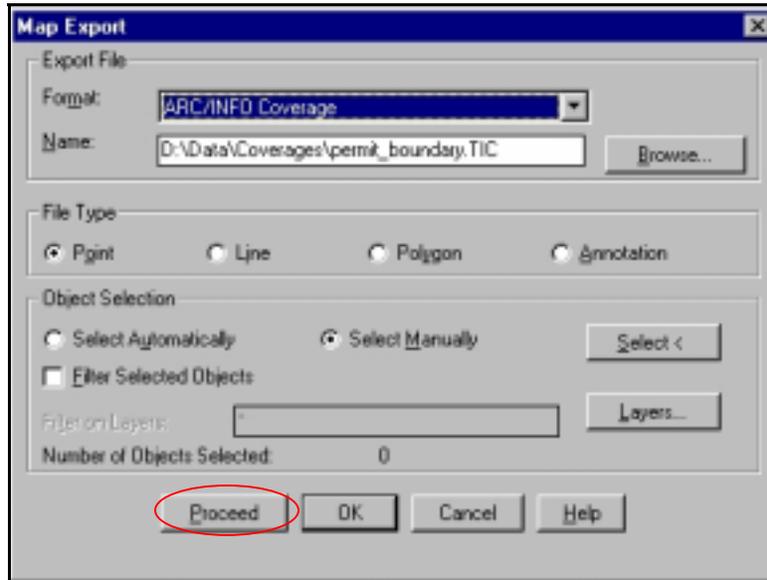
2. Select the file format you want to export, and then specify the file name and object feature type.



3. Specify how you want to select objects for the export.



#### 4. Choose Proceed



#### 5. Map Export Options dialog box, you can specify a new coordinate system, the mapping for layers, block names, object data, or an external database



Choose Proceed to start the translation.

## **Lesson 3: Editing and Cleaning**

---

AutoCAD Map provides a powerful range of tools for editing mapping data. The tools can be used to isolate selected data by breaking map objects where they cross a boundary, or by trimming objects and discarding data either inside or outside of a selected closed boundary. AutoCAD Map provides the ability to automate the process of removing errors from map data.

### **Methods**

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#### **Boundary Breaking**

1. Allows you to break objects at the location where they cross a specified polygon.
2. Creates vectors and polygons with start and points that straddle a cutting edge.
3. Does not break objects such as blocks, text, hatch patterns, and other objects with insertion points that do not form edges.

#### **Boundary Trimming**

1. Removes unnecessary detail or isolates the features within an area.
2. Similar to TRIM command, with the added options that the trimming boundary can be defined during the command or use a boundary from a previous query.
3. An existing boundary must be a circle or a closed polyline.
4. Trimming inside a boundary clears information from an area, while trimming outside a boundary discards all the data outside the area of interest.
5. Boundary Trim *deletes* data!

## Types of Errors

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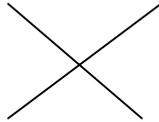
**Undershoots**



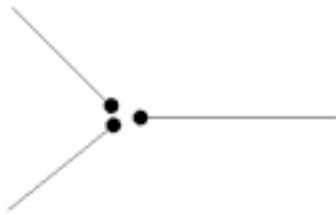
**Dangles**



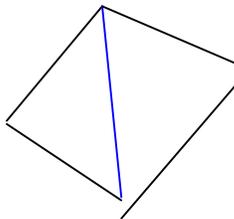
**Crossings**



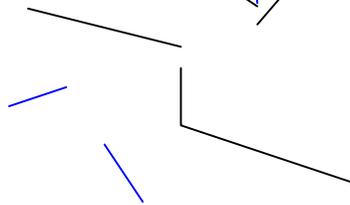
**Node Clusters**



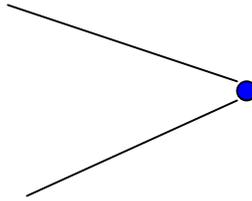
**Duplicates**



**Shorts**



## Pseudo Nodes



## Methods of Cleanup

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- Identify all errors, mark each error, and correct the problems using edit commands and grips.
- Identify all errors, examine each error, and correct the problems with AutoCAD Map cleanup options.
- Identify one error type, correct it automatically, then move on to another type of error.

## AutoCAD Map Clean up Tools

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AutoCAD Map provides tools for removing or correcting the several different types of digitizing errors previously discussed.

The tools allow you:

Select Automatically, which uses all the available objects in the drawing (Points, blocks, and text, are not considered)

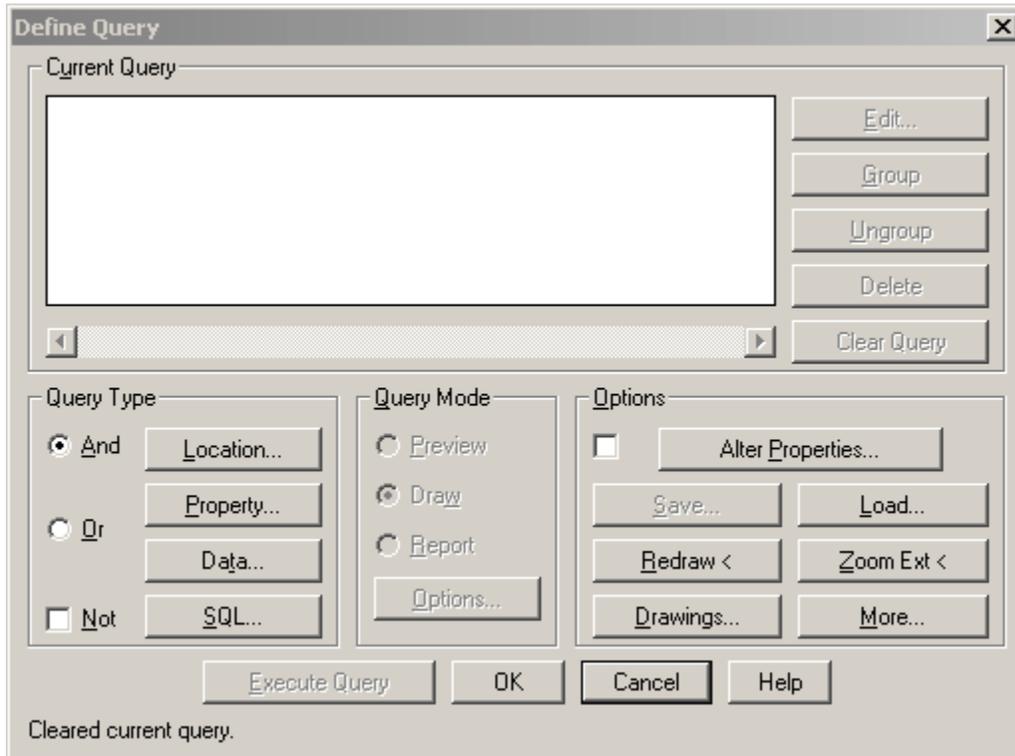
Select Manually lets you specify objects by picking, or with any selection set, such as All, Crossing, or Fence.

Filter Layers limits cleanup operations to the layers specified.

## Lesson 4: Working with Object Data

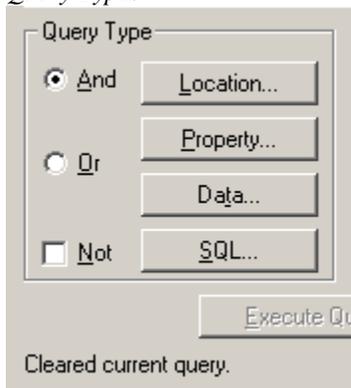
### Queries

#### Define Query Dialog Box



A query allows you to retrieve objects from source drawings or external databases.

#### Query Types



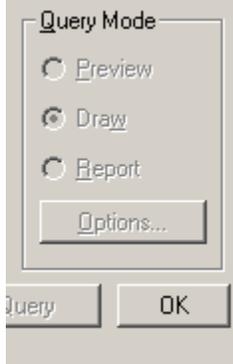
1. Location: Based on the spatial location of the object in the source drawing
2. Property: AutoCAD object properties (layer or color)
3. Data: Information stored as non-graphical object data in a drawing file.
4. SQL: Information in linked external database.

These query types can be used in combination with each other to create compound queries.

## Query Modes

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After creation of a query, the mode of the query has to be defined. The three modes are as follows:

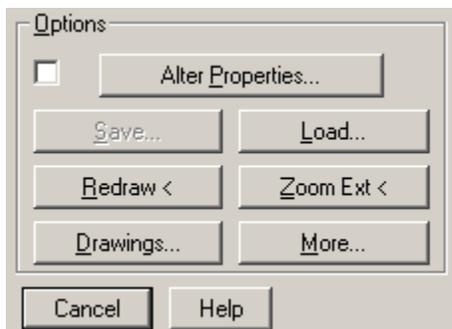


1. Preview: Displays queried objects but does not retrieve the objects. No editing functions are available.
2. Draw: Retrieves queried objects from source drawings or external databases and copies them to the work session drawing.
3. Report: Directs queried data to an ASCII text file.

## Query Options

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Query options can be used to make changes to the current query or query settings.



1. Alter Properties: Changes the properties of queried objects. The checkbox must be checked for the changes to take effect.
2. Save: Saves the current query settings to a file. These settings are then available to any drawing at any time.
3. Load: Retrieves a saved query setting file for use in the current query.
4. Redraw: Clears any preview queries performed.
5. Zoom Ext: Allows the user to zoom to the extents of any active drawing in the drawing set.
6. Drawings: Allows the user to attach, detach, activate, and deactivate drawings to be used for the current query.
7. More: Allows the user to change the general query settings for the entire drawing.

## **Lesson 5: Converting Drawing Coordinate Systems**

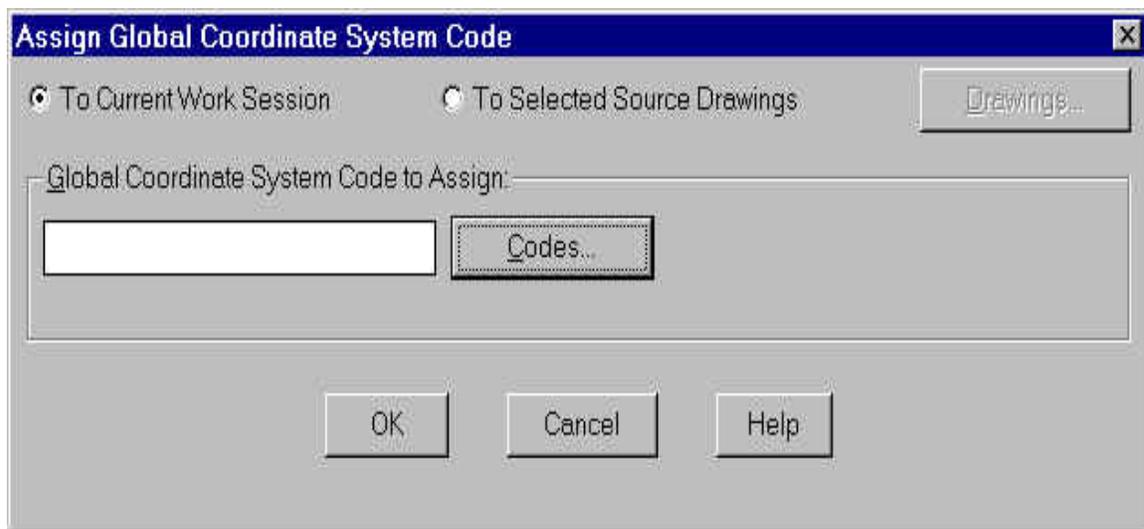
This procedure will explain how to convert drawings from one coordinate system to another using AutoCAD Map R2, R3, or R4. Follow the outline for each version, when a difference exists between the three follow the instructions for your particular version.

This example will convert a drawing in WV South 27 to WV South 83. The process will be the same regardless of the original or target system. We will refer to the original drawing as ORIGINAL.DWG and the new drawing as TARGET.DWG, with the obvious intention of preserving the original drawing. At your discretion you can overwrite ORIGINAL.DWG with the contents of TARGET.DWG.

### **Assigning the systems**

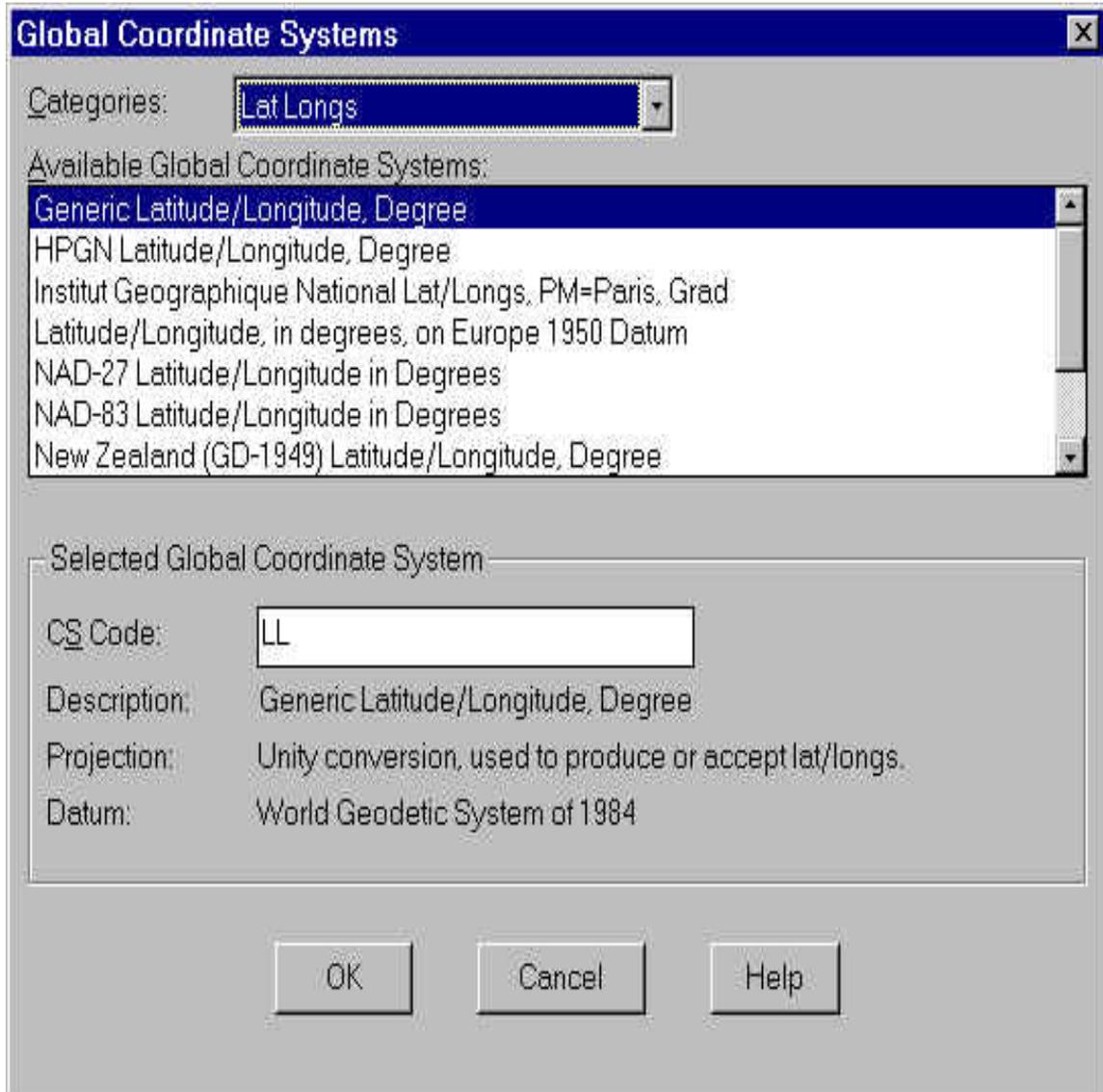
For Map to successfully produce the conversion, it needs to be told the coordinate system of the original and target drawings.

#### **For MapR2:**

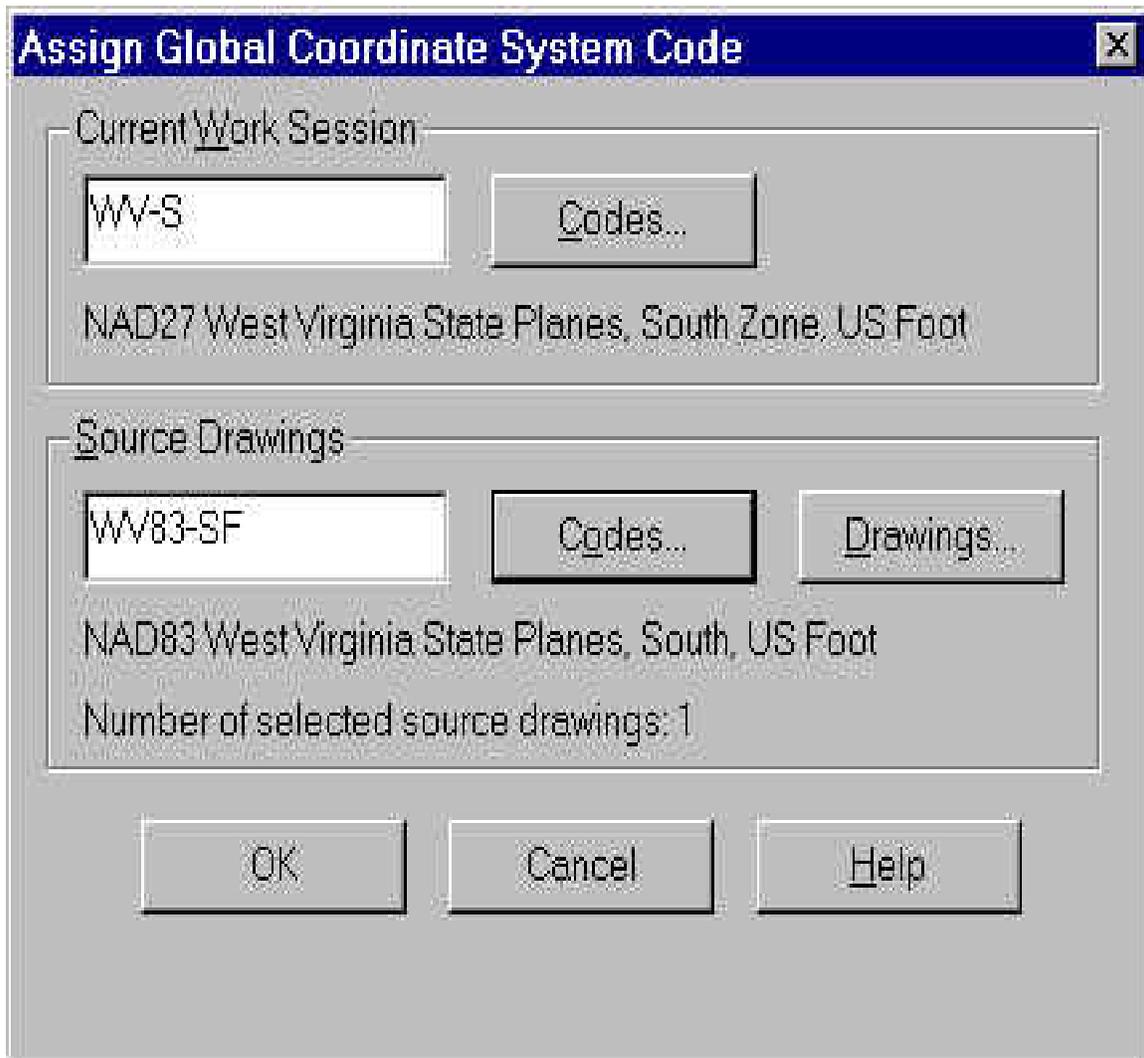


1. Start AutoCAD Map with a new, empty drawing. Do not load the drawing.
2. From the Map pulldown, choose Map Tools, then Assign Global Coordinate System.
3. Set the radio button to 'To Current Work Session'.
4. Choose the Codes button in the center of the dialog to bring up the 'Global Coordinate Systems' dialog as shown below.
5. Pull down the categories pulldown and choose (in this example) USA, West Virginia.
6. From the list of 'Available Coordinate Systems', choose NAD27 West Virginia State Planes South, US Foot.
7. The CS Code field should now read: WV-S, which we will assign to the current (target) drawing.
8. Choose OK to exit the dialog and make this assignment.
9. Press the Enter key at the command prompt to repeat the ADESETCRDSYS command.
10. Set the radio button to 'To Selected Source Drawings'.
11. Choose the Drawings button, select the desired drawing (ORIGINAL.DWG), add it to the selected drawings and choose OK. The bottom of the assignment dialog should say 1 Drawing(s) Selected.
12. Choose the Codes button in the center of the dialog to bring up the 'Global Coordinate Systems' dialog.
13. If necessary, pull down the categories pulldown and choose USA, West Virginia.
14. From the list of 'Available Coordinate Systems', choose NAD83 West Virginia State Planes South, US Foot.
15. The CS Code field should now read: WV83-SF, which we will assign to the (ORIGINAL.DWG) drawing on disk.

16. Choose OK to exit the dialog and make this assignment. This may take a few seconds depending on the size of the drawing.



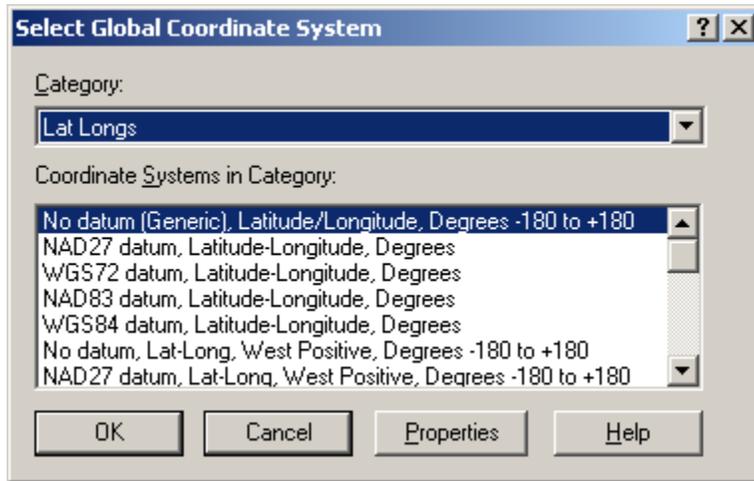
**For MapR3:**



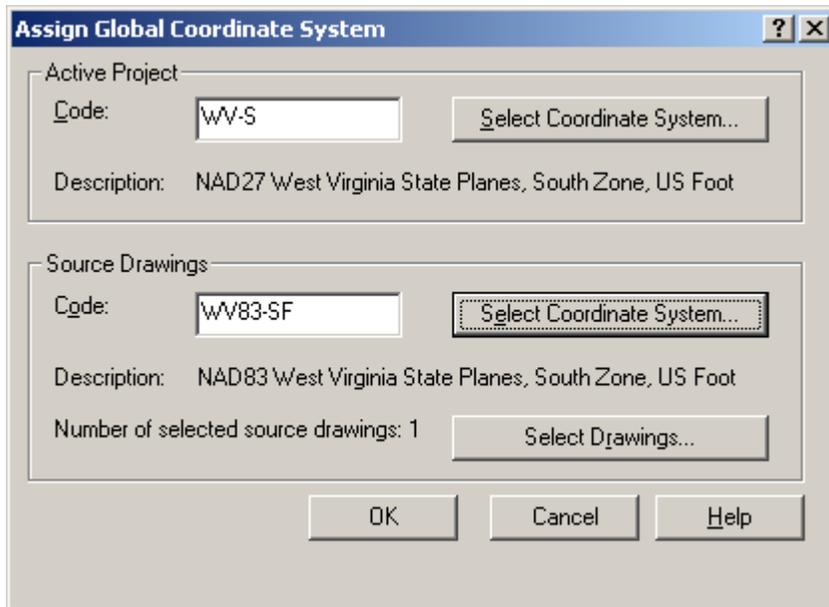
1. Start AutoCAD Map with a new, empty drawing. Do not load the drawing.
2. From the Map pulldown, choose Map Tools, then Assign Global Coordinate System.
3. Choose the Codes button in the 'Current Work Session' section to bring up the 'Global Coordinate Systems' dialog as shown above.
4. Pull down the categories pulldown and choose (in this example) USA, West Virginia.
5. From the list of 'Available Coordinate Systems', choose NAD27 West Virginia State Planes South, US Foot.
6. The top edit field should now read: WV-S, which we will assign to the current (target) drawing.
7. In the middle 'Source Drawings' section, choose the Drawings button, select the desired drawing (ORIGINAL.DWG), add it to the selected drawings and choose OK. The middle the assignment dialog should say Number of selected source Drawings: 1.
8. Choose the Codes button in the center of the dialog to bring up the 'Global Coordinate Systems' dialog.
9. If necessary, pull down the categories pulldown and choose USA, West Virginia.
10. From the list of 'Available Coordinate Systems', choose NAD83 West Virginia State Planes South, US Foot.
11. The CS Code field should now read: WV83-SF, which we will assign to the (ORIGINAL.DWG) drawing on disk.

12. Choose OK to exit the dialog and make both assignments. This may take a few seconds depending on the size of the drawing.

**For MapR4 (Map 2000):**



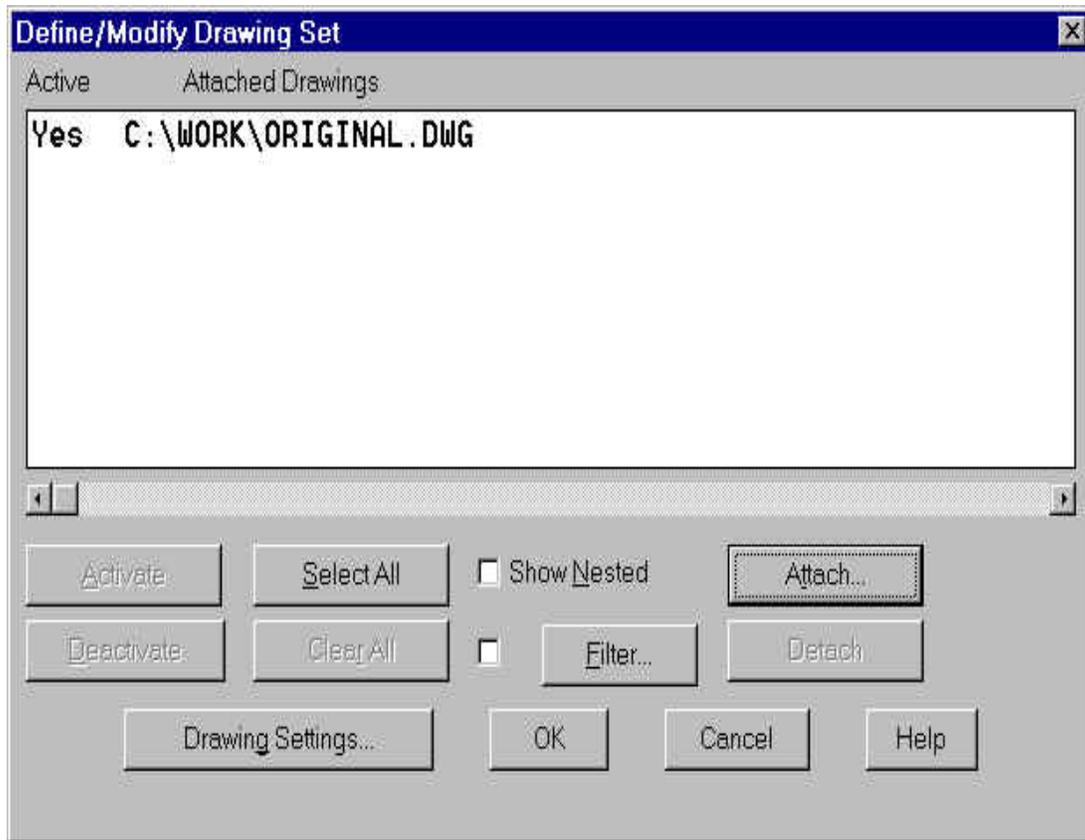
1. Start AutoCAD Map with a new, empty drawing. Do not load the drawing.
2. From the Map pulldown, choose Map Tools, then Assign Global Coordinate System.
3. Choose the 'Select Coordinate System' button in the 'Active Project' section to bring up the 'Global Coordinate Systems' dialog as shown above.
4. Pull down the categories pulldown and choose (in this example) USA, West Virginia.
5. From the list of 'Available Coordinate Systems', choose NAD27 West Virginia State Planes South, US Foot.
6. The top edit field should now read: WV-S, which we will assign to the current (target) drawing.
7. In the middle 'Source Drawings' section, choose the Select Drawings button, select the desired drawing (ORIGINAL.DWG), add it to the selected drawings and choose OK. The middle of the assignment dialog should say Number of selected source drawings: 1.
8. Choose the 'Select Coordinate System' button in the center of the dialog to bring up the 'Global Coordinate Systems dialog.
9. If necessary, pull down the categories pulldown and choose USA, West Virginia.
10. From the list of 'Available Coordinate Systems', choose NAD83 West Virginia State Planes South, US Foot.
11. The CS Code field should now read: WV83-SF, as shown below, which we will assign to the (ORIGINAL.DWG) drawing on disk.
12. Choose OK to exit the dialog and make both assignments. This may take a few seconds depending on the size of the drawing.



At this point we have assigned coordinate systems to both drawings and are ready to proceed to querying the objects into the current (target) drawing.

### **Attaching the Source Drawing**

At this point we have informed Map about what coordinate system the ORIGINAL.DWG is in, but have not attached it as a source drawing.



1. From the Map pulldown, choose Drawings, Define/Modify Drawing Set.
2. Choose the Attach button, select, add, and open the ORIGINAL.DWG.
3. The dialog should now show your drawing attached and active, and then choose OK.

## Querying the Objects

AutoCAD Map does the transformation as drawing objects are being queried into the current drawing. So the next step is to setup a simple query to import all of the objects.

1. From the Map pulldown, choose Query, Define Query.
2. Choose the Location button in the lower left.
3. In the 'Location Condition' dialog, 'All' is the default so simply choose OK.
4. In the center of the 'Define Query' dialog, set the query mode to 'Draw'.
5. Choose the Execute Query button to query in the objects.



### Finishing Up

The geometry is now available in the current drawing in its translated form. Simply do zoom extents to display the geometry, and then save the drawing.

## **Lesson 6: Database Connection**

### **Definitions**

- Database: a collection of textual information organized into tables, views, queries, and reports, all stored in one file.
- Table: one part of a database with a data structure made of horizontal rows or records with vertical columns defining the data elements.
- Environment: the database management software (DBMS), the databases it can access, and the users and programs that can access those databases.
- Catalog: the directory path name that is the location of the database.
- Schema: the catalog subdirectory where the database tables reside.
- Link: consists of a link template and a value in the key column in a database.
- Link Template: a five part address consisting of the environment, catalog, schema, table, and key columns. A link template is stored as object data with each linked drawing object
- UDL: stands for Universal Data Link. A UDL lists the location and version of a database (or the location of a data source name (DSN)) and the appropriate database driver.

### **Connecting a Database**

- Three ways to connect a database
  1. Drag & Drop a database into the Project Workspace.
  2. Right click on Databases in the Project Workspace then select attach.
  3. Go to the Map pulldown menu and then select Database→Data Sources→Attach.
- You can also use a UDL from a database that was attached to a different project.
- All tables in the attached database are shown in the project workspace.
- The reference to the external database is maintained in the project. The environment, catalog, and schema are written to the system registry.
- The databases are not attached to any source drawings at this point. When the project is closed, all database connections are terminated.

### **Viewing Data**

- Three ways to open the Data View window.
  - 1) Double-click on a table in the Project Workspace.
  - 2) Right click on a table then choose Edit Table or View Table from the shortcut menu.
  - 3) Double-click on a Link Template or Query in the Project Workspace.
- These options show all records in the table.
- Records can be filtered using the Recordsè Filter command from the Data View menu.
- Records can be sorted by double-clicking on a column. The first time you double click it is sorted in ascending order. The second time it is sorted in descending order.
- To sort multiple columns, choose the Sort Multiple Columns option from the view menu. Choose the columns to sort and the records are sorted first on the first column values. Then any duplicate values in the first column are sorted by the second column value and so on.
- If the table is opened in edit mode, you may change, add, or delete records. You cannot change the table structure or the data type.
- Undo only works for one action in the Data View window.
- Add a new record by editing the last row (marked with an \*). When you move to another record, the new record is added to the database.

### **Defining Link Templates**

- Two ways to define link templates

- 1) Right-click on a database in the Project Workspace and choose Define Link Template from the shortcut menu.
  - 2) From the Map pulldown, choose Database → Define Link Template.
- In the Data View window choose Links → Define Link Template.
  - In the Define Link Template dialog box, first give the template a name. (31 characters maximum, no spaces or symbols)
  - Next, choose the column or columns that you want to use as “key columns”
    - ✓ A “key column” is a column used to link records to objects.
  - The new link template is shown in the Project Workspace and the Data View window.

## Linking Objects

- 4 ways to link data
    - 1) Create the link as you digitize the object
    - 2) Copy a drawing that already has database links generated.
    - 3) Generate links from existing blocks and attributes in a map with the Database → Generate Links option in the Map menu.
    - 4) Click the Link button (looks like a short chain) in the Data View window.
  - The generate links command has 4 options for link creation.
    - 1) Blocks: links records to a block based on the blocks attribute values.
    - 2) Text: links records to text objects
    - 3) Enclosed Blocks: links records to a polyline that encloses a block.
    - 4) Enclosed text: links records to a polyline that encloses a text object.
- For both the block and enclosed block options, the attribute tag and the table column name must match.

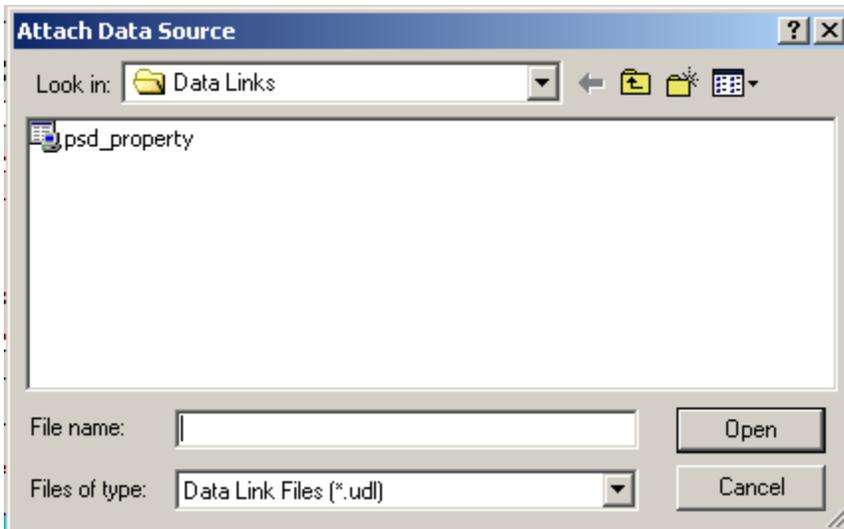
## Viewing Linked Records

- From the Data View window, linked records can be viewed by clicking the “View Linked Records” button then clicking an object in the drawing.
- The records linked to that object are shown as highlighted records in the Data View window.
- Viewing Linked Objects
- Objects linked to a record can be viewed by selecting the record in the Data View window and then clicking the “View Linked Objects” button.
- The objects linked to that record are shown in the drawing window. With the correct settings, the linked objects are highlighted and the window zooms to the object.

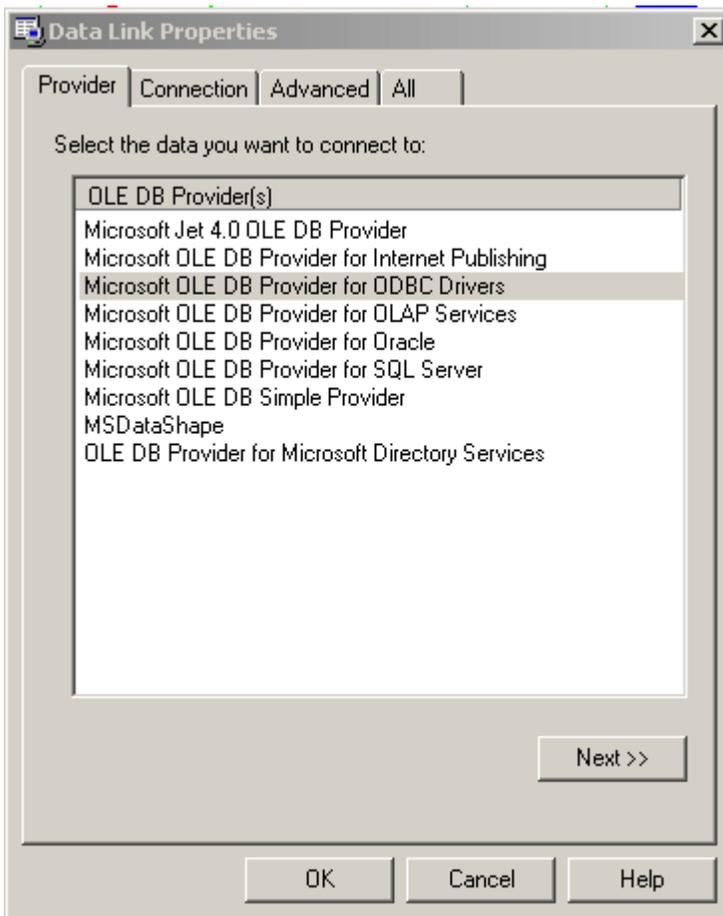
## Exercise

Open the drawing titled Org.dwg. Make sure that you project workspace is visible. If the project workspace has been closed, you can reopen it by going to the Map pulldown menu and choosing **Utilities** → **Project Workspace**. We will now attach the database named bond.mdb to this drawing.

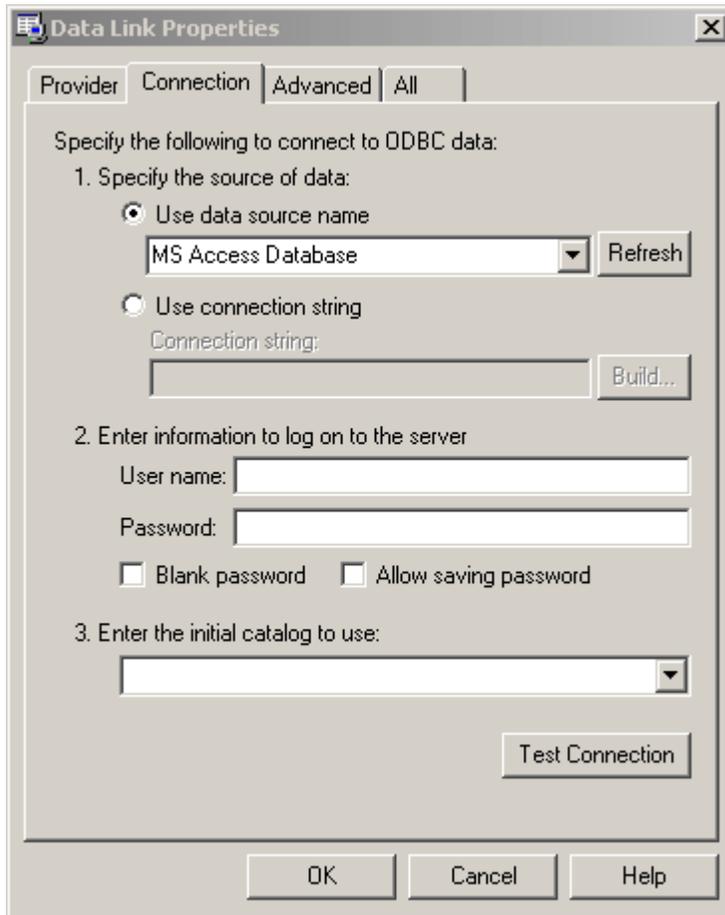
Double click on the Data Sources folder in the Project Workspace. You should get a dialog box like the one shown below. In the Files of type box, change the file type to Microsoft Access files and then navigate to the file bond.mdb. This file should be in your Cad Class folder. Once you have selected bond.mbd, click open to attach the database file. If the database is attached properly, you should see bond listed under the data sources folder with all of the tables and queries listed below that.



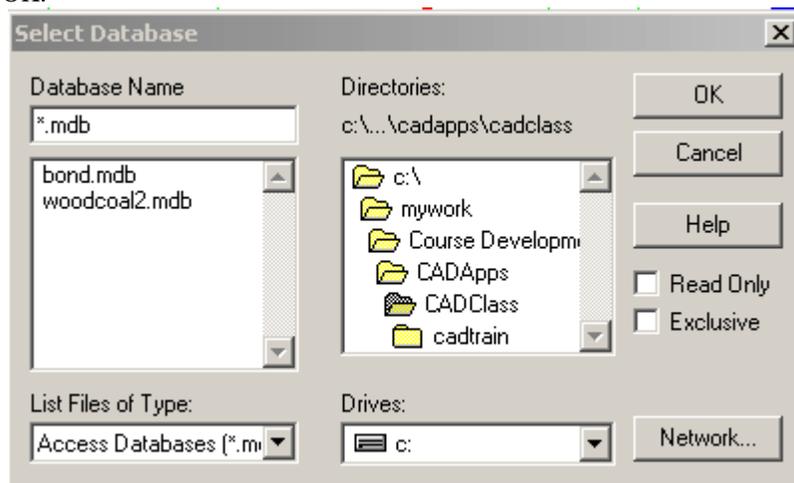
If you receive an error message after clicking on open, there could be a problem with the database configurations in Map. Click OK in the error message dialog, and then you should see bond listed under the data sources folder with a small red “x” next to it. The easiest way to fix this problem is to type **dbconnect** on the command line. This will open the database connectivity menu and box. The box should show up somewhere near the Project Workspace. You should see bond listed again in this box with a small red “x” on it. If you double click on bond, you should get another error message. Click on the “Configure” button in the lower right corner to configure the database. You should get the dialog box shown below.



Click on the Connection tab and click the radio button next to “Use data source name” and select “MS Access Database” from the dropdown list. This should be all that you need to connect to the database. The other options could be used, but this is the quickest and easiest way to go. After you have set these options as they are shown below, click on OK.

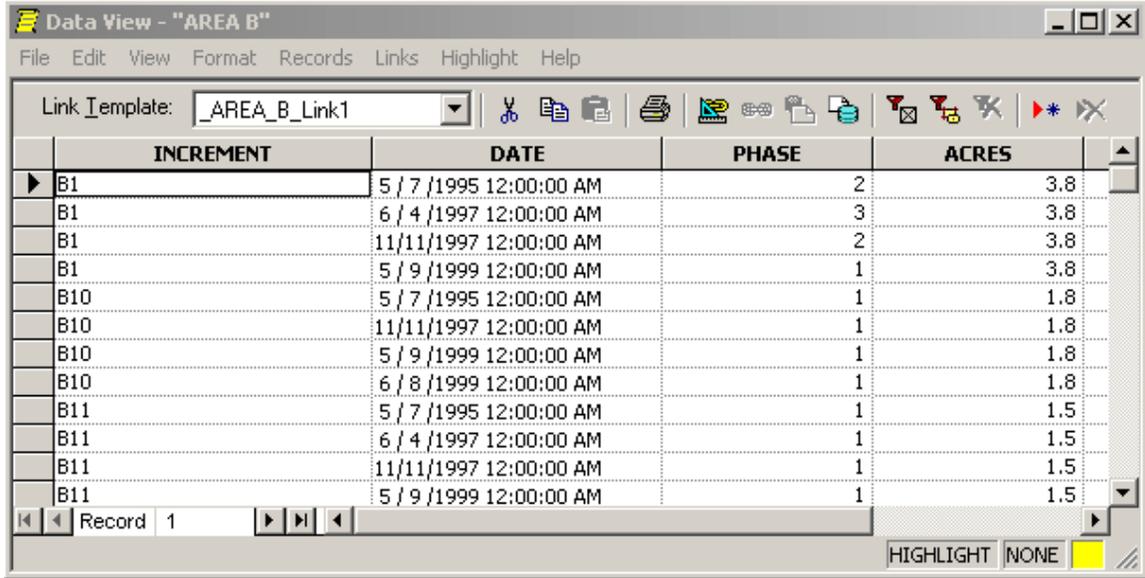


After you click ok you will be prompted to select the file to connect. Select bond.mdb and click OK.

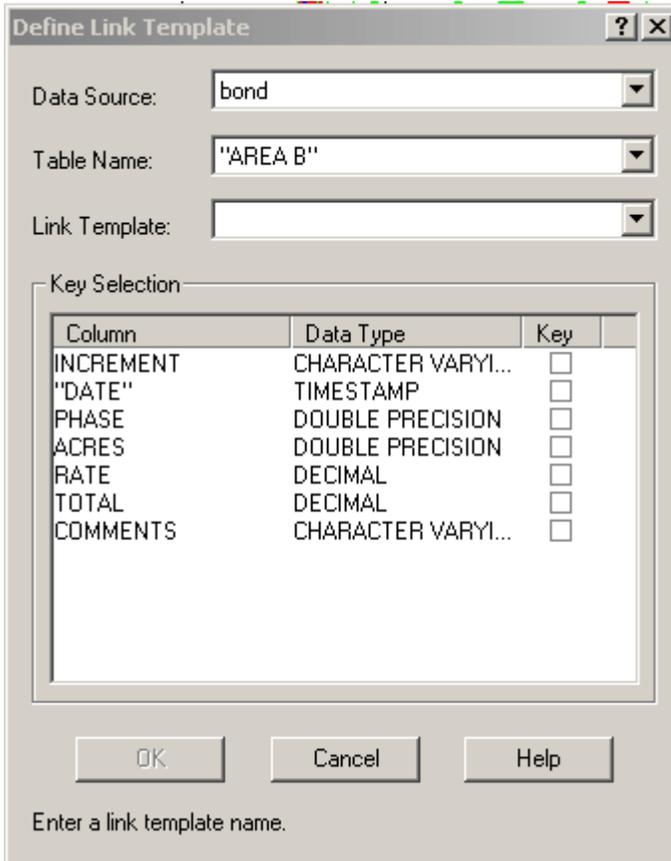


You should now see all of the tables in bond listed in the Data Sources area of the Dbconnect box. Close this box, and then double click bond in the Project Workspace. You should now have all of the tables listed

in the Project Workspace. Double click on the table named “Area B” and you should see the table displayed in a new window. This table can be edited, sorted, queried, etc., just like any other database. At this time, the database is not linked to any object in the drawing; it is just attached to the drawing.



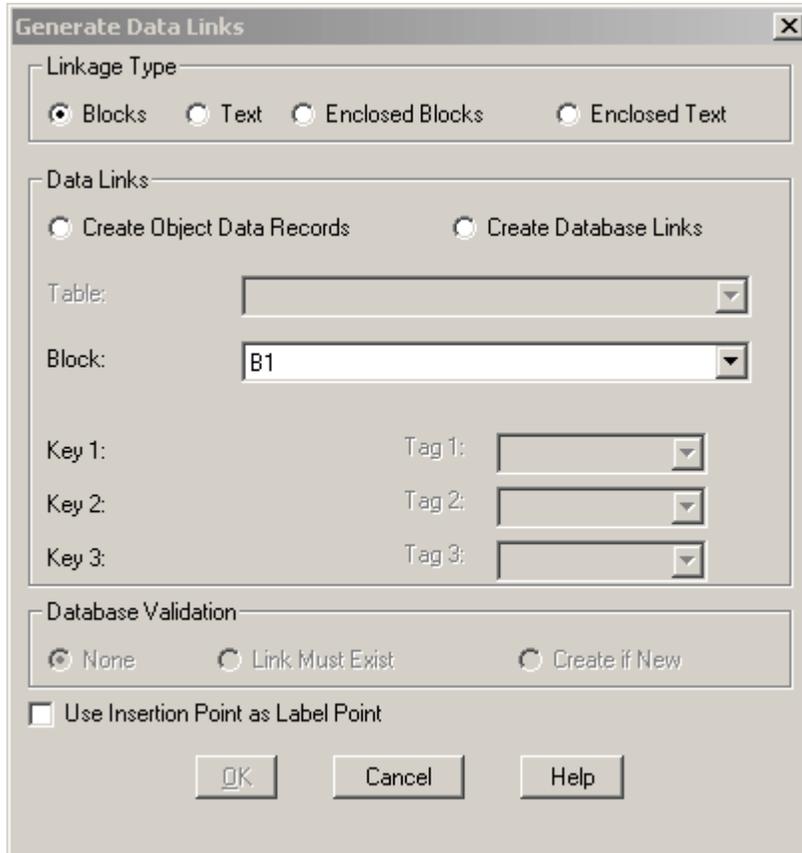
In order to link object to the database, we must define a link template first. To define a link template, right click on the link template folder in the Project Workspace and then choose “Define Link Template.” You should get the dialog box shown below.



The data source and table fields identify the specific table to be linked. The link template field is where you can give the template a name. The Key selection field allows the user to define which columns in the table are to be used to generate links.

For this exercise, we will be using the table named “Area B” from the database named “bond.” For the Link Template name, type in “Area\_B\_Link\_1” and check the box next to Increment in the Key Selection field. Once this is finished, click ok.

The next step is to generate the database links. Before we generate the links, isolate the layer with the bond increments on it using the isolate layers command. Next, right click on the Area\_B\_Link\_1 link template in the Project Workspace and then choose Generate Links. You should get the Generate Links dialog box shown below.



For this exercise, we will be linking to enclosed text. This will create the link on the polyline that forms the perimeter of each increment. Click the radio button next to Enclosed Text, and click the radio button beside “Create Database Links”. On the Table dropdown, chose Area\_B\_Link\_1. Make sure that Key 1 says INCREMENT next to it, and then choose OK. You will be prompted on the command line for the text to generate links from. Type “s” for select, and then use a window selection to choose all of the text in the increments. Hit enter and the command line should show 30 links created. You can now view the linked records in the data view window. There is a second database already connected to the drawing that has water information. This can be viewed at any time. The database is also linked to objects in the drawing.

## XX. Q&A

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