LESSON 8

EXTERNAL DATA AND SPATIAL REFERENCING
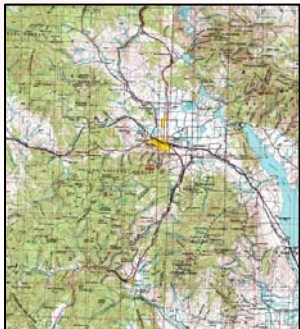
Digital Elevation Models from the National Elevation Dataset - 30 meter

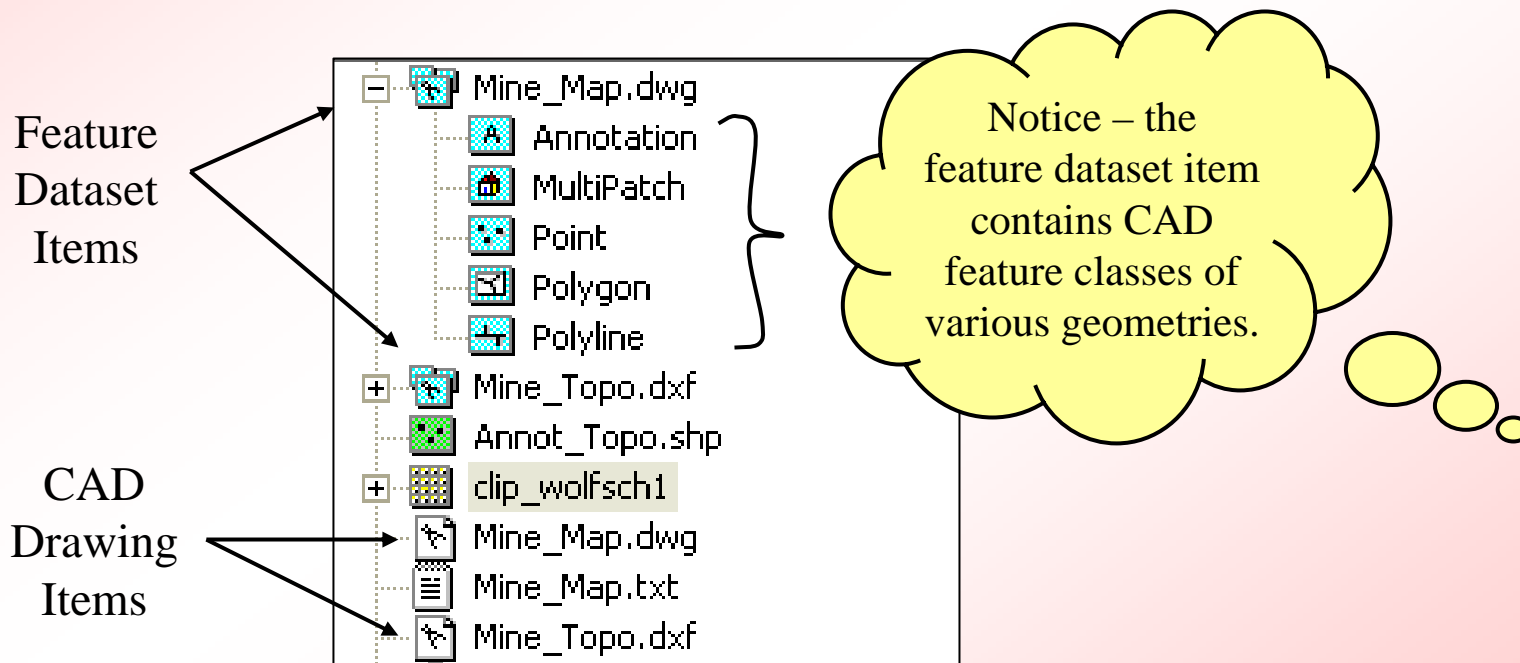| type	tile type	projection
grid - ASCII	Other	NAD_1983_StatePlane_Montana_FIPS_2500
grid - ASCII	Other	NAD_1983_UTM_Zone_11N,12N,or13N
USGS DEM	Other	NAD_1983_StatePlane_Montana_FIPS_2500
USGS DEM	Other	NAD_1983_UTM_Zone_11N,12N,or13N

LESSON 8 OBJECTIVES

By the end of this lesson, you will be able to:

- Manipulate and explore CAD files using ArcGIS.

- Project data to a specified coordinate system.

- Georeference various data formats.

- Work with raster images in ArcCatalog and ArcMap.

CAD Data In ArcCatalog

- AutoCAD data (.dxf, .dwg) is displayed in two different formats.
- The two data formats are generated by ArcGIS

Feature Dataset Items

CAD Drawing Items

Notice – the feature dataset item contains CAD feature classes of various geometries.

Mine_Map.dwg
  Annotation
  MultiPatch
  Point
  Polygon
  Polyline
Mine_Topo.dxf
Annot_Topo.shp
clip_wolfsch1
Mine_Map.dwg
Mine_Map.txt
Mine_Topo.dxf

CAD Properties

ArcCatalog - ArcView - C:\ArcGIS_9x_Intro_Course\D

File   Edit   View   Go   Tools   Window   Help

Location: C:\ArcGIS_9x_Intro_Course\Data\exercise8\BM_Mine.[

Stylesheet: FGDC ESRI

Contents   Pr

- exercise6
- exercise7
- exercise8
  - BM_Mine.DWG
    - Annotation
    - MultiPatch
    - Point
    - Polygon
    - Polyline
  - BM.sid
  - BM_Mine.DWG
  - BM_Mine.lyr
  - BM_mine.mxd

Name

- Annotation
- MultiPatch

Copy	Ctrl+C
Delete	
Rename	F2
Export	▶
Properties...	

CAD Feature Dataset Properties

General | Spatial Reference

CAD Dataset Path

c:\arcgis_9x_intro_course\data\exercise8\BM_Mine.DWG

This dataset set may be treated as a CAD Drawing or as a Feature Dataset containing point, polyline, and polygon features, or as annotation.

CAD Drawing Layers

Visible Layers

```
0
TRAIL
FENCE
IDXCONT-T
IDXCONT
INTCONT
SPOTELEV
BUILDING
UPOLE
VEGT
```

Invisible Layers

CAD Dataset Feature Counts

Point Feature Count :   1004

Polyline Feature Count :   2032

Polygon Featue Count :   703

MultiPatch Feature Count :   703

Annotation Count :   308
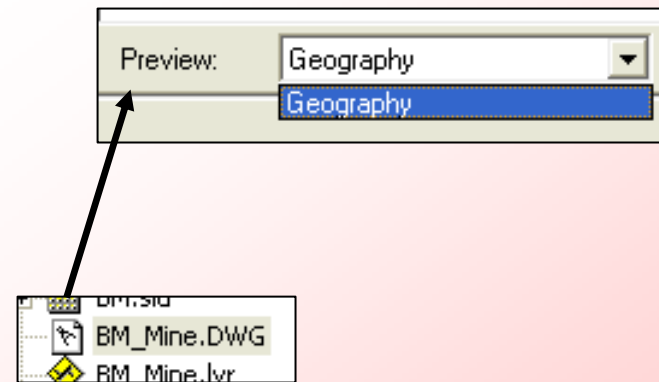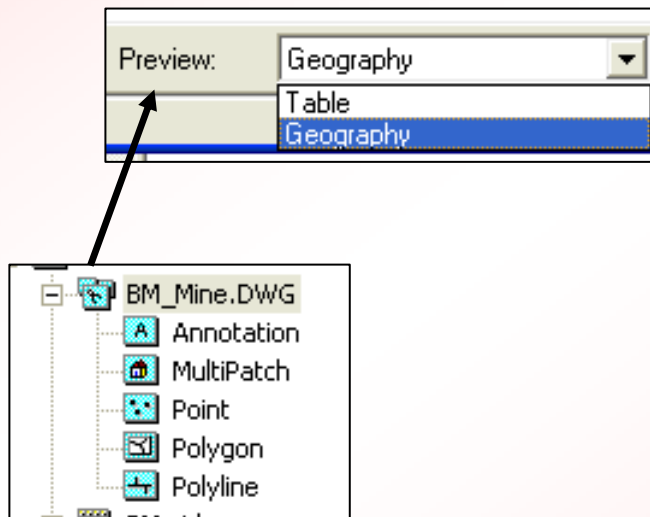
Summary
of Feature
Classes

OK   Cancel   Apply
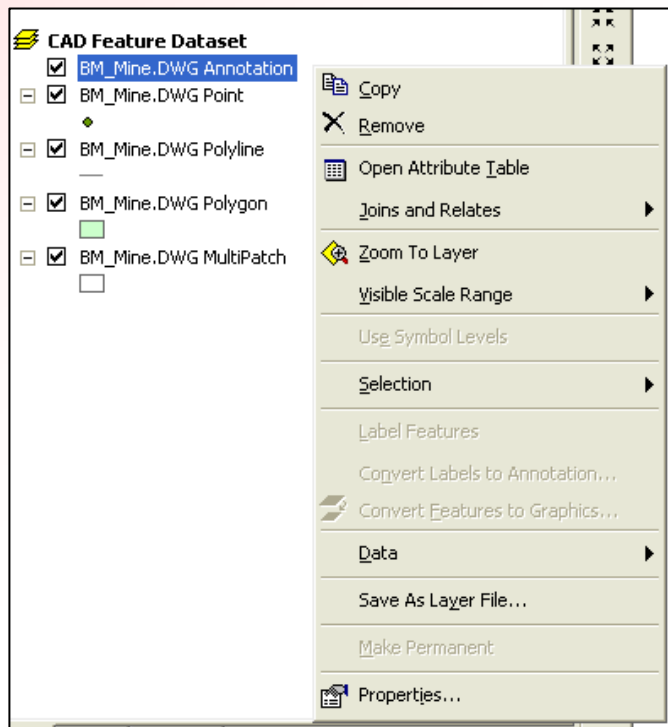
CAD Files in ArcCatalog

In ArcCatalog, CAD Feature Datasets can be previewed in both geography and table format.

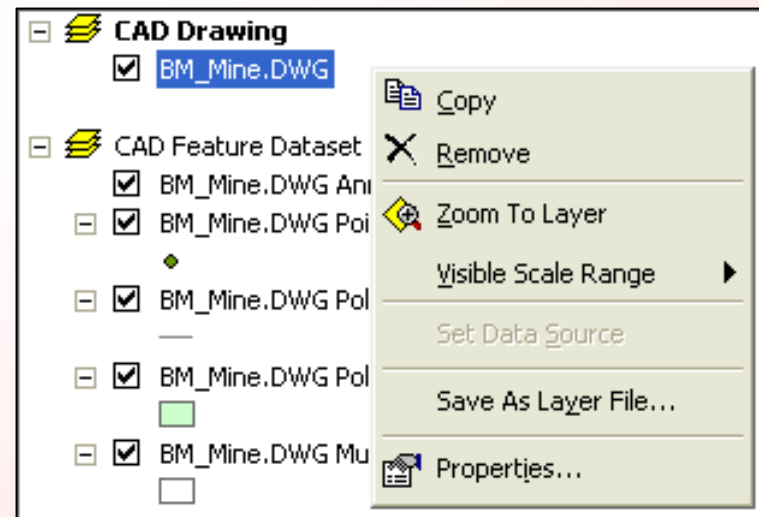The ArcCatalog preview for a CAD drawing is limited to geography.

CAD Files in ArcMap

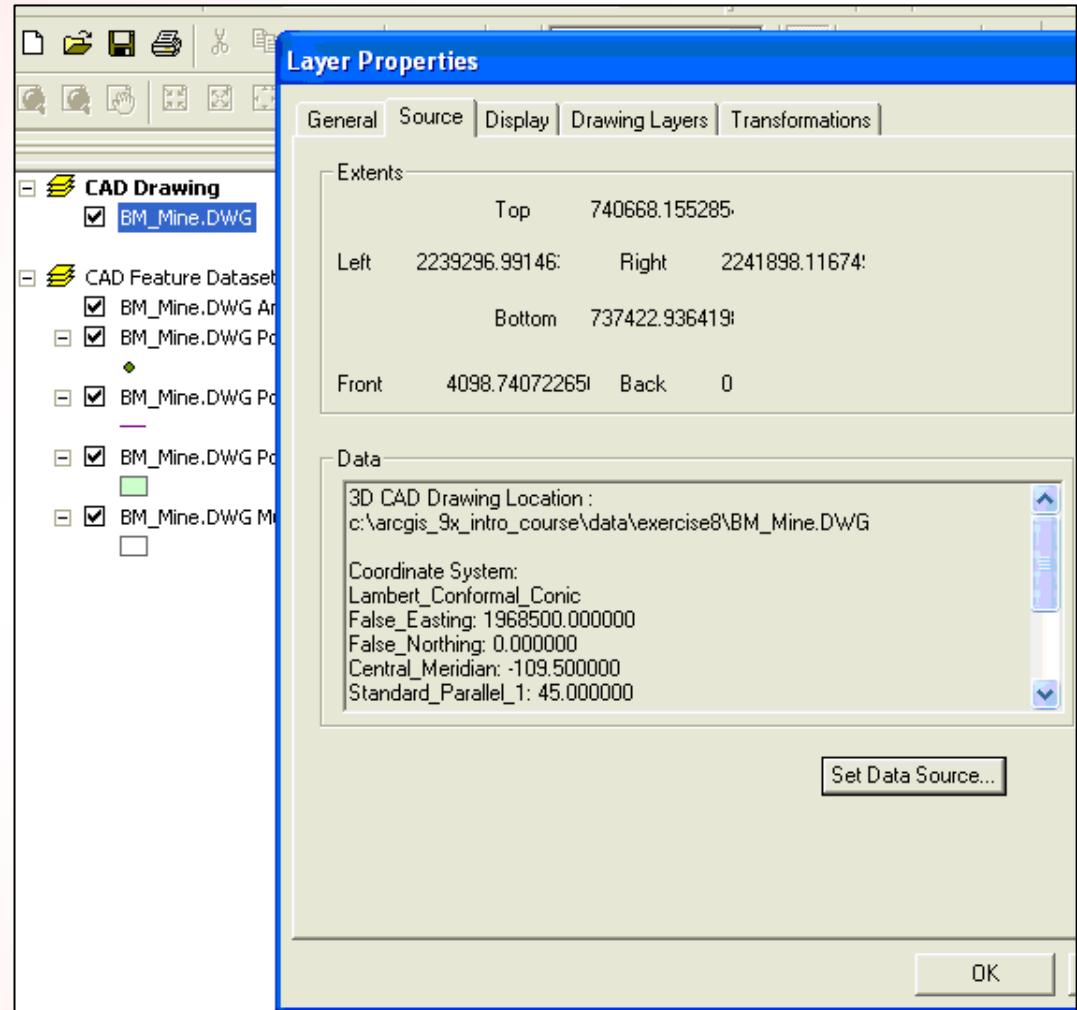CAD Feature Datasets have more options in ArcMap

CAD Drawings are limited – basically for viewing purposes and examining the file contents. Note there is no attribute table.

CAD Drawing Symbology

- No options to change symbology for CAD drawings.

- Drawings retain the colors, lineweights, etc. that were set in AutoCAD.

Layer Properties

General | Source | Display | Drawing Layers | Transformations

Extents

	Top	740668.155285·	
Left	2239296.99146:	Right	2241898.11674:
	Bottom	737422.936419:	
Front	4098.74072265(	Back	0

Data

3D CAD Drawing Location :
c:\arcgis_9x_intro_course\data\exercise8\BM_Mine.DWG

Coordinate System:
Lambert_Conformal_Conic
False_Easting: 1968500.000000
False_Northing: 0.000000
Central_Meridian: -109.500000
Standard_Parallel_1: 45.000000

Set Data Source...

OK

CAD Drawing
☑ BM_Mine.DWG

CAD Feature Dataset
☑ BM_Mine.DWG Ar
☑ BM_Mine.DWG Pc
☑ BM_Mine.DWG Pc
☑ BM_Mine.DWG Pc
☑ BM_Mine.DWG M

CAD Feature Dataset Symbology

- Different geometries are grouped together, and ArcMap randomly assigns different colors to each.

- Access symbology properties separately for each feature class.

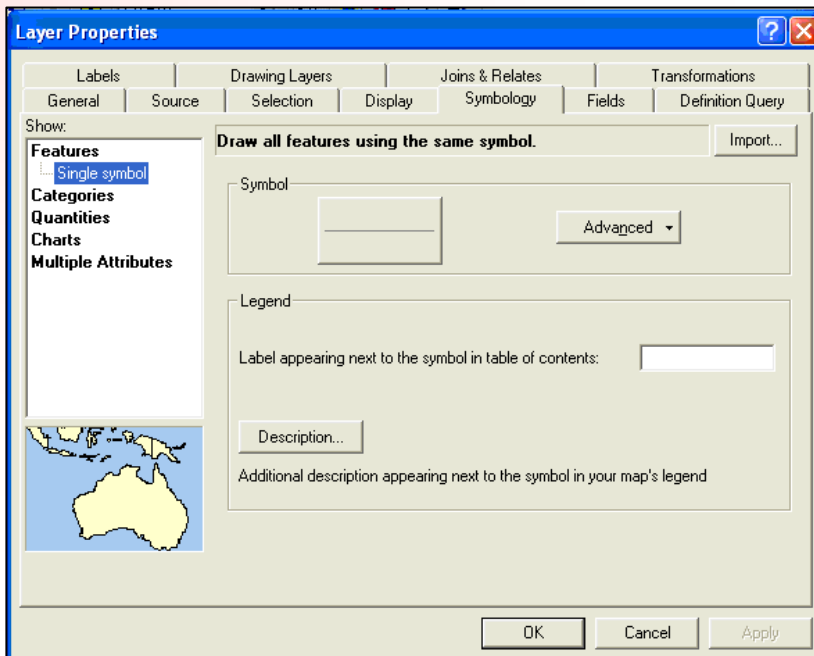- Changing color only – left click on the symbol.
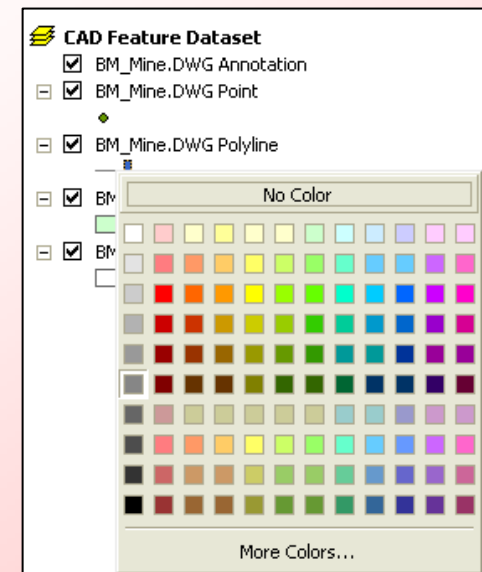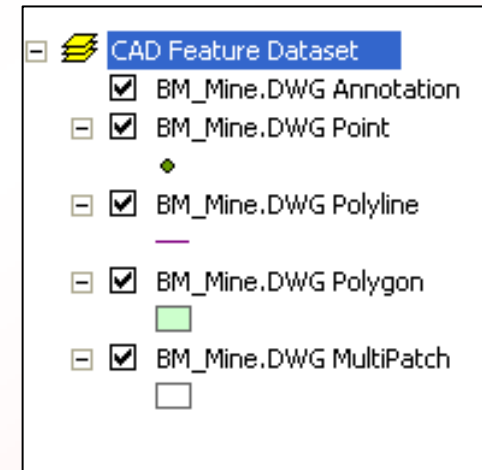
CAD Feature Dataset Symbology

- Access the Symbol selector box by single-clicking on the symbol below each feature class.
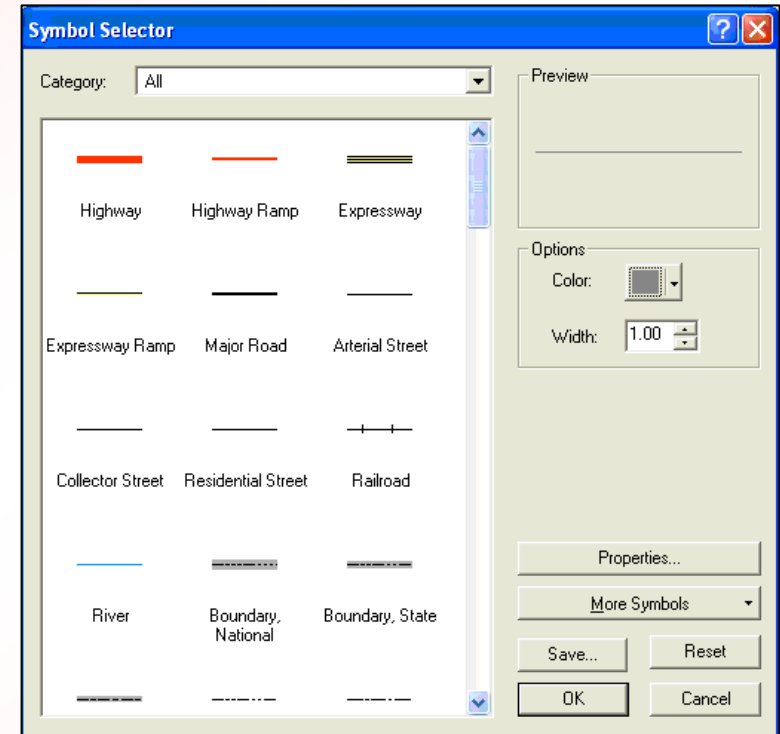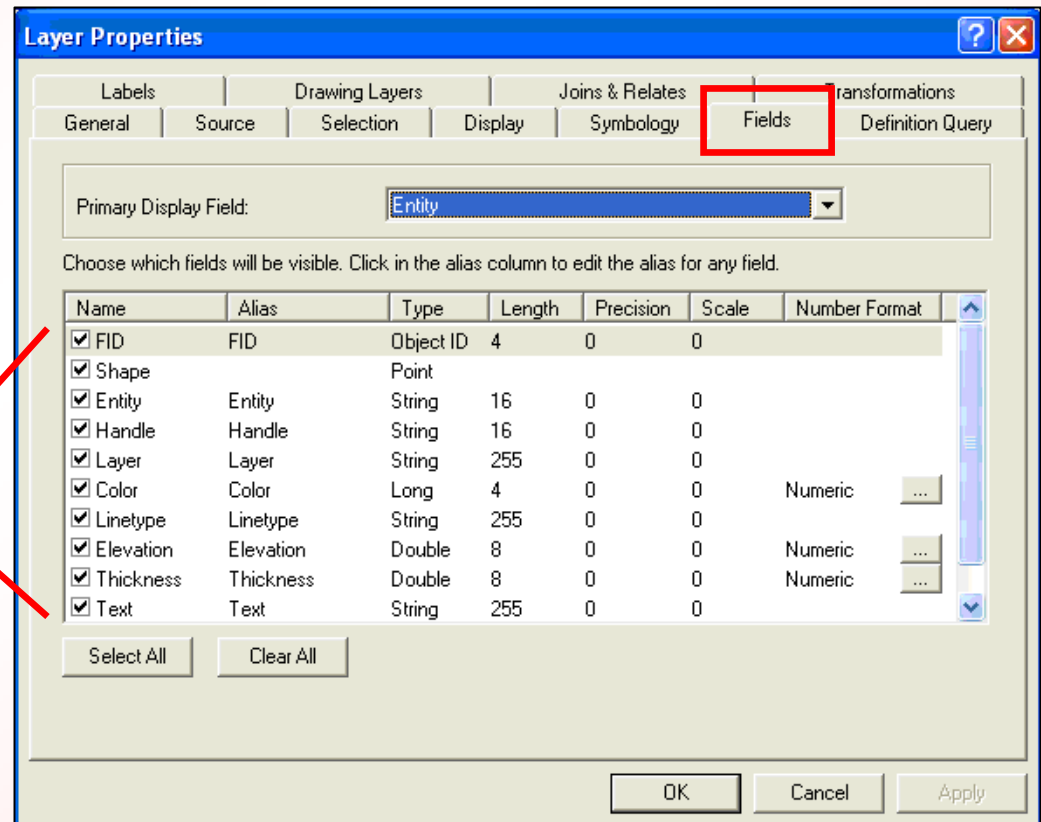

- Or access the Symbology tab in the Layer properties box by right-clicking on the feature class and selecting Properties.

CAD Drawing Fields

- CAD Drawings (white icon) do not have Attribute Tables in ArcGIS.

Standard CAD fields

CAD Attribute Tables and Feature Classes

- Contains information from the CAD file, including elevation data.
- Same query options available as for shapefiles.
- CAD data is Read-Only! No editing allowed.

Add Field should be grayed out, but it is not. This is a bug in ArcGIS 9.0.

Raster Datasets

- A raster model, otherwise known as a raster dataset (image), is, in its simplest form, a matrix (grid) of cells (pixels).
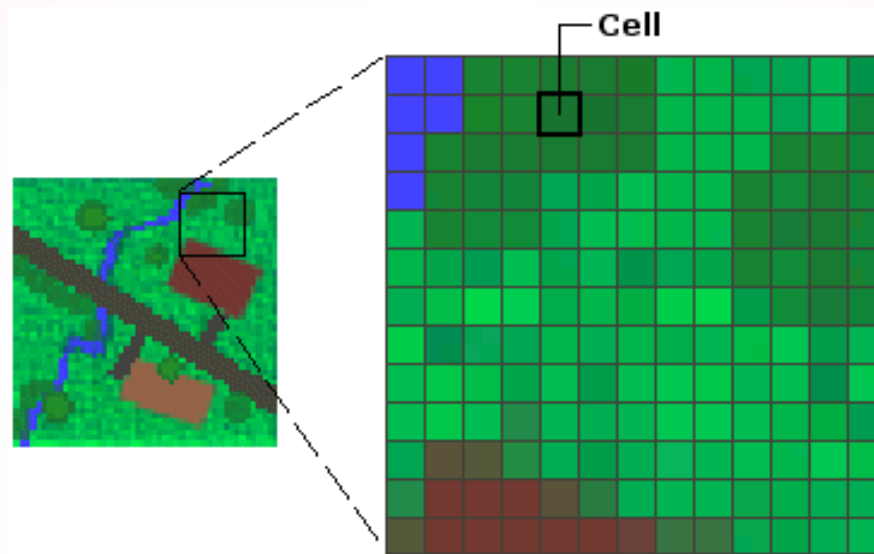
Raster Properties in ArcCatalog

- When you right-click on a raster and select properties, you will see this dialog box:

- You can define spatial reference and run statistics from within the dataset properties box.
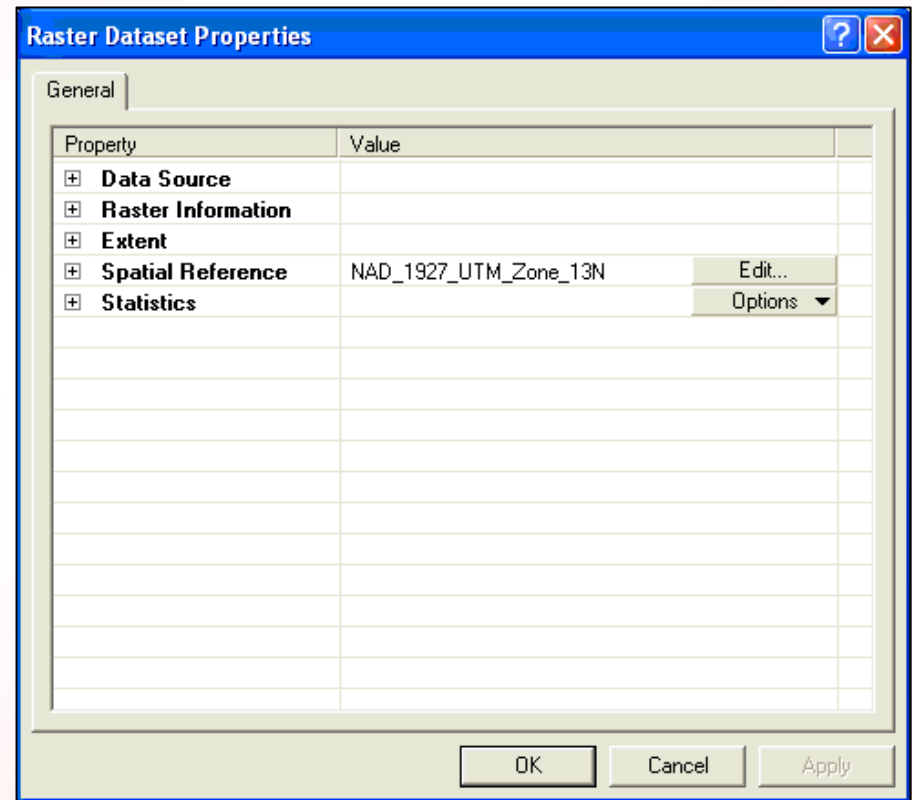
Raster Images in ArcMap

- Cells of a raster are always in cartesian coordinates and all have an equal area.

- Be careful when projecting raster data; it can create lots of area distortion.

Raster Symbology

- Depending on the type of file, rasters have different options for symbology.

- Examples below are shown for MrSID and TIFF formats, respectively.
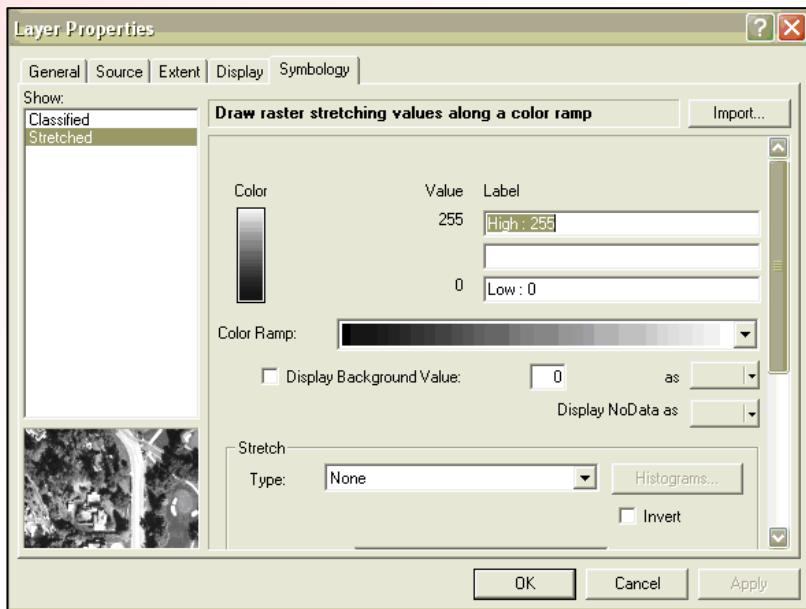
MrSid Symbology

TIFF Symbology

Raster Attributes

MrSID Attribute Table (B/W)

TIFF Attribute Table

Georeferencing Data

Slurry Impoundment

Permit Area
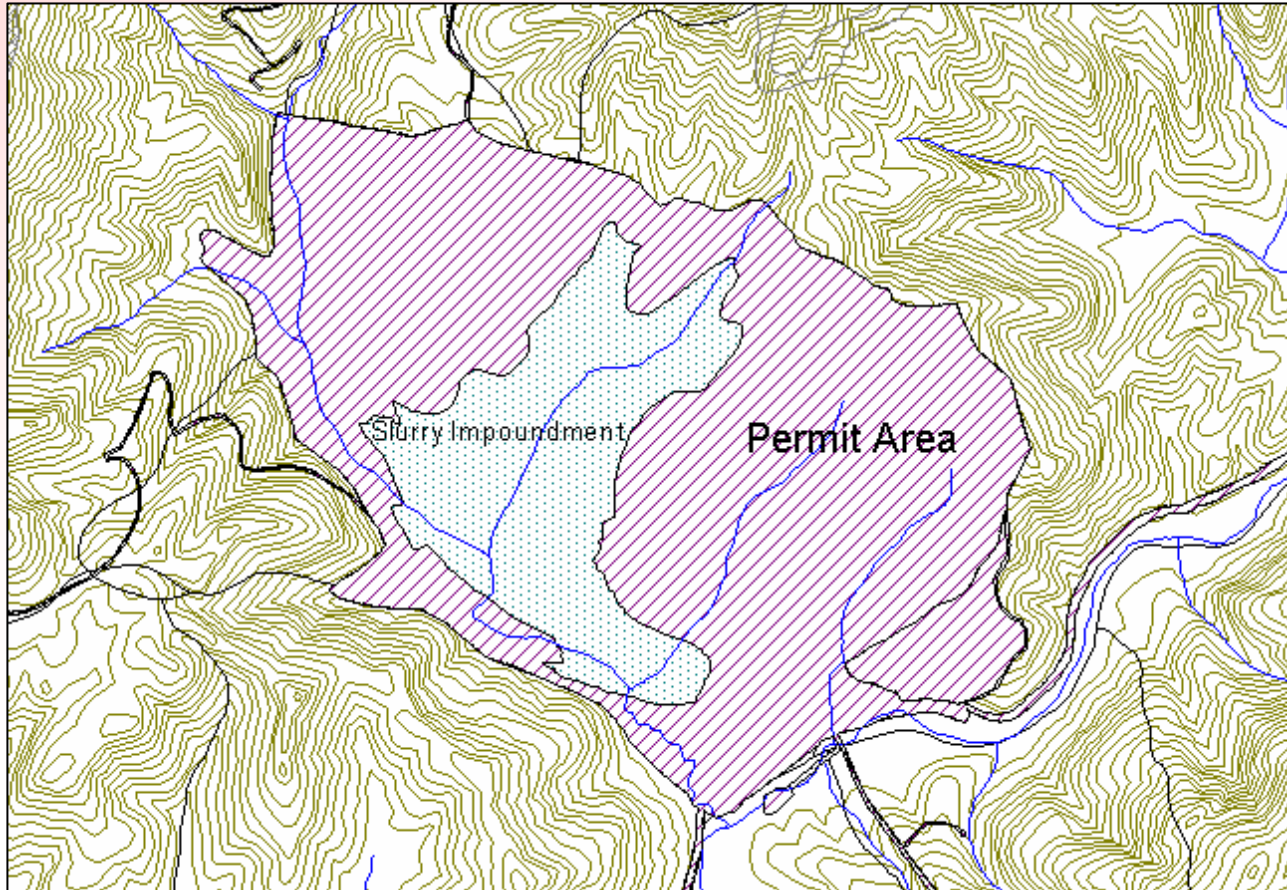
Projection and Transformation Information For Data

- Projection information, if it exists, is easily accessible in text format.

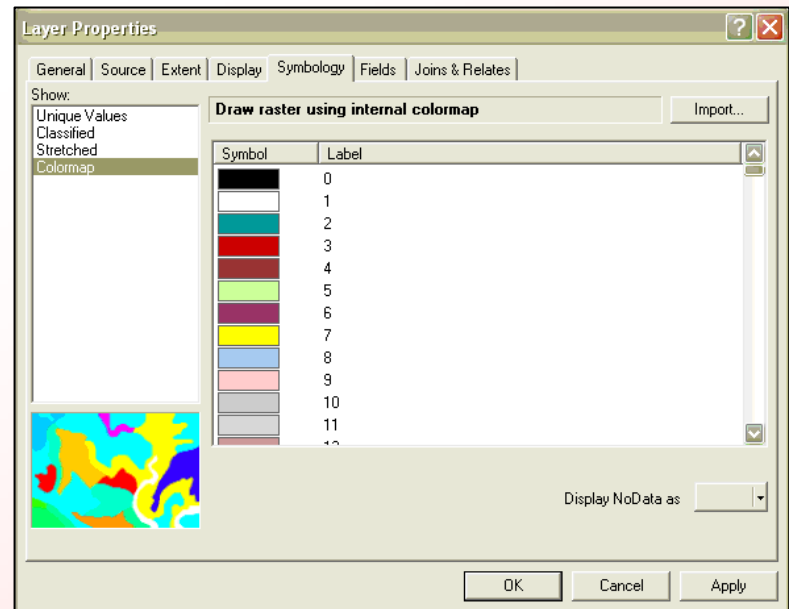- A world file does not specify a projection for the image – it simply is a transformation from the raster coordinates to the coordinates in a given projection.
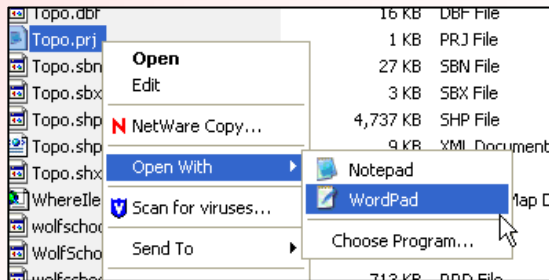
PRJ file – sample contents

TFW, JPW, SDW etc. file – sample contents

PROJCS["NAD_1927 _StatePlane_Montana_South_FIPS_2503",GEOGCS ["GCS_North_American_1927",DATUM ["D_North_American_1927",SPHEROID["Clarke_ 1866",6378206.4,294.9786982]],PRIMEM ["Greenwich",0.0],UNIT ["Degree",0.0174532925199433]],PROJECTION ["Lambert_Conformal_Conic"],PARAMETER ["False_Easting",2000000.0],PARAMETER ["False_Northing",0.0],PARAMETER ["Central_Meridian",-109.5],PARAMETER ["Standard_Parallel_ 1",44.86666666666667],PARAMETER ["Standard_Parallel_2",46.4],PARAMETER ["Latitude_Of_Origin",44.0],UNIT ["Foot_US",0.3048006096012192]]

WolfSchool.tfw - WordPad

2.438400000000
0.000000000000
0.000000000000
-2.438400000000
333748.630124290124
5083016.922502051100

ArcCatalog: Viewing Projection Information for Shapefiles

Copy   Ctrl+C
X Delete
Rename   F2
Export   ▶
Properties...

Shapefile Properties

General | Fields | Indexes

	Field Name	Data Type
	FID	Object ID
	Shape	Geometry
	TOPO_ID	Long Integer

Click any field to see its properties.

Field Properties

Geometry Type	Line
Avg Num Points	0
Grid 1	1000
Grid 2	0
Grid 3	0
Contains Z values	No
Contains M values	No
Default Shape field	Yes
Spatial Reference	NAD_1927_StatePlane_M ...

To add a new field, type the name into an empty row in the Field Name column, click in the Data Type column to choose the data type, then edit the Field Properties.

Import...

OK   Cancel   Apply

Spatial Reference Properties

Coordinate System | X/Y Domain

Name: NAD_1927_StatePlane_Montana_South_FIPS_2503

Details:

Alias:
Abbreviation:
Remarks:
Projection: Lambert_Conformal_Conic
Parameters:
 False_Easting: 2000000.000000
 False_Northing: 0.000000
 Central_Meridian: -109.500000
 Standard_Parallel_1: 44.866667
 Standard_Parallel_2: 46.400000
 Latitude_Of_Origin: 44.000000
Linear Unit: Foot_US (0.304801)
Geographic Coordinate System:

Select...   Select a predefined coordinate system.

Import...   Import a coordinate system and X/Y, Z and M domains from an existing geodataset (e.g., feature dataset, feature class, raster).

New... ▾   Create a new coordinate system.

Modify...   Edit the properties of the currently selected coordinate system.

Clear   Sets the coordinate system to Unknown.

Save As...   Save the coordinate system to a file.

OK   Cancel   Apply

ArcCatalog: Viewing Projection Information for CAD Files

Context menu:
- Copy   Ctrl+C
- Delete
- Rename   F2
- Export   ▶
- **Properties...**

CAD Drawing Properties

Tabs: General | Spatial Reference

World File Name

No Default World File

Projection

Projection File :
c:\arcgis_9x_intro_course\data\exercise1\Mine_Topo.prj

Coordinate System :
Lambert_Conformal_Conic
False_Easting: 2000000.000000
False_Northing: 0.000000
Central_Meridian: -109.500000

[Edit...]

CAD Dataset Extents

XMin : 2611666.5	XMax: 2637496.43
YMin : 653600	YMax 676900
ZMin : 3310	ZMax 3866.15

[OK] [Cancel] [Apply]

Spatial Reference Properties

Tabs: Coordinate System | X/Y Domain

Name: NAD_1927_StatePlane_Montana_South_FIPS_2503

Details:

Geographic Coordinate System:
Name: GCS_North_American_1927
Alias:
Abbreviation:
Remarks:
Angular Unit: Degree (0.017453292519943299)
Prime Meridian: Greenwich (0.000000000000000000)
Datum: D_North_American_1927
  Spheroid: Clarke_1866
   Semimajor Axis: 6378206.4000000000400000000
   Semiminor Axis: 6356583.7999989980900000000
   Inverse Flattening: 294.9786982000000000000

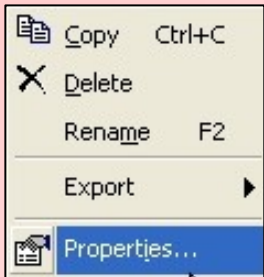| Button	Description
Select...	Select a predefined coordinate system.
Import...	Import a coordinate system and X/Y, Z and M domains from an existing geodataset (e.g., feature dataset, feature class, raster).
New... ▾	Create a new coordinate system.
Modify...	Edit the properties of the currently selected coordinate system.
Clear	Sets the coordinate system to Unknown.
Save As...	Save the coordinate system to a file.

[OK] [Cancel] [Apply]
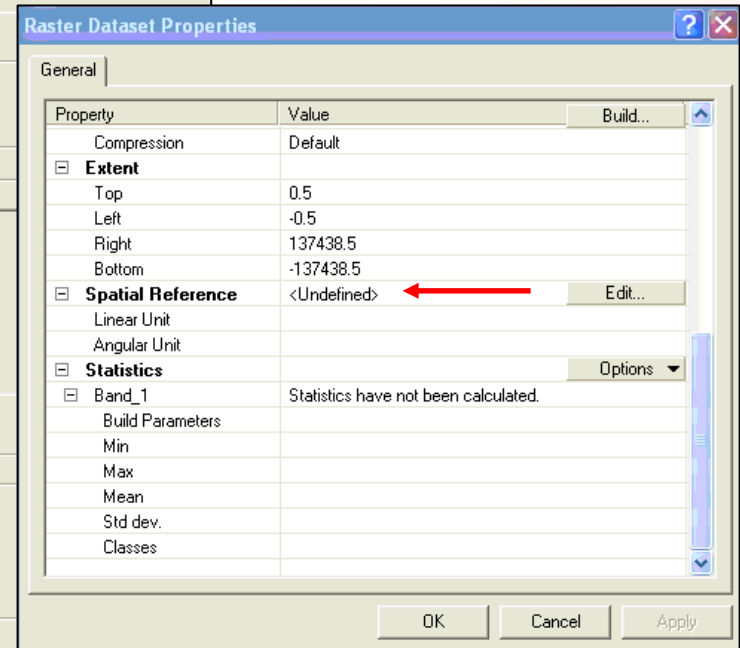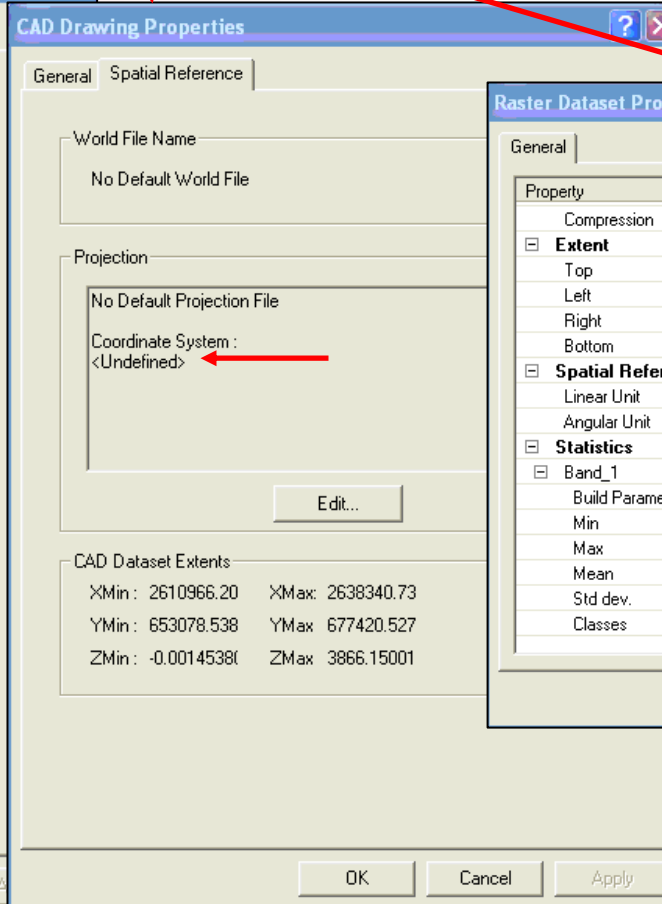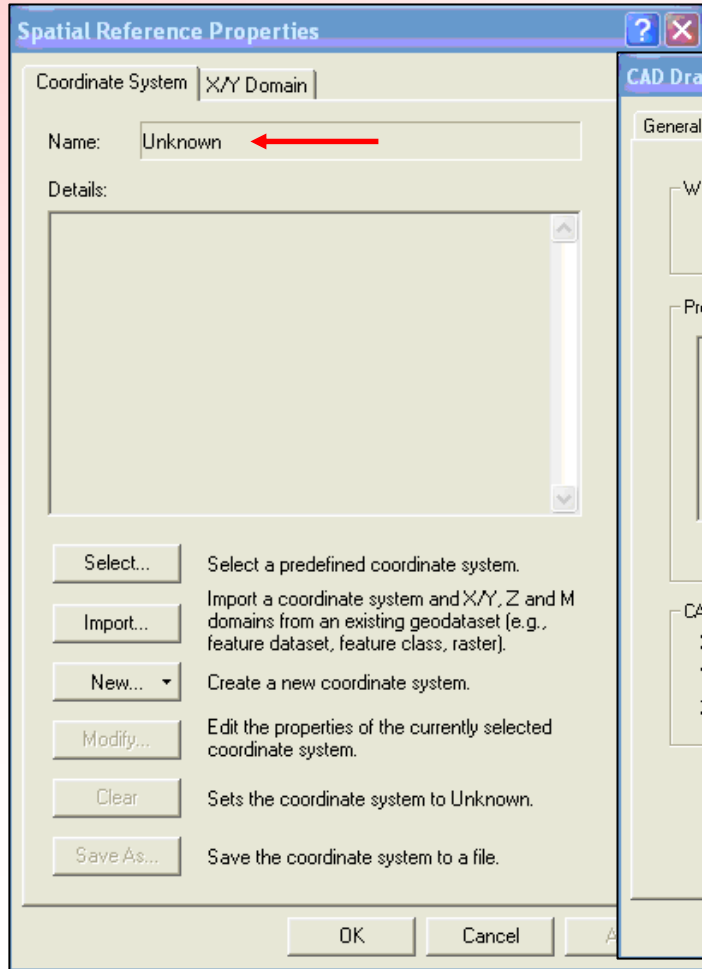
ArcCatalog: Viewing Projection Information for Raster Files

Copy Ctrl+C
Delete
Rename F2
Export ▶
Properties...

Raster Dataset Properties

General

Property	Value
Top	184127
Left	783735
Right	794915
Bottom	169054
⊟ **Spatial Reference**	NAD_1983_StatePlane_Montana_FIPS Edit...
Linear Unit	Meter (1.000000)
Angular Unit	Degree (0.017453292519943299)
False_Easting	600000
False_Northing	0
Central_Meridian	-109.5
Standard_Parallel_1	45
Standard_Parallel_2	49
Latitude_Of_Origin	44.25
Datum	D_North_American_1983
⊟ **Statistics**	Options ▼
⊟ **Band_1**	
Build Parameters	skipped columns:1, rows:1, ignored value:
Min	3

OK   Cancel   Apply

Spatial Reference Properties

Coordinate System | X/Y Domain

Name: NAD_1983_StatePlane_Montana_FIPS_2500

Details:

Alias:
Abbreviation:
Remarks:
Projection: Lambert_Conformal_Conic
Parameters:
  False_Easting: 600000.000000
  False_Northing: 0.000000
  Central_Meridian: -109.500000
  Standard_Parallel_1: 45.000000
  Standard_Parallel_2: 49.000000
  Latitude_Of_Origin: 44.250000
Linear Unit: Meter (1.000000)
Geographic Coordinate System:

Select... — Select a predefined coordinate system.

Import... — Import a coordinate system and X/Y, Z and M domains from an existing geodataset (e.g., feature dataset, feature class, raster).

New... ▼ — Create a new coordinate system.

Modify... — Edit the properties of the currently selected coordinate system.

Clear — Sets the coordinate system to Unknown.

Save As... — Save the coordinate system to a file.

OK   Cancel   Apply

What Happens When the Projection Is Undefined?

Copy   Ctrl+C
Delete
Rename   F2
Export   ▶
Properties…

Spatial Reference Properties

Coordinate System | X/Y Domain

Name: Unknown ←

Details:

Select…   Select a predefined coordinate system.

Import…   Import a coordinate system and X/Y, Z and M domains from an existing geodataset (e.g., feature dataset, feature class, raster).

New… ▾   Create a new coordinate system.

Modify…   Edit the properties of the currently selected coordinate system.

Clear   Sets the coordinate system to Unknown.

Save As…   Save the coordinate system to a file.

OK   Cancel

CAD Drawing Properties

General | Spatial Reference

World File Name
No Default World File

Projection
No Default Projection File

Coordinate System :
<Undefined> ←

Edit…

CAD Dataset Extents
XMin: 2610966.20   XMax: 2638340.73
YMin: 653078.538   YMax: 677420.527
ZMin: -0.0014538(ZMax: 3866.15001

OK   Cancel   Apply

Raster Dataset Properties

General

Property	Value	
Compression	Default	Build…
Extent		
Top	0.5	
Left	-0.5	
Right	137438.5	
Bottom	-137438.5	
Spatial Reference	<Undefined> ←	Edit…
Linear Unit		
Angular Unit		
Statistics		Options ▾
Band_1	Statistics have not been calculated.	
Build Parameters		
Min		
Max		
Mean		
Std dev.		
Classes		

OK   Cancel   Apply

Selecting a Coordinate System for a Shapefile:

- Click on Select

- After choosing a predefined coordinate system, click Apply and OK.

- You don't have to save a projection file – ArcGIS does this automatically for shapefiles.
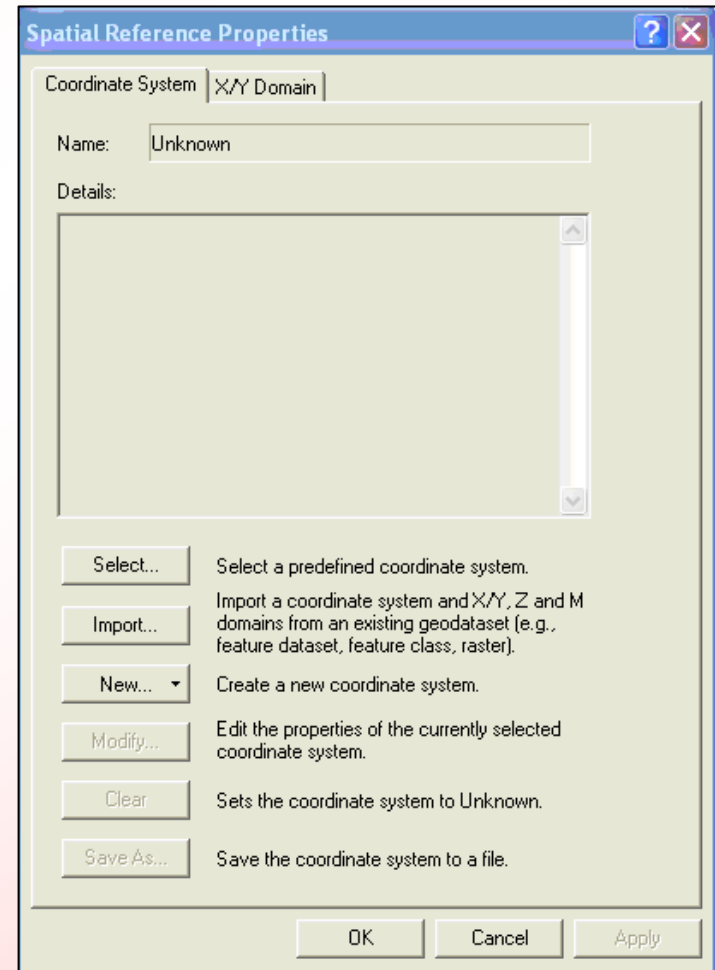
Selecting a Predefined Coordinate System for CAD Data:

Selecting a Predefined Coordinate System for CAD Data:

Double-click to open folders
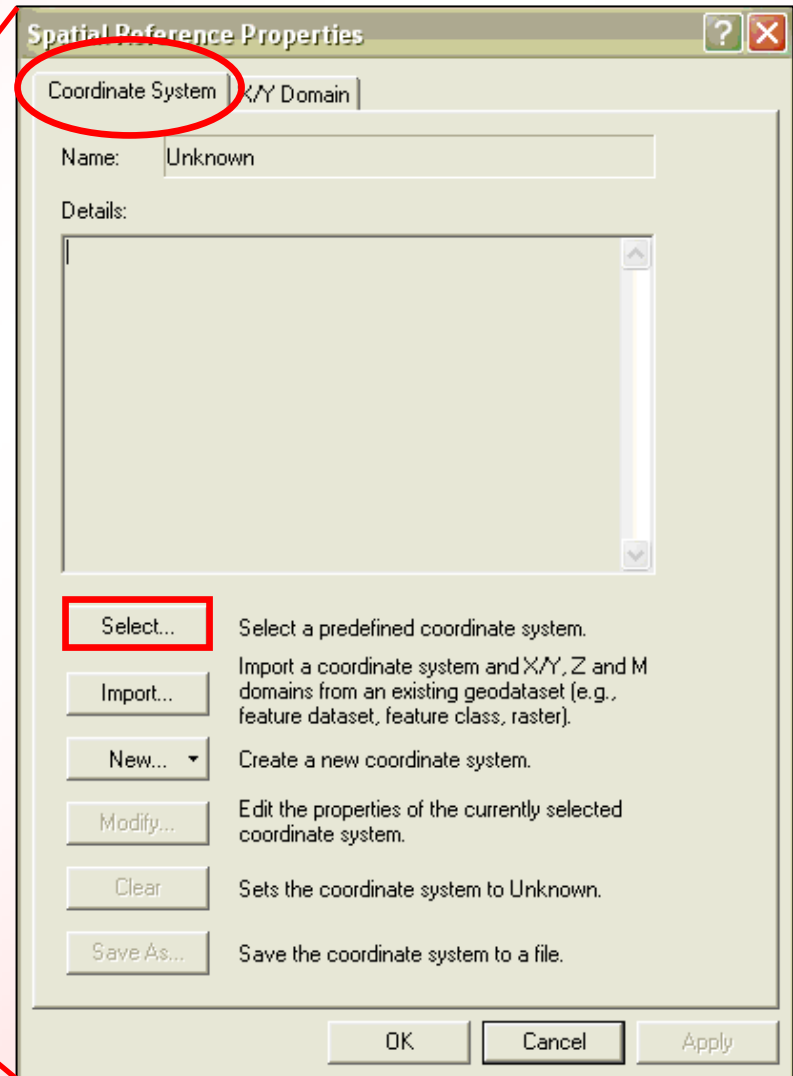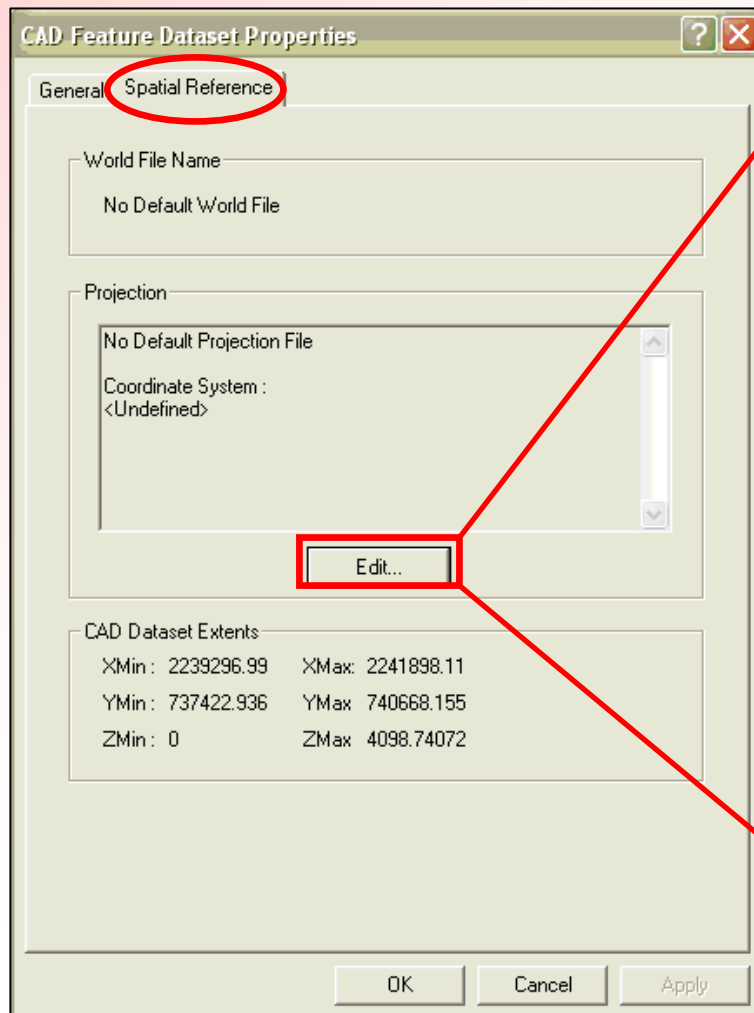
Choose a coordinate system
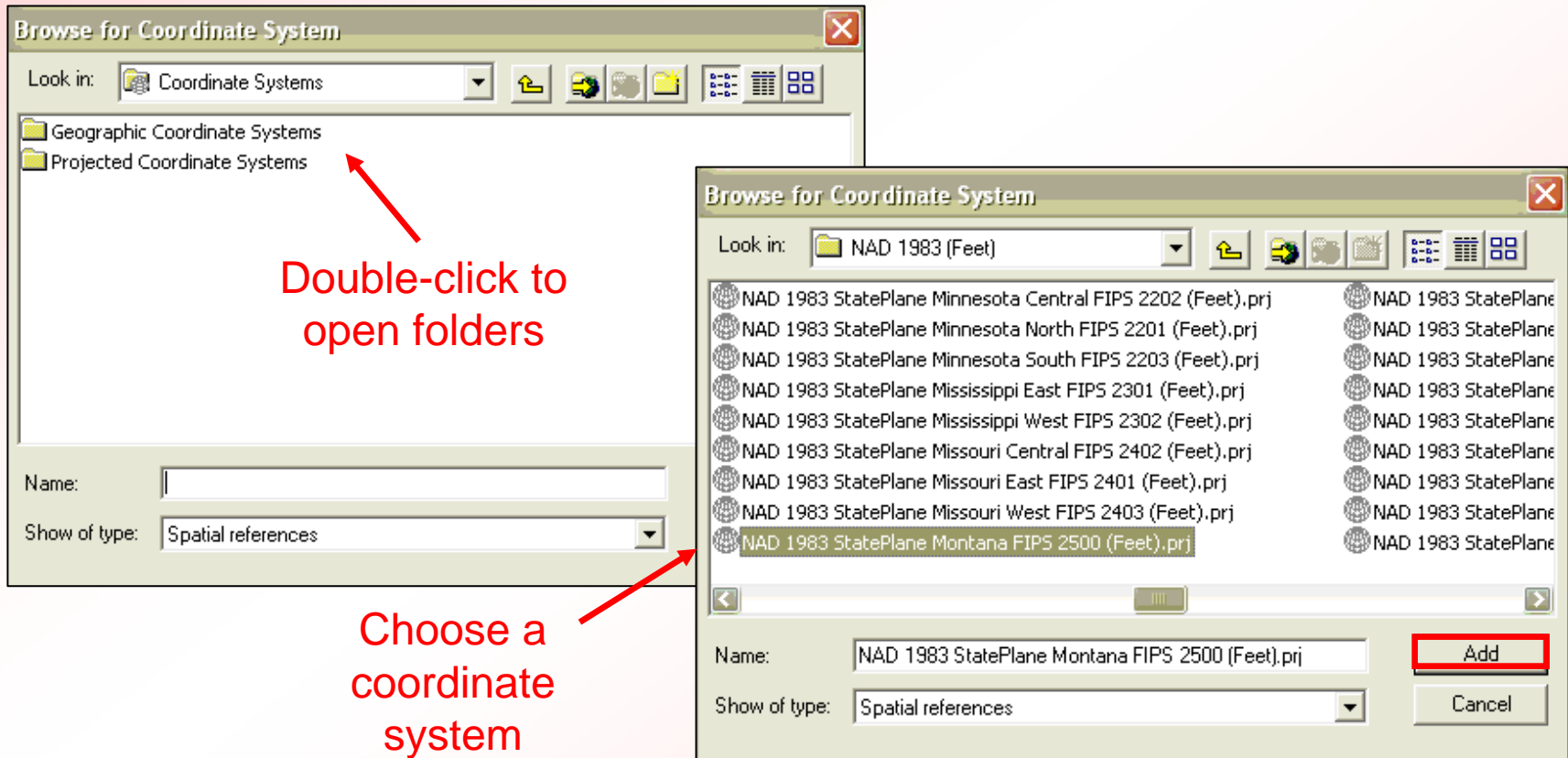
Importing a Coordinate System for a CAD file
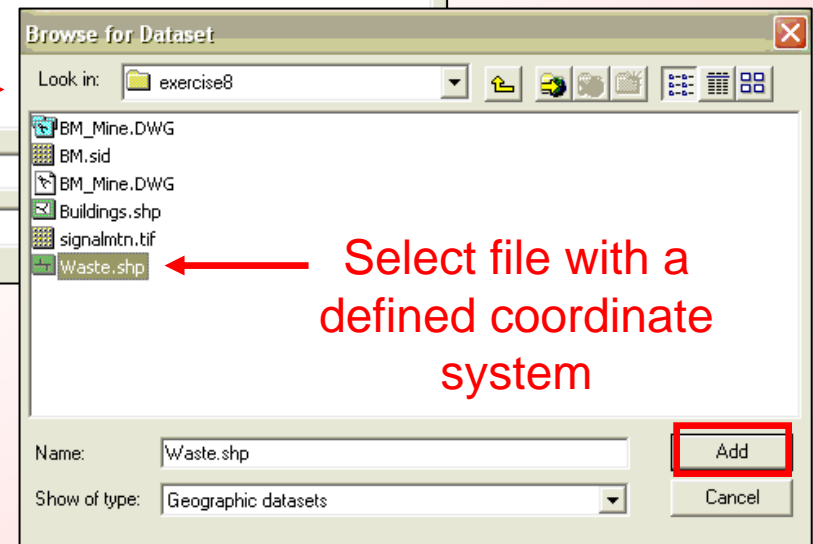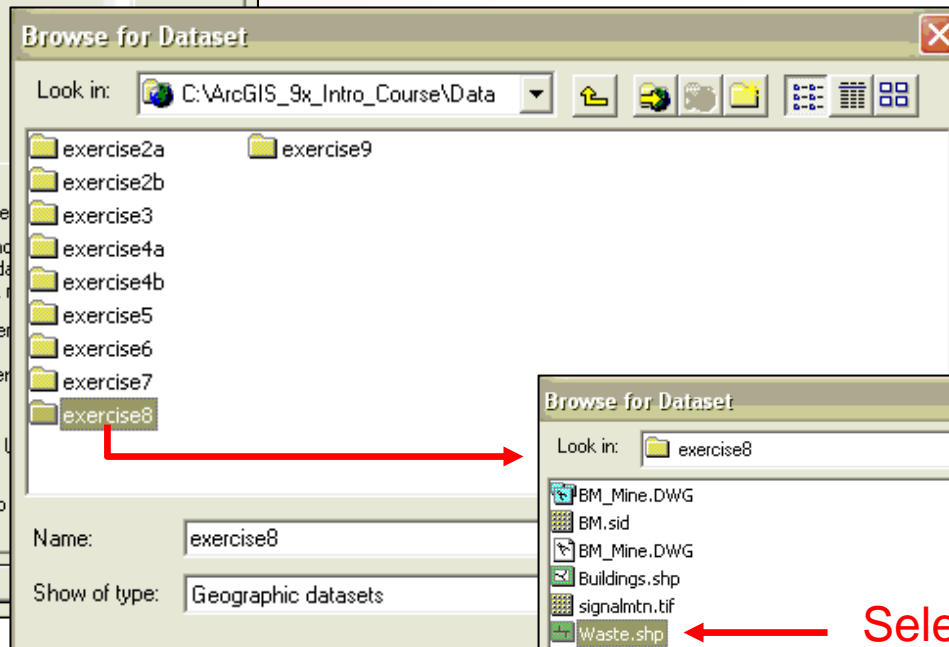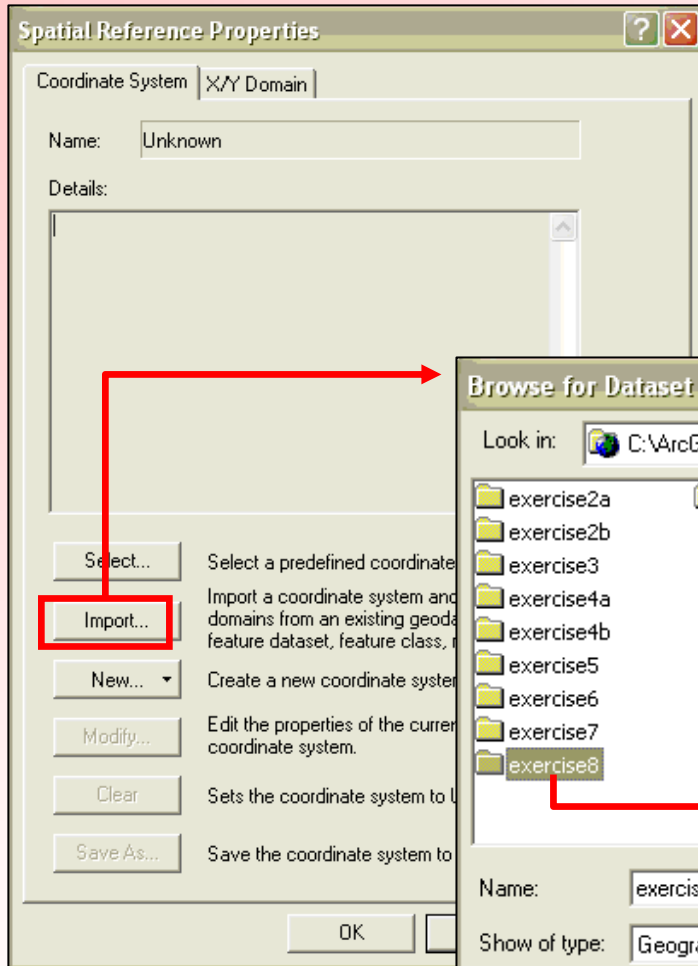
Select file with a defined coordinate system

Copying An Existing .prj File for CAD Data

Select projection file

Copy and paste

Rename
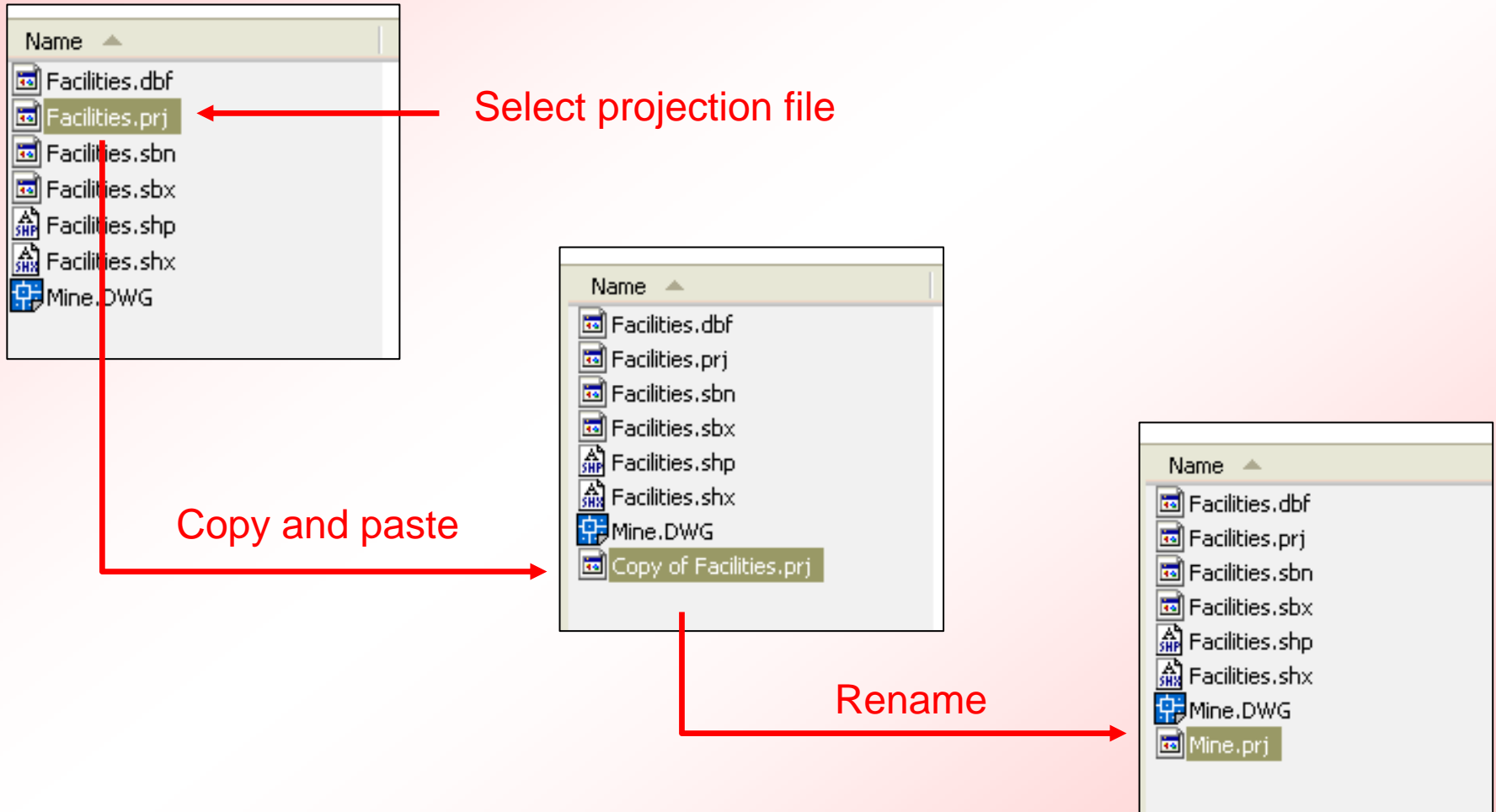
Raster Data

- Air photo
- Quad. Maps
- Scanned maps
- Other photos
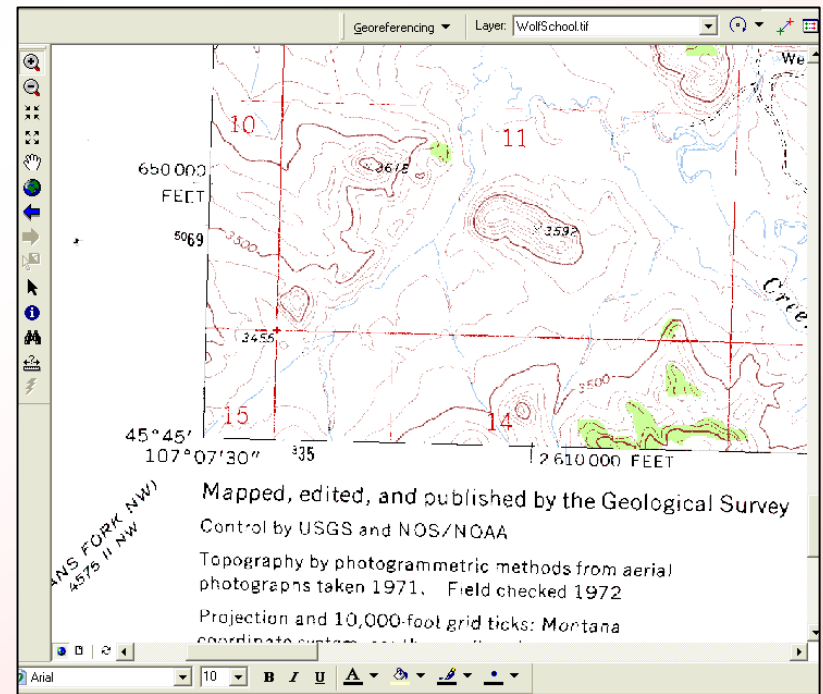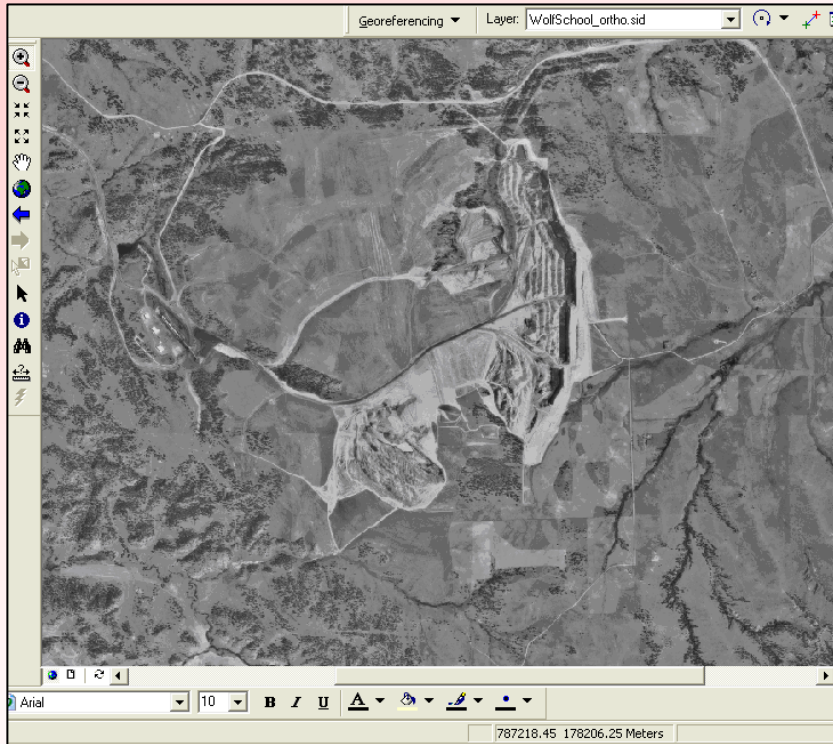
Raster Georeferencing

transform

Shift
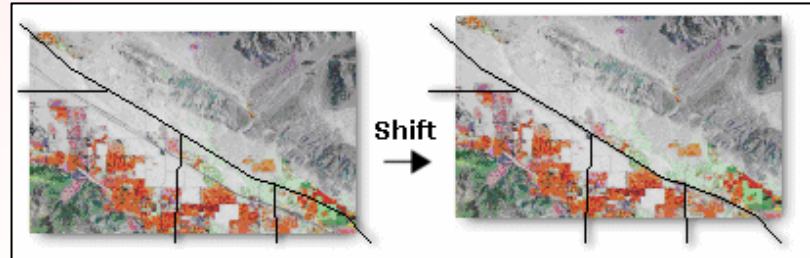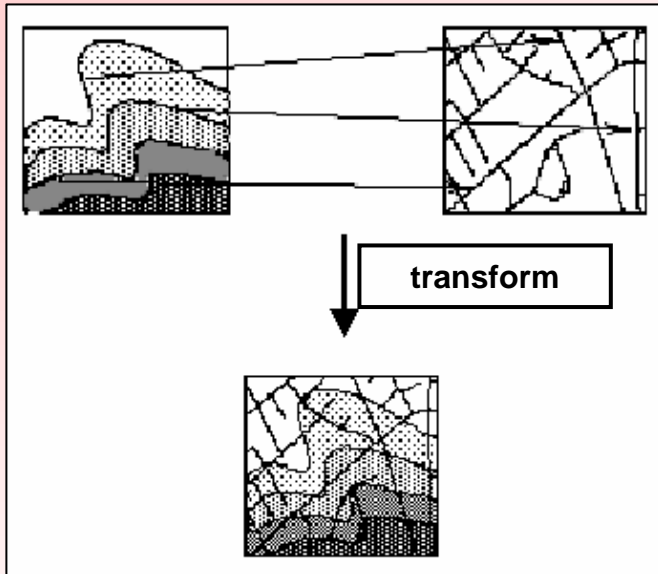
- Manipulating the position of a raster image to fit other data.
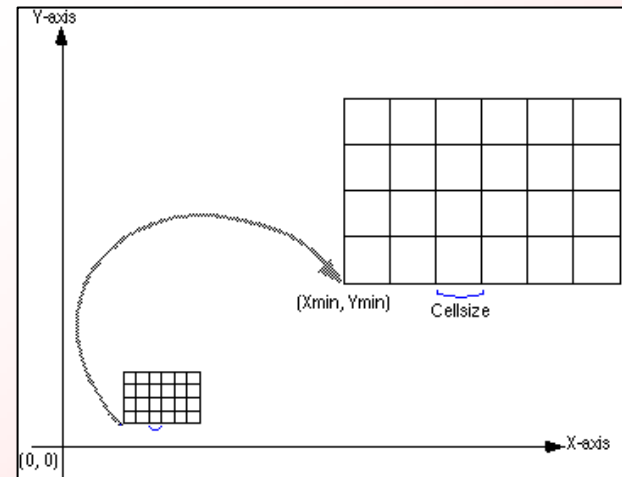
Georeferencing Options for Raster Data

- Align the raster

- Transform the raster

- Interpret the root mean square error

- Resample the raster dataset

- Should you rectify your raster?
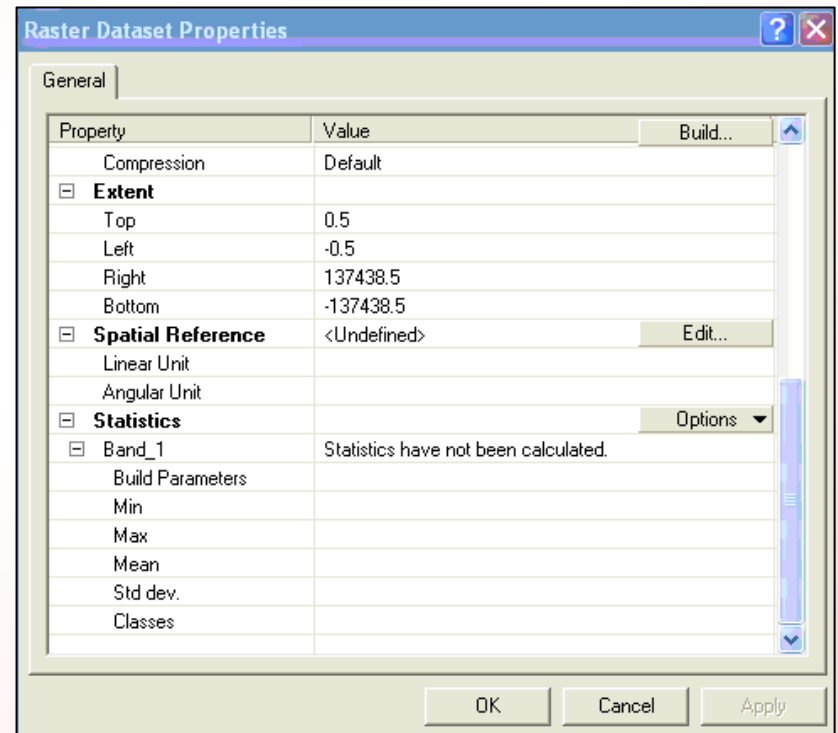
Using The Georeferencing Toolbar
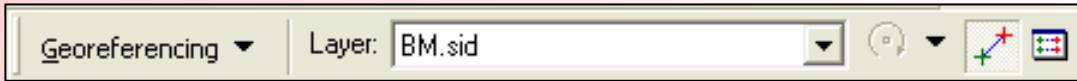
Add Control Points
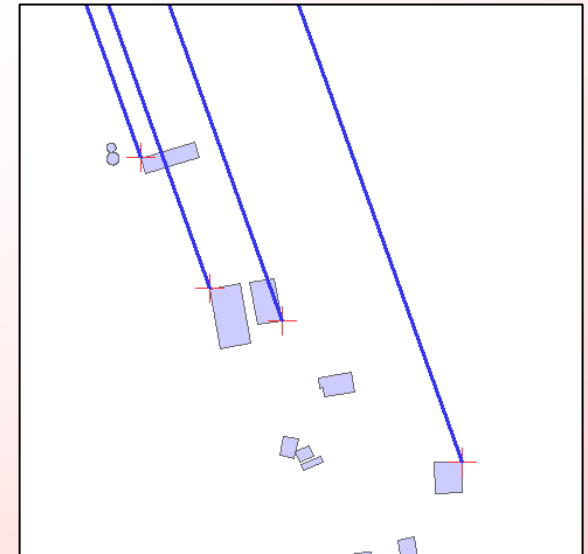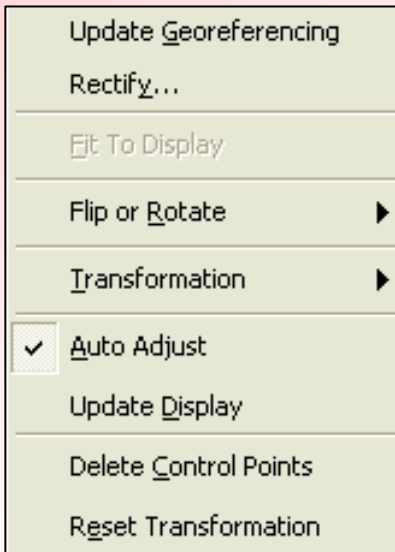
- Link points on the raster image to points in a shapefile or other data.

Georeferencing Raster Data

- End result is alignment of vector and raster data
- Observe the RMS error in situations where accuracy matters

Georeferencing with World Files

- The georeferencing can be saved for future use with the "Update Georeferencing" tool.

- This tool creates a file, called a **World File**, that resides in the same directory as the image and tells GIS software where and how to display the image.

bm.sdw   BM.sid

Update Georeferencing

Rectify...

Fit To Display

Flip or Rotate   ▶

Transformation   ▶

✓ Auto Adjust

Update Display

Delete Control Points

Reset Transformation
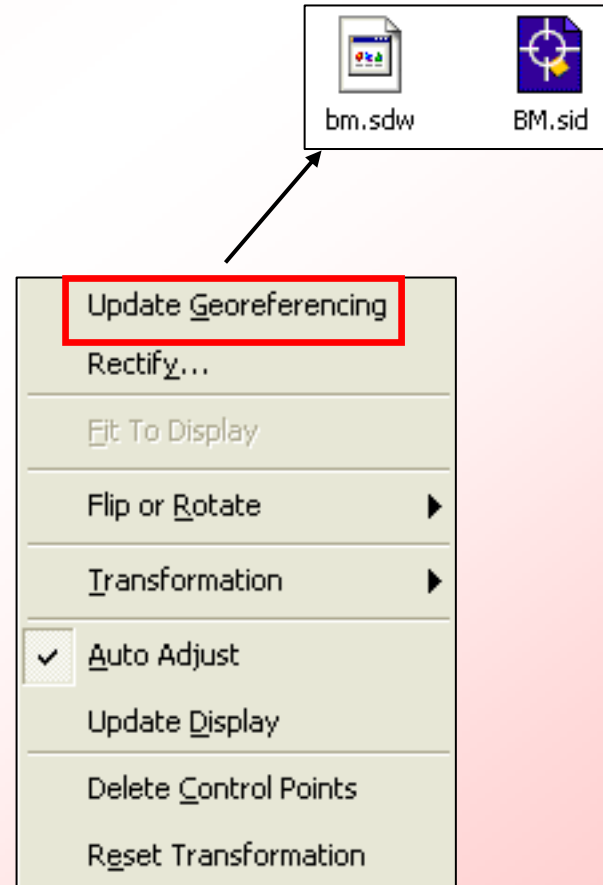
Rectifying Images
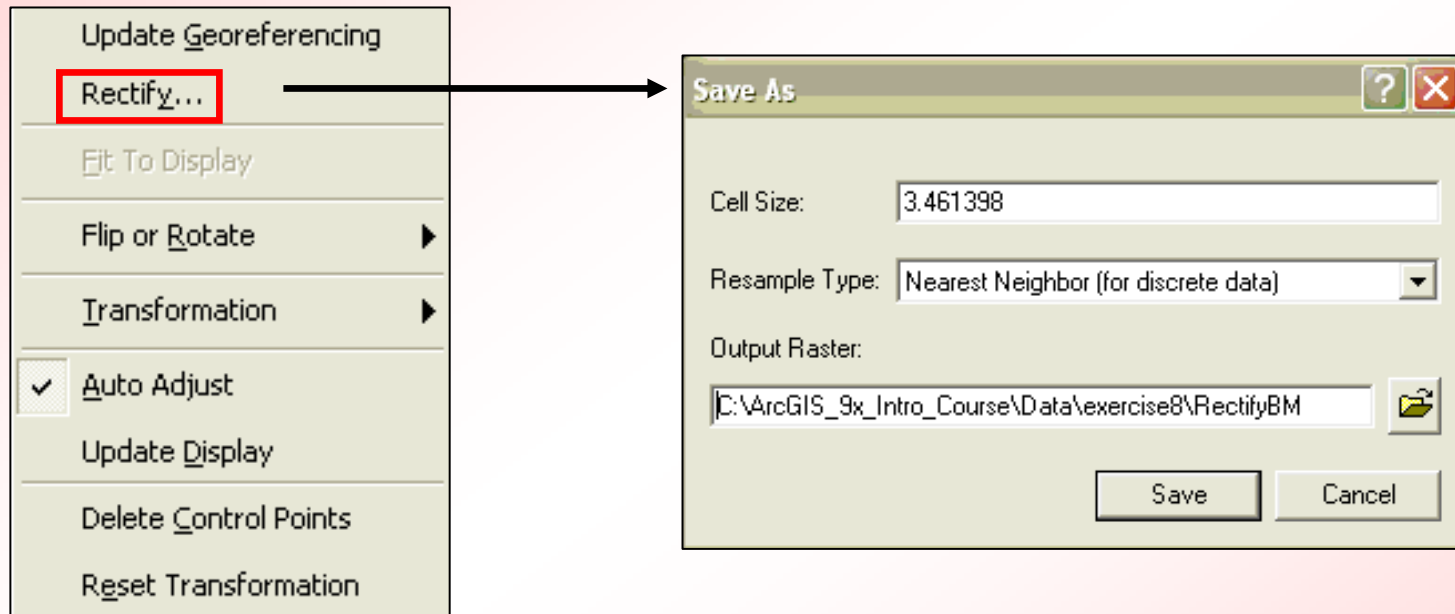
- Image is converted to real-world coordinates
- Coordinate information becomes part of the rectified image file.

The Clip Tool: Making Rasters More Manageable
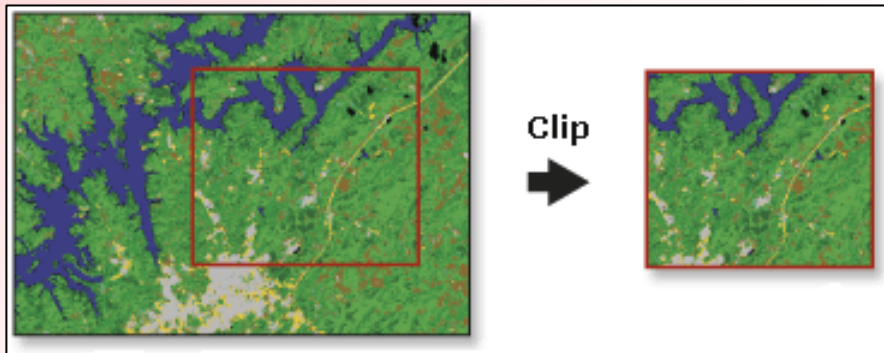
- Raster data can have huge file sizes.
- Clip tool not only reduces the extents of the dataset, it reduces geoprocessing time.
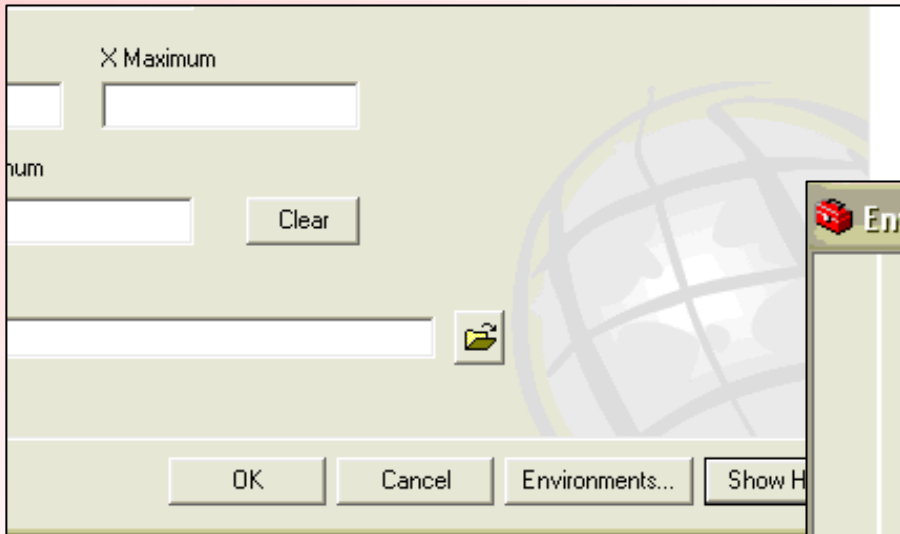- Increases performance
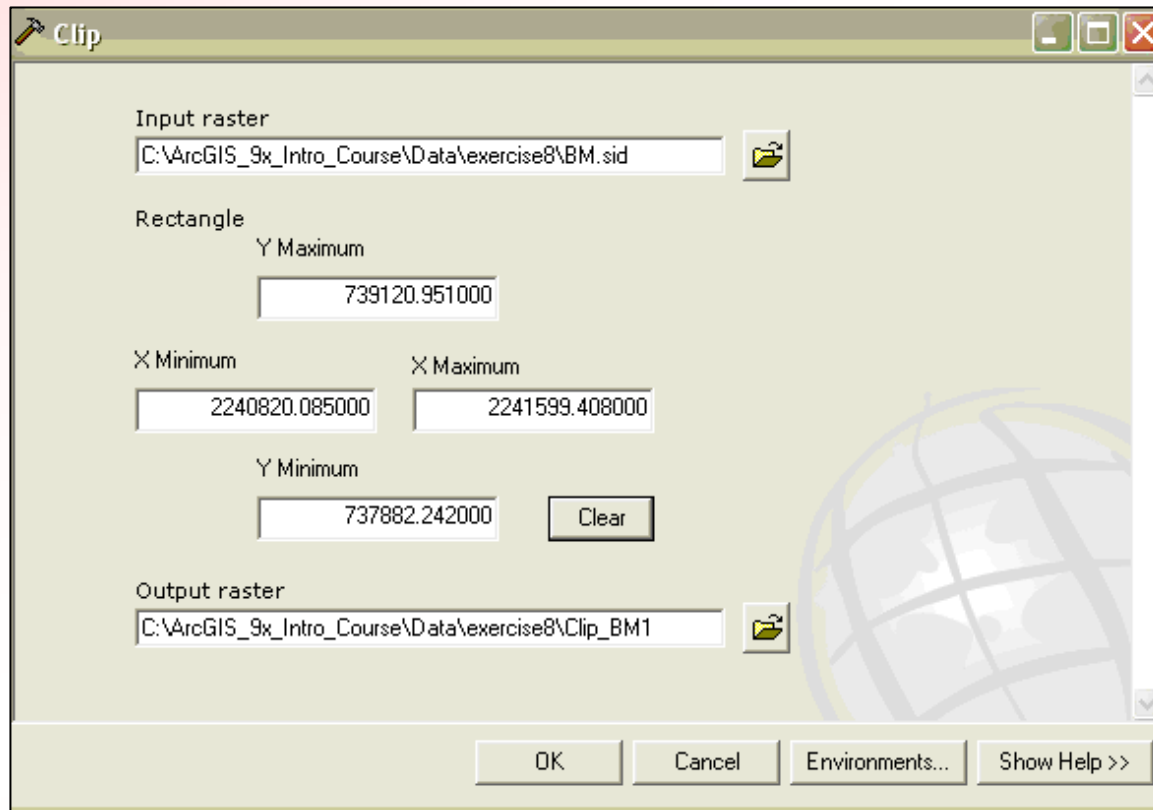- Available with any ArcGIS license
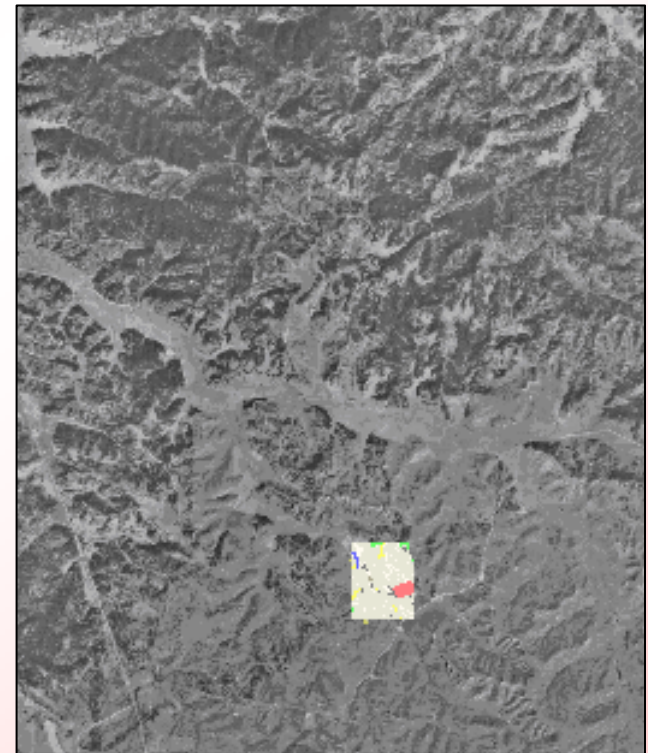
Using the Clip Tool

Data Management tools > Raster > Clip
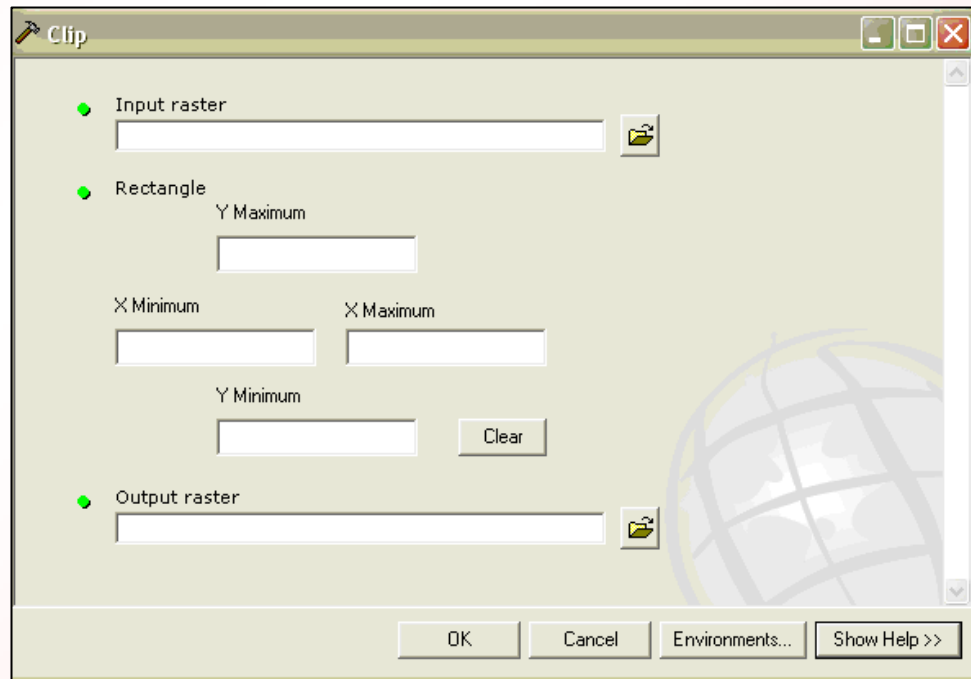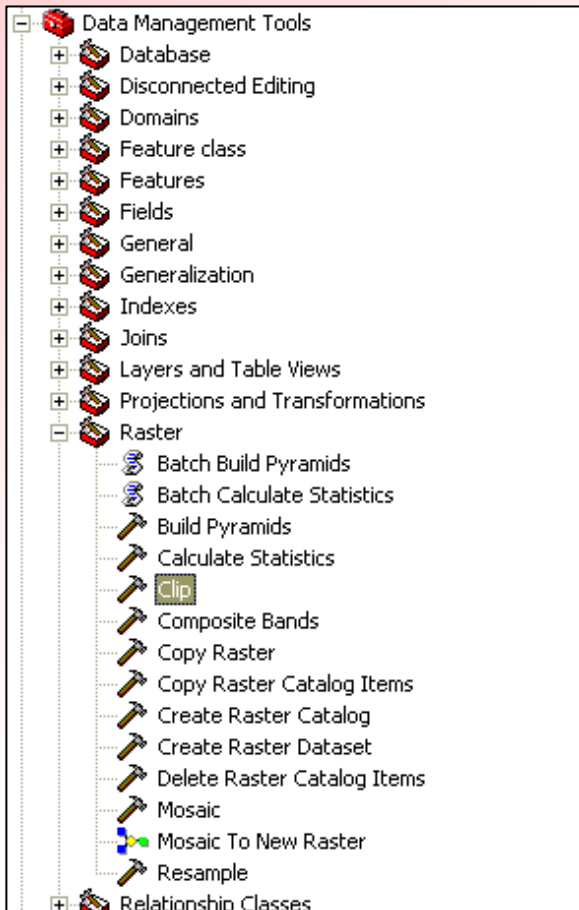
Use Environment Settings to Set the Extents
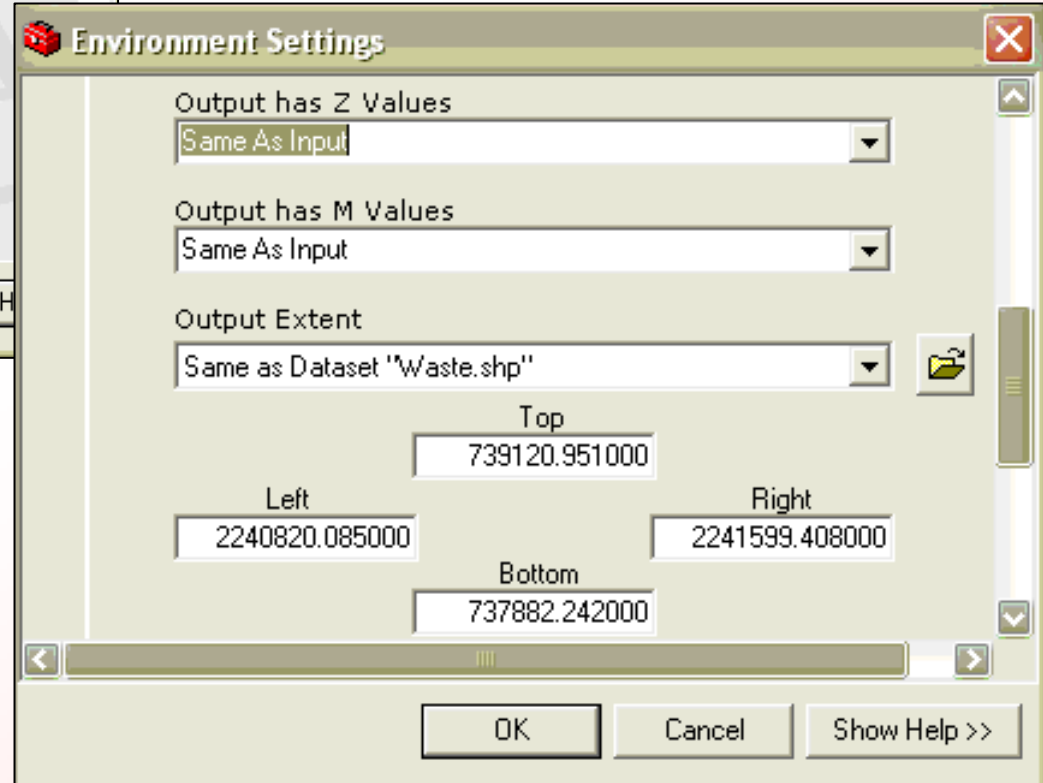
Clipped Raster is Created

Summary Questions

- What are some of the differences between the two types of CAD files that ArcGIS displays (i.e. – the difference between the blue file and the white file)?

- What are some ways to spatially reference CAD data?

- What is georeferencing and what are the different options available to the ArcGIS user for georeferencing a raster image?

- What else can you do with raster data in ArcGIS?

Exercise 8: CAD Data, Raster Images, and Coordinate Systems
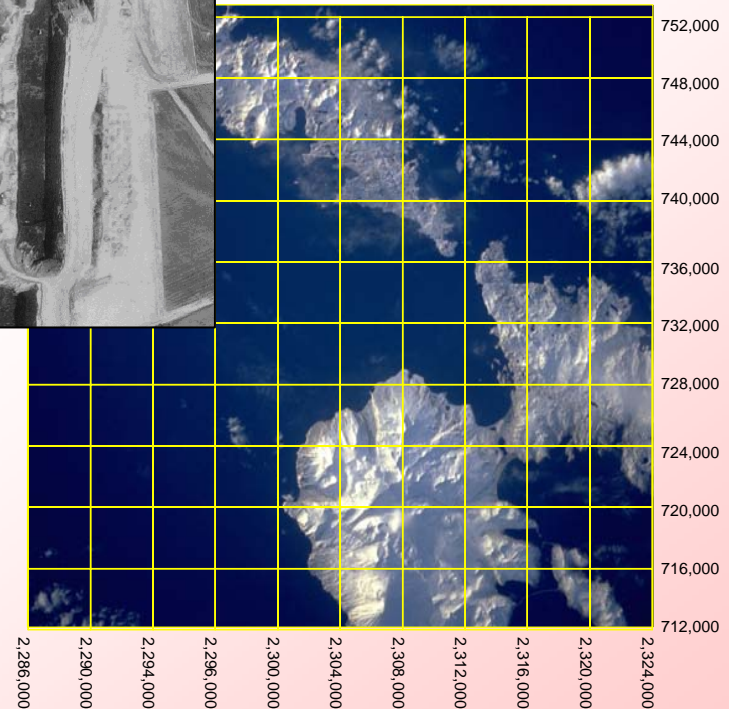
Annotation	CAD Annotation Feature Class
MultiPatch	CAD MultiPatch Feature Class
Point	CAD Point Feature Class
Polygon	CAD Polygon Feature Class
Polyline	CAD Polyline Feature Class