Intro to ArcGIS Pro

Oklahoma State Training

DATAMARK TECHNOLOGIES

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Introductions

- DATAMARK Technologies
- Oklahoma GIS Committee Members
- Class Attendees

Agenda

Day 1 – Intro to ArcGIS Pro and Displaying Data
- ArcGIS Pro Overview – 1 hr
- Introduction to ArcGIS Pro – 3 hrs
- Introduction to Catalog – 1 hr
- Attribute Tables and Queries – 2 hrs
- Attribute Editing – 2 hrs

Day 2 - Editing and Data Management
- Symbology and Labeling – 2 hrs
- Geometry Editing – 3 hrs
- Advanced Editing Techniques – 1 hr
- Cartography and Map Creation– 1 hr
- Best Practices and Oklahoma NG9-1-1 GIS Toolkit Overview – 1 hr

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But first…

What is GIS?
- A system that allows us to answer questions and make decisions that involve a 'where'
  - Where is it?
  - How far away is it?
  - What is near it?
  - How do I get to it?
  - Where is the best location to do X?

GIS is…
- A framework for gathering, managing, analyzing and displaying data that has a geographical or spatial component
- An integration of hardware, software, data and people

ArcGIS Pro Overview

What is ArcGIS Pro?

- ArcGIS Pro is Esri's modern desktop GIS application designed for mapping, spatial analysis, and data visualization. It offers a streamlined interface, 64-bit performance, and integration with ArcGIS Online for sharing and collaboration
- Part of the ArcGIS platform, integrates with ArcGIS Online and Enterprise for cloud-based workflows, and for sharing and collaboration

Key Benefits

- High Performance: Optimized for large datasets and complex analysis
- Scalable: Works for individuals, teams, and enterprise-level deployments
- Interoperability: Connects with other Esri products and external data sources

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Creating a Pro Project

What is a Pro Project?

- A Pro Project organizes all your maps, layouts, data connections, and tools in one workspace. Creating a project ensures consistency and enables easier resource management. When created, projects typically include a default geodatabase and toolbox for storing data and workflows.
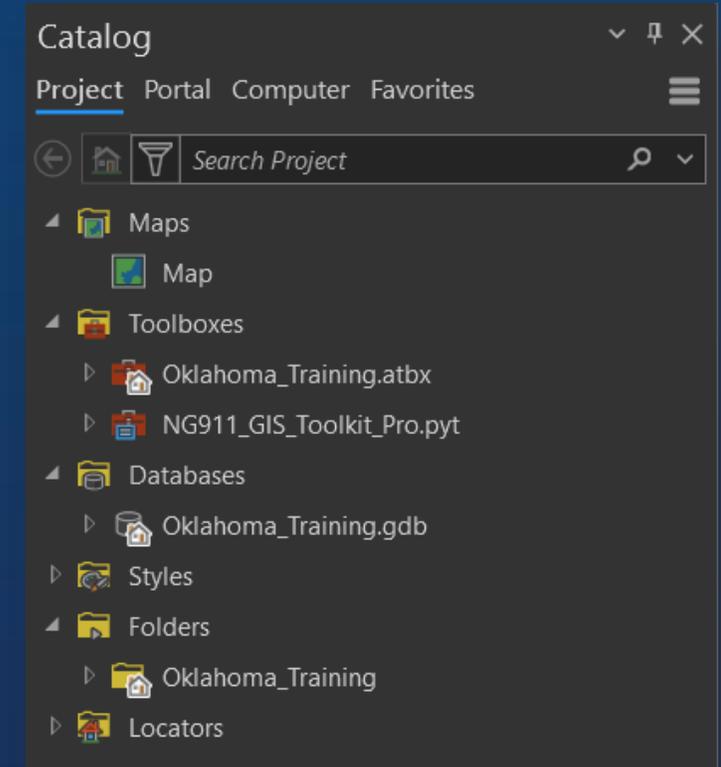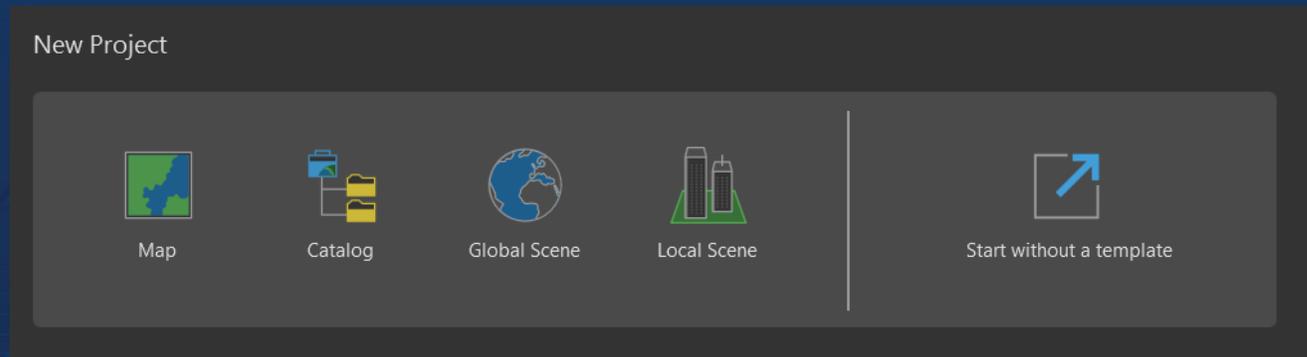
Data Storage in ArcGIS Pro

Storage Options

- File Geodatabase: Local, single-user, efficient for analysis
- Enterprise Geodatabase: Multi-user, versioning, collaboration
- Cloud Services: ArcGIS Online for sharing and scalability

Choosing the Right Storage

- Consider data size, editing needs, and collaboration
- Local projects → File Geodatabase
- Enterprise workflows → Enterprise Geodatabase
- Distributed teams → Cloud-based storage

Class Exercise 1

Map Interface

Module 2

Exploring Ribbons

- ArcGIS Pro is designed with a ribbon-based interface for intuitive navigation and productivity
- Ribbon Interface: Located at the top of the application, organized into tabs
- Key Tabs:
  - Map: Tools for navigation, adding layers, and managing map views
  - Insert: Add new maps, layouts, and data frames
  - Analysis: Access geoprocessing tools and spatial analysis functions
  - View: Manage panes, windows, and multiple map views
  - Contextual Tabs: Appear based on selected items (e.g., layer-specific tools)

Map Ribbon

The **Map tab** is the primary ribbon for interacting with maps in ArcGIS Pro. It contains groups of tools organized by functionality:
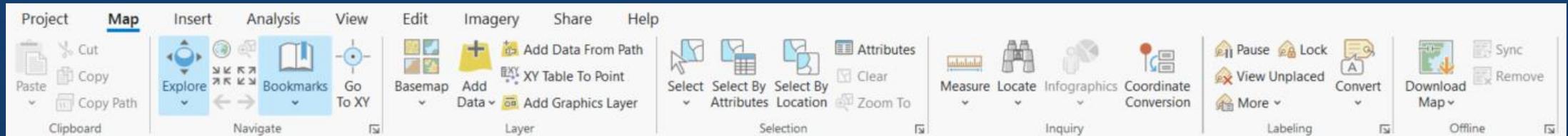
1. Navigate Group
- **Explore**: Pan, zoom, and identify features in the map.
- **Bookmarks**: Save and manage map extents for quick navigation
- **Full Extent / Previous / Next Extent**: Quickly adjust the map view

2. Layer Group
- **Add Data**: Import layers from local files, databases, or ArcGIS Online.
- **Basemap**: Choose from predefined basemaps (e.g., imagery, streets).
- **Add Preset Layer**: Quickly add common layers like elevation or imagery.

3. Selection Group
- **Select**: Choose features interactively.
- **Clear Selection**: Remove all selected features.
- **Select by Attributes / Location**: Advanced selection using queries.

- **Measure**: Calculate distances, areas, and feature lengths.
- **Locate**: Search for addresses, coordinates, or places.
- **Coordinate Conversion**: Convert between coordinate formats.

5. Labeling Group
- Provides tools to manage and customize how labels appear on your map.
- Labels are dynamic text derived from feature attributes, helping users interpret spatial data effectively.

Insert Ribbon

The **Insert tab** is the primary ribbon adding new elements to your project, such as new maps, scenes, and layouts.

1. Project - Create or manage project templates
- Functionality:
  - Allows you to start new projects based on predefined templates
  - Templates can include maps, layouts, styles, and connections to data sources
  - Useful for maintaining consistency across multiple projects

2. Knowledge Graph - Integrate and analyze complex relationships between entities.

3. Layer Templates - Quickly add preconfigured layers to your map
- Functionality:
  - Provides a gallery of **layer templates** (e.g., Map Notes, Bright Notes)
  - Templates include predefined symbology and settings for common tasks
 - Speeds up map creation by avoiding manual configuration

Insert Ribbon

4. Link Analysis - Inserts tools for analyzing **relationships between features**. Helps visualize and quantify connections (links) between entities in a network.

5. Measurements - Adds measurement tools to your map or layout. Allows you to measure distance, area, and location coordinates interactively.

6. Styles - Insert or manage styles for symbology and design. Styles include color schemes, symbols, and fonts for consistent cartographic design.

7. Favorites - Provides quick access to favorite items you've marked. Favorites can include layers, templates, styles, or other frequently used resources. Speeds up workflow by avoiding repeated searches for commonly used items.

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Edit Ribbon

The **Edit tab** provides all the commands needed for creating and modifying spatial data.
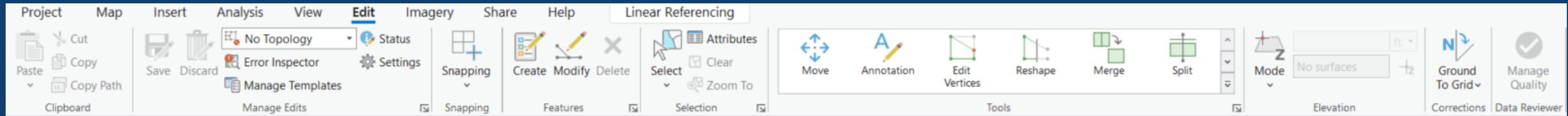
1. **Clipboard –** Handles copying and pasting features. Quickly duplicate or move features between layers or maps.
2. **Manage Edits –** Controls editing environment and settings.
   - Note: There's no manual "start/stop" edit session—editing begins automatically when you modify data and ends when you save or discard edits.
3. **Snapping –** Ensures precise alignment of features during editing. Prevents gaps or overlaps by snapping vertices to other features within a specified distance.
4. **Features –** Create, modify, and manage features templates. Opens pane with templates for feature creation and contains the full collection of tools for editing existing features.
5. **Selection -** Controls how you select features for editing and allows you to isolate features within map. Opens Attributes pane for selected features to perform attribute edits.
6. **Tools –** Provides a quick access to the editing tools. (On Day 2 we will explore many of these editing tools!)
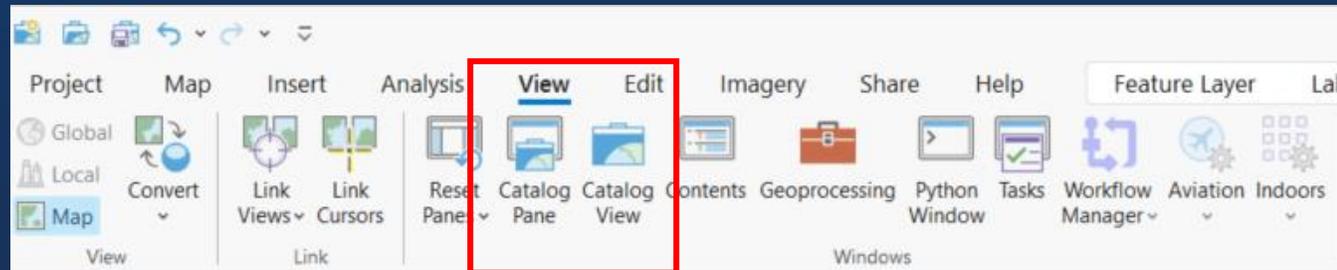
Class Exercise 2

Introduction to Catalog

Module 3

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Catalog

- Catalog is a central location for managing GIS data in ArcGIS Pro
- Provides access to maps, layers, databases, and tools
- Organizes resources for efficient project management

Navigating Catalog

- Catalog can be accessed through the 'View' ribbon and can be opened as Catalog View (full screen view of Catalog – below image) or Catalog Pane (docked window for quick access – right image)
- Expand folders and databases to locate data
- Search functionality helps find specific resources quickly

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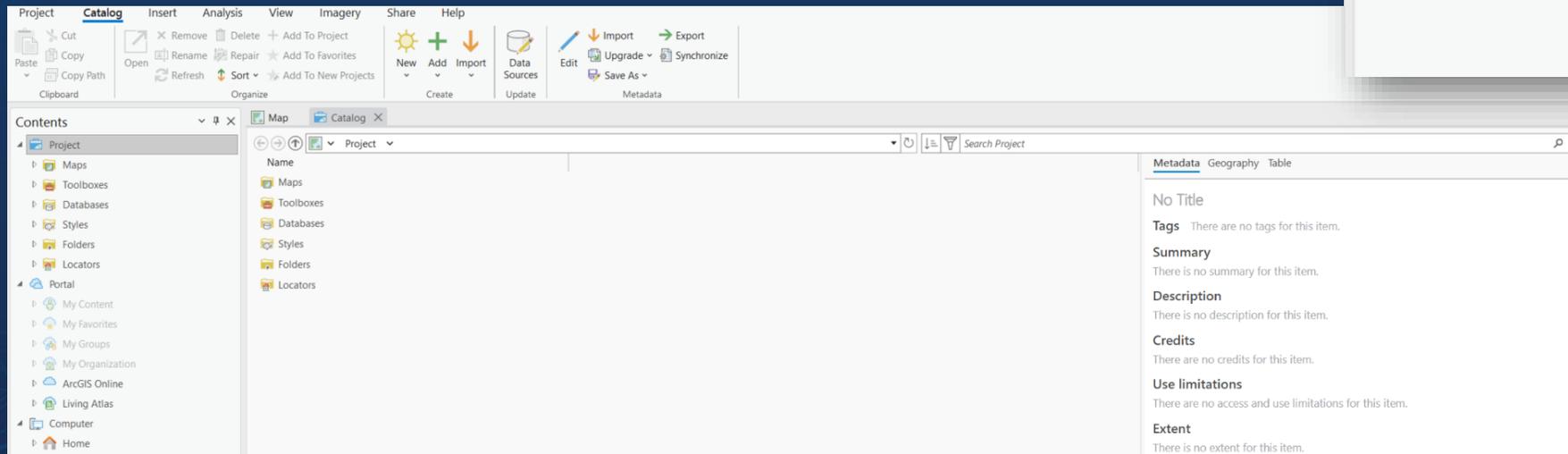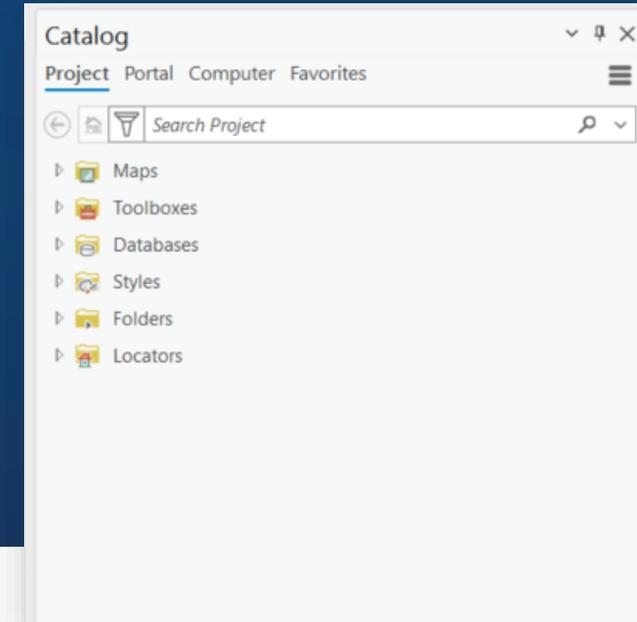
Viewing and Adding Data in Catalog

- Preview spatial and tabular data in the Catalog pane
- Check attribute tables and geometry before adding to map
- Supports multiple formats like shapefiles, geodatabases, and rasters
- Drag and drop data from Catalog into the map view
  - Use 'Add Data' button for precise selection
- Ensure coordinate systems match for proper alignment

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Metadata

- Metadata describes the content, quality, and lineage of data
- Edit metadata in Catalog by right clicking the layer and selecting 'Edit Metadata'
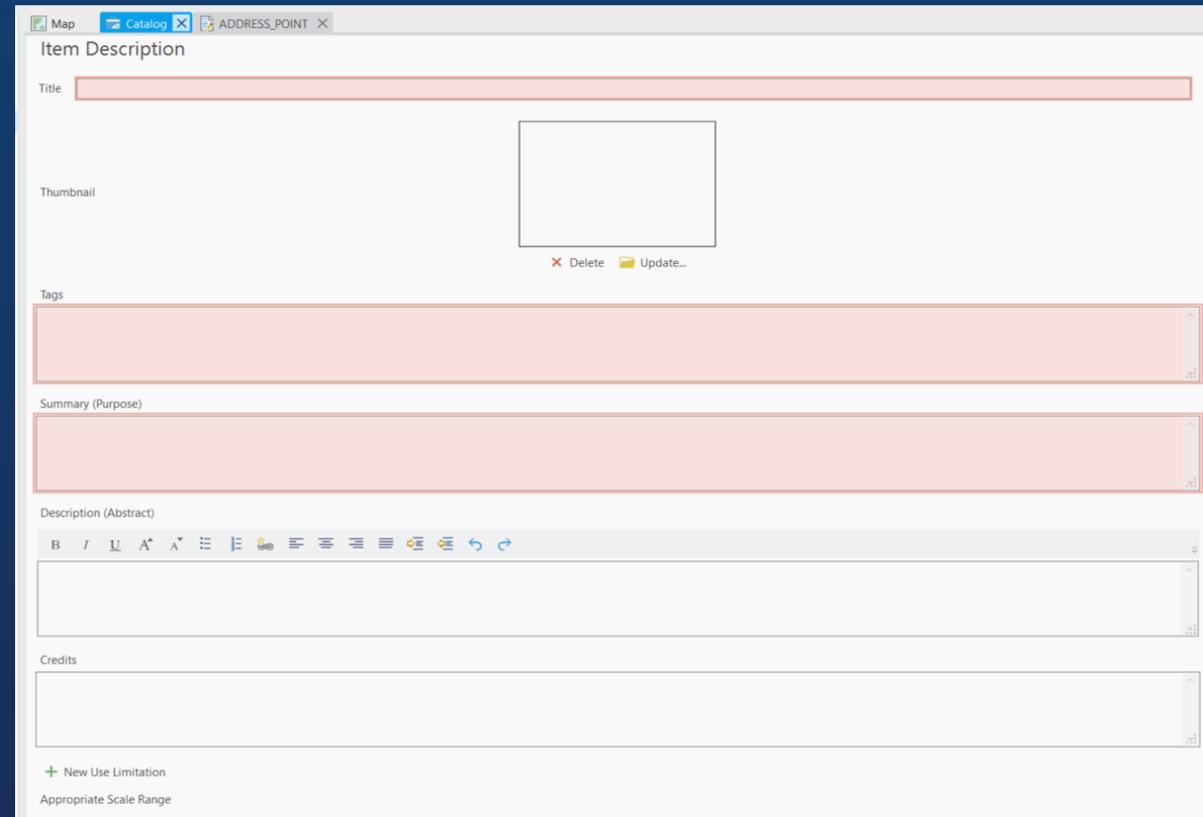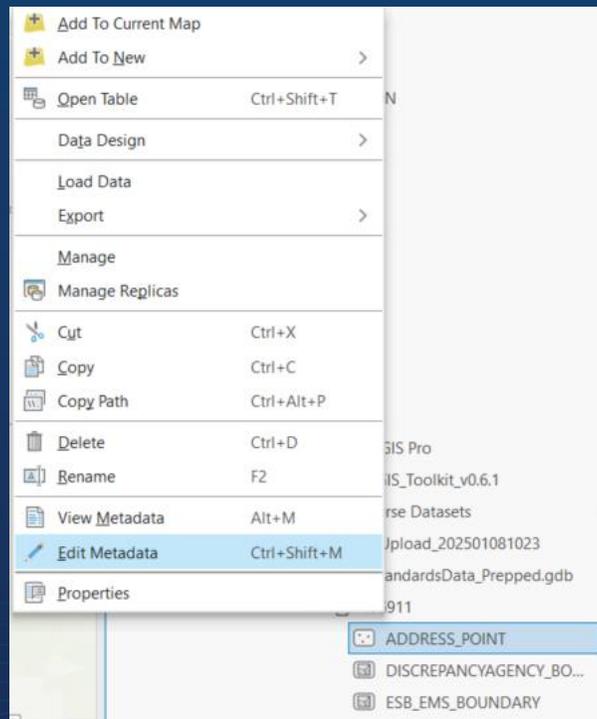
Importing and Exporting Data

- Import tables, shapefiles, and data into geodatabase
- Export layers to different formats for sharing
- Use geoprocessing tools for batch operations

Class Exercise 3

Exploring Attribute Tables

Module 4

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Attributes

- Information that relates to a spatial feature in a dataset
- Maps are just a picture!
- GIS links maps and data

Hydrants

Hydrant #	Pressure	Test Date
22456	441000 PSI	09/01/2020
22457	360000 PSI	09/08/2020
22458	426000 PSI	09/01/2020
22459	439000 PSI	09/01/2020
22460	238000 PSI	09/02/2020
22461	3310100 PSI	09/02/2020
22462	3510100 PSI	09/07/2020

Address Points

USPS Data Element	Address Field	E911 Ex. Value
Street Number	Address	101
Predirectional	PreDir	N
Street Name	Street	Main
Street Suffix	StreetType	ST
Postdirectional	SufDir	NE
Secondary Unit Indicator	Bldg Unit	APT
Secondary Number	BldgName	3
City	City	Guthrie
State	State	OK
Zip	Zip	73044

Road Centerlines

Predir.	Street Name	Street Type	Postdir.
N	Main	St	NE
N	Main	St	NE
N	Main	St	NE
N	Main	St	NE
W	Franklin	Blvd	NW
W	Franklin	Blvd	NW
W	Franklin	Blvd	NW
W	Franklin	Blvd	NW

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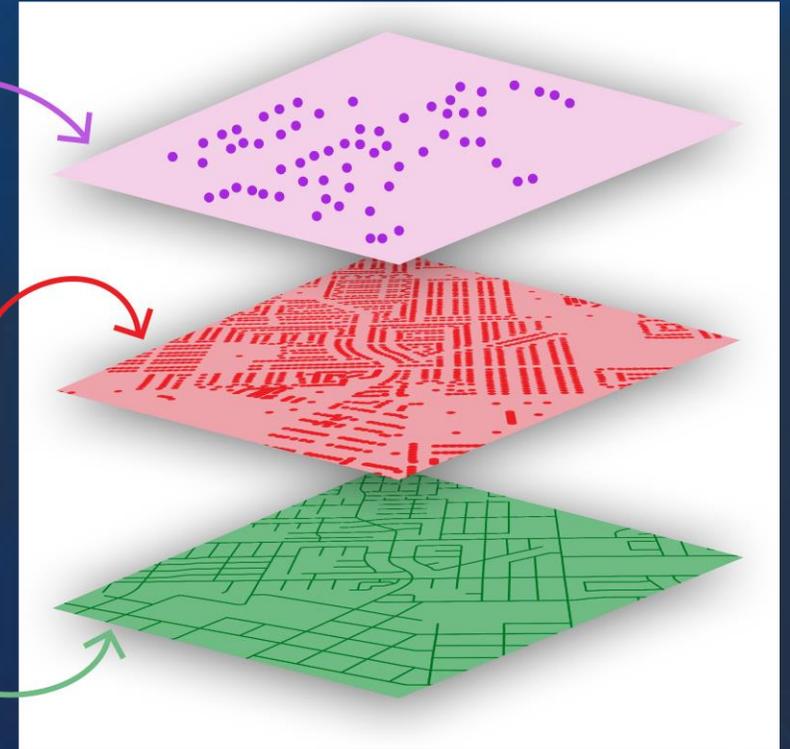
Attribute Tables

- The attribute table is a view of the database that stores descriptive information about geographic features in each layer or table

- Each record represents a single feature, and each field represents a specific attribute

- Attribute tables show the fields for a layer and show feature selections

- Features can be created, updated, or deleted from the Attributes Table or the Attributes Pane

Queries

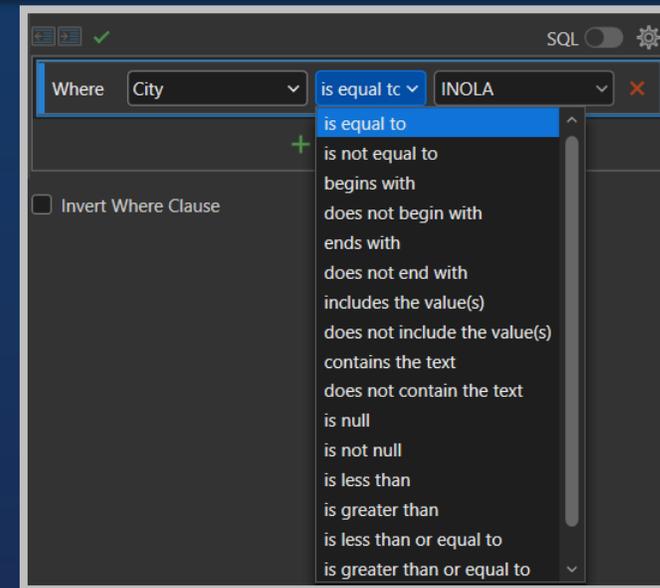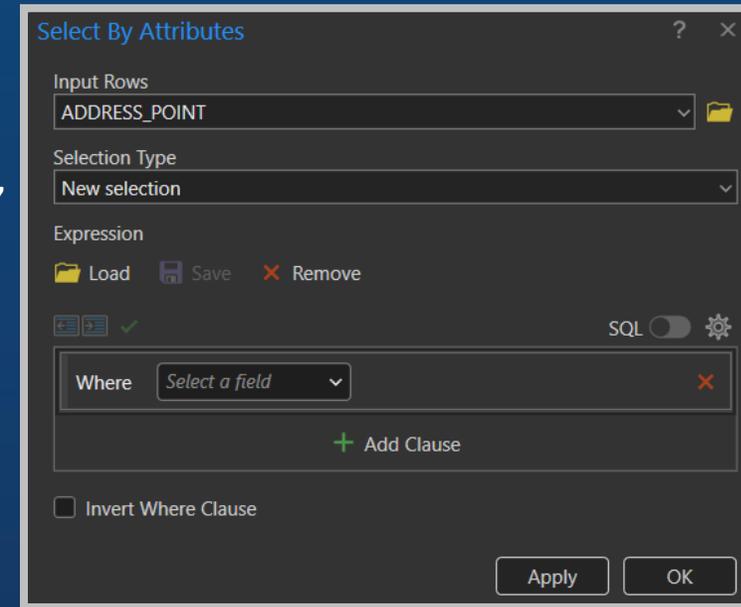Module 5

Attribute Queries

Attribute queries in ArcGIS Pro are operations that allow you to select, analyze, or manipulate table records based on their attributes.

Instead of asking "What features are within a mile of this city?" (a spatial query), an attribute query asks questions like:

- Which values in this field are null?
- Are their field values greater than 100?
- Are the values of Field A the same as those of Field B

Key Characteristics:

- Uses Structured Query Language (SQL) as a tool to investigate values in a given table
- Queries relate to one table (or feature class) at a time
- In ArcGIS Pro, there is a robust Expression Builder that makes it easier to create, test, and reuse attribute queries
- Multiple selection types including: Subset selection, Remove from selection, and Add to selection. These queries can be combined with manual feature selection or spatial selections

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Spatial Queries

Spatial queries in ArcGIS Pro are operations that allow you to select, analyze, or manipulate geographic features based on their spatial relationships rather than just attribute data.
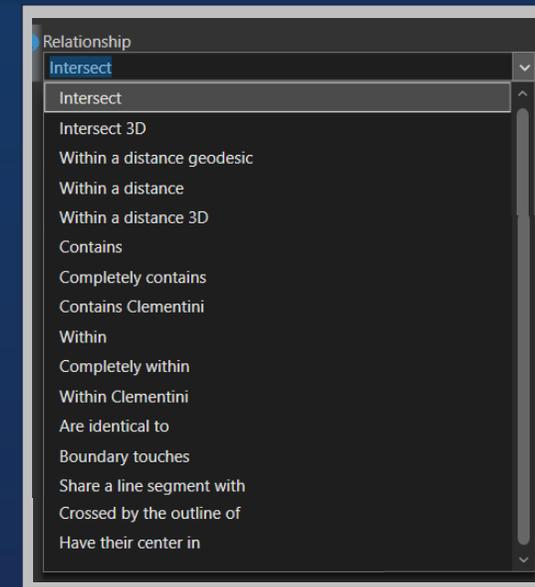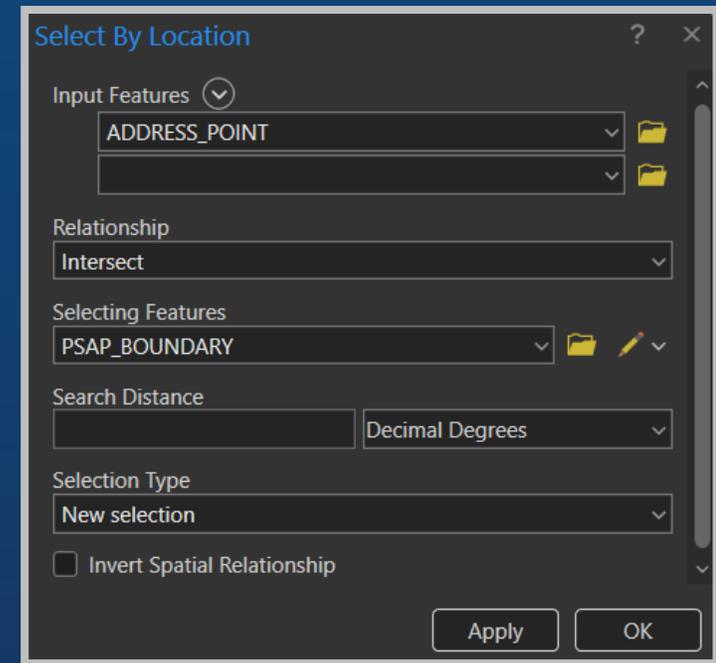
Instead of asking "What features have a population greater than 10,000?" (an attribute query), a spatial query asks questions like:

- Which features intersect this polygon?
- What points are within 500 meters of this line?
- Which parcels are completely contained within a city boundary?

Key Characteristics:

- Uses geometry relationships such as intersect, within, contains, touches, crosses, or overlaps
- Often combined with attribute queries for more complex analysis
- Common tools include Select by Location, Spatial Join, and Overlay Analysis
- Spatial queries are essential for tasks like proximity analysis, finding overlapping areas, or determining spatial patterns in GIS workflows

Class Exercises 4, 5, and 6

Select By Location

Input Features
ADDRESS_POINT

Relationship
Intersect

Selecting Features
PSAP_BOUNDARY

Search Distance
[ ] Decimal Degrees

Selection Type
New selection

[ ] Invert Spatial Relationship

Apply   OK

Relationship
Intersect

- Intersect
- Intersect 3D
- Within a distance geodesic
- Within a distance
- Within a distance 3D
- Contains
- Completely contains
- Contains Clementini
- Within
- Completely within
- Within Clementini
- Are identical to
- Boundary touches
- Share a line segment with
- Crossed by the outline of
- Have their center in

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Day 2

Symbology

Refers to the way geographic features are visually represented on a map. Determines how points, lines, polygons, and raster data appear, using symbols, colors, patterns, and sizes to convey meaning.

Symbology basics:

- Symbols: Graphic representations for features (e.g., icons for points, line styles, fill patterns)

- Color and Size: Used to show categories, quantities, or relationships

- Transparency: Controls visibility and layering

- Labeling and Text: Adds descriptive information to features

- Rendering Methods: Includes single symbol, unique values, graduated colors, proportional symbols, and more!
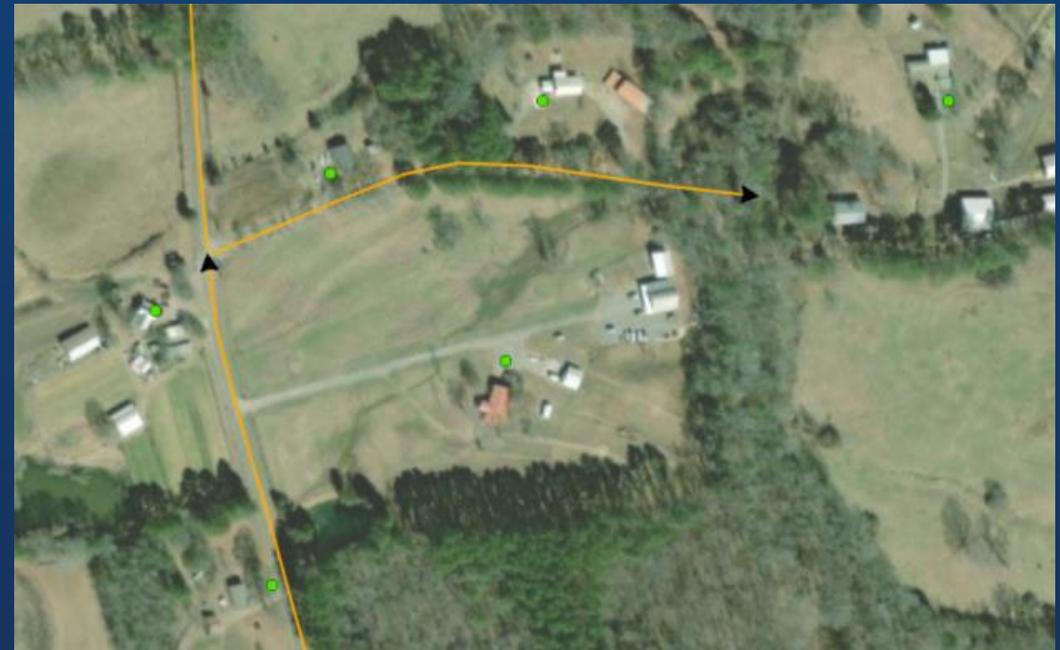
Symbology

- Symbology within ArcGIS Pro can be accessed through the Feature Layer ribbon of a selected feature class
- The Symbology pane will appear with the options to adjust the layer's symbology
- Select the symbol image to open the Gallery and Properties options which allow you to adjust the color, size, shape, and more
- Save customized symbology to be a part of your "Favorites" for quick access in the future
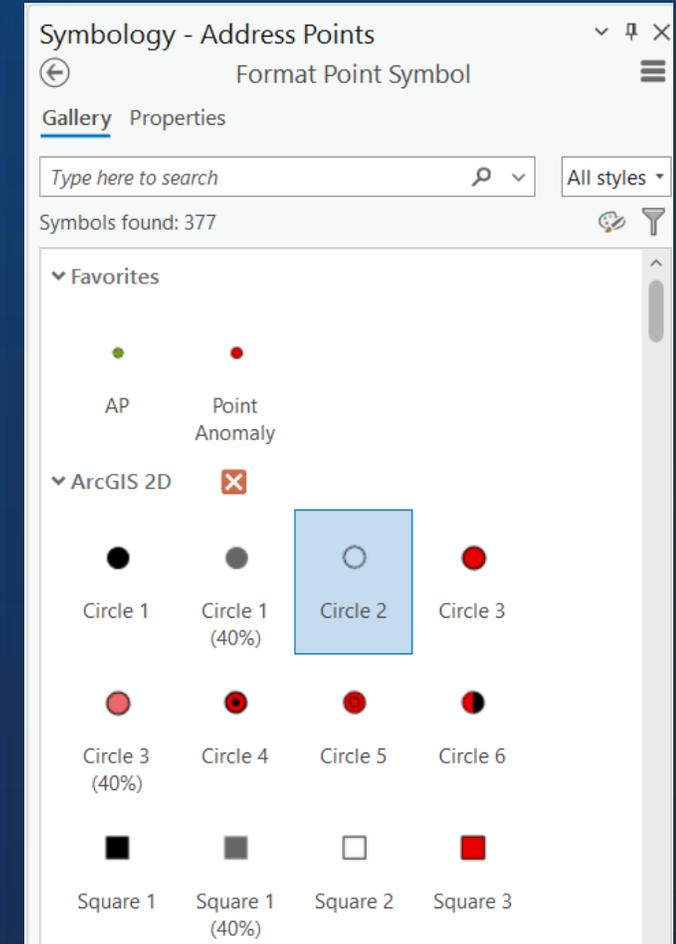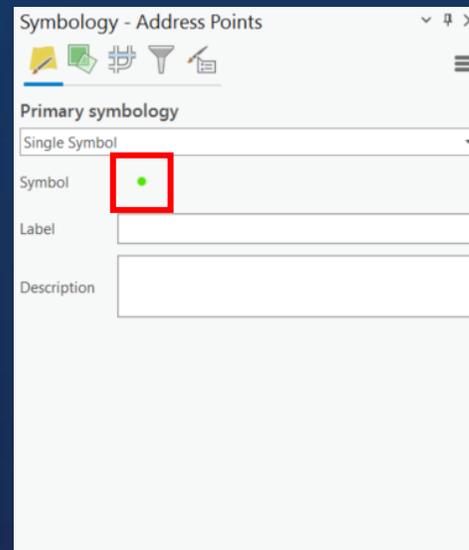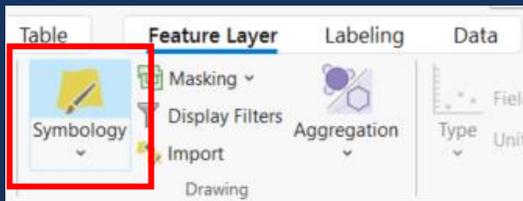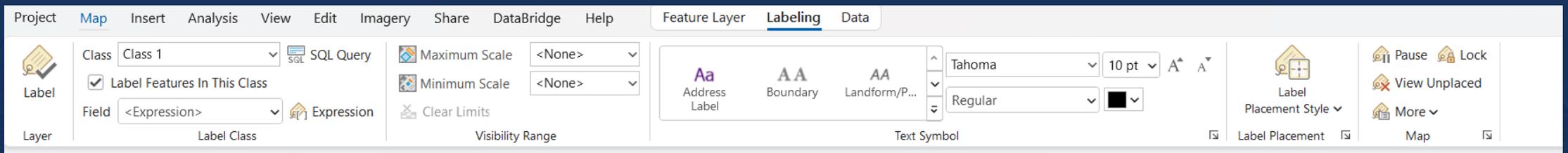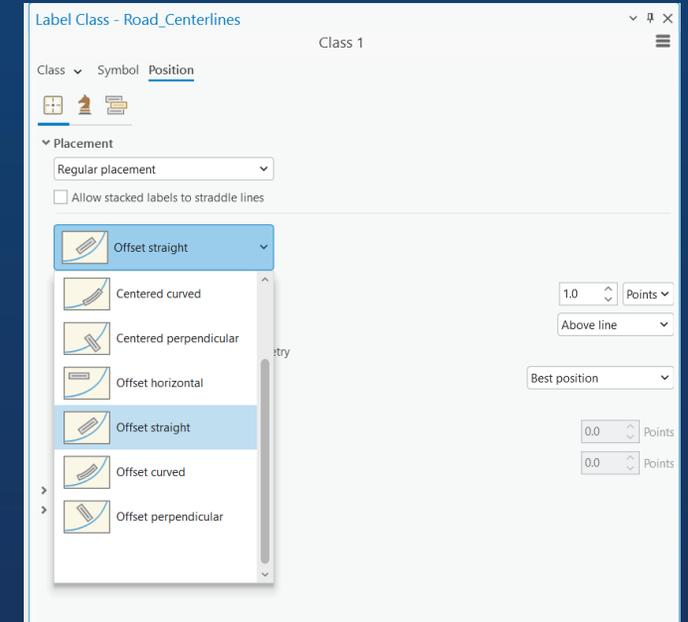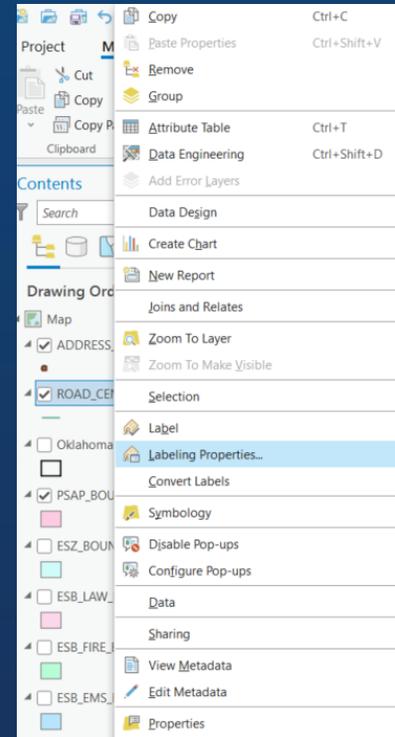
Labeling

- The process of automatically placing text on a map to describe features, such as names of roads, addresses, cities, or other attributes from your data.

- Labels are generated dynamically based on feature attributes and placement rules. They update automatically when the map scale or extent changes.

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Labeling in ArcGIS Pro

- Labeling can be accessed in the Ribbon when the layer is selected in the Contents pane *or* by right clicking the feature class and selecting Labeling Properties
- Expressions can be written in Arcade, Python, or VBScript
- Allows multiple label classes and scale – dependent visibility

Labeling Syntax

Expressions can be written in Arcade, Python, or VBScript

VBScript
- Field delimiters: Field names are enclosed in square brackets [FIELDNAME]
- Concatenation: The ampersand (&) operator is used to join strings, fields, and text. Text will use double quotes (") to surround the values.
  - Example: [FIELD1] & " " & [FIELD2]
- Line breaks: Must use & vbnewline &

Python
- Field delimiters: Field names are enclosed in square brackets [FIELDNAME]
- Concatenation: The plus sign (+) operator is used to join strings, fields, and text. Text will use double quotes (") *or* single quotes (') to surround the values.
  - Example: [FIELD1] + ' ' + [FIELD2]
- Line breaks: Must use + '\n' +

Arcade
- Field delimiters: Field names are formatted as $feature.NAME
- Concatenation: The plus sign (+) operator is used to join strings, fields, and text. Text will use double quotes (") *or* single quotes (') to surround the values.
  - Example: $feature.NAME + " - " + $feature.TYPE
 - Line breaks: Must use + TextFormatting.NewLine +

Class Exercise 7

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Data Editing

Modules 7

Editing

- Editing is when you create, update, or delete a feature's geometry or attributes

- Editing occurs in an edit session, but in ArcGIS Pro, an edit session is started by default when you open a project

- Editing a feature's geometry happens when you place or move the vertices that represent a feature's spatial geometry

- Editing a feature's attributes happens when you type or calculate new field values for one or more features using the Attributes Table or Attributes Pane

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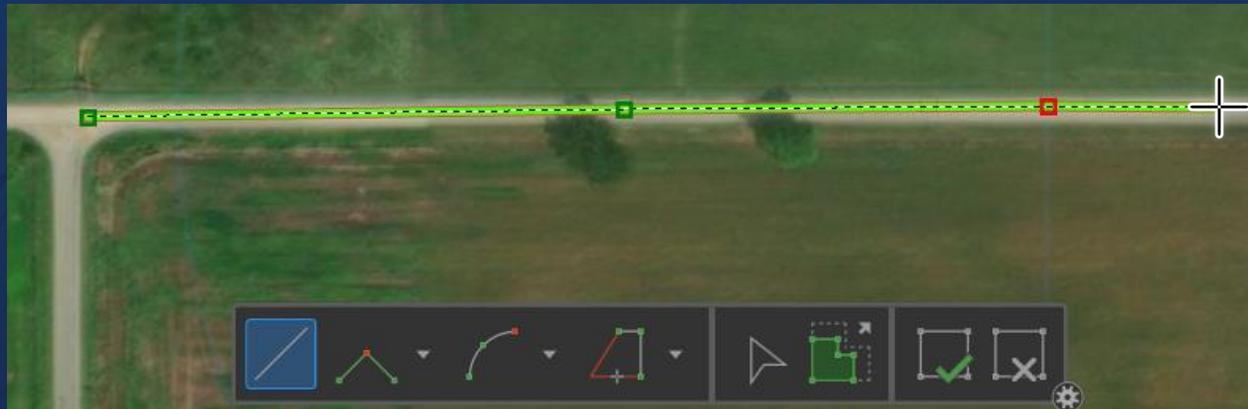
Edit Tools
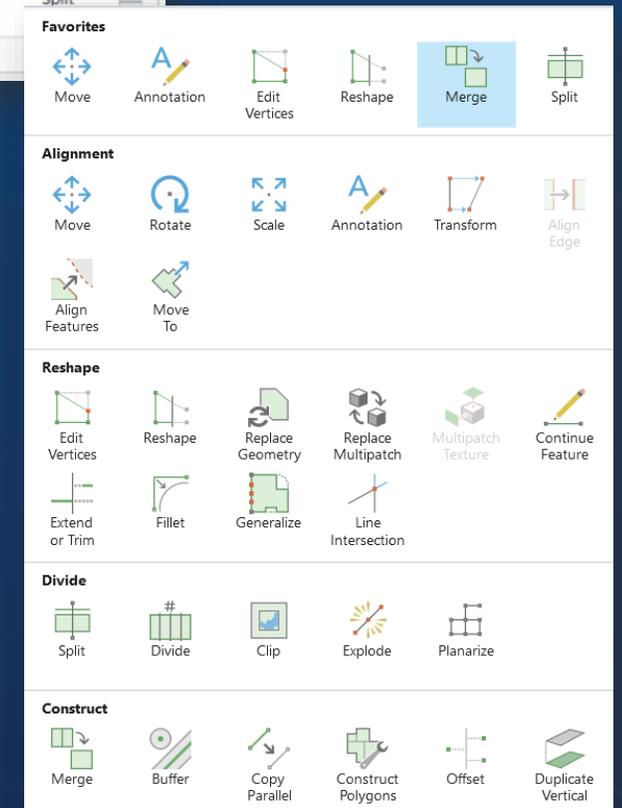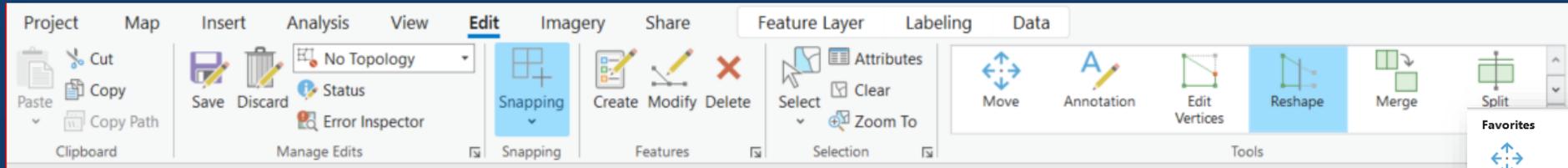
- Functions such as creating features, saving edits, selections, and all editing tools can be found within the Edit Ribbon
- Enable Snapping to support topologically accurate editing
- Expand the Tools section to view the tool gallery
- Customize the tool gallery to add commonly used tools within your Favorites
- Utilize the Search bar when looking for a tool

Cartography and Map Creation

Module 8

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Cartography

- Cartography is the art and science of making maps
- It involves the study and practice of representing geographic information visually, using symbols, colors, and design principles to communicate spatial relationships effectively.
- Maps <u>tell a story</u> to the reader
- There are some etiquette basics of cartography:
  - Colors automatically tell the reader information about the feature
    - Ex: Blue = water features, "cooler"/"less" metrics
  - Size matters! The larger the size given to a feature or label, the more important you're telling your reader it is
  - Labels and feature placement can also tell the reader what is most important on your map

Layout Views

- Layout Views are the workspace to design a digital or paper map using the GIS data
- Layout Views contain one or more map frames based on the maps in your Project and cartographical objects such as a Legend and North Arrow
- Layout views update in real-time based on how you change the GIS data or its symbology and labeling in your Project map

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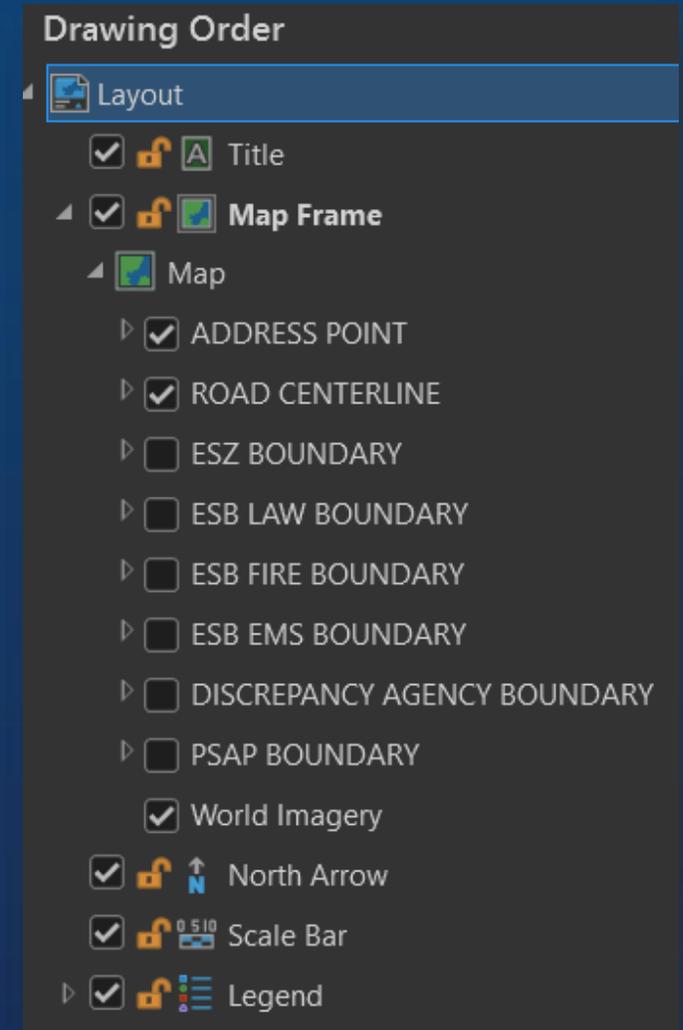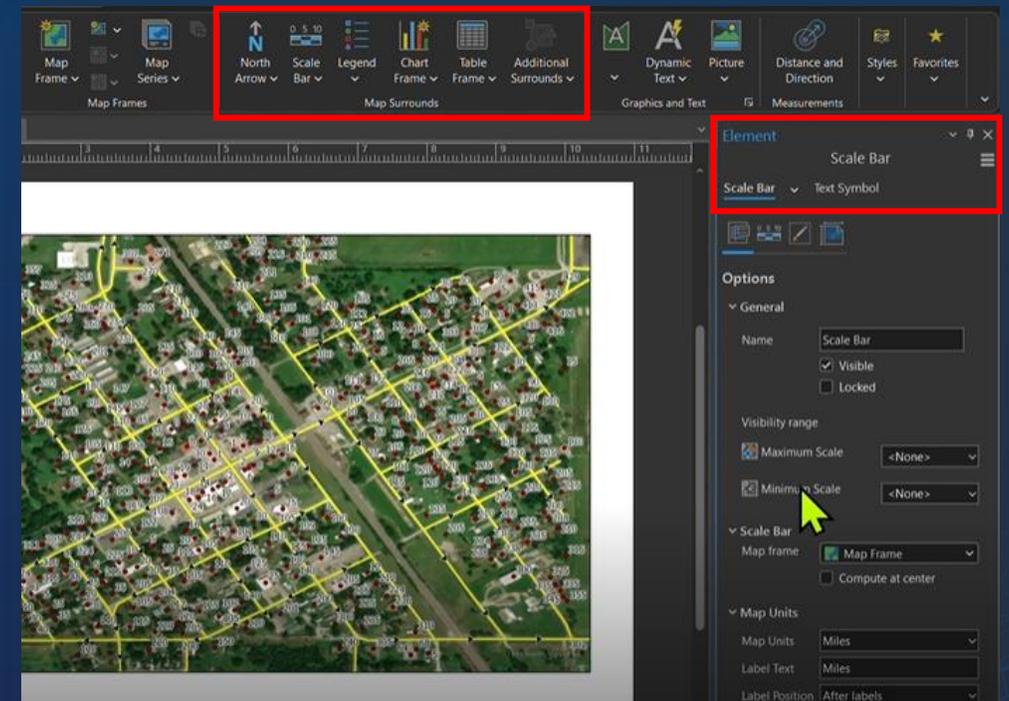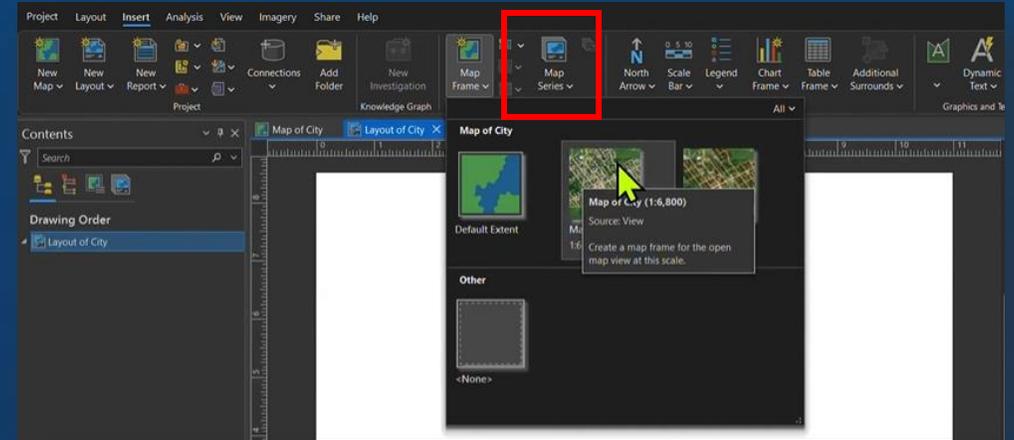
Map Creation

Add Your Map Frame
- In the layout view, click Insert → Map Frame
- Select the map you created earlier and draw the frame on the layout in the layout space

Add Map Elements
- In the layout view, click select element to add to frame
- Draw a box within the map frame to place element
- Right click the placed element to open element properties to further adjust the details of the contents

Additional Notes
- Map frame is dynamic, as you move the location of the map in your Map tab, it will adjust the visual display of your Layout frame
- Map frame can be adjusted from Layout view if map is activated. Right click and active frame to pan and select within the map
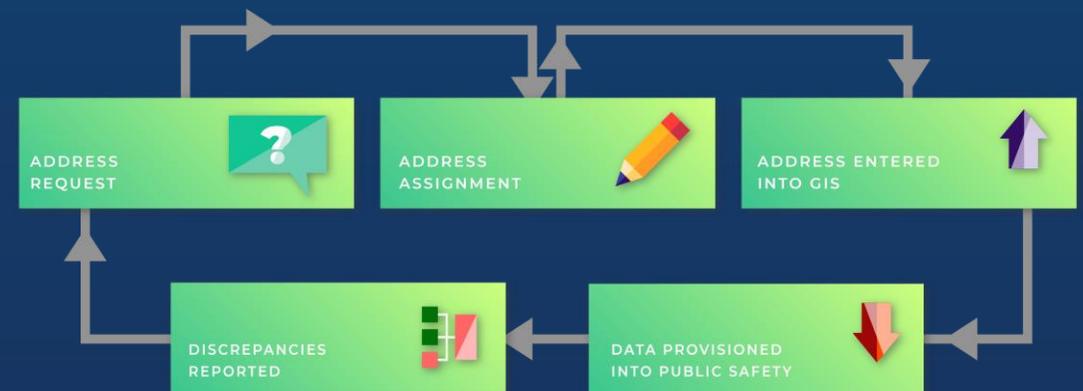
Creating a Quality Assurance (QA) Culture

- QA enforces those best practices
- Stakeholder engagement
- Business needs for data - who manages
- NG9-1-1 Education
- Improving existing workflows
- Iterative validations on NG9-1-1 data
- NOT a one and done
- Scheduled - may need more frequently if increased editing and adding data

ADDRESS REQUEST

ADDRESS ASSIGNMENT

ADDRESS ENTERED INTO GIS

DISCREPANCIES REPORTED

DATA PROVISIONED INTO PUBLIC SAFETY

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Best Practices

- Maintain required fields within data
- Be mindful of how other features impact data attributes
- Address point within road range - ranges may require adjusting when address points are added or removed
- Breaking road centerlines at boundaries and updating attributes appropriately
- Parse address elements
- Standardize attributes
- Leverage domains to reduce inconsistencies and errors
- Avoid blank values in data and replace with NULL

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Tips and Tricks in ArcGIS Pro

- Use the Command Search!
- Use Field Calculator "helpers" to perform quick updates
- Save your feature symbology to be used in the future without having to configure
- Import Symbology from other layers
- Drag and drop folders from File Explorer directly into the Catalog Pane to quickly make folder connections
- Utilize the Quick Access Toolbar for all your favorites
- Instead of searching in the ribbons, right click the map to activate "Select Features" tool, "Explore cursor" tool, and others
- When editing vertices, press the keyboard space bar to temporarily turn off snapping while editing
- Use the Attribute window to edit fields with domains

Oklahoma NG9-1-1 GIS Toolkit v3

- Newest version of the OK Toolkit has been released and can be downloaded from the GIC site: https://www.okmaps.onenet.net/address_standards.htm

- OK Toolkit v3 is built for ArcGIS Pro and uses the newest NG9-1-1 and Address Standard Schema

- Layout of the toolkit categories and tools have been condensed and simplified from previous versions

- The OK toolkit must be incorporated in your QA/QC process and data will be required to be submitted to the OK Repository on a quarterly basis

Upcoming trainings to be announced in the coming months!

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