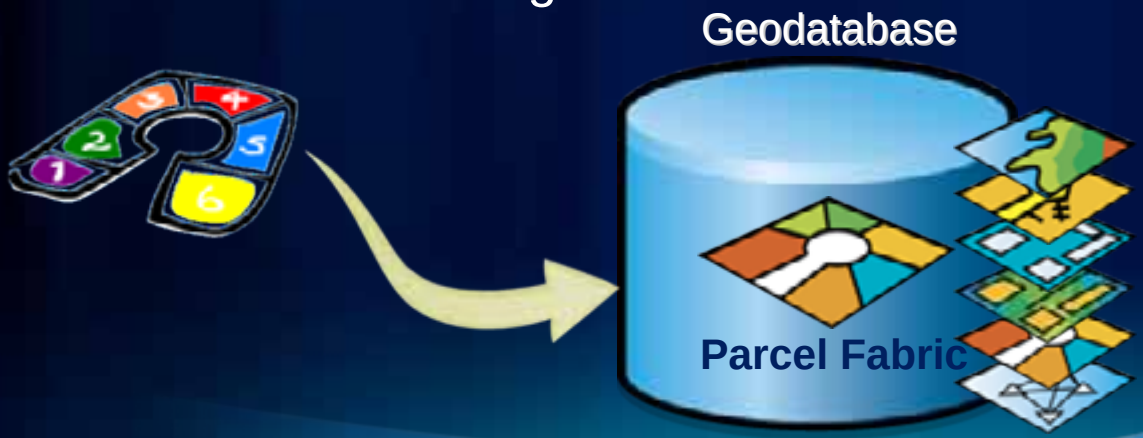
Esri International User Conference | San Diego, CA

Technical Workshops | 7/13/2011

ArcGIS for Land Records: Migrating your Data

J.D. Overton
Chris Buscaglia

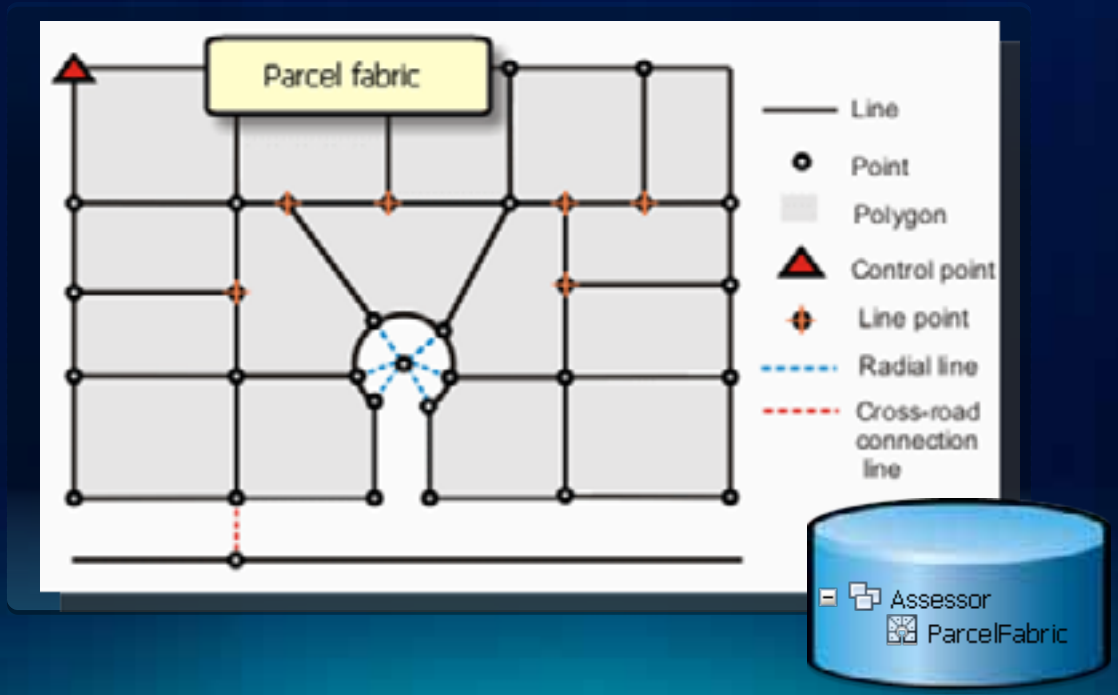


Session Goals

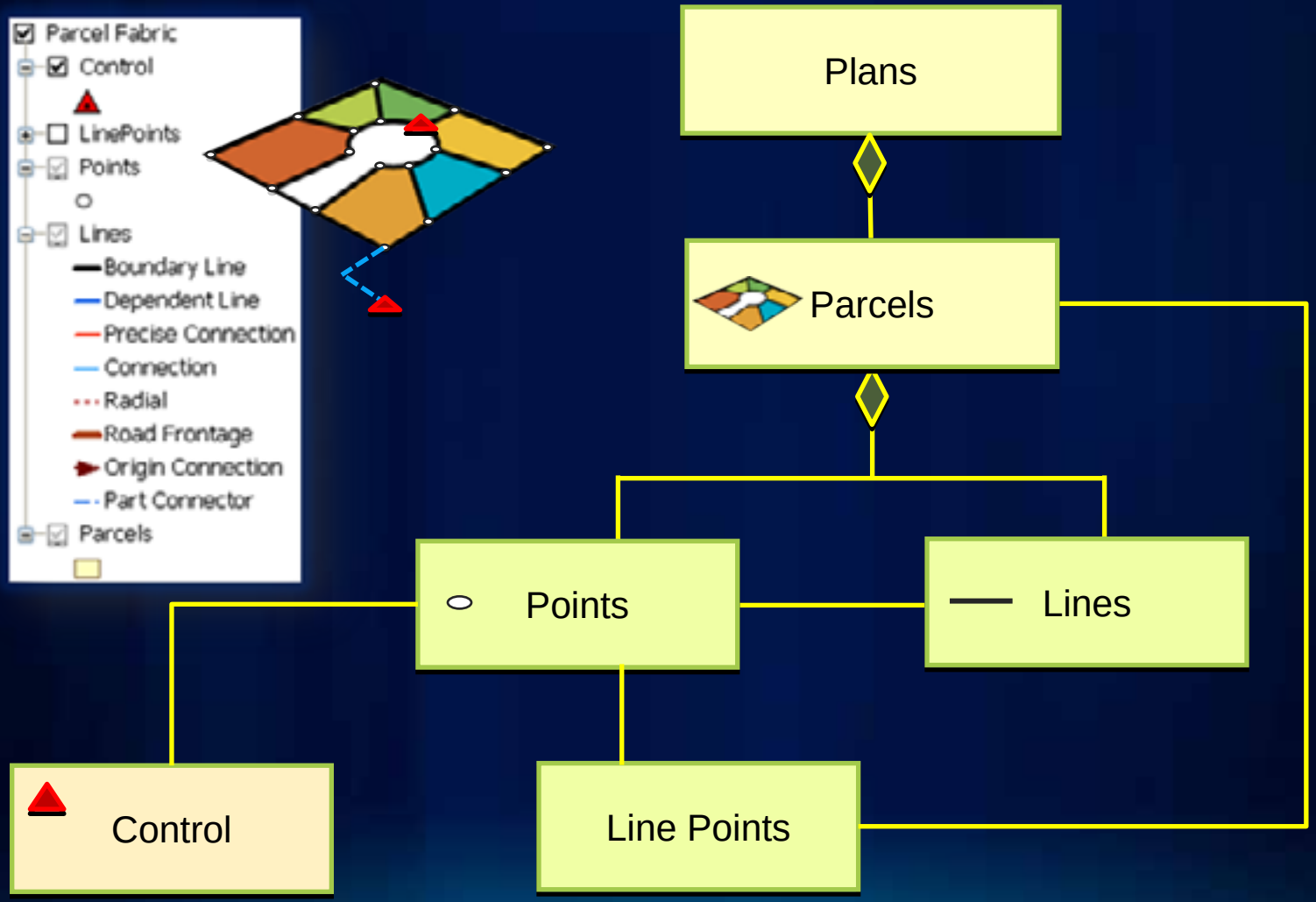
- Introduce Parcel Fabric data model
- Review data migration strategies
- Develop an Editing Map for daily workflows

What is a Parcel Fabric?

- **Set of related tables and feature classes in a geodatabase**
- **Forms a parcel boundary network**
- **Explicit topology**
  - defined by common parcel corners
    (no overlaps and gaps between neighboring parcels)



How parcel fabric data is stored?



Plans

Plans

ID	Name	SurveyDate
1	Crane's Roost	08/25/2007

Parcels

Points

Lines

Control

Line Points

Plans

- Store and manage plans, plats, legal records…
- Parcels can be created in and grouped by their associated legal record

How parcel fabric data is stored?

Plans

ID	Name	SurveyDate
1	Crane's Roost	08/25/2007

Parcels

ID	Parcel Name	Plan ID
100	28	1

Points

Lines

Control

Line Points

Parcels can be grouped with an associated Plan

Plans

1

1-M

Parcels

ID	Name	SurveyDate
1	Crane's Roost	08/25/2007

ID	Parcel Name	Plan ID
100	28	1
101	27	1

Points

Lines

Control

Line Points

Parcels are defined by a set of boundary lines

Plans

Parcels

1

1-M

Points

Lines

Control

Line Points

ID	Parcel Name	Plan ID
100	28	1
101	27	1

ID	Bearing	Distance	Parcel ID
200	N85-11-28E	95.46	101
201	S10-46-34E	417.10	101
202	N89-43-27W	168.55	101
203			101
204	S 2-25-04E	145.01	101
205	N 3-03-26E	200.00	101

2-point Lines have a Start and End point

Plans

Parcels

Control

Points

ID	X	Y	Z
301			
302			
303			
304			
305			
306			

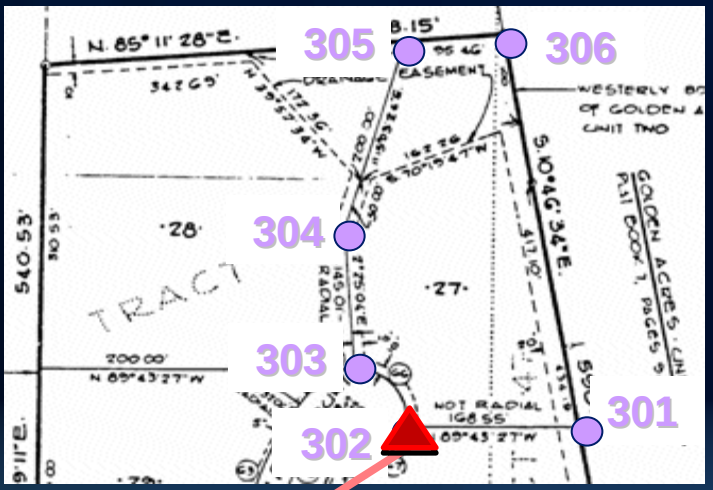
2-1

1-M

Lines

ID	Distance	From Point	To Point
200	95.46	301	302
201	417.10	302	303
202	168.55	303	304
203		304	305
204	145.01	305	306
205	200.00	306	301

Points can be associated with a Control Point



Plans

Parcels

Lines

Points

ID	X	Y	Z
301			
302			
303			
304			
305			
306			

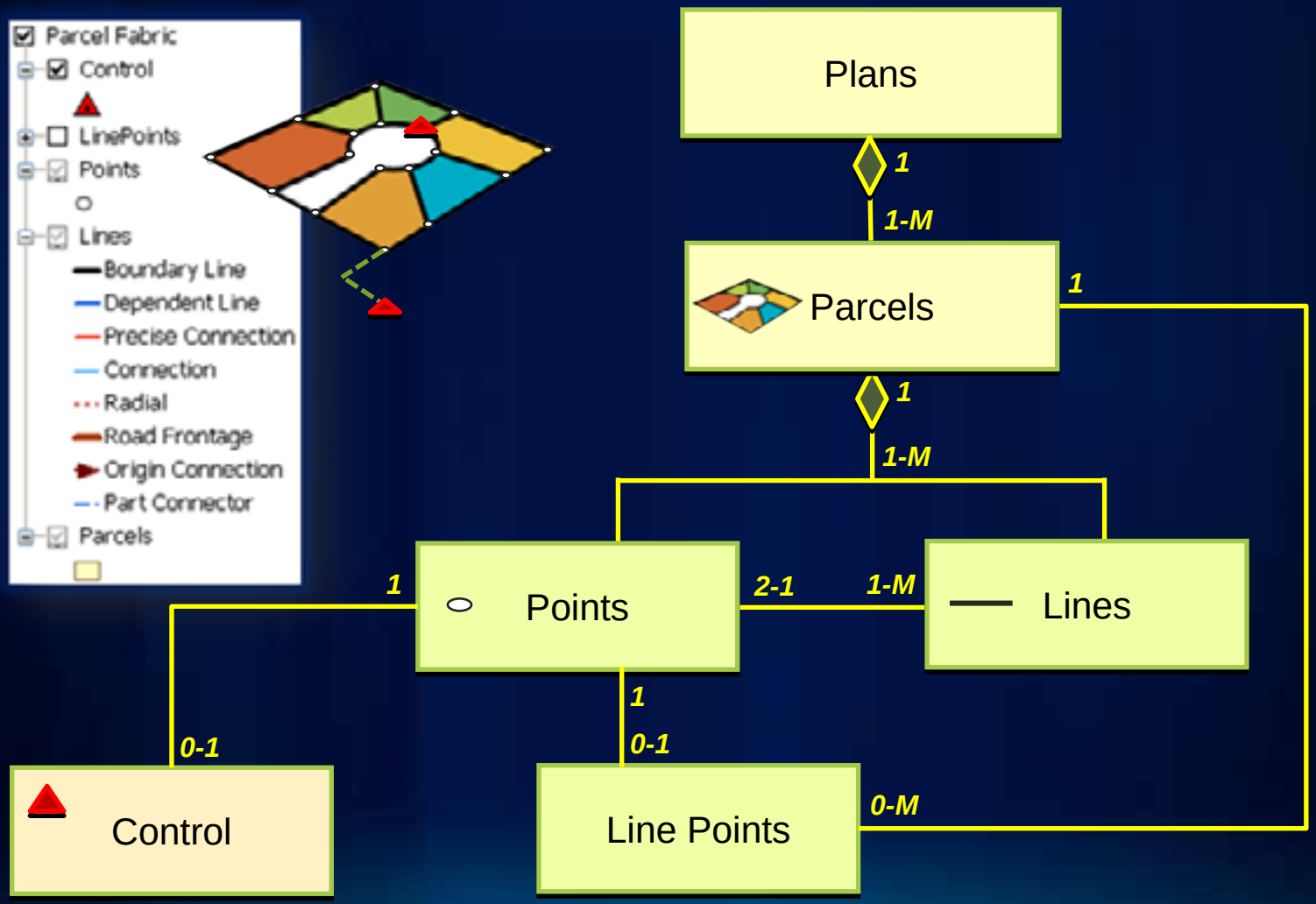
1

0-1

Control

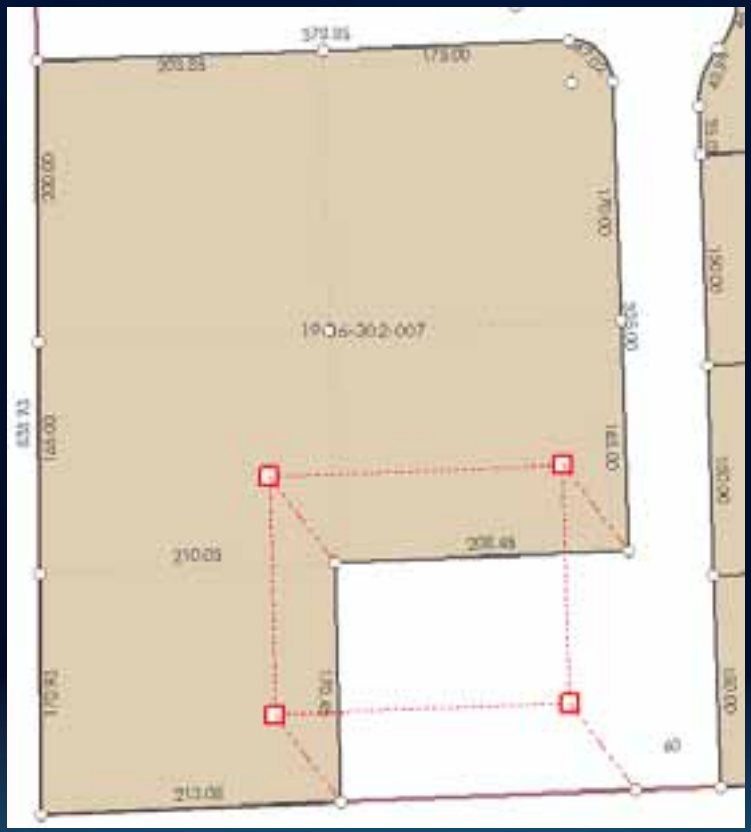
ID	Name	X	Y	Z	PointID
401	CP1				302

Parcel Fabric Data Model Relationships



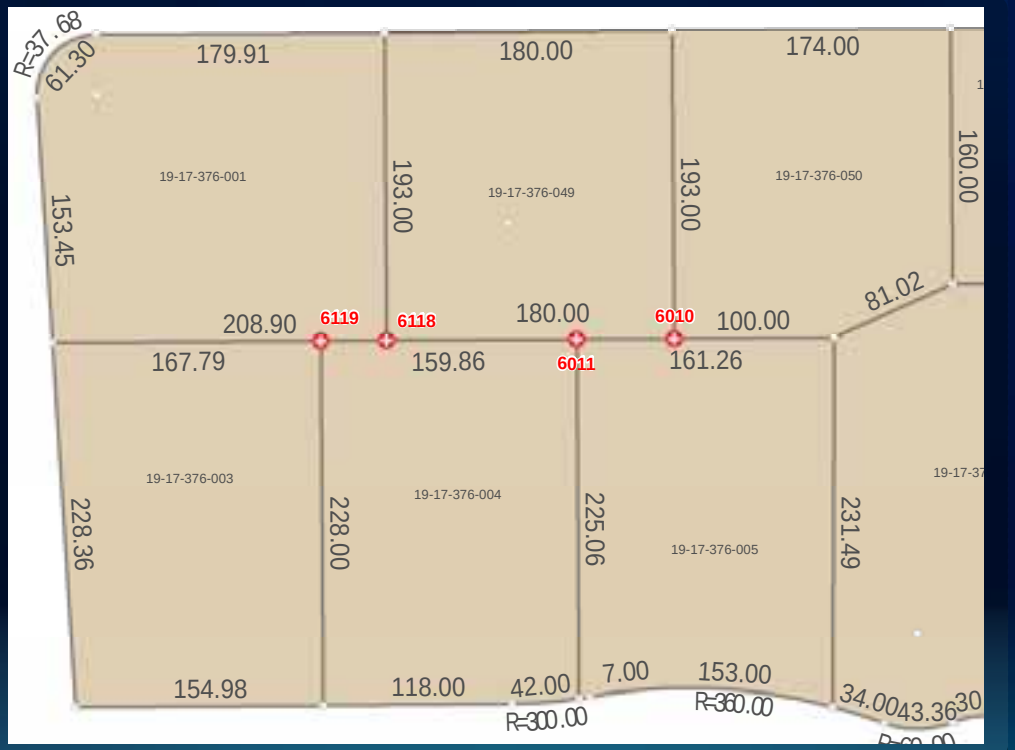
Data Integrity of Parcels in a Fabric

- **Topological accuracy**
  - Parcels are joined using shared points



Line points

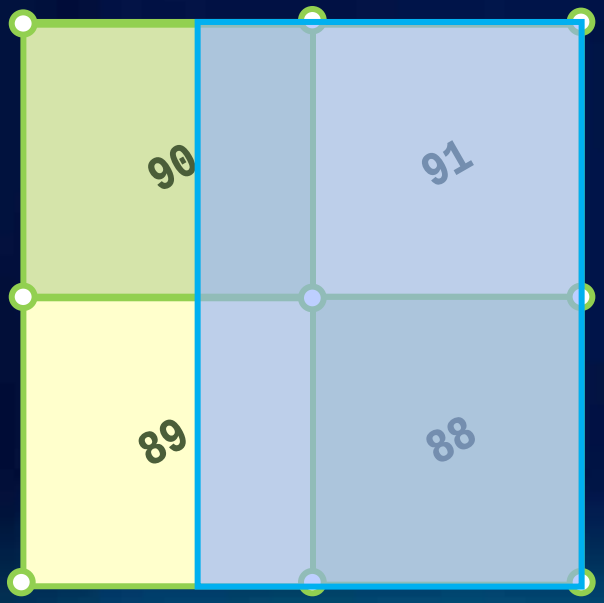
- **Added to existing parcel point when:**
  - **Point is on boundary of adjacent parcel**
- **Does not split the boundary line**



Data Model

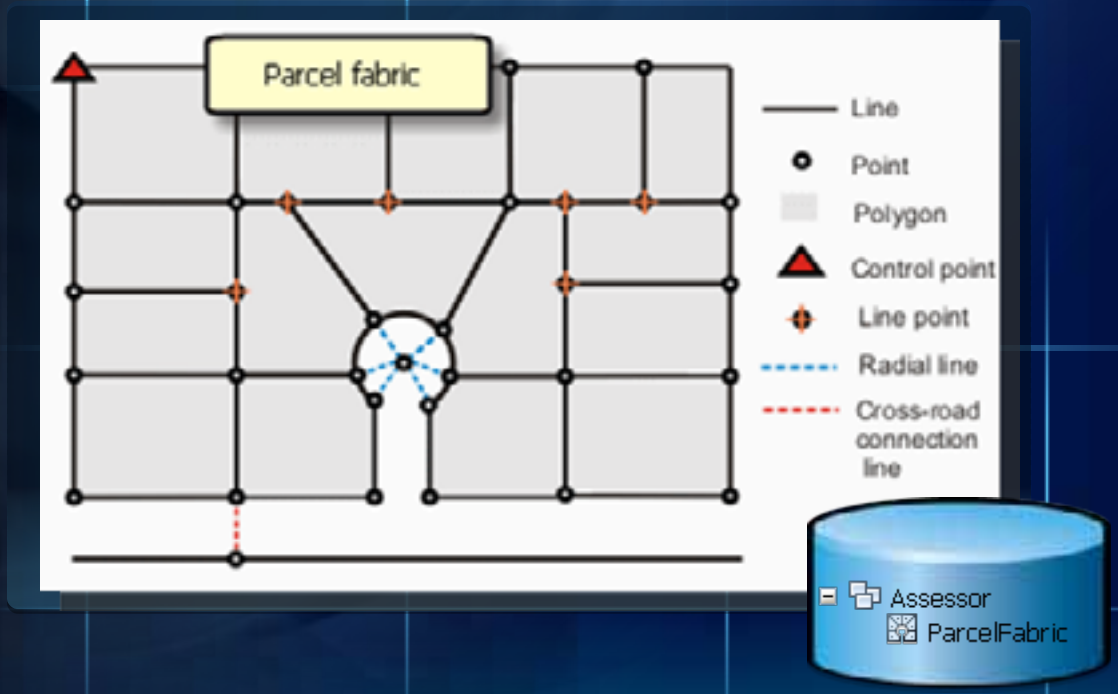
Fabric allows overlapping parcels

- Natural boundaries
- Donut/island and multipart parcels
- Historic parcels

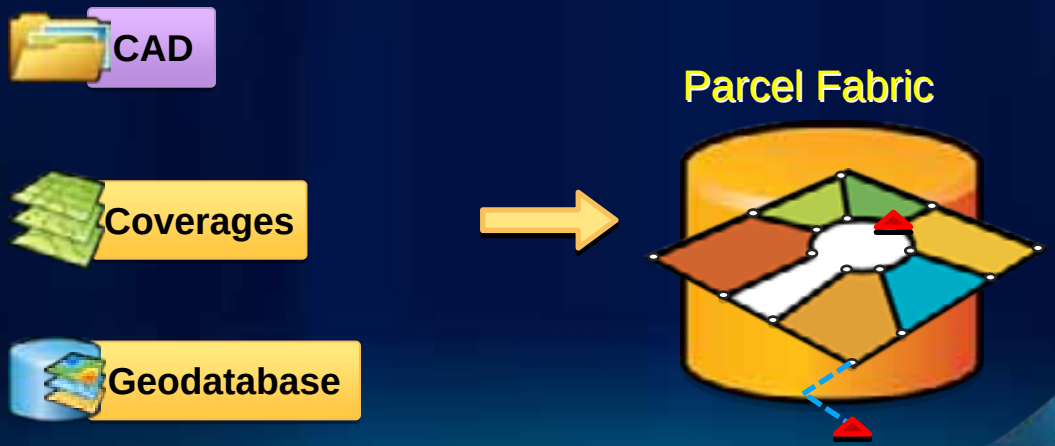


Demonstration

Parcel Fabric Data Model

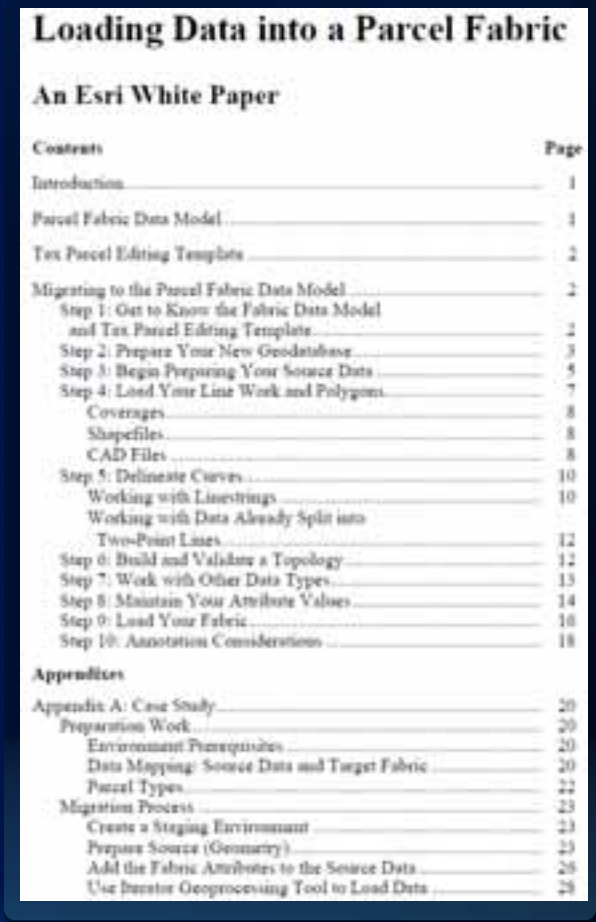


Data Migration Strategies



Loading Data into a Parcel Fabric – White Paper

- **Important aspects:**
  - **Different paths depending on source data**
  - **Use a topology to check data integrity**
  - **Modeling different parcel types**
    - **(lots, subdivisions, etc.)**
  - **Delineating curves**
  - **Annotation**



Loading Data into a Parcel Fabric

An Esri White Paper

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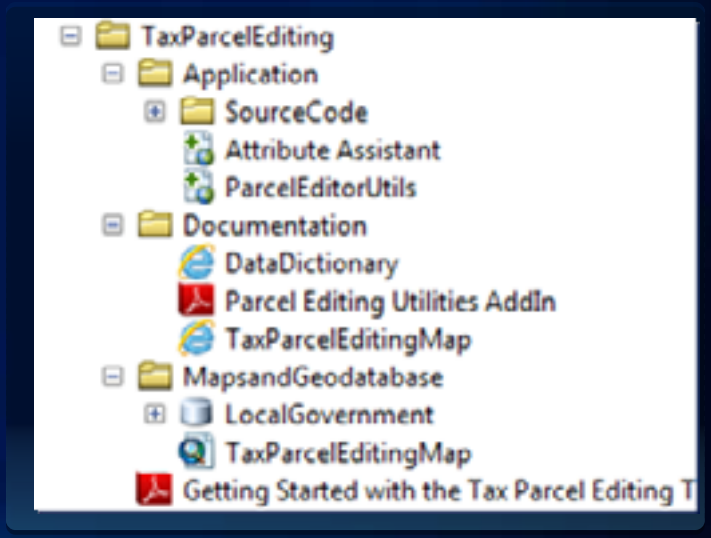
http://www.esri.com/library/whitepapers/pdfs/loading_data_parcel_fabric.pdf

Get to know the Tax Parcel Editing Template for 10

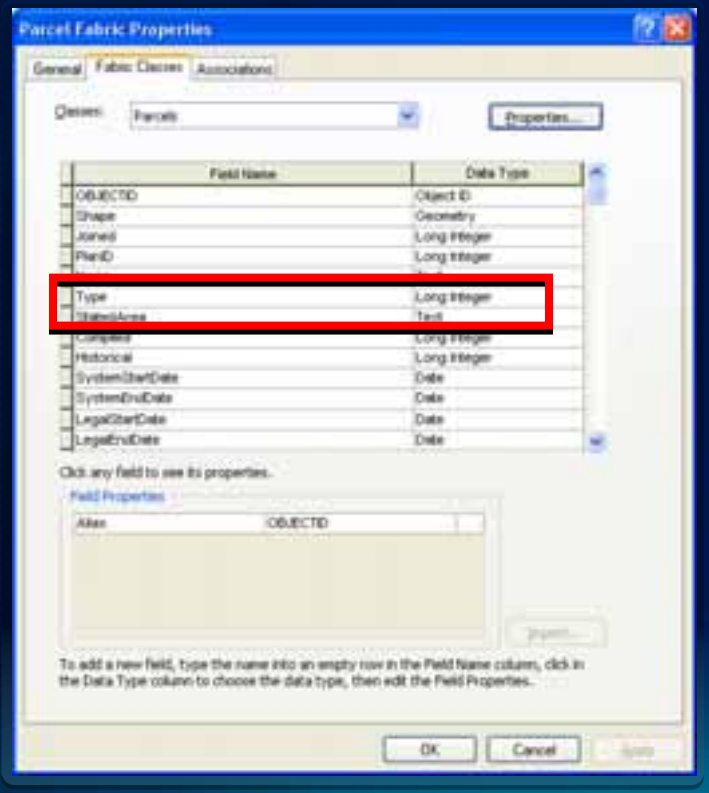
- Download from ArcGIS.com and includes:
  - Maps and Geodatabase
  - Documentation
  - Application
  - Getting Started Document
- Watch the videos, read the blogs
- Work with sample data
- Review Local Government GDB

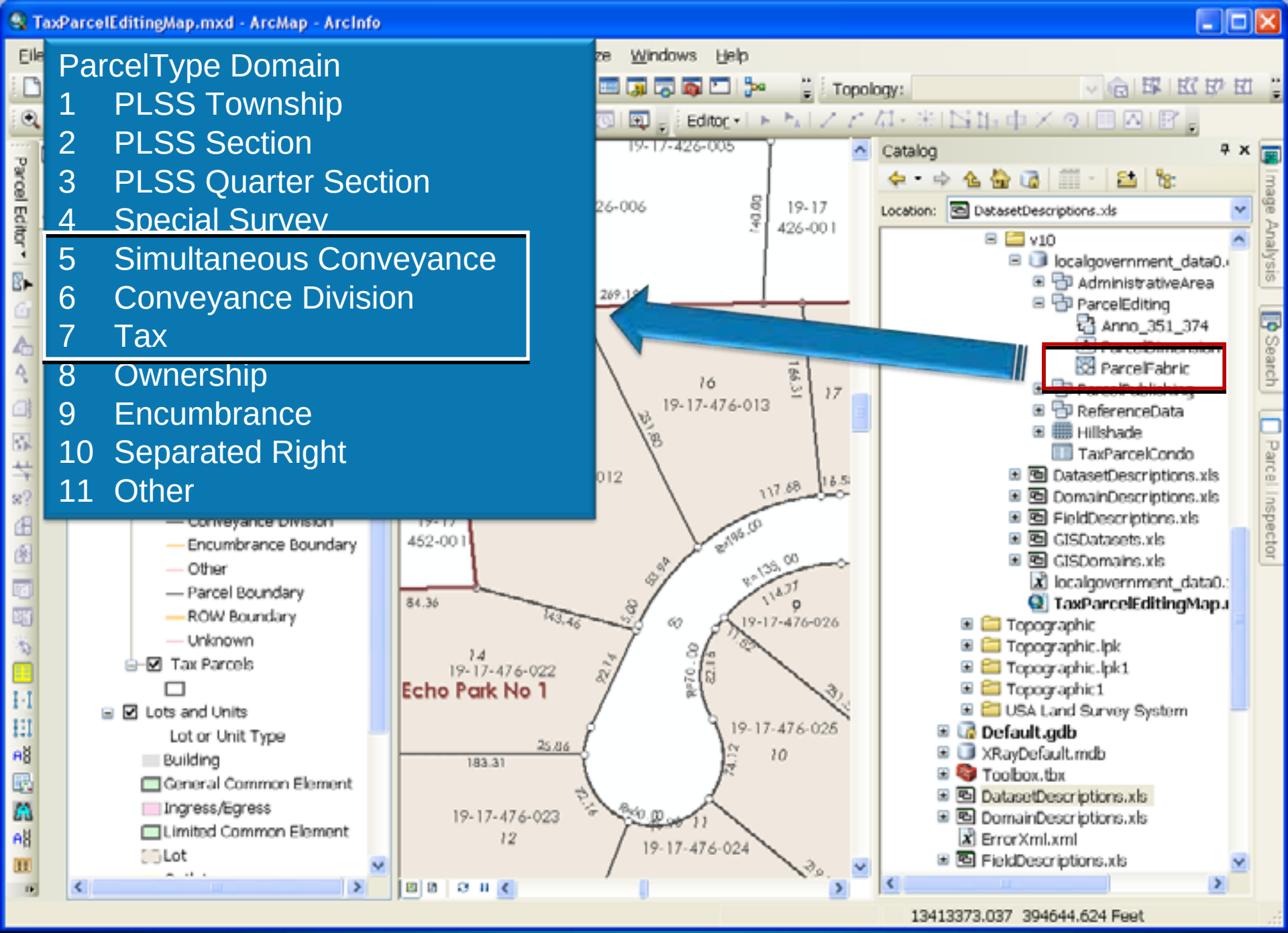


Search for "Tax Parcel Editing Template for ArcGIS 10" on ArcGIS.com

Local Government Information Model – Parcel Fabric

- Manage multiple parcel types in a parcel fabric
- Supports National Parcel Data Standard (FGDC)
- Use as starting point for your implementation

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ParcelType Domain
1 PLSS Township
2 PLSS Section
3 PLSS Quarter Section
4 Special Survey
5 Simultaneous Conveyance
6 Conveyance Division
7 Tax
8 Ownership
9 Encumbrance
10 Separated Right
11 Other
Catalog
Location: DatasetDescriptions.xls
ParcelFabric
Encumbrance Boundary
Other
Parcel Boundary
ROW Boundary
Unknown
Tax Parcels
Lots and Units
Lot or Unit Type
Building
General Common Element
Ingress/Egress
Limited Common Element
Lot
Echo Park No 1
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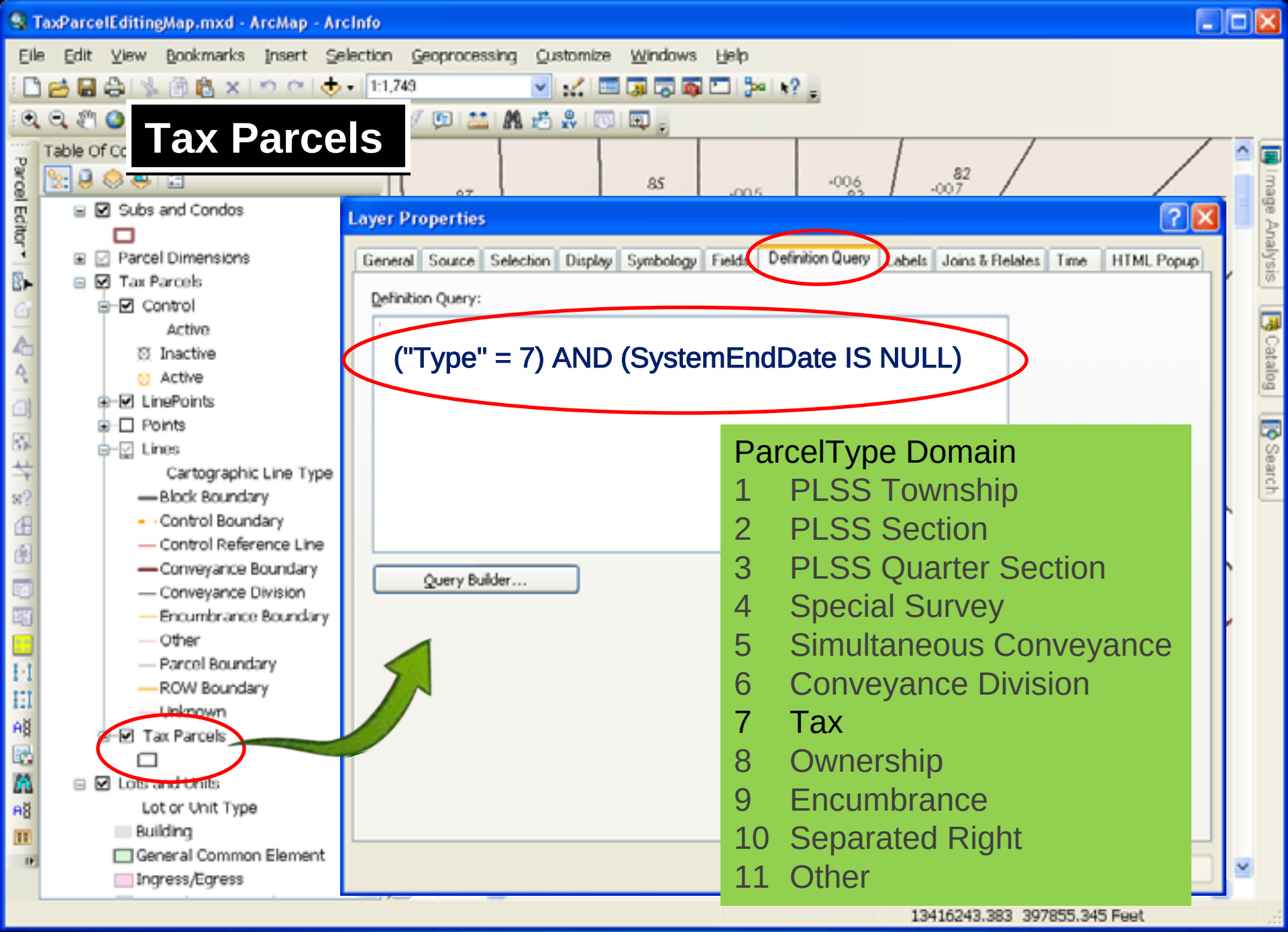
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Subs and Condos
Parcel Dimensions
Tax Parcels
Control
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Cartographic Line Type
Block Boundary
Control Boundary
Control Reference Line
Conveyance Boundary
Conveyance Division
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Lot or Unit Type
Building
General Common Element
Ingress/Egress
Layer Properties
General Source Selection Display Symbology Fields Definition Query Labels Joins & Relates Time HTML Popup
Definition Query:
("Type" = 7) AND (SystemEndDate IS NULL)
Query Builder...
ParcelType Domain
1 PLSS Township
2 PLSS Section
3 PLSS Quarter Section
4 Special Survey
5 Simultaneous Conveyance
6 Conveyance Division
7 Tax
8 Ownership
9 Encumbrance
10 Separated Right
11 Other
Image Analysis
Catalog
Search
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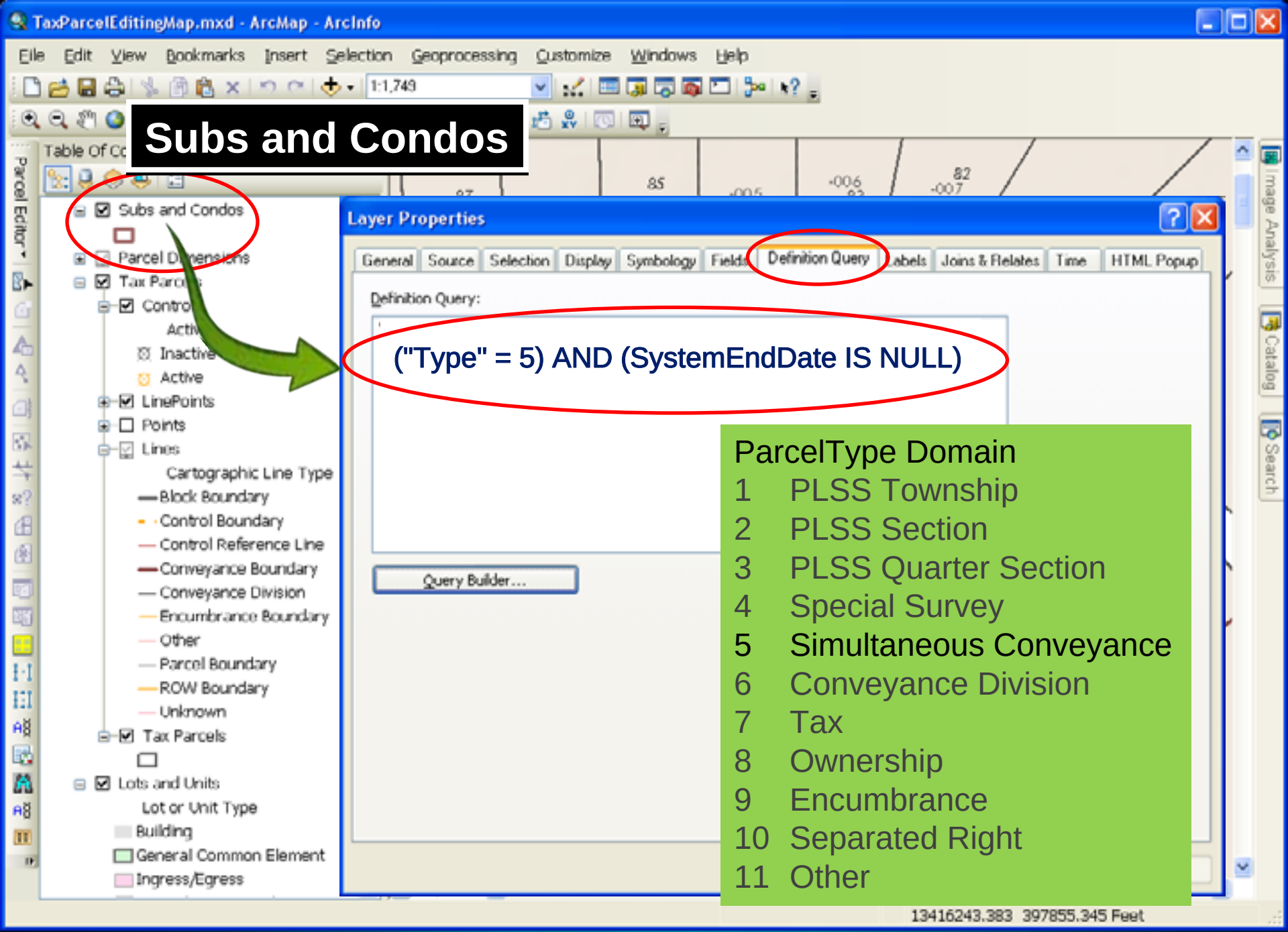
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Lots and Units
Lot or Unit Type
Building
General Common Element
Ingress/Egress
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General Source Selection Display Symbology Fields Definition Query Labels Joins & Relates Time HTML Popup
Definition Query:
("Type" = 5) AND (SystemEndDate IS NULL)
Query Builder...
ParcelType Domain
1 PLSS Township
2 PLSS Section
3 PLSS Quarter Section
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5 Simultaneous Conveyance
6 Conveyance Division
7 Tax
8 Ownership
9 Encumbrance
10 Separated Right
11 Other
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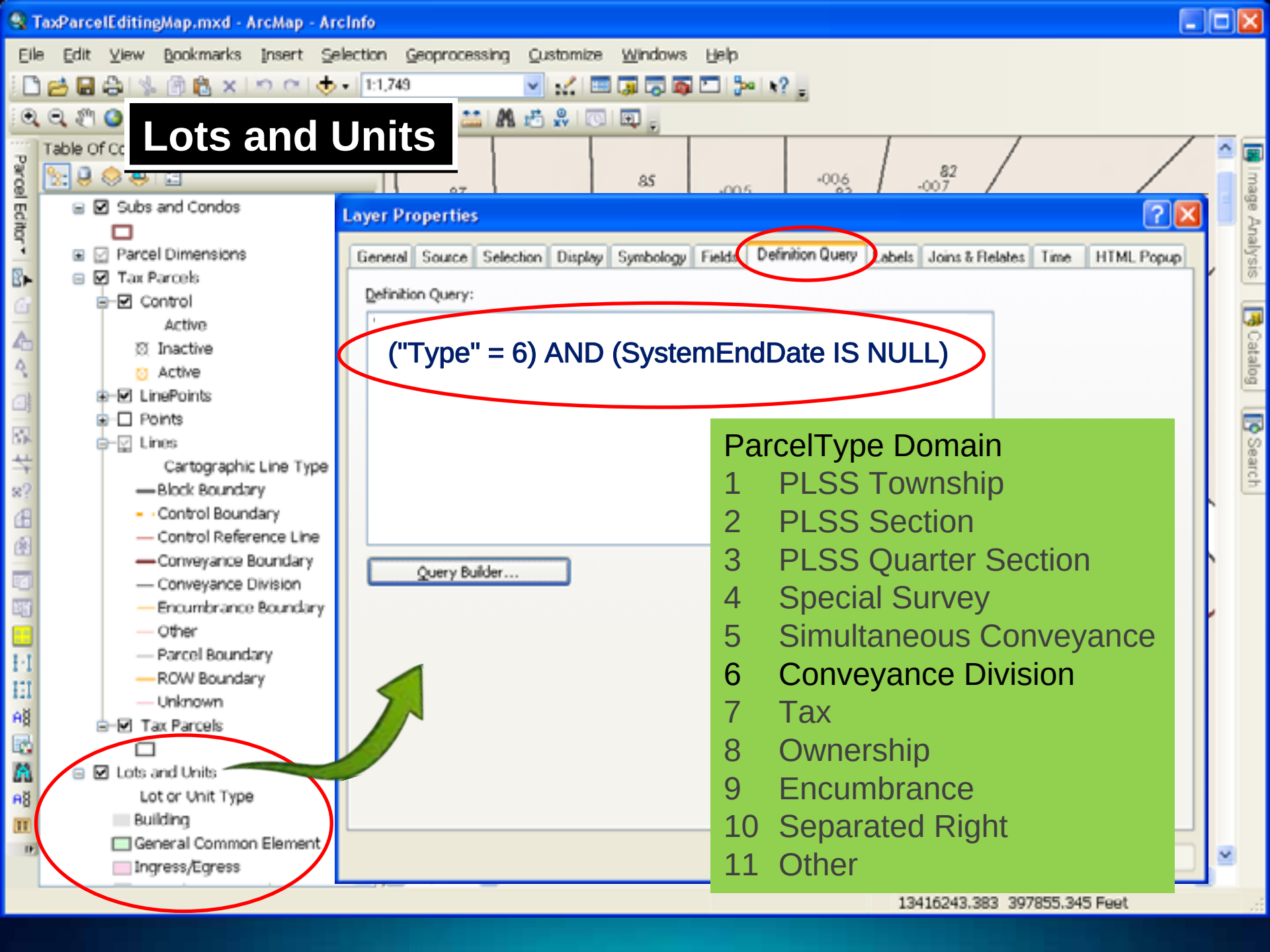
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Tax Parcels
Lots and Units
Lot or Unit Type
Building
General Common Element
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Query Builder...
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1 PLSS Township
2 PLSS Section
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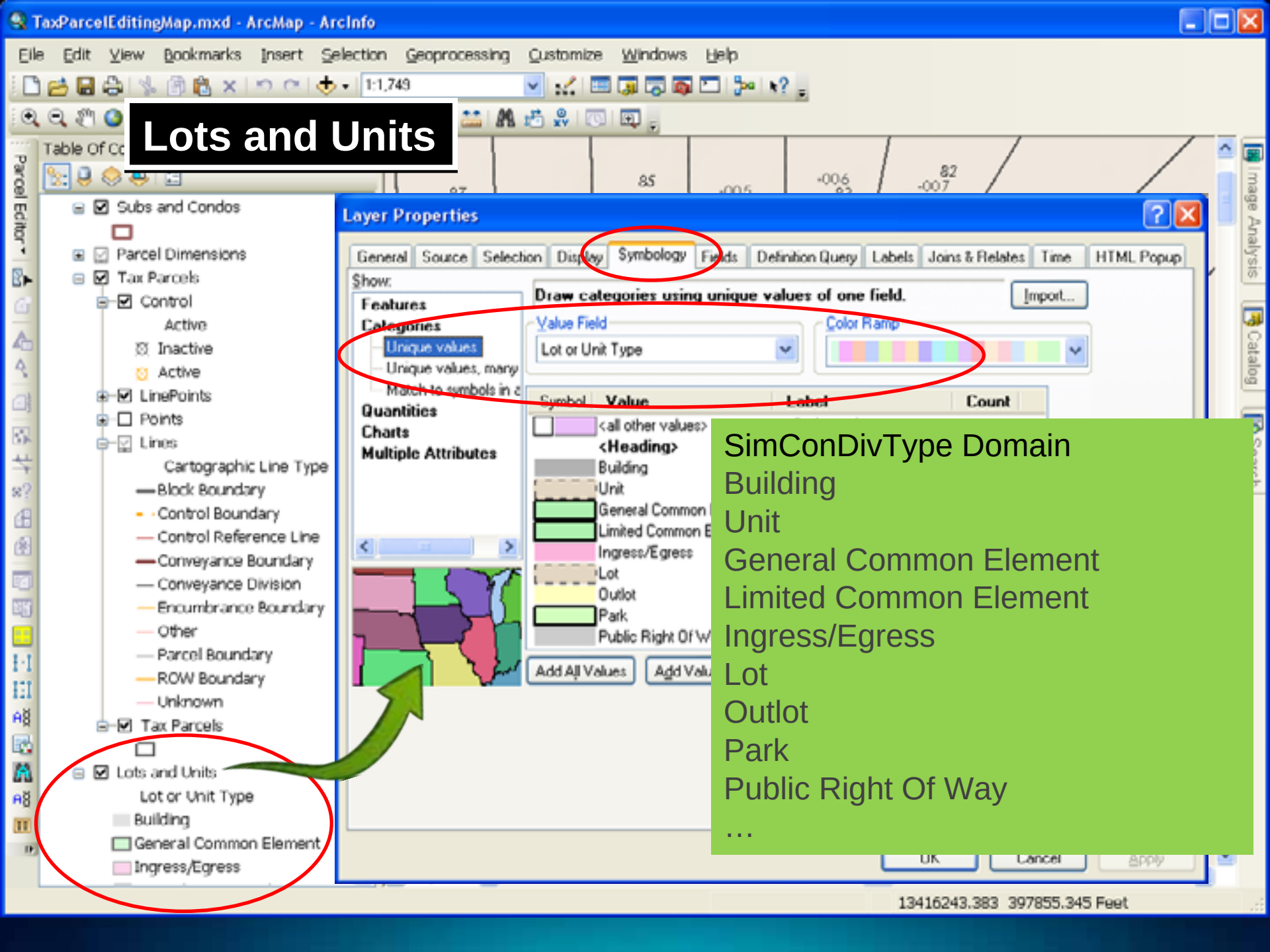
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Fields
Definition Query
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Time
HTML Popup
Show:
Features
Categories
Unique values
Unique values, many
Quantities
Charts
Multiple Attributes
Draw categories using unique values of one field.
Import...
Value Field
Lot or Unit Type
Color Ramp
Symbol
Value
Label
Count
<all other values>
<Heading>
Building
Unit
General Common
Limited Common
Ingress/Egress
Lot
Outlot
Park
Public Right Of W
Add All Values
Add Valu
OK
Cancel
Apply
Subs and Condos
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Building
Unit
General Common Element
Limited Common Element
Ingress/Egress
Lot
Outlot
Park
Public Right Of Way
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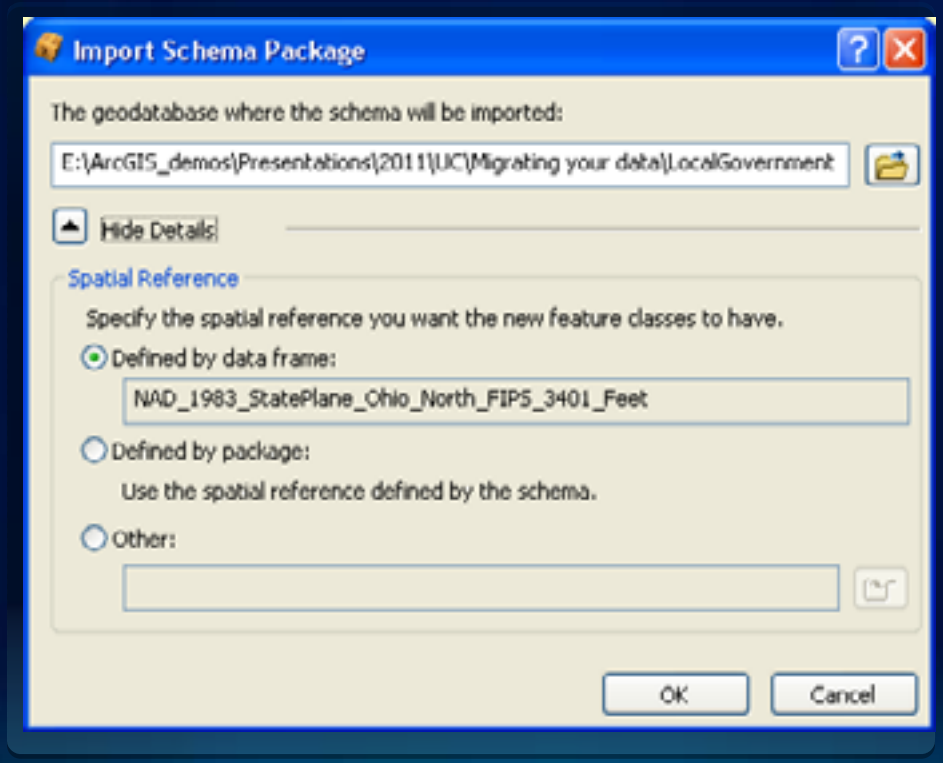
Unpack the Local Government Schema Package

- **Browse for a target Geodatabase**
- **Specify the spatial reference**



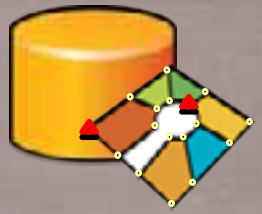
Preparing Your Source Data

General Migration Overview

Source Data

Staging Geodatabase

Target Parcel Fabric



Loading Your Data in a Parcel Fabric

- Establish target fabric schema before loading any data
- Modifying fabric schema once data is loaded is possible
  - Calculating fields will require edit session.
- Add fields to Staging datasets that match target fabric and pre-populate
- Start with a ***SMALL*** subset and go though entire process

Migration Workflow

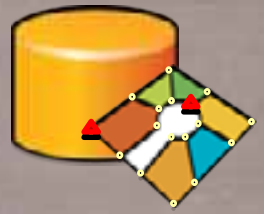
Source Data

- Examine Template
- Generate Inventory
- Select Sample data
- Prepare & clean
- Identify COGO
- Map attributes

Staging Geodatabase

- Add/Calc staging fields
- Validate topology
- Fix topology errors
  - Dangles
  - Overlaps
  - Slivers/gaps
- Fix Curves

Target Parcel Fabric



- Author Editing Map
- Add/Alias fields
- Merge courses
- Merge curve center points
- Associate control
- Improve Accuracy

Migrating CAD Files

CAD Files

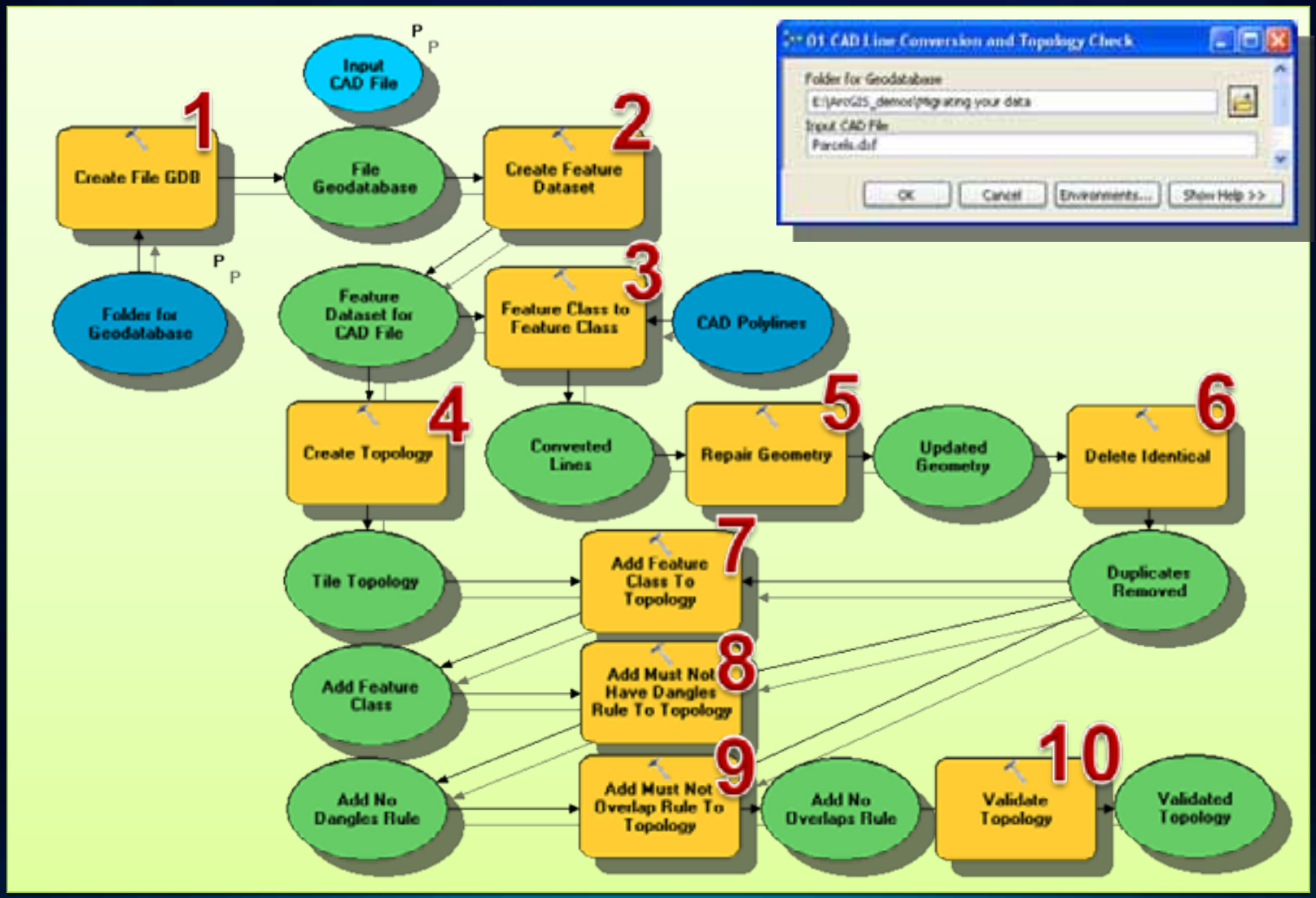
- Schema and structure varies
- Typically divided into multiple files (tiles, facets, etc.)
- Parcels maintained in files as:
  - Polylines
  - Annotation

Overview of CAD Migration

- Create a Staging File Geodatabase and Feature Dataset
- Use **Select** Geoprocessing Tool to import Polylines
  "Layer" in ('PARCEL_LINE', 'ROW_LINE')
- Run **Repair Geometry** (GP) to remove NULL features
- Create a Geodatabase Topology to validate lines:
  - **Must Not Overlap**
  - **Must Not Have Dangles**
- Create parcel polygons with **Feature To Polygon** (GP) using CAD Text (parcel number) as Label Features
- Follow steps for migrating a Geodatabase Topology

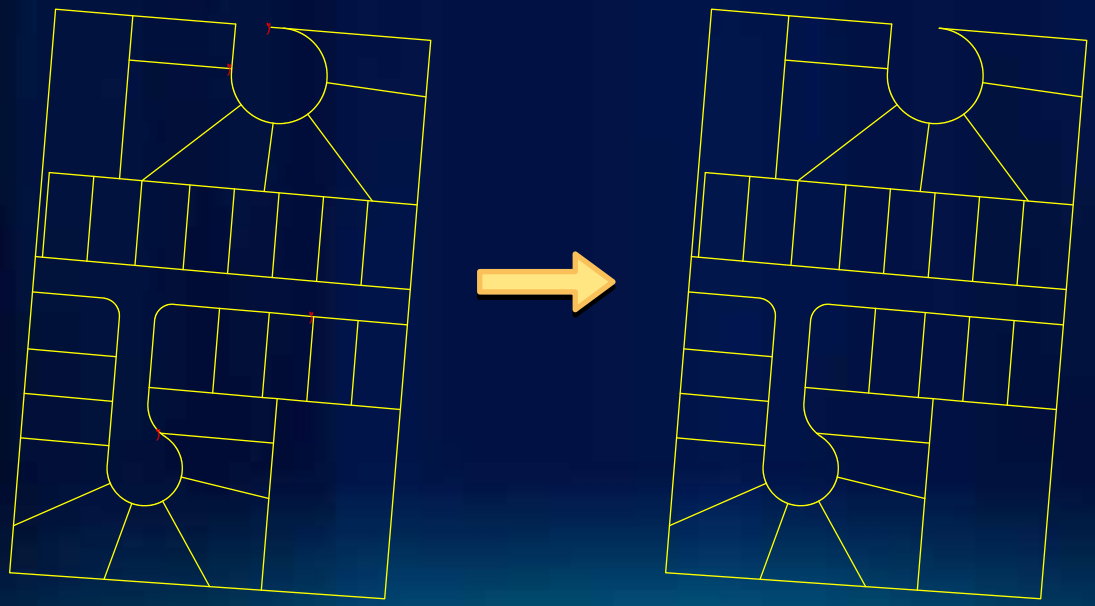
ArcInfo

Sample CAD To Geodatabase Conversion Model



Fix Topology Errors

- **Common fixes for dangles**
  - **Extend (undershoot)**
  - **Trim (overshoot)**
  - **Planarize (Select lines with dangles and adjacent lines)**

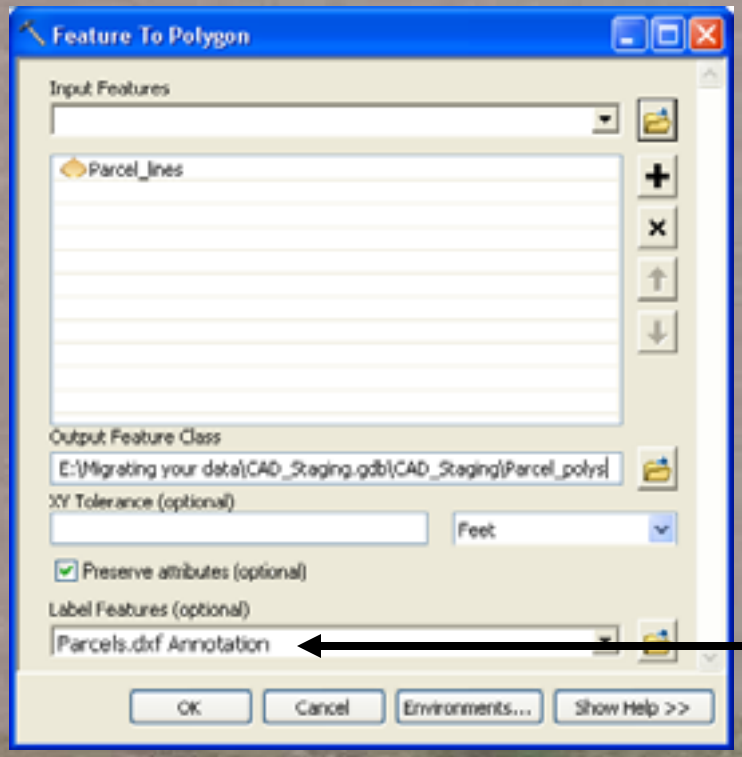


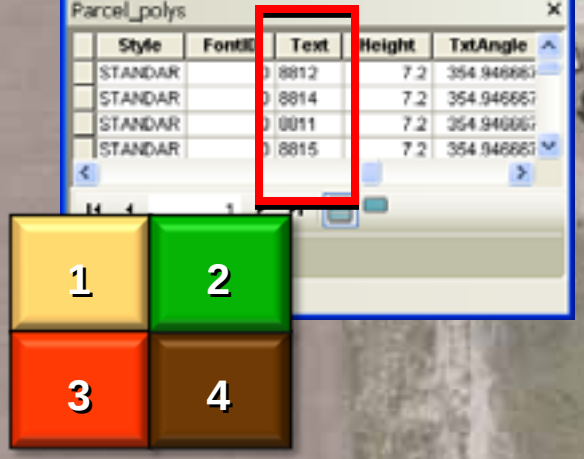
Source Data – What if my lines have lots of errors?

- Some problems can be identified and fixed on the source data.
  - Keep working with software/tools you are most familiar
  - No impact on the legacy system downtime
- Must Not Overlap Errors
  - Planarize should be able to eliminate most if not all of these.

Create Parcel_polys (Staging)

- Feature To Polygon Geoprocessing Tool
  - Input Features Imported and validated Lines
  - Label Features CAD Annotation

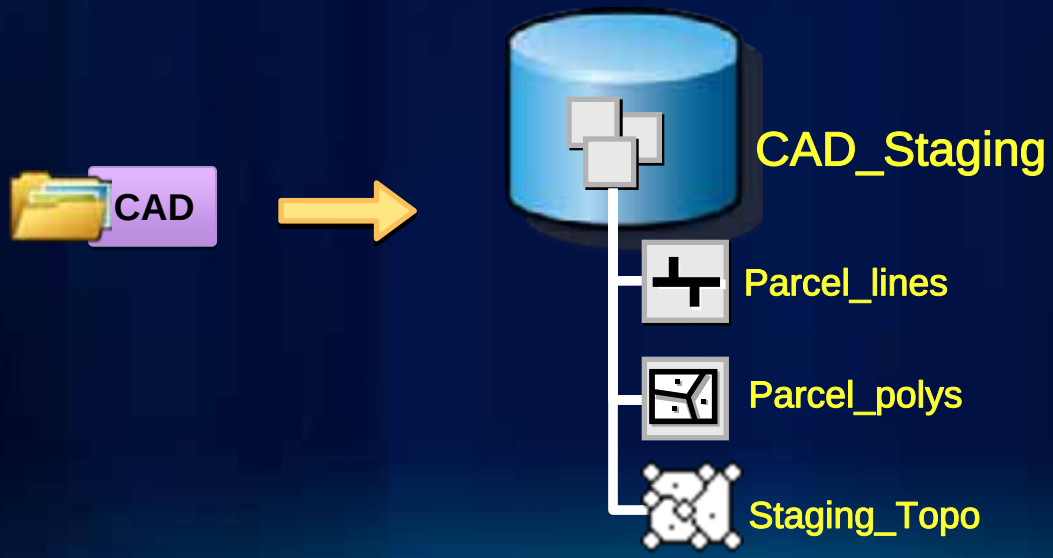




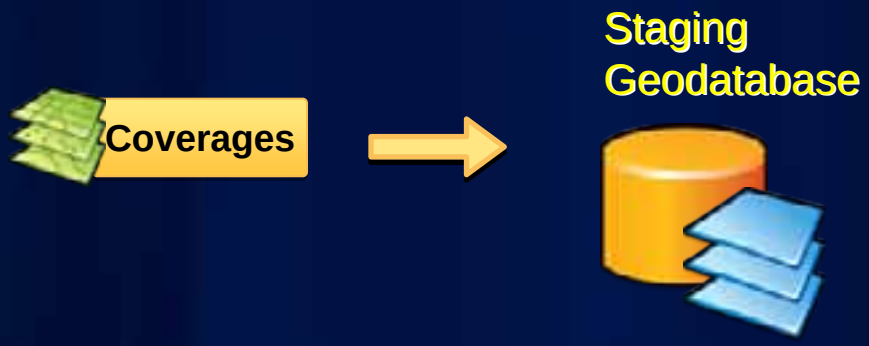
Def Query: "Layer" = 'PIN_ANNO'

Preliminary (CAD) Staging Data ready

- Parcel_lines have no dangles or overlaps
- Parcel_polys have been created
- Continue “Migrating Geodatabase Topology” (discussed later)

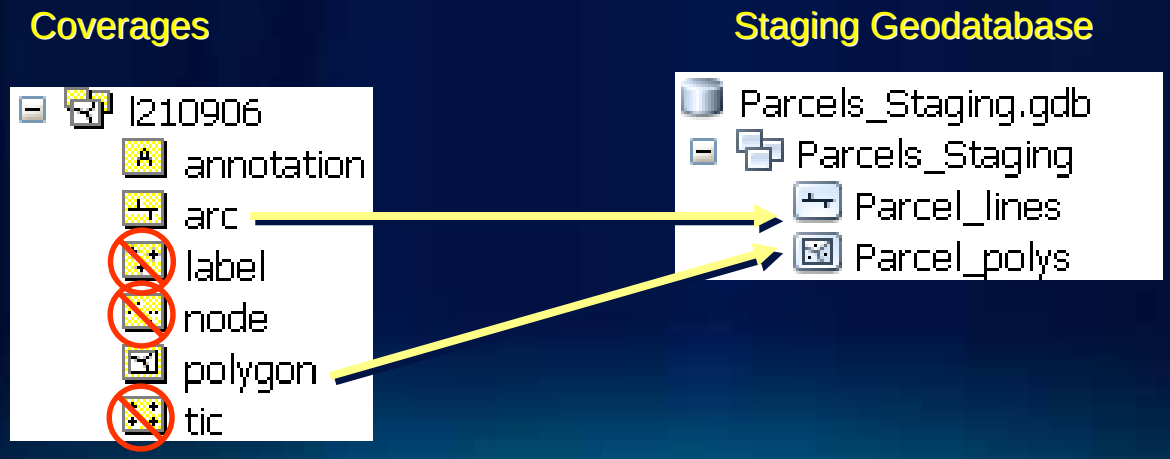


Migrating ArcInfo Coverages



Coverages

- Migrate arcs, polygons, and regions to Staging Geodatabase
- Topology in coverage easily translates to Geodatabase
- Remove internal coverage fields LPOLY#, RPOLY#, etc. during import.

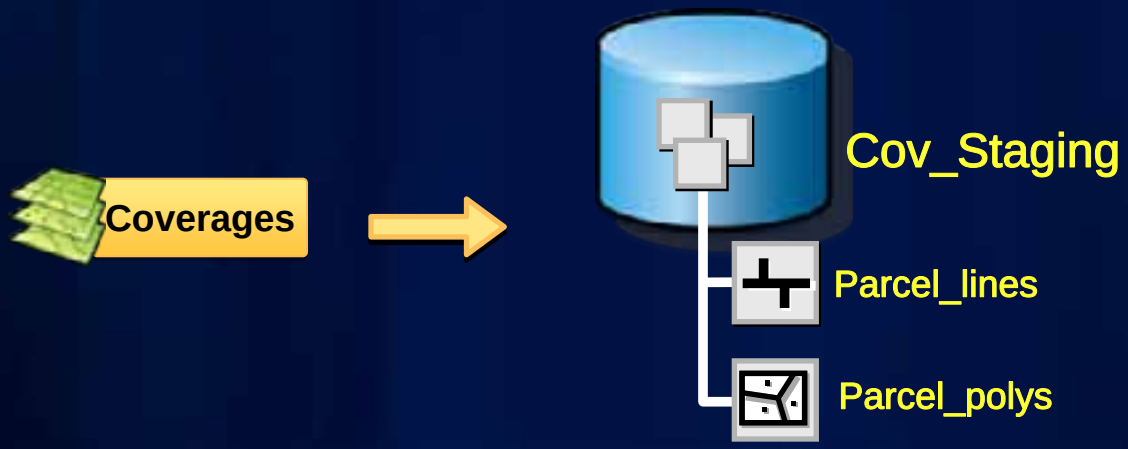


Librarian and ArcStorm

- COPYOUT or EXTRACT into one or more coverages
- Start with a relatively small pilot area

Preliminary (Coverage) Staging Data ready

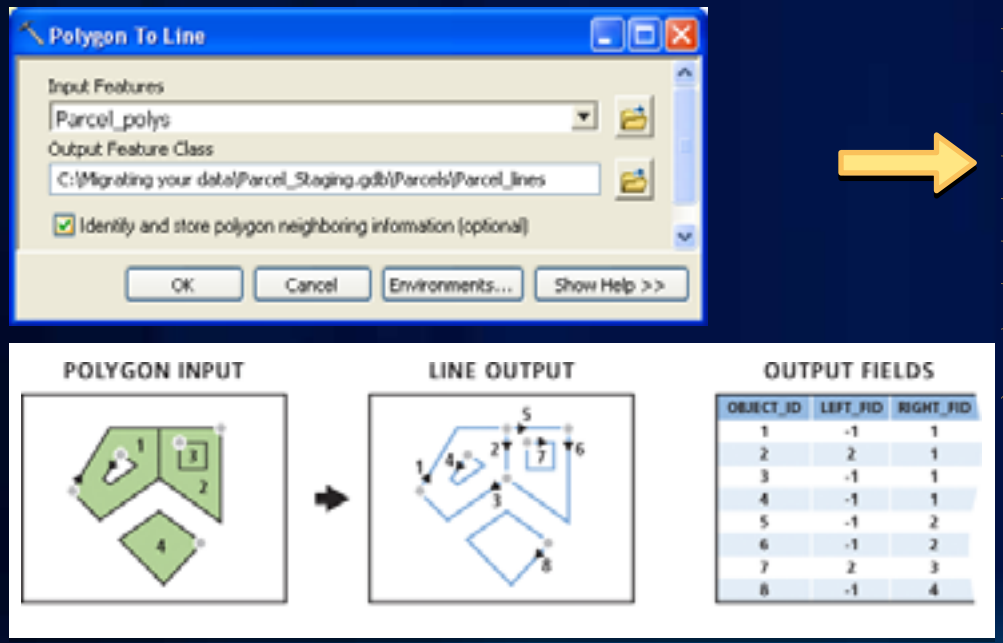
- Parcel_lines imported from arcs
- Parcel_polys imported from polygons
- Continue “Migrating Geodatabase Topology”

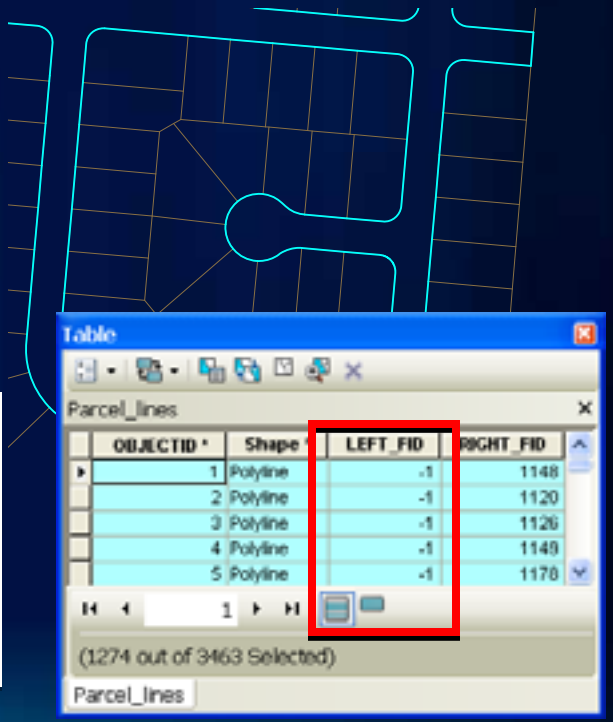


Source Data – What if I only have Polygons?

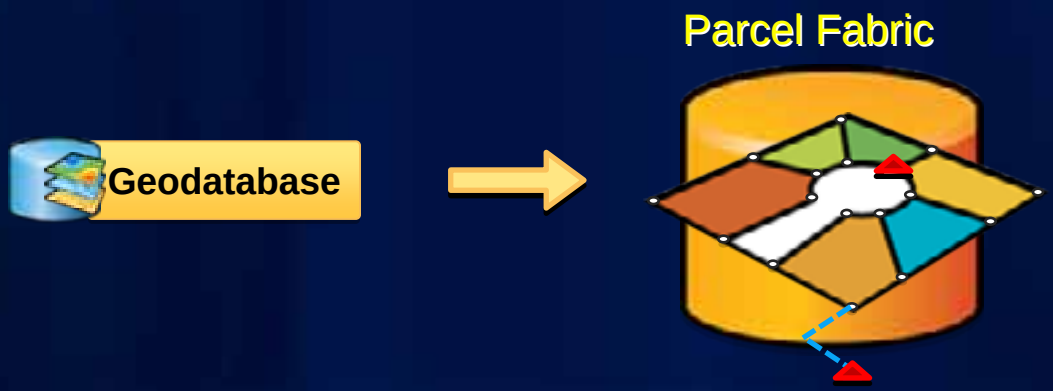
ArcInfo

- Use **Polygon to Line** GP Tool to create the Lines
- LEFT_FID = -1 may help identify ROW boundaries

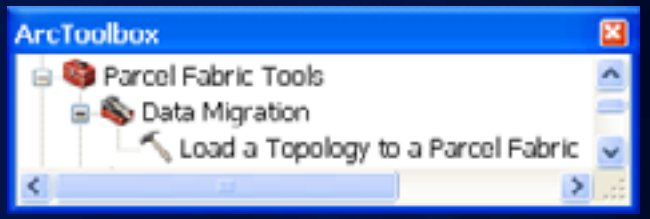




Migrating Geodatabase Topology



Load a Topology to a Parcel Fabric



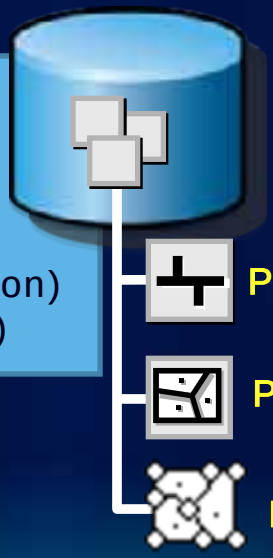
Target Parcel Fabric

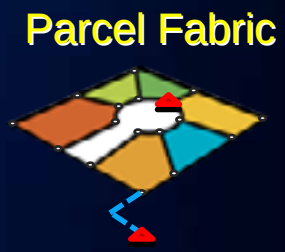
Error free Geodatabase Topology

Containing Parcel Lines and Parcel Polygons

That is Validated against 6 Topology Rules

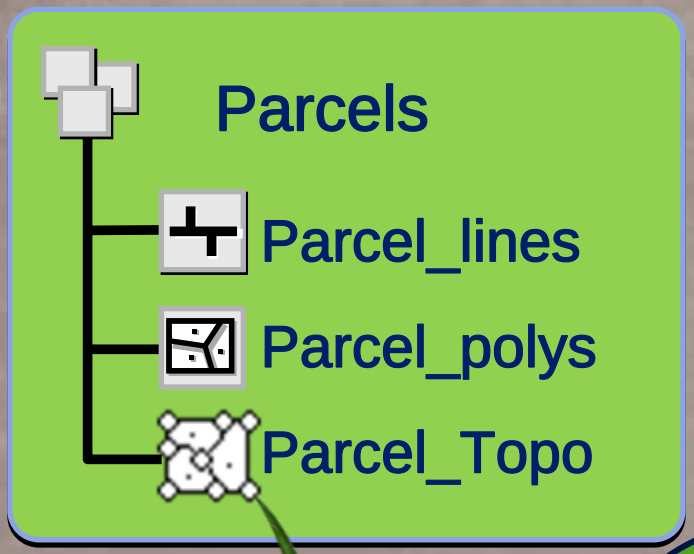
- Line—Must be Single Part
- Line—Must Not Self-Overlap
- Line—Must Not Self-Intersect
- Line—Must Not Intersect Or Touch Interior
- Line—Must be Covered by Boundary Of (polygon)
- Polygon—Boundary Must be Covered By (Line)





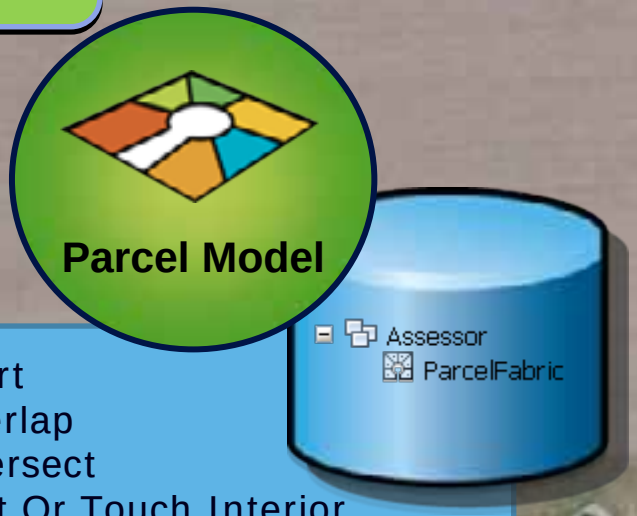
Migrating Data into Tax Parcel Editing Template

Tax Parcels



Staging Fields

- Name = [PARCELNUM]
- Type = 7
- LegalStartDate = Sub_poly.[DATE]
- StatedArea = CAMA.[ACRES]



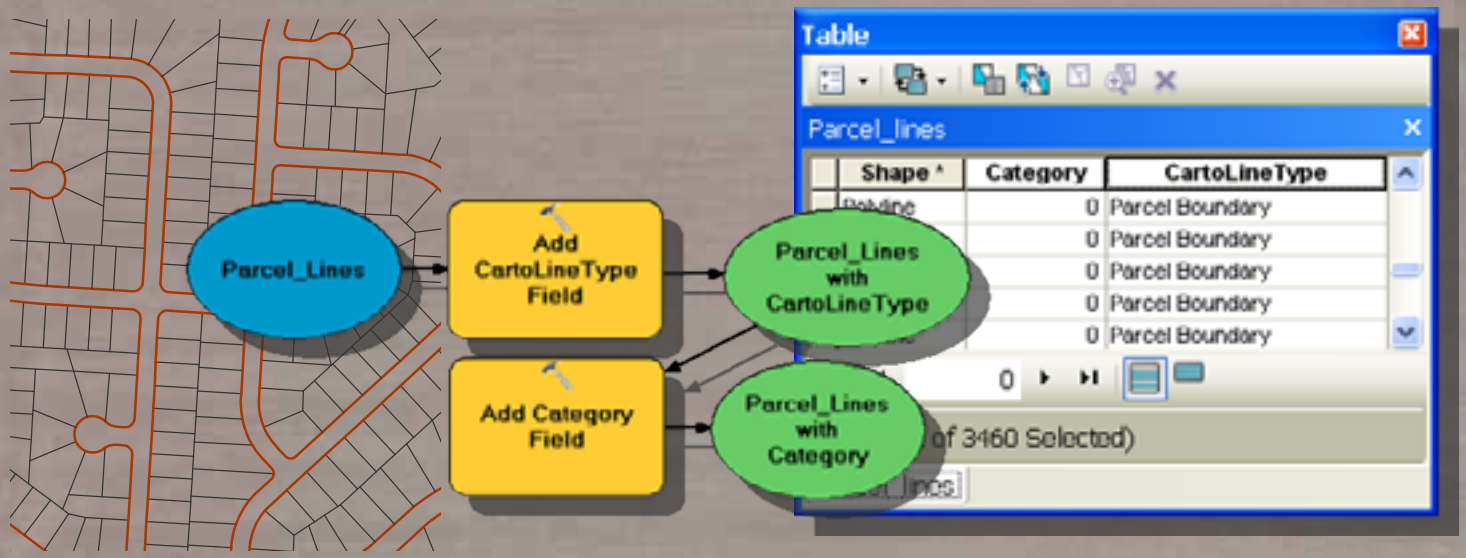
- Line—Must be Single Part
- Line—Must Not Self-Overlap
- Line—Must Not Self-Intersect
- Line—Must Not Intersect Or Touch Interior
- Line—Must be Covered by Boundary Of (polygon)
- Polygon—Boundary Must be Covered By (Line)

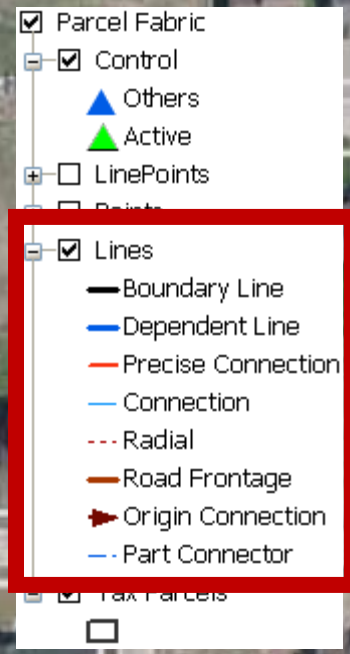
ParcelType Domain

1	PLSS Township
2	PLSS Section
3	PLSS Quarter Section
4	Special Survey
5	Simultaneous Conveyance
6	Conveyance Division
7	Tax
8	Ownership
9	Encumbrance
10	Separated Right
11	Other

Parcel_lines (Staging)

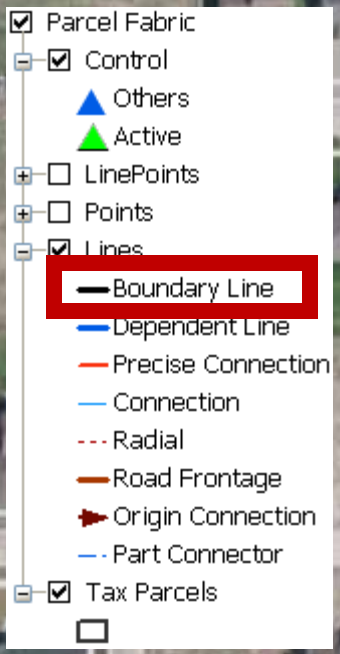
- Add fields to match Parcel fabric schema
  - Category (Long Integer)
  - CartoLineType (Text 50)

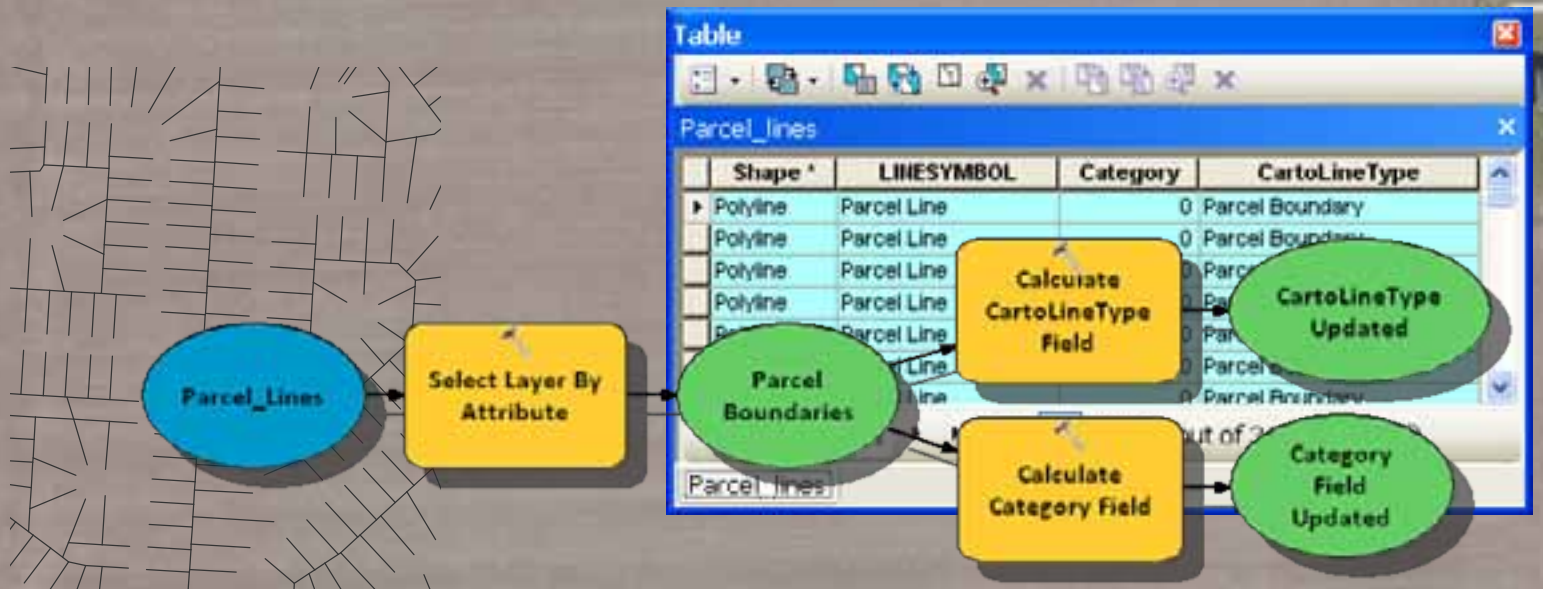




Parcel_lines (Staging)

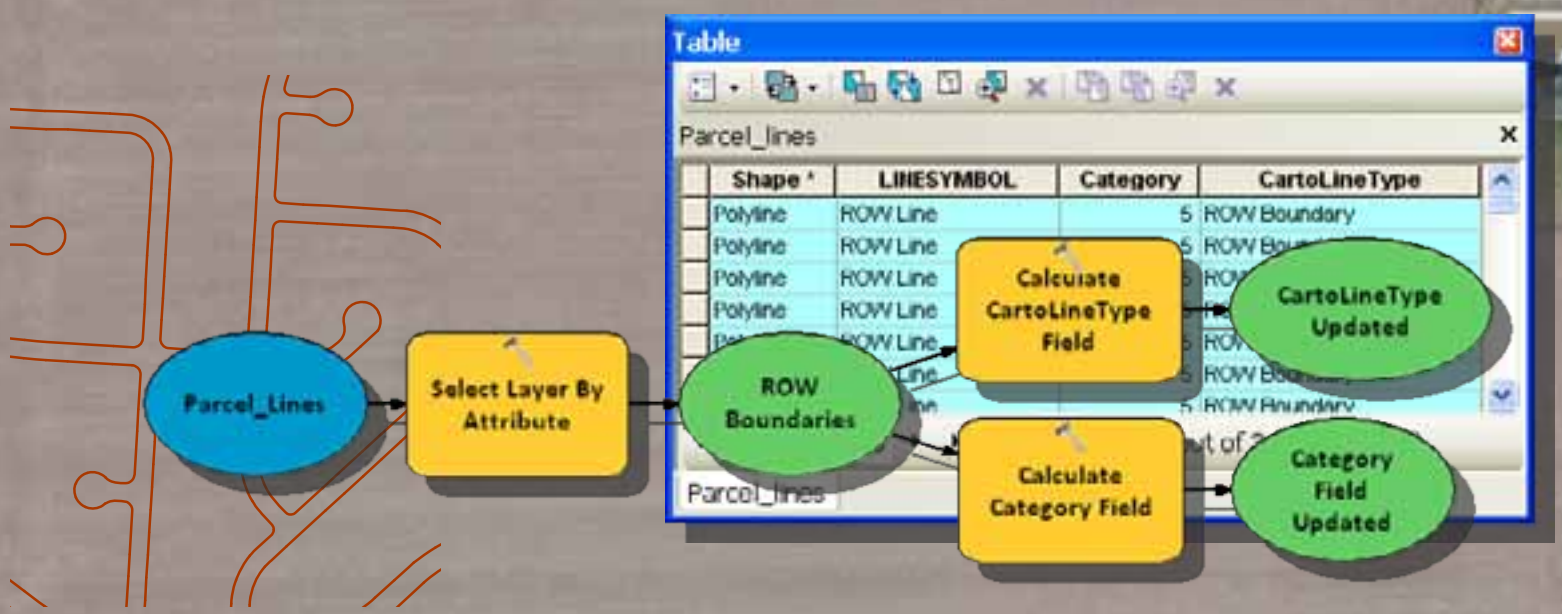
- Populate staging fields for Parcel Lines
  - Category = 0
  - CartoLineType = “Parcel Boundary”

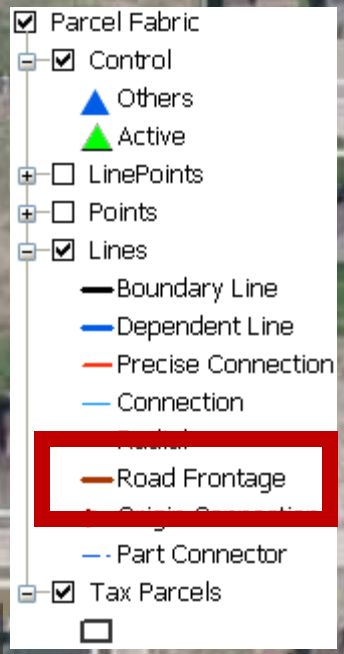




(ROW) Parcel_lines (Staging)

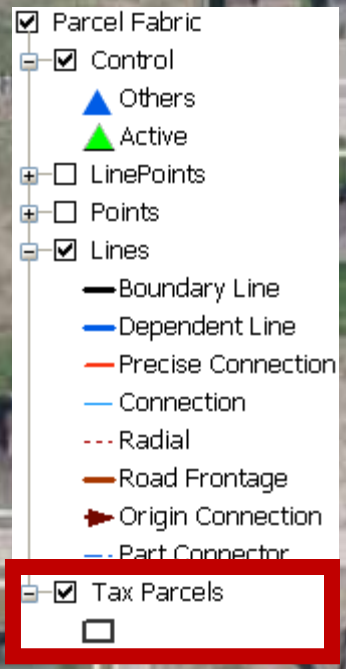
- Populate staging fields for ROW Lines
  - Category = 5
  - CartoLineType = “ROW Boundary”

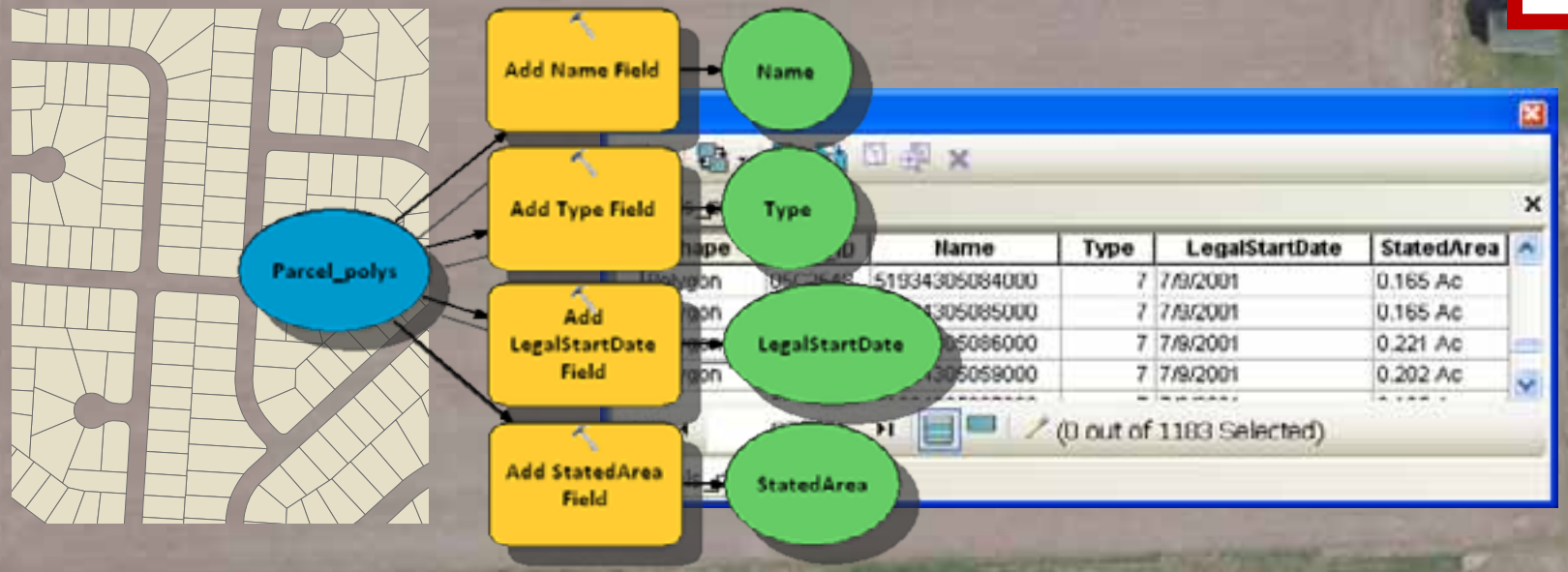




Parcel_polys (Staging)

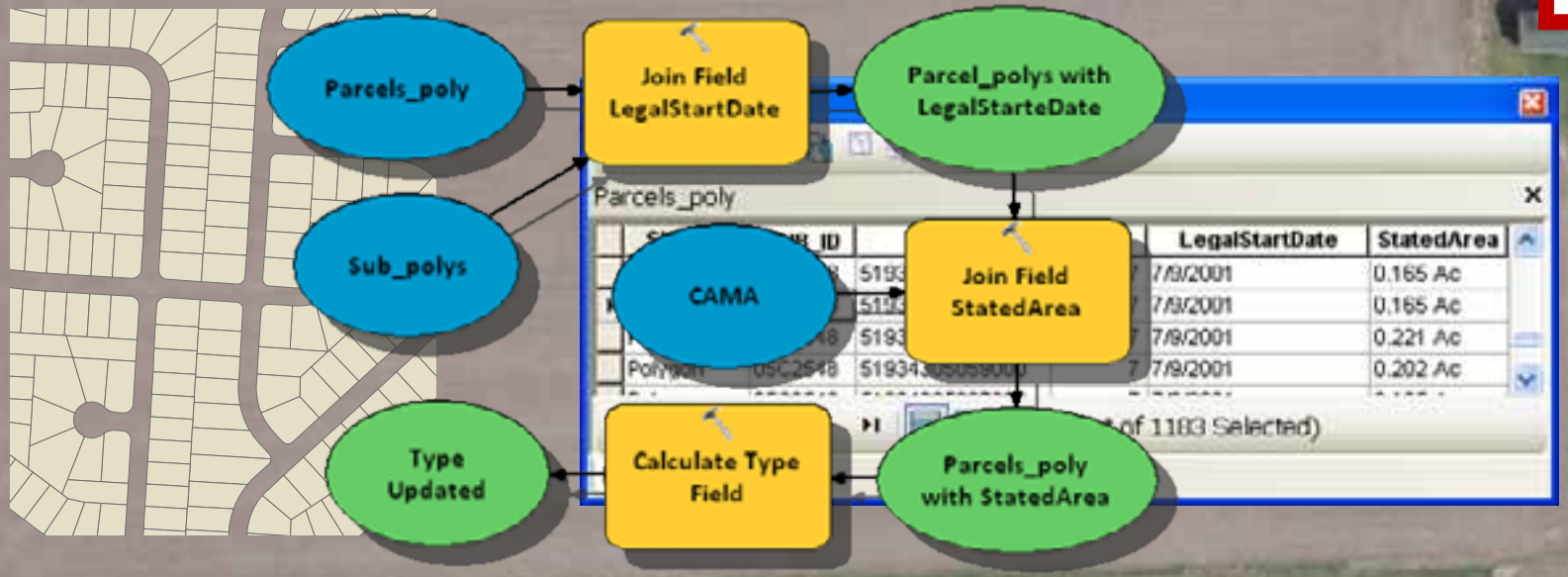
- Add matching fields in fabric schema
  - Name (Text 50)
  - Type (Long Integer)
  - LegalStartDate (Date)
  - StatedArea (Text 50)

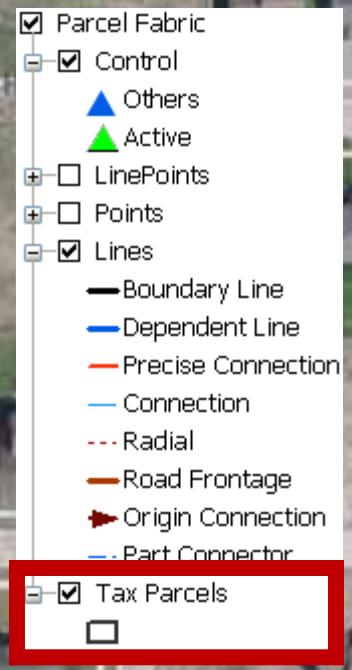




Parcel_polys (Staging)

- Populate staging fields for Parcels
  - Name = PARCEL_NO
  - Type = 7 (Tax Parcel)
  - LegalStartDate = Sub_poly.[LegalStartDate]
  - StatedArea = CAMA.[DEEDED_ACREAGE]

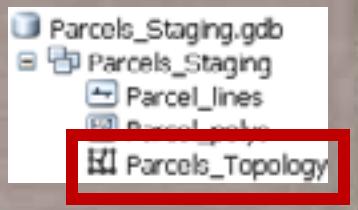


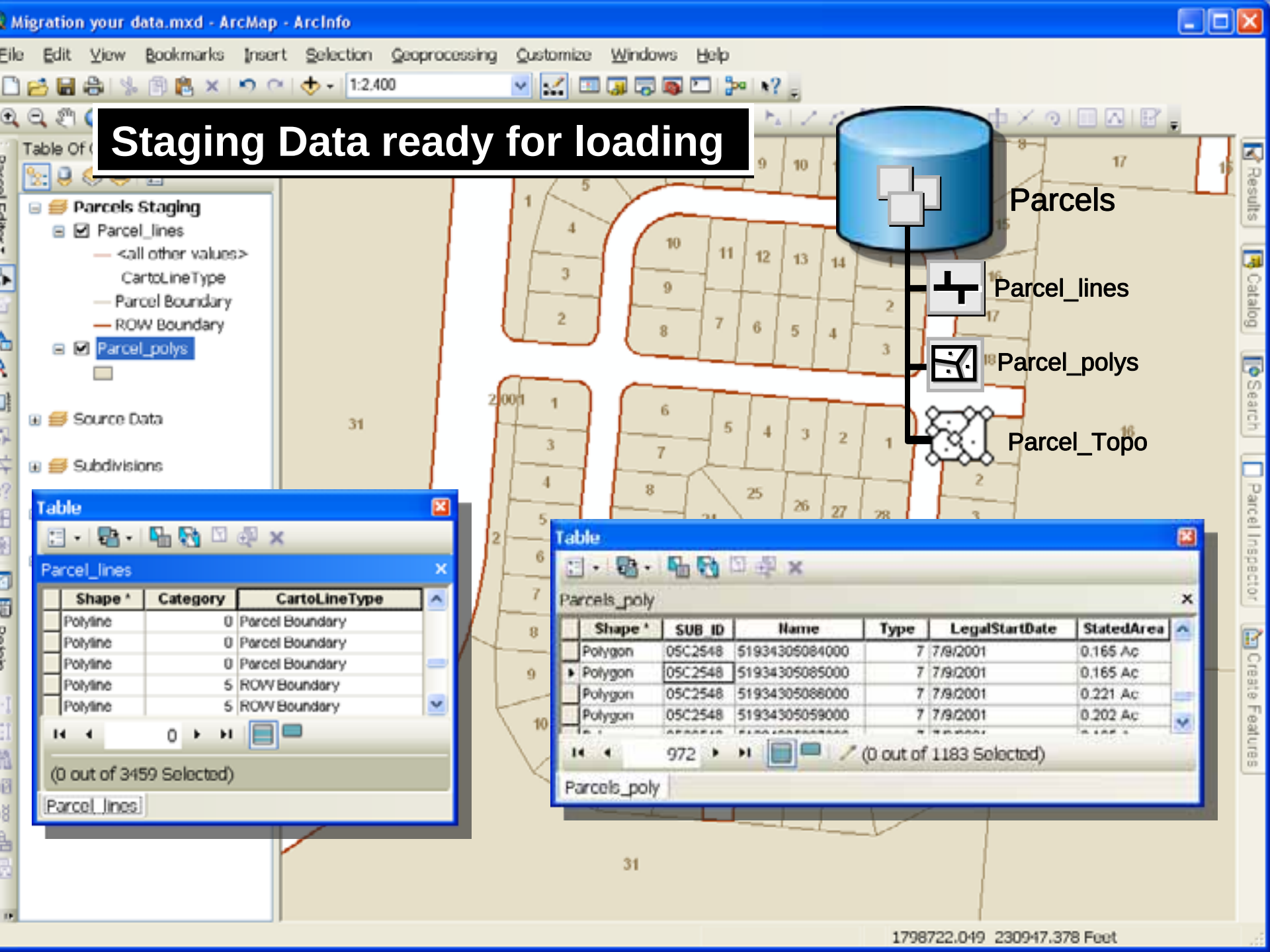


Create and Validate (Staging) Topology

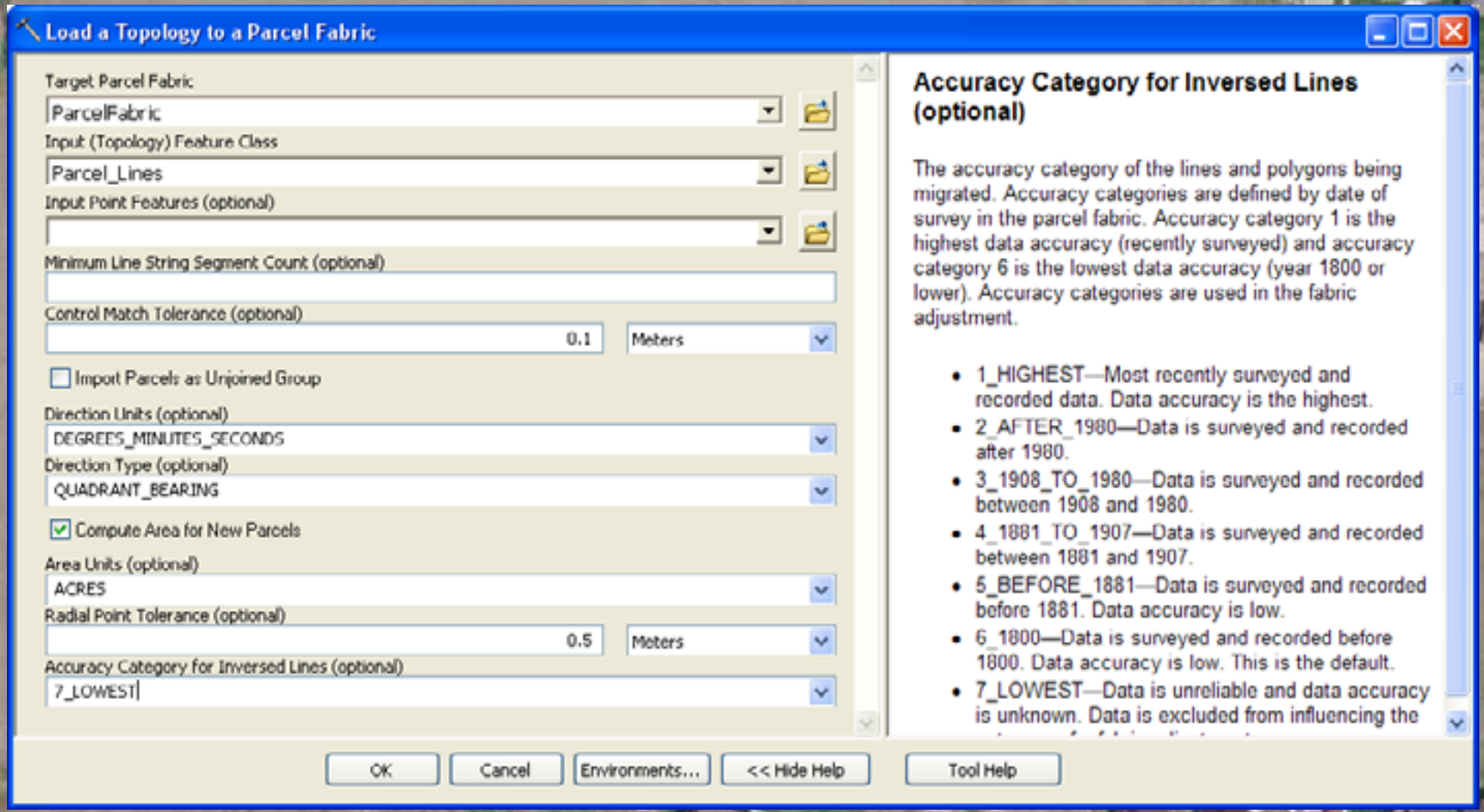
- Include Staging Line and Polygon Feature Classes
- Accept Default Cluster Tolerance
- 2 Ranks
  - Lines Rank 1
  - Polygons Rank 2
- Add Topology Rules listed below

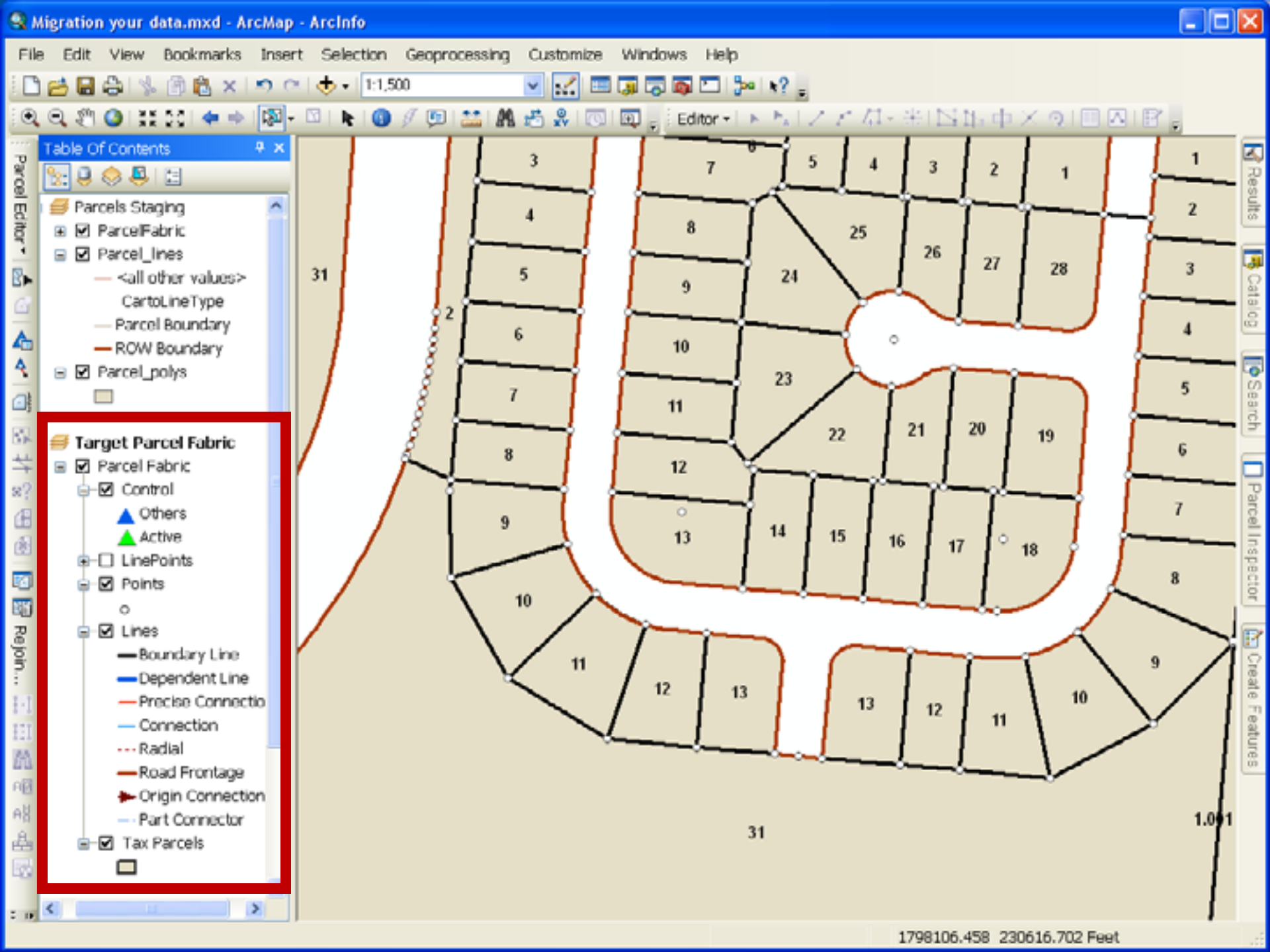
•Line—Must be Single Part
•Line—Must Not Self-Overlap
•Line—Must Not Self-Intersect
•Line—Must Not Intersect Or Touch Interior
•Line—Must be Covered by Boundary Of (polygon)
•Polygon—Boundary Must be Covered By (Line)




Migration your data.mxd - ArcMap - ArcInfo
File Edit View Bookmarks Insert Selection Geoprocessing Customize Windows Help
1:2,400
Staging Data ready for loading
Parcels Staging
Parcel_lines
<all other values>
CartoLineType
Parcel Boundary
ROW Boundary
Parcel_polys
Source Data
Subdivisions
Parcels
Parcel_lines
Parcel_polys
Parcel_Topo
Table
Parcel_lines
Shape * Category CartoLineType
Polyline 0 Parcel Boundary
Polyline 0 Parcel Boundary
Polyline 0 Parcel Boundary
Polyline 5 ROW Boundary
Polyline 5 ROW Boundary
(0 out of 3459 Selected)
Parcel_lines
Table
Parcels_poly
Shape * SUB_ID Name Type LegalStartDate StatedArea
Polygon 05C2548 51934305084000 7 7/9/2001 0.165 Ac
Polygon 05C2548 51934305085000 7 7/9/2001 0.165 Ac
Polygon 05C2548 51934305086000 7 7/9/2001 0.221 Ac
Polygon 05C2548 51934305059000 7 7/9/2001 0.202 Ac
(0 out of 1183 Selected)
Parcels_poly
1798722.049 230947.378 Feet

Load Topology in a Fabric




Migration your data.mxd - ArcMap - ArcInfo
File Edit View Bookmarks Insert Selection Geoprocessing Customize Windows Help
1:1,500
Editor
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ParcelFabric
Parcel_lines
<all other values>
CartoLineType
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ROW Boundary
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Others
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LinePoints
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Dependent Line
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Radial
Road Frontage
Origin Connection
Part Connector
Tax Parcels
Parcel Editor
Rejoin...
Results
Catalog
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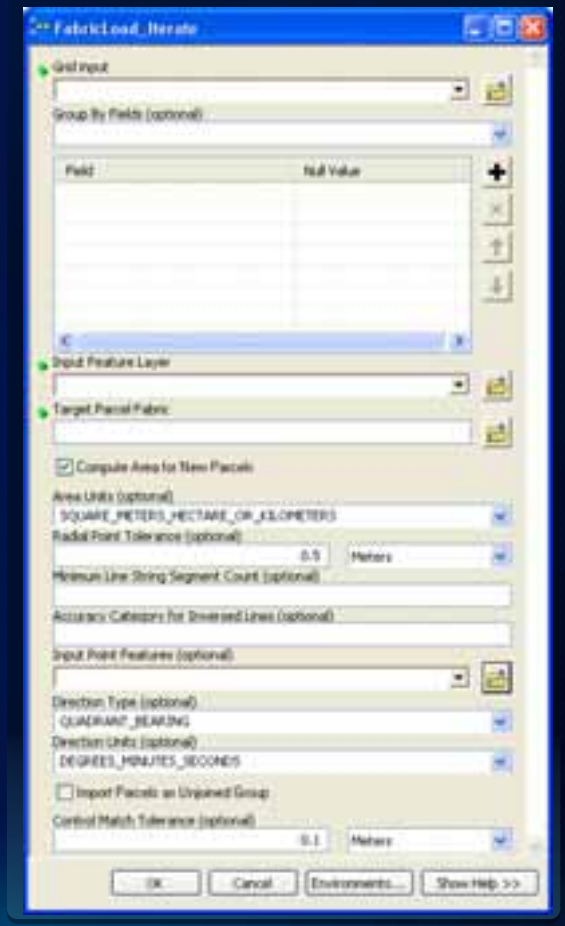
Create Features
1798106.458 230616.702 Feet

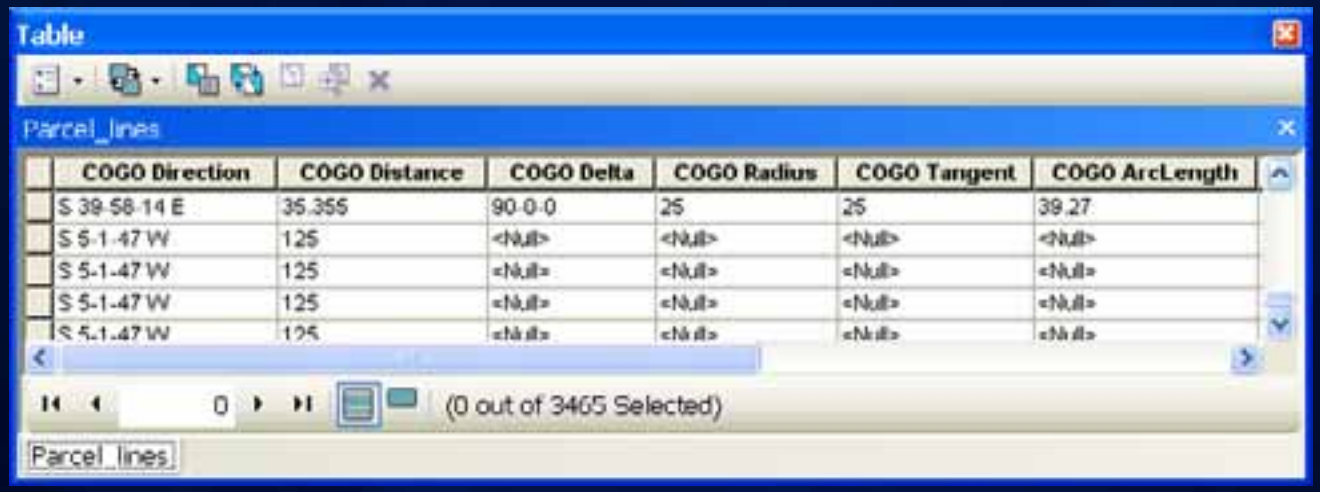
Iteratively Load to the Parcel Fabric

- **Loads a topology to a Fabric iteratively based upon a polygon feature class (grid)**
- **Create Fishnet GP Tool to generate polygon grid**



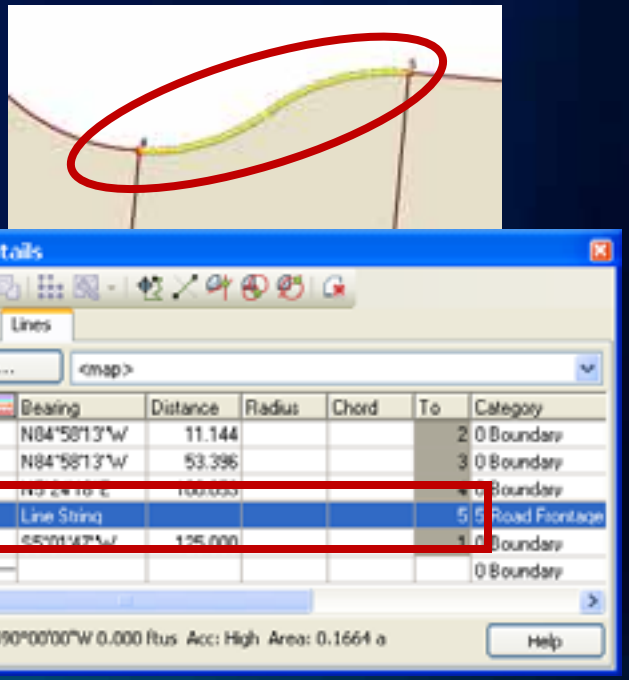
COGO Attributes

- Lines **with** COGO attributes are transferred **as is**
- Lines **without** COGO attributes
  - Will be inversed when data is loaded into the fabric
  - Calculated field will be set to True



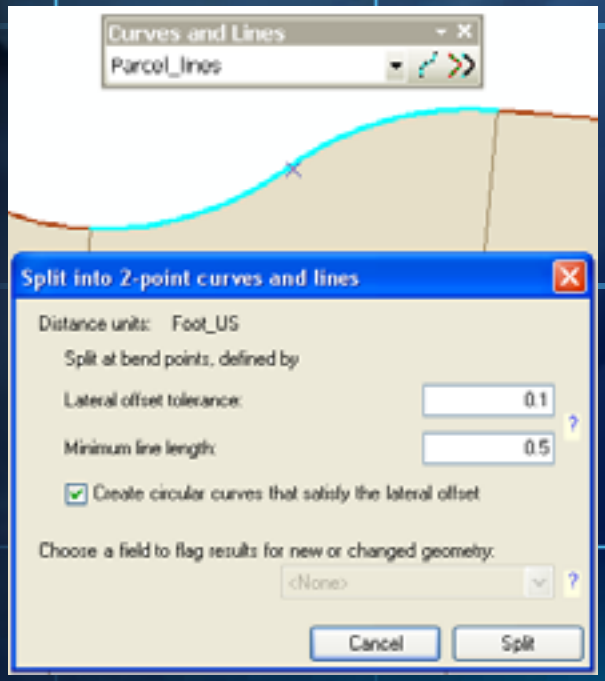
How are curves represented in your data?

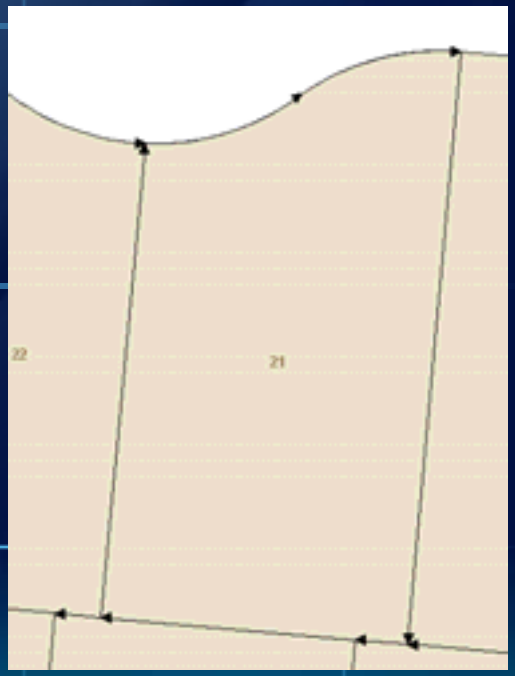
- **Densified curves will be loaded as Linestrings**
  - **May be able to be converted with Curves and Lines Add-In**



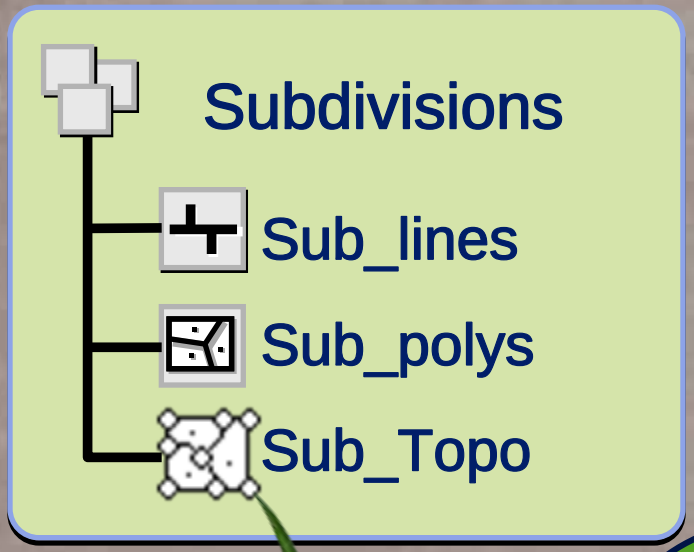
Demonstration

Curves andLines Add-in



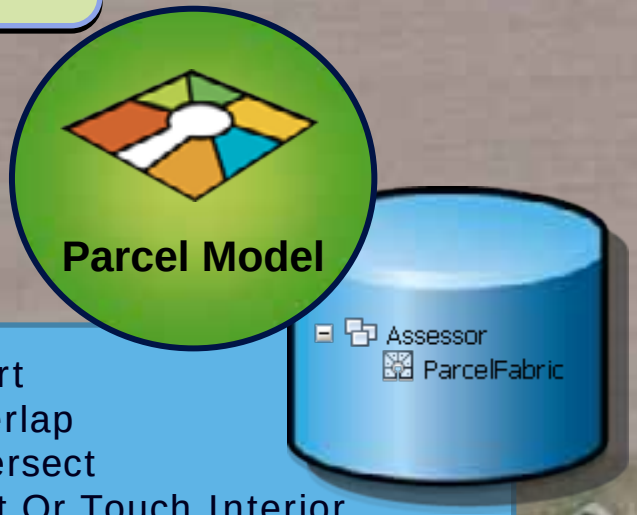


Simultaneous Conveyances (Subdivisions)



Staging Fields

Name = [Sub_name]
Type = 5
LegalStartDate = [DATE]
SimConType = “Subdivision”
PlanName = [Sub_name]



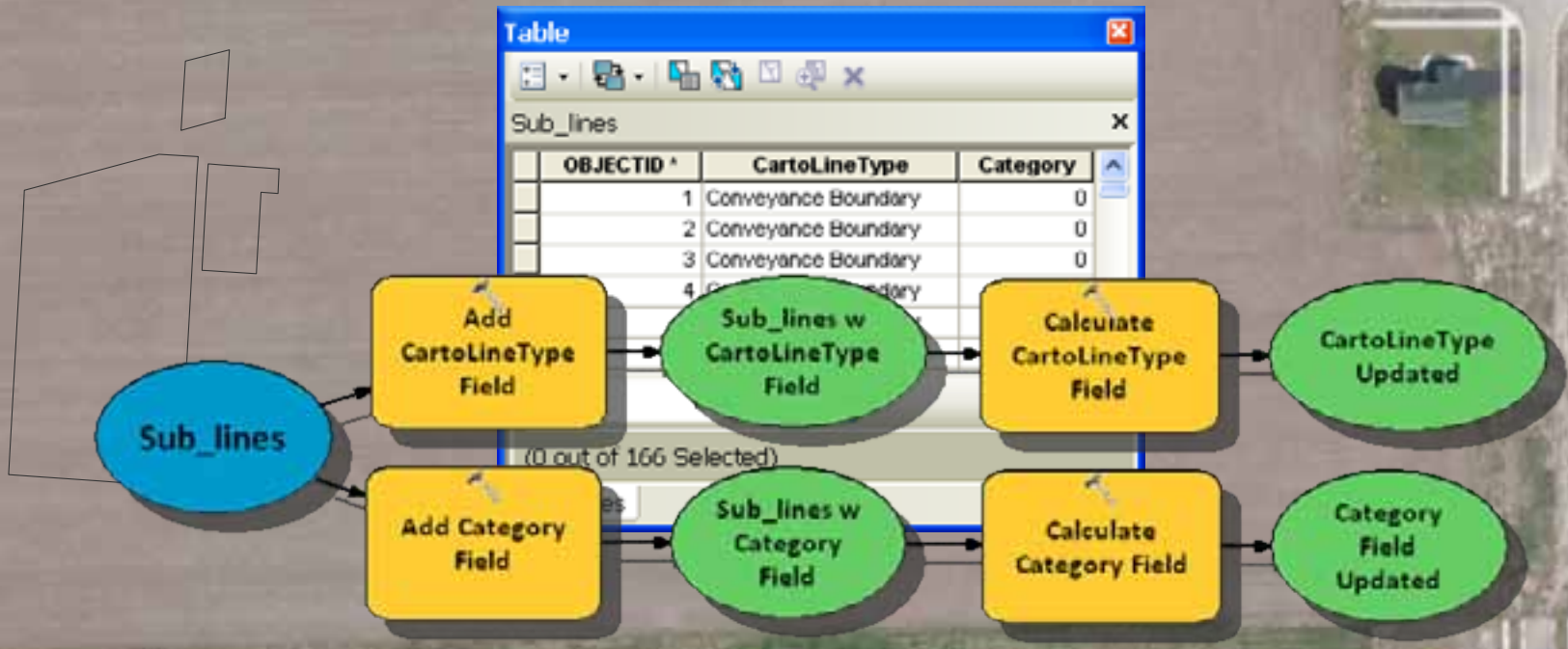
- Line—Must be Single Part
- Line—Must Not Self-Overlap
- Line—Must Not Self-Intersect
- Line—Must Not Intersect Or Touch Interior
- Line—Must be Covered by Boundary Of (polygon)
- Polygon—Boundary Must be Covered By (Line)

ParcelType Domain

1	PLSS Township
2	PLSS Section
3	PLSS Quarter Section
4	Special Survey
5	**Simultaneous Conveyance**
6	Conveyance Division
7	Tax
8	Ownership
9	Encumbrance
10	Separated Right
11	Other

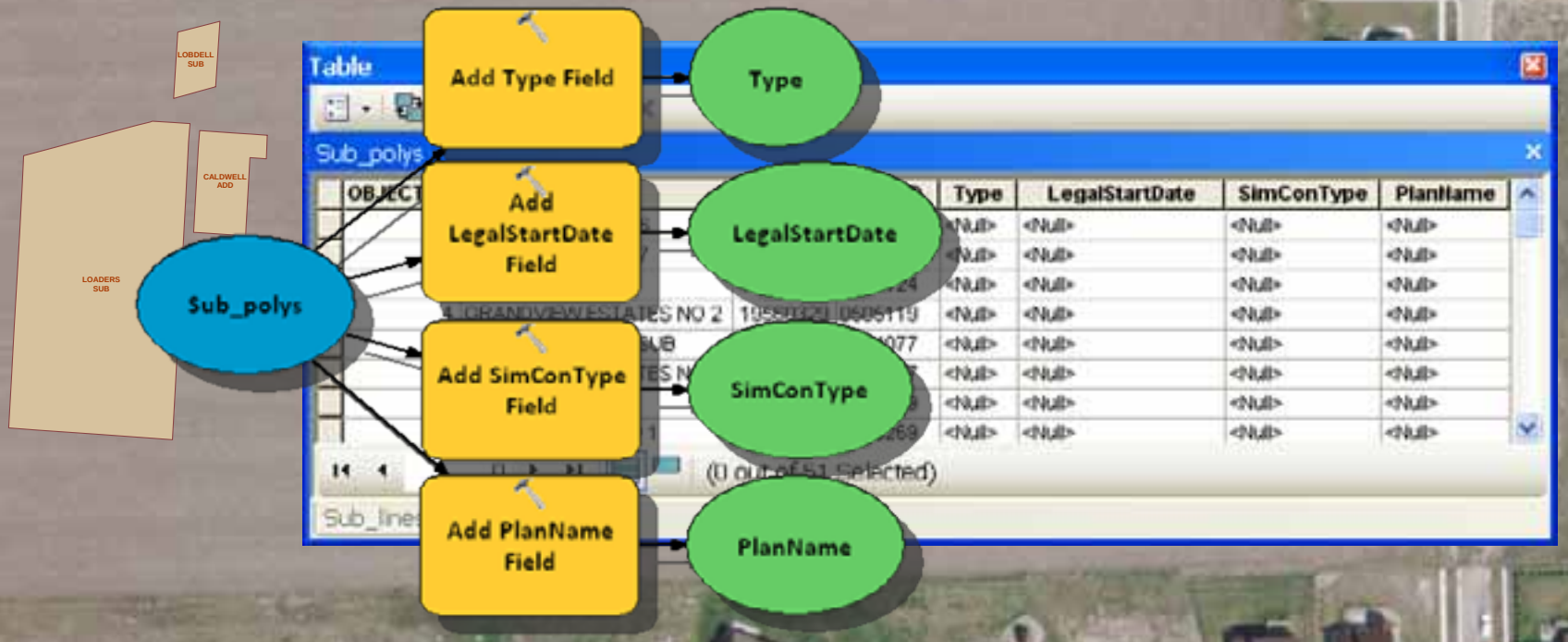
Sub_lines (Staging)

- Add and Calculate Staging Fields
  - CartoLineType = “Conveyance Boundary”
  - Category = 0



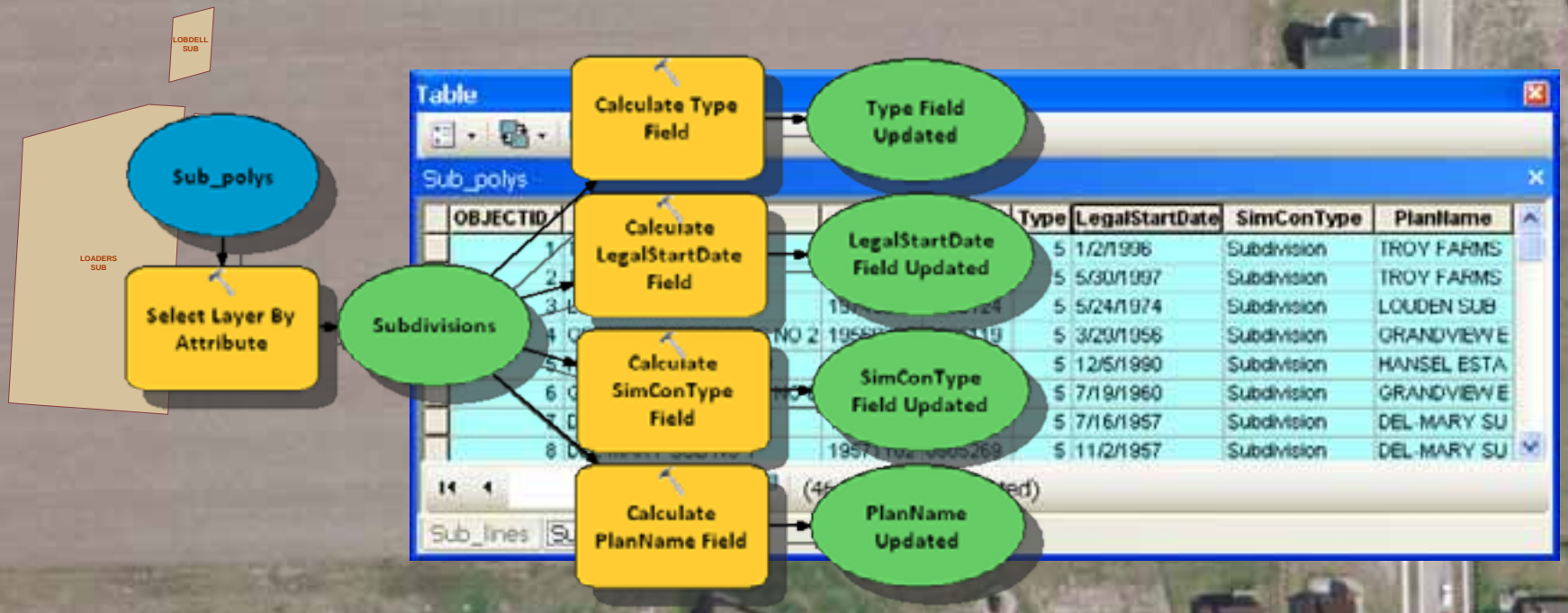
Sub_polys – Add Staging Fields

- Type (Long)
- LegalStartDate (Date)
- SimConType (Text 50)
- PlanName (Text 255)



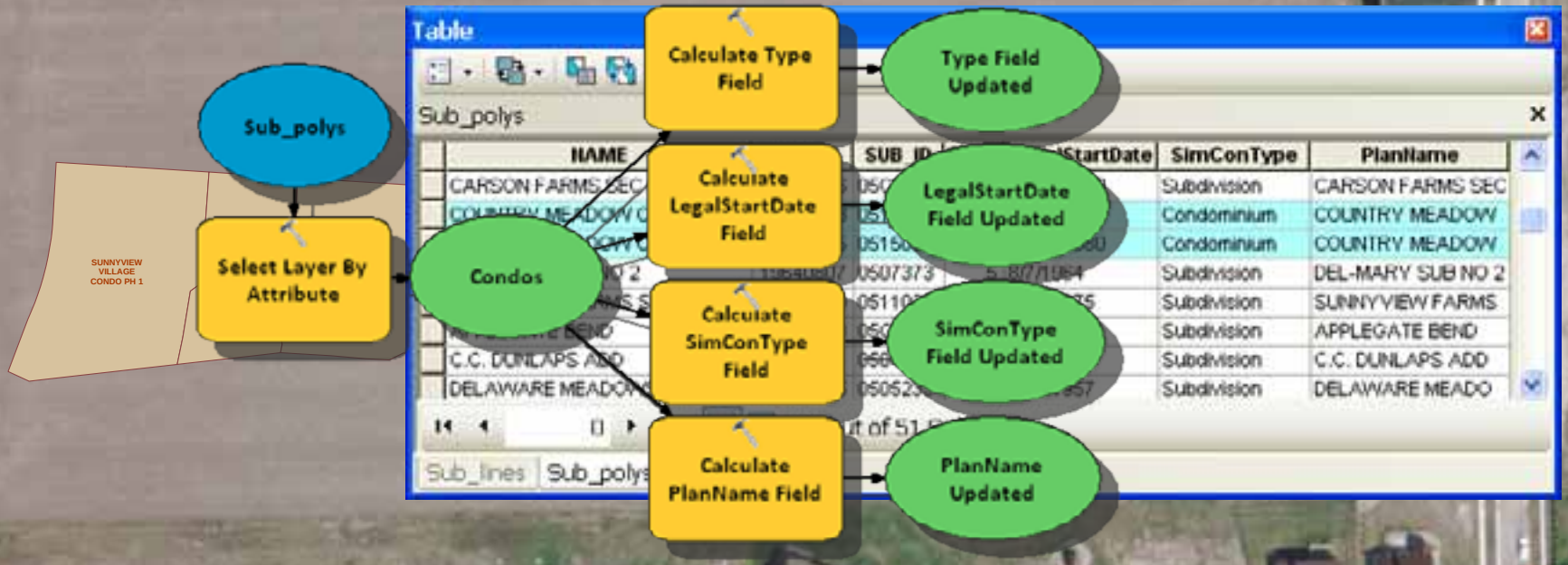
Sub_polys – Calc fields for “Subdivision”

- Select Expression NOT([NAME] LIKE ‘%CONDO%’)
  Type = 5
  LegalStartDate = [DATE]
  SimConType = “Subdivision”
  PlanName = [NAME]



Sub_polys – Calc fields for “Condominium”

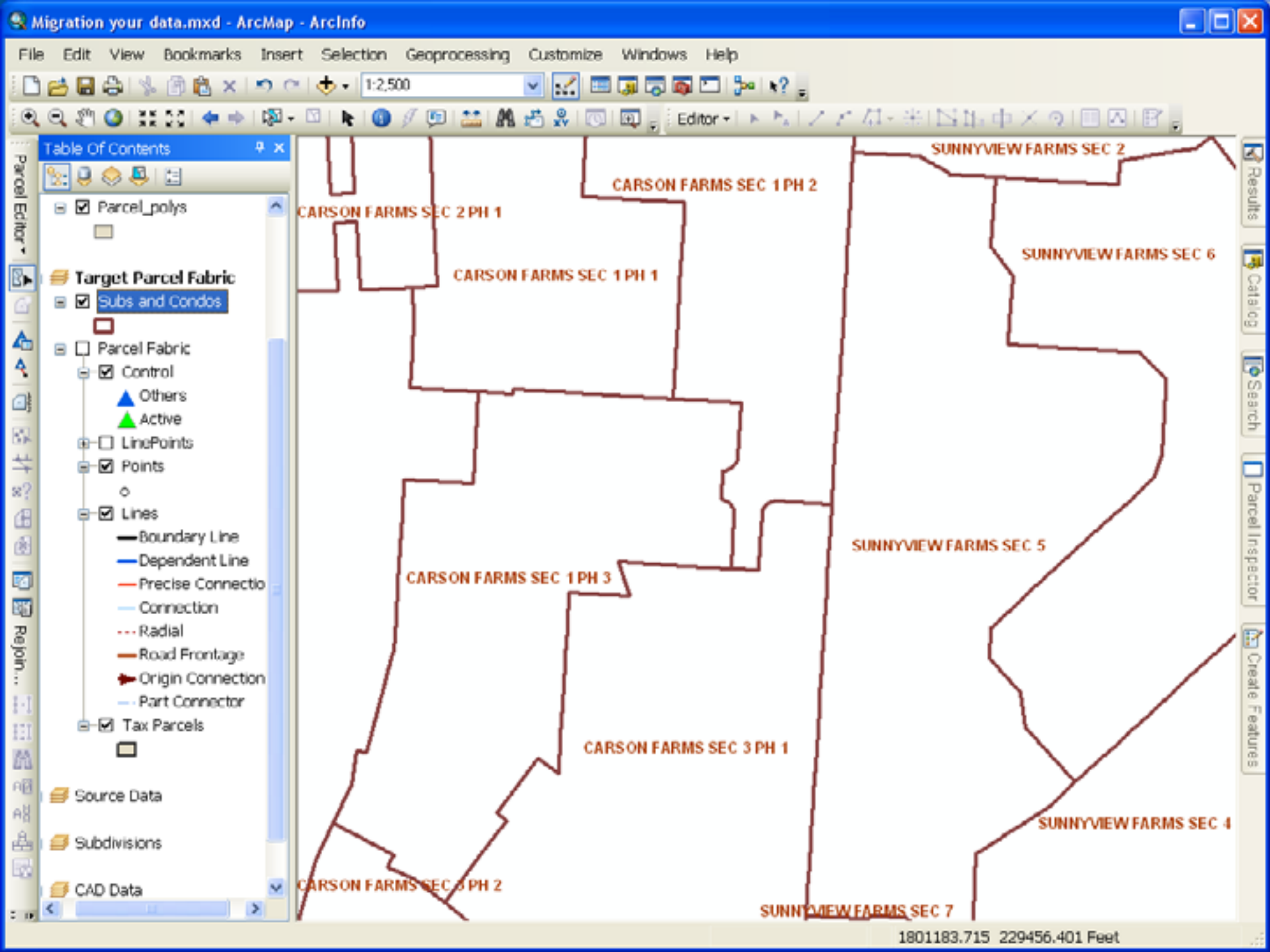
- Select Expression [NAME] LIKE ‘%CONDO%’
  Type = 5
  LegalStartDate = [DATE]
  SimConType = “Condominium”
  PlanName = [NAME]



Create and Validate (Staging) Topology

- Include Staging Line and Polygon Feature Classes
- 2 Ranks
  - Lines Rank 1
  - Polygons Rank 2
- Add Topology Rules listed below

•Line—Must be Single Part
•Line—Must Not Self-Overlap
•Line—Must Not Self-Intersect
•Line—Must Not Intersect Or Touch Interior
•Line—Must be Covered by Boundary Of (polygon)
•Polygon—Boundary Must be Covered By (Line)


Migration your data.mxd - ArcMap - ArcInfo
File Edit View Bookmarks Insert Selection Geoprocessing Customize Windows Help
1:2,500
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Lines
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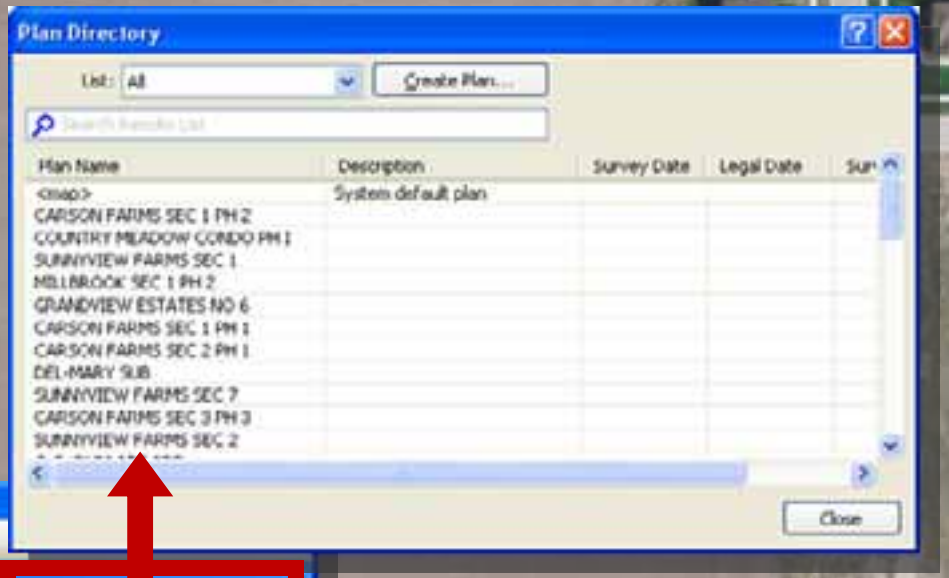
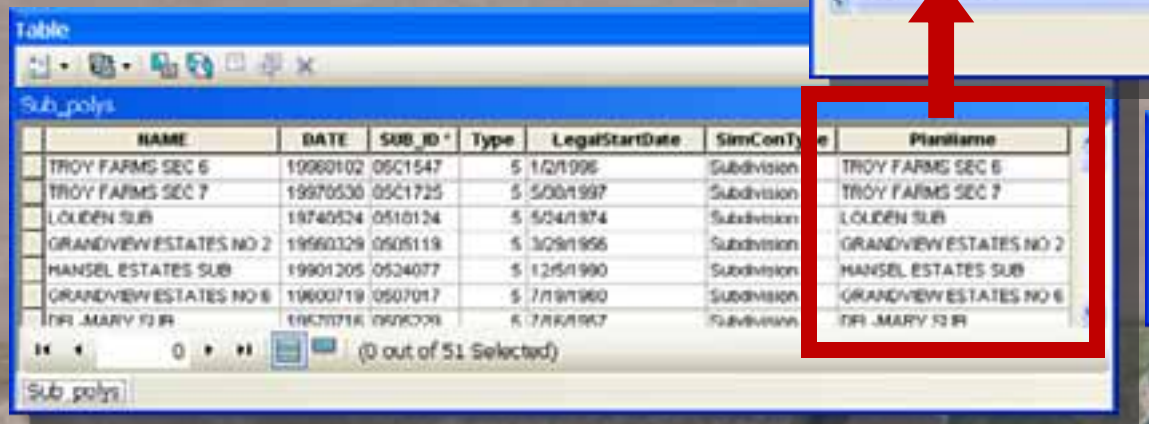
Dependent Line
Precise Connectio
Connection
Radial
Road Frontage
Origin Connection
Part Connector
Tax Parcels
Source Data
Subdivisions
CAD Data
CARSON FARMS SEC 2 PH 1
CARSON FARMS SEC 1 PH 2
CARSON FARMS SEC 1 PH 1
CARSON FARMS SEC 1 PH 3
CARSON FARMS SEC 3 PH 1
CARSON FARMS SEC 3 PH 2
SUNNYVIEW FARMS SEC 2
SUNNYVIEW FARMS SEC 6
SUNNYVIEW FARMS SEC 5
SUNNYVIEW FARMS SEC 4
SUNNYVIEW FARMS SEC 7
1801183.715 229456.401 Feet

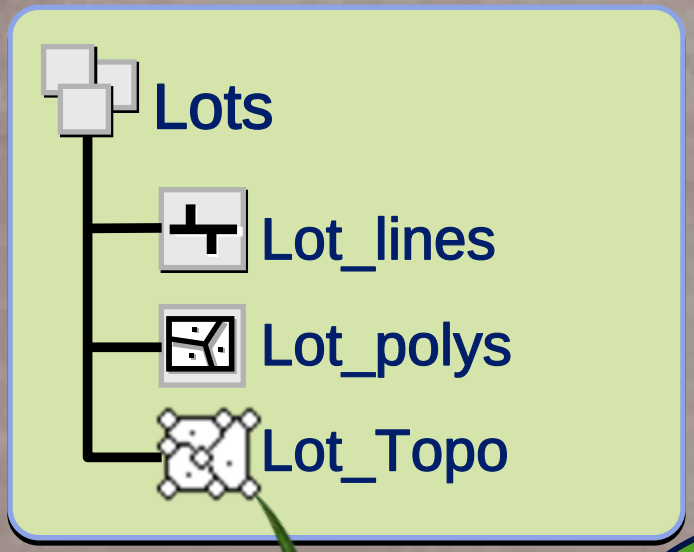
Pre-Populating Plan Directory

- Add PlanName to Staging Polygons (Subs/parcels/lots)
- Calculate values
- Plan Directory will get automatically populated and linked to fabric parcels as data is loaded into fabric

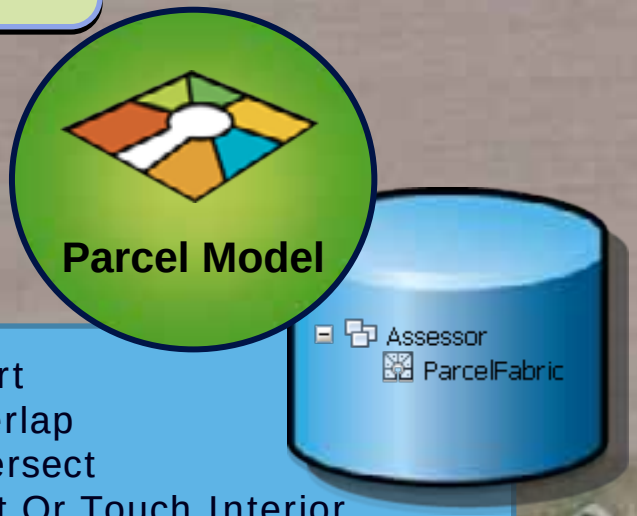




Lots and Units



Name = [Lot_number]
Type = 6
LegalStartDate = [DATE]
SimConDivType = “Lot“
PlanName = [Sub_name]



- Line—Must be Single Part
- Line—Must Not Self-Overlap
- Line—Must Not Self-Intersect
- Line—Must Not Intersect Or Touch Interior
- Line—Must be Covered by Boundary Of (polygon)
- Polygon—Boundary Must be Covered By (Line)

ParcelType Domain	
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2	PLSS Section
3	PLSS Quarter Section
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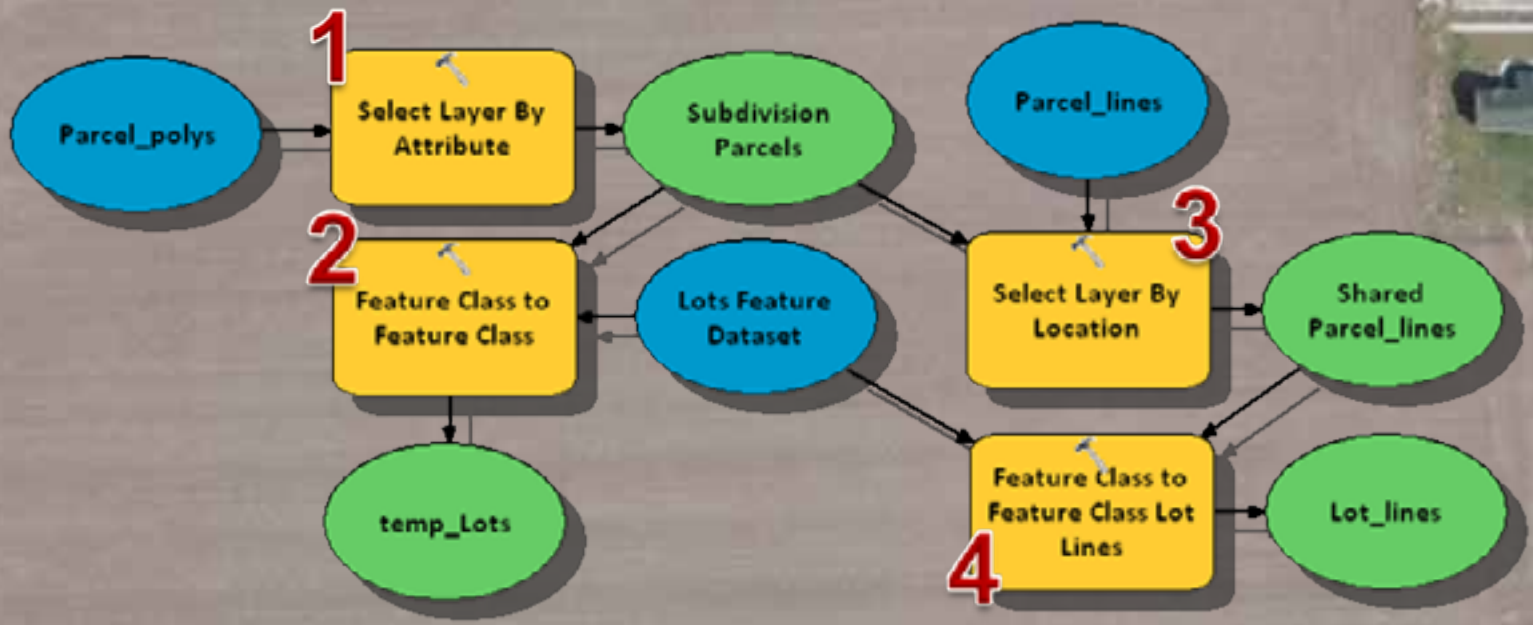
6	**Conveyance Division**
7	Tax
8	Ownership
9	Encumbrance
10	Separated Right
11	Other

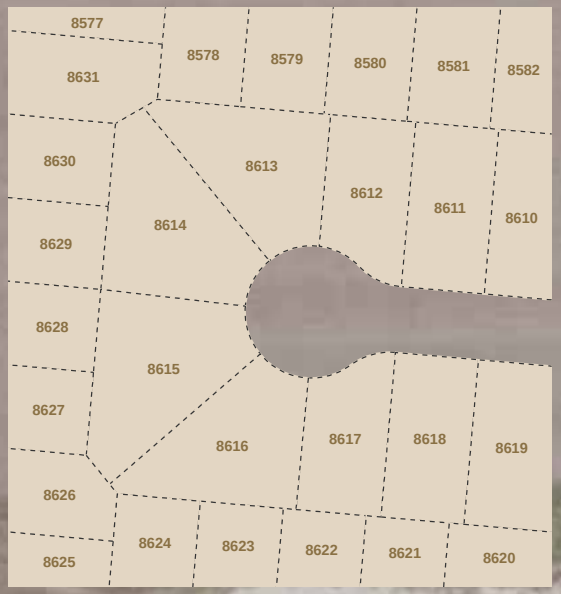
Derive Lot Staging layers from Parcel lines/polys

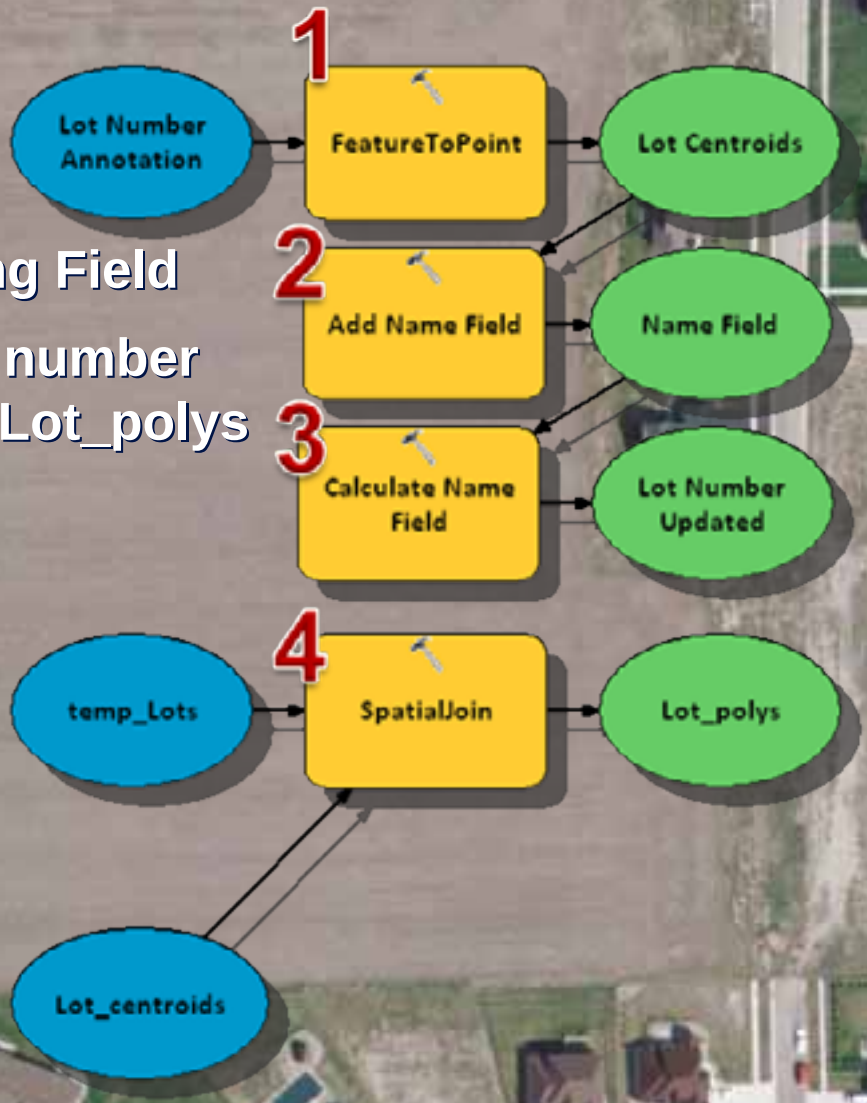
- Select/Export Parcel_polys with SUB_ID value
- Select/Export Parcel_Lines by Location that Share a line segment with Parcel_polys



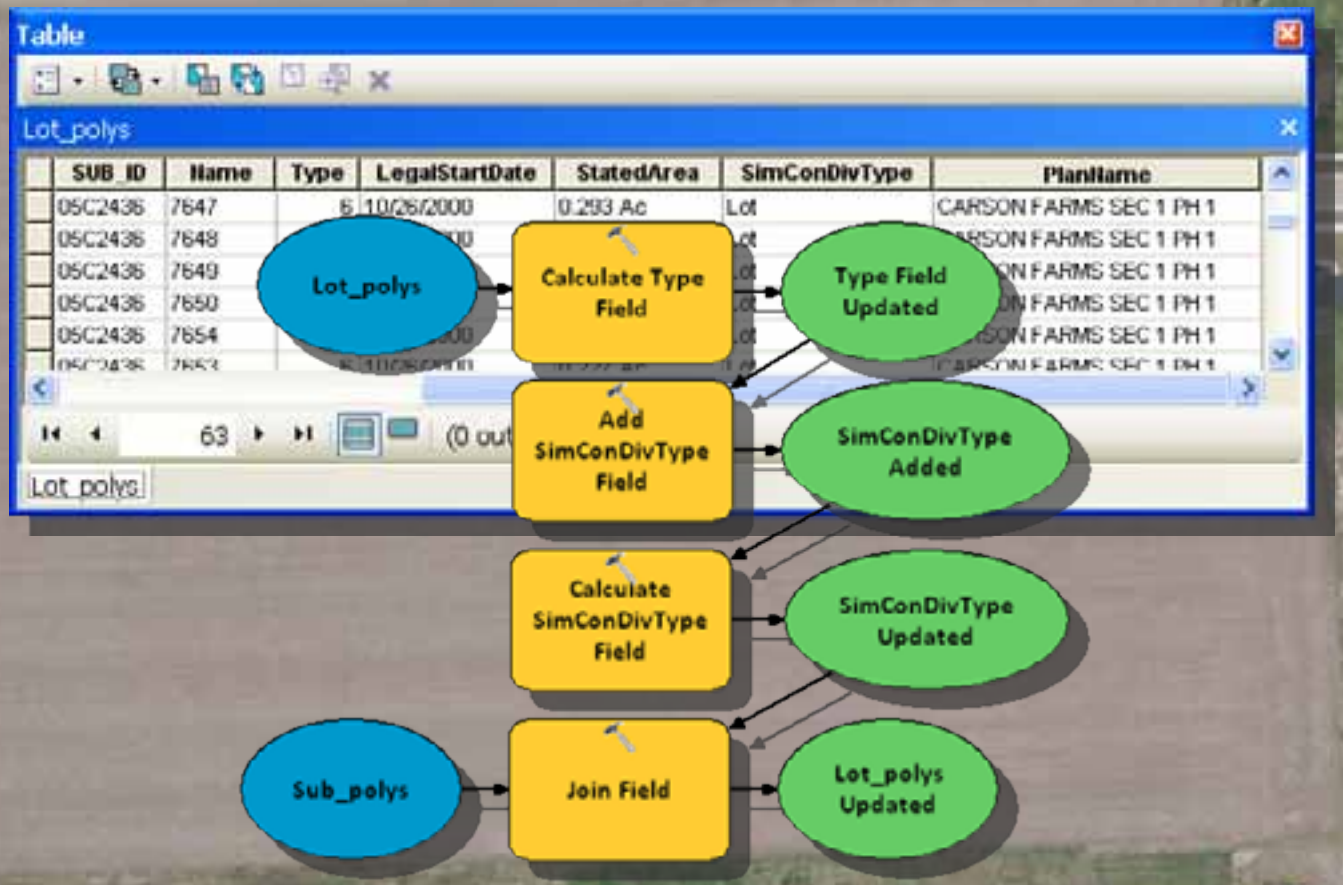
Derive Lot Number from Annotation

- Feature to Point
  - Lot Centroid
- Add/Calculate Name Staging Field
- Spatial Join to transfer Lot number from Lot Centroids to final Lot_polys





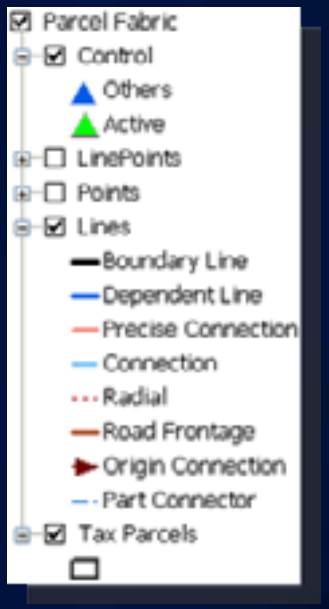
Add/Calculate Remaining Staging Fields



Authoring an Editing Map

Configuring Tax Parcels in Editing Map

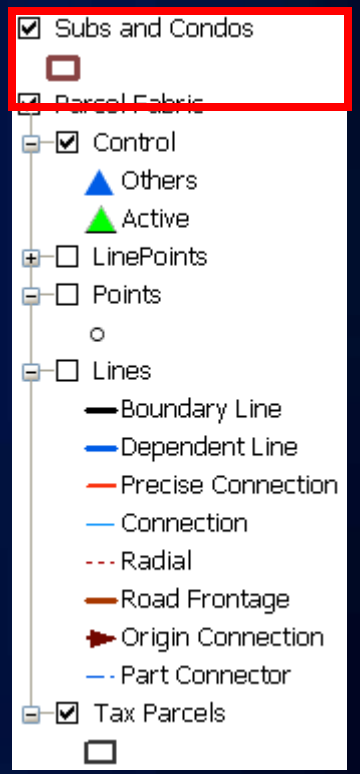
- Add Parcel Fabric Layer to map
- Rename Parcels Sub Layer “Tax Parcels”
- Open Layer Properties for Tax Parcels
  - Select Symbol
  - Definition Query
    (SystemEndDate IS NULL) AND ("Type" = 7)
  - Set Labeling Properties if desired



- Save Tax Parcels (Fabric sub layer) as Layer File
  Fabric Authoring Layer.lyr

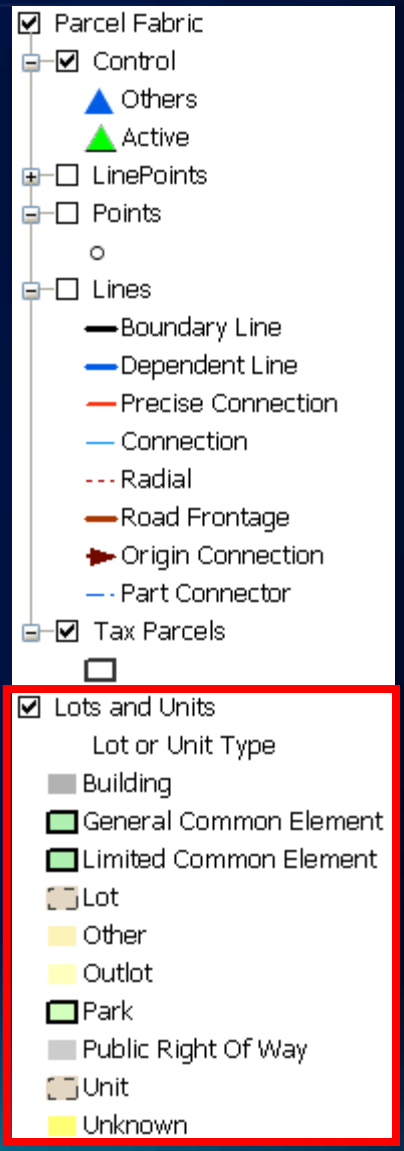
Configuring Subs and Condos in Editing Map

- Load ***Fabric Authoring Layer.lyr*** into Map
- Rename Layer “Subs and Condos”
- Open Layer Properties for Tax Parcels
  - Select Symbol
  - Definition Query
    (SystemEndDate IS NULL) AND ("Type" = 5)
  - Set Labeling Properties if desired

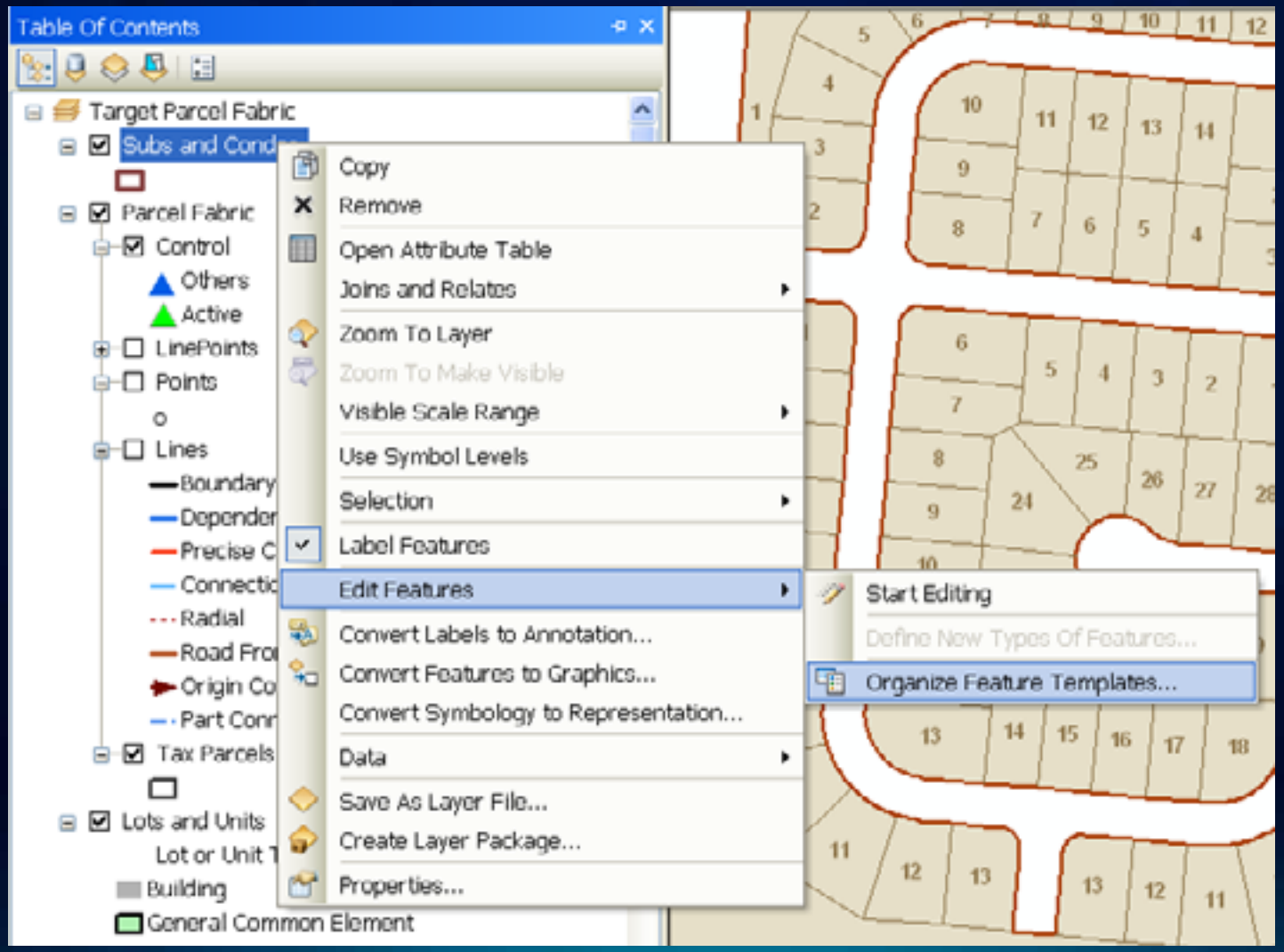


Configuring Lots and Units in Editing Map

- Load ***Fabric Authoring Layer.lyr*** into Map
- Rename Layer “Lots and Units”
- Open Layer Properties for Tax Parcels
  - Symbol Properties
    - Unique Values
    - Value Field “Lot or Unit Type”
  - Definition Query
    (SystemEndDate IS NULL) AND ("Type" = 6)
  - Set Labeling Properties if desired

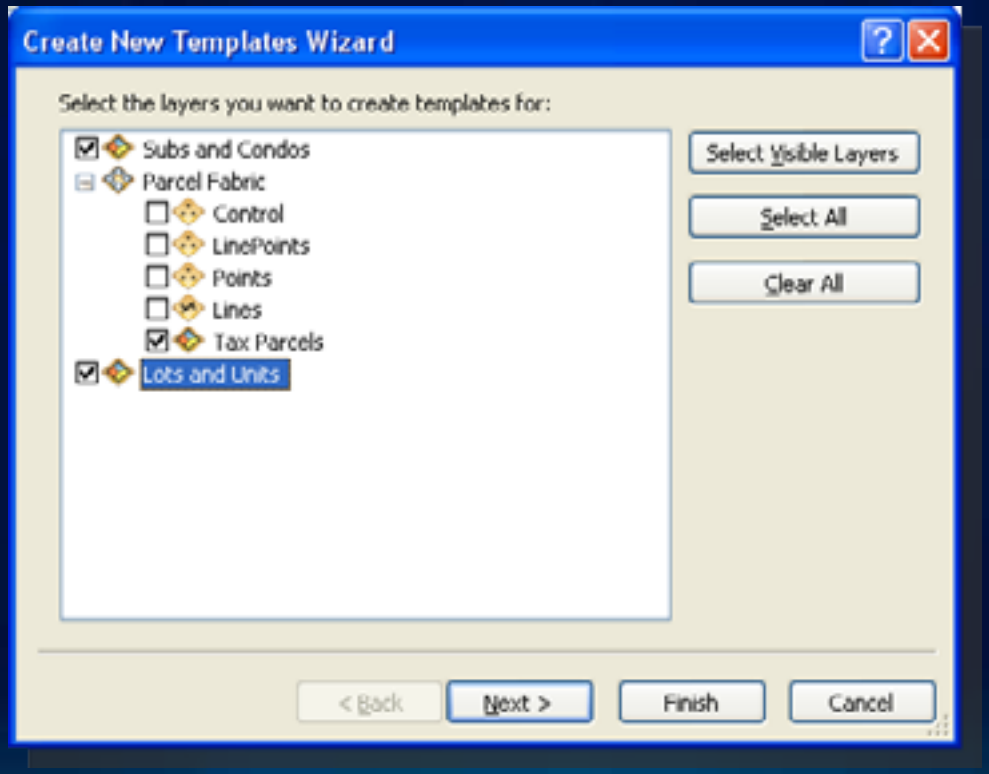


Establish Feature Templates for Parcel Types



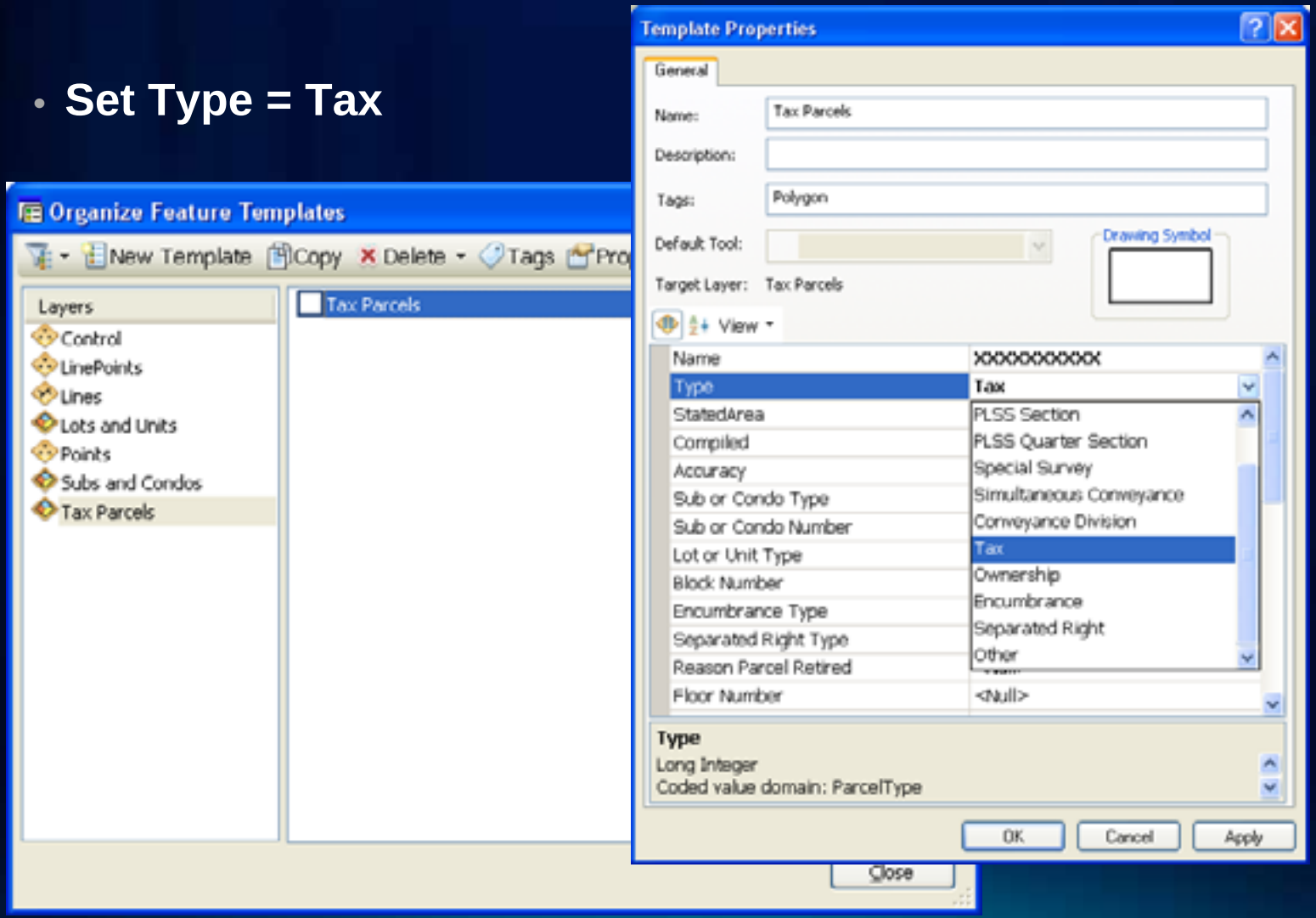
Create Templates for each Parcel Type

- **Create Templates for each Parcel Type**



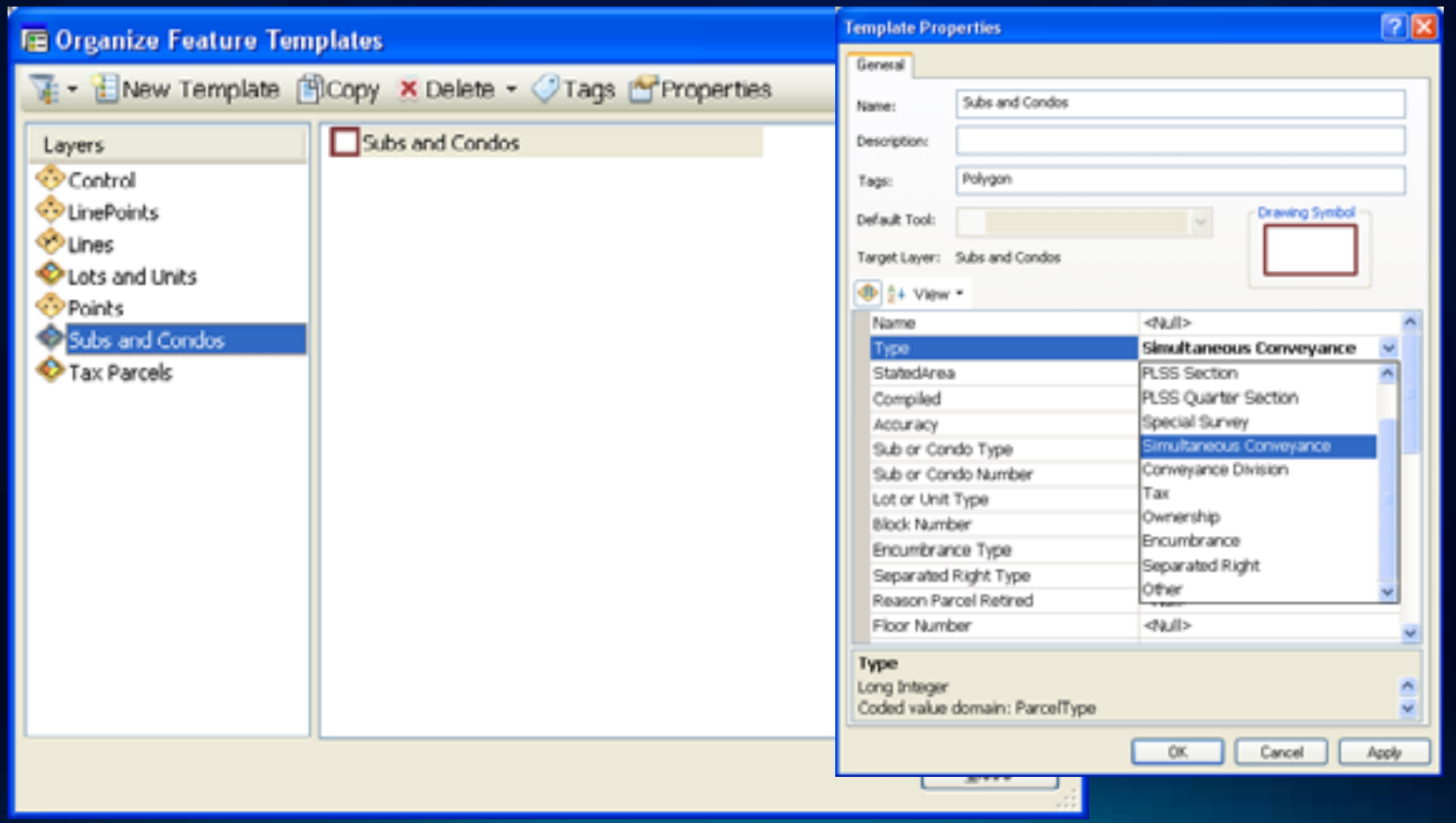
Edit Properties for Tax Parcel Feature Template

- **Set Type = Tax**



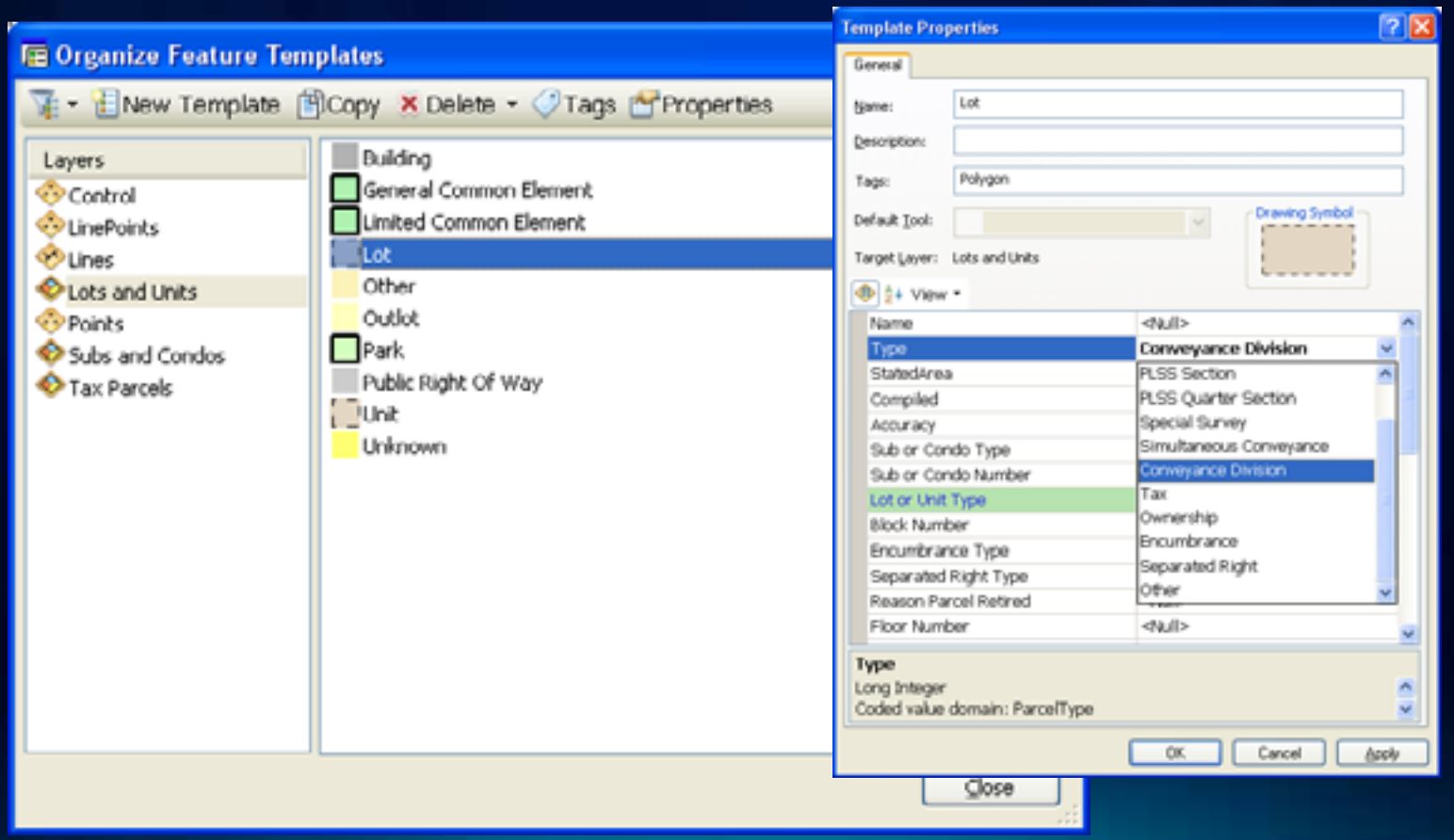
Edit Properties for Subs and Condos Feature Template

- Set Type = Simultaneous Conveyance
- Set Sub or Condo Type = Subdivsion

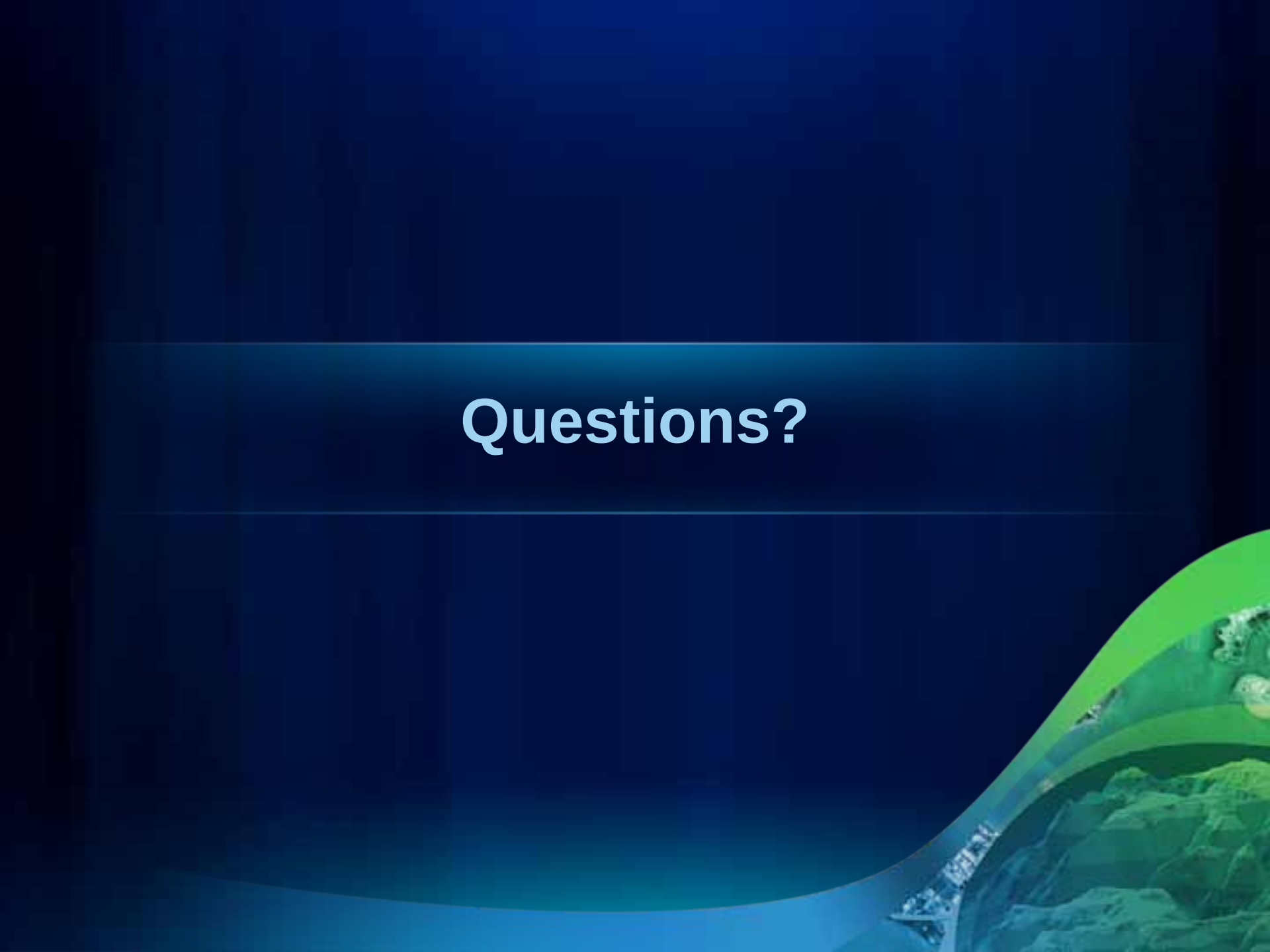


Edit Properties for Lot/Unit Feature Templates

- Set Type = Conveyance Division
- Repeat for each Feature Template



Questions?



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