

DIGITAL MAPPING TECHNIQUES 2019

The following was presented at DMT'19
(May 19 – 22, 2019 - Montana Technological
University)

The contents of this document are provisional

See Presentations and Proceedings
from the DMT Meetings (1997-2019)

<http://ngmdb.usgs.gov/info/dmt/>

STATEMAP, EDMAP, and Who Mapped What? Compiling 50 Years of Geologic Mapping into an Effective GIS

By Lainey Le Blanc

420 Hackberry Ln

Tuscaloosa, AL 35404

Telephone: 205-247-3567

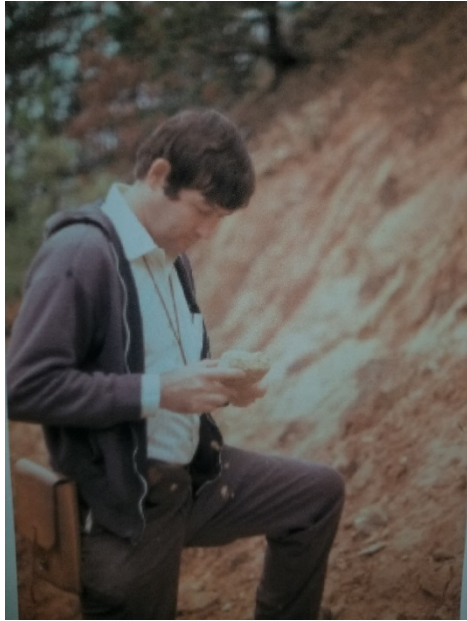
Email: LLeBlanc@gsa.state.al.us

Compiling a seamless geologic map and GIS of the Coosa Deformed Belt - 30+ geologic quads and 50 years of geologic mapping by Dr. William Thomas. Creating this map requires reconciling various data formats and publication types while implementing topology, addressing errors, and keeping continuity. Data products compiled includes STATEMAPs, EDMAPs, hand-drawn paper maps, coverages, and geodatabases. This project presents many issues faced when compiling geologic mapping data such as legacy format errors, lack of agreement across quadrangles, incongruent boundaries, and differences in resolution. The results shown are preliminary and the project is still ongoing.

Slide 9: Because of these incongruous quad boundaries from differences in legacy formats and the way that people draw the map boundary I wanted to find a standardized 7.5 minute quad index to georeference everything and for display purposes. I did not use the NRCS quad index because it is an index of the historical topo DRG's, and I did not want to introduce any stretch/skew inherent to those datasets since they were scanned maps. I dug a quad index that we were using at the Survey that was created in 2000 for the Gulf Wide Information System and tested it against the re-projected USGS 2012 quad index, which I reprojected from NAD 1983 to NAD1927. I tested it by inputting an X and Y that would match the quad corner and what I found was that the corner aligned with the older G-WIS quad index vs. the USGS 2012 quad index. Strangely enough, the 1983 USGS quad index aligns perfectly, but when re-projected it does not. I wanted everything to truly be in the NAD UTM 1927 projection I ended up using the G-WIS quad index.

Slide 10: The mappers decide where to draw the quad boundary which leads to this issue. I don't know what type of basemap they're using to draw the boundary or where they draw within the boundary line of the georeferenced basemap? These incongruent boundaries is why I chose to use a standardized quad index for my georeferencing, I couldn't rely on the given boundaries.

Slides 23-25: Snapshots of the same area throughout the publishing years of the compilation map. Notice the differences in the resolution i.e. number of orientation points.



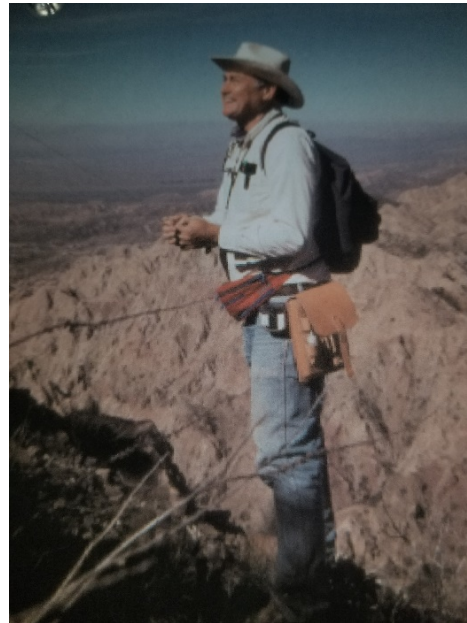
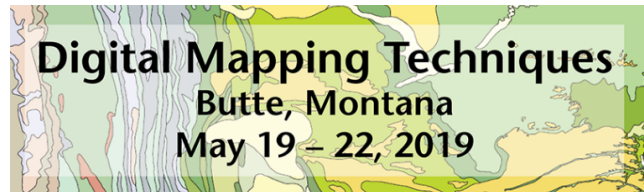
STATEMAP, EDMAP, and Who Mapped What? Compiling 50 Years of Geologic Mapping into an Effective GIS

Lainey Le Blanc

Dr. William (Bill) Thomas

Geological Survey of Alabama

May 21, 2019





What is the Coosa Deformed Belt?

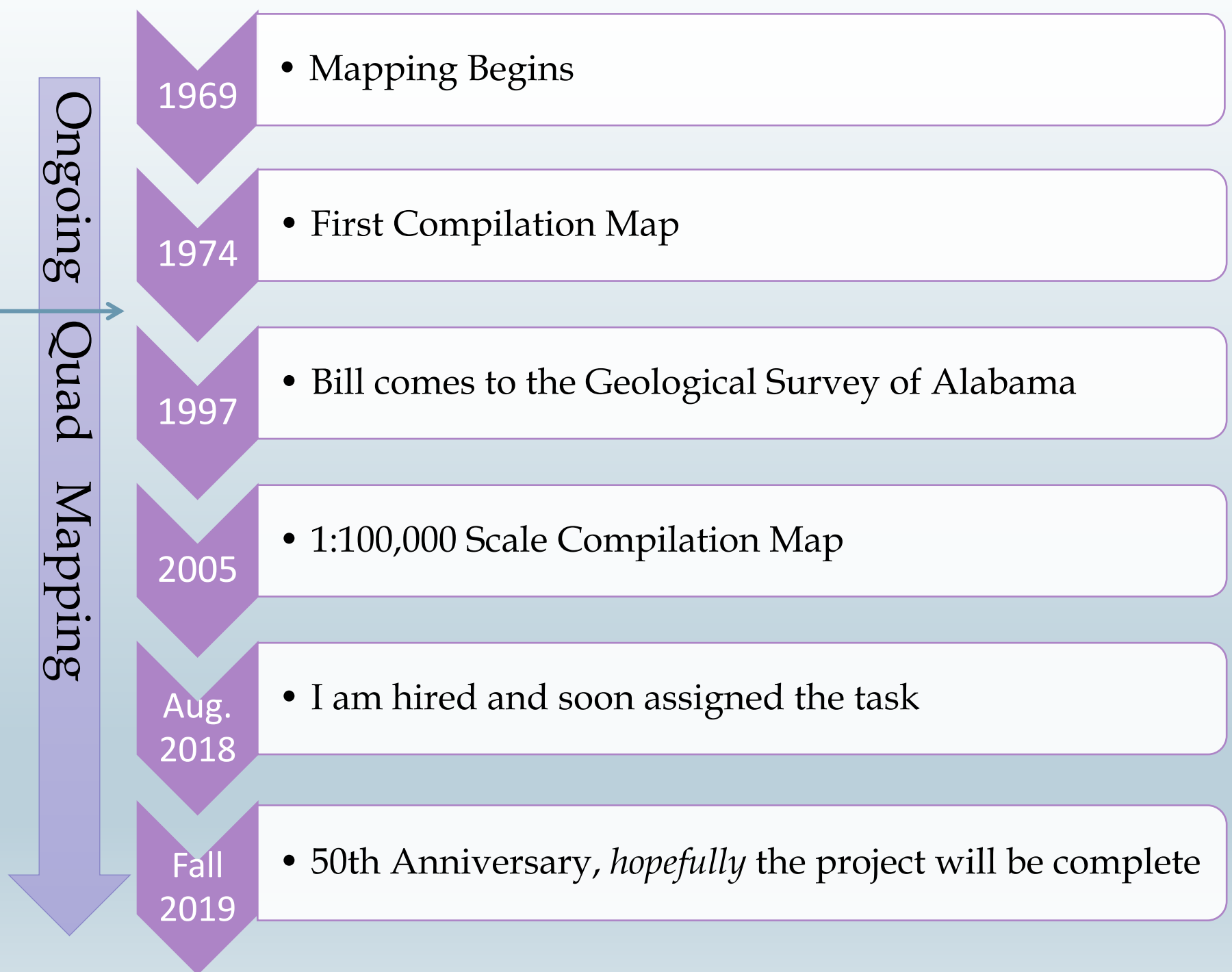
“The Coosa deformed belt is a narrow linear zone of complex structure between the Pell City thrust fault and the Coosa synclinorium in the southeastern part of the Appalachians in Alabama. The deformed belt consists mainly of thin imbricate thrust slices, the number of which varies along strike.” -AGS 1974

Spanning 34 quads in NE Alabama.



Timeline of the Coosa Deformed Belt compilation maps

1992 STATEMAP
1996 EDMAP



- EXPLANATION
- PENNSYLVANIAN
 pr POTTSVILLE FM
 MISSISSIPPIAN
 fph PARKWOOD FM
 FLOYD SH
 fr FORT PAYNE CHERT
 MAURY SHALE
- DEVONIAN
 fm FROG MOUNTAIN SS (< 100 FT)
 FM FROG MOUNTAIN SS (> 100 FT SANDSTONE)
- ORDDVICIAN
 cm COLVIN MOUNTAIN SS
 s GREENSPORT FM
 a ATHENS SH
 lo LITTLE OAK LS
 n NEWALA LS
- CAMBRIAN-ORDDVICIAN
 k KNOX GROUP
- CAMBRIAN
 c CONASAUGA FM
 r ROME FM
 SHADY FM (NOT MAPPED)
 w WEISNER FM
- FAULT
 - - - CONTACT
 O6 LOCALITY DISCUSSED IN FIELD GUIDE

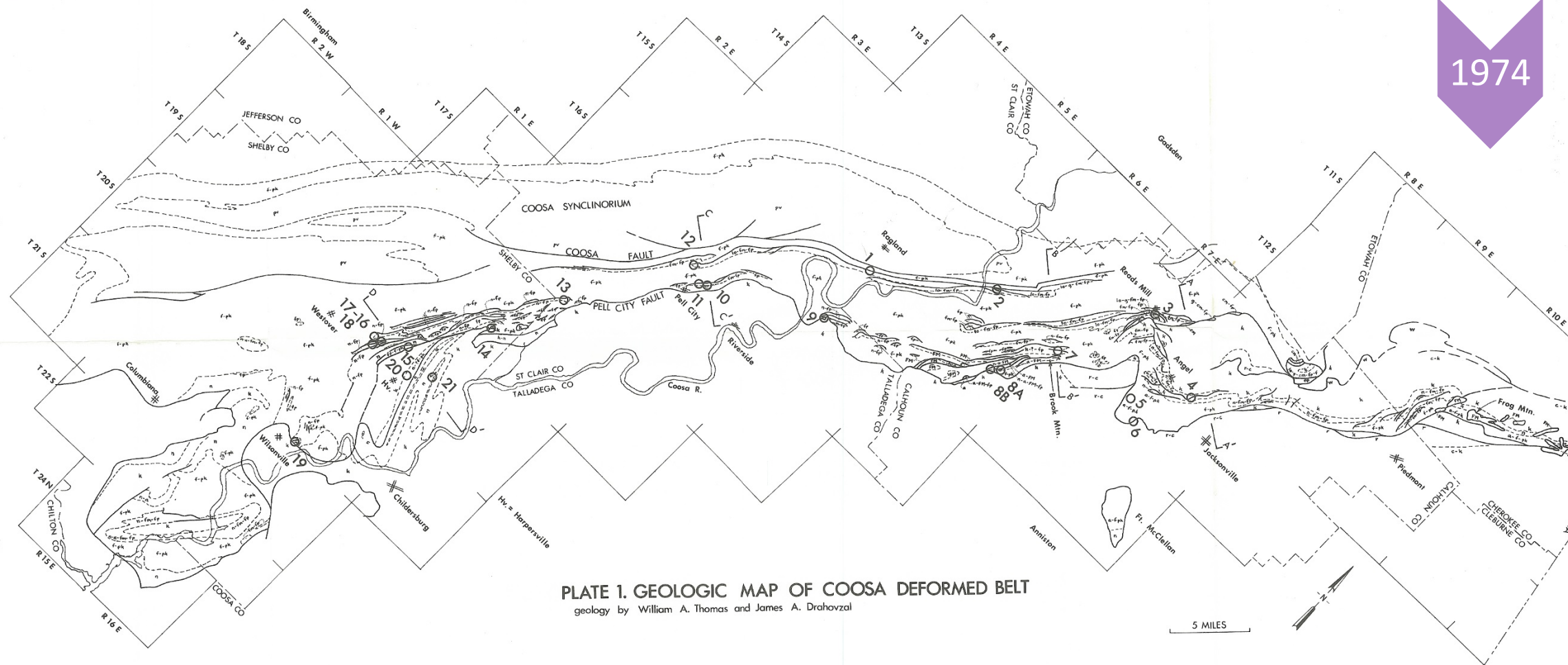


PLATE I. GEOLOGIC MAP OF COOSA DEFORMED BELT
 geology by William A. Thomas and James A. Drahovzal

5 MILES



A GUIDEBOOK FOR THE TWELFTH ANNUAL FIELD TRIP
 OF THE
 ALABAMA GEOLOGICAL SOCIETY
 DECEMBER 6-7, 1974

Alabama Geological Society 12th Annual Field Trip Guidebook

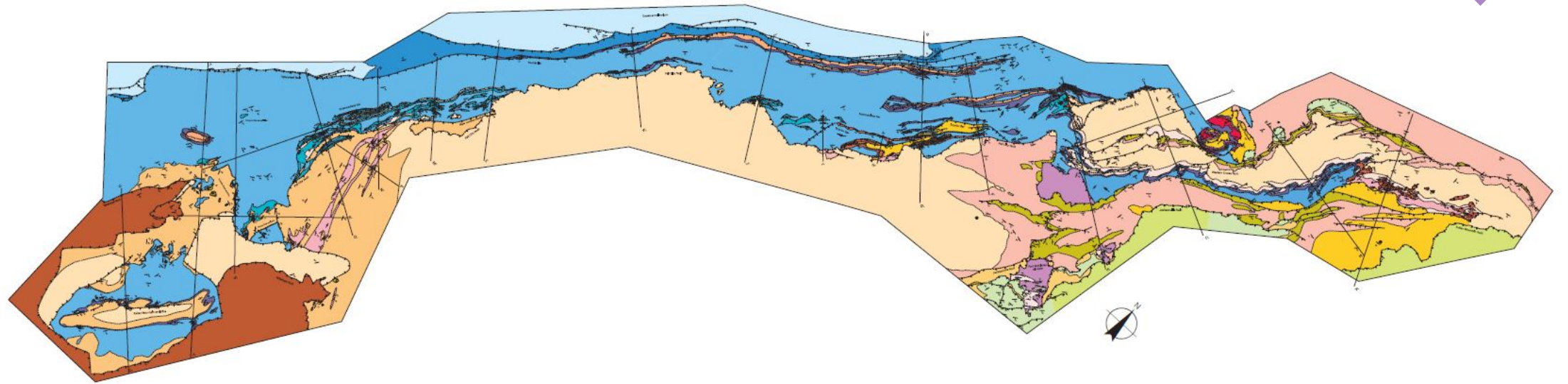
1:250,000

1:100,000 Compilation Map

GEOLOGICAL SURVEY OF ALABAMA

MONOGRAPH 17 PLATE 1

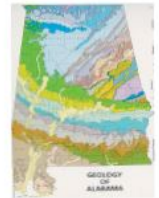
2005



GEOLOGIC MAP OF THE COOSA DEFORMED BELT, ALABAMA

By

William A. Thruw and James A. Drakeford
2006

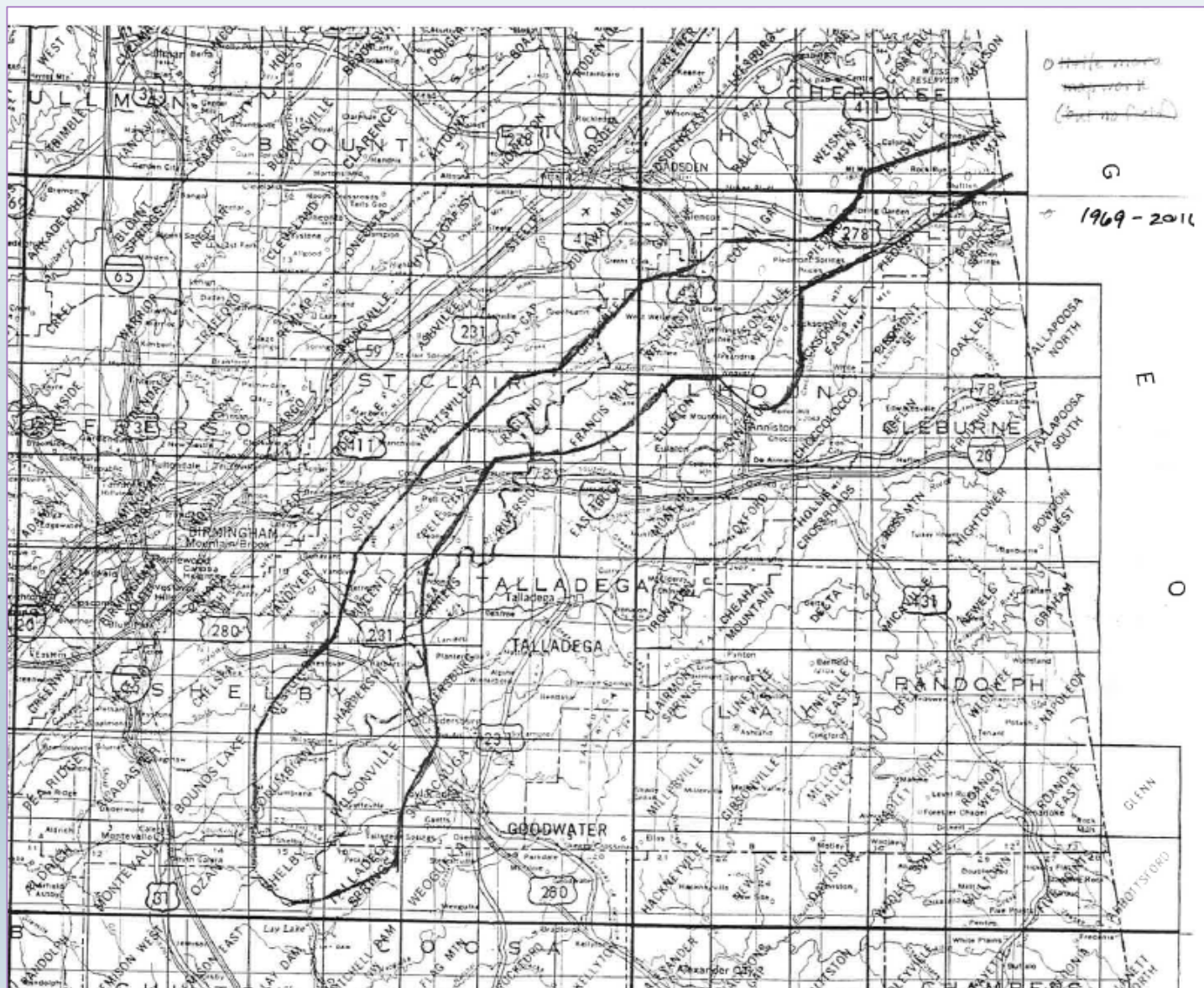


What did Bill want?

- 1:24,000 compilation map of the geology of the Coosa Deformed Belt including:
 - structural data, contacts and faults, map units, and cross-section lines
- No Qal- faults/contacts continue over waterways
- Symbolized as approximately located

In 2019,

- Most of these quads have been mapped for other USGS projects
- Mapping software has improved



Product Type Breakdown

34 Quads Total

STATEMAP - 16 quads

Current STATEMAP - 5 quads

Current STATEMAP & EDMAP - 2 quads

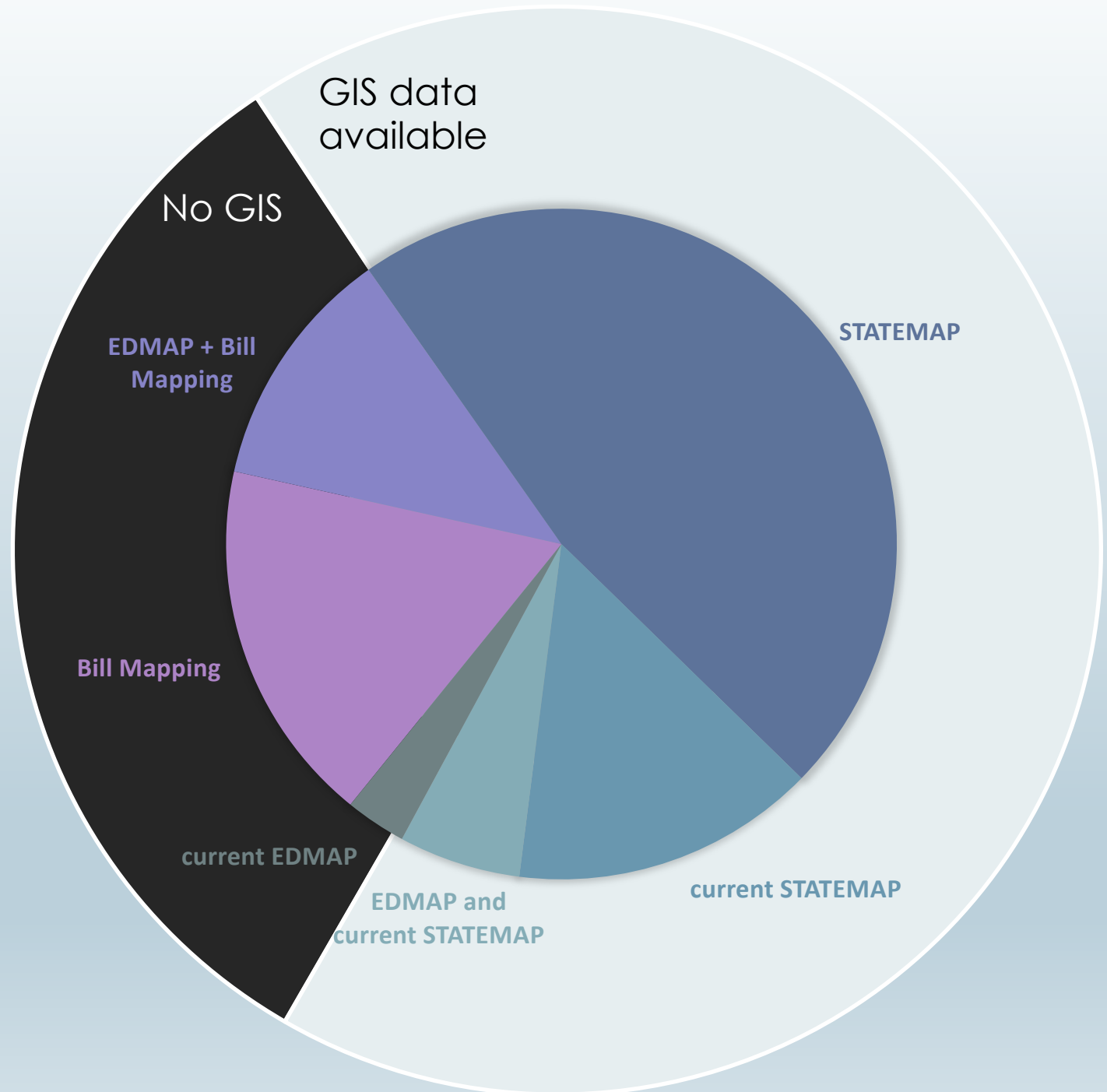
Current EDMAP - 1 quad

EDMAP & Bill Mapping - 4 quads

Bill Mapping - 6 quads

GIS Data Available - 23 quads

No GIS Data - 11 quads



Published STATEMAP Timeline

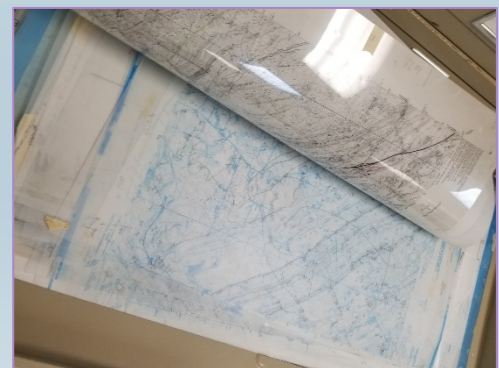
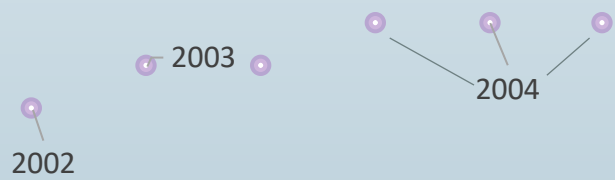
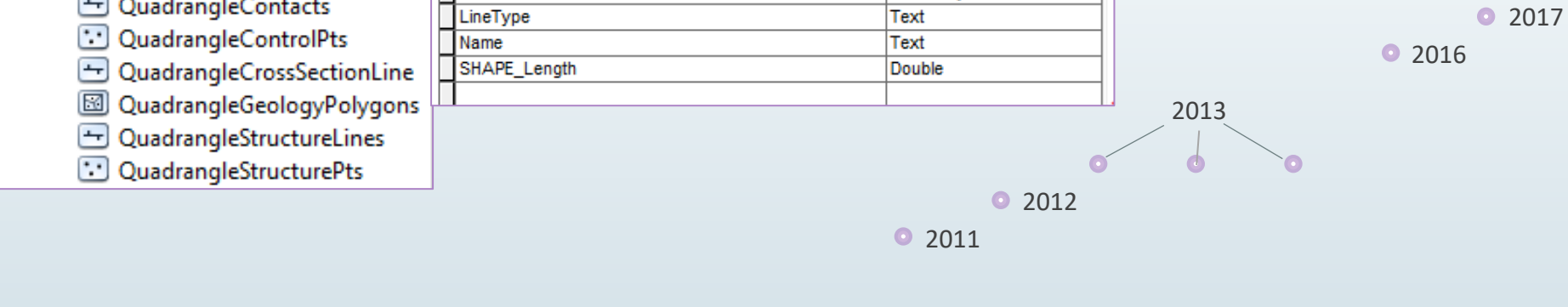
2019
2017
2015
2013
2011
2009
2007
2005
2003
2001
1999
1997
1995
1993
1991

QuadrangleTemplate.mdb

- QuadrangleGeology
 - QuadrangleContacts
 - QuadrangleControlPts
 - QuadrangleCrossSectionLine
 - QuadrangleGeologyPolygons
 - QuadrangleStructureLines
 - QuadrangleStructurePts

Field Name	Data Type
OBJECTID	Object ID
SHAPE	Geometry
LineType	Text
Name	Text
SHAPE_Length	Double

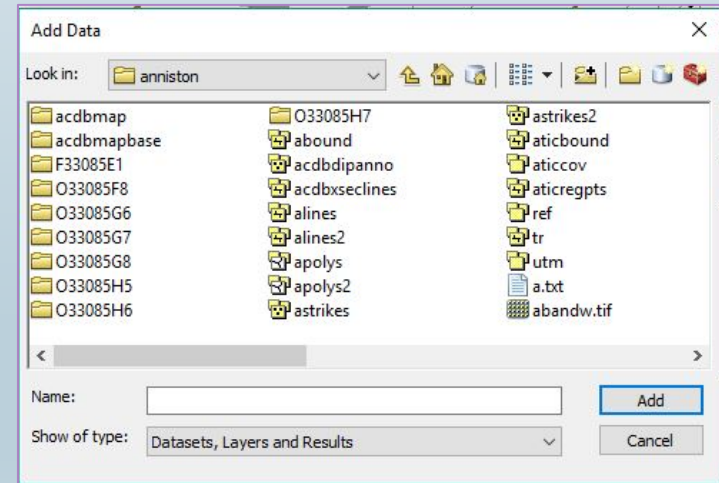
2006: Map creation in ArcMap begins



Mylar map creation



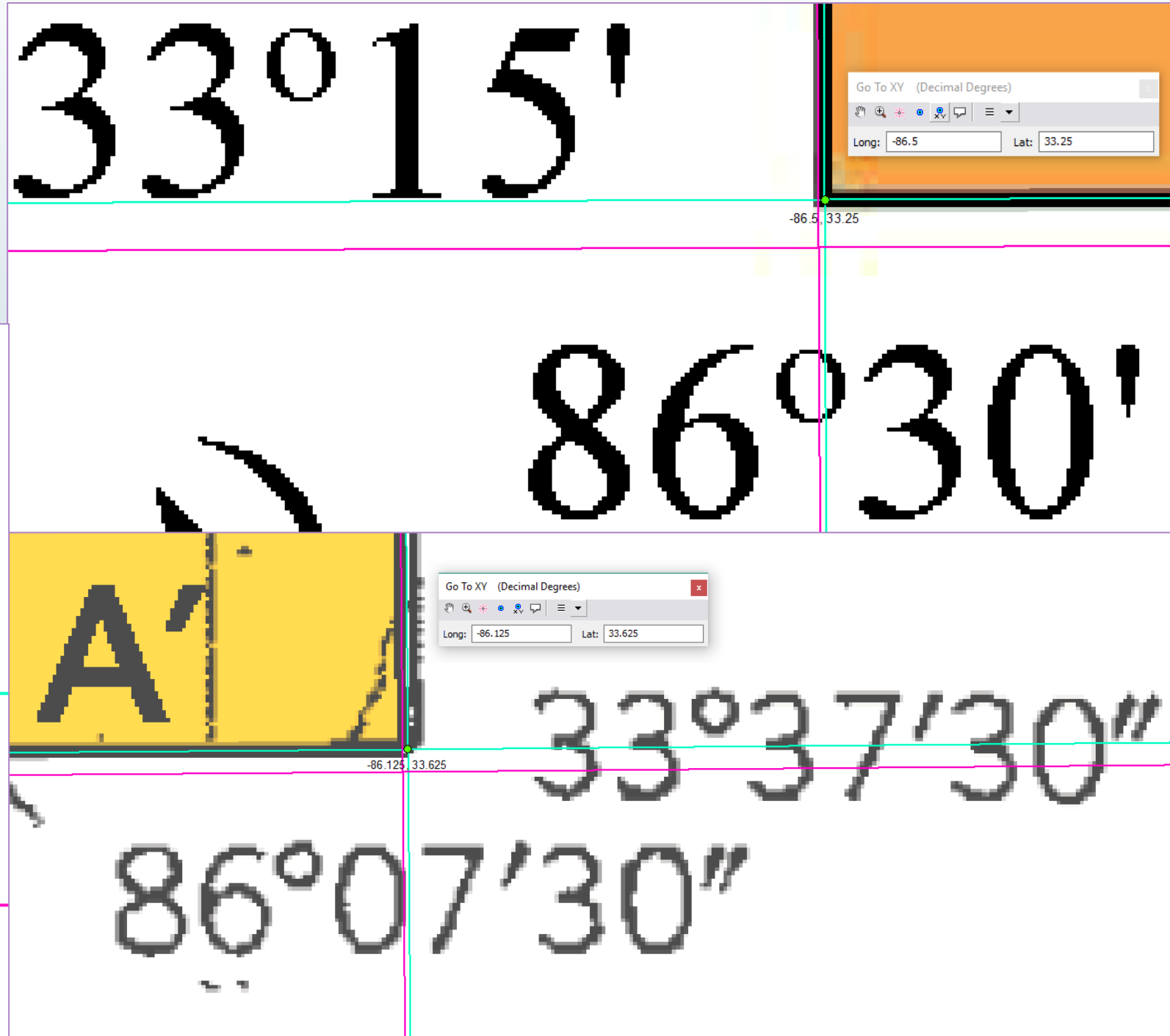
“Heads-down” digitizing



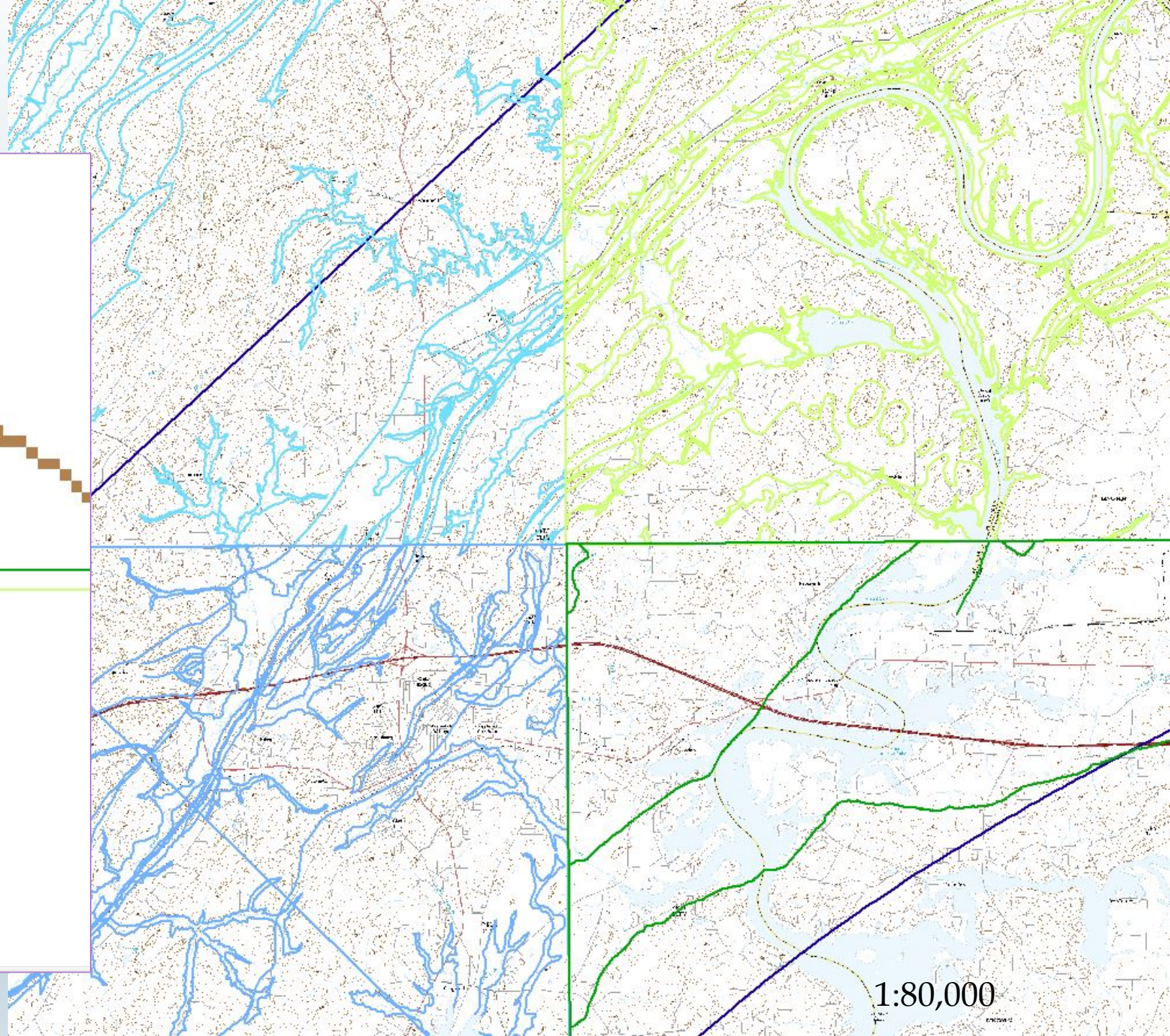
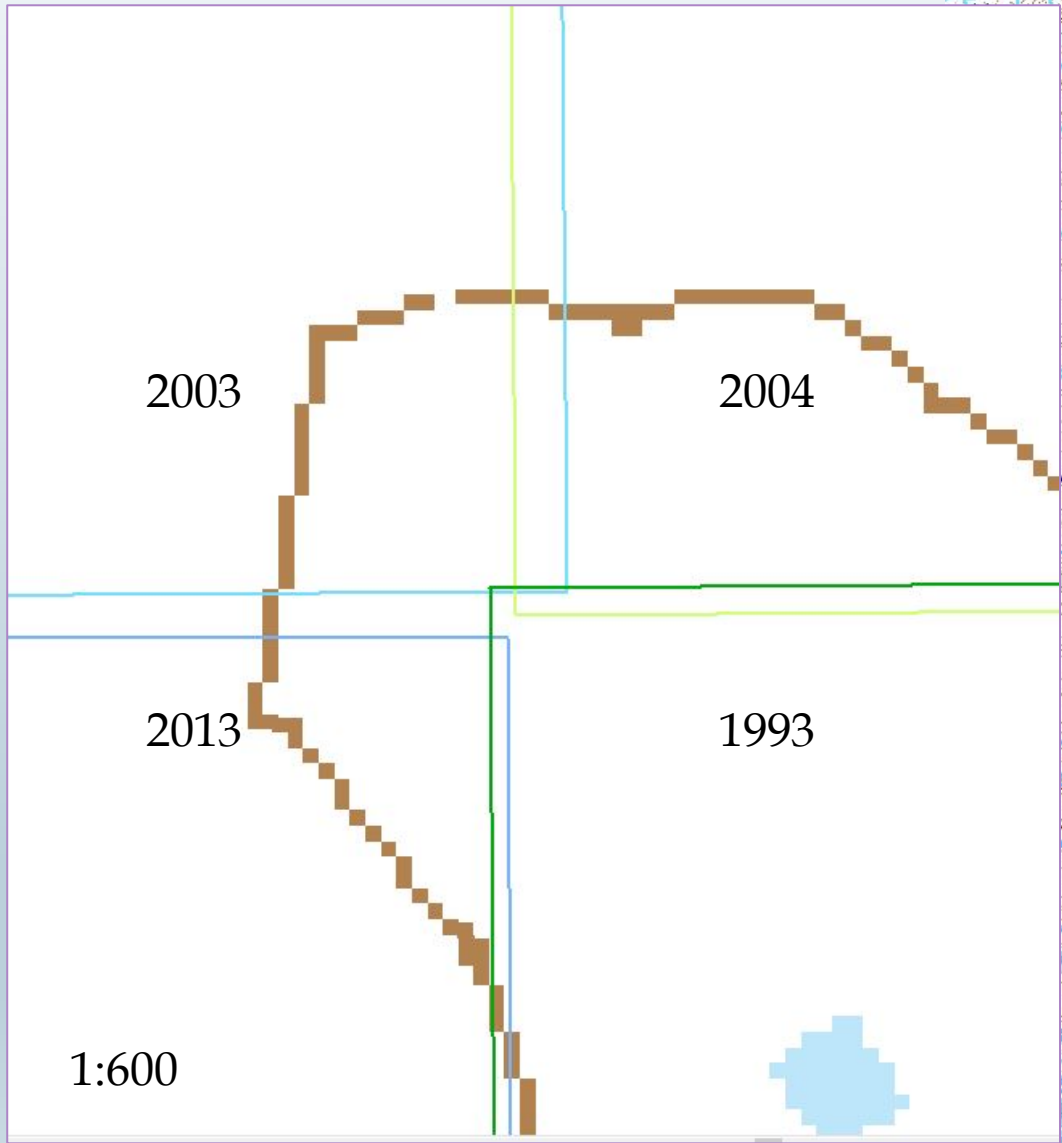
ArcInfo Coverages

Finding a Topo 7.5" Index

- NRCS 2002
- USGS 2012 (pink)
- G-WIS 2000 (teal)

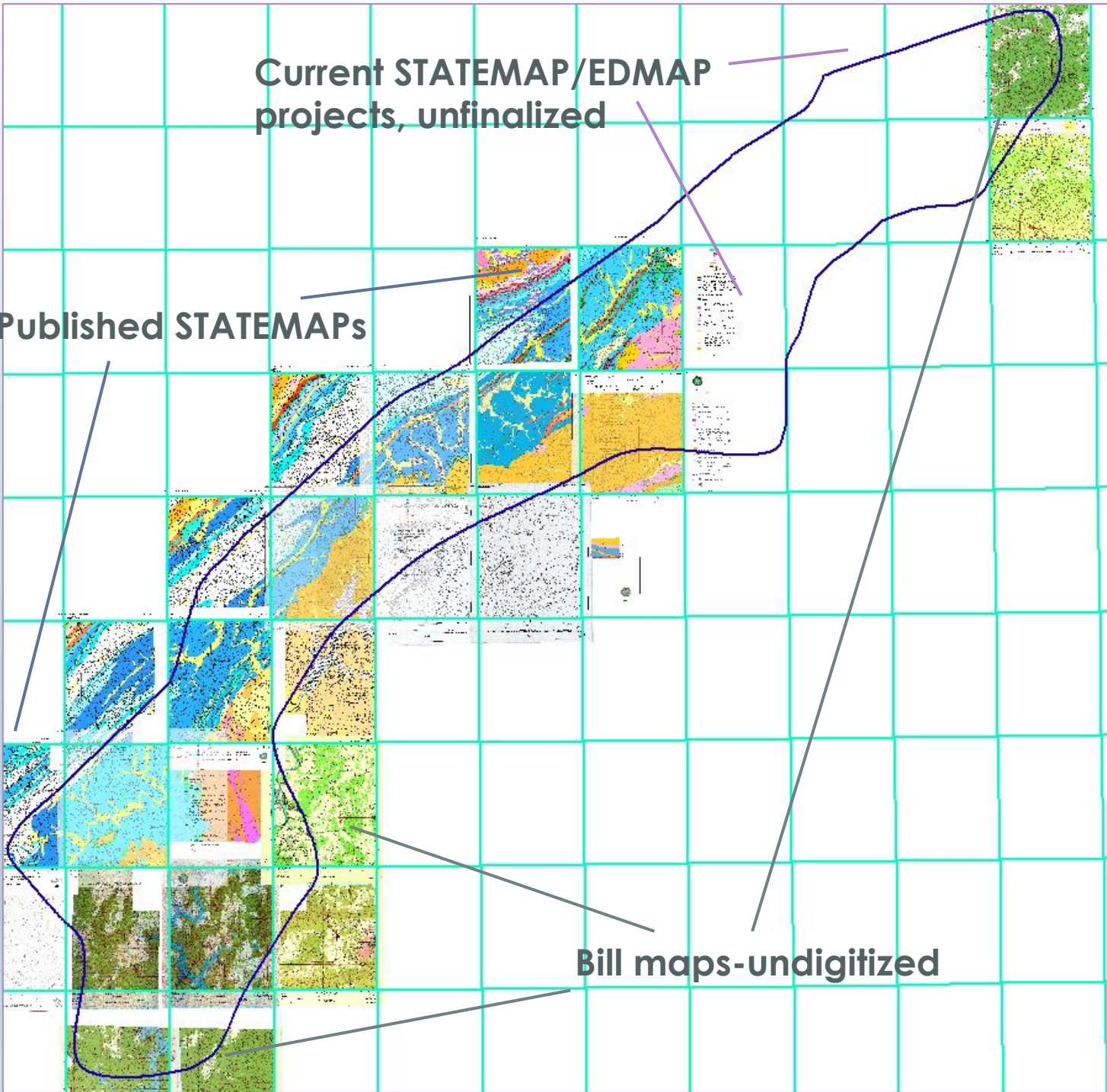


Incongruous Quad Boundaries



1:80,000

Georeferenced maps

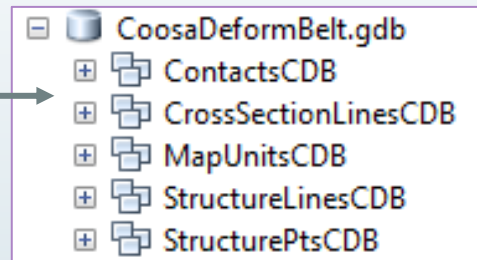
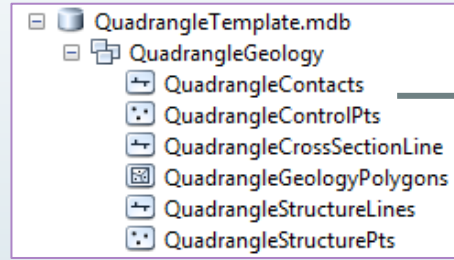


Coosa Deformed Belt: Geodatabase Schema

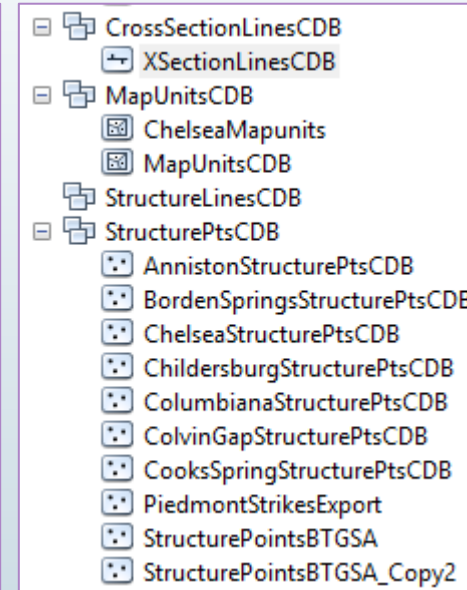
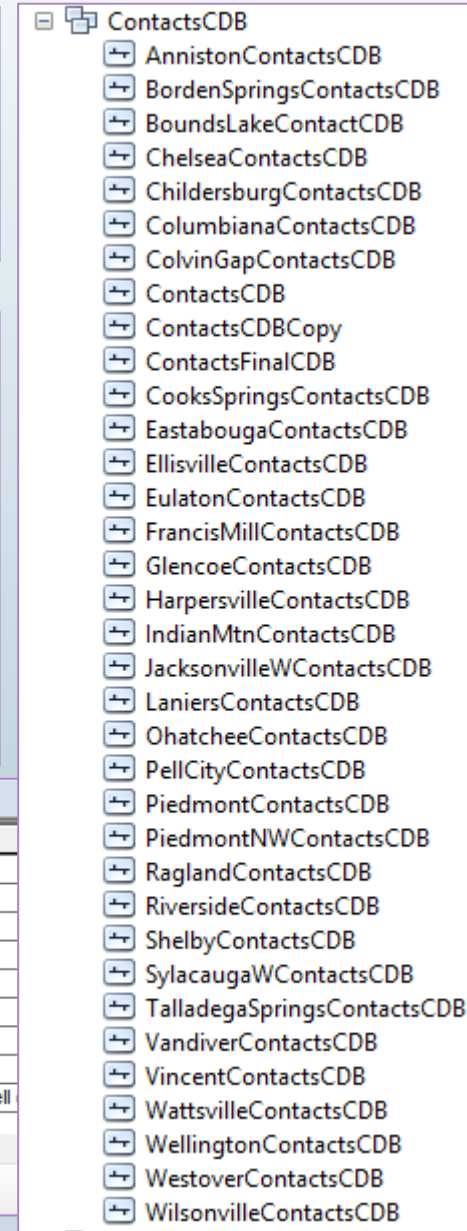
Feature Dataset for each geological feature type

Each feature class has the fields XTypeCDB, QuadName, and Notes

Loaded all structure pt. data into one feature class



Point_Type	Azimuth_Strike	Dip	QuadName	Notes
Bedding	165	30	Columbiana	<Null>
Vertical bedding	25	90	Columbiana	<Null>
Bedding	22	15	Columbiana	<Null>
Bedding	22	85	Columbiana	<Null>
Bedding	20	15	Columbiana	<Null>
Bedding	23	44	Shelby	<Null>
Overtured bedding	297	20	Shelby	<Null>
Overtured bedding	55	14	Shelby	<Null>
Overtured bedding	101	44	Shelby	<Null>
Bedding	154	22	Shelby	<Null>
Overtured bedding	35	65	Shelby	<Null>
Overtured bedding	288	42	Shelby	<Null>



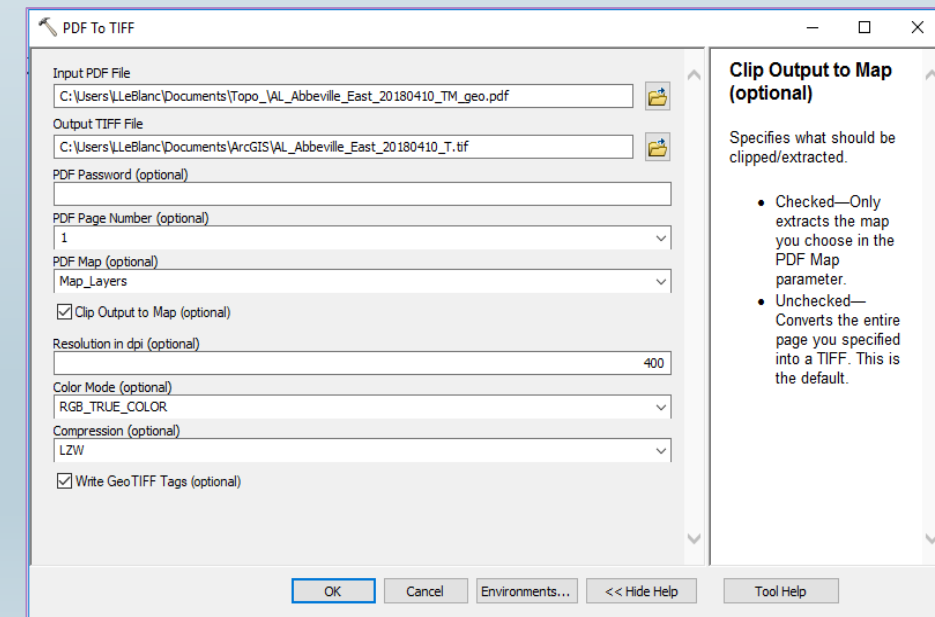
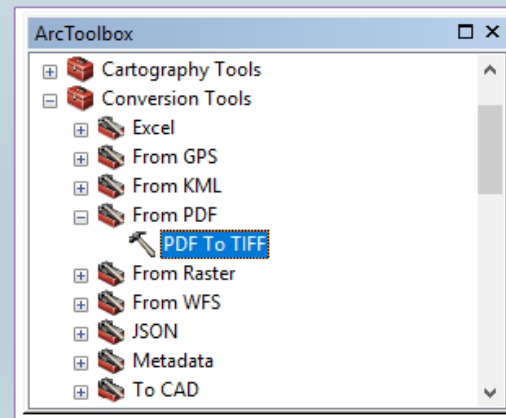
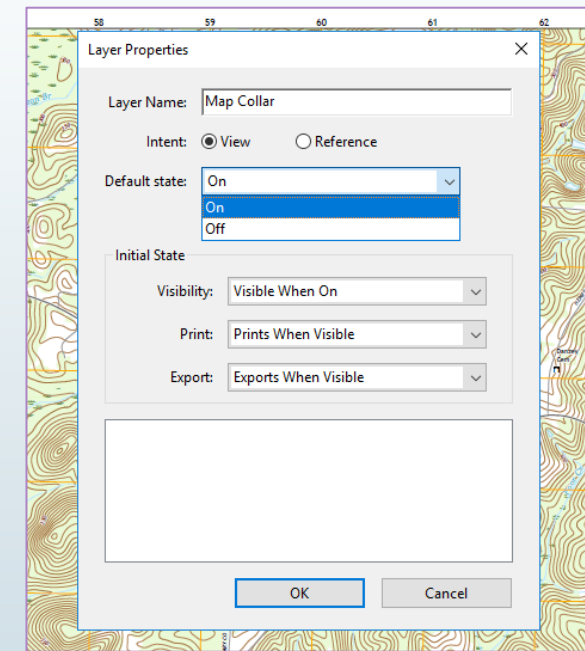
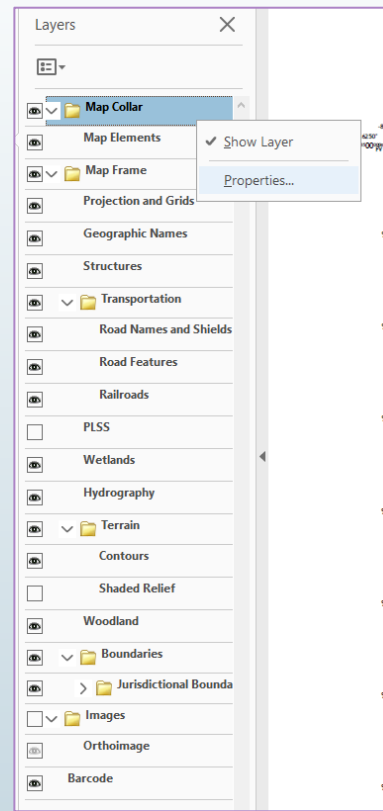
No more personal geodatabases!

LineTypeCDB	Name	QuadName	Notes
Thrust fault, approximately located	<Null>	Chelsea	<Null>
Thrust fault, approximately located	<Null>	Chelsea	<Null>
Thrust fault, approximately located	Yellowleaf Fault	Chelsea, Westover	not sure if yellowleaf fault
Thrust fault, approximately located	Yellowleaf Fault ?	Westover	Ppvl vs. Ppv not sure if yellowleaf fault
Thrust fault, approximately located	Yellowleaf Fault ?	Westover	can't tell where it ocontinues on
Thrust fault, approximately located	Yellowleaf Fault	Westover, Vandiver, Vincent	<Null>
Thrust fault, approximately located	Yellowleaf Fault	Vincent, Cooks Springs	Cooks Springs quad refers to it as Yellowleaf Fault?
Thrust fault, approximately located	Pell City Fault	Harpersville, Vincent, Laniers	unsmoothed
Thrust fault, approximately located	Pell City Fault	Harpersville, Vincent	Wedge of fault, in Vincent it is not referred to as the pell
Thrust fault, approximately located	Pell City Fault	Laniers, Pell City	unsmoothed. barbs to the right/down

(0 out of 188 Selected)

Topo Basemap...for now

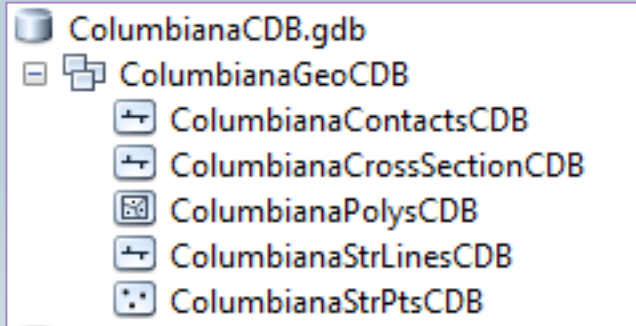
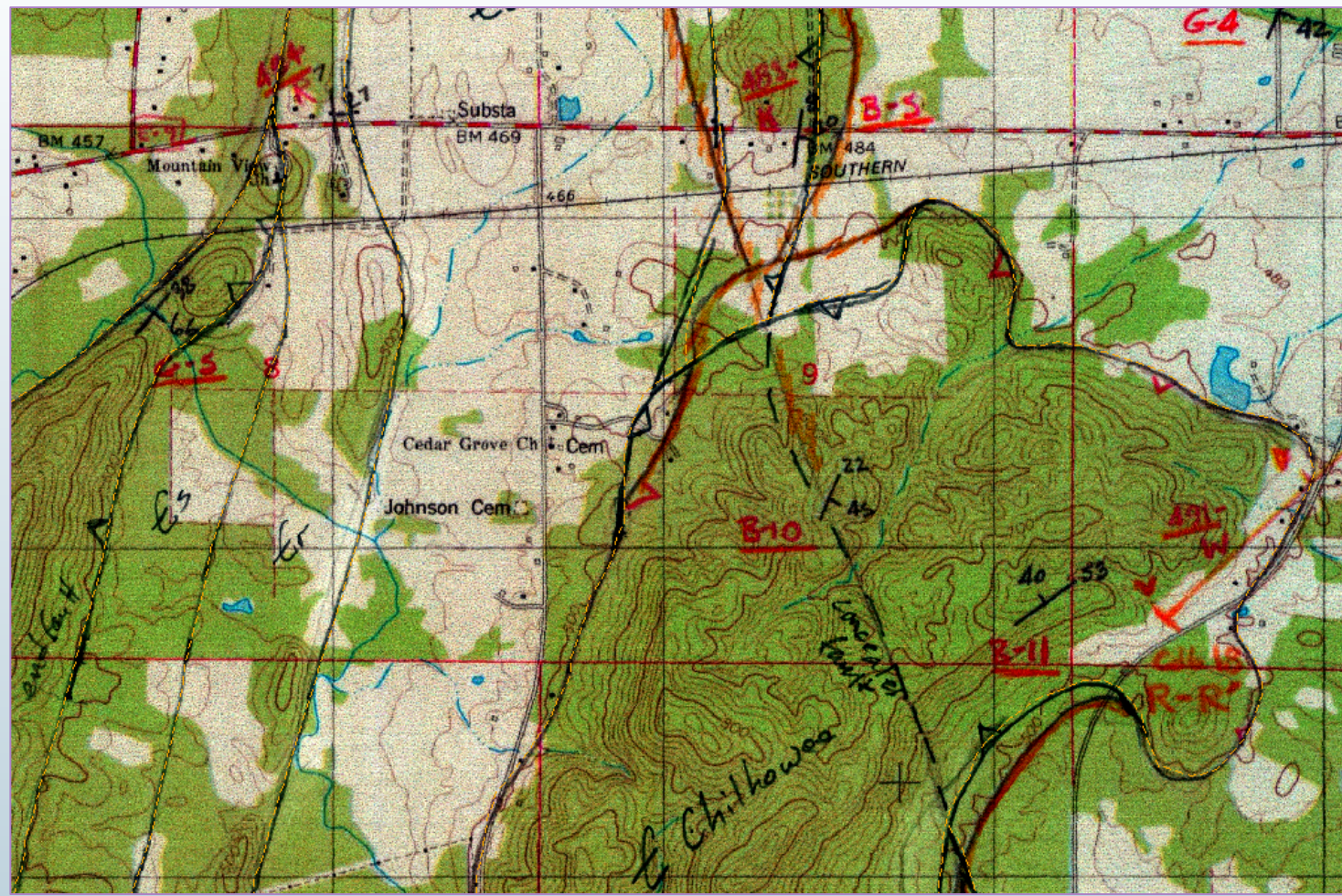
- 7.5' Topographic maps (historical and otherwise) have been the primary base-map used at the Survey
- Easier to compare maps with alike base-maps for georeferencing and Bill's edits
- Used 2018 USGS geopdf's with colored layers turned off
- Had to clip white collar



Contacts and Faults

No GIS

- Scan Bill's maps
- Georeference to the 7.5' G-WIS Index
- Rectify the quad to lock-in the projection
- Digitize the data using the same format as the Quad Template w/new fields LineTypeCDB and Notes in a new file gdb



ColumbianaContactsCDB						
	OBJECTID *	SHAPE *	LineType	LineTypeCDB	Name	Notes
▶	2	Polyline	Contact, approximately located	Contact, approximately located	<Null>	<Null>
	3	Polyline	Thrust fault, approximately located	Thrust fault, approximately located	<Null>	<Null>
	4	Polyline	Thrust fault, approximately located	Thrust fault, approximately located	<Null>	<Null>
	5	Polyline	Thrust fault, approximately located	Thrust fault, approximately located	<Null>	<Null>
	6	Polyline	Contact, approximately located	Contact, approximately located	<Null>	<Null>
	7	Polyline	Thrust fault, approximately located	Thrust fault, approximately located	<Null>	<Null>
	8	Polyline	Contact, approximately located	Contact, approximately located	<Null>	<Null>

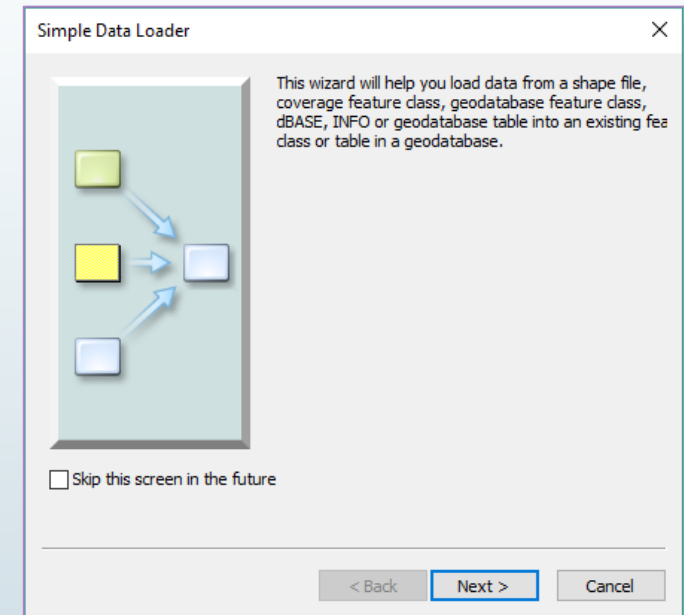
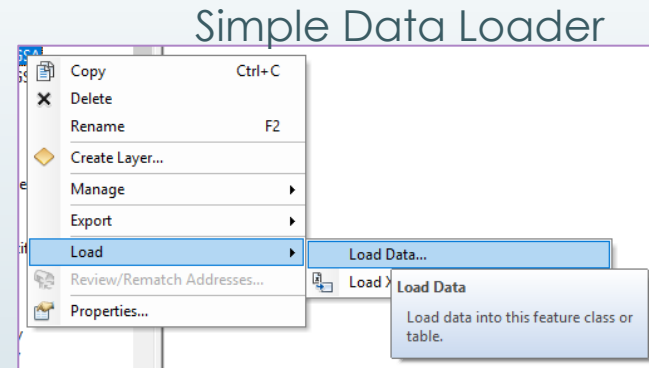
Navigation icons: ◀ ▶ | 1 ▶ ▶▶ | (0 out of 45 Selected)

Contacts and Faults

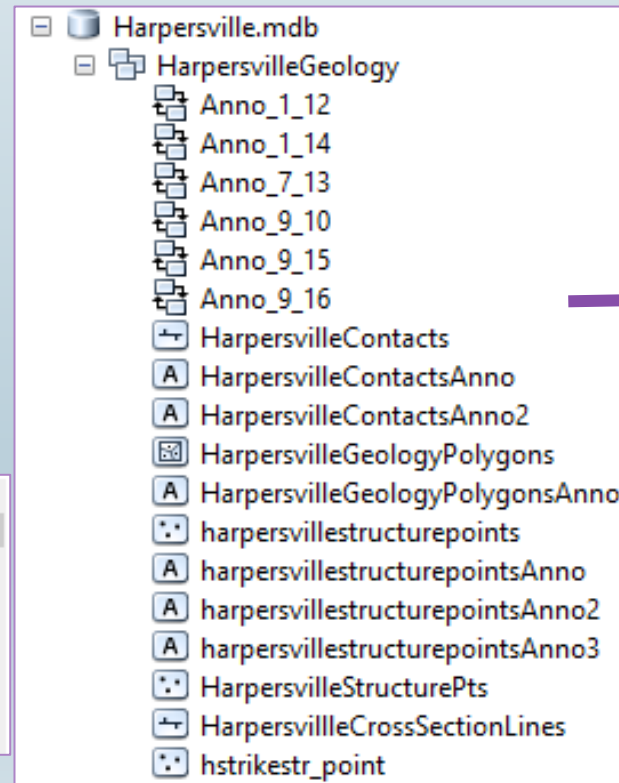
GIS Exists

- Create new file gdb: QuadNameCDB
- Load data into new file gdb from old personal mdb Quad Template
- Add attributes of LineTypeCDB and Notes field
- Georeference published quad series plate to 7.5' Index (for comparing) and rectify
- Get rid of all Qal contacts and quad boundaries
- Calculate field of LineTypeCDB to "X, approximately located"
- Add topology rules

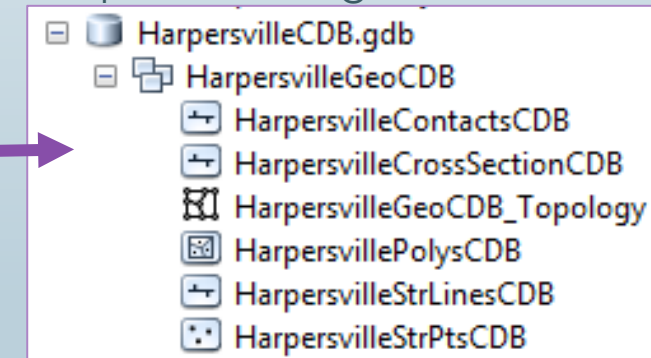
Field Name	Data Type
OBJECTID	Object ID
SHAPE	Geometry
LineType	Text
LineTypeCDB	Text
Name	Text
Notes	Text
SHAPE_Length	Double



Original Quad personal database



Simplified CDB geodatabase

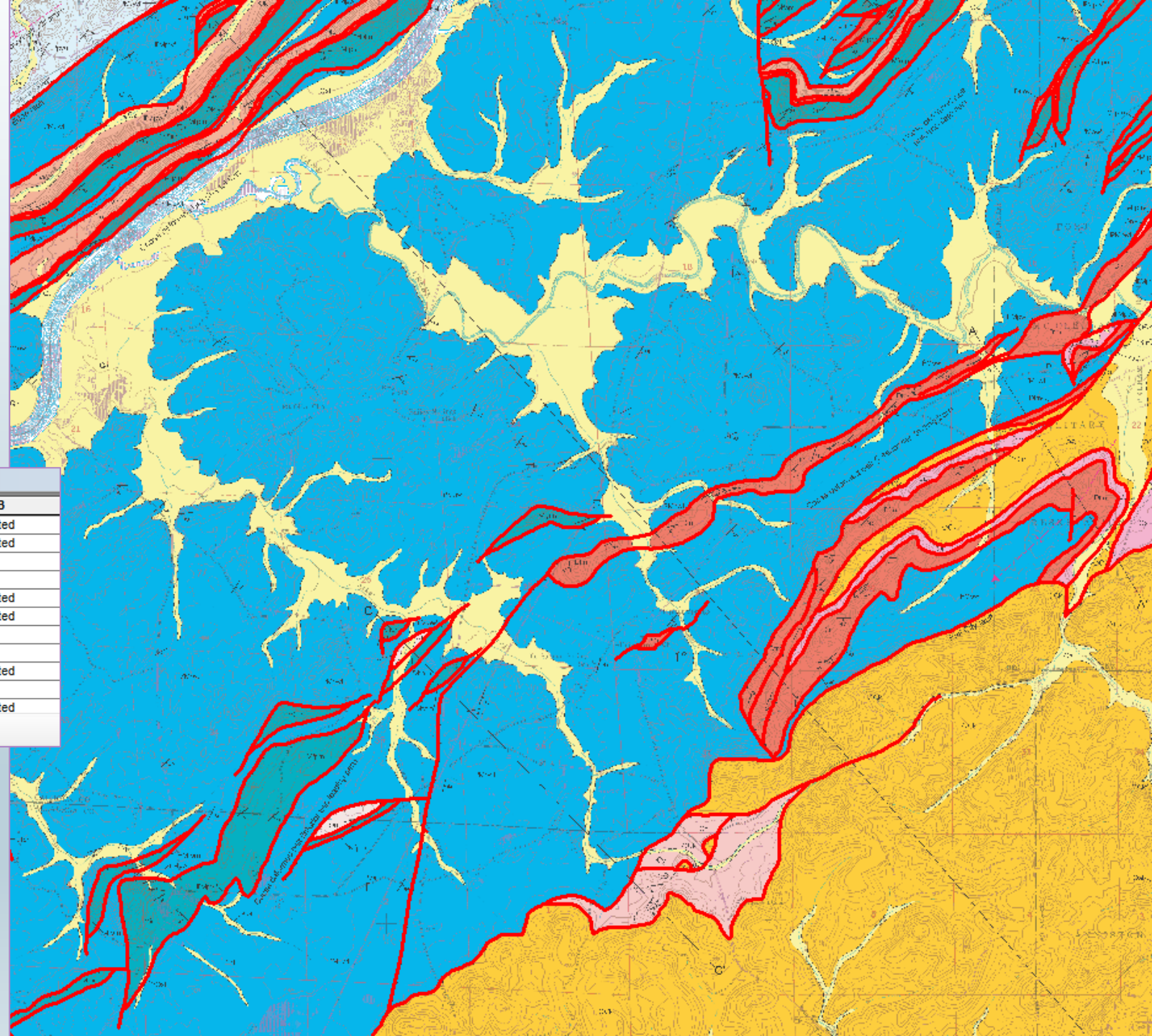


Excluded annotations and cross-section lines

Contacts and Faults

GIS Exists: The Result

Contacts continue across Qal



FrancisMillContactsCDB

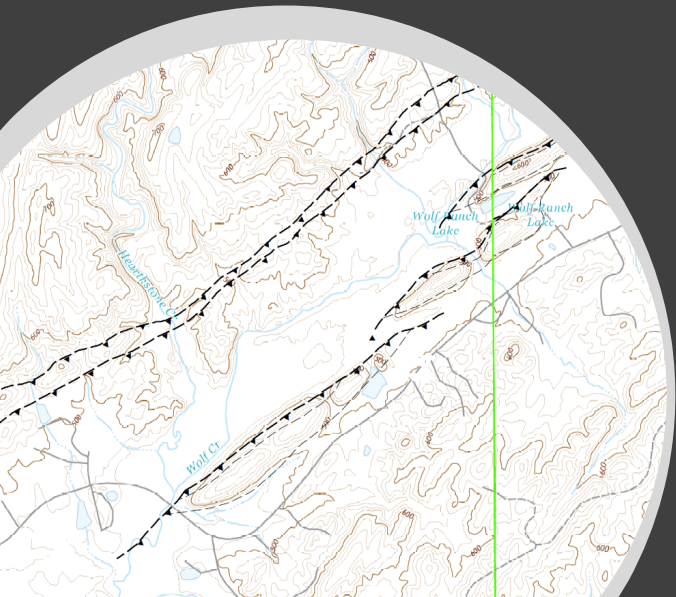
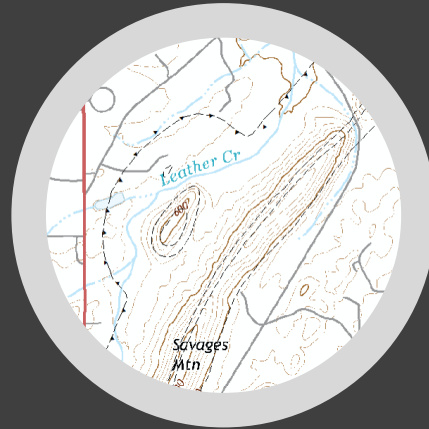
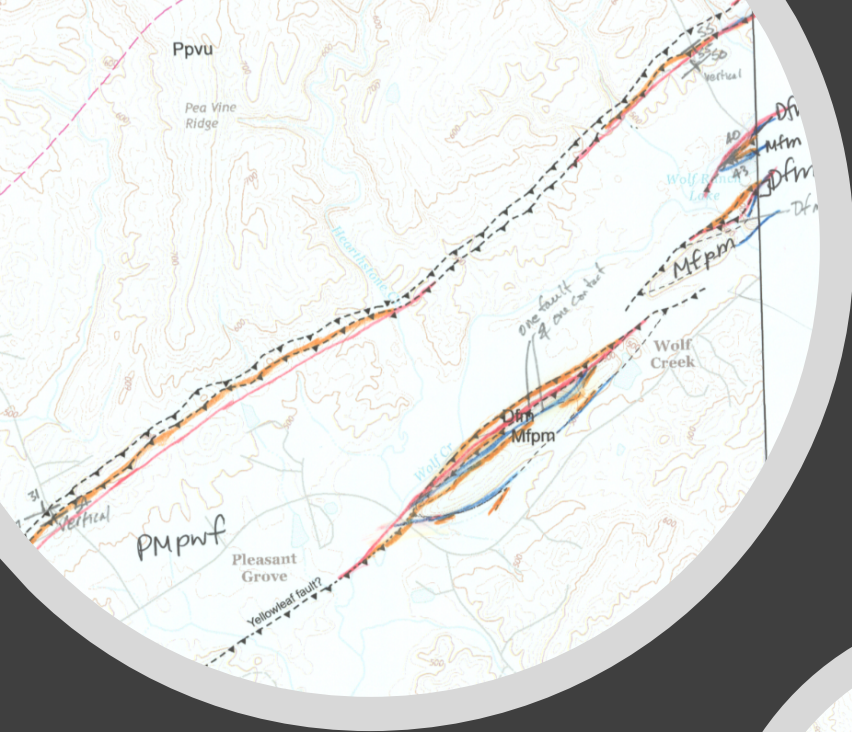
OBJECTID*	SHAPE*	LineType	LineTypeCDB
165	Polyline	Thrust fault, concealed	Thrust fault, approximately located
166	Polyline	Thrust fault, concealed	Thrust fault, approximately located
167	Polyline	Contact, concealed	Contact, approximately located
168	Polyline	Contact, concealed	Contact, approximately located
169	Polyline	Thrust fault, concealed	Thrust fault, approximately located
170	Polyline	Thrust fault, concealed	Thrust fault, approximately located
171	Polyline	Contact, concealed	Contact, approximately located
172	Polyline	Contact, concealed	Contact, approximately located
173	Polyline	Thrust fault, concealed	Thrust fault, approximately located
174	Polyline	Contact, concealed	Contact, approximately located
175	Polyline	Thrust fault, concealed	Thrust fault, approximately located

1 (0 out of 290 Selected)

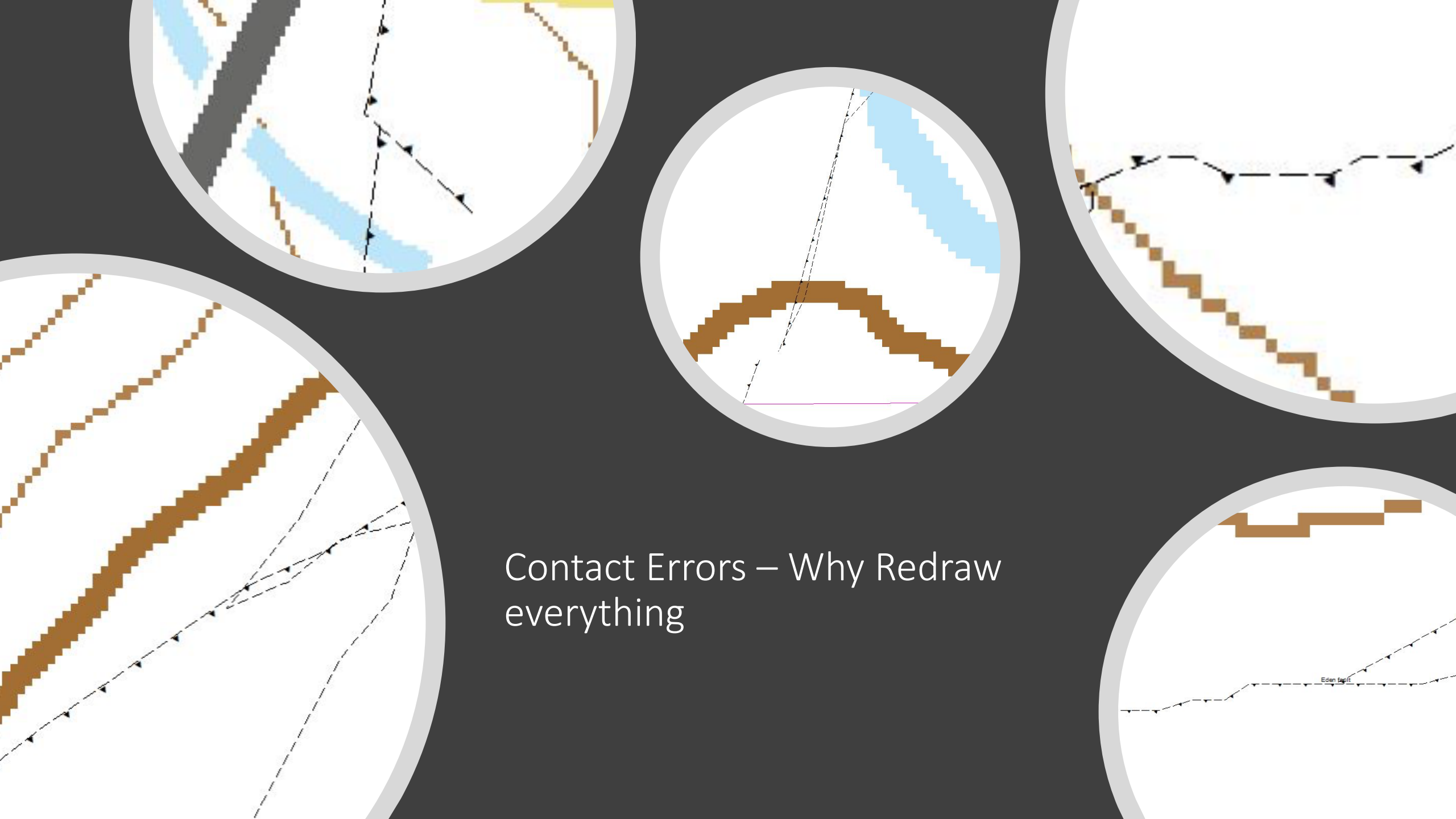
Qal vs. no Qal Contacts and Faults



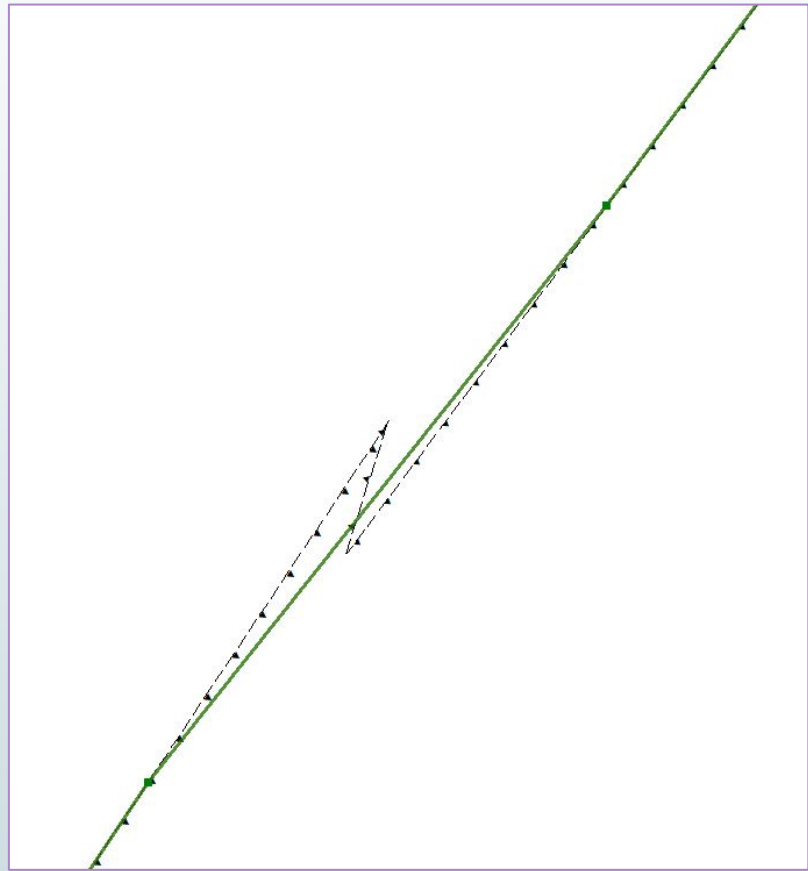
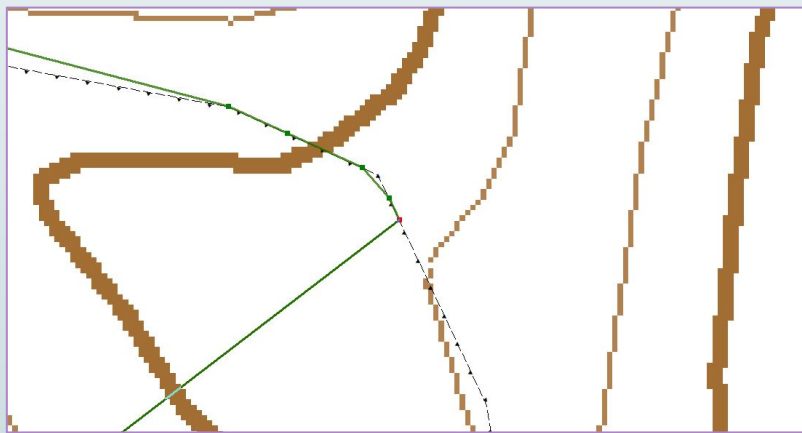
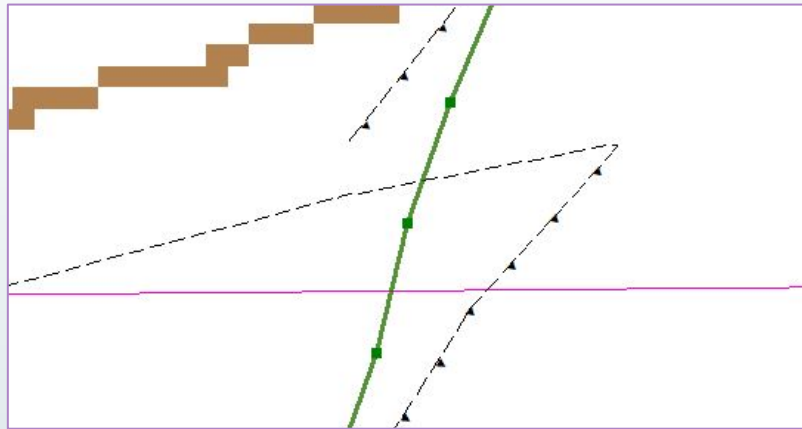
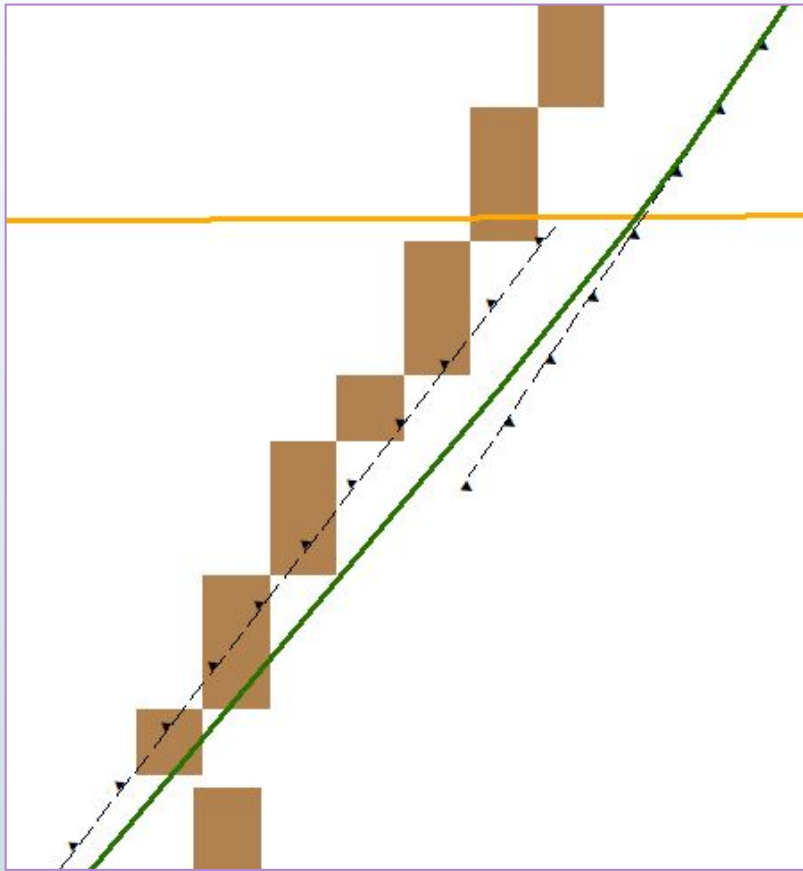
Contacts and Faults, Bill edits



- Print map at 1:24,000 only contacts and faults with USGS topo basemaps
 - Easier to compare maps with alike basemaps, topographic maps are the primary base-map used at the Survey
- Bill reviews and marks corrections
- Make changes and load into the CDB geodatabase
- Re-draw all contacts and faults across the quads



Contact Errors – Why Redraw everything

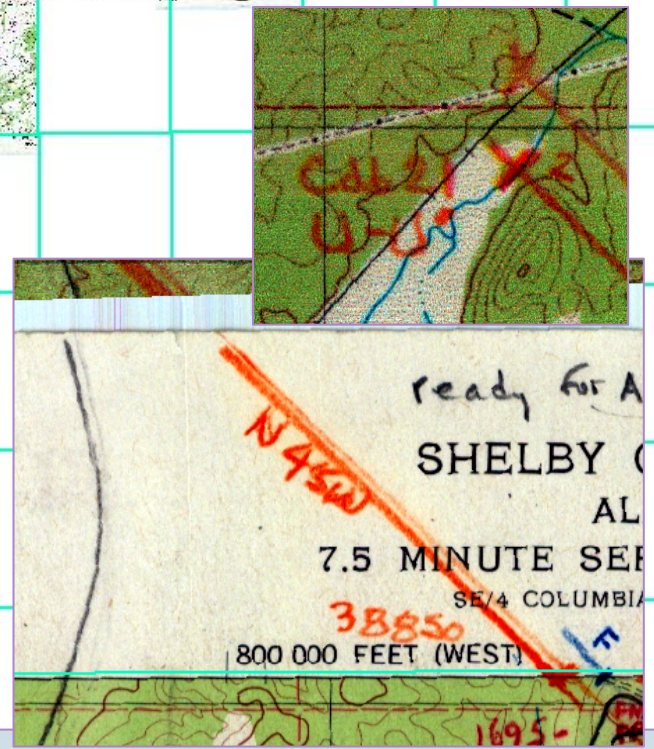
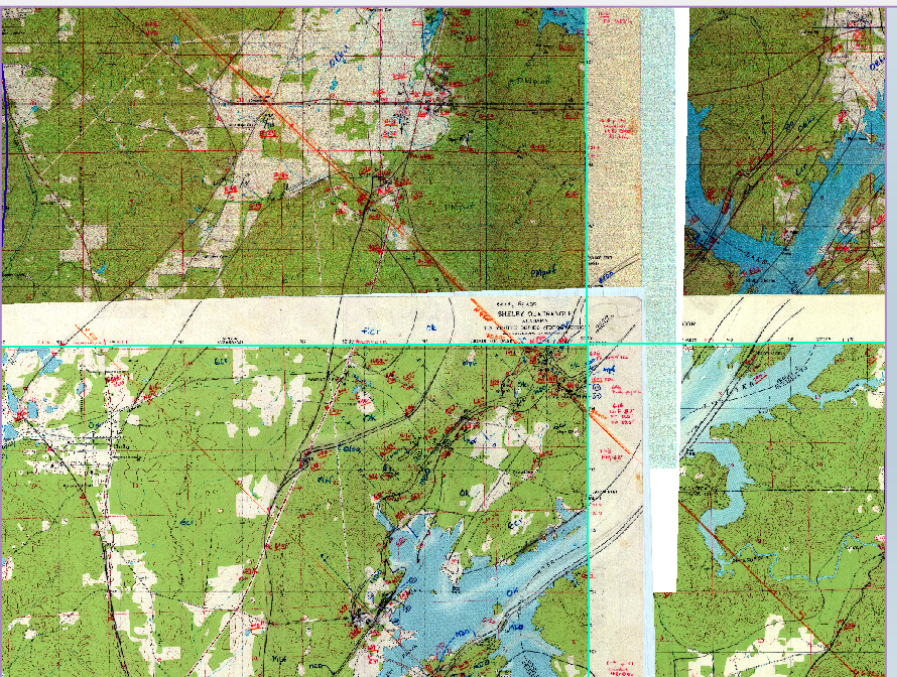
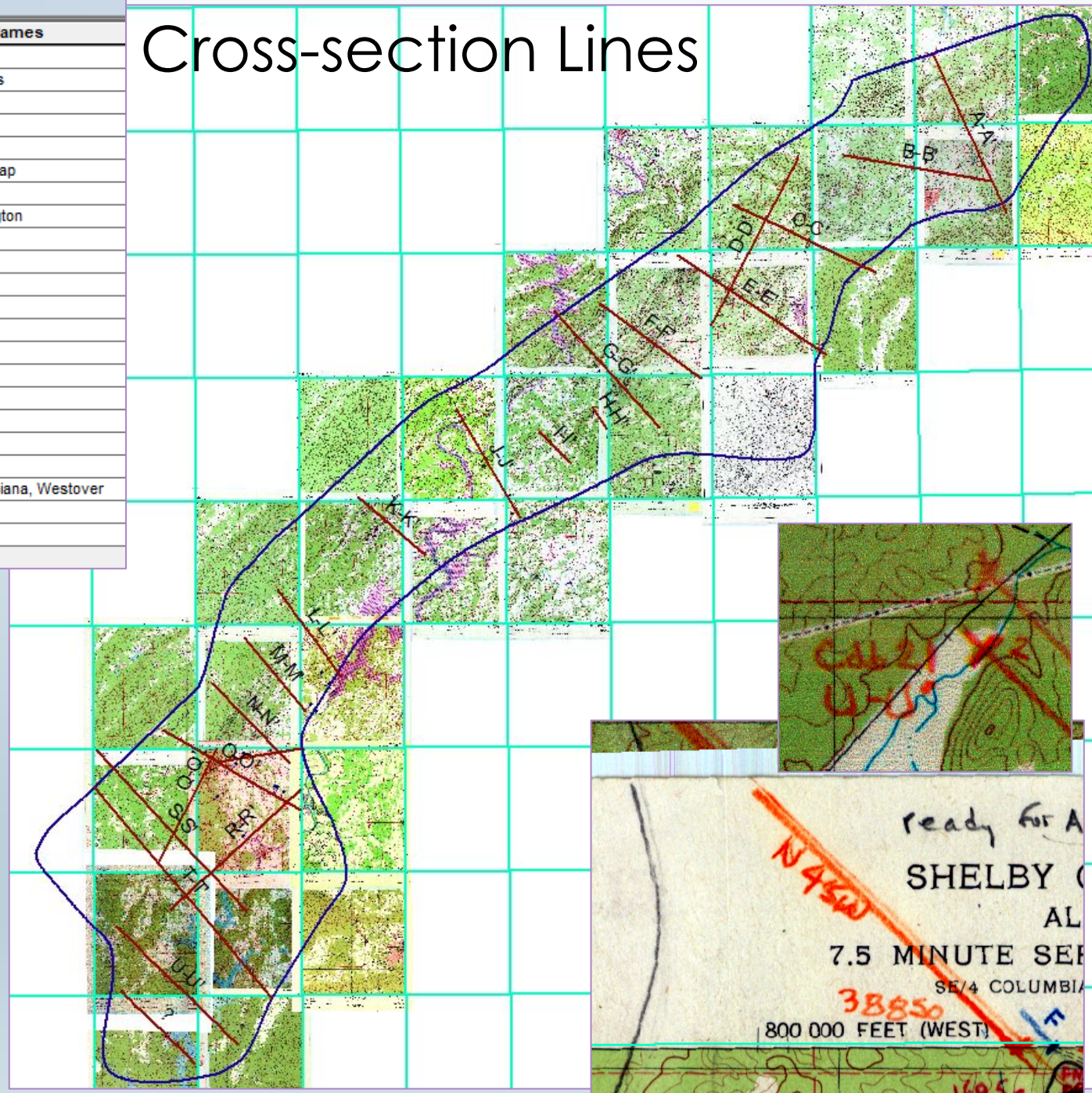


Snap to CDB boundary, smooth and simplify tool, eliminate jaggedness of legacy formats, and create continuous contacts across quad boundaries. Run topology.

Re-drawing: contacts and faults fixes

OBJECTID *	SHAPE *	LineTypeCDB	CrossSectionLabel	Trend	QuadNames
1	Polyline	Cross section	?	N45W	Columbiana, Shelby
2	Polyline	Cross section	U-U'	N45W	Columbiana, Shelby, Talladega Springs
3	Polyline	Cross section	L-L'	?	Cooks Springs, Laniers
4	Polyline	Cross section	D-D'	<Null>	Jacksonville W, Colvin Gap
7	Polyline	Cross section	A-A'	N24W	Piedmont, Ellisville
8	Polyline	Cross section	C-C'	N64W	Jacksonville E, Piedmont NW, Colvin Gap
9	Polyline	Cross section	B-B'	N79W	Piedmont NW, Piedmont
11	Polyline	Cross section	E-E'	?	Jacksonville E, Jacksonville W, Wellington
12	Polyline	Cross section	G-G'	?	Eulaton, Wellington, Ohatchee
13	Polyline	Cross section	I-I'	?	Francis Mill
15	Polyline	Cross section	J-J'	?	Eastaboga, Ragland, Francis Mill
16	Polyline	Cross section	K-K'	?	Riverside, Pell City, Wattsville
17	Polyline	Cross section	M-M'	?	Vincent, Laniers
18	Polyline	Cross section	N-N'	<Null>	Vincent, Harpersville
19	Polyline	Cross section	O-O'	<Null>	Vandiver, Harpersville
20	Polyline	Cross section	P-P'	<Null>	Harpersville
22	Polyline	Cross section	R-R'	<Null>	Columbiana, Harpersville
23	Polyline	Cross section	S-S'	N43W	Westover, Harpersville, Wilsonville
24	Polyline	Cross section	F-F'	<Null>	Eulaton, Wellington, Ohatchee
26	Polyline	Cross section	T-T'	N40W	Talladega Springs, Wilsonville, Columbiana, Westover
27	Polyline	Cross section	Q-Q'	<Null>	Harpersville, Westover
28	Polyline	Cross section	H-H'	<Null>	Francis Mill

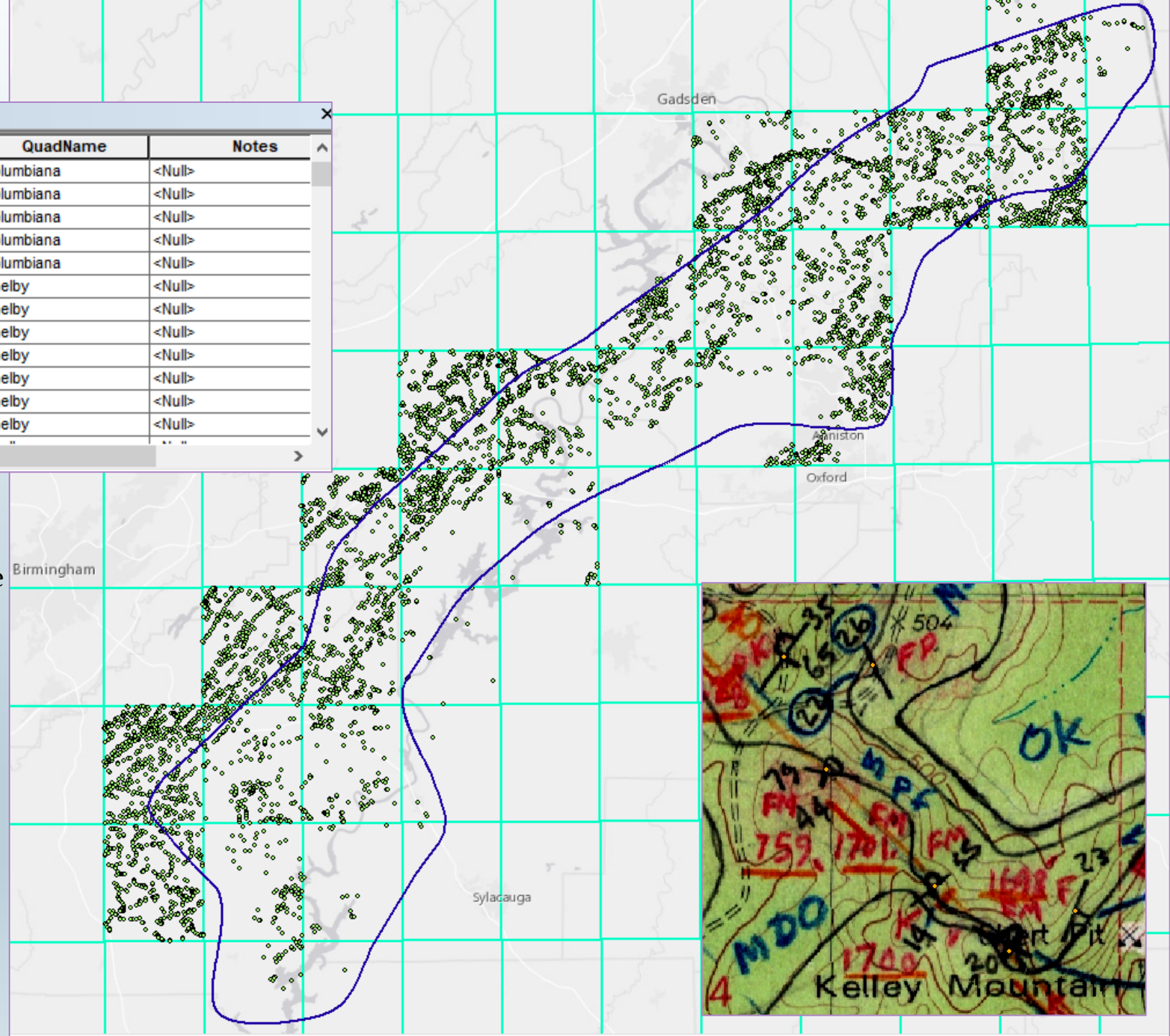
Cross-section Lines



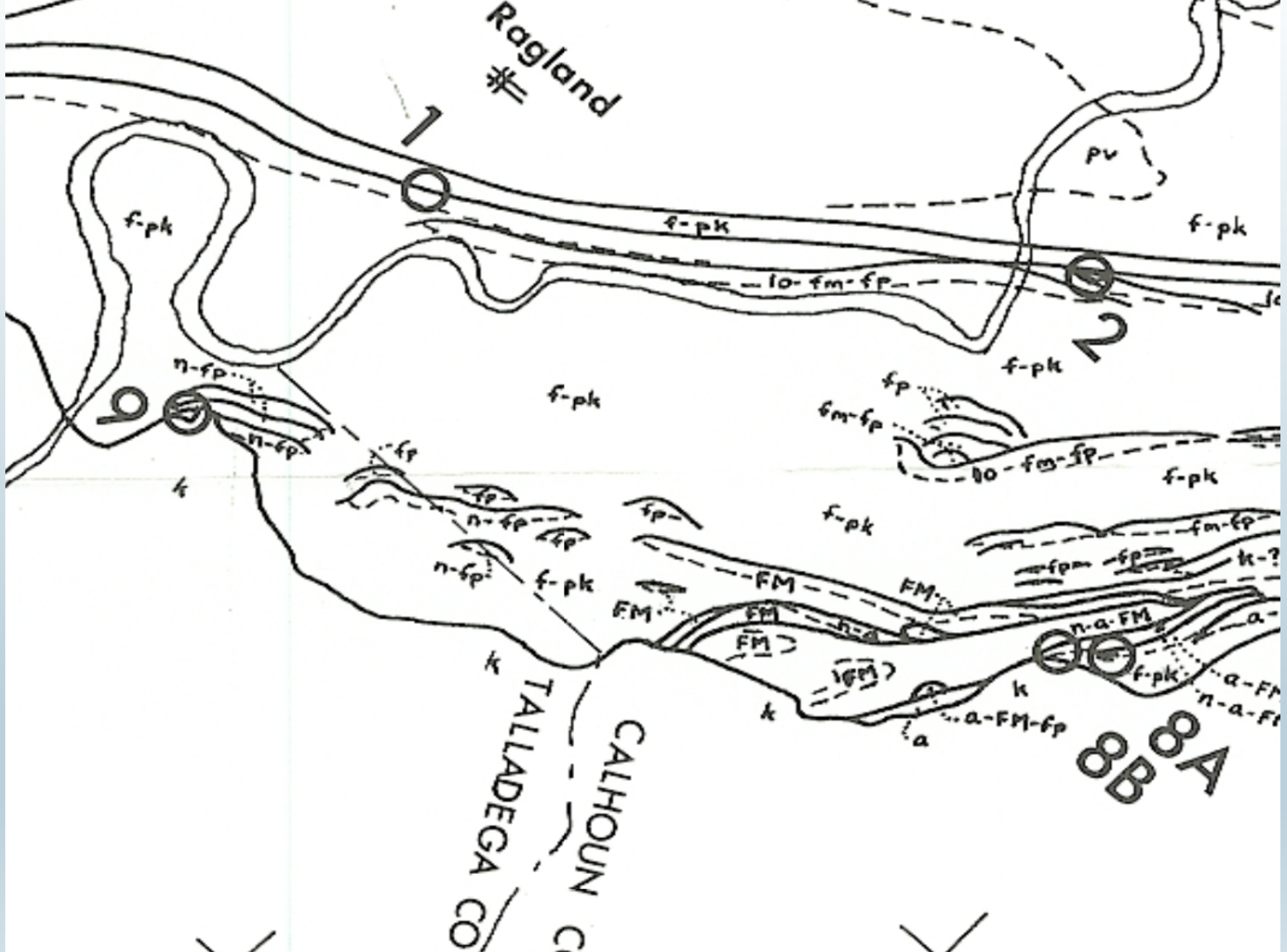
Structure points

StructurePointsBTGSA

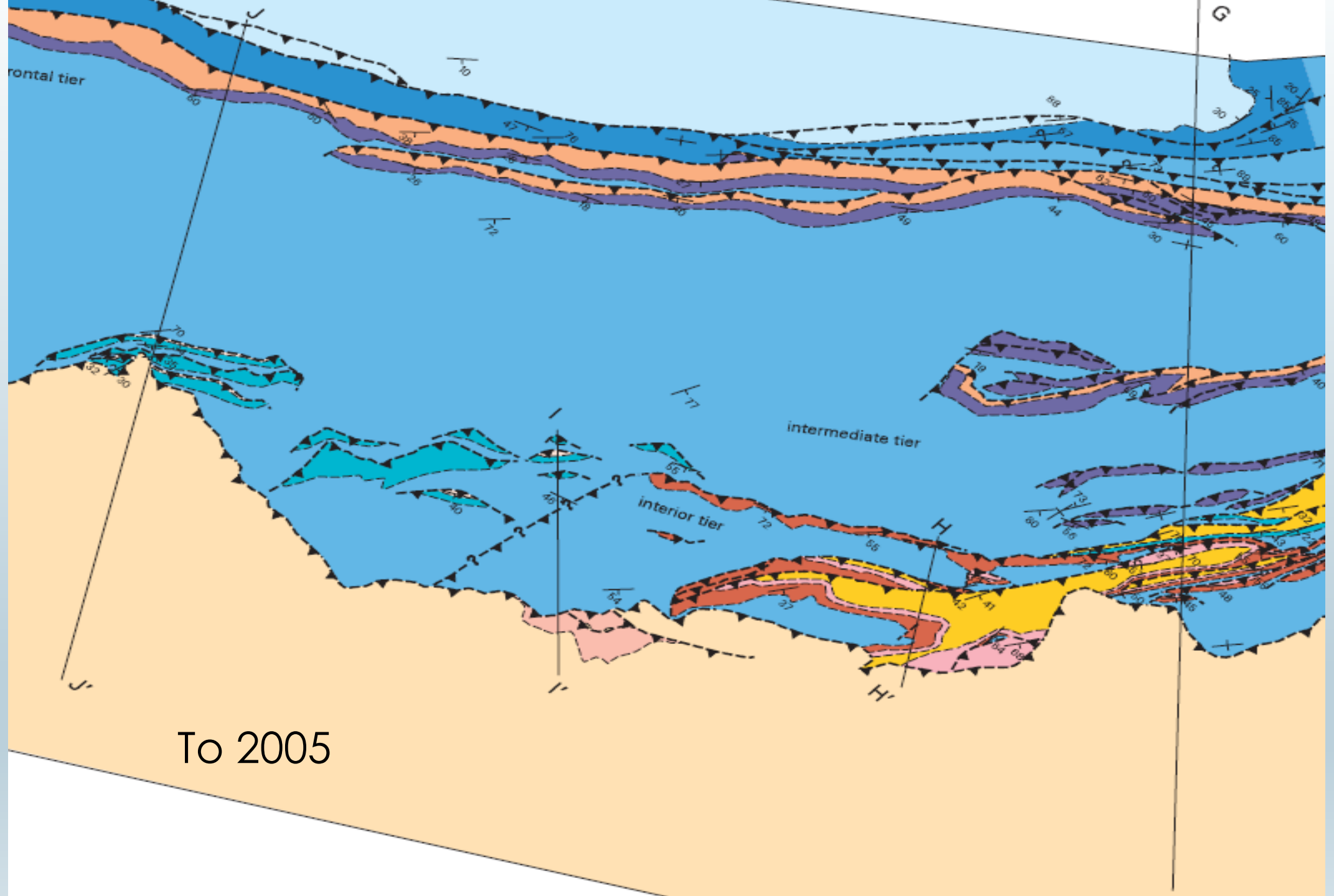
OBJECTID *	SHAPE *	Point_Type	Azimuth_Strike	Dip	QuadName	Notes
73	Point	Bedding	165	30	Columbiana	<Null>
74	Point	Vertical bedding	25	90	Columbiana	<Null>
75	Point	Bedding	22	15	Columbiana	<Null>
76	Point	Bedding	22	85	Columbiana	<Null>
77	Point	Bedding	20	15	Columbiana	<Null>
78	Point	Bedding	23	44	Shelby	<Null>
79	Point	Overtured bedding	297	20	Shelby	<Null>
80	Point	Overtured bedding	55	14	Shelby	<Null>
81	Point	Overtured bedding	101	44	Shelby	<Null>
82	Point	Bedding	154	22	Shelby	<Null>
83	Point	Overtured bedding	35	65	Shelby	<Null>
84	Point	Overtured bedding	288	42	Shelby	<Null>



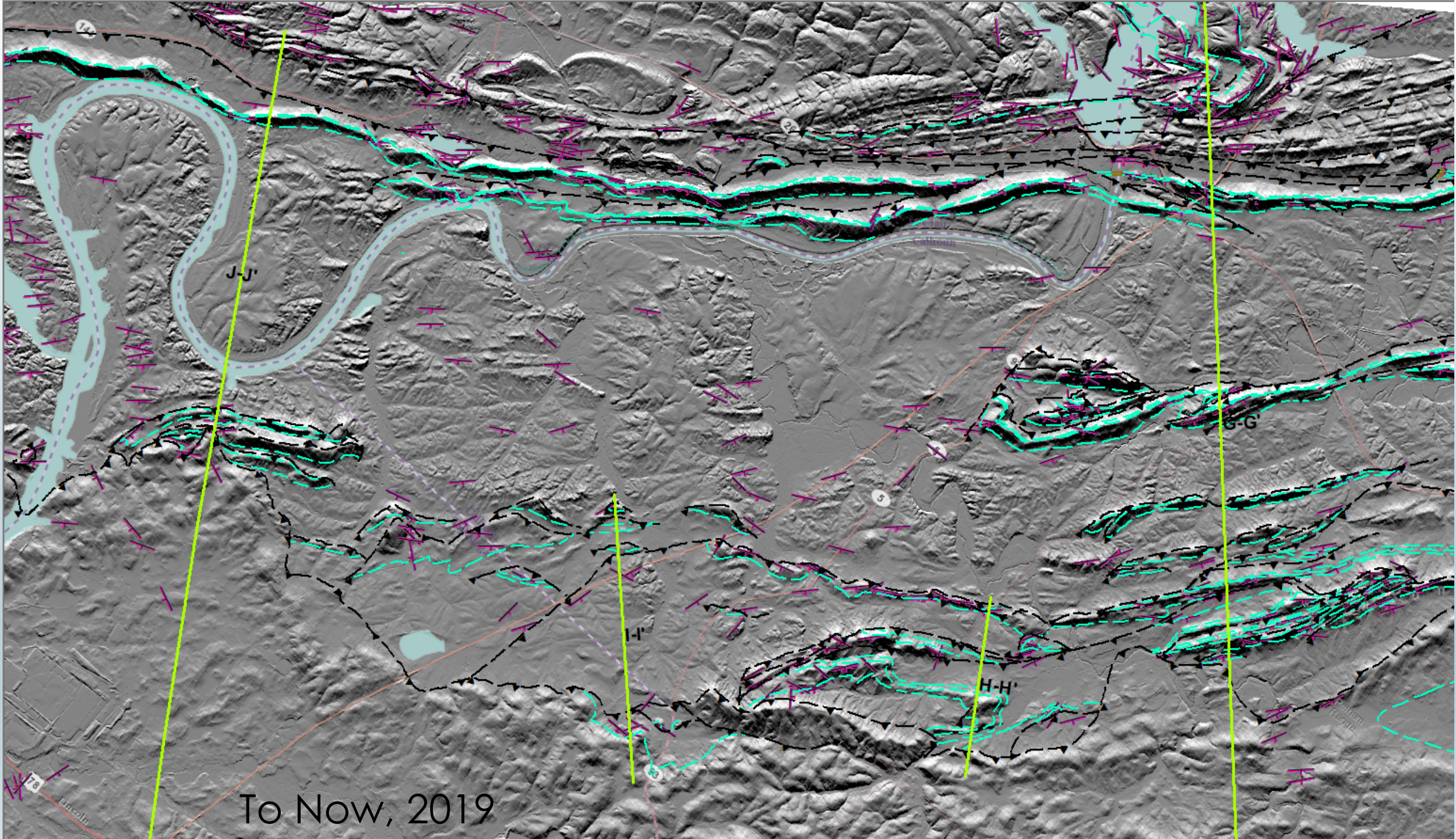
- No GIS: Pulled structure point data from georeferenced scans
 - Some had no strike values – had to measure on map
- W/GIS: Loaded the structure point feature classes from each quad personal database all into one feature class in my CDB geodatabase
- 6758 pts



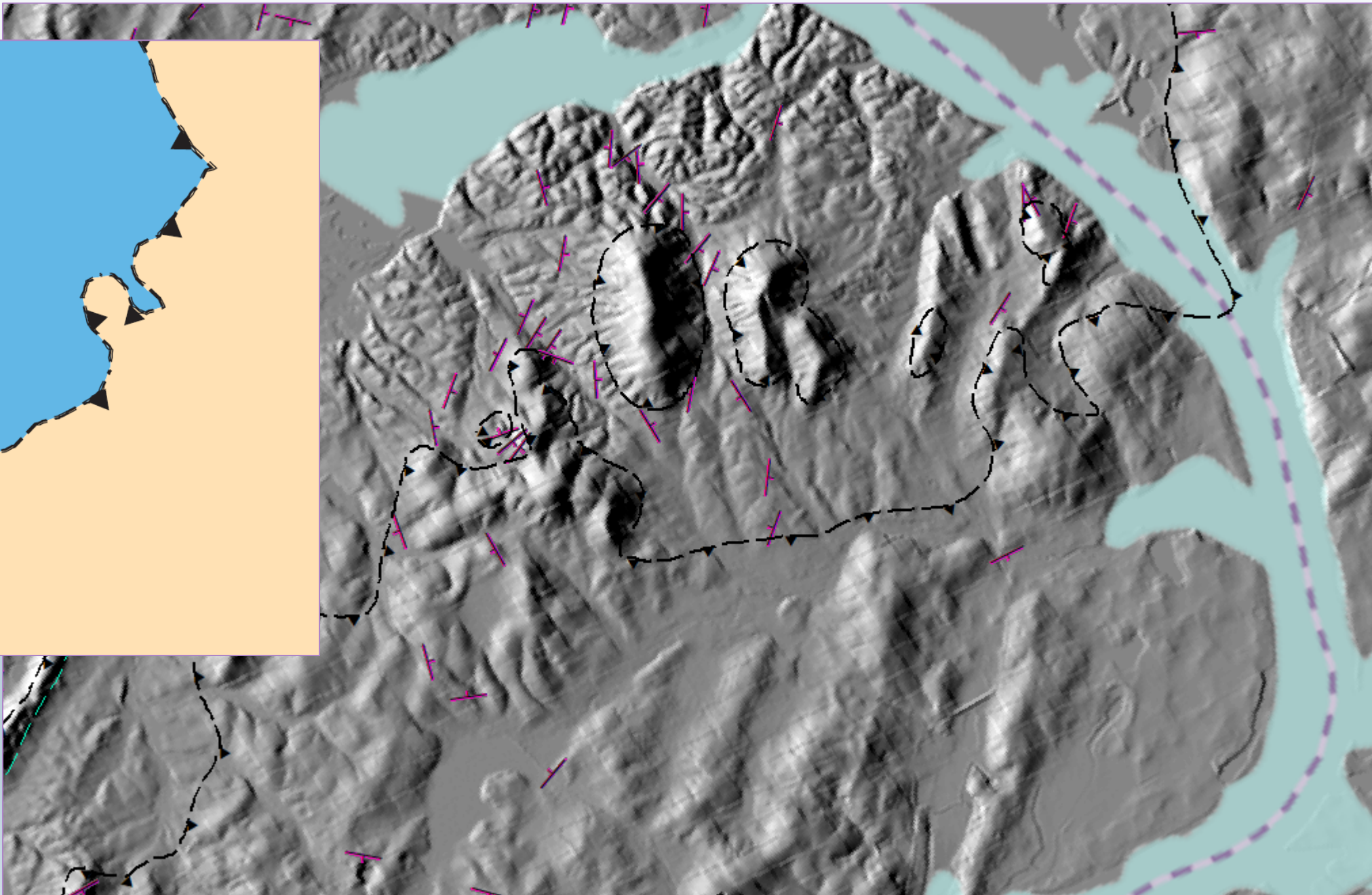
1974, From then



To 2005



To Now, 2019

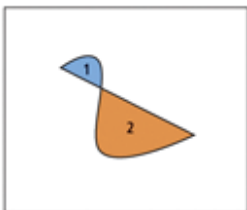
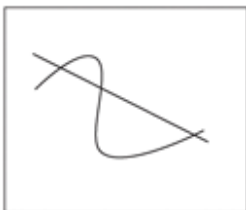


Feature To Polygon

Creates a feature class containing polygons generated from areas enclosed by input line or polygon features.

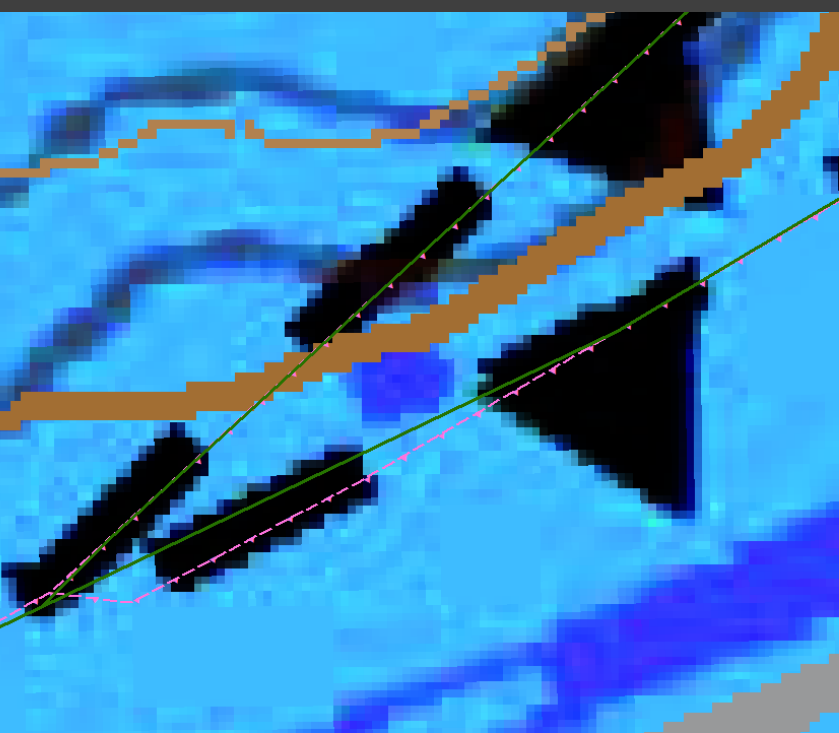
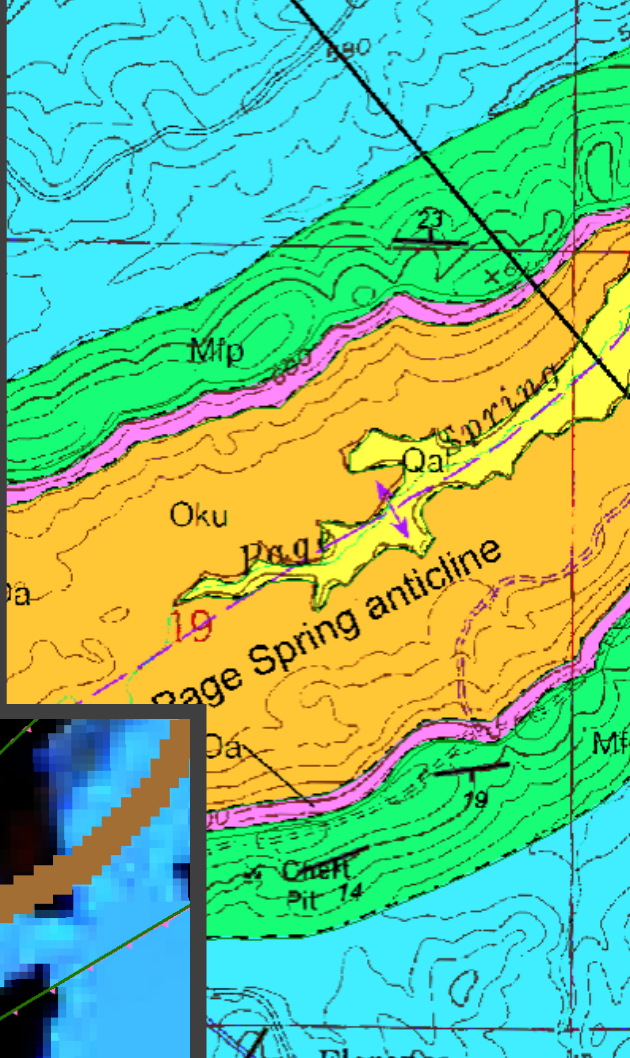
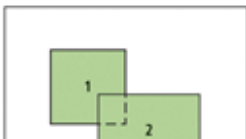
LINE INPUT

OUTPUT



POLYGON INPUT

OUTPUT



Moving Forward

- Finish re-drawing contacts and faults
- Compile structure lines (anticlines and synclines)
- Create map unit layer by using the feature to polygon tool
- Data Symbolization?
- To GeMS?
- Web-app/map

Open in Map Viewer

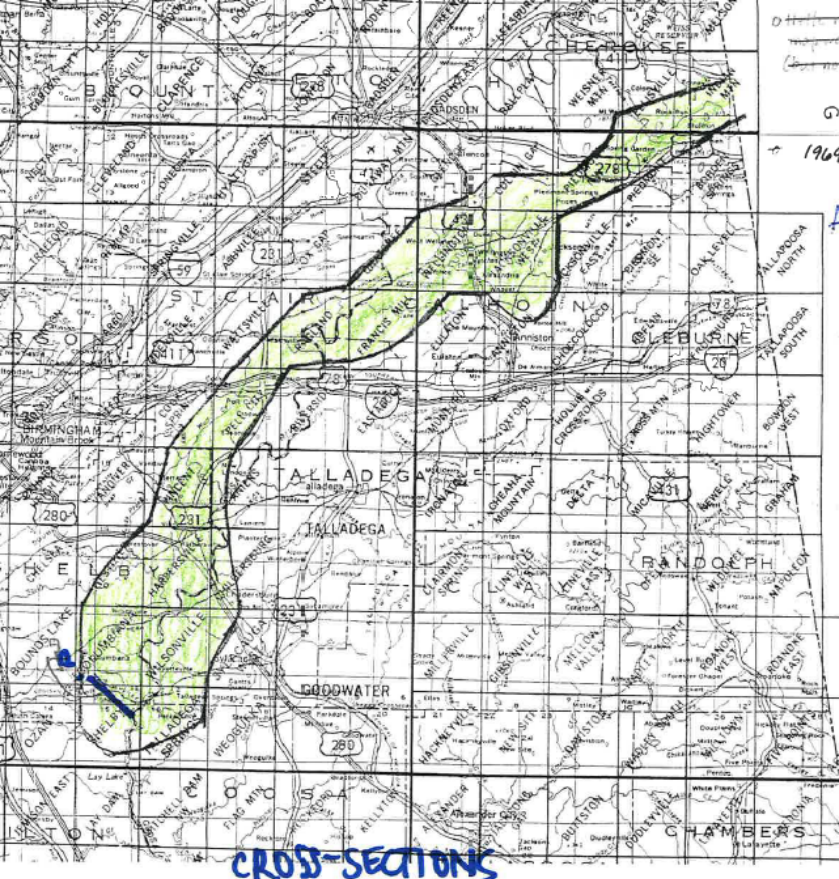
Open in ArcGIS Desktop ▾

Create Presentation

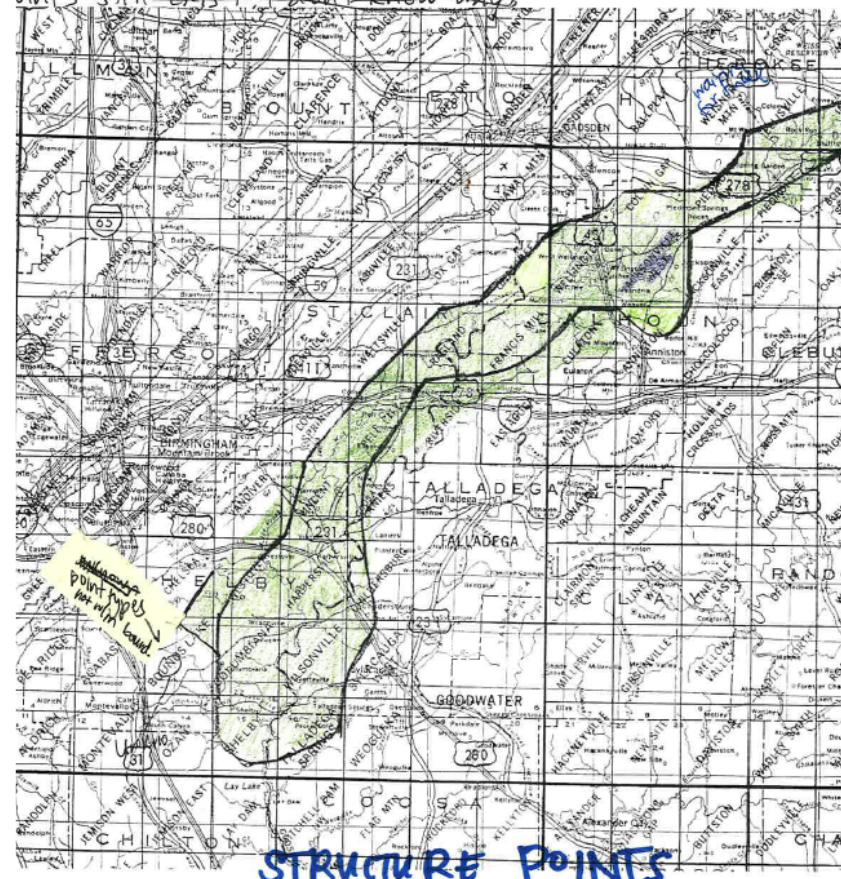
Create Web App ▾

- Using a Template
- Using the Web AppBuilder
- Using Operations Dashboard

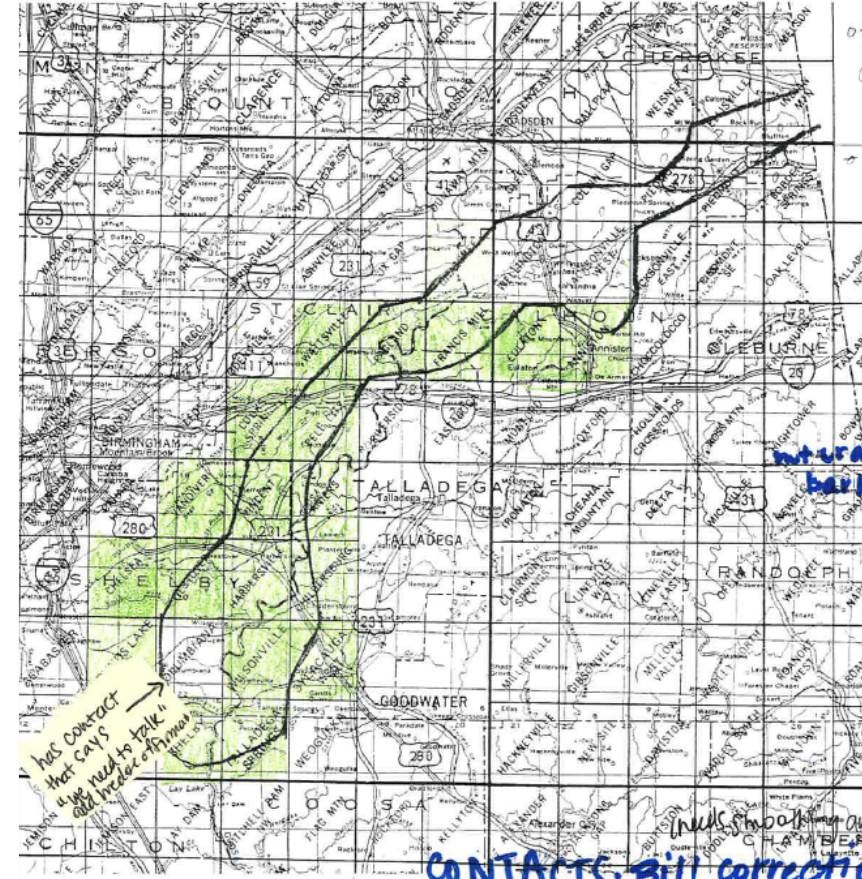
Item Information



CROSS-SECTIONS



STRUCTURE POINTS



CONTACTS all corrected

Questions?

