USGS
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StateMap Forum

2015 1st Quarterly SM Forum

Topic: Cross Sections

March 9, 2015

U.S. Department of the Interior
U.S. Geological Survey

Announcements

- StateMap Award Decision Letters Distributed
- Call for Forum Topics!

USGS

StateMap Awards – Next Steps

- **Remember – The Award Decision Letter is notification only and funds are not available until the award itself is issued.**

- **SINCE YOUR FUNDING IS LESS THAN THE AMOUNT REQUESTED, YOU WILL NEED TO SUBMIT THE FOLLOWING DOCUMENTS:**

1. **Revised form SF 424 (signed since the revision will not be going through grants.gov)**
2. **Revised summary sheet**
3. **Revised budget sheets (itemize all costs providing a budget breakdown especially "salary", "other", "analyses", and "field expenses" items)**
4. **Revised deliverables if they will change**
5. **A summary narrative of what changed is always beneficial**

- **PLEASE SCAN AND SUBMIT THE REVISED INFORMATION VIA EMAIL TO KIM DOVE (KDOVE@USGS.GOV) AS SOON AS POSSIBLE BUT *NO LATER THAN 30 DAYS PRIOR TO YOUR START DATE*. PLEASE WORK DIRECTLY WITH YOUR OFFICE OF SPONSORED PROGRAMS OR CONTRACTS OFFICE TO PREPARE AND SUBMIT THE REVISED FORMS AND INFORMATION. THE REVISED INFORMATION SHOULD NOT BE SUBMITTED ON GRANTS.GOV AS THE PROGRAM ANNOUNCEMENT AS CLOSED. YOUR COOPERATIVE AGREEMENT CANNOT PROCEED UNTIL THESE MATERIALS ARE RECEIVED.**

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All budget costs must be itemized. Failure to do so may delay receipt of your award. Itemize, itemize, itemize!

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CROSS SECTIONS

USGS

Cross sections – Are they required?

- D. Geologic Map Products

- A geologic map is defined as a map that depicts the geographic distribution at the Earth's surface of bedrock and/or surficial geologic materials and structures, on a published base map showing topography, hydrography, culture, cadastral, and other base information. Digital geologic maps may also contain a great variety of point data for specific sites, creating a 3-dimensional database. A geologic map should include: (1) a clear and legible base (include base map credit and map projection), (2) scale and contour interval, (3) north arrow and magnetic declination, (4) title, authorship, publisher, and date, (5) location index map, (6) field data or field data stations, (7) description of map units, (8) explanation of map symbols, and (9) unit symbols on map. A geologic map may also include correlation or sequence of map units, stratigraphic columns, cross sections, and text.

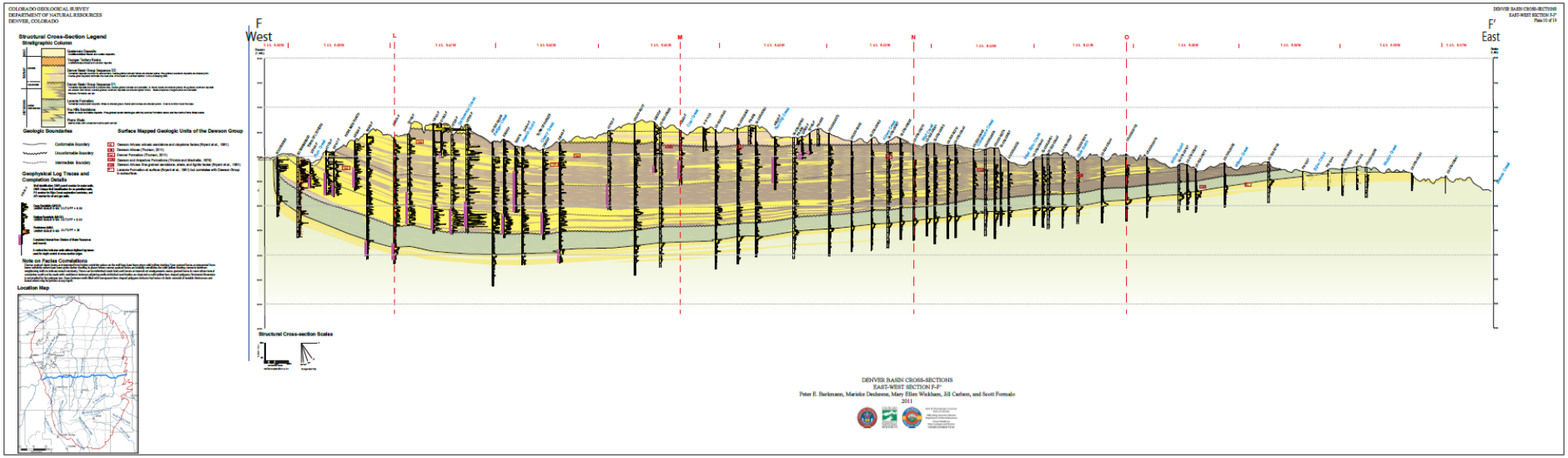
USGS

Today's Agenda

- **US Geological Survey –**
  - Stratigraphic cross-sections: an example from Laramide synorogenic strata of the Denver Basin, Colorado – Peter Barkmann (CO Geological Survey) and Marieke Dechesne (USGS)
  - Geoprocessing tools for working with geologic cross-sections in ArcGIS - Cross Section toolbox for ArcGIS 10.2 by Evan Thoms, USGS, Anchorage, AK – Presented by Tracey Felger
- **New Jersey Geological and Water Survey – Scott Stanford**
- **Florida Geological Survey – Rick Green**

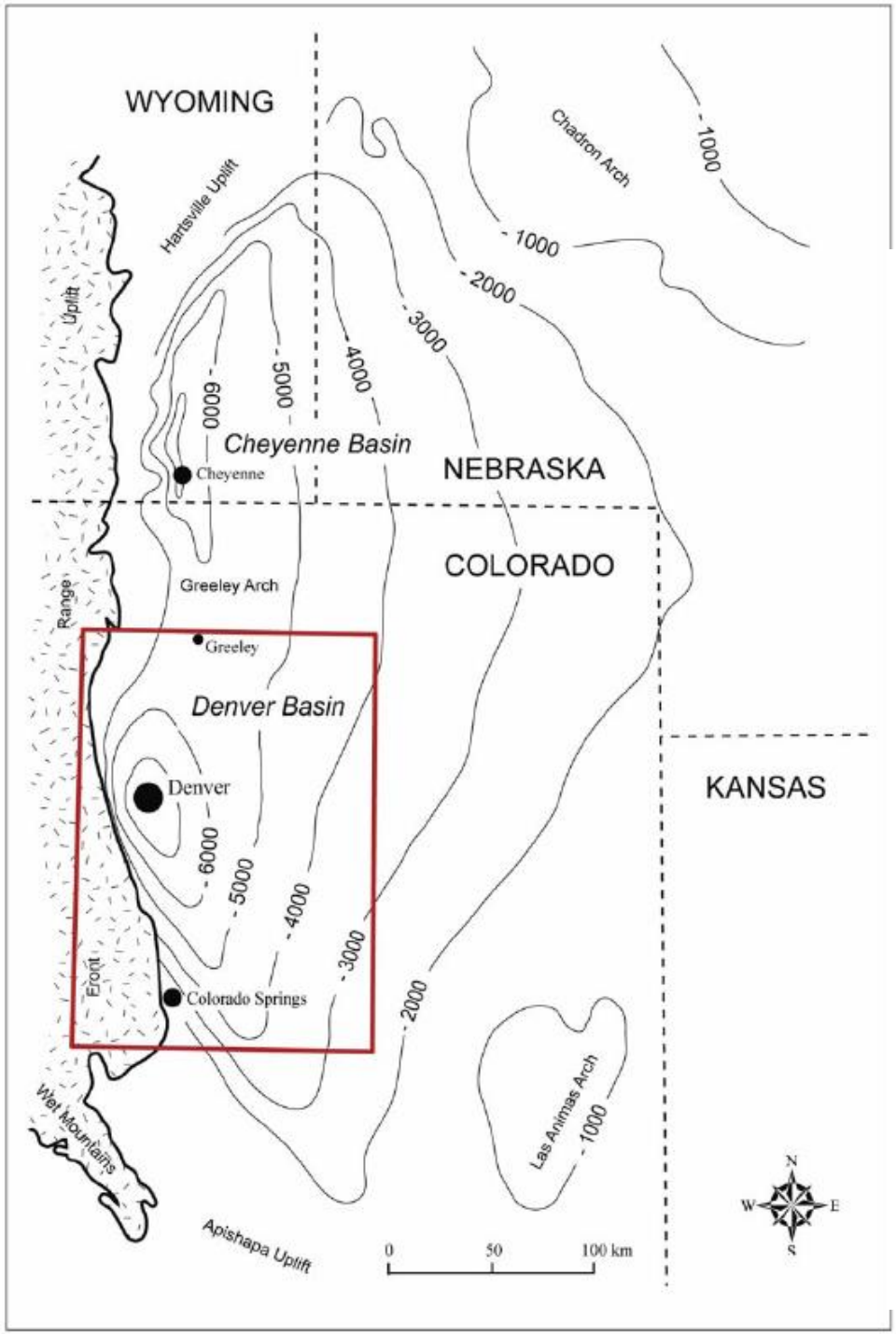
USGS

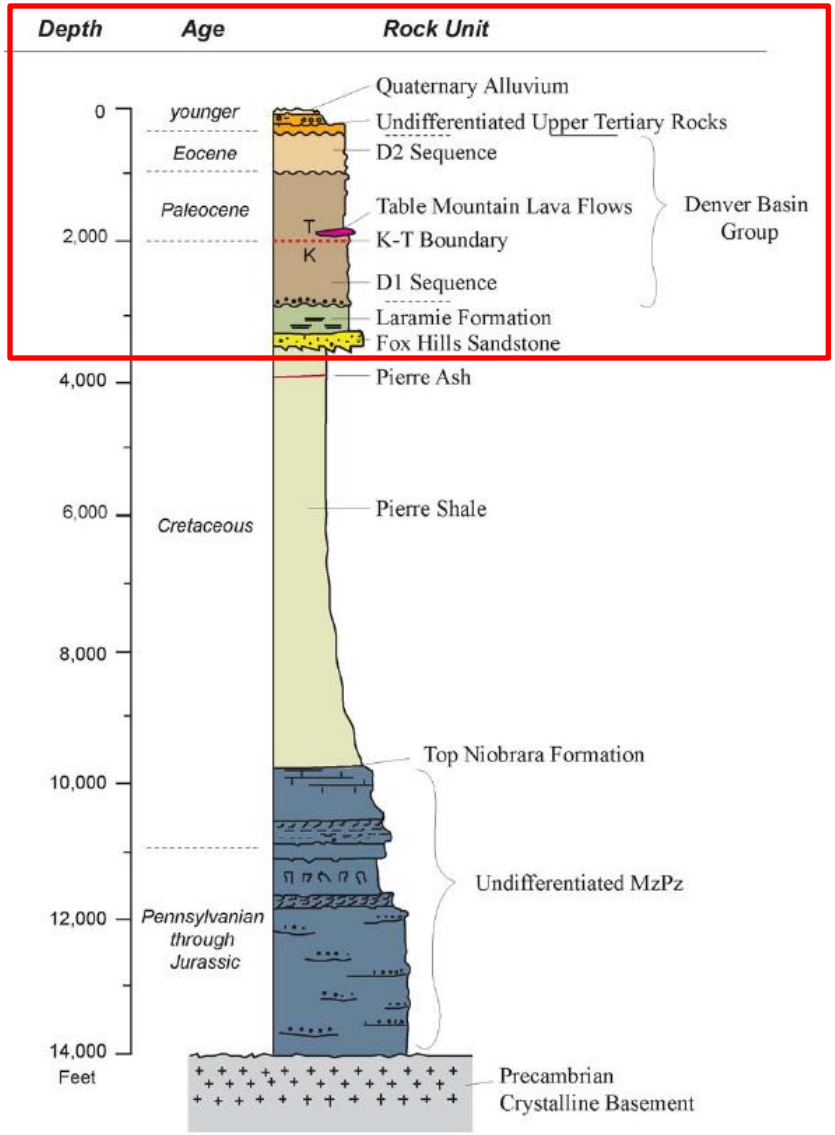
Stratigraphic cross-sections: an example from Laramide synorogenic strata of the Denver Basin, Colorado



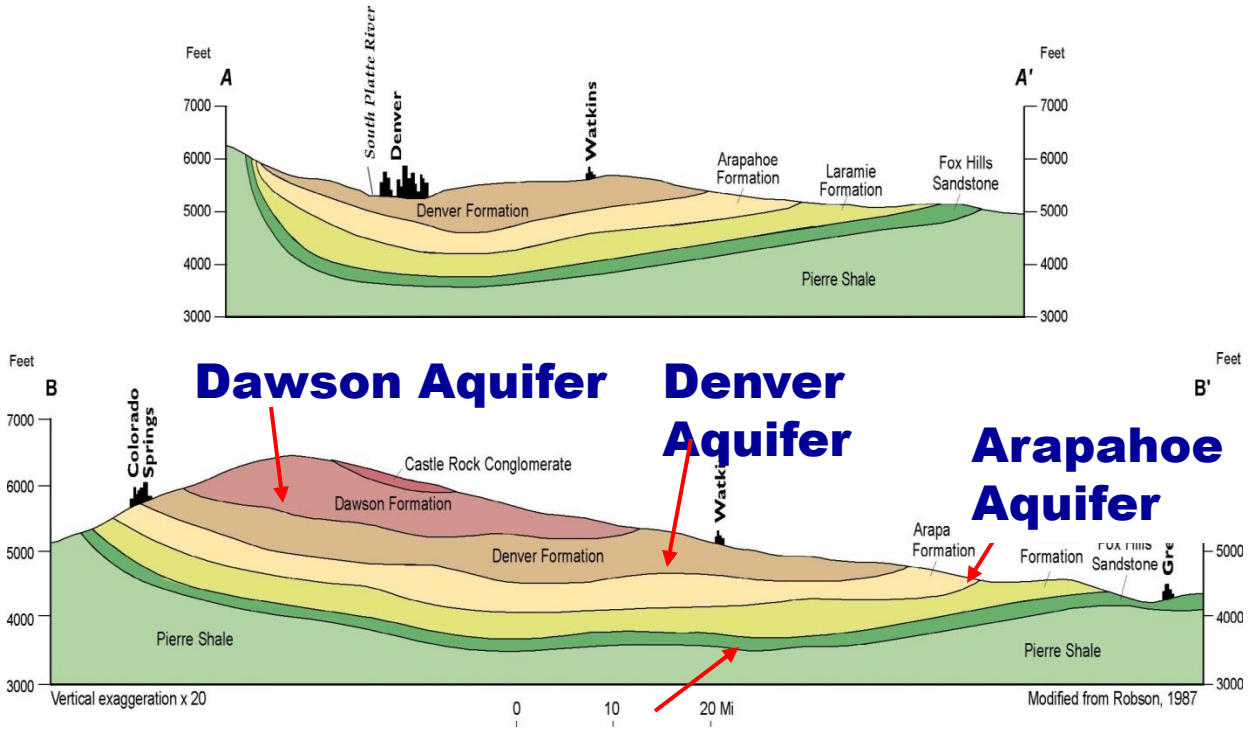
Peter Barkmann (Colorado Geological Survey)
Marieke Dechesne (USGS)

Published by the Colorado Geological Survey (2011):
Cross-sections of the fresh-water bearing strata of the Denver Basin between Greeley and Colorado Springs, Colorado
Peter Barkmann, Marieke Dechesne, Mary Ellen Wickham, Jill Carlson, Scott Formolo


WYOMING
NEBRASKA
COLORADO
KANSAS
Hartsville Uplift
Chadron Arch
Uplift
Cheyenne Basin
Cheyenne
Greeley Arch
Range
Greeley
Denver Basin
Denver
Front
Colorado Springs
Wet Mountains
Las Animas Arch
Apishapa Uplift
1000
2000
3000
4000
5000
6000
0
50
100 km
N
W
E
S


Depth
Age
Rock Unit
0
2,000
4,000
6,000
8,000
10,000
12,000
14,000
Feet
younger
Eocene
Paleocene
Cretaceous
Pennsylvanian through Jurassic
T
K
Quaternary Alluvium
Undifferentiated Upper Tertiary Rocks
D2 Sequence
Table Mountain Lava Flows
K-T Boundary
D1 Sequence
Laramie Formation
Fox Hills Sandstone
Denver Basin Group
Pierre Ash
Pierre Shale
Top Niobrara Formation
Undifferentiated MzPz
Precambrian Crystalline Basement

Traditional Layer-cake View of the Denver Basin



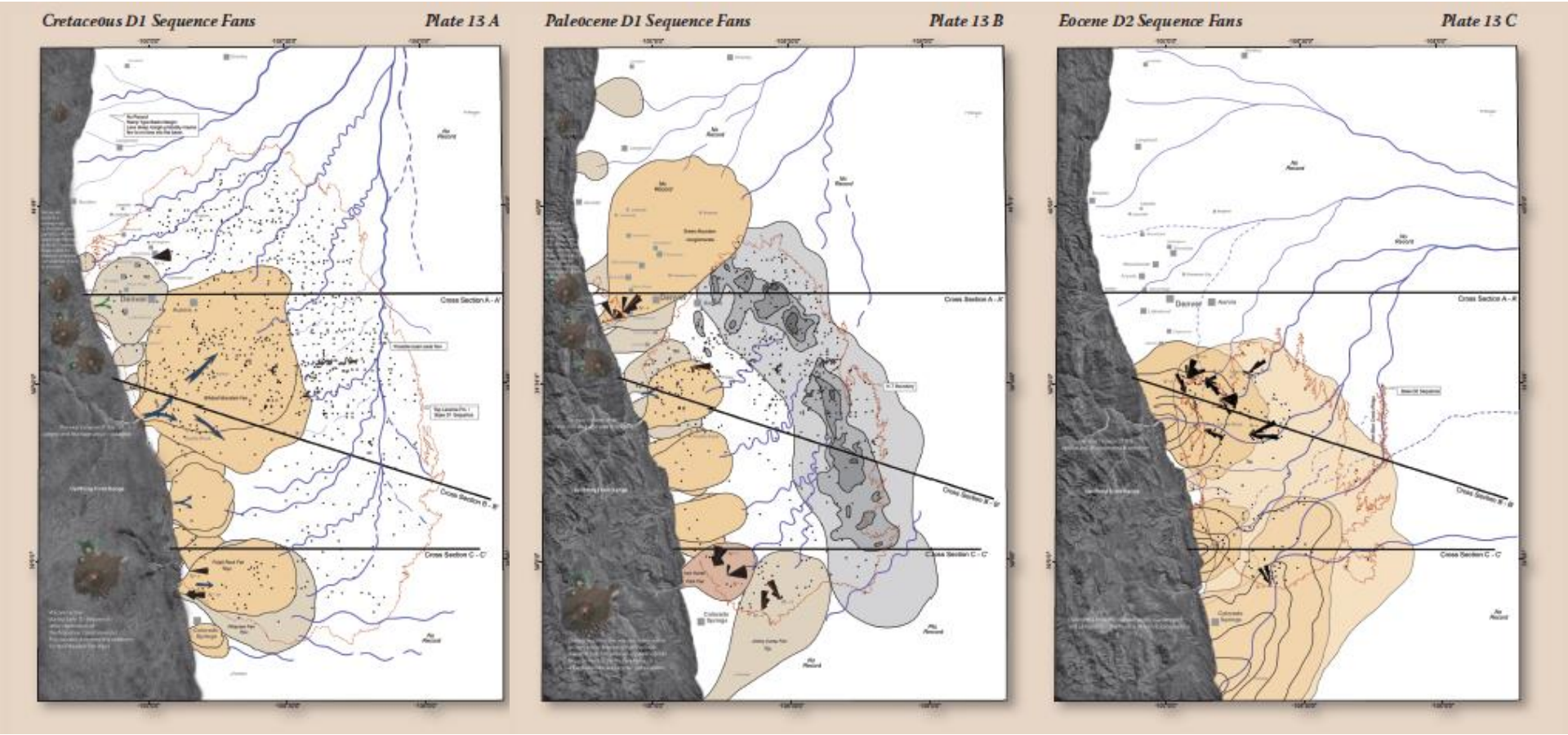
Dawson Aquifer

Denver Aquifer

Arapahoe Aquifer

Laramie-Fox Hills Aquifer Aquifer

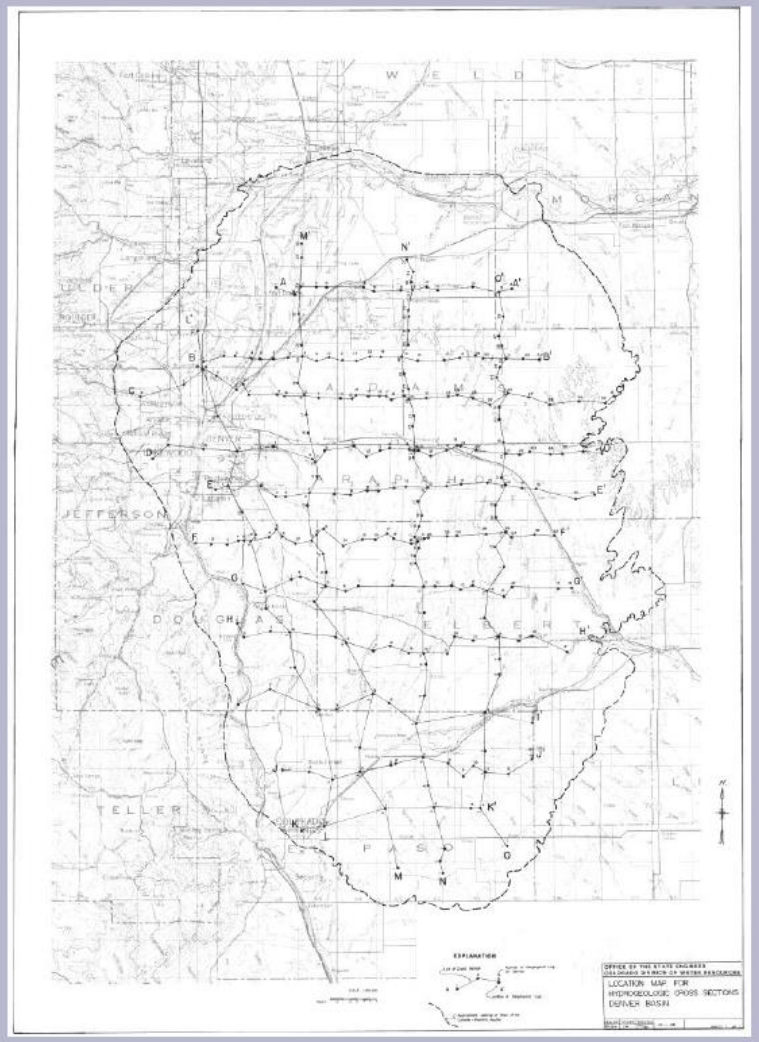
Paleogeographic maps of the main Denver Basin aquifer units:



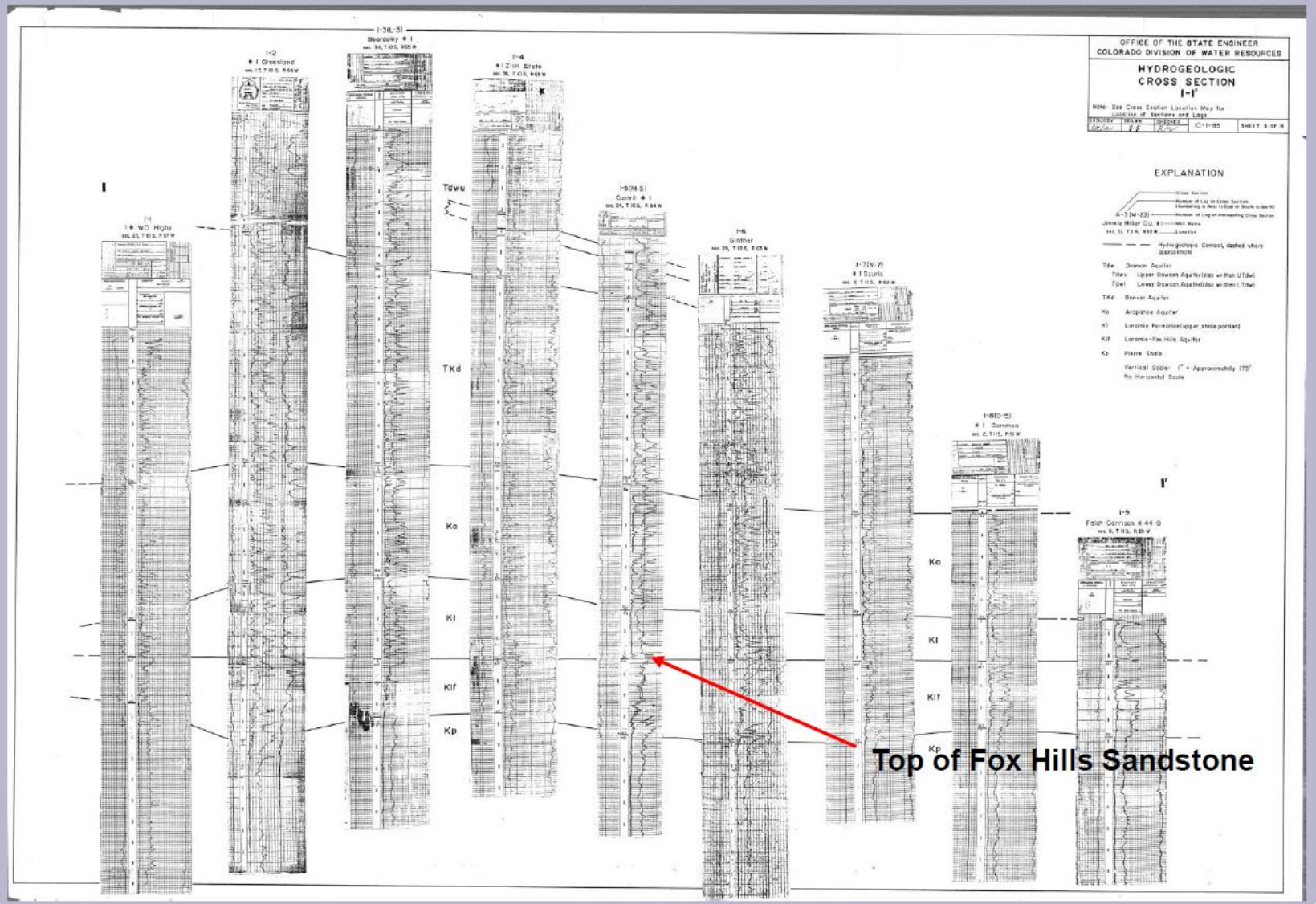
- Fan systems coming off the rising (Laramide) Front Range
- No layer cake: west to east changes in aquifer quality

Patterned after 1985 DWR Cross-Sections Used in Preparing Denver Basin Rules and Regulations:

- 15 lines
- 298 logs



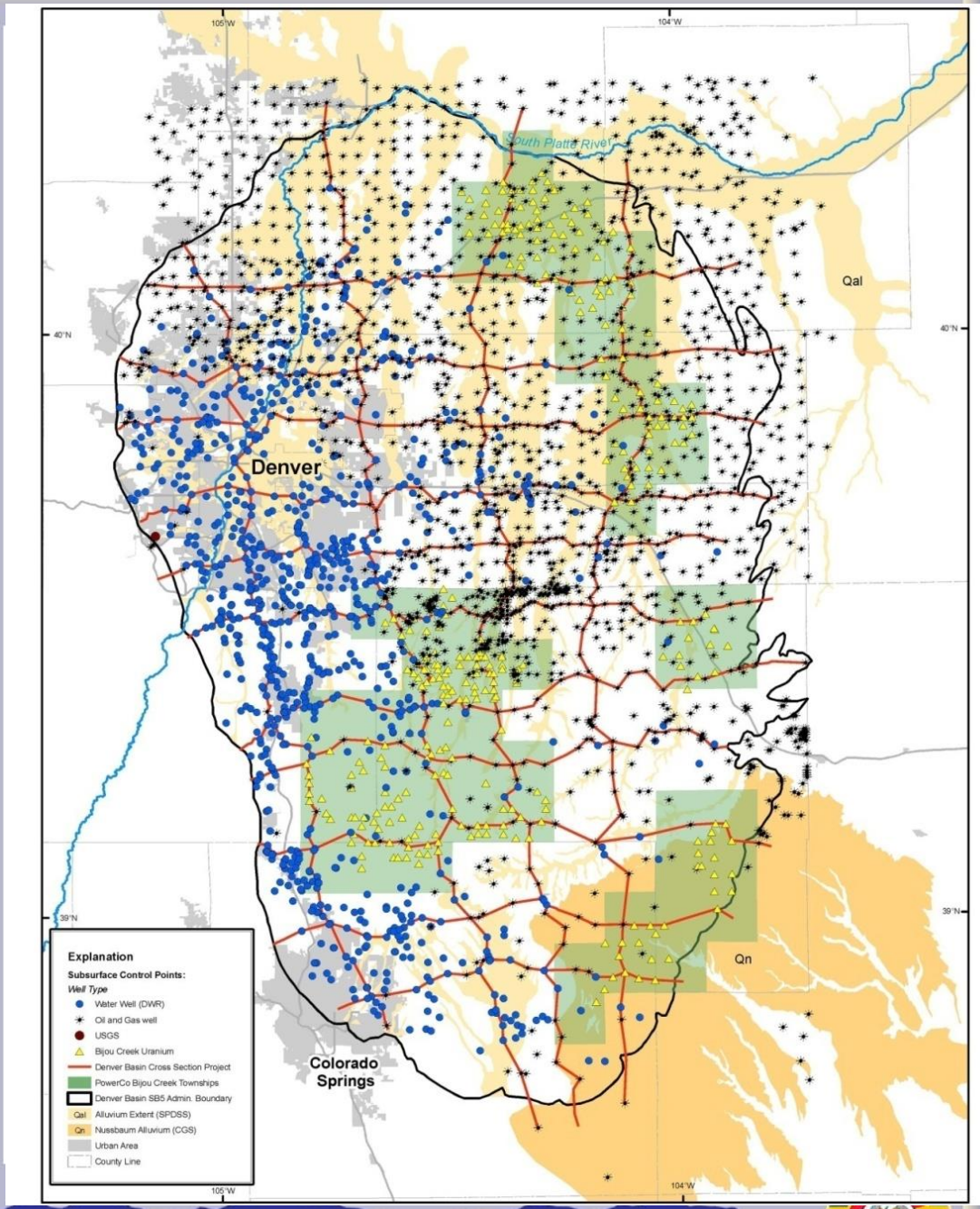
Original Stratigraphic Section



- 15-Lines
- 3,500 Points
  - Water wells (DWR data base)
  - Oil and Gas wells (COGCC & PI/Dwights library)
  - Uranium Exploration Holes
  - Outcrop points
  - Topographic features

Followed 1985 cross-section lines for new publication

"fence diagram approach"



Alternative way:
Projecting wells onto cross-section line using a structure map

(Done for:
Bedrock geologic map of the Denver Basin – CGS, 2011)

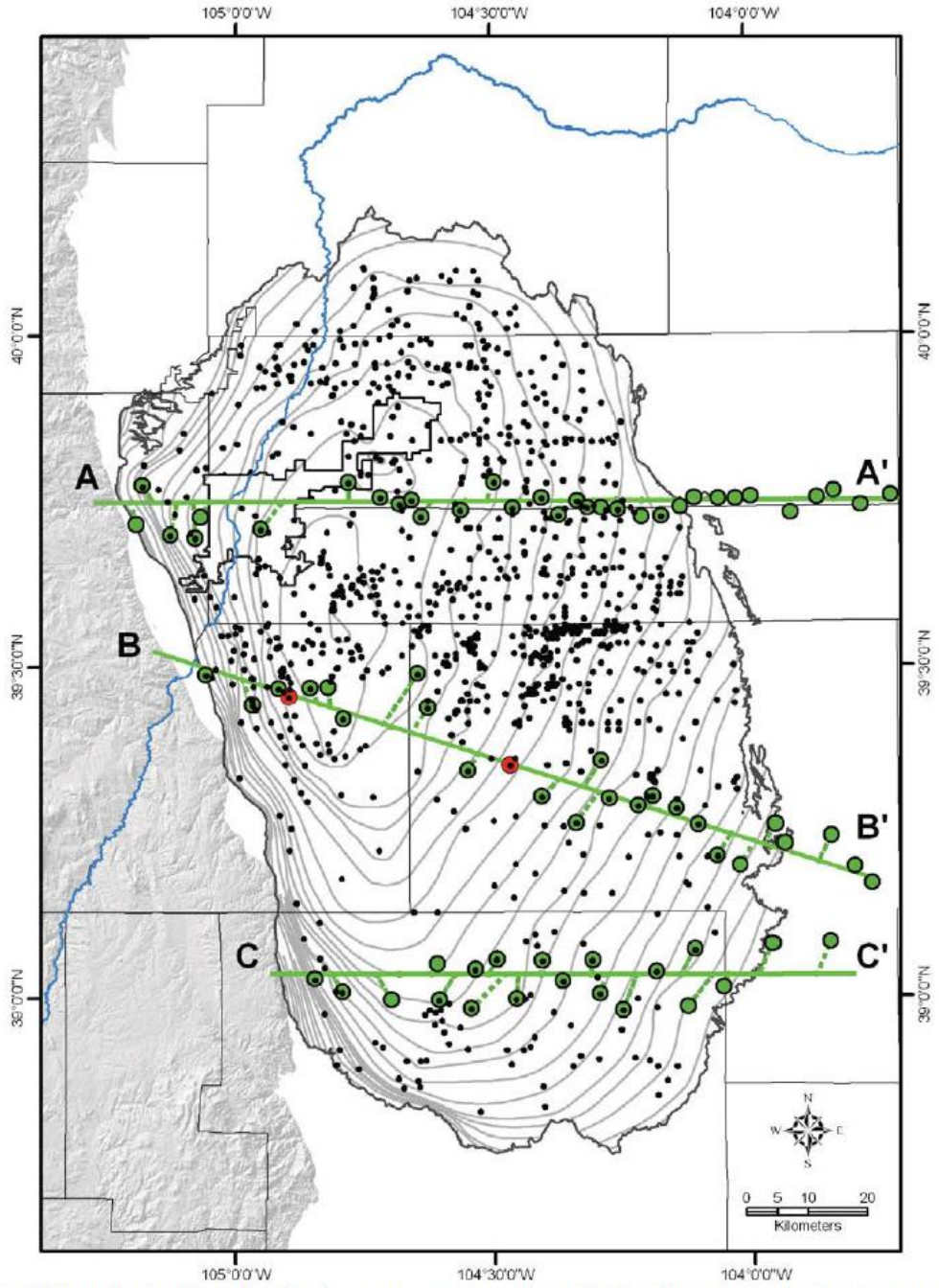
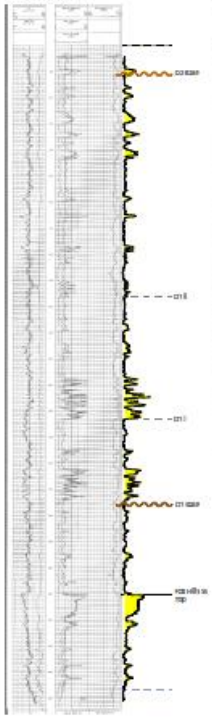


Figure 16. Well projection lines for the three cross-sections along the Top Laramie Formation Structure Map.

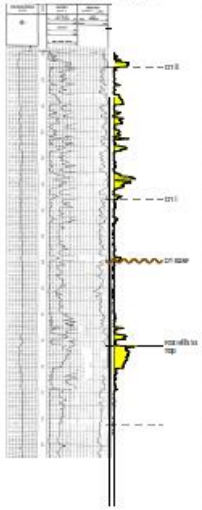
COLORADO GEOLOGICAL SURVEY
DEPARTMENT OF NATURAL RESOURCES
DENVER, COLORADO

GEOPHYSICAL TYPE LOGS

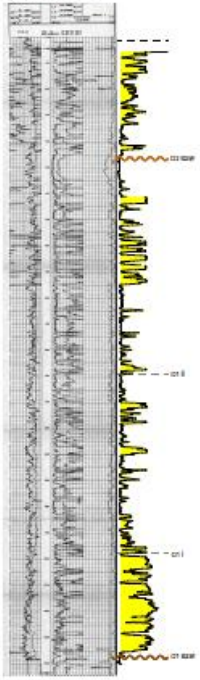
ECCV SLFH-3
49395-F
Sec 15 ,TWP 5s, RGE 66W
Elev: KB 5,920 ft MSL
TD: 2,534
SECTION E-E'



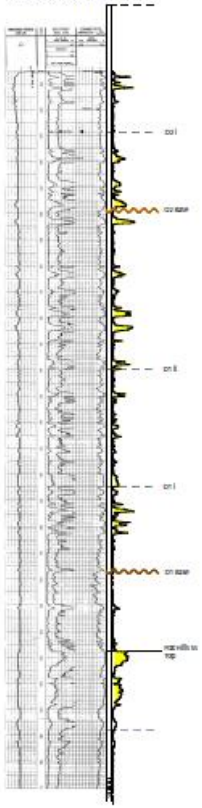
BAUGHMAN
05-005-06613
Sec 6 ,TWP 5S, RGE 62W
Elev: KB 5,575 ft MSL
TD: 7,606
SECTION S E-E' & N-N'



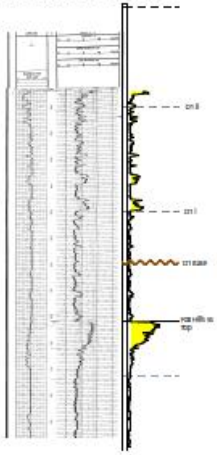
CASTLE PINES
USGS WELL
(44' NORTH OF
CASTLE PINES CORE)
Sec 9 ,TWP 7s, RGE 67W
Elev: KB 6,606 ft MSL
TD: 2,439
SECTION L-L'



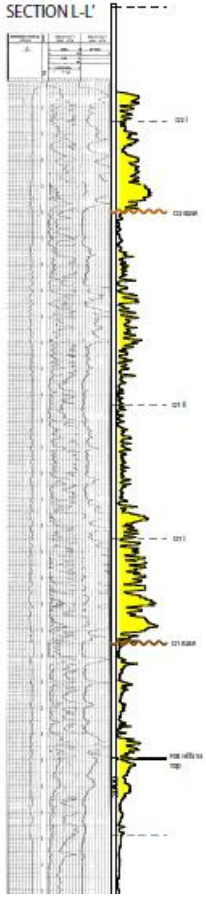
TANIN NO. 1
05-039-06103
Sec 1 ,TWP 9S, RGE 65W
Elev: KB 6,779 ft MSL
TD: 9,043
SECTION H-H'



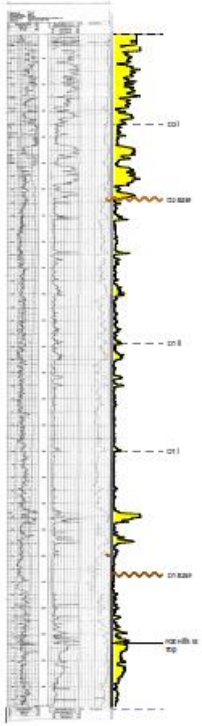
EHNANN 14-23
05-039-06018
Sec 23 ,TWP 7S, RGE 61W
Elev: KB 6,167 ft MSL
TD: 7,370
SECTION S G-G' & O-O'



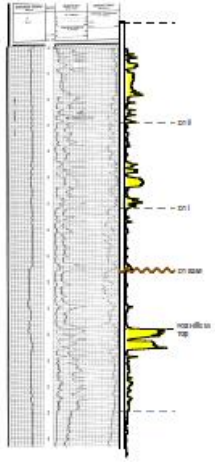
#1 GREENLAND CATTLE
05-035-05000
Sec 17 ,TWP 10S, RGE 66W
Elev: KB 7,172 ft MSL
TD: 9,833
SECTION L-L'

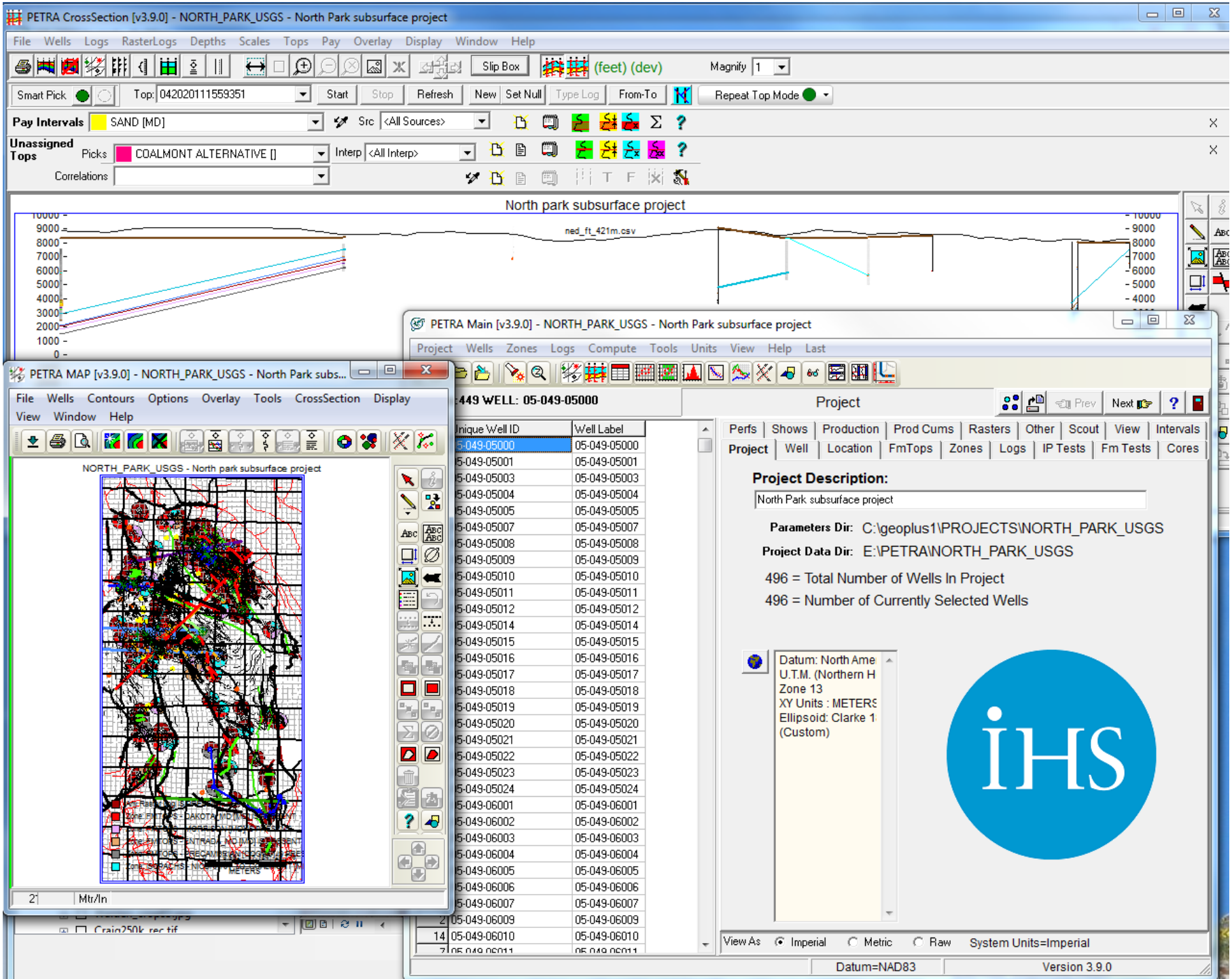


PAINT BRUSH HILLS LFH
55192-F
Sec 25 ,TWP 12s, RGE 65W
Elev: GR 7,260 ft MSL
TD: 2,573
SECTION J-J'

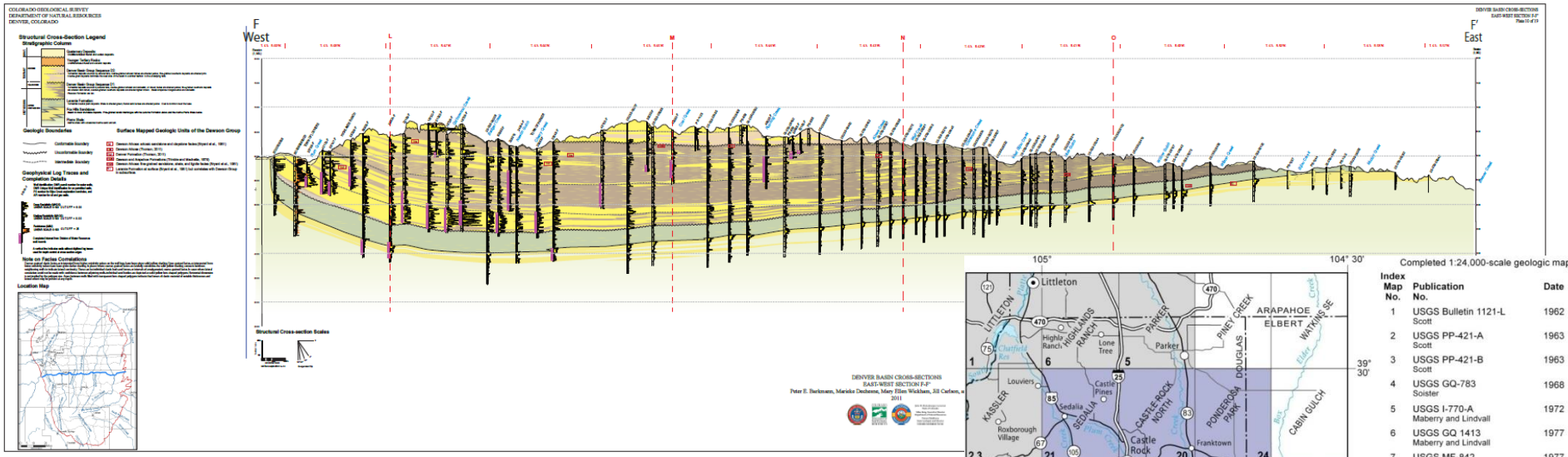


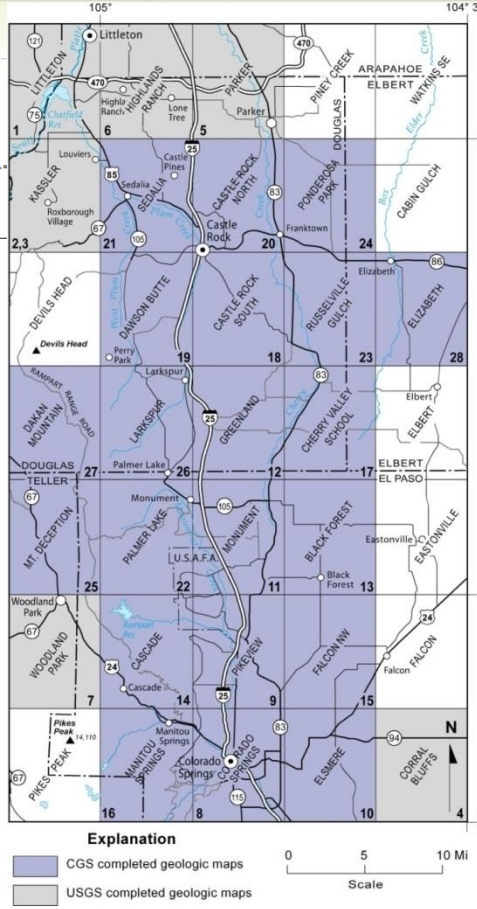
#1 DZUROVCHIN
05-039-06116
Sec 19 ,TWP 10S, RGE 61W
Elev: KB 6,304 ft MSL
TD: 7,194
SECTION I-I'




PETRA CrossSection [v3.9.0] - NORTH_PARK_USGS - North Park subsurface project
File Wells Logs RasterLogs Depths Scales Tops Pay Overlay Display Window Help
Slip Box
(feet) (dev)
Magnify 1
Smart Pick
Top: 042020111559351
Start Stop Refresh New Set Null Type Log From-To
Repeat Top Mode
Pay Intervals SAND [MD]
Src <All Sources>
Unassigned Tops
Picks COALMONT ALTERNATIVE []
Interp <All Interp>
Correlations
North park subsurface project
ned_ft_421m.csv
PETRA MAP [v3.9.0] - NORTH_PARK_USGS - North Park subs...
File Wells Contours Options Overlay Tools CrossSection Display
View Window Help
NORTH_PARK_USGS - North park subsurface project
Mtr/In
PETRA Main [v3.9.0] - NORTH_PARK_USGS - North Park subsurface project
Project Wells Zones Logs Compute Tools Units View Help Last
449 WELL: 05-049-05000
Project
Prev
Next
Unique Well ID
Well Label
05-049-05000
05-049-05001
05-049-05003
05-049-05004
05-049-05005
05-049-05007
05-049-05008
05-049-05009
05-049-05010
05-049-05011
05-049-05012
05-049-05014
05-049-05015
05-049-05016
05-049-05017
05-049-05018
05-049-05019
05-049-05020
05-049-05021
05-049-05022
05-049-05023
05-049-05024
05-049-06001
05-049-06002
05-049-06003
05-049-06004
05-049-06005
05-049-06006
05-049-06007
05-049-06009
05-049-06010
Perfs Shows Production Prod Cums Rasters Other Scout View Intervals
Project Well Location FmTops Zones Logs IP Tests Fm Tests Cores
Project Description:
North Park subsurface project
Parameters Dir: C:\geoplus1\PROJECTS\NORTH_PARK_USGS
Project Data Dir: E:\PETRA\NORTH_PARK_USGS
496 = Total Number of Wells In Project
496 = Number of Currently Selected Wells
Datum: North Ame
U.T.M. (Northern H
Zone 13
XY Units : METERS
Ellipsoid: Clarke 1
(Custom)
iHS
View As Imperial Metric Raw System Units=Imperial
Datum=NAD83
Version 3.9.0

cross-sections:





Completed 1:24,000-scale geologic maps:

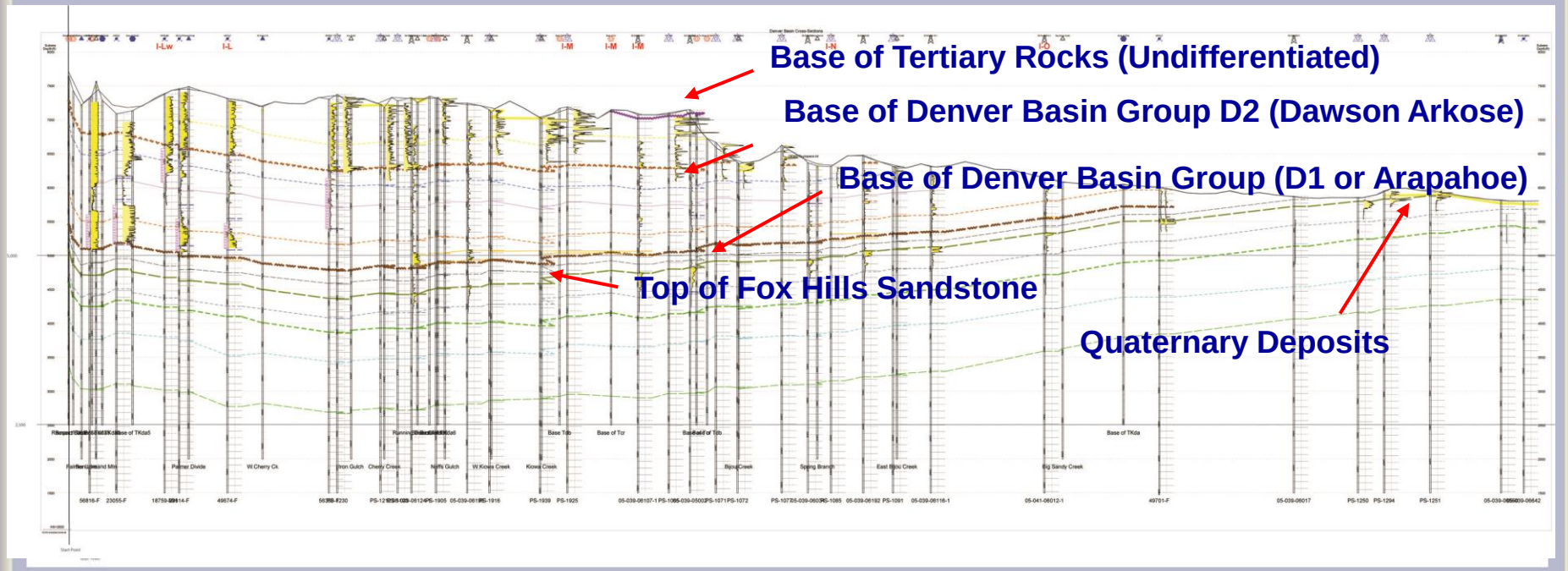
Index Map No.	Publication No.	Date
1	USGS Bulletin 1121-L Scott	1962
2	USGS PP-421-A Scott	1963
3	USGS PP-421-B Scott	1963
4	USGS GQ-783 Soister	1968
5	USGS I-770-A Maberry and Lindvall	1972
6	USGS GQ 1413 Maberry and Lindvall	1977
7	USGS MF-842 Wobus and Scott	1977
8	CGS OF 00-03 Carroll and Crawford	2000
9	CGS OF 01-03 Thorson and others	2001
10	CGS OF 02-02 Madole and Thorson	2002
11	CGS OF 02-4 Thorson and Madole	2003
12	CGS OF 03-9 Thorson	2003
13	CGS OF 03-06 Thorson	2003
14	CGS OF 03-18 Morgan and others	2003
15	CGS OF 03-8 Madole	2003
16	CGS OF 03-19 Keller and others	2005
17	CGS OF 04-06 Thorson	2004
18	CGS OF 04-05 Thorson	2004
19	CGS OF 04-07 Morgan and others	2004
20	CGS OF 05-02 Thorson	2005
21	CGS OF 05-06 Morgan and others	2005
22	CGS OF 06-06 Keller and others	2006
23	CGS OF 06-08 Thorson	2006
24	CGS OF 07-04 Thorson	2007
25	CGS OF 07-07 Temple and others	2007
26	CGS OF 08-07 Thorson (updated 2008)	2008
27	CGS OF 08-16 Thorson	2008
28	CGS OF 09-03 Morgan	2009

- **Integrates geology from 28 quads (STATEMAP)**
- **Emphasis on strata forming Denver Basin Bedrock aquifers**

Main Software:

ArcGIS - IHS Petra - Illustrator

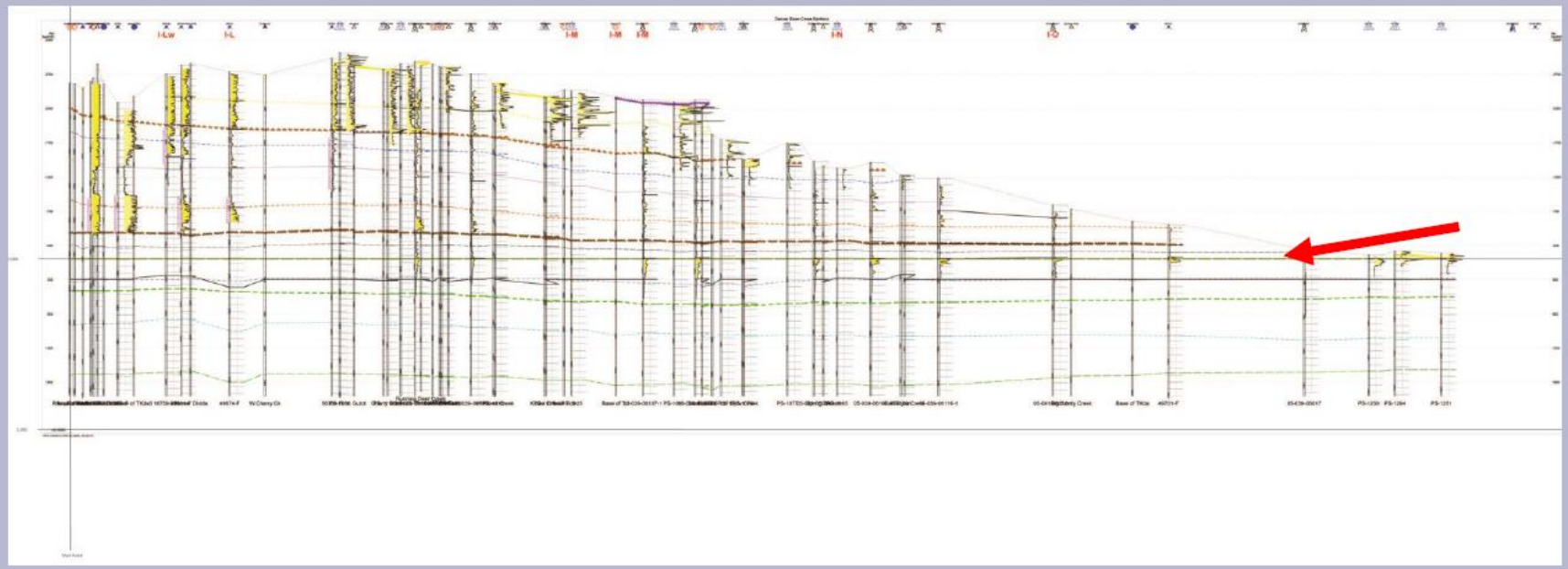
Primary Correlations



- Done independently of previous interpretations
- Correlating in the Denver Basin is Proverbial “Forest for the Trees”!

Top of Fox Hills Sandstone

Choosing different datums for correlation purposes

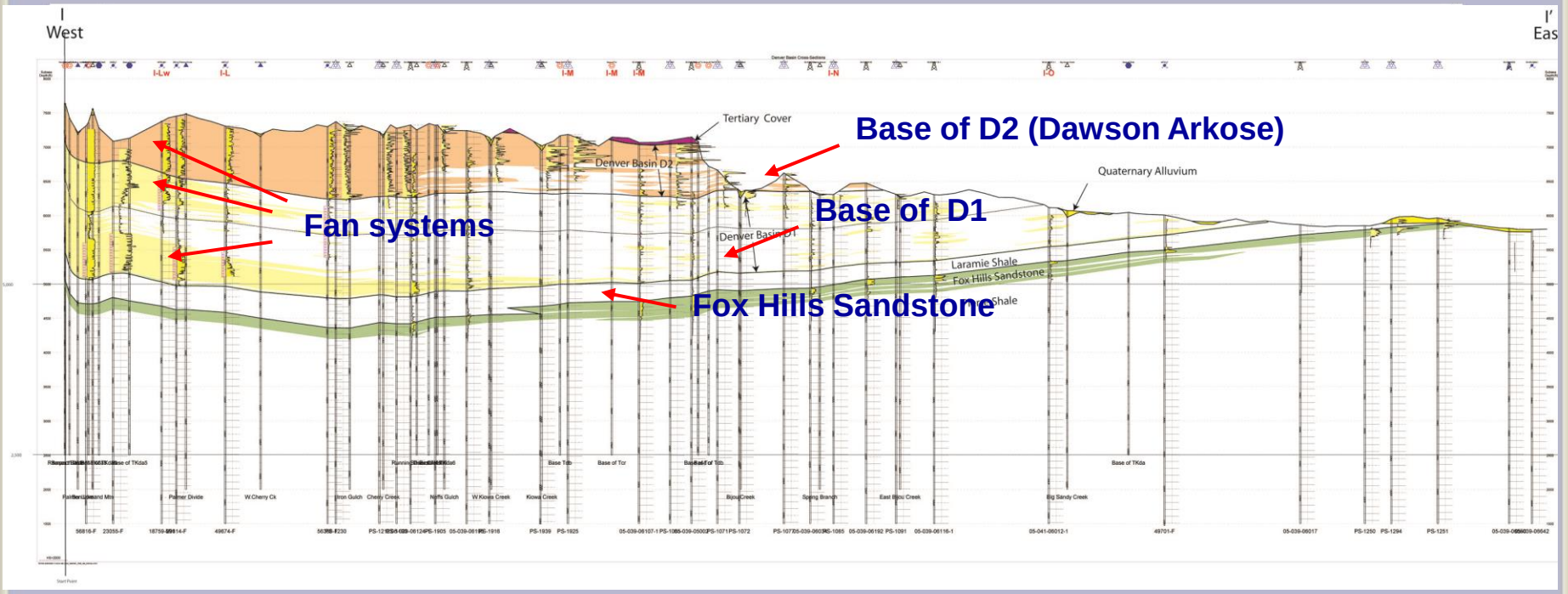


Base of Denver Basin Group D1 (Arapahoe Conglomerate)

Choosing different datums for correlation purposes

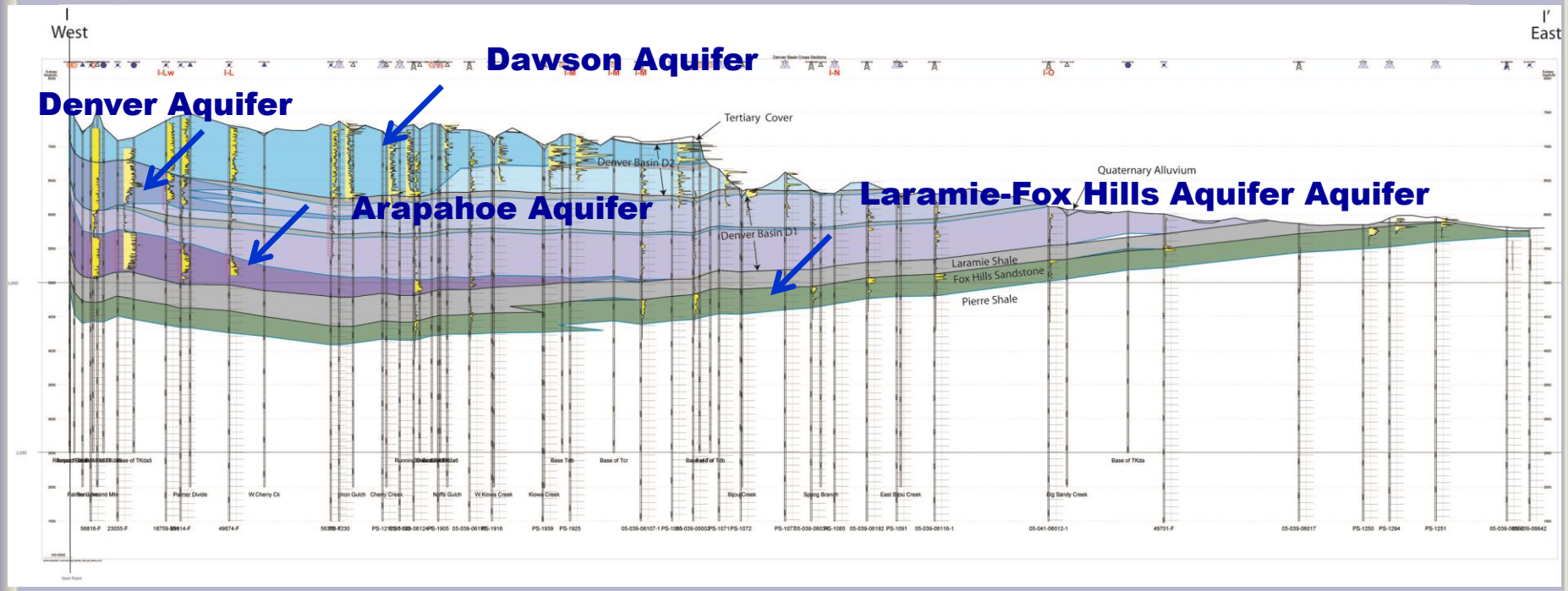
Structural Cross-section

Add Litho-Facies (In Illustrator)



Structural Cross-section

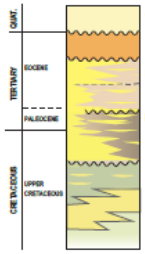
Add Hydro-stratigraphic Facies



COLORADO GEOLOGICAL SURVEY
DEPARTMENT OF NATURAL RESOURCES
DENVER, COLORADO

Structural Cross-Section Legend

Stratigraphic Column



Quaternary Deposits:
Undifferentiated fluvial and eolian deposits.

Younger Tertiary Rocks:
Undifferentiated fluvial and volcanic deposits.

Denver Basin Group Sequence D2:
Terrestrial deposits sourced by alluvial fans, coarse-grained arkosic facies are shaded yellow, fine-grained overbank deposits are shaded pink. Coarse-grain deposits dominate the west side of the basin in a similar fashion to the underlying fans.

Denver Basin Group Sequence D1:
Terrestrial deposits sourced by alluvial fans, coarse-grained arkosic and andesitic, or mixed, facies are shaded yellow; fine-grained overbank deposits are shaded dark brown. coarse-grained overbank deposits are shaded lighter brown. Basal Arapahoe Conglomerate and andesitic Pitkview Formation are tan.

Laramie Formation:
Terrestrial coastal plain deposits. Shale is shaded green, fluvial sand lenses are shaded yellow. Coal is common near the base.

Fox Hills Sandstone:
Beach to lower shoreface deposits. Fine-grained sands intertongue with the Laramie Formation above and the marine Pierre Shale below.

Pierre Shale:
Marine shale with occasional marine sand and silt.

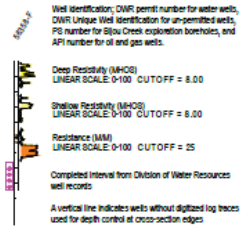
Geologic Boundaries

- Conformable Boundary
- Unconformable Boundary
- Intermediate Boundary

Surface Mapped Geologic Units of the Dawson Group

- Tds — Dawson Arkose: arkosic sandstone and claystone facies (Bryant et al., 1981)
- Tda — Dawson Arkose (Thorson, 2011)
- TKd-t — Denver Formation (Thorson, 2011)
- TKDA — Dawson and Arapahoe Formations (Trimble and Machette, 1979)
- TKDf — Dawson Arkose: fine-grained sandstone, shale, and lignite facies (Bryant et al., 1981)
- Kl — Laramie Formation at surface (Bryant et al., 1981) but correlates with Dawson Group in subsurface.

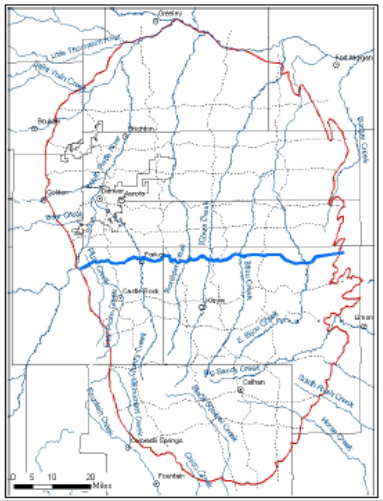
Geophysical Log Traces and Completion Details



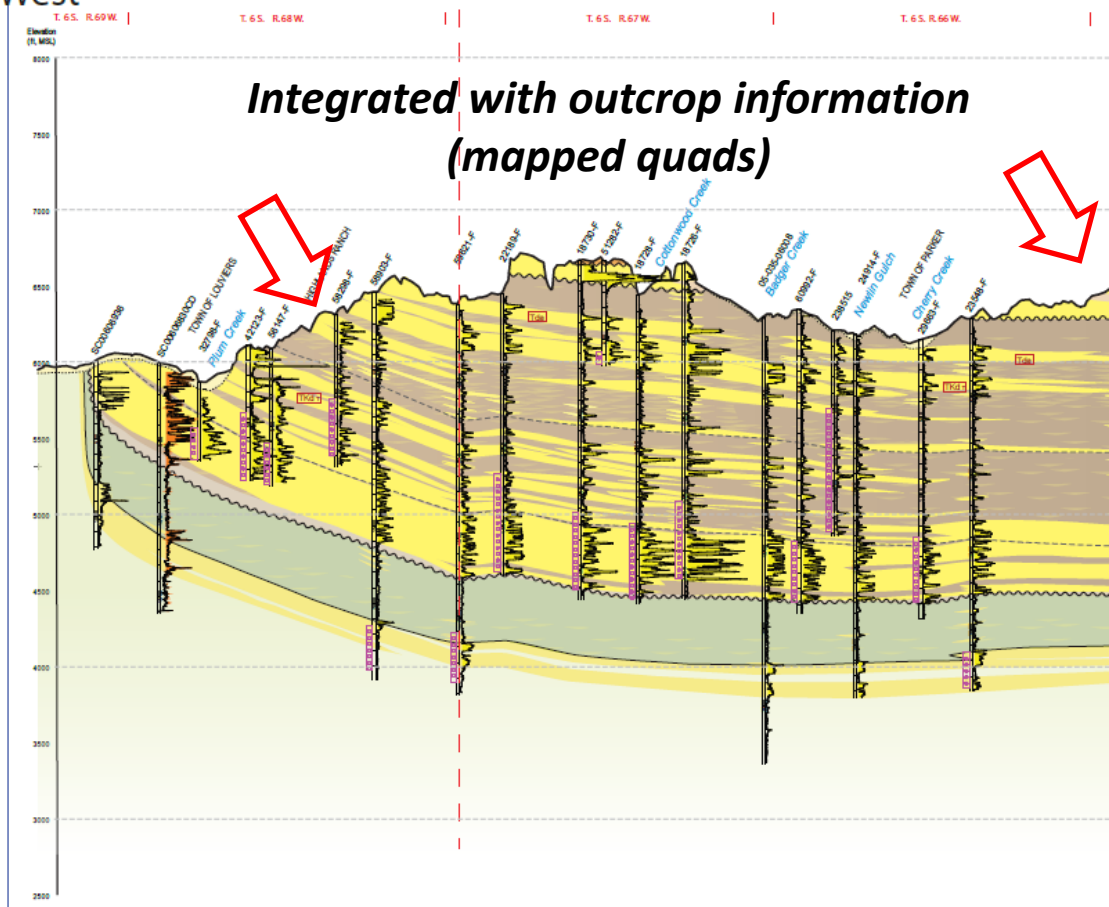
Note on Facies Correlations

Coarser-grained clastic facies, as interpreted from higher resistivity values on the well logs, have been given solid yellow shading. Finer-grained facies, as interpreted from lower resistivity values have been given darker shading. In places where coarser-grained facies are laterally correlative, the solid yellow shading connects between neighboring wells to indicate lateral continuity. These can be individual clastic beds and lenses, or intervals of amalgamated, coarse-grained facies. In cases where lateral correlation could not be made with confidence between adjoining wells, individual sand bodies are depicted as solid yellow lens-shaped polygons. Horizontal dimension is not implied by the polygon size. Areas between wells filled with transparent lens-shaped polygons indicate that lenses of clastic material of variable thicknesses and lateral extent may be present at any depth.

Location Map

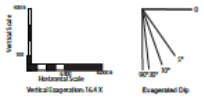


F
West
L



Integrated with outcrop information (mapped quads)

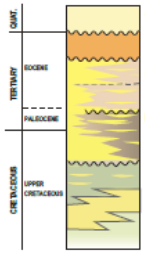
Structural Cross-section Scales



COLORADO GEOLOGICAL SURVEY
DEPARTMENT OF NATURAL RESOURCES
DENVER, COLORADO

Structural Cross-Section Legend

Stratigraphic Column



Quaternary Deposits:
Unconsolidated fluvial and eolian deposits.

Younger Tertiary Rocks:
Unconsolidated fluvial and volcanic deposits.

Denver Basin Group Sequence D2:
Terrestrial deposits sourced by alluvial fans, coarse-grained arkosic facies are shaded yellow, fine-grained overbank deposits are shaded pink. Coarse-grain deposits dominate the west side of the basin in a similar fashion to the underlying fans.

Denver Basin Group Sequence D1:
Terrestrial deposits sourced by alluvial fans, coarse-grained arkosic and andesitic, or mixed, facies are shaded yellow; fine-grained overbank deposits are shaded dark brown, coarse-grained overbank deposits are shaded lighter brown. Basal Arapahoe Conglomerate and andesitic Pitkview Formation are tan.

Laramie Formation:
Terrestrial coastal plain deposits. Shale is shaded green, fluvial sand lenses are shaded yellow. Coal is common near the base.

Fox Hills Sandstone:
Beach to lower shoreface deposits. Fine-grained sands intertongue with the Laramie Formation above and the marine Pierre Shale below.

Pierre Shale:
Marine shale with occasional marine sand and silt.

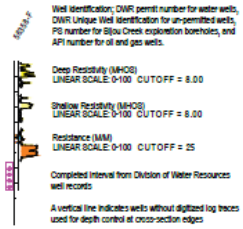
Geologic Boundaries

- Conformable Boundary
- Unconformable Boundary
- Intermediate Boundary

Surface Mapped Geologic Units of the Dawson Group

- Tds — Dawson Arkose: arkosic sandstone and claystone facies (Bryant et al., 1981)
- Tda — Dawson Arkose (Thorson, 2011)
- TKd-t — Denver Formation (Thorson, 2011)
- TKDA — Dawson and Arapahoe Formations (Trimble and Machette, 1979)
- TKd — Dawson Arkose: fine-grained sandstone, shale, and lignite facies (Bryant et al., 1981)
- Kl — Laramie Formation at surface (Bryant et al., 1981) but correlates with Dawson Group in subsurface.

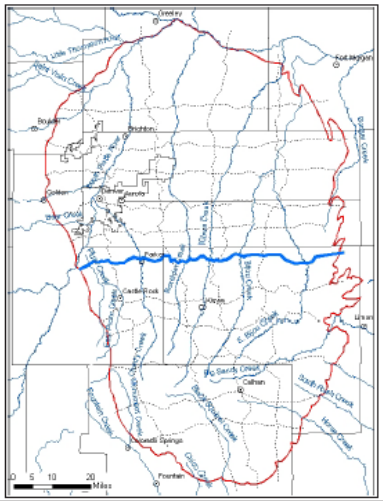
Geophysical Log Traces and Completion Details



Note on Facies Correlations

Coarser-grained clastic facies, as interpreted from higher resistivity values on the well logs, have been given solid yellow shading. Finer-grained facies, as interpreted from lower resistivity values have been given darker shading. In places where coarser-grained facies are laterally correlative, the solid yellow shading connects between neighboring wells to indicate lateral continuity. These can be individual clastic beds and lenses, or intervals of amalgamated, coarser-grained facies. In cases where lateral correlation could not be made with confidence between adjoining wells, individual sand bodies are depicted as solid yellow lens-shaped polygons. Horizontal dimension is not implied by the polygon size. Areas between wells filled with transparent lens-shaped polygons indicate that lenses of clastic material of variable thicknesses and lateral extent may be present at any depth.

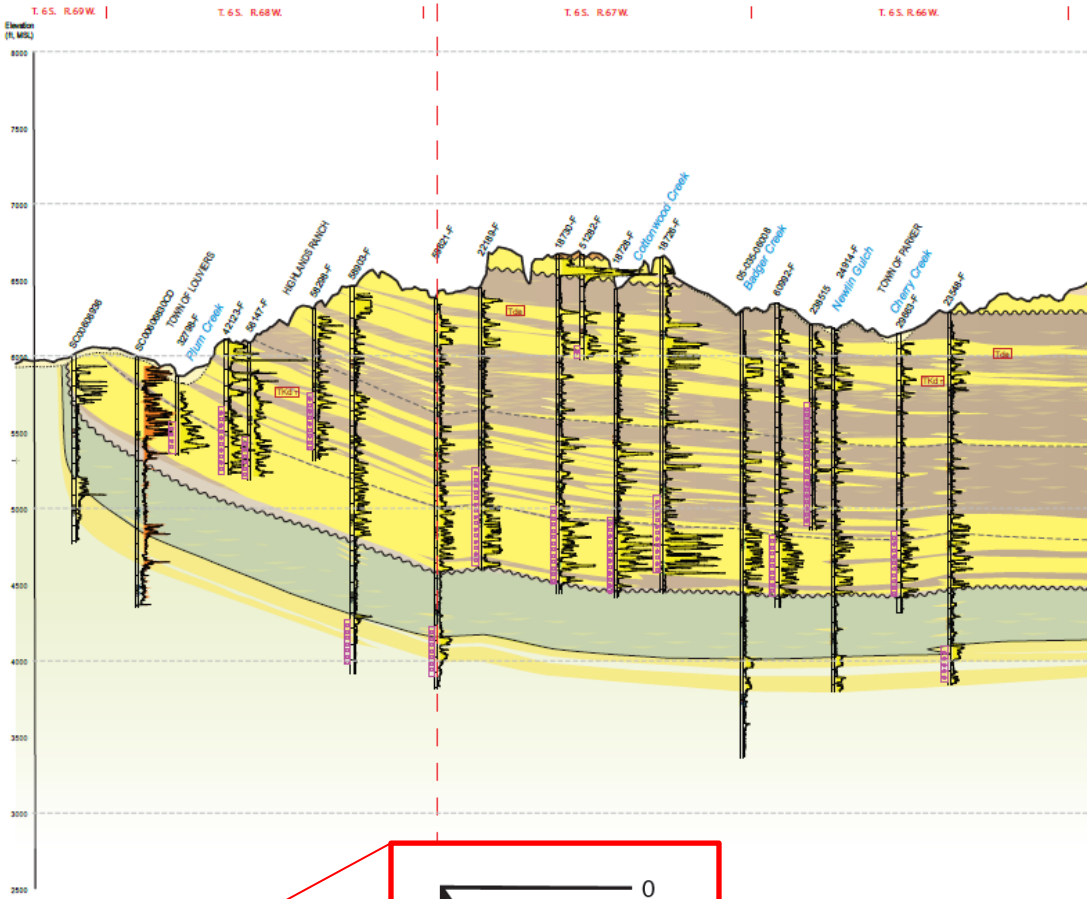
Location Map



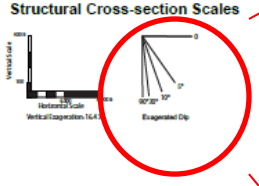
F

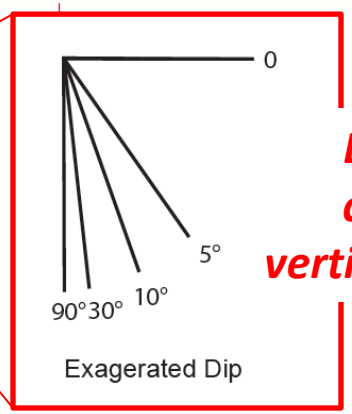
West

L



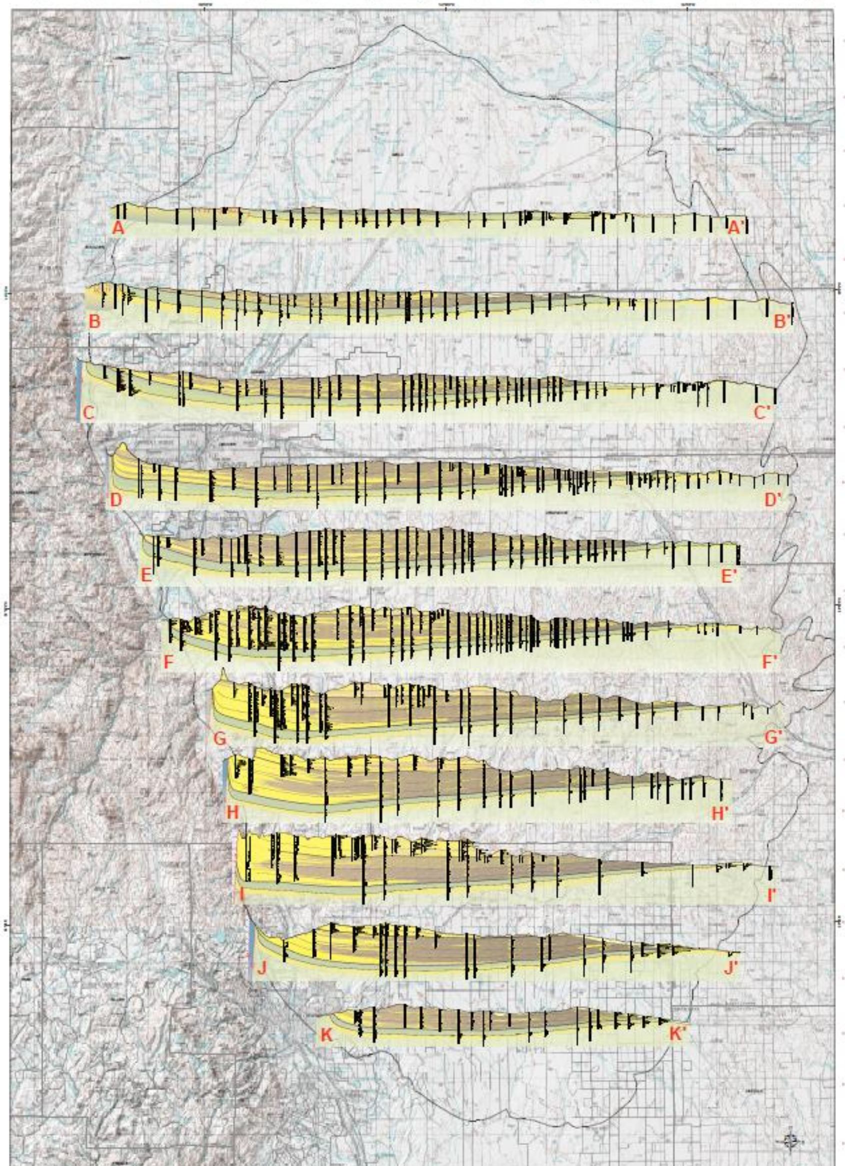
Structural Cross-section Scales





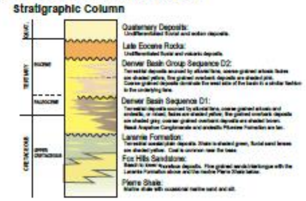
Dip direction corrected for vertical exaggeration

WEST-TO-EAST COMPILATION



Structural Cross-Section Legend

Stratigraphic Column



Geologic Boundaries

Conformable Boundary

Unconformable Boundary

Intermediate Horizon

Geophysical Log Traces

Resistivity (MHOS) or Resistance (MM)
LINEAR SCALE: 0-100

Higher values to the right indicate coarser-grained more permeable stratigraphic intervals.

INTRODUCTION

Fresh groundwater in the Upper Cretaceous through Paleogene strata of the Denver Basin is held in the pore spaces between the grains of sedimentary rocks that were deposited in ever changing environments. Based on the geography at the time of deposition, the characteristics of these sedimentary rocks vary considerably, both laterally and with depth. Accordingly, the ability of the rocks to store and transmit water also varies laterally and with depth. New data and refined interpretations continue to reveal the diverse characteristics and spatial heterogeneity of these sedimentary rocks. This spatial heterogeneity directly affects how the aquifers respond to exploitation. Management of the groundwater resource within these strata requires a systematic understanding of the characteristics and heterogeneity using the most current data and technology available.

The fifteen cross-sections in this publication depict stratigraphic and structural relationships of the Upper Cretaceous through Paleogene strata within the Denver Basin. They integrate subsurface data from 737 boreholes with surface geologic mapping to provide a regional three dimensional view of the water-bearing strata. Computer-based technologies provide robust tools for cross-section preparation and interpretation drawing information from a broad array of sources.

Alignments of the cross-sections in this publication follow those of cross-sections prepared by the Colorado Division of Water Resources (DWR) in the 1980s while developing the Denver Basin Rules (DWR, 1987). Eleven cross-sections extend from the west side of the basin at the base of the Front Range uplift east across the basin. Four cross-sections parallel the Front Range uplift from north to south. Plates 1 and 2 are compilations of the cross-sections at a horizontal scale of 1:250,000 to allow regional comparisons of stratigraphic relations across the basin. Plate 3 is a geologic base map showing cross-section alignments and all boreholes used in cross-section preparation. Plate 4 includes type logs with brief descriptions of criteria used for geophysical log picks. Individual cross-sections are included as Plates 5 through 19 at a detailed horizontal scale of 1:75,000 and a vertical exaggeration of 18.4.

This work builds upon and complements the geologic map compilation of the southwestern part of the Denver Basin by Thorson (2011). The compilation map integrates results of surface geologic mapping by the CGS under STATEMAP component of the National Geologic Cooperative Mapping Program. This work also complements the Denver Basin geologic map series by Dechesne et al. (2011). The map series includes a bedrock geologic map, structure maps, and isopach maps of the Upper Cretaceous to Paleogene strata deposited during the Laramide mountain building event. Both publications serve as detailed references for the strata depicted in these cross-sections.

GRAPHIC REPRESENTATION

Relationships shown in the cross-sections illustrate variability in stratigraphic architecture at different depths and geographic locations across the basin. Coarser grained clastic facies, as interpreted from higher resistivity values on the well logs, have been given solid yellow shading. Finer grained facies, as interpreted from lower resistivity values have been given darker shading. In places where coarser grained facies are laterally correlative, the solid yellow shading connects between neighboring wells to indicate lateral continuity. These can be individual clastic beds and lenses, or intervals of amalgamated, coarse grained facies. In cases where lateral correlation could not be made with confidence between adjoining wells, individual sand bodies are depicted as solid yellow lens-shaped polygons. Horizontal dimension is not implied by the polygon size. Areas between wells filled with subtle lens-shaped polygons indicate that lenses of clastic material of variable thicknesses and lateral extent may be present at any depth.

Graphic presentations on the cross-sections include the following features:

- Formation boundaries
  - Conformable contacts
  - Unconformable boundaries
  - Intermediate boundaries used for correlations
- Major stratigraphic intervals
  - Coarse grained facies, shown in shades of yellow
    - Continuous deposits
    - Lenticular sandstone bodies
    - Alluvial fan systems
  - Fine grained facies, shown as a background color

Geologic formations mapped at the surface are identified on the detailed cross-sections in Plates 5 through 19. Exposures on the west and south side of the basin are based on recent mapping by CGS under the STATEMAP component of the National Cooperative Geologic Mapping Program. Results of this detailed 1:24,000 scale quadrangle mapping have been compiled at a scale of 1:50,000 by Thorson (2011). Elsewhere, exposures are based on mapping at a scale of 1:100,000 by Colton (1978), Trimble and Machette (1979a, 1979b) or mapping at a scale of 1:250,000 by Braddock and Cole (1978), Bryant et al. (1981), Scott et al. (1978), Sharps, J.A. (1976, 1980).

Horizontal Scale

1:250,000

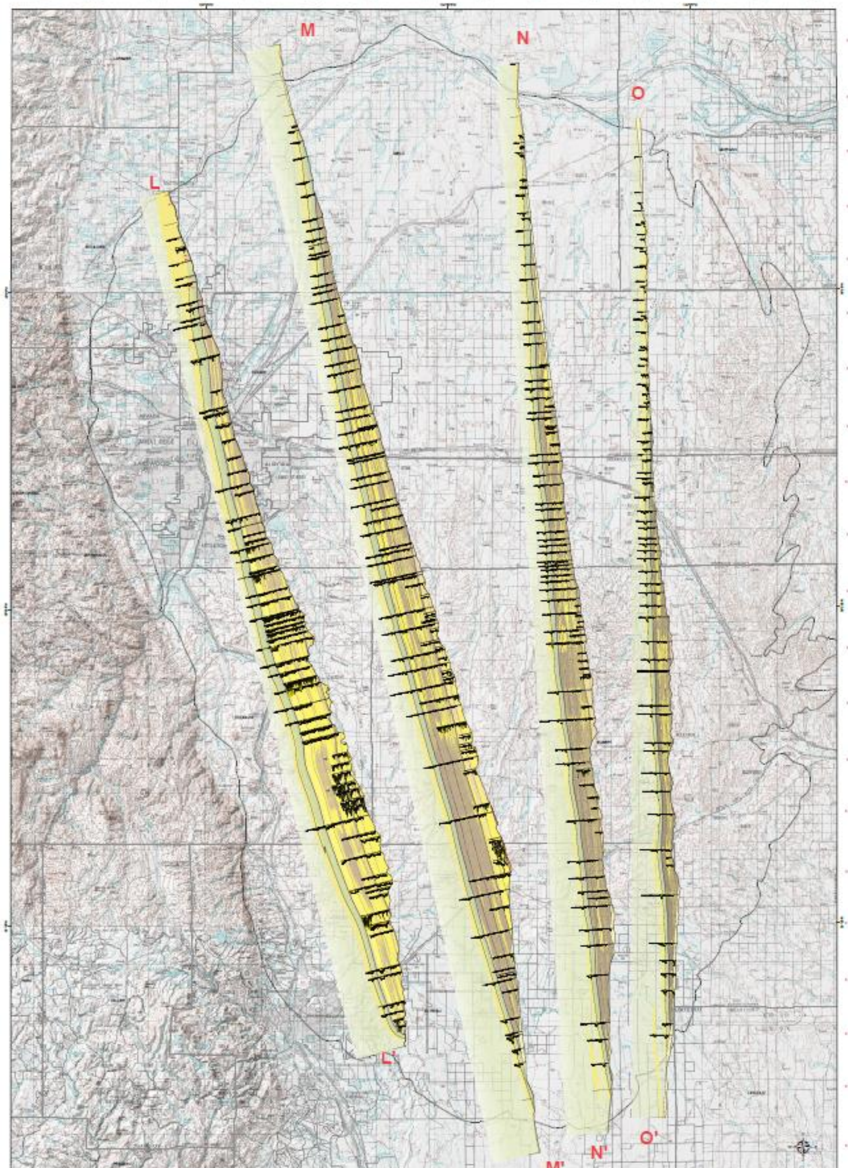
Vertical Scale for Cross-sections

Vertical Exaggeration Approximately 11X

CROSS-SECTIONS OF THE FRESH-WATER BEARING STRATA OF THE DENVER BASIN BETWEEN GREELEY AND COLORADO SPRINGS, COLORADO

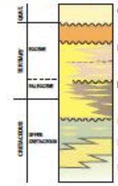
By Peter E. Barkmann, Marieke Dechesne, Mary Ellen Wickham, Jill Carlson, and Scott Formolo
2011

NORTH-TO-SOUTH COMPILATION



Structural Cross-Section Legend

Stratigraphic Column



Quaternary Deposits:

Younger Tertiary Rocks:

Denver Basin Group Sequence D2:

Denver Basin Sequence D1:

Laramie Formation:

Fox Hills Sandstone:

Pierre Shale:

Geologic Boundaries

Conformable Boundary

Unconformable Boundary

Intermediate Surface

Geophysical Log Traces

Resistivity (MHOS) or Resistance (M/M)
LINEAR SCALE 0-100

Higher values to the right indicate coarser-grained more permeable stratigraphic intervals.

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Braddock, W.A., and Cole, J.C., 1978, Preliminary geologic map of the Greeley 1° x 2° quadrangle, Colorado and Wyoming: U.S. Geological Survey Open File Report OF78-532, scale 1:250,000.

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Tweto, O., 1979, Geologic map of Colorado: U.S. Geological Survey, scale 1:500,000.

Horizontal Scale

Universal Transverse Mercator, Zone 13, NAD83

1:250,000

Vertical Scale for Cross-sections

Suggested Dip

Vertical Exaggeration Approximately 1:2

CROSS-SECTIONS OF THE FRESH-WATER BEARING STRATA OF THE DENVER BASIN BETWEEN GREELEY AND COLORADO SPRINGS, COLORADO

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2011

Tracey Felger and Evan Thoms

GEOPROCESSING TOOLS FOR WORKING WITH GEOLOGIC CROSS-SECTIONS IN ARCGIS - CROSS SECTION TOOLBOX FOR ARCGIS 10.2 BY EVAN THOMS, USGS, ANCHORAGE, AK

USGS

Evan Thoms' Cross-Section Tool

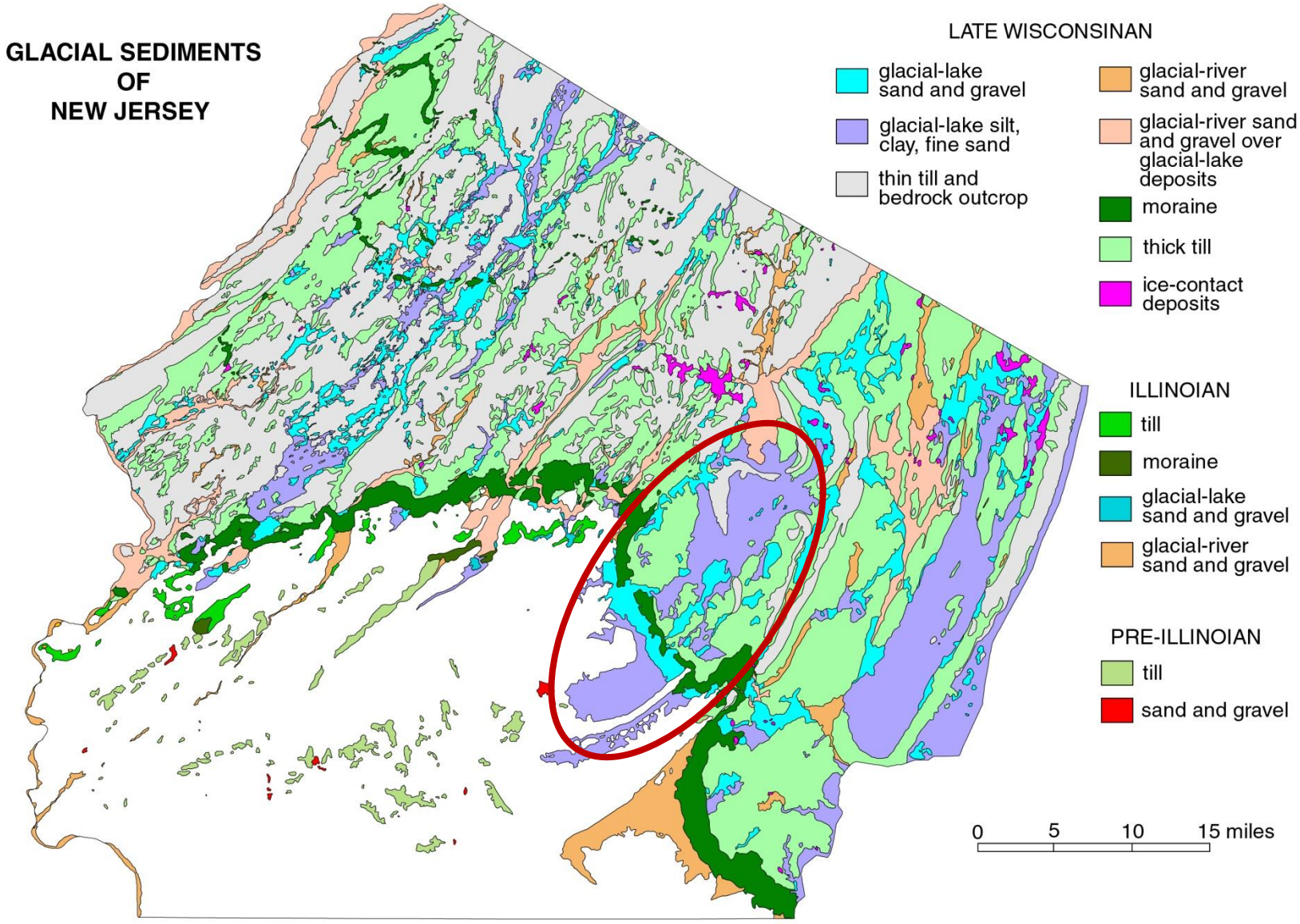
- Find the tools posted on Github at https://github.com/evanthoms/Cross-Section
- The link to Hawths tools are at http://www.spatialecology.com/htools/tooldesc.php

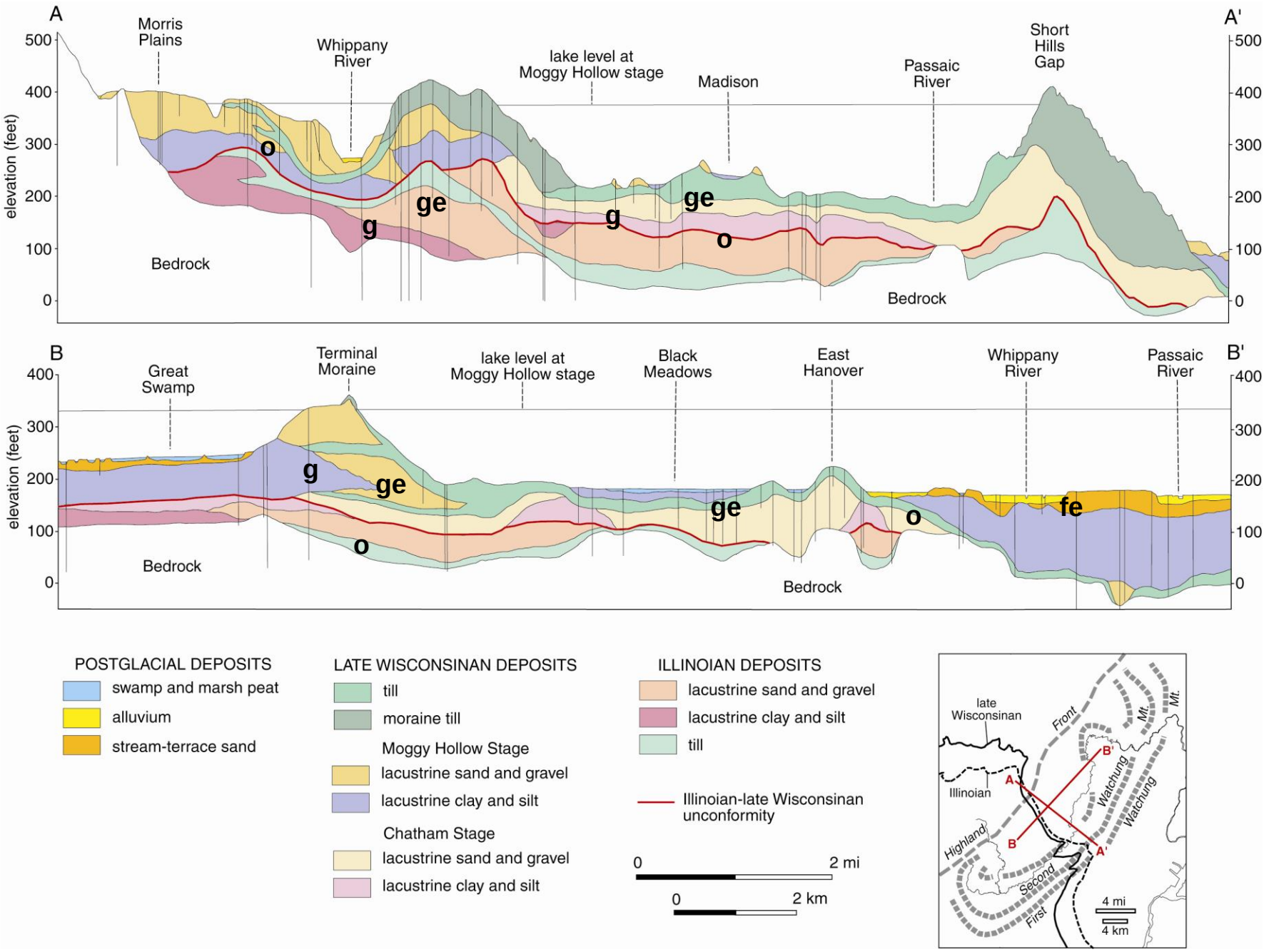
USGS

Scott Stanford

NEW JERSEY GEOLOGICAL AND WATER SURVEY

USGS


GLACIAL SEDIMENTS
OF
NEW JERSEY
LATE WISCONSINAN
glacial-lake sand and gravel
glacial-lake silt, clay, fine sand
thin till and bedrock outcrop
glacial-river sand and gravel
glacial-river sand and gravel over glacial-lake deposits
moraine
thick till
ice-contact deposits
ILLINOIAN
till
moraine
glacial-lake sand and gravel
glacial-river sand and gravel
PRE-ILLINOIAN
till
sand and gravel
0 5 10 15 miles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Morris Plains
Whippany River
lake level at Moggy Hollow stage
Madison
Passaic River
Short Hills Gap
elevation (feet)
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g
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Bedrock
B
B'
Great Swamp
Terminal Moraine
lake level at Moggy Hollow stage
Black Meadows
East Hanover
Whippany River
Passaic River
fe
POSTGLACIAL DEPOSITS
swamp and marsh peat
alluvium
stream-terrace sand
LATE WISCONSINAN DEPOSITS
till
moraine till
Moggy Hollow Stage
lacustrine sand and gravel
lacustrine clay and silt
Chatham Stage
lacustrine sand and gravel
lacustrine clay and silt
ILLINOIAN DEPOSITS
lacustrine sand and gravel
lacustrine clay and silt
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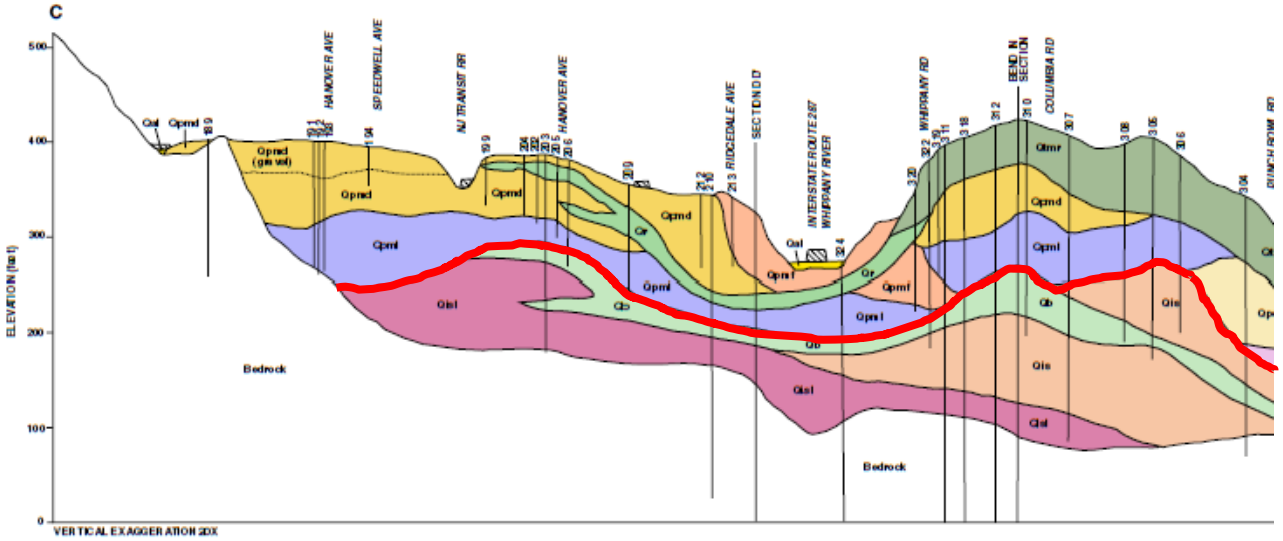
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ELEVATION (feet)
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HANOVER AVE
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NJ TRANSIT RR
HANOVER AVE
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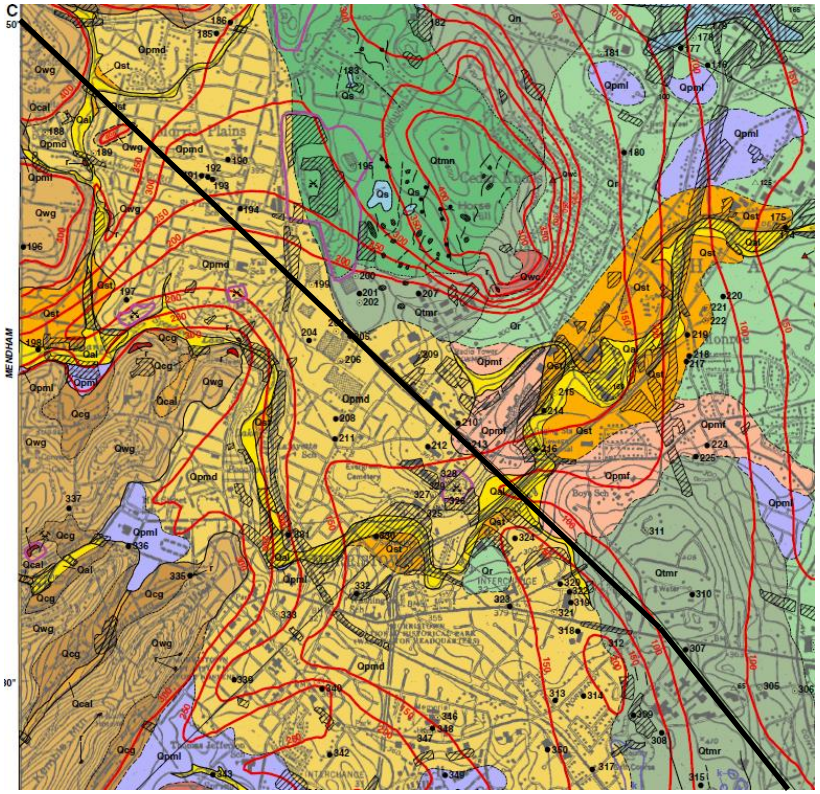
SECTION D D'
INTERSTATE ROUTE 287
WHIPPANY RIVER
WHIPPANY RD
BEND IN SECTION
COLUMBIA RD
Qal
Qpmd
Qpmd (glacial)
Qpml
Qtmr
Qtmn
Qr
Qb
Qis
Bedrock
VERTICAL EXAGGERATION 20X


C
C'
MENDHAM
Morris Plains
Qpmd
Qpml
Qtmr
Qtmn
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Qwg
Qcg
Qcal
Qal
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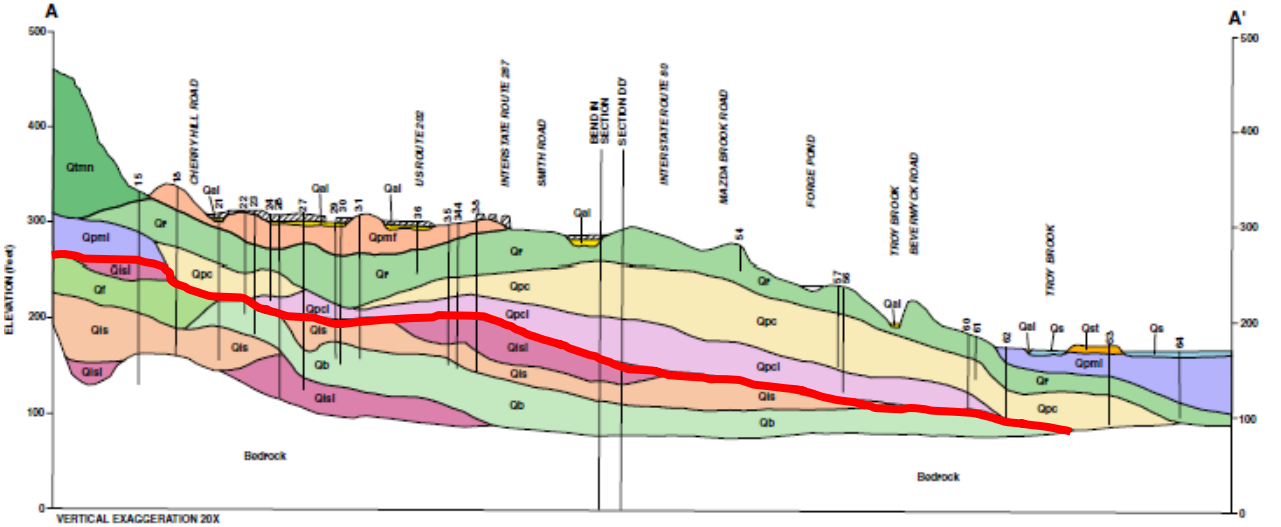
Qb
Qis
Qe
Qs
Qwcl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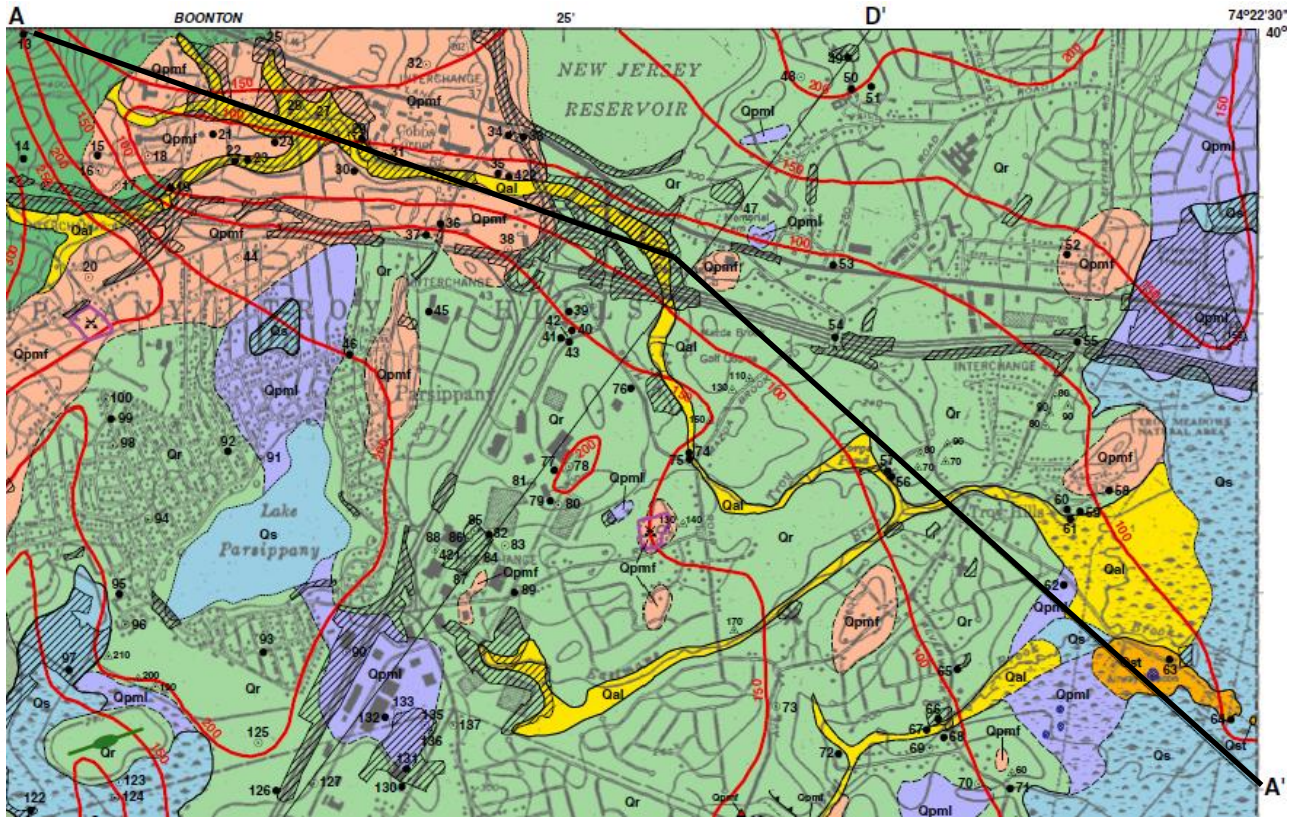
CHERRY HILL ROAD
US ROUTE 202
INTERSTATE ROUTE 287
SMITH ROAD
SEND IN SECTION
SECTION DD'
INTERSTATE ROUTE 80
MAZDA BROOK ROND
FORGE POND
TROY BROOK
BEVERLY CK ROAD
TROY BROOK
Qtmn
Qpml
Qpmf
Qpc
Qpcl
Qr
Qf
Qls
Qlsl
Qb
Qal
Qs
Qst
Bedrock
VERTICAL EXAGGERATION 20X

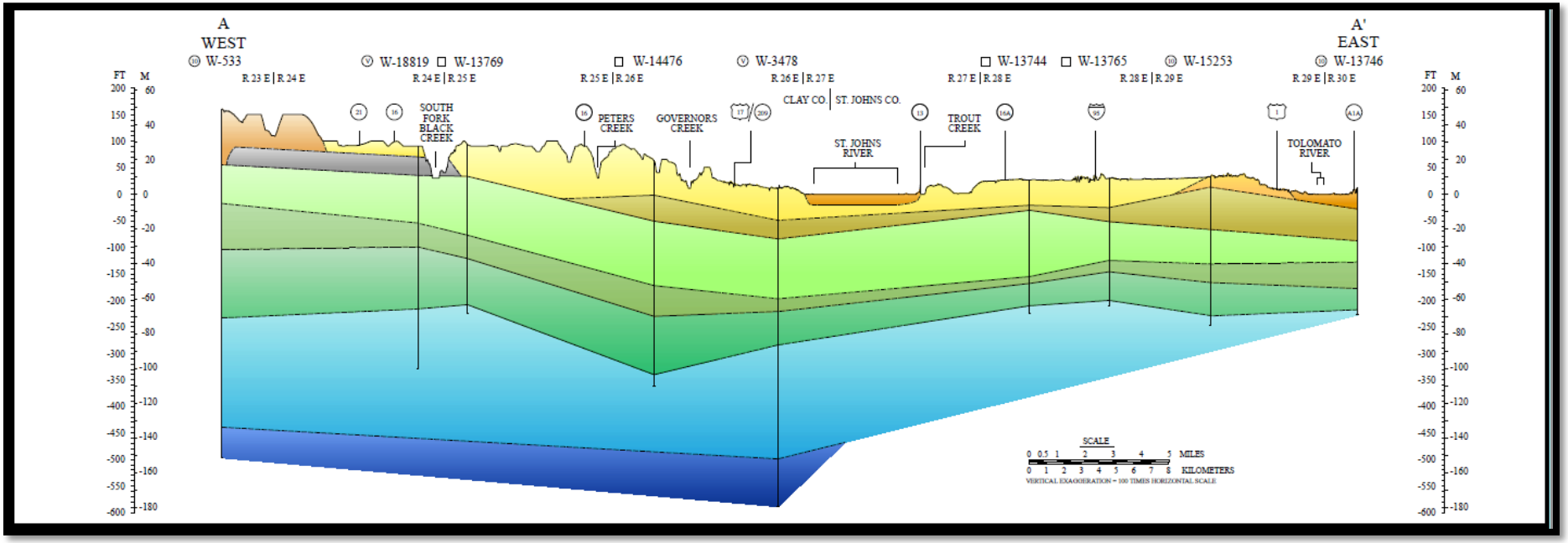

A
BOONTON
25'
D'
74°22'30"
40°
NEW JERSEY
RESERVOIR
Lake
Parsippany
Troy Hills
Troy Meadows
Qpmf
Qpml
Qr
Qs
Qal
Qst
A'

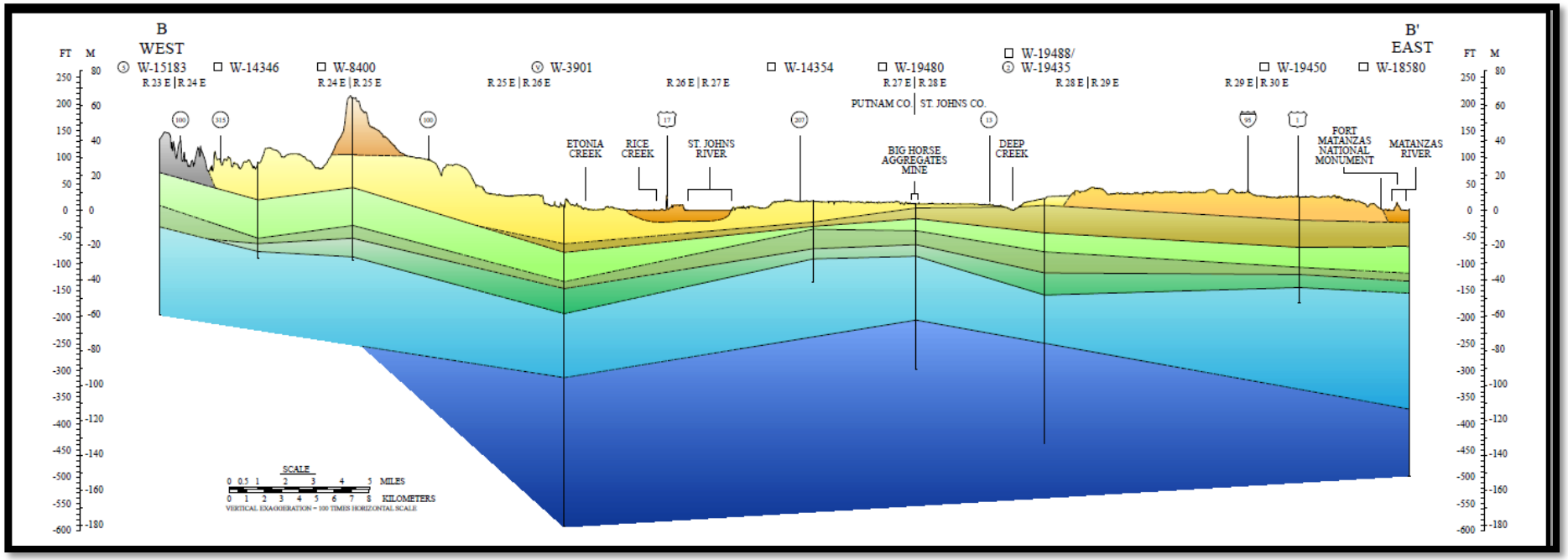
Rick Green

FLORIDA GEOLOGICAL SURVEY

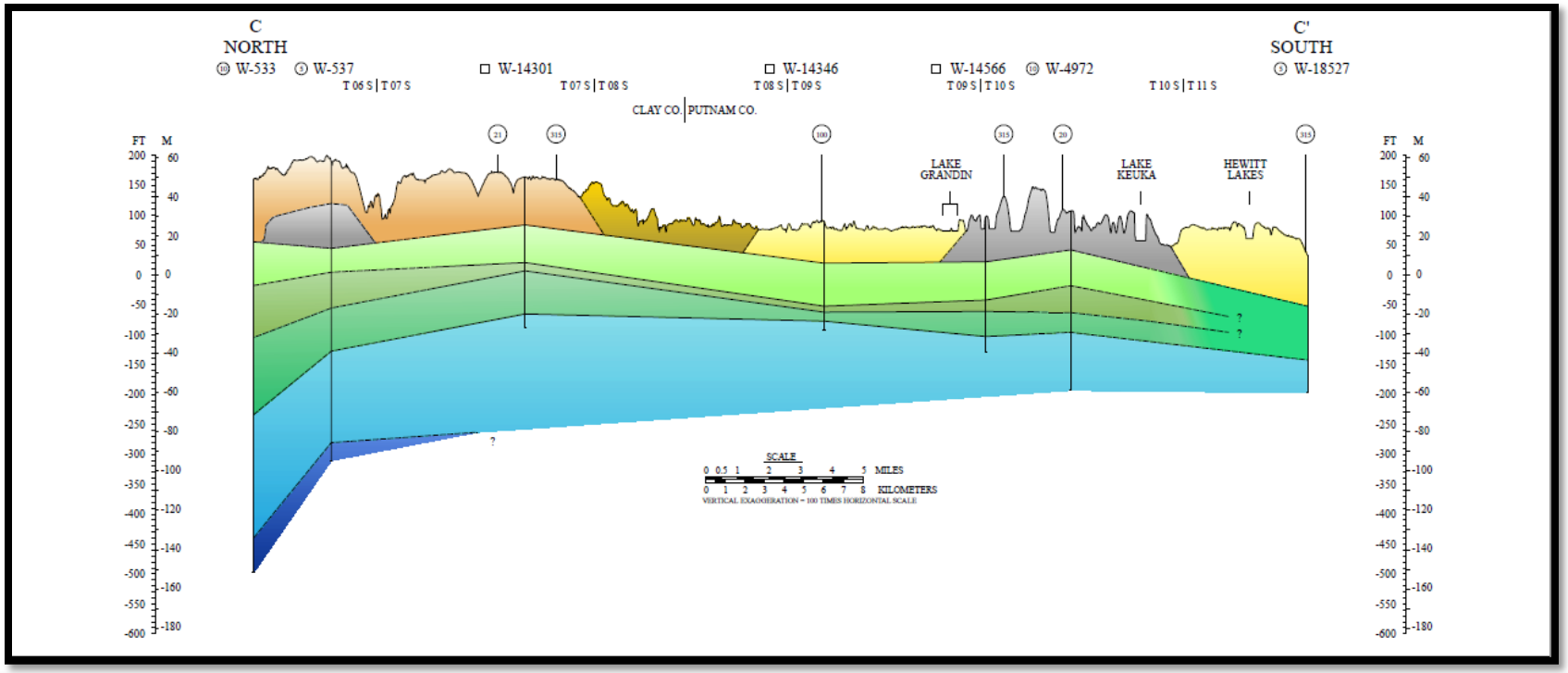
USGS

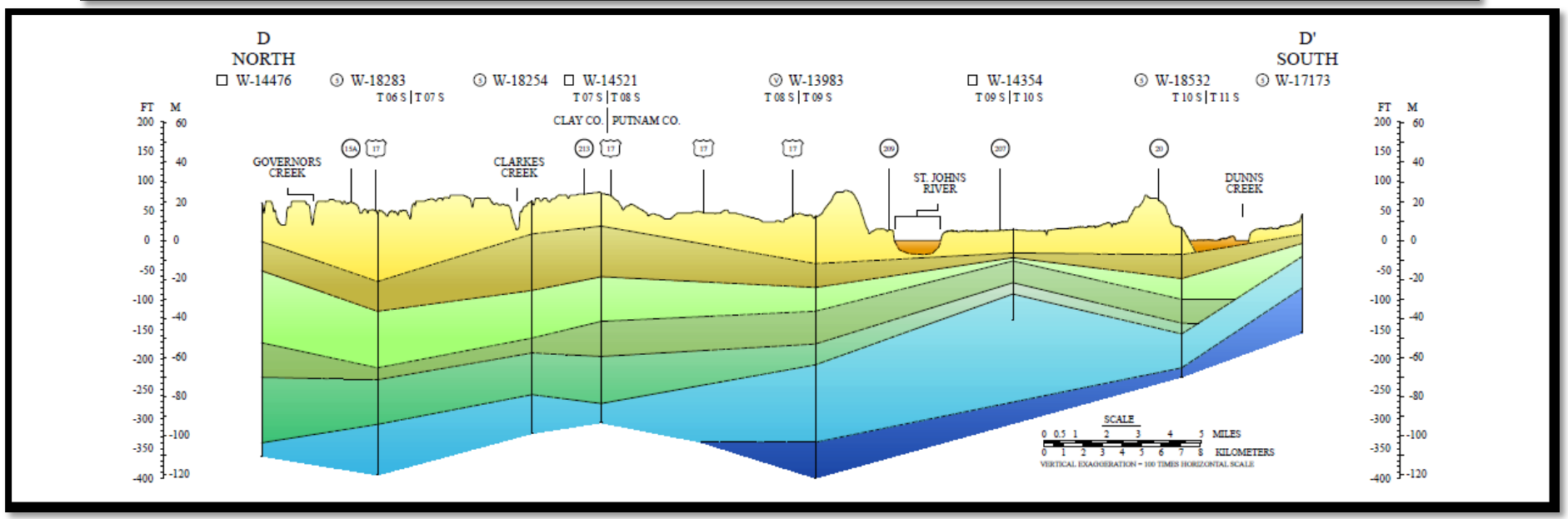
Geologic Cross Sections for the Saint Augustine 30 x 60 Minute Quadrangle, Northeast Florida



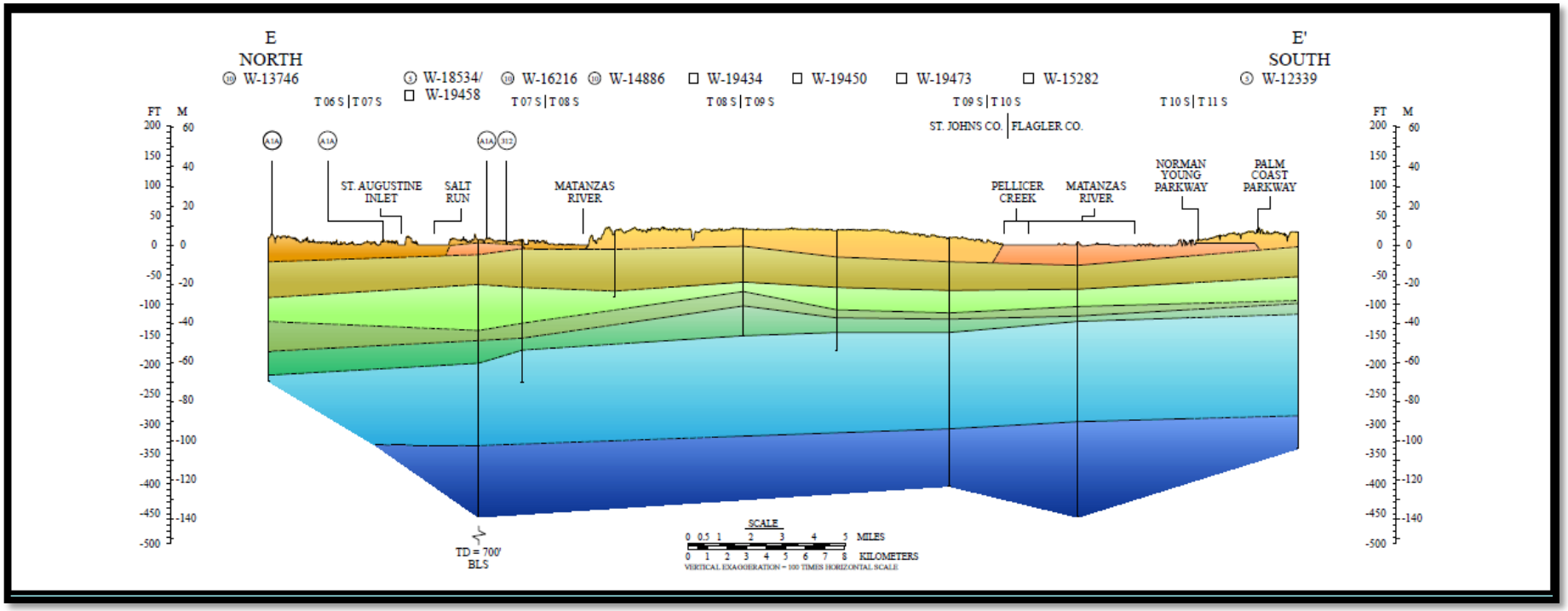


Geologic Cross Sections for the Saint Augustine 30 x 60 Minute Quadrangle, Northeast Florida





Geologic Cross Sections for the Saint Augustine 30 x 60 Minute Quadrangle, Northeast Florida



Additional ArcGIS Cross Section Tools

- **Contributed by Jennifer Carrell at the Illinois State Geological Survey**
- For cross sections (ArcMap): http://www.arcgis.com/home/item.html?id=54584a5e302e4014a495b8fc37fe0663
- 3D Boreholes (ArcScene): http://www.arcgis.com/home/item.html?id=adc9a9dcd9c14957a04b83270dcbc8f7
- 3D raster cross sections (ArcScene): http://www.arcgis.com/home/item.html?id=133a6dc35a5f45d094b73effa68fefcb
- Note that these tools were written in VBA, which requires you to install the VBA libraries separately. We're working on migrating these to a VB.NET add-in.

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StateMap Forum

QUESTIONS AND DISCUSSION

USGS

StateMap Forum

THANK YOU

USGS