

# Fox Hills Sandstone Reservoir Geometry

## Control on Aquifer Quality

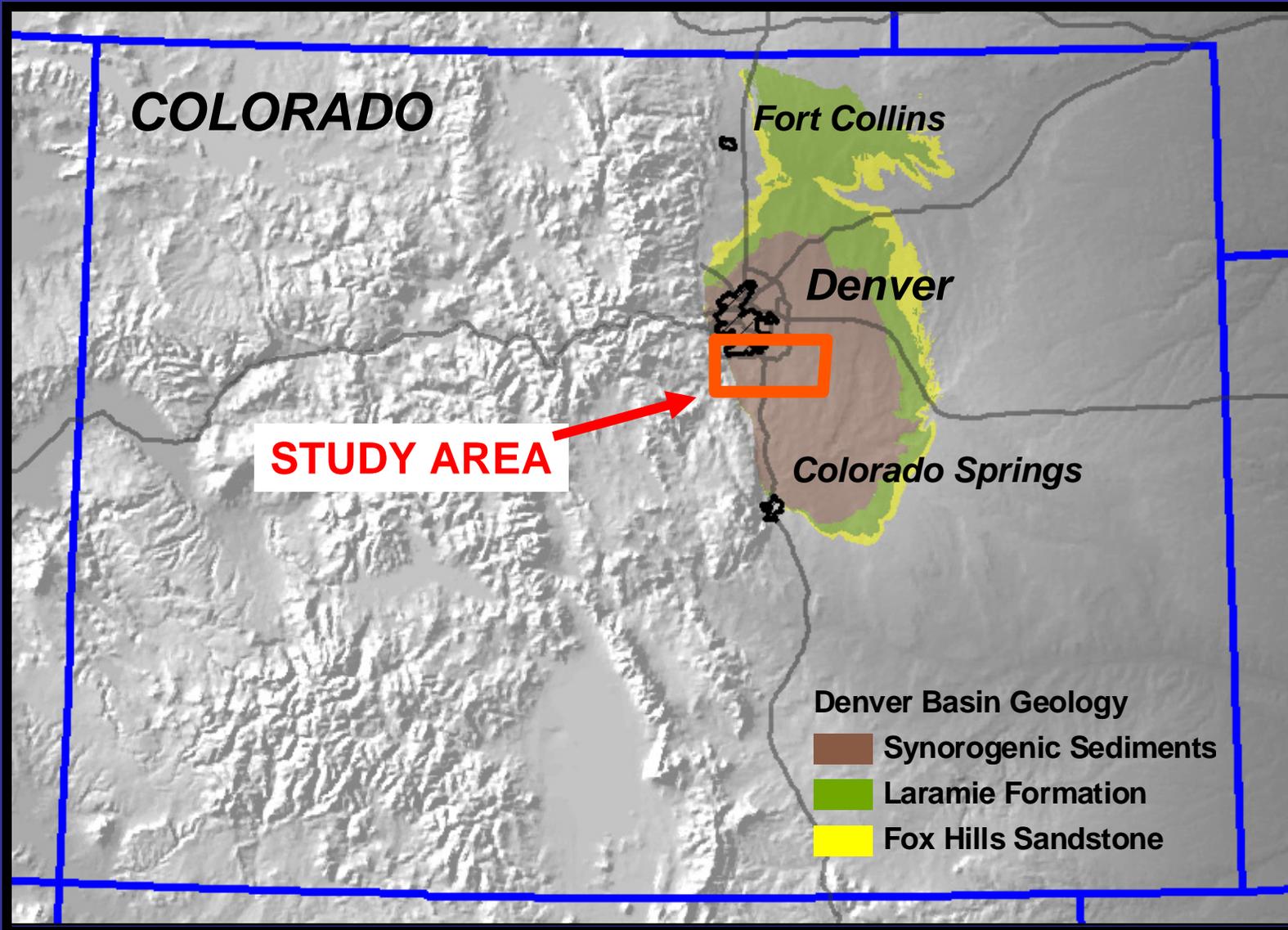
Marieke Dechesne & Bob Raynolds



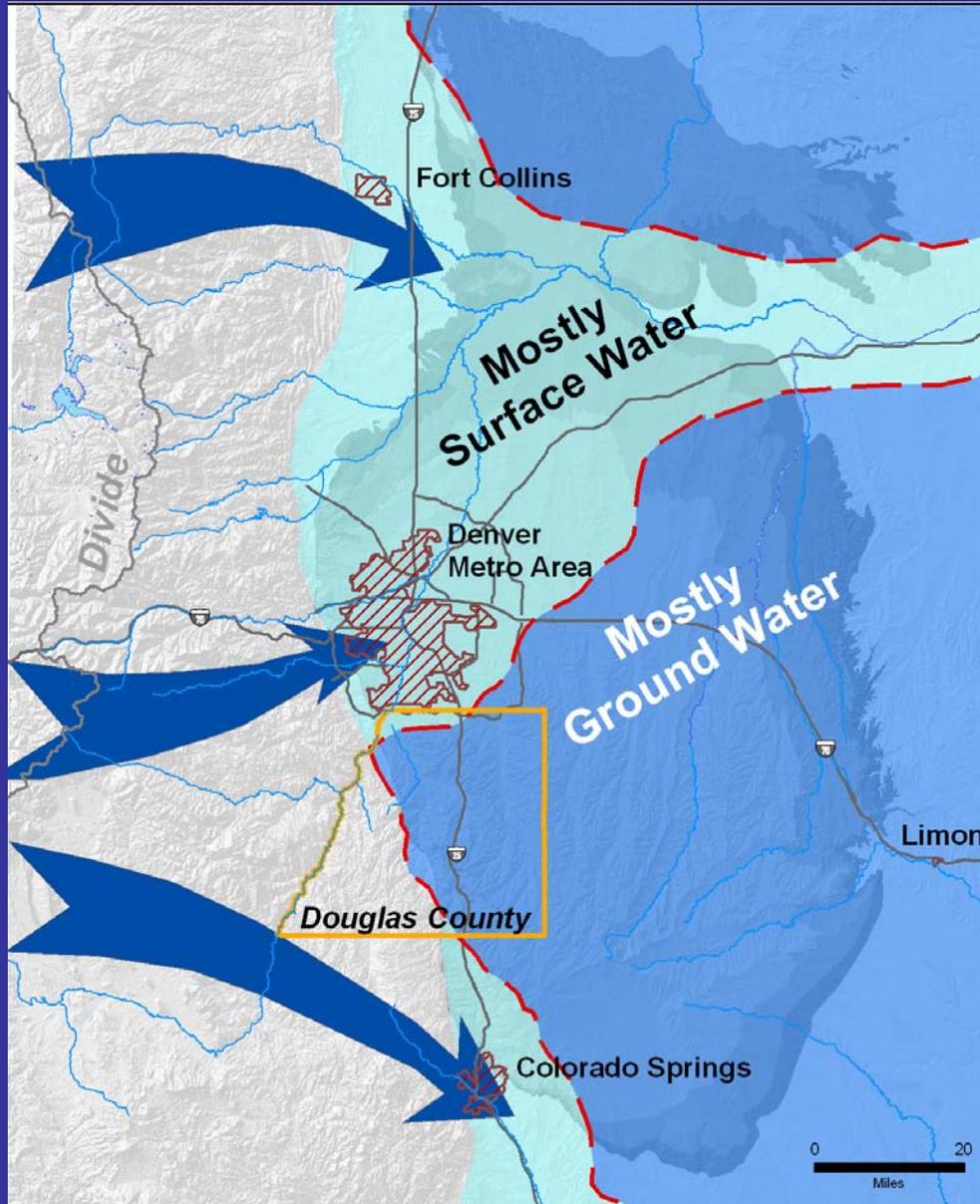
# Fox Hills Sandstone

- Where and Why?
- Geometry & Stacking Pattern
- Reservoir Architecture
  - Ground Water Resources:
    - Quantity
    - Quality

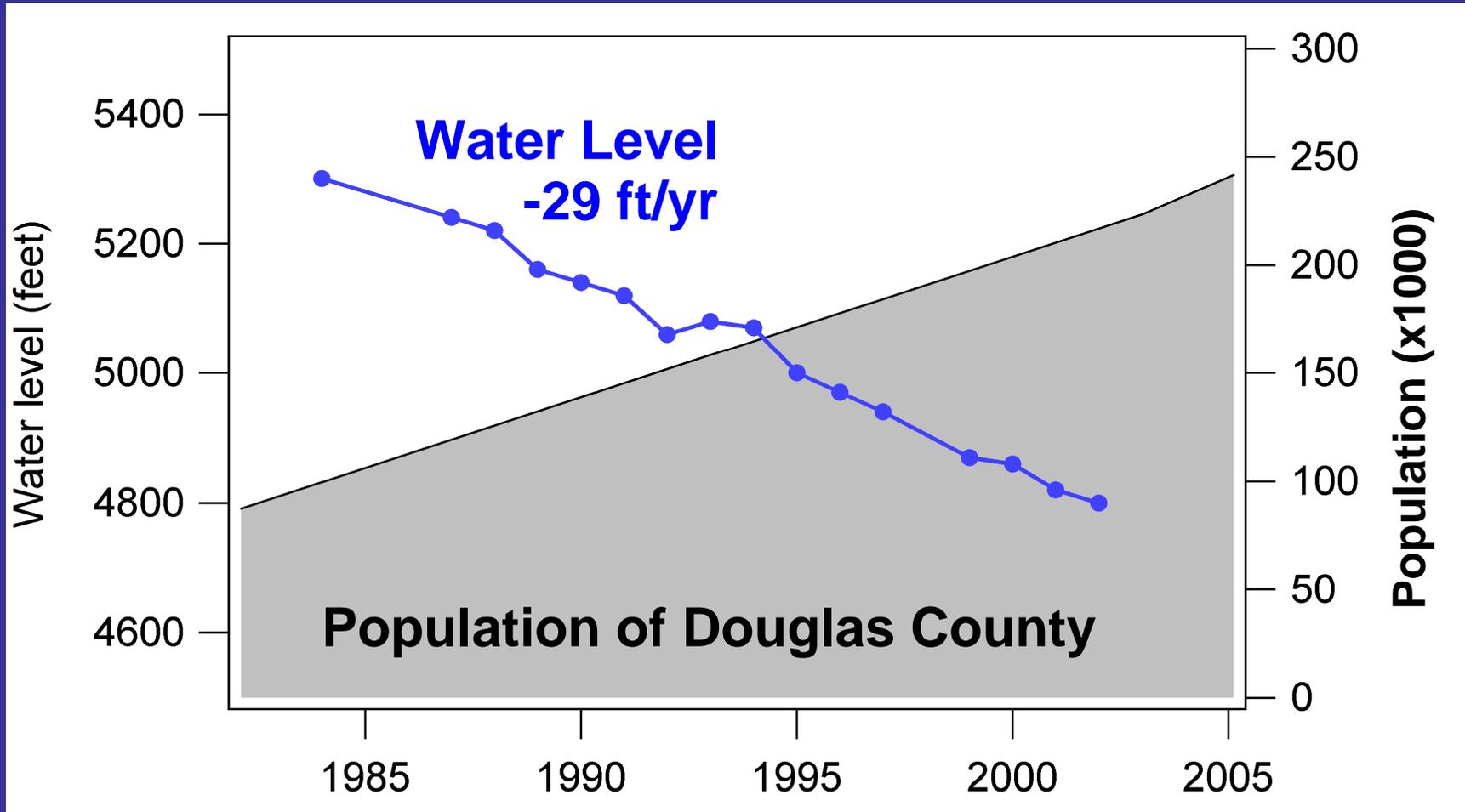
# Denver Basin



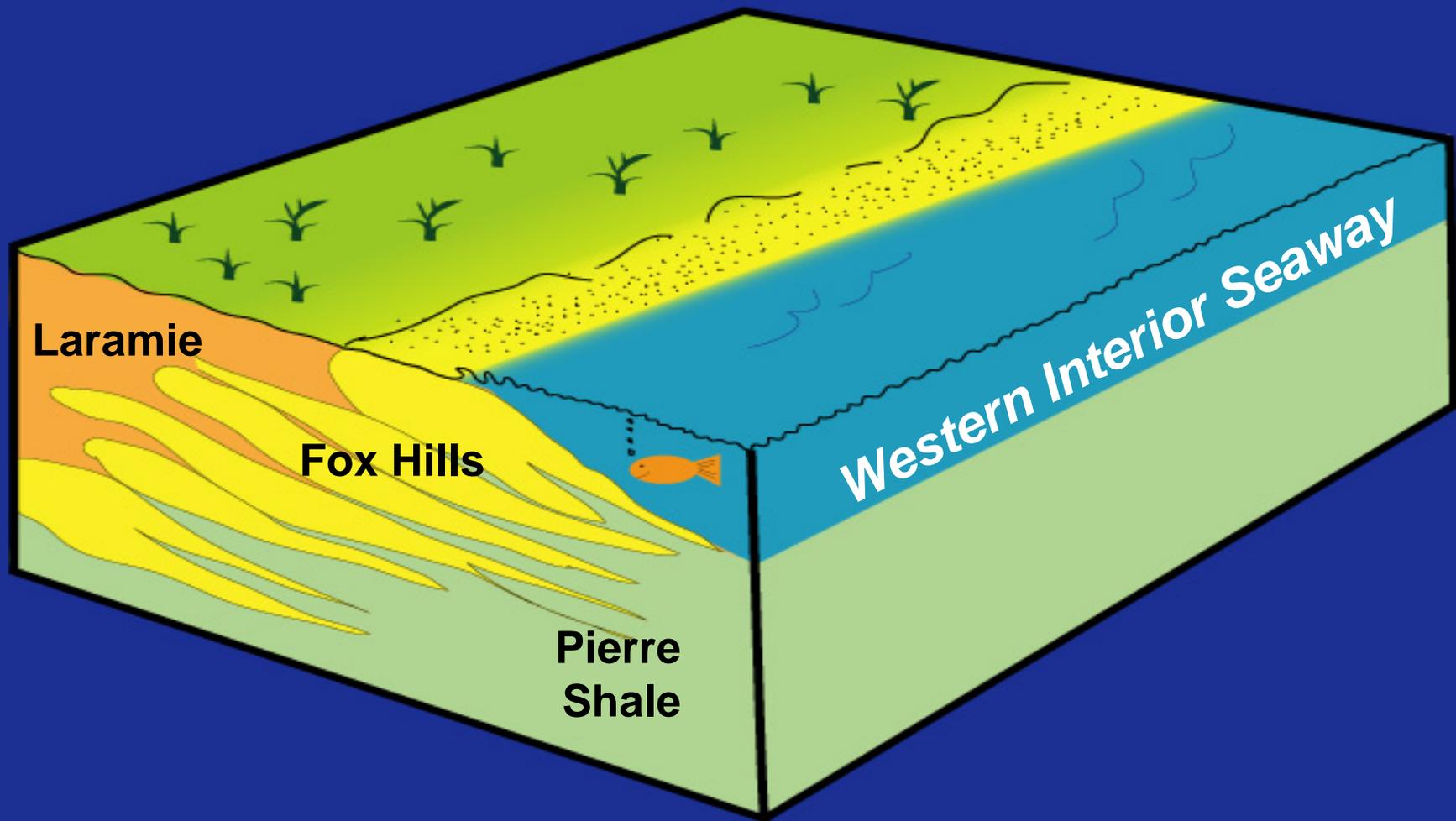
# Where Does Your Water Come From?



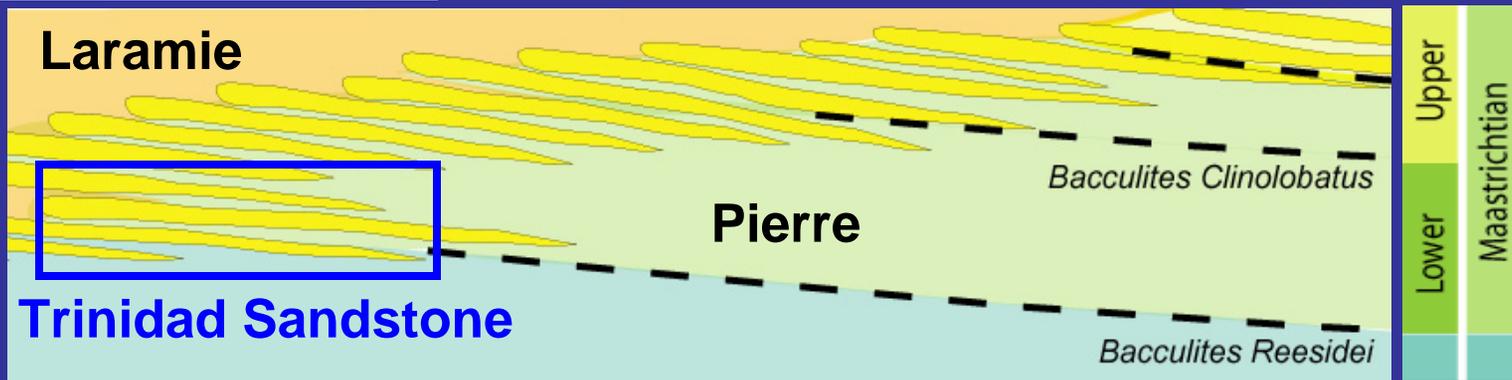
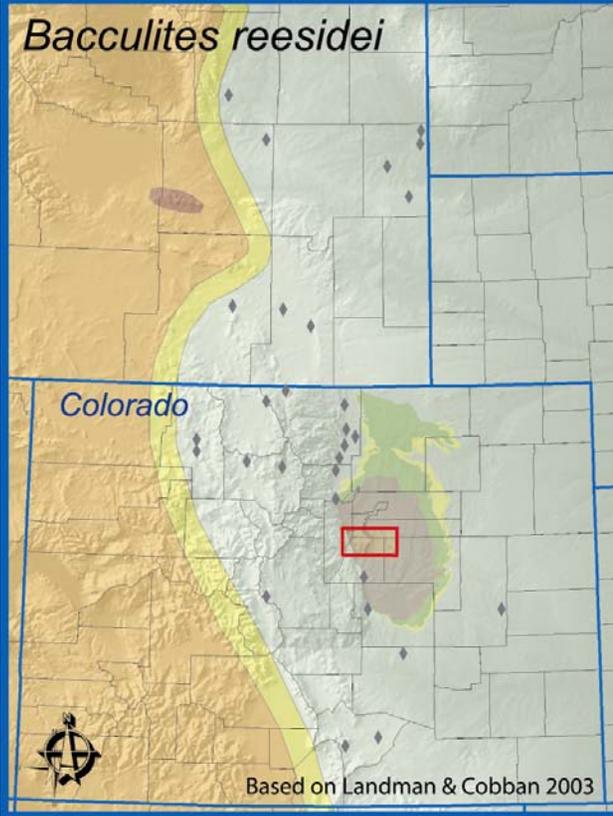
# Population vs. Water



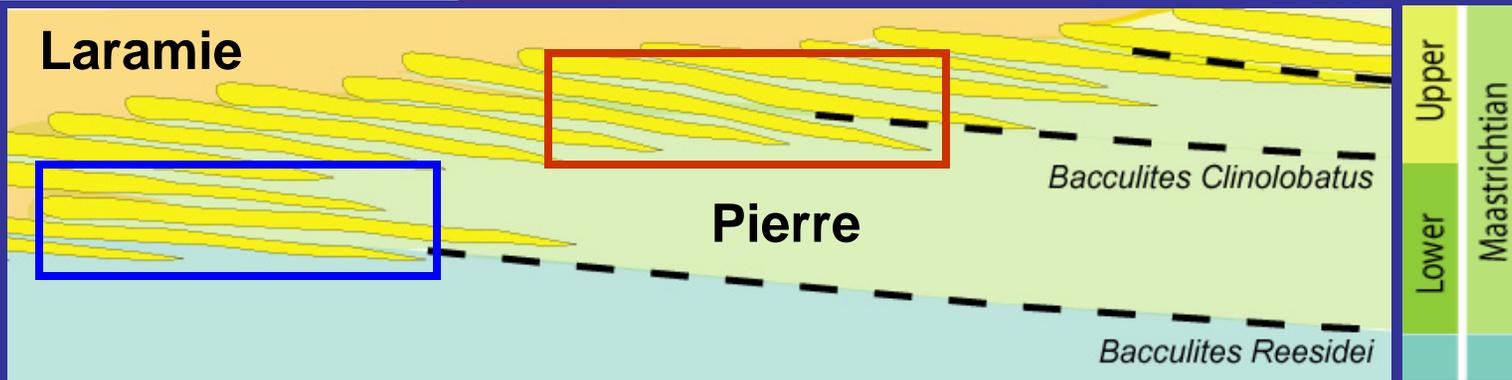
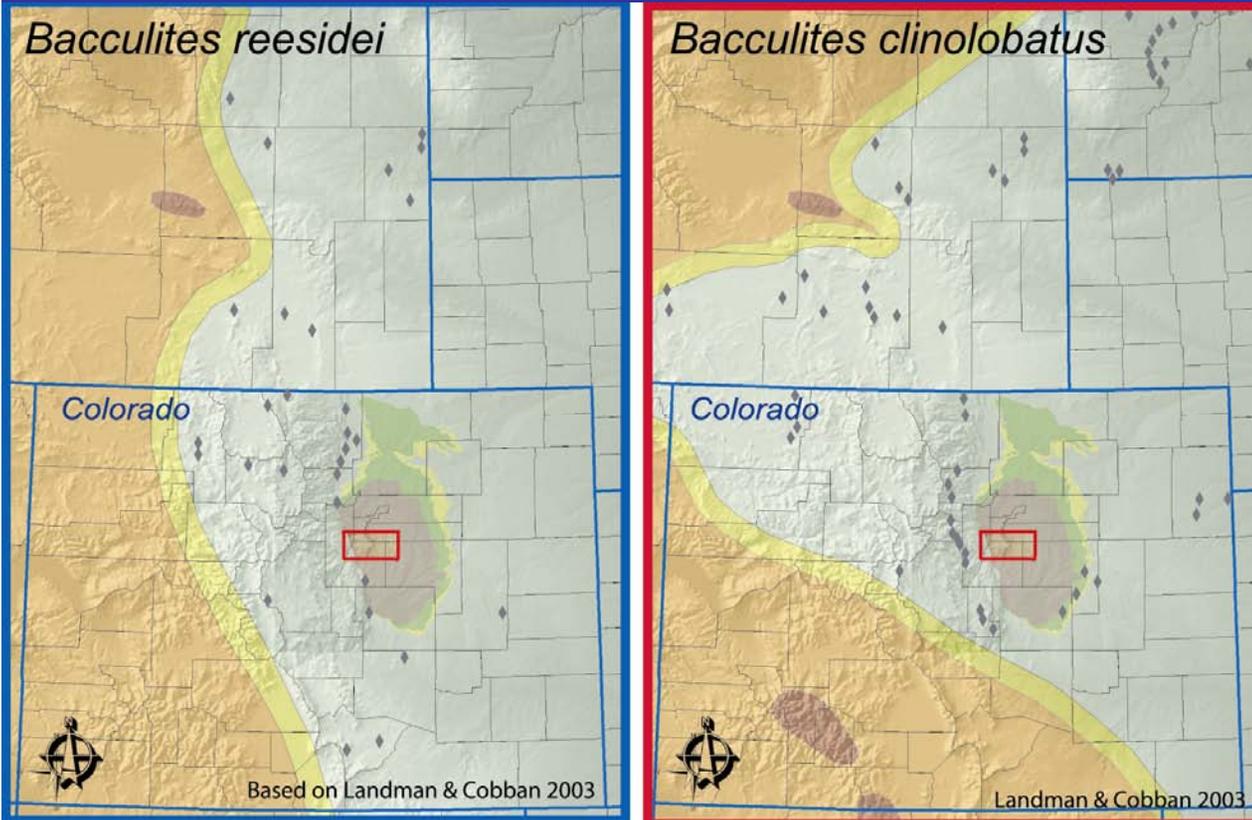
# Fox Hills Deposition



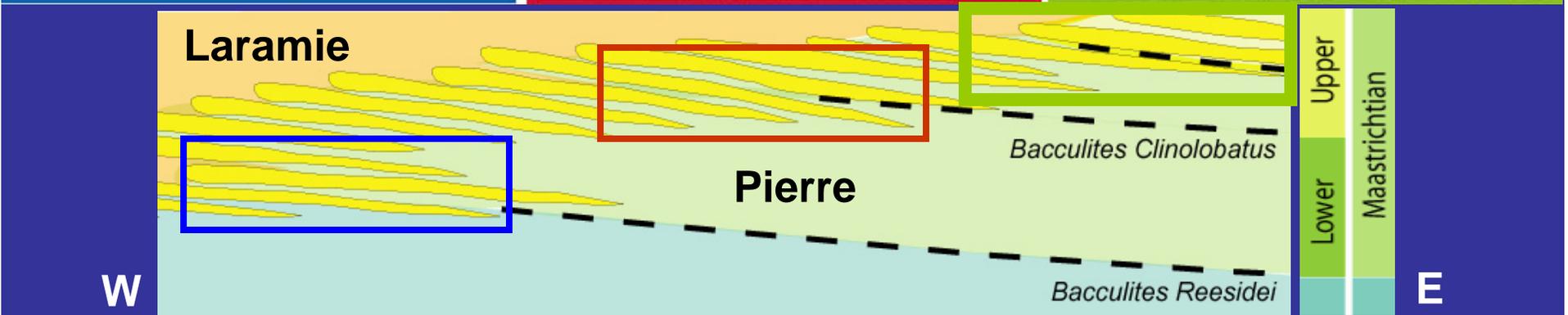
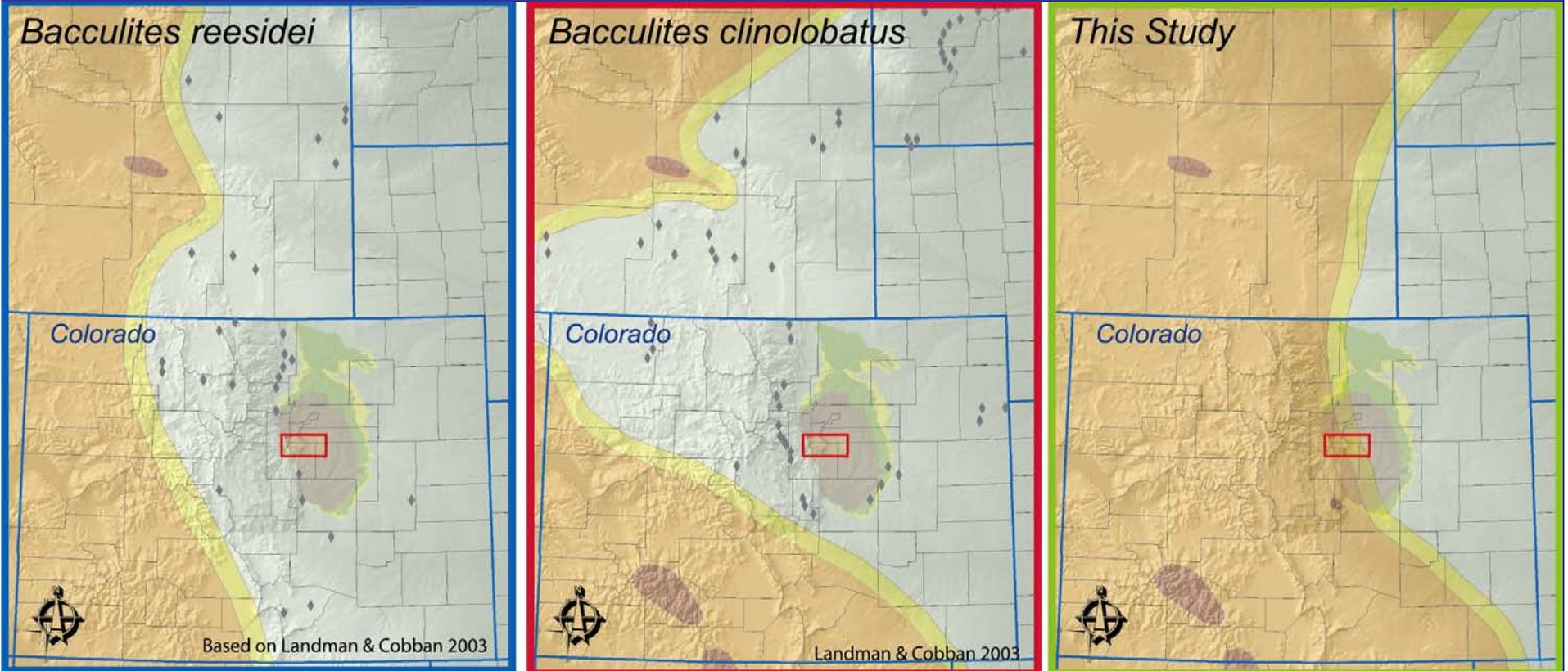
# Fox Hills Paleogeography



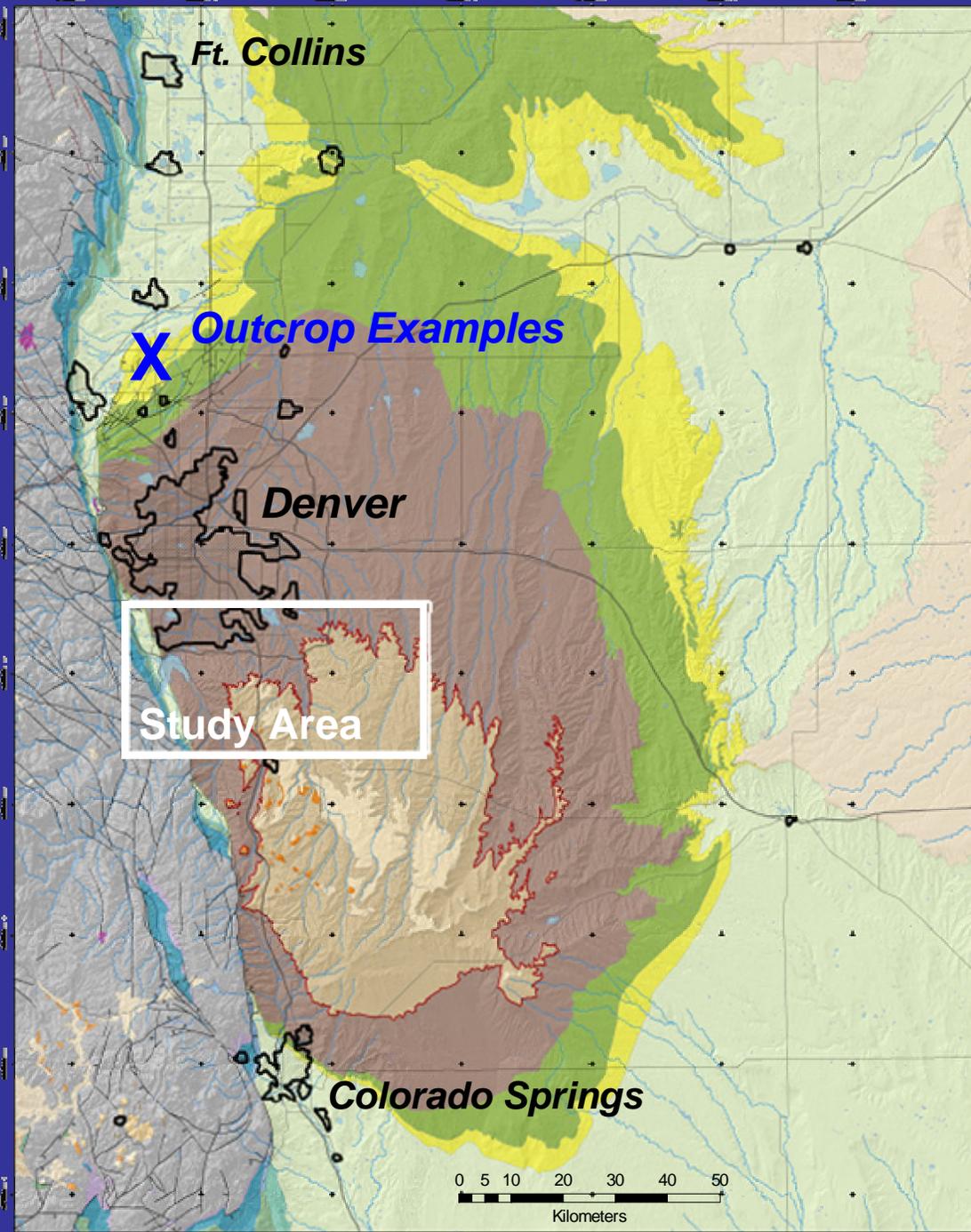
# Fox Hills Paleogeography



# Fox Hills Paleogeography



# Denver Basin Geology



## *Simplified Legend*

- Undivided Tertiary Sediments
- D2 Sequence
- D1 Sequence
- Laramie Formation
- Fox Hills Sandstone
- Undivided Pierre Shale

# Fox Hills Shingles in Outcrop

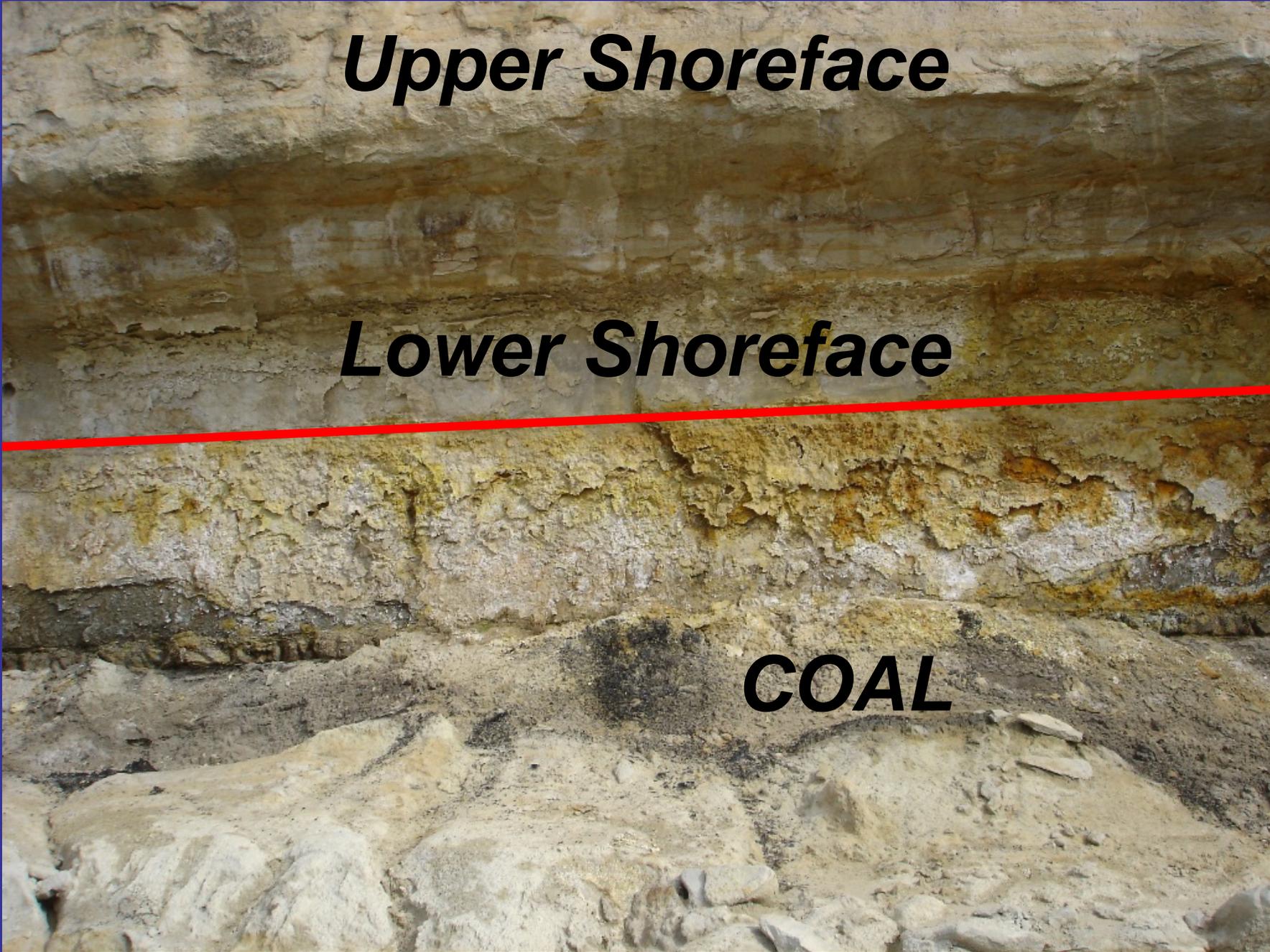


White Rocks, City of Boulder Open Space









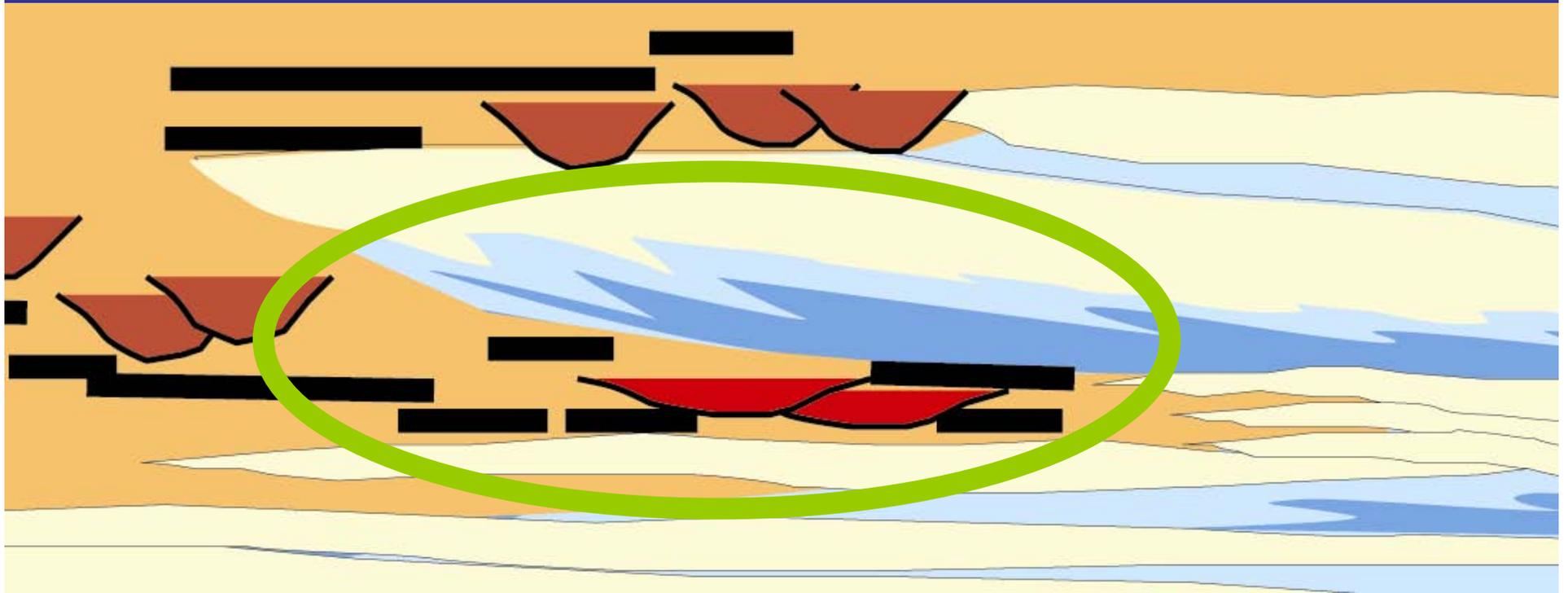
***Upper Shoreface***

The image shows a vertical rock face with distinct horizontal layers. The top section is labeled 'Upper Shoreface' and consists of light-colored, relatively smooth rock. Below this is the 'Lower Shoreface', which is more textured and yellowish. A red line is drawn horizontally across the rock face, separating the upper and lower shoreface sections. Below the red line, there is a dark, thin layer labeled 'COAL', followed by a thicker, lighter-colored layer. The bottom of the image shows more fragmented and layered rock.

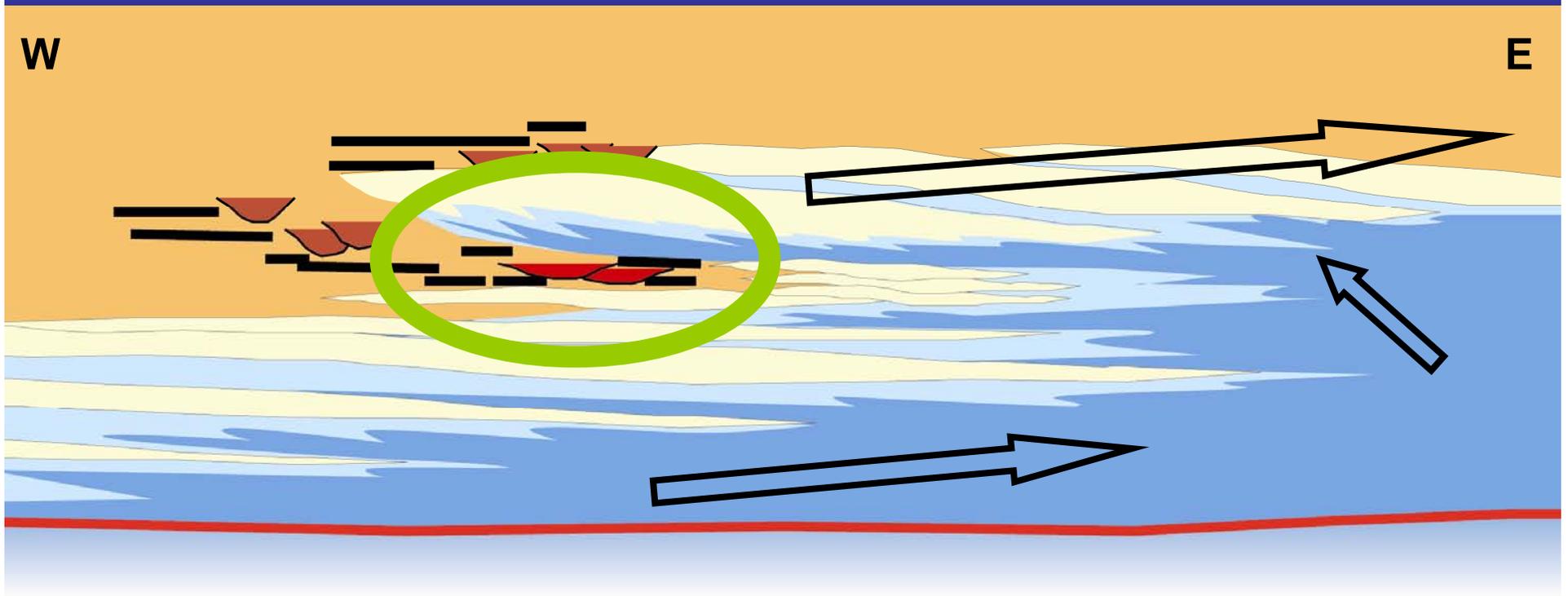
***Lower Shoreface***

**COAL**

# Lower Shoreface on Coal



# Lower Shoreface on Coal



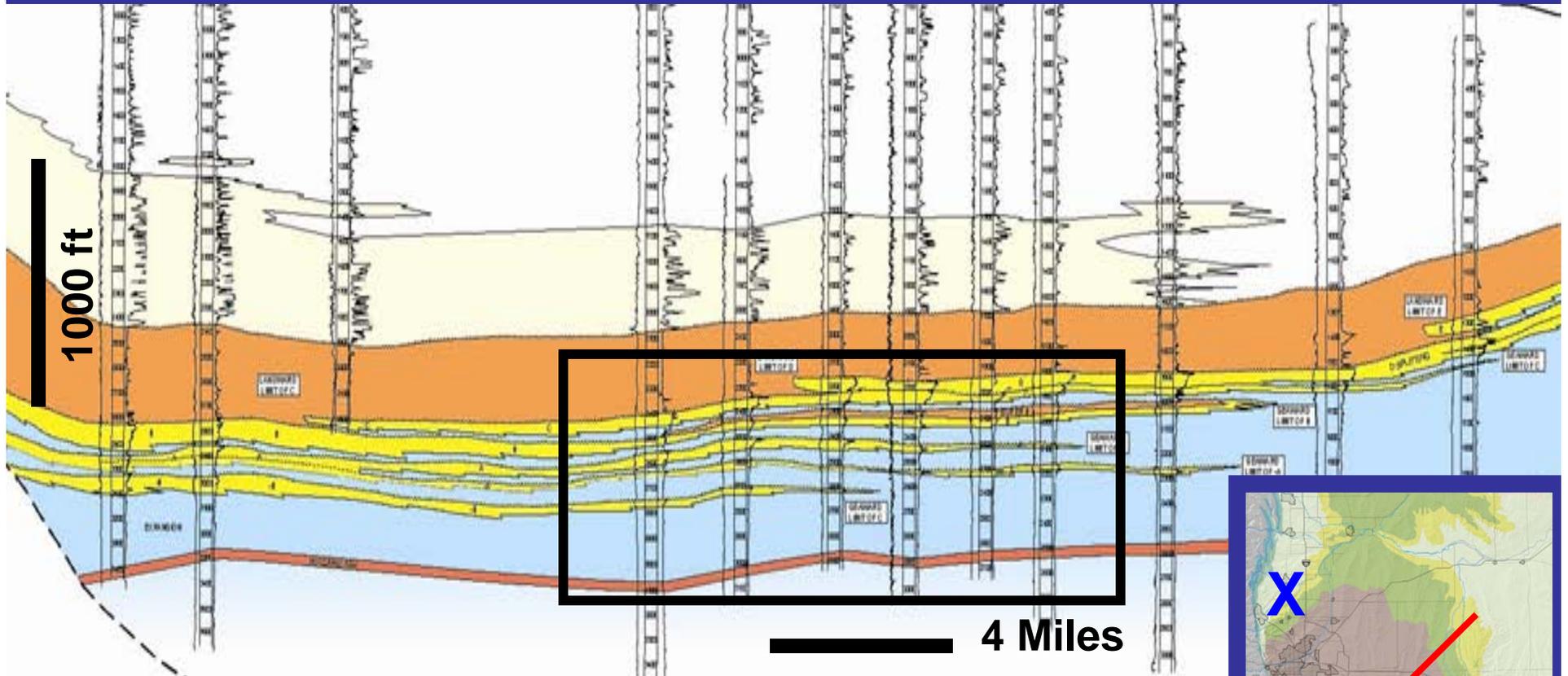
- Progradation ~ Aggradation ~ Progradation



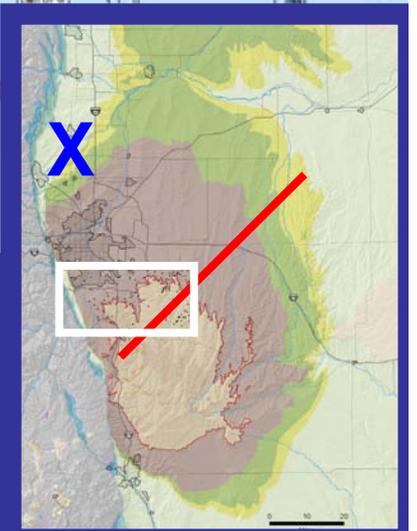
# Fox Hills Cross Section

SW

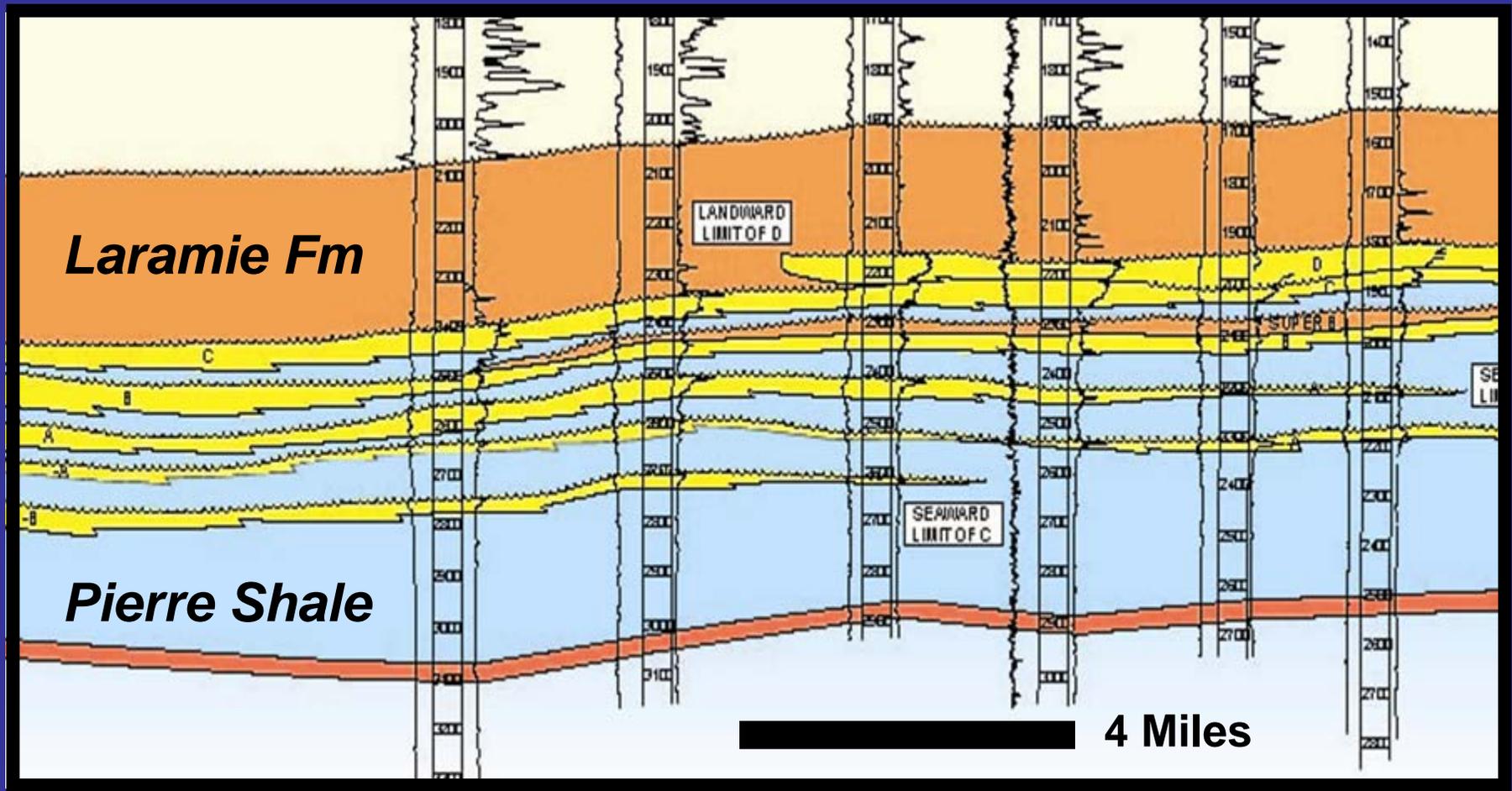
NE



- Overall regressive stacking pattern
- 8 Individual shingles mapped



# Cross Section in of Study Area



1000 ft

4 Miles

# Fox Hills in Outcrop

**Fox Hills Outcrop**



**C. B. Land, 1972**

**Greater Green River Basin, Wyoming**

# Shingles at Same Scale

## Fox Hills Outcrop



## Mesa Verde (Point Lookout) Subsurface



## San Juan Basin, New Mexico

# Shingles at Same Scale

## Fox Hills Outcrop



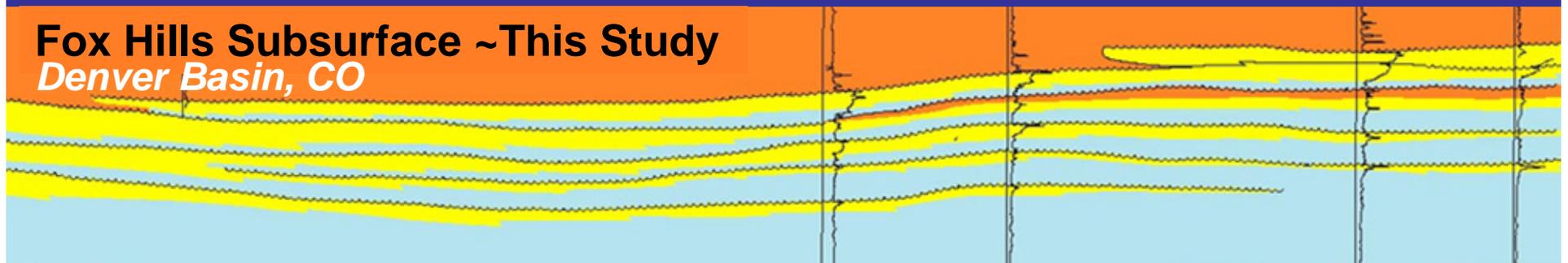
## Mesa Verde (Point Lookout) Subsurface

*San Juan Basin, NM*



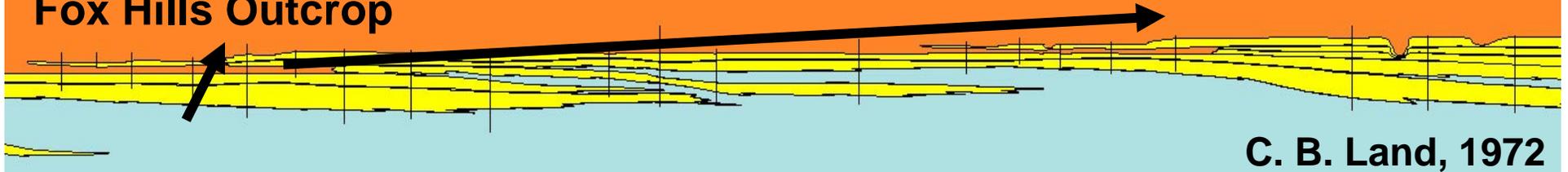
## Fox Hills Subsurface ~This Study

*Denver Basin, CO*

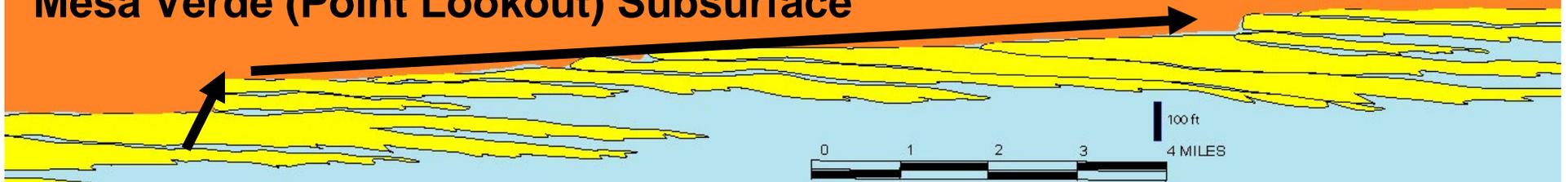


# Shingles at Same Scale

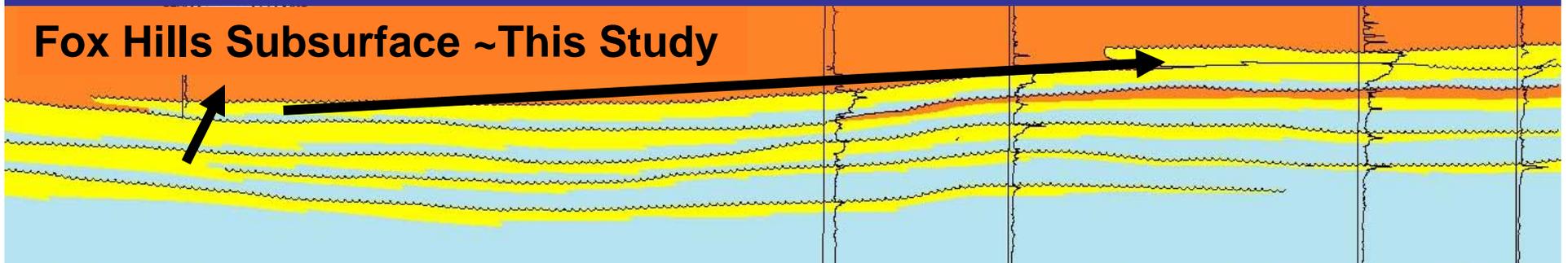
**Fox Hills Outcrop**



**Mesa Verde (Point Lookout) Subsurface**



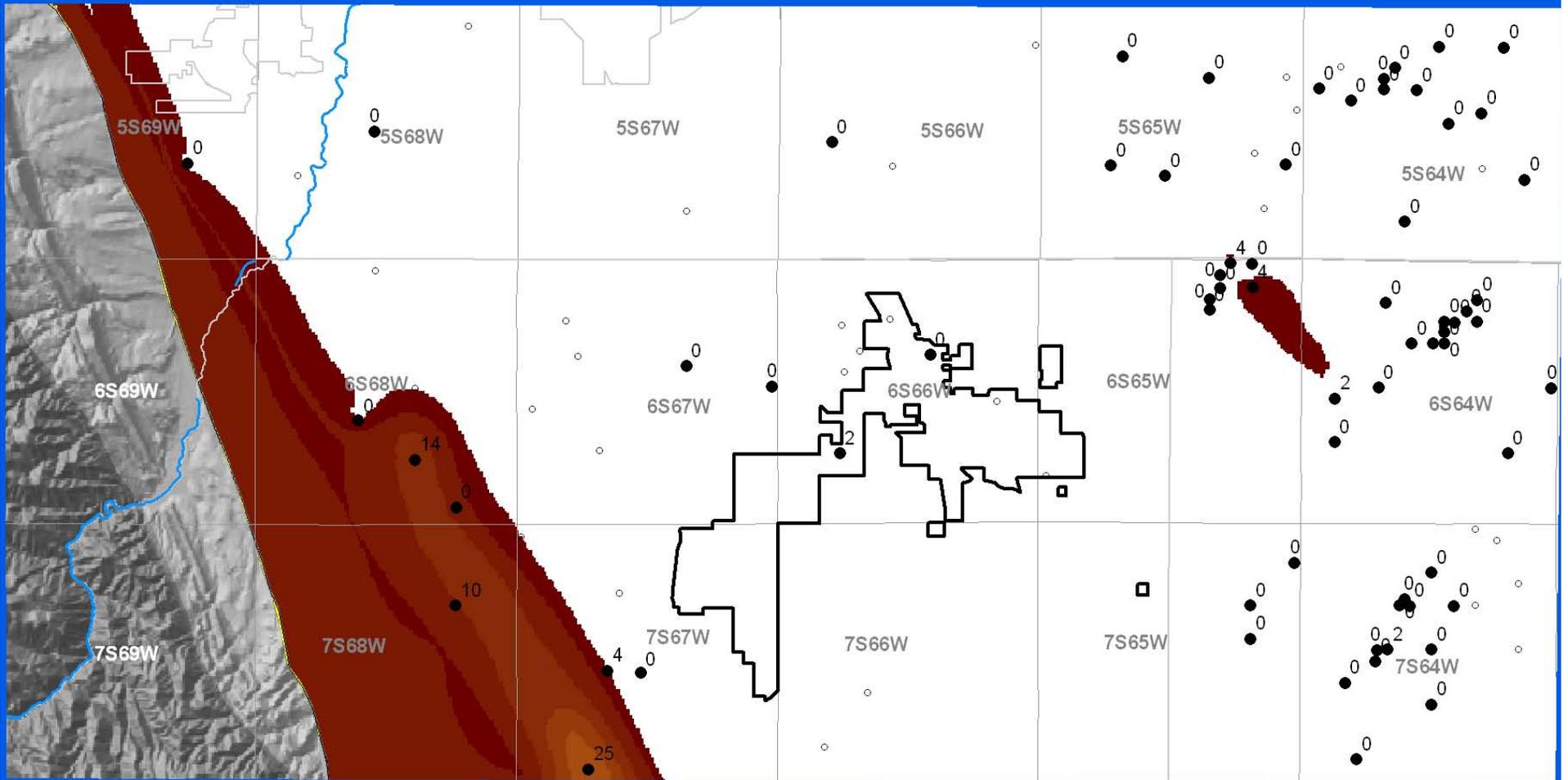
**Fox Hills Subsurface ~This Study**



- Stacking pattern comparable
- Shingle lengths similar



# Net Sand Maps By Shingle

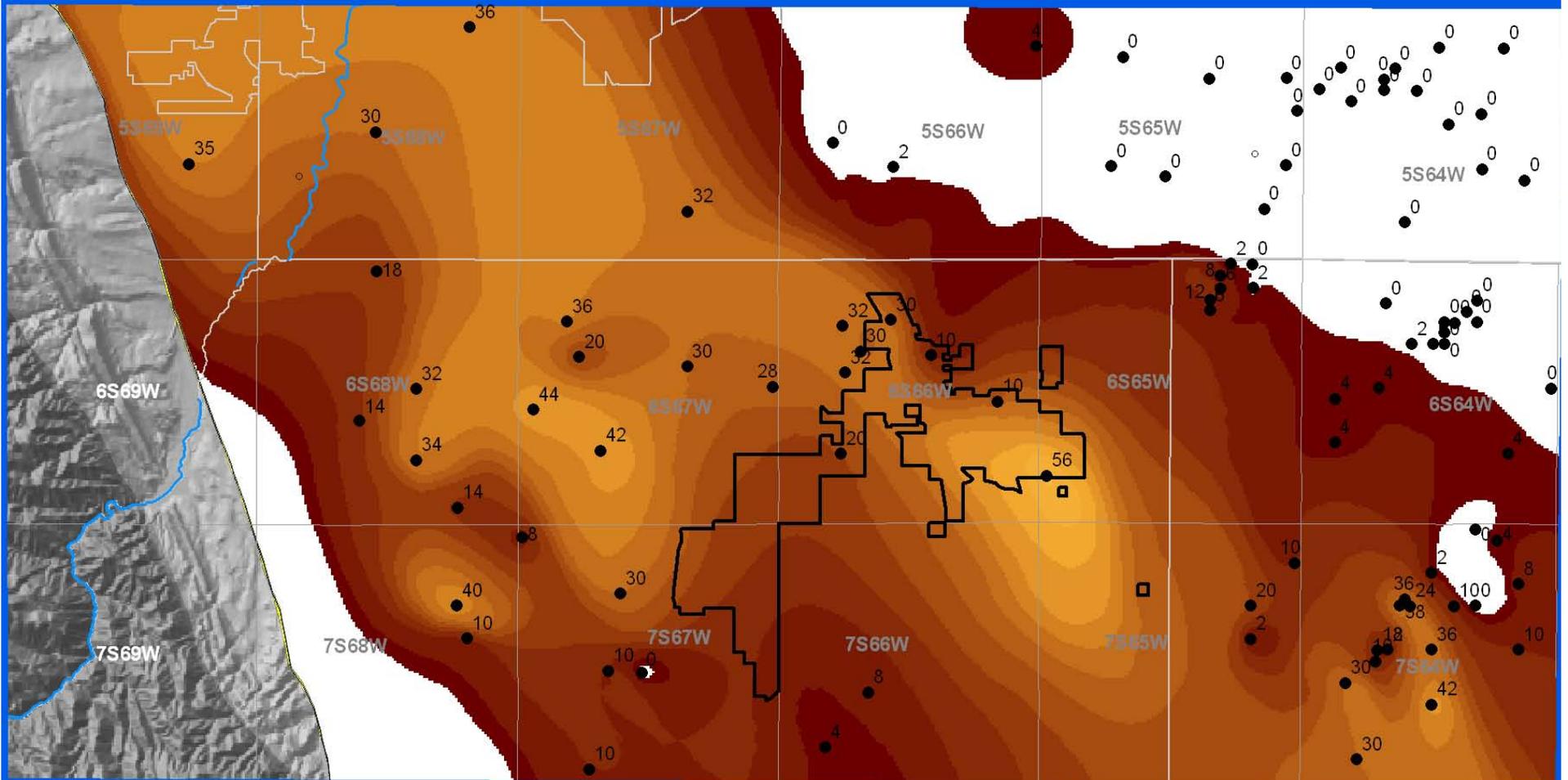


- Thickness 0 - 25 ft...

Shingle -B



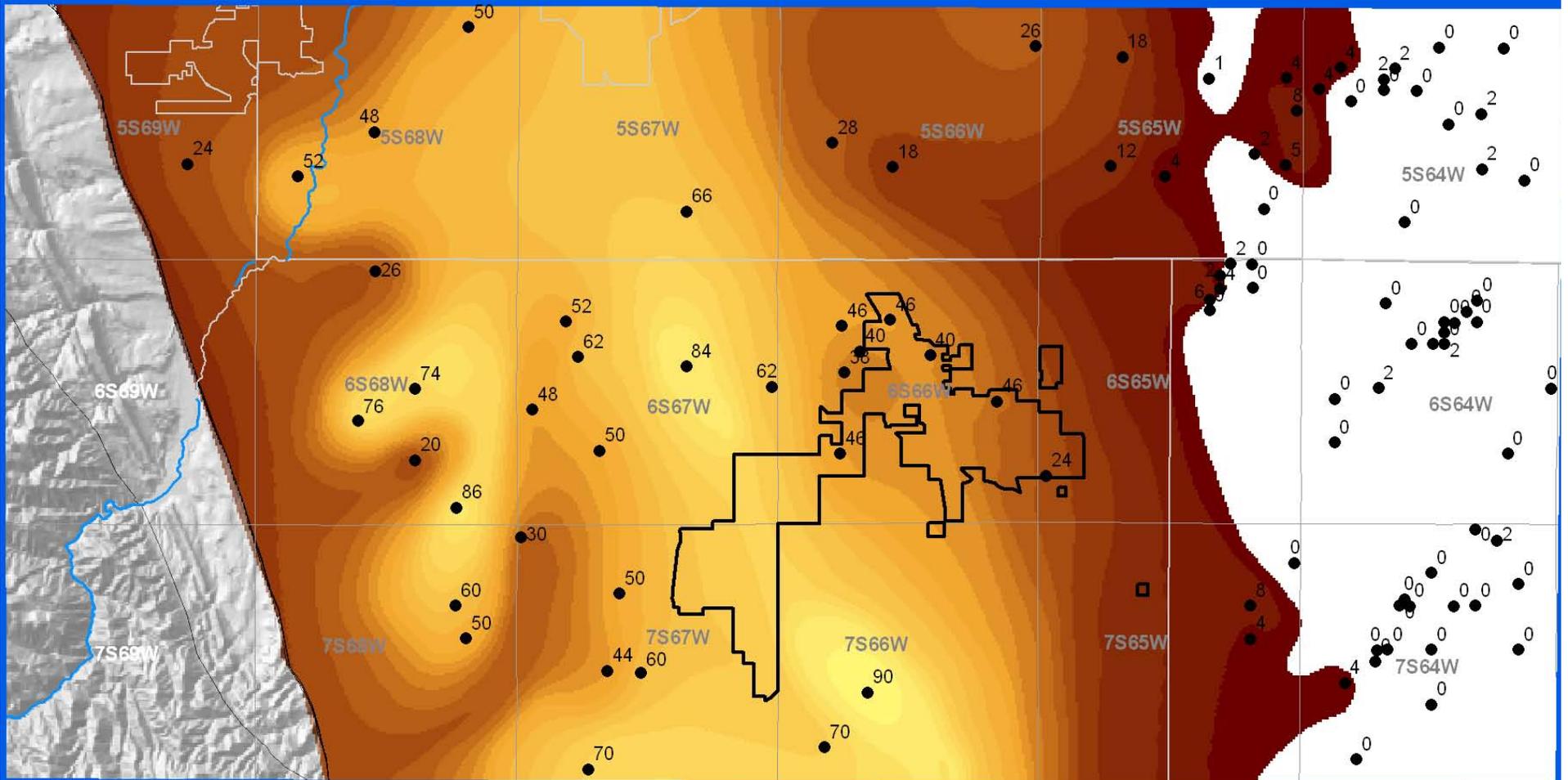
# Net Sand Maps By Shingle



• Thickness 0 - 56 ft...

Shingle A

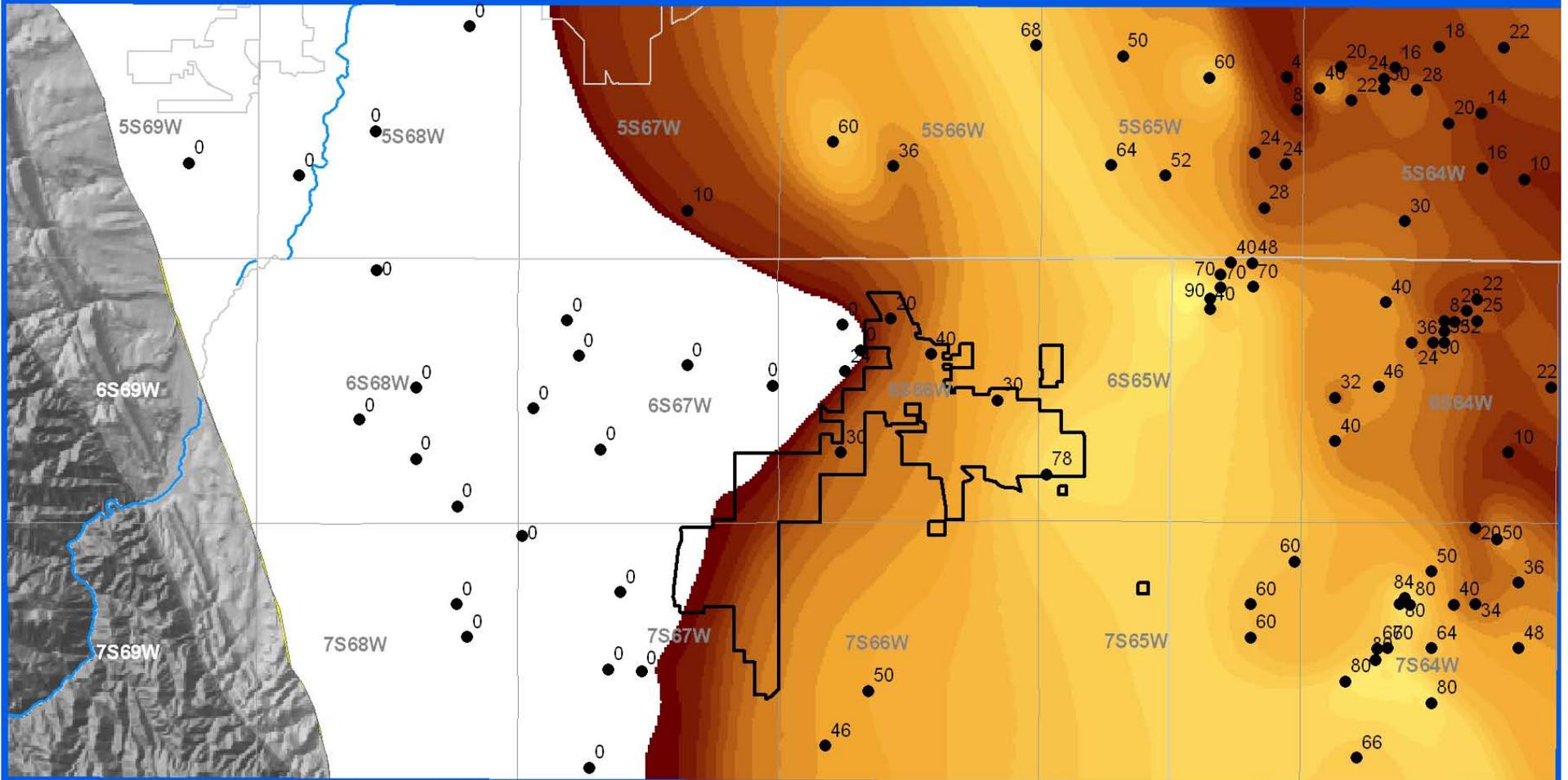
# Net Sand Maps By Shingle



• Thickness 0 - 90 ft...

Shingle B

# Net Sand Maps By Shingle

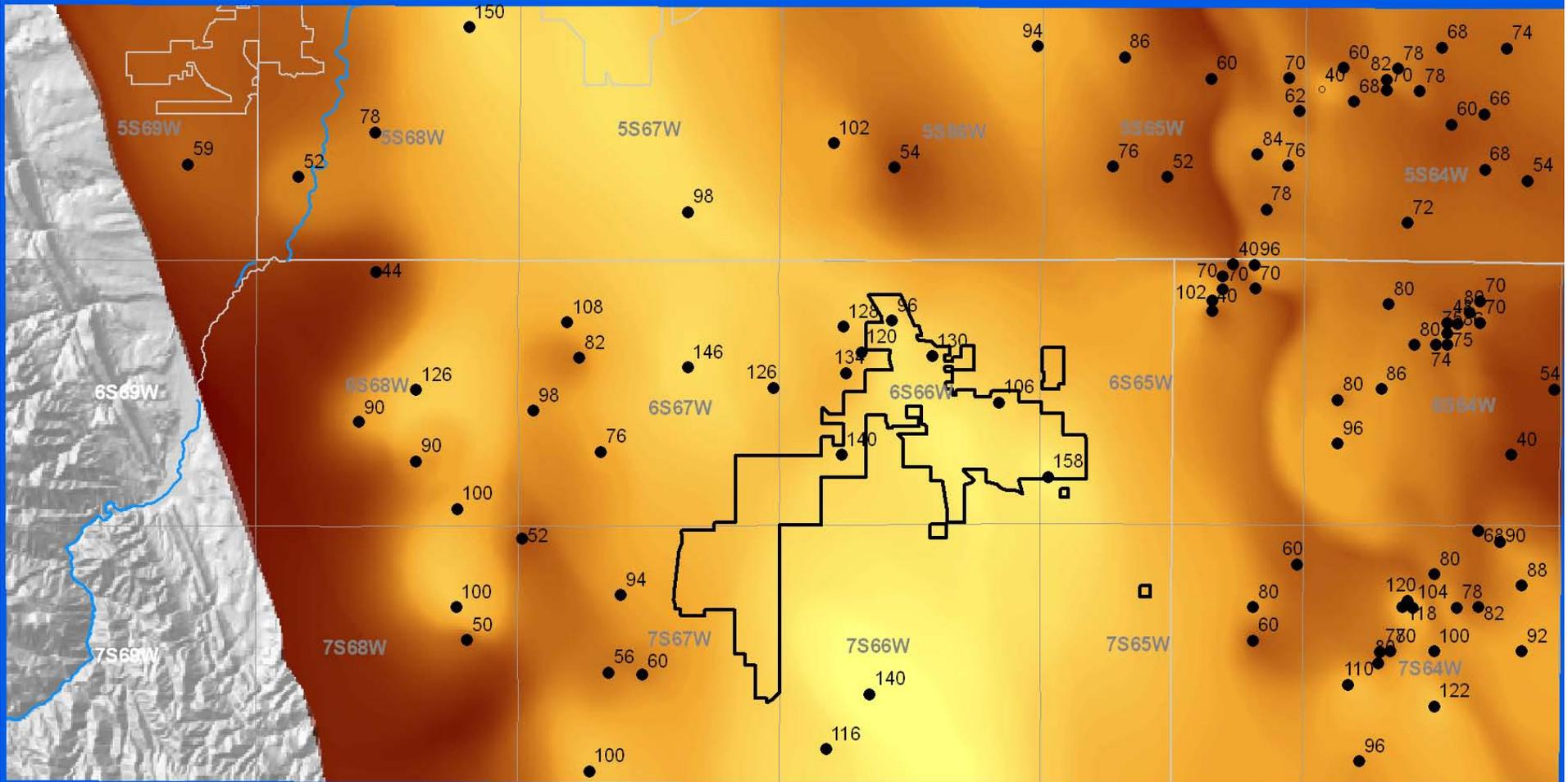


- Thickness 0 - 90 ft...

Shingle C

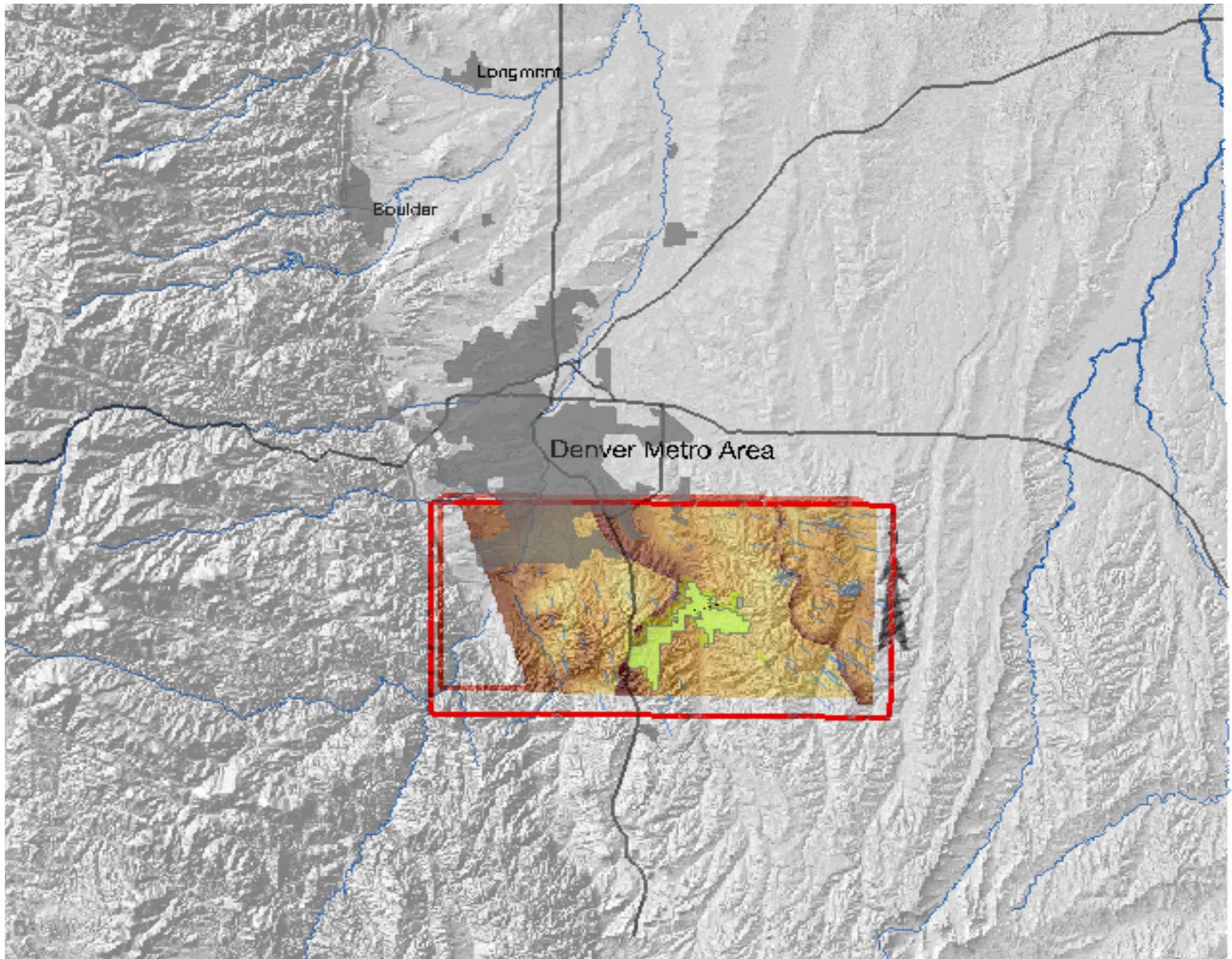


# Total Fox Hills Net Sand

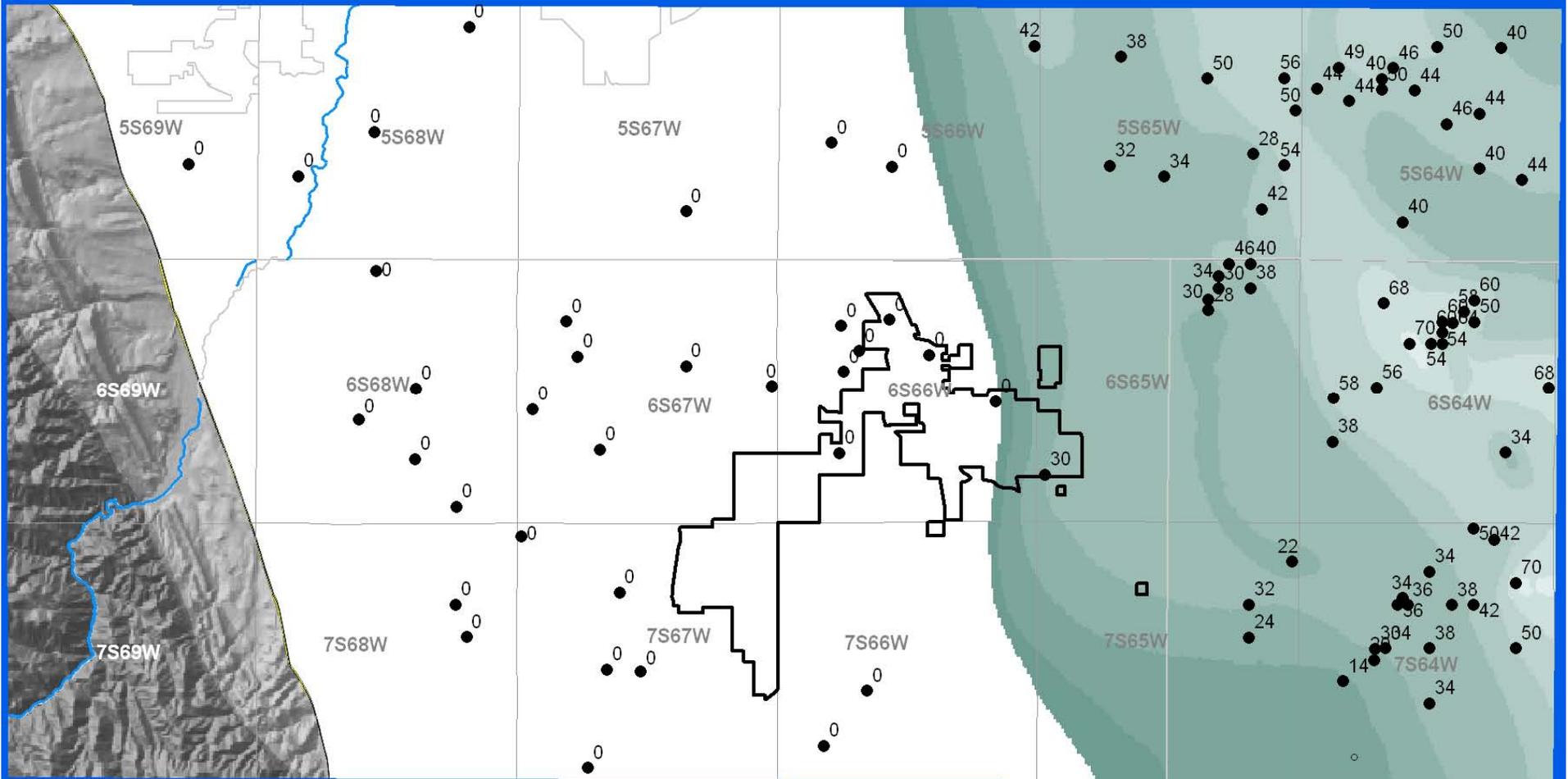


- Thickness 0 - 158 ft...

Volume in Study Area =  
44,434 million cubic meters  
~ 36 million acre/feet



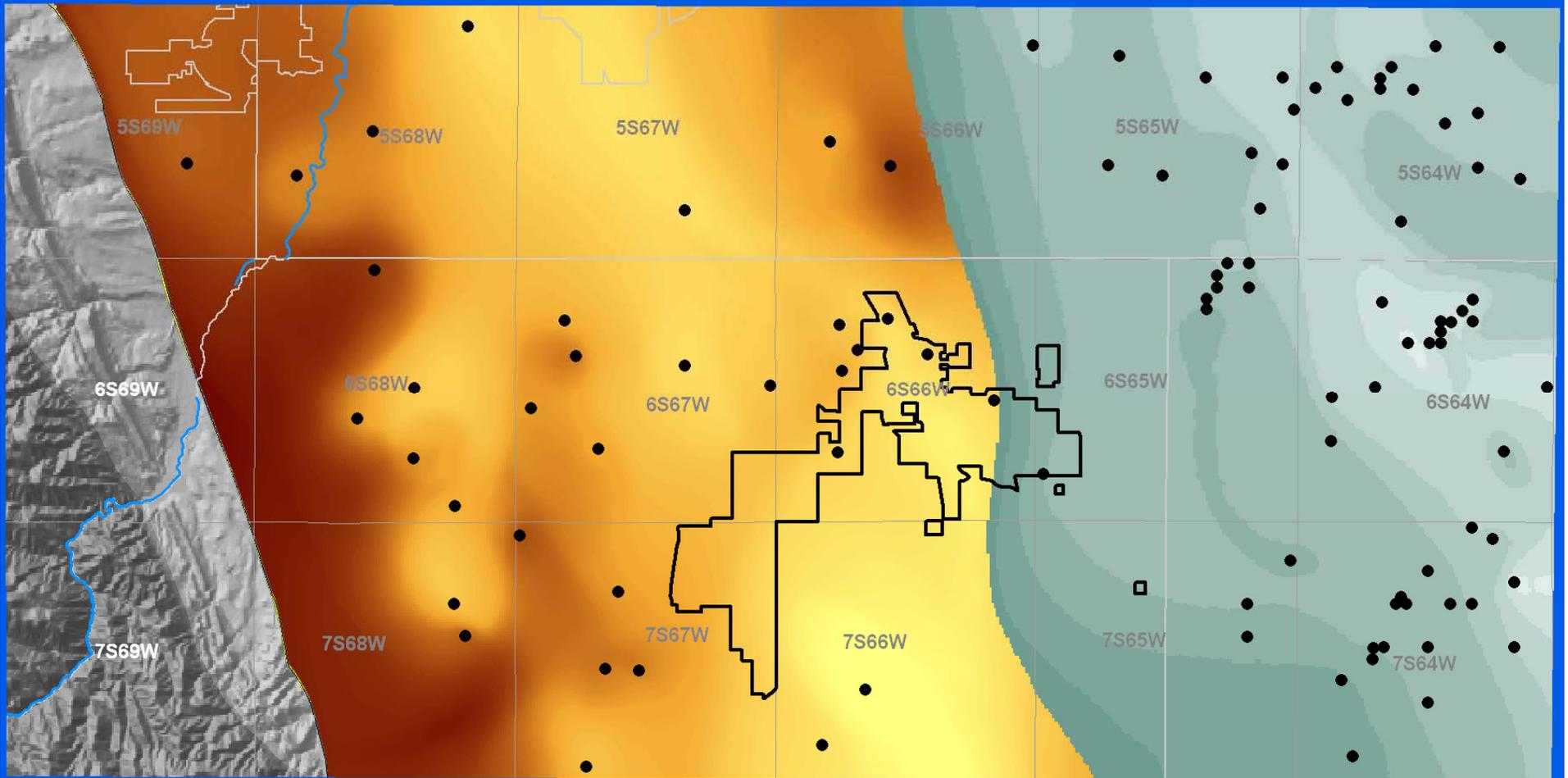
# Total Thickness of Coal Layer



- H<sub>2</sub>S in Water...

Shingle Super B

# In Summary:



- Total Net Sand with Coal Layer

# Fox Hills Sandstone

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- 3D Geometry of Individual Shingles
  - Reservoir Controls Ground water:
    - Quantity: **Volume = ok**
    - Quality: **Coal layers = poor**
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# Fox Hills:

“... *End of the World* ...” -wells

Parker Water and Sanitation District

Cretaceous  
Western Interior Seaway

DENVER MUSEUM OF  
**NATURE & SCIENCE**