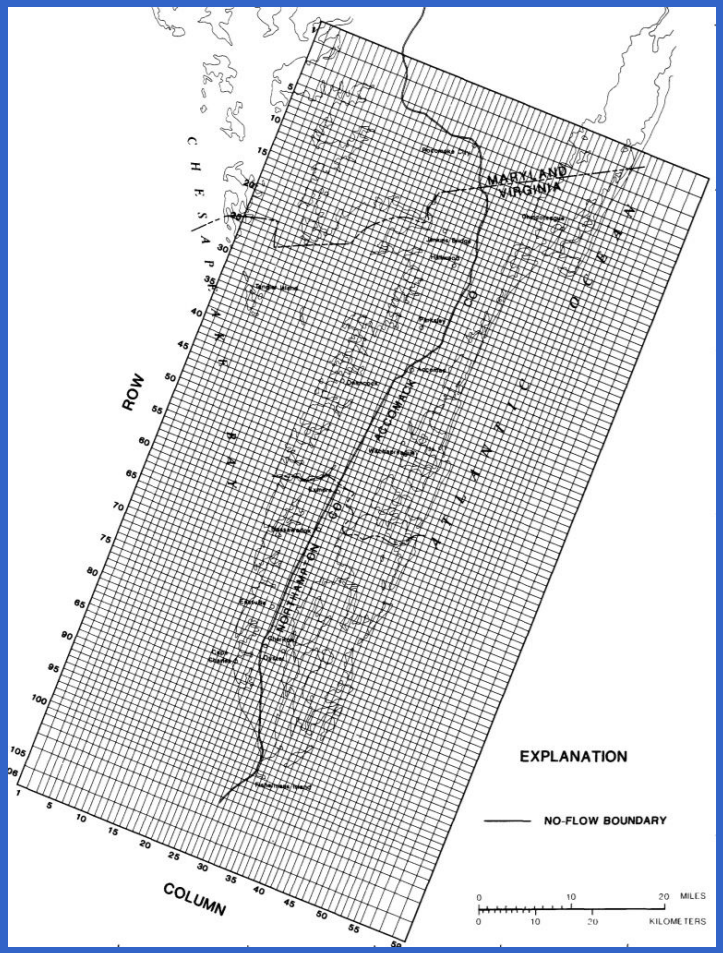
Previous Groundwater Studies

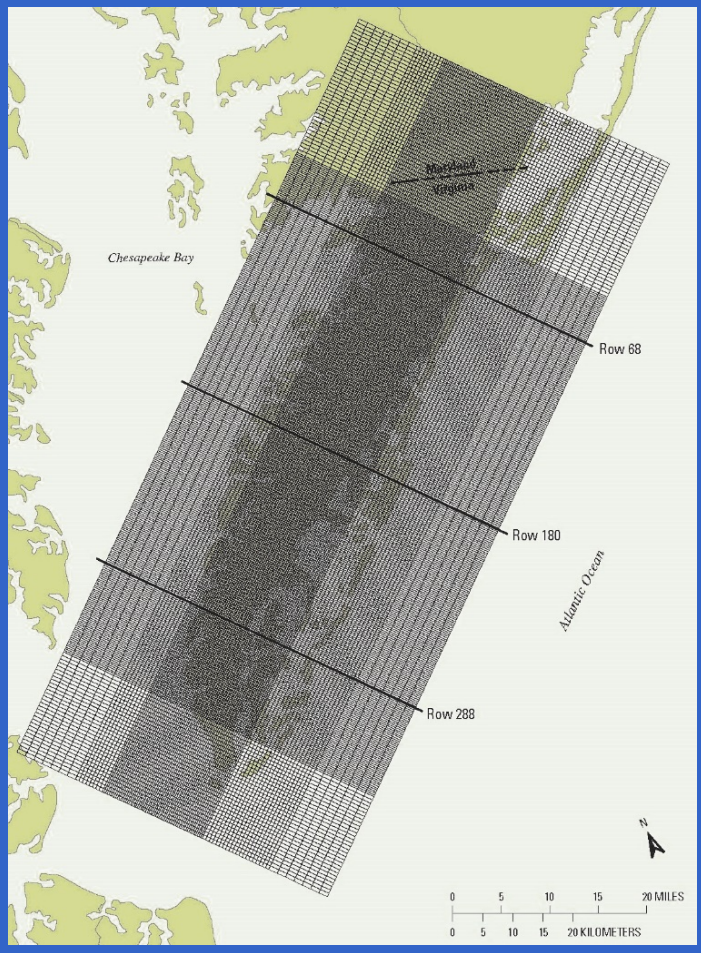
1994 USGS MODEL

- first numerical simulation
- 1982 SWCB framework

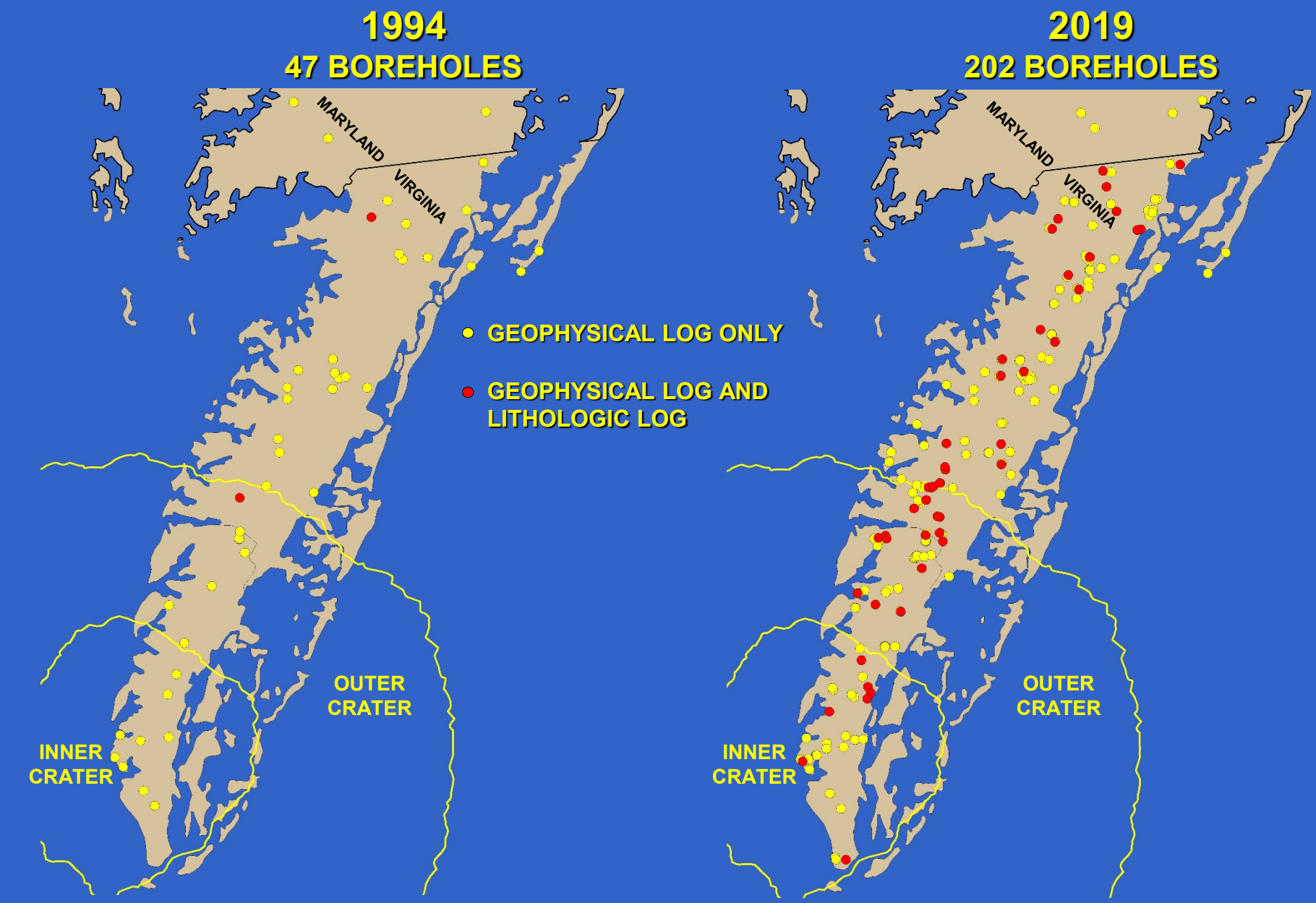


2009 USGS MODEL

- increased resolution
- 1982-94 framework



Framework Borehole Data

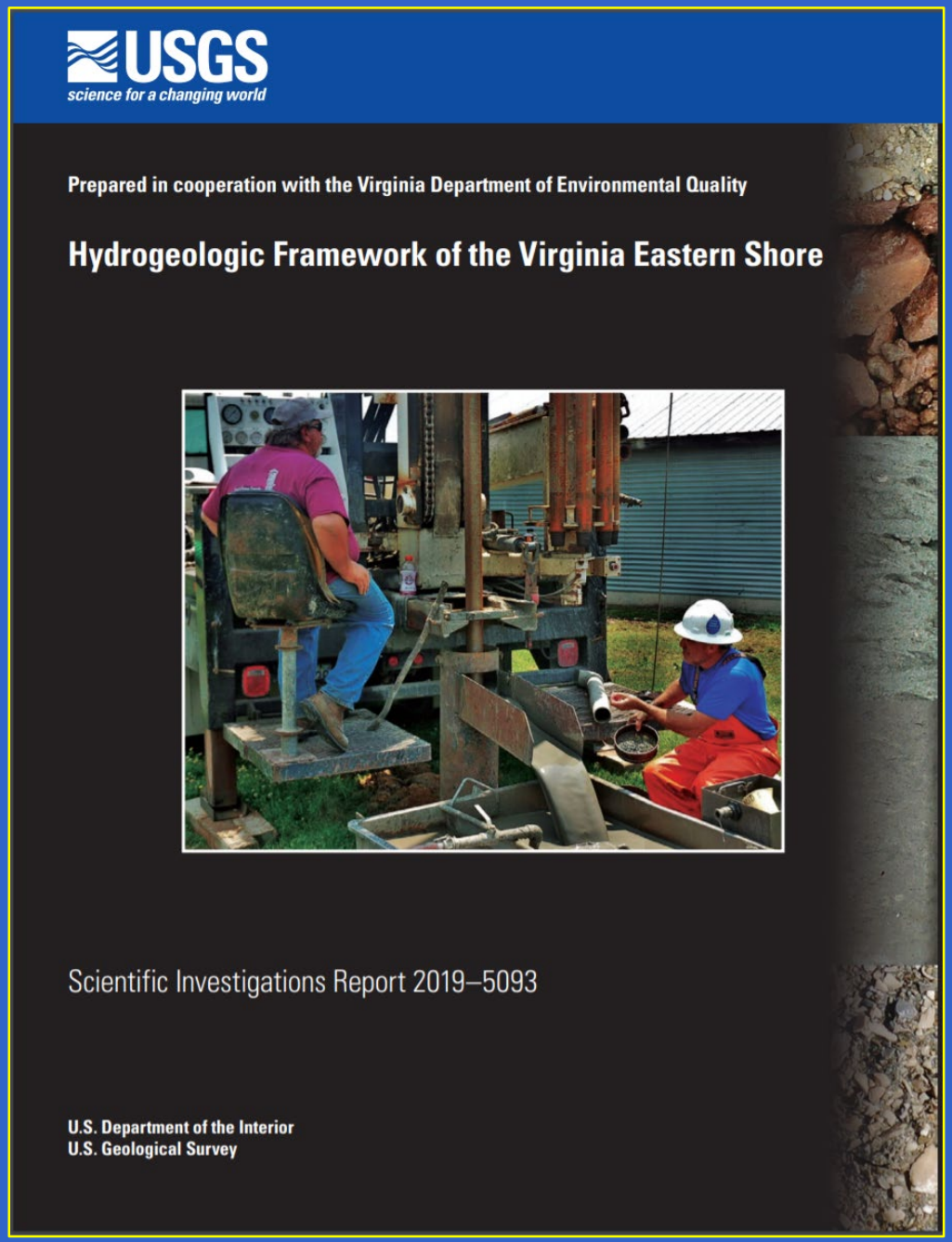


USGS-DEQ Eastern Shore Study

- *2017 part-time "scoping effort"*
- *2018 hydrogeologic framework revision*
- *2019 publication*

USGS SIR 2019-5093

- body (text, figures, tables)
- 13 plates
  - borehole locations
  - hydrogeologic section
  - structural contour maps
  - 250 mg/L chloride surface contour map
- 3 online data appendixes
  - aquifer altitudes at boreholes
  - aquifer hydraulic properties
  - chloride concentrations



Terms

FRAMEWORK

- static description of subsurface
  - configuration of aquifers/confining units
  - sediment composition/hydraulic properties
  - configuration of saltwater interface
- direct observation/measurement
- exact
- incomplete coverage

MODEL

- simulation of flow
  - sources/sinks
  - rates of movement
  - changes over time
- complete coverage
- approximation
- theoretical representation

Terms

FRAMEWORK → MODEL

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- simulation of flow
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Report Table of Contents

- Abstract
- Introduction
  - Purpose and Scope
  - Description of the Study Area
    - Geologic Setting
    - Groundwater Conditions
  - Methods of Investigation
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- Hydrogeologic Framework
  - Geologic Relations
    - Stratigraphy
    - Depositional History
  - Hydrogeologic-Unit Descriptions
    - Composition
    - Configuration
      - Yorktown-Eastover Aquifer System
        - Top-Surface Undulations
        - Paleochannel Incision
        - Upper Confining Unit
      - Surficial Aquifer
      - Hydrogeologic Units Within Paleochannels
  - Aquifer Hydraulic Properties
  - Saltwater-Transition Zone
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    - Configuration
    - Saltwater Ridge
  - Information Uses and Limitations
    - Digital Model Improvement
    - Limitations
- Summary and Conclusions
- References Cited

Report Table of Contents

Abstract
Introduction
- Purpose and Scope
- Description of the Study Area
  - Geologic Setting
  - Groundwater Conditions
- Methods of Investigation
- Previous Investigations

Hydrogeologic Framework
- Geologic Relations
  - Stratigraphy
  - Depositional History
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    - Yorktown-Eastover Aquifer System
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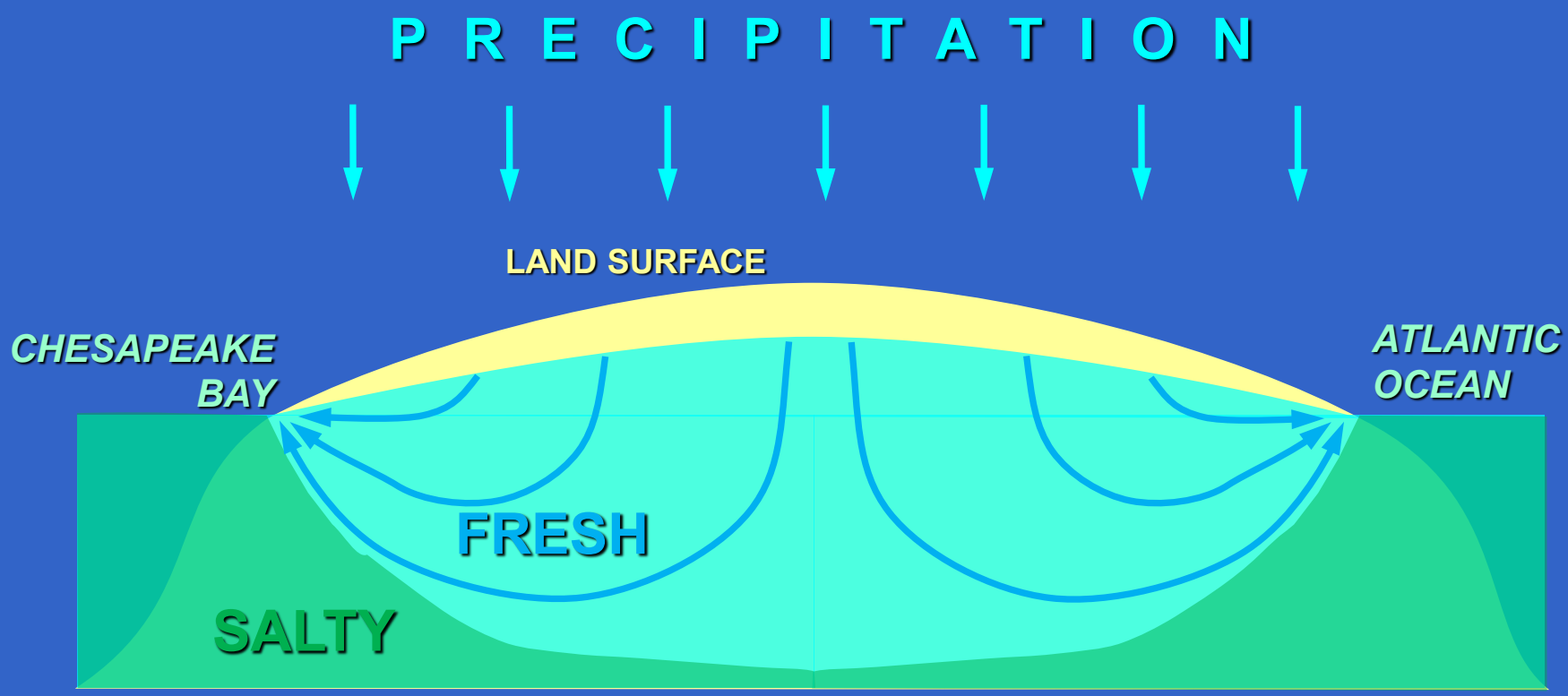
- Aquifer Hydraulic Properties
- Saltwater-Transition Zone
  - Groundwater Chloride Concentrations
  - Configuration
  - Saltwater Ridge
- Information Uses and Limitations
  - Digital Model Improvement
  - Limitations

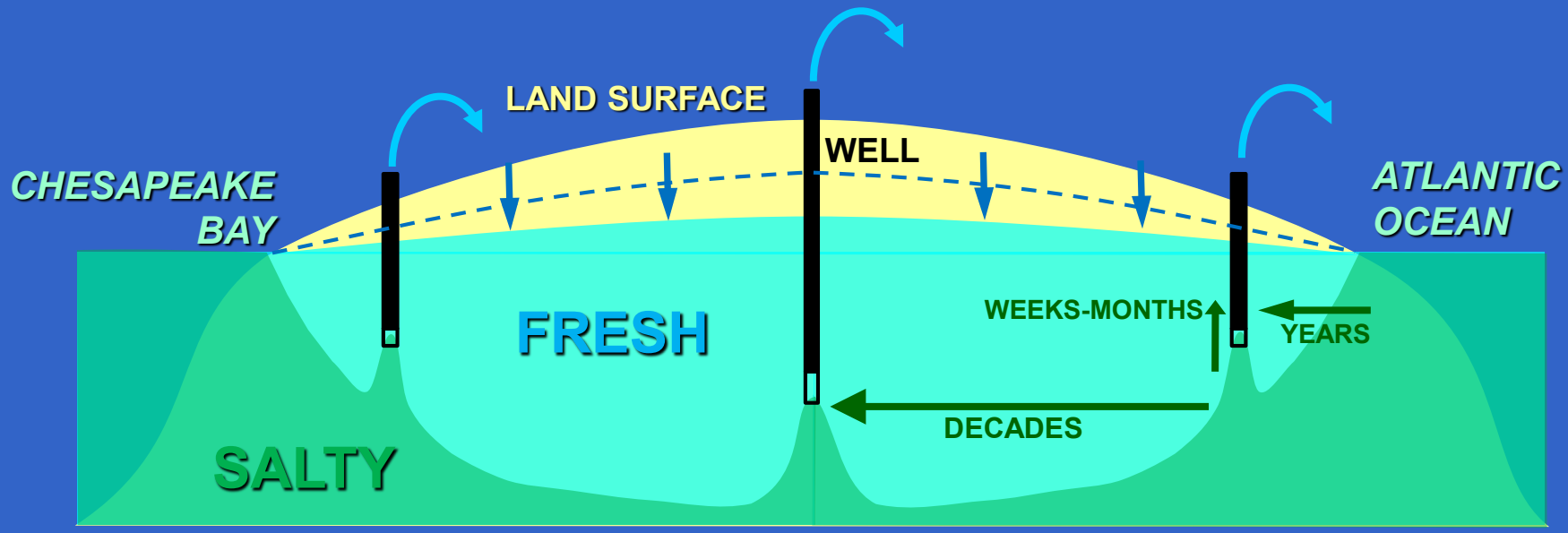
Summary and Conclusions
References Cited

Groundwater Flow



*** VERTICAL SCALE GREATLY EXAGGERATED ***

Pumping-Induced Effects



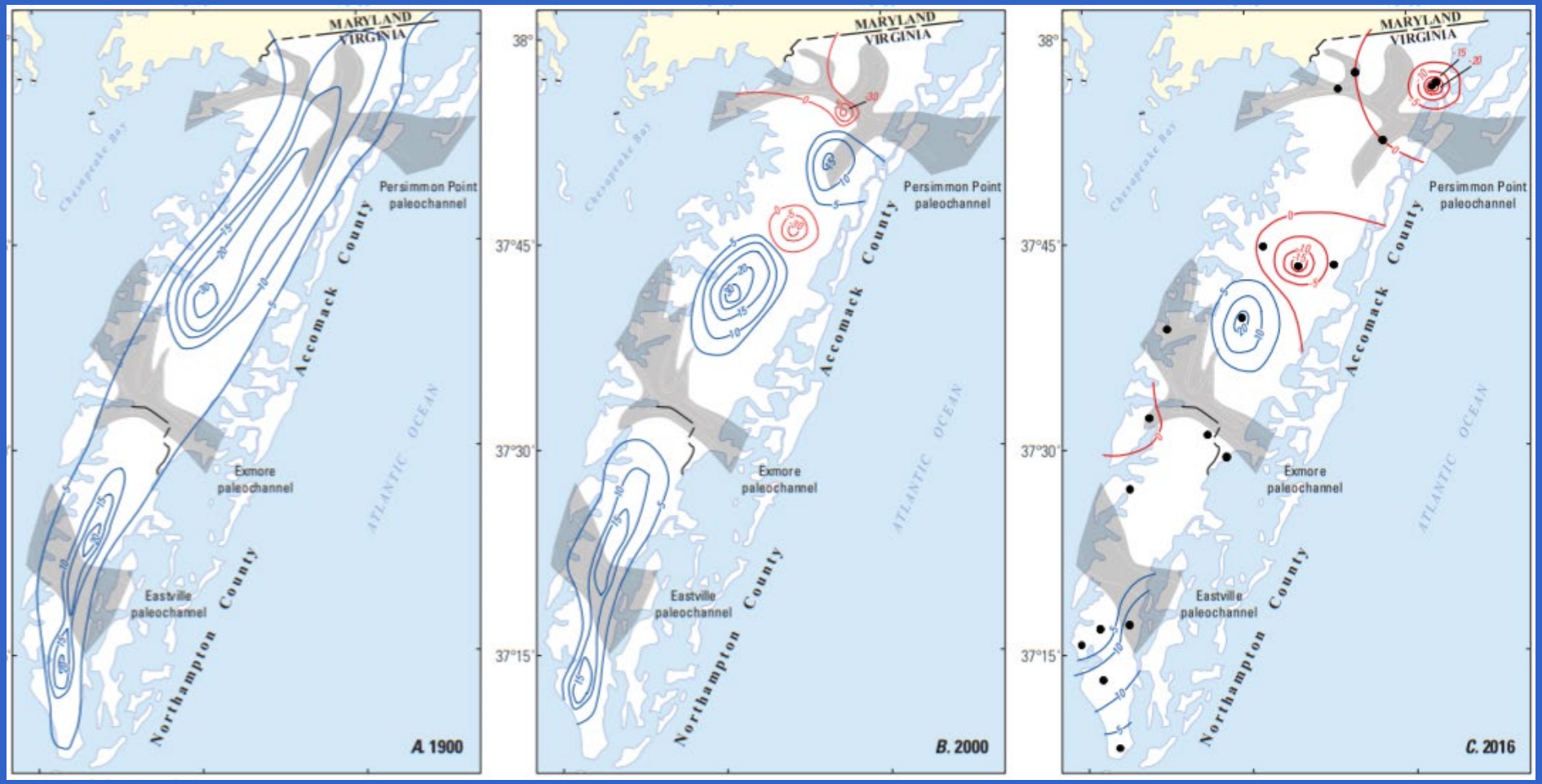
*** VERTICAL SCALE GREATLY EXAGGERATED ***

Groundwater Levels

(report figure 3)

S I M U L A T E D **OBSERVED**

1900 **2000** **2016**



Report Table of Contents

- Abstract
- Introduction
  - Purpose and Scope
  - Description of the Study Area
    - Geologic Setting
    - Groundwater Conditions
  - Methods of Investigation
  - Previous Investigations
  - Hydrogeologic Framework
  - Geologic Relations
    - Stratigraphy
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    - Composition
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      - Yorktown-Eastover Aquifer System
        - Top-Surface Undulations
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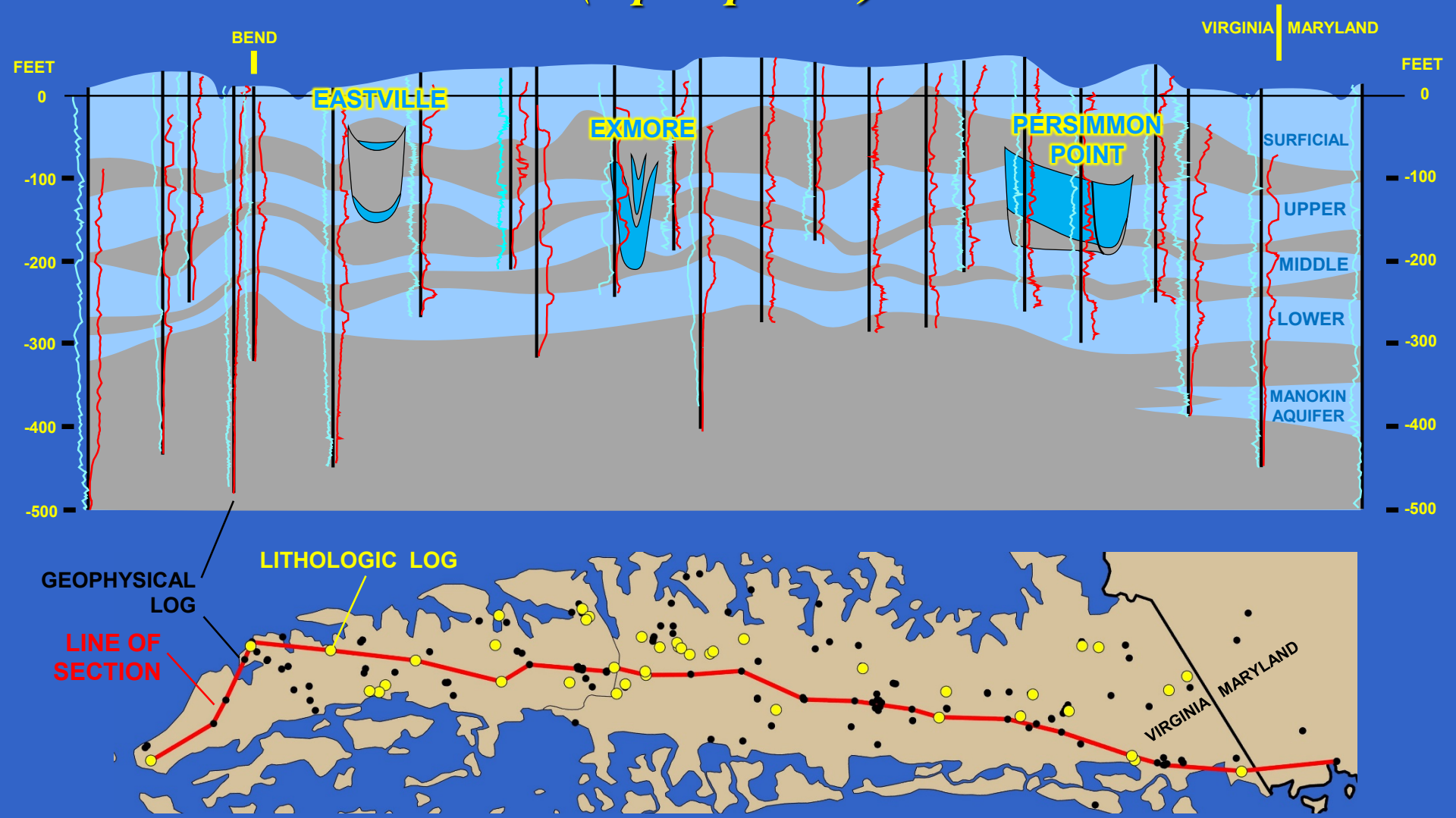
Hydrogeologic Section

(report plate 2)



VERTICAL EXAGGERATION 260X

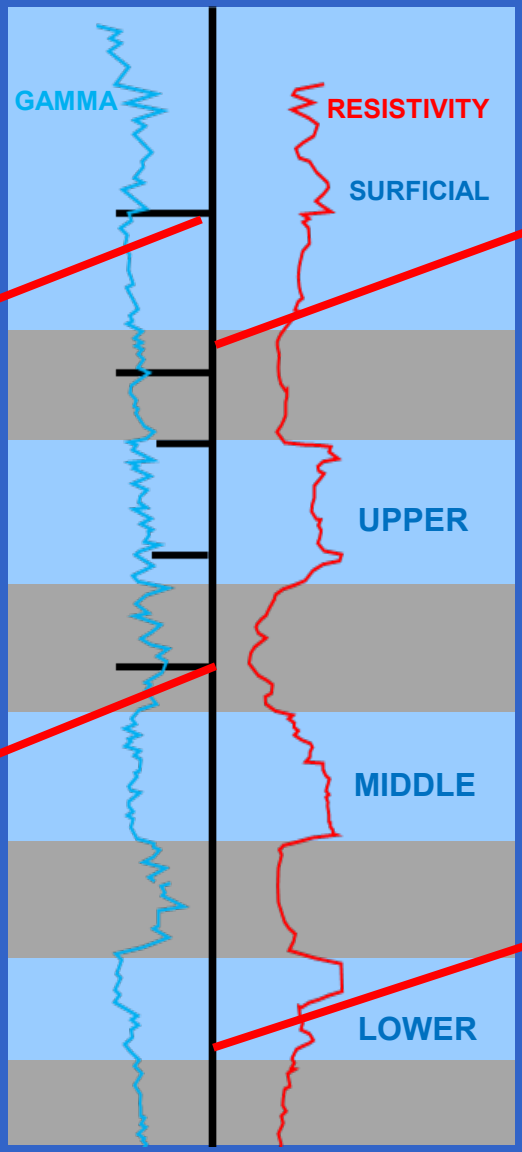
Borehole Geophysical Log and Lithology

(report figure 5)

SAND AND GRAVEL

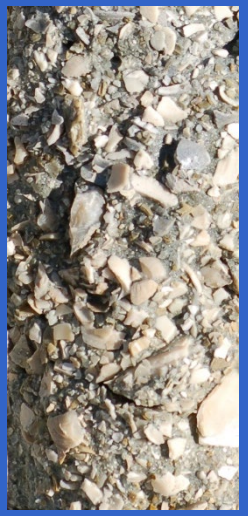
2 INCHES

SILT AND CLAY

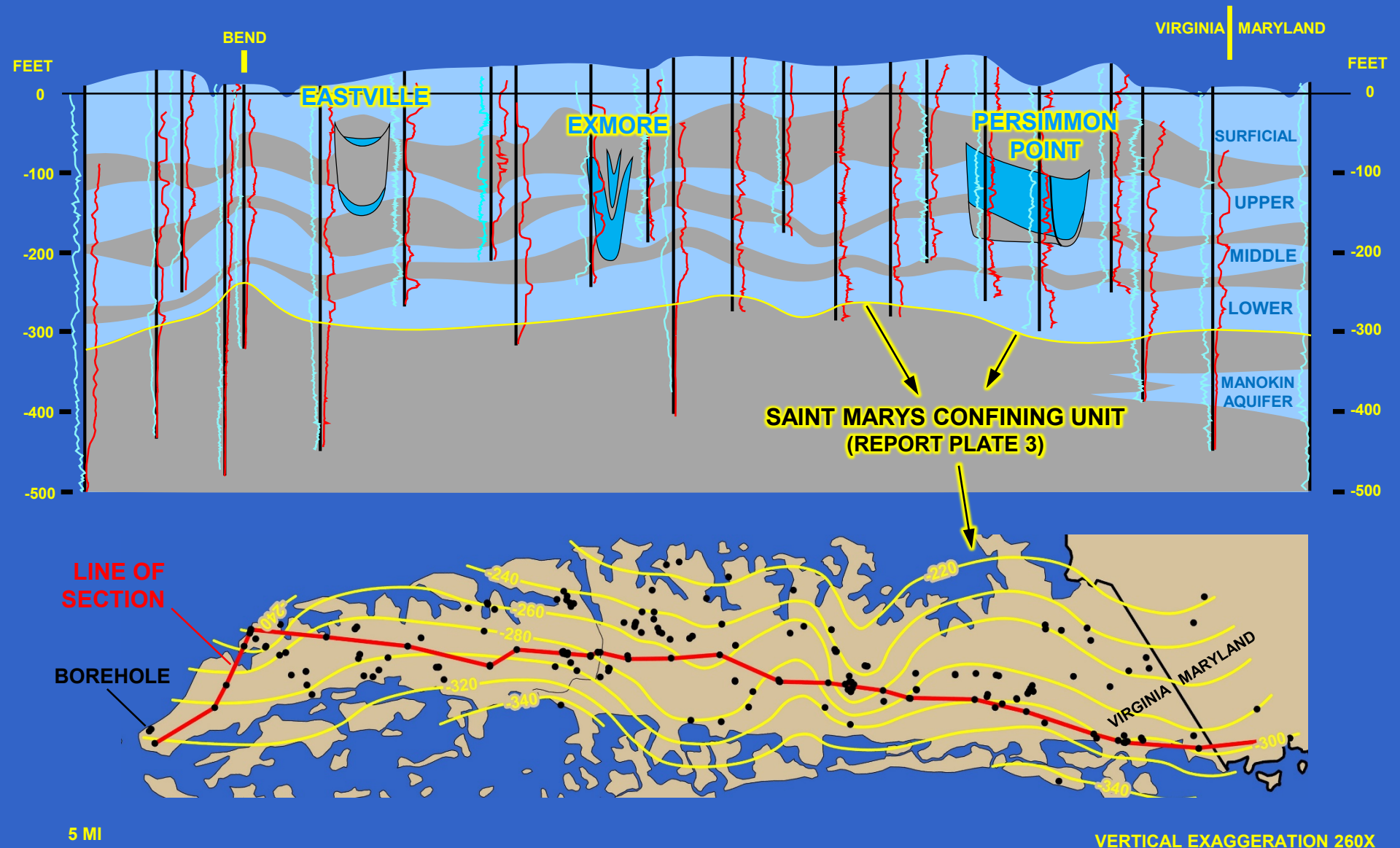


SILTY FINE SAND

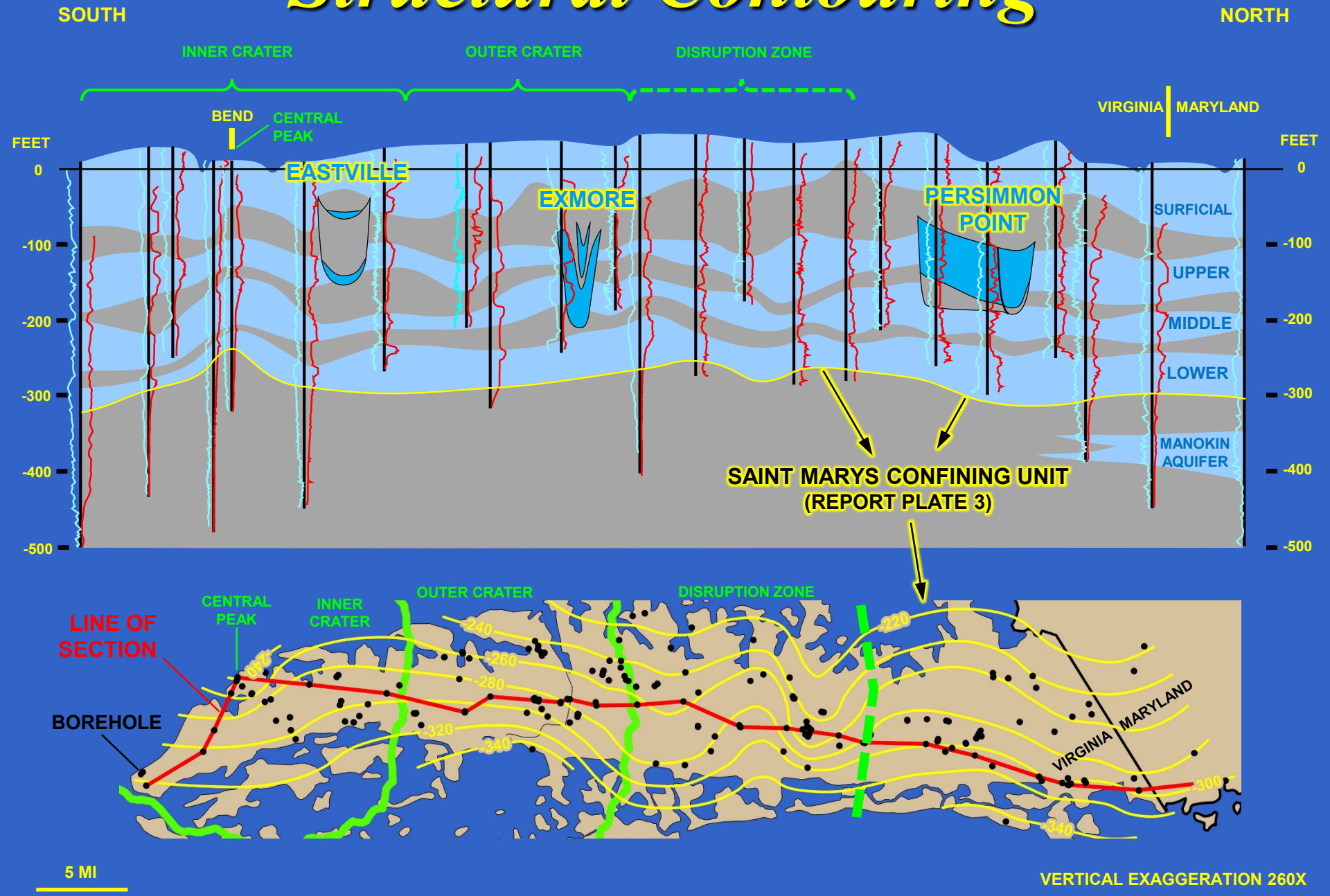
SHELLS AND SAND



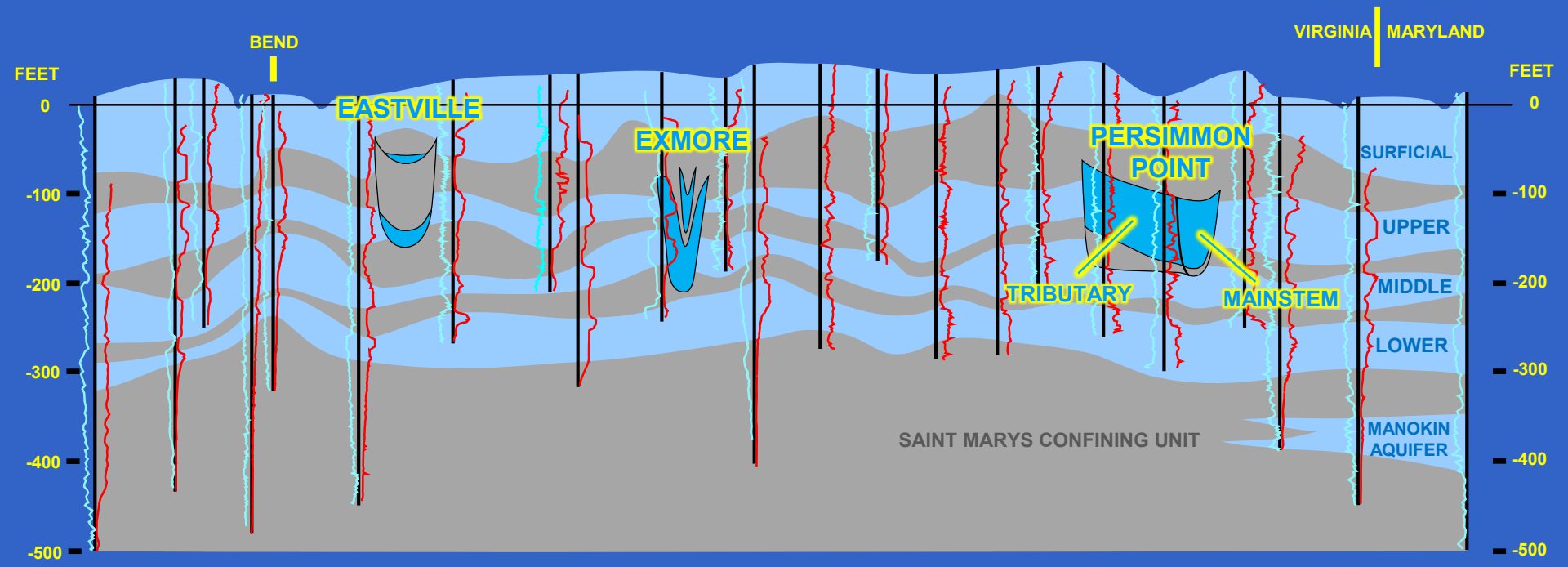
Structural Contouring

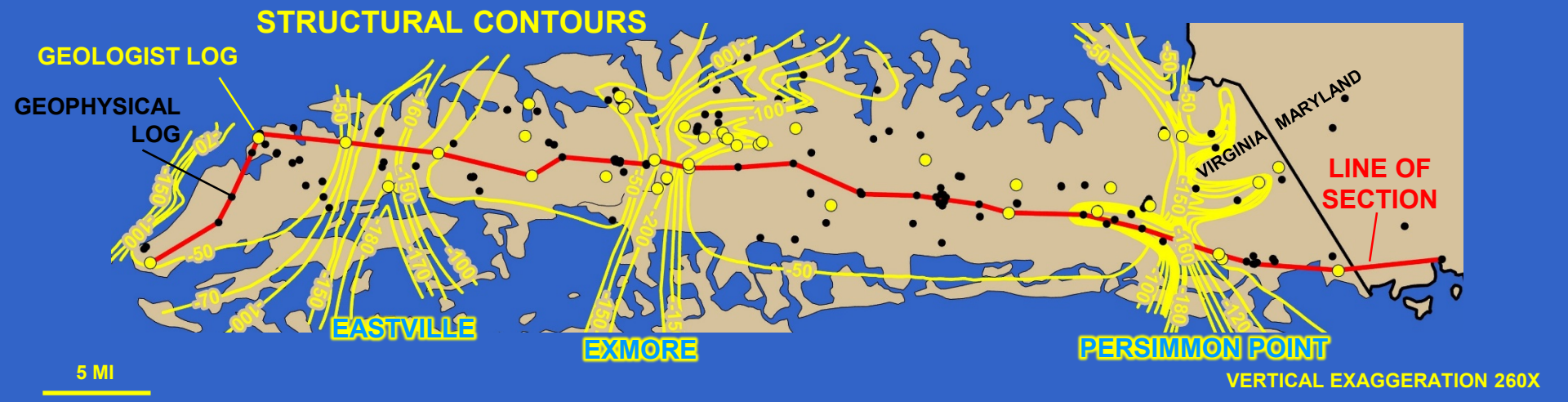


Structural Contouring



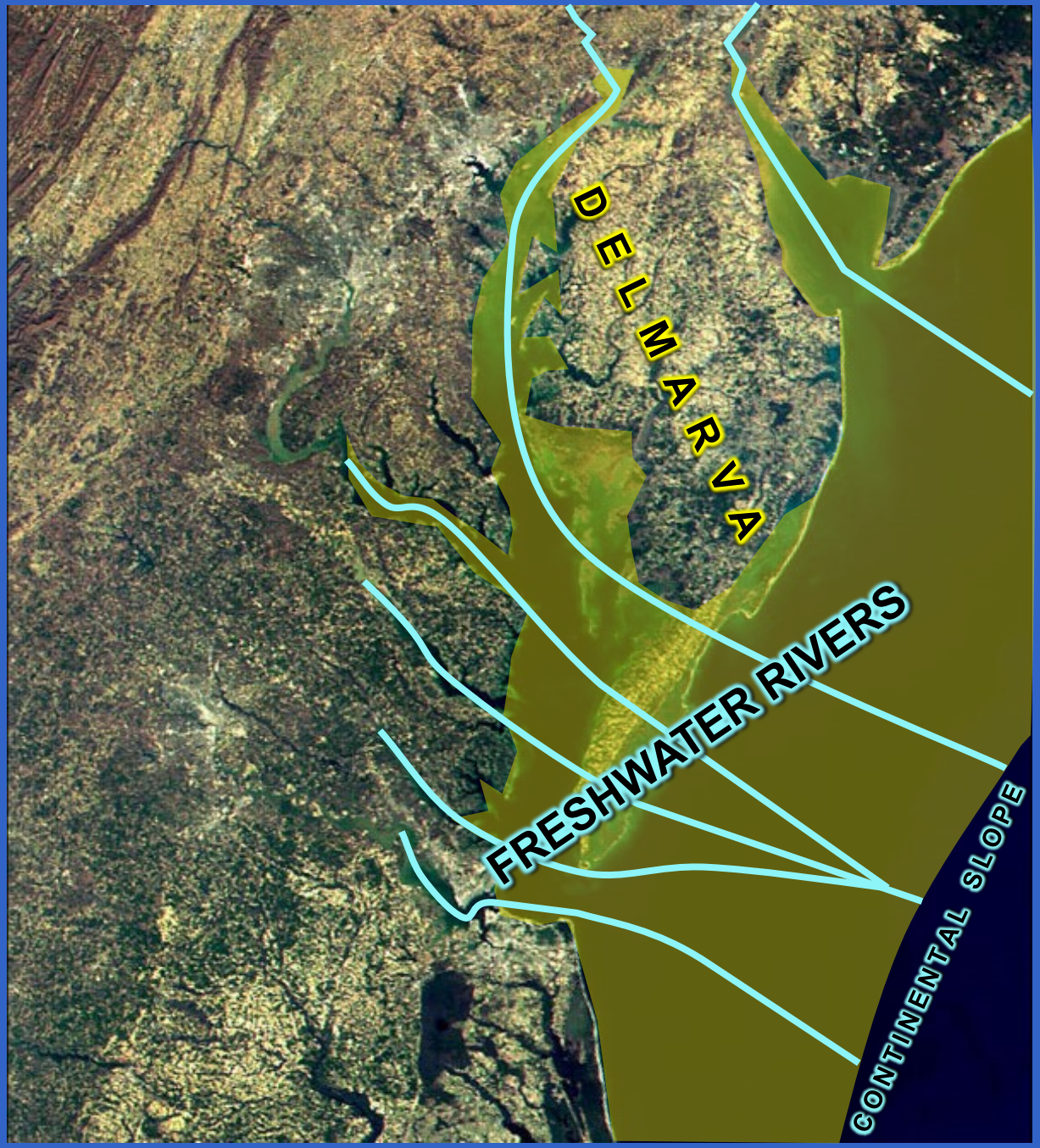
Paleochannels



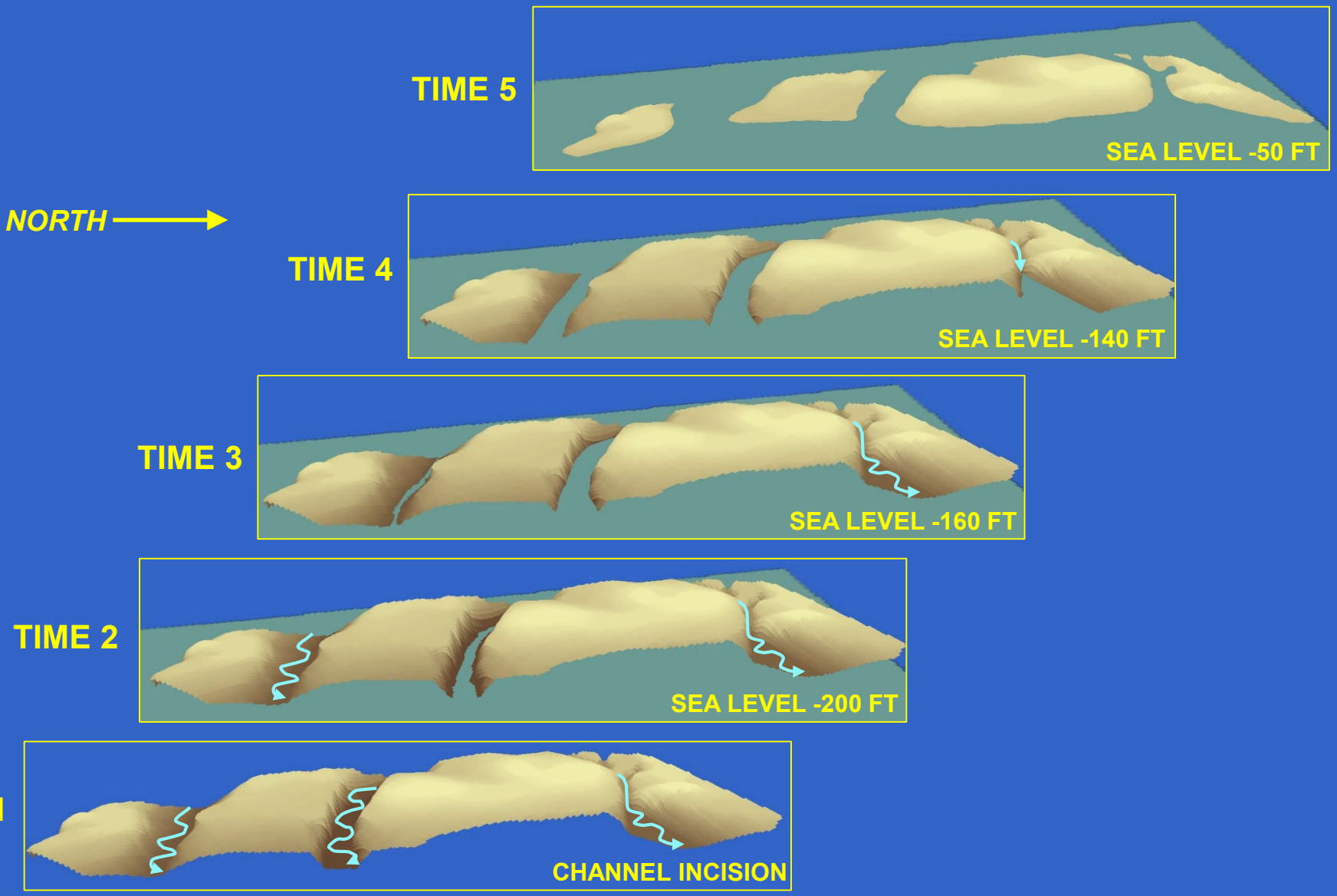


Mid-Pleistocene Low Sea-Level Stand

adapted from Hobbs, 2004



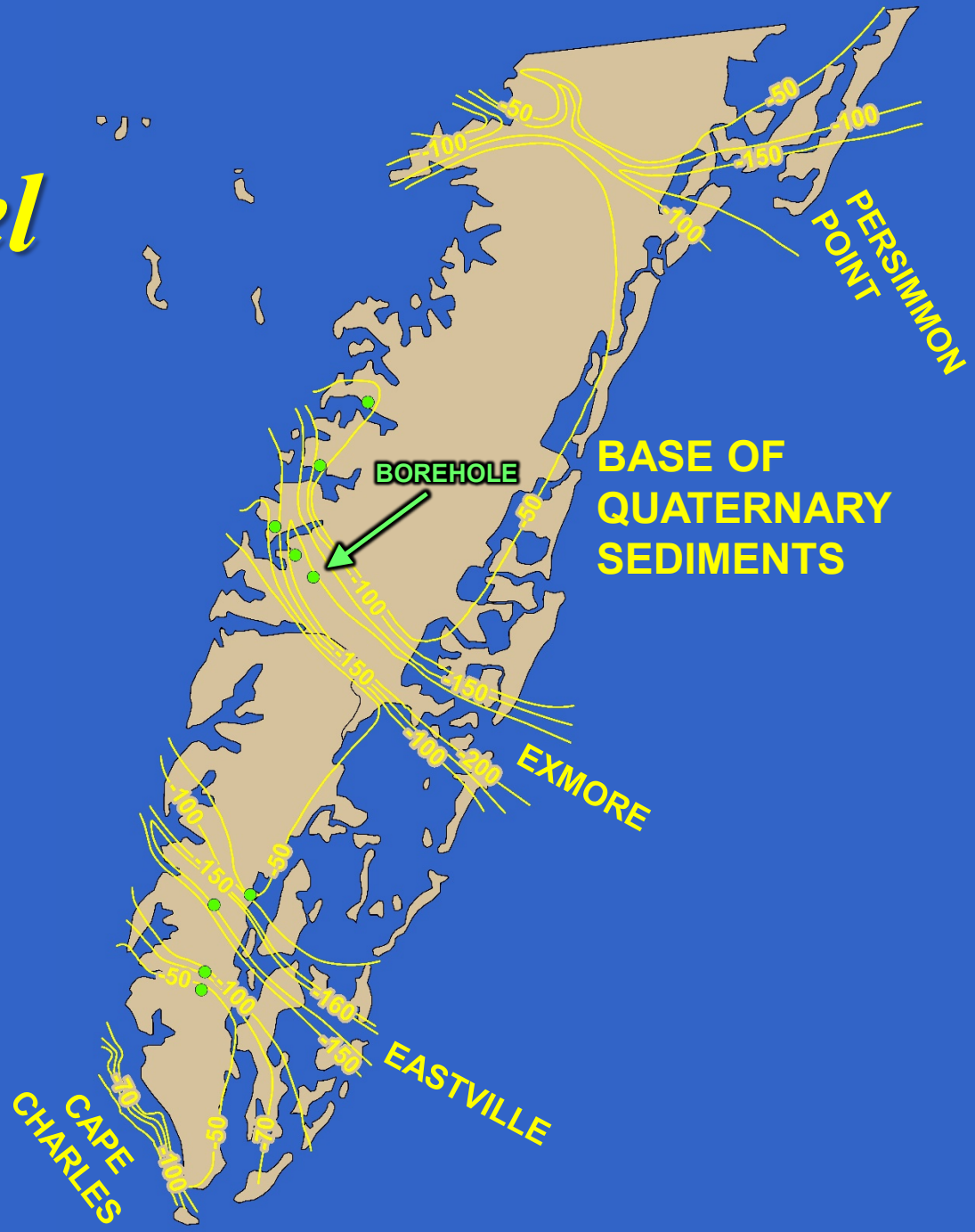
Channel Inundation and Filling



Previous Paleochannel Studies

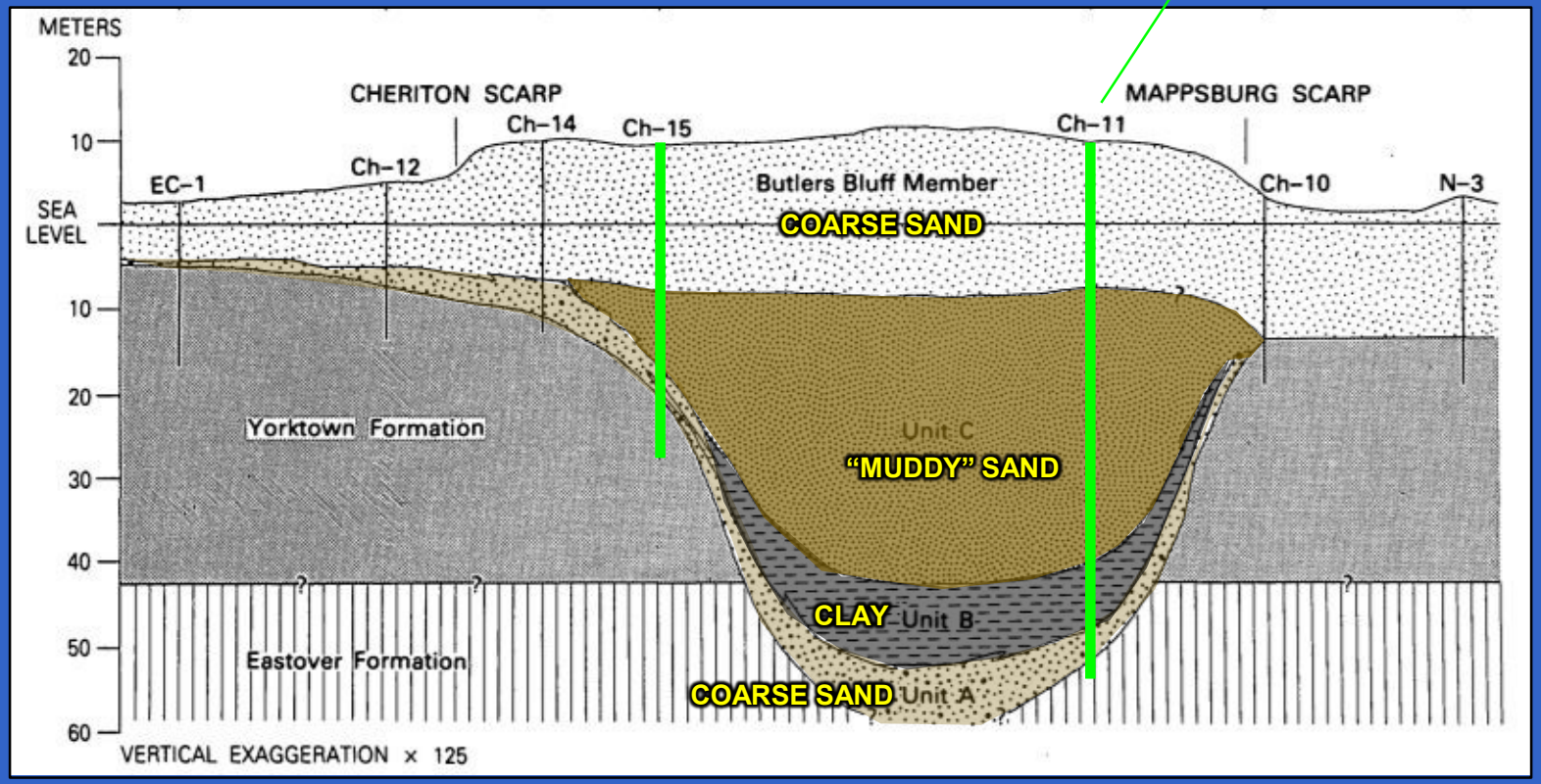
- *positions of channels approximately known*
- *channel-fill sediments poorly known*
- *original borehole data mostly unavailable*

adapted from Mixon, 1985; Powars 2011



Previously Documented Paleochannel Sediments

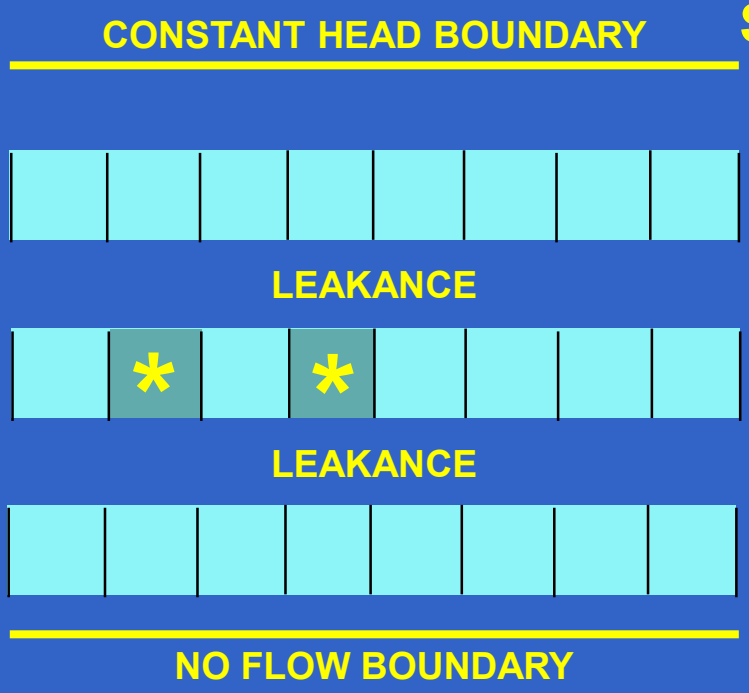
(Mixon, 1985)



Previous Modeling

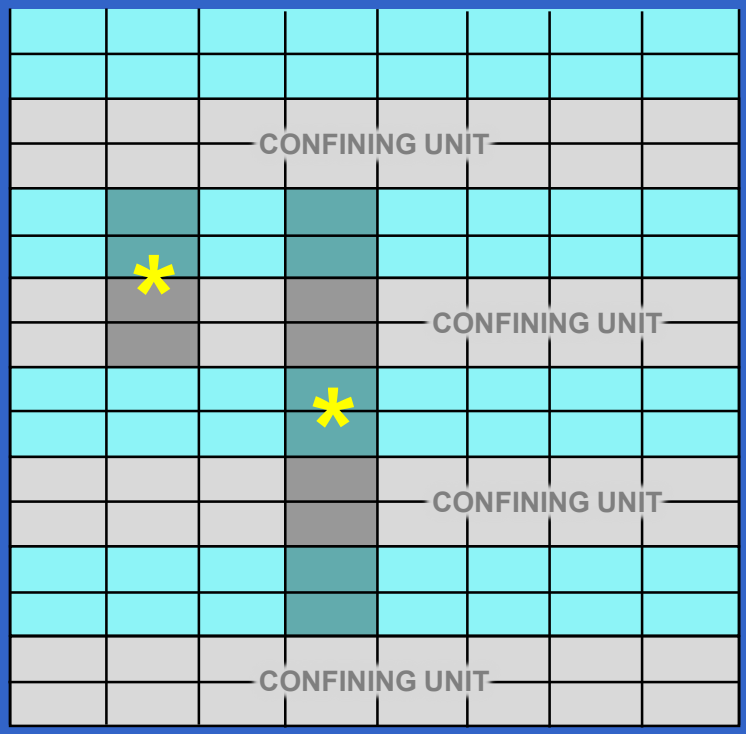
NORTH →

1994 MODEL



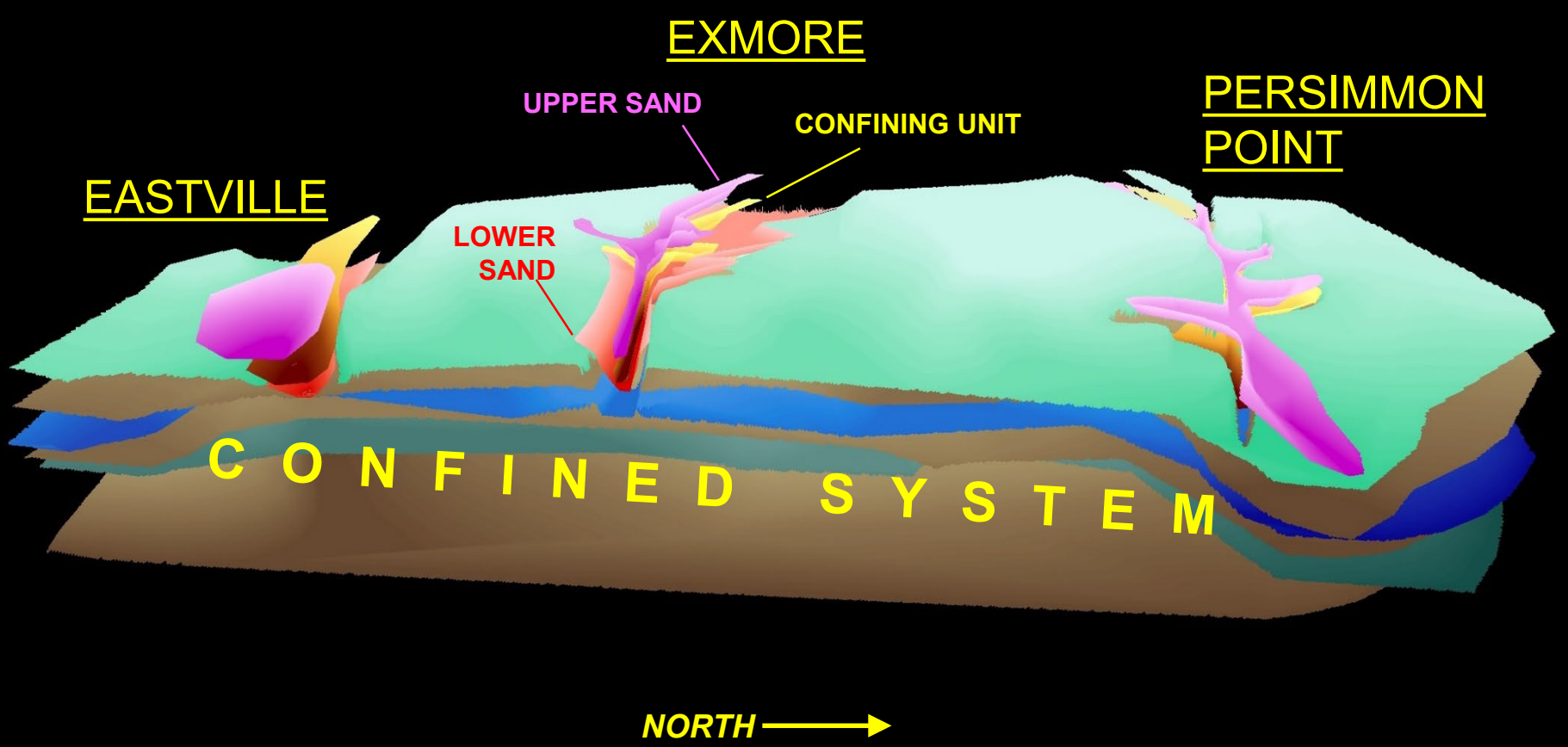
* PALEOCHANNEL LESS PERMEABLE THAN CONFINED AQUIFERS

2009 MODEL

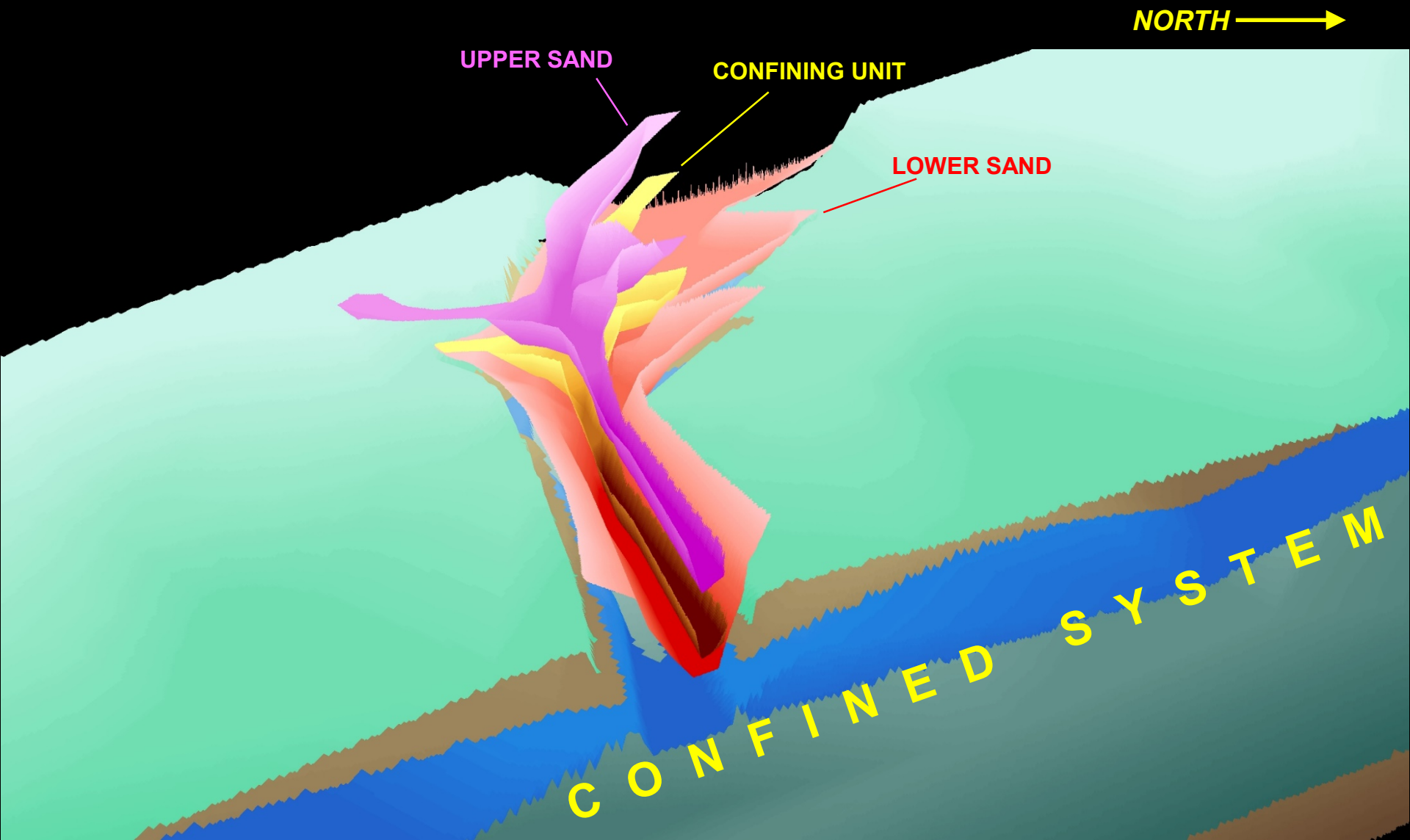


* PALEOCHANNEL MORE PERMEABLE THAN CONFINED AQUIFERS

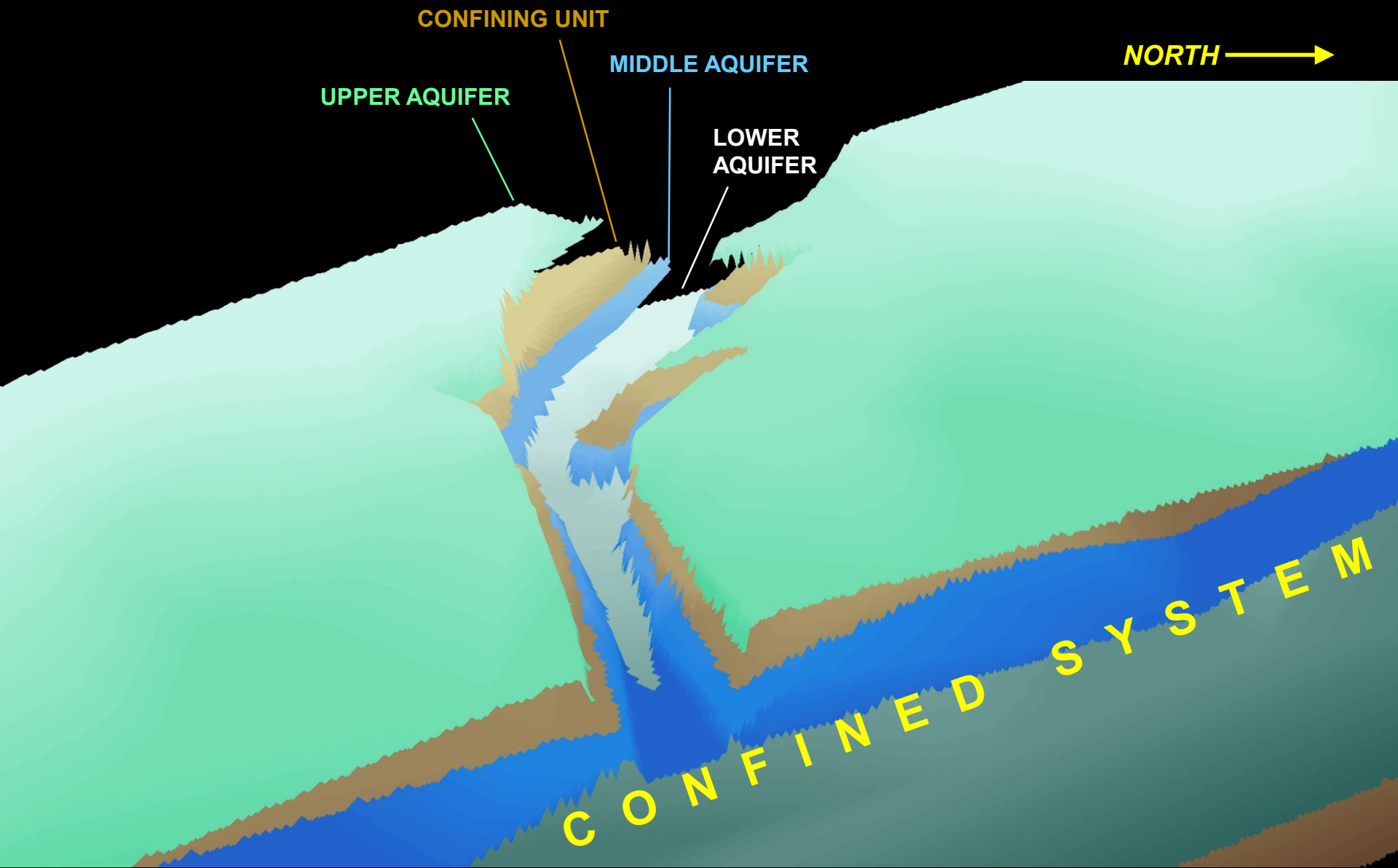
Revised Hydrogeologic Framework



Exmore Paleochannel



Confined System Incision



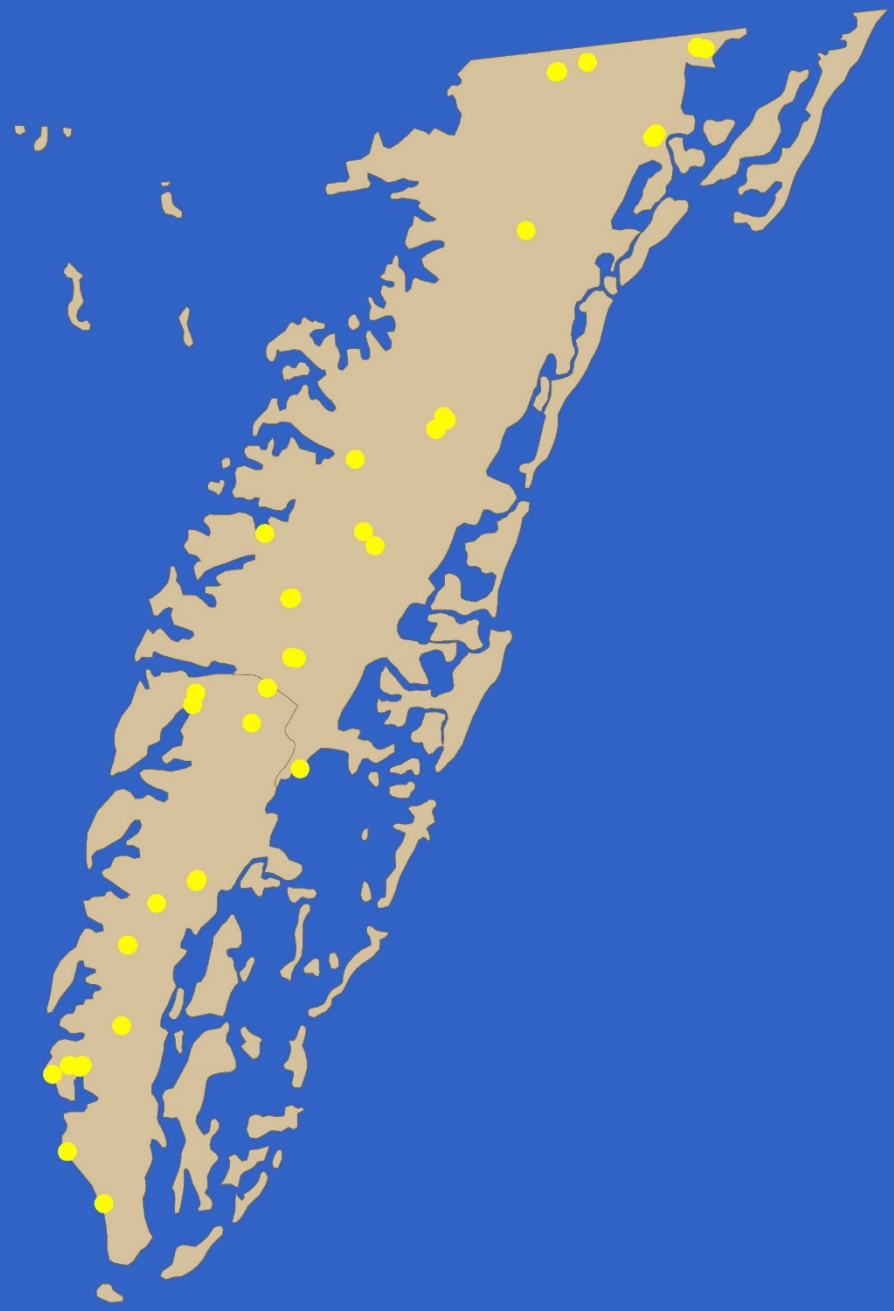
Report Table of Contents

- Abstract
- Introduction
  - Purpose and Scope
  - Description of the Study Area
    - Geologic Setting
    - Groundwater Conditions
  - Methods of Investigation
  - Previous Investigations
- Hydrogeologic Framework
  - Geologic Relations
    - Stratigraphy
    - Depositional History
  - Hydrogeologic-Unit Descriptions
    - Composition
    - Configuration
      - Yorktown-Eastover Aquifer System
        - Top-Surface Undulations
        - Paleochannel Incision
        - Upper Confining Unit
      - Surficial Aquifer
      - Hydrogeologic Units Within Paleochannels
  - → Aquifer Hydraulic Properties
  - Saltwater-Transition Zone
    - Groundwater Chloride Concentrations
    - Configuration
    - Saltwater Ridge
  - Information Uses and Limitations
    - Digital Model Improvement
    - Limitations
- Summary and Conclusions
- References Cited

Aquifer Tests

(report figure 6)

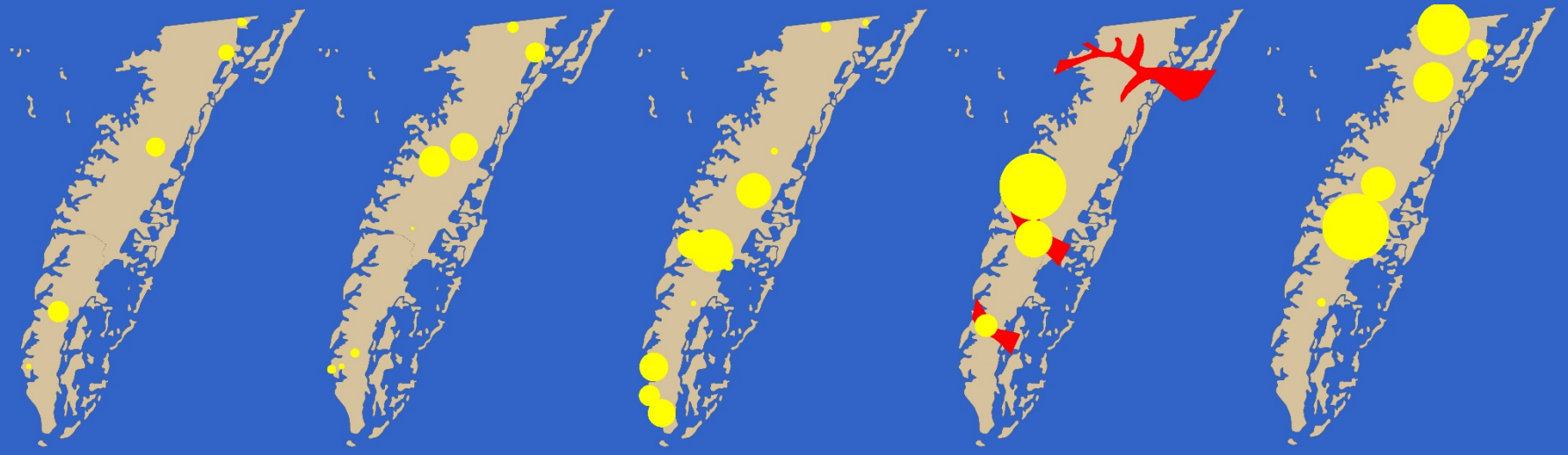
- **VA DEQ permit files**
- **36 tests**
- **58 wells**
- **133 analyses**



Transmissivity

M E A N (FT^2/D)

LOWER	MIDDLE	UPPER	PALEO-CHANNELS	SURFICIAL



R A N G E S

LOWER	MIDDLE	UPPER	PALEO-CHANNELS	SURFICIAL	FT^2/D
133	30	143	1820	214	MIN
2080	4360	8270	20340	20290	MAX

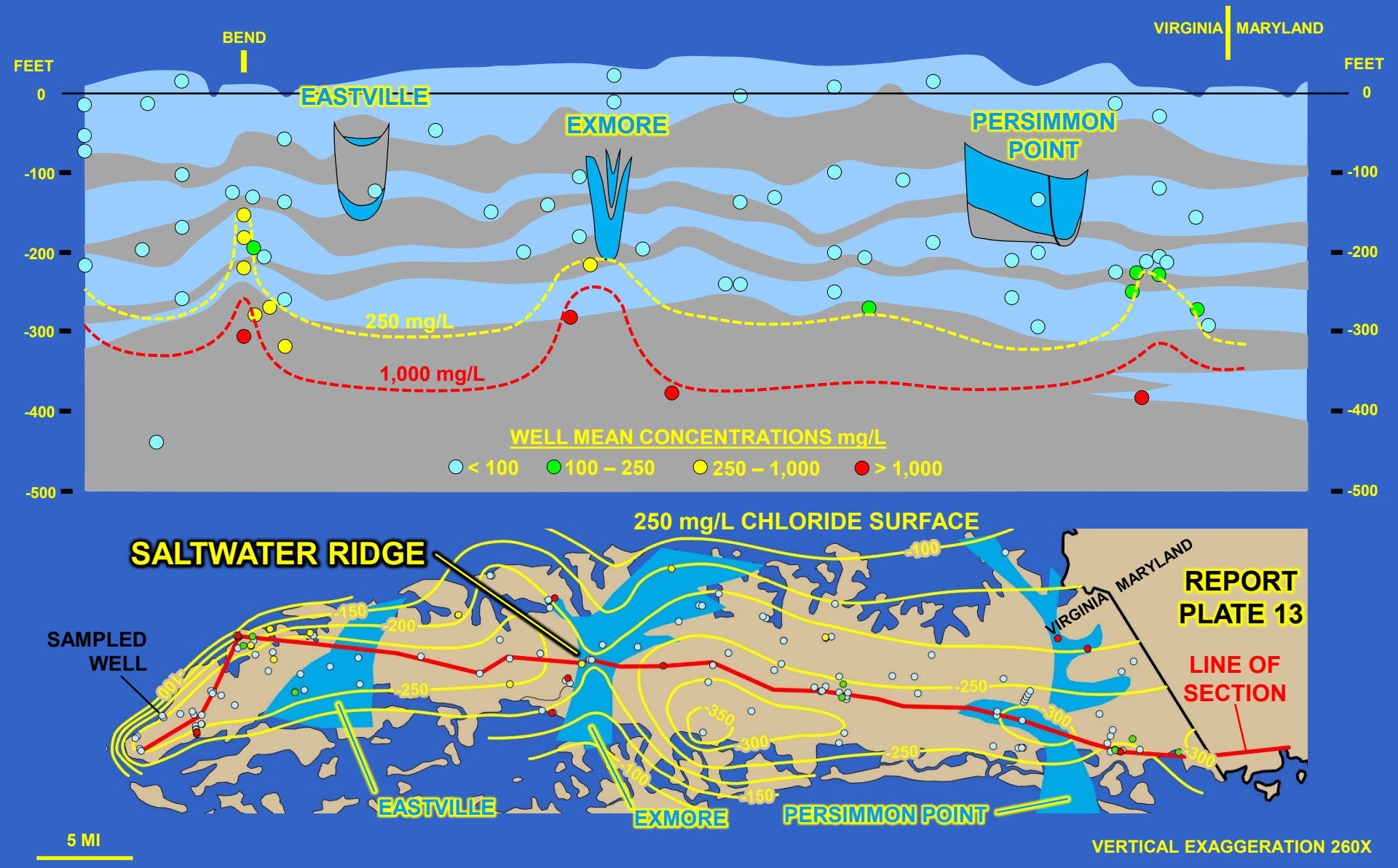
Report Table of Contents

Abstract
Introduction
- Purpose and Scope
- Description of the Study Area
  - Geologic Setting
  - Groundwater Conditions
- Methods of Investigation
- Previous Investigations

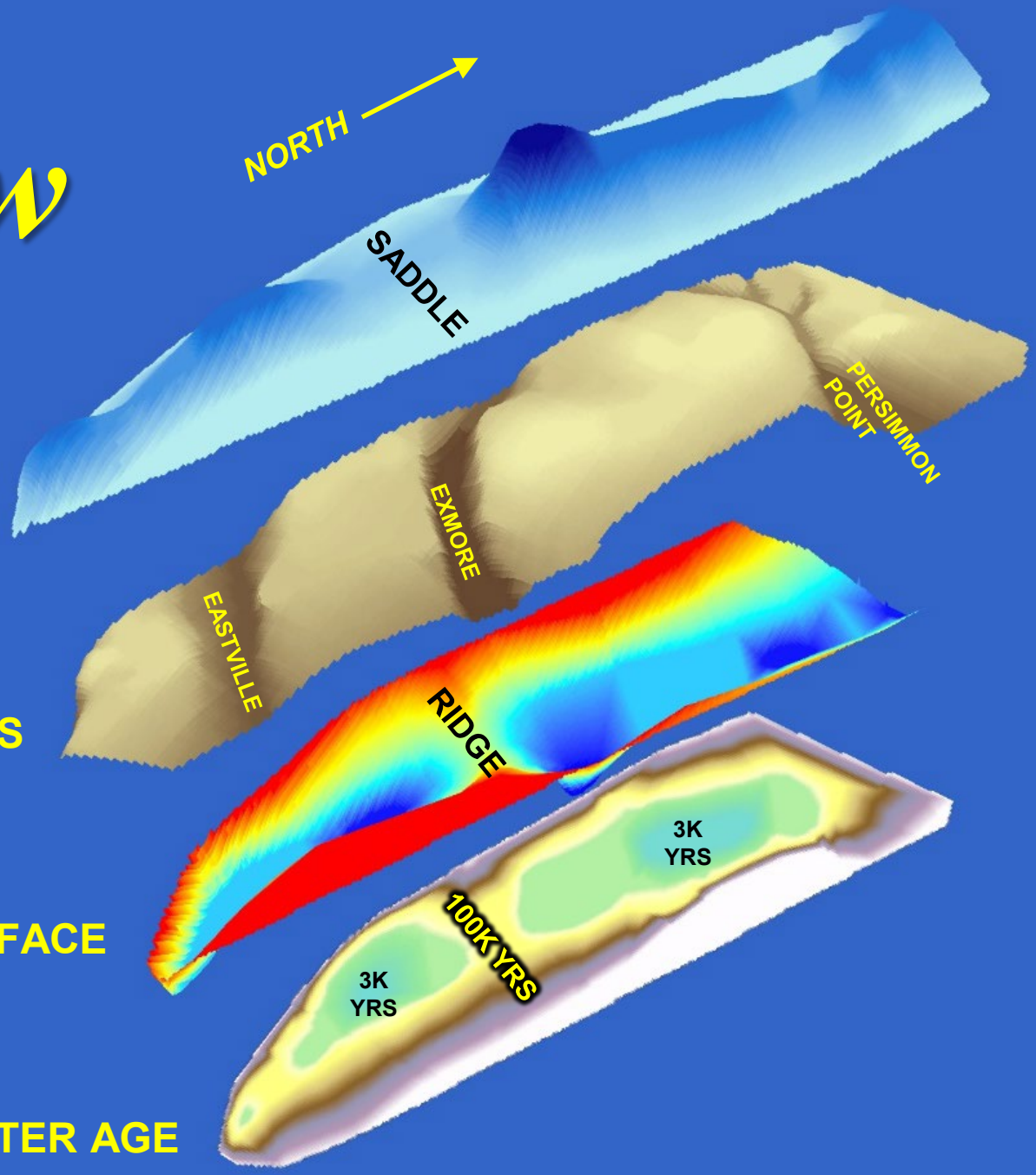
Hydrogeologic Framework
- Geologic Relations
  - Stratigraphy
  - Depositional History
- Hydrogeologic-Unit Descriptions
  - Composition
  - Configuration
    - Yorktown-Eastover Aquifer System
      - Top-Surface Undulations
      - Paleochannel Incision
      - Upper Confining Unit
    - Surficial Aquifer
    - Hydrogeologic Units Within Paleochannels
- Aquifer Hydraulic Properties
- Saltwater-Transition Zone
  - Groundwater Chloride Concentrations
  - Configuration
  - Saltwater Ridge
- Information Uses and Limitations
  - Digital Model Improvement
  - Limitations

Summary and Conclusions
References Cited

Groundwater Chloride



3-D View



PREDEVELOPMENT WATER LEVELS

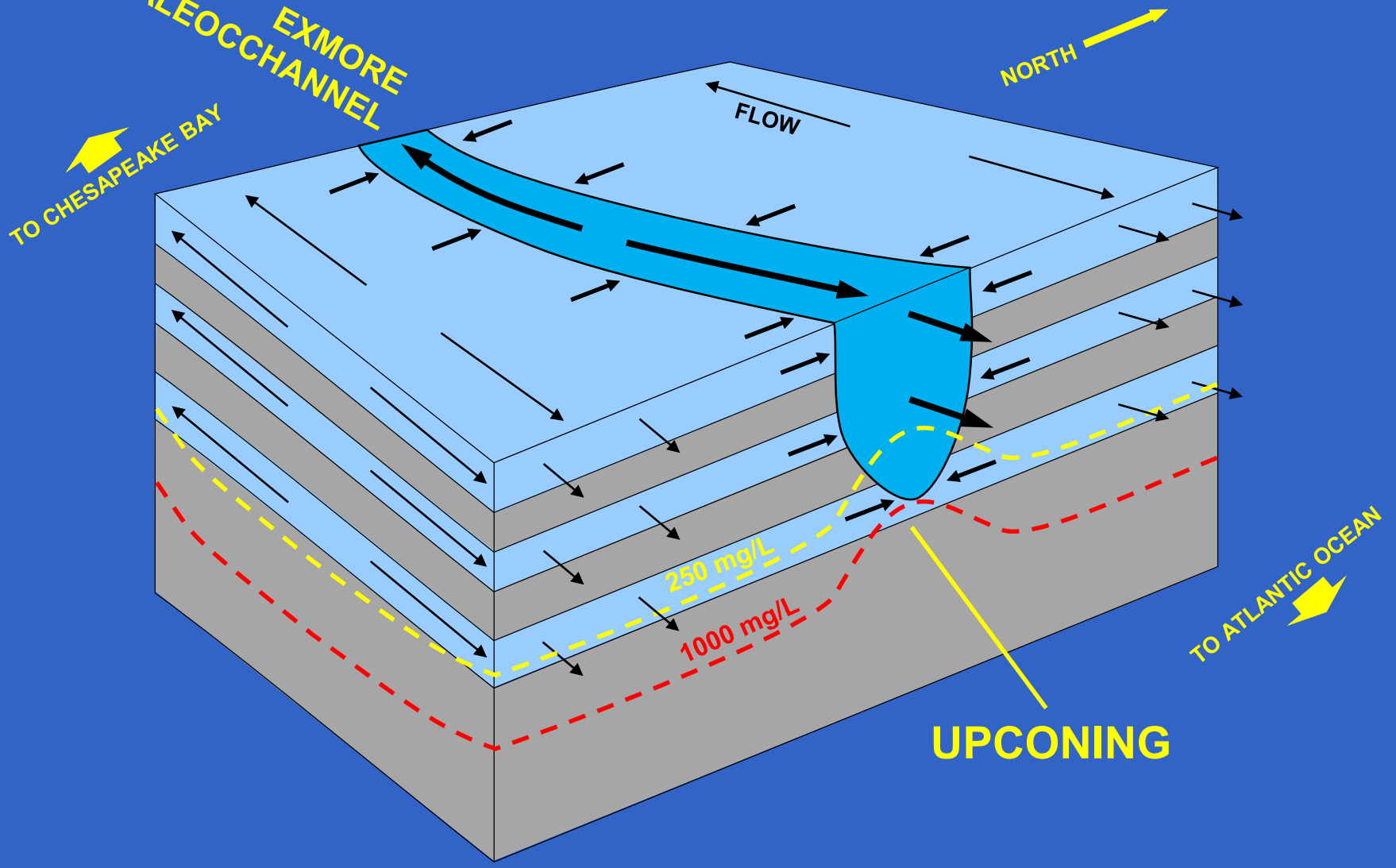
PALEOCHANNELS

250 mg/L CHLORIDE SURFACE

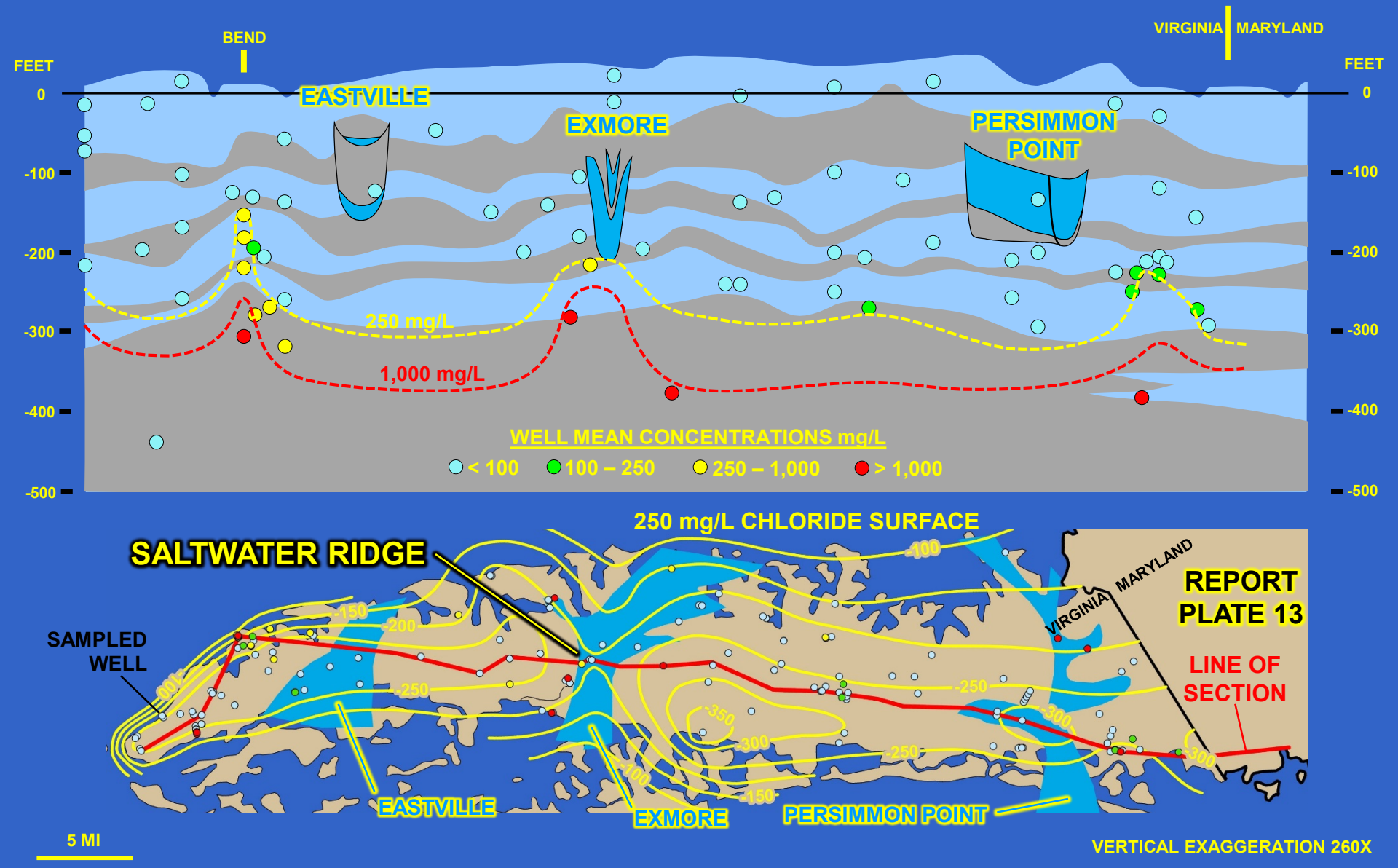
ESTIMATED GROUNDWATER AGE

Saltwater-Ridge Formation

(report figure 7)



Groundwater Chloride



Shallow Saltwater

Report Table of Contents

- Abstract
- Introduction
  - Purpose and Scope
  - Description of the Study Area
    - Geologic Setting
    - Groundwater Conditions
  - Methods of Investigation
  - Previous Investigations
- Hydrogeologic Framework
  - Geologic Relations
    - Stratigraphy
    - Depositional History
  - Hydrogeologic-Unit Descriptions
    - Composition
    - Configuration
      - Yorktown-Eastover Aquifer System
        - Top-Surface Undulations
        - Paleochannel Incision
        - Upper Confining Unit
      - Surficial Aquifer
      - Hydrogeologic Units Within Paleochannels
  - Aquifer Hydraulic Properties
  - Saltwater-Transition Zone
    - Groundwater Chloride Concentrations
    - Configuration
    - Saltwater Ridge
  - Information Uses and Limitations
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    - Limitations
- Summary and Conclusions
- References Cited

Revised Model

- Jason Pope project chief
- aligned with USGS national model grid
- 8 layers
- 300 columns x 540 rows
- 250 m cells confined
- surficial aquifer detail
  - 50-175 m cells
  - hi-res LiDAR DEM
- 1900 - 2020

Acknowledgements

- *Todd Beach, Scott Bruce – borehole data*
- *Bundick Well & Pump – borehole logs*
- *Ryan Green – chloride data*
- *Matt Link – aquifer-test data*
- *Scott Kudlas – program support*