Salt Water Intrusion:
An Introduction and Overview

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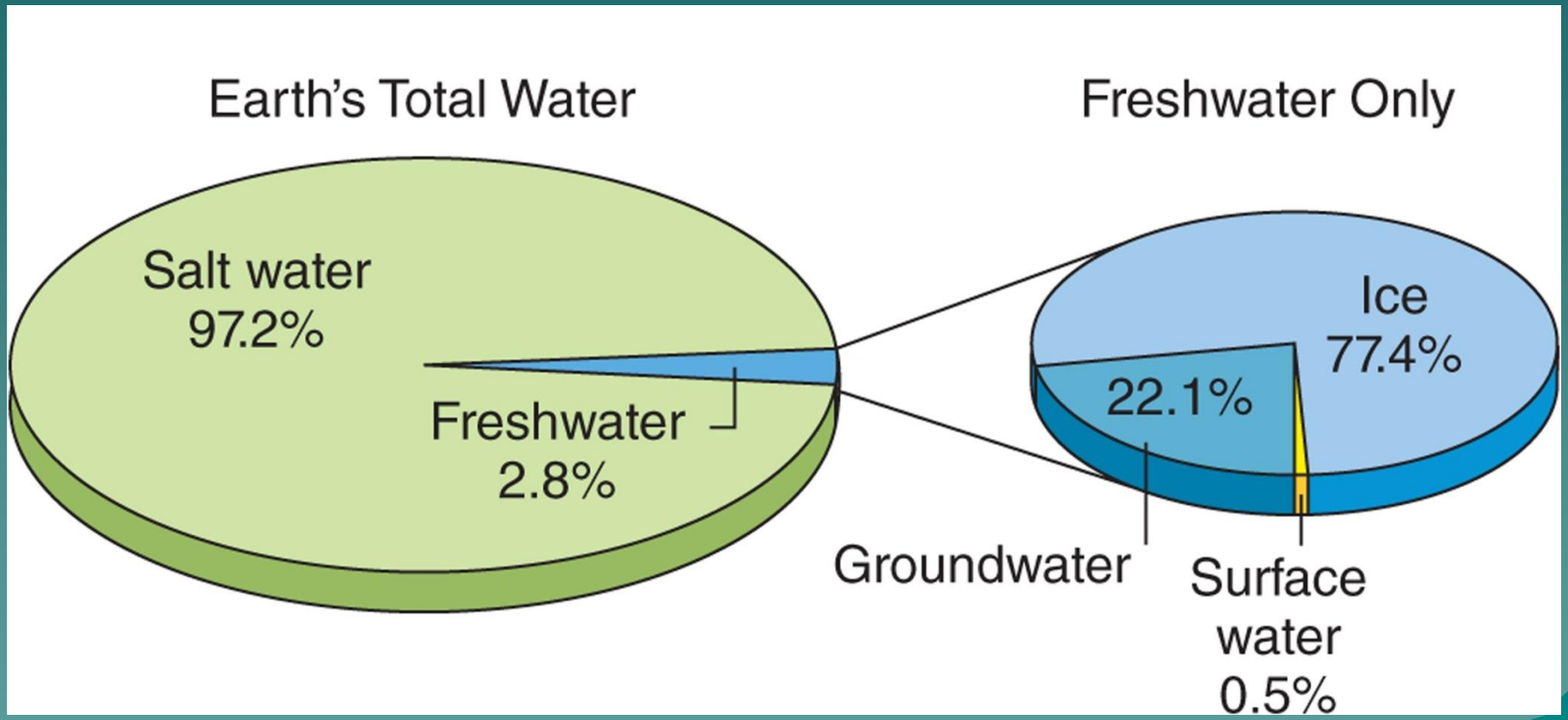
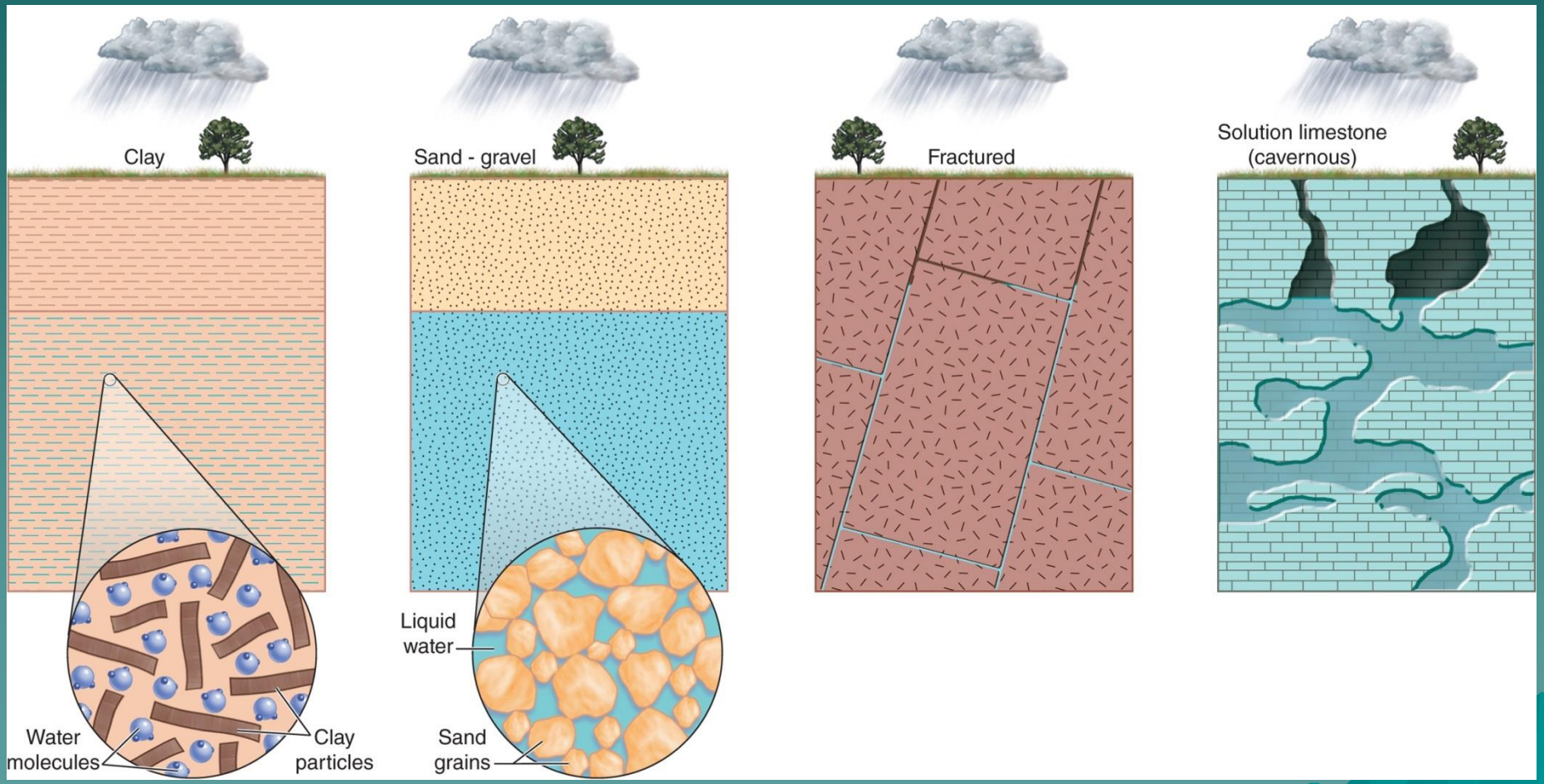
South Carolina
Savannah River
Savannah
Tybee Island
Wilmington Island
Ogeechee River
Little Tybee Island
Skidaway Island
Wassaw Island
Ossabaw Island
St. Catherines Island
Blackbeard Island
Altamaha River
Darien
Sapelo Island
Little St. Simons Island
Brunswick
Sea Island
St. Simons Island
Jekyll Island
Little Cumberland Island
Cumberland Island
N

N
S
0
2.5
5
7.5
10 Kilometers

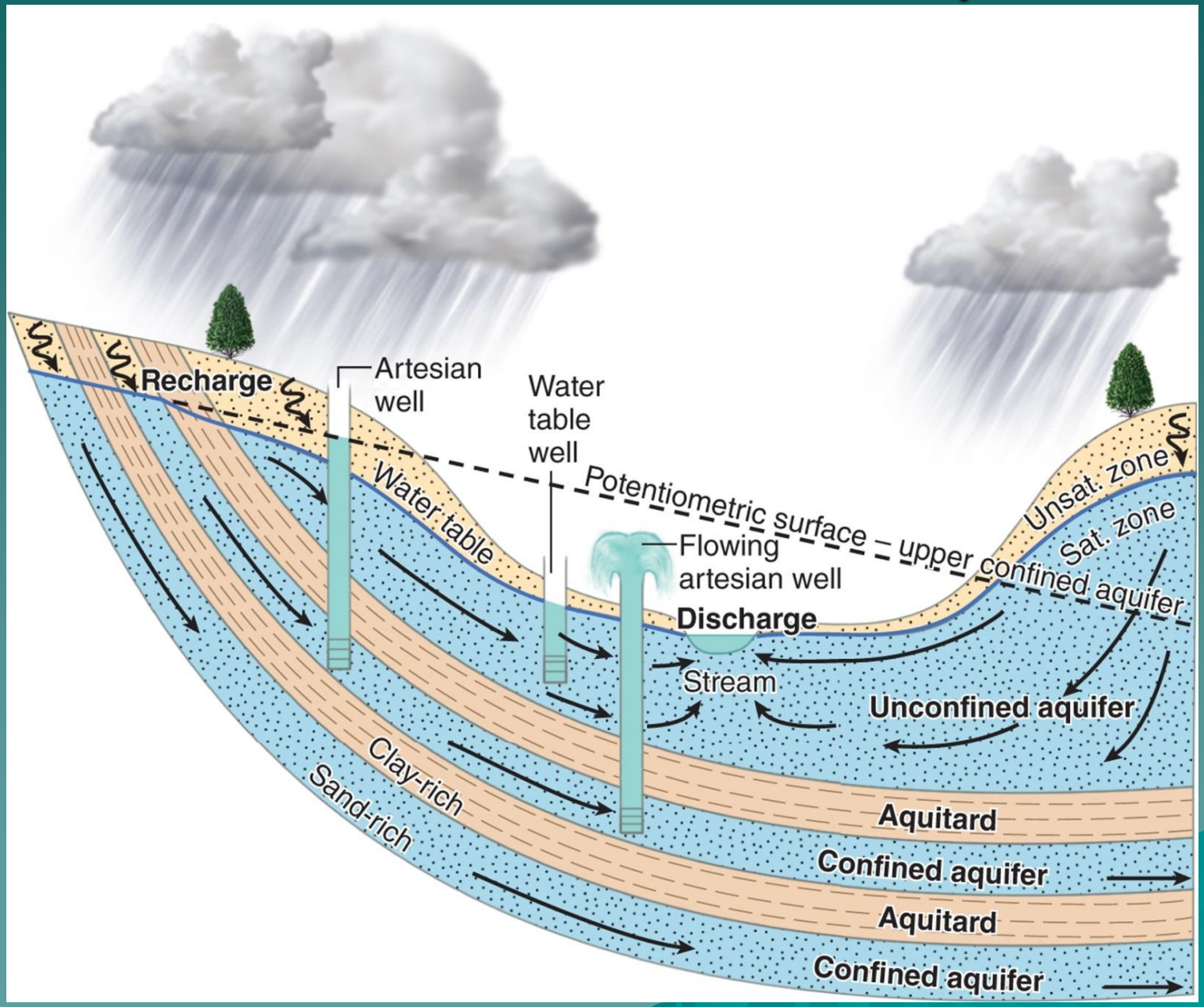
Groundwater Resources



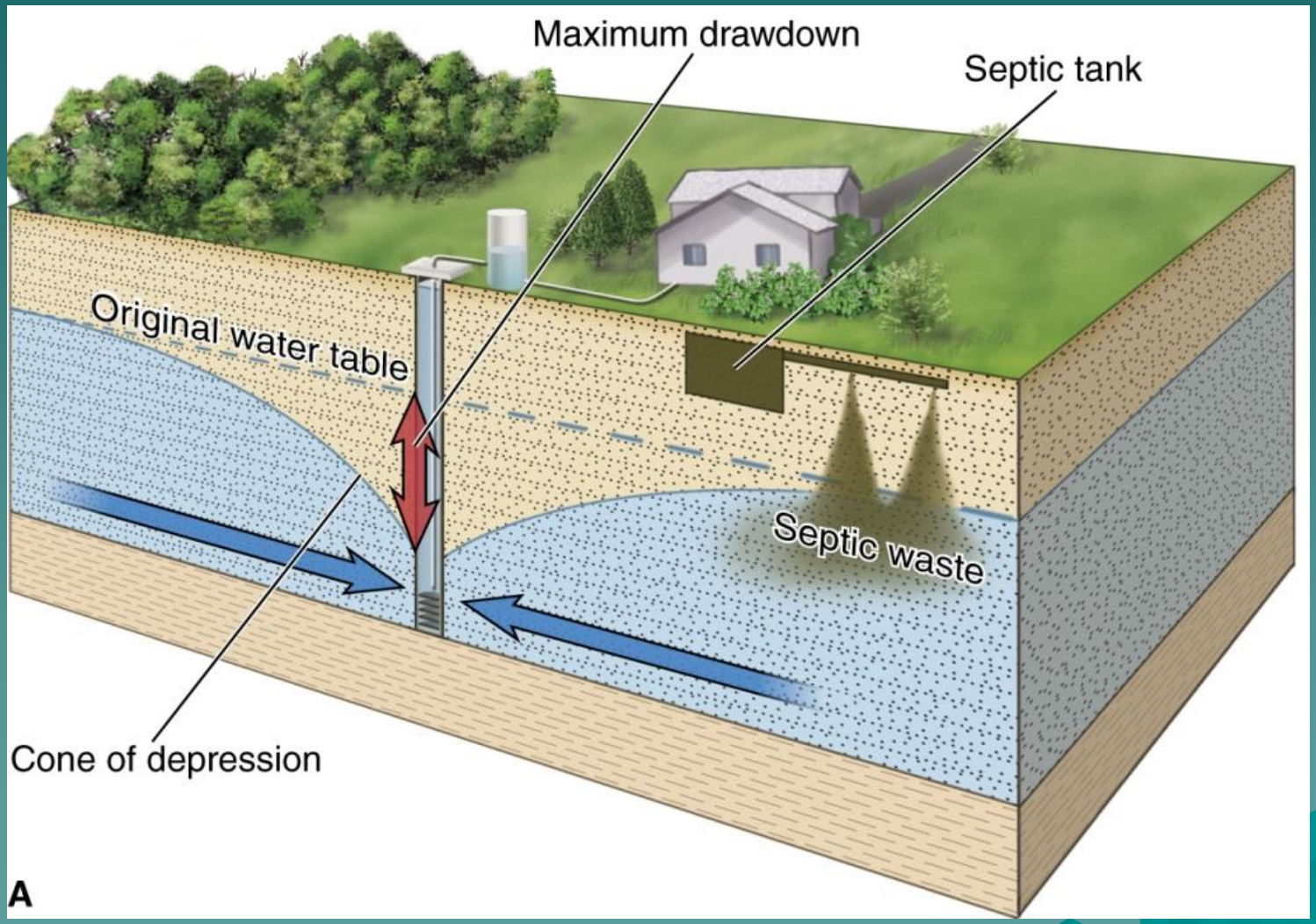
Aquifers and Aquitards/Aquicludes



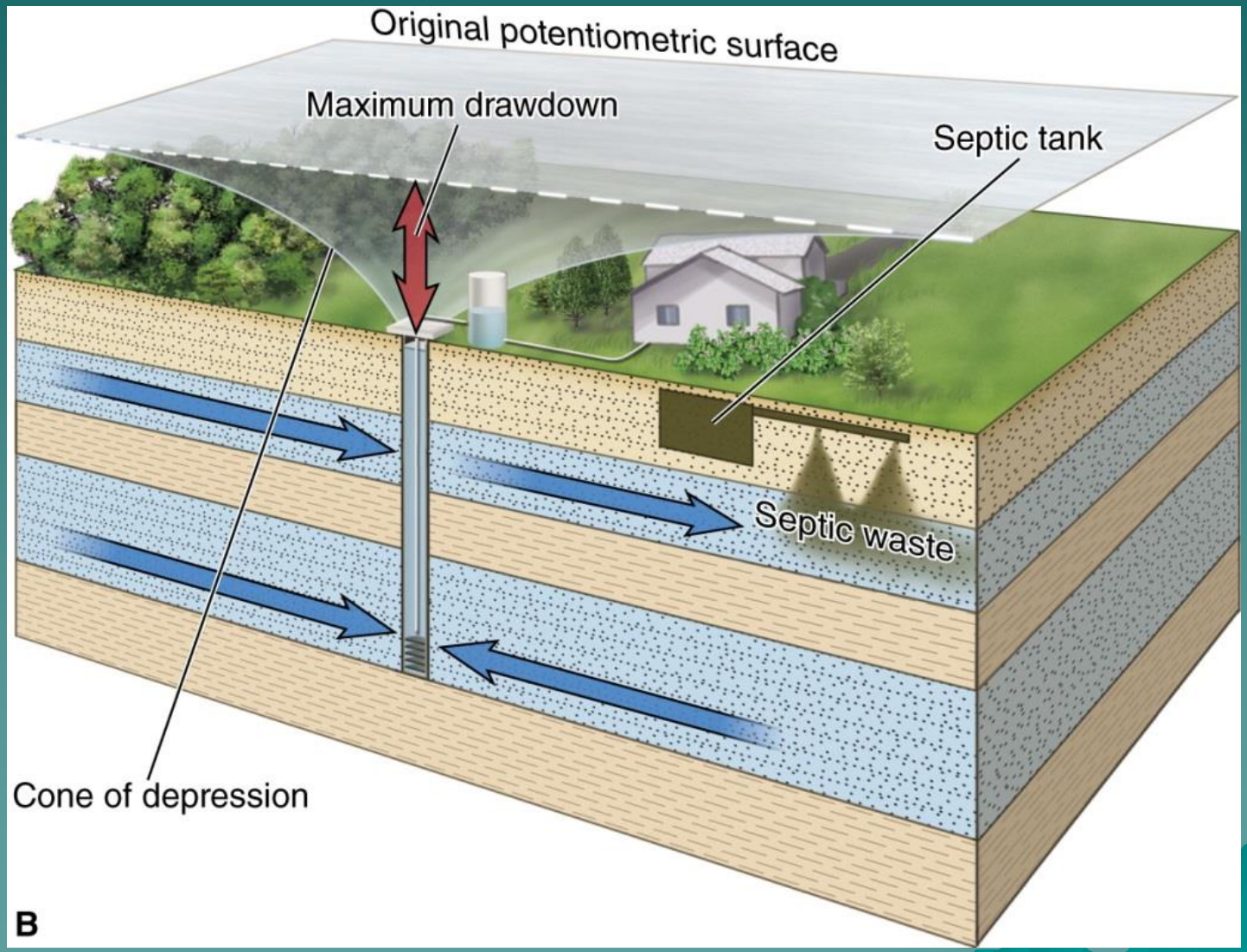
Unconfined & Confined Aquifers

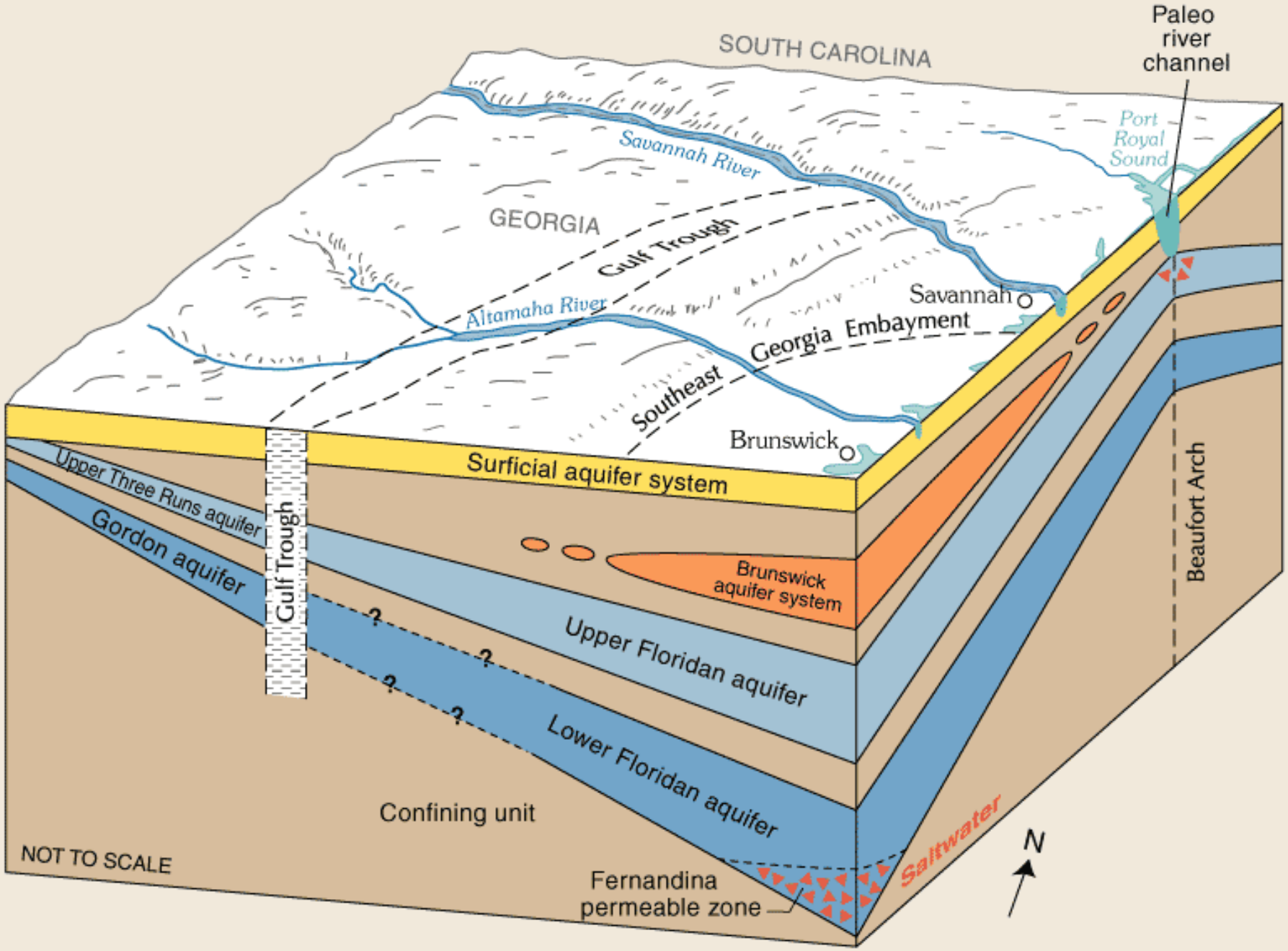


Cone of Depression

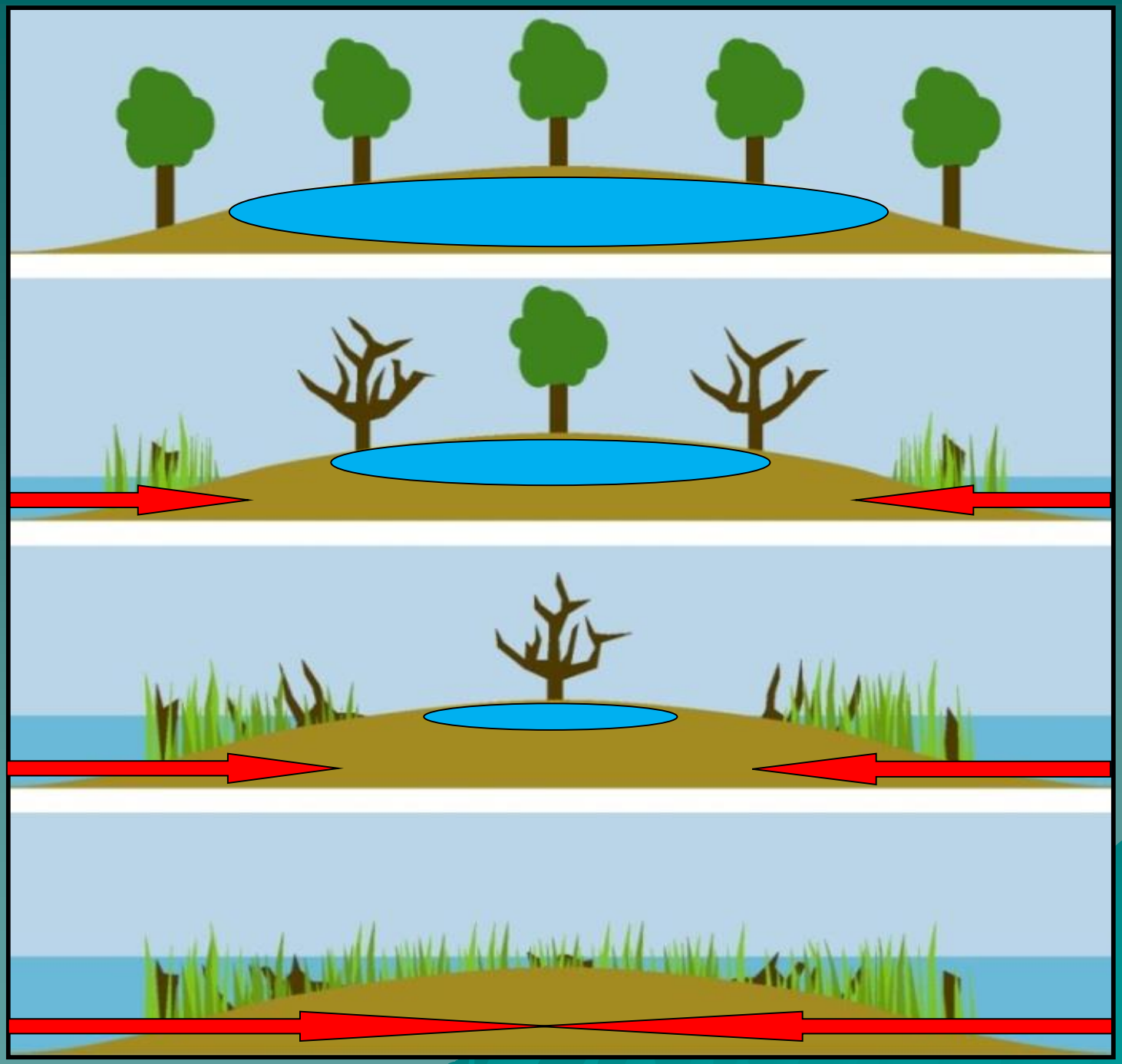


Cone of Depression

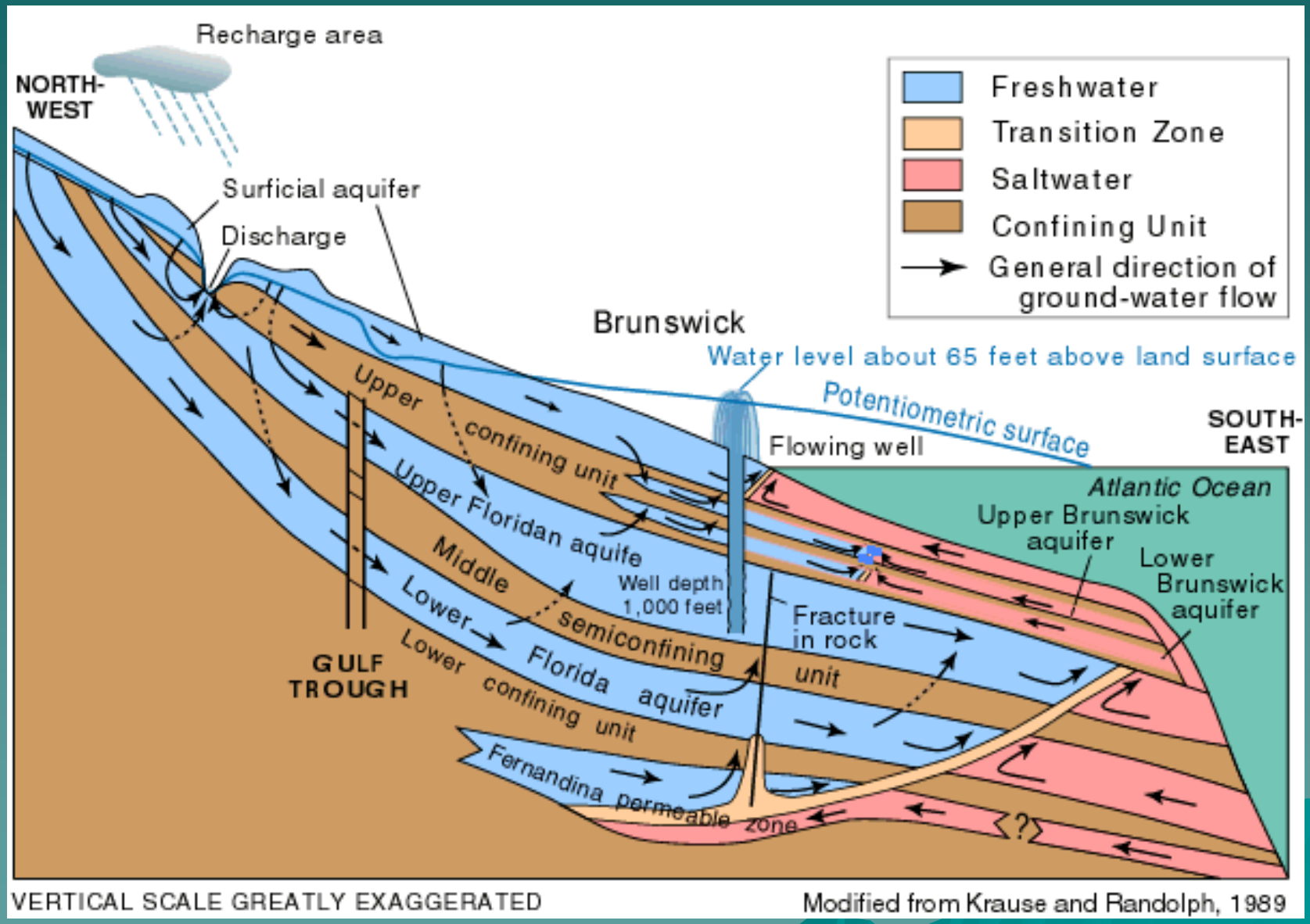



SOUTH CAROLINA
Paleo river channel
Port Royal Sound
Savannah River
GEORGIA
Gulf Trough
Altamaha River
Savannah
Southeast Georgia Embayment
Brunswick
Surficial aquifer system
Upper Three Runs aquifer
Gordon aquifer
Gulf Trough
Brunswick aquifer system
Upper Floridan aquifer
Lower Floridan aquifer
Confining unit
Beaufort Arch
Saltwater
N
NOT TO SCALE
Fernandina permeable zone

Surficial Aquifer

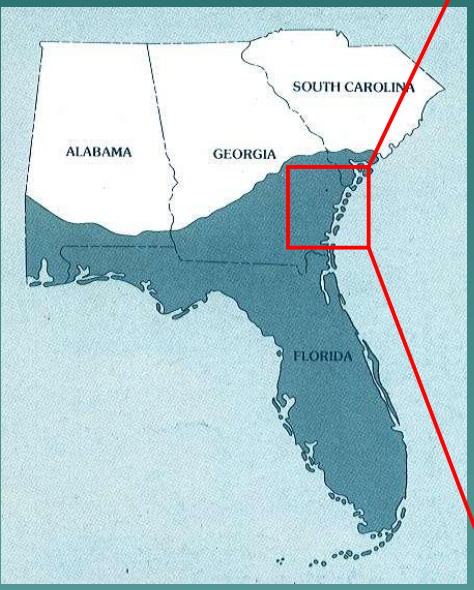


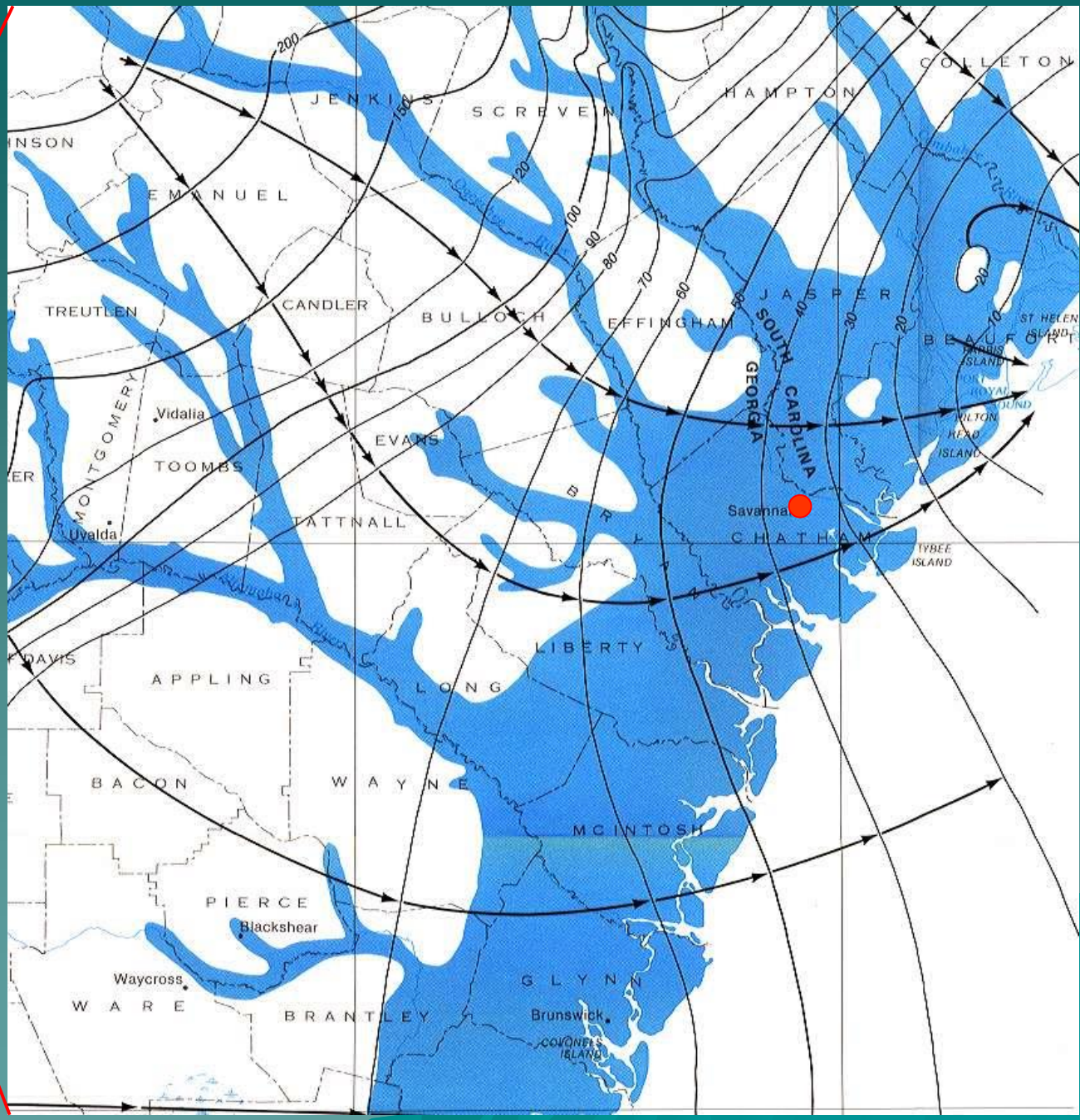
Floridan Aquifer System



(USGS, 2001)

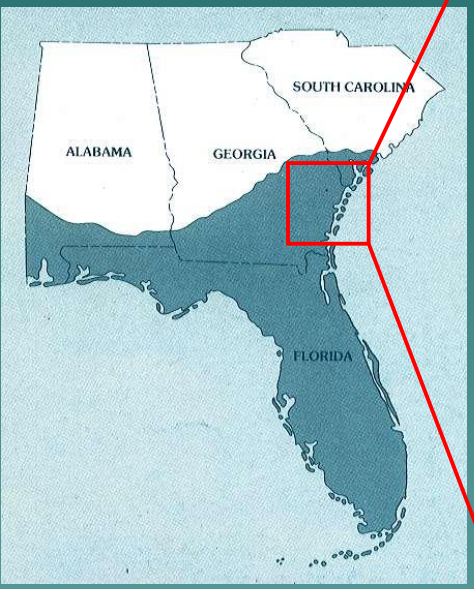
1880 Conditions

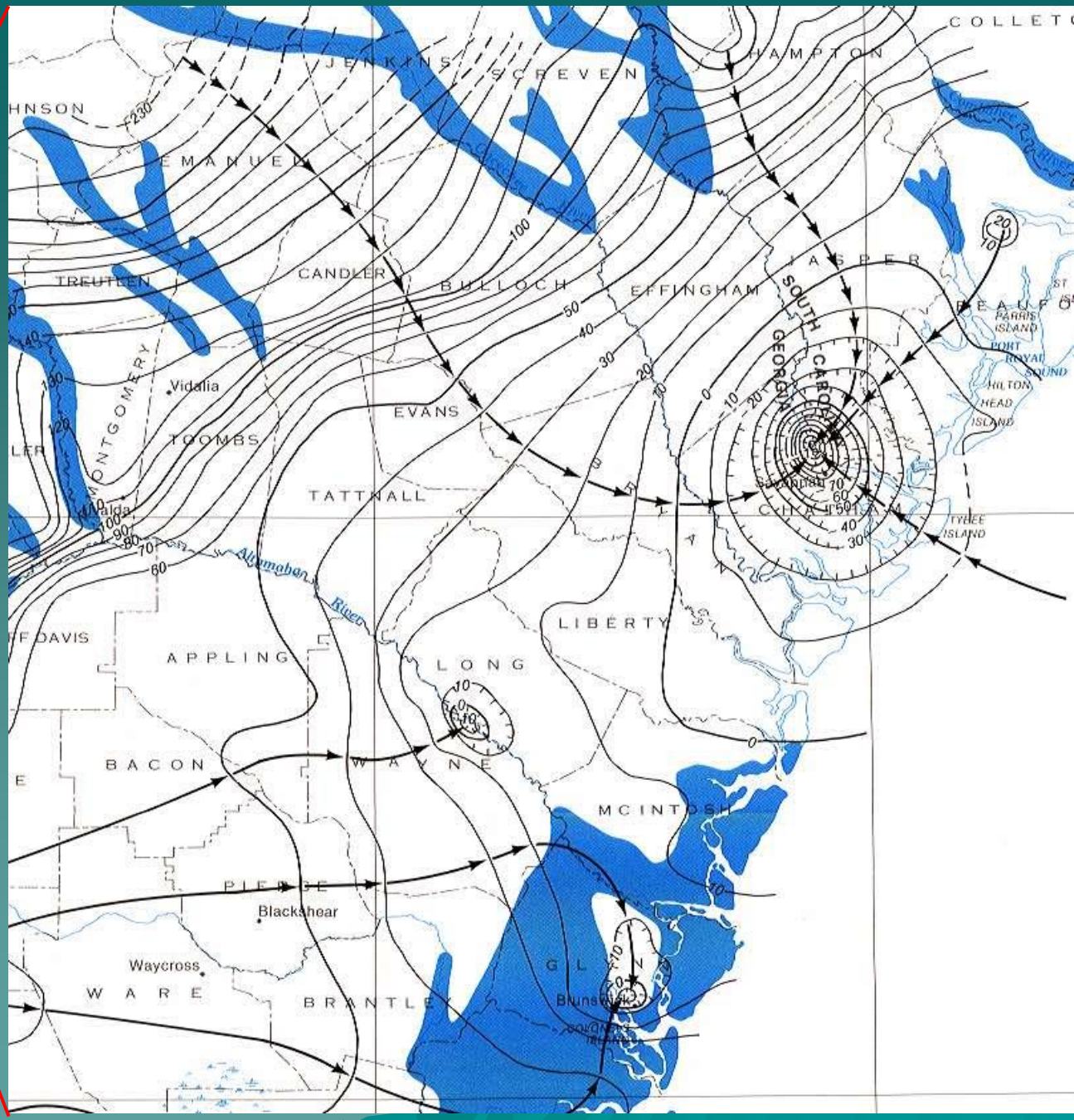




(Krause and Randolph, 1989)

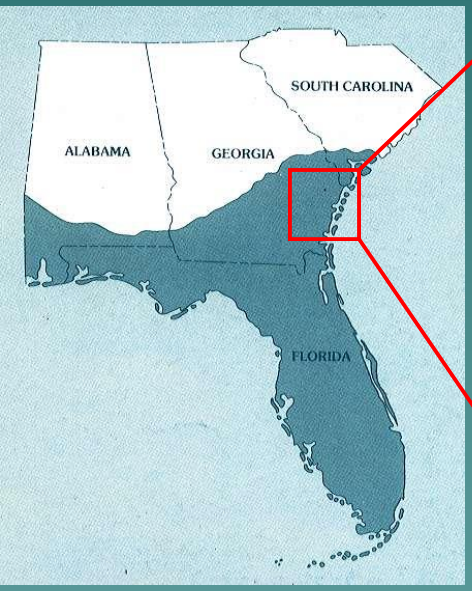
1986 Conditions

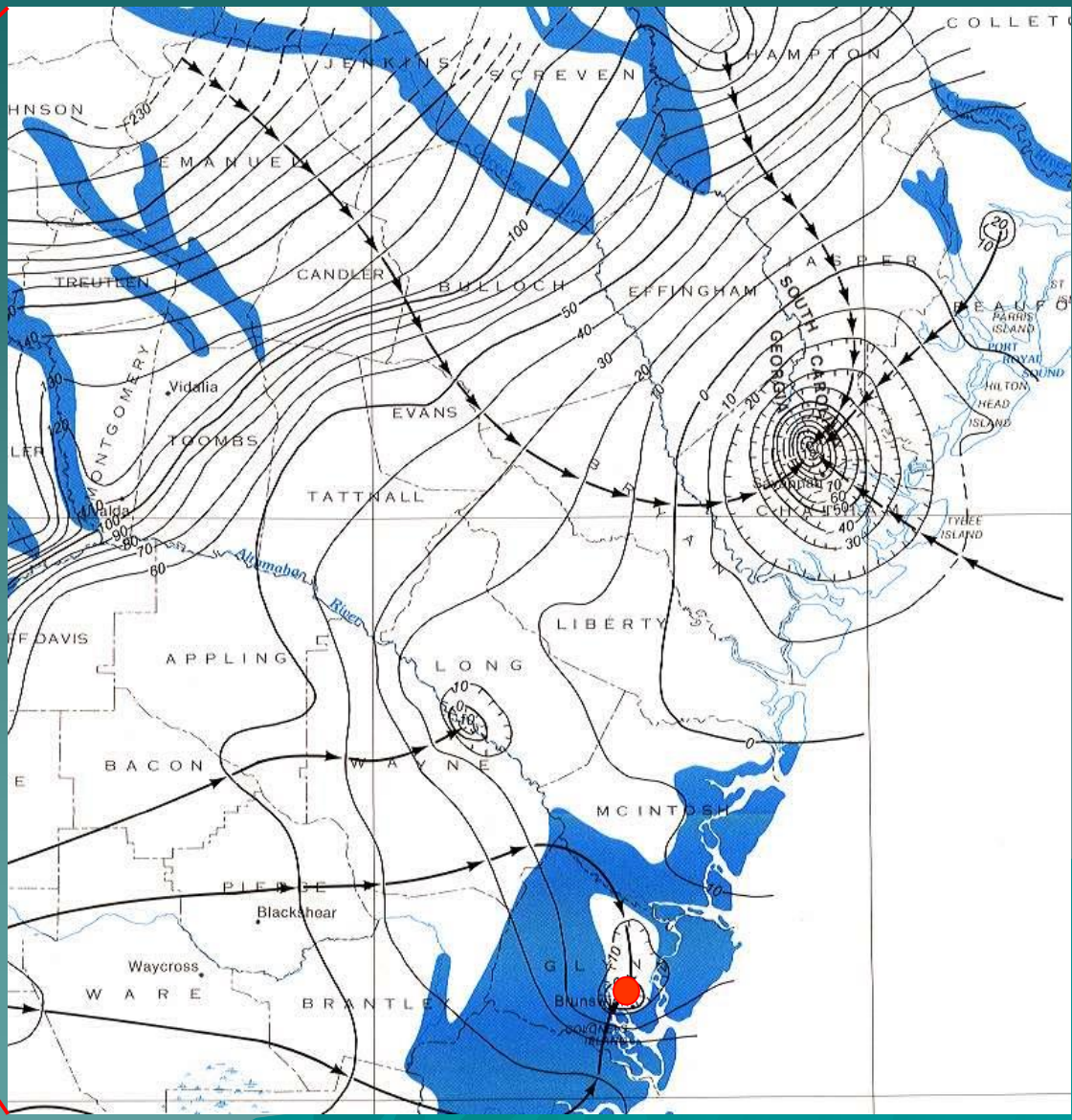




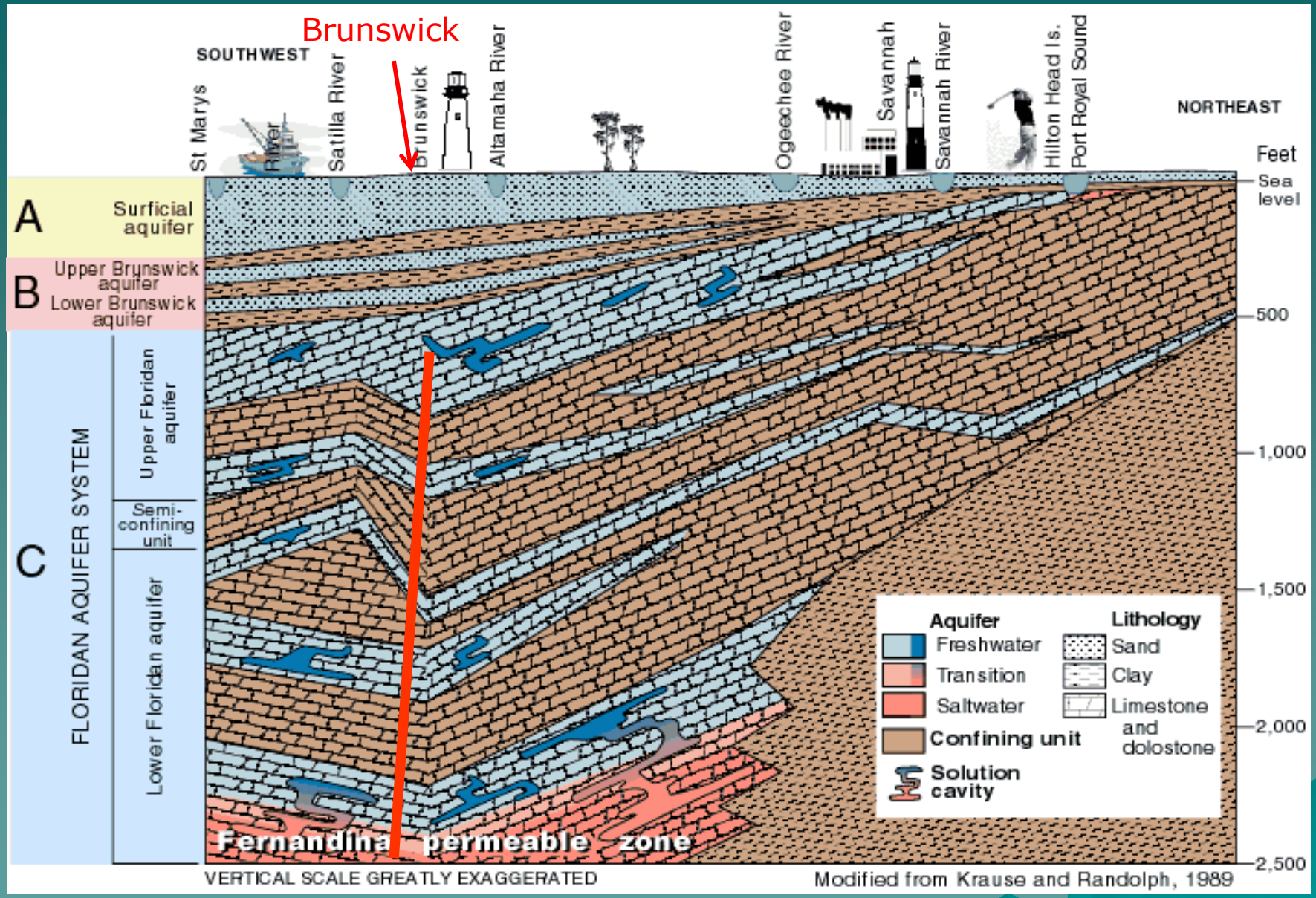
(Krause and Randolph, 1989)

Vertical Saltwater Intrusion



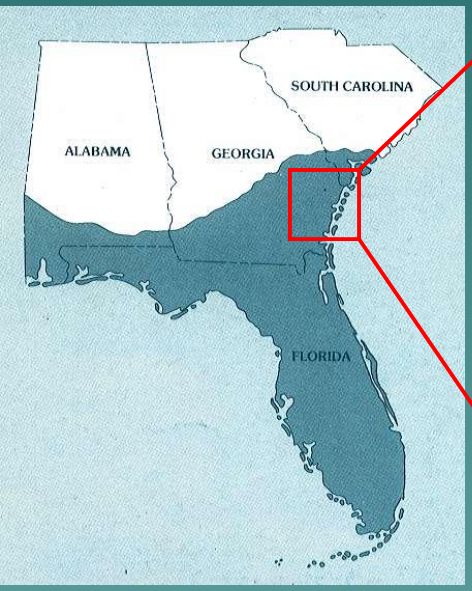


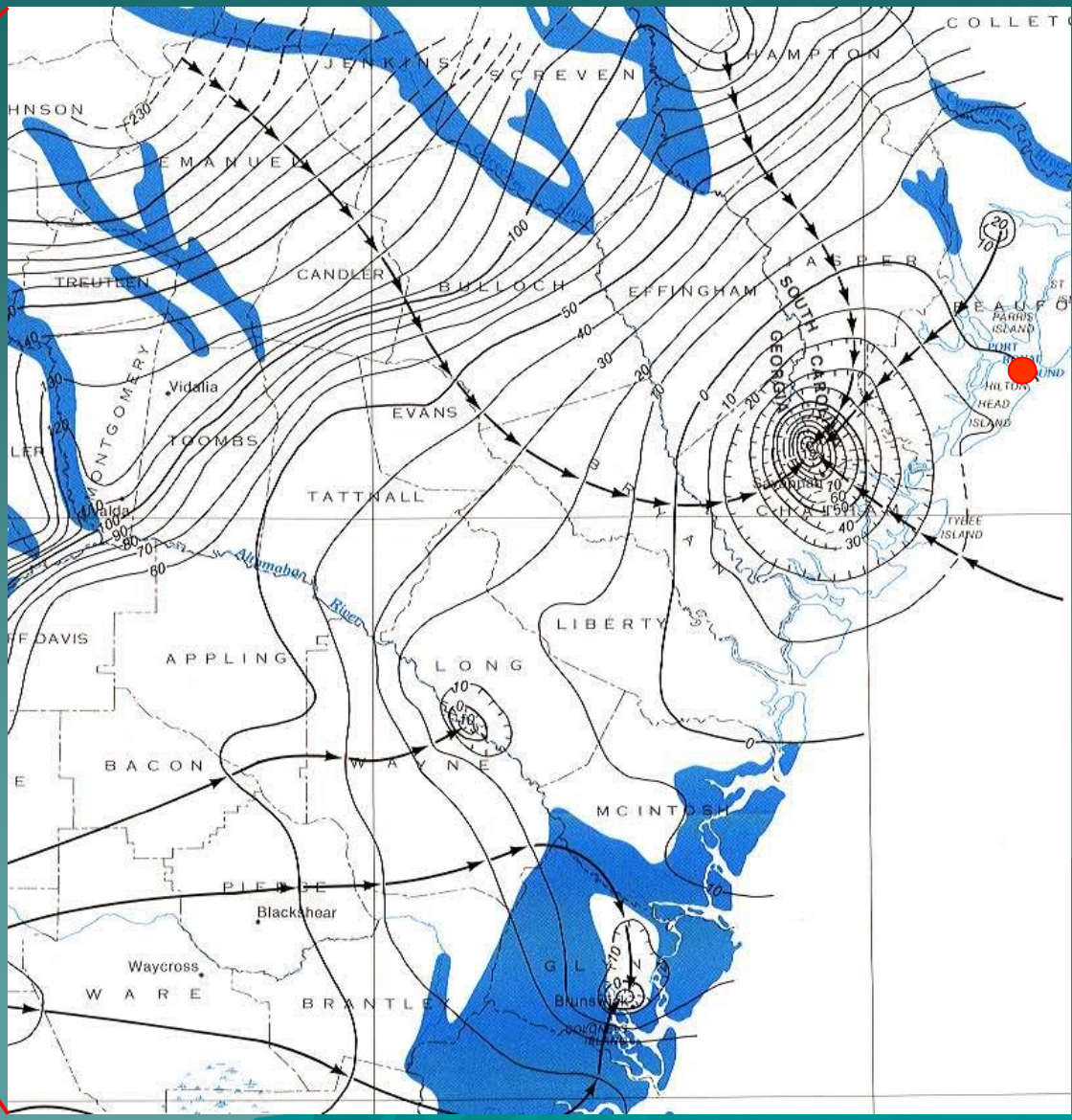
(Krause and Randolph, 1989)


Brunswick
SOUTHWEST
NORTHEAST
St Marys River
Satilla River
Brunswick
Altamaha River
Ogeechee River
Savannah
Savannah River
Hilton Head Is.
Port Royal Sound
Feet
Sea level
500
1,000
1,500
2,000
2,500
A
Surficial aquifer
B
Upper Brunswick aquifer
Lower Brunswick aquifer
C
FLORIDAN AQUIFER SYSTEM
Upper Floridan aquifer
Semi-confining unit
Lower Floridan aquifer
Fernandina permeable zone
Aquifer
Freshwater
Transition
Saltwater
Confining unit
Solution cavity
Lithology
Sand
Clay
Limestone and dolostone
VERTICAL SCALE GREATLY EXAGGERATED
Modified from Krause and Randolph, 1989

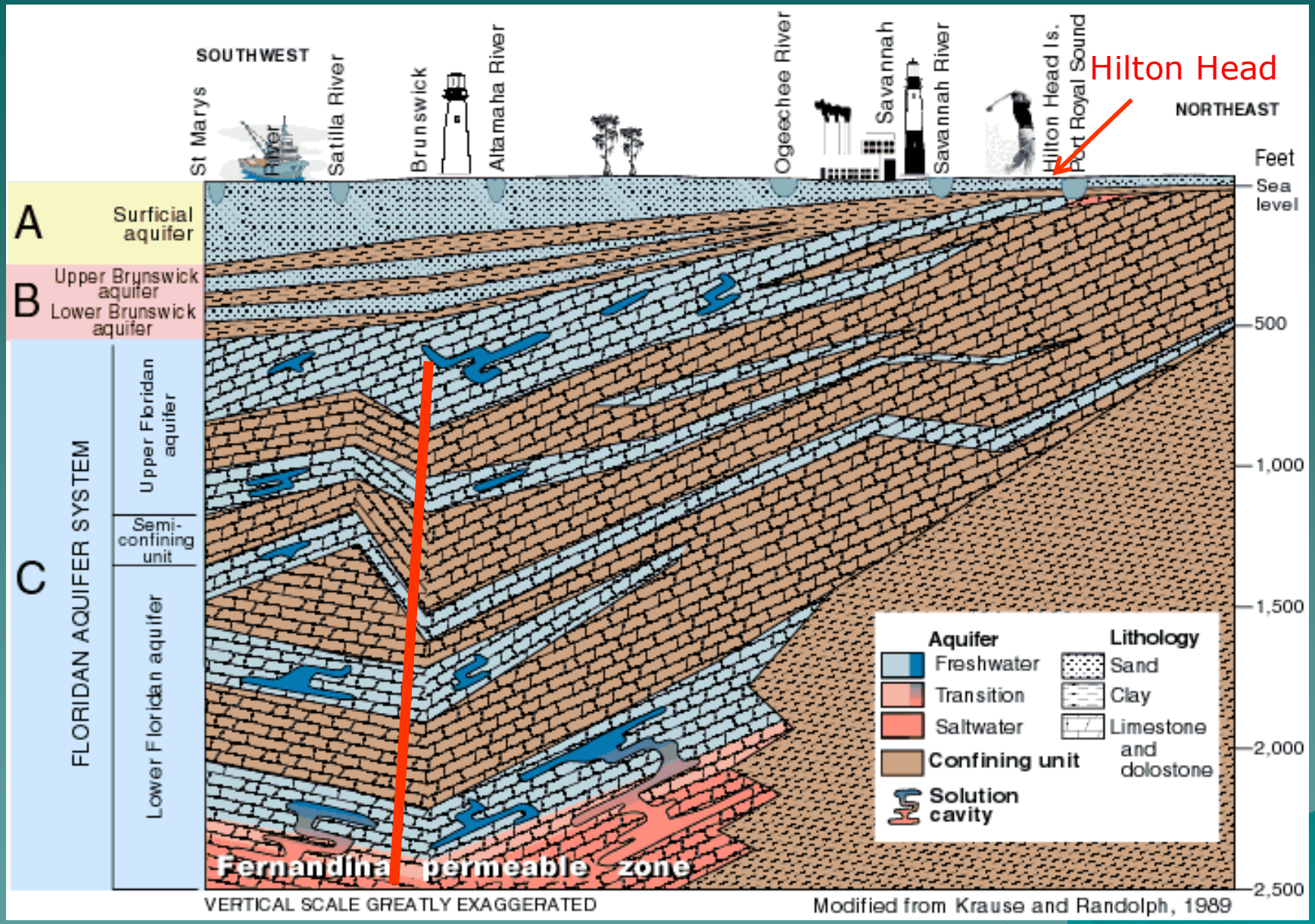
(USGS, 2001)

Lateral Saltwater Intrusion





(Krause and Randolph, 1989)


SOUTHWEST
NORTHEAST
St Marys River
Satilla River
Brunswick
Altamaha River
Ogeechee River
Savannah
Savannah River
Hilton Head Is.
Port Royal Sound
Hilton Head
Feet
Sea level
500
1,000
1,500
2,000
2,500
A
Surficial aquifer
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Upper Brunswick aquifer
Lower Brunswick aquifer
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Upper Floridan aquifer
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Lower Floridan aquifer
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Transition
Saltwater
Confining unit
Solution cavity
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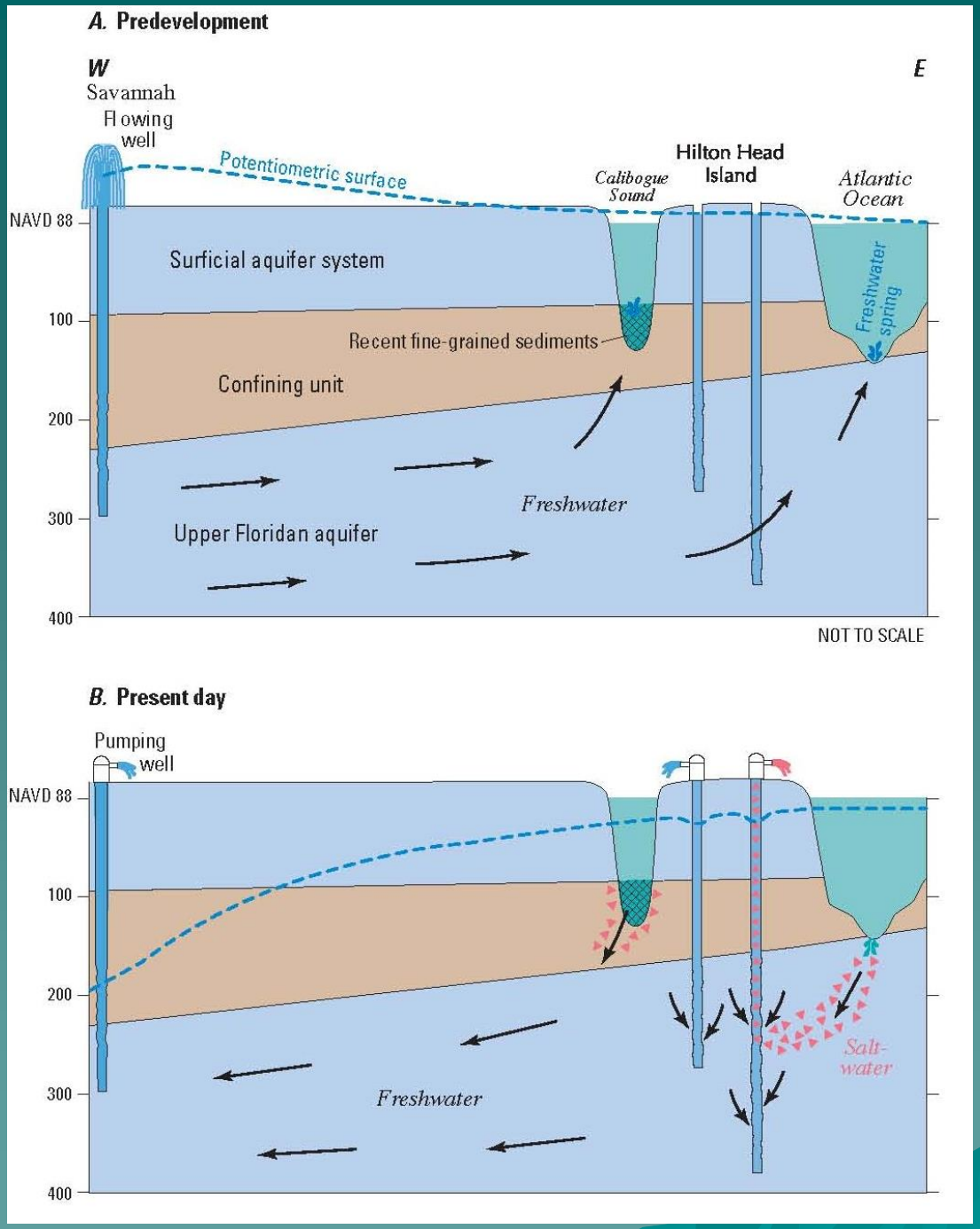
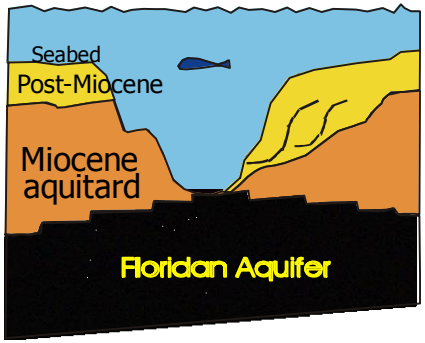
Sand
Clay
Limestone and dolostone
Fernandina permeable zone
VERTICAL SCALE GREATLY EXAGGERATED
Modified from Krause and Randolph, 1989

(USGS, 2001)



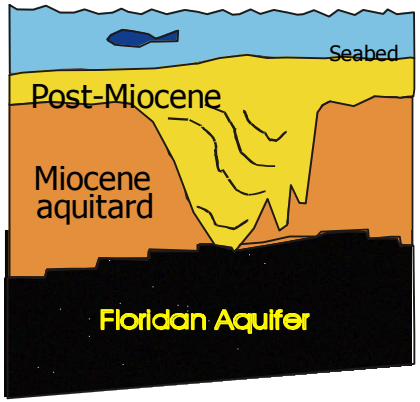
(USGS, Payne, 2010)

(A) Modern tidal creek

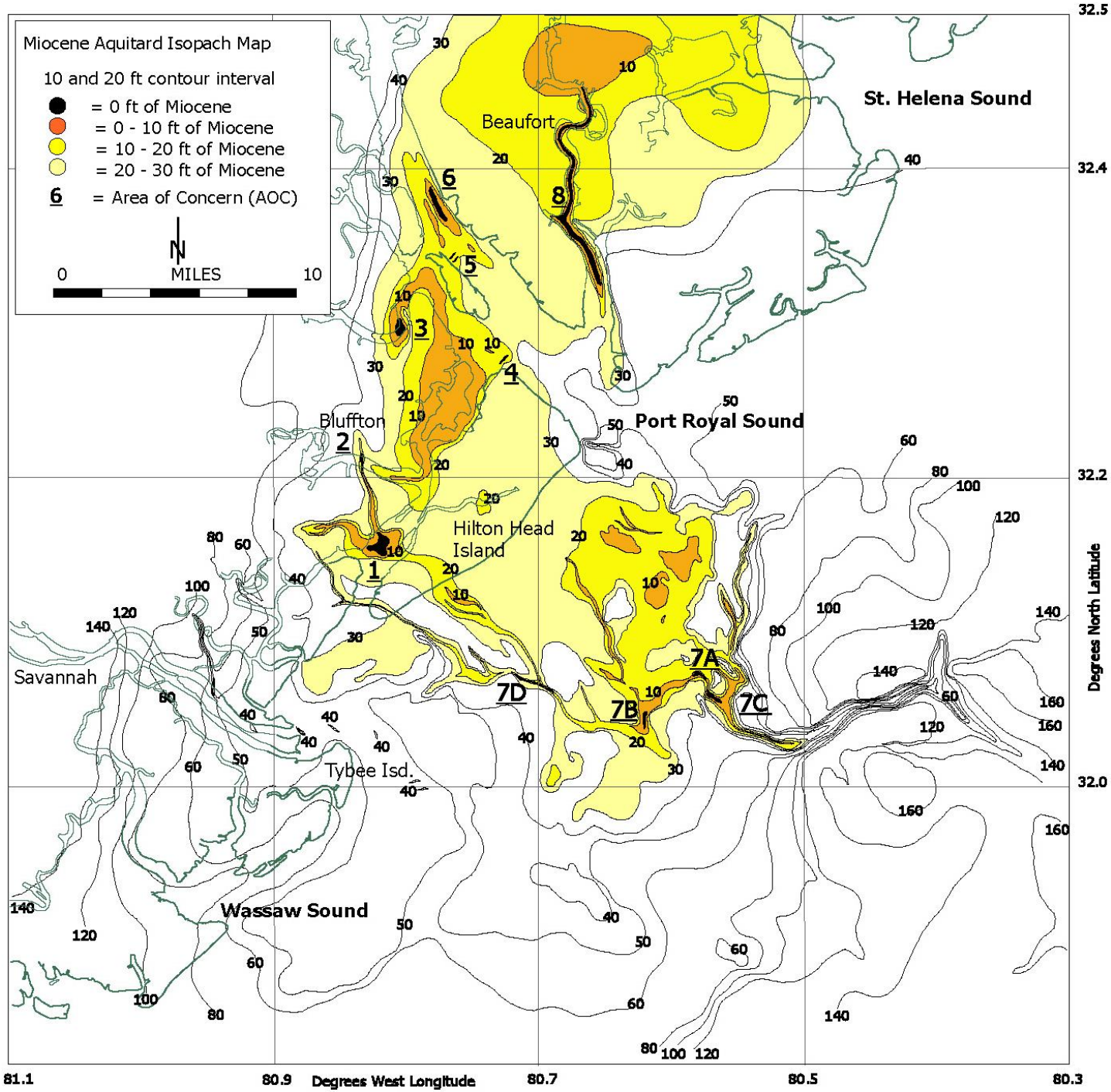


Calibogue Sound

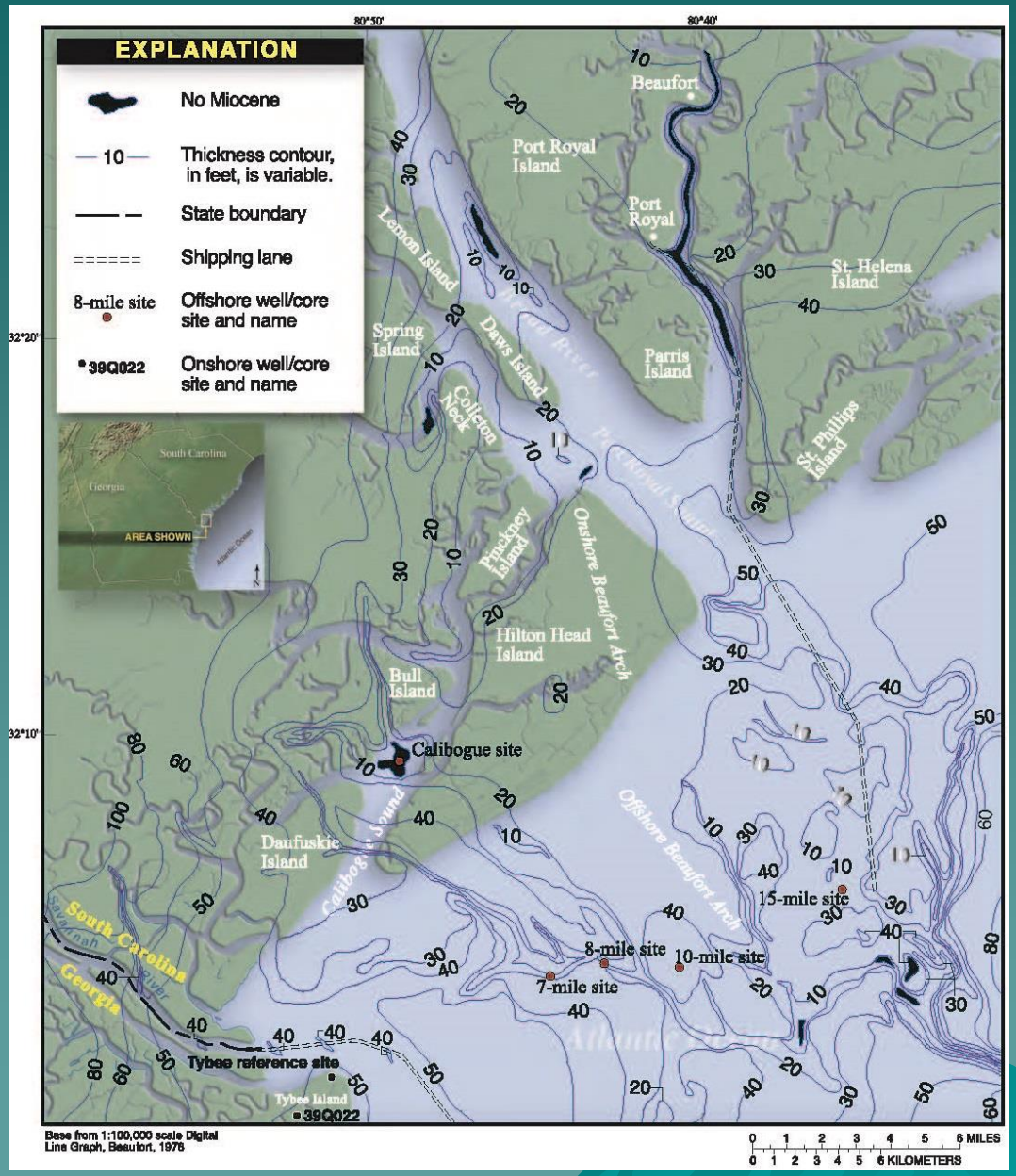
(B) Infilled paleochannel



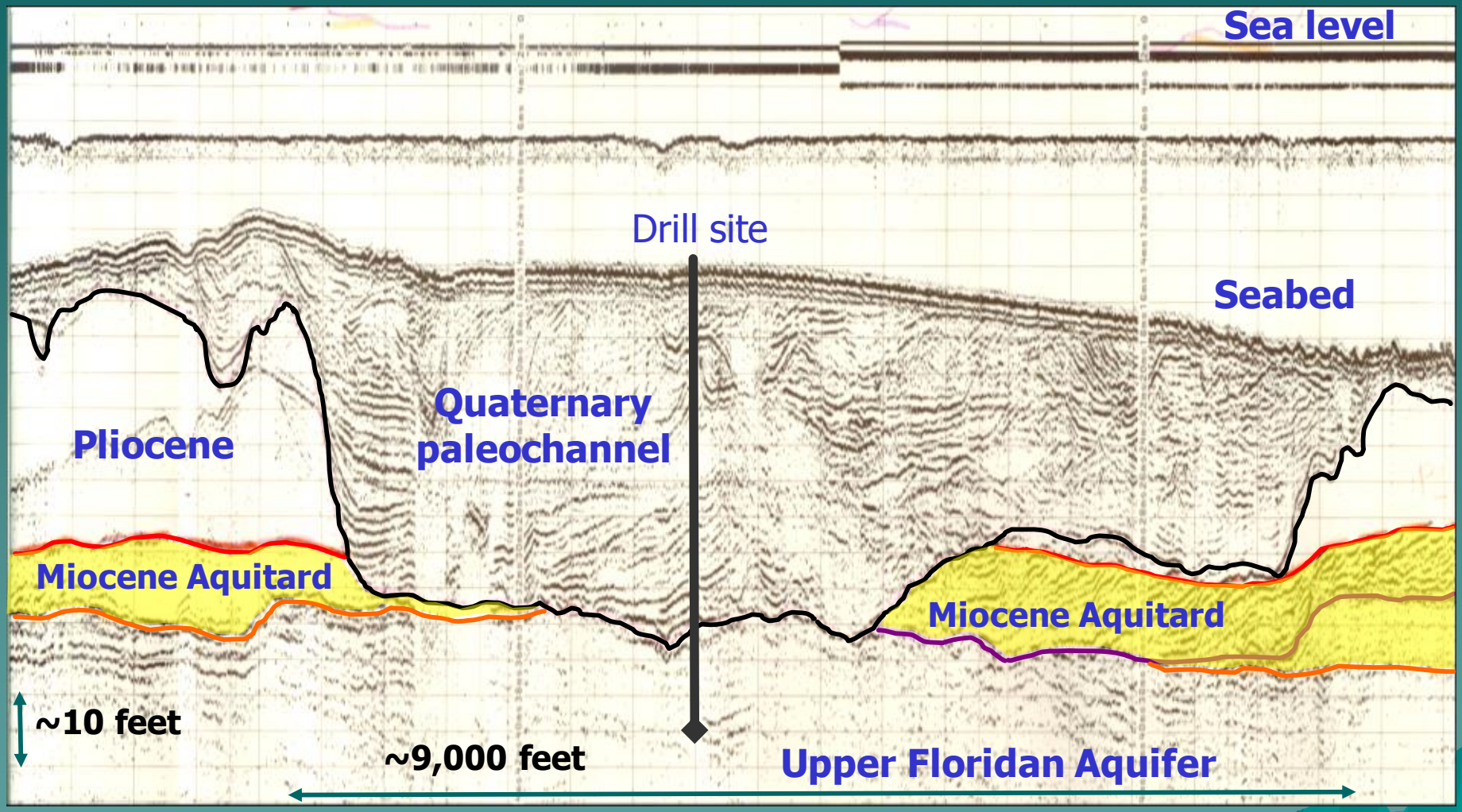
Savannah River paleochannel



Other Paleochannels

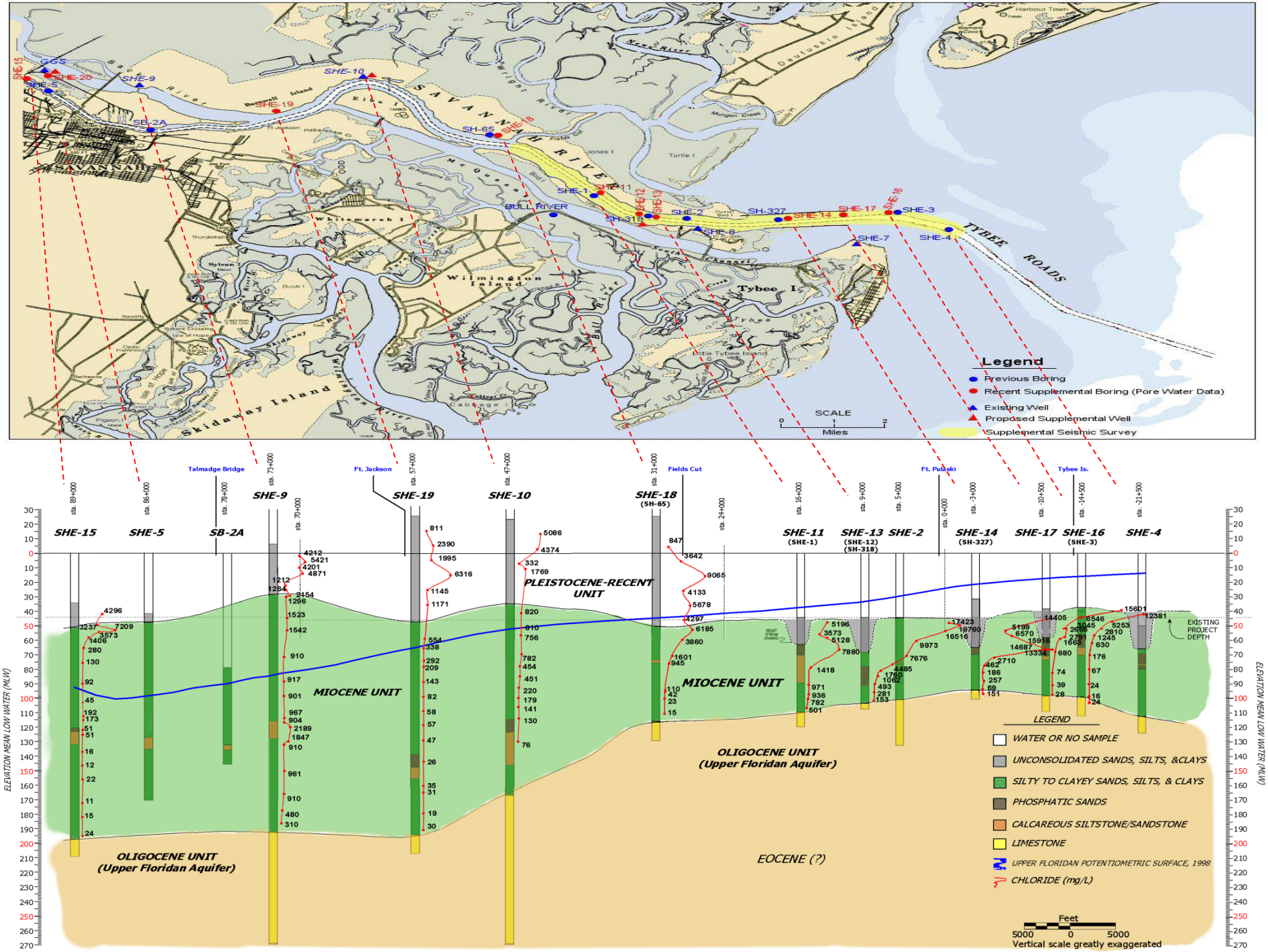


(USGS, Falls et al, 2005)


Sea level
Drill site
Seabed
Quaternary paleochannel
Pliocene
Miocene Aquitard
Miocene Aquitard
~10 feet
~9,000 feet
Upper Floridan Aquifer

Savannah Harbor Expansion Project

Savannah Harbor Expansion Project



SAVANNAH RIVER
TYBEE ROADS
Wilmington Island
Tybee I
Skidaway Island
Whitemarsh I
Bull River
Wright River
Jones I
Turtle I
Little Tybee Island
Harbour Town
Legend
Previous Boring
Recent Supplemental Boring (Pore Water Data)
Existing Well
Proposed Supplemental Well
Supplemental Seismic Survey
SCALE
Miles
SHE-15
SHE-5
SB-2A
SHE-9
SHE-19
SHE-10
SHE-18 (SH-65)
SHE-11 (SHE-1)
SHE-13 (SHE-12) (SH-318)
SHE-2
SHE-14 (SH-327)
SHE-17
SHE-16 (SHE-3)
SHE-4
Talmadge Bridge
Ft. Jackson
Fields Cut
Ft. Pulaski
Tybee Is.
PLEISTOCENE-RECENT UNIT
MIOCENE UNIT
OLIGOCENE UNIT (Upper Floridan Aquifer)
EOCENE (?)
EXISTING PROJECT DEPTH
ELEVATION MEAN LOW WATER (MLW)
LEGEND
WATER OR NO SAMPLE
UNCONSOLIDATED SANDS, SILTS, &CLAYS
SILTY TO CLAYEY SANDS, SILTS, & CLAYS
PHOSPHATIC SANDS
CALCAREOUS SILTSTONE/SANDSTONE
LIMESTONE
UPPER FLORIDAN POTENTIOMETRIC SURFACE, 1998
CHLORIDE (mg/L)
Feet
5000 0 5000
Vertical scale greatly exaggerated