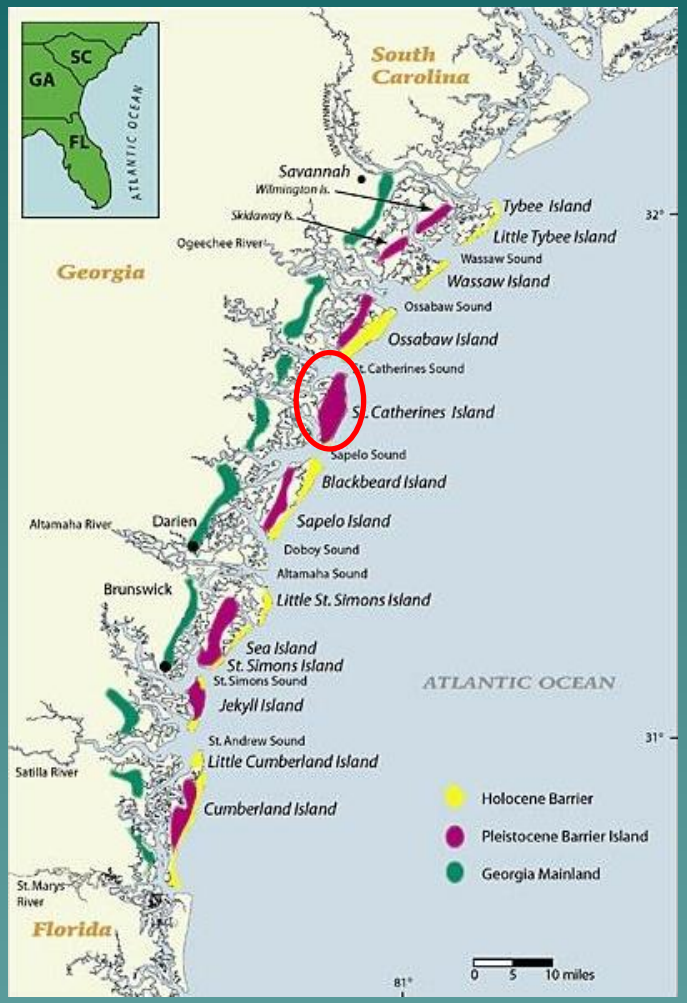
Evidence for Stratigraphic Partitioning of the Surficial Aquifer on St. Catherines Island, Georgia

James Reichard, R. Kelly Vance, and Brian Meyer; Dept. of Geology and Geography Georgia Southern University and Dept. of Geosciences, Georgia State University

St. Catherines Island

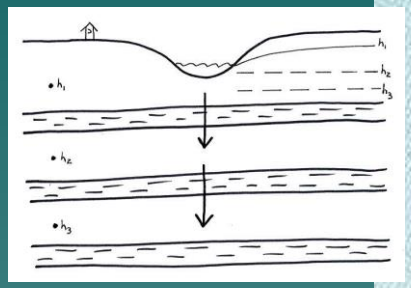
(Reichard et. al. 2014)

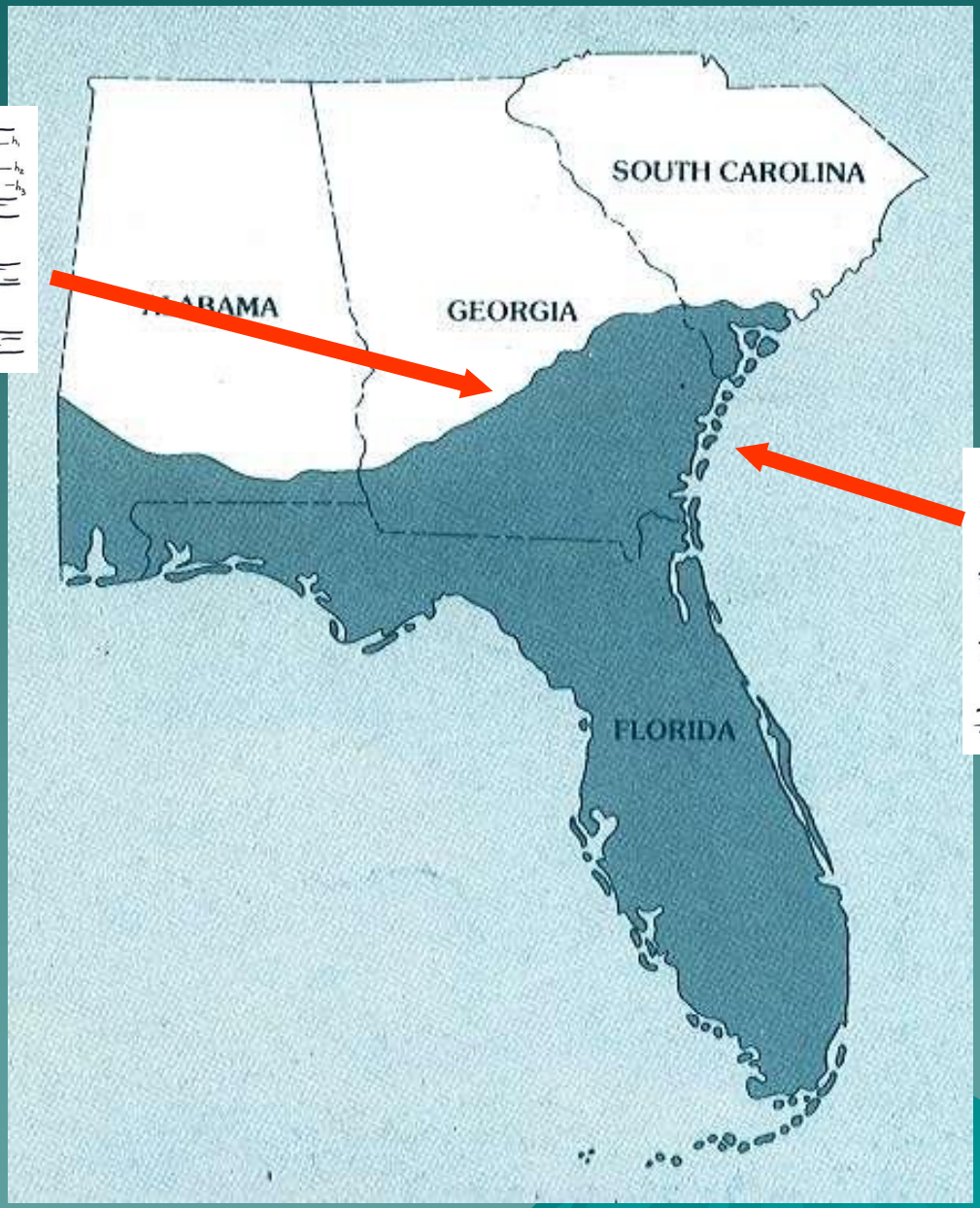
St. Catherines Island

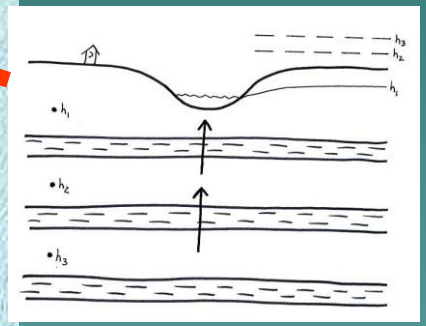


(V.J., Henry, 2005)

Regional Hydrogeology

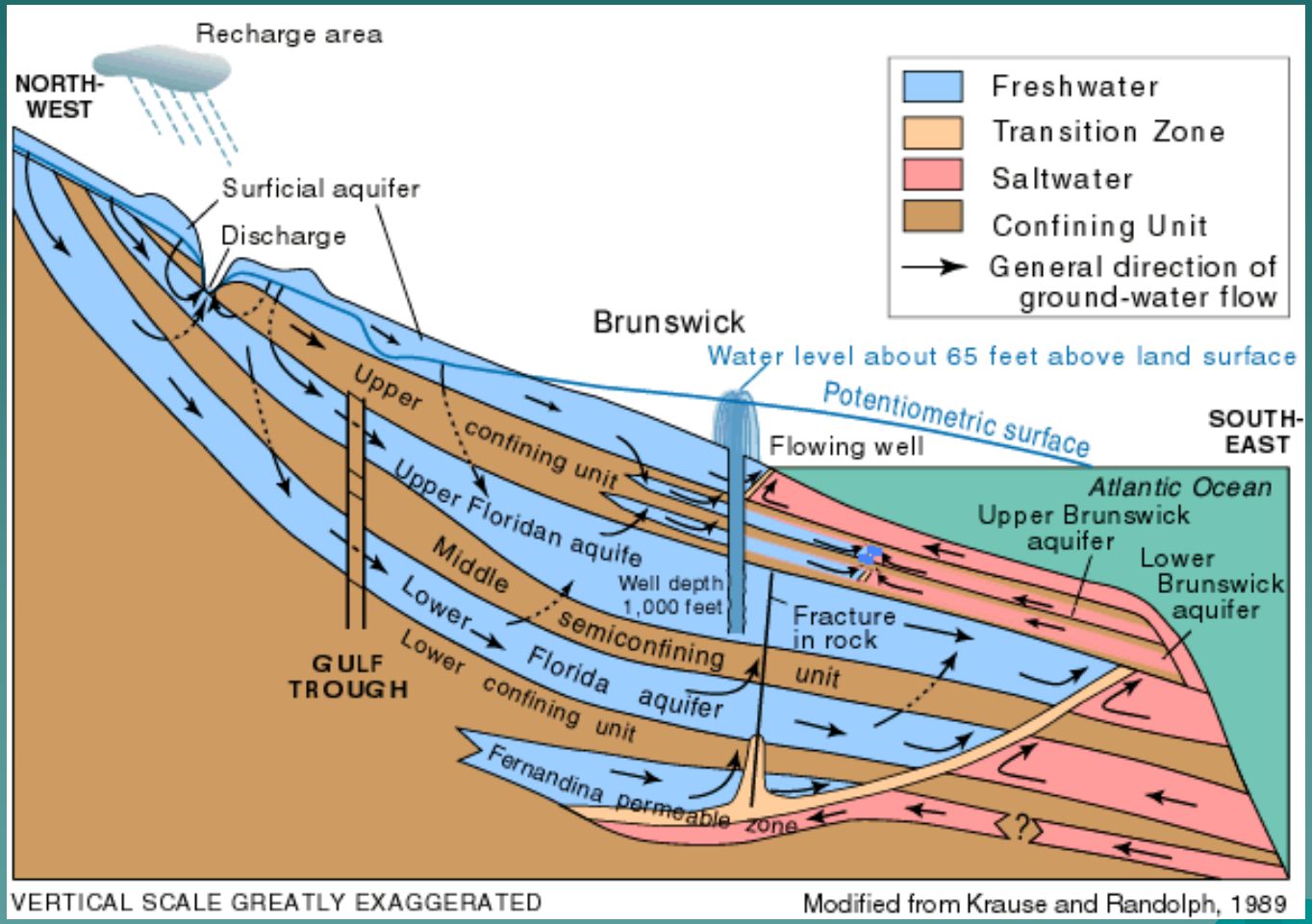






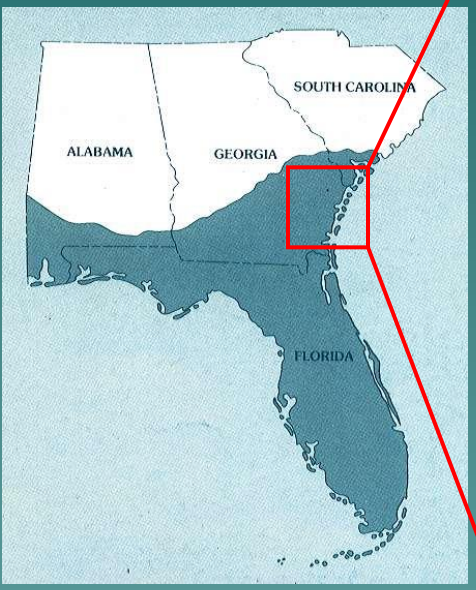
(Miller, 1986)

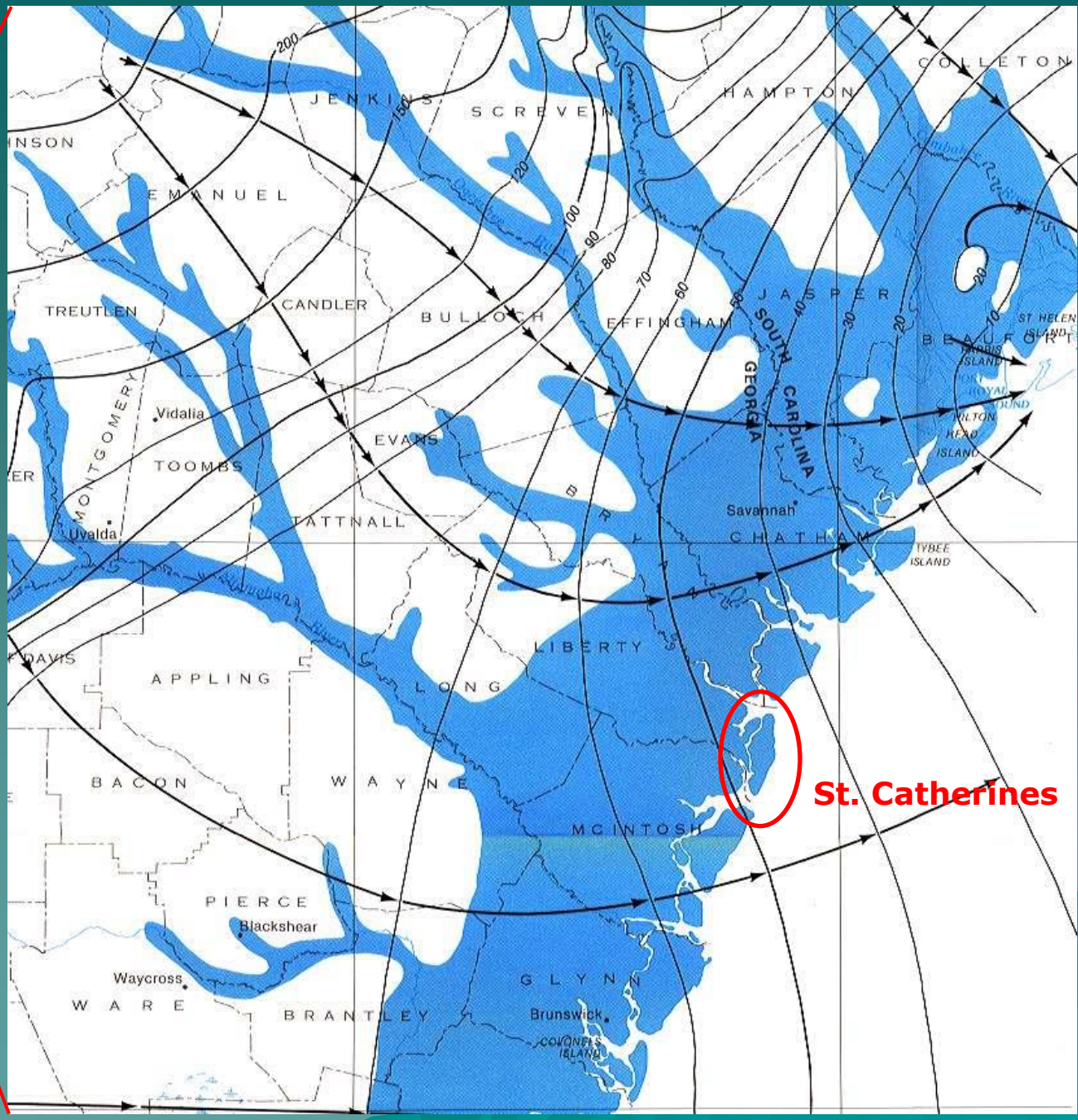
Regional Hydrogeology



(USGS, 2001)

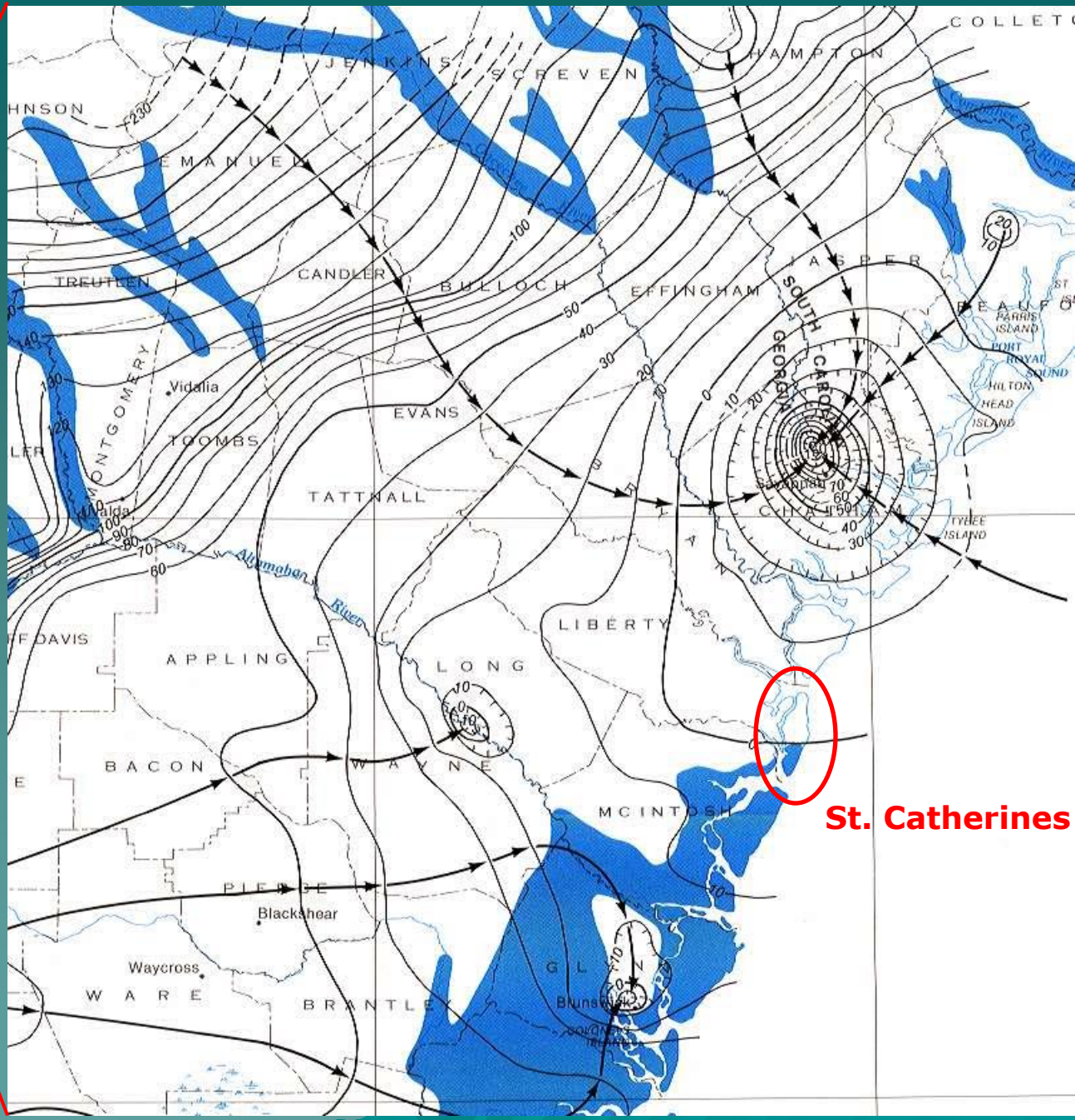
1880 Conditions





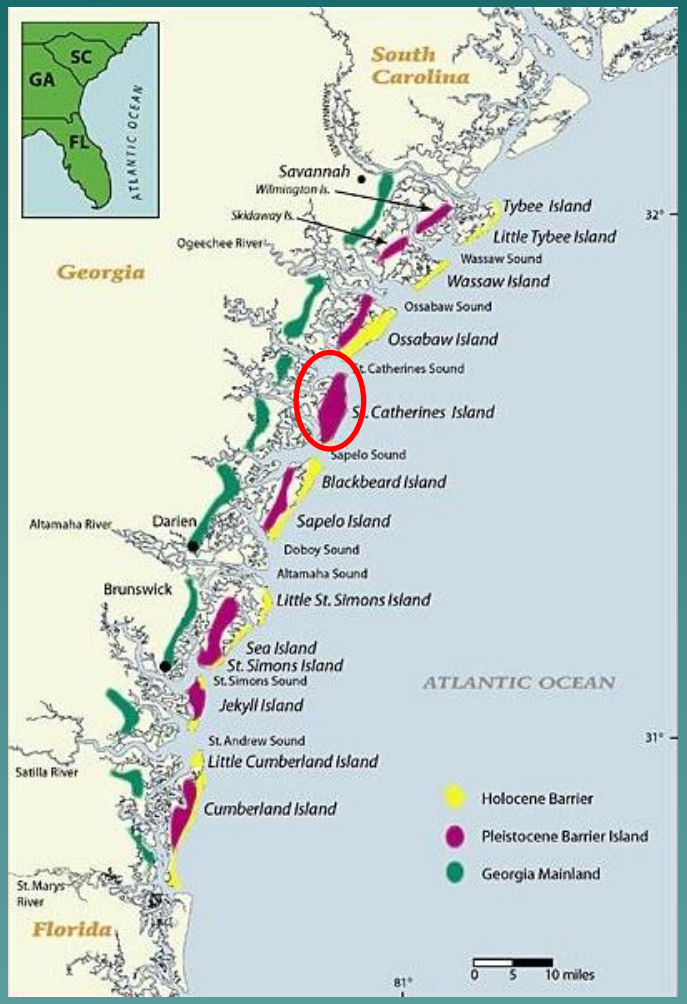
(Krause and Randolph, 1989)

1986 Conditions

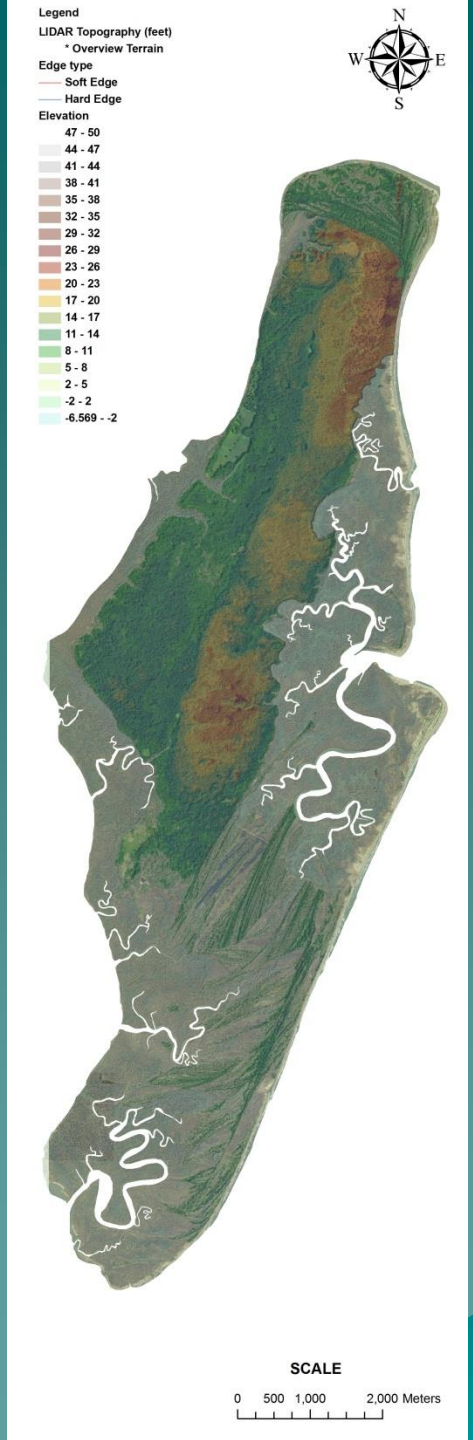


(Krause and Randolph, 1989)

St. Catherines Geology

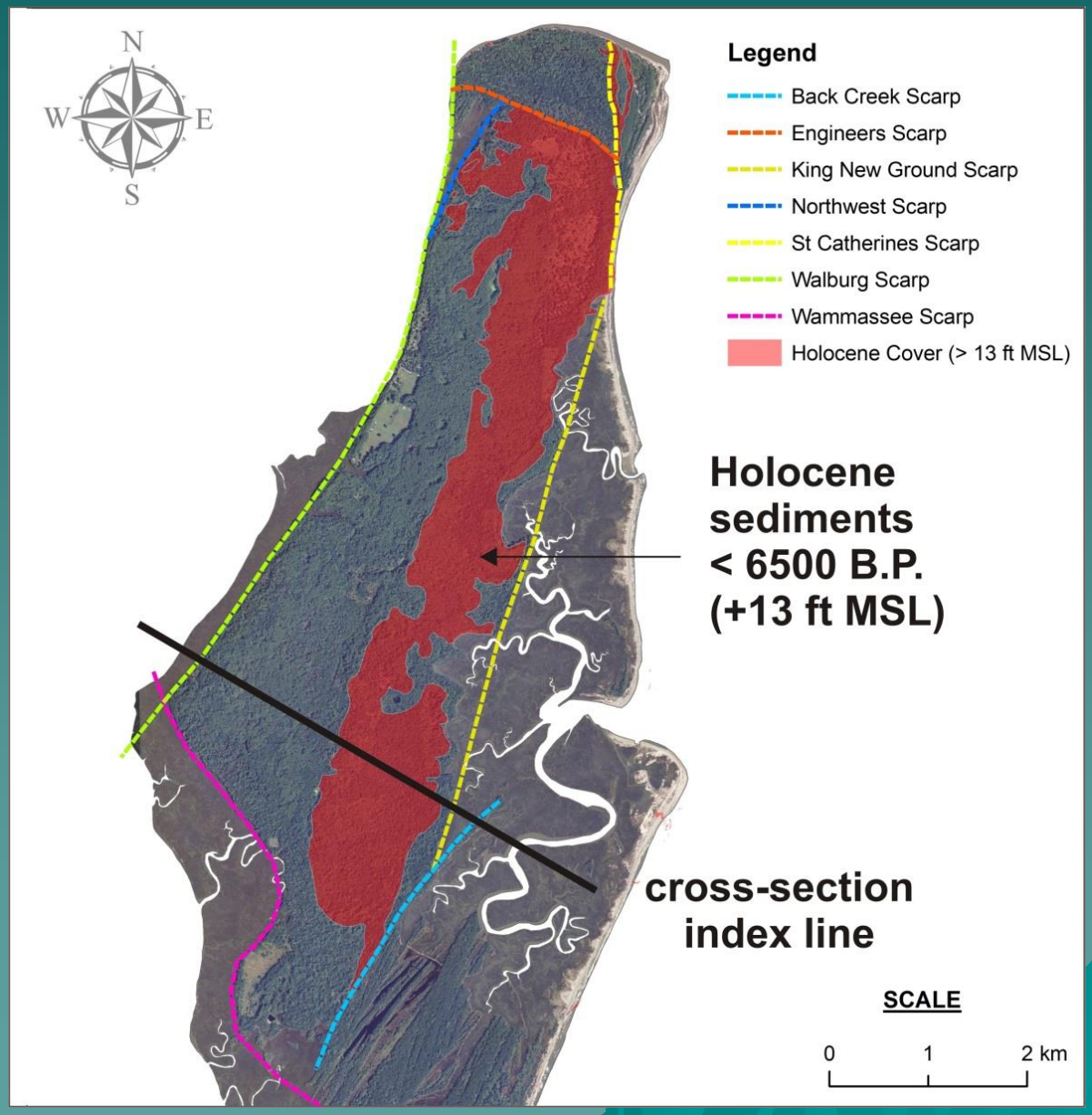


(V.J., Henry, 2005)

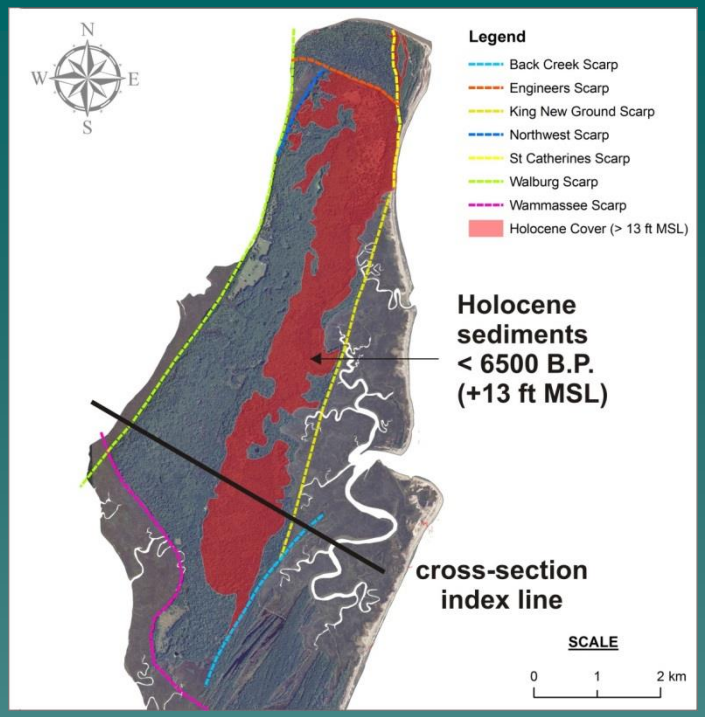


(Meyer et. al. 2009)

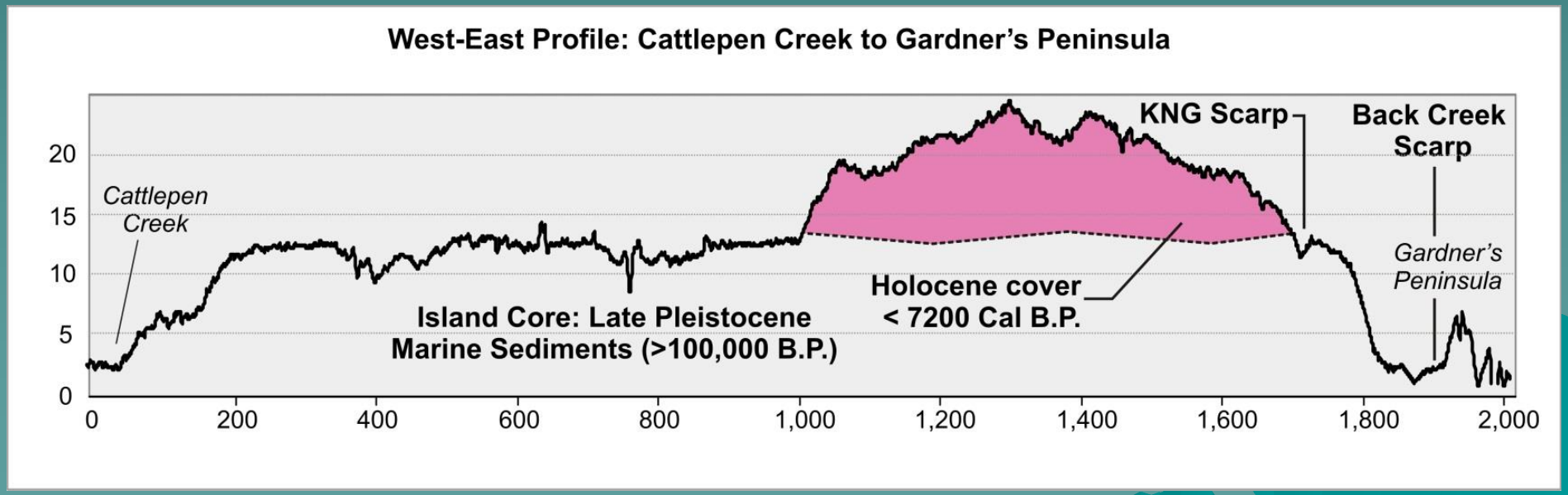
Shoreline Change Study



(Meyer, 2014)

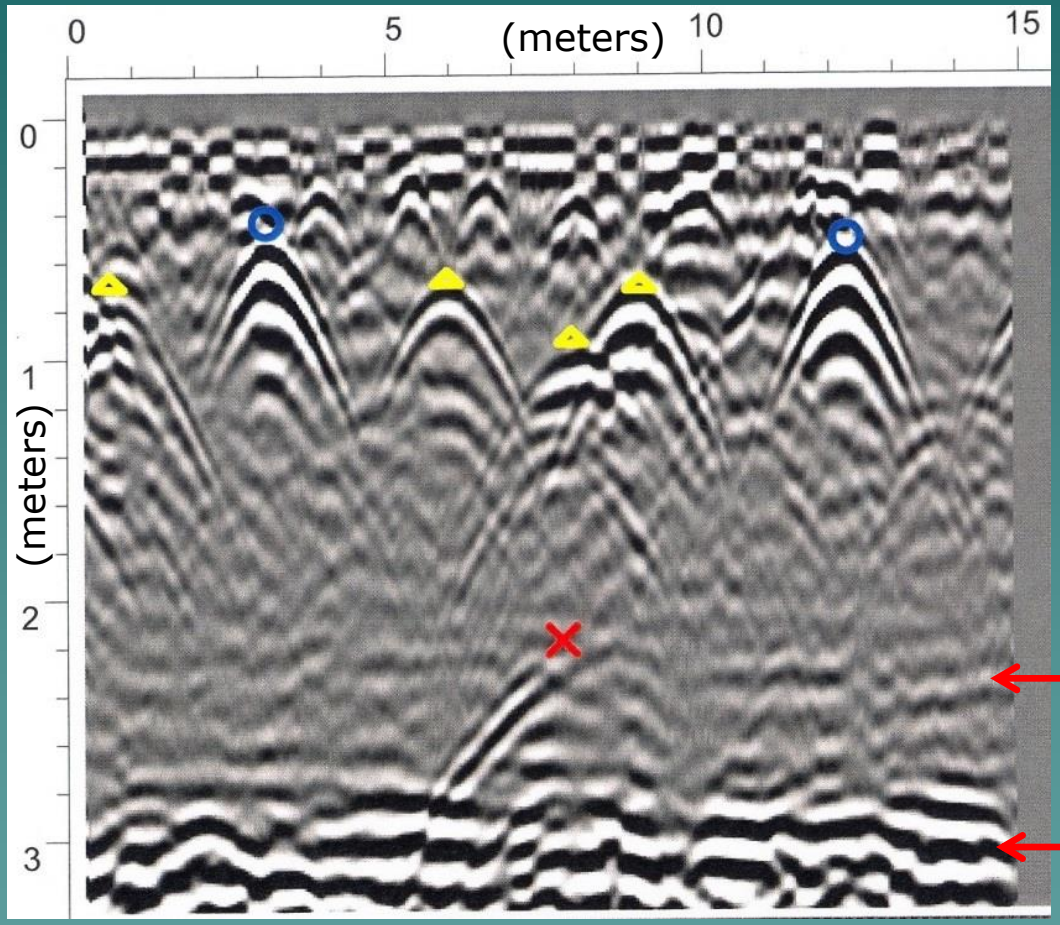


(Meyer, 2014)

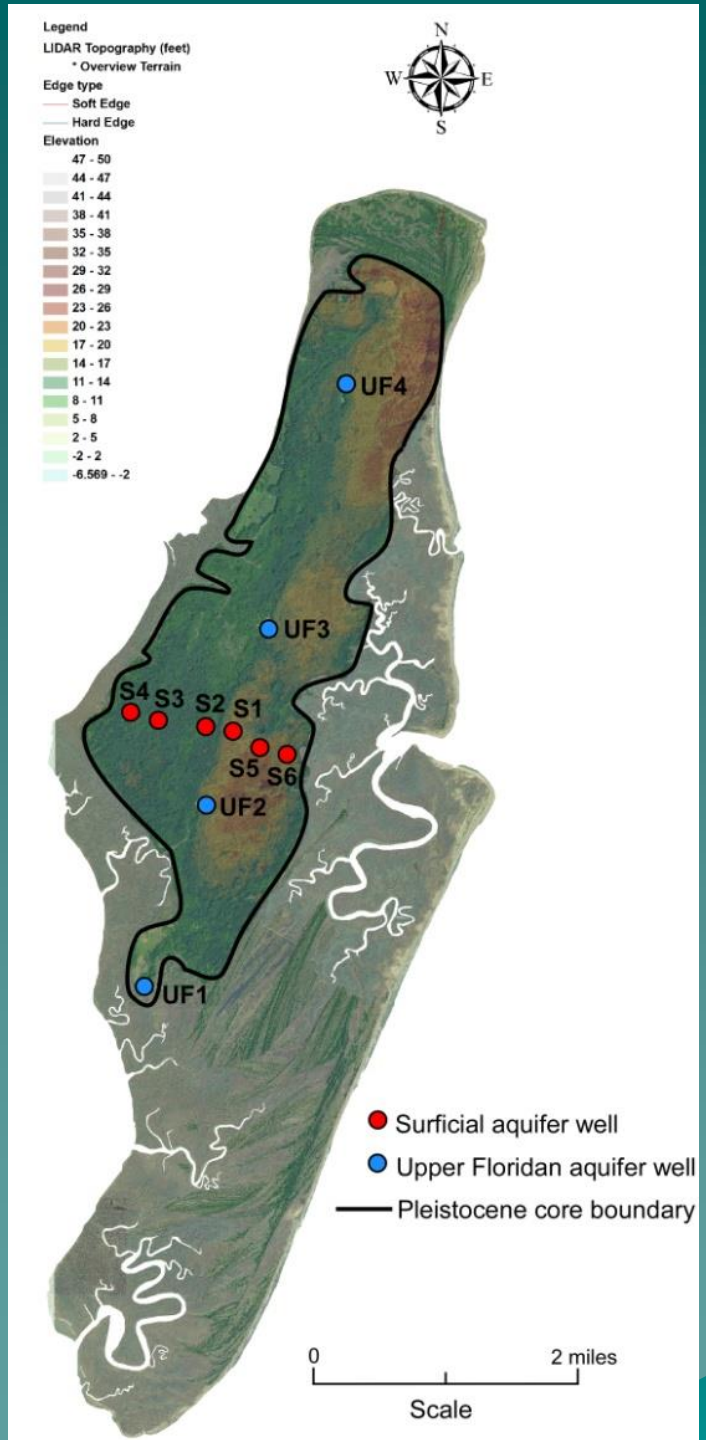


(Meyer, 2014)

Ground Penetrating Radar

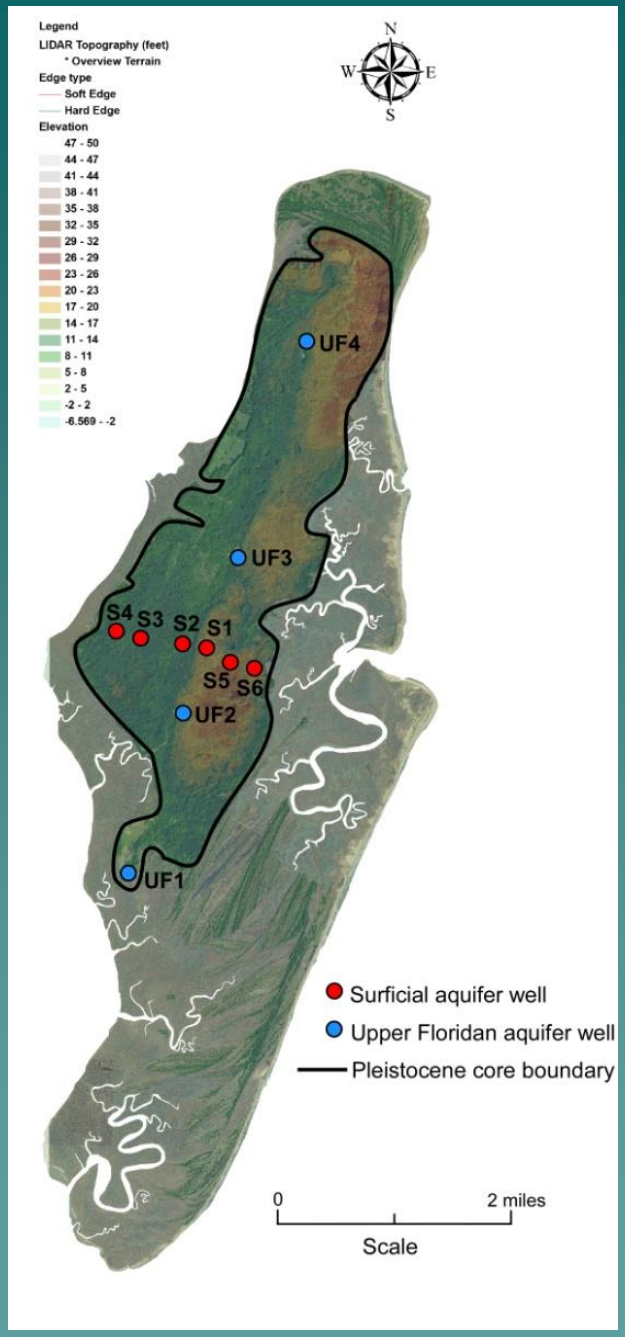


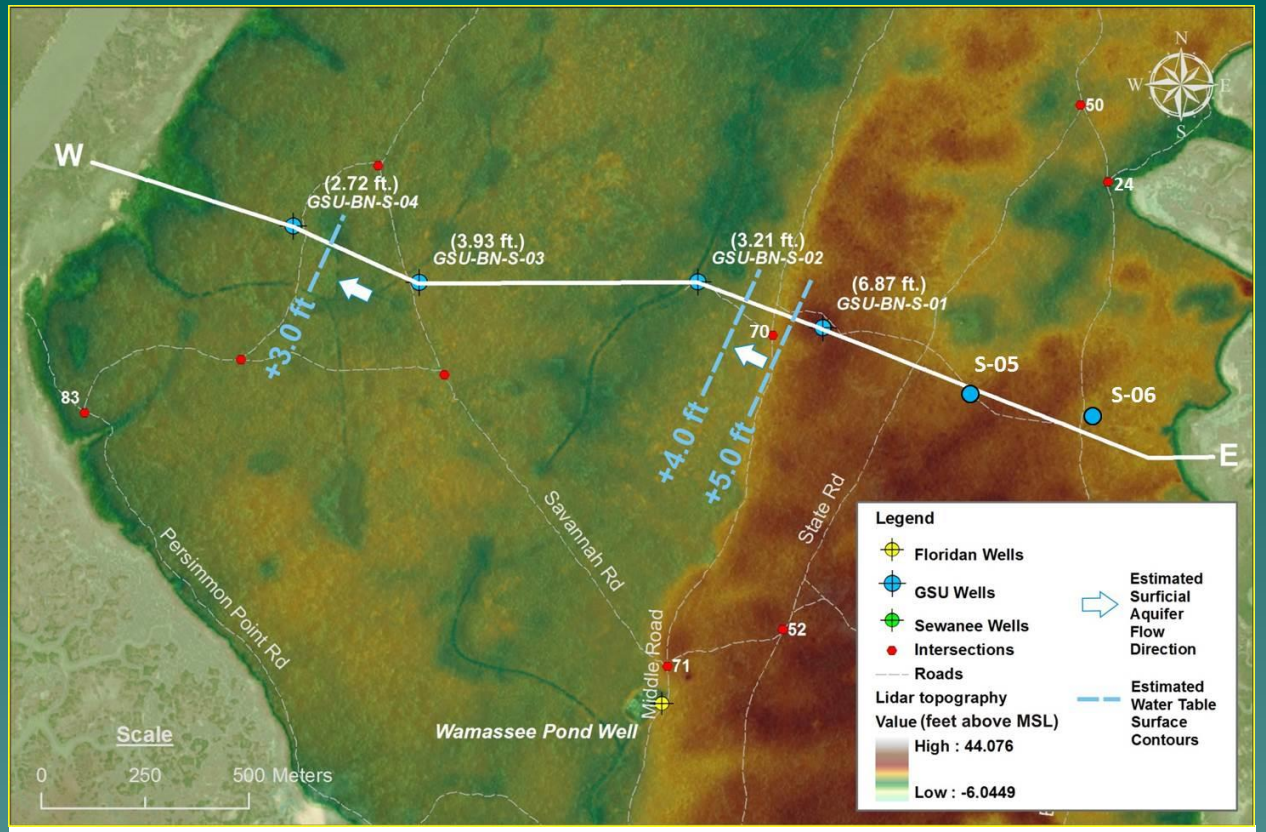
(Vance et al, 2013)

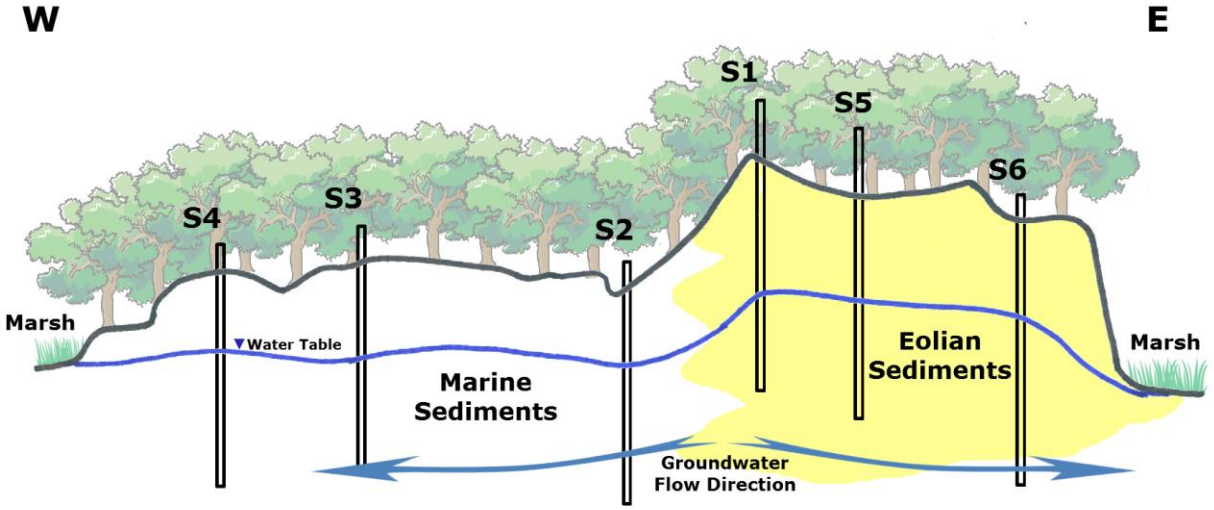


(after Meyer et. al. 2009)

Surficial Well Installation


Legend
LIDAR Topography (feet)
* Overview Terrain
Edge type
Soft Edge
Hard Edge
Elevation
47 - 50
44 - 47
41 - 44
38 - 41
35 - 38
32 - 35
29 - 32
26 - 29
23 - 26
20 - 23
17 - 20
14 - 17
11 - 14
8 - 11
5 - 8
2 - 5
-2 - 2
-6.569 - -2
N
W
E
S
UF4
UF3
UF2
UF1
S4
S3
S2
S1
S5
S6
Surficial aquifer well
Upper Floridan aquifer well
Pleistocene core boundary
0
2 miles
Scale


W
(2.72 ft.)
GSU-BN-S-04
(3.93 ft.)
GSU-BN-S-03
(3.21 ft.)
GSU-BN-S-02
(6.87 ft.)
GSU-BN-S-01
+3.0 ft
+4.0 ft
+5.0 ft
83
70
50
24
52
71
S-05
S-06
E
Persimmon Point Rd
Savannah Rd
State Rd
Middle Road
Wamassee Pond Well
Scale
0
250
500 Meters
Legend
Floridan Wells
GSU Wells
Sewanee Wells
Intersections
Roads
Lidar topography
Value (feet above MSL)
High : 44.076
Low : -6.0449
Estimated Surficial Aquifer Flow Direction
Estimated Water Table Surface Contours


W
E
S1
S5
S6
S4
S3
S2
Marsh
Water Table
Marine Sediments
Eolian Sediments
Marsh
Groundwater Flow Direction

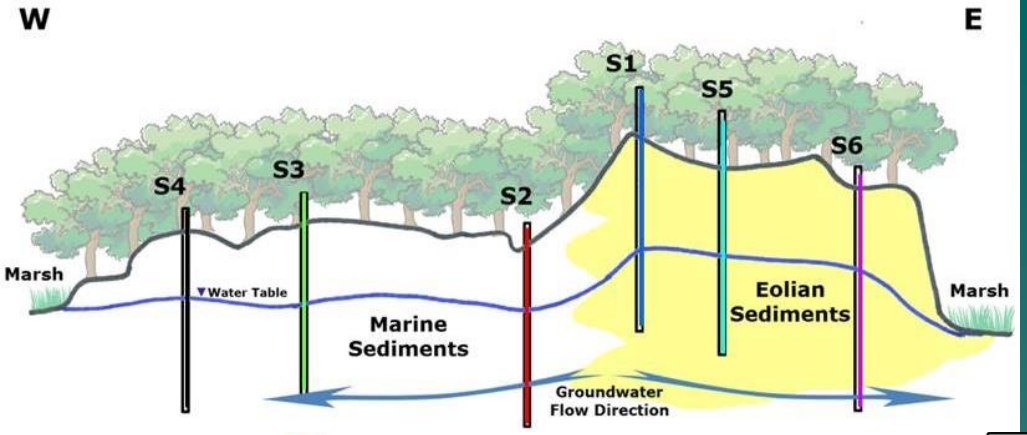
- Field Data

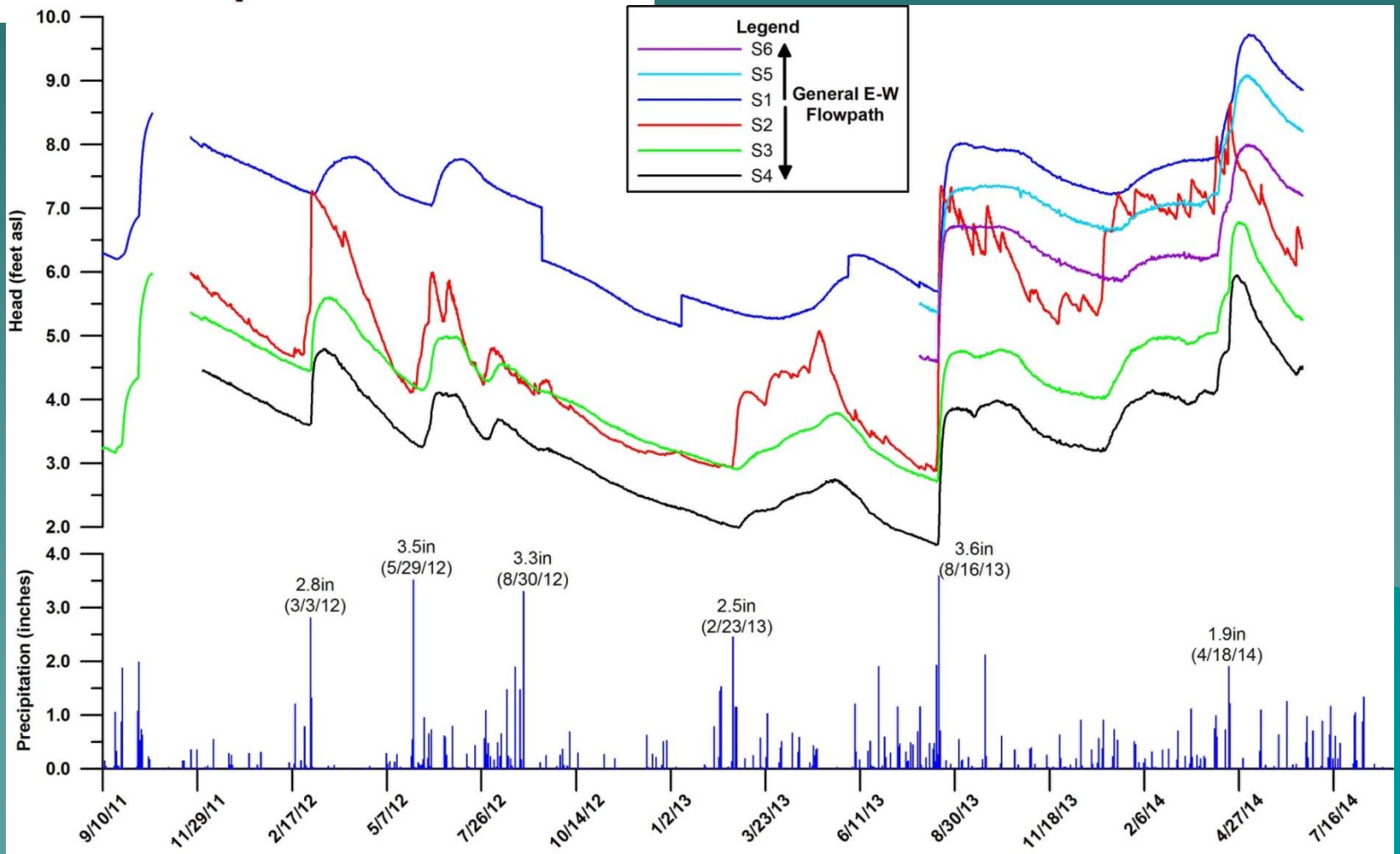
  Head, temp, DO, conductivity, pH, ORP, & alkalinity

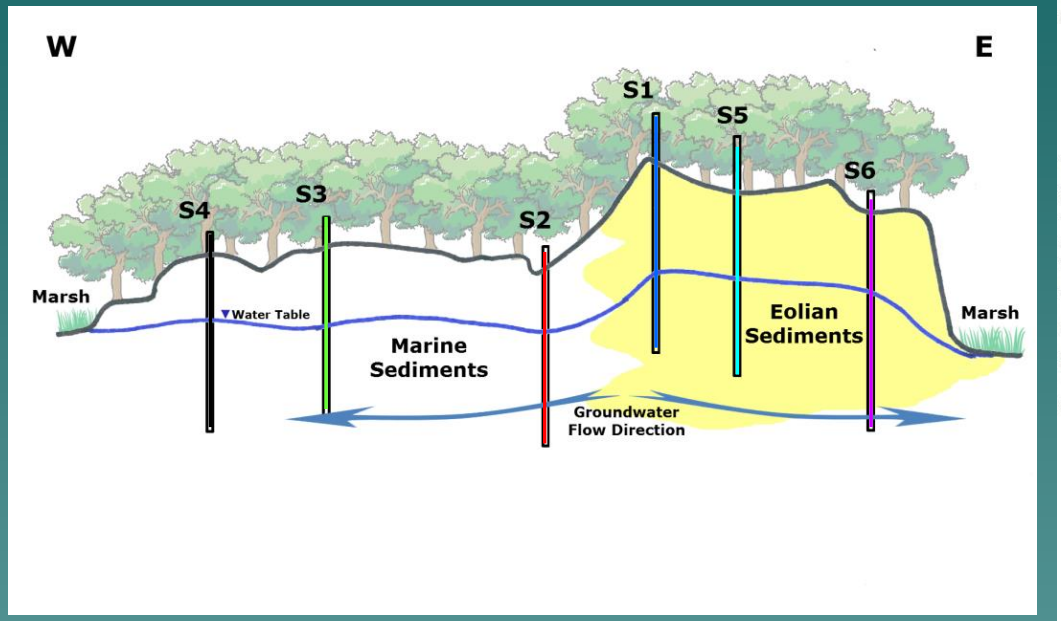
- Major ion chemistry

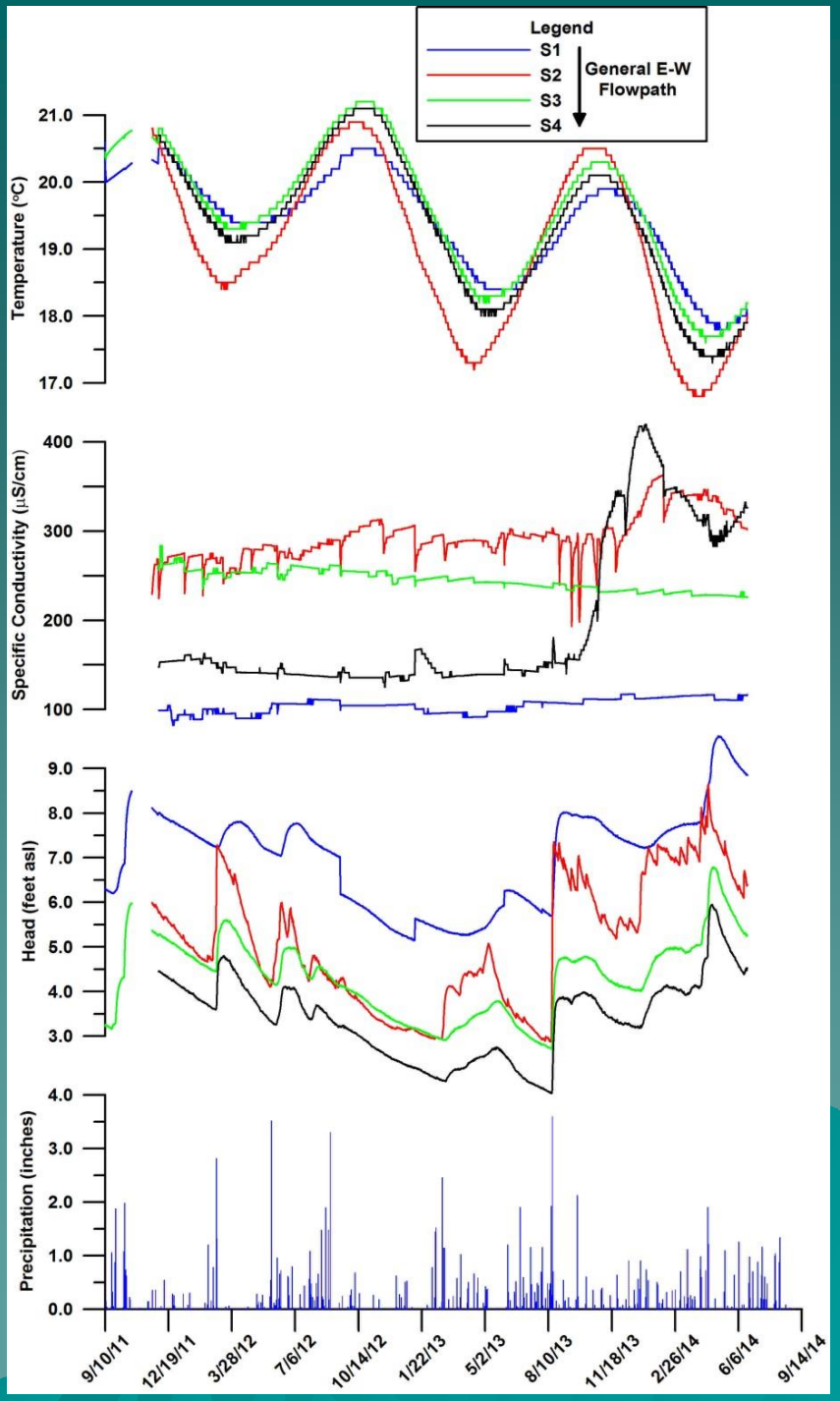
  Na^+, NH_4^+, K^+, Mg^{2+}, Ca^{2+}

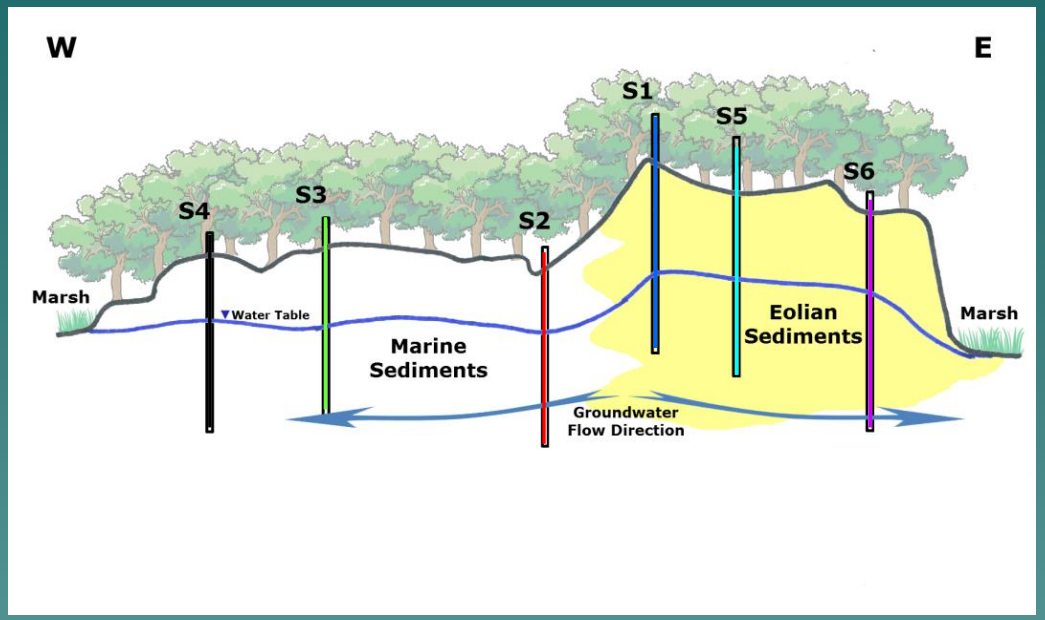
  F^-, Cl^-, NO_3^-, PO_4^{3-}, SO_4^{2-}

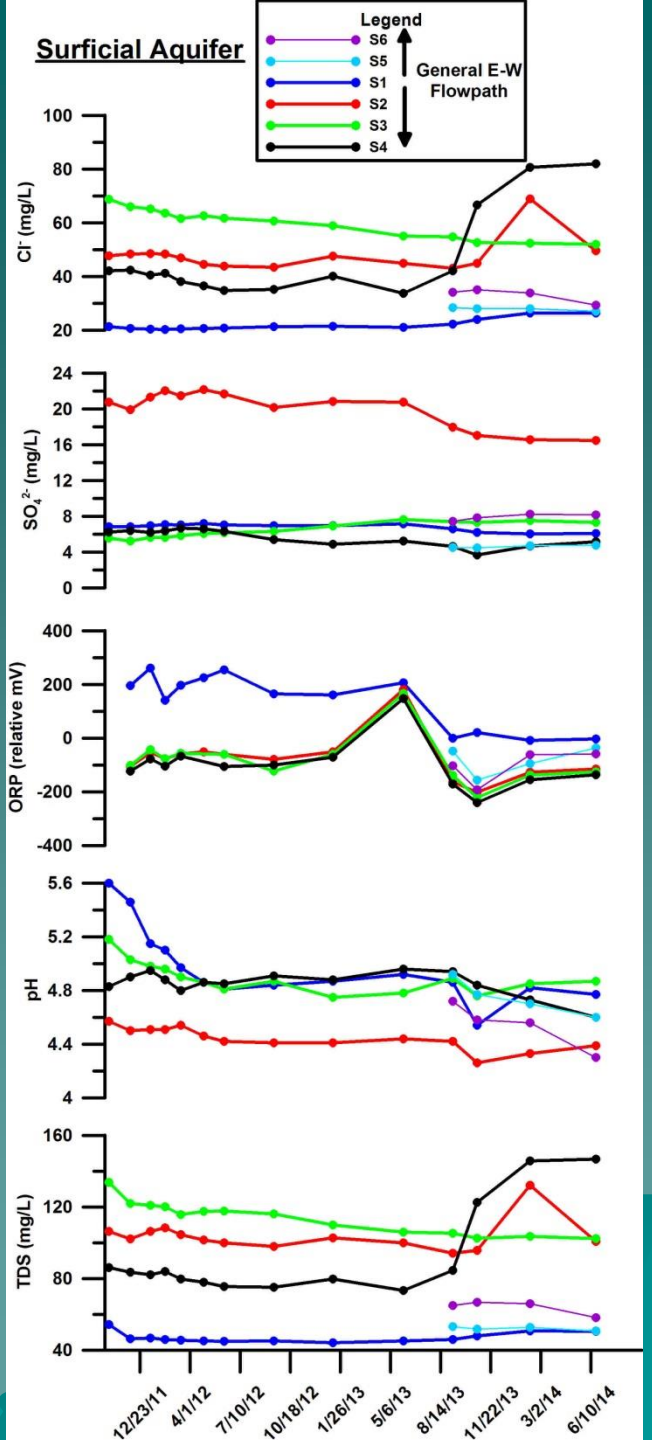

W
E
S1
S5
S6
S4
S3
S2
Marsh
Water Table
Marine Sediments
Eolian Sediments
Marsh
Groundwater Flow Direction


Legend
S6
S5
S1
S2
S3
S4
General E-W Flowpath
Head (feet asl)
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
Precipitation (inches)
4.0
3.0
2.0
1.0
0.0
2.8in (3/3/12)
3.5in (5/29/12)
3.3in (8/30/12)
2.5in (2/23/13)
3.6in (8/16/13)
1.9in (4/18/14)
9/10/11
11/29/11
2/17/12
5/7/12
7/26/12
10/14/12
1/2/13
3/23/13
6/11/13
8/30/13
11/18/13
2/6/14
4/27/14
7/16/14

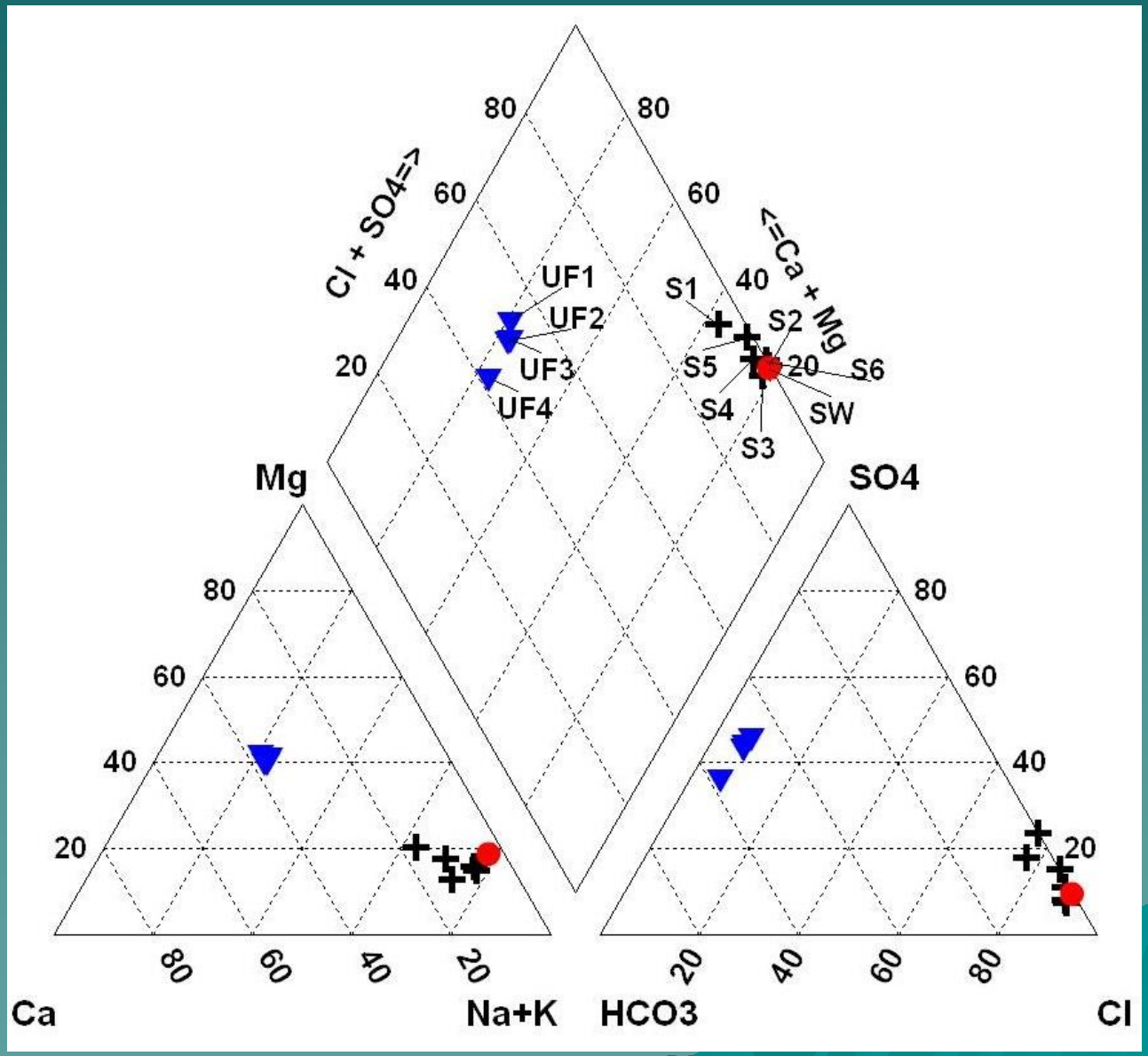

W
E
S1
S5
S6
S4
S3
S2
Marsh
Water Table
Marine Sediments
Eolian Sediments
Marsh
Groundwater Flow Direction


Legend
S1
S2
S3
S4
General E-W Flowpath
Temperature (°C)
21.0
20.0
19.0
18.0
17.0
Specific Conductivity (µS/cm)
400
300
200
100
Head (feet asl)
9.0
8.0
7.0
6.0
5.0
4.0
3.0
Precipitation (inches)
4.0
3.0
2.0
1.0
0.0
9/10/11
12/19/11
3/28/12
7/6/12
10/14/12
1/22/13
5/2/13
8/10/13
11/18/13
2/26/14
6/6/14
9/14/14

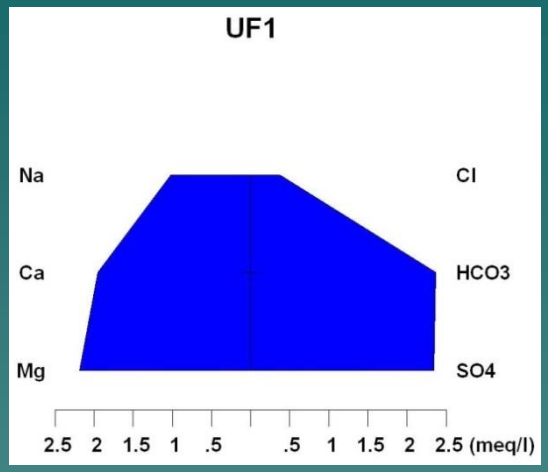

W
E
S1
S5
S6
S4
S3
S2
Marsh
Water Table
Marine Sediments
Eolian Sediments
Marsh
Groundwater Flow Direction

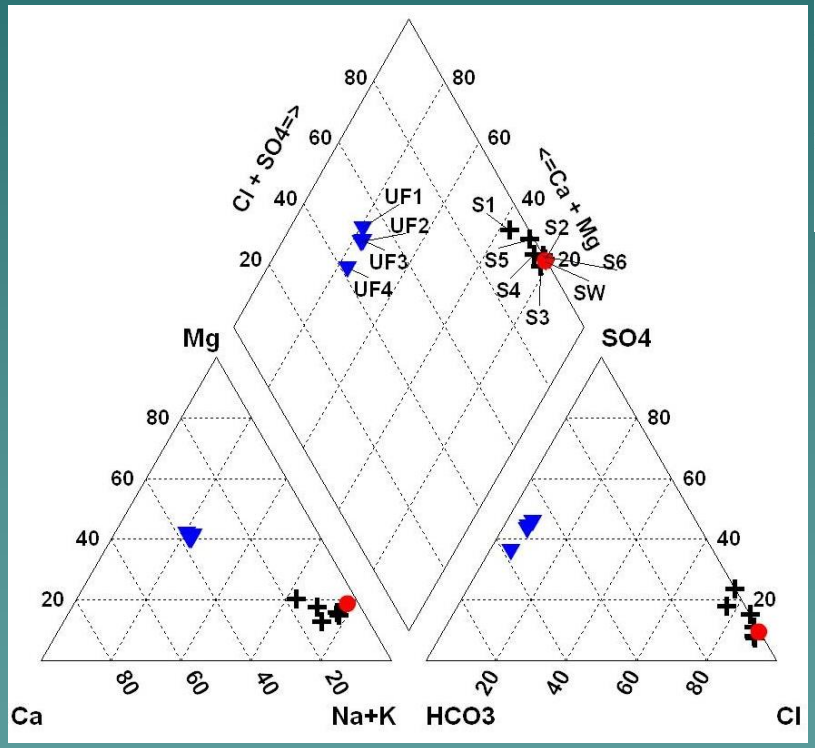

Surficial Aquifer
Legend
S6
S5
S1
S2
S3
S4
General E-W Flowpath
Cl⁻ (mg/L)
100
80
60
40
20
SO4 2- (mg/L)
24
20
16
12
8
4
0
ORP (relative mV)
400
200
0
-200
-400
pH
5.6
5.2
4.8
4.4
4
TDS (mg/L)
160
120
80
40
12/23/11
4/1/12
7/10/12
10/18/12
1/26/13
5/6/13
8/14/13
11/22/13
3/2/14
6/10/14

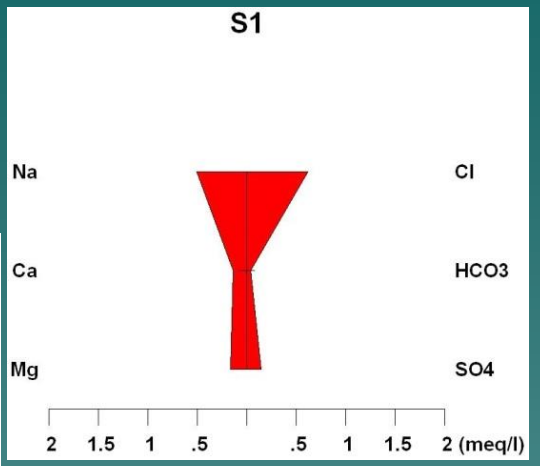
Piper Diagram Analysis

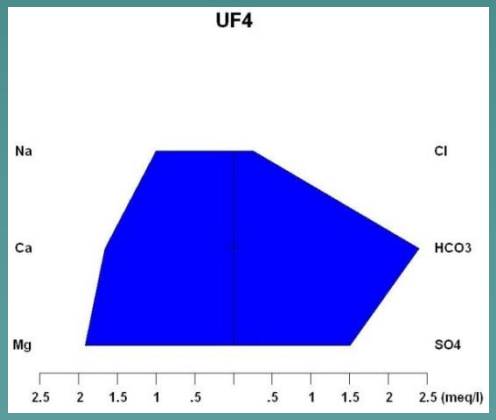


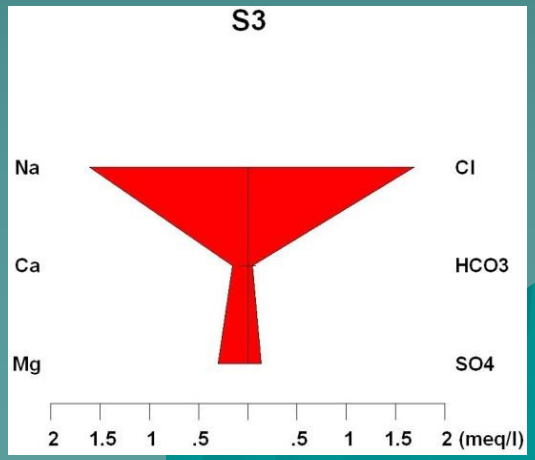
Piper and Stiff Diagram Analysis

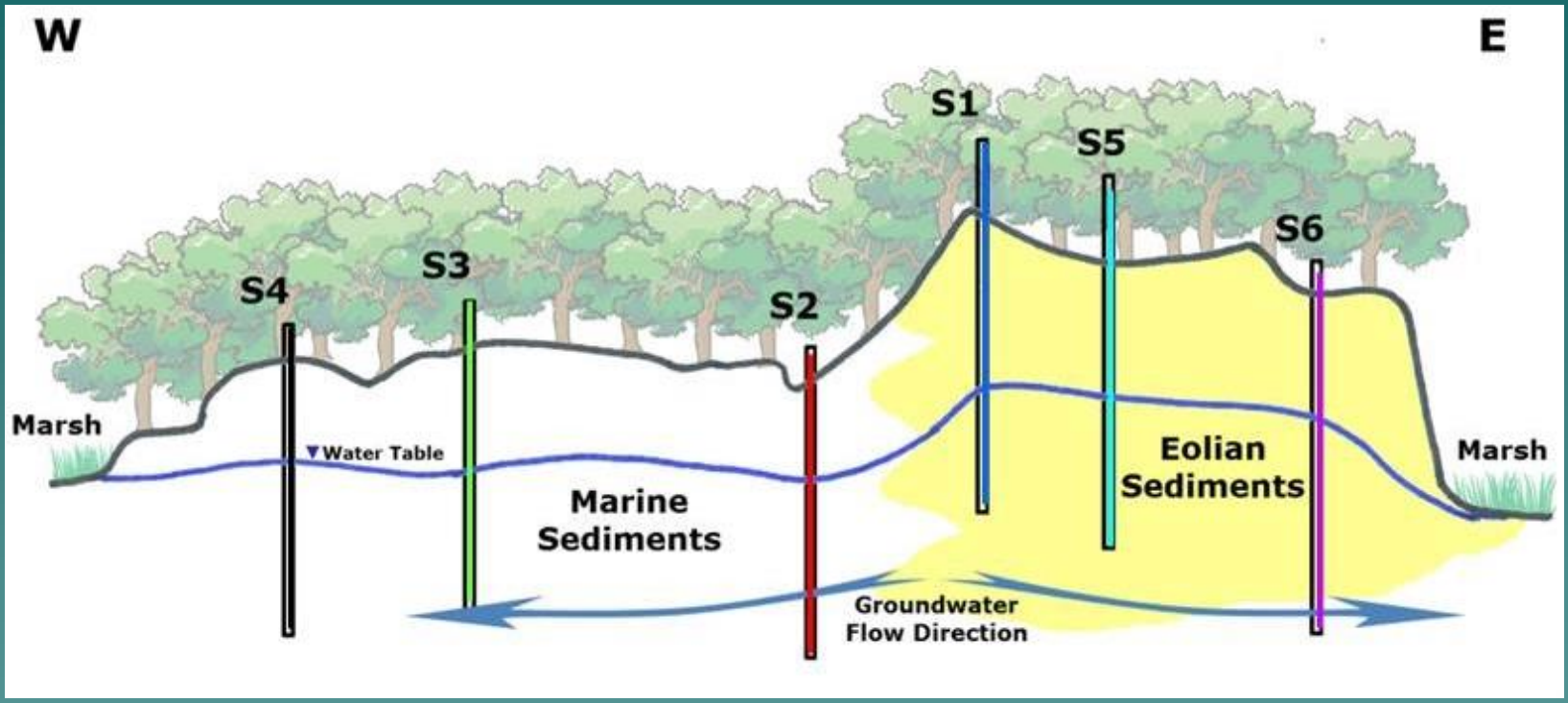


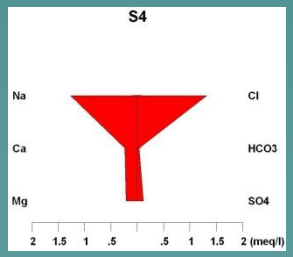


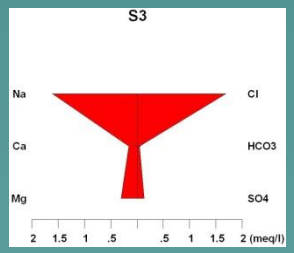


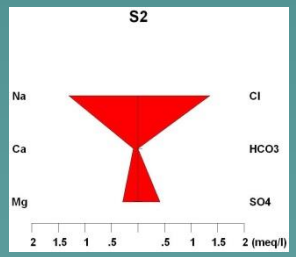


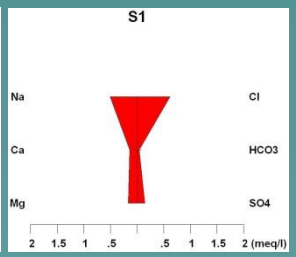


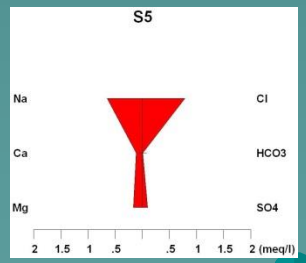

W
E
S1
S5
S6
S4
S3
S2
Marsh
Water Table
Marine Sediments
Eolian Sediments
Marsh
Groundwater Flow Direction

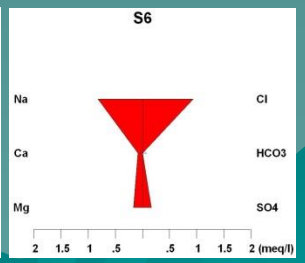

S4
Na
Ca
Mg
Cl
HCO3
SO4
2 1.5 1 .5 .5 1 1.5 2 (meq/l)


S3
Na
Ca
Mg
Cl
HCO3
SO4
2 1.5 1 .5 .5 1 1.5 2 (meq/l)


S2
Na
Ca
Mg
Cl
HCO3
SO4
2 1.5 1 .5 .5 1 1.5 2 (meq/l)


S1
Na
Ca
Mg
Cl
HCO3
SO4
2 1.5 1 .5 .5 1 1.5 2 (meq/l)


S5
Na
Ca
Mg
Cl
HCO3
SO4
2 1.5 1 .5 .5 1 1.5 2 (meq/l)


S6
Na
Ca
Mg
Cl
HCO3
SO4
2 1.5 1 .5 .5 1 1.5 2 (meq/l)

Conclusions

- Chemical data show that the surficial aquifer on St. Catherines Island is a Na-Cl type freshwater system.
- Western part of transect contains groundwater with ion proportions similar to seawater, which is consistent with it being underlain by Pleistocene marine sediments.
- Groundwater in topographically high areas has lower proportions of Na-Cl and fewer TDS, supporting the interpretation of underlying Holocene terrestrial sands.
- Long-term changes in chloride and TDS in western part of transect point to gradient changes triggering the movement of different type waters into the system.

Acknowledgments

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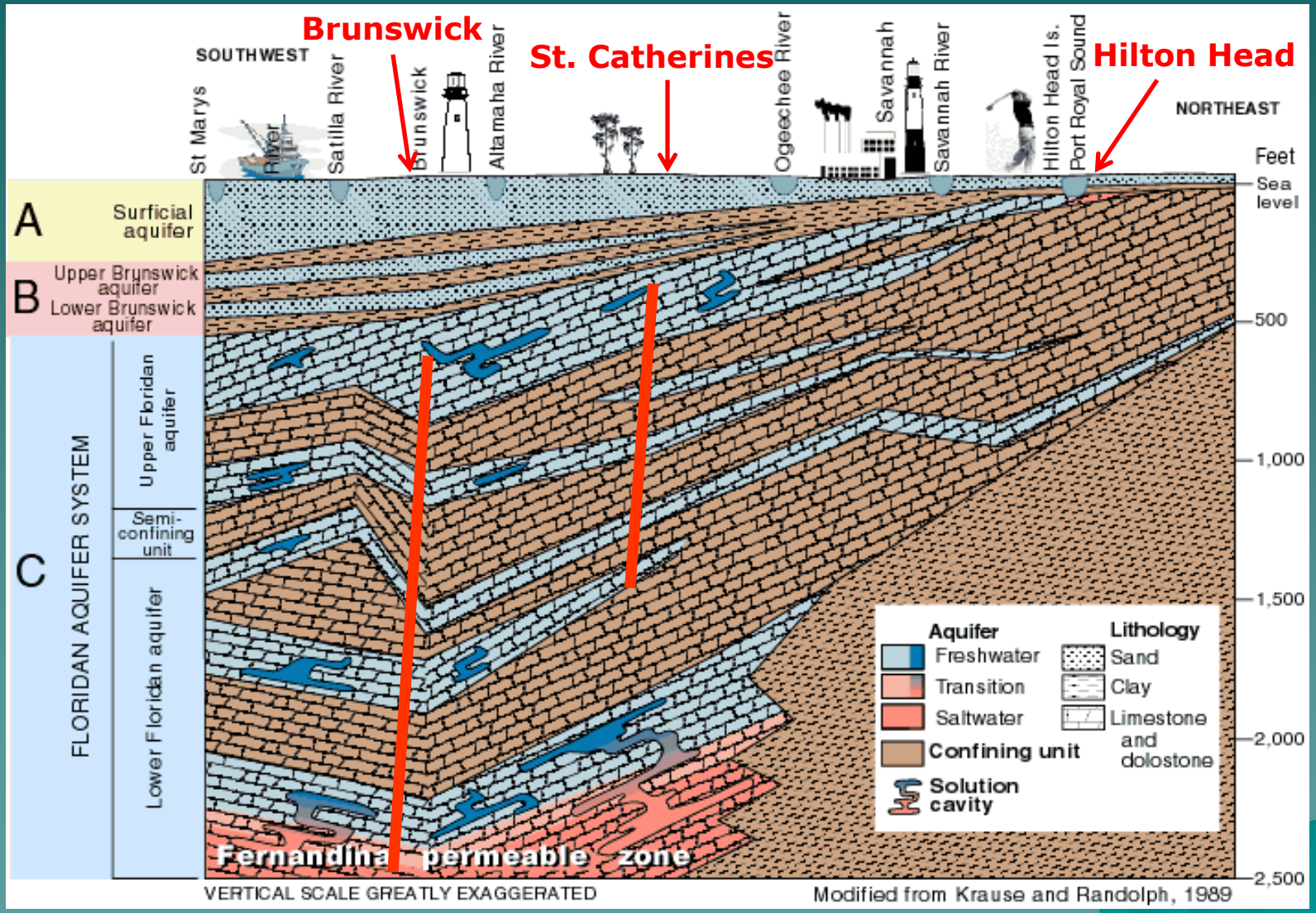
- Royce Hayes, St. Catherines Island Superintendent, for providing logistical support.

Questions?

Regional Hydrogeology



(USGS, 2001)

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