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Simulation of Groundwater Flow in the Southern Hills Aquifer System and Movement of Saltwater in the "2,000-Foot" Sand of the Baton Rouge Area, Louisiana

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


ARKANSAS
TEXAS
MISSISSIPPI
0 50 MILES
0 50 KILOMETERS
BATON ROUGE
FAULTING
NEW ORLEANS
Gulf of Mexico
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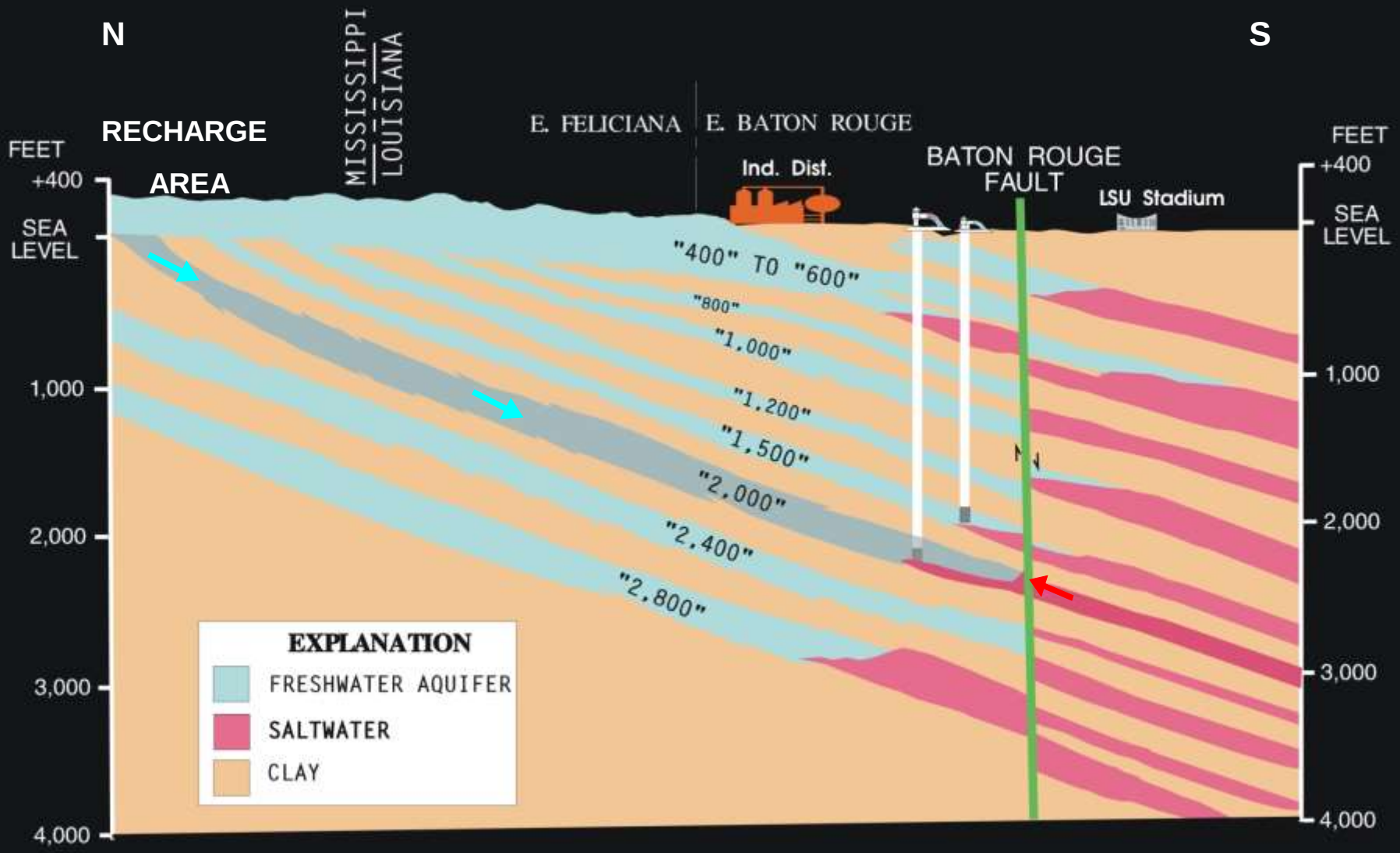
SALTWATER ENCROACHMENT-- 2,000-FOOT" AQUIFER



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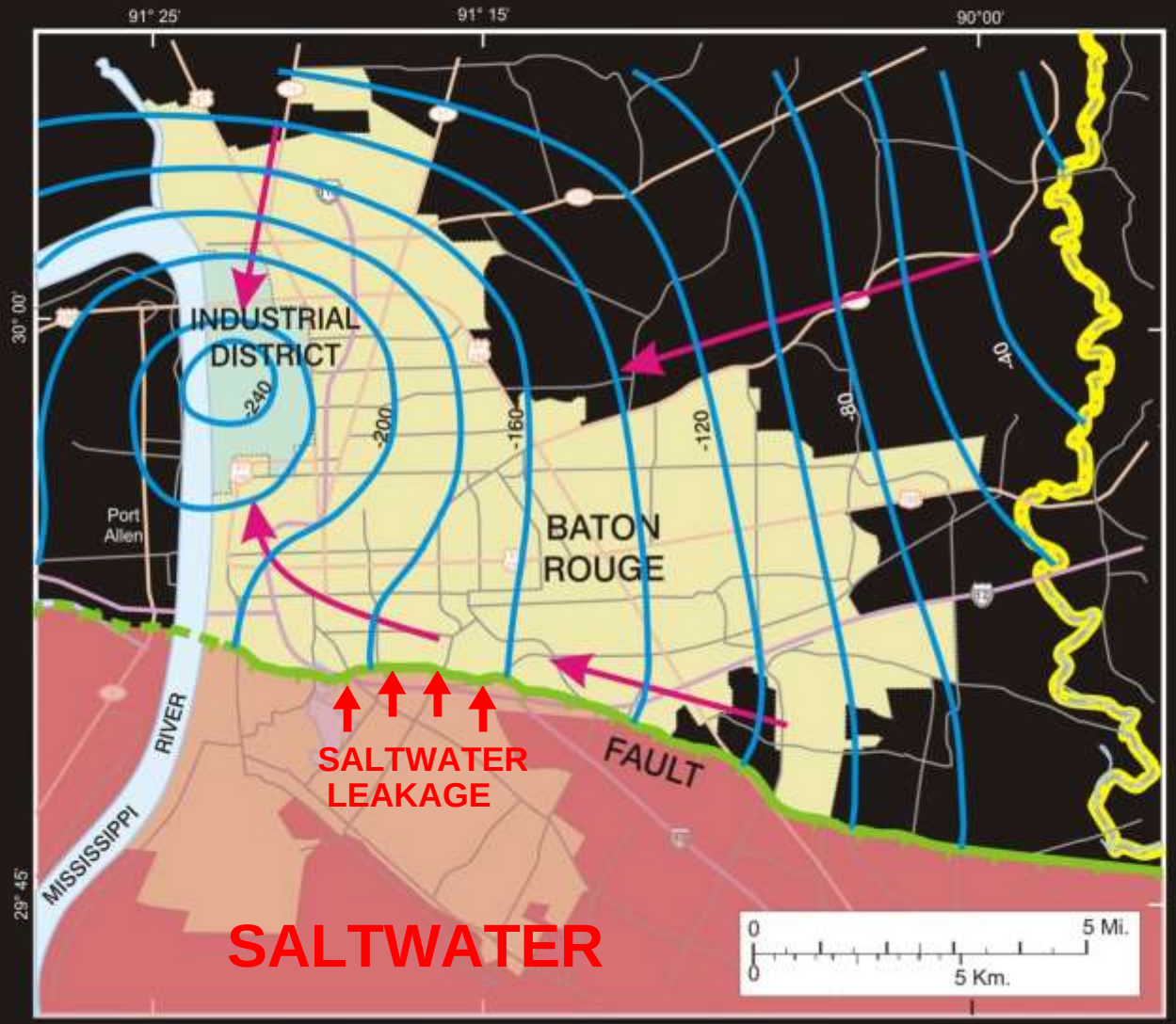
POTENTIOMETRIC SURFACE AND GROUND-WATER FLOW IN THE “2,000-FOOT” SAND, 2002



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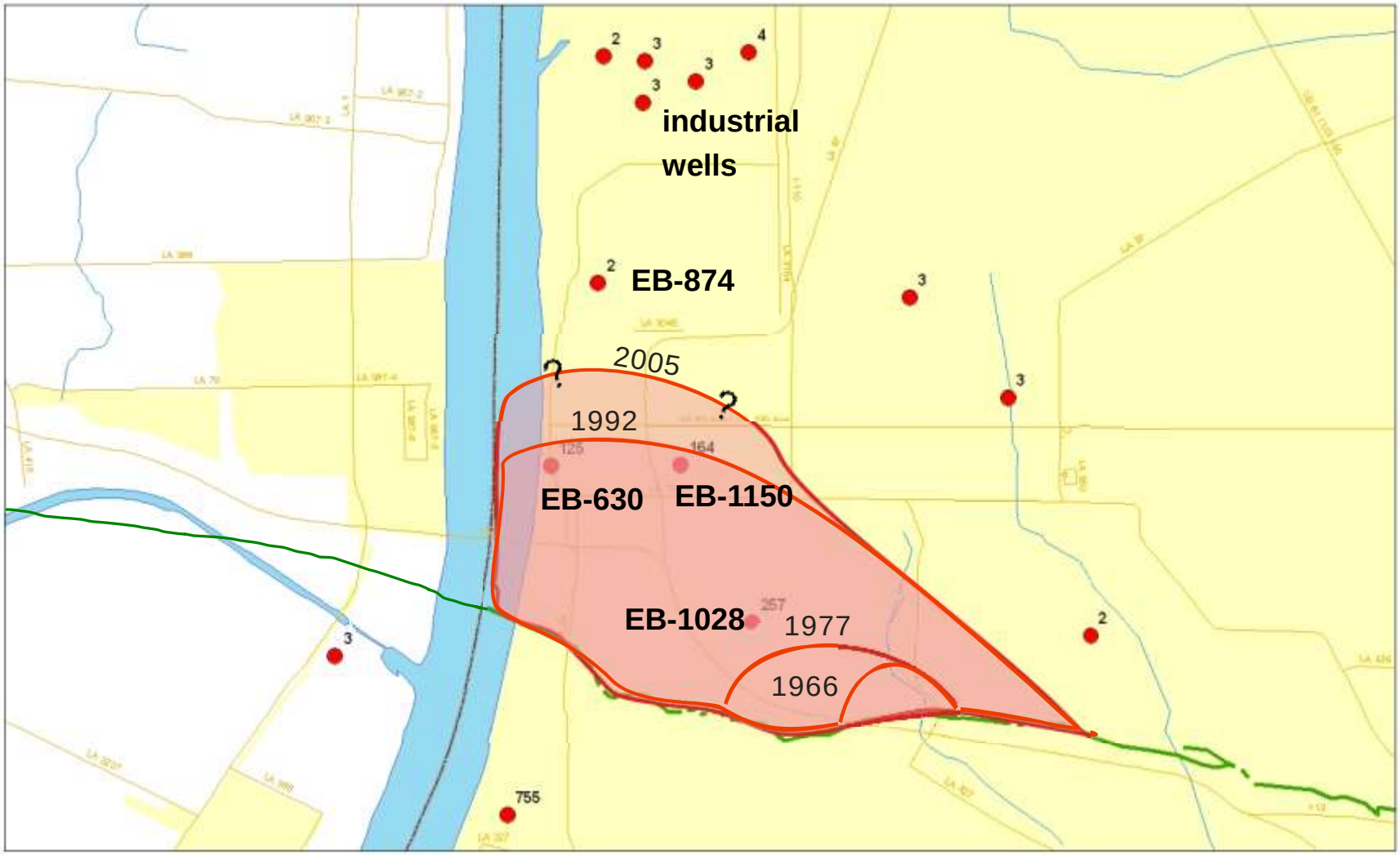
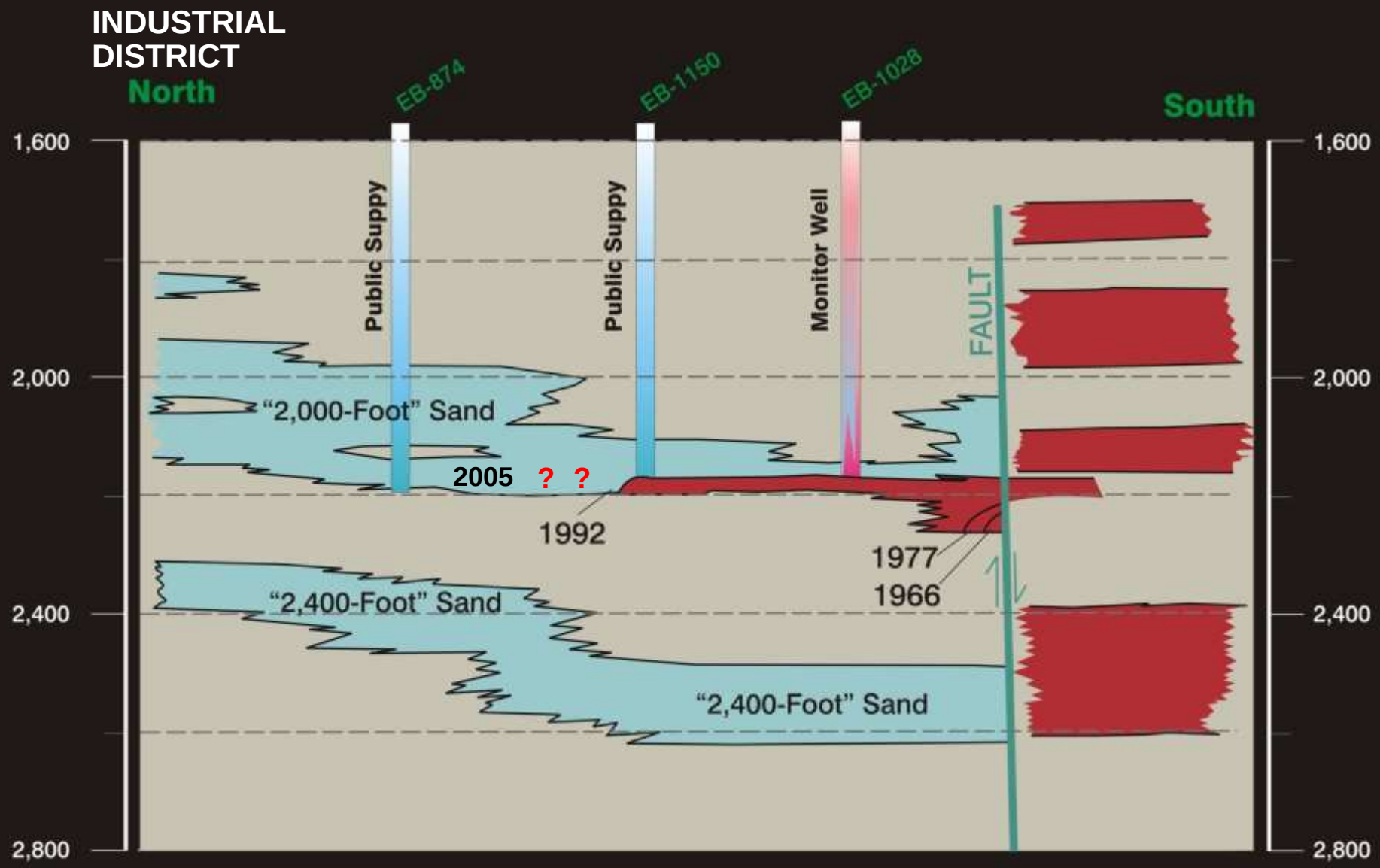


Location of saltwater and chloride concentrations at sampled wells and in the “2,000-foot” sand. (Note: The location of the saltwater interface in 2005 is unpublished and subject to revision.)

MOVEMENT OF SALTWATER IN THE "2,000-FOOT" SAND



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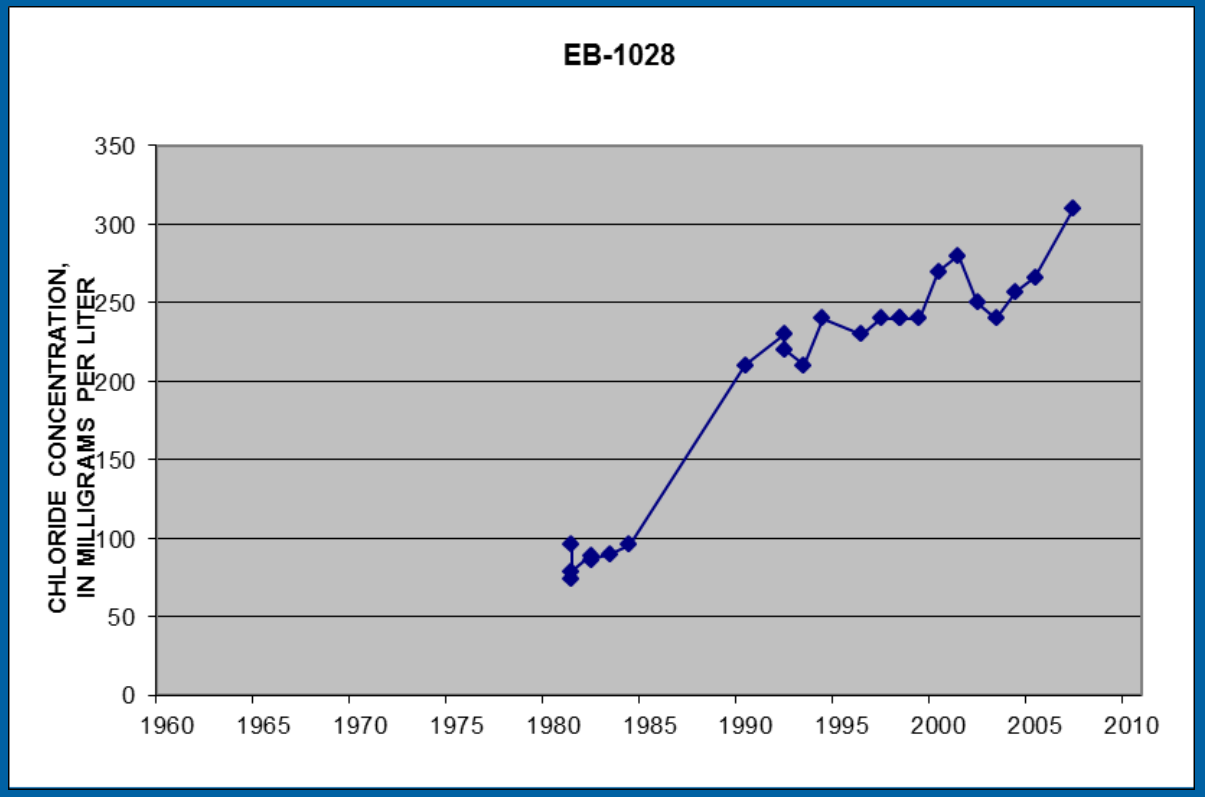
0 1 2 MILES

Graph of chloride concentrations at well EB-1028 screened in the “2,000-foot” sand and located between the Baton Rouge fault and downtown pumping stations



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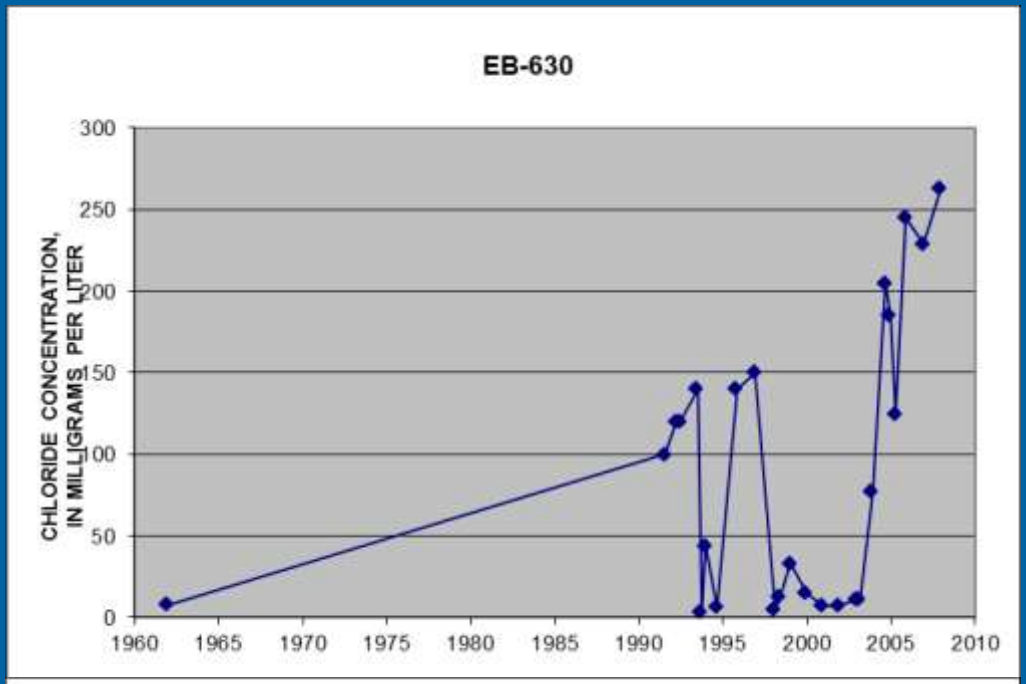
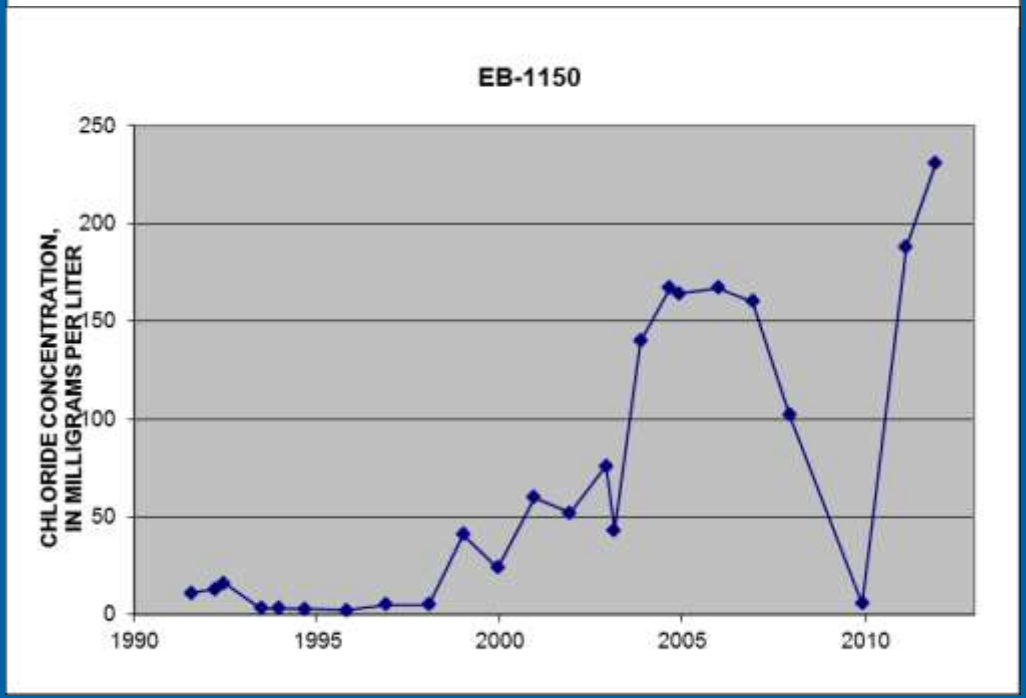
Graphs of chloride concentrations in downtown Baton Rouge public supply wells screened in the "2,000-foot" sand





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Common questions?

- How fast is the saltwater moving?
- When will it reach the industrial district?
- How salty will the water get?
- How will changes in pumping affect saltwater movement?
- How can the saltwater be controlled?
- Where would additional data be useful?

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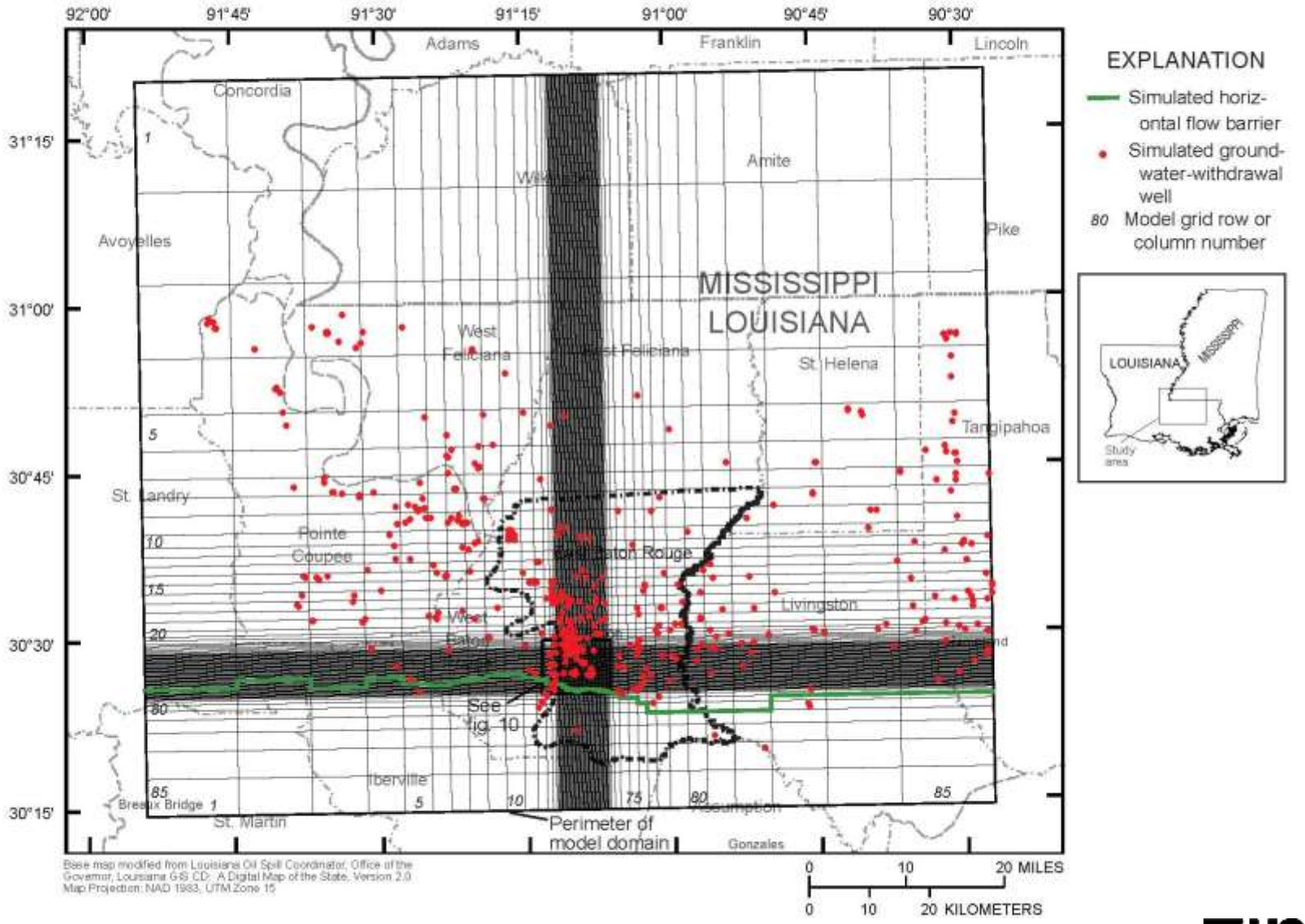

LOCATION OF MODEL GRID AND 605 SIMULATED WITHDRAWAL WELLS

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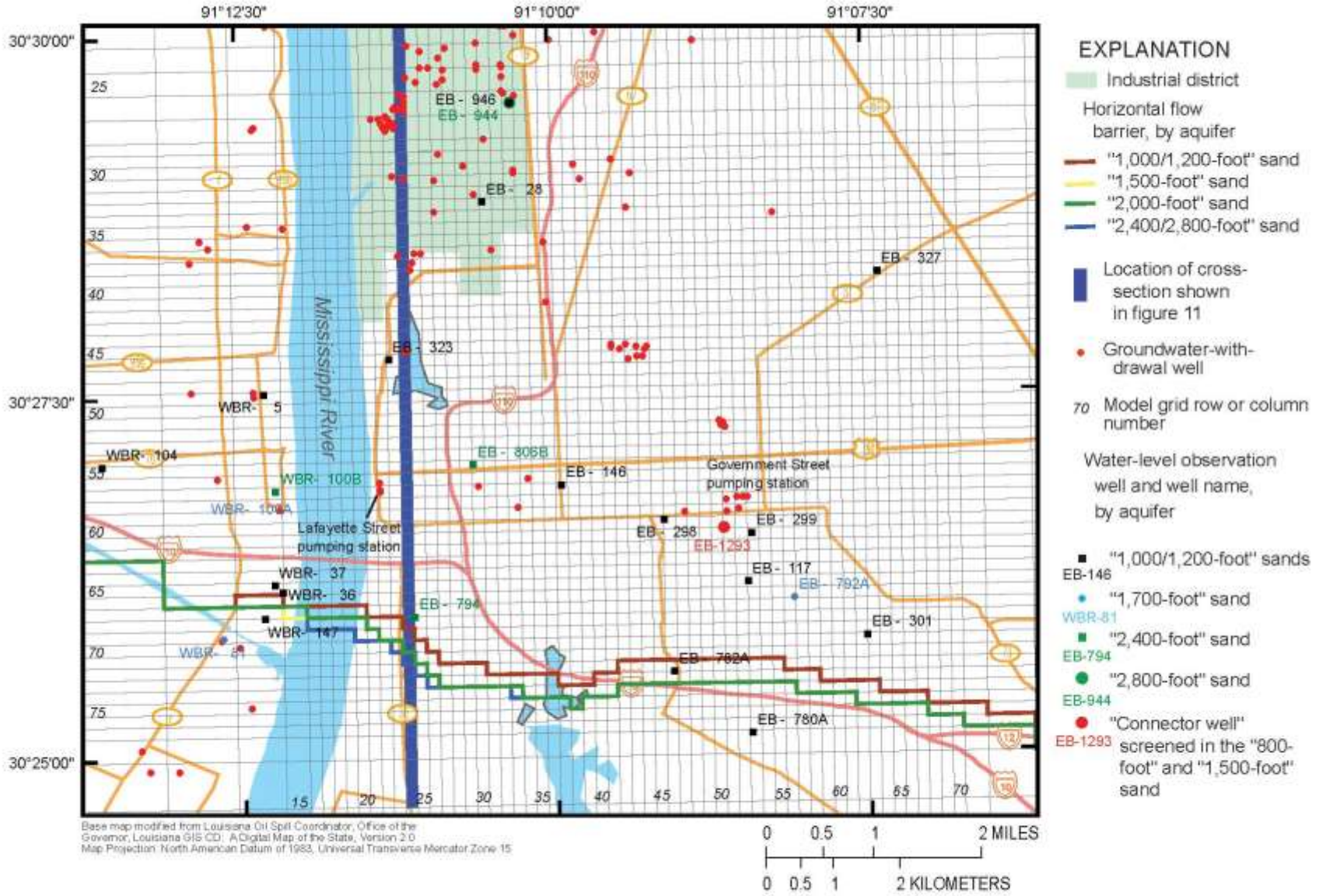

Location of the detailed model area, horizontal flow barrier, withdrawal wells, observation wells, and the cross section shown on figure 11.

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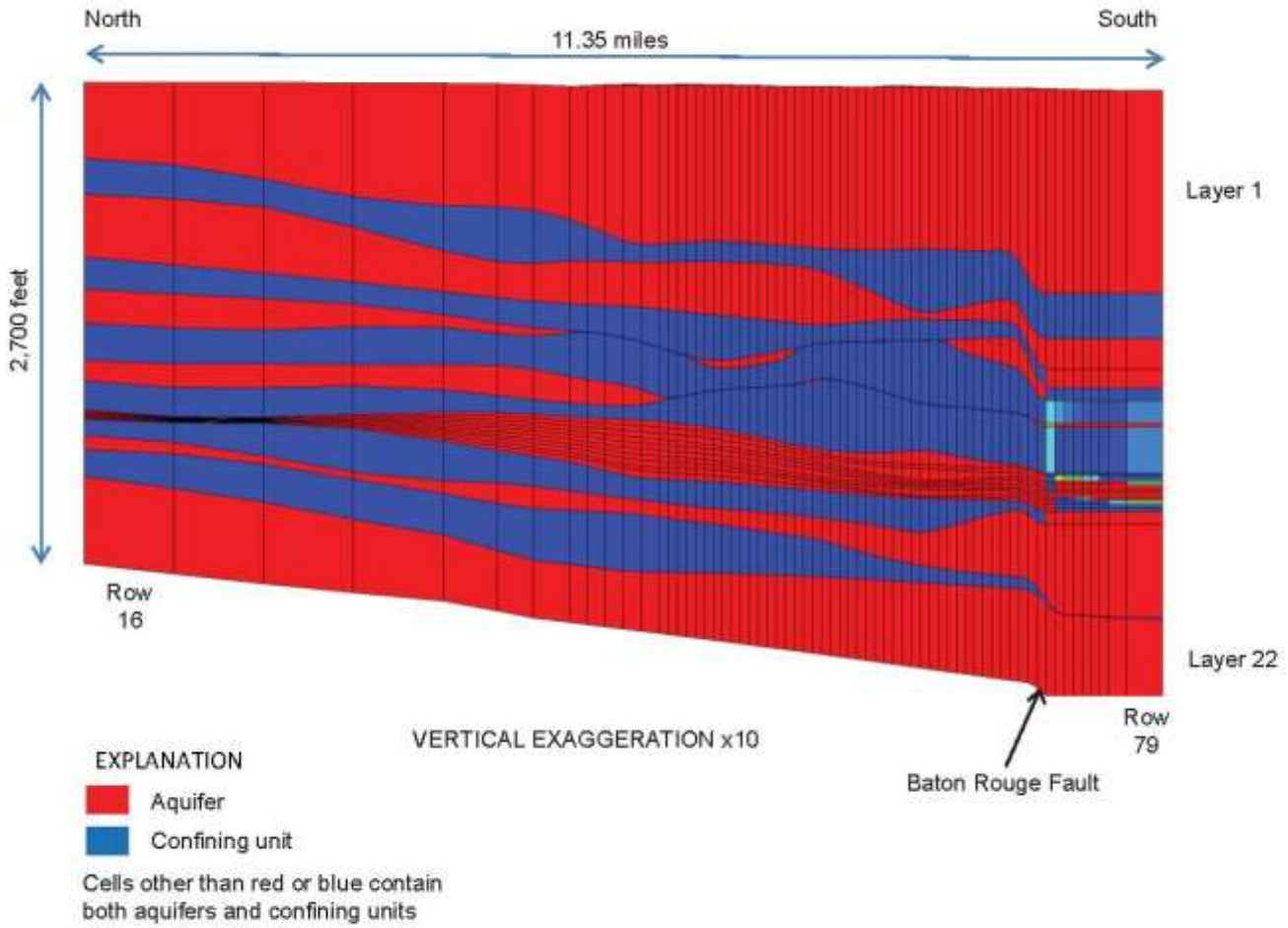

North-to-south cross section along model column 24 showing aquifers, confining units, and finite-difference discretization.

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Calibration Dataset

- 4,555 water-level measurements made at various times between 1940 and 2007 from 161 wells the model area
- 283 measurements of chloride concentrations in water collected between 1940 and 2007 from 16 wells screened in the “2,000-foot” sand in the detailed model area

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MODFLOW MODEL CALIBRATION RESULTS

Simulated and observed water levels at 5 wells screened in the “2,000-foot” sand in the detailed model area.

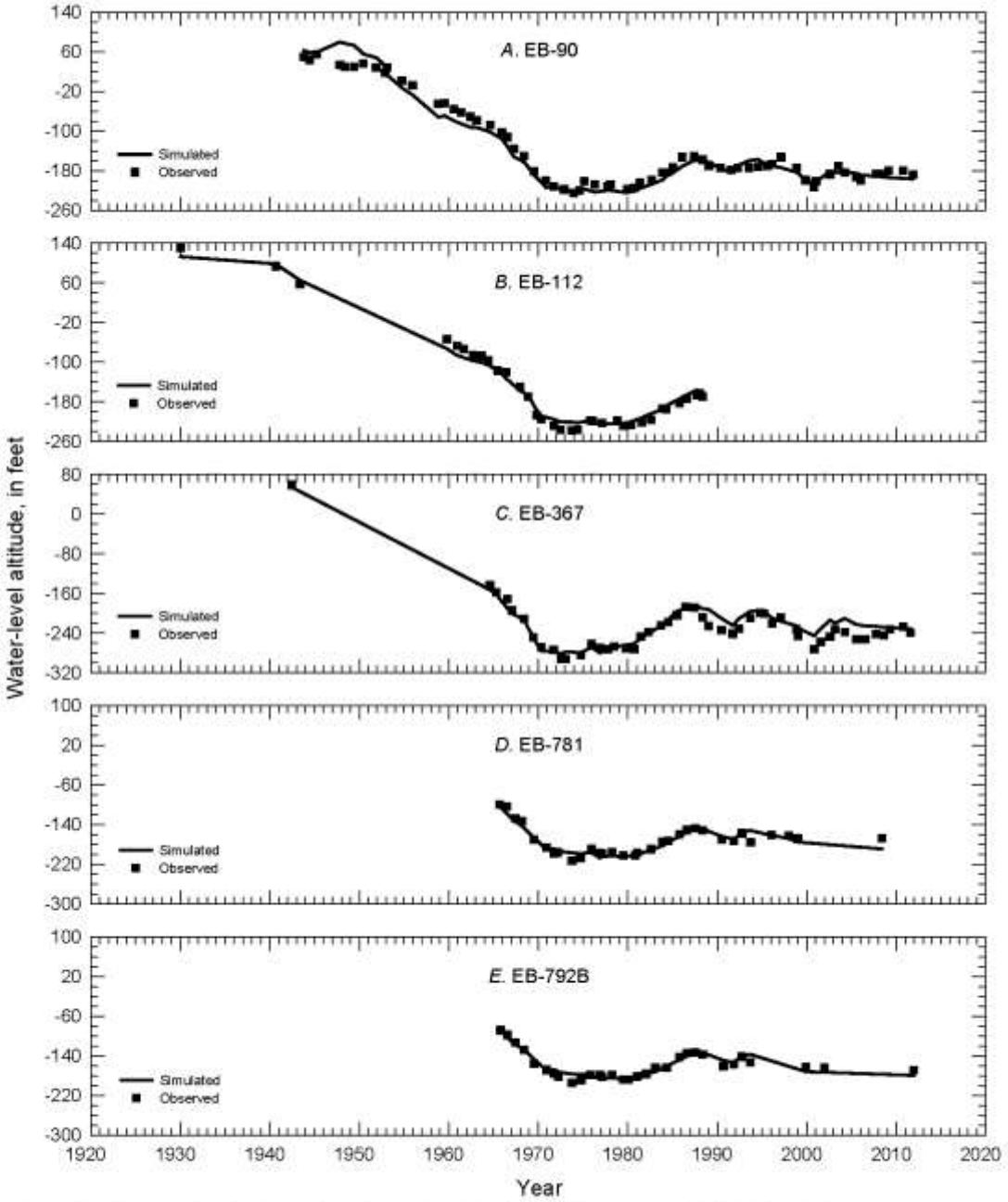

Figure 22. Simulated and observed water levels within the "2,000-foot" sand of the Baton Rouge area in southeastern Louisiana (see fig. 18*B* for well locations).

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SEAWAT MODEL CALIBRATION RESULTS

Simulated and observed chloride concentrations at selected wells screened in the “2,000-foot” sand in the detailed model area

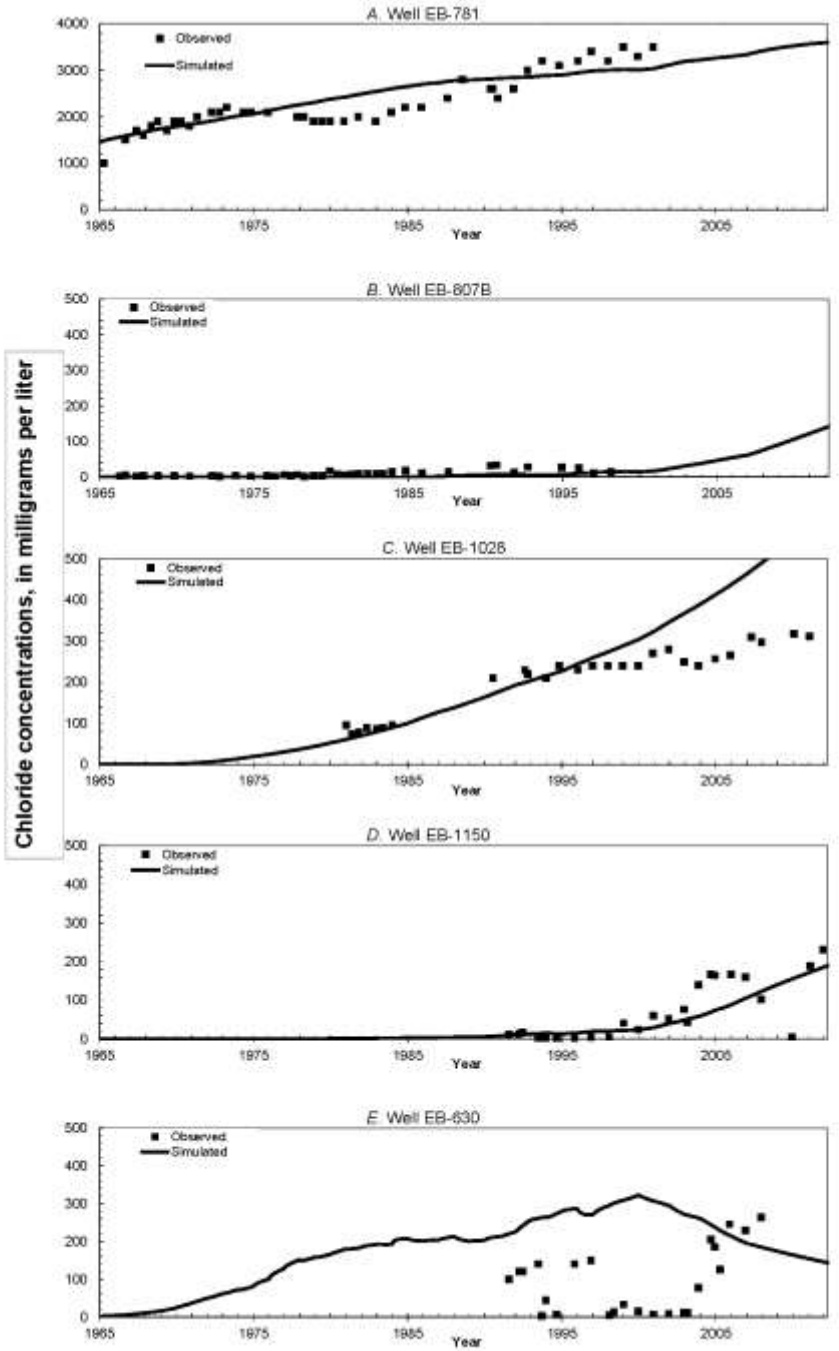

Figure 26. -Simulated and observed chloride concentrations at observation wells within the "2000-ft sand" of the Baton Rouge area in southeastern Louisiana (see fig. 27 for well locations).

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Hypothetical Scenarios (run through 2047)

1. Continued withdrawals at 2007 rates
2. Reduced withdrawals from the “2,000-foot” sand at selected industrial wells
3. Cessation of withdrawals from the “2,000-foot” sand in the industrial district
4. Scavenger well at the base of the “2,000-foot” sand

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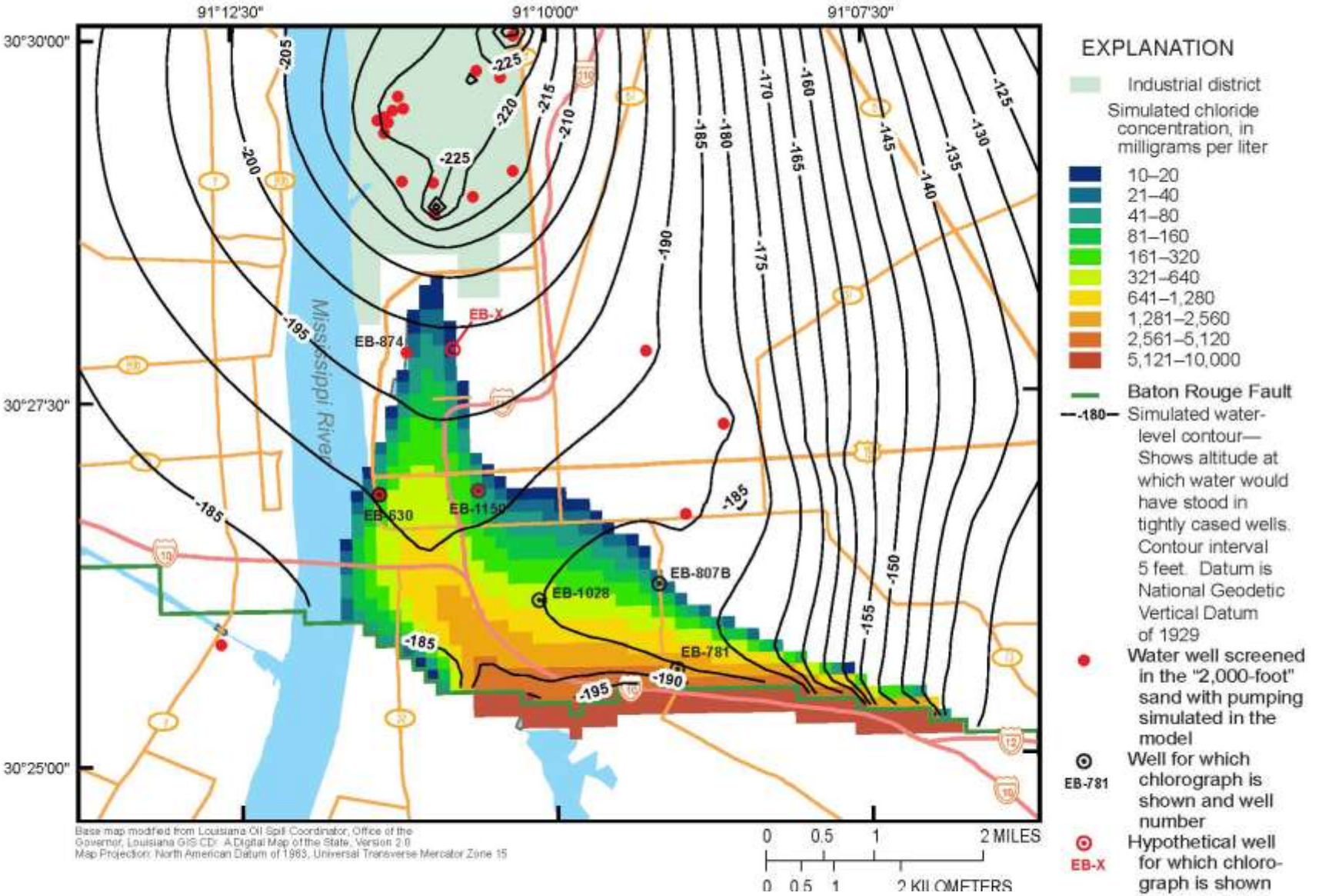
2007 CONDITIONS



SIMULATED 2007 WATER LEVELS AND CHLORIDE CONCENTRATIONS IN THE "2,000-FOOT" SAND IN THE DETAILED MODEL AREA

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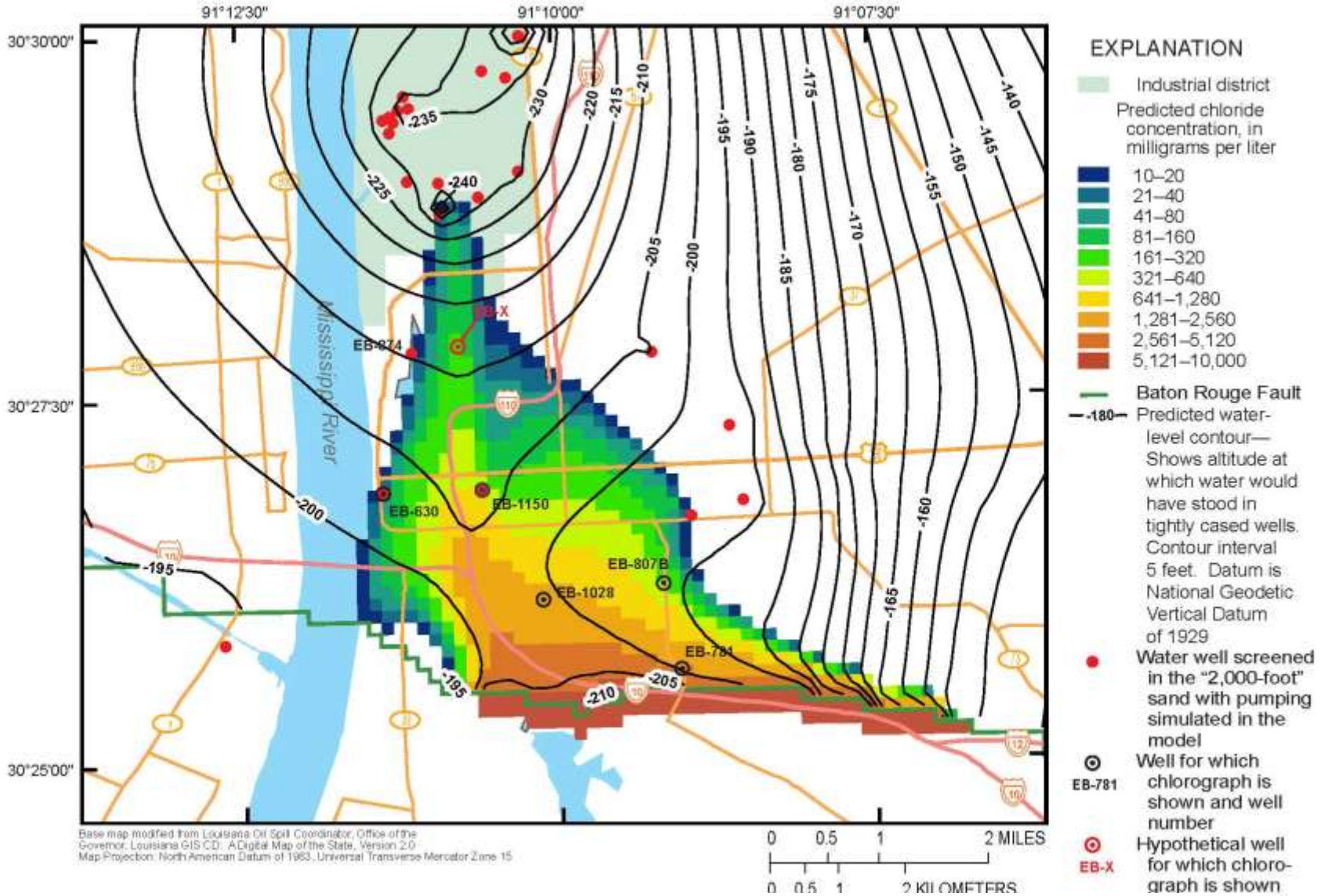
SCENARIO 1



SIMULATED 2047 WATER LEVELS AND CHLORIDE CONCENTRATIONS IN THE "2,000-FOOT" SAND AFTER CONTINUED PUMPING AT 2007 RATES

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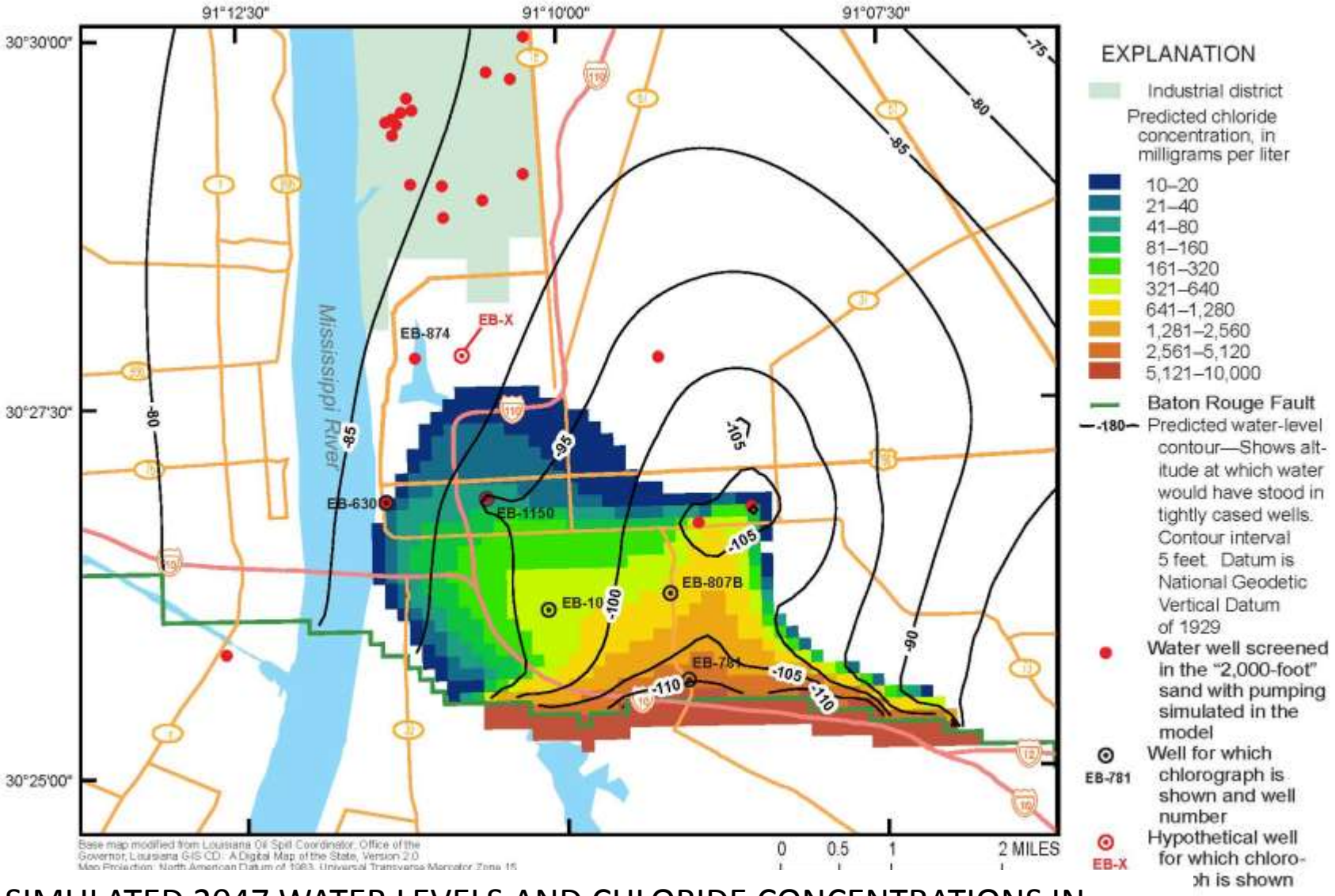
SCENARIO 5



SIMULATED 2047 WATER LEVELS AND CHLORIDE CONCENTRATIONS IN THE "2,000-FOOT" SAND AFTER CESSATION OF PUMPING FROM THE "2,000-FOOT" SAND IN THE INDUSTRIAL DISTRICT

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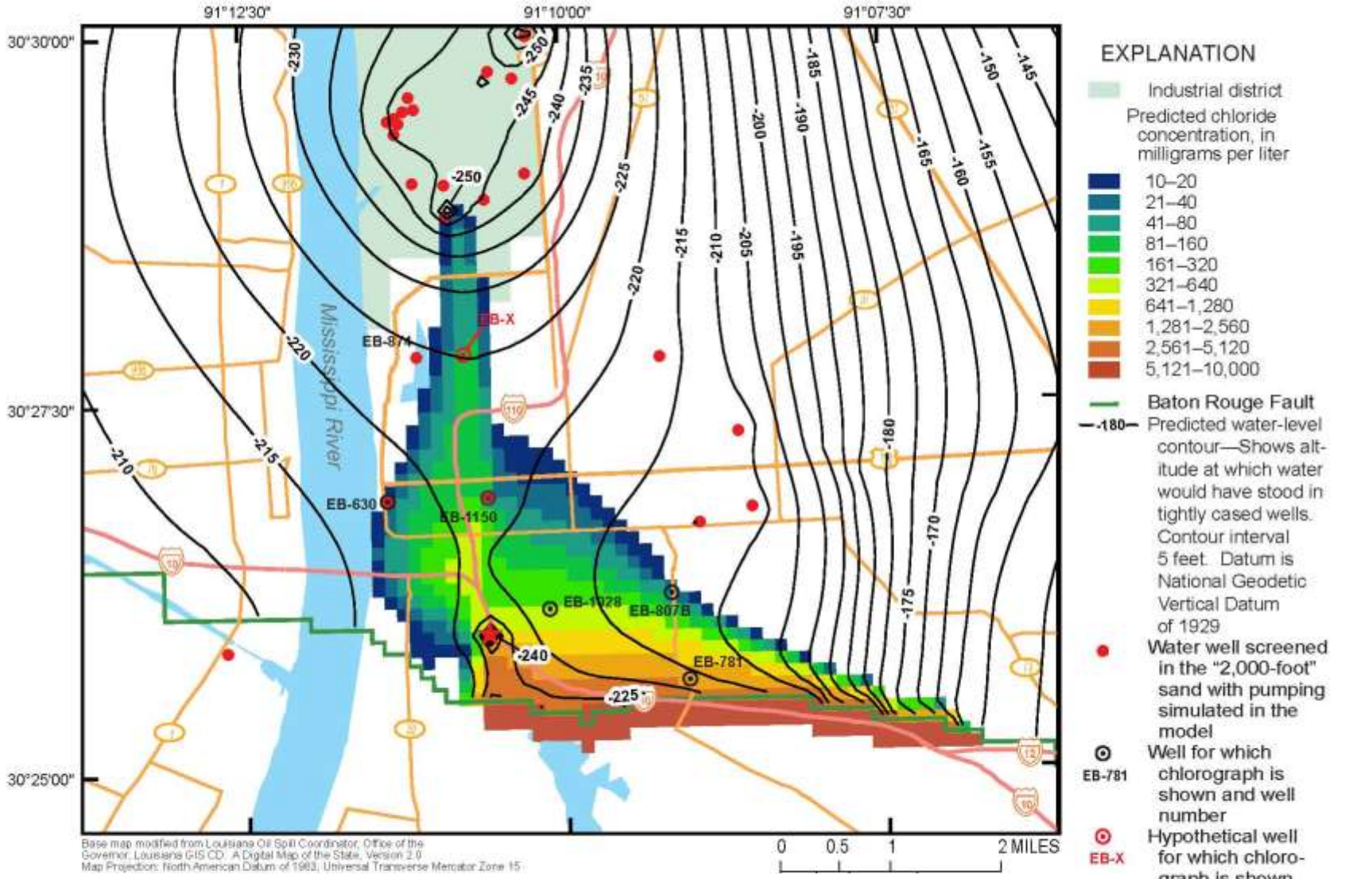
SCENARIO 3b



SIMULATED 2047 WATER LEVELS AND CHLORIDE CONCENTRATIONS IN THE "2,000-FOOT" SAND AFTER SCAVENGER WELL NEAR THOMAS DELPIT DRIVE PUMPING 2 MGAL/D FROM THE BASE OF THE "2,000-FOOT" SAND

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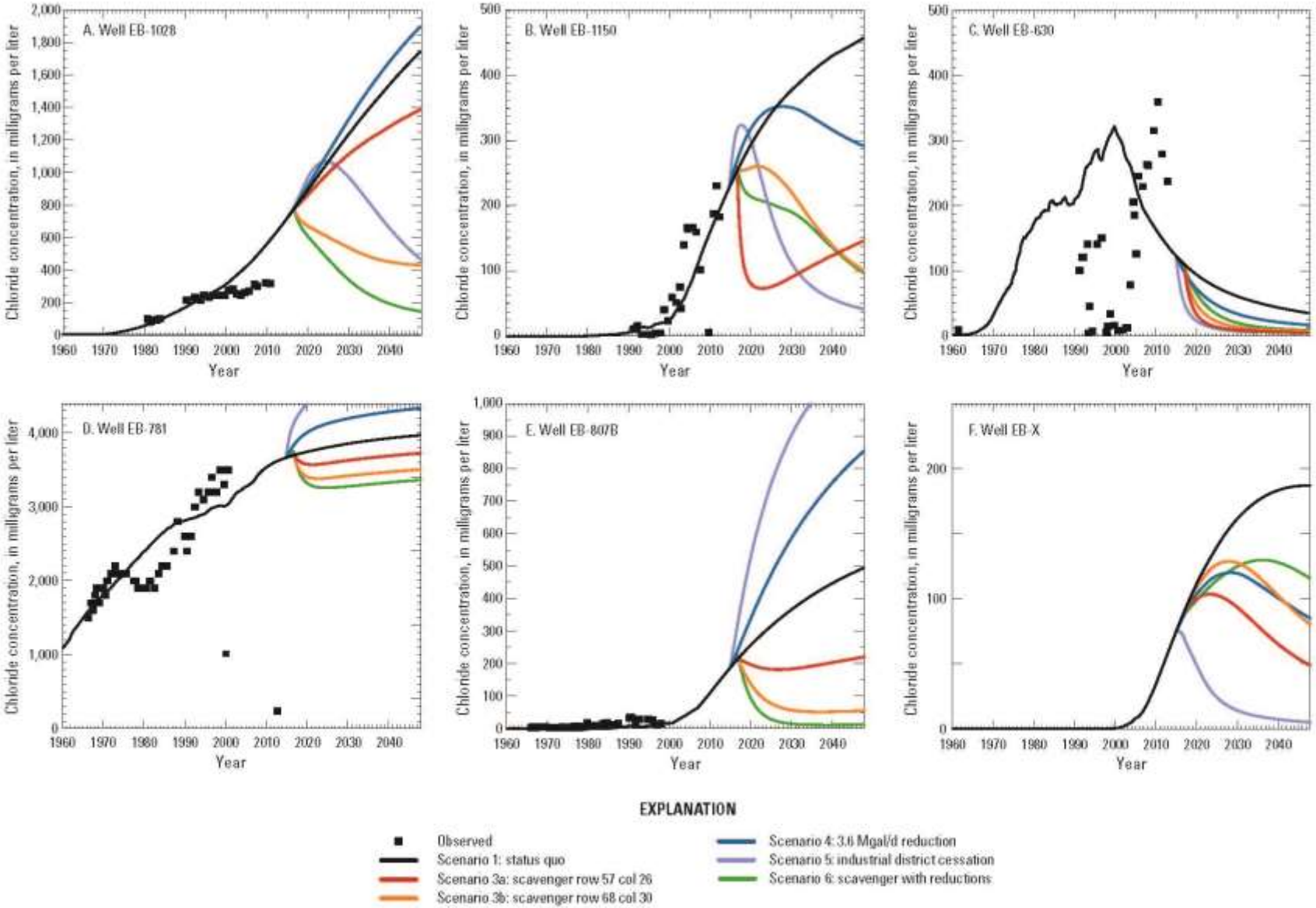

COMPARISON OF CHLORIDE CONCENTRATIONS SIMULATED BY HYPOTHETICAL FUTURE PUMPING SCENARIOS AT 5 REAL WELLS AND 1 HYPOTHETICAL WELL (EB-X).

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Table 6. Simulated plume areas and chloride concentrations.

[mg/L, milligrams per liter; r, row; c, column]

Date and scenario	Plume area (square miles)	Mean layer 18 cell concentration (mg/L)	Median layer 18 cell concentration (mg/L)
2007: (start for all scenarios)	5.10	955	411
2047: scenario 1	6.41	1,068	400
2047: scenario 3a: r57c26	5.08	1,230	655
2047: scenario 3b: r68c30	4.74	930	169
2047: scenario 4	6.39	1,047	393
2047: scenario 5	5.55	907	278

QUESTIONS?

The report is available on-line at:
http://pubs.usgs.gov/sir/2013/5227/pdf/sir2013-5227.pdf

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