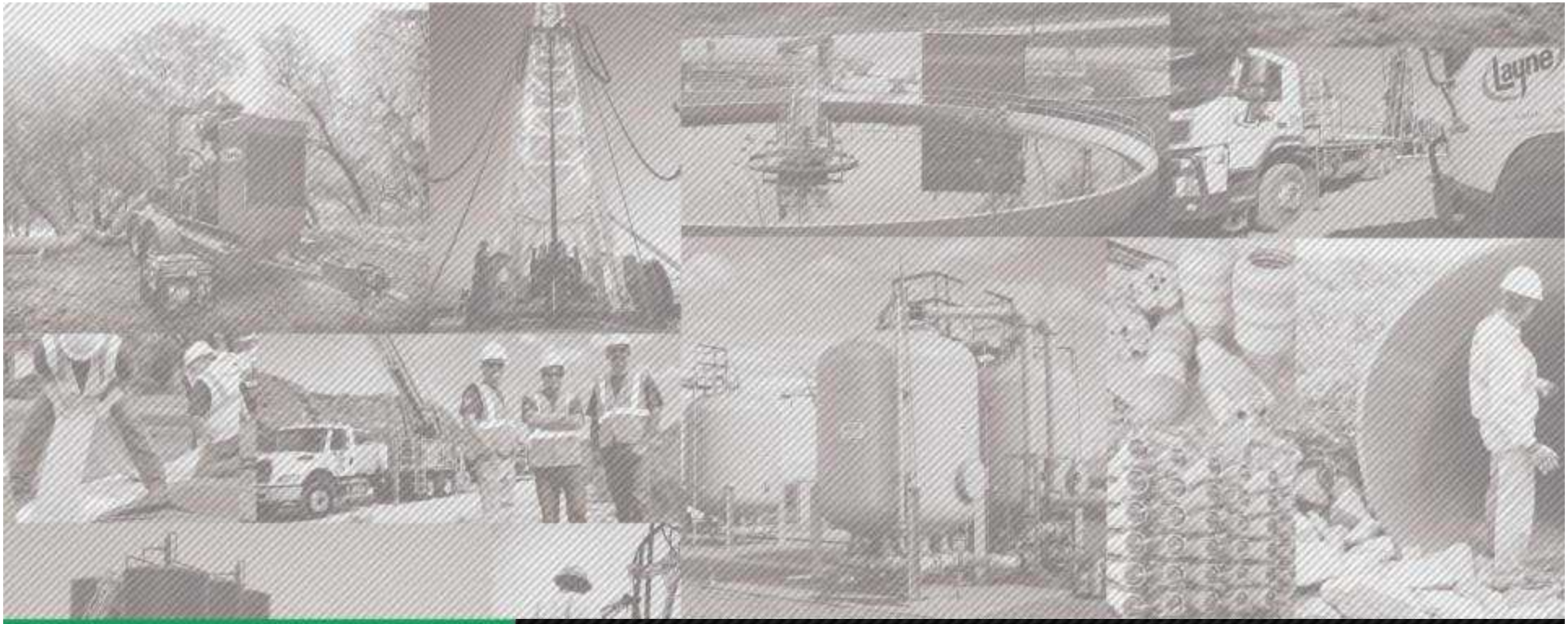


Mitigating the Effects of Saltwater Intrusion

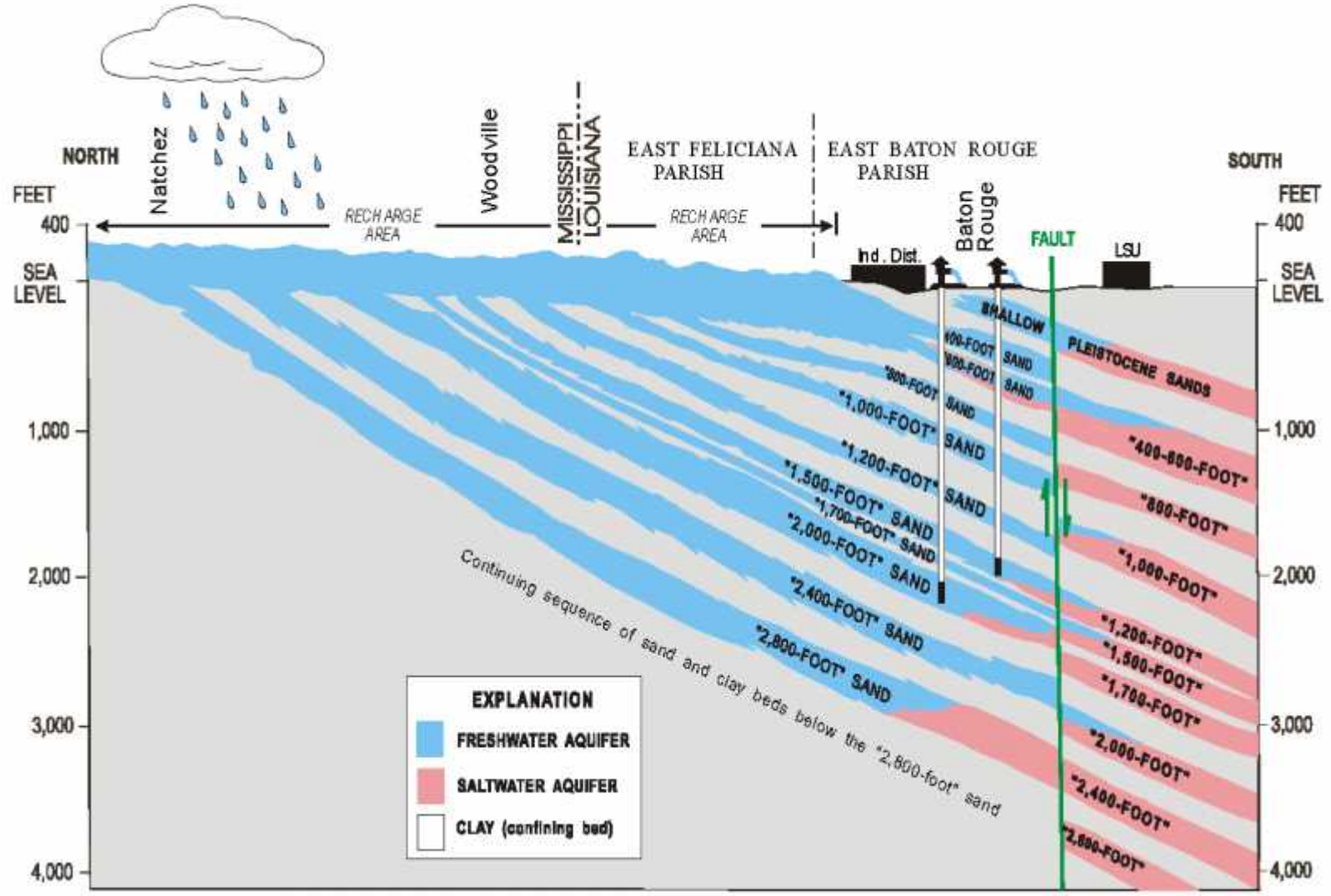
Vic Kelson, Layne Hydro
Bloomington, IN

Texas Desal Conference
September 30, 2015

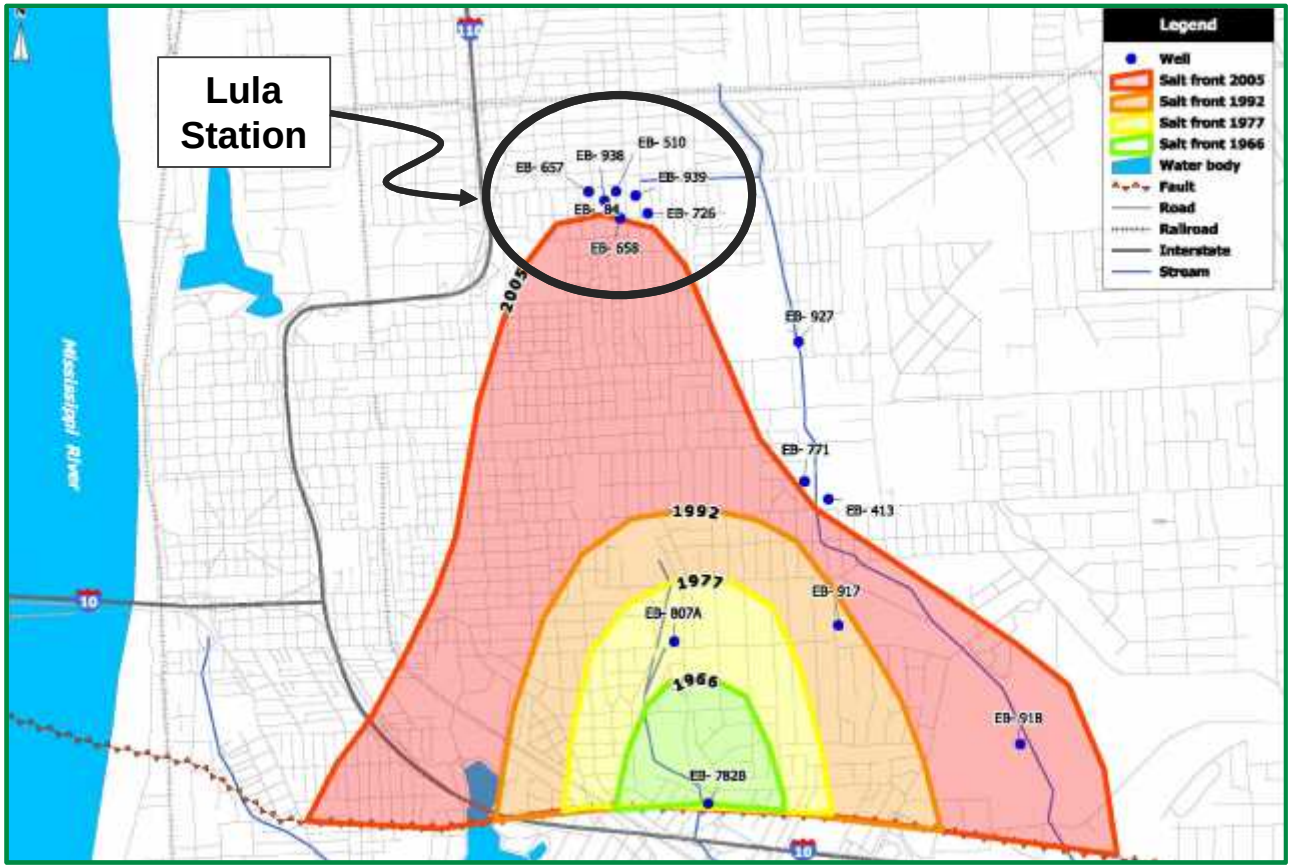
OVERVIEW

- Baton Rouge, LA depends on deep groundwater wells for public and industrial water supplies
- For nearly 50 years, a brackish-water plume has been moving northward in the “1500-foot Sand” aquifer
- This intrusion is a long-term threat to public water supply
- Over the last four years, we have worked with Baton Rouge Water Company to develop a strategy for protecting a major public water supply well field

THE PROBLEM IN BATON ROUGE

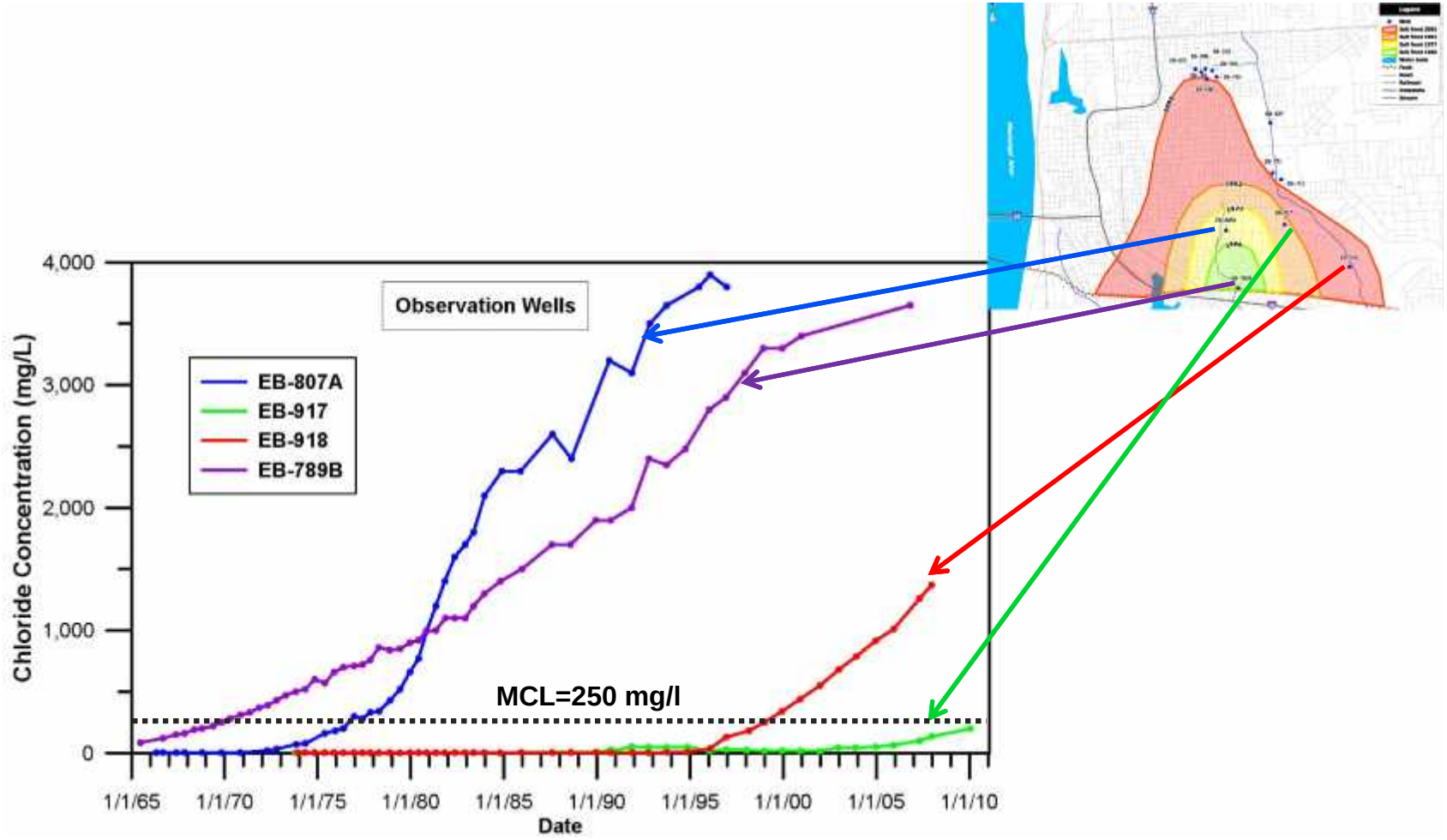


INTRUSION OF BRACKISH WATER

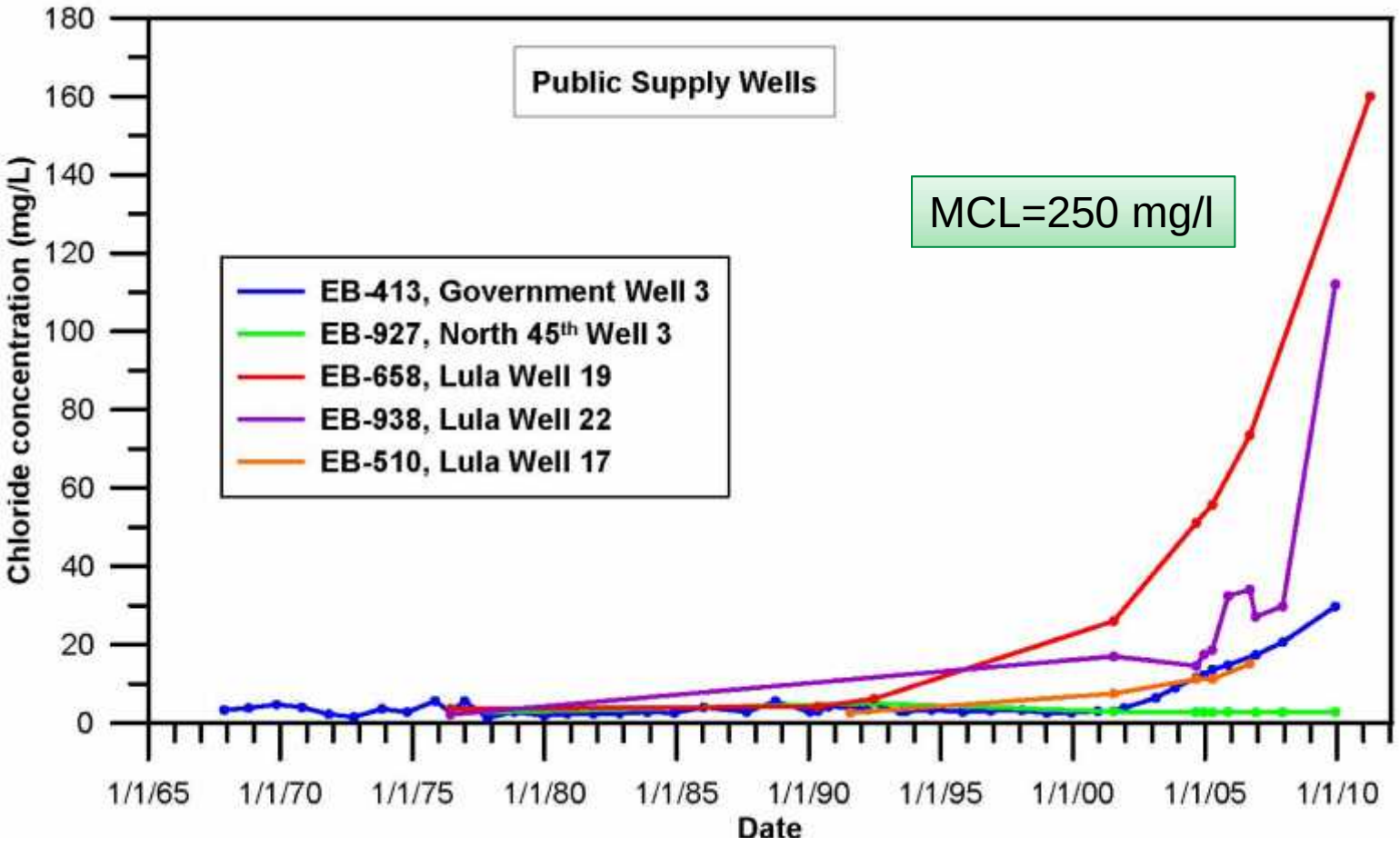


- Brackish water enters the 1500-foot Sand aquifer at the Baton Rouge Fault
- Chloride is moving north towards pumping centers
- Salt is now approaching BRWC's Lula pumping station
- Abandon and move well field?
- Construct treatment facilities?

NORTHWARD MOVEMENT OF CHLORIDE



ARRIVAL OF CHLORIDE AT BRWC WELLS



MITIGATION, NOT REMEDIATION

Issue: BRWC relies on the Lula Station, and its viability is at risk

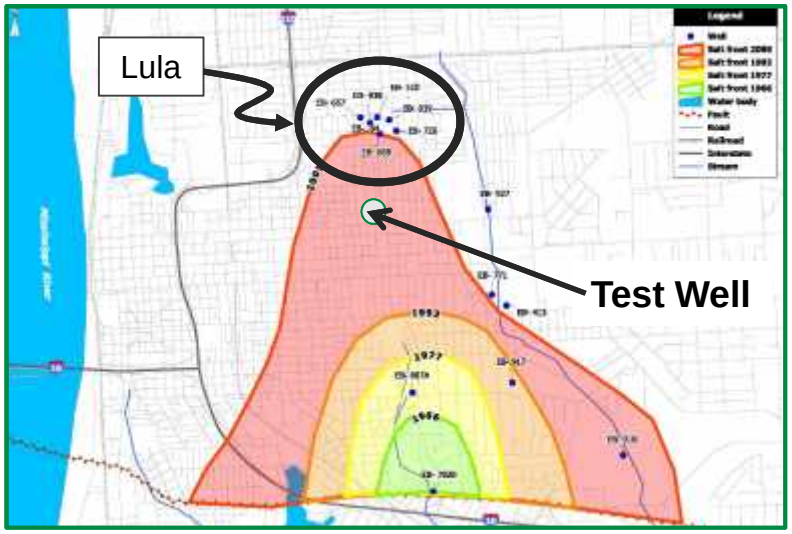
- Remediation of the regional aquifer is impractical in the short term
  - Competing water users
  - Significantly reduced pumping would be necessary
  - Any remedial strategy would take decades (at least)
  - Who pays?

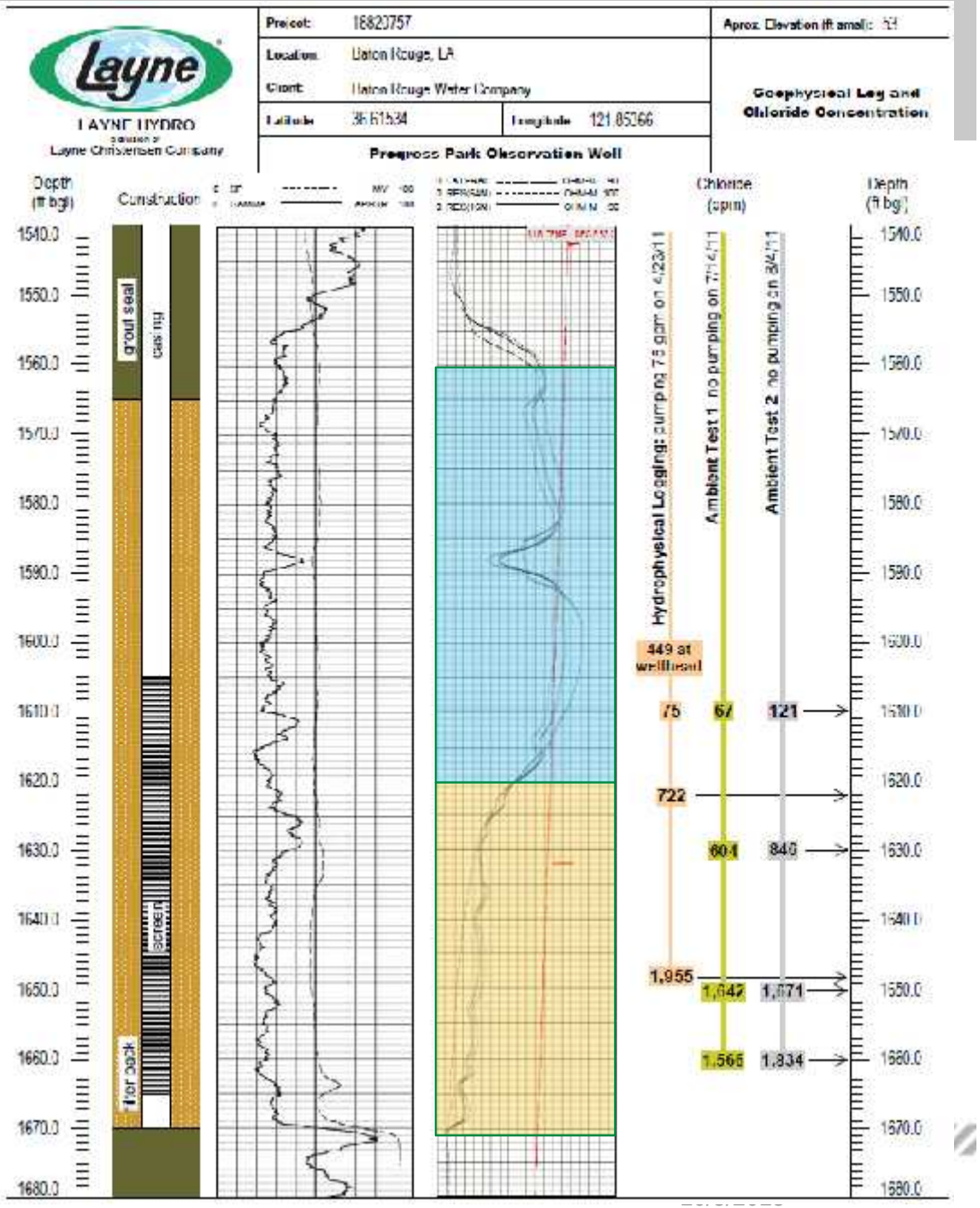
- Objective: ensure reliable operations of Lula for 20-30 more years
  - We need a practical, cost-effective approach to mitigating the impact of advancing chloride in the 1500-foot sand at Lula

TEST WELL AT PROGRESS PARK

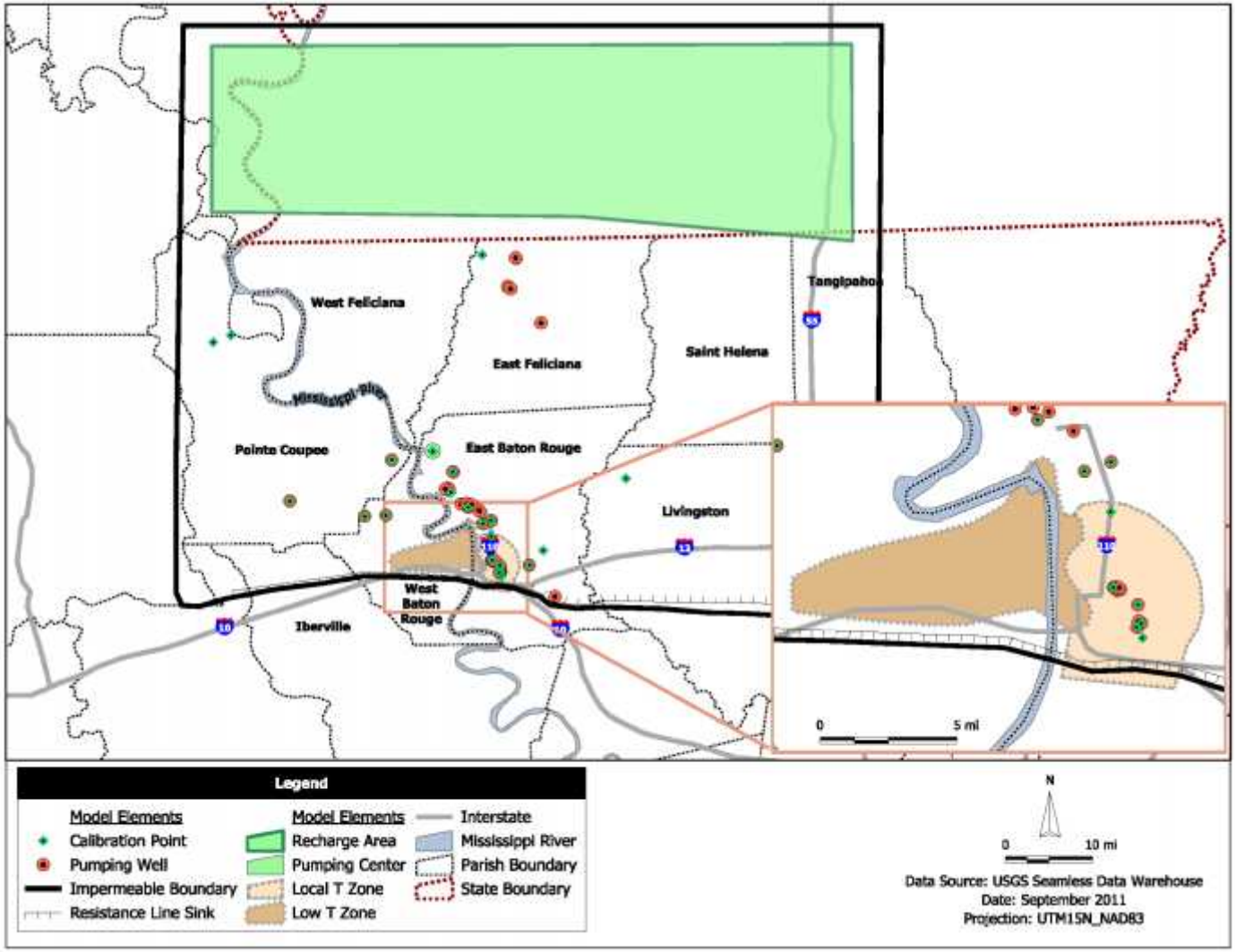
Test well screened over most of the 1500-foot sand

Hydrophysical logging and discrete sampling demonstrate that high-chloride water is stratified at the bottom of the aquifer.

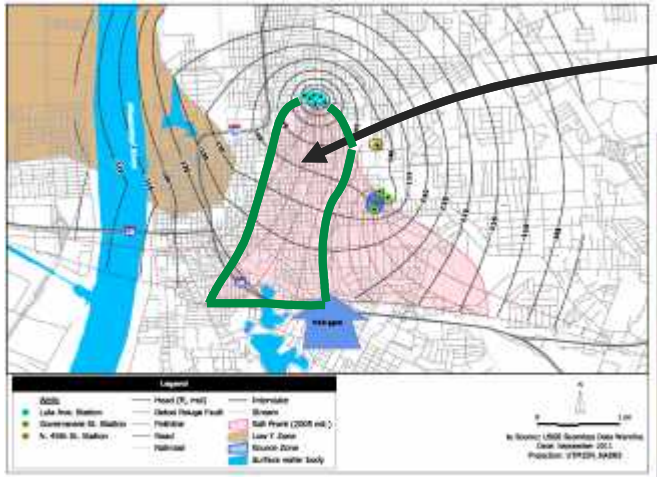




REGIONAL GROUNDWATER FLOW MODEL

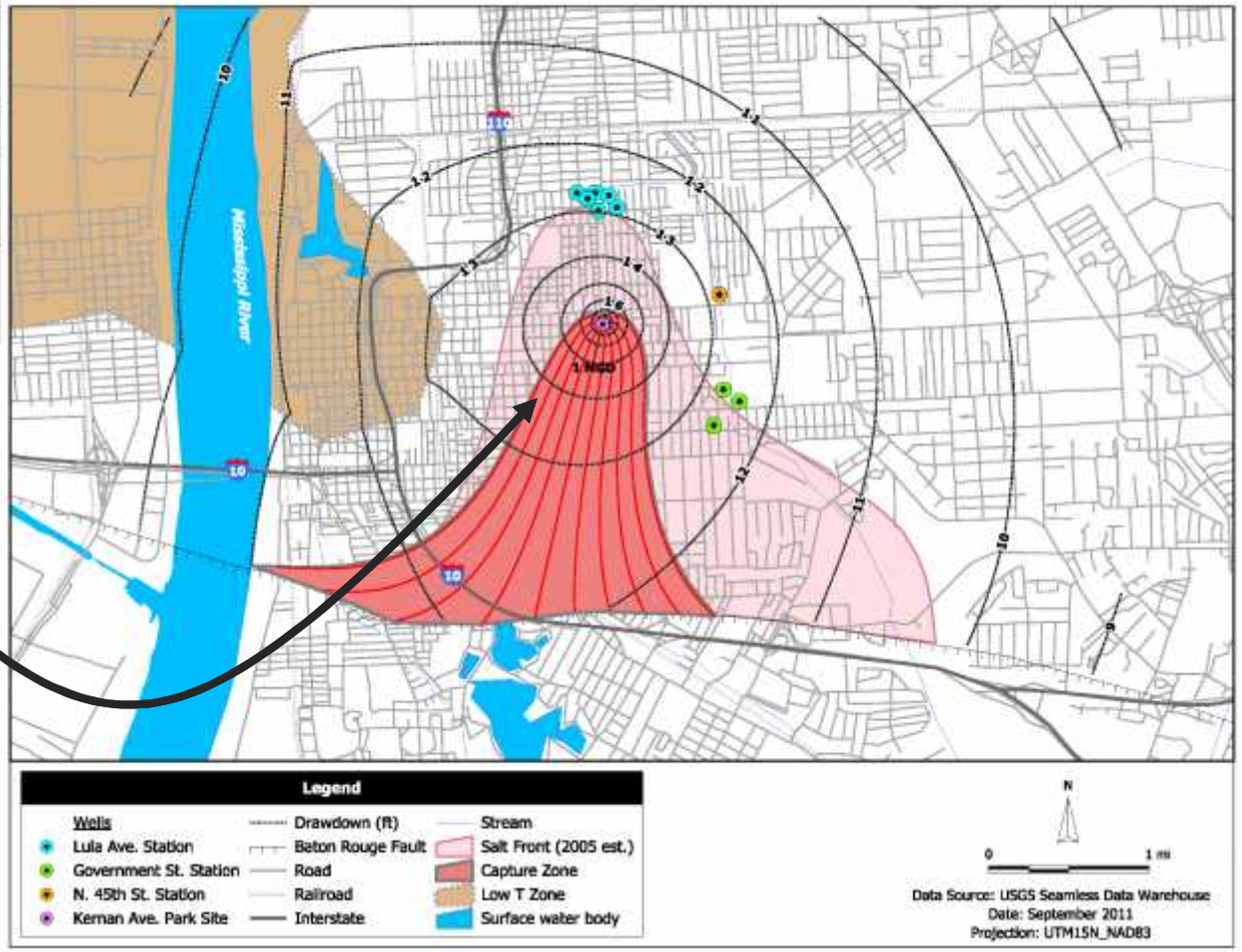


CAN THE SALT BE INTERCEPTED?



Contributing area for Lula

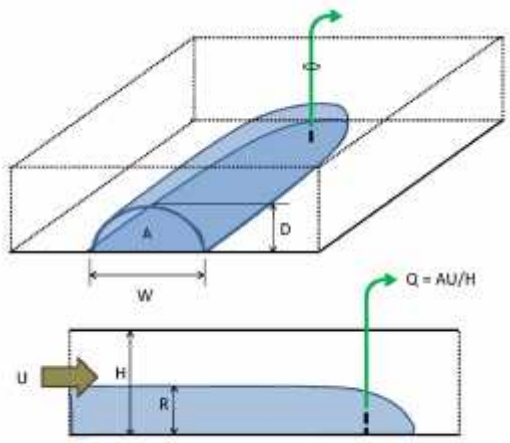
A properly located 1 MGD pumping center would protect the Lula Station



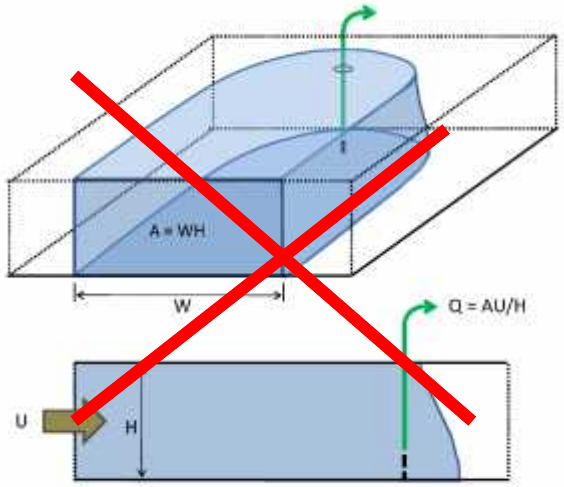
WHAT TO DO WITH THE BRACKISH WATER?

- Dispose of it all?
- Desalinization and disposal of brine?
- Separate fresh and salt water?

PUMP ONLY THE DEEP SECTION?



Small
Pumping rate

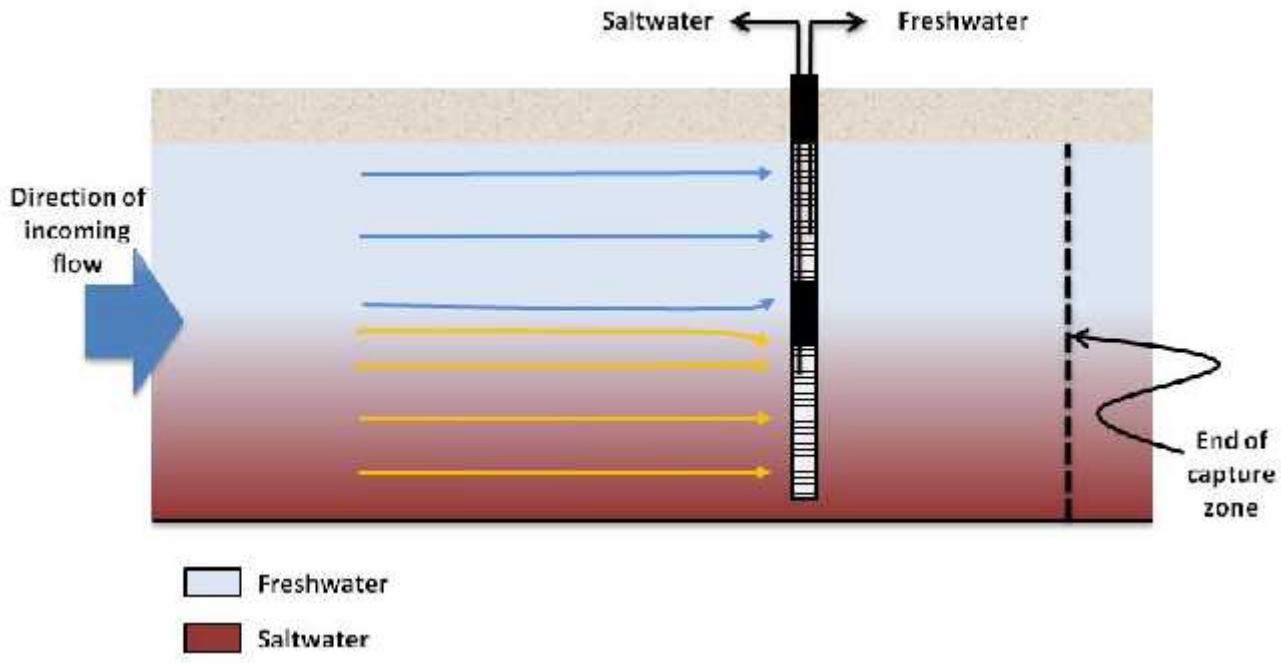


Large
Pumping rate

At a pumping rate large enough to capture the width of the plume, the well will capture the entire saturated section

Thus, numerous small wells installed in a row would be required to simply scavenge the lower portion of the aquifer

IN-SITU SEPARATION USING TWO SCREENS

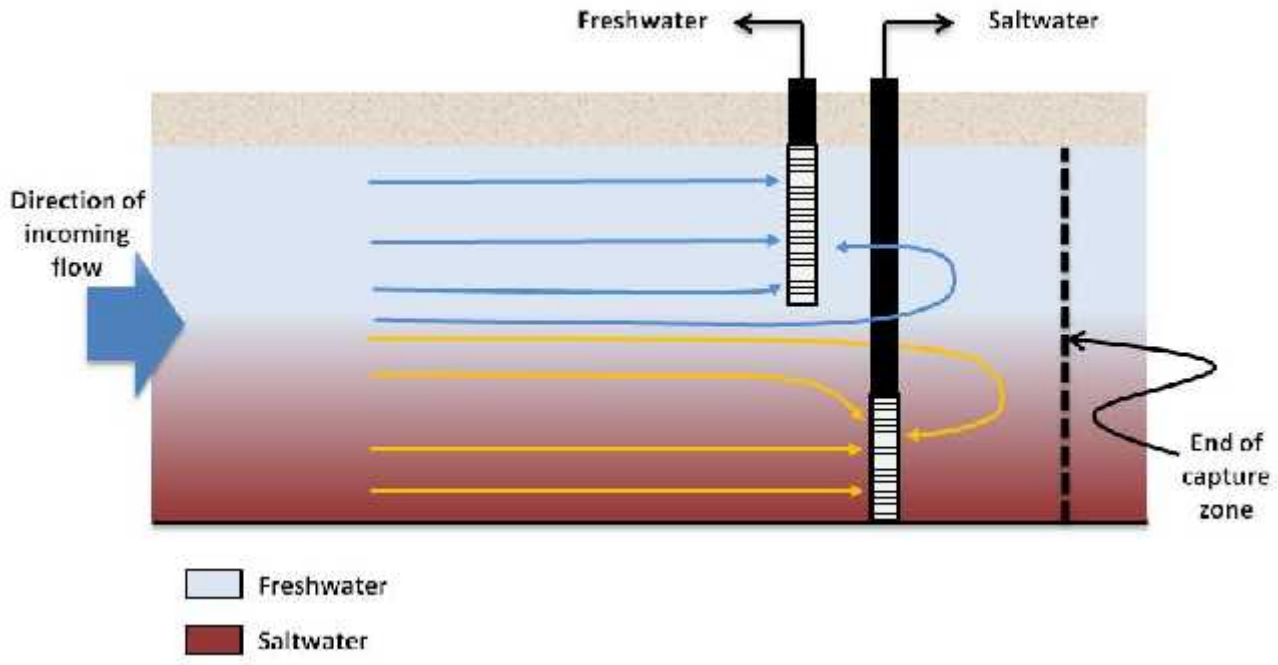


A well with two screens could be constructed, one pumping the fresh section and the other pumping the brackish section

Must account for changing thickness of the brackish fraction over time

This design would be costly in a deep well

A SCAVENGER “COUPLE”

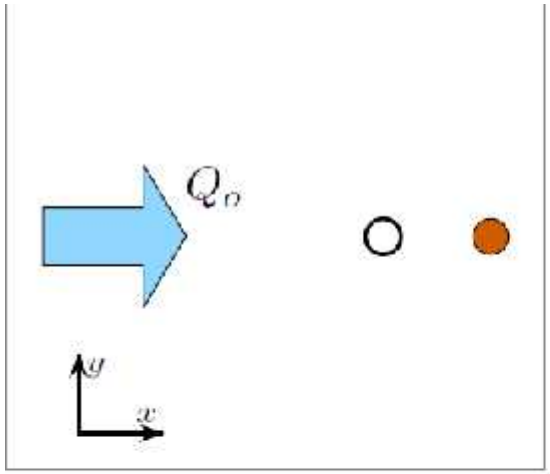


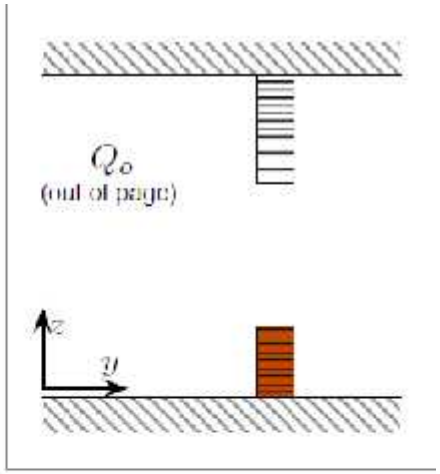
Two separate wells, built close together

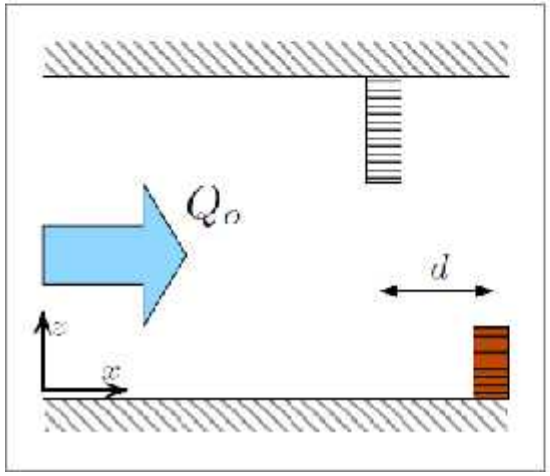
Vertical gap between screens allows for adjustments as brackish water advances using variable-frequency drives on the pumps

How close together do the wells need to be?

DESIGN MODELING







Case 2

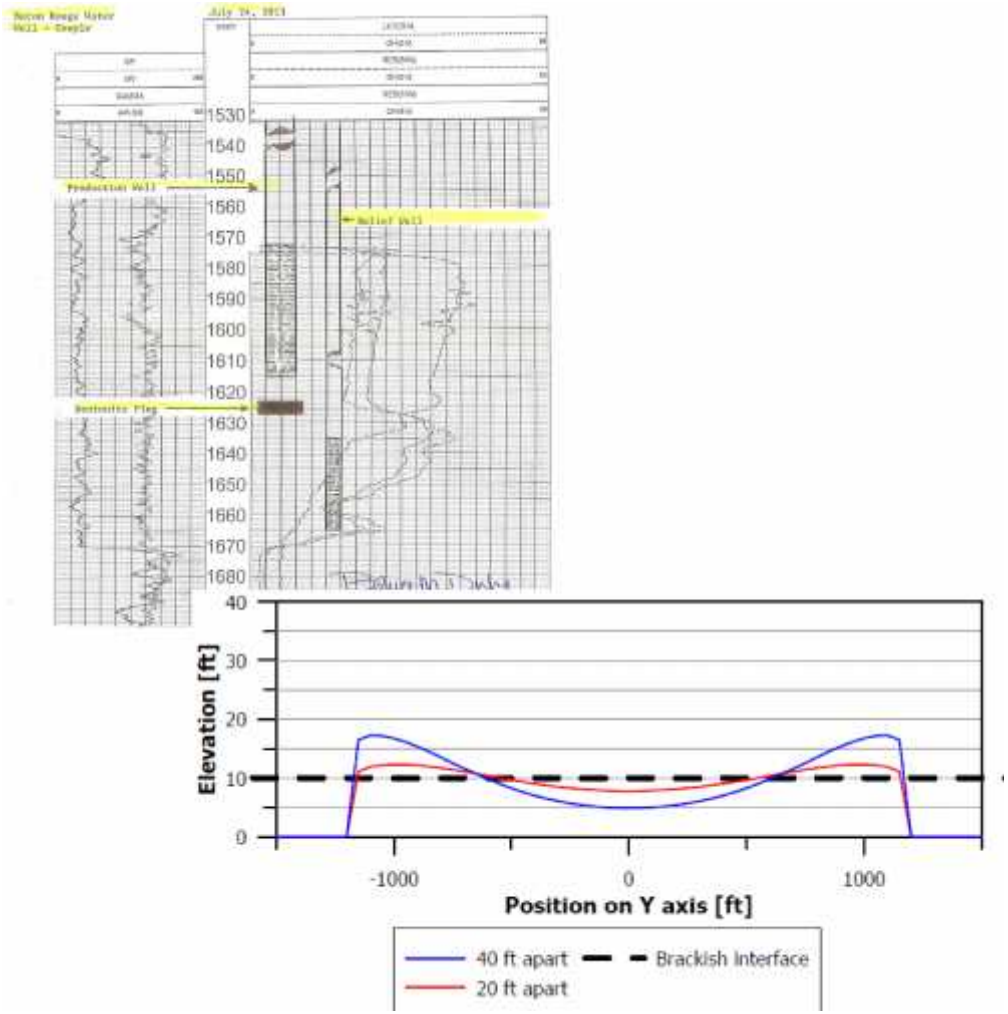
Brackish well downgradient

3D analytic element model of uniform flow near a well couple

Traced particle paths originating far up-gradient of the couple and used a bisection approach to identify the elevation of the dividing surface between the two wells

Compared numerous arrangements of wells, the distance *d* between the wells and the lengths of the screens

DESIGN CALCULATIONS



For all simulations, we compared

1. The elevation of the separating surface; and
2. The integrated difference between the modeled surface and the ideal surface

Examined the effectiveness of the couple as the brackish front advances

Chose screen length and diameter based on the model results

WHAT WE DIDN'T ANTICIPATE

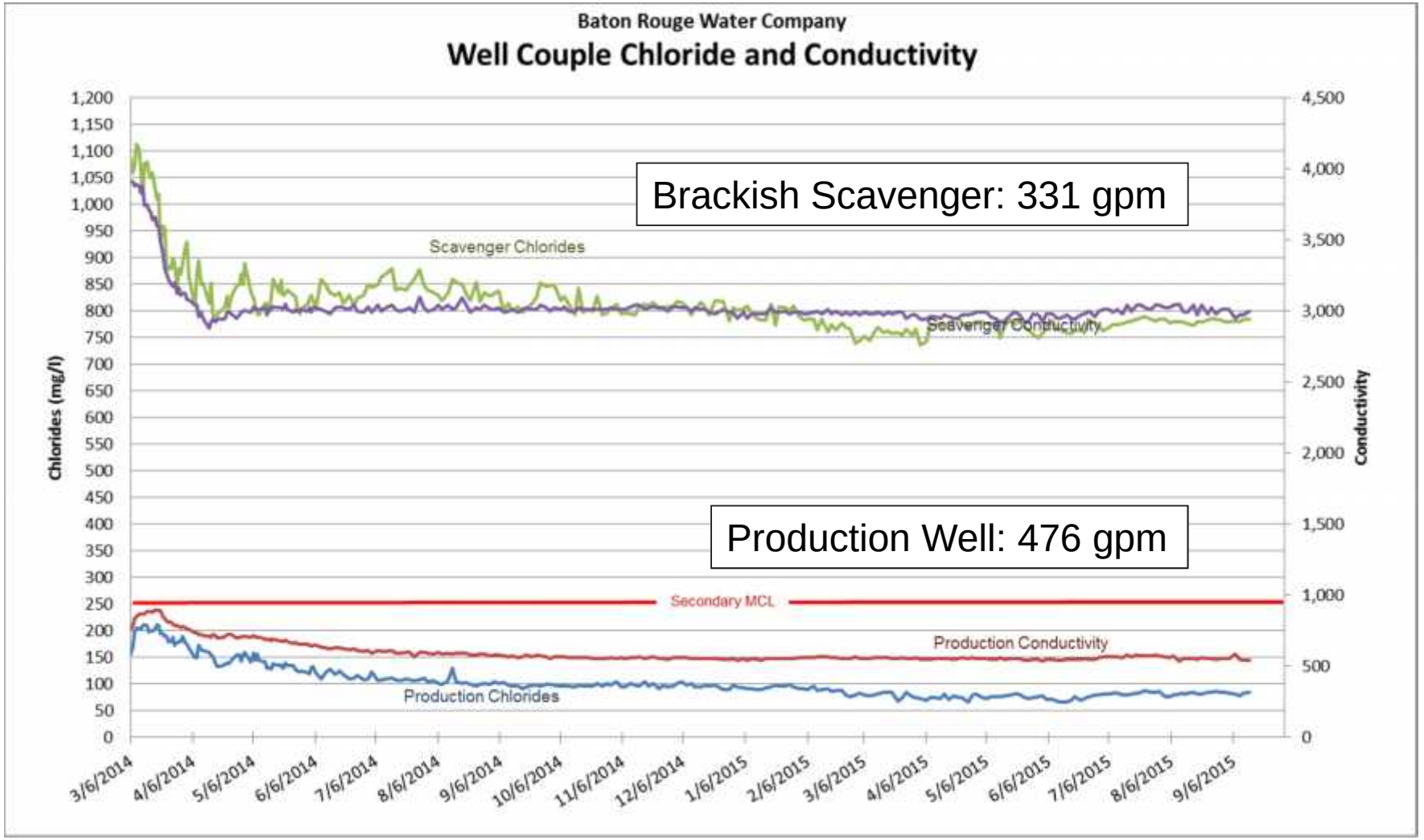
'Scavenger' Well Guards Baton Rouge's Drinking Water

Project Keeps Saltwater Intrusion from Public Supply

By Holly Case

If you don't have good water, it doesn't matter what other resources you have. Securing a good public water supply is one of the most basic but most important concerns for any town. Like many municipalities, Baton Rouge, La., has found its water supply stressed to its limits by population growth and city expansion. Some creative thinking about drilling a new well was a key component in addressing those limits.

18 MONTHS SINCE STARTUP



CONCLUSIONS

- This is a pragmatic mitigation strategy, not a remediation methodology
- Scavenger wells can be a reliable strategy for mitigating the impacts of salt-water intrusion
  - Most useful at the edge of approaching salt
  - Intercepts approaching high-TDS water
  - Separates the usable fraction of the saturated thickness for industry or public supply
  - Reduced need for water treatment
- Site-specific analysis and design is a must
  - Modeling can demonstrate the feasibility and help in cost/benefit analysis

THANK YOU