# BRAZOSPORT WATER AUTHORITY BRACKISH GROUNDWATER DEVELOPMENT

## FEASIBILITY AND CHALLENGES FOR A SUSTAINABLE ALTERNATE WATER SUPPLY

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# Presentation Outline

- Introduction
- Implementation Steps
- Production Test Well Drilling
- Alternative Design Concepts
- Summary

# Introduction

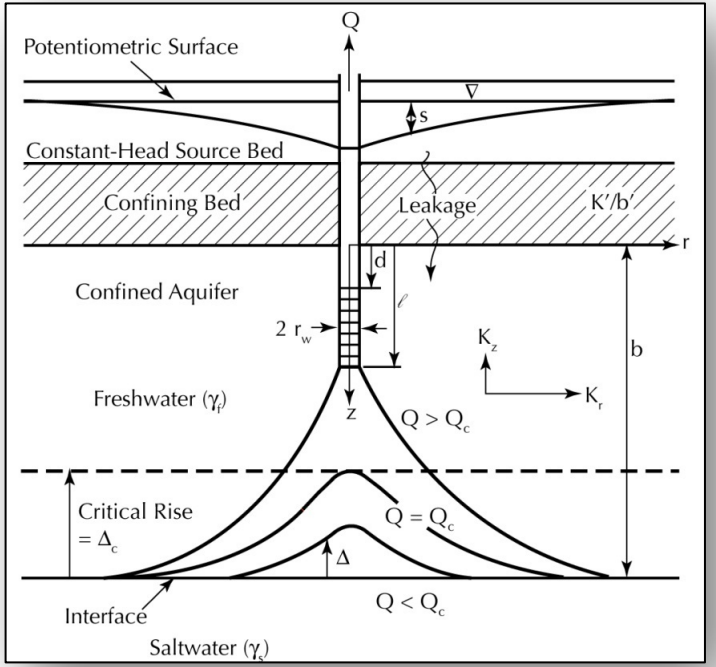
***Brazosport Water Authority is implementing a key alternative water supply project – the development of brackish groundwater from the Gulf Coast Aquifer with Reverse Osmosis Treatment - to ensure a reliable supply during drought***

# Brackish Groundwater

***A significant untapped water resource, but care is needed to ensure sustainable water quality.***

# Brackish Groundwater Development – Lessons Learned from Florida

- Florida began to use BWRO in the late 60's / early 70's
- Significant increase in use since early 2000, coinciding with reduced costs for treatment
- Approximately 25% of water supply in FL is now from brackish groundwater
- BUT - early well design focused on water quantity, not water quality,
  - up-coning of very saline groundwater has led to abandonment of some wells
  - more detailed evaluations are now undertaken



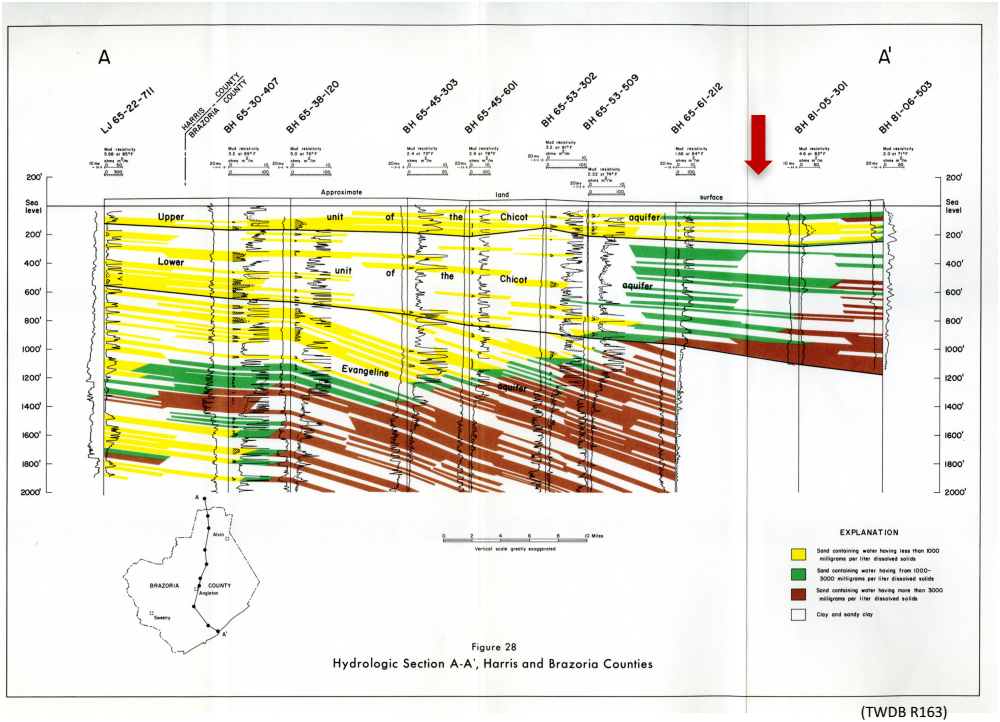

*(From Motz, 1992)*

# Project Objectives

- ***Construct a full size test production well to confirm well yield and salinity***
  - ***Approximate depth 1,200 feet bls, Upper Evangeline aquifer***
  - ***Design yield 1,600 gpm***
  - ***Target salinity 3,000 to 5,000 TDS, preferably lower***
- ***Use production well for ROWTP pilot testing***
- ***Drill additional production wells once aquifer characteristics known and ROWTP design confirmed***
- ***Ultimate Treated Water Capacity 6MGD***

# Phase I Implementation Steps

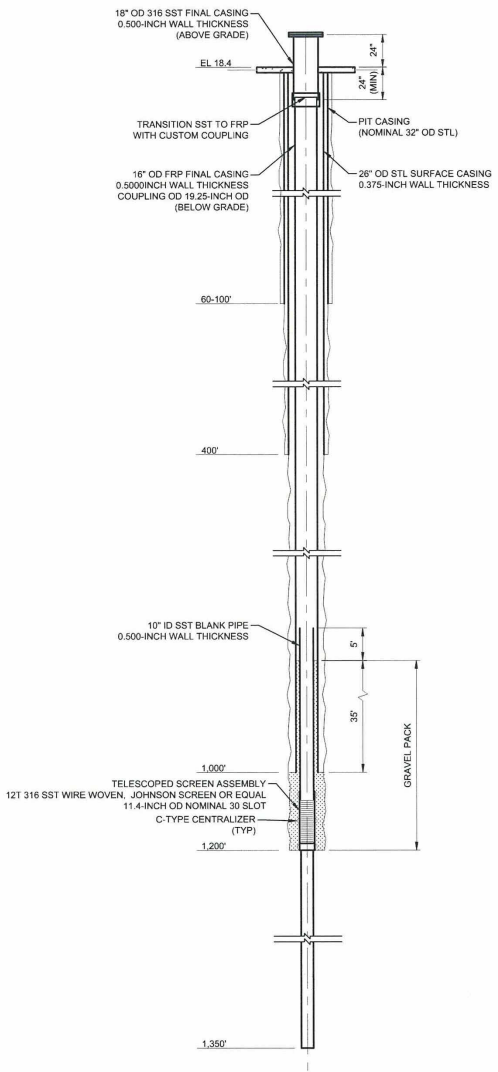
- Desktop Evaluation
  - Extensive use made of deep geophysical log plots from O&G wells to identify sand thickness and depths, anticipated salinities and depth to lowermost USDW
- Well Design
- Permitting
  - Included TCEQ Exception request for alternate well casing material (FRP)
- Construction and Testing




(TWDB R163)

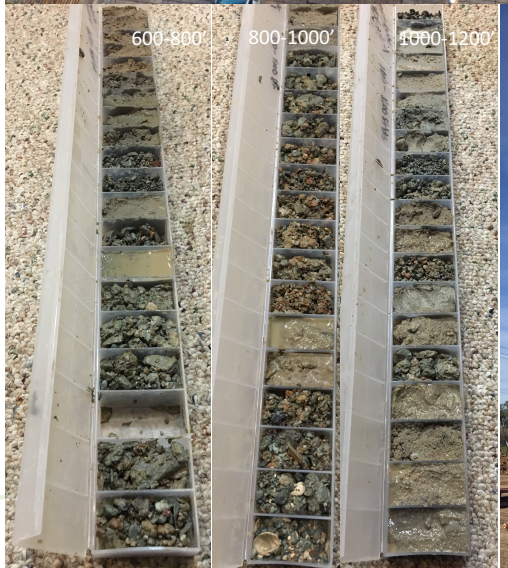
# Well Design Considerations

- Pilot drilling to 1,350 feet bls to fully characterize aquifer, including salinity of groundwater below anticipated production interval
- Isolate shallow fresh groundwater with Intermediate Casing String
- Nom 16-inch Corrosion Resistant Final Casing, 316 Stainless Steel or FRP, Intermediate casing diameters to accommodate either string
- Well Screen drop set using pipe supported wire-wrap screen, under reamed hole with gravel pack, and slot sizes based on sand analysis to minimize head loss, and ensure SDI's met
- Back-plugged pilot hole



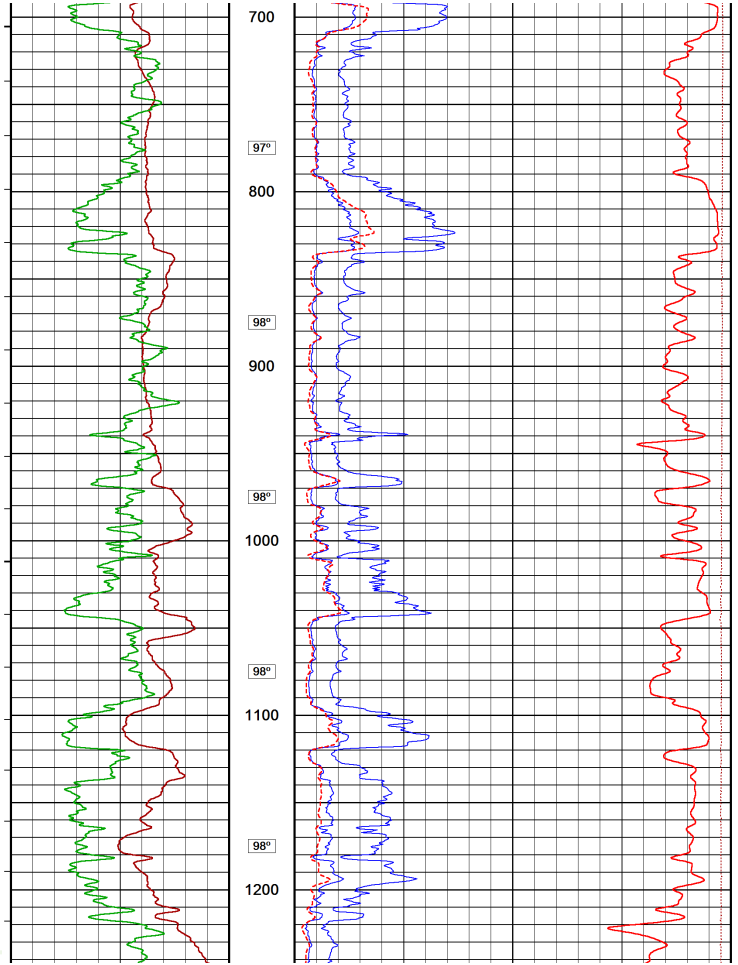
# Well Drilling

- Pilot Hole
  - Drill Cuttings
  - Grain Size Analysis
  - Circulation Salinity
  - Geophysical Logging
- Detailed Screen Design
- Over Development incl. Sand and SDI Testing
- Well Testing
  - Step Drawdown
  - Constant Rate
  - WQ, sand and SDI Testing
  - WL Recovery



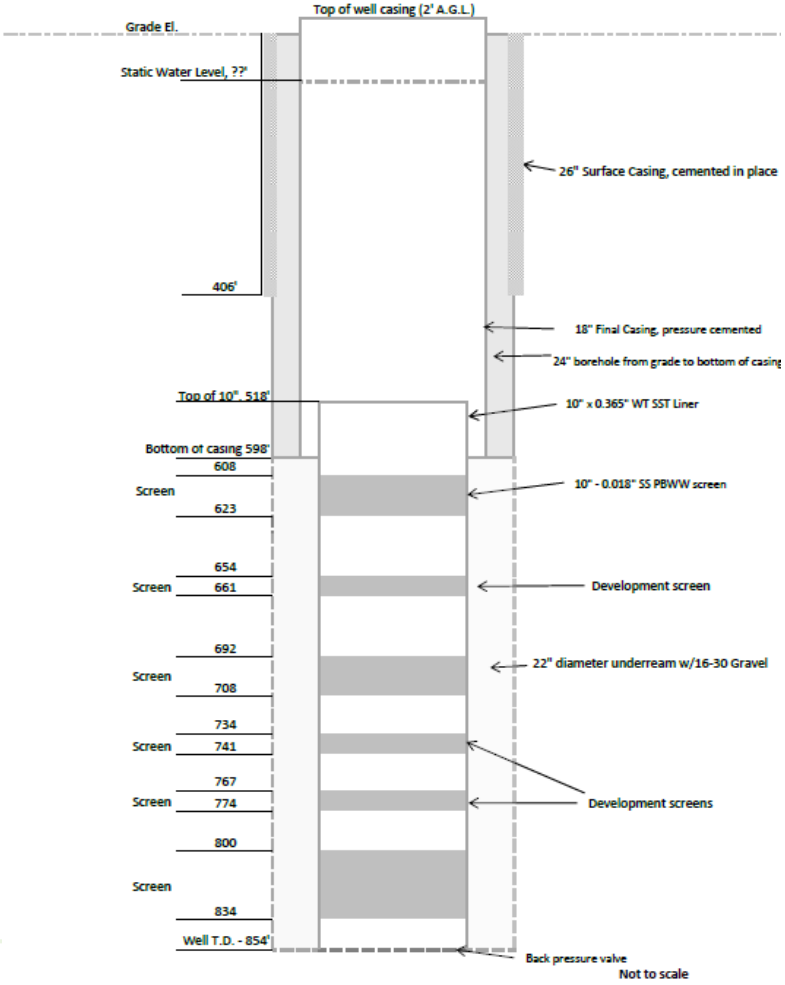

# Geophysical Log Interpretation

- Logging Suite
  - Induction Resistivity
  - Photo Density
  - Compensated Neutron
  - Spectral Gamma Ray Log
- Interpretation made in conjunction with chip samples and grain size analysis
- “Fresh Water” sands identified:
  - 510-528’, 600-625’, 694-708’, 795-834’
- Permeable “Brackish Water” sands identified:
  - 940-980, 1,010-1040, 1,095-1,120’, 1,140-1,220
- Lowermost USDW below 1,270’ ?



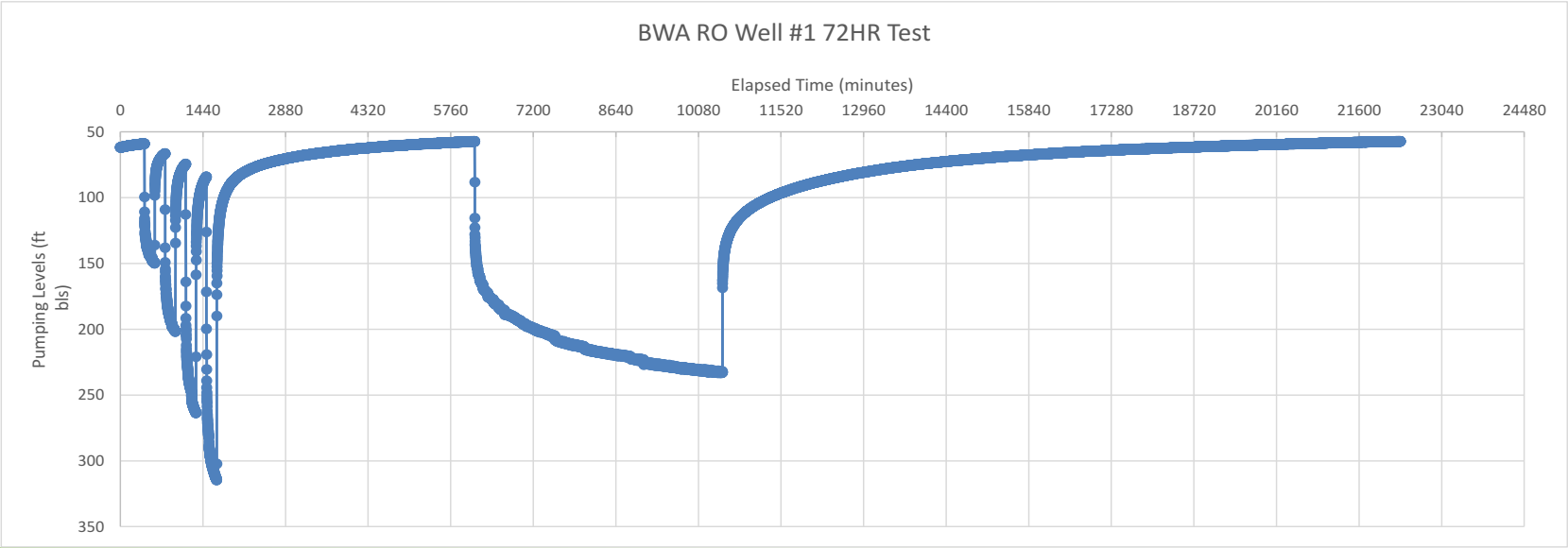
# Screen Design

- Precise screen intervals designed to intersect coarser grained water bearing sands
- Intermediate screened intervals designed to assist with well development and reduce well losses due to screen open area.



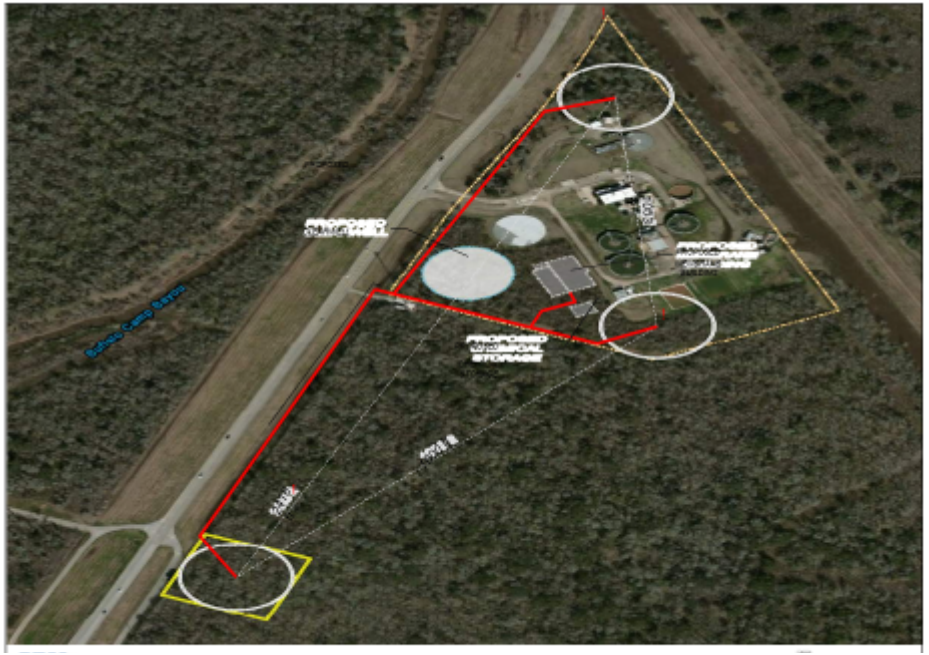
# Results

- Water Quality from upper “Fresh Water Zone” very good, approx. 1,100 mg/L TDS, low SDI’s, but testing up to 1750 gpm confirmed well yield limited to approximately 850 gpm with well spacing still unclear due to slow recovery characteristics
- Water Quality from lower “Brackish Water Zone” uncertain, anticipated to be approximately 4,000 to 6,000 mg/L TDS

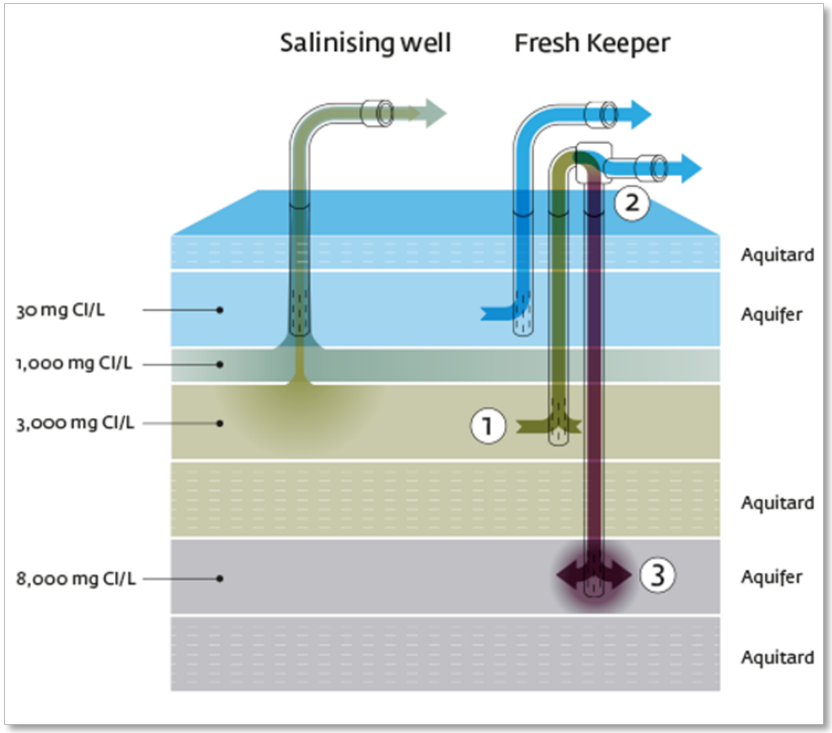


# Alternative Design Concepts

- Construct a lower “Brackish Water Zone” Well (TW2) and confirm water quality and yield
- Construct an upper “Fresh Water Zone” production well (TW3) within 100’ of TW2, confirm water quality and yield, well interference effects with TW1, and vertical hydraulic interaction with TW2
- Simultaneously pump TW2 and TW3 into common raw water main at surface to achieve design yield, operate wells with variable speed pumps to achieve desired blended water quality
- Pending results, further pairs of wells may be constructed



# Freshkeeper Concept




## Concept:

1. Pump (intercept) brackish water
2. Use brackish water as additional drinking water source (BWRO)
3. Dispose BWRO concentrate through deep well injection

# Lessons Learned?

- Understand aquifer dynamics and then design wells accordingly.
  - If a detailed pilot study had not been completed it is possible an entire well field with a much thicker production interval would have been constructed leading to questionable sustainable water quality.
- Key design consideration – separate sand layers with significantly differing water quality
- FRP is a viable casing material, but greater contractor confidence is required in Texas

# Summary

- *BWA is moving forward with an Alternative Brackish Groundwater Supply Project to provide additional water resources for drought periods using innovative solutions, and utilizing aquifers that previously were not well understood*
- *The foundation for successful implementation for Brackish groundwater development is a thorough understanding of the local hydrogeologic setting that then allows sustainable development to proceed*
- *Given the uncertainties, implementation with a phased approach is a logical way to proceed*

# Thank you!