

Stakeholder Meeting #1 Work Order – Brackish Groundwater Commingling Contract No. 2000012442

A Presentation by

Van Kelley, INTERA
Steve Young, INTERA

Texas Water 
Development Board

February 05, 2020

 **INTERA**
GEOSCIENCE & ENGINEERING SOLUTIONS



Agenda

- Conceptual Discussion of Commingling
- Texas Water Well Drillers Advisory Council Summit
 - Summary of Feedback
- Review of Brackish Groundwater Scope of Work
 - Work Order Objectives
 - Scope of Work & Progress
 - Schedule
- Request for Input



Conceptual Discussion of Commingling

Commingling

- What is commingling of groundwater and why would it be a topic of discussion?
- Defined in 16 TAC §76.10(16)
- **Commingling** – the mixing, mingling, blending or combining through the borehole casing or annulus or the filter pack of water *that differ in chemical quality*, which *causes quality degradation* of any *aquifer* or *zone*

16 TAC §76.10(16) Allows for Interpretation

- Meaning of “*differ in chemical quality*”
 - TDS
 - Fresh (<1,000 TDS); Slightly Saline (1,000-3,000 TDS); Moderately Saline (3,000 to 10,000 TDS); Very Saline (10K – 35K)
 - Water Use (Potable, Irrigation, Livestock, Desalination)
 - Primary Drinking Water Standards (Federal and State)
 - Secondary Drinking Water Standards (Federal and State)

- Meaning of “*degradation*”
 - Cross over a classification boundary
 - Prevents a type of use

16 TAC §76.10(16) Allows for Interpretation

- Meaning of “*aquifer*”
 - Definition provided in 30 CFR 710.5
 - Specific Aquifers (Queen City, Chicot, Simsboro)
 - Aquifer Systems (Gulf Coast , Wilcox)
- Meaning of “*zones*”
 - Boundary related to property or well field
 - Water Quality (Freshwater Zone vs Brackish zone)
 - Geochemical facies (Ca-HCO₃ vs Na-Cl)
 - Screened sections in a well

Factors Affecting the Potential for Commingling

- Stratification of Water Quality
 - Caused by regional flow processes (TDS)
 - Caused by specific deposits (Arsenic)
- Vertical Hydraulic Gradients
 - Naturally Occurring (artesian conditions)
 - Pumping Induced (depressurized zones)
- Well Completion
 - Screens intersecting desirable water
 - Casing blocking undesirable water
- Drilling and Well Operations
 - Well (period of non pumping)
 - Borehole (time left open)

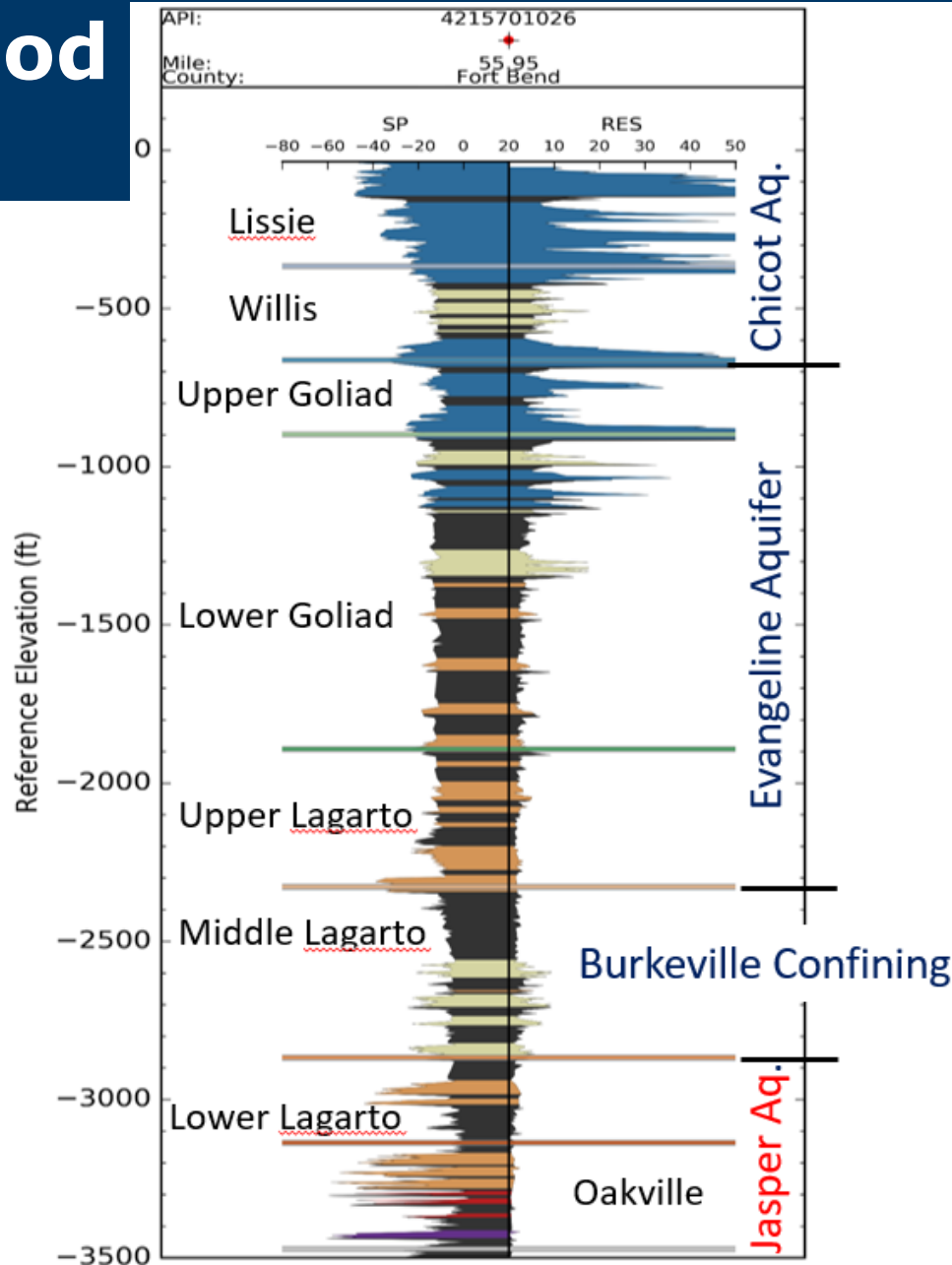
Indirect Method for TDS

- Geophysical logs provide indirect data on:
 - Lithology
 - Water Quality (TDS)
 - Stratification

Sands

Quality	TDS (mg/L)
Fresh	< 1,000
Slightly Saline	1,000 - 3,000
Moderately Saline	3,000 - 10,000
Very Saline	10,000 - 35,000
Brine	> 35,000

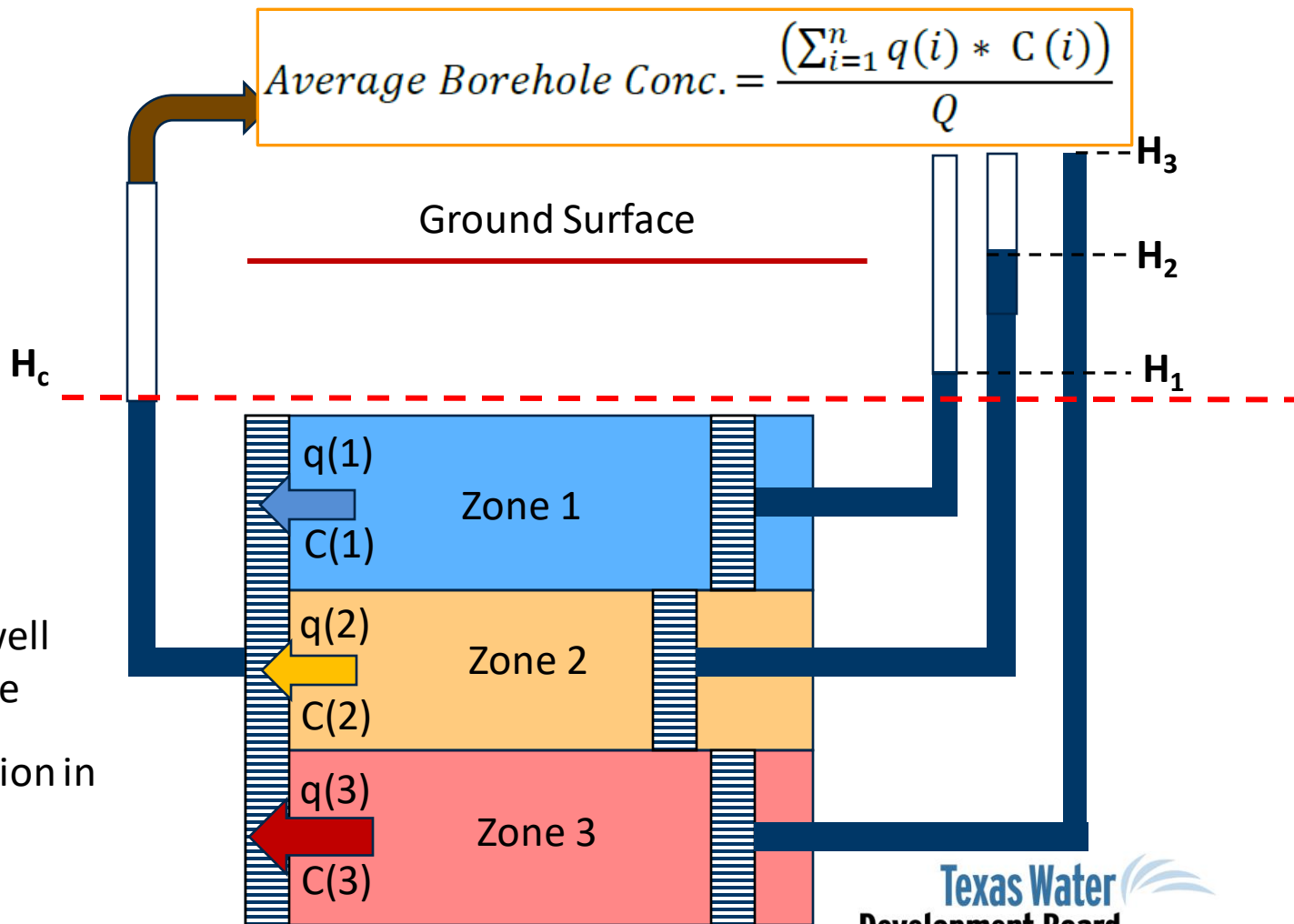
Shale



Zonal Flow in a Pumping Well: Conceptualization

Commingling occurring in well but there is no potential for commingling to cause degradation in an aquifer or a zone

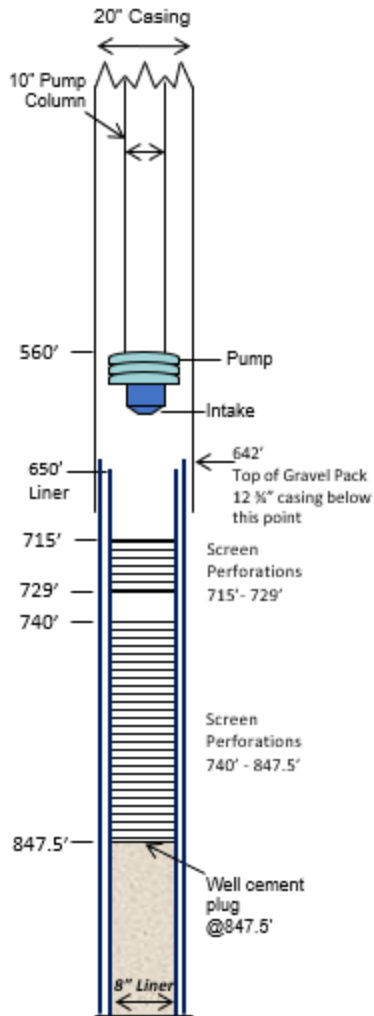
$$\text{Average Borehole Conc.} = \frac{(\sum_{i=1}^n q(i) * C(i))}{Q}$$



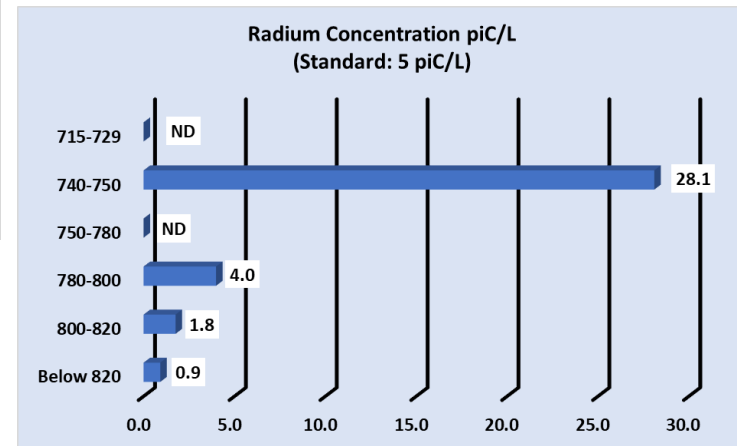
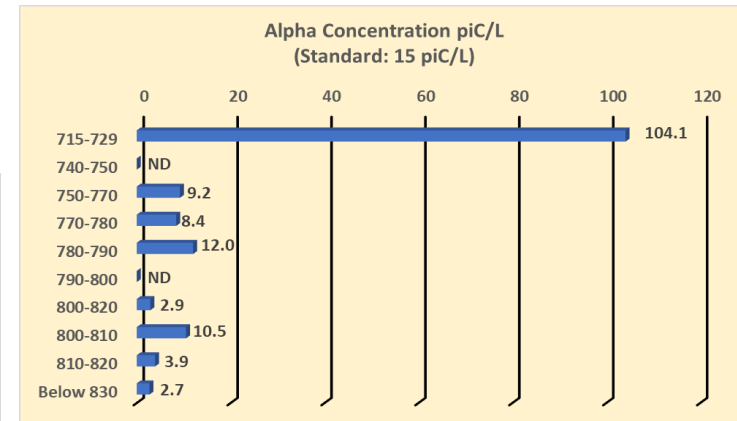
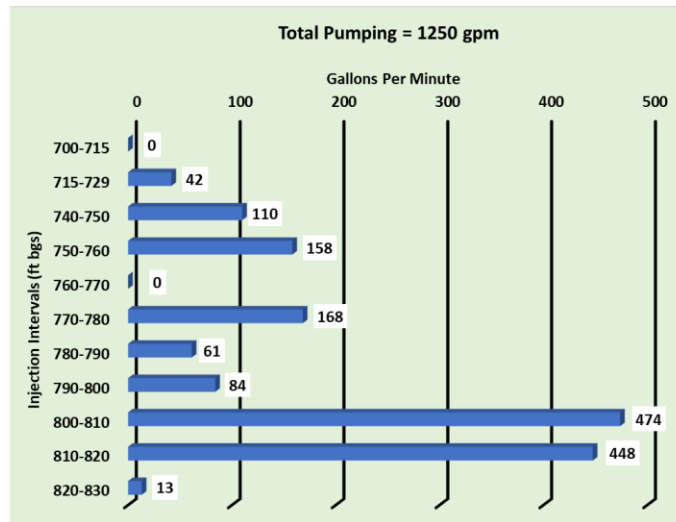
q = flow into well from a Zone

C = concentration in a zone

Direct Information of Zonal Flow and Water Quality



Data from a Well in Harris County*



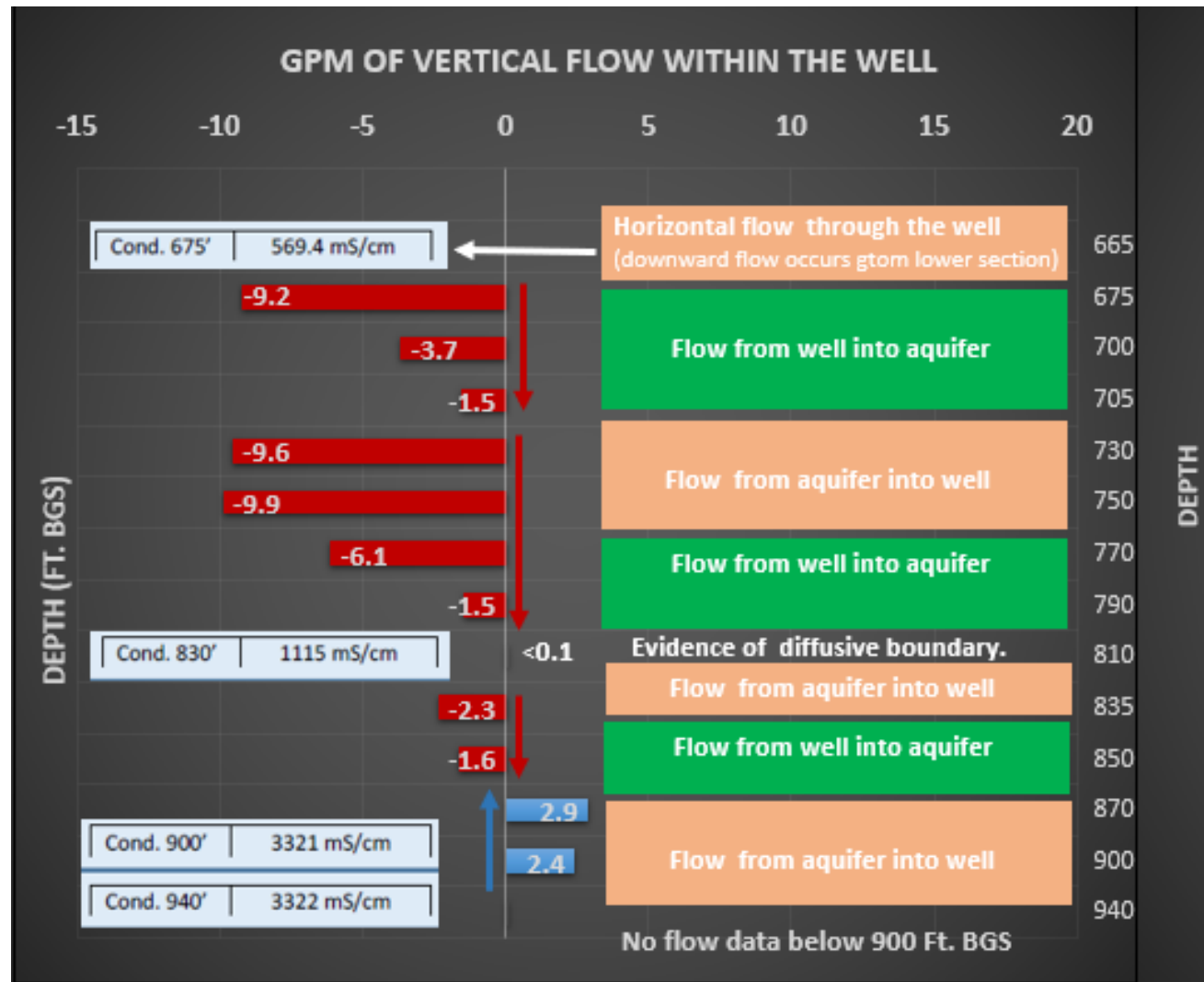
Direct Information of Ambient Zonal Flow in a Well*

Data from a Well in Comal County*

Vertical Flow within the Borehole

downward 

upward 





Review of TDLR Water Well Drillers Advisory Council Summit

TDLR Water Well Drillers Advisory Council Summit

- Held August 17th, 2018
- Workgroup developed **5 questions** regarding commingling of groundwater

Texas Department of Licensing and Regulation
TEXAS WATER WELL DRILLERS ADVISORY COUNCIL SUMMIT
Friday, August 17, 2018 at 9:00 a.m.
North Campus Building, 1st Floor Public Meeting Room, Suite 125E
1106 Clayton Lane – Austin, TX 78723

SUMMIT AGENDA

If you require auxiliary aids, services or materials in an alternate format contact the Texas Department of Licensing and Regulation at least 5 working days prior to the meeting date. Phone: (512)475-4765, FAX: (512)475-2874, E-MAIL: Advisory.Boards@tdlr.texas.gov, TDD/RELAY TEXAS: 1-800-relay-VV (voice), 1-800-relay-TX (TDD).

Watch the meeting on TDLR's YouTube channel at –
<https://www.youtube.com/user/TexasLicensing>

- A. Roll Call, Certification of Quorum, and Call Summit to Order
- B. Presentations on Water Well Related Groundwater Commingling Issues by Regulatory Program Management Division (RPM) Staff:
 - Welcome and Introductions
 - Overview of the workgroup process, determinations and the information gathered
 - Current water well construction standards for wells encountering injurious water

1. Define (groundwater) Degradation. 76.10 (16) & (19) - 76.100 (c)(1) & 76.105 (b)(3)
2. Identify the amount of time and what conditions must be met for a test well to stay open. 76.100 (c)(6)
3. What is the minimum well construction standards to produce brackish water? 76.102.
4. Would mixing 20,000 mg/l with 30,000 mg/l brackish water be considered commingling.
5. Define aquifers and zones. 76.10 (16)

<https://www.youtube.com/watch?v=GhxWjjLjbwA>

TDLR Water Well Drillers Advisory Council Summit

- Significant number of stakeholders requested additional stakeholder interaction prior to any rule modifications as well as clear identification of the objectives of any modifications

Organization	Input
Texas Oil and Gas Association	Written and Verbal
Texas Alliance of Groundwater Conservation Districts	Written
Texas Groundwater Association	Written and Verbal
Texas Groundwater Protection Committee	Written
Texas Commission on Environmental Quality	Written
Texas Water Development Board	Written
Texas Desalination Association	Written
Panola Co. Groundwater Conservation District	Verbal
Rusk Co. Groundwater Conservation District	Verbal
Independent PG	Verbal

TDLR Water Well Drillers Advisory Council Summit

- Statutes cited by those providing written or verbal input
 - 16 TAC 76
 - TWC Chapter 26 – Water Quality Control
 - TWC Chapter 27 – Injection Wells
 - TWC Chapter 36 – Groundwater Conservation Districts
 - Several federal regulations

Issue	Regulations / Statutes
Degradation	Water Quality Control - TWC Chapter 26.401-408
	WWD and WWPI Rules - 16 TAC 76.10(42) among others
	WWD and WWPI Rules - 16 TAC 76.10(42)
Time Borehole Open	WWD and WWPI Rules - 16 TAC 76.10(42) analogous to PWS program
	WWD and WWPI Rules - 16 TAC 76.100(c) (6)
Minimum Stnds for BRAC well	Minimum Public Drinking Water - 30 TAC 290 Chp F (assumes BW is a PWS)
	WWD and WWPI Rules - 16 TAC 76.102 but no other
	WWD and WWPI Rules - 16 TAC 76.101(a)(2)
Is this Comingling (20K v 30 k)	WWD and WWPI Rules - 16 TAC 76.10(16)
	WWD & WWPI Rule 16 TAC 76.10(16) and I<10K TDS protected under Injection Well Act -TWC Chp 27 and the federal CWA
Define Aquifer and Zone	TWDB Definitions
	10 CFR 40, App A; 10 CFR 960.2; 30 CFR 710.5; 40 CFR 146.03, 260.10, 270.2; 40 CFR 257.3-4
	RCRA, CERCLA, Safe DW Act and Clean Water act (CWA)
	TWC Chapter 36.001(6), (7) USGS definition of aquifer

Summit Input - Degradation

- No definition so proposed to default to “**Pollution**” defined in TAC 76.10 (42)
 - *The alteration of the physical, thermal, chemical, or biological quality of, or the contamination of, any water that renders the water harmful, detrimental, or **injurious** to humans, animals, vegetation, or property, or to public health, safety, or welfare, or impairs the usefulness or the public enjoyment of the water for any or reasonable purpose. (same as 30 TAC 331.10(86) – UIC)*
- Also referred to TWC 26.401-408, Subchapter J, Groundwater Protection
 - *26.401(c) It is the policy of this state that: (1) discharges of pollutants, disposal of wastes, or other activities subject to regulation by state agencies be conducted in a manner that will **maintain present uses and not impair potential uses of groundwater or pose a public health hazard**; and.....*

Summit Input – 20K v 30K TDS

- Differing opinions as to whether mixing 20,000 with 30,000 TDS groundwater is commingling
- Some considered it commingling based upon a strict interpretation of the definition 76.10(16)
- Texas Groundwater Protection Committee did not consider it commingling because both TDS levels are within the same salinity class (also considered use)
- Several others suggested that if the proposed use was maintained, it was likely not commingling
 - Another suggested that use had to be combined with origin from the same aquifer



Review of Brackish Groundwater Commingling Task Order

Study Objectives and Outcomes

- Objective of Study – To document a scientific assessment of brackish groundwater commingling issues statewide and with a focus on select aquifer/regions.
- Desired Outcomes – Provide documentation to support further discussions on the definition of commingling and what possibly qualifies as commingling in a brackish groundwater setting.

Scope of Work

Task Number	Task Description
Task 1	Project Management
Task 2	Stakeholder Outreach
Task 3	Review of Statutes and Terminology
Task 4	Statewide Assessment of Comingling Issues
Task 5	Assessment of Select Aquifers/Regions
Task 6	Review of Findings
Task 7	Recommendations and Need for Future Study
Task 8	Reporting

Task 2: Stakeholder Outreach

- Objective:
- Receive input from key stakeholders regarding key issues related to comingling as it relates to brackish groundwater
- Meetings – the scope of work specified two stakeholder meetings.
 - The second meeting would be scheduled later in the year
 - *However, please feel free to contact myself or James at any point during the project to provide input or insight*

Task 3: Review of Statutes and Terminology

- Review applicable code and statutes which may be relevant to brackish groundwater commingling
- Document relevant definitions as they apply to the concepts of commingling of brackish groundwater
- Used key terms to guide:
 - Commingling,
 - Degradation,
 - Injurious,
 - Pollution and
 - Beneficial Use



Task 3: Review of Statutes and Terminology

TEXAS ADMINISTRATIVE CODE		
TITLE	PART	CHAPTER / SUBCHAPTER
<i>TAC Title 16 - Economic Regulation</i>	Part 1 - RRC	Chapter 3 - Oil and Gas Division
	Part 4 - TDLR	Chapter 76 - WWD & WWPI Rules
<i>TAC - Title 30 - Environmental Quality</i>	Part 1 - TCEQ	Chapter 3 - Definitions
	Part 1 - TCEQ	Chapter 293 C - Reqs for GW Conservation Districts
	Part 1 - TCEQ	Chapter 290 D - Rules and Regs PWS Systems
	Part 1 - TCEQ	Chapter 290 F - DW Standards and Reporting for PWS
	Part 1 - TCEQ	Chapter 331 - Underground Injection Control
<i>TAC - Title 31 - Natural Resources</i>	Part 10 - TWDB	Chapter 356 - Groundwater Management
	Part 18 - Texas GWPC	Chapter 601 - Groundwater Contamination Report
TEXAS STATUTES		
TITLE	PART	SUBJECT
<i>TAC Title 12 - Occupations Code</i>	Subtitle A	Chapters 1901 & 1902
<i>Texas Water Code</i>	Chapter 5	TCEQ
<i>Texas Water Code</i>	Chapter 6	TWDB
<i>Texas Water Code</i>	Chapter 26	Water Quality Control
<i>Texas Water Code</i>	Chapter 27	Injection Wells
<i>Texas Water Code</i>	Chapter 28	Water Wells and Drilled or Mined Shafts
<i>Texas Water Code</i>	Chapter 35	Groundwater Studies
<i>Texas Water Code</i>	Chapter 36	Groundwater Conservation Districts

Task 3: Commingling

- Only definition of commingling in the statutes and codes reviewed was 16 TAC 76.10(16)
- **Commingling** – the mixing, mingling, blending or combining through the borehole casing or annulus or the filter pack of water *that differ in chemical quality*, which *causes quality degradation* of any *aquifer* or *zone*
- 16 TAC 76 has no definition of degradation

Task 3: Commingling

- Is commingling meant to protect mixing with fresh water or any other water quality?
 - **76.100(1) Technical Requirements--Locations and Standards of Completion for Wells** - All wells shall be completed so that aquifers or zones containing waters *that differ in chemical quality are not allowed to commingle* in the casing, borehole annulus or the filter pack and cause quality degradation of any aquifer or zone.
 - **76.103. Technical Requirements--Re-completions** - The landowner shall have the continuing responsibility of ensuring that a well does not allow the *commingling of injurious water with fresh water* through the wellbore to other porous strata.
 - **76.105 (a) & (c). Technical Requirements--Standards for Water Wells (Drilled before June 1, 1983).** - *commingling of aquifers or zones of water of different quality*

Task 3: Commingling

- The UIC Code (30 TAC 331) cites prevention of commingling in Subchapter H Standards for Class V Wells (331.132)
 - (g) *Other protection measures. (1) **Commingling prohibited.** All wells, especially those that are gravel packed, shall be completed so that aquifers or zones containing waters **that are known to differ significantly in chemical quality** are not allowed to commingle through the borehole-casing annulus or the gravel pack and cause quality degradation of any aquifer containing **fresh water.***
- Subchapter K Standards for ASR Class V Wells (331.183 & 186) referring to ASR mixing “bubble”.

Task 3: Degradation

- *Degradation* is the qualifying word in the definition of commingling. It is not defined but does show up across several codes and statutes.
- The term *nondegradation* is in the definition of pollution in TWC 26 Water Quality Control
- Subchapter J - Groundwater Protection: 26 TWC 401(b) and (c) state:
 - (b) The legislature determines that, ..., it is the goal of groundwater policy in this state that the existing quality of groundwater not be *degraded*. This goal of *nondegradation* does not mean zero-contaminant discharge.
 - (c) It is the policy of this state that: (1) discharges of pollutants, disposal of wastes, or other activities subject to regulation by state agencies be conducted in a manner that will **maintain present uses and not impair potential uses of groundwater or pose a public health hazard**; and....

Task 3: Pollution & Injurious

- **“Pollution”** defined in 16 TAC 76.10 (42)
 - *The alteration of the physical, thermal, chemical, or biological quality of, or the contamination of, any water that renders the water harmful, detrimental, or **injurious** to humans, animals, vegetation, or property, or to public health, safety, or welfare, or impairs the usefulness or the public enjoyment of the water for any or reasonable purpose. (same as 30 TAC 331.10(86) – UIC)*
- **“Injurious”** defined in 16 TAC 76.10 (33)
 - *Water that is harmful to vegetation, land or other water as set forth in §1901.254(a) and §1902.252(a) of the Code.*
 - Texas Occupations Code does not define **injurious** however the context is injurious is to avoid injury or pollution.

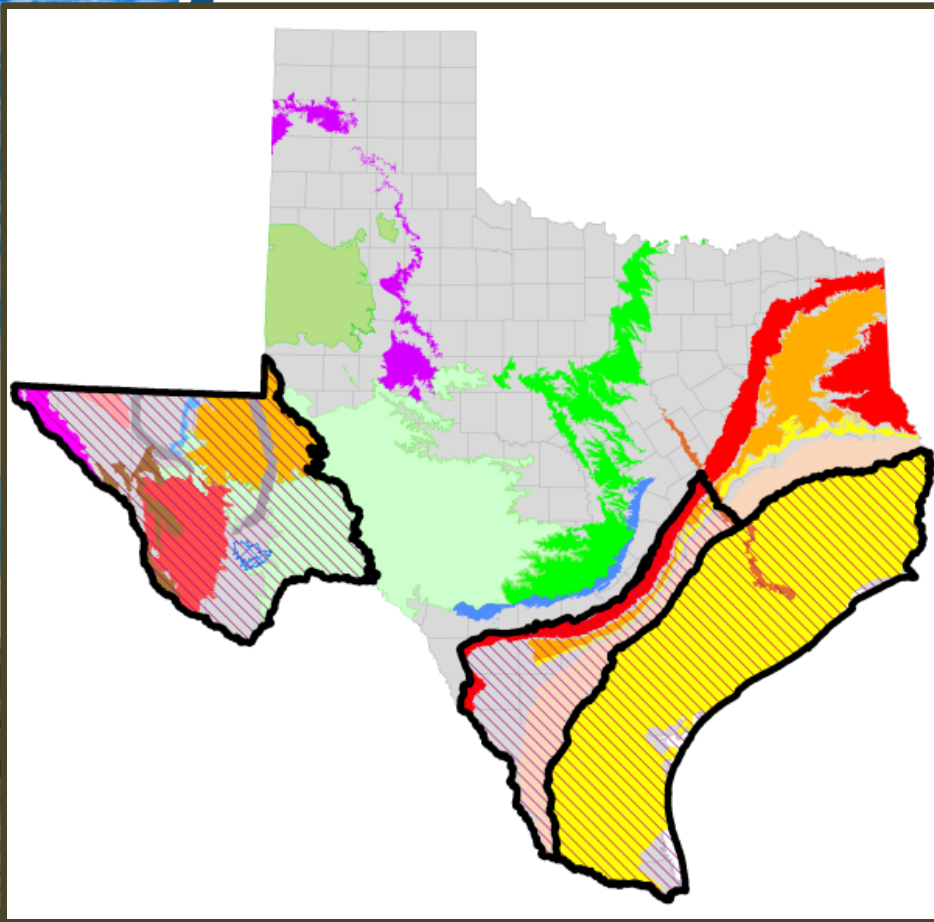
Task 3: Contamination

- **“Contamination”** defined in 30 TAC Subchapter D- Public Water Systems 30 TAC 290(17)
 - *The presence of any foreign substance (organic, inorganic, radiological, or biological) in water which tends to degrade its quality so as to constitute a health hazard or impair the usefulness of the water.*
- **“Groundwater Contamination”** in Texas Groundwater Protection Committee 31 TAC 601.3(7) –
 - *... groundwater contamination, ...is limited to contamination ...and affecting groundwater that contains a concentration of: (A) less than or equal to 10,000 milligrams per liter (mg/liter) of dissolved solids; or (B) greater than 10,000 mg/liter of dissolved solids if it is: (i) currently extracted for beneficial use such as domestic, industrial, or agricultural purposes; or (ii) hydrologically connected with, and with the potential for contaminant movement to, a surface waterbody or another zone of groundwater that has a concentration of less than or equal to 10,000 mg/liter of dissolved solids.*

Task 3: Review of Statutes and Terminology

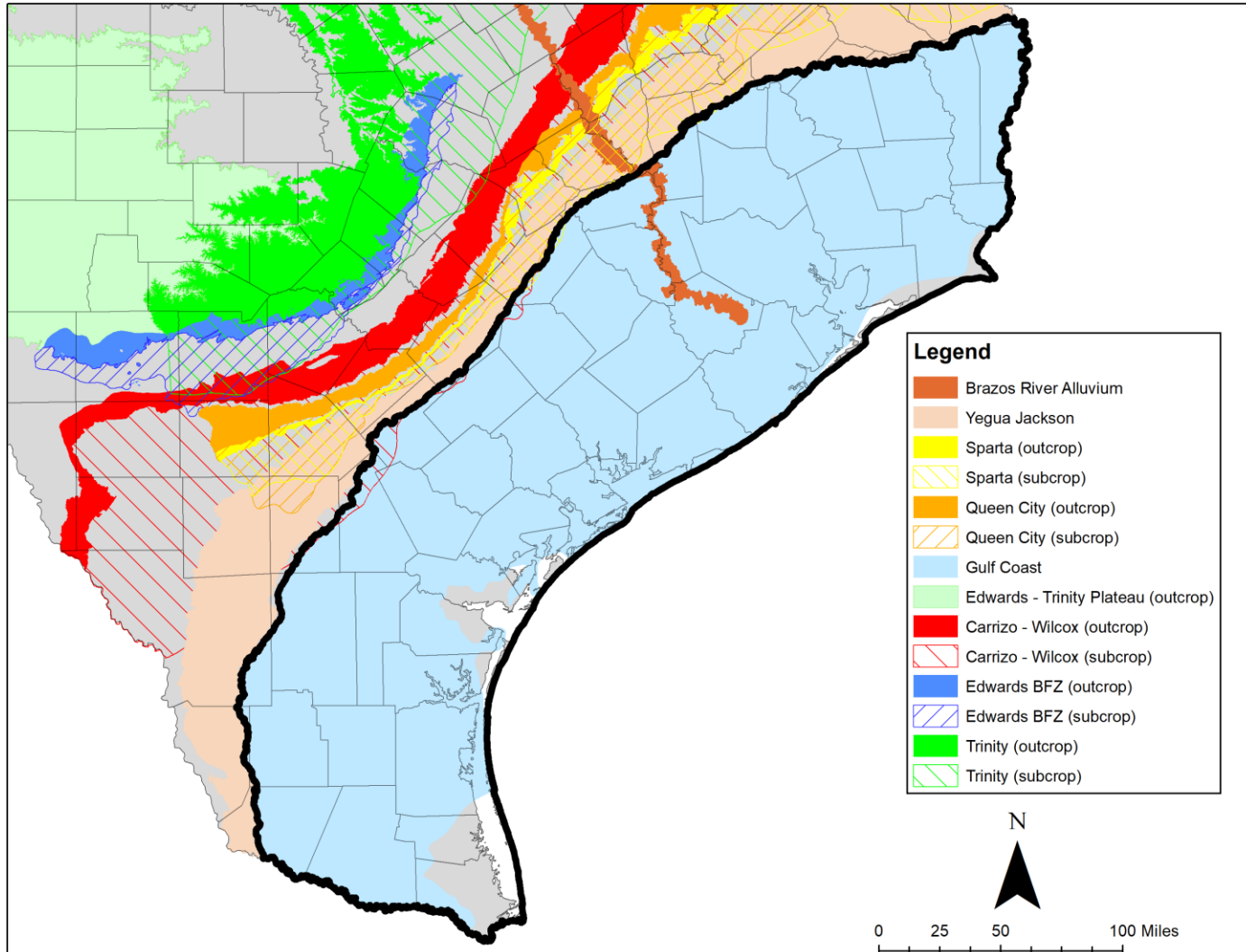
- Review of statutes and codes will be draft documented in February – *in progress*
- Finds that there is no clear definition of what should constitute “commingling”
- It is clear prevention of commingling is meant to protect human health and the environment
- It is not clear how TDS thresholds (such as 1,000 and or 10,000 mg/L TDS) or groundwater use should be considered in the determination of commingling

Task 5 - Assessment of Select Aquifer/Regions

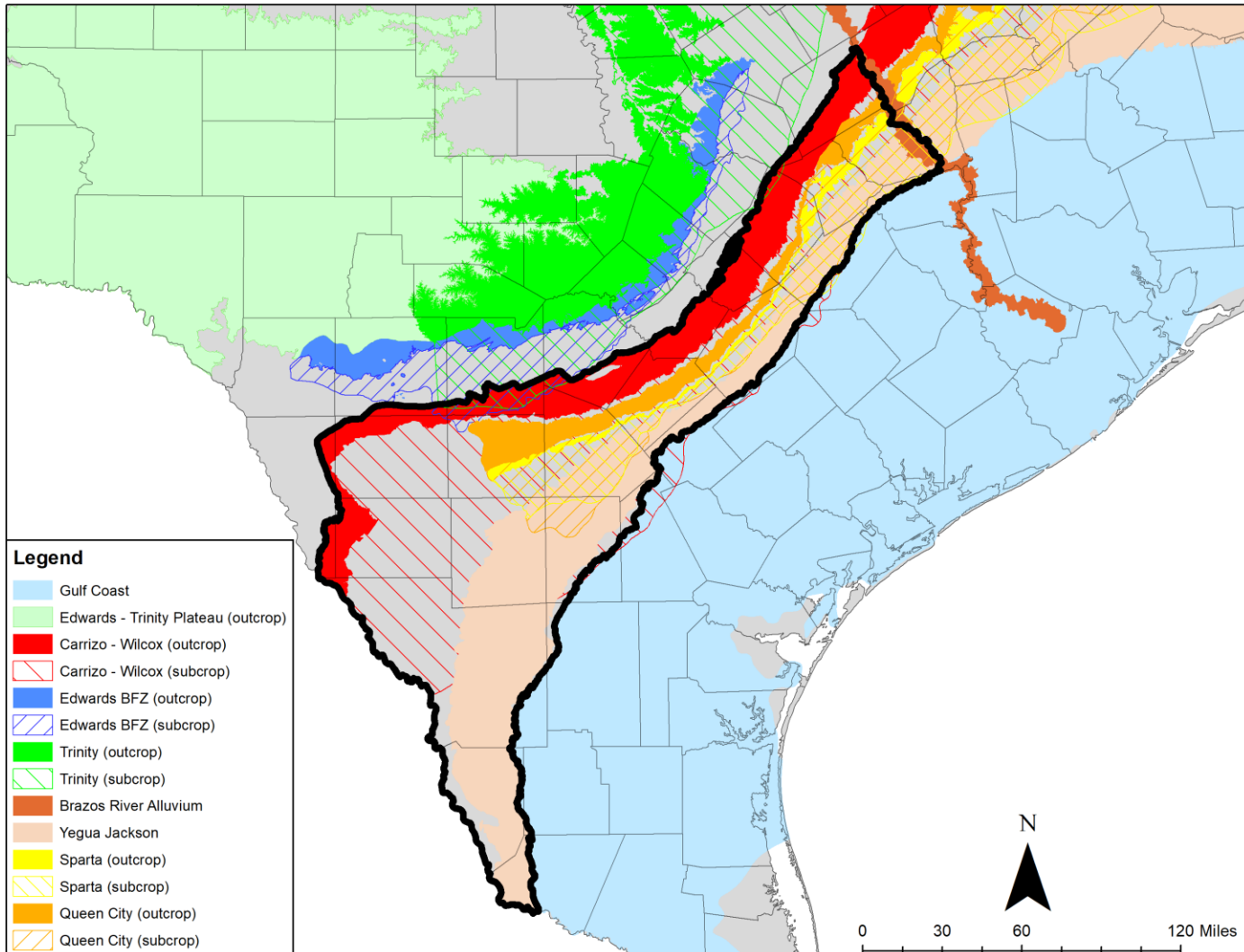


- Develop data driven assessments of potential for comingling in the following aquifers/regions:
 - Gulf Coast Aquifer System
 - Eagle Ford Region Aquifers
 - Trans Pecos Aquifers
- This assessment will look at typical well completions and their potential to cause commingling

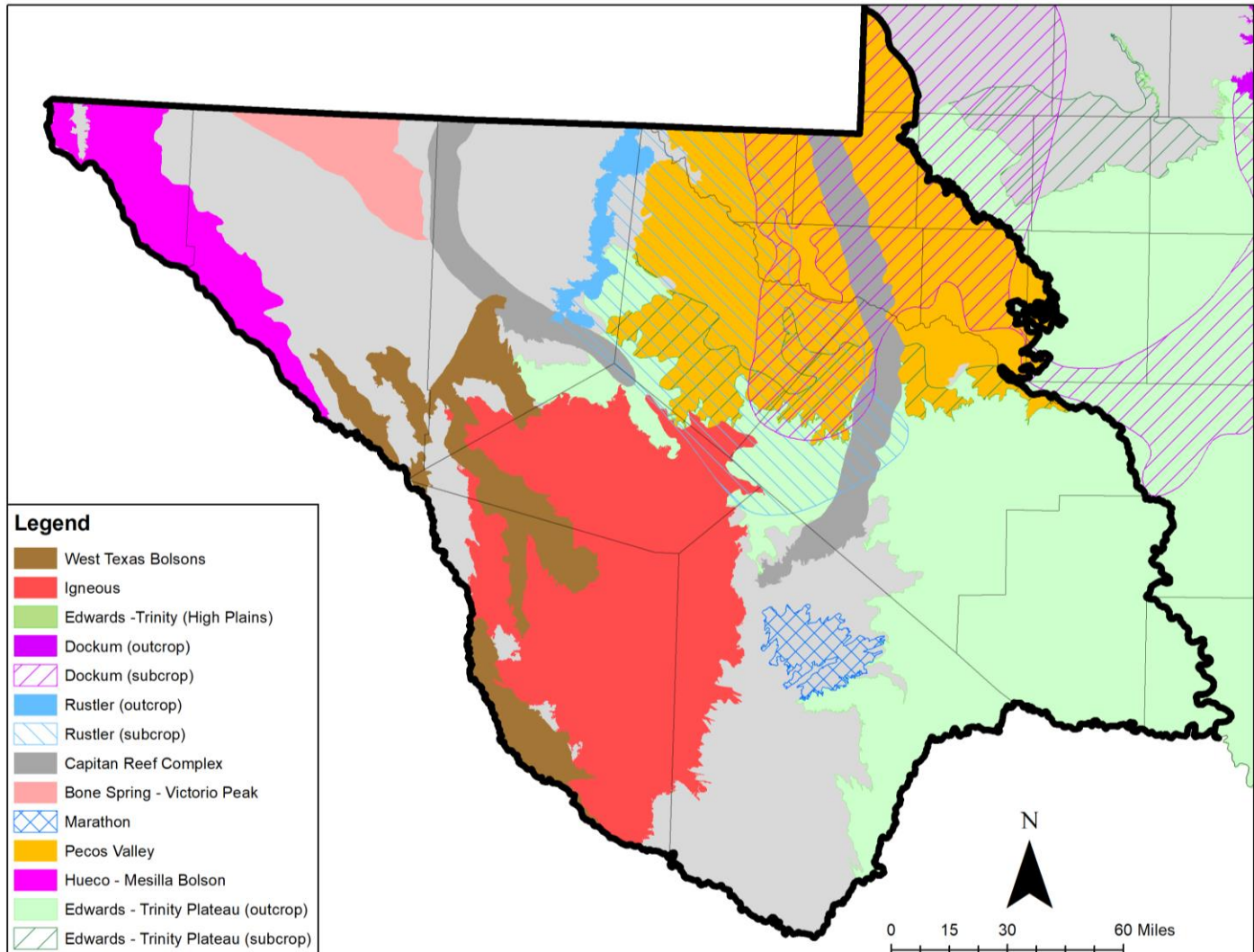
Select Aquifer/Regions – Gulf Coast Aquifers



Select Aquifer/Regions – Eagle Ford



Select Aquifer/Regions – Trans Pecos

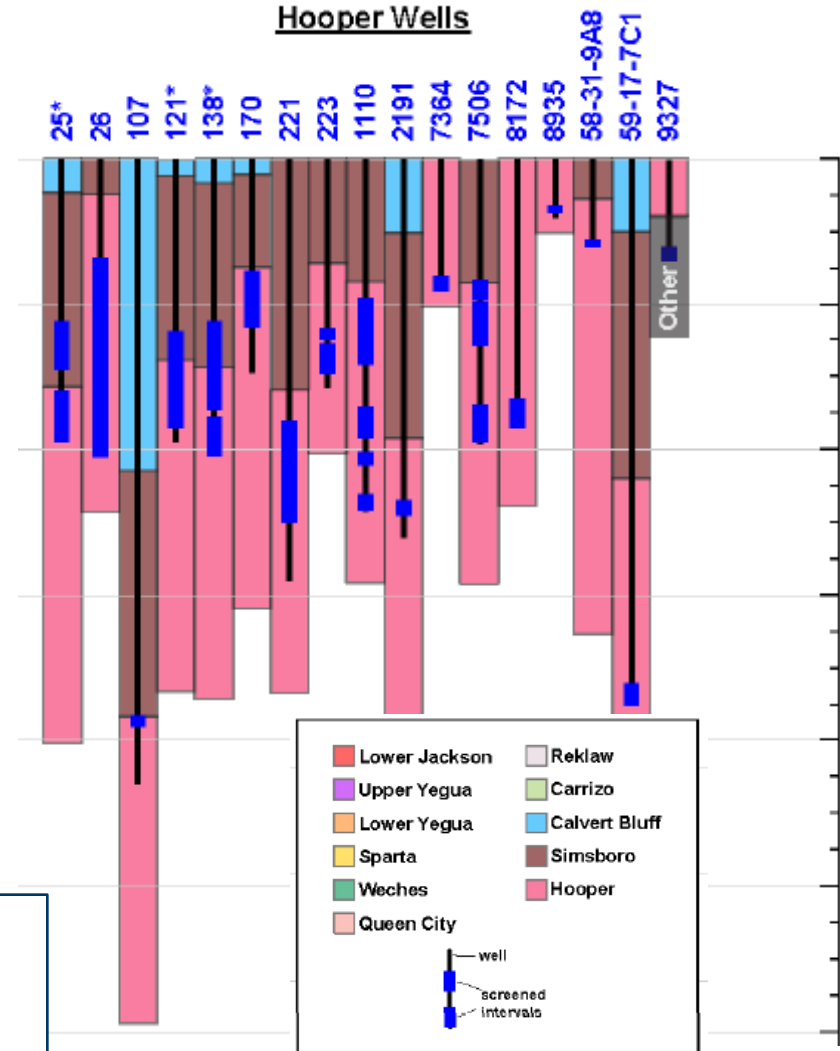
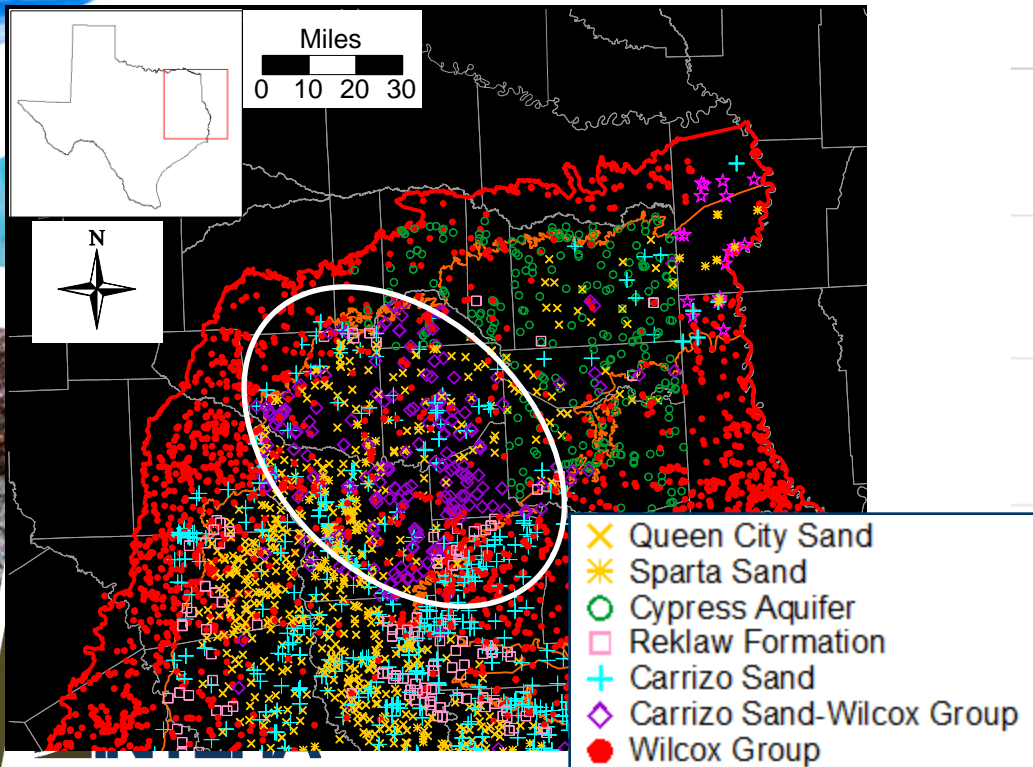


Task 5 – Assessment of Select Aquifer/Regions

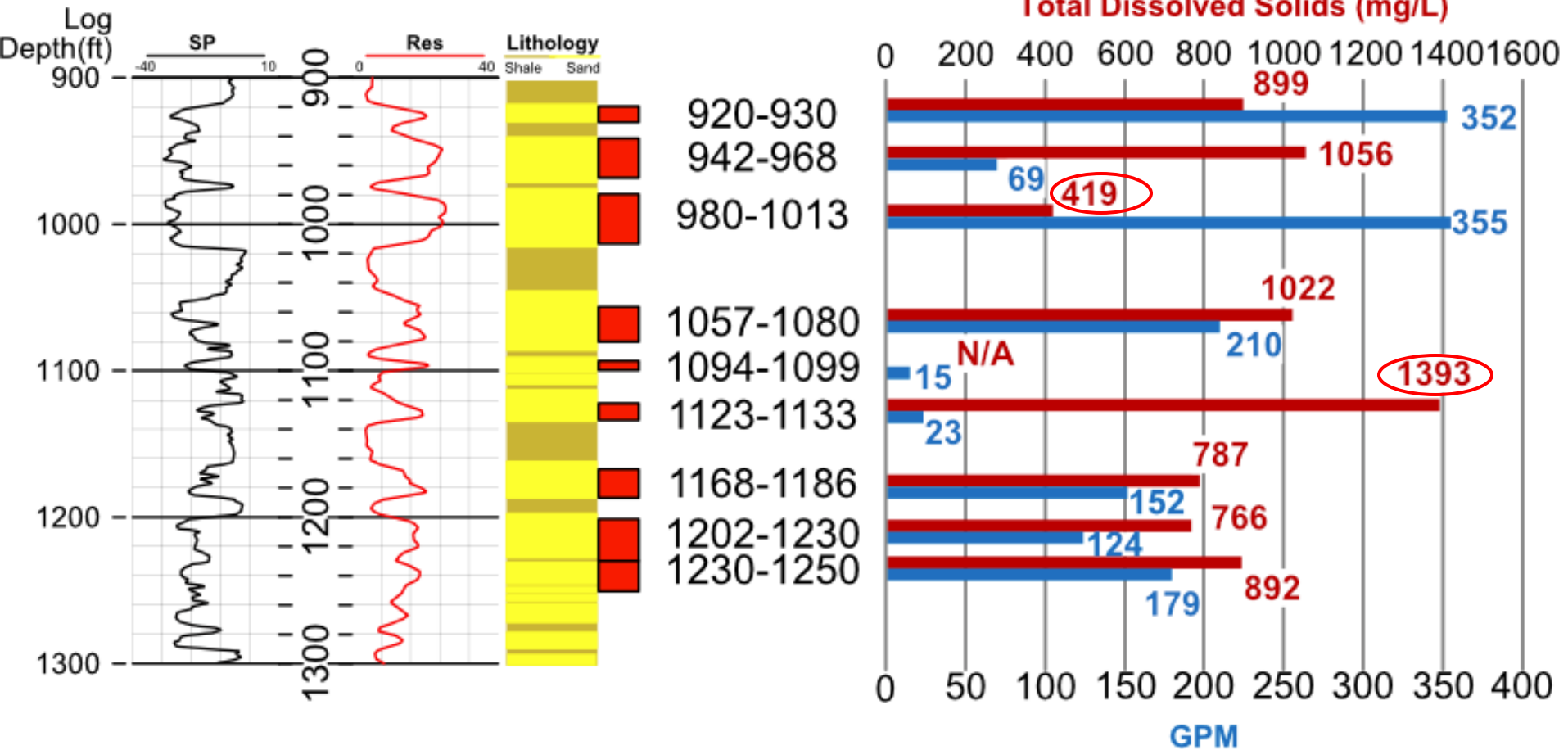
- Conditions that could cause brackish commingling
 - Presence of brackish groundwater
 - Vertical variability in aquifer or zonal water quality
 - Vertical lithologic stratification of aquifers
 - Vertical head gradients
 - Well completions that co-complete brackish zones with freshwater or chemically differing brackish zones
- We will use regional data, logs and aquifer studies to estimate water quality and will seek publicly available zonal water quality data.
- We will review well completion practices in these aquifers to understand how they may cause comingling of brackish groundwater

Task 5 – Assessment of Select Aquifer/Regions

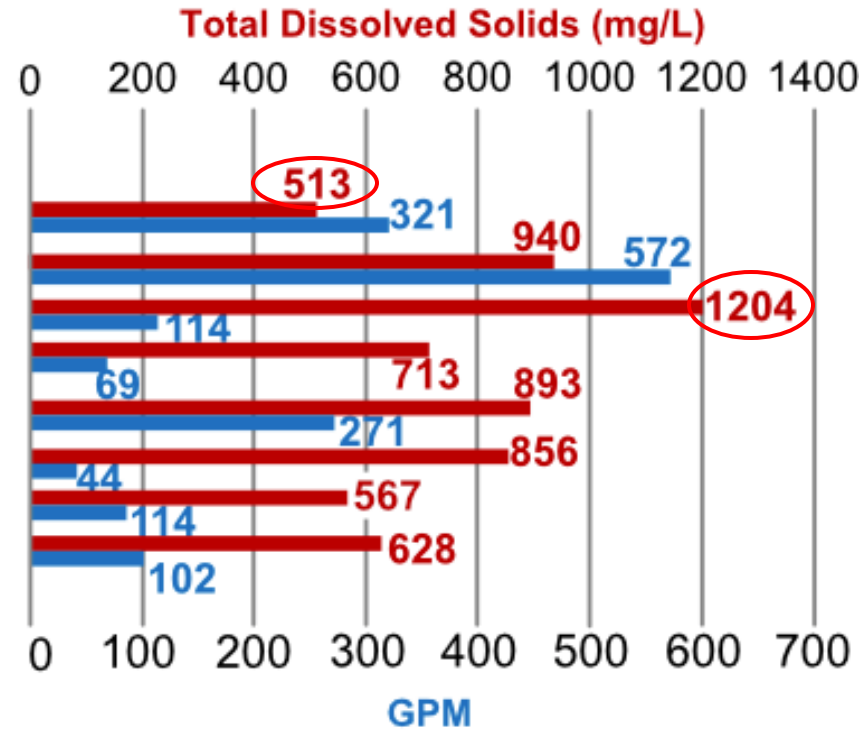
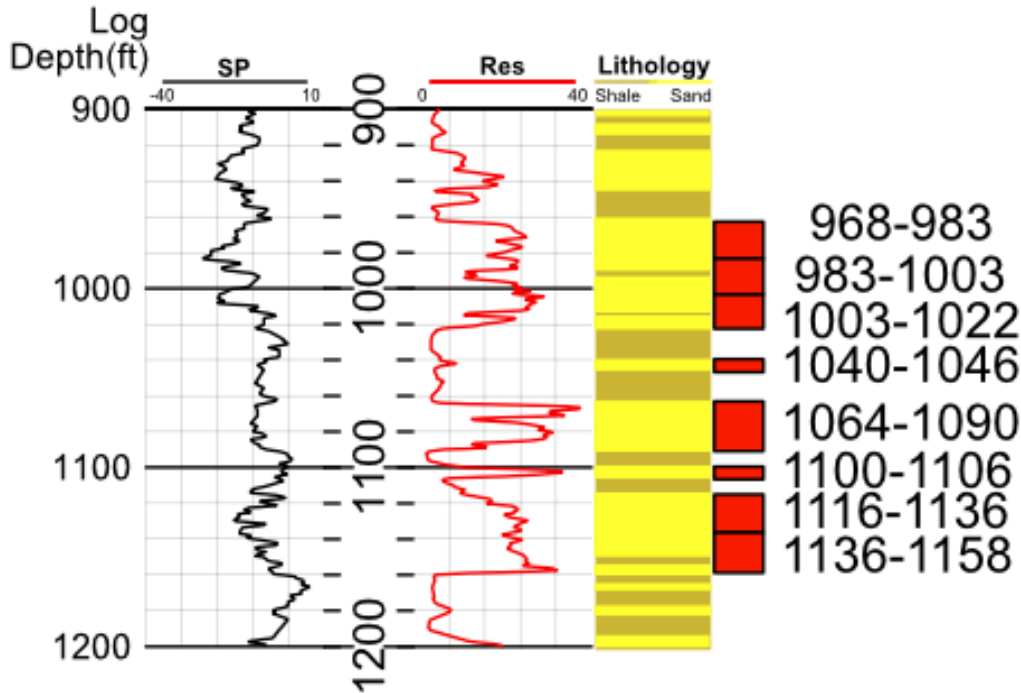
- Example: We will use a combination of graphics and statistics to characterize well completions across multiple aquifers



Zonal Sampling - Gulf Coast Aquifer



Zonal Sampling – Gulf Coast Aquifer



Task 5 – Assessment of Select Aquifer/Regions

- Develop conceptual models and supporting data to identify the key issues related to water quality commingling in each of the focus areas.
- The data and conceptual models will provide a basis to offer opinions regarding where comingling can occur
- Discuss comingling from a brackish groundwater perspective – what is comingling in a brackish reservoir
- A discussion of well completion standards that would limit the potential for comingling

Task 4 – Statewide Assessment of Commingling Issues

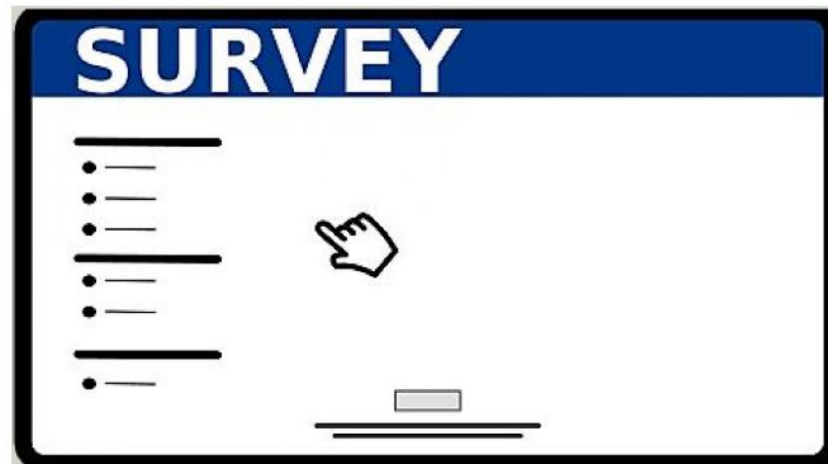
- Based upon what we learn in Task 5, we will perform a much more general statewide assessment of commingling issues as they relate to brackish groundwater
- Based upon definition of several evaluation criteria (can be qualitative or quantitative) which measure the relative potential for an aquifer to have commingling of *brackish groundwater with brackish, fresh or saline groundwater*
- Each criterion will describe an aquifer condition that could describe suitability for commingling of groundwater through a well bore.

Schedule

Task	2020			2021					
	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June
1.0 Project Management									
2.0 Stakeholder Outreach					▼				▼
3.0 Review of Statutes and Terminology					▼				
4.0 Statewide Survey									▼
5.0 Regional Aquifer Survey									▼
6.0 Review of Findings									▼
7.0 Recommendations, Need for Future Study									▼
8.0 Reporting									
▼ Draft Report/Section Submittal									

Input Please

- Please feel free to contact me on any issues you would like to discuss regarding this work order
- We will be sending out a survey to those stakeholders attending today to solicit input on issues associated with commingling and we would appreciate your participation



Questions / Input



Van Kelley

vkelly@intera.com

512-569-0689

James Golab

james.golab@twdb.texas.gov

512-475-1540