Delineating Buffer Zones for Brackish Water Resource Protection in Texas

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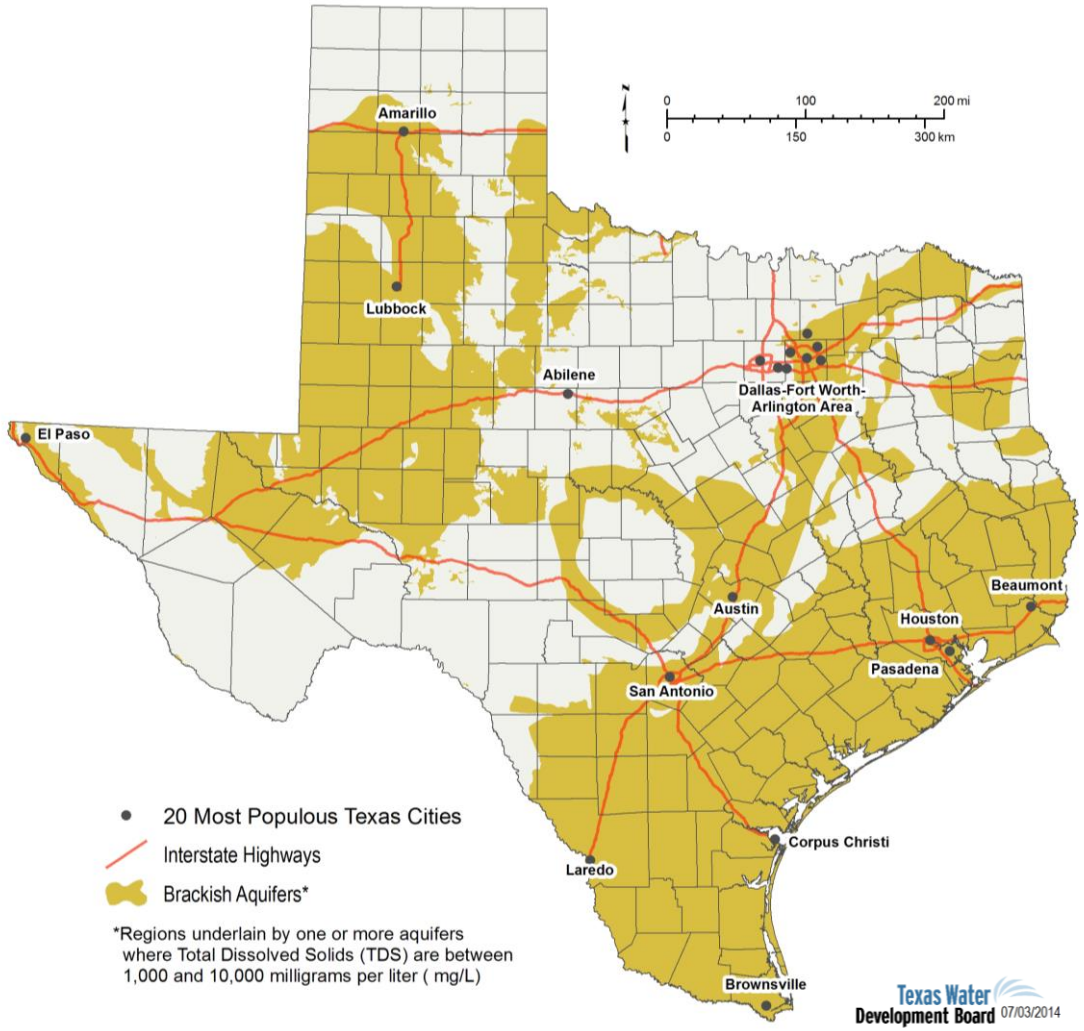
Presentation Outline

1. Background
2. Objectives
3. Approach
4. Tools and Methods
5. Key Limitations
6. Summary

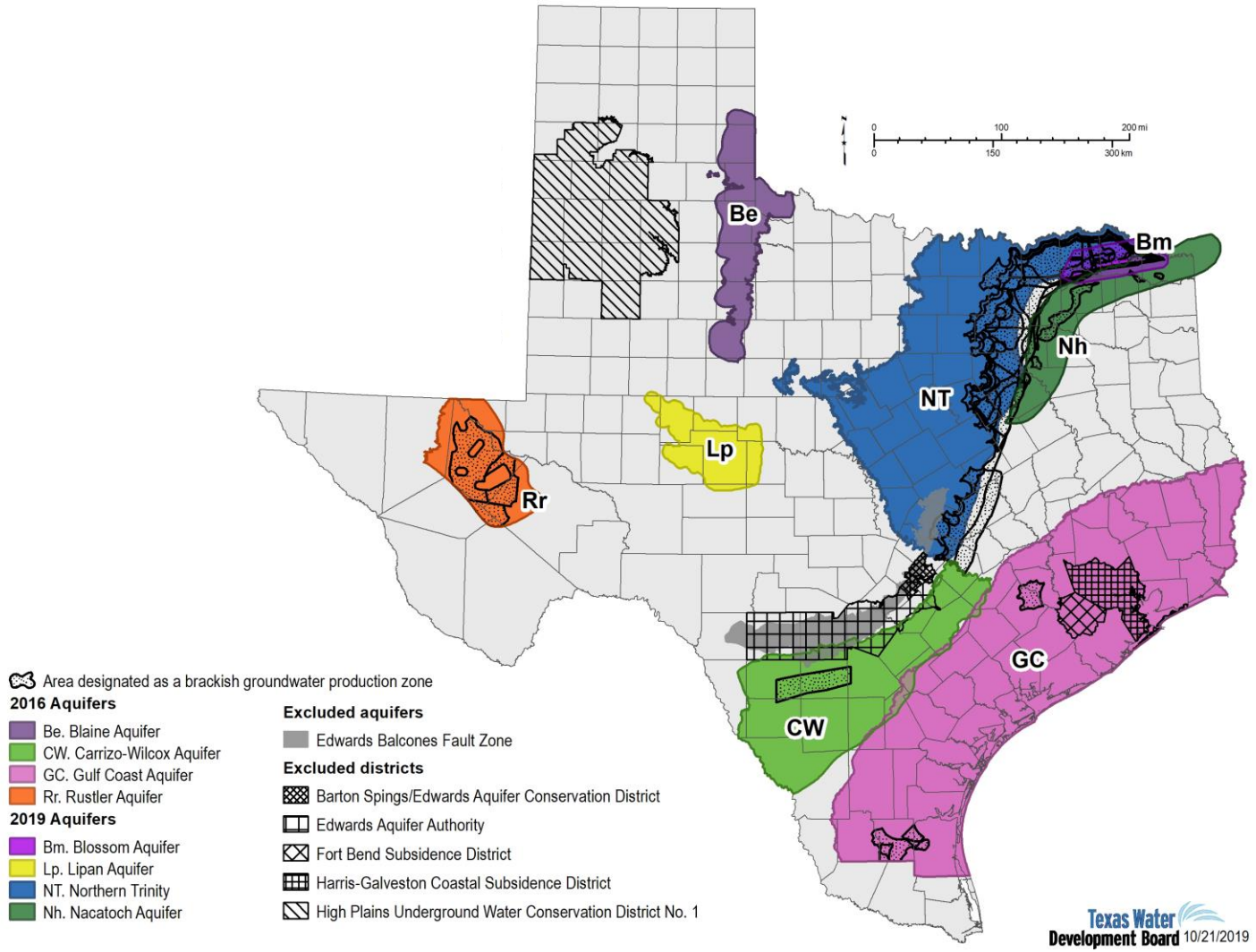
1. Background – Brackish Groundwater

- Brackish groundwater is defined as water with TDS between 1,000 and 10,000 mg/L
- Texas House Bill (HB) 30 identifies brackish groundwater as a vital resource
- Texas has tremendous resources in brackish groundwater
  - Increasing water demands
  - Increasing water rights costs
  - Decreasing freshwater supplies
  - Stricter drinking water standards
  - More cost-effective desalination technology



1. Background – Buffer Zones

- Buffer existing well use
  - Agricultural, domestic, municipal
- Buffer freshwater
- Buffer state lines
- **Buffer injection and disposal wells permitted under TWC Chapter 27**



1. Background – Class II Injection Wells

- EPA classifies wells that inject fluids associated with oil and natural gas as Class II wells
- Over 75,000 active Class II wells in Texas
- Current default buffer zone distance is 15 miles; refinement is needed
  - Modeling tools to delineate buffer distances for Class II injection wells from designated Brackish Groundwater Production Zones
  - Statewide assessment is needed

2. Objectives

- Develop a scientifically defensible methodology for determining an appropriate buffer distance.
  - Each Class II Injection well
  - Within various aquifers in the state of Texas

- Avoid designation of Brackish Groundwater Production Zones in areas already used for wastewater injection.

2. Questions

- Where are the Class II injection wells?
- Which aquifers are of interest and which Class II injection wells intercept these aquifers?
- What is the fate of well injectate?

3. Approach

- Develop a streamlined methodology and supporting tools

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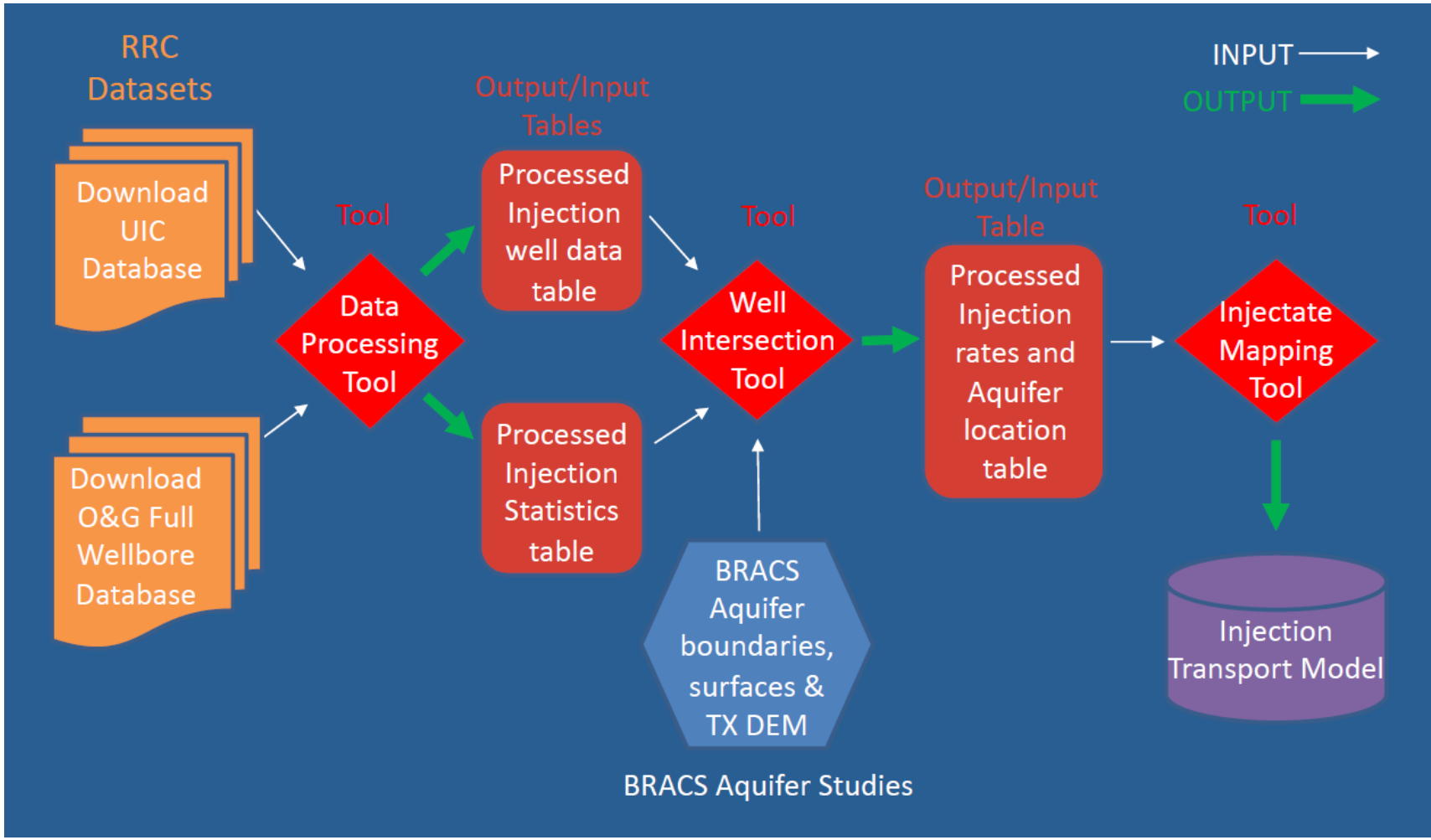
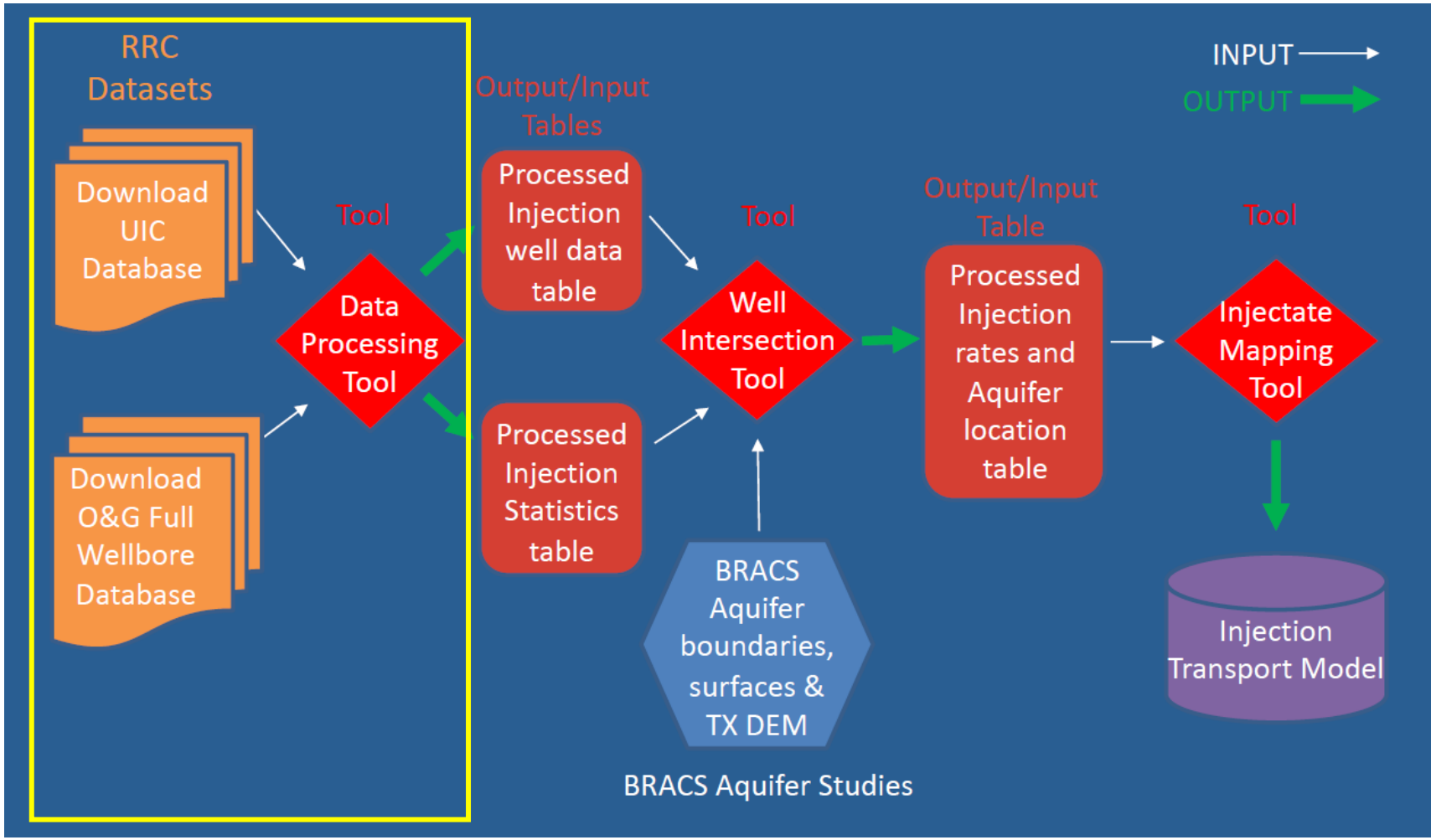


3. Approach

- Develop a streamlined methodology and supporting tools
- Identify data sources
- Data processing tool



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- Develop a streamlined methodology and supporting tools
- Identify data sources
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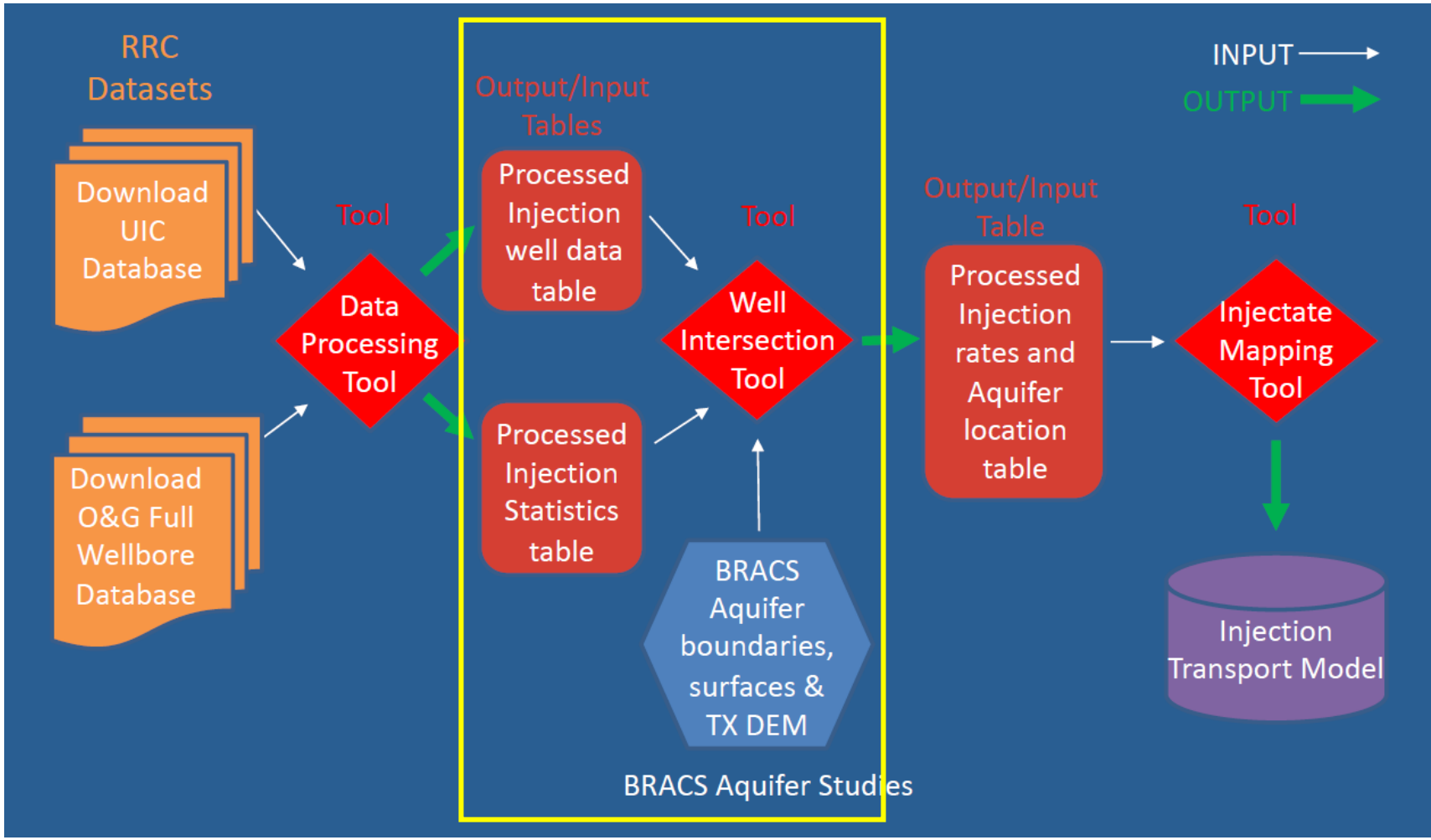
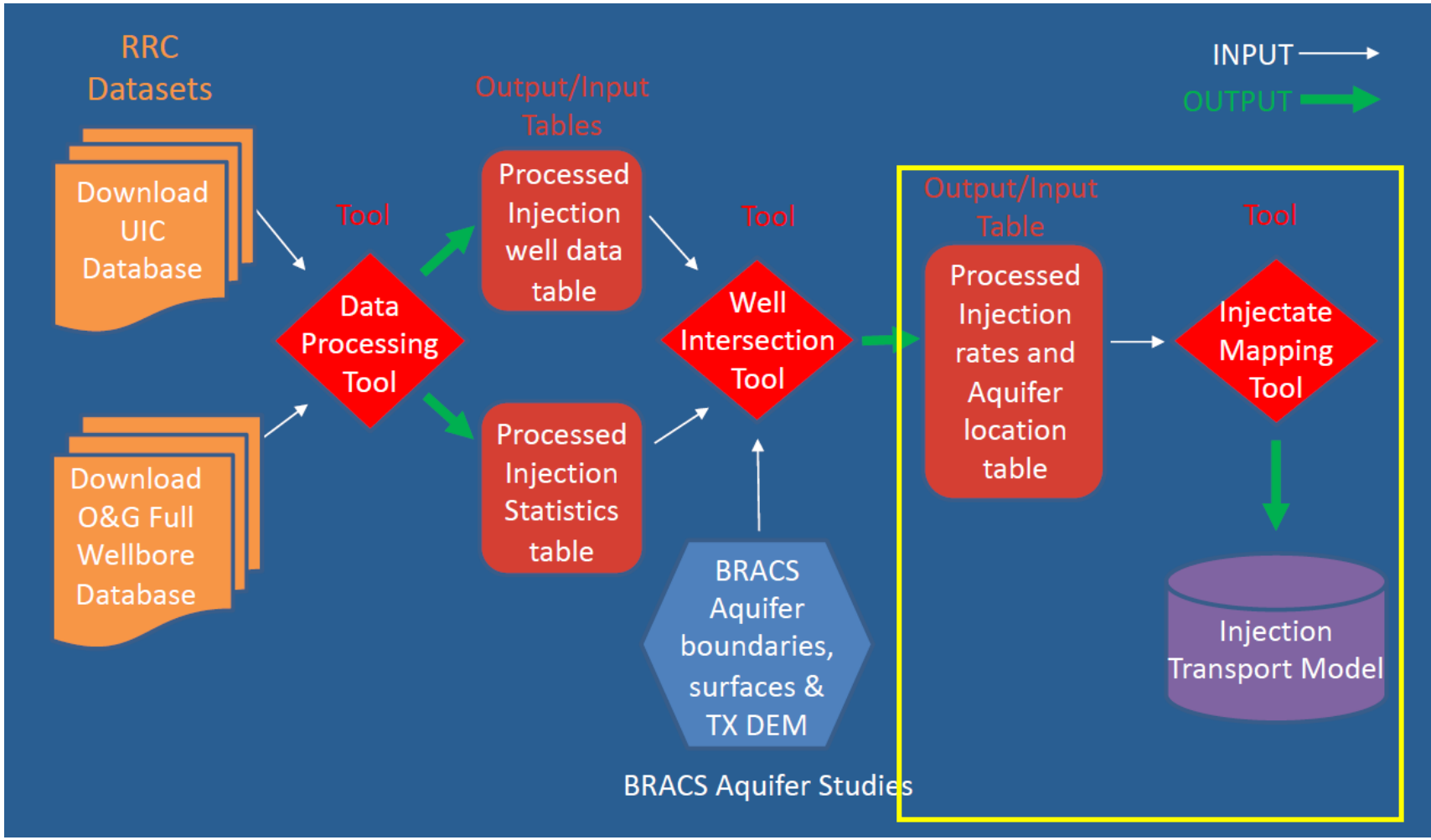
- Injection well parameters
- Aquifer parameter assessment
- Well intersection tool



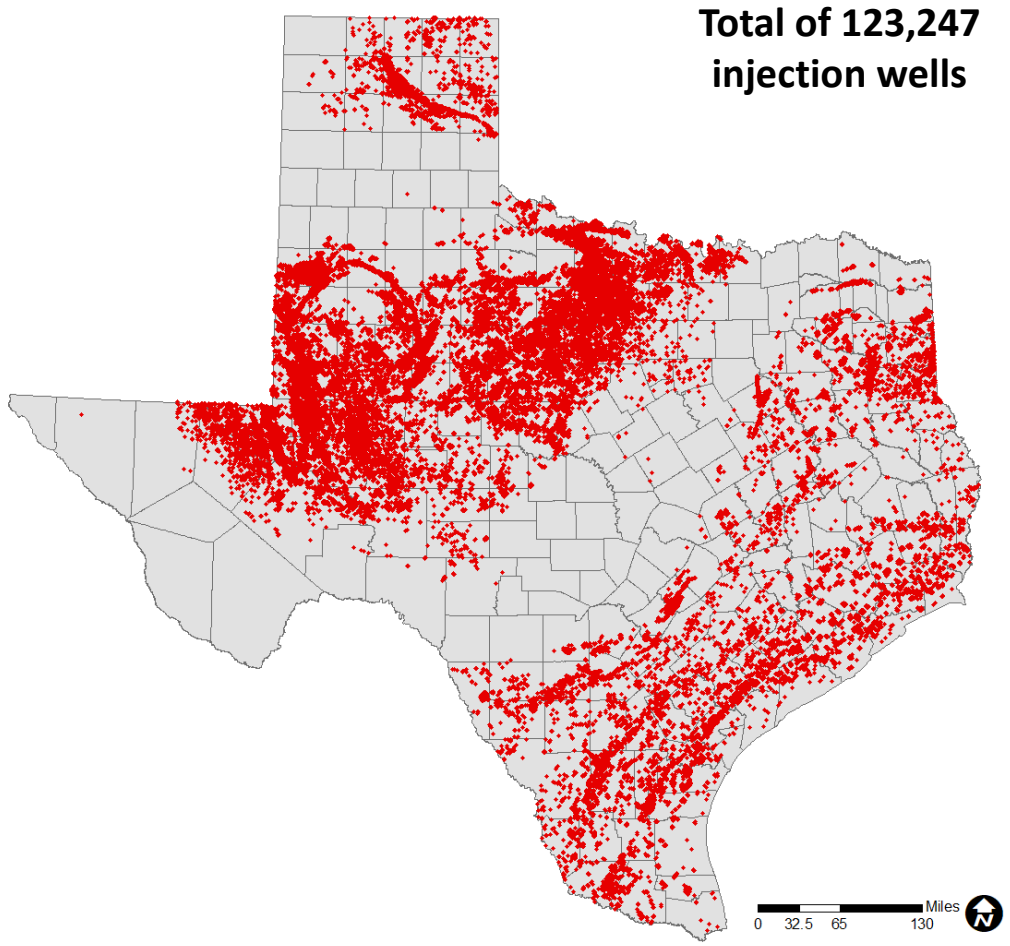
3. Approach

- Develop a streamlined methodology and supporting tools
- Identify data sources
- Data processing tool
- Injection well parameters
- Aquifer parameter assessment
- Well intersection tool
- Injectate migration methods
- Develop mapping tool



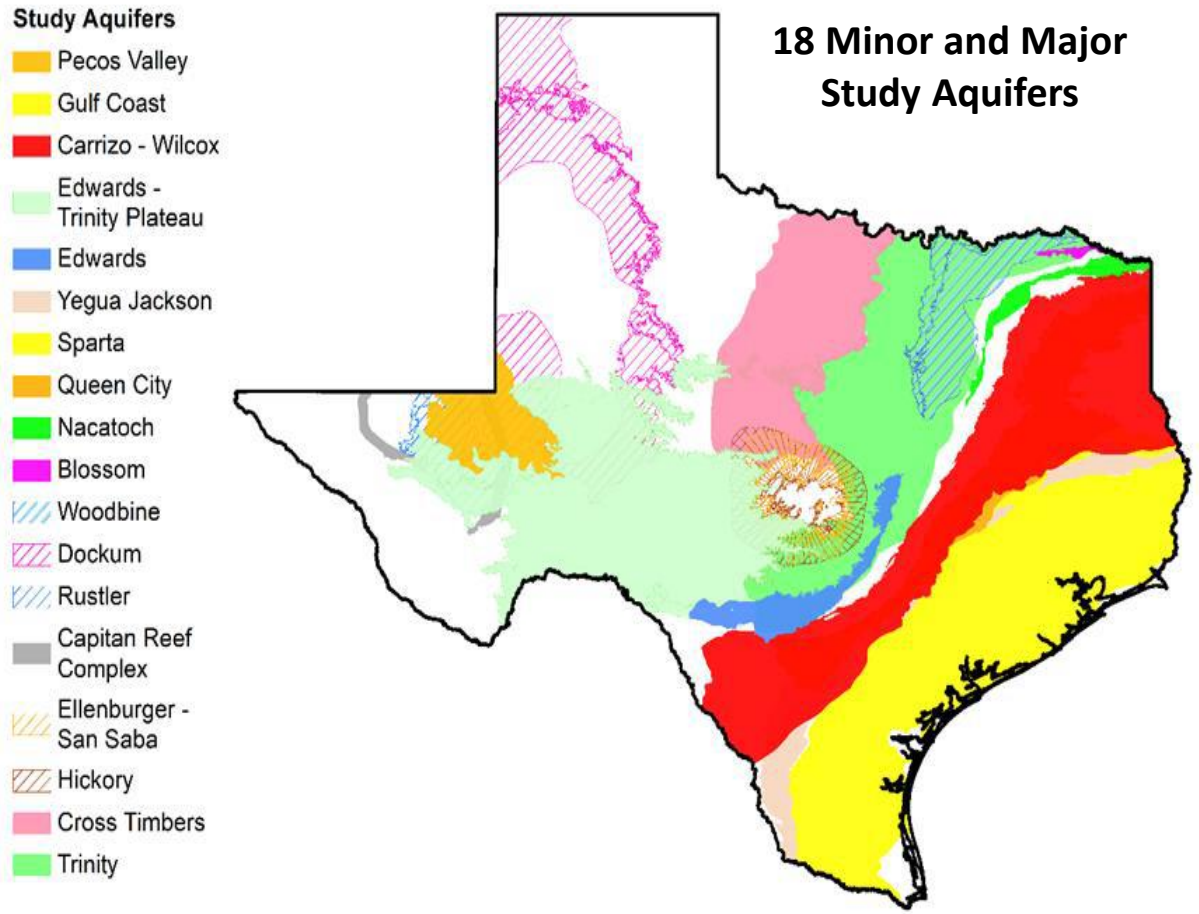
4. Tools and Methods – Injection Wells

- Data sources
  - Railroad Commission (RRC) Underground Injection Control (UIC) Database
  - RRC Oil and Gas Well Data
- A custom online tool developed using the Feature Manipulation Engine (FME) platform
  - Imports RRC datasets
  - Exports tables for well intersection workflow
- Injection rates and volumes



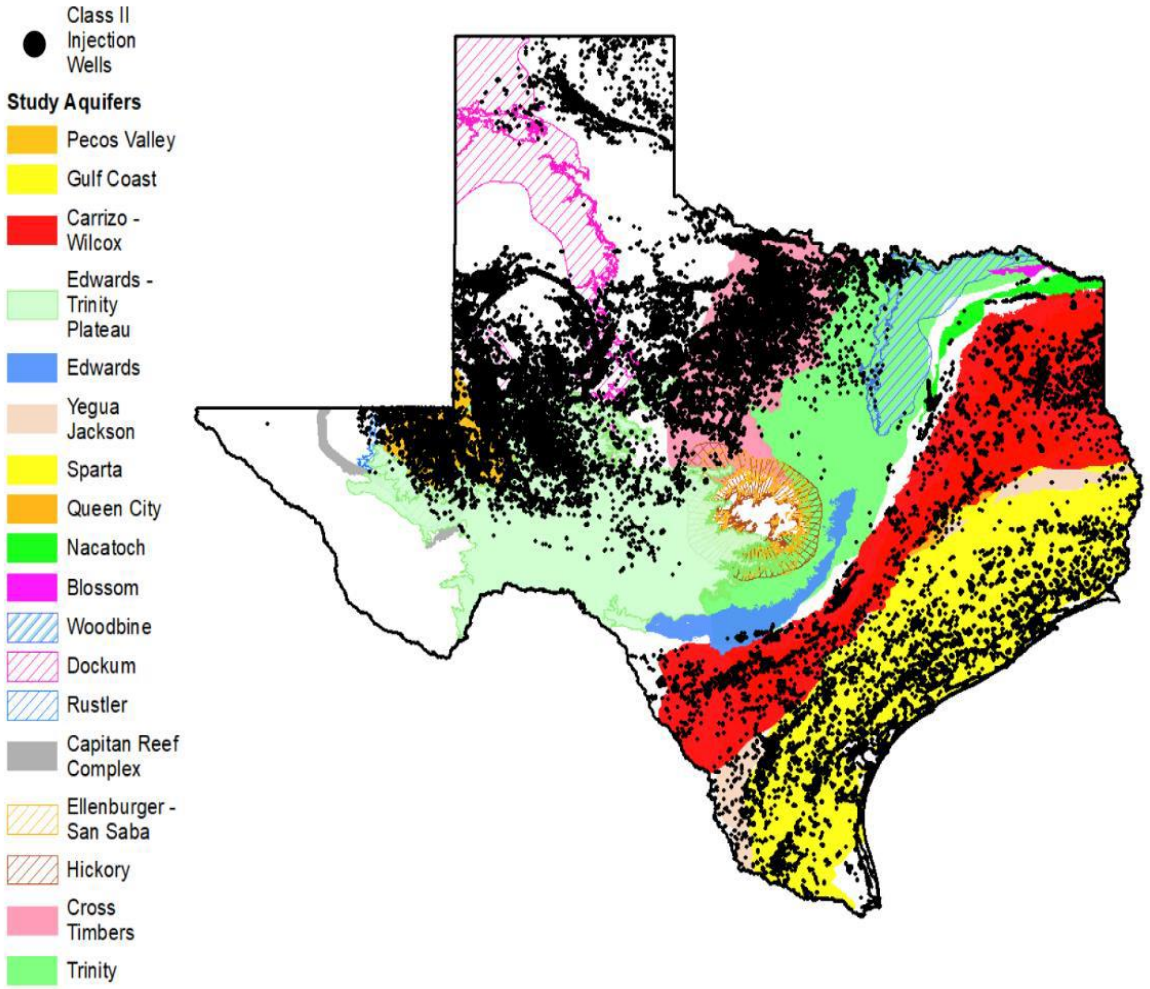
4. Tools and Methods – Aquifers

- TWDB identified 18 aquifers for recommending brackish groundwater production zones
- Aquifer parameter assessment
  - Published GAMs & BRACS reports
  - USGS studies
  - Limited literature review for identification & analysis purposes
  - Publicly available geodatabases
- Aquifer parameters for mapping
  - Horizontal hydraulic conductivity
  - Effective porosity
  - Hydraulic gradient
  - Flow direction



4. Tools and Methods – Well Intersection

- Identify aquifers with Class II injection wells – horizontal location of wells



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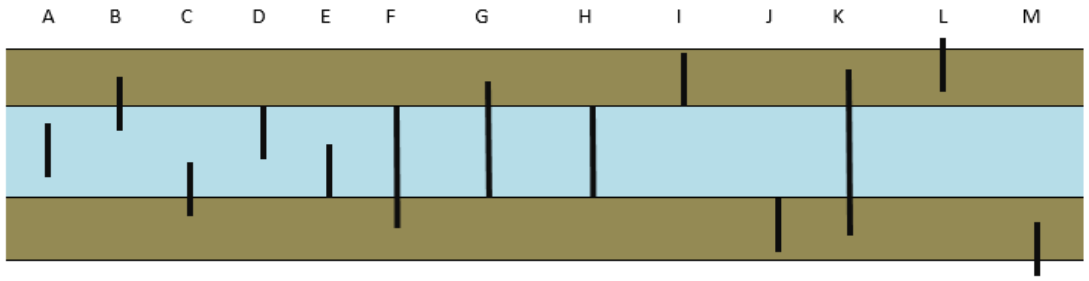
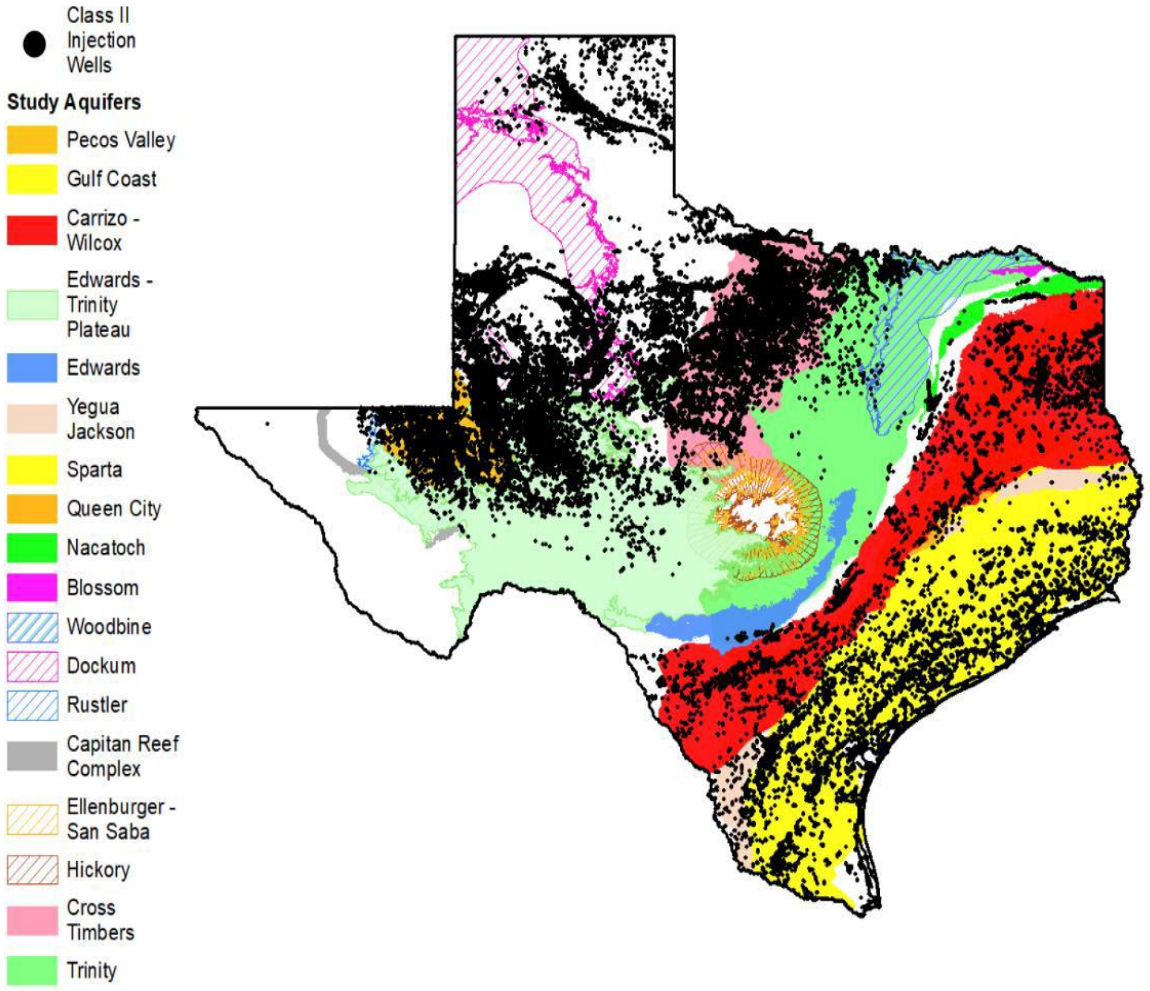
- Identify aquifers with Class II injection wells – horizontal location of wells
- Well injection depth and aquifer penetration – vertical location of wells





4. Tools and Methods – Well Intersection

- Identify aquifers with Class II injection wells – horizontal location of wells
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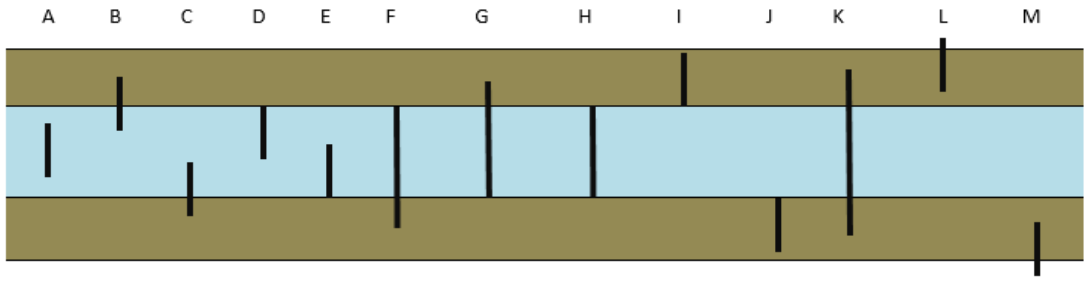
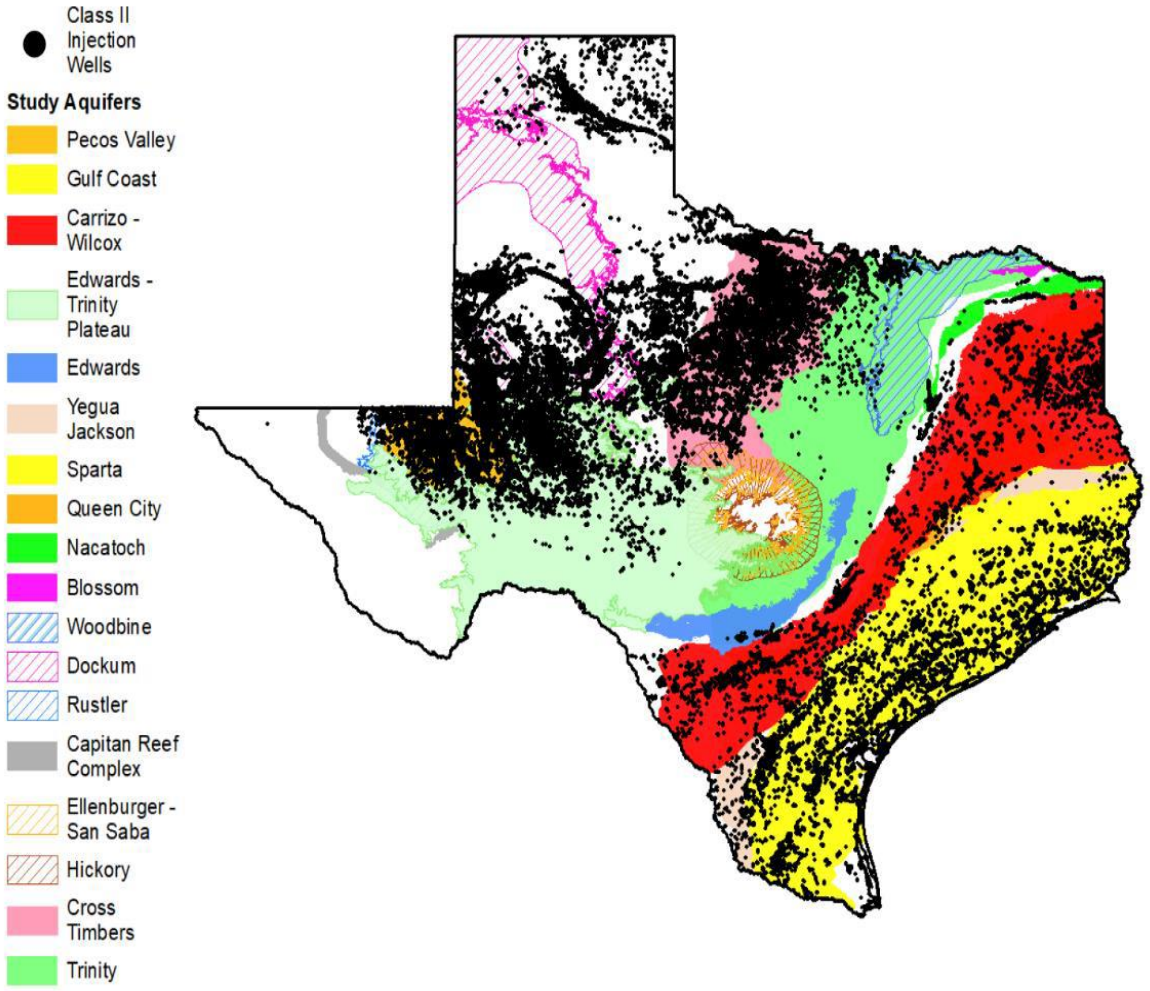
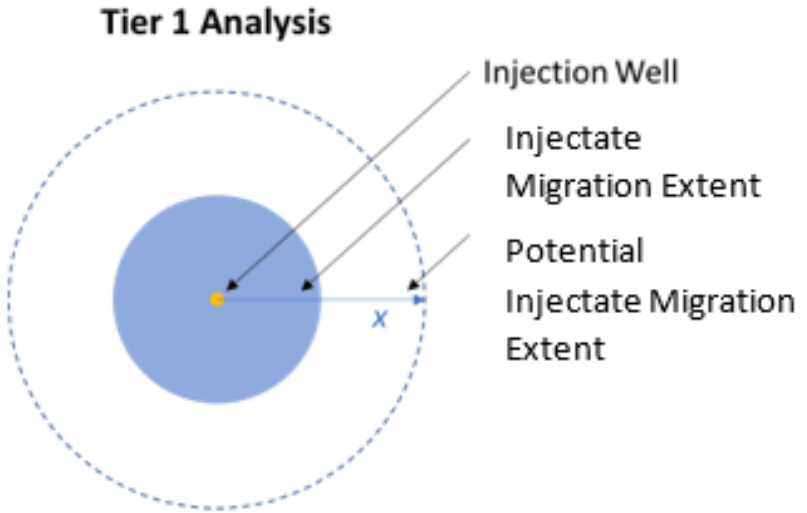
- Generate tables for migration and mapping tool

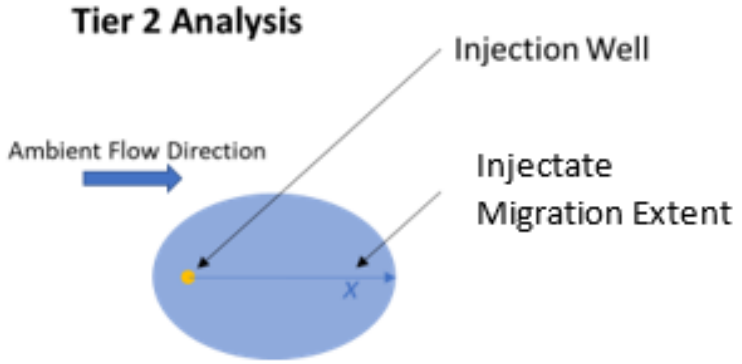




4. Tools and Methods – Injectate Migration

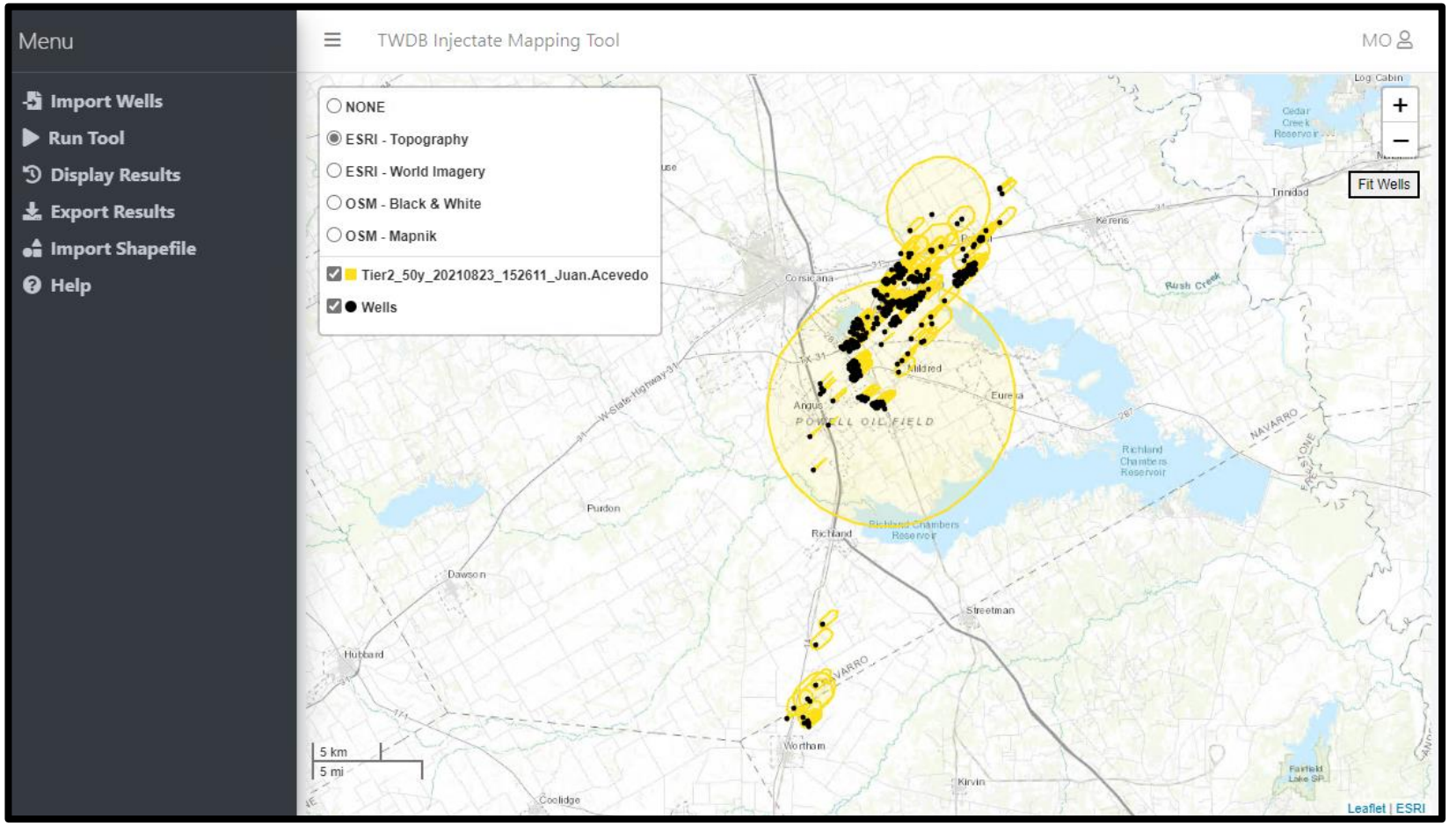
- Various considerations for selecting methods
  - Analytical and numerical models
  - Various processes were considered
  - Data availability
  - Screening level statewide analysis for Texas
  - Practical run times
- Methods
  - EPA (1994) – Tier 1 analysis
  - Bear and Jacobs (1965) – Tier 2 analysis





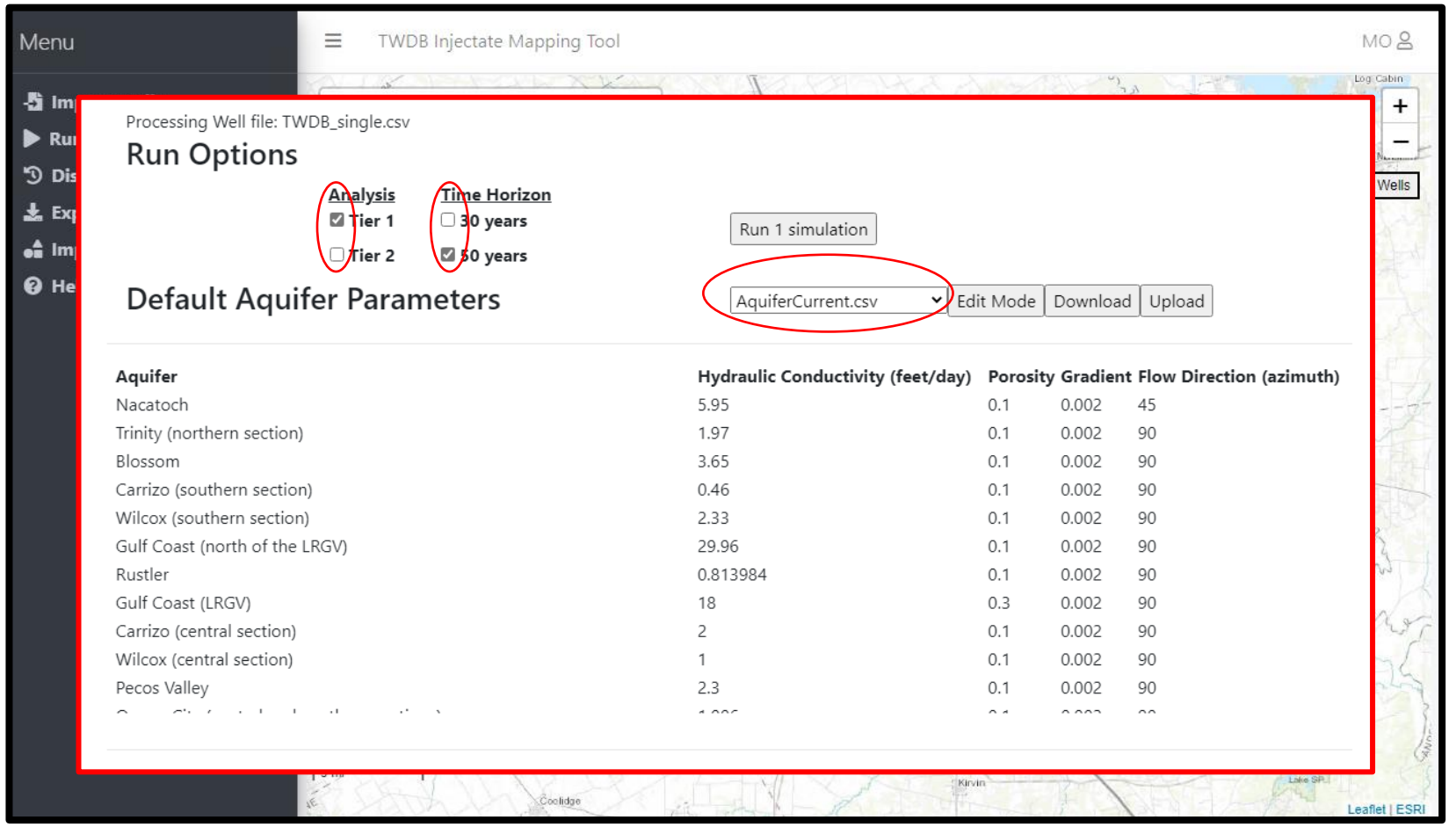
4. Tools and Methods – Online Mapping Tool

- Imports injection well data
- Imports aquifer parameters
- Computes injectate migration



4. Tools and Methods – Online Mapping Tool

- Imports injection well data
- Imports aquifer parameters
- Computes injectate migration
- Tier 1 and Tier 2 analysis
- Simulates migration for a 30-year and 50-year time horizon
- Exports shapefile with injectate migration extents



5. Key Limitations

- Aquifer data availability
- Injection well data availability
  - Many wells with incomplete or erroneous data in RRC databases
- Screening level analysis and associated approximations
- Effects of multiple wells can potentially underestimate injectate extent
- Injectate mapping tool provides visualization of subsurface transport of injectate – it does not, by itself, set actual buffer distances

6. Summary

- Methods and tools were developed for a streamlined process
- The project finished within budget and on schedule
- TWDB is scheduled to use these methods and tools through 2032
- Presented to a stakeholder workgroup comprised of ~40 members from various state government entities, oil and gas industry, environmental consultants, and academia
- Interagency coordination between TWDB, TCEQ, and RRC was key for the statewide mapping of well injectate migration
- Final report is available here: https://www.twdb.texas.gov/groundwater/bracs/projects/Injection/index.asp

Thank you for your time!

Questions?

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