


Importance of Protecting the Edwards Aquifer Contributing Zone/Trinity Aquifer Recharge Zone

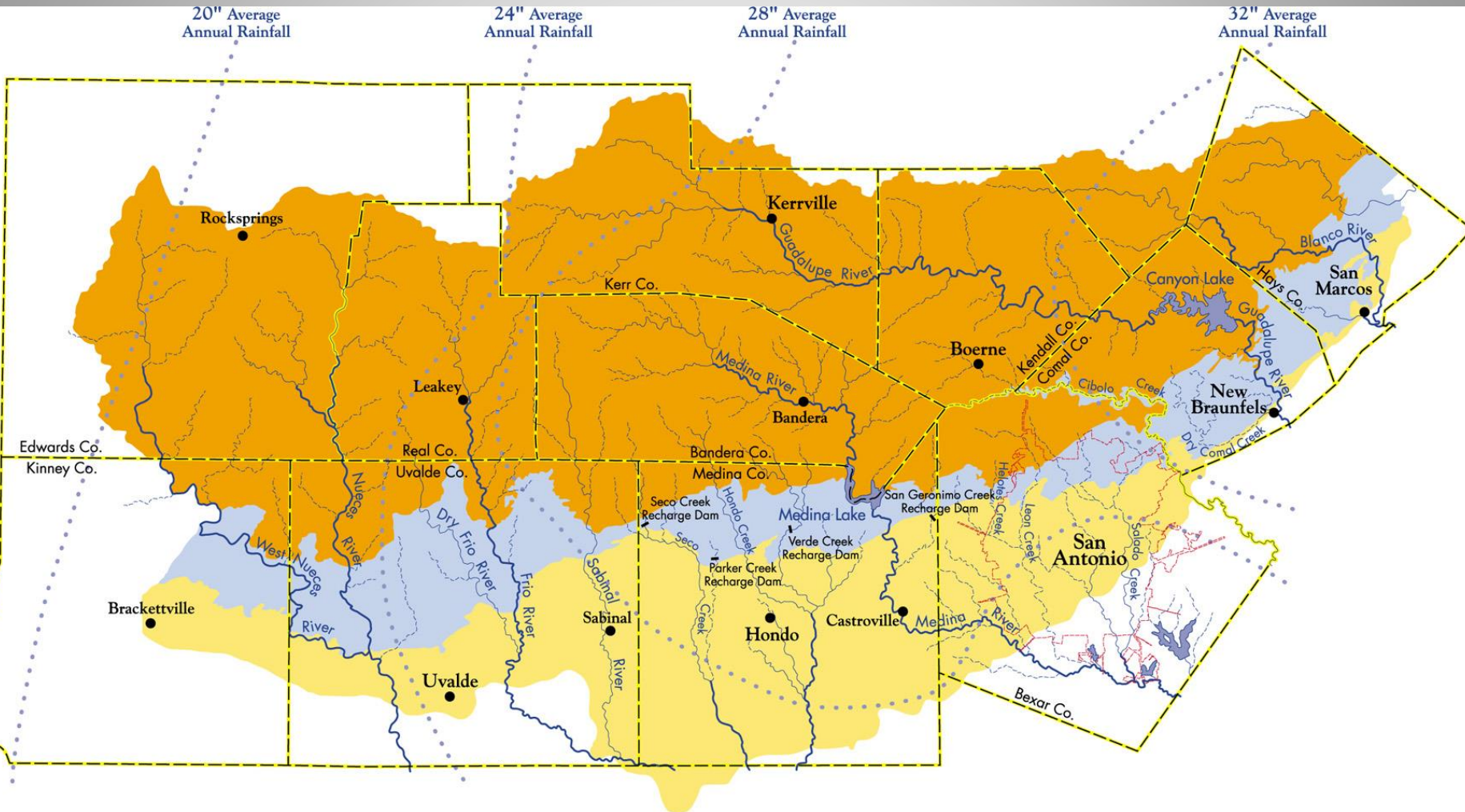


 **Trinity Glen Rose GCD**
July 13, 2023

by
Ronald T. Green, Ph.D., P.G. LLC

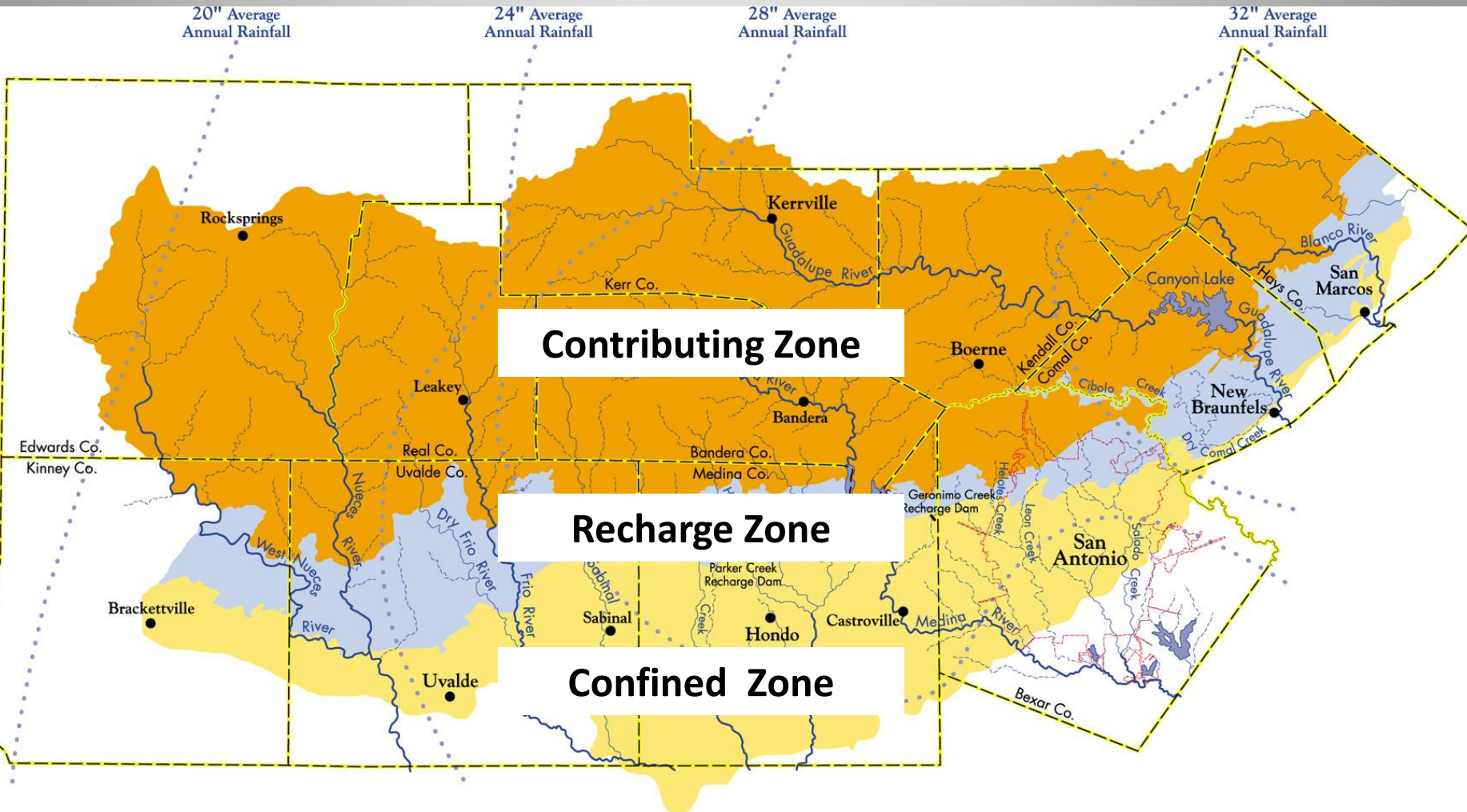
**What is the relationship between the
Trinity and Edwards aquifers?**

Edwards Aquifer



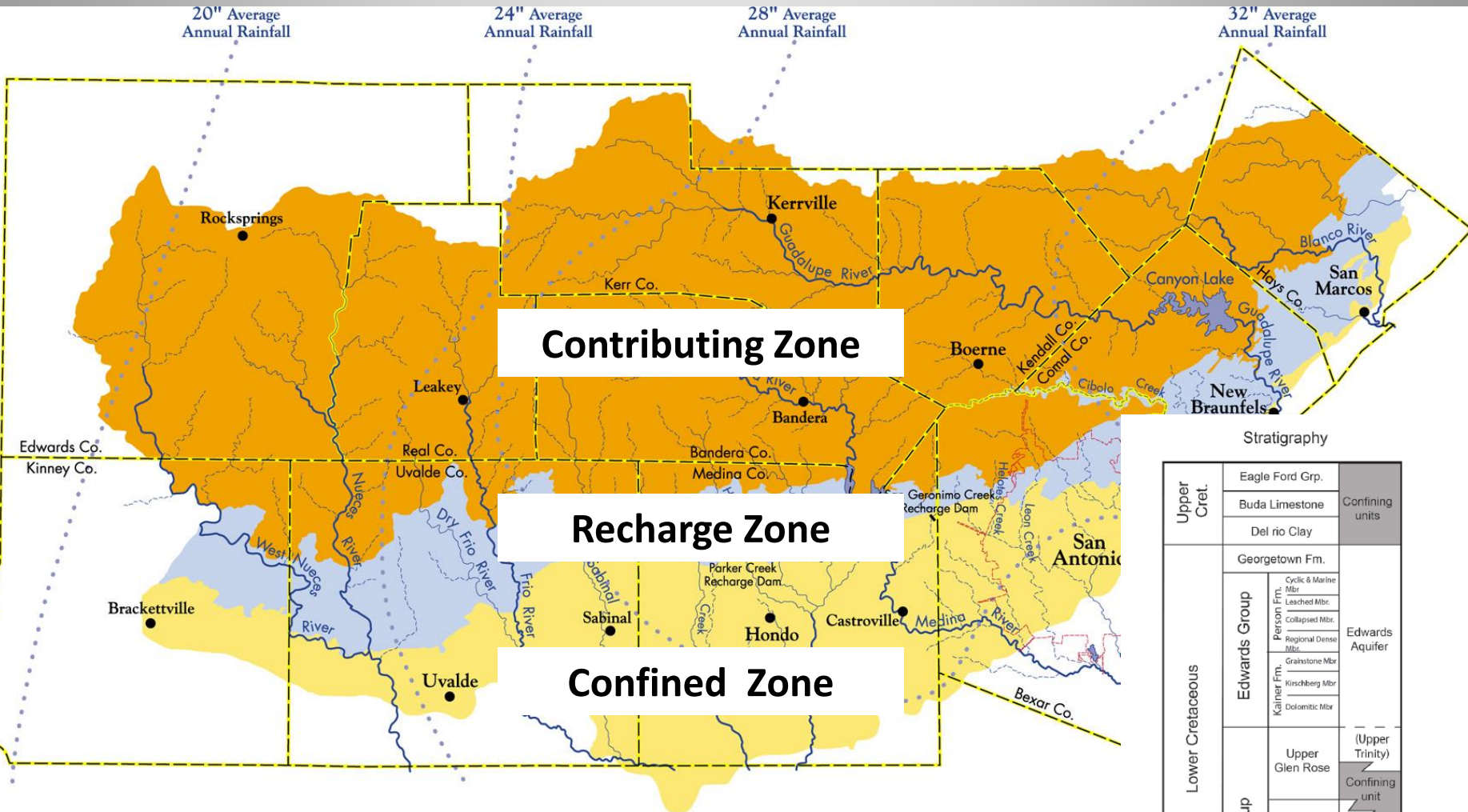
Source: Edwards Aquifer Authority 2008

Edwards Aquifer



Source: Edwards Aquifer Authority 2008

Edwards Aquifer

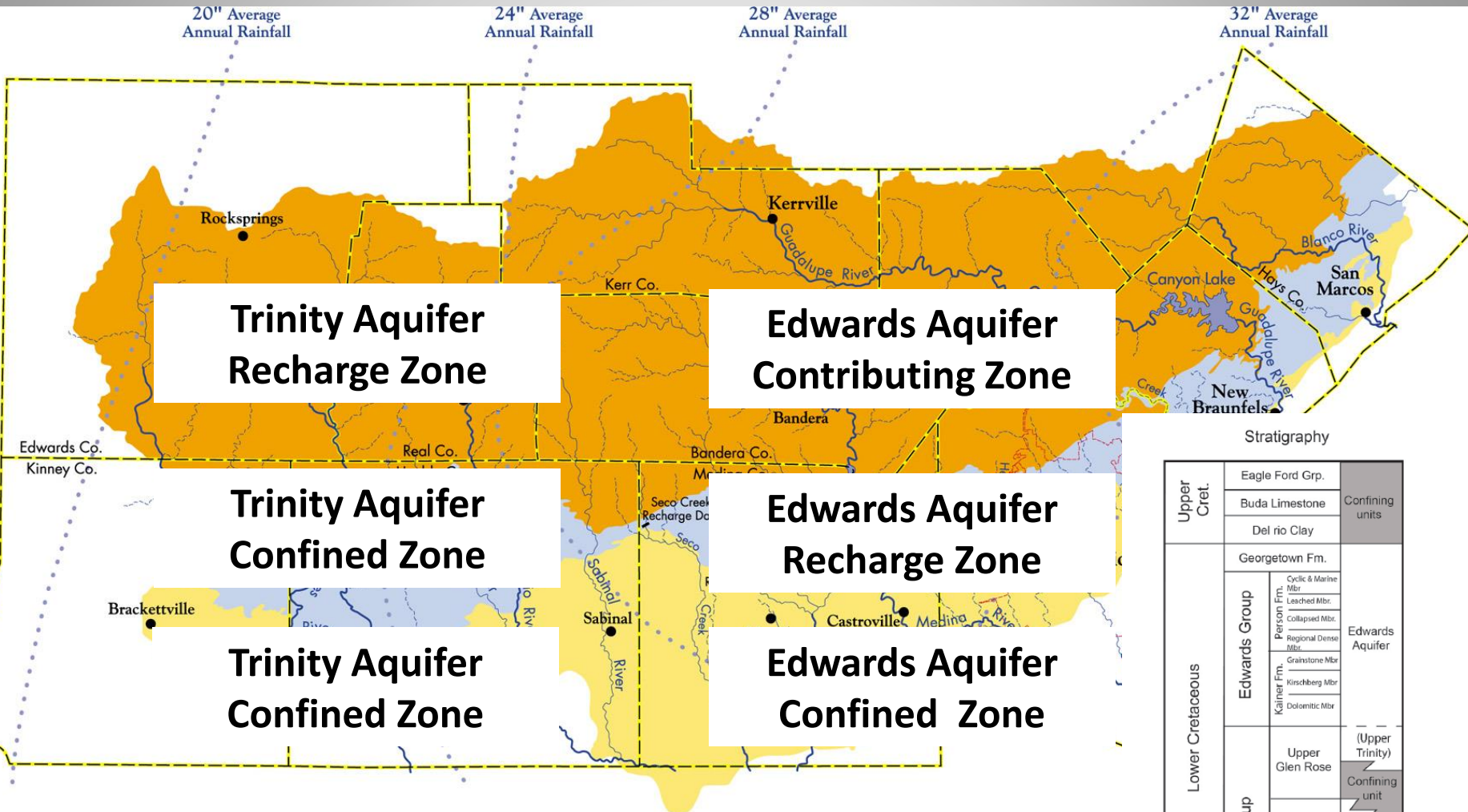


Stratigraphy

Upper Cret.	Eagle Ford Grp.	Confining units		
	Buda Limestone			
	Del rio Clay			
Lower Cretaceous	Georgetown Fm.	Edwards Aquifer		
	Edwards Group		Cyclic & Marine Mbr.	
			Leached Mbr.	
			Collapsed Mbr.	
			Regional Dense Mbr.	
			Grainstone Mbr.	
			Kainer Fm.	
	Trinity Group		Upper Glen Rose	(Upper Trinity) Confining unit
			Lower Glen Rose	Middle Trinity Aquifer
			Hensel	
Cow Creek				
	Hammett	Confining unit		

Source: Edwards Aquifer Authority 2008

Edwards Aquifer – Trinity Aquifer



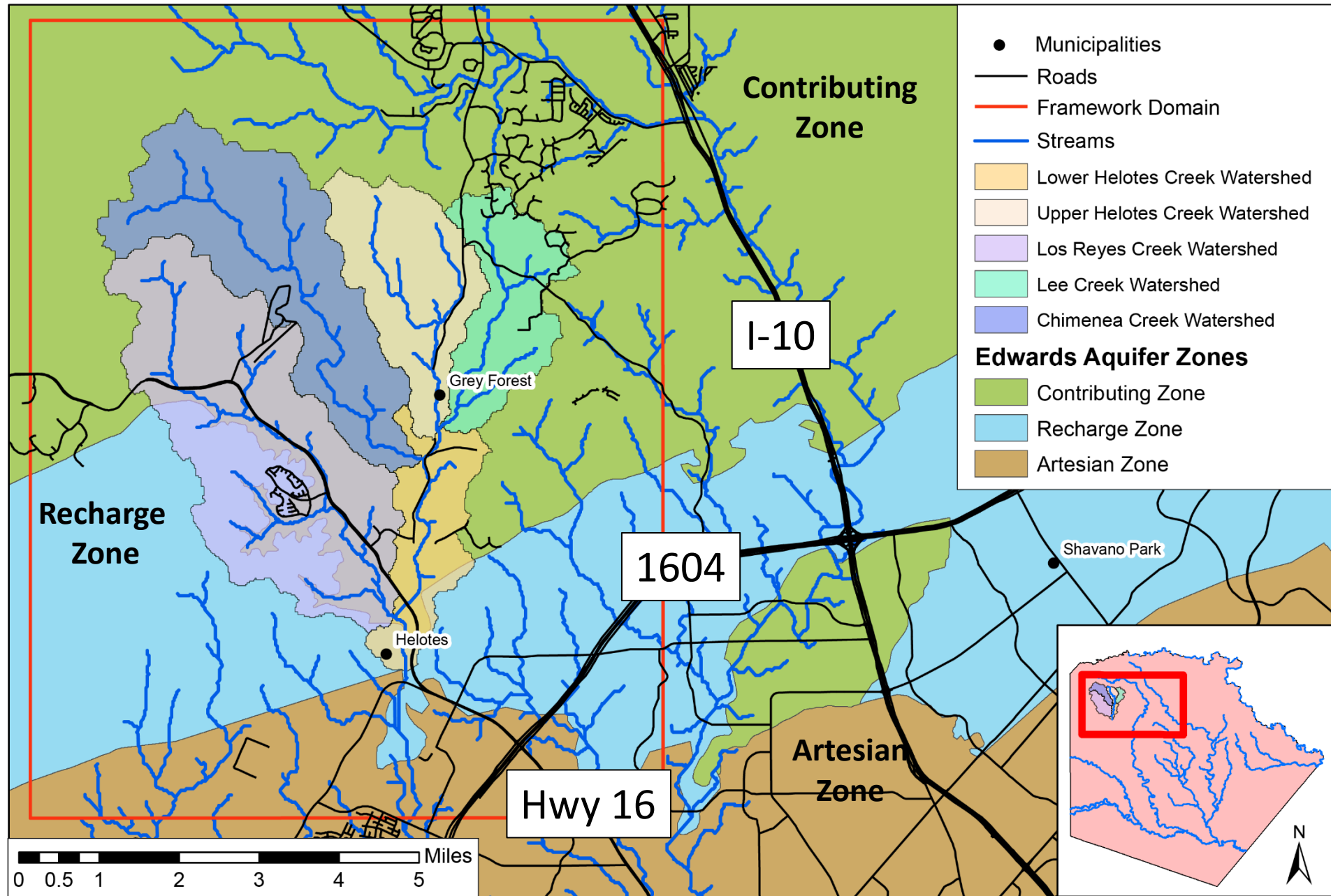
Stratigraphy

Upper Cret.	Eagle Ford Grp.	Confining units		
	Buda Limestone			
	Del rio Clay			
Lower Cretaceous	Georgetown Fm.	Edwards Aquifer		
	Edwards Group		Cyclic & Marine Mbr.	
			Lesched Mbr.	
			Collapsed Mbr.	
			Regional Dense Mbr.	
			Grainstone Mbr.	
			Kirschberg Mbr.	
	Trinity Group		Dolomitic Mbr.	
			Upper Glen Rose	(Upper Trinity)
				Confining unit
Lower Glen Rose				
	Hensel	Middle Trinity Aquifer		
	Cow Creek			
	Hammett	Confining unit		

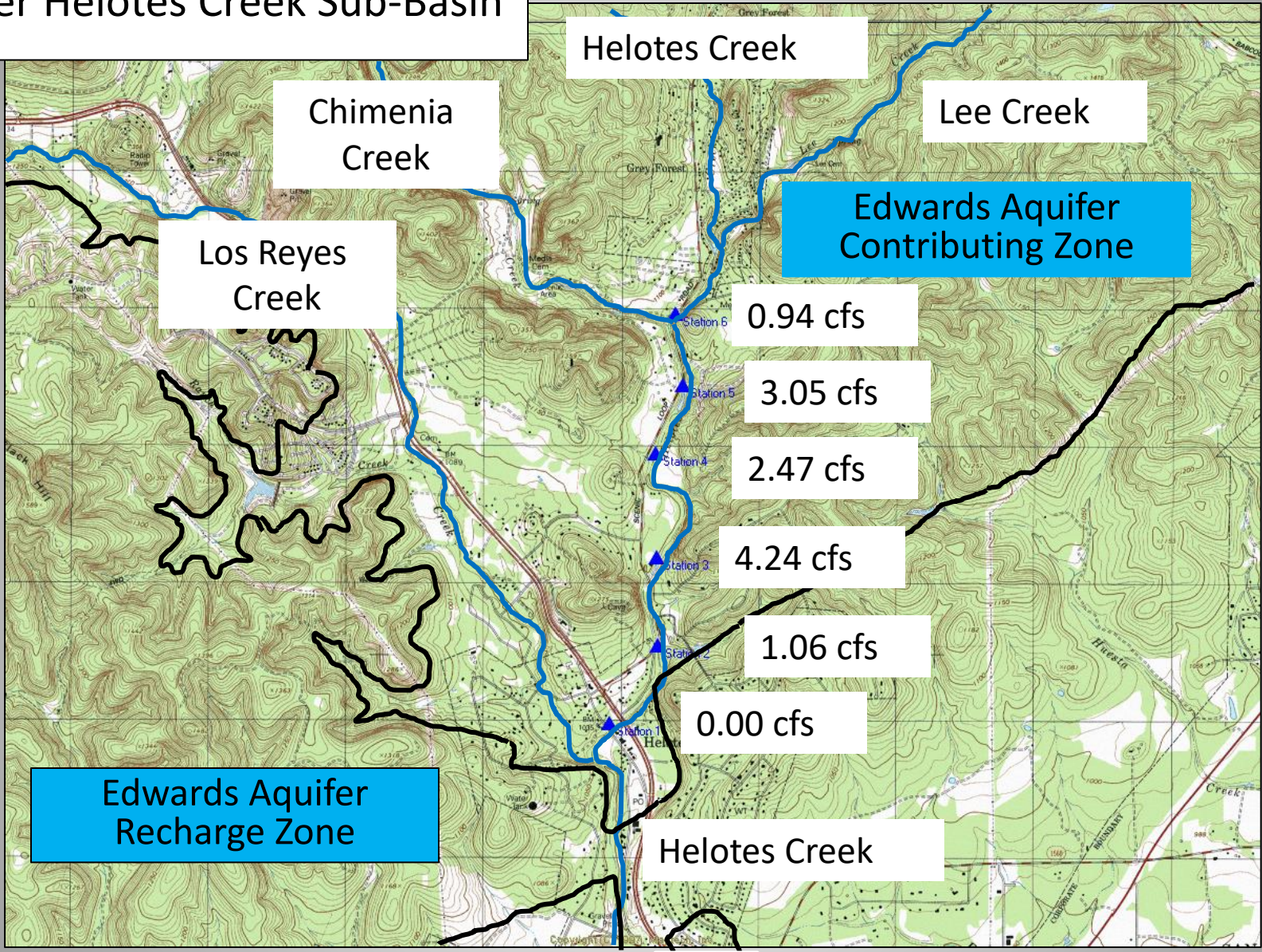
Source: Edwards Aquifer Authority 2008

Transition from Trinity to Edwards Aquifer

Gain/Loss Study of Helotes Creek



Lower Helotes Creek Sub-Basin



Helotes Creek

Chimenea Creek

Lee Creek

Edwards Aquifer Contributing Zone

Los Reyes Creek

0.94 cfs

3.05 cfs

2.47 cfs

4.24 cfs

1.06 cfs

0.00 cfs

Edwards Aquifer Recharge Zone

Helotes Creek

Lower Helotes Creek Sub-Basin

Helotes Creek Contributing Zone

Chimenea
Creek

Los Reyes
Creek

Edwards Aquifer
Recharge Zone

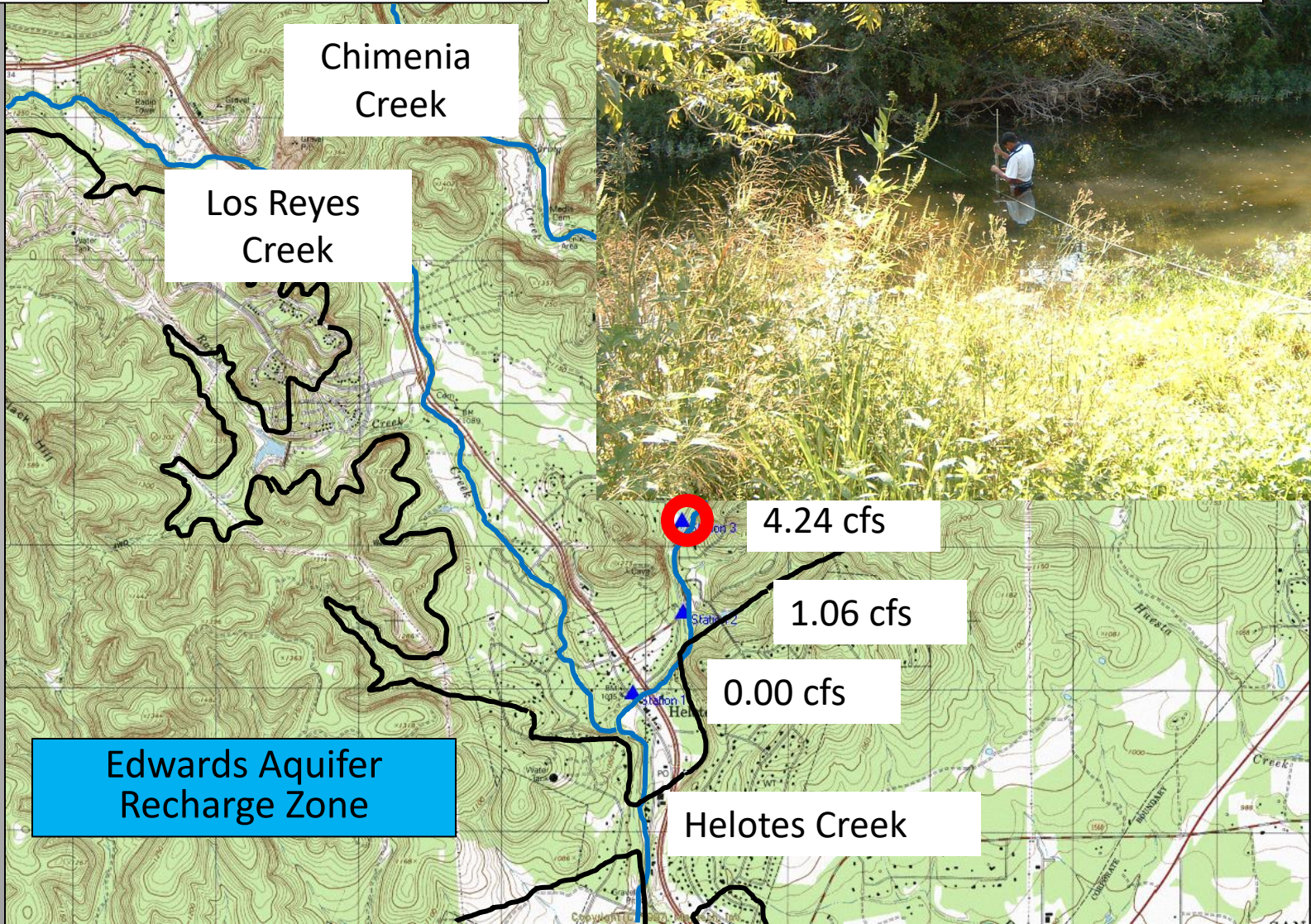
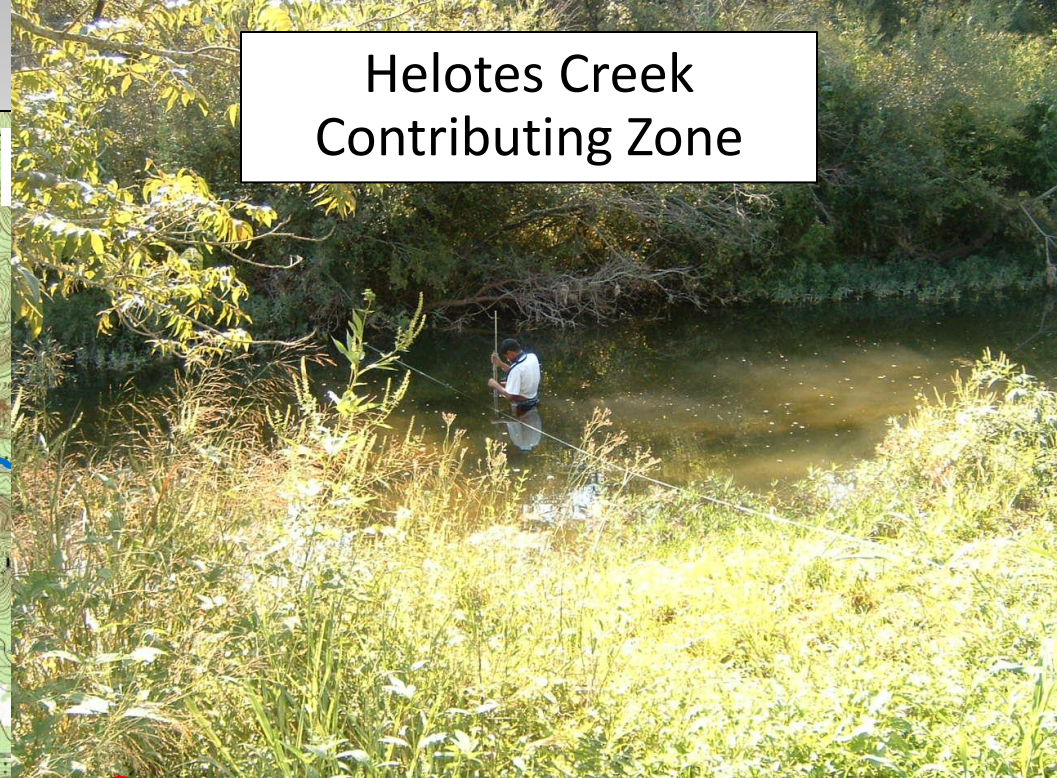


4.24 cfs

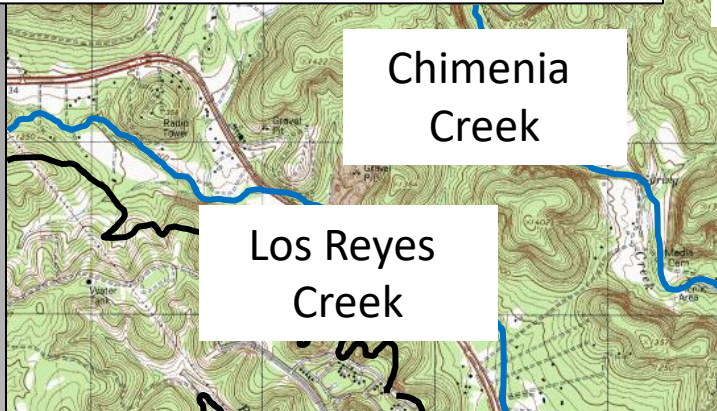
1.06 cfs

0.00 cfs

Helotes Creek



Lower Helotes Creek Sub-Basin

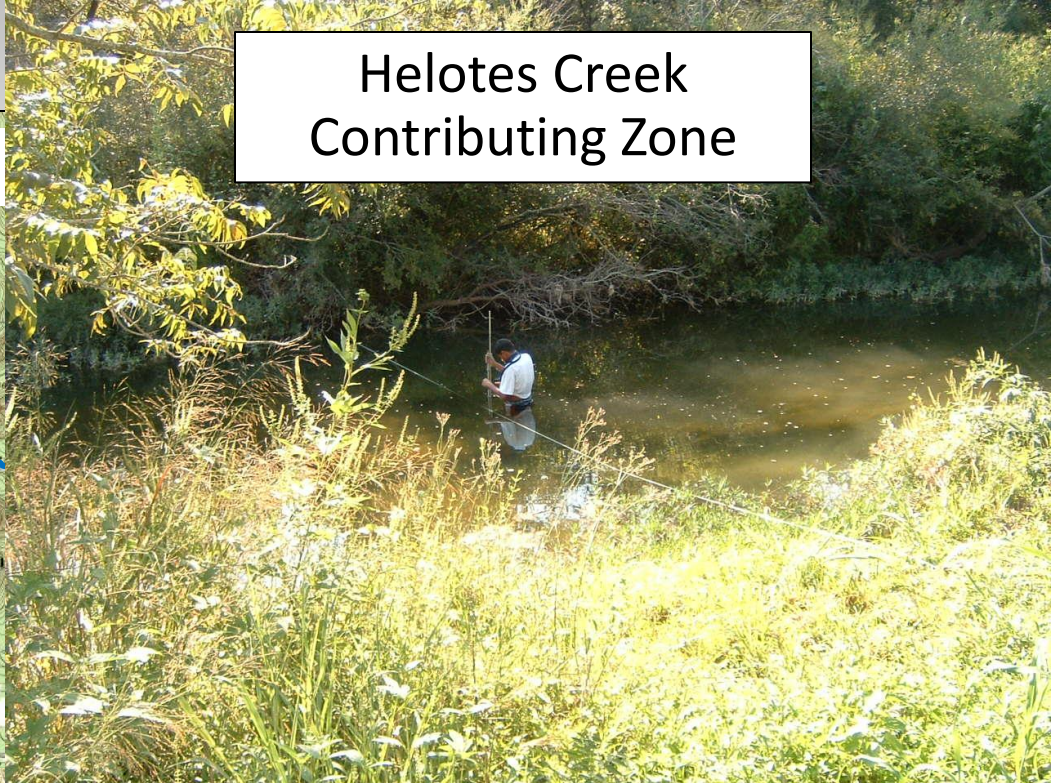


Chimenia
Creek

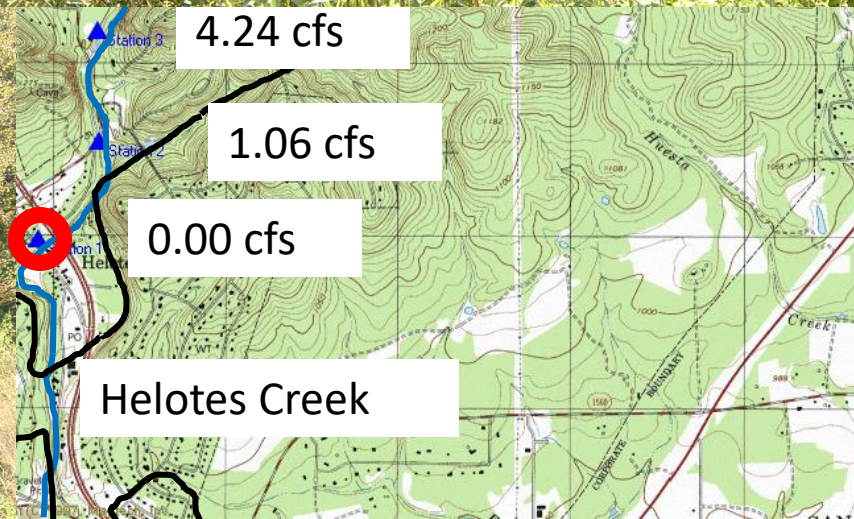
Los Reyes
Creek

Helotes Creek looking
downstream toward
Recharge Zone

Helotes Creek Contributing Zone



Location of USGS river
gauging station



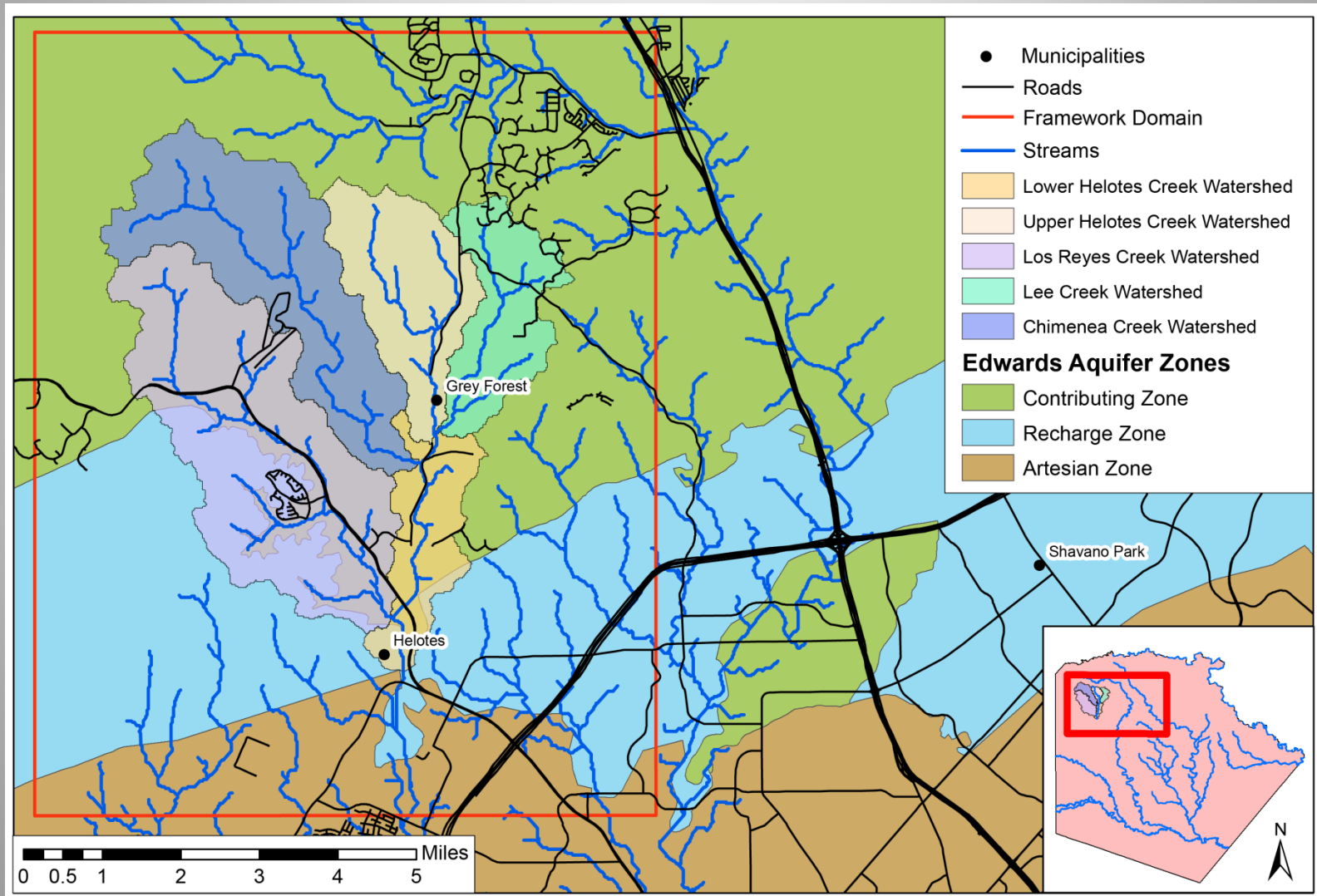
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Helotes Creek

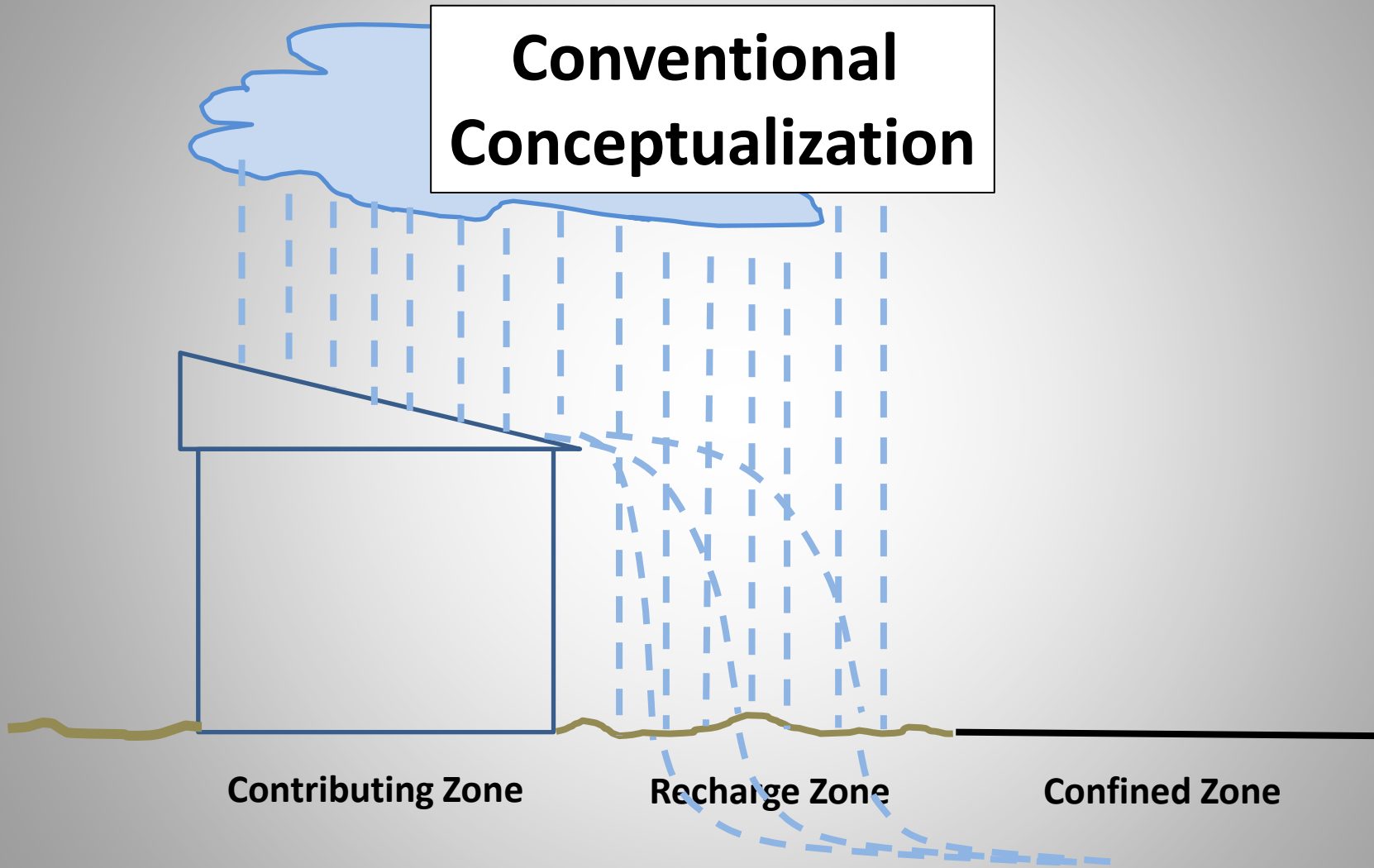
Edwards Aquifer Recharge Zone Absent in Helotes Creek Watershed



Allogenic + Autogenic Recharge

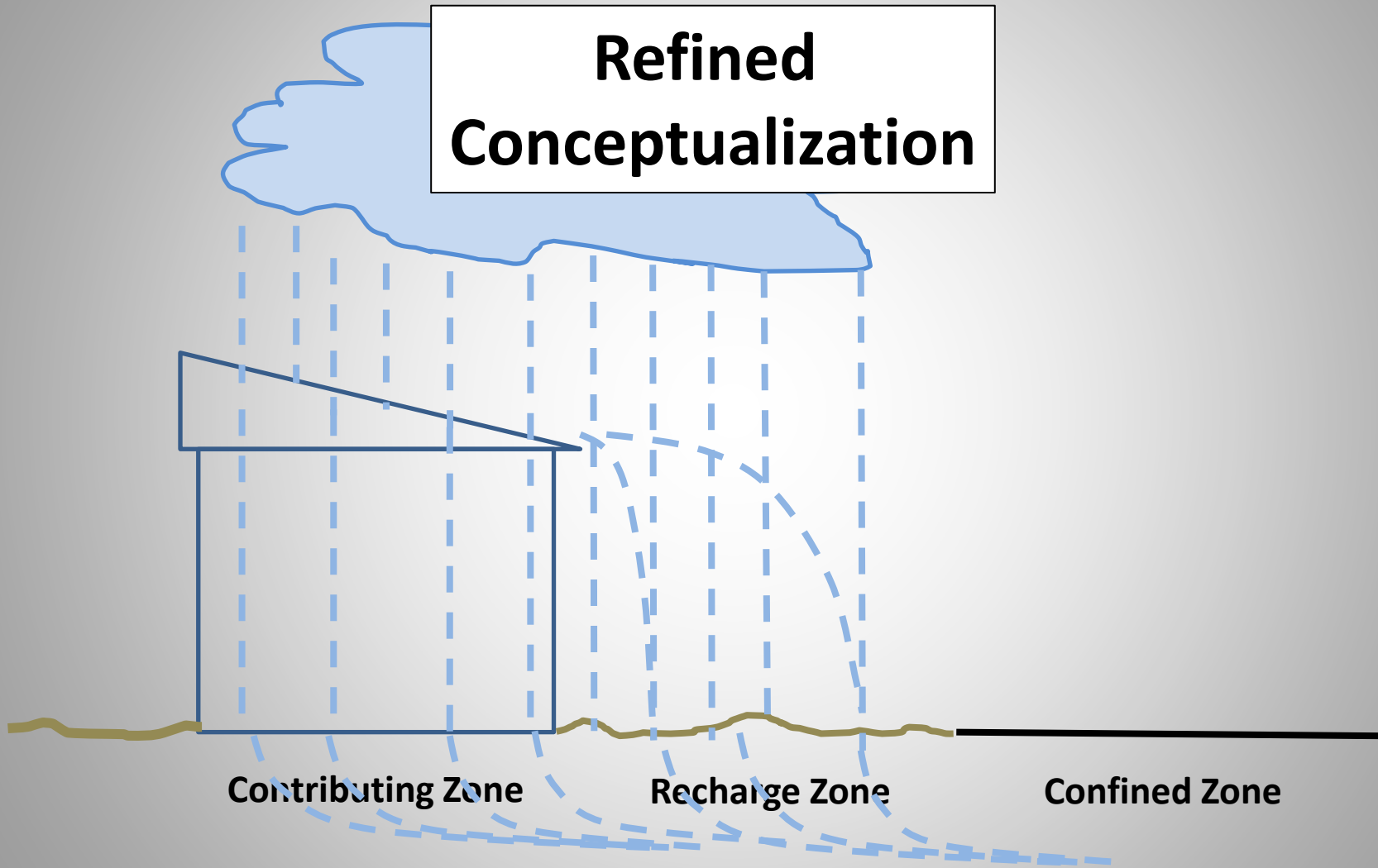
(Derived from **Within** and from **Yonder**)

**Conventional
Conceptualization**

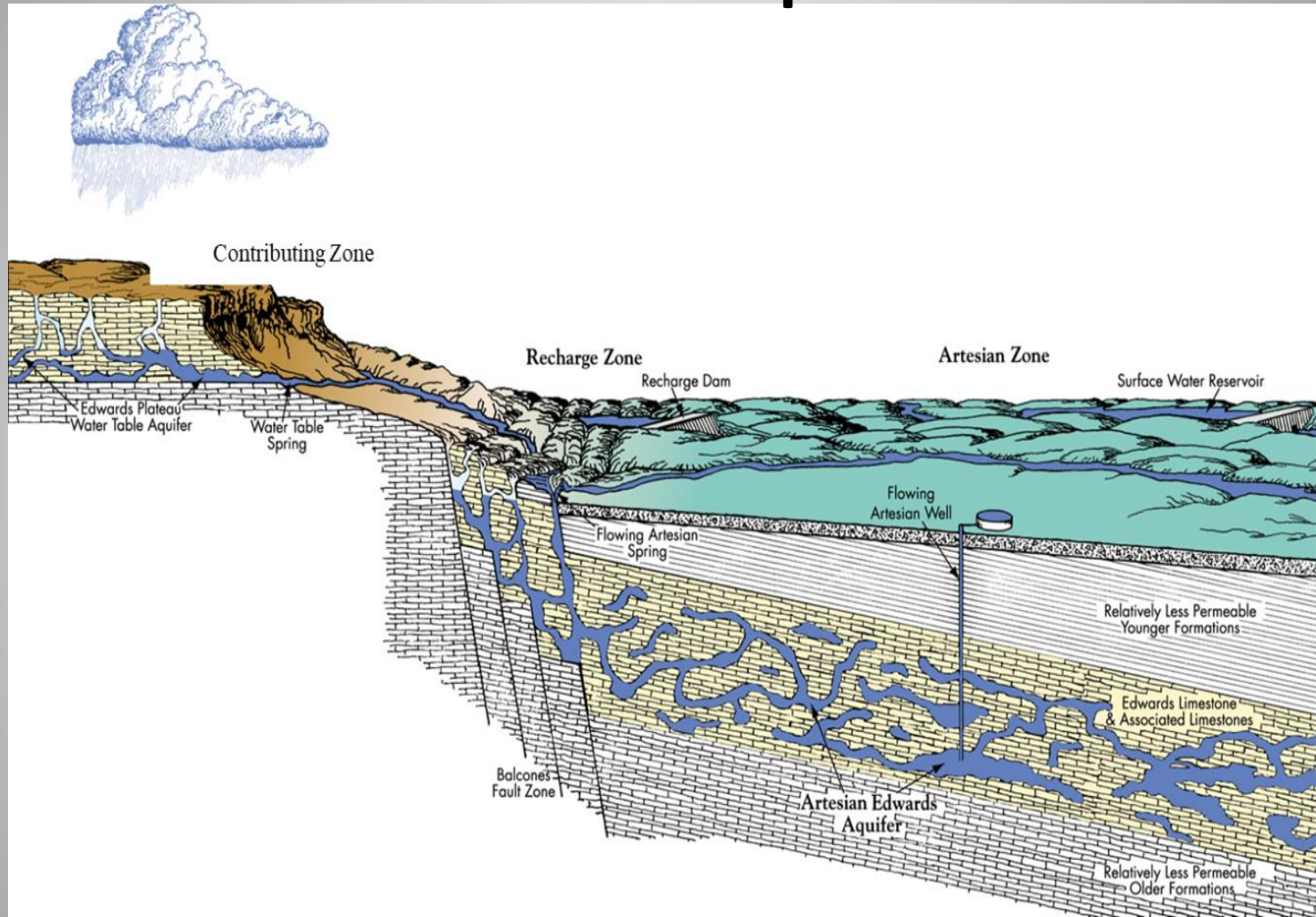


Autogenic + Allogenic Recharge

**Refined
Conceptualization**

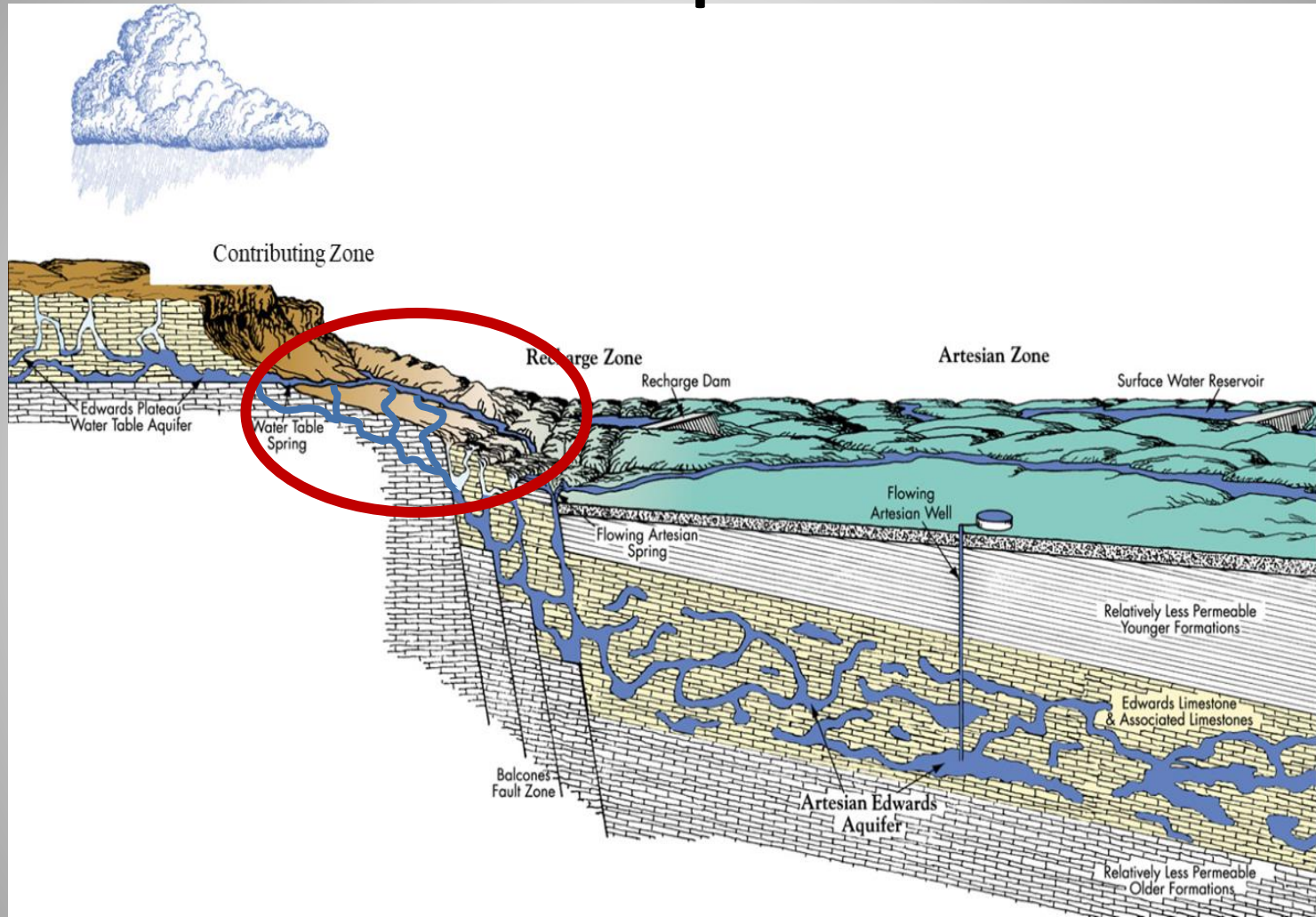


Edwards Aquifer Conventional Conceptualization



Source: Edwards Aquifer Authority 2008

Edwards Aquifer Refined Conceptualization



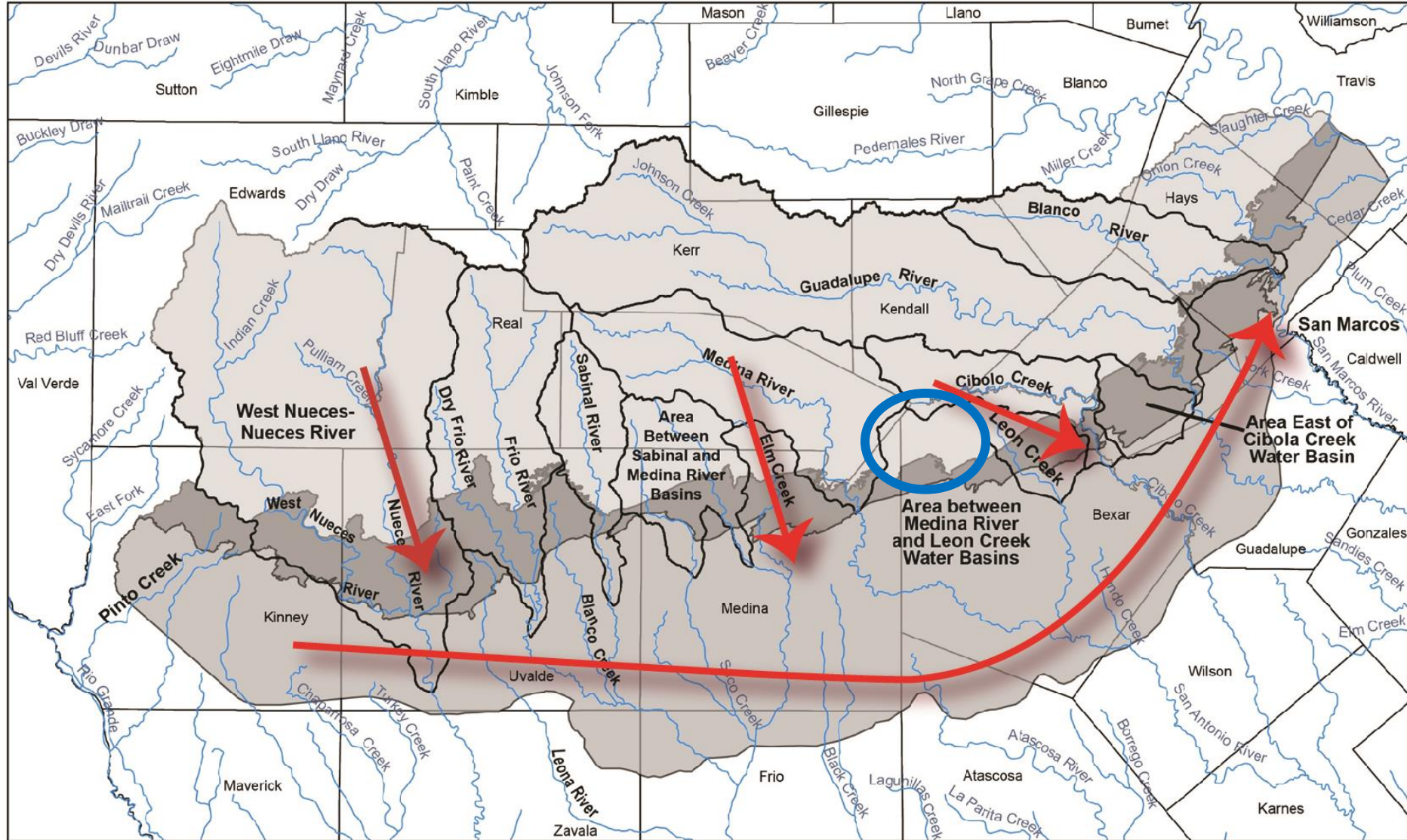
Source: Edwards Aquifer Authority 2008

**Why is development in NW Bexar County
so important to recharge of the
Trinity and Edwards aquifers?**

How Does Development Impact the Environment?

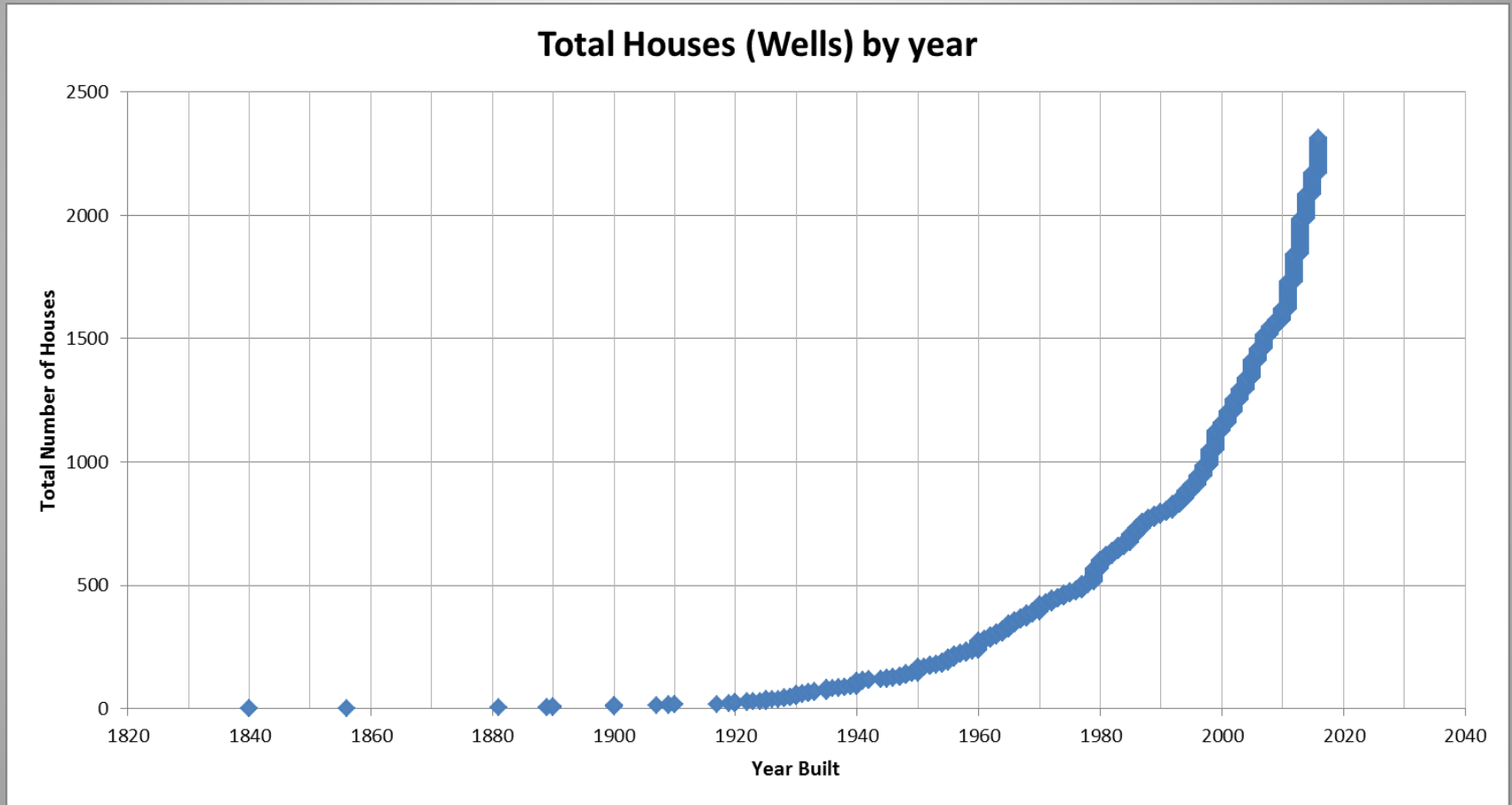
- Dense development increases impervious cover, increases flooding, and degrades runoff.
- Wastewater effluent can degrade the environment if discharged within watersheds.
- Degraded runoff and effluent can impact the Trinity and Edwards aquifers if recharge water is degraded.

Recharge closer to SAWS wellfields has less opportunity to be diluted



What is the State of the Contributing Zone in NW Bexar County?

“Exponential” Residential Growth In Helotes Creek Watershed



Bexar County Appraisal District

Use trophic state to determine degradation of the watershed

Oligotrophic



Pristine

Mesotrophic

So-So

Eutrophic



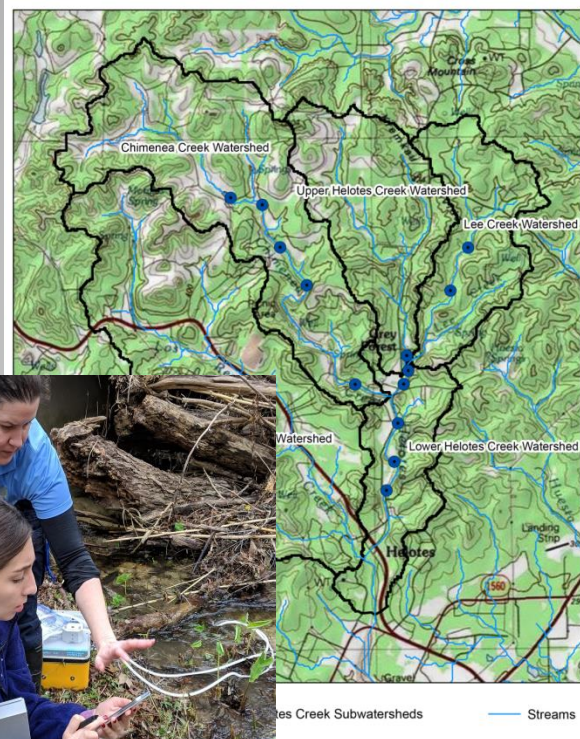
Degraded

**Conventional indicators of degradation
(i.e., nutrients such as P and N) may not be
sufficiently sensitive to detect source area
degradation until after the causes of degradation
are firmly entrenched**

EAA/SwRI Sampled Water and Periphyton/Seston to Determine Trophic State of Helotes Creek Watershed

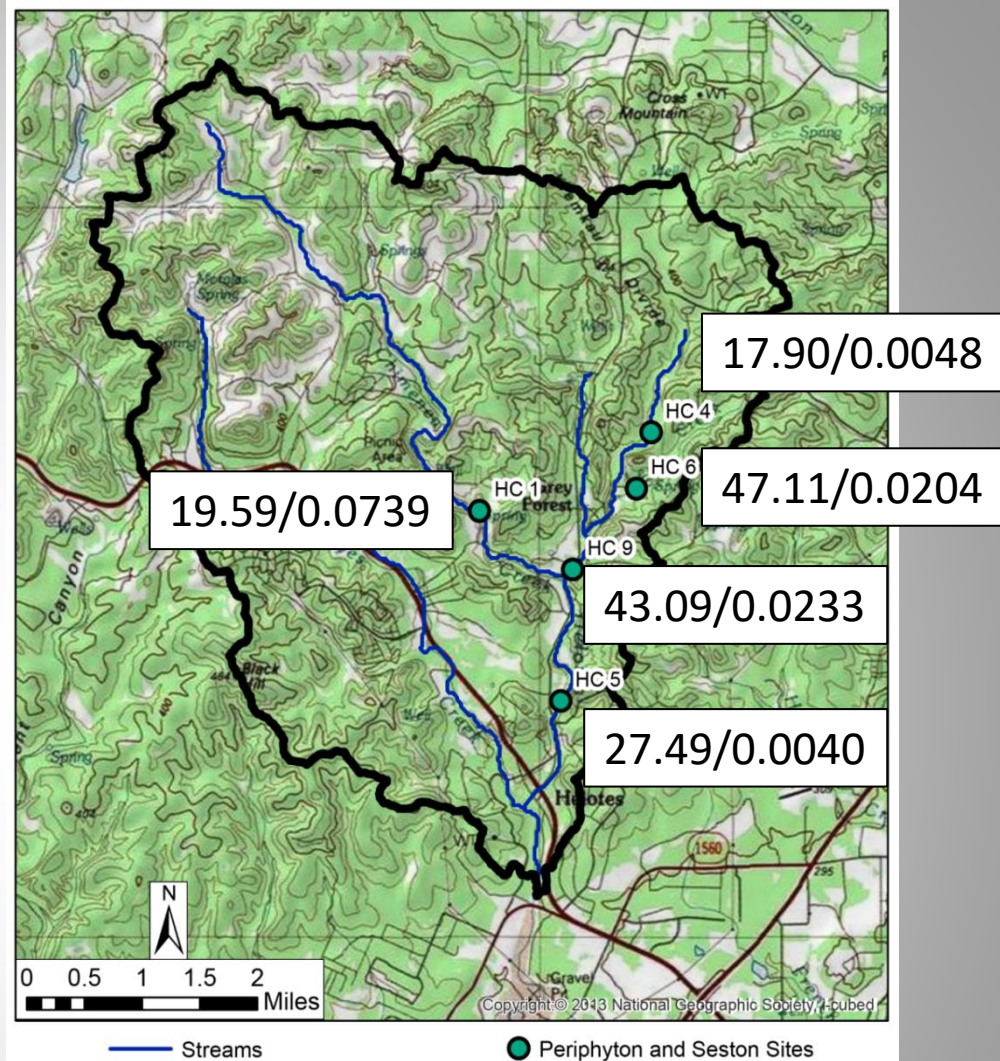


EAA/SwRI Sampled Water and Periphyton/Seston to Determine Trophic State of Helotes Creek Watershed



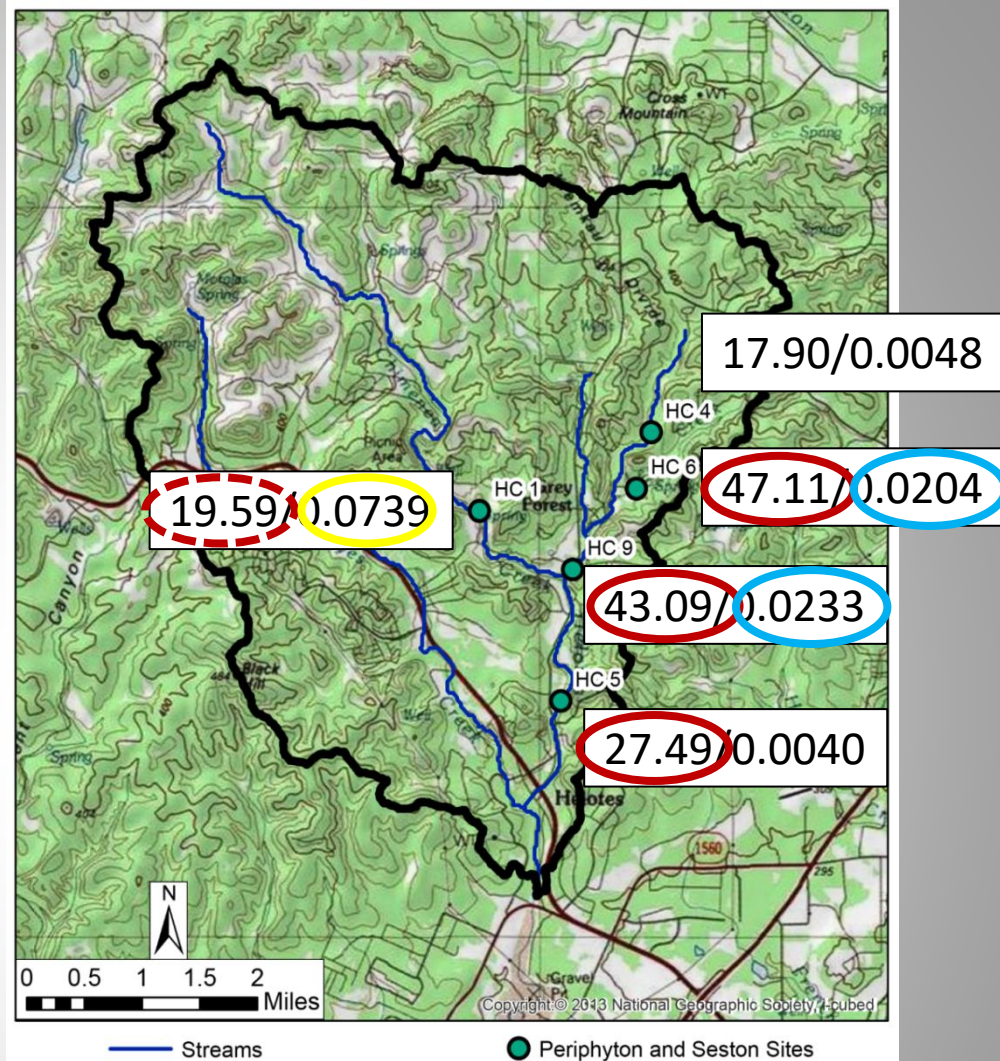
Periphyton – slime stuck to rocks in creek bed
Seston – stuff that floats in creek water
(bio-accumulators)

Periphyton/Seston collected 2019



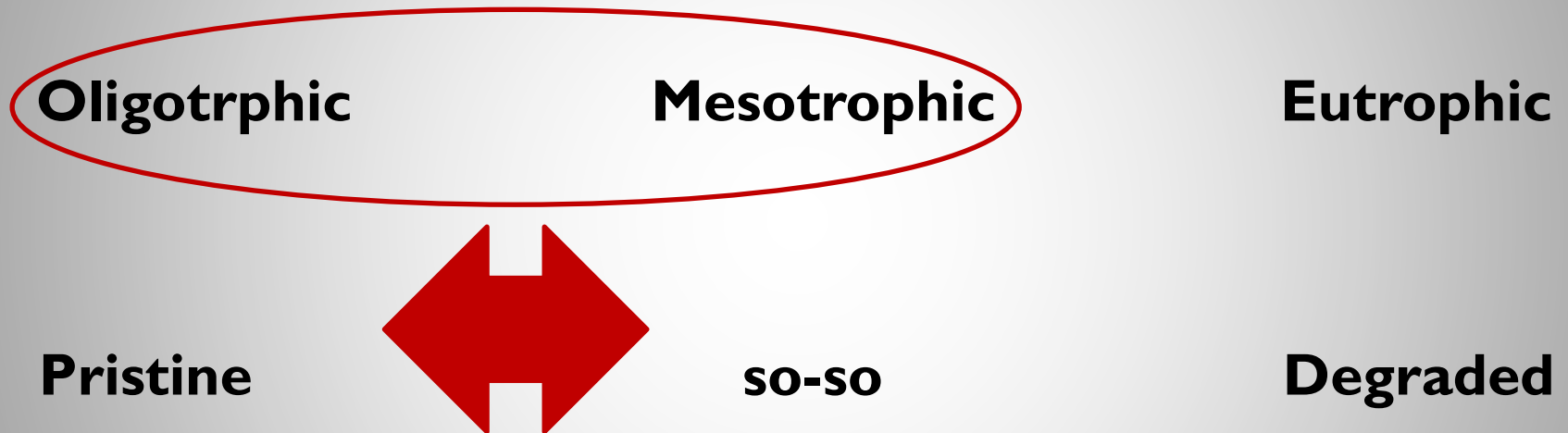
Variable	Oligotrophic-mesotrophic boundary	Mesotrophic-eutrophic boundary
Mean benthic chlorophyll (mg/m ²)	20	70
Maximum benthic chlorophyll (mg/m ²)	60	200
Sestonic chlorophyll (mg/L)	0.010	0.030

Periphyton/Seston collected 2019



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Use trophic state to determine degradation of the watershed



Helotes Creek is already marginally degraded

What is the Future of the Contributing Zone in NW Bexar County?



Proposition 1 Water Quality Demonstration Projects Edwards Aquifer Protection Program

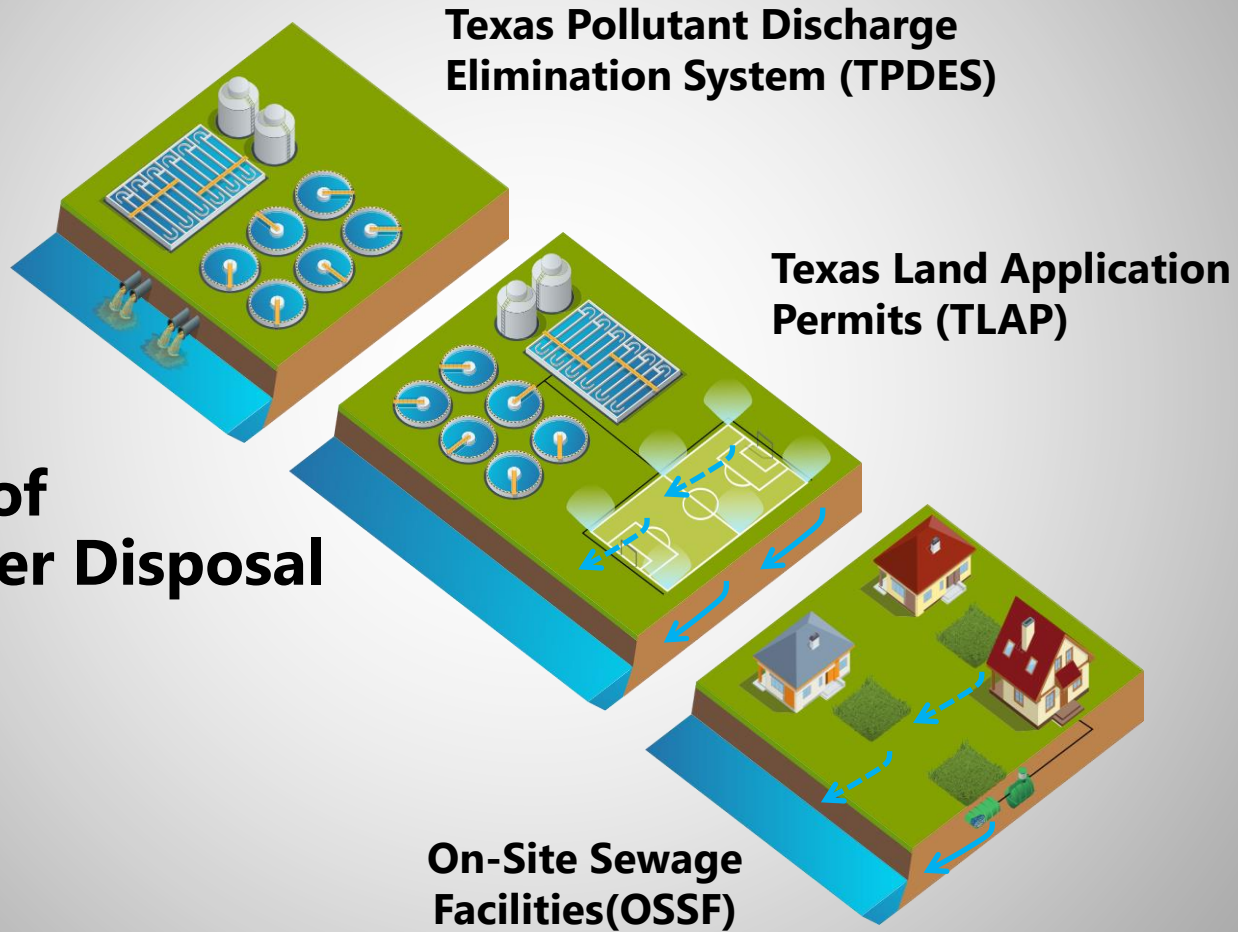
Comparative Evaluation of Wastewater Disposal Practices in the Contributing Zone of the Edwards Aquifer (2018-2020)

Southwest Research Institute®

**with
Edwards Aquifer Authority
City of Austin
University of Texas – San Antonio**

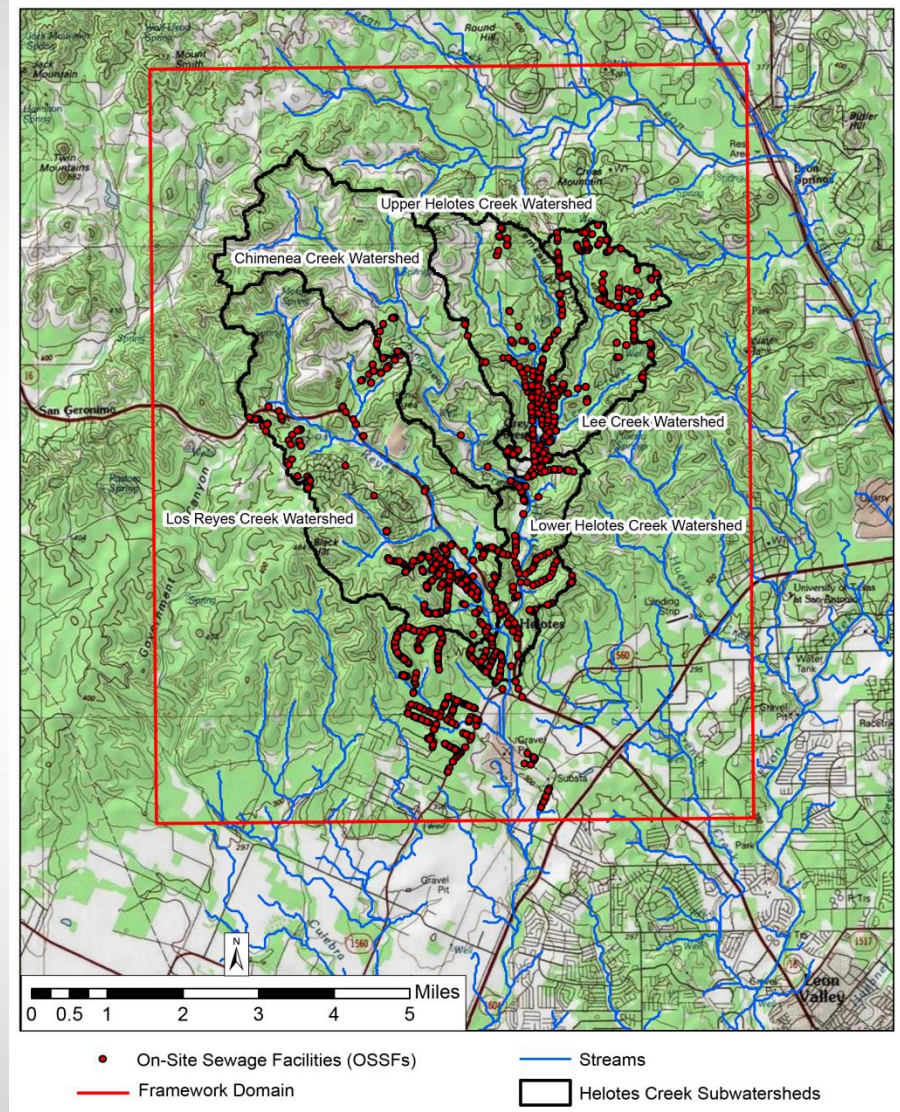
Project Overview/Scope

Methods of Wastewater Disposal



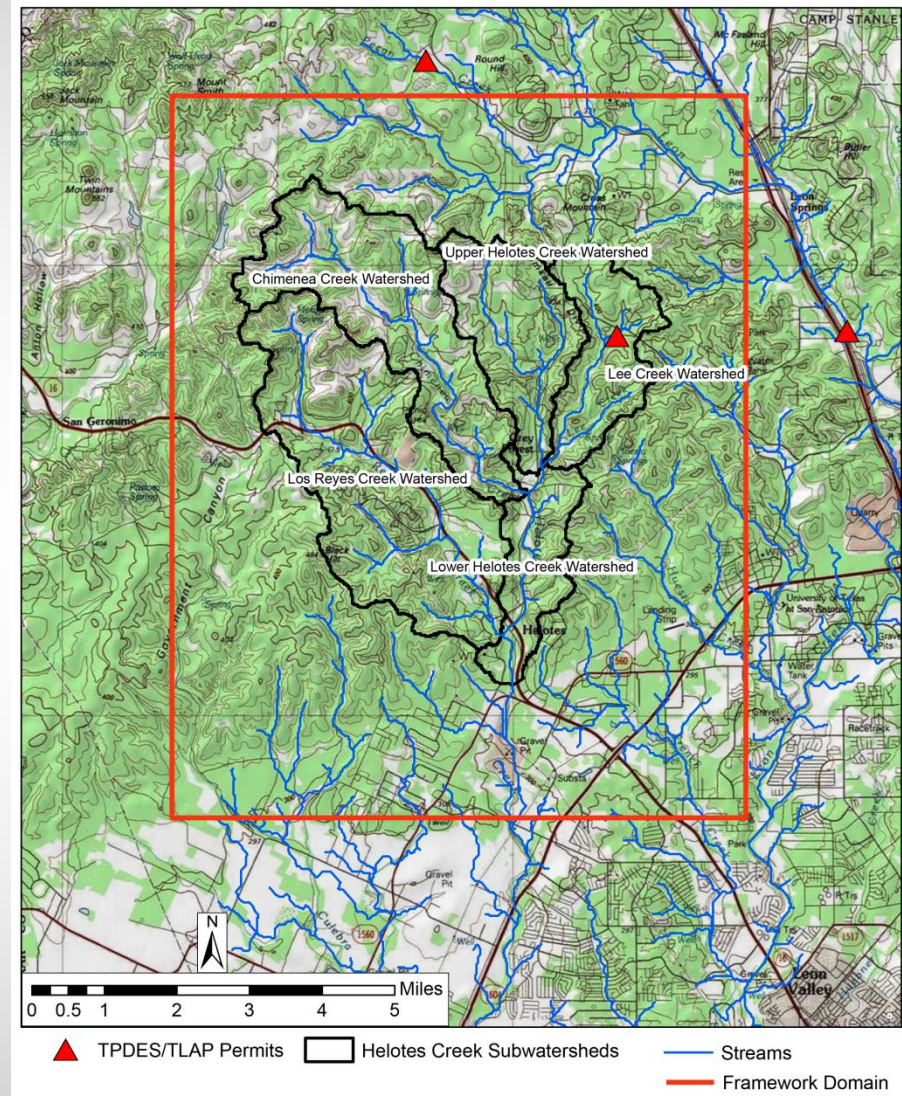
OSSF Permits

- There are 1,412 OSSFs within the watershed
- Both standard systems and aerobic-surface spray systems,
- Distance to creek beds:
 - Lowest: < 1 ft
 - Greatest: ~ 2569 ft
 - Average: ~ 827.3 ft
 - Median: ~ 762.4 ft



No TPDES and TLAP in Study Area*

- **TPDES** = Texas Pollutant Discharge Elimination System; federally-regulated permits
- **TLAP** = Texas Land Application Permit; state-regulated permits

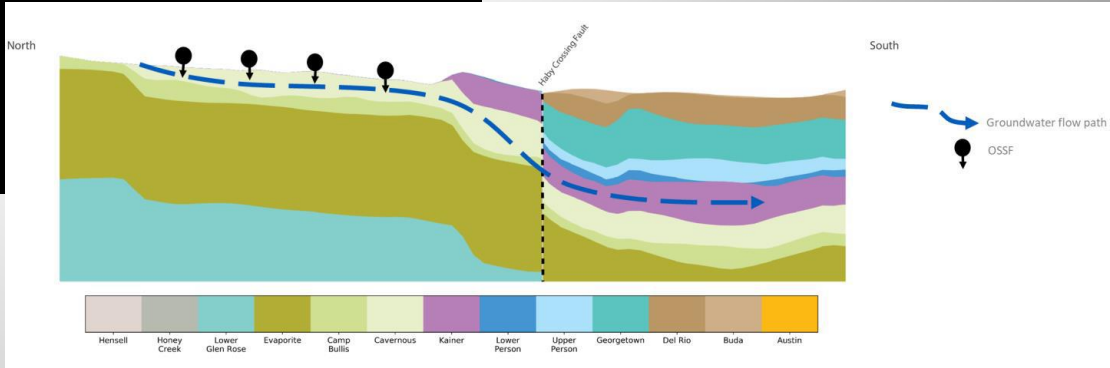
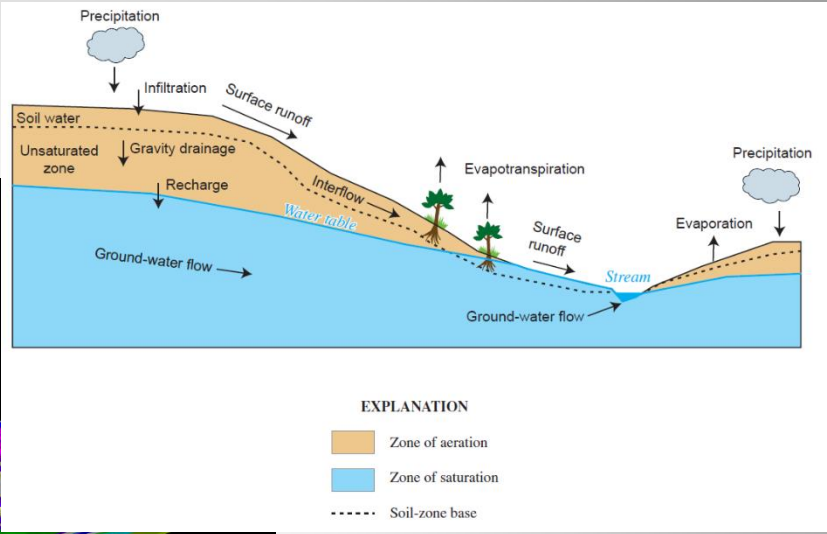
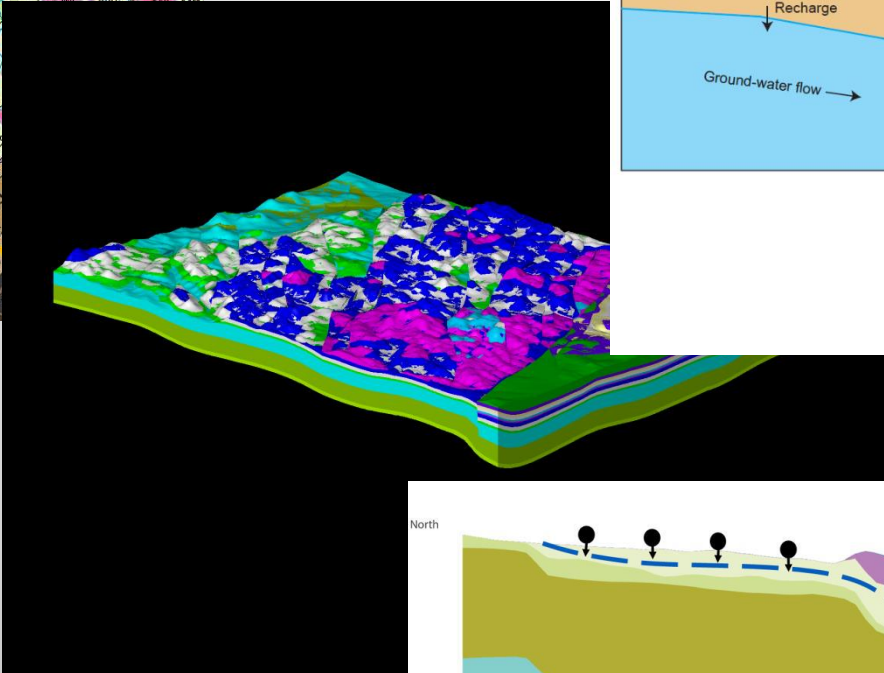
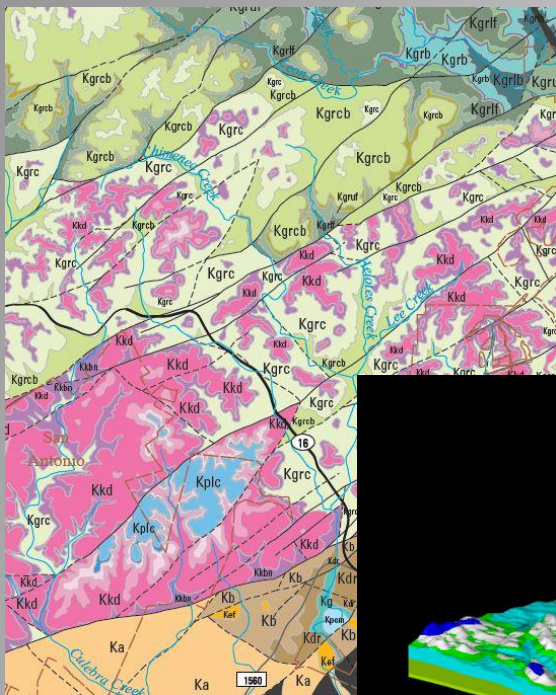


* One was "in the books" but addressed at another area in Bexar County

Developed Integrated Hydrologic Model to Predict Impact of Different Types of Waste Disposal Facilities

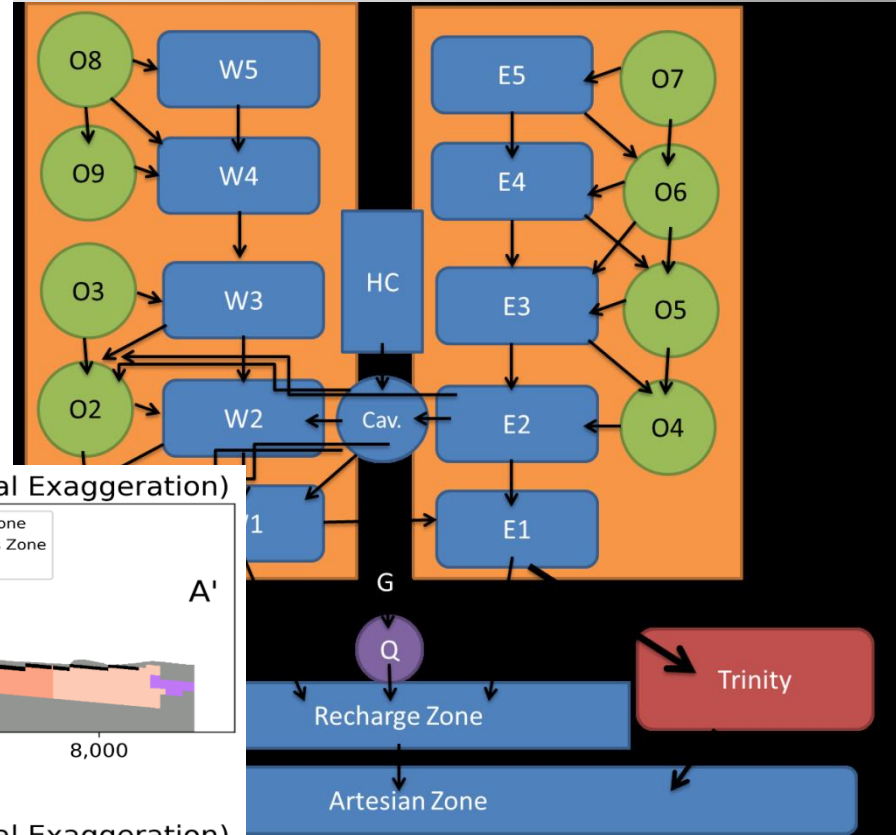
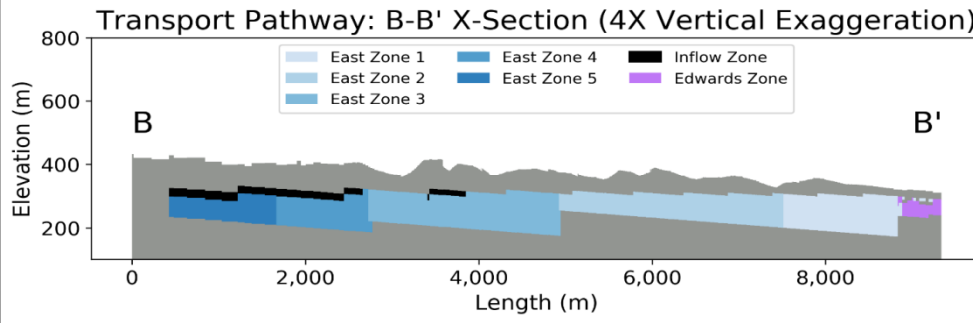
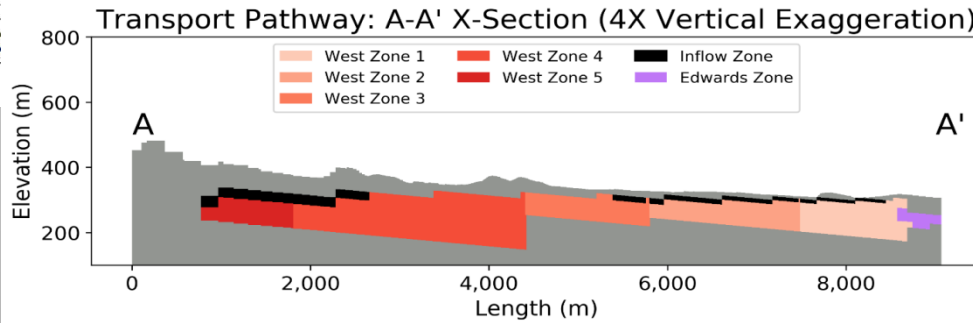
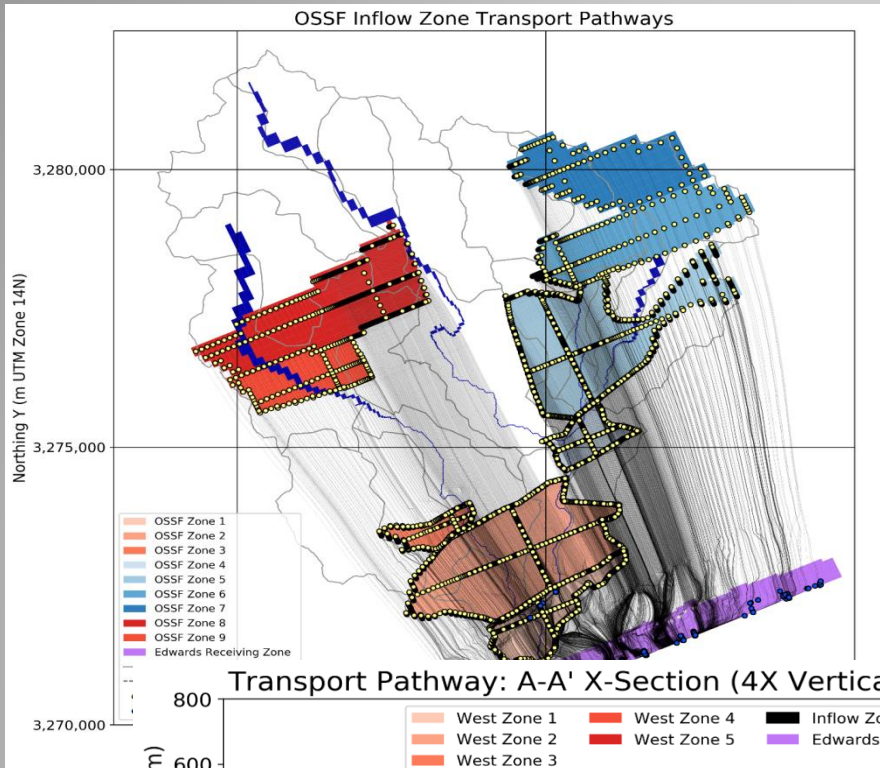
- Hydrologic modeling requires two integrated models.
 - Groundwater Model
 - Surface-Water Flow Model
- All modeling software is open source and available in the public domain.

Integrated Model

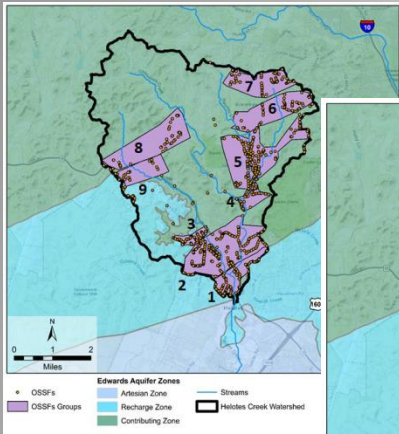


All Effluent Ends Up in Edwards Aquifer

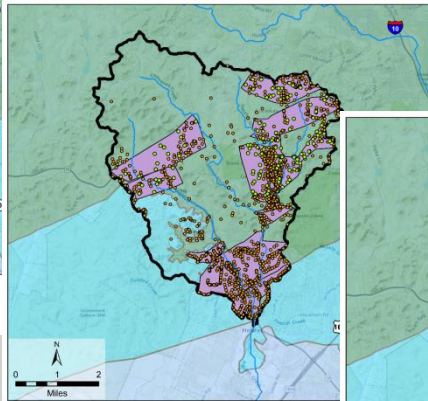
Transport Model GoldSim



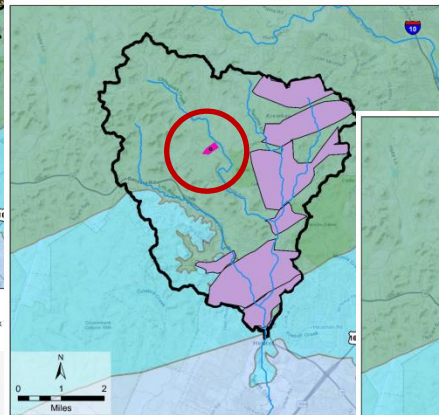
Considered Eight Scenarios



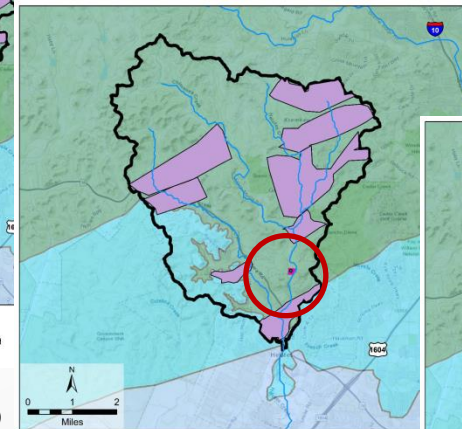
Basecase
Existing OSSFs



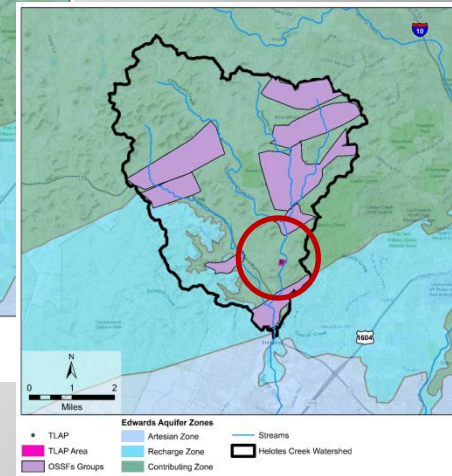
Scenarios 1-3
OSSFs



Scenarios 4 & 6
Upstream TLAP



Scenarios 5 & 7
Downstream TLAP

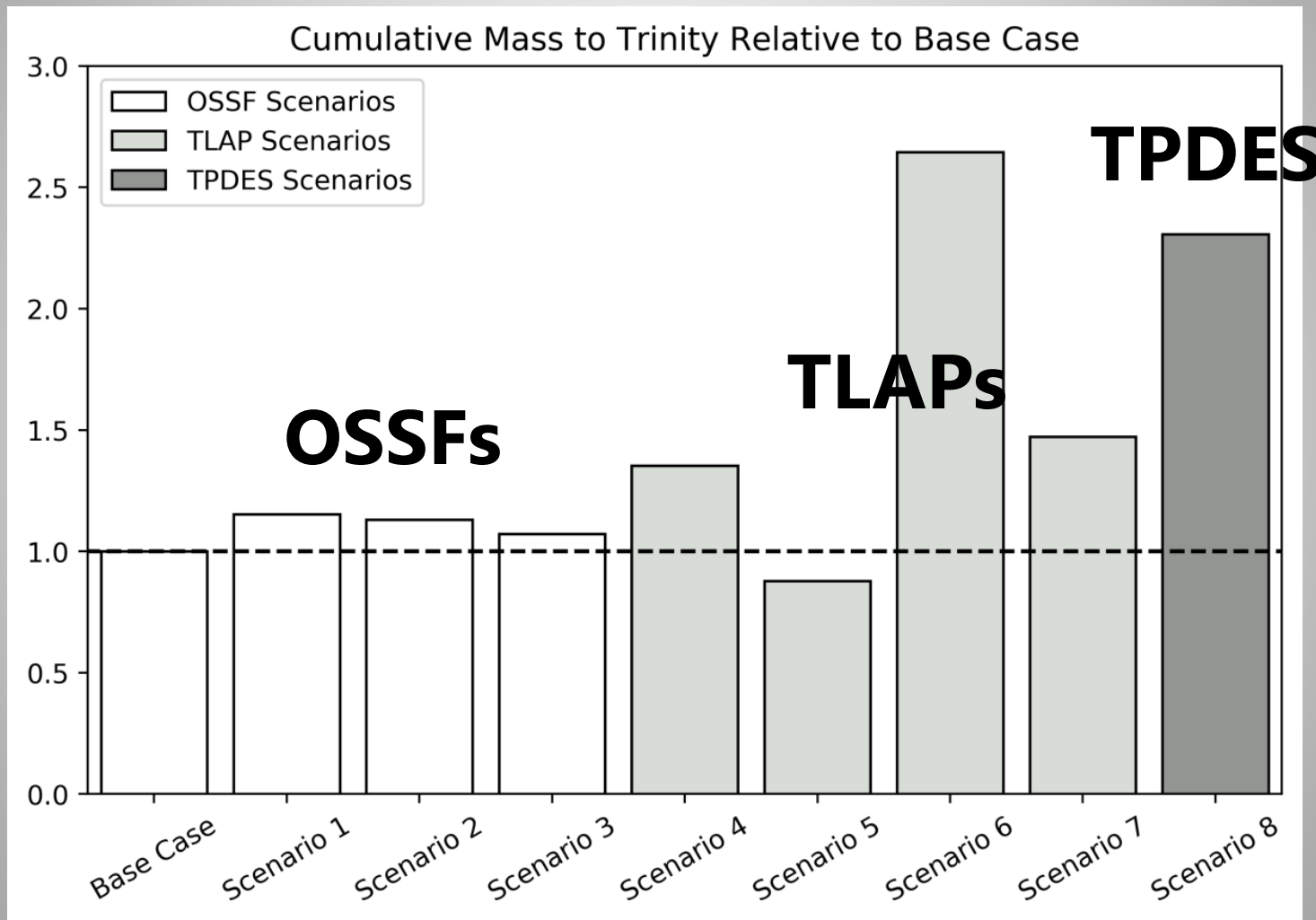


Scenario 8
Downstream TPDES

Scenarios

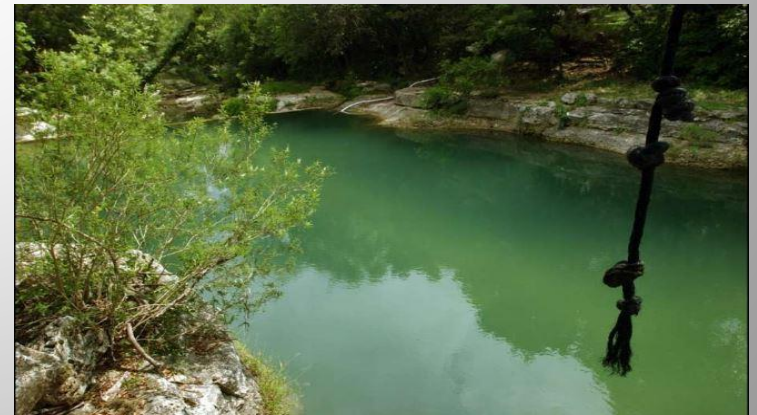
- OSSF scenarios **include unaccounted and defective facilities.**
- Capacity of the TPDES and TLAP facilities equates to **4,800 homes over 1,800 acres**, a residential development conceivable in the 15,640 acre Helotes Creek watershed.

Results



Conclusions of EAPP Study

- **Integrated model developed** to simulate wastewater impact on recharge
- Impact of OSSF, TLAP, and TPDES **simulated**
- Trophic state of Helotes Creek is already **marginally impacted**
- **Eight scenarios evaluated**, many others possible (i.e., simulating particular facilities, varying distance to creek, field testing TLAP & TPDES, etc.)
- Increased discharge of effluent, **regardless of facility type**, will render the creek **clearly degraded**



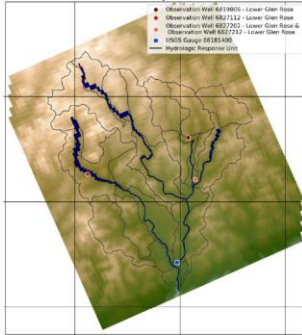
Closing Note

**Impact of development within Helotes
is not addressed in this evaluation**

Questions

Background Documentation

Comparative Evaluation of Wastewater Disposal Practices in the Contributing Zone of the Edwards Aquifer



Prepared for:

City of San Antonio, Parks and Recreation Department,
Edwards Aquifer Protection Program
and
San Antonio River Authority

by:

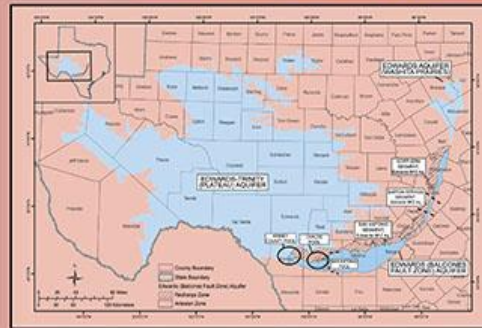
Mauricio E. Flores, Ronald T. Green, PhD, P.G., Kindra Nicholaides,
Paul Southard, Rebecca Nunu, David Ferrill, PhD, P.G., Gary Walter, PhD,
Stuart Stothoff, PhD, P.G., Nicholas Martin, P.G., P.H.
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July 2020

The Edwards Aquifer: The Past, Present, and Future of a Vital Water Resource

Edited by John M. Sharp Jr., Ronald T. Green,
and Geary M. Schindel



Memoir 215



The Edwards Aquifer

Jack Sharp and Ron Green



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<https://gw-project.org/books/the-edwards-aquifer/>

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