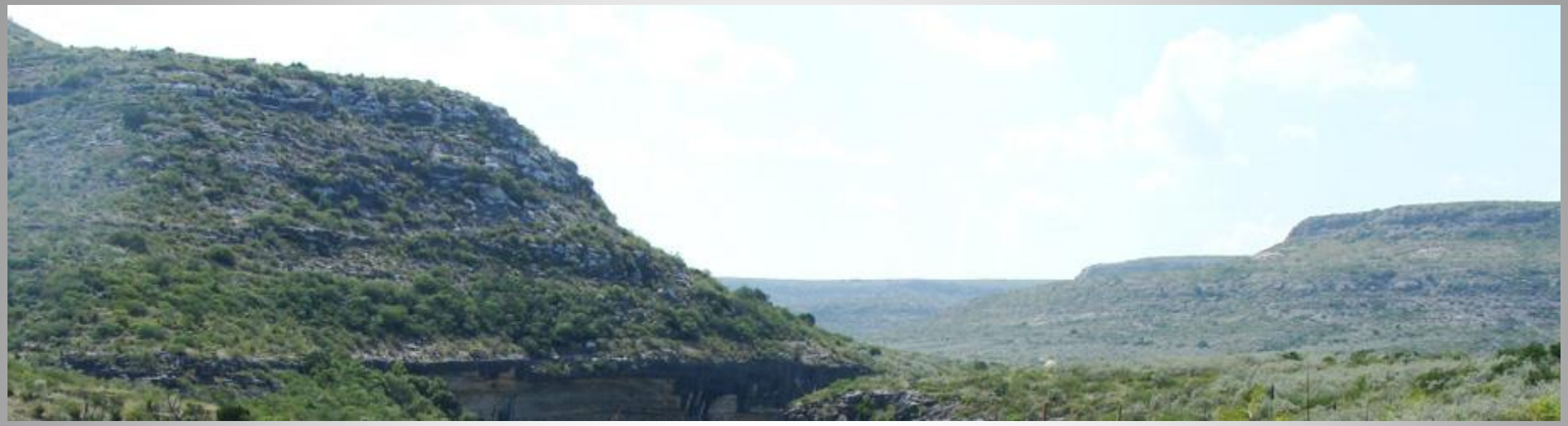
Importance of Protecting the Edwards Aquifer Contributing Zone/Trinity Aquifer Recharge Zone

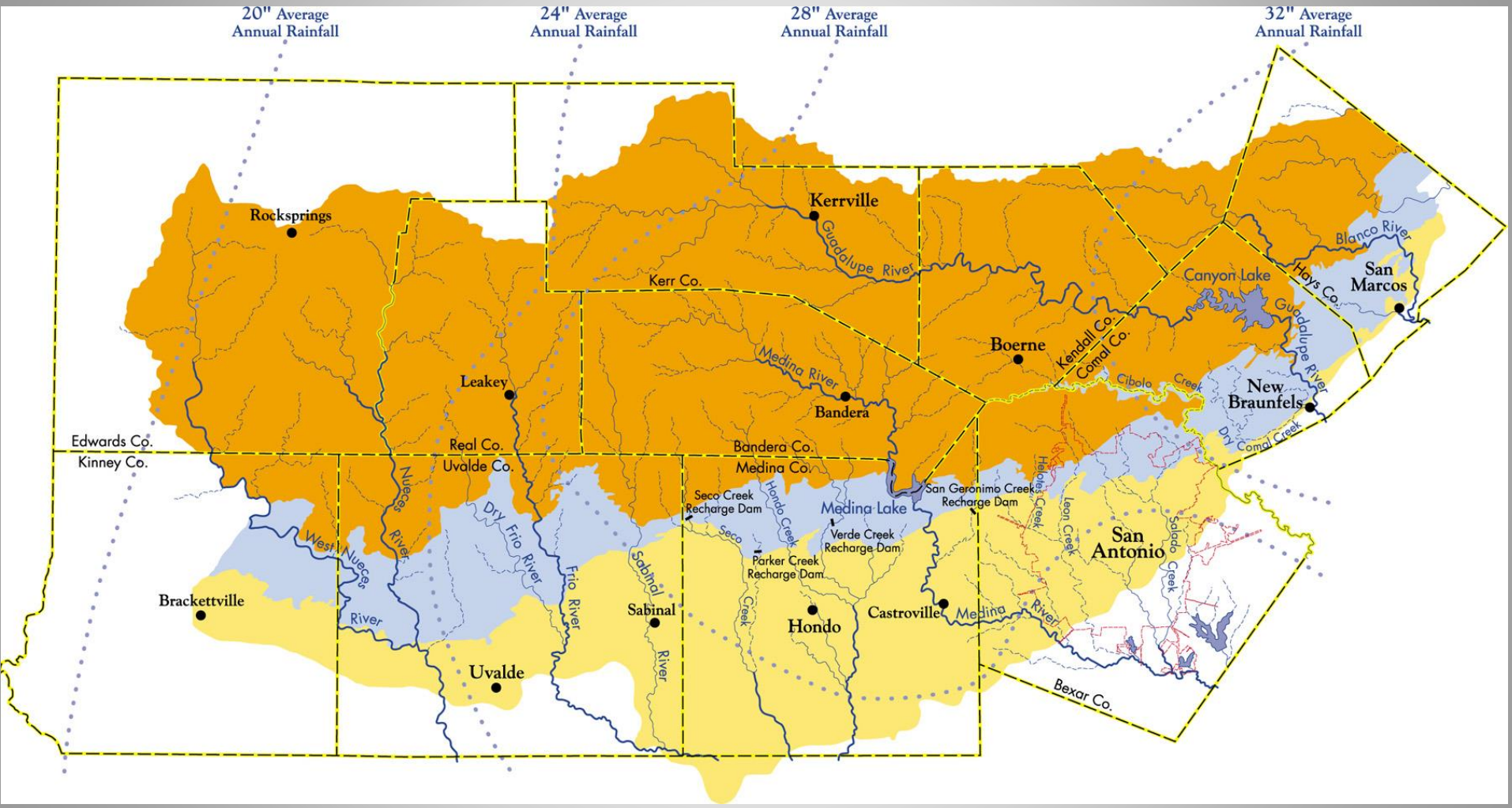


Trinity Glen Rose GCD
July 13, 2023

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

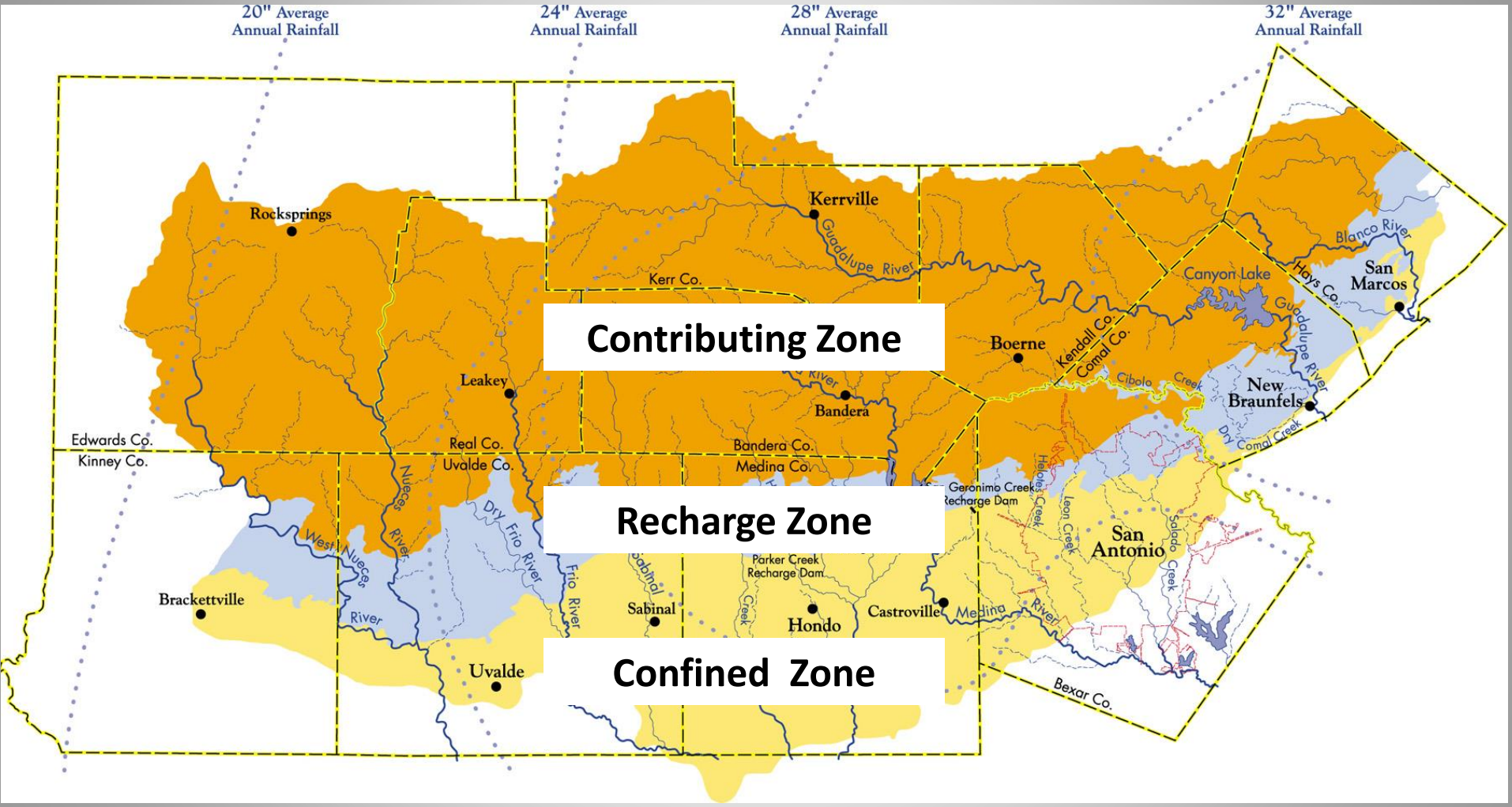
What is the relationship between the Trinity and Edwards aquifers?

Edwards Aquifer



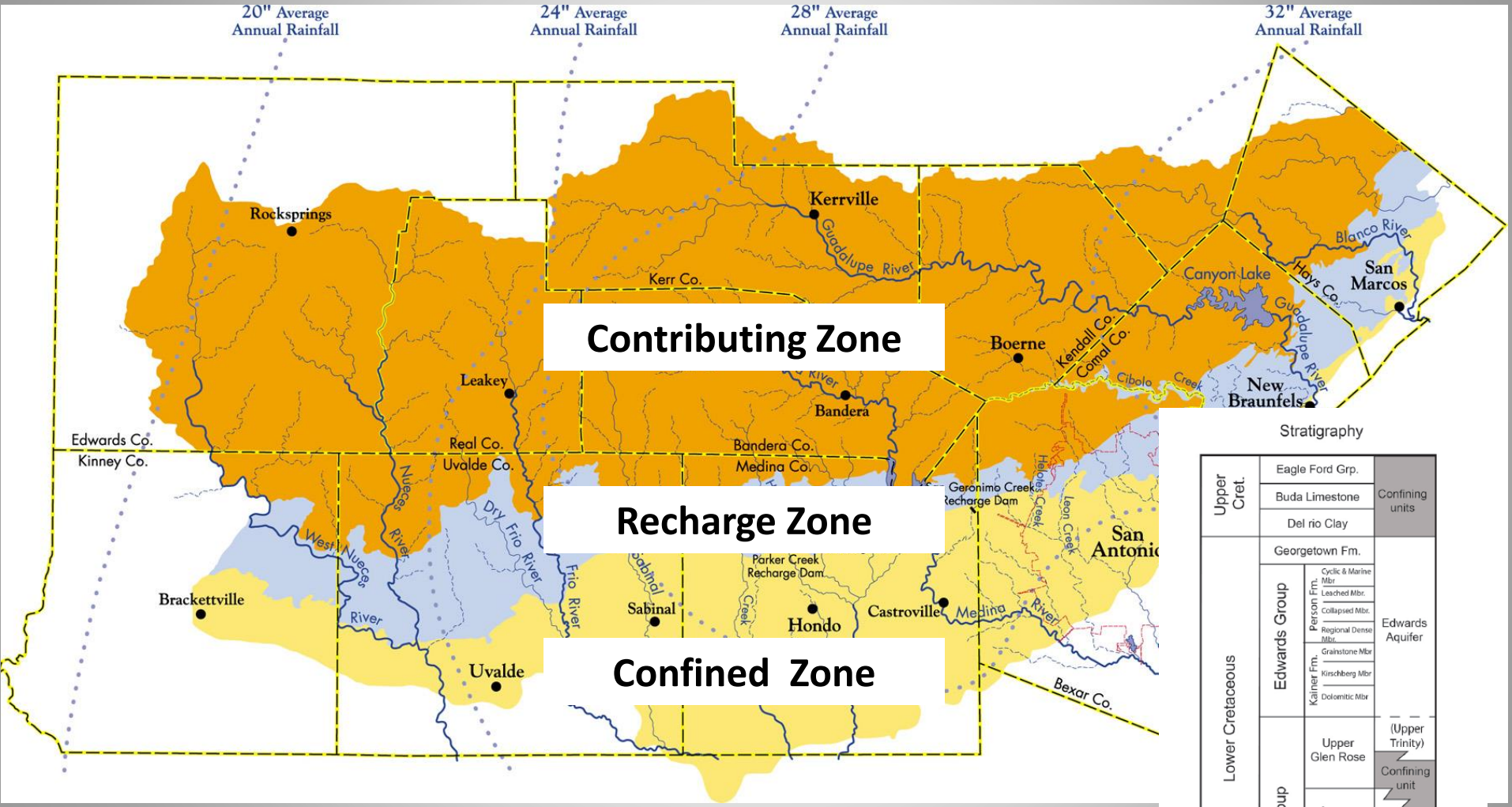
Source: Edwards Aquifer Authority 2008

Edwards Aquifer



Source: Edwards Aquifer Authority 2008

Edwards Aquifer

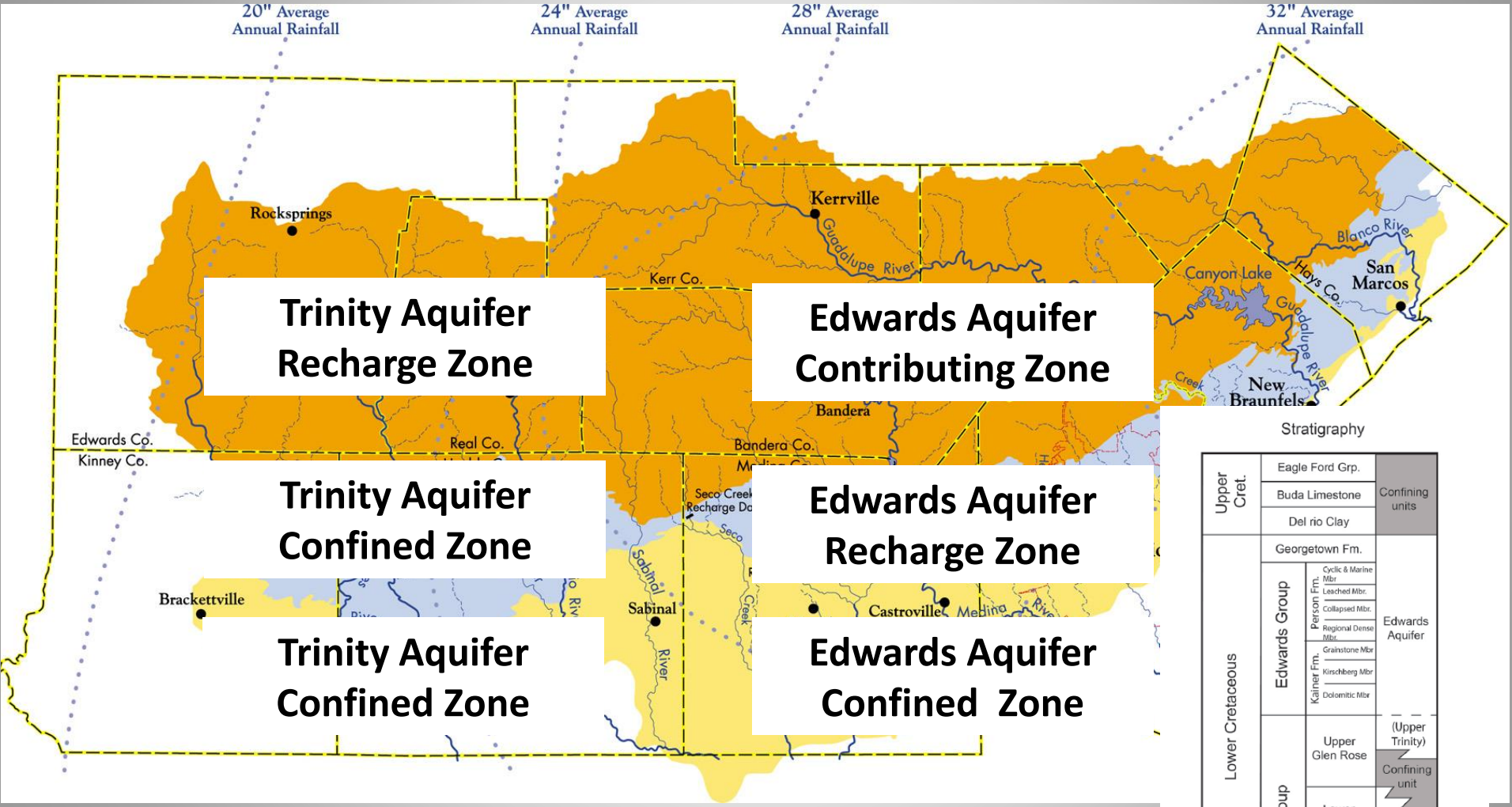


Stratigraphy

Upper Cret.	Eagle Ford Grp.		Confining units
	Buda Limestone		
	Del rio Clay		
Lower Cretaceous	Georgetown Fm.		Edwards Aquifer
	Edwards Group	Person Fm.	Cyclic & Marine Mbr
			Leached Mbr.
			Collapsed Mbr.
			Regional Dense Mbr.
		Kainer Fm.	Grainstone Mbr
			Kirschberg Mbr
			Dolomitic Mbr
	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

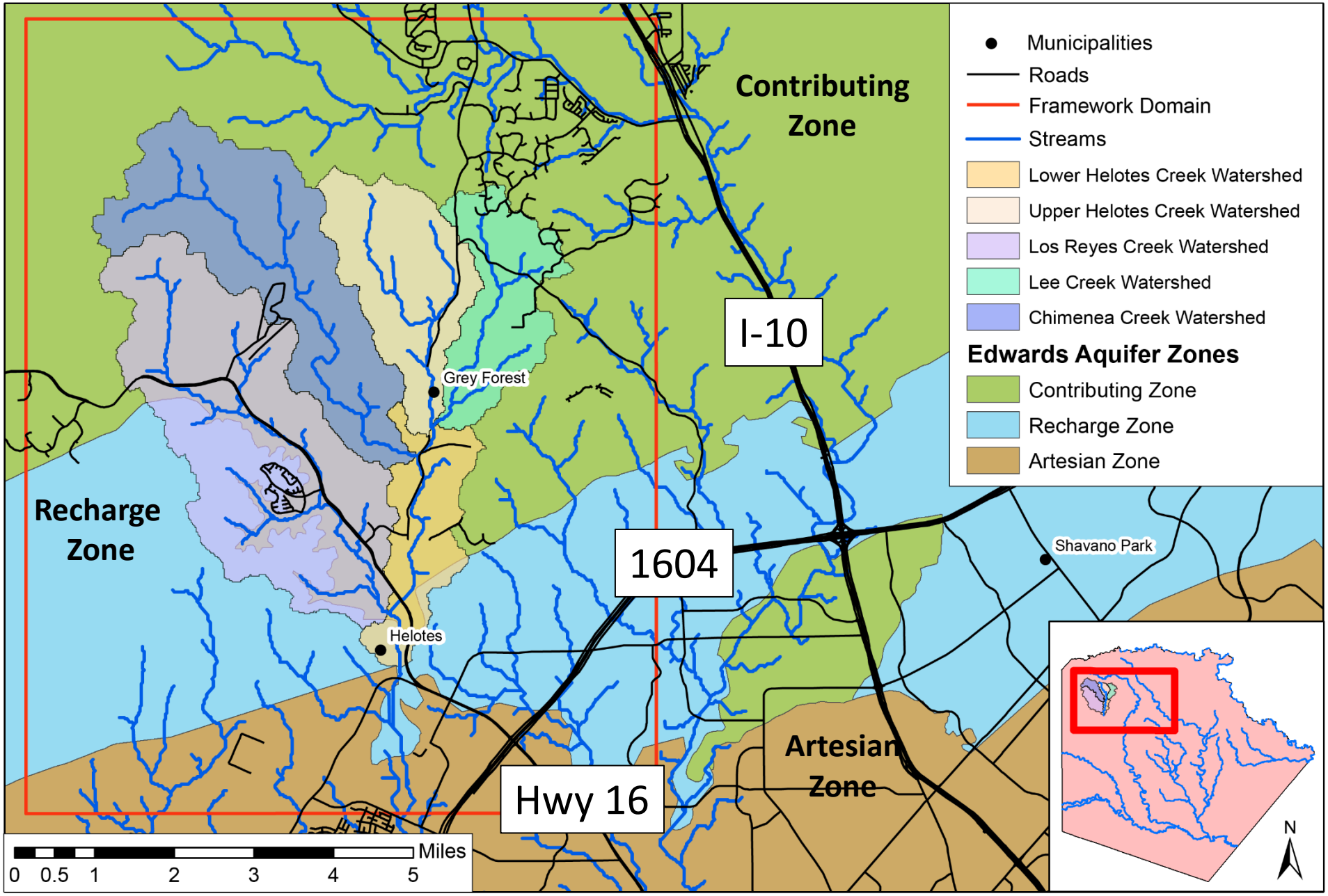
Edwards Aquifer – Trinity Aquifer



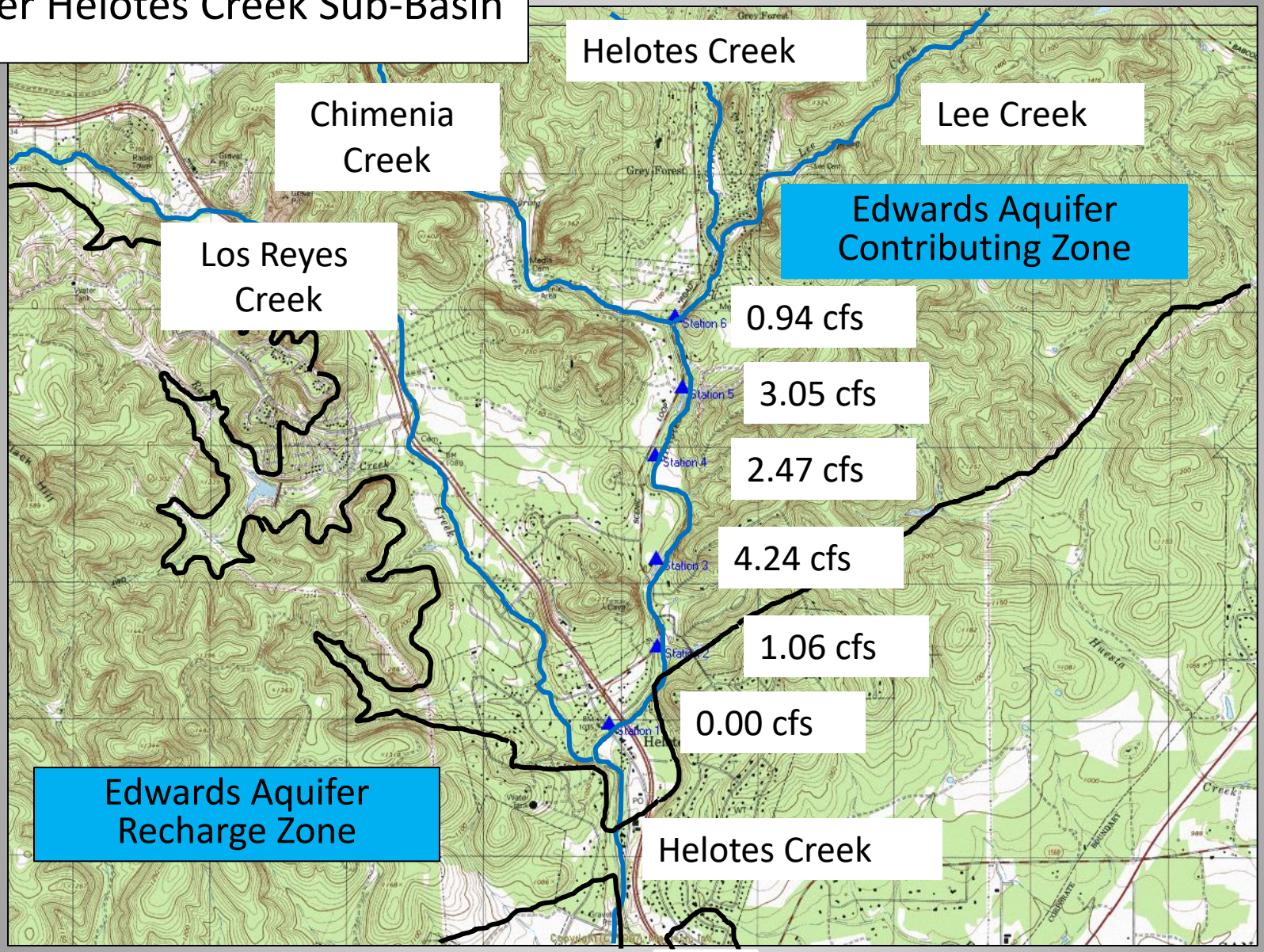
Source: Edwards Aquifer Authority 2008

Transition from Trinity to Edwards Aquifer

Gain/Loss Study of Helotes Creek


Municipalities
Roads
Framework Domain
Streams
Lower Helotes Creek Watershed
Upper Helotes Creek Watershed
Los Reyes Creek Watershed
Lee Creek Watershed
Chimenea Creek Watershed
Edwards Aquifer Zones
Contributing Zone
Recharge Zone
Artesian Zone
Contributing Zone
Recharge Zone
Artesian Zone
I-10
1604
Hwy 16
Grey Forest
Helotes
Shavano Park
Miles
0 0.5 1 2 3 4 5
N

Lower Helotes Creek Sub-Basin



Lower Helotes Creek Sub-Basin

Helotes Creek Contributing Zone

Chimenia Creek

Los Reyes Creek

4.24 cfs

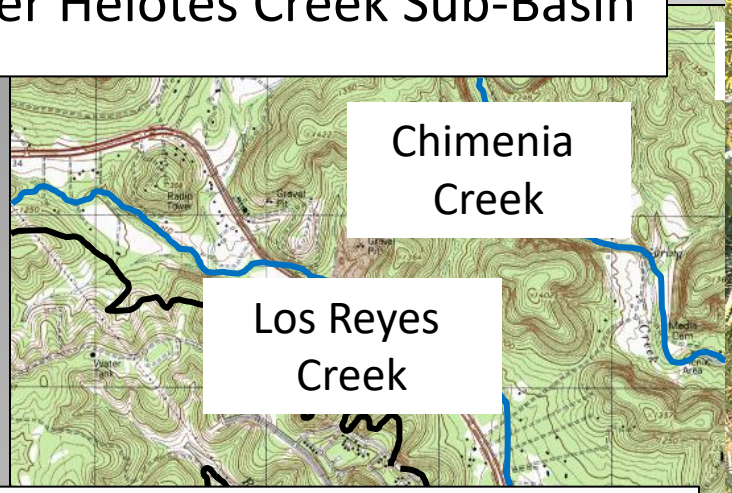
1.06 cfs

0.00 cfs

Edwards Aquifer Recharge Zone

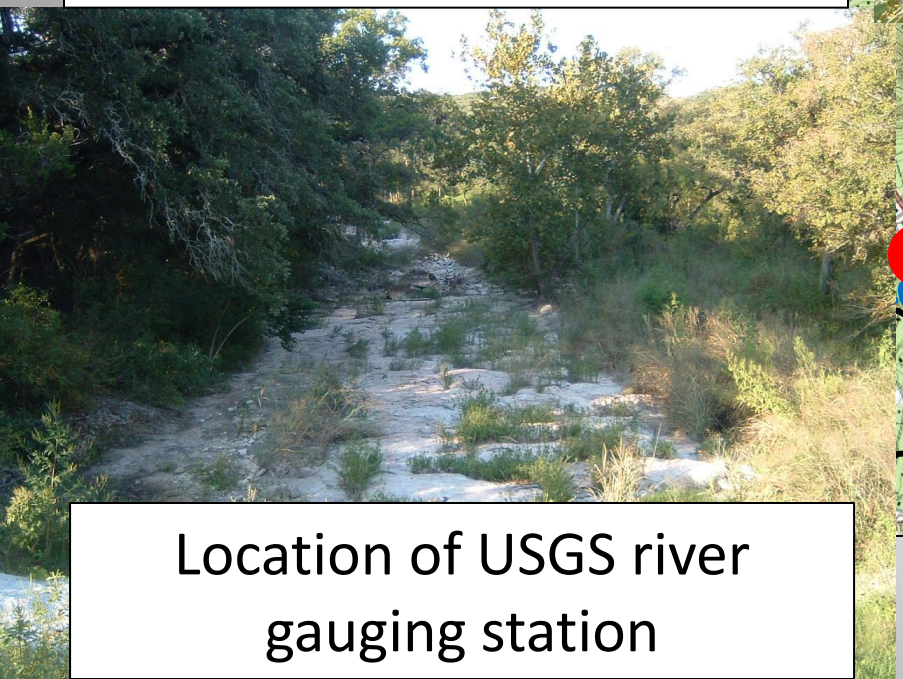
Helotes Creek

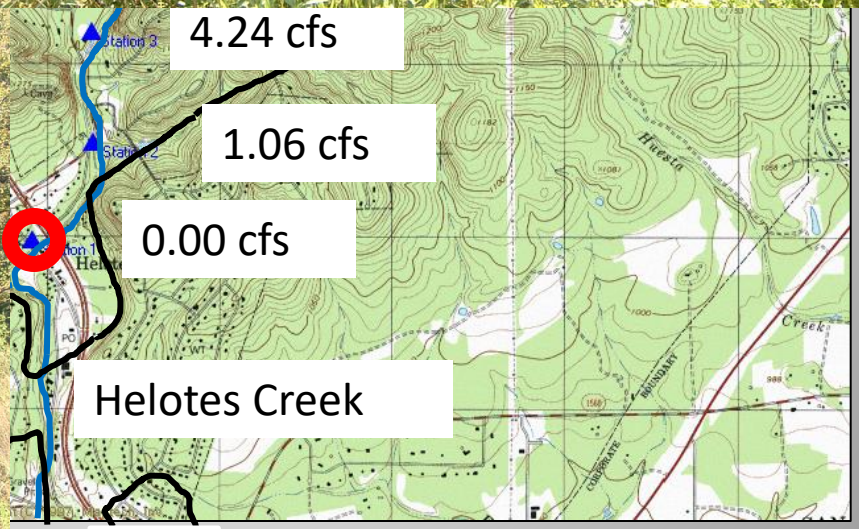
Lower Helotes Creek Sub-Basin



Helotes Creek Contributing Zone

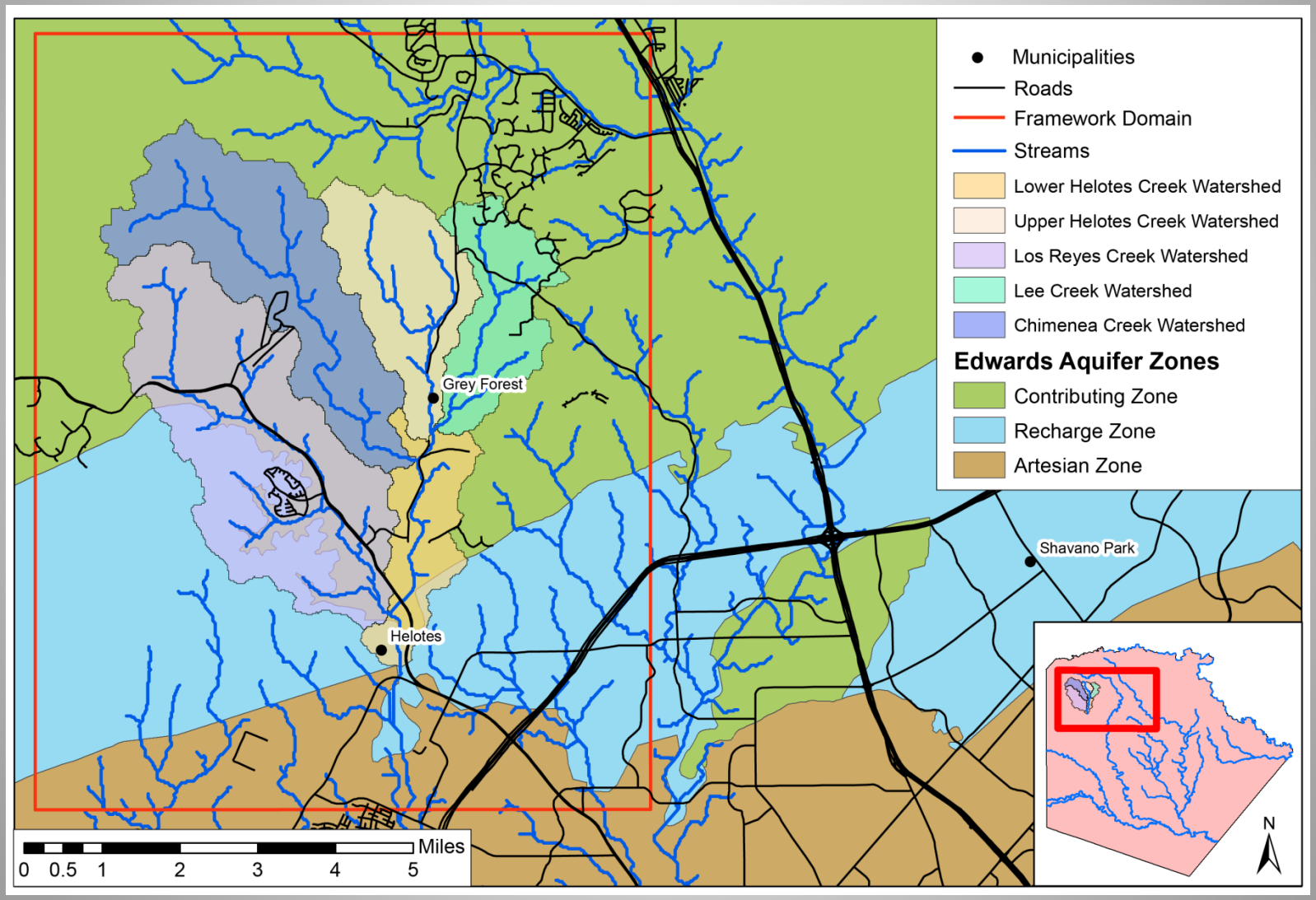
Helotes Creek looking downstream toward Recharge Zone





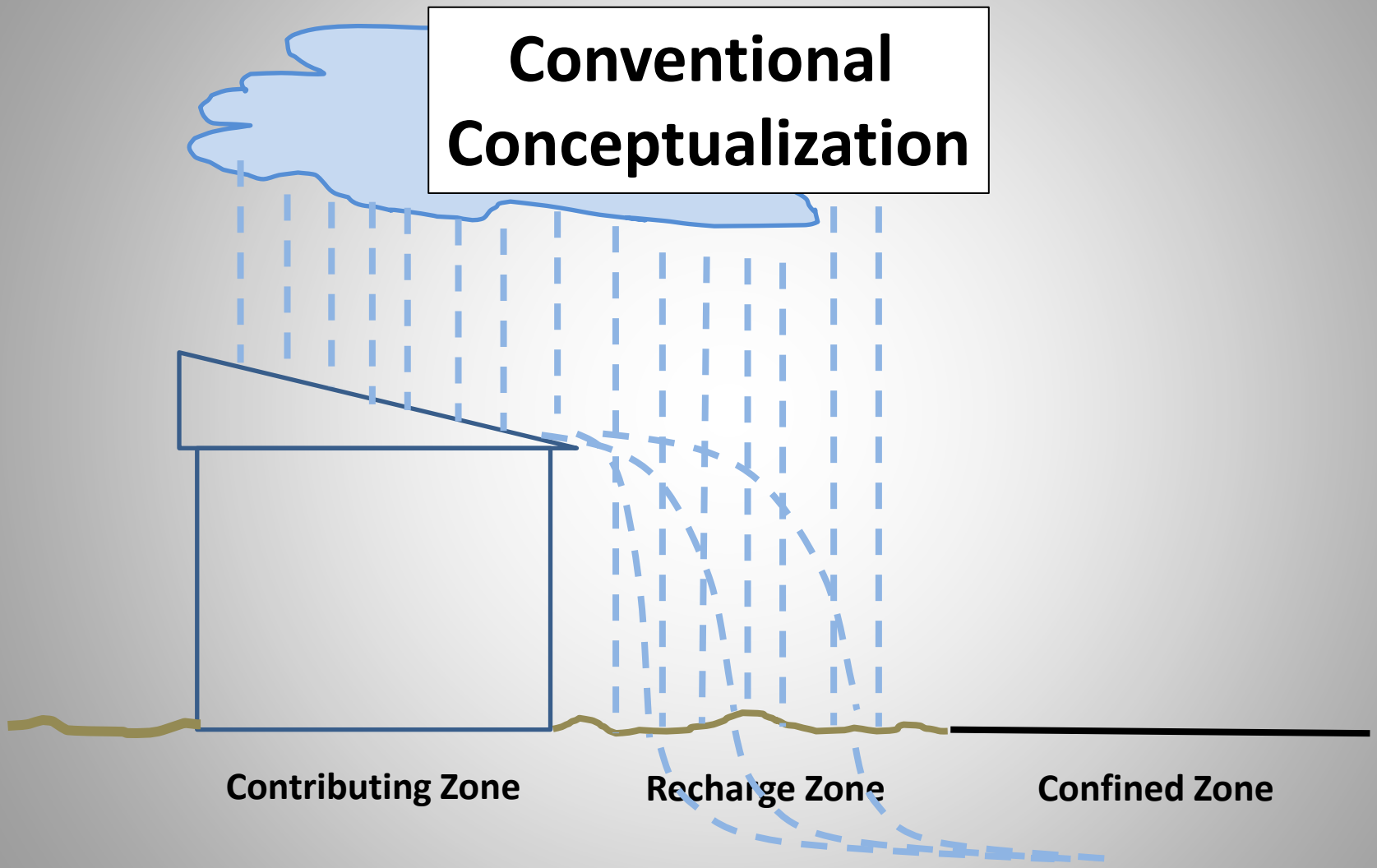
Location of USGS river gauging station

Edwards Aquifer Recharge Zone Absent in Helotes Creek Watershed

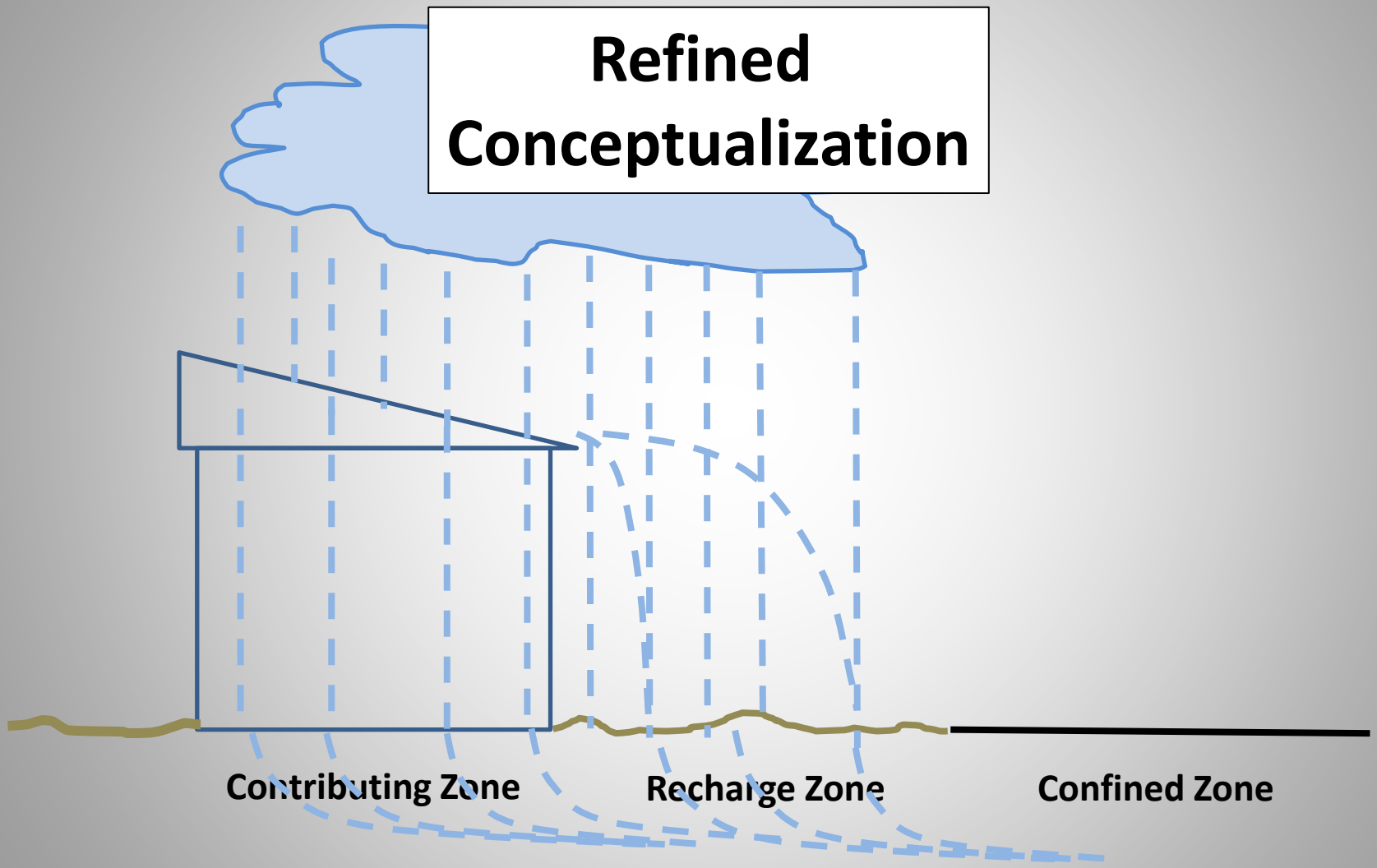


Allogenic + Autogenic Recharge

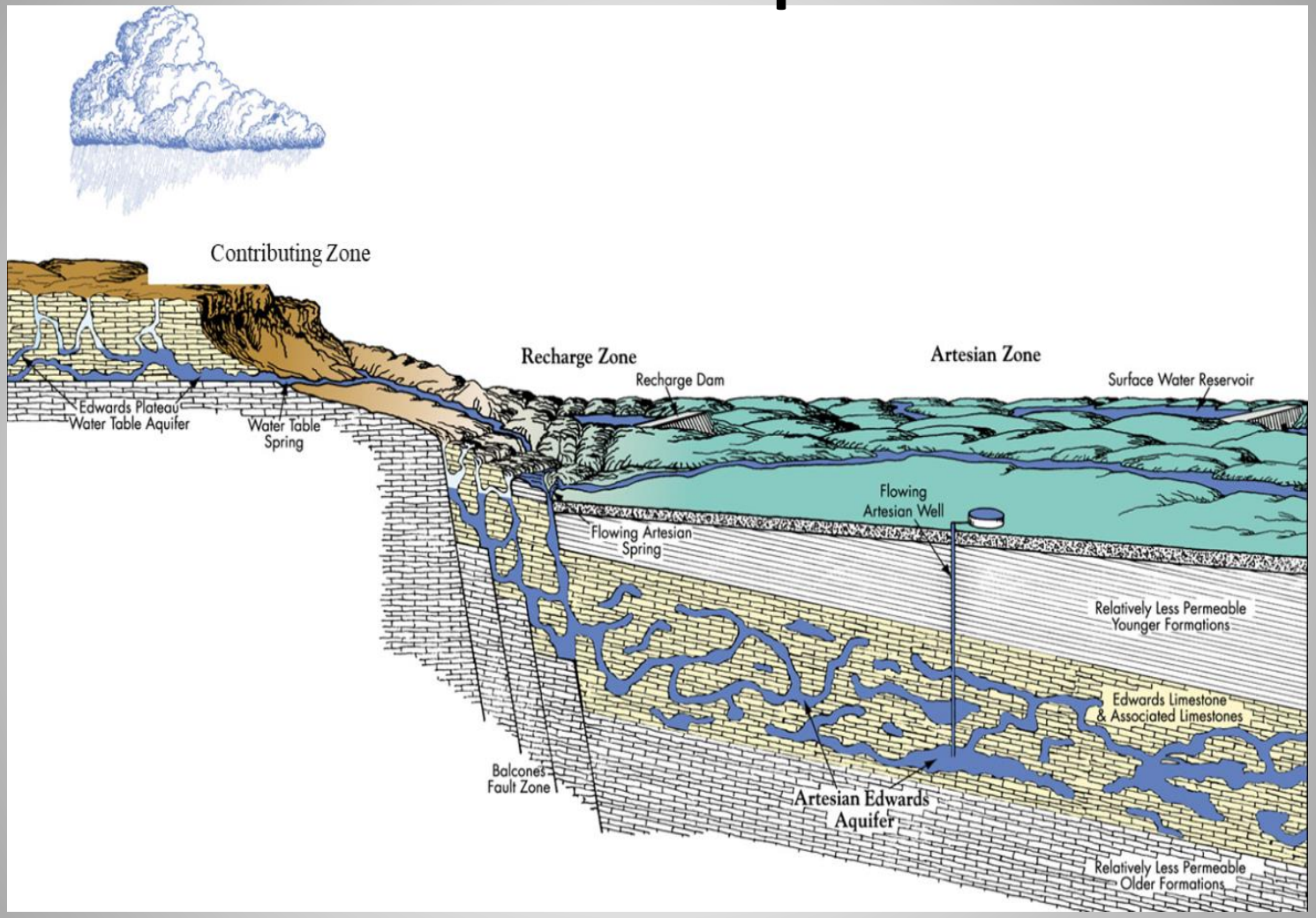
(Derived from Within and from Yonder)



Autogenic + Allogenic Recharge

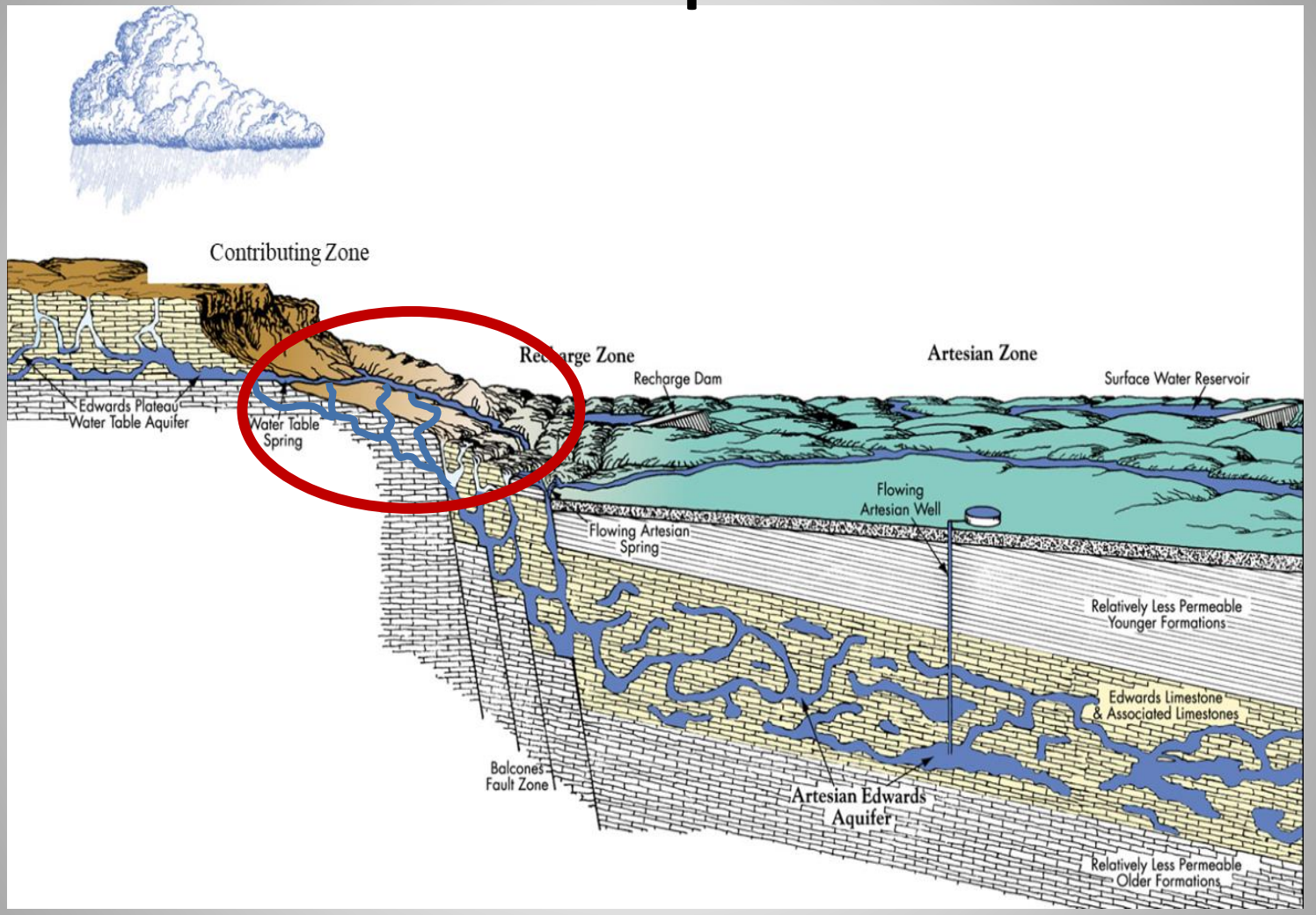


Edwards Aquifer
Conventional Conceptualization



Source: Edwards Aquifer Authority 2008

Edwards Aquifer
Refined Conceptualization



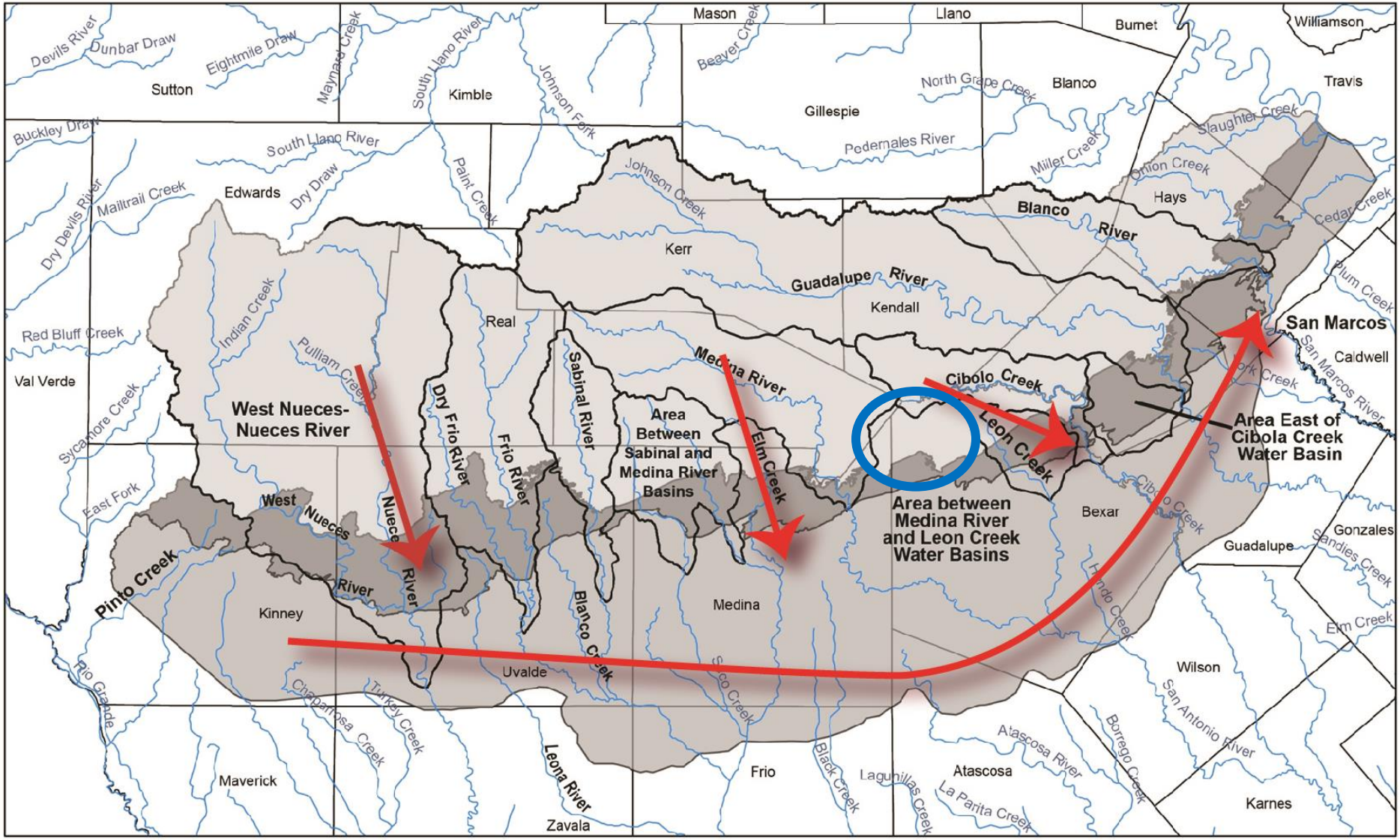
Source: Edwards Aquifer Authority 2008

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

How Does Development Impact the Environment?

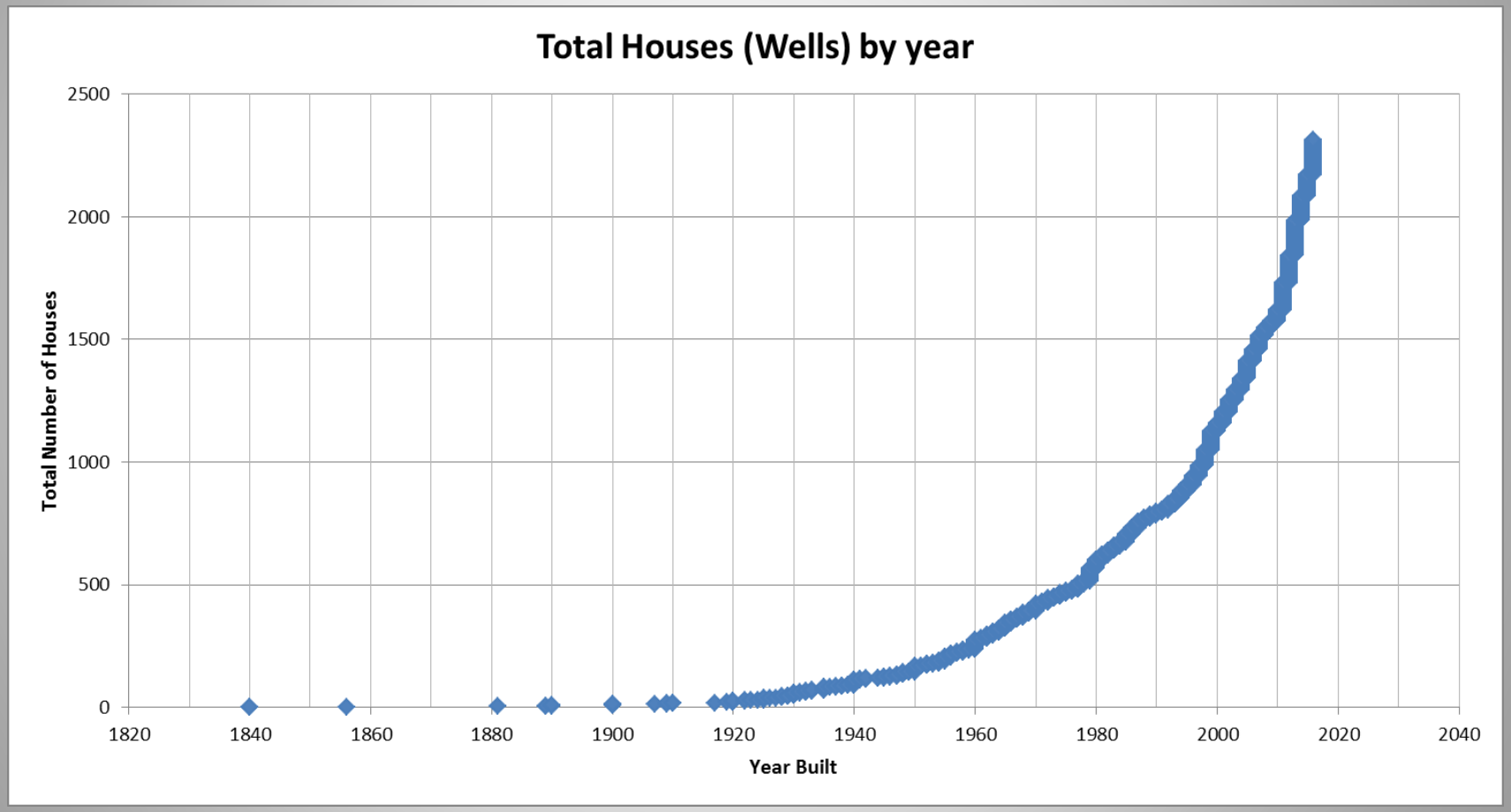
- Dense development increases impervious cover, increases flooding, and degrades runoff.
- Wastewater effluent can degrade the environment if discharged within watersheds.
- Degraded runoff and effluent can impact the Trinity and Edwards aquifers if recharge water is degraded.

Recharge closer to SAWS wellfields has less opportunity to be diluted



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

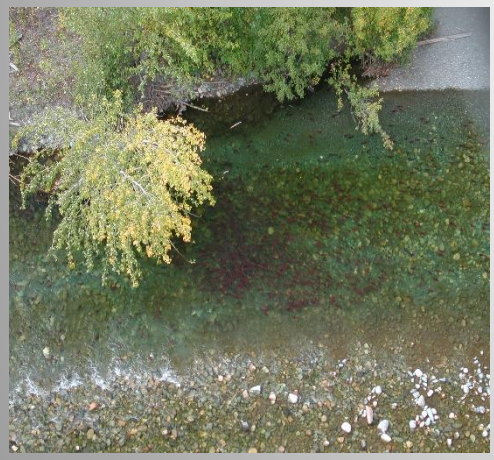
"Exponential" Residential Growth In Helotes Creek Watershed



Bexar County Appraisal District

Use trophic state to determine degradation of the watershed

Oligotrphic **Mesotrophic** **Eutrophic**



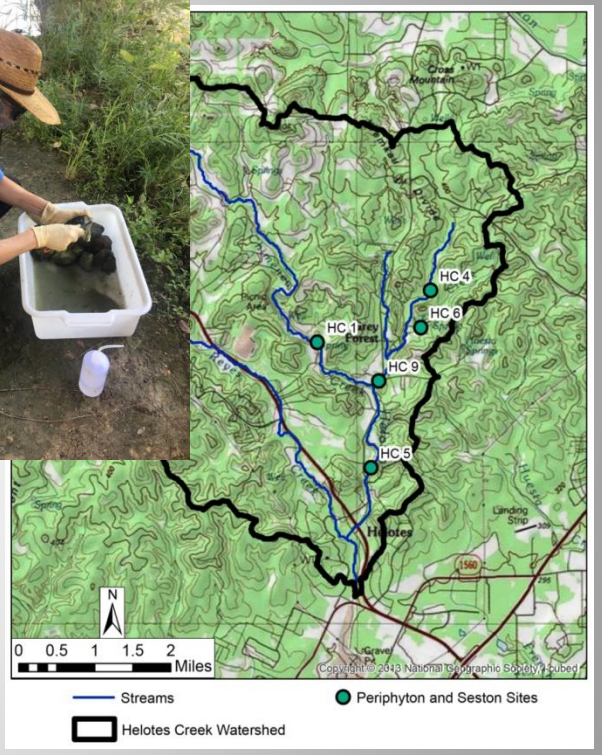
So-So

Pristine **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

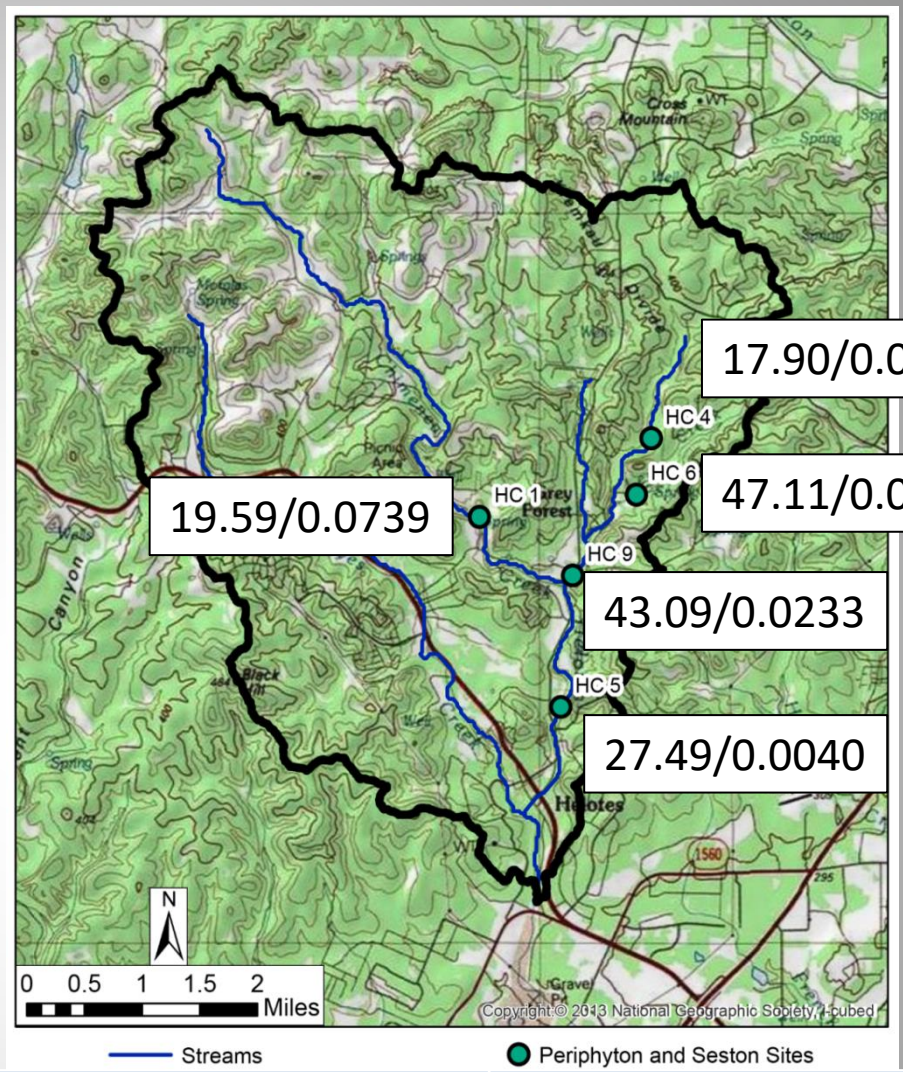
EAA/SwRI Sampled Water and Periphyton/Seston to Determine Trophic State of Helotes Creek Watershed

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



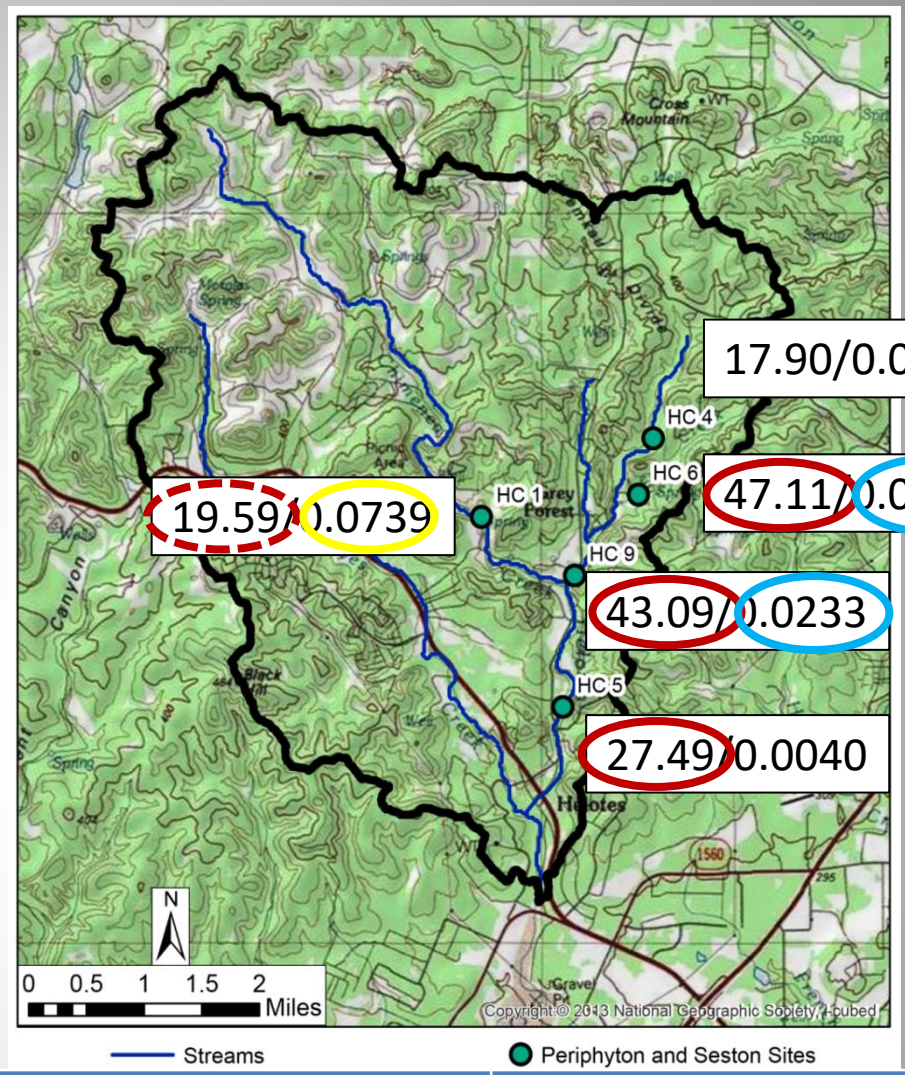
Periphyton – slime stuck to rocks in creek bed
Seston – stuff that floats in creek water (bio-accumulators)

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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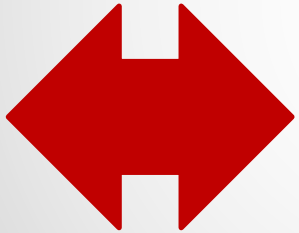
Use trophic state to determine degradation of the watershed

Oligotrphic **Mesotrophic** **Eutrophic**



Pristine **so-so** **Degraded**

<u>Helotes Creek is already marginally degraded</u>

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

Proposition 1 Water Quality Demonstration Projects
Edwards Aquifer Protection Program

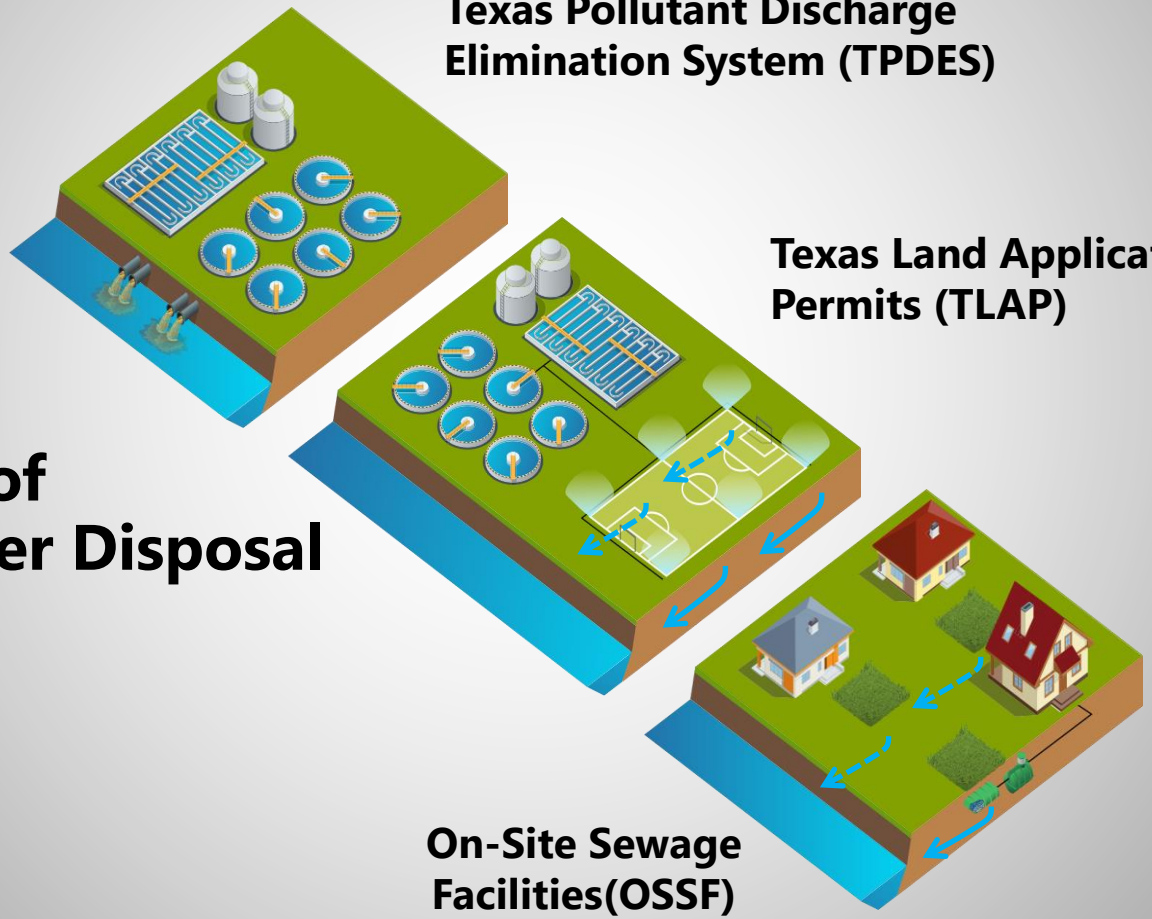
Comparative Evaluation of Wastewater Disposal Practices in the Contributing Zone of the Edwards Aquifer (2018-2020)

Southwest Research Institute®

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

Project Overview/Scope

Methods of Wastewater Disposal



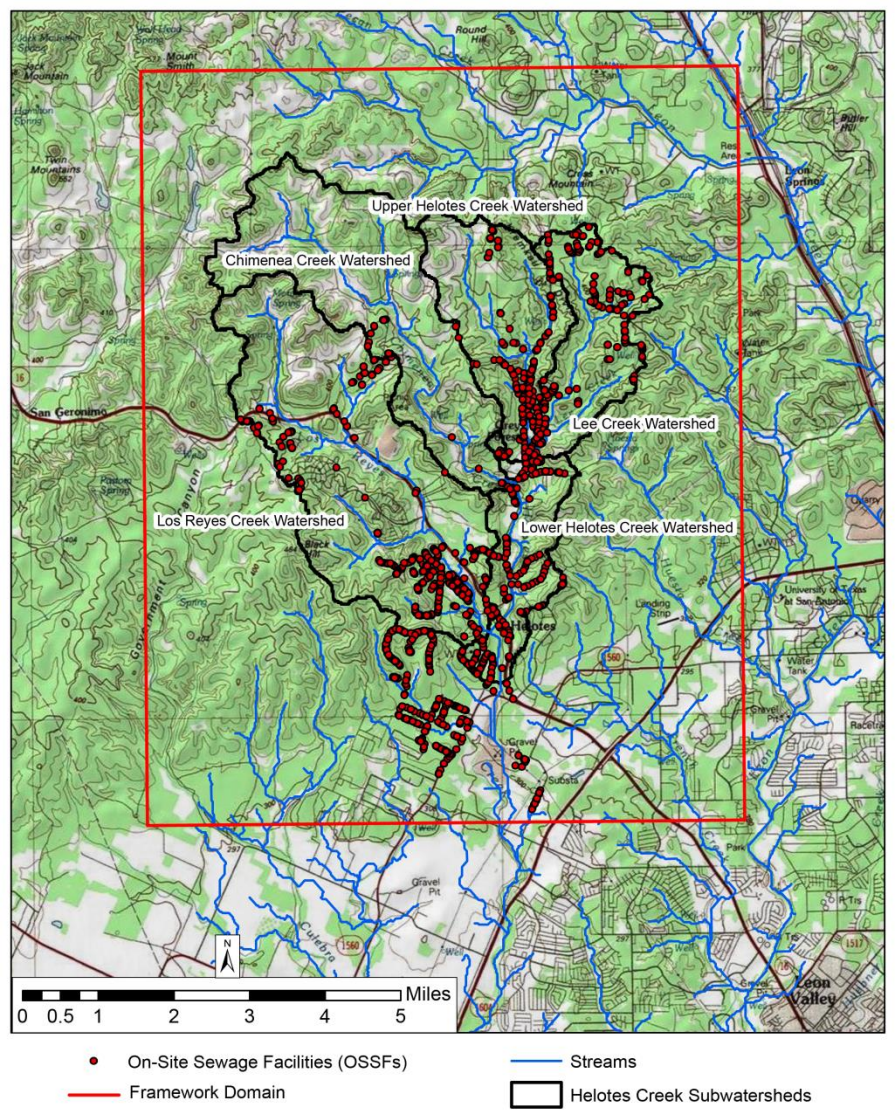
Texas Pollutant Discharge Elimination System (TPDES)

Texas Land Application Permits (TLAP)

On-Site Sewage Facilities(OSSF)

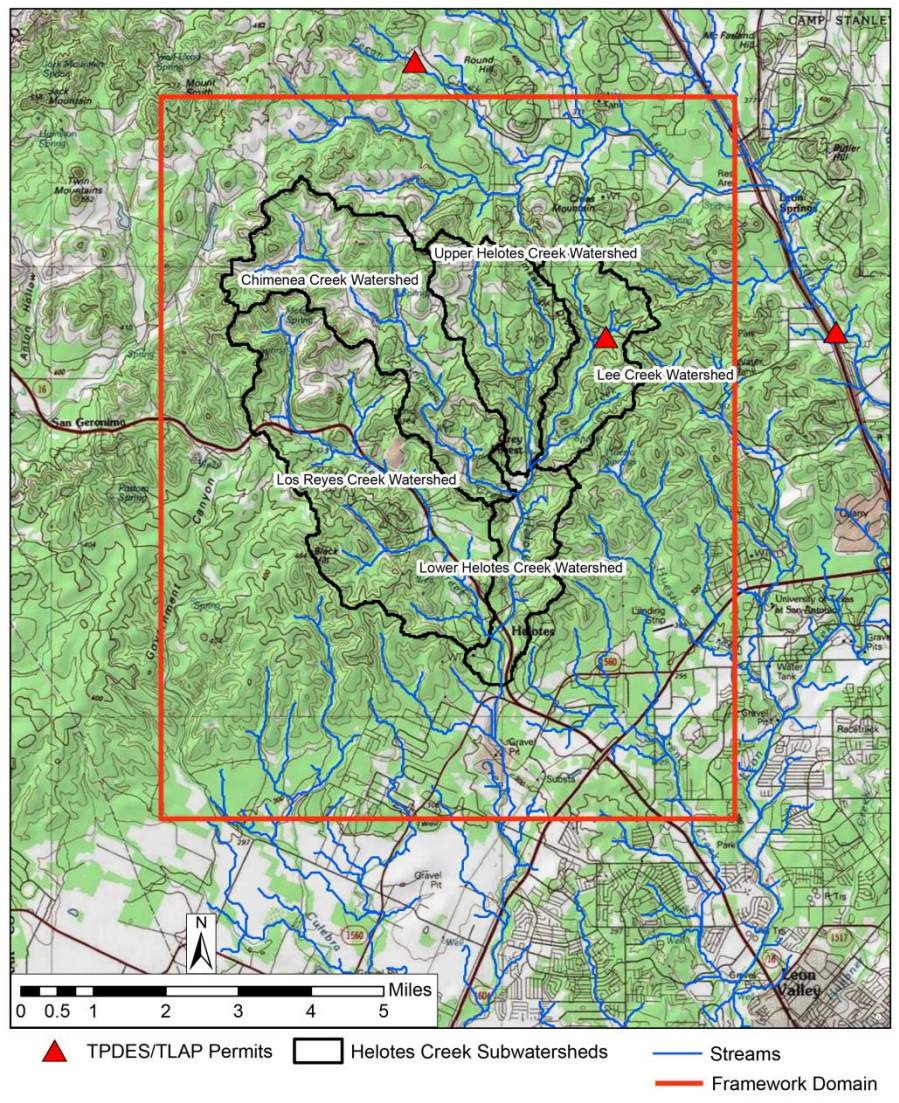
OSSF Permits

- 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*

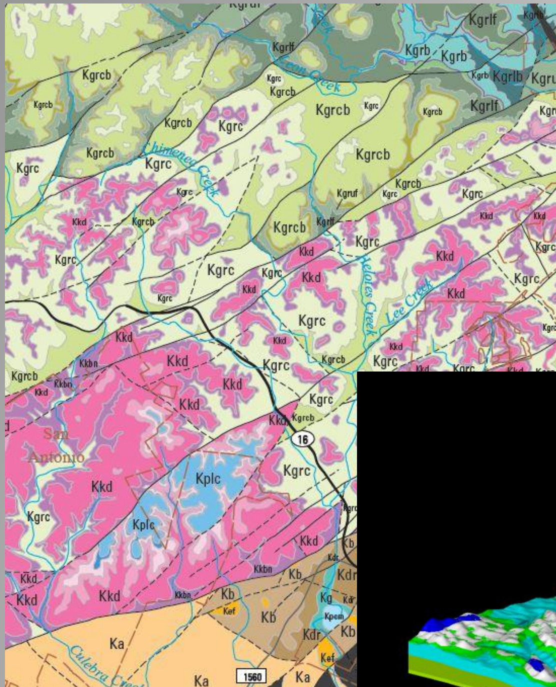
- **TPDES** = Texas Pollutant Discharge Elimination System; federally-regulated permits
- **TLAP** = Texas Land Application Permit; state-regulated permits



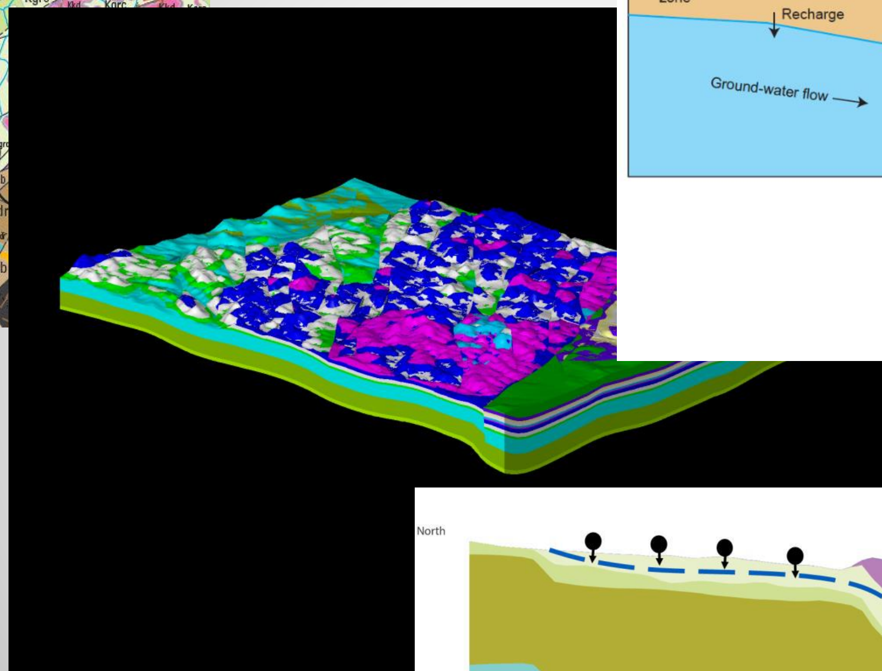
* One was "in the books" but addressed at another area in Bexar County

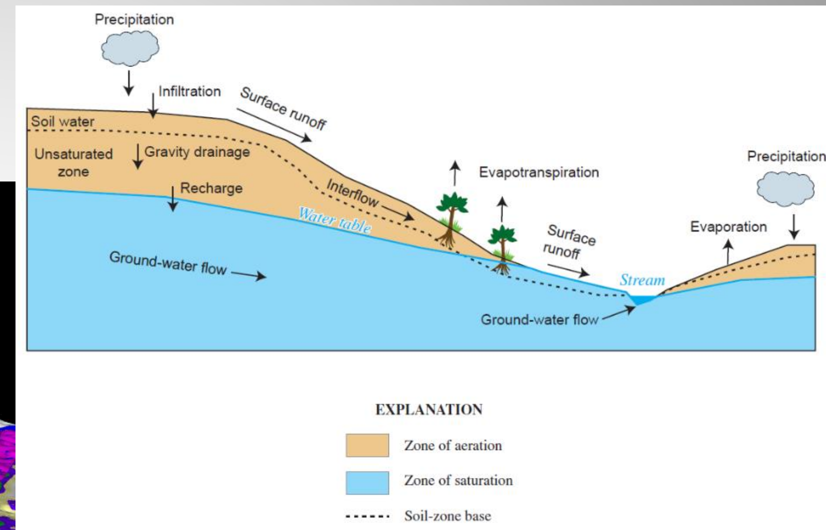
Developed Integrated Hydrologic Model to Predict Impact of Different Types of Waste Disposal Facilities

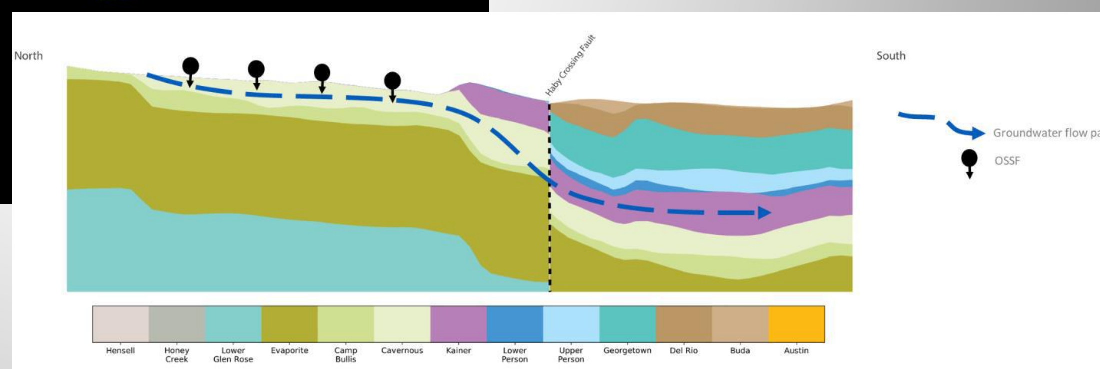
- Hydrologic modeling requires two integrated models.
  - Groundwater Model
  - Surface-Water Flow Model
- All modeling software is open source and available in the public domain.



Integrated Model

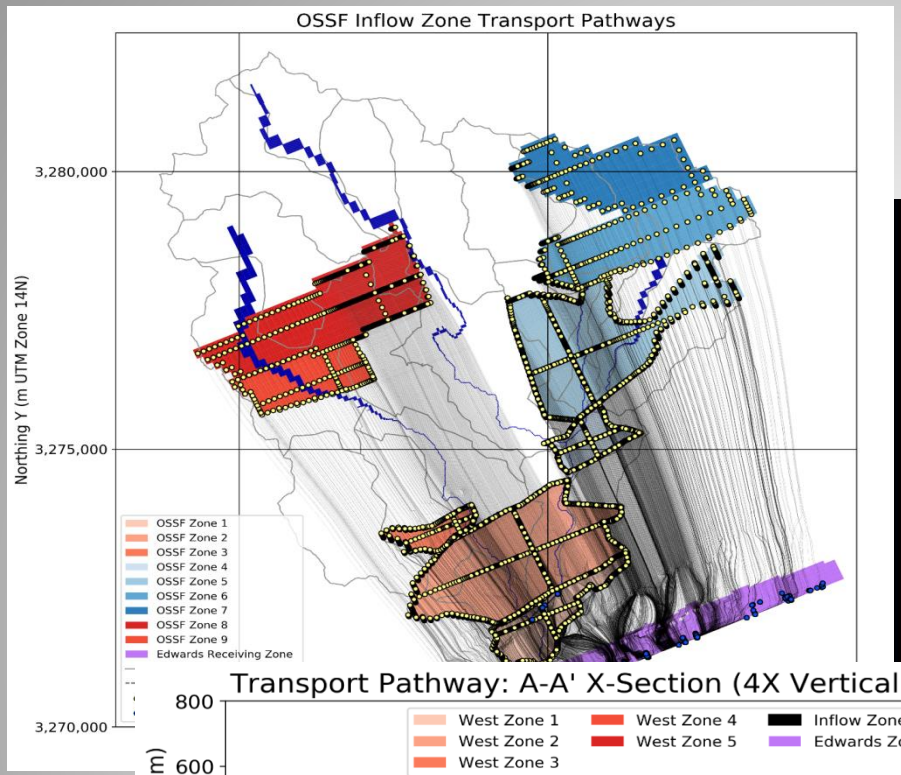


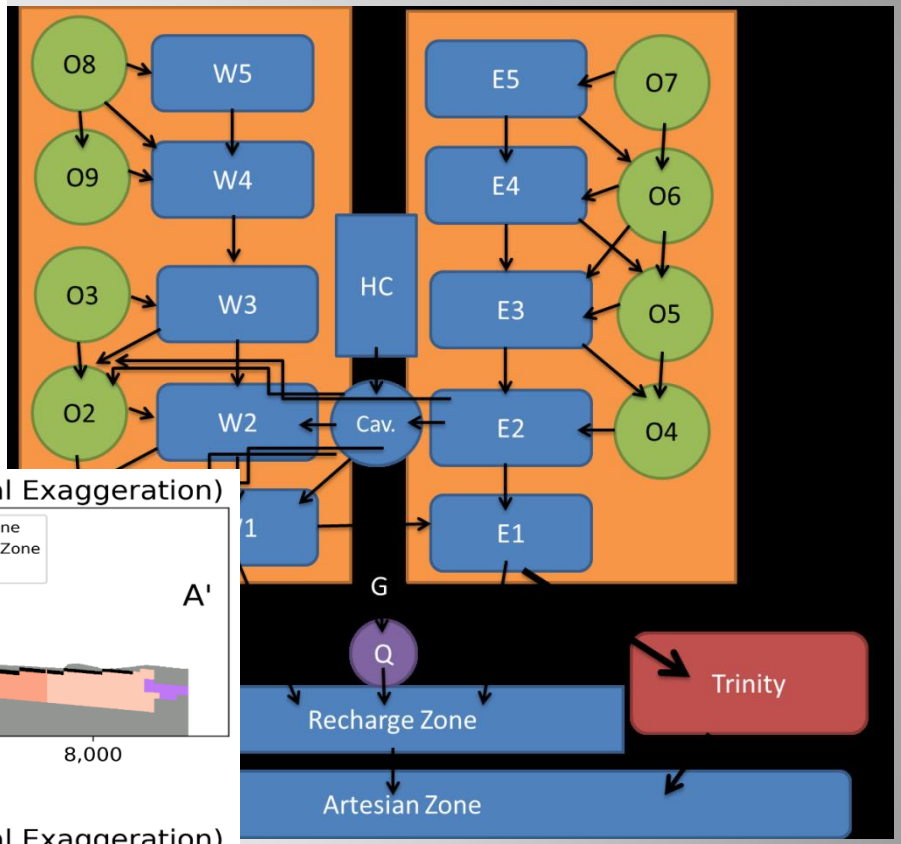


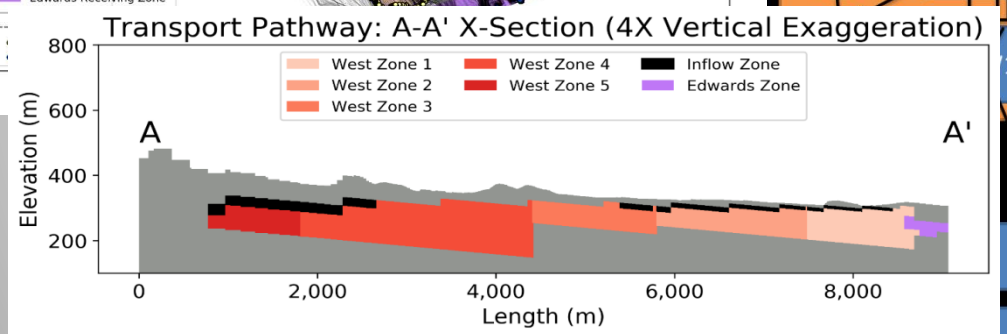


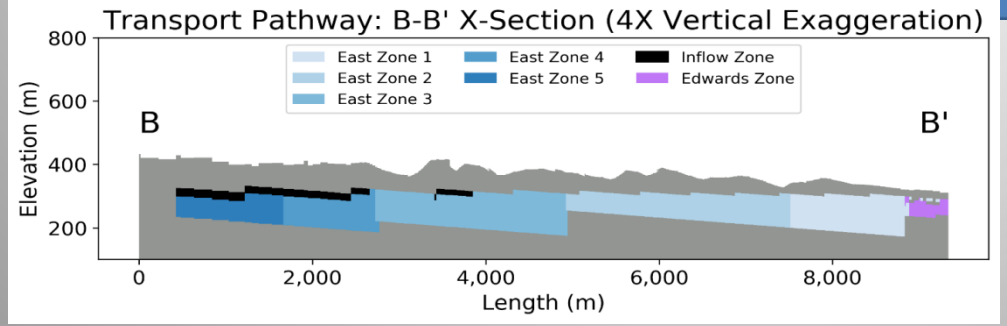
All Effluent Ends Up in Edwards Aquifer

Transport Model GoldSim

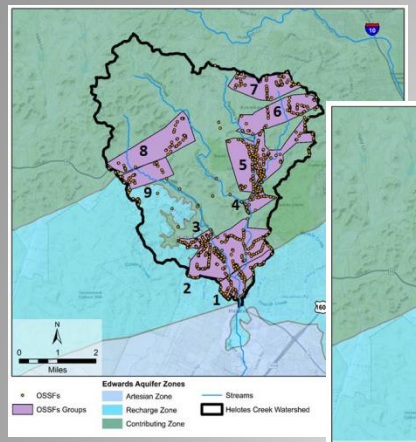




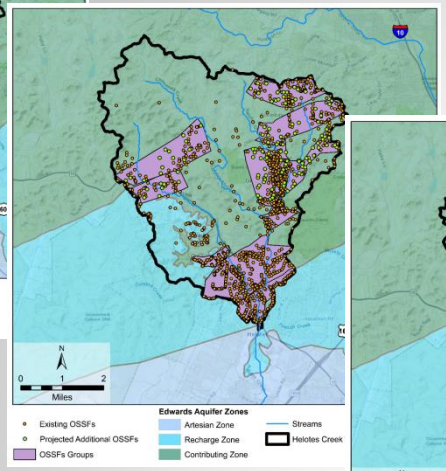




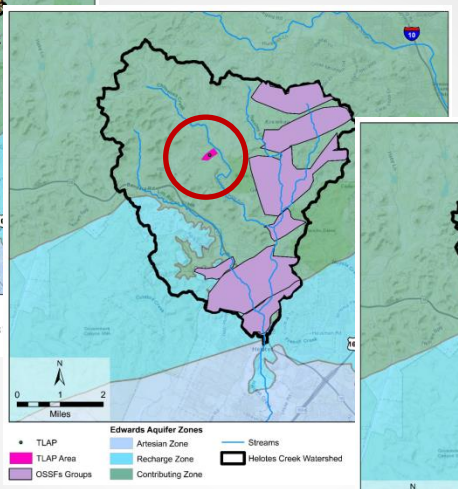
Considered Eight Scenarios



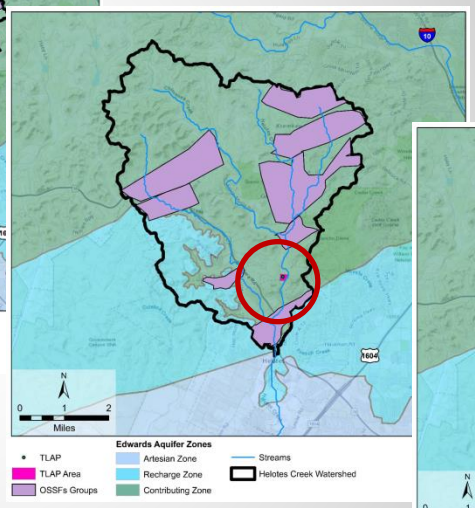
Basecase
Existing OSSFs



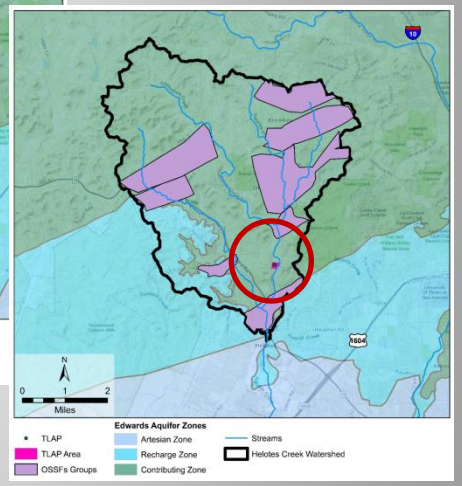
Scenarios 1-3
OSSFs



Scenarios 4 & 6
Upstream TLAP



Scenarios 5& 7
Downstream TLAP



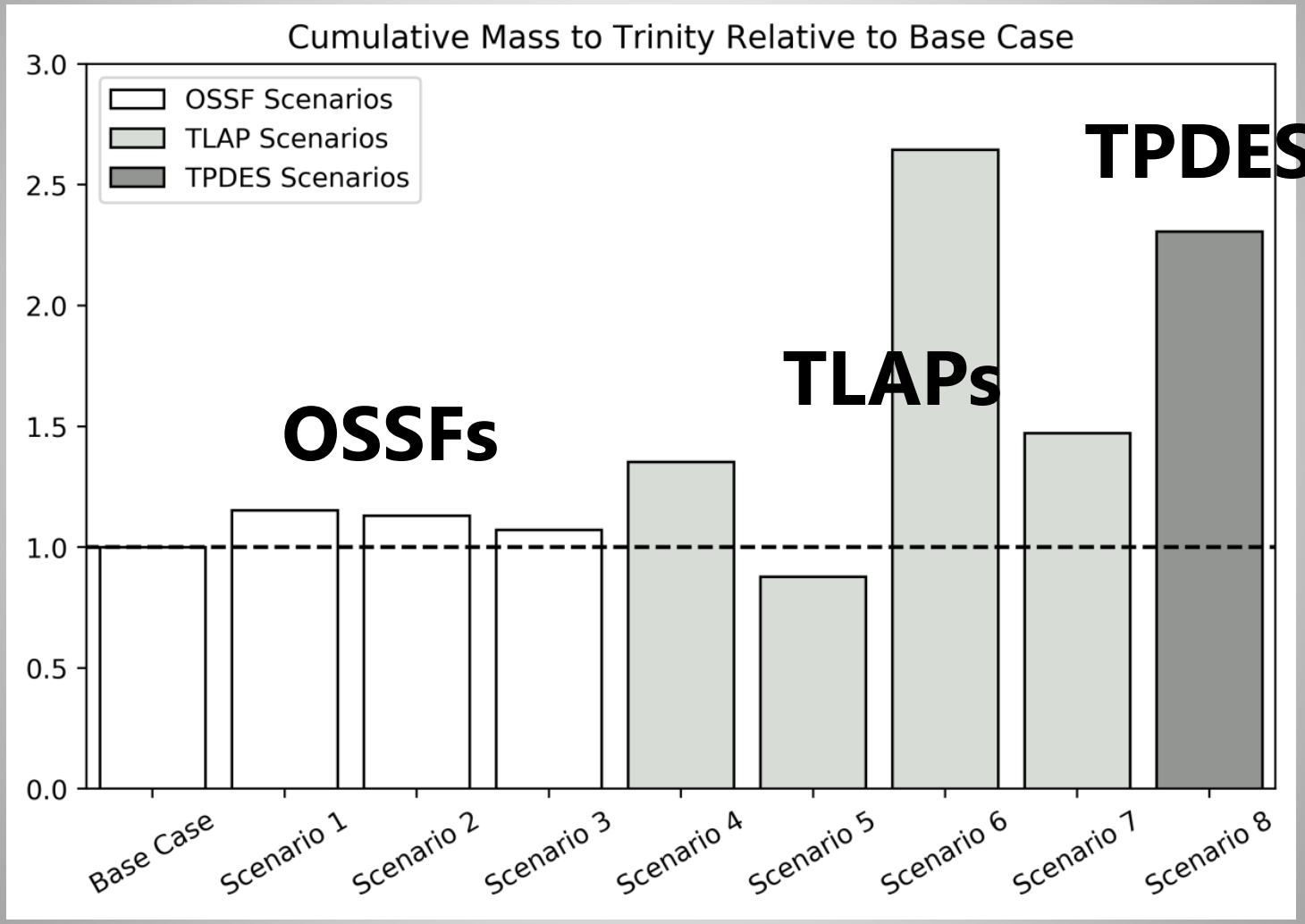
Scenario 8
Downstream TPDES

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


Cumulative Mass to Trinity Relative to Base Case
OSSF Scenarios
TLAP Scenarios
TPDES Scenarios
3.0
2.5
2.0
1.5
1.0
0.5
0.0
OSSFs
TLAPs
TPDES
Base Case
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Scenario 7
Scenario 8

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**

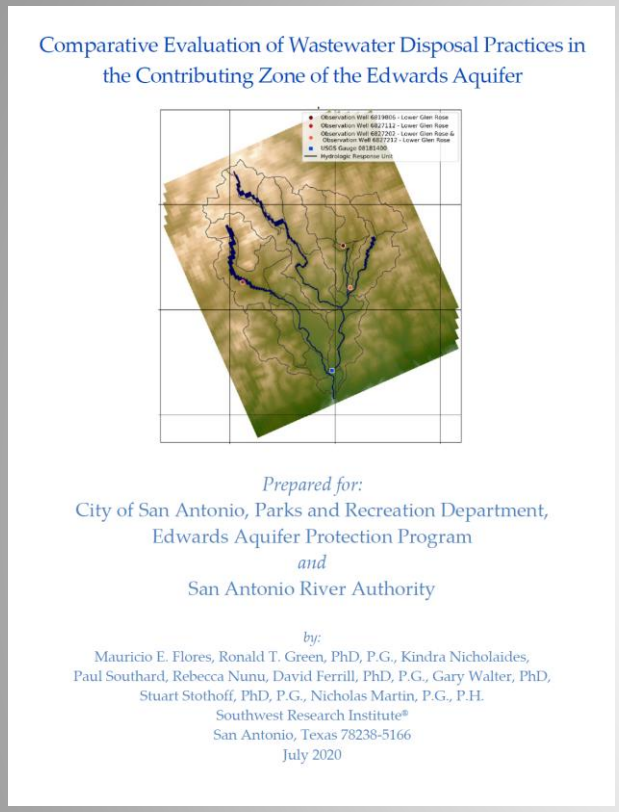
Source: The Helotes Herald

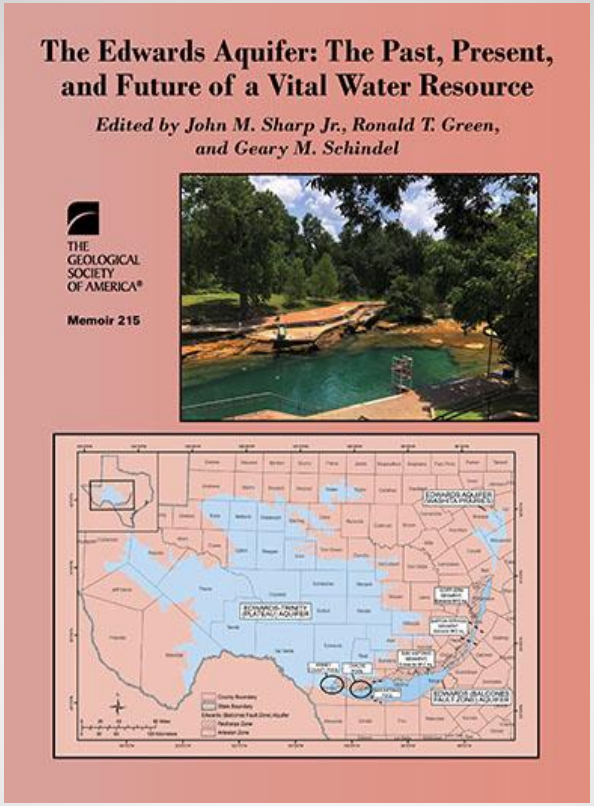
Closing Note

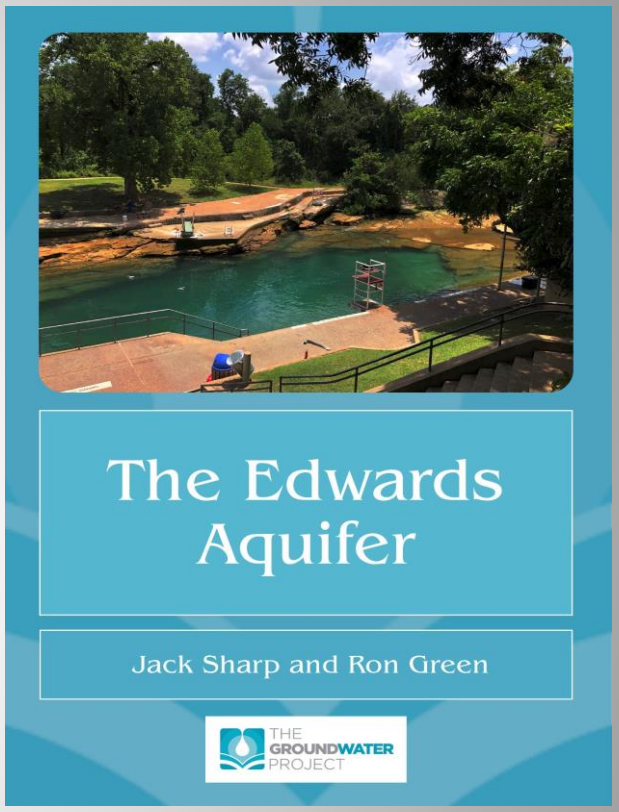
Impact of development within Helotes is not addressed in this evaluation

Questions

Background Documentation







Available online at Greater Edwards Aquifer Alliance Website
https://aquiferalliance.org/final_report_revised_102220/

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

Contact Information

Ronald T. Green, Ph.D., P.G. LLC
Contractor
Space Sciences and Engineering Division
Southwest Research Institute
6220 Culebra
San Antonio, Texas 78238
1.210.316.9242 (cell)
rgreen@swri.edu