Groundwater dependent habitats of the Carrizo-Wilcox and associated aquifers

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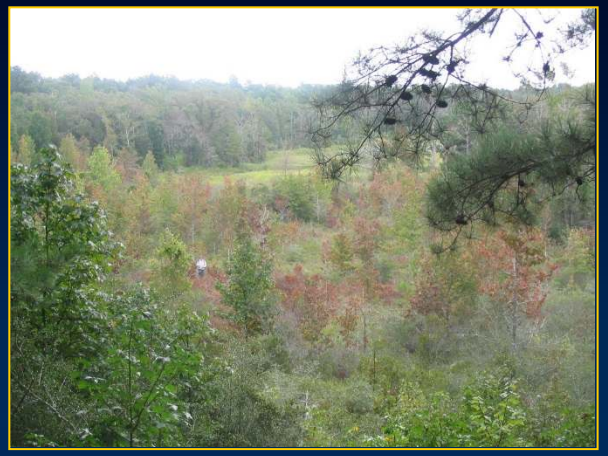
Why is TPWD here?



- Responsibility to protect fish and wildlife resources in Texas

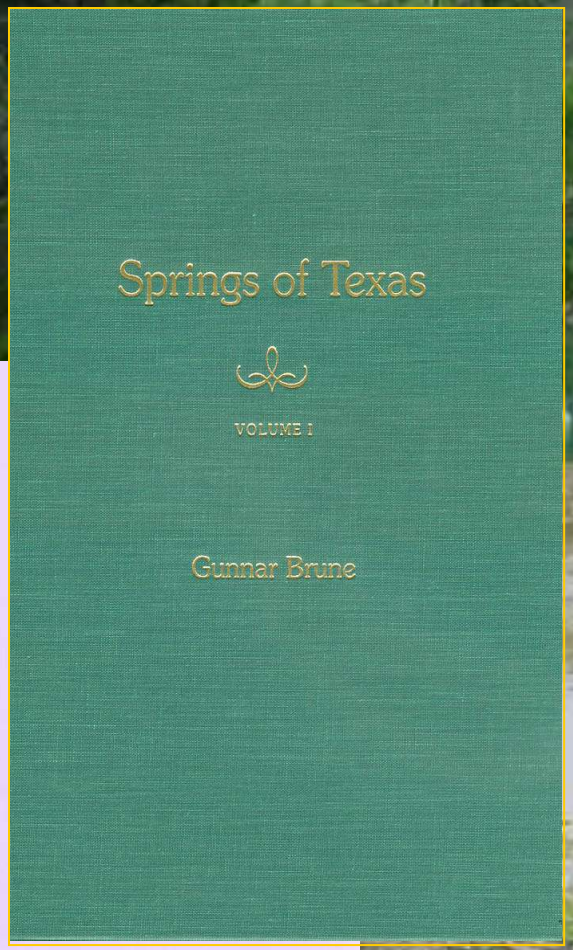
- Provide input to GCDs and GMAs as requested

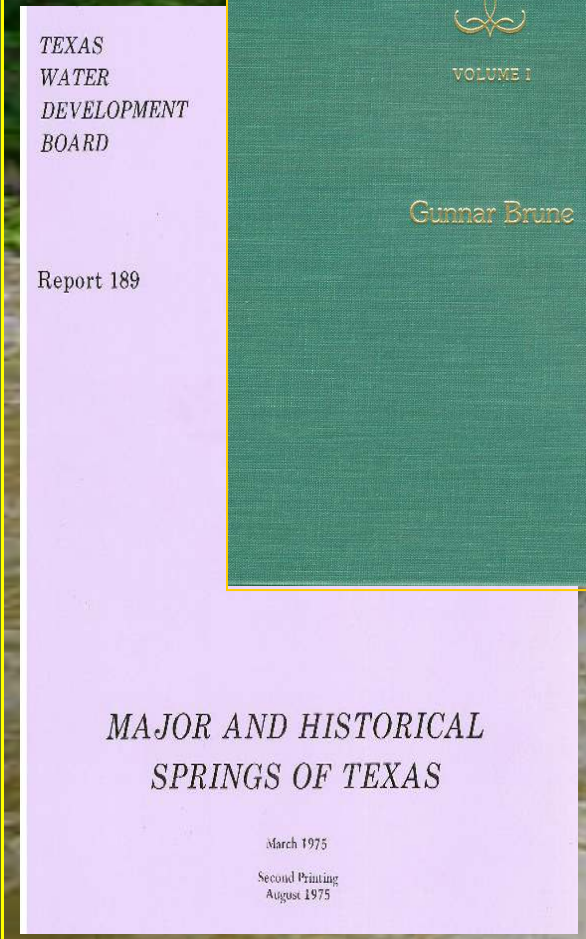
Importance of Springs and Baseflows

- Springs
  - Support unique aquatic environments, including rare species
  - Serve as a barometer of local aquifer conditions
  - Relatively inexpensive means of monitoring groundwater
  - Provide important baseflows to rivers

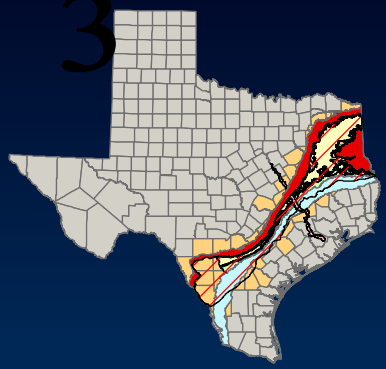
- Baseflows
  - Dependent on aquifer discharge
  - Important component of natural flow regime
  - Support habitats during dry periods

Texas Springs





- Foundation of knowledge based on work of Gunnar Brune
- Documented loss and decline of Tx Springs
- 65 of 281 (23%) M&H springs no longer flowed (1975)
- Limited data for most springs
- Little to no biological information



Springs of Carrizo-Wilcox and associated minor aquifers

BOWIE
HOPKINS
CASS
CAMP
MARION
UPSHUR
VAN ZANDT
HARRISON
PANOLA
RUSK
SHELBY
NAVARRO
FREESTONE
LIMESTONE
HOUSTON
SABINE
ANGELINA
FALLS
TRINITY
MADISON
MILAM
WILLIAMSON
WALKER
GRIMES
WASHINGTON
FAYETTE
CALDWELL
GUADALUPE
BEXAR
UVALDE
MEDINA
LAVACA
MAVERICK
ZAVALA
FRIO
KARNES
DIMMIT
LA SALLE
MCMULLEN
LIVE OAK
BEE
WEBB

Carrizo Aquifer

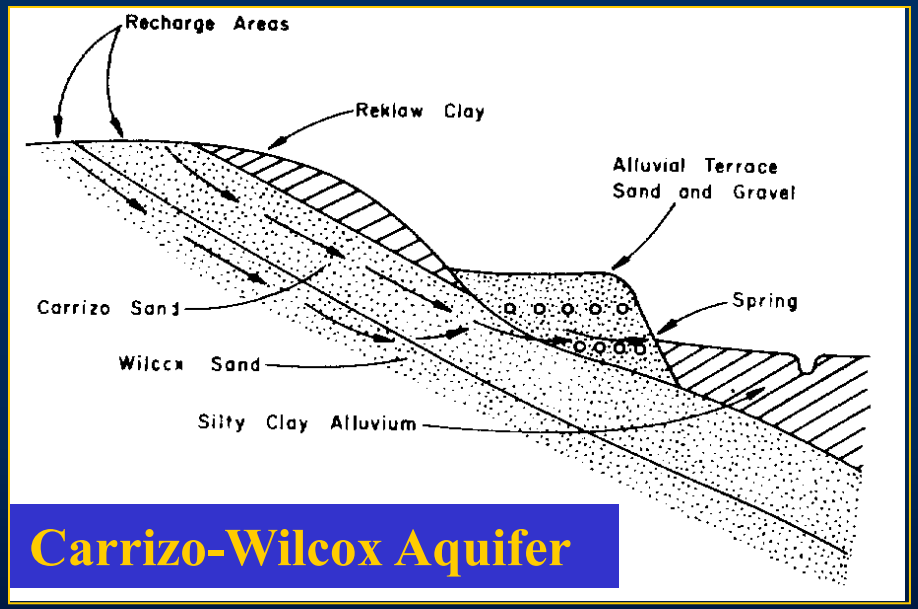
- Carrizo downdip
- Carrizo outcrop

Minor Aquifers

- Yegua Jackson
- Brazos River Alluvium
- Queen City
- Sparta
- Springs

Characteristics of Sandy Springs vs. Limestone Springs

- Springs typically smaller, younger, and less stable
- Low transmissivity imparts less variability in and greater persistence of flow
- Small interstitial spaces limits distribution of hypogean species – few aquatic endemics



Groundwater Dependent Habitats (i.e. springs)

- Rheocrenes (Streams)
- Helocrenes (Hillside Seeps and Bogs)
- Limnocrenes (Ponds)
- Baseflow Springs (Rivers and streams)
- Hyporheic habitats

GMA12 Model Results
What does the Future Hold?

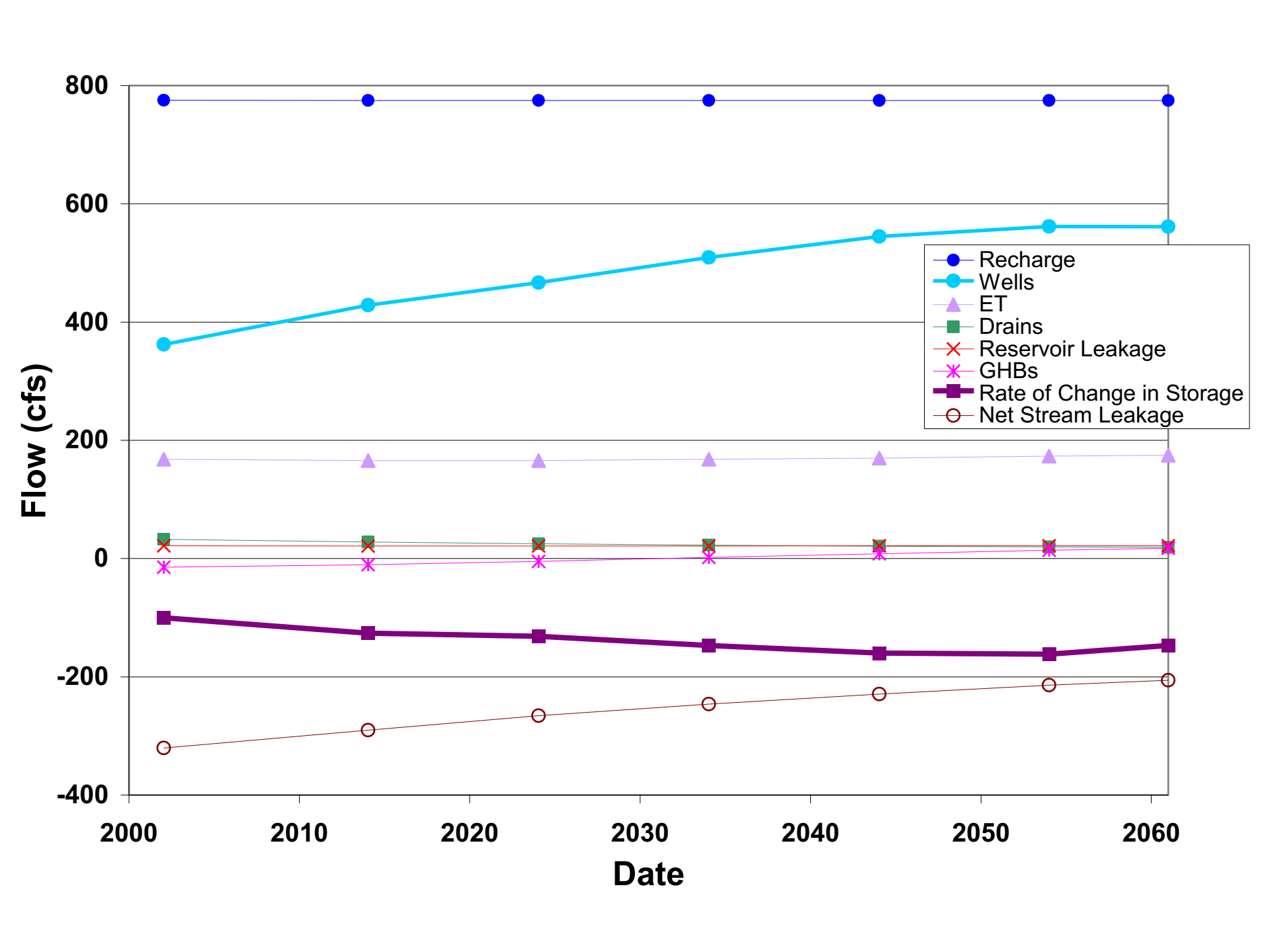
- Key Points to Remember for Discussion
  - 10,000' view
    - Looking for gross effects, not splitting hairs
    - Looking at entire QC-SP-CW model
  - Model provided by URS on 4/27/07
    - No changes made by TPWD
  - Boundary conditions drive the model

Boundary Conditions

- Recharge (diffuse): direct infiltration
- Reservoir Leakage: leakage through bottom of reservoir
- ET: evapotranspiration
- Stream Leakage: leakage through bottom of rivers and streams
- General Head Boundaries: represent interaction with younger strata and horizontally adjacent models
- Drains: represent areas with very shallow water tables, e.g., wetlands
- Wells: represent pumping

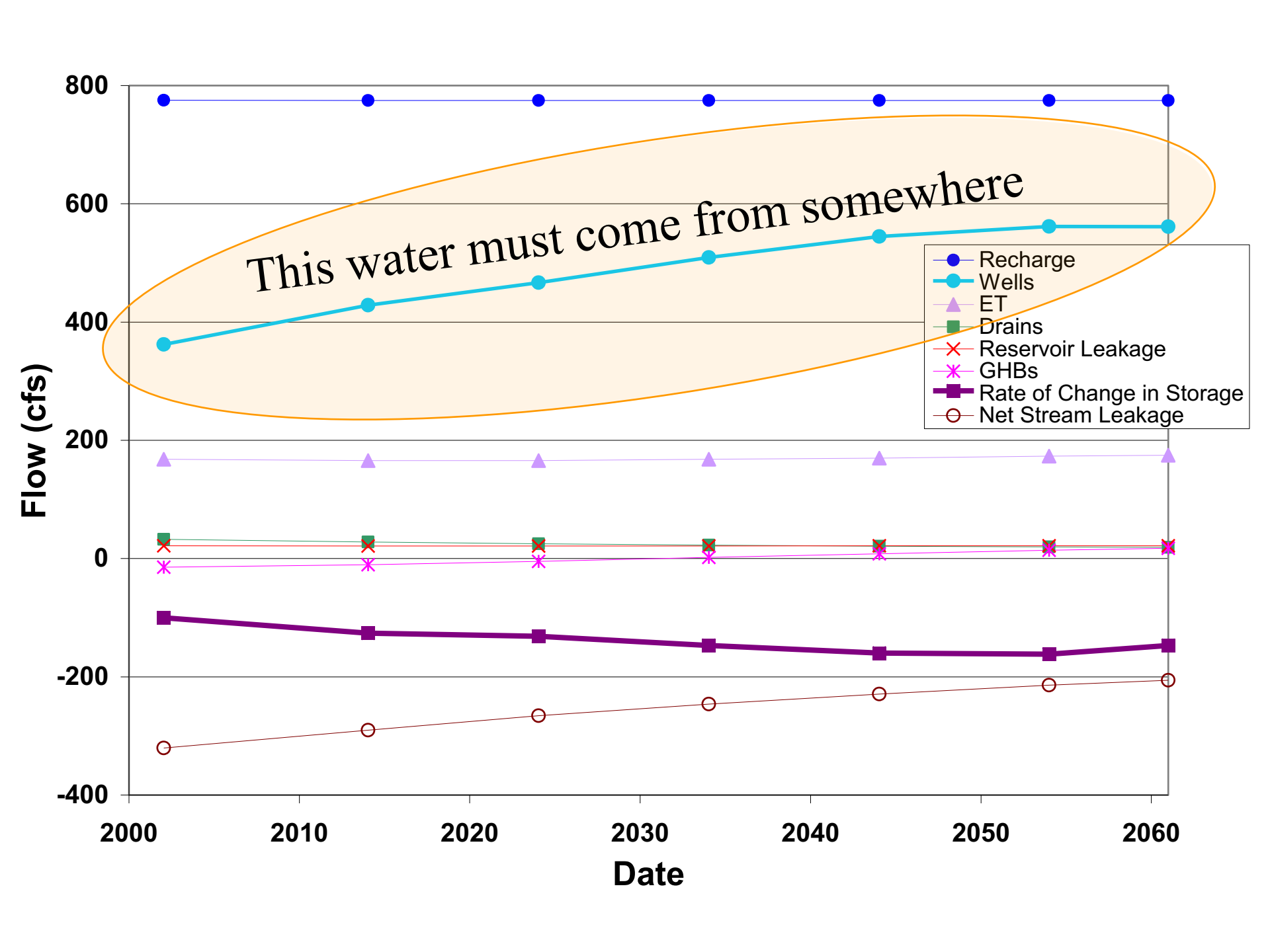
Water Balance

Arrows denote direction of positive values

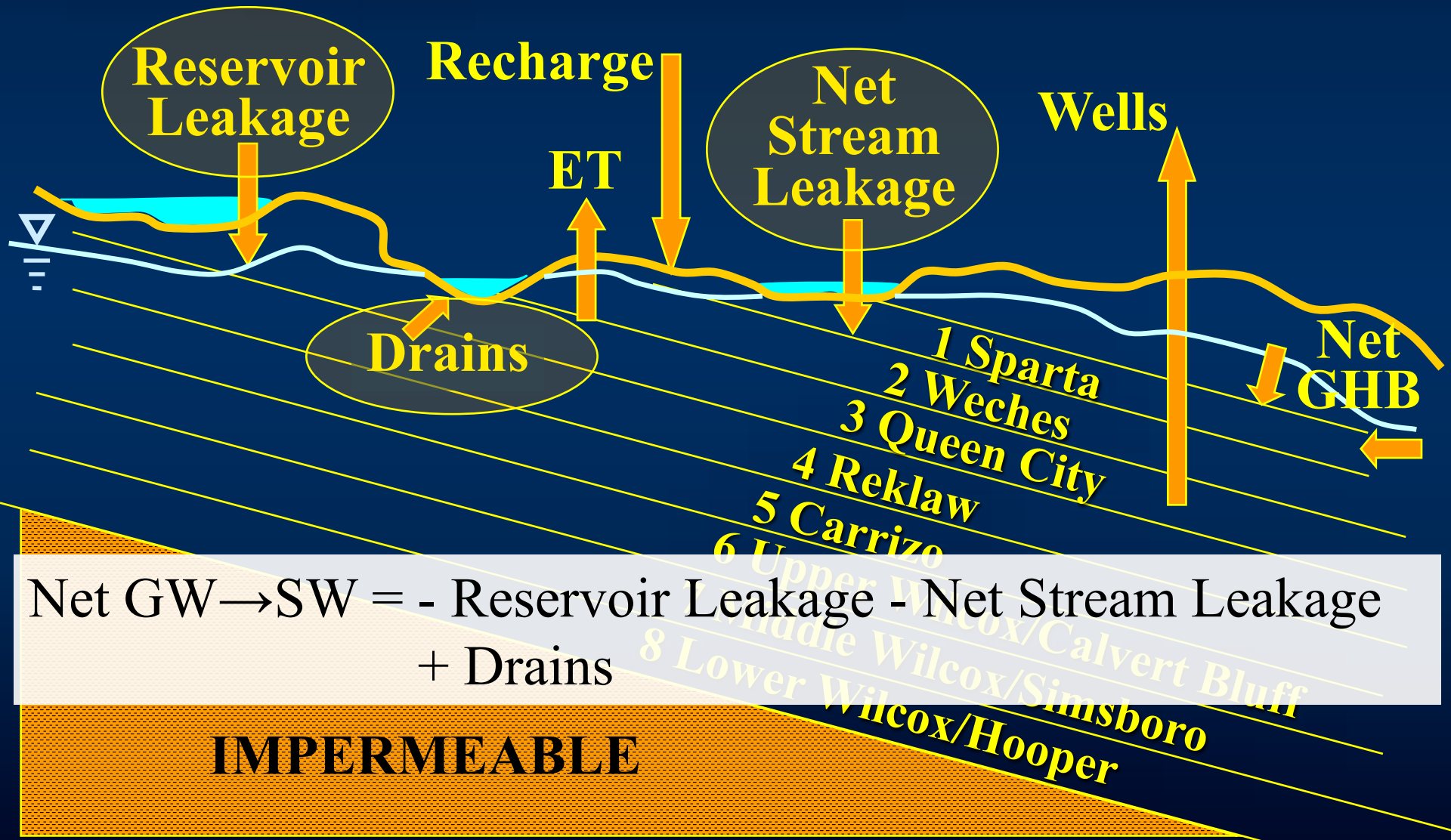

800
600
400
200
0
-200
-400
Flow (cfs)
2000
2010
2020
2030
2040
2050
2060
Date
Recharge
Wells
ET
Drains
Reservoir Leakage
GHBs
Rate of Change in Storage
Net Stream Leakage

Question

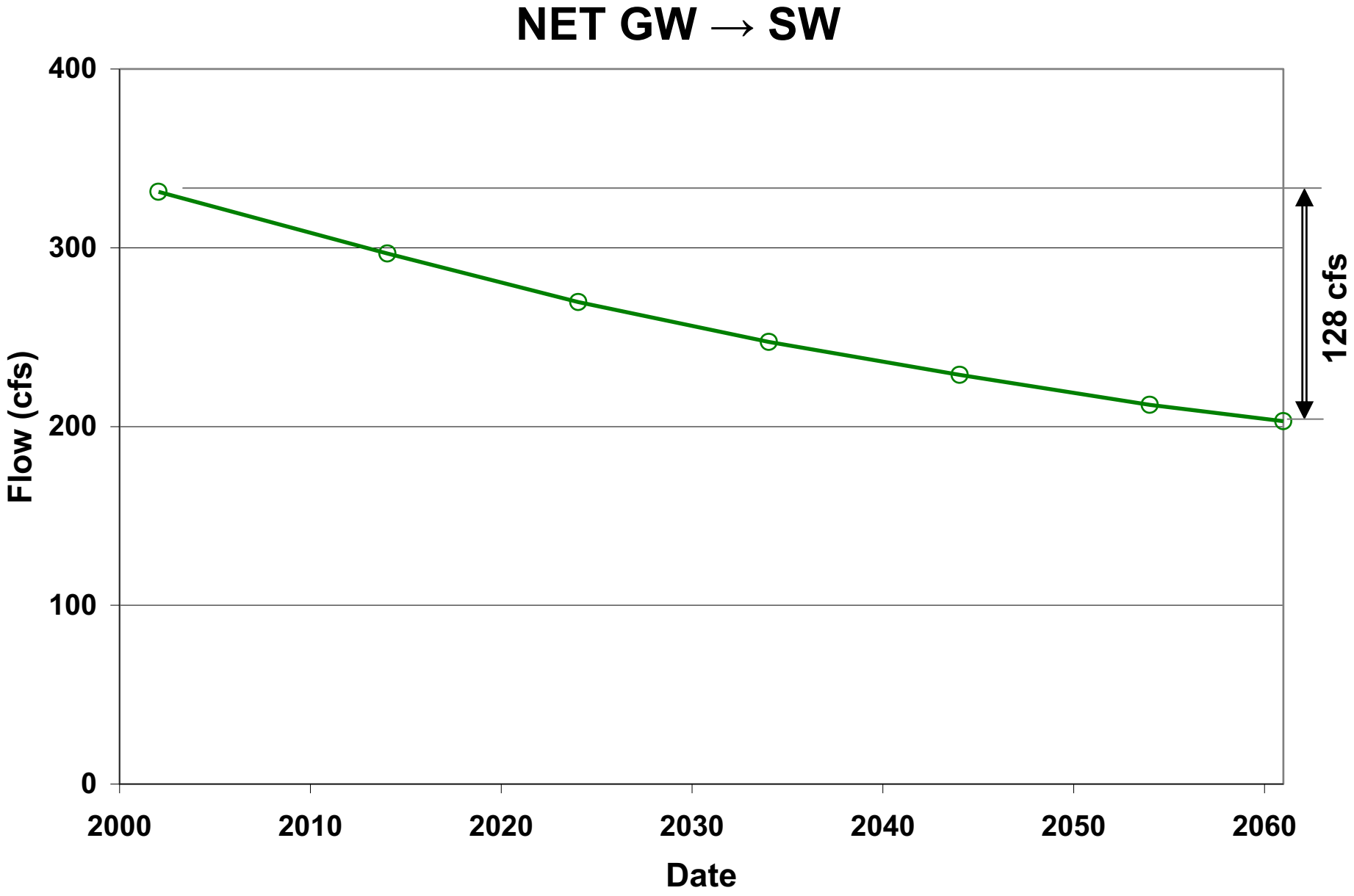
- What is the potential future interaction between the QC-SP-CW aquifer and rivers, streams, and lakes?


800
600
400
200
0
-200
-400
Flow (cfs)
2000
2010
2020
2030
2040
2050
2060
Date
This water must come from somewhere
Recharge
Wells
ET
Drains
Reservoir Leakage
GHBs
Rate of Change in Storage
Net Stream Leakage

GW → SW Terms



Net GW→SW = - Reservoir Leakage - Net Stream Leakage + Drains


NET GW → SW
400
300
200
100
0
Flow (cfs)
128 cfs
2000
2010
2020
2030
2040
2050
2060
Date

What does 128 cfs decrease mean for environment?

- 128 cfs ≈ 93,000 ac-ft/yr ≈ 83 MGD
- For comparison:
  - Brazos River near Highbank (1965 – 2007)
    average flow: 2700 cfs
    median flow: 1000 cfs
    25th %-ile: 460 cfs
- Impact to habitats unclear
- Monitoring important

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