

Rattle Battle 1:

<https://youtu.be/2d0Z1ExYJQQ>

Crotalus basiliskus

Rattle Battle 2:

<https://youtu.be/BTSuObooq2c>

Follow up items

- ▶ **THANK YOU, Mike Hammack** for the information on printing the curriculum. Says Mike: “If you go there, I recommend that first you download the pdf file onto a thumb drive for them to use.”

New Braunfels Shipping and Mailbox Emporium

New B1308 Common St #205, New Braunfels, TX 78130

- ▶ **THANK YOU, Steve Jones!** Steve found this at the Comal County Engineer site on river flow. Provides a lot of information on Comal County in an easy to access format.
- ▶ https://cceo.org/mainpage/river_flow

Nerdy Fun - Streamflow

Video - Canyon Dam Release at 5000cfs

▶ <https://youtu.be/-Fbq8nhzTyg>

<https://waterdata.usgs.gov/tx/nwis/rt> **USGS 08167800**

Guadalupe Rv at Sattler, TX

<http://www.gbra.org/conditions/data.aspx> Streamflow data map

<https://waterdata.usgs.gov/tx/nwis/current/?type=flow>



Lindheimer Chapter Texas Waters Specialist May 23, 2019

Chapter 5: The Ecological Significance of Natural Flow Regimes

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Humans have long been fascinated by the dynamism of free-flowing waters. Yet we have expended great effort to tame rivers for transportation, water supply, flood control, agriculture, and power generation. It is now recognized that harnessing of streams and rivers comes at great cost: Many rivers no longer support socially valued native species or sustain healthy ecosystems that provide important goods and services (Naiman et al. 1995, NRC 1992).

Riparian Recovery Animation
<https://youtu.be/bUdnKlmsiL8> (0:32)

FYI: Reading Resource on the Guadalupe River

https://tpwd.texas.gov/publications/pwdpubs/pwd_rp_t3200_1047/17_c_tx_guadalupe.phtml

Questions to Consider

1. What factors determine the structure of a stream corridor?
2. How does a stream reach “equilibrium”?
3. How does stream flow relate to groundwater?
4. How do natural flow patterns affect things like sediment, organic matter, temp, nutrient balance & organisms life cycle?

Challenge

Look at a map of the watershed in which you live.

1. What stream order is your local flowing water?
2. What vegetation zone should you expect to find?
3. Is there a specific stage of ecological succession you would expect to see?

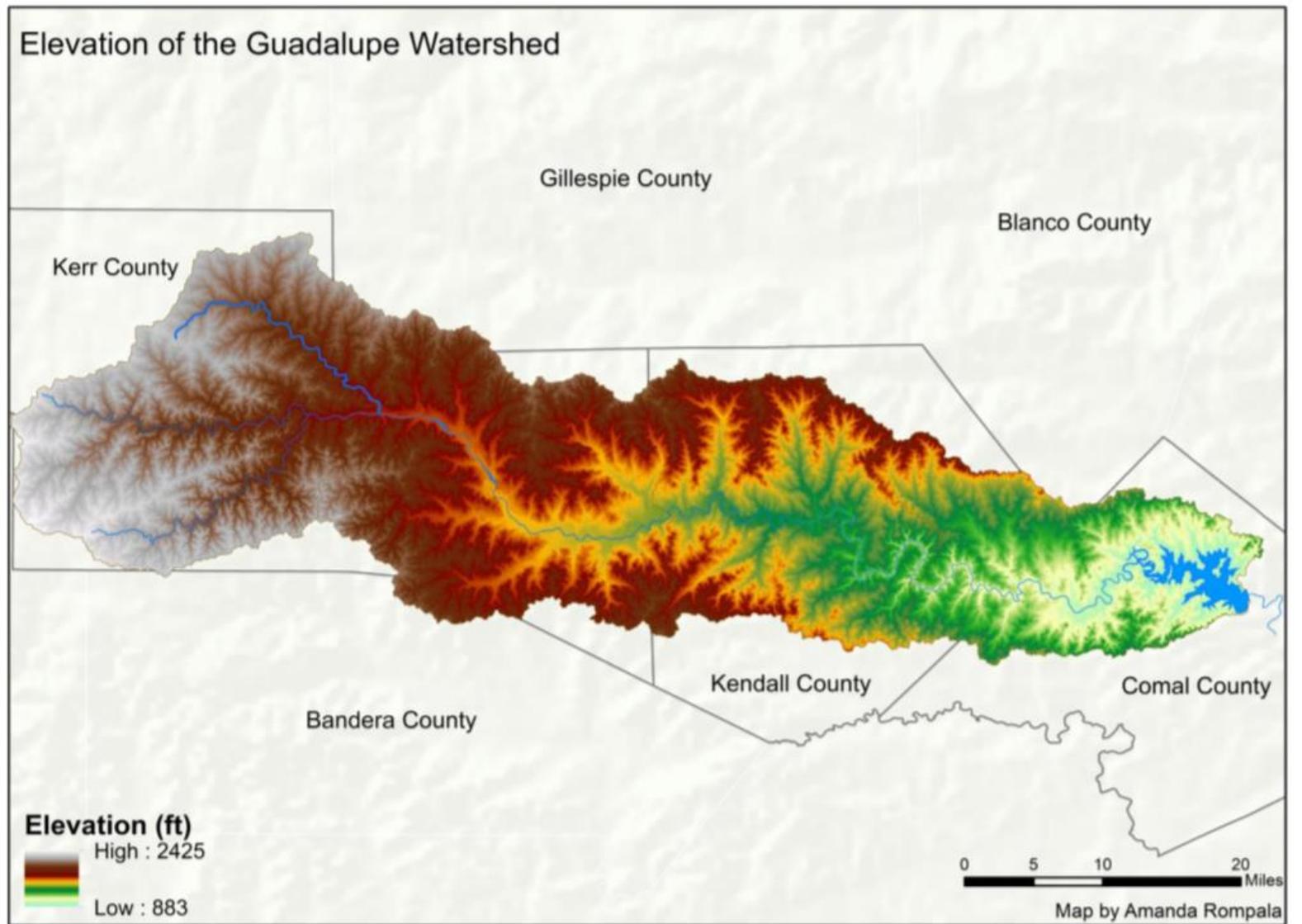
Natural Flow Regimes

- Natural Flow - Physical structure which conveys water
- Regime - In this context, refers to a system where there is a heavy ecological influence by one particular factor

Natural flow regimes are determined by the climate, run-off, catchment size and geomorphology without the impacts of dams, weirs, extraction and river management.

Resource:
http://www.hillcountryalliance.org/wp-content/uploads/2017/11/GRA_HCA_UpperGuadalupe_LitReview.pdf

Figure 1: Topographic Map of the Upper Guadalupe River



Guadalupe River

Just how natural is its flow?

- ▶ Named after the Virgen de Guadalupe in 1689 (at least the lower river)
- ▶ North Fork (30° 06' N, 99° 39' W) & South Fork (30° 04' N, 99° 20' W) in Kerr Co.; join after 22 miles
- ▶ Total 250 miles long, empties into San Antonio Bay
- ▶ Upper Guadalupe: A series of **eight** small low water dams are located between Kerrville and Comfort. These dams do not seriously restrict water flow. Below the sixth dam (2 miles above Comfort), a mill channel with a 10-foot waterfall exists.
- ▶ Canyon Lake impoundment
- ▶ Lower Guadalupe: ~~Six~~ four small reservoirs - ~~Lake Dunlap~~, Lake Placid, Meadow Lake, Lake Gonzales, ~~Wood Lake~~, and Lake McQueeney have been established on the river in Guadalupe and Gonzales Counties.

https://tpwd.texas.gov/publications/pwdpubs/pwd_rp_t3200_1047/17_c_t_x_guadalupe.phtml



Some Upper Guad Dams



Kerrville



Ingram



Center Point

1. What factors determine the structure of a stream corridor?

▶ Constantly changing and morphing because of variation in flow

Four major components:

- ▶ Stream channel
- ▶ Riparian corridor
- ▶ Floodplain
- ▶ Transitional upland fringe

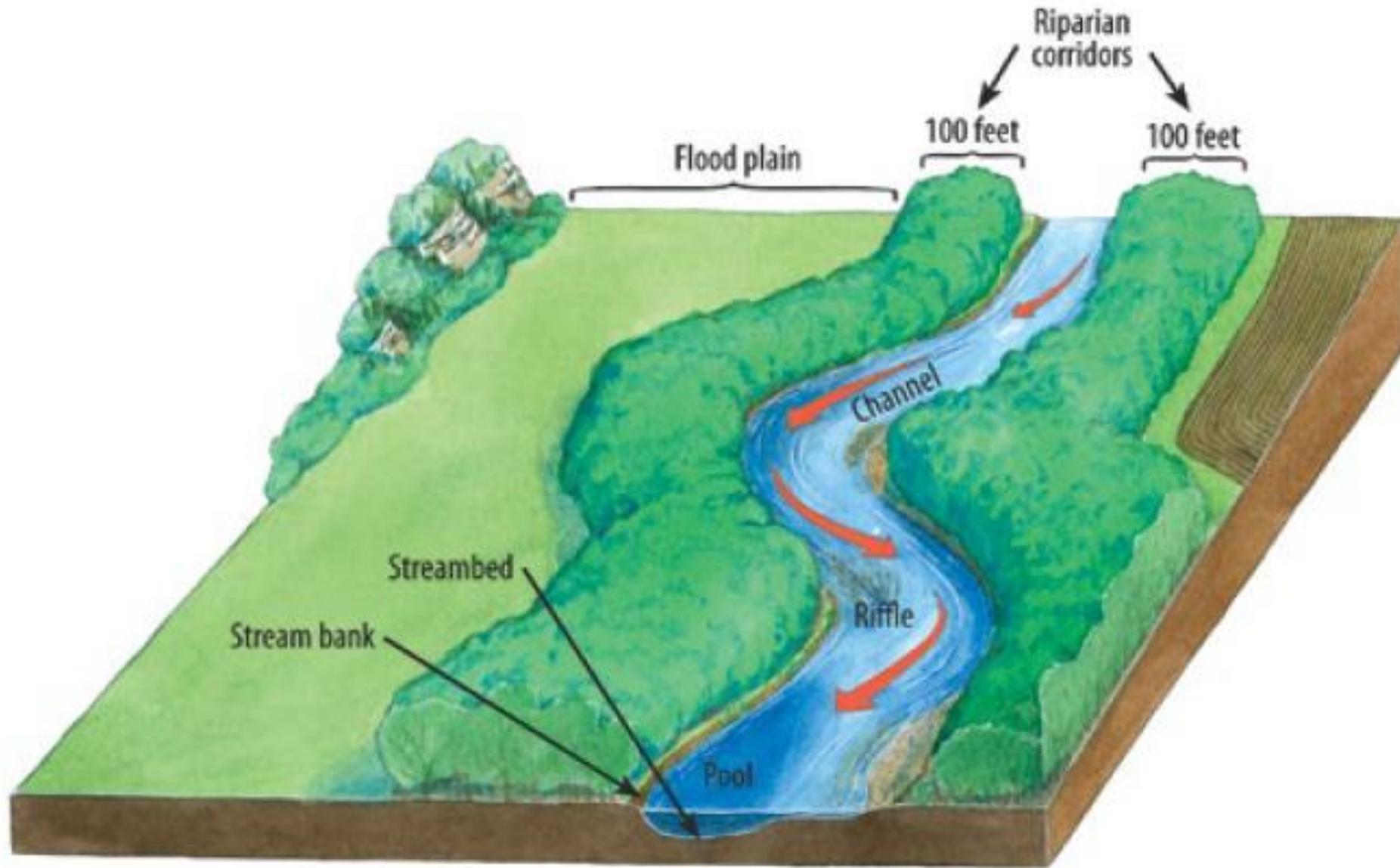


Figure 5.1 - Parts of a Stream. Image used with permission from the Missouri Department of Conservation.

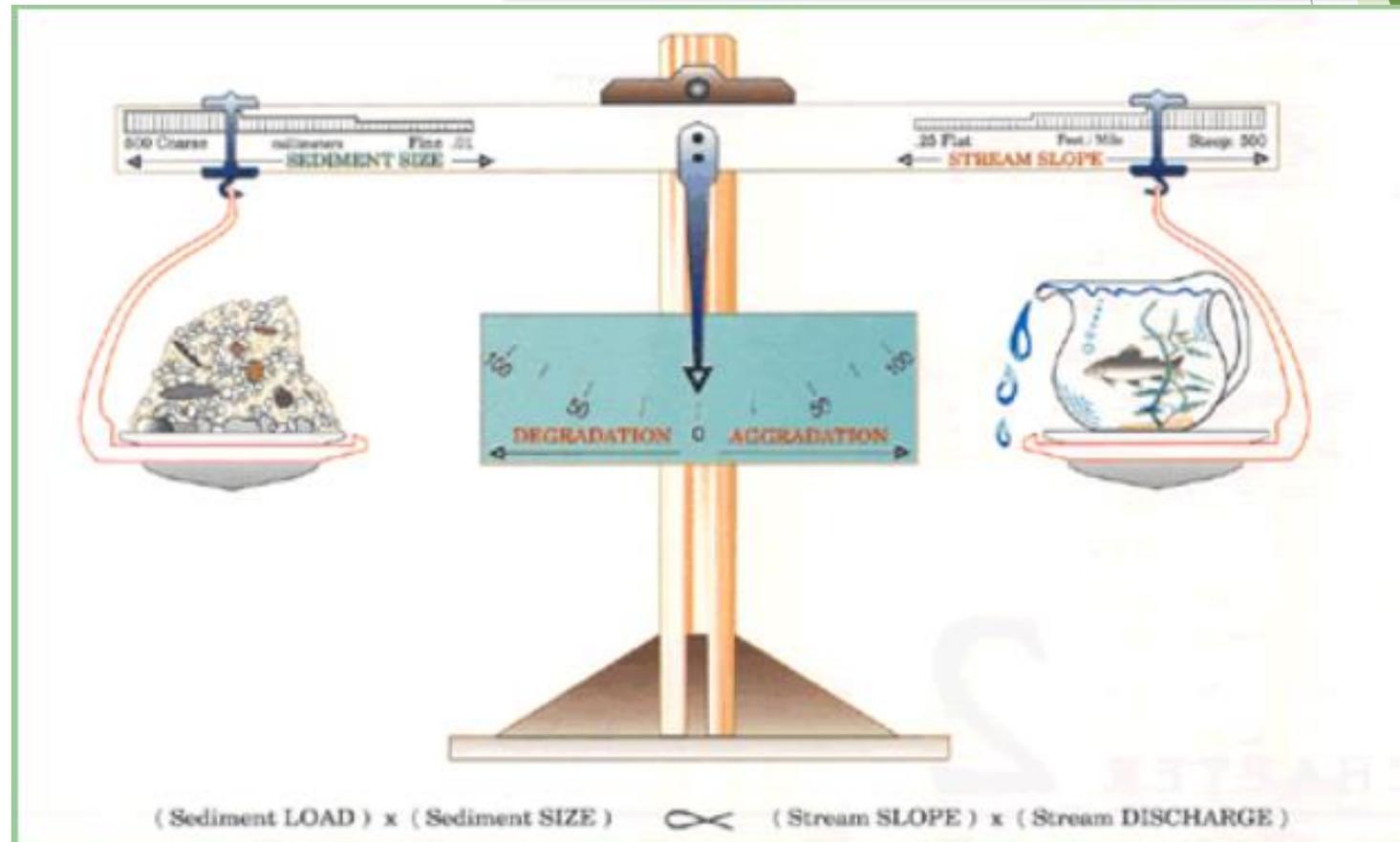
2. How does a stream reach “equilibrium”?

► Channel equilibrium involves the interplay of four basic factors:

- Sediment discharge (Q_s)
- Sediment particle size (D_{50})
- Streamflow (Q_w)
- Stream slope (S)

A stream is constantly working toward a

natural balance with its primary components: water, sediment, energy and vegetation. This balance is often called a *dynamic equilibrium* because the primary components are always changing as climate and landscape change. In other words, the stream is trying to hit a moving target as water, sediment, energy and vegetation naturally fluctuate over time.



3. How does stream flow relate to groundwater?

Surface water and groundwater systems are connected in most landscapes. Streams interact with groundwater in three basic ways:

1. Streams gain water from inflow of groundwater through the streambed
2. Streams lose water by outflow through the streambed
3. They do both depending upon the location along the stream.

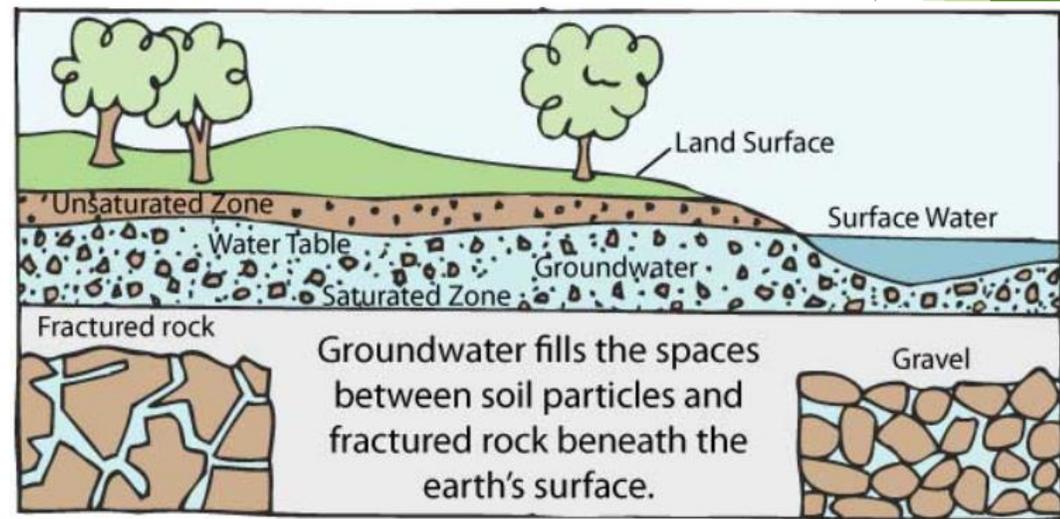
It is the groundwater contribution that keeps streams flowing between precipitation events or after snowmelt.

For a stream to gain water, the elevation of the water table in the vicinity of the stream must be higher than the streamwater surface.

For a stream to lose water to groundwater, the water table must be below the elevation of the stream-water surface in the vicinity of the stream.

If the water table has large variations during the year, a stream segment could receive water from groundwater for a portion of the year and lose water to groundwater at other times.

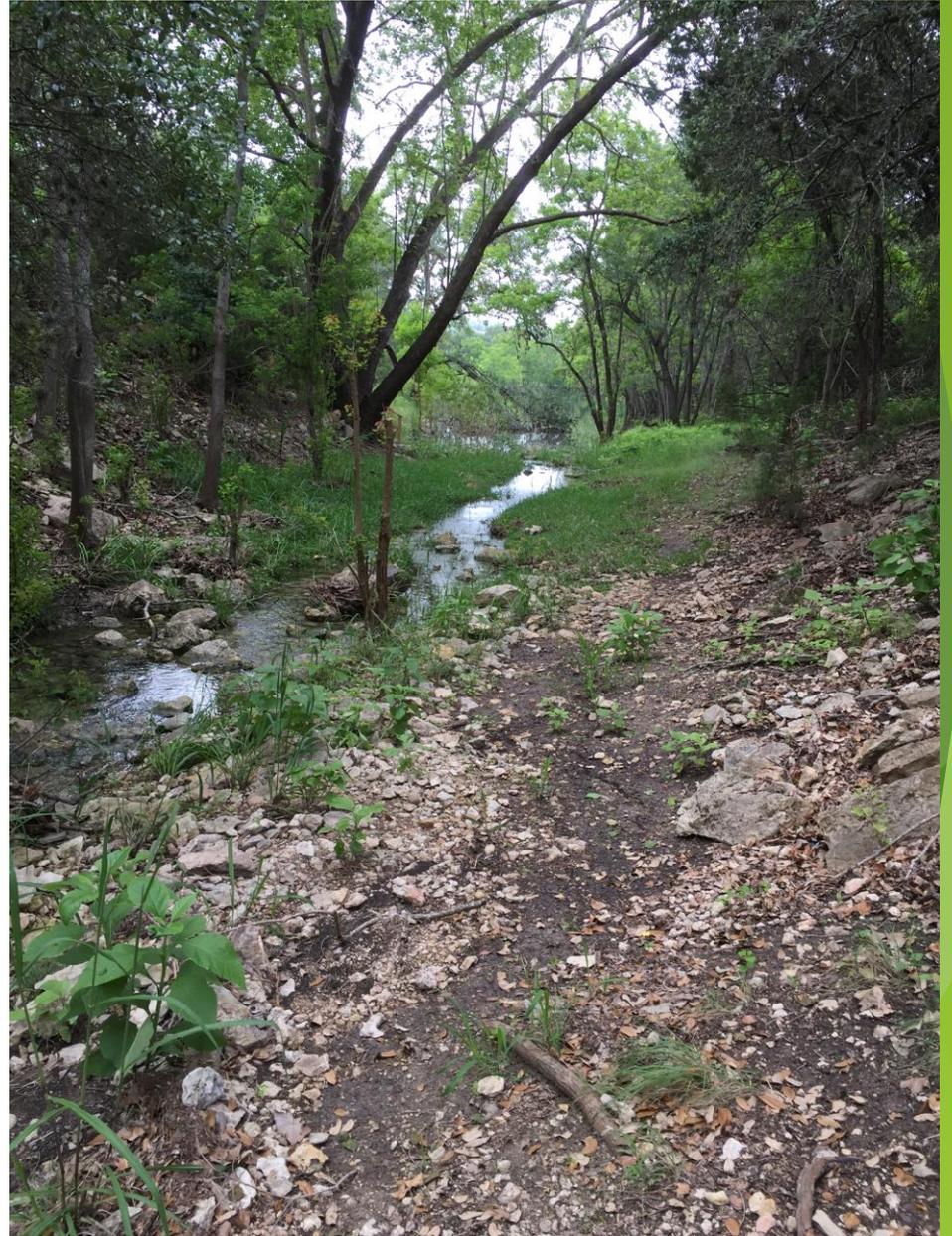
- ▶ Groundwater: the water found underground in the cracks and spaces in soil, sand and rock. It is stored in and moves slowly through geologic formations of soil, sand and rocks called aquifers.
- ▶ Streamflow, or discharge: Volume of water that moves over a point during a fixed period of time, or cubic feet per second (CFS)



Types of Streamflow & Examples

- ▶ Perennial - Flow continuously during both wet & dry conditions; baseflow occurs reliably due to the movement of ground water into the channel
- ▶ Intermittent - Flow only during certain times of the year; usually > 30 days/year
- ▶ Ephemeral - Flow only during or immediately after rain, usually < 30 days/year





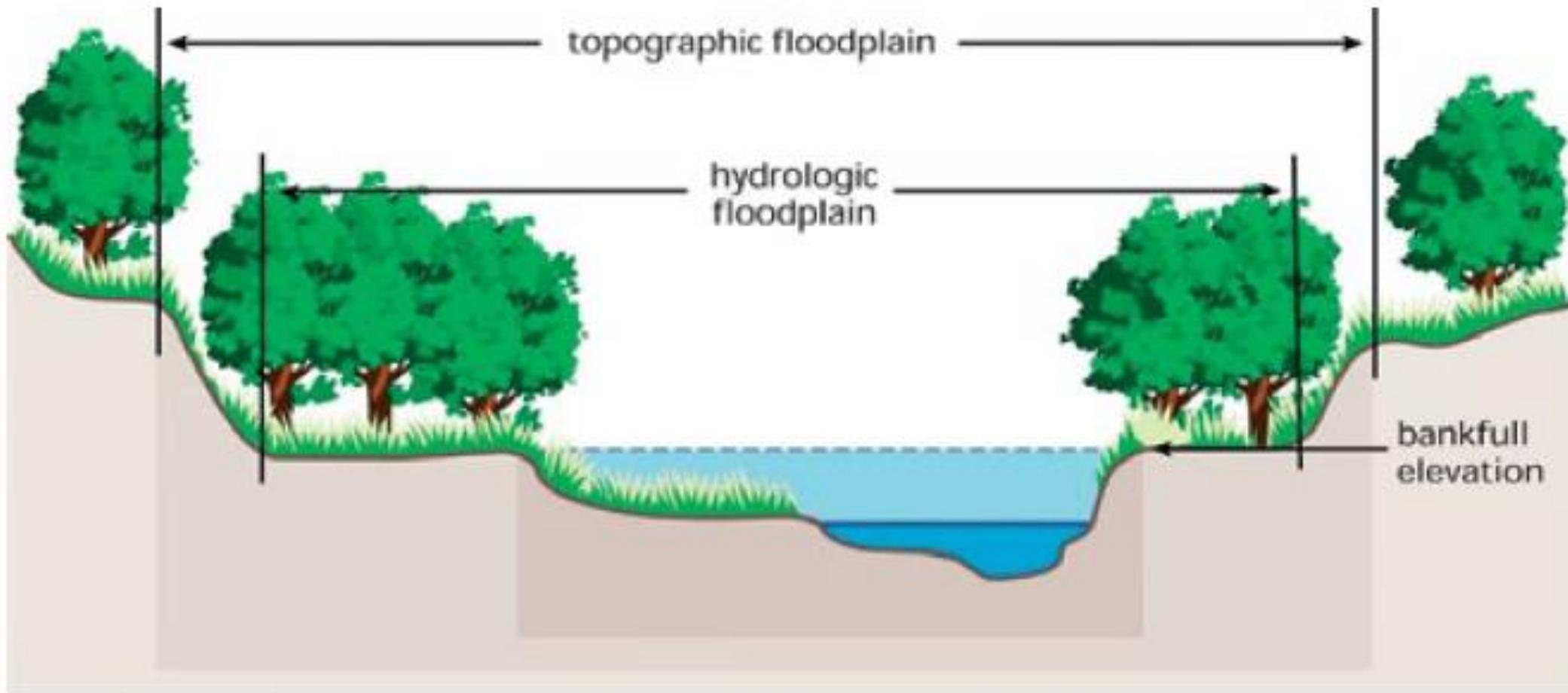


Figure 5.3 - The hydrologic floodplain is defined by bankfull elevation. The topographic floodplain includes the hydrologic floodplain and higher floodplains up to a defined elevation that corresponds to a specific flood frequency. Used with permission from the NRCS.

4. How do natural flow patterns affect things like sediment, organic matter, temp, nutrient balance & organisms life cycle?

- ▶ Natural flow regimes are determined by the climate, run-off, catchment size and geomorphology without the impacts of dams, weirs, extraction and river management. Any of the above will alter a flow regime.
- ▶ Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands is recognized as a major factor contributing to loss of biological diversity and ecological function in aquatic ecosystems, including floodplains.
- ▶ Alteration to natural flow regimes can occur through reducing or increasing flows, altering seasonality of flows, changing the frequency, duration, magnitude, timing, predictability and variability of flow events, altering surface and subsurface water levels and changing the rate of rise or fall of water levels (Walker 1985; Cadwallader and Lawrence 1990; Gehrke *et al.* 1995; Kingsford 1995; Maheshwari *et al.* 1995; Poff *et al.* 1997; Boulton and Brock 1999; Robertson *et al.* 1999, 2001).

Table 1. Physical responses to altered flow regimes.

Source(s) of alteration	Hydrologic change(s)	Geomorphic response(s)	Reference(s)
Dam	Capture sediment moving downstream	Downstream channel erosion and tributary headcutting	Chien 1985, Petts 1984, 1985, Williams and Wolman 1984
		Bed armoring (coarsening)	Chien 1985
Dam, diversion	Reduce magnitude and frequency of high flows	Deposition of fines in gravel	Sear 1995, Stevens et al. 1995
		Channel stabilization and narrowing	Johnson 1994, Williams and Wolman 1984
		Reduced formation of point bars, secondary channels, oxbows, and changes in channel planform	Chien 1985, Copp 1989, Fenner et al. 1985
Urbanization, tiling, drainage	Increase magnitude and frequency of high flows	Bank erosion and channel widening	Hammer 1972
		Downward incision and floodplain disconnection	Prestegard 1988
Levees and channelization	Reduced infiltration into soil	Reduced baseflows	Leopold 1968
	Reduce overbank flows	Channel restriction causing downcutting	Daniels 1960, Prestegard et al. 1994
		Floodplain deposition and erosion prevented	Sparks 1992
		Reduced channel migration and formation of secondary channels	Shankman and Drake 1990
Groundwater pumping	Lowered water table levels	Streambank erosion and channel downcutting after loss of vegetation stability	Kondolf and Curry 1986

What happens when a natural flow regime is returned to a River?

Glines Canyon Dam Removal - Time Lapse
This would definitely not be my dream job...
<https://youtu.be/mQusj6tD97w> (1:32)

After Largest Dam Removal in U.S. History, This River Is Thriving (2016)
<https://youtu.be/VipVo8zPH0U> (3:21)

October 28, 2011 – The White Salmon River in Washington state is flowing again as the nearly 100-year-old Condit Dam was disabled with explosives Wednesday. The reservoir draining took about 2 hours.

<https://youtu.be/4LxMHmw3Z-U> (2:02)

HOW WOLVES CHANGE RIVERS (4:34)

<http://themetapicture.com/when-they-brought-these-wolves/>

HOW WHALES AFFECT CLIMATE (4:51)

<https://youtu.be/M18HxXve3CM>

Remarkable Riparian Organization

Website (photos of a recovering riparian area)

<http://www.remarkableriparian.org/index.php>

FYI: Blanco River - Riparian Recovery (14:36)

<https://youtu.be/U8BucDGS1CA>

Reservoir on the Guadalupe River

Formed in 1931 by the construction of a dam to provide hydroelectric power to the area.

Management of the dam and lake was assumed by the Guadalupe-Blanco River Authority on May 1, 1963.

Venue for outdoor recreation, including fishing and boating. Fish: catfish, crappie, striped bass, and largemouth bass.

Lake Dunlap Dam Failure

<https://www.kens5.com/article/news/lake-dunlaps-future-is-grim-after-spillway-fails-at-nearby-dam/273-759614b0-59aa-49cb-a1f1-857f662ffaa9> (2:36)

Lake Dunlap Two Days Later

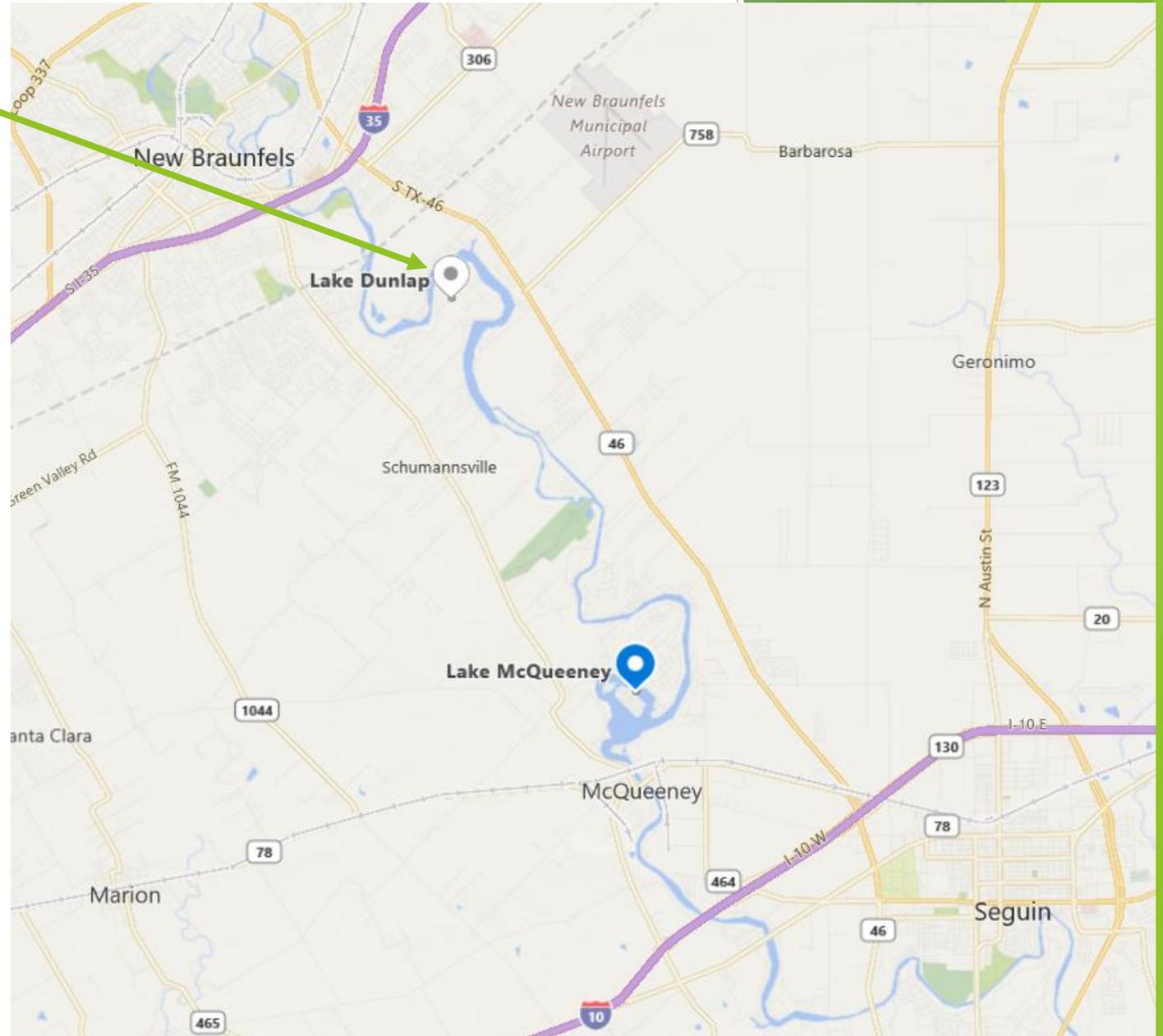
https://youtu.be/TiElHUzg_xk (1:52)

Lake Wood Dam Failure 2016 (Gonzales, Texas)

<https://www.youtube.com/watch?v=eg8gR2Gex-I> (2:24)

Lake Wood 2018

<https://youtu.be/leDTUtm1LoI>



Next Up: Texas Water Law, Chapter 9