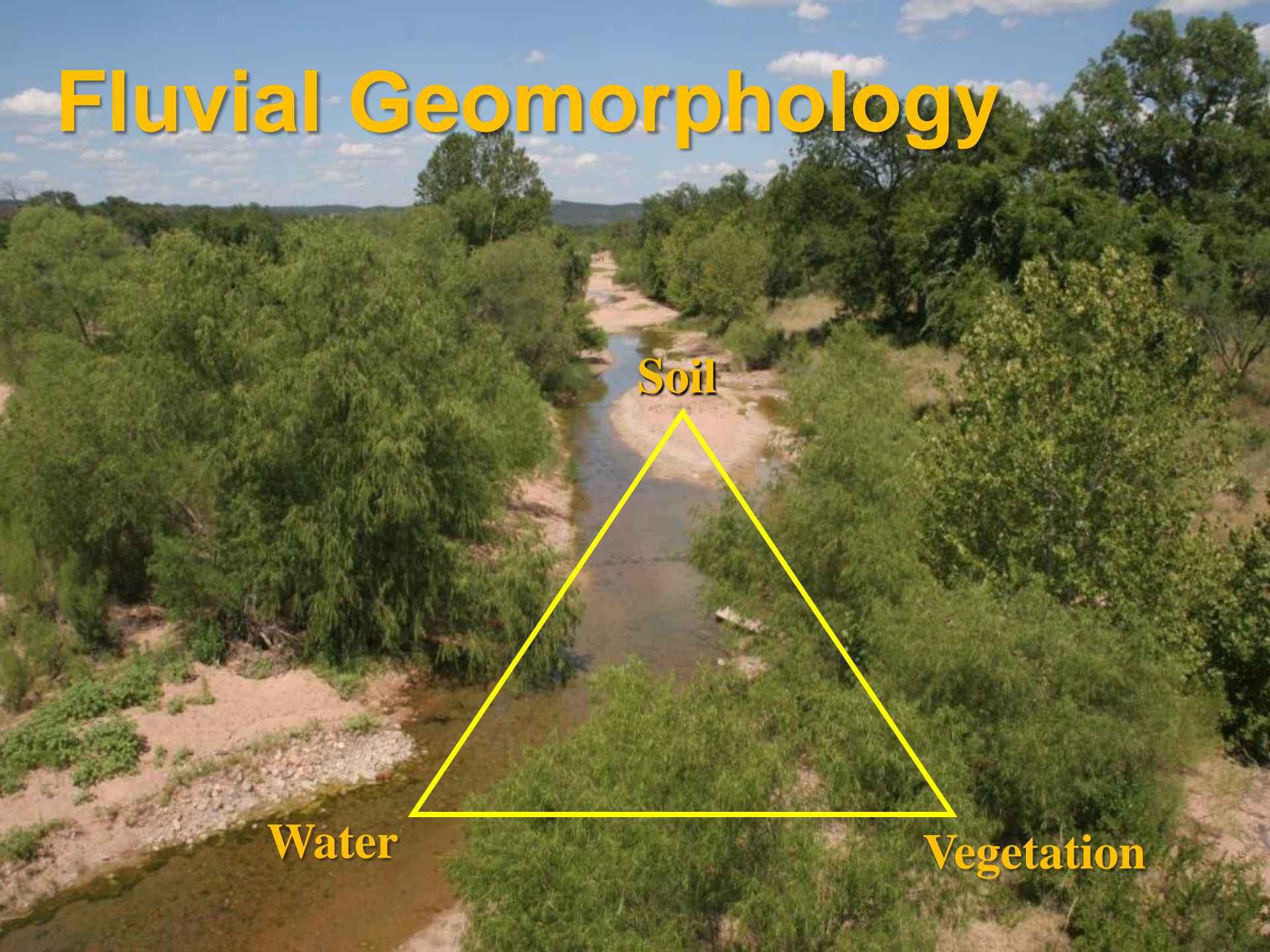


How Streams Function

Melissa Parker
Texas Parks and Wildlife Department

TEXAS
PARKS &
WILDLIFE

Fluvial Geomorphology



Soil

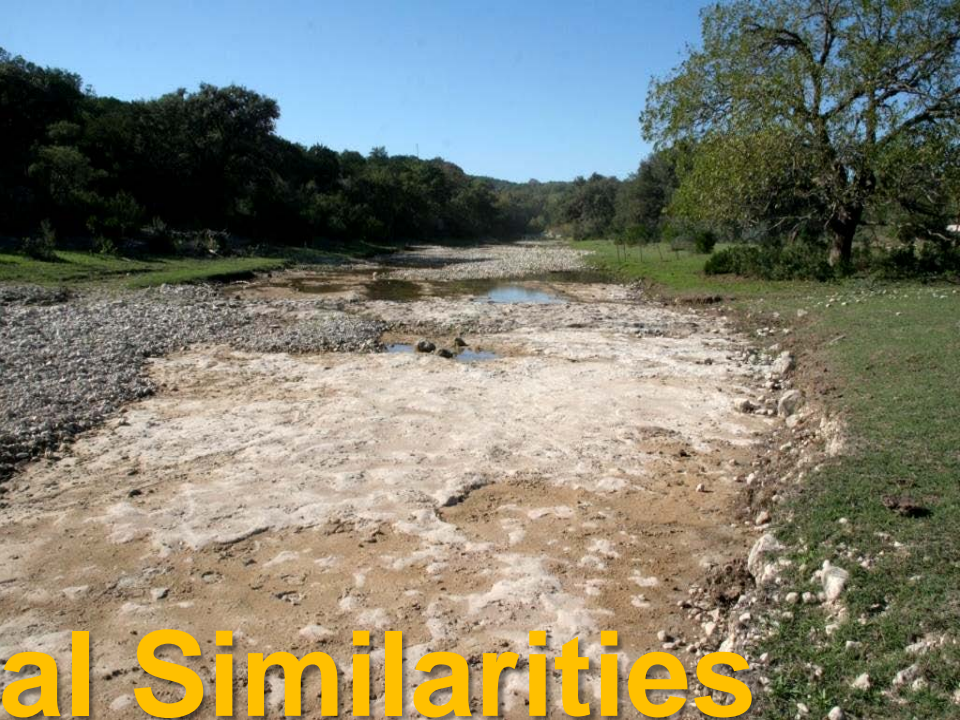
Water

Vegetation

OBJECTIVES

- Basic stream processes
- Watershed and stream relationships
- Stream, floodplain & riparian management

What do streams want to do?



Many Universal Similarities



Functions of a Stream

- **Transport water**
- **Transport & deposit sediment**
- **Transport & replenish nutrients**
- **Biological functions (food, shelter, shading, movement, etc.)**



Stream, Floodplain and Riparian Areas are One

- Erosion Control
- Water Quality Improvement
- Wildlife Habitat
- Aquatic Habitat
- Recreation
- Water Storage
- Flood Protection

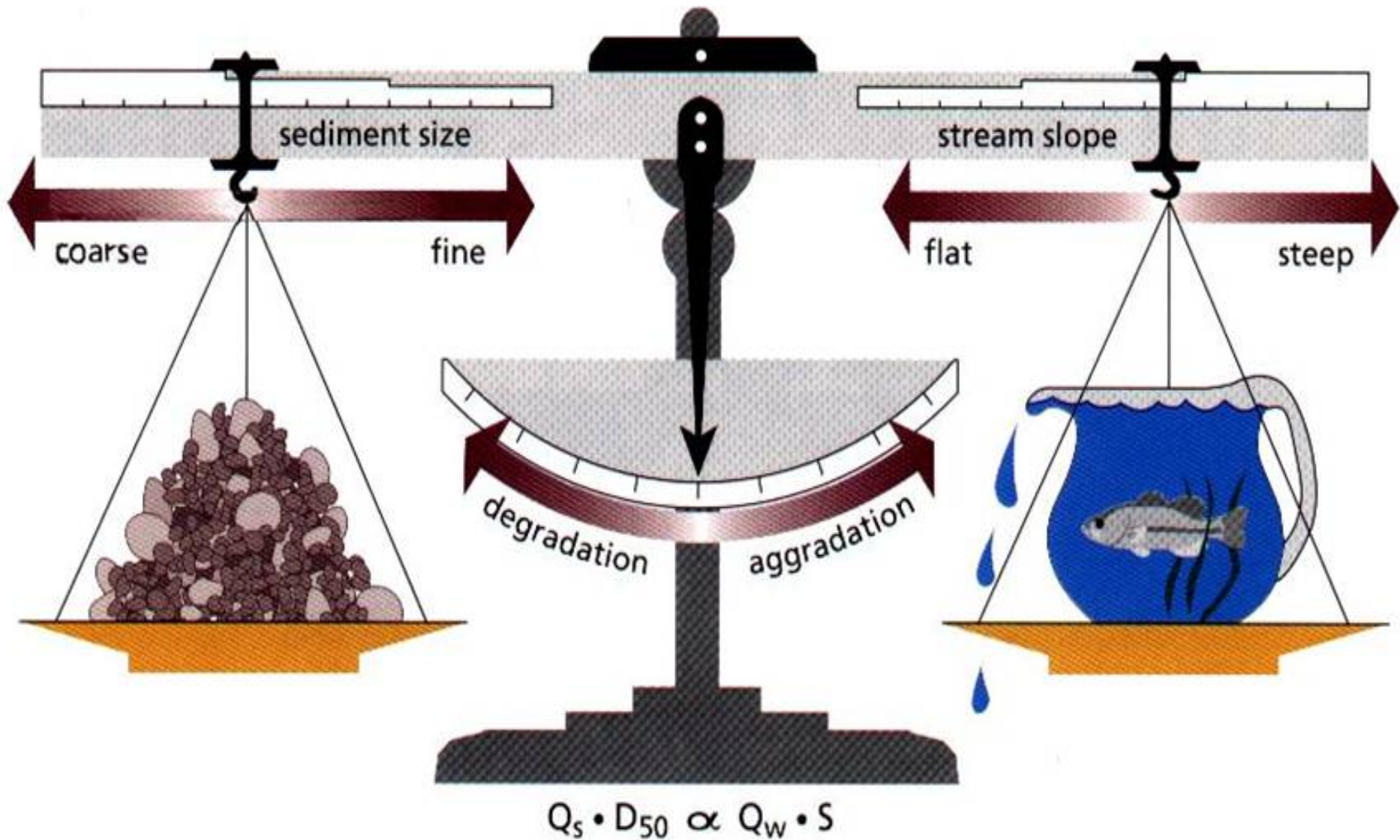


Stream Facts



- Streambank and watershed erosion are natural processes
- A dynamic equilibrium exists in stable stream channels
- Floods have beneficial functions
- When changes are made in the watershed or stream, the stream will adjust to fix itself

Lane's Relationship, 1950



10 Lessons on How Streams Work

Exaggerated sketch of the screwlike path of a particle of water around a river bend

Path of current around a river bend

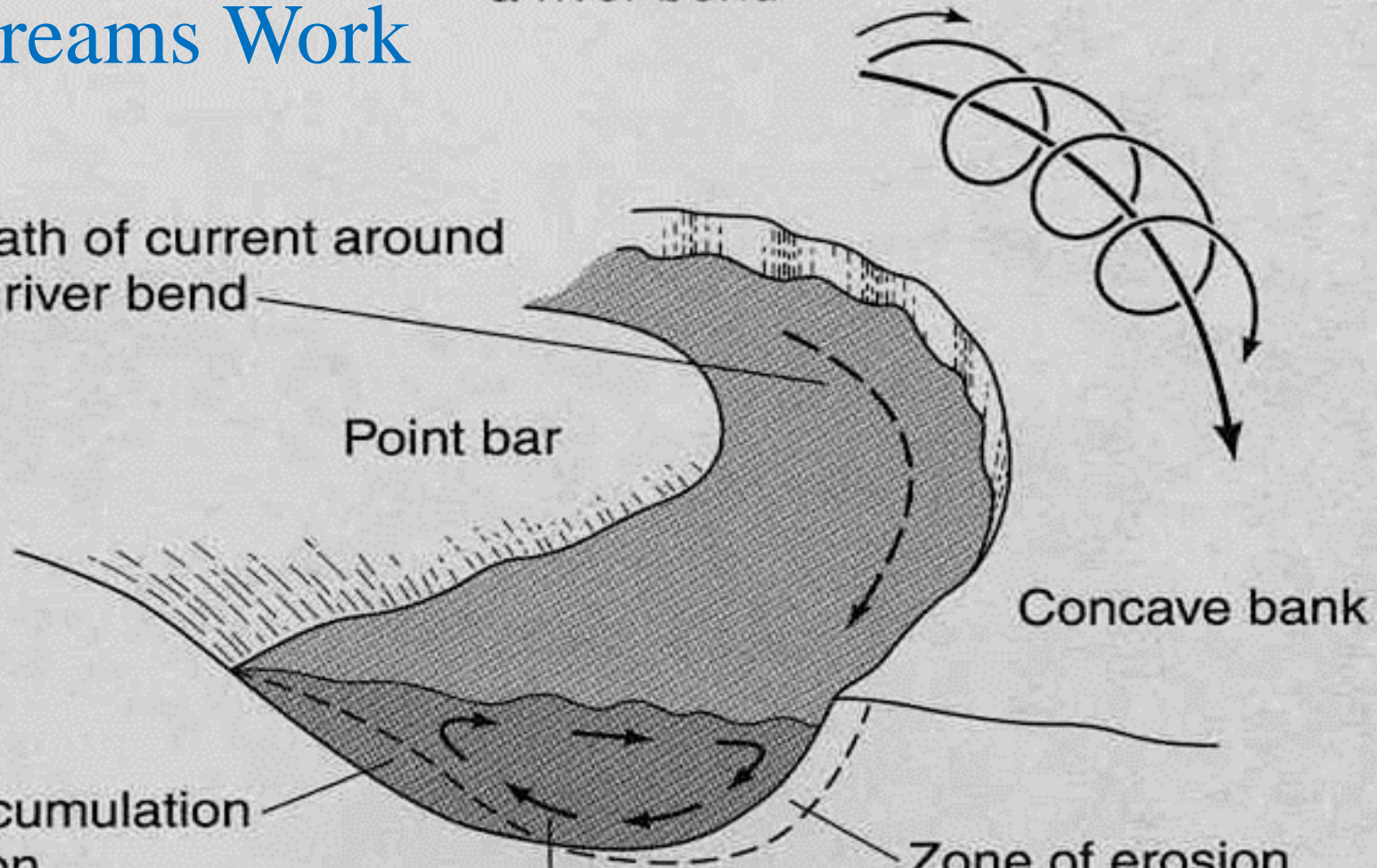
Point bar


Concave bank

Zone of accumulation or deposition

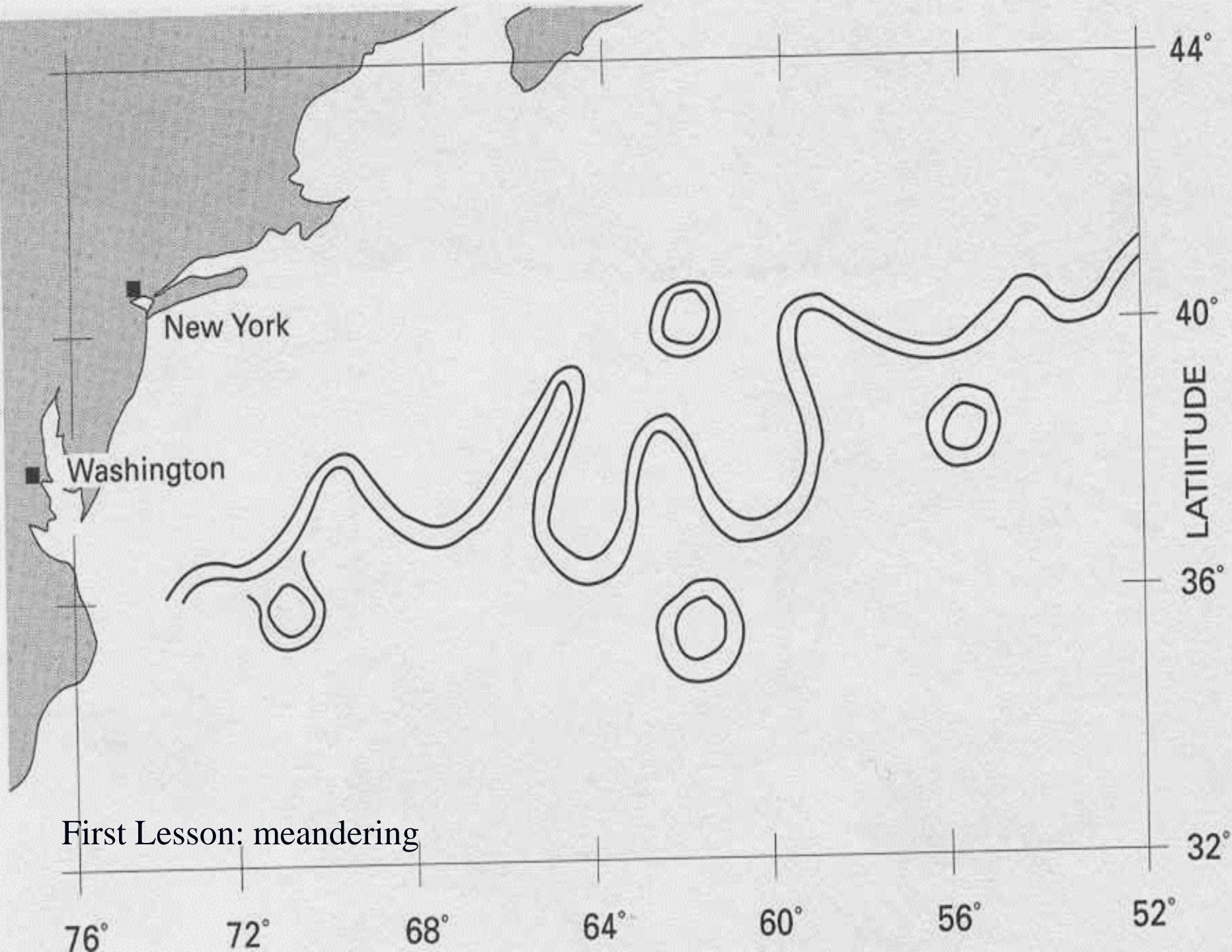
Zone of erosion

Circulatory current in water flowing around a river bend



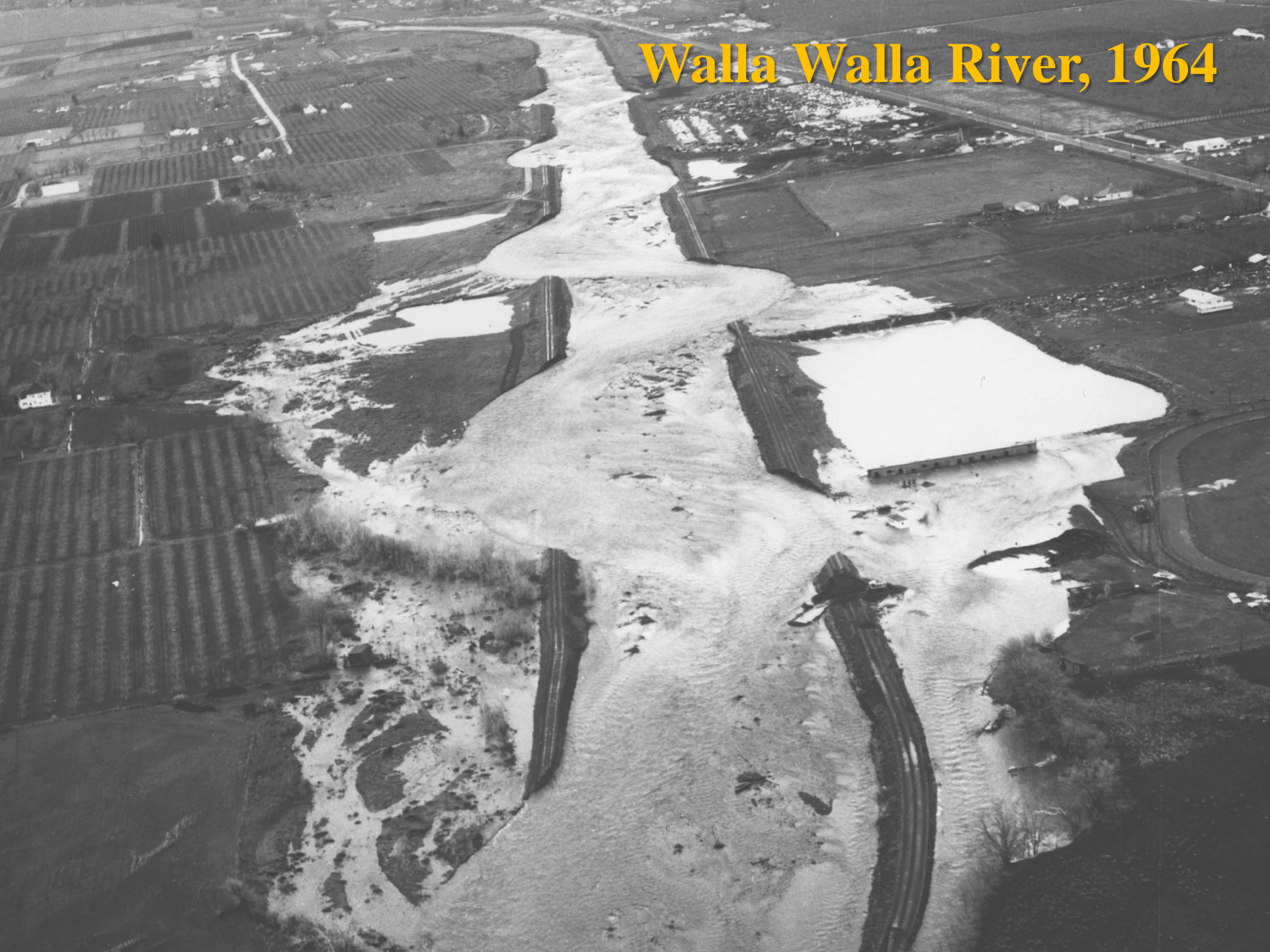
A wide, meandering stream flows through a lush green landscape. The stream is light-colored, possibly due to sediment or sand, and winds in a series of gentle curves across the grassy fields. The surrounding terrain is covered in dense green vegetation, with some rocky outcrops visible on the left. In the distance, a range of low mountains or hills is visible under a sky filled with soft, white clouds. The overall scene conveys a sense of a natural, undisturbed waterway.

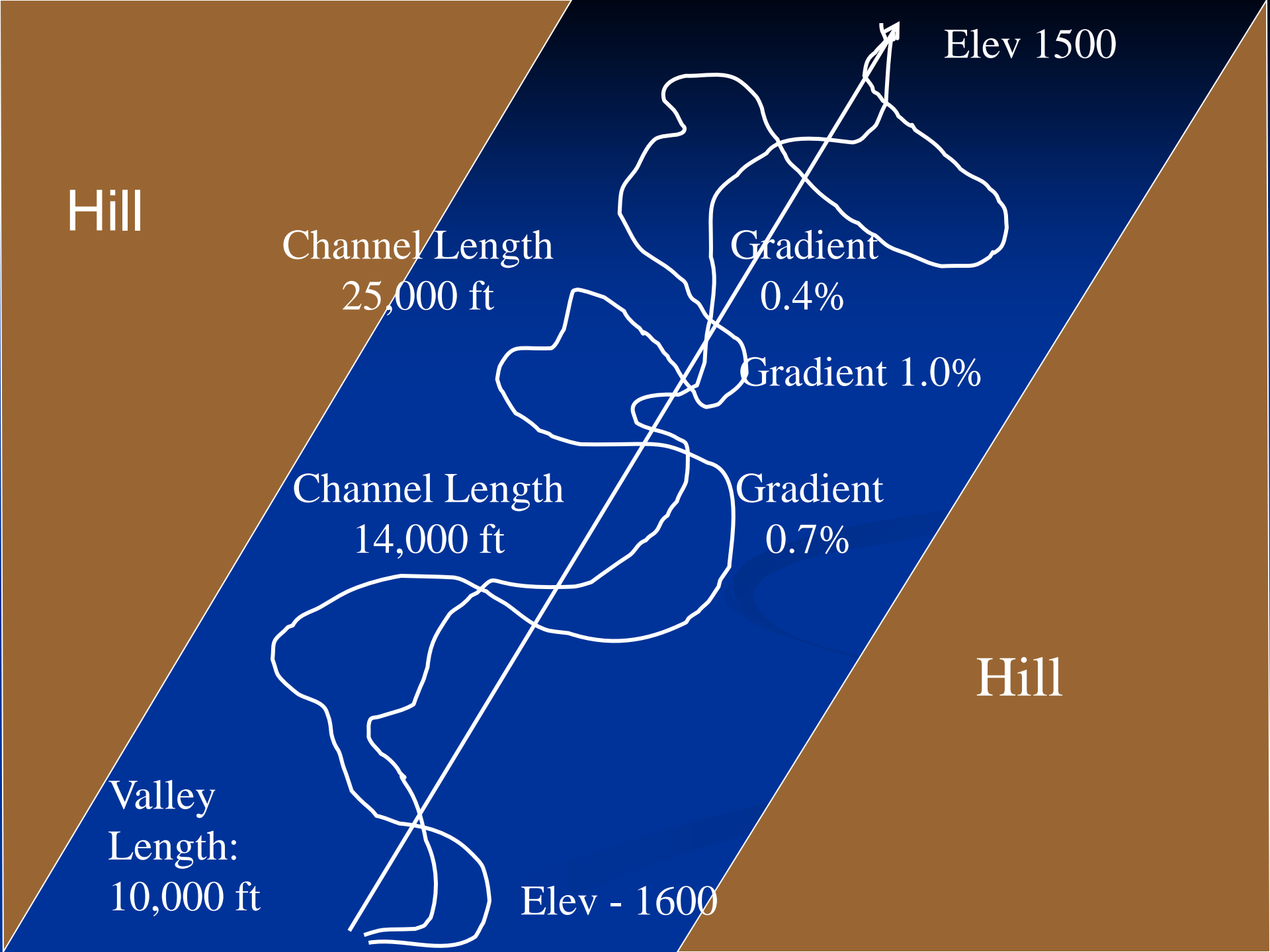
**Lesson 1:
Streams do not
want to be wide
and straight, they
want to meander**



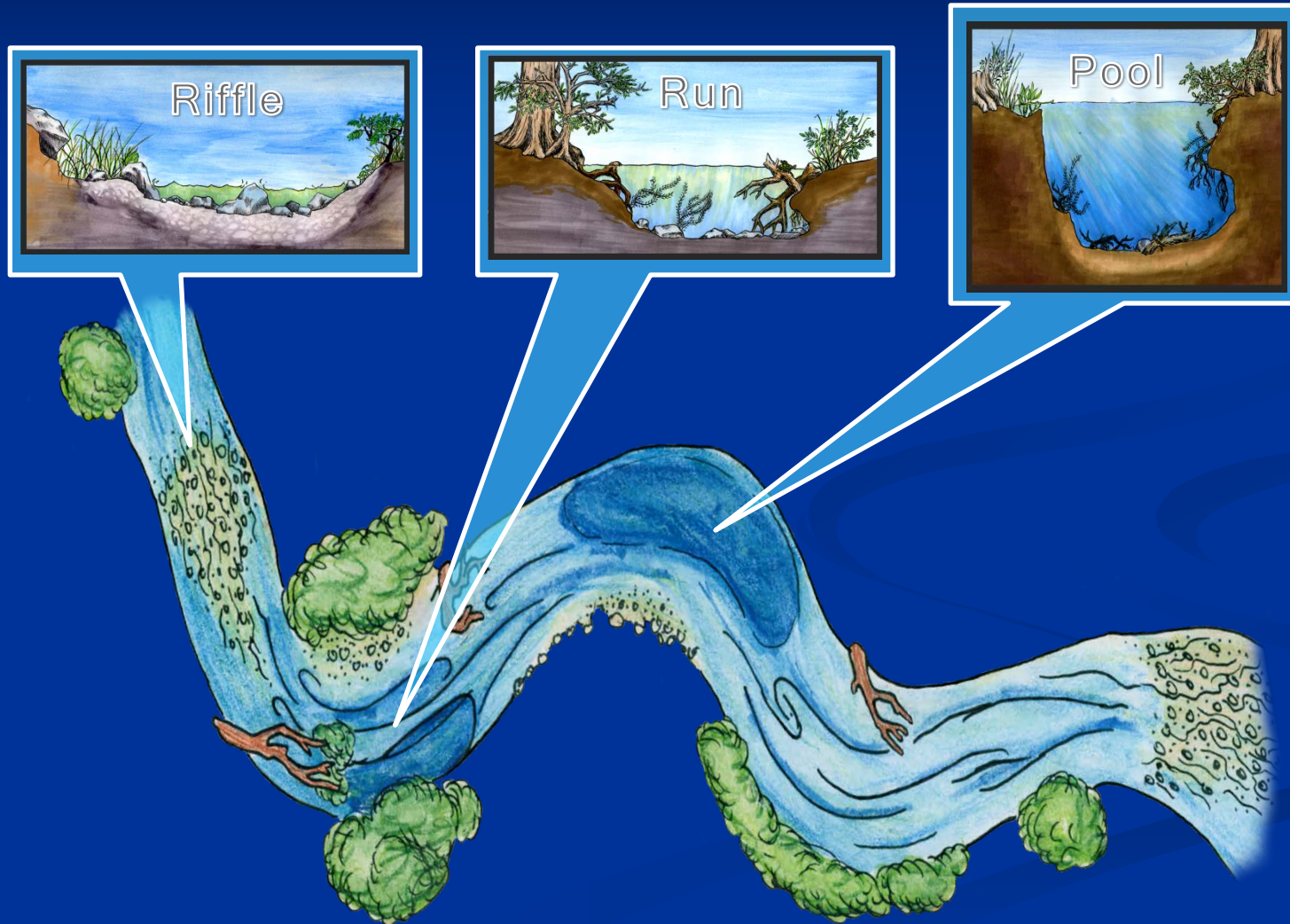
First Lesson: meandering

Walla Walla River, 1964





The patterns of rivers are naturally developed to dissipate the energy of the moving water and to transport sediment. The meander geometry and associated riffles and pools adjust to keep the system operating efficiently.



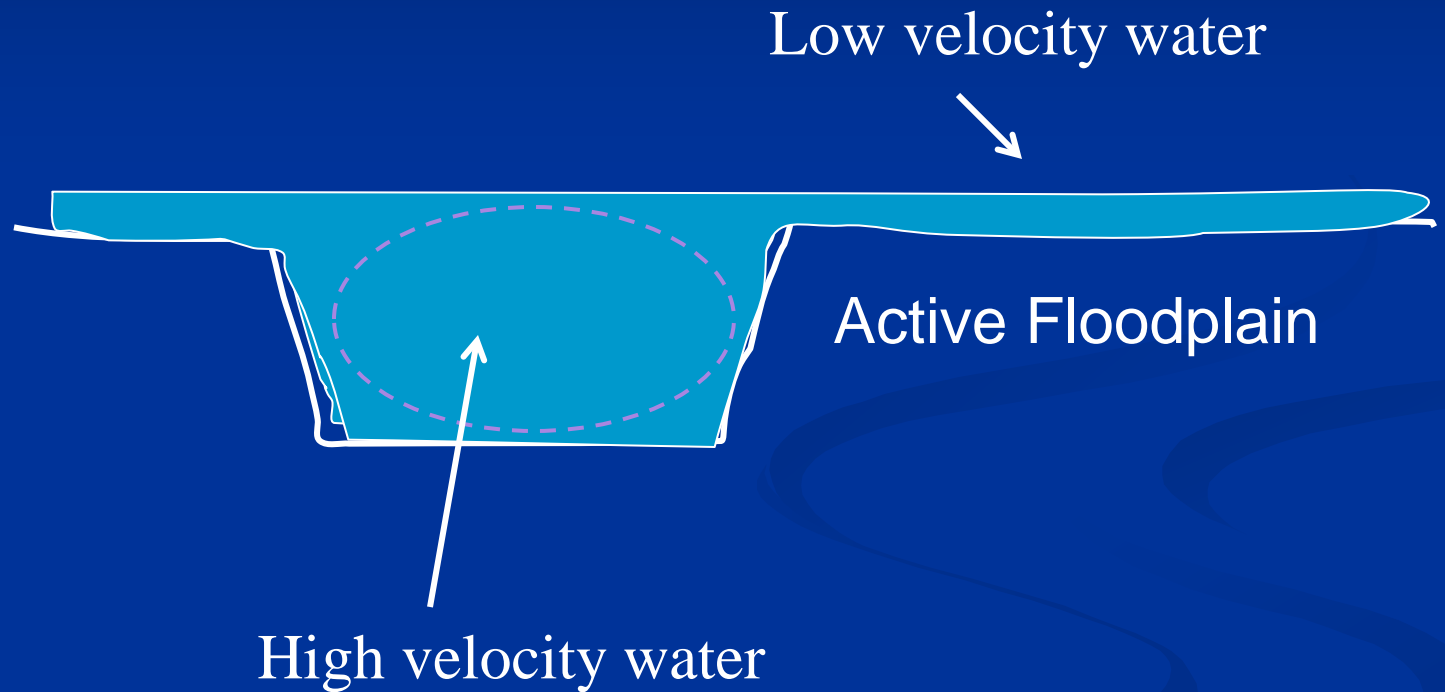
Bankfull Flow

1 – 2 Year Flood



Next Lesson

Lesson 2: Floodplains Dissipate Energy and Trap Sediment





Floodplain

Large Wood Dissipates Energy





Wood Catches Sediment





Large Wood Helps to Build Floodplains and Channels

4 1,540 years *BP

3 2,270 years *BP

1 2,476 years BP*

2 9,450 years *BP

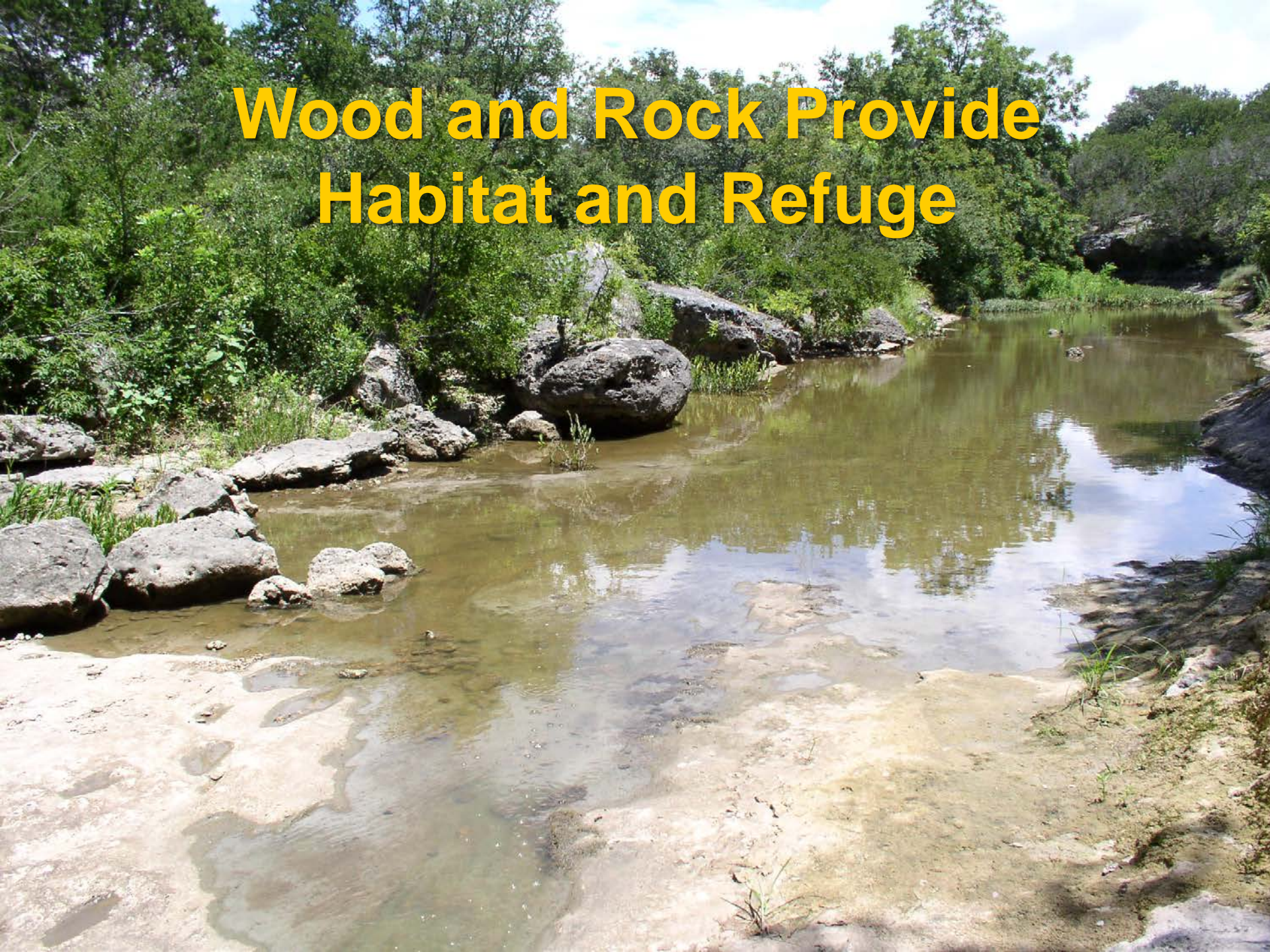
*BP= Before Present
(ref. AD 1950)

*The Temporal Distribution and
Carbon Storage of Large Oak
Wood in Streams and Floodplain
Deposits*

Richard P. Guyette, Daniel C. Dey,
and Michael C. Stambaugh

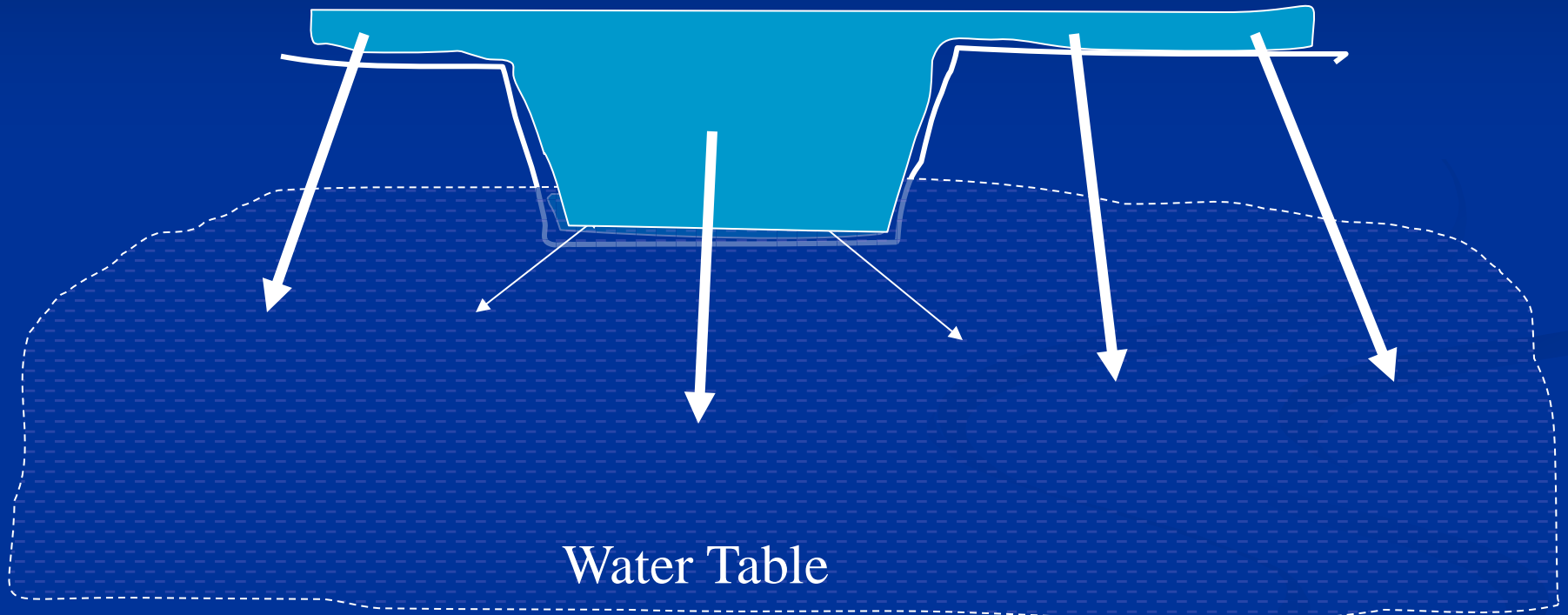


Wood and Rock Provide Habitat and Refuge



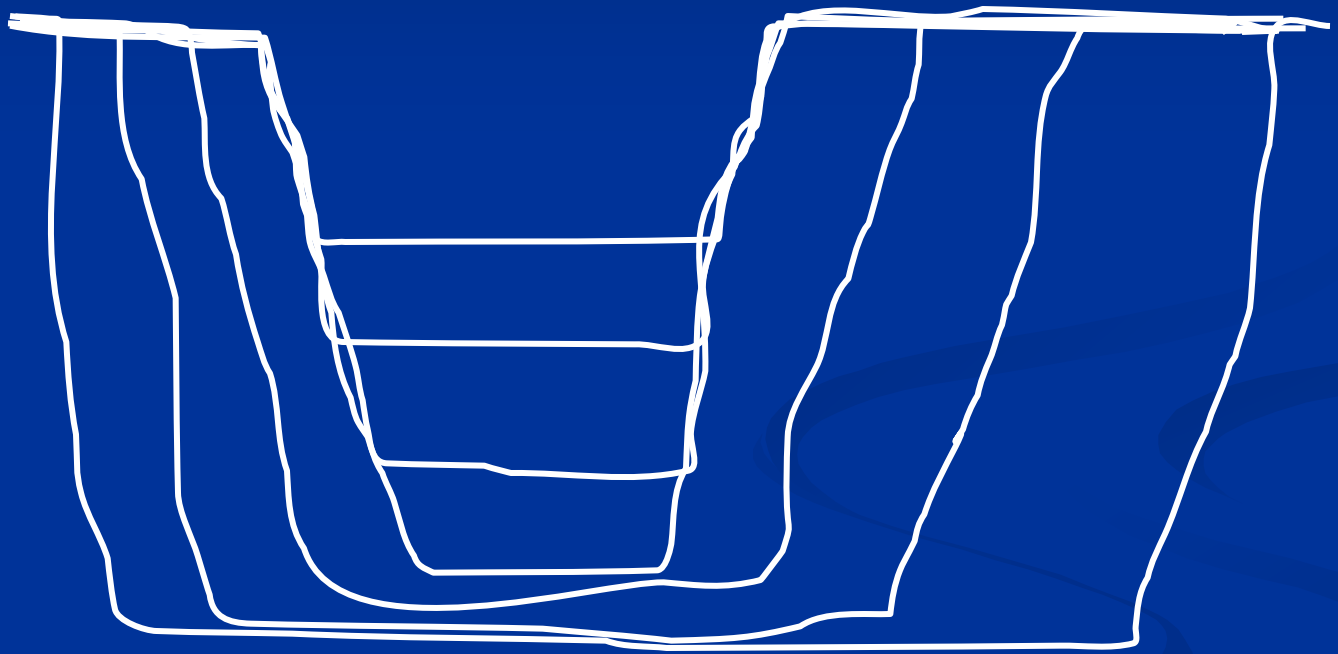
Lesson 3:

Flooding Recharges Water Tables



Lesson 4:

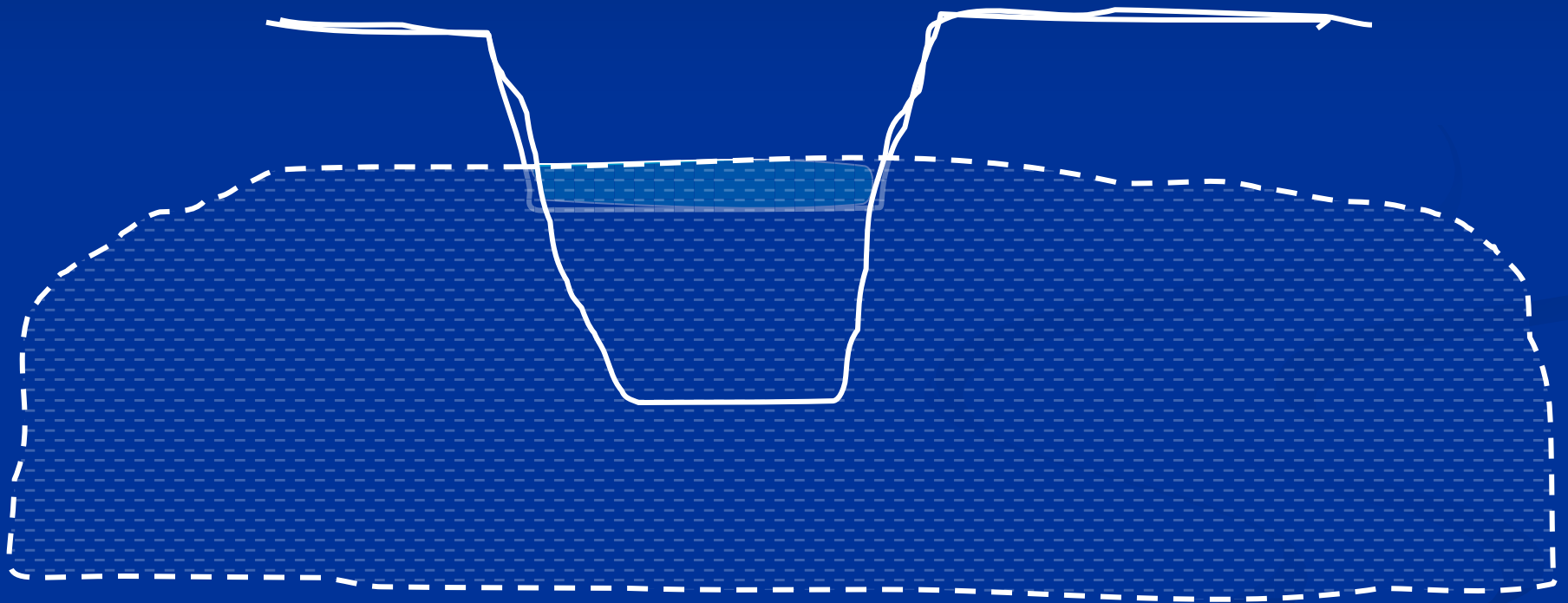
Excessive Erosion Enlarges the Channel



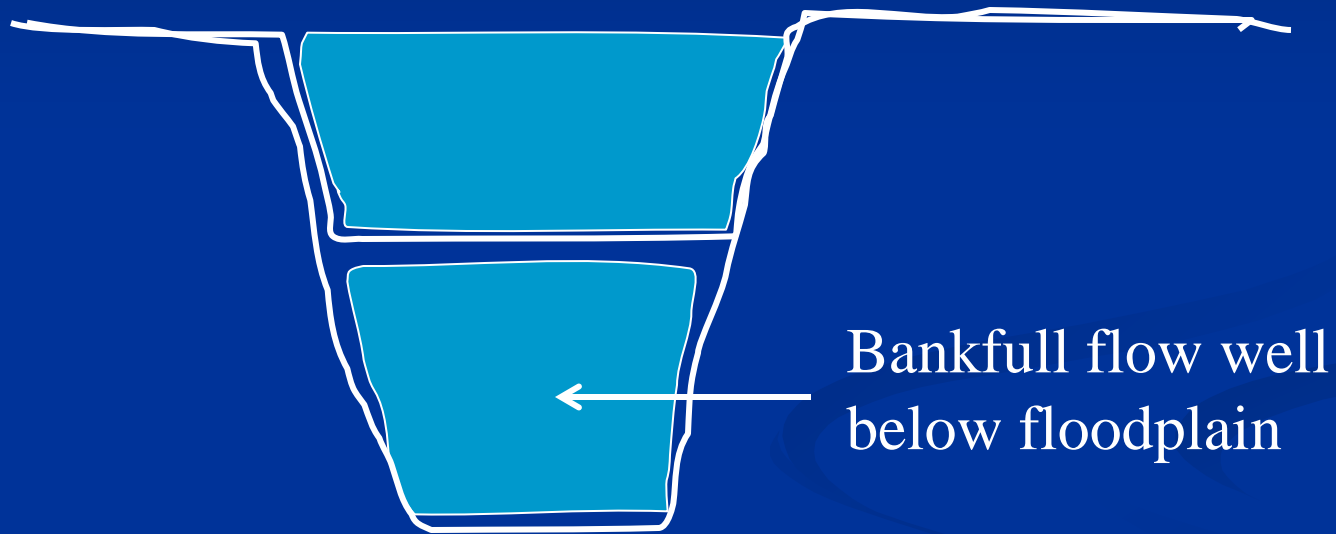


Lesson 5:

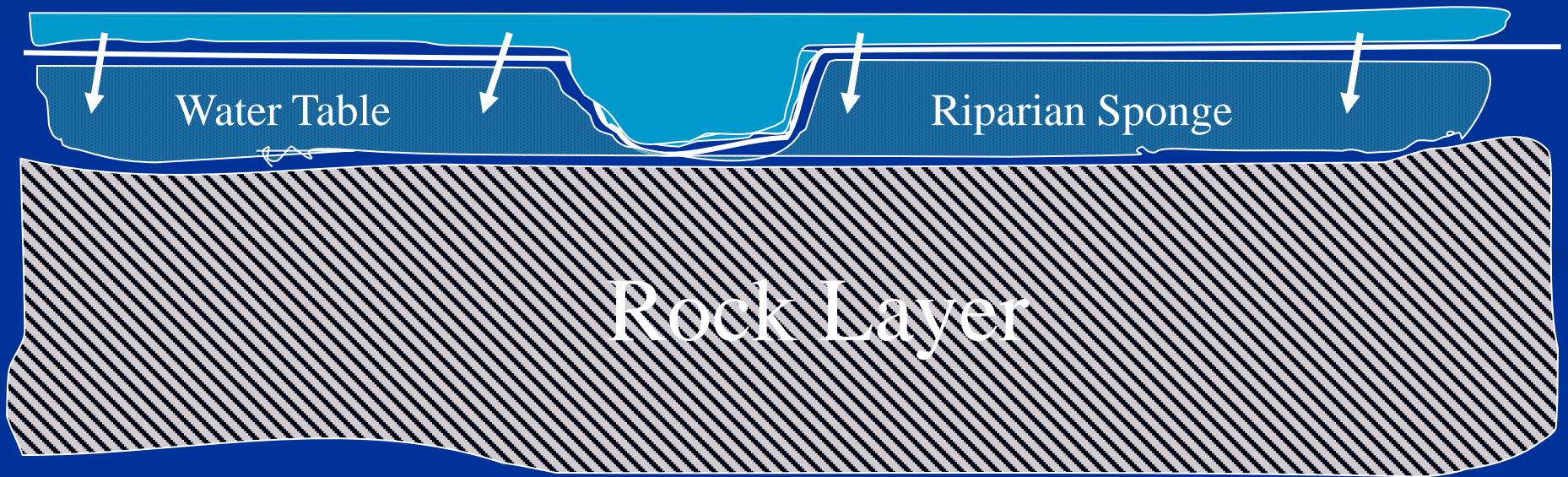
Downcutting Drains the Water Table



Lesson 6: Downcutting Causes Loss of Access to the Floodplain

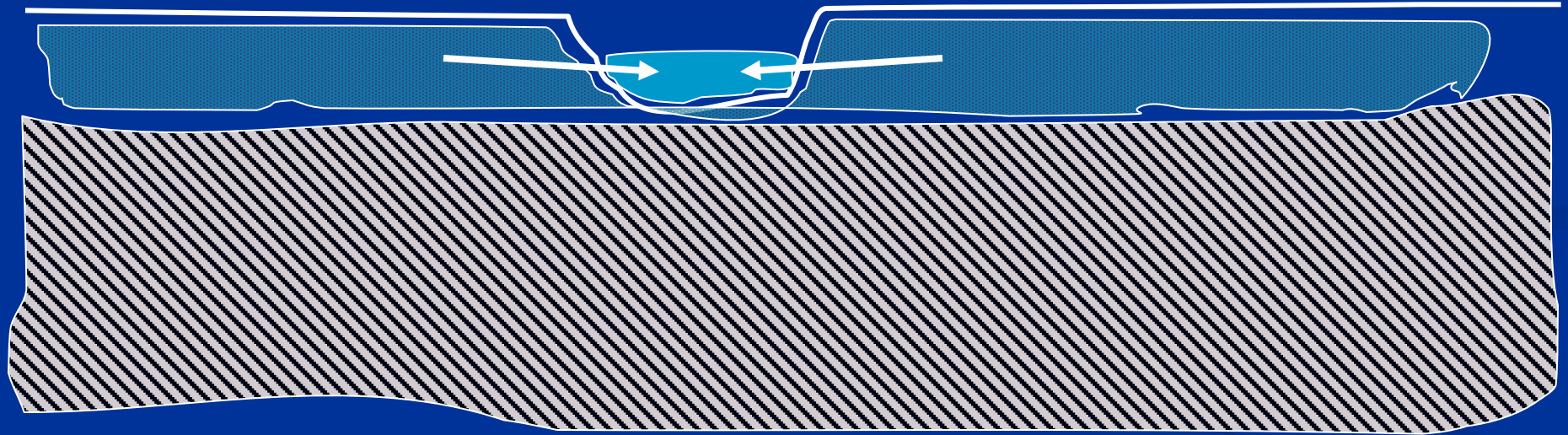






Lesson 7:

The Water Table Sustains Base Flow

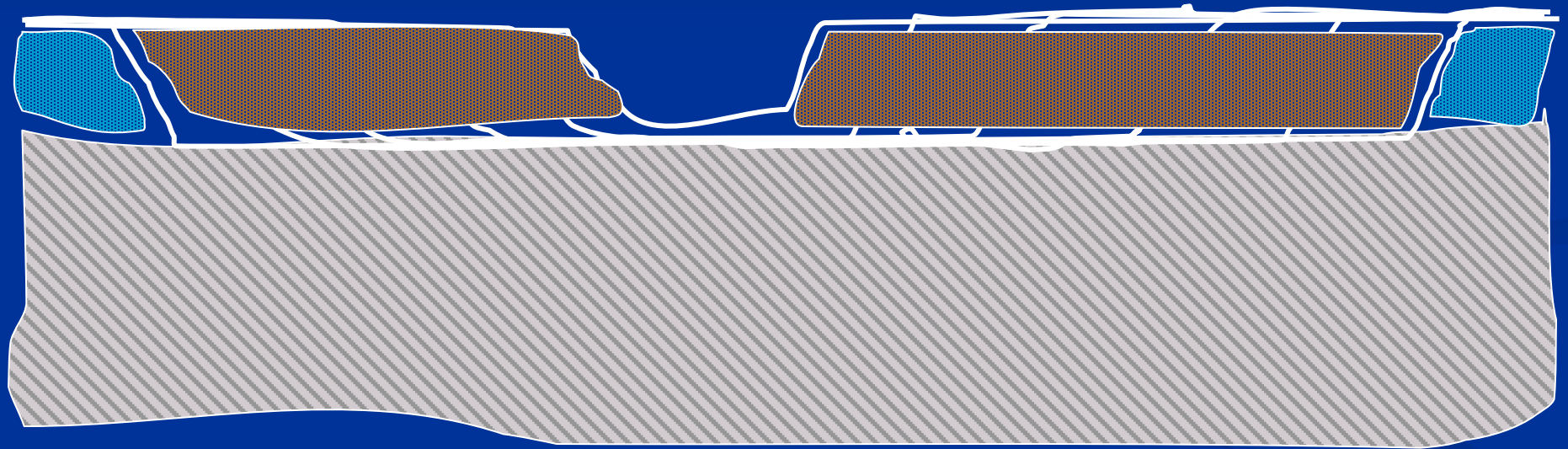


Riparian Sponge



Lesson 8:

Channel Widening Reduces the Riparian Sponge





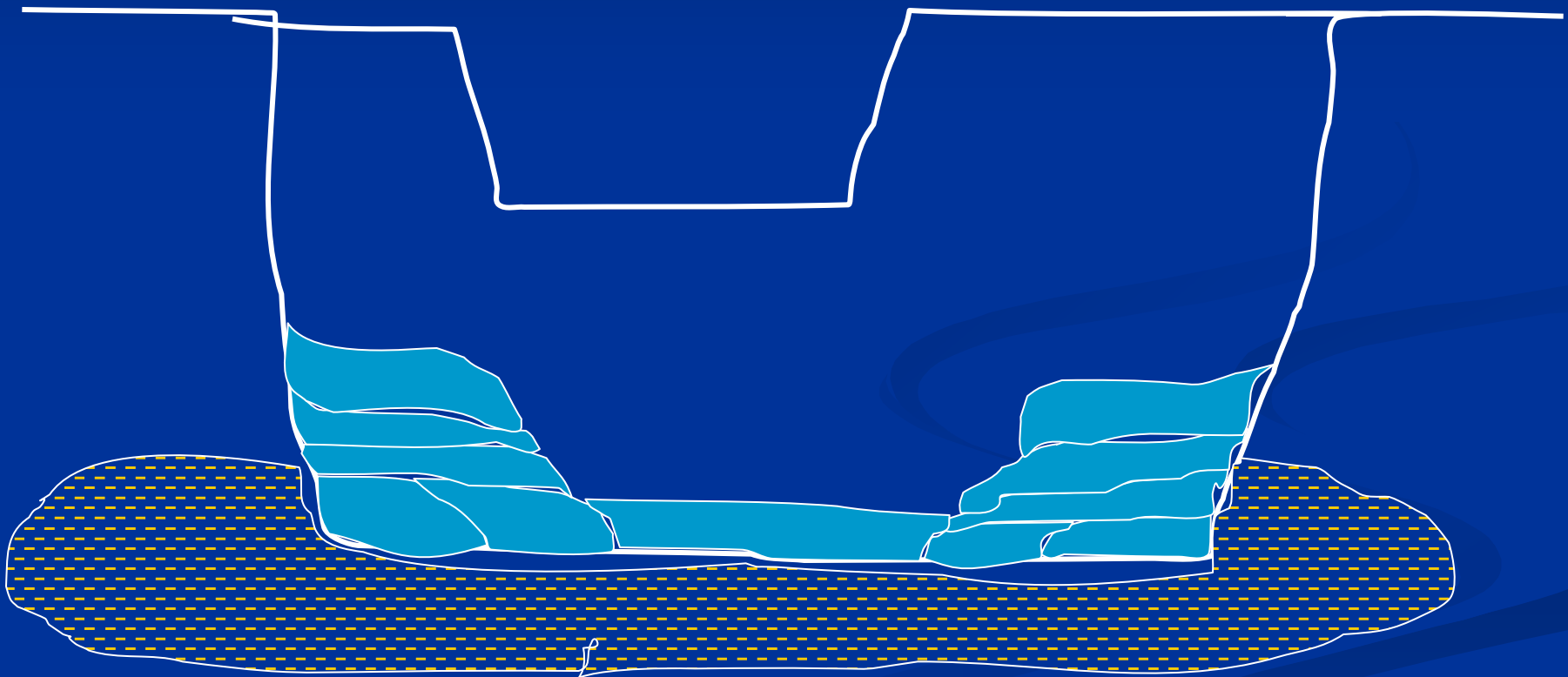
Lesson 9:

Overly Wide Channels Reduce Sediment Transport Ability





Lesson 10: Degraded and Eroded Channels can be Restored



Natural Channel Restoration













Bear Creek – Riparian Restoration

Central Oregon
3500' Elevation
12" Precipitation

Wayne Elmore,
National Riparian Service Team
Full Stream Consulting





1977

Intermittent flow – No fish

Accelerated erosion - Sediment loss

100 years of poor grazing management = Poor vegetation

Wet riparian area (sponge) = 4 acres / mile

Water storage = 1.5 ac ft / mile

Bank erosion = 12,500 feet



1977

A Change in Grazing Management

1977 – 1984: No grazing / Reduced grazing to jump-start recovery

1985 – Present: Short term grazing during late winter to improve riparian vegetation



1983



1986



June 1987



Aug 1987



1988



1993



Feb 1996



April 1996



Oct 1996

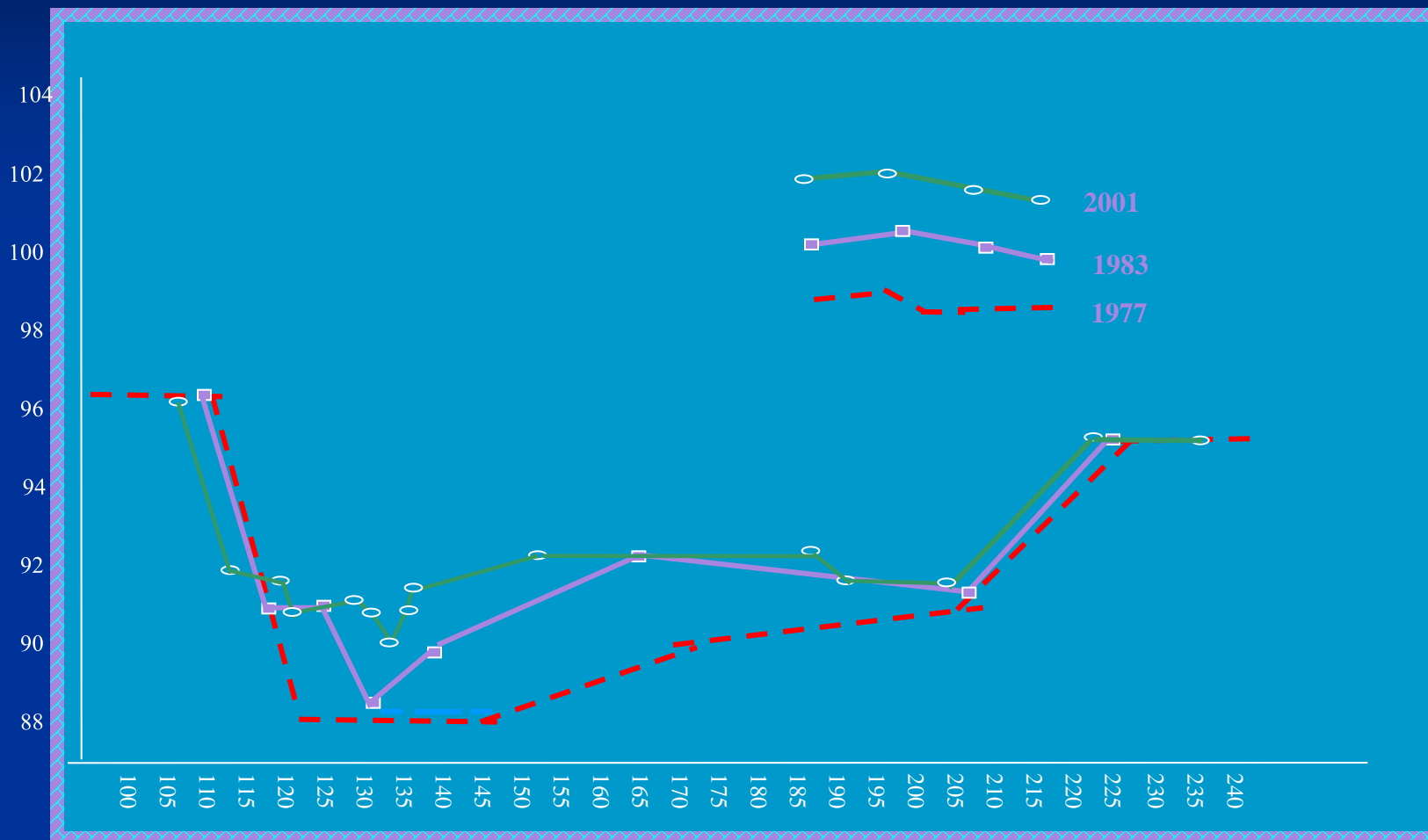


2001

7 10 '01

Bear Creek : Change In Channel Profile (1977 – 2001)

2001



- **Sediment Captured = 7400 CY/Mile**
- **Riparian “Sponge” = 12 Ac/Mile**
- **Water Storage = 2,100,000 Gal/Mile**
(net gain of 4.9 ac ft of storage/mile)
- **Perennial flow; prime aquatic habitat**
- **10x Increase in livestock forage**
- **Bank erosion = 100 feet**



Bear Creek



1977

1986





Nueces River 2007



2008



2009



2010



2011



2012

2012 04 08



2013





May 2014

Summary

- Streams are dynamic. Their main function is to transport water and sediment.
- A stream's morphology is predictable and measurable. A change in one variable will cause an adjustment in another.
- The stream, floodplain, and riparian area are one system (think watershed!).
- Floods have beneficial functions.
- Lateral and vertical stability maintain base flows, the water table, and the “riparian sponge.”