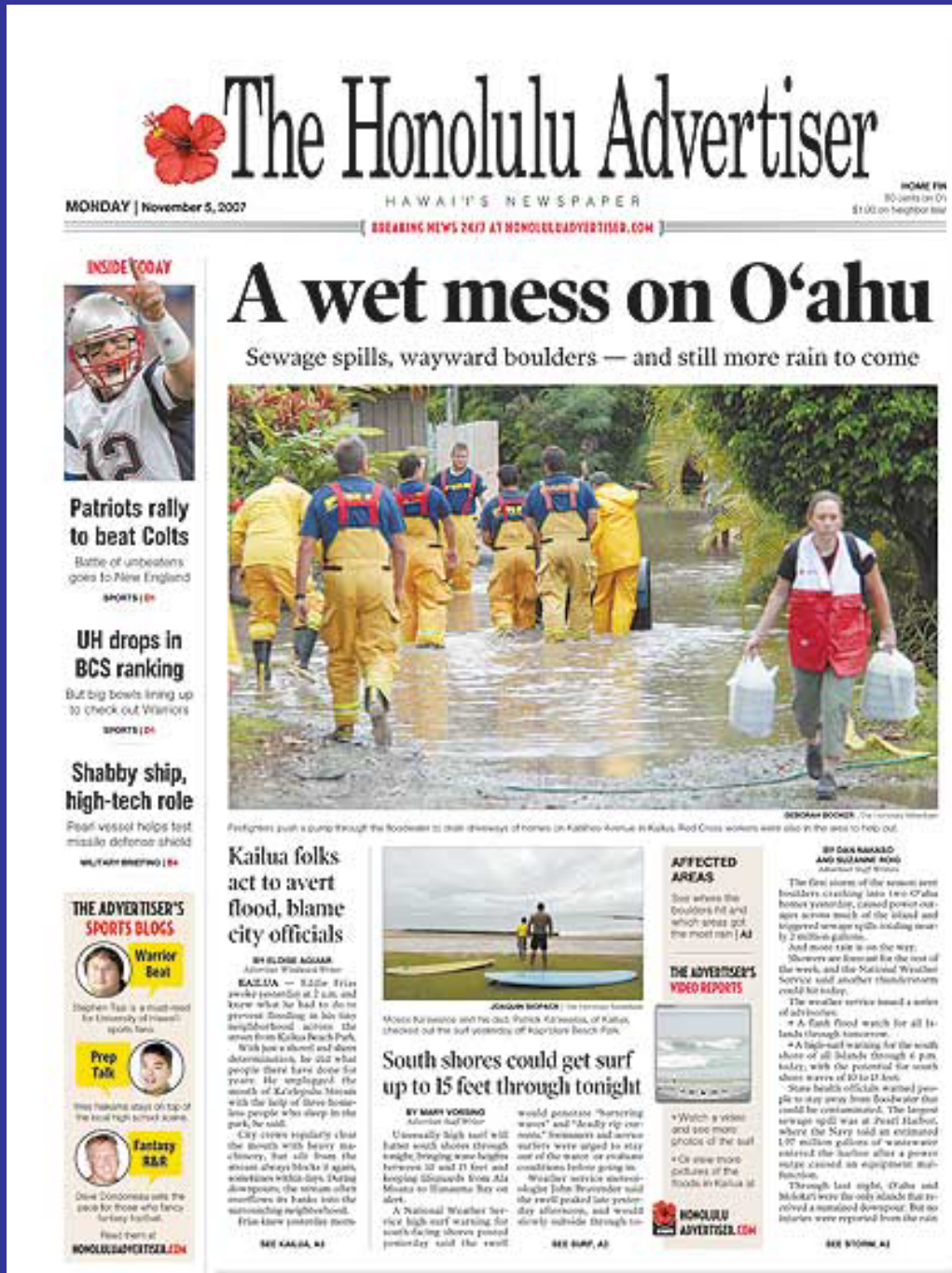


The Honolulu Advertiser

MONDAY | November 5, 2007

HAWAII'S NEWSPAPER

BREAKING NEWS 24/7 AT HONOLULUADVERTISER.COM

INSIDE TODAY

Patriots rally to beat Colts

Battle of unbeatens goes to New England

SPORTS | D1

UH drops in BCS ranking

But big bowls lining up to check out Warriors

SPORTS | D1

Shabby ship, high-tech role

Pearl vessel helps test missile defense shield

MILITARY BRIEFING | B4

THE ADVERTISER'S SPORTS BLOGS

Warrior Beat

Prep Talk

Fantasy R&R

HONOLULUADVERTISER.COM

A wet mess on O'ahu

Sewage spills, wayward boulders — and still more rain to come

DEBORAH BOOKER

Firefighters push a pump through the floodwater to drain driveways of homes on Kaithea Avenue in Kailua. Red Cross workers were also in the area to help out.

Kailua folks act to avert flood, blame city officials

BY ELOISE AGUIAR
Advertiser Windward Writer

KAILUA — 5:15a Erin awoke yesterday at 7 a.m. and knew what he had to do to prevent flooding in his tiny neighborhood across the street from Kailua Beach Park.

With just a shovel and sheer determination, he and what people there have done for years. He unplugged the mouth of Ka'elepulu Stream with the help of three homeless people who sleep in the park, he said.

City crews regularly clear the mouth with heavy machinery, but silt from the stream always blocks it again, sometimes within days. During downpours, the stream often overflows its banks into the surrounding neighborhood.

Erin knew yesterday morn-

SEE KAILUA, A3

JOAQUIN BORDADO

Moana Kanahele and his dad, Patrick Kanahele, of Kailua, checked out the surf yesterday off Kapiolani Beach Park.

South shores could get surf up to 15 feet through tonight

BY MARY VORSINO
Advertiser Staff Writer

Unusually high surf will batter south shores through tonight, bringing wave heights between 10 and 15 feet and keeping lifeguards from Ala Moana to Hanauma Bay on alert.

A National Weather Service high surf warning for south-facing shores posted yesterday said the swell would generate "battering waves" and "deadly rip currents." Swimmers and surfers were urged to stay out of the water or evaluate conditions before going in.

Weather service meteorologist John Bravender said the swell peaked late yesterday afternoon, and would slowly subside through to-

SEE SURF, A3

AFFECTED AREAS

See where the boulders hit and which areas got the most rain | A3

THE ADVERTISER'S VIDEO REPORTS

• Watch a video and see more photos of the surf

• Or view more pictures of the floods in Kailua at

HONOLULU ADVERTISER.COM

BY DAN NAKASO AND SUZANNE ROIG
Advertiser Staff Writers

The first storm of the season sent boulders crashing into two O'ahu homes yesterday, caused power outages across much of the island and triggered sewage spills totaling nearly 2 million gallons.

And more rain is on the way.

Showers are forecast for the rest of the week, and the National Weather Service said another thunderstorm could hit today.

The weather service issued a series of advisories:

• A flash flood watch for all Islands through tomorrow.

• A high-surf warning for the south shore of all Islands through 6 p.m. today, with the potential for south shore waves of 10 to 15 feet.

State health officials warned people to stay away from floodwater that could be contaminated. The largest sewage spill was at Pearl Harbor, where the Navy said an estimated 1.97 million gallons of wastewater entered the harbor after a power outage caused an equipment malfunction.

Through last night, O'ahu and Moloka'i were the only Islands that received a sustained downpour. But no injuries were reported from the rain

SEE STORM, A3



JAMM AQUINO / JAQUINO@STARBULLETIN.COM

What causes the most damage on Oahu?

A) Surface water
B) Groundwater
C) Big surf
D) Tsunami

Surface Water

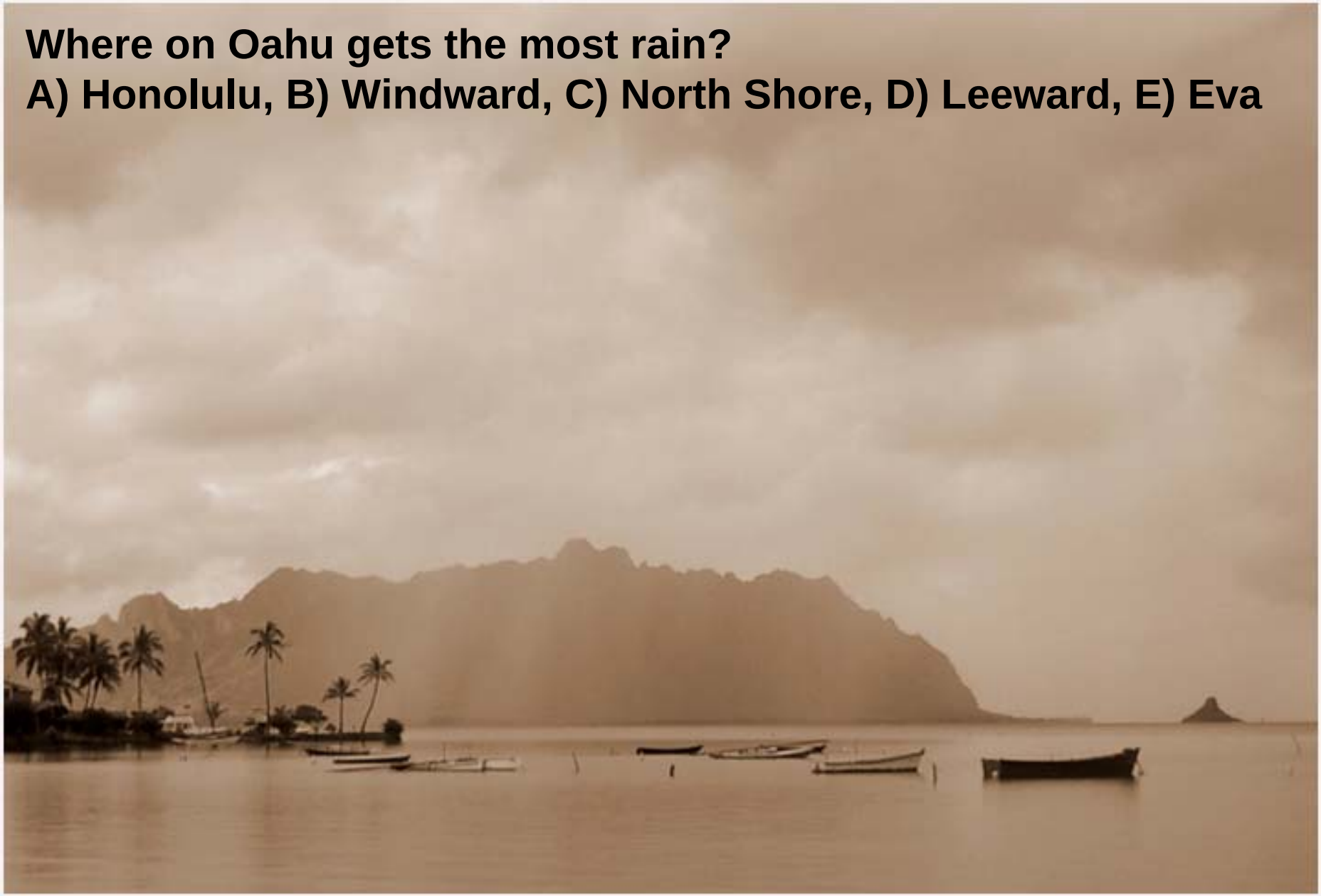






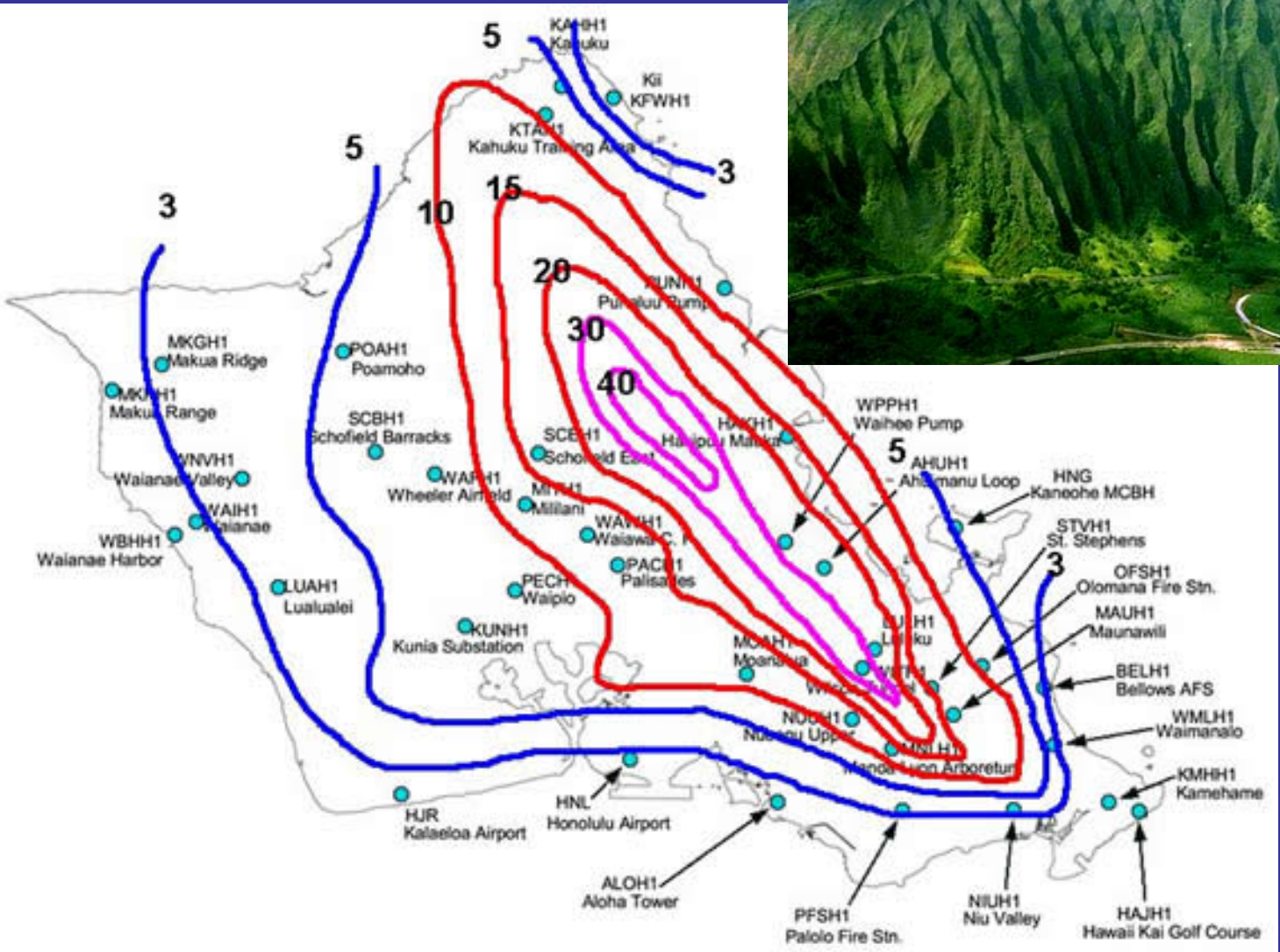


Where on Oahu gets the most rain?
A) Honolulu, B) Windward, C) North Shore, D) Leeward, E) Eva



One week's rainfall (inches) on Oahu





What are the sources of Oahu's water?



1) Tradewinds

and…

2) "Orographic Effect"

control rainfall distribution in Hawaii



What are other sources of Oahu's water?









What are other sources of Oahu's water?









How much water flows across the surface?





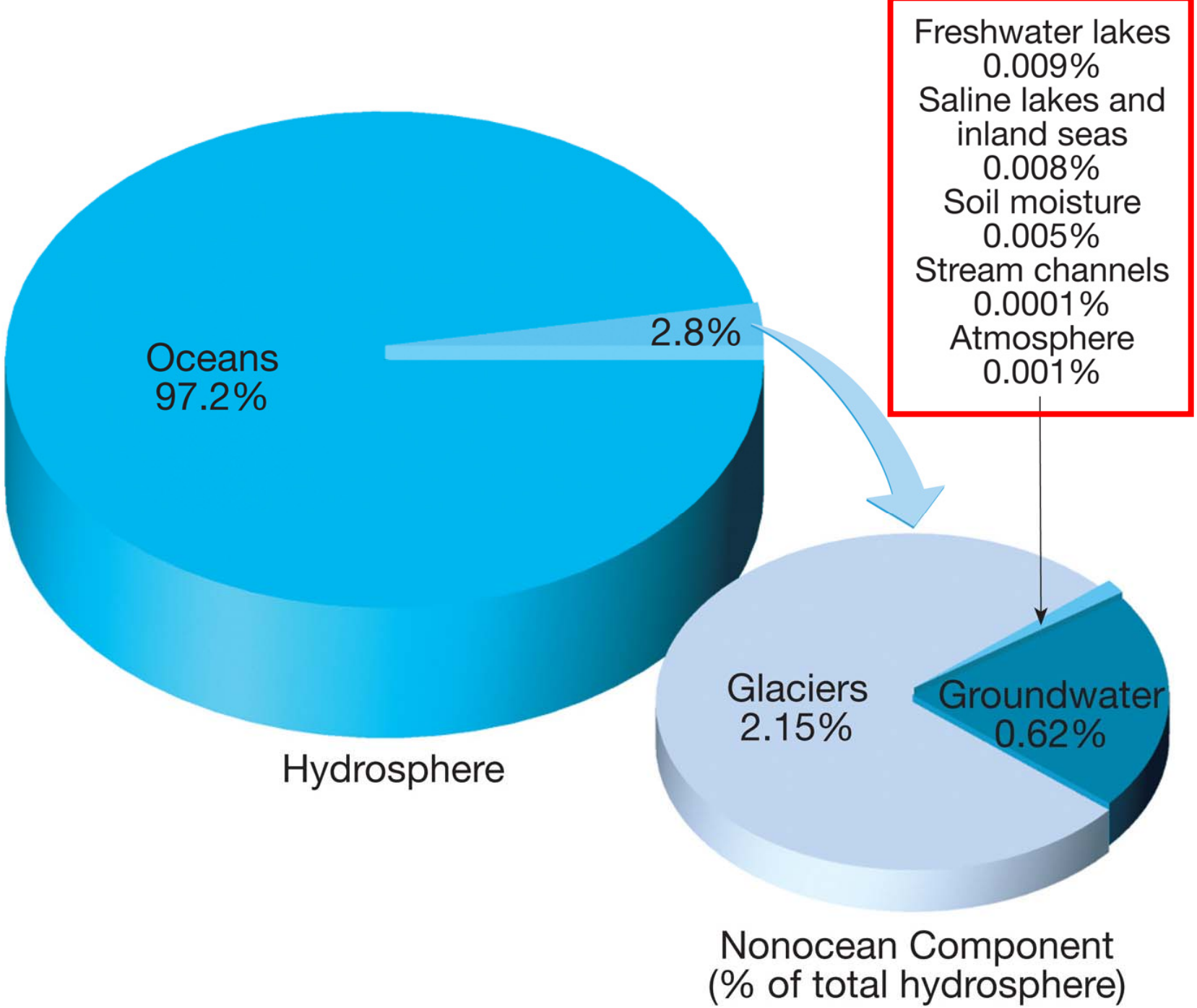
How much water flows across the surface?





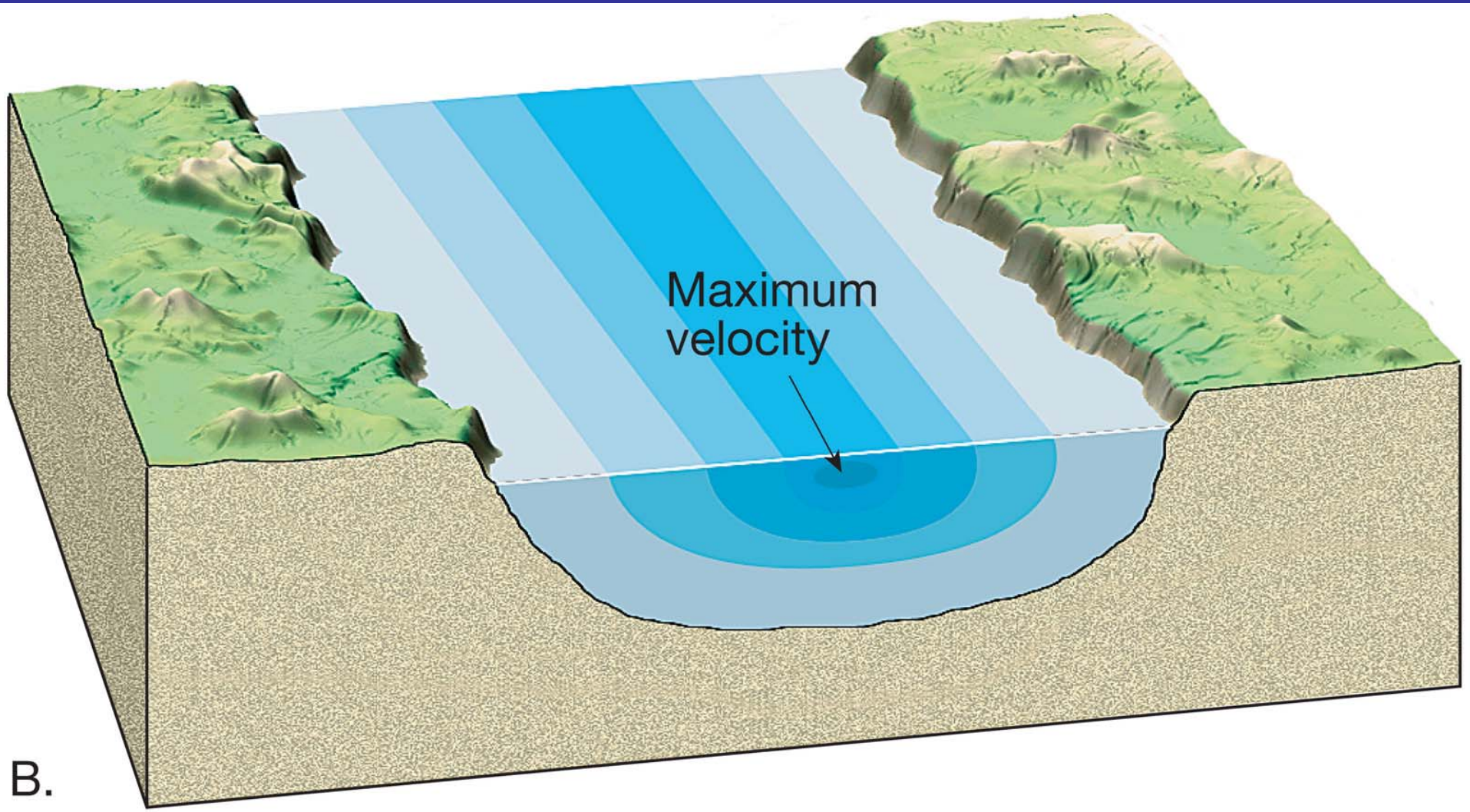
Oahu RUNOFF = 50-90% of rainfall, fog drip, irrigation



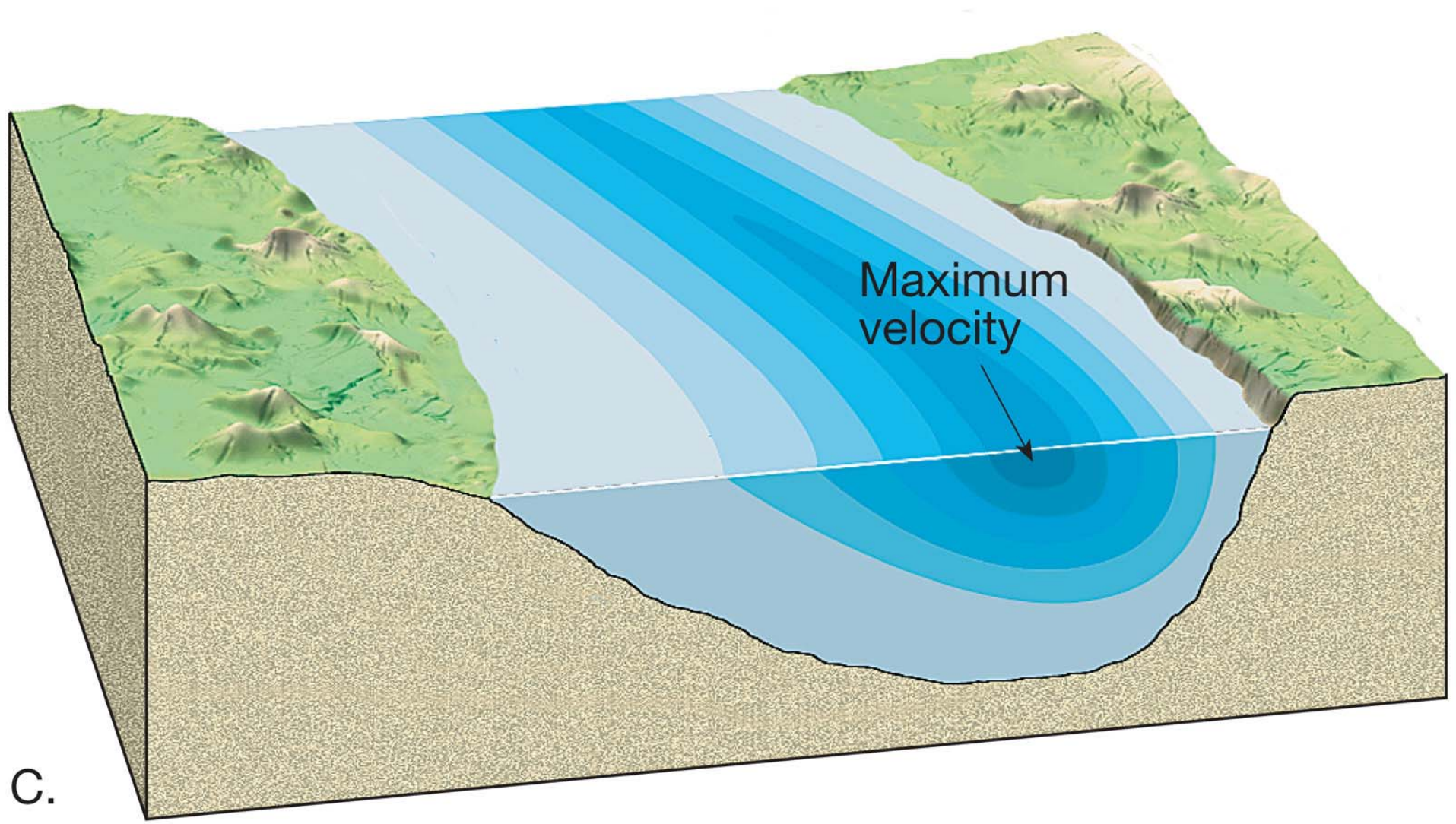

Freshwater lakes
0.009%
Saline lakes and
inland seas
0.008%
Soil moisture
0.005%
Stream channels
0.0001%
Atmosphere
0.001%
Oceans
97.2%
2.8%
Hydrosphere
Glaciers
2.15%
Groundwater
0.62%
Nonocean Component
(% of total hydrosphere)

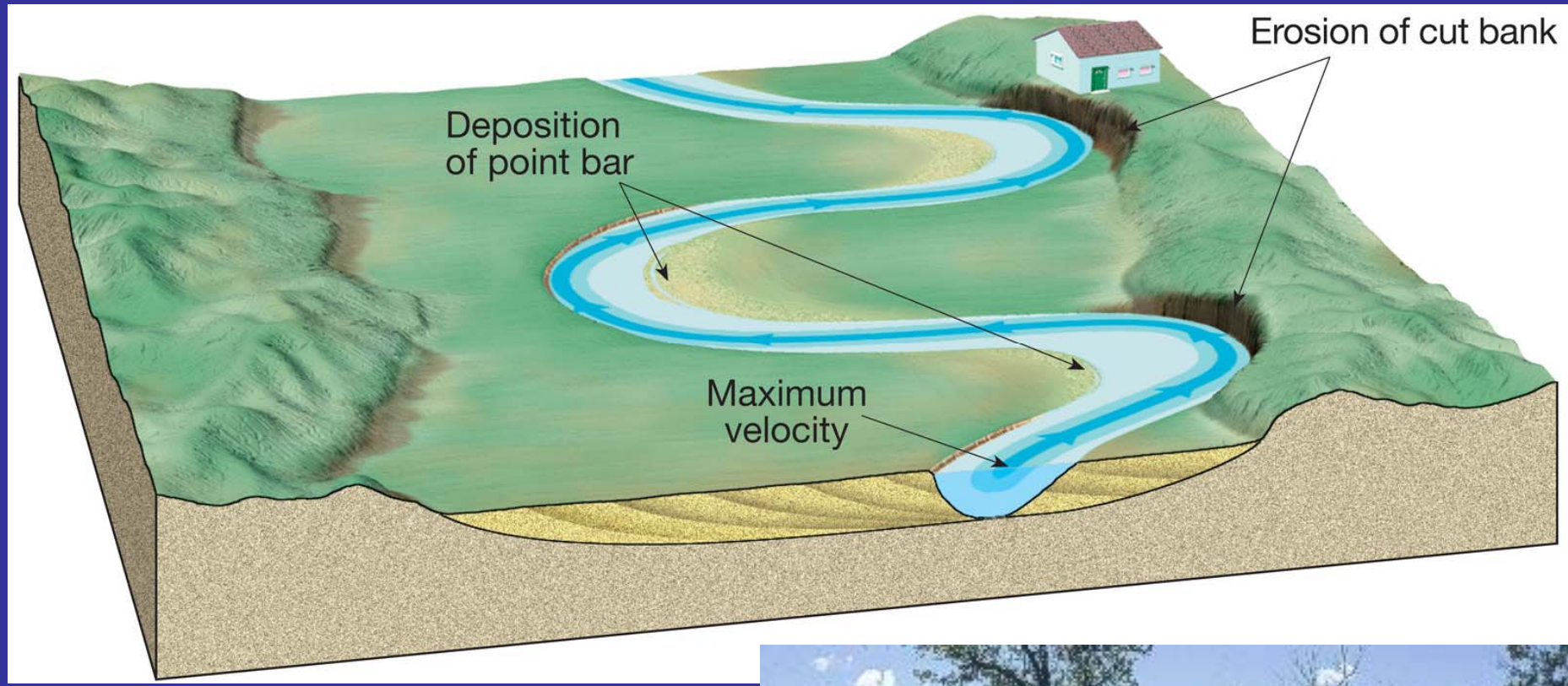

Where is the fastest flowing water?
A) Right
B) Left
C) Center
D) Top
E) Bottom

Maximum velocity where friction is lowest



Centrifugal force shifts max velocity to outer edges of bend

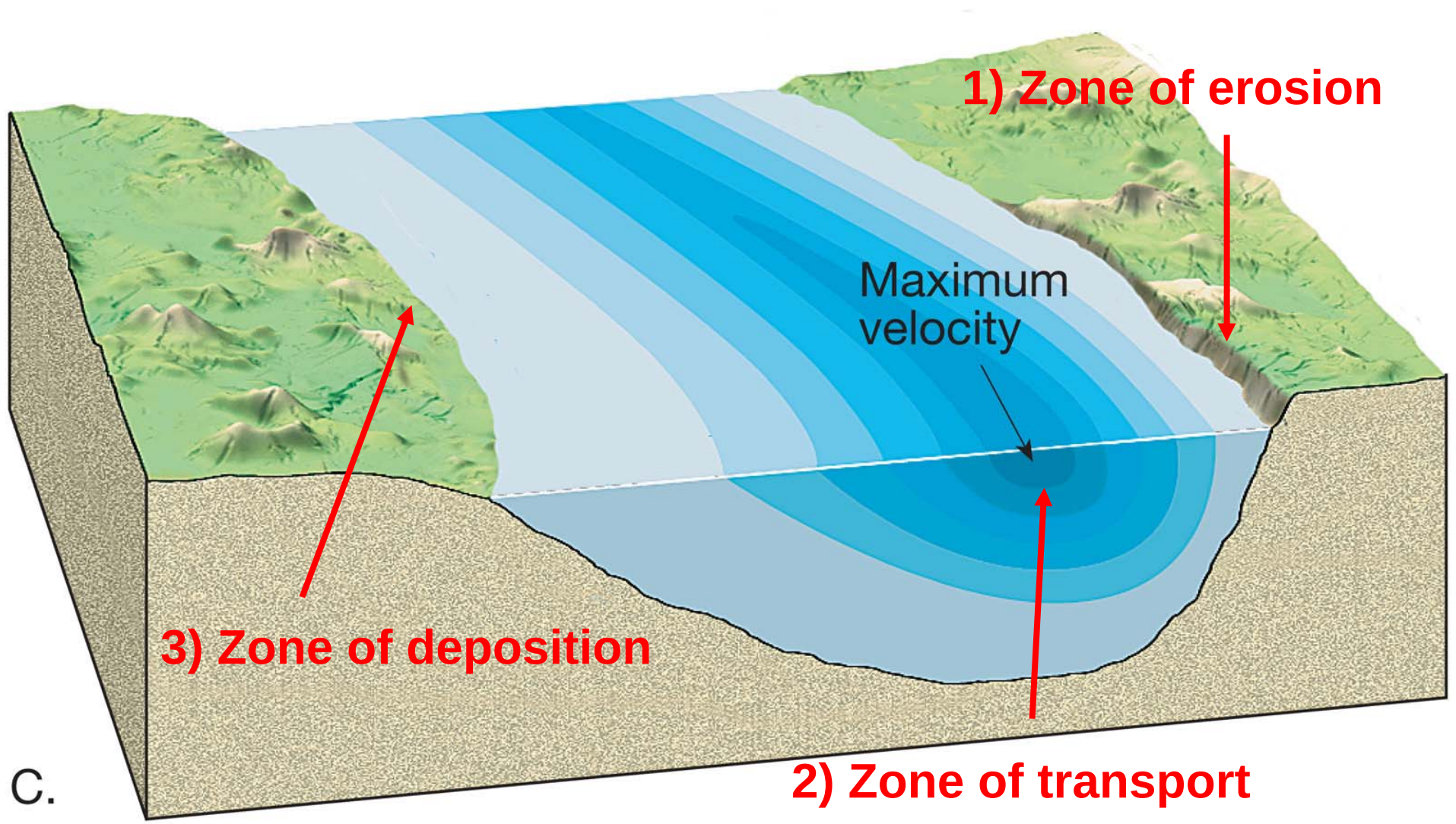



Erosion of cut bank
Deposition
of point bar
Maximum
velocity

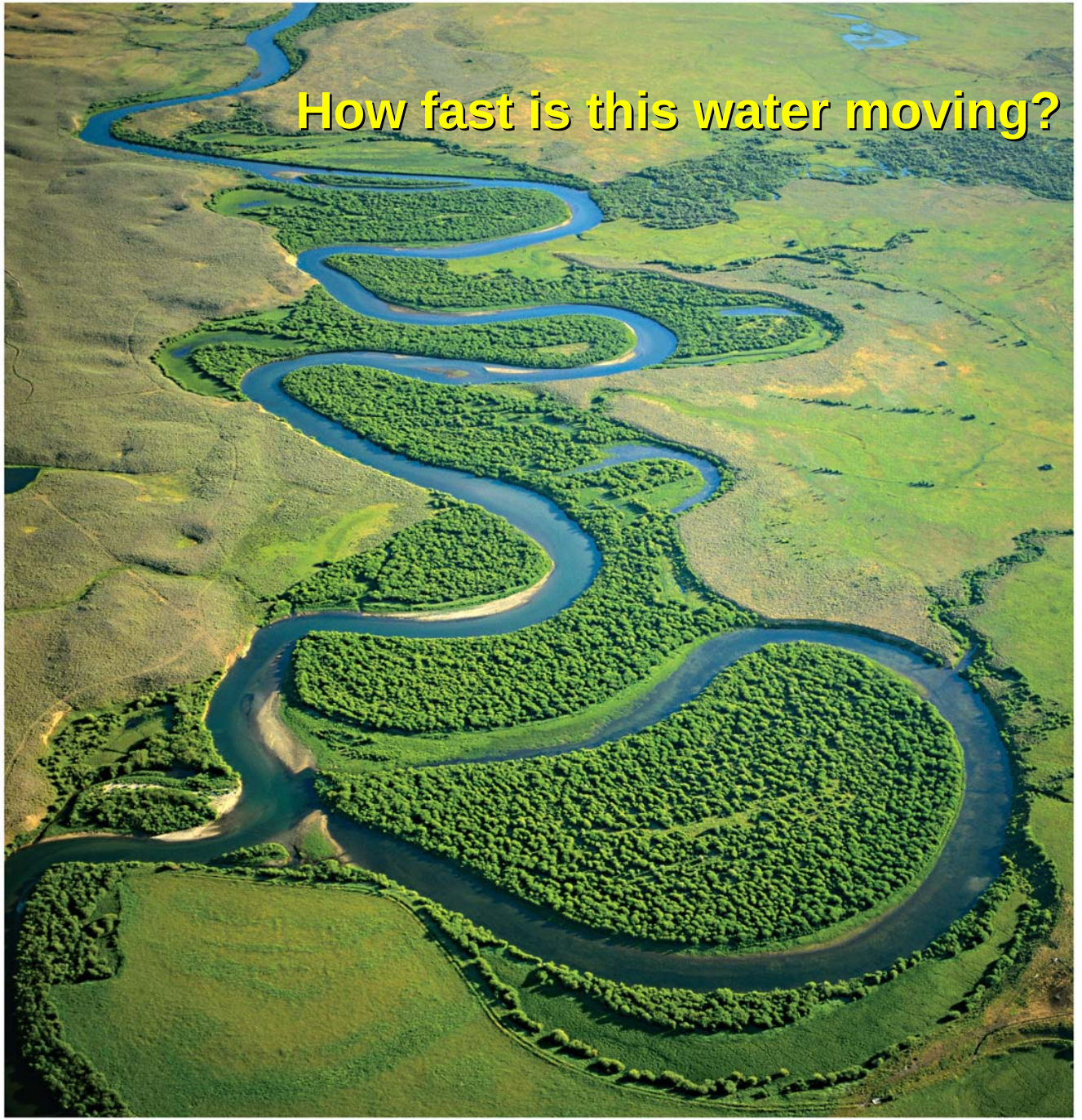


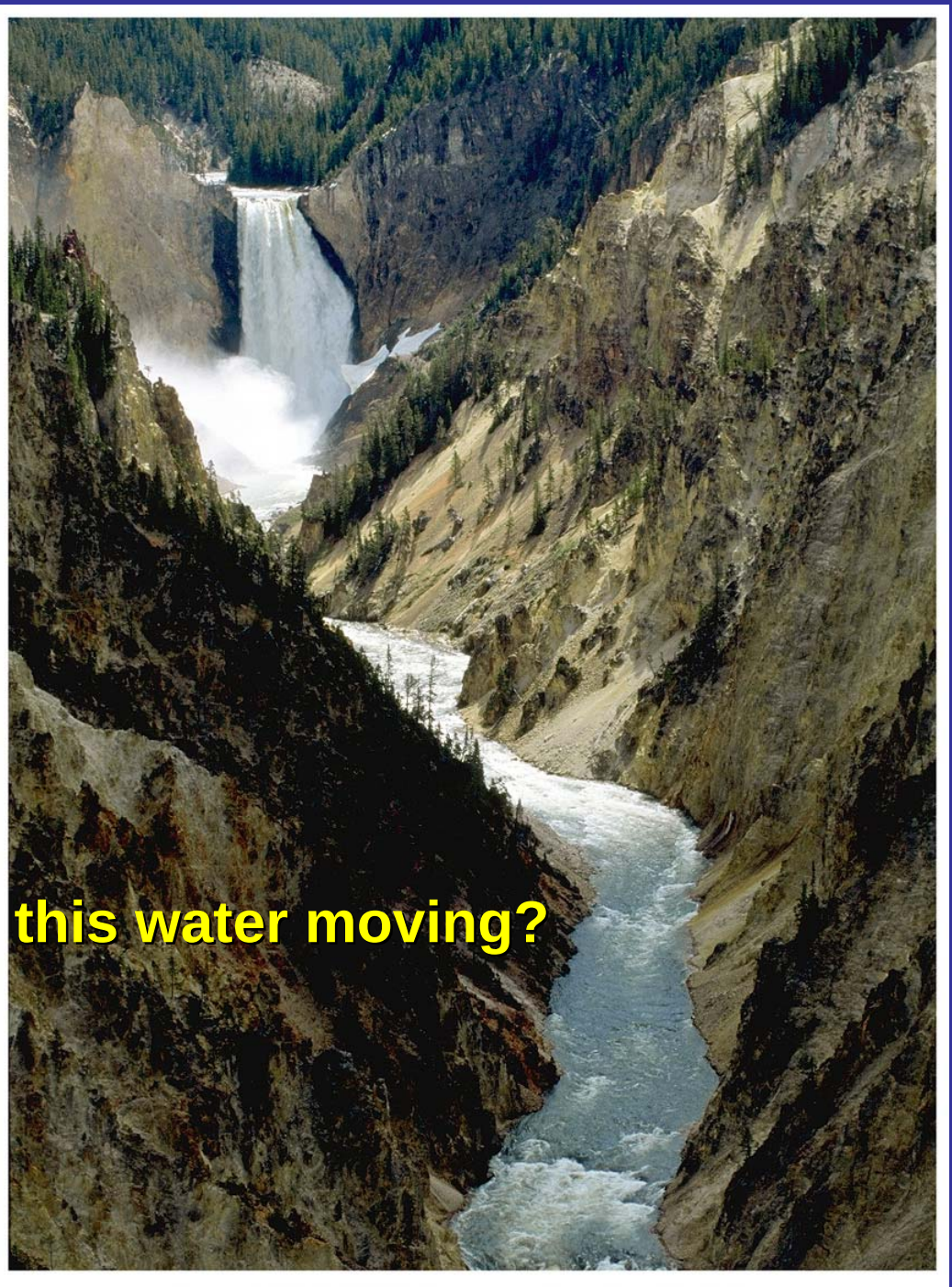


Running water most important agent sculpting Earth's surface



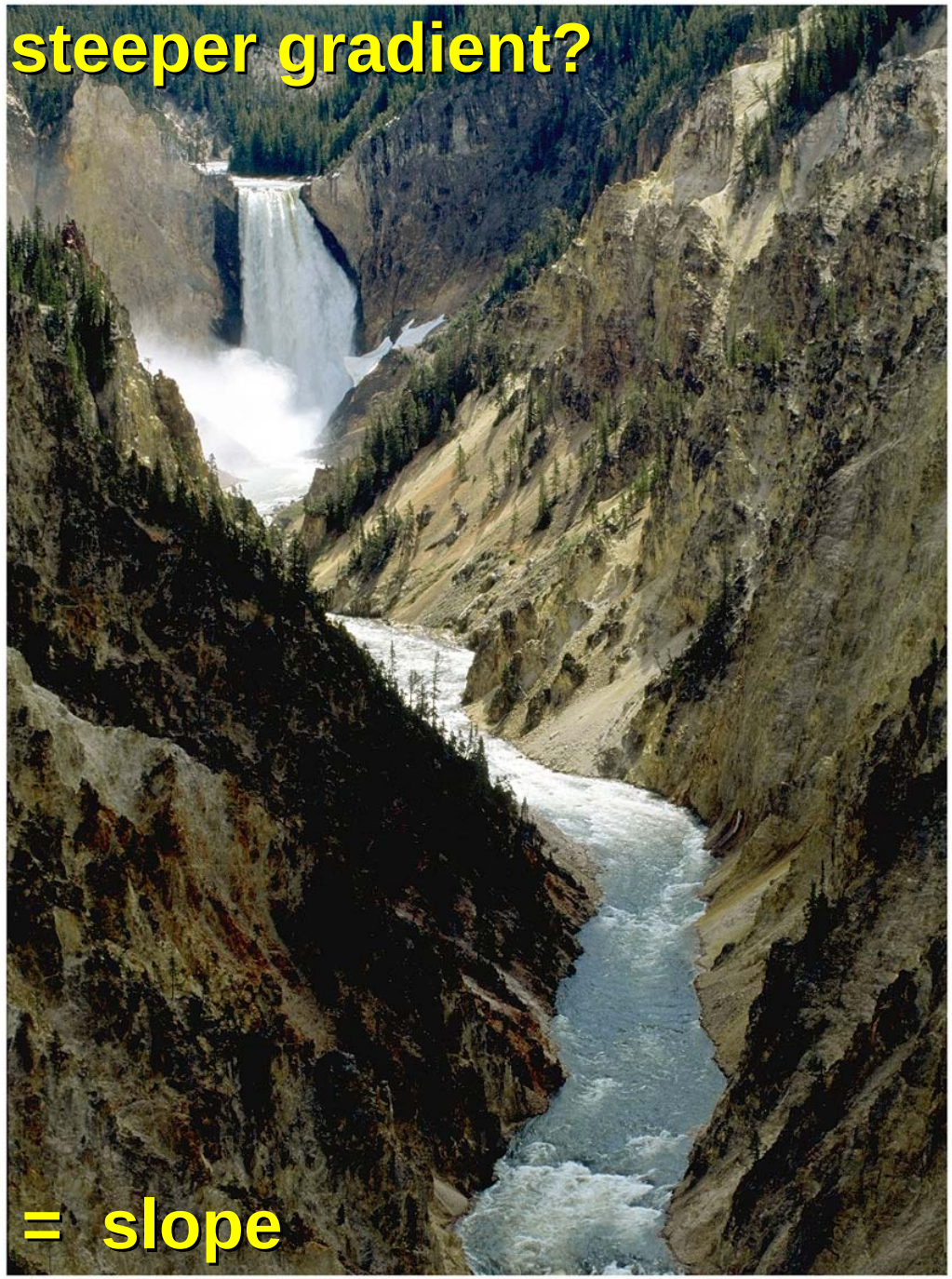
3 zones common to all river systems


How fast is this water moving?



How fast is this water moving?

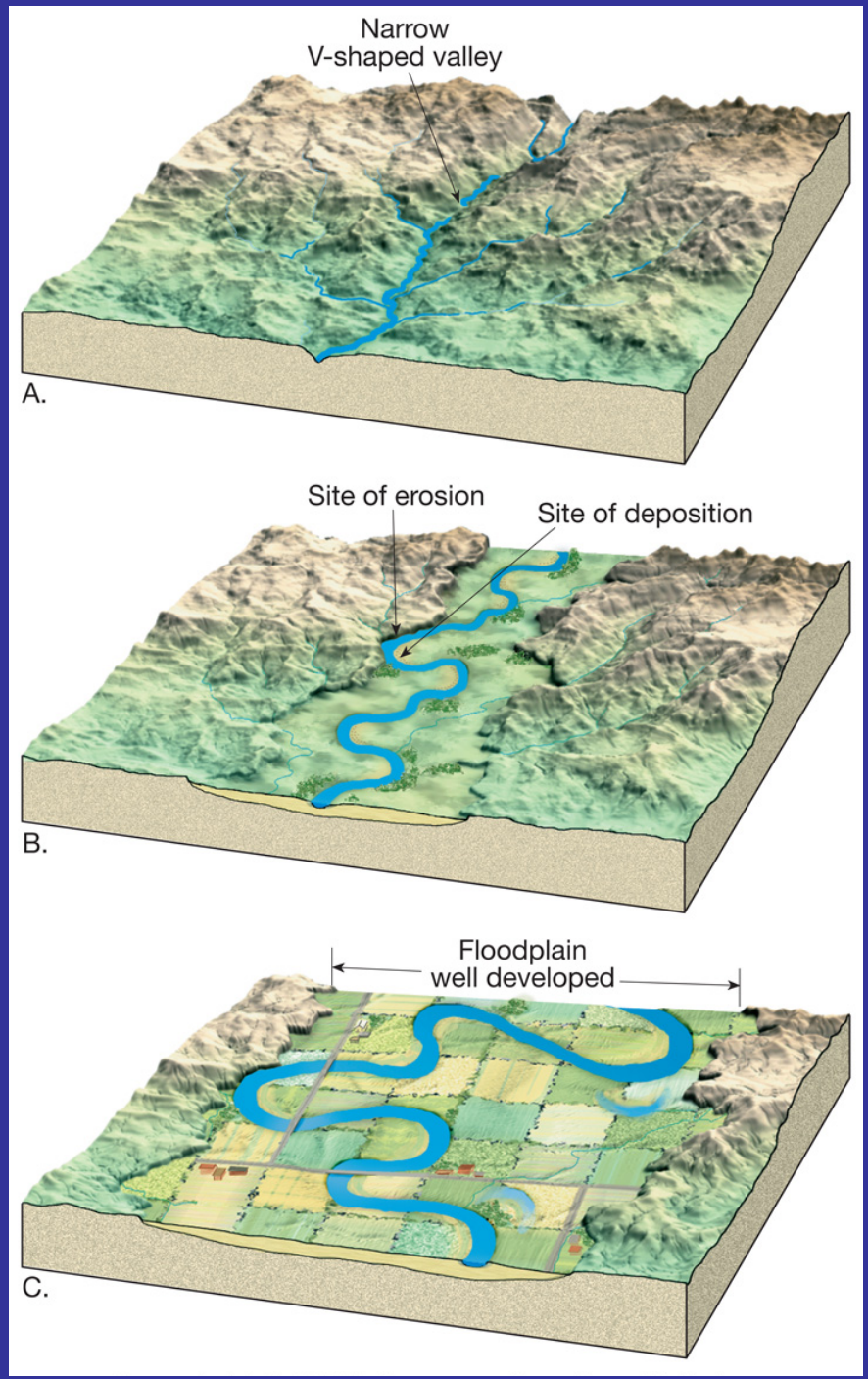




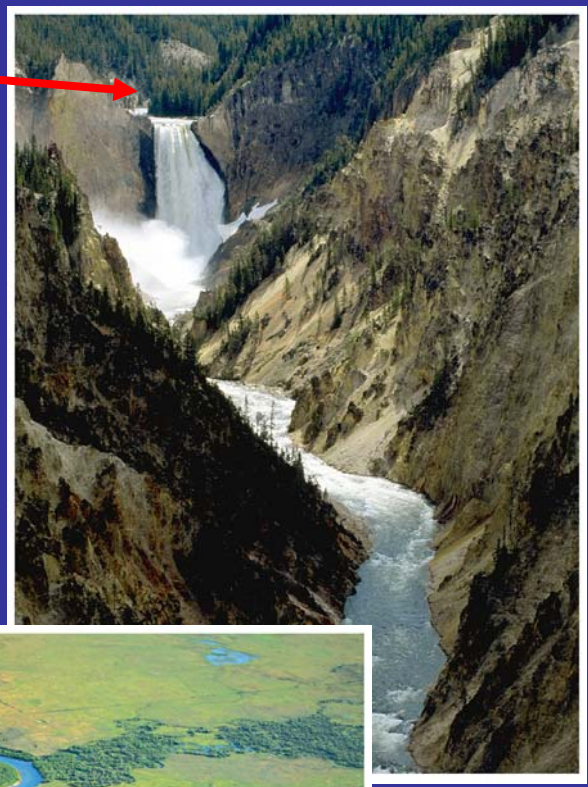
Which has the steeper gradient?

Gradient = slope

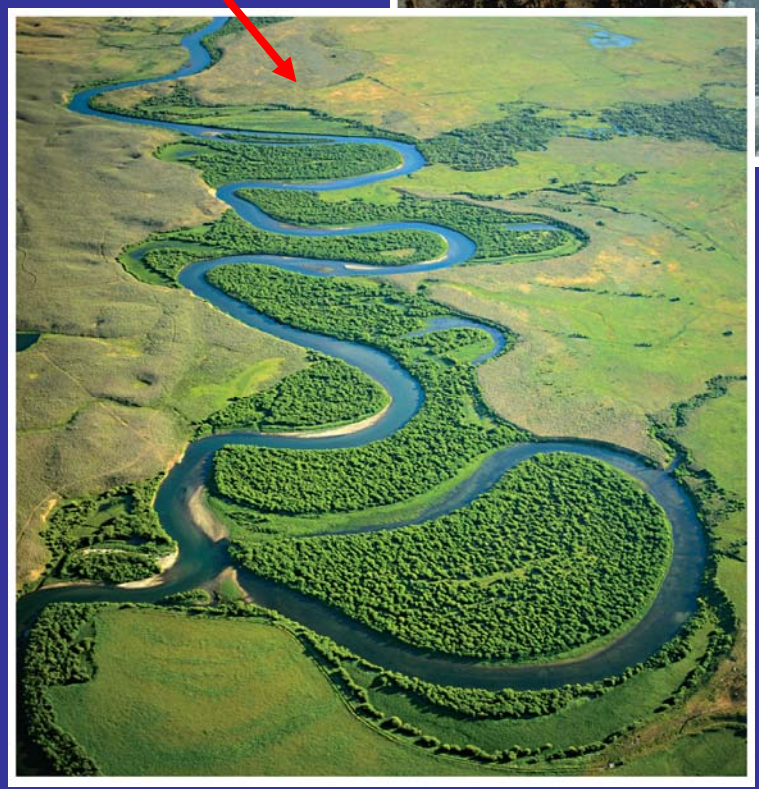
Floodplain Development

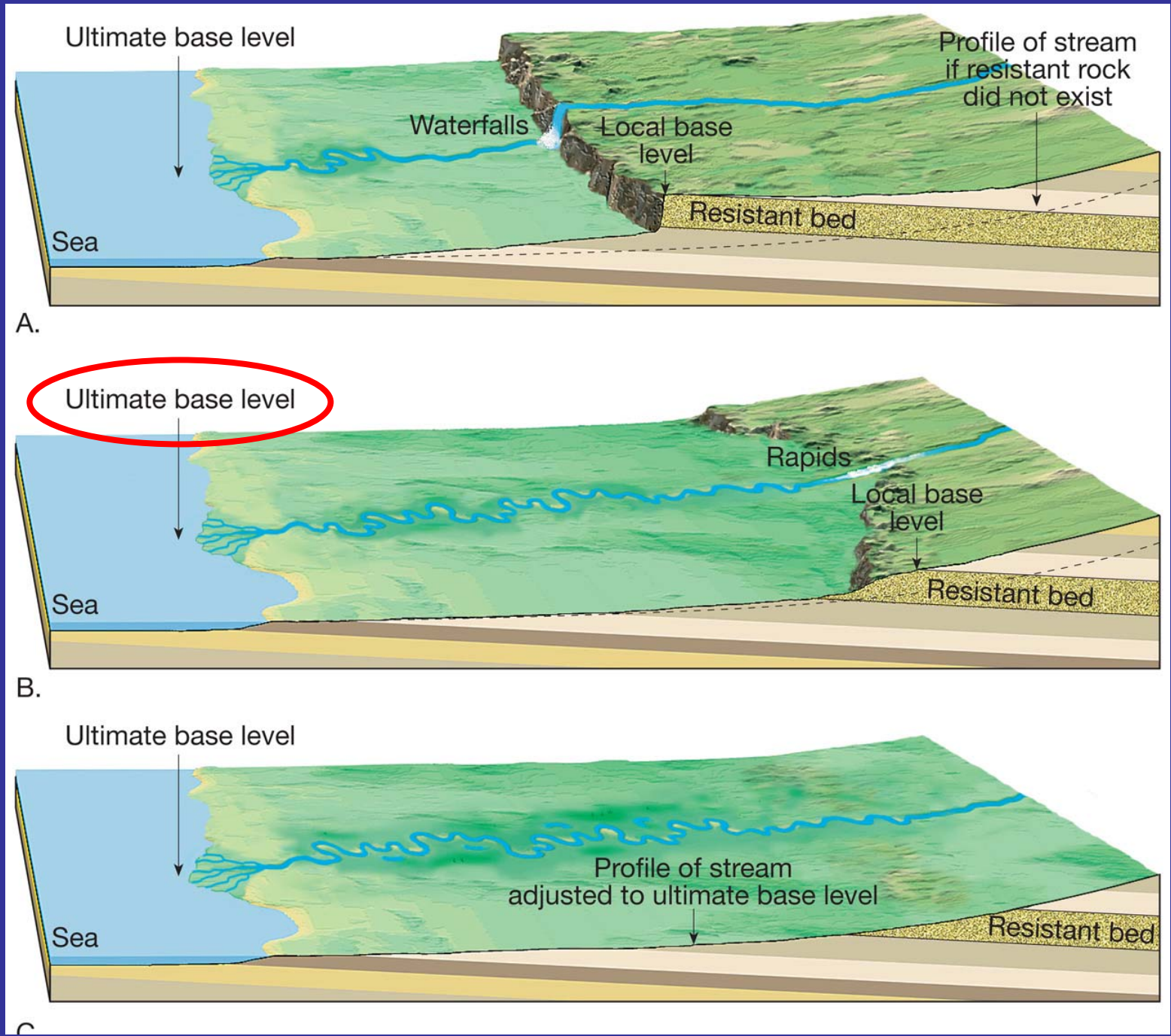


Immature



Mature




Ultimate base level
Profile of stream
if resistant rock
did not exist
Waterfalls
Local base
level
Resistant bed
Sea
A.
Ultimate base level
Rapids
Local base
level
Resistant bed
Sea
B.
Ultimate base level
Profile of stream
adjusted to ultimate base level
Resistant bed
Sea
C.

Young

Old


Where are the boundaries…
…of this river?


Floodplain
River





Floodplains:

1) Good for agriculture

2) Bad place to build your house!



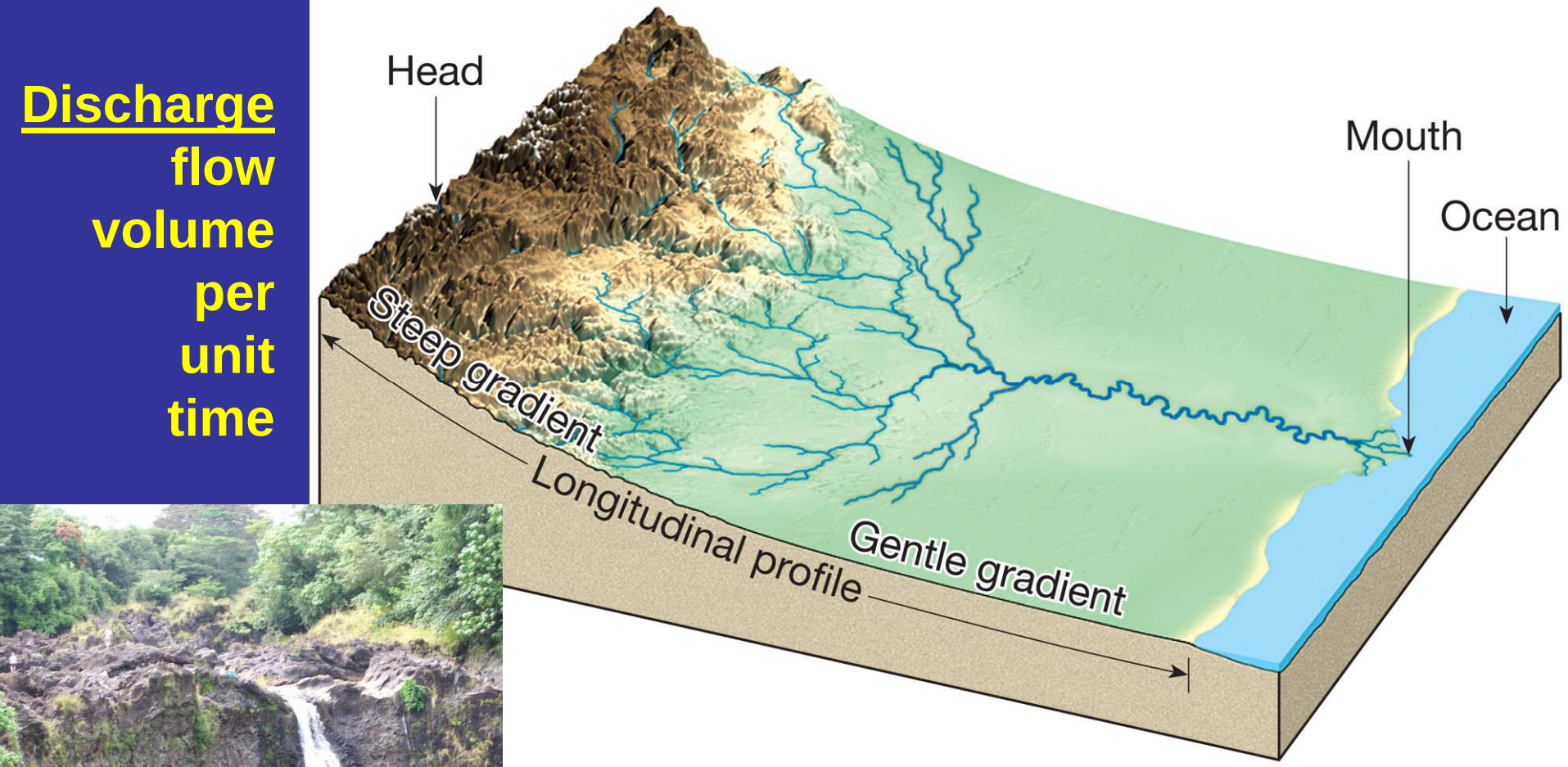
Immature river systems:

V-shaped valleys
Steep gradients
Straight channels

Mature river systems:

Broad floodplains
Low gradients
Sinuous channels

Discharge flow volume per unit time





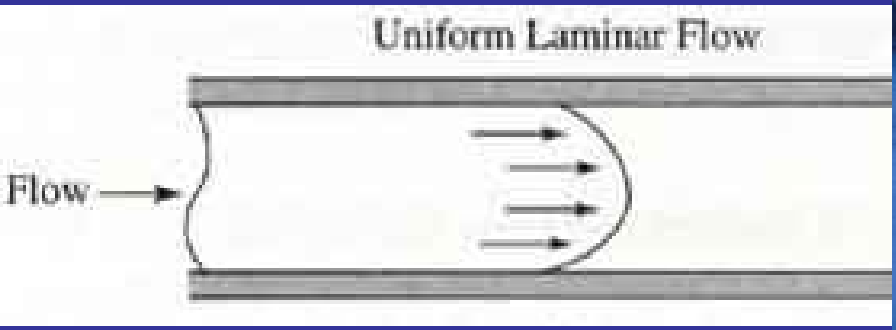
Discharge varies with -

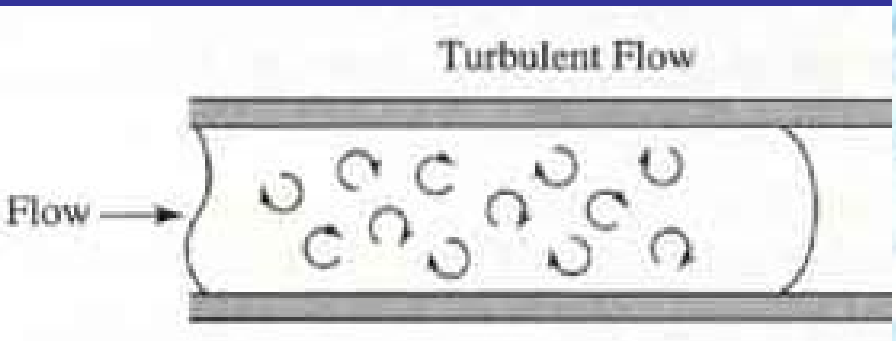
1) location relative to stream profile

2) seasonally


Antelope Canyon, Arizona

Which flow regime leads to erosion?





Which water is moving faster?





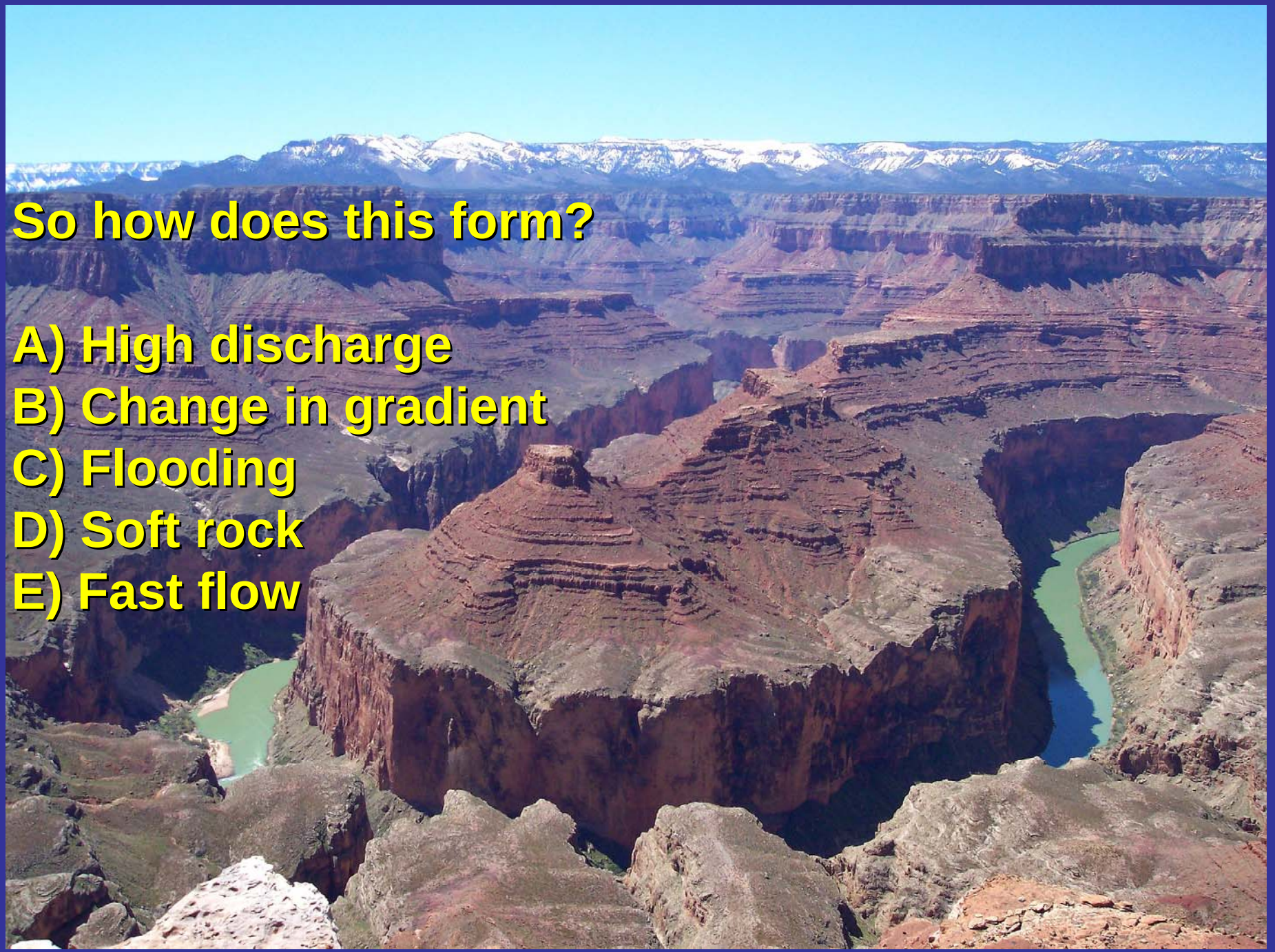
Factors contributing to erosion/downcutting:

1) Location of maximum velocity

2) Turbulent vs. laminar flow

3) Stream gradient (which is a function of height above base level)

4) Discharge volume


So how does this form?
A) High discharge
B) Change in gradient
C) Flooding
D) Soft rock
E) Fast flow

Why do we care about river dynamics?

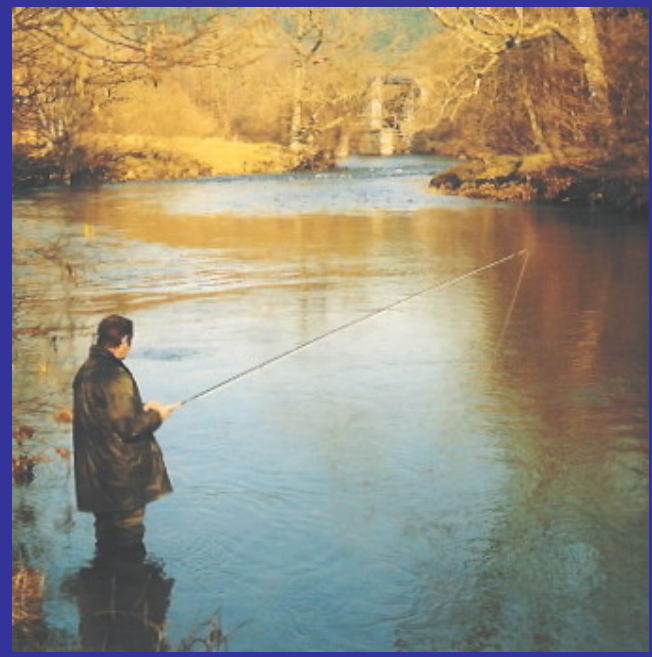


Why do we care about river dynamics?



Himalayan-sourced rivers supply drinking water to one BILLION people





RECREATION



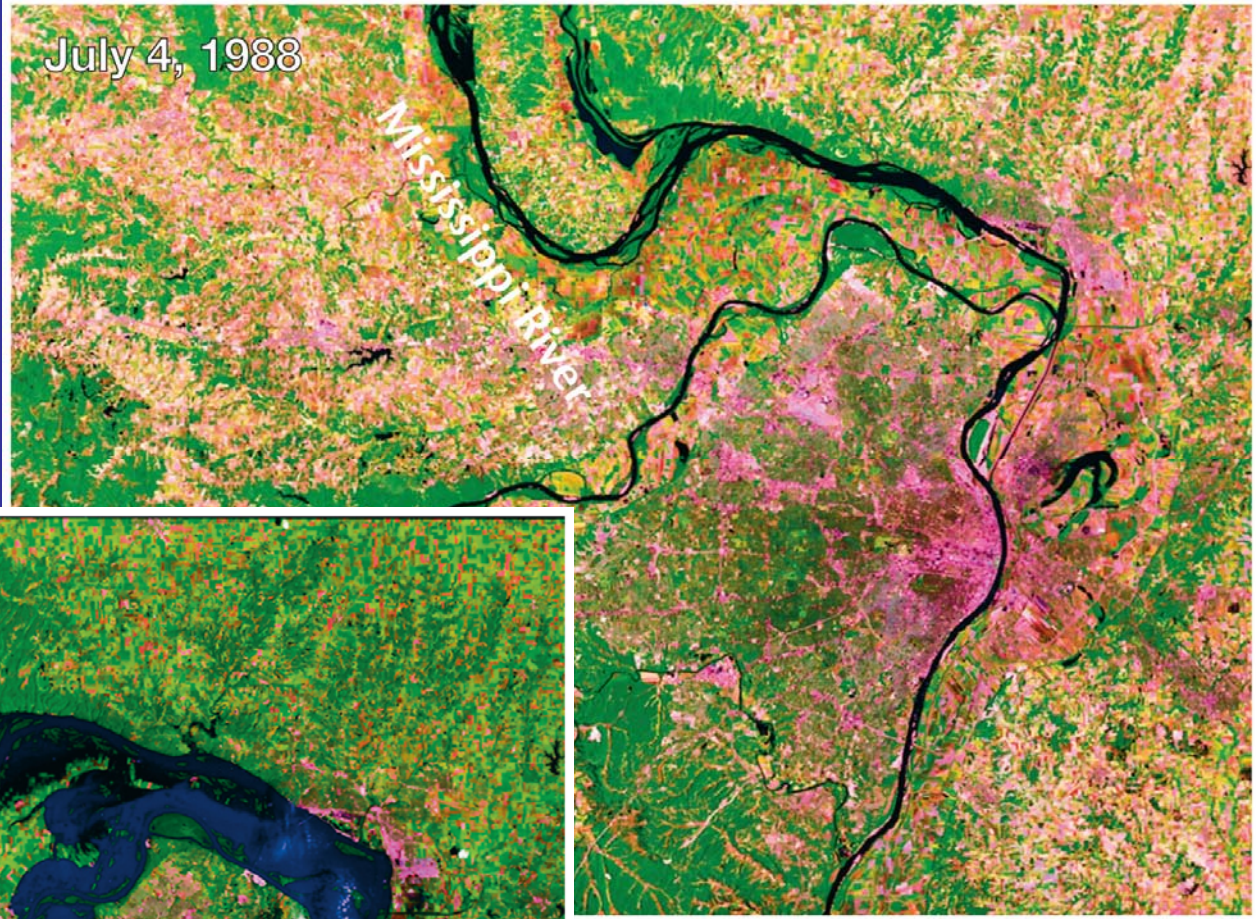


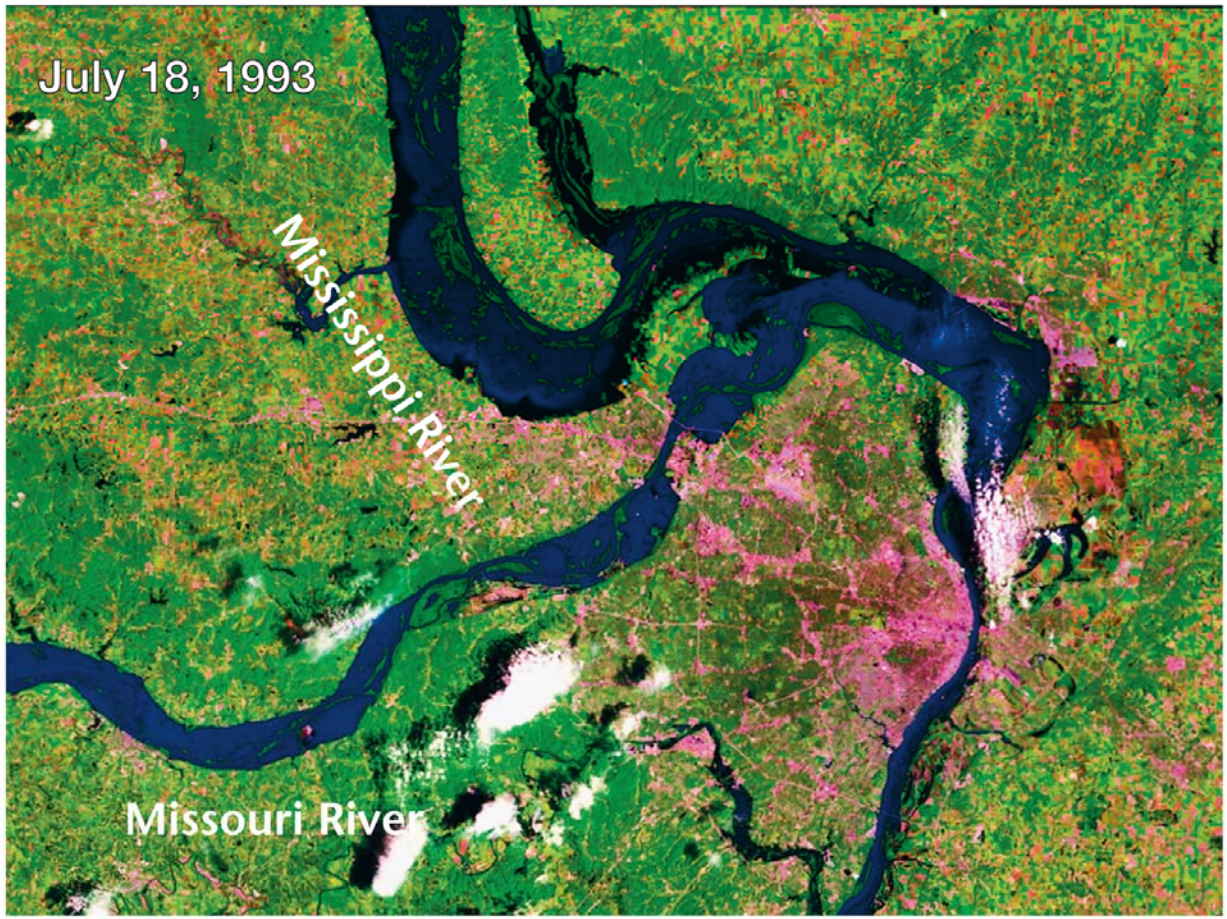
AGRICULTURE, INDUSTRY

Flood Control! - floods most destructive geologic hazard



Missouri / Mississippi floods of 1993





14 million acres Inundated

50,000 people displaced





Is this river…

A) Mature
B) Immature







Amazon River - <u>10x</u> flow volume of all world's other rivers *<u>combined</u>*



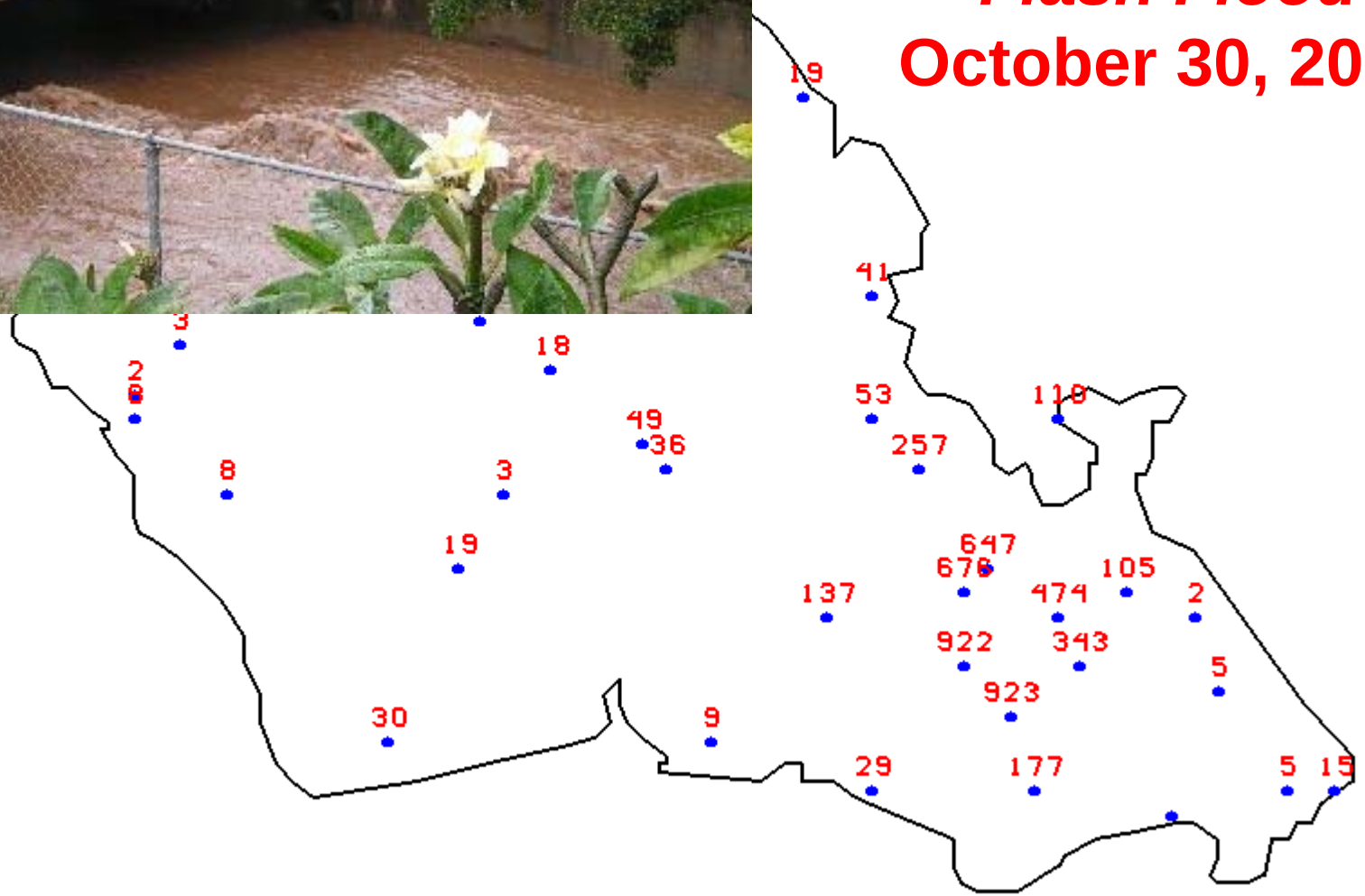
65 Mya flowed West





Manoa Stream (?)
Flash Flood
October 30, 2004

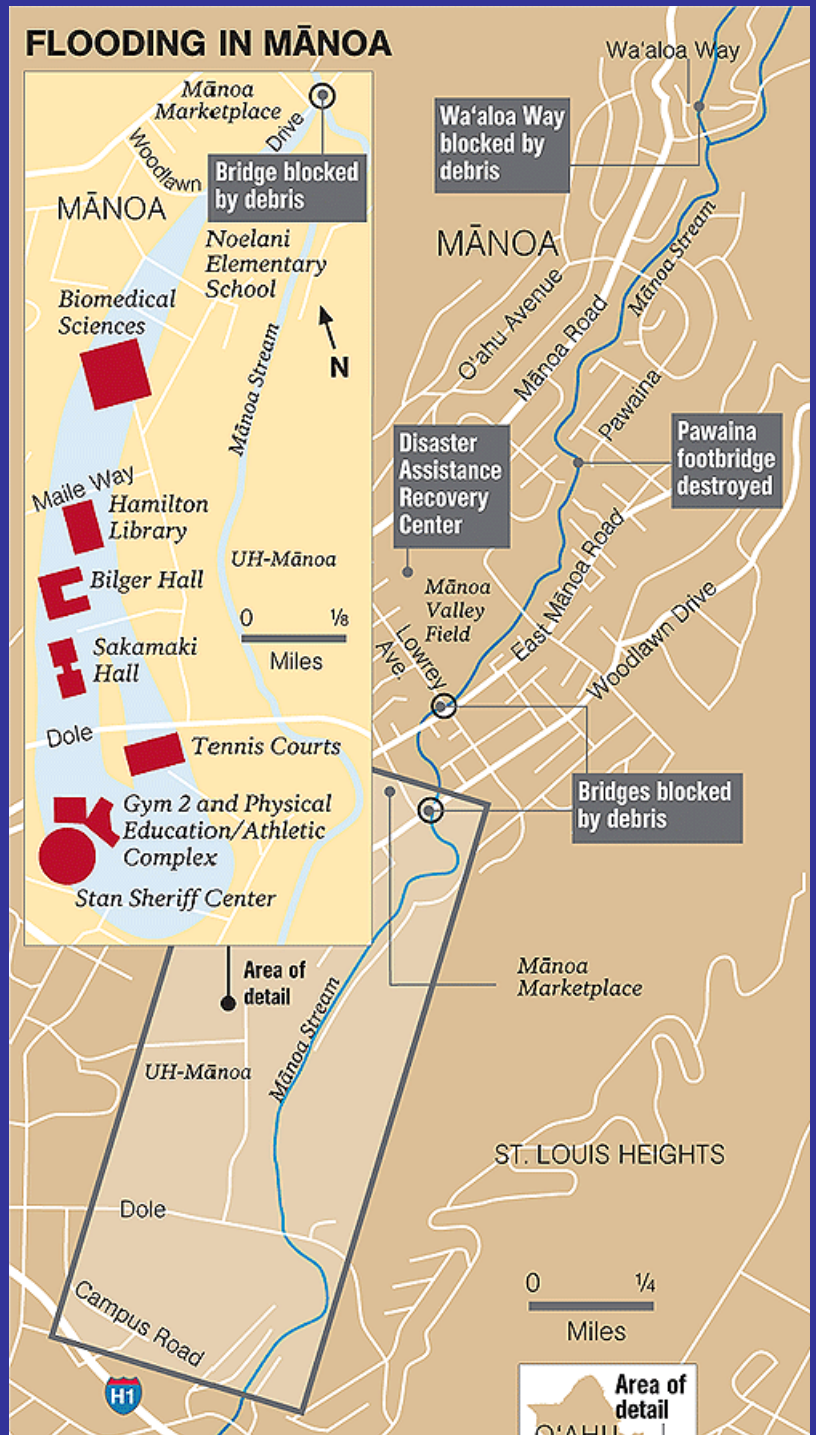




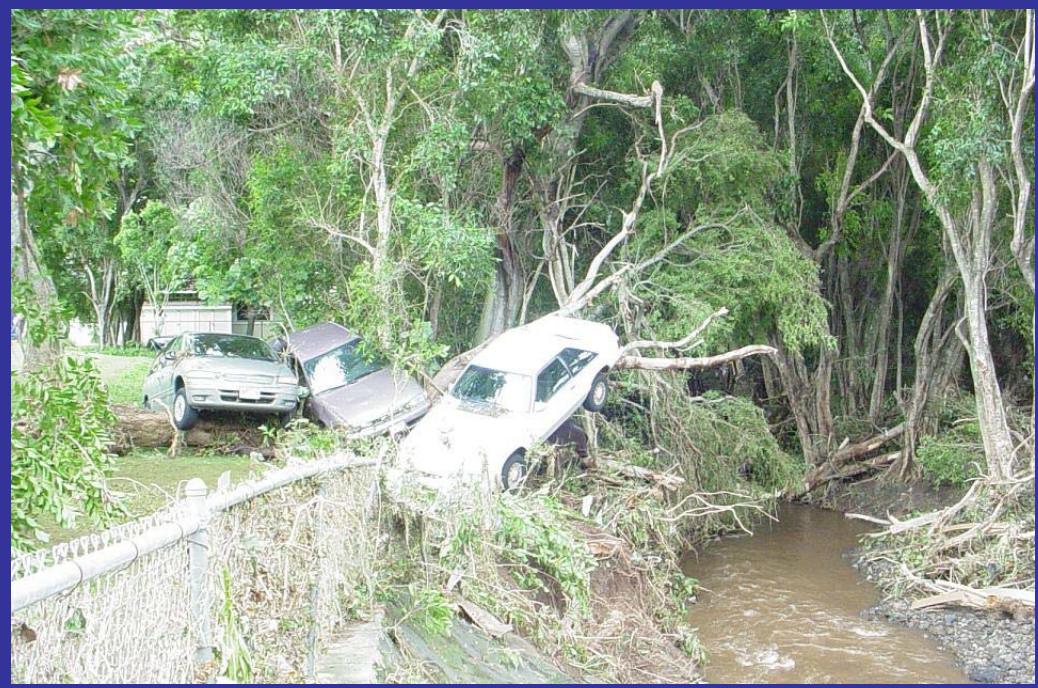


What about Manoa's topography makes flooding likely?

FLOODING IN MĀNOA









Flood hits first in Woodlawn area of Manoa



UH Biomedical Building







UH Hamilton Library







Sakamaki Hall, Krauss Annex

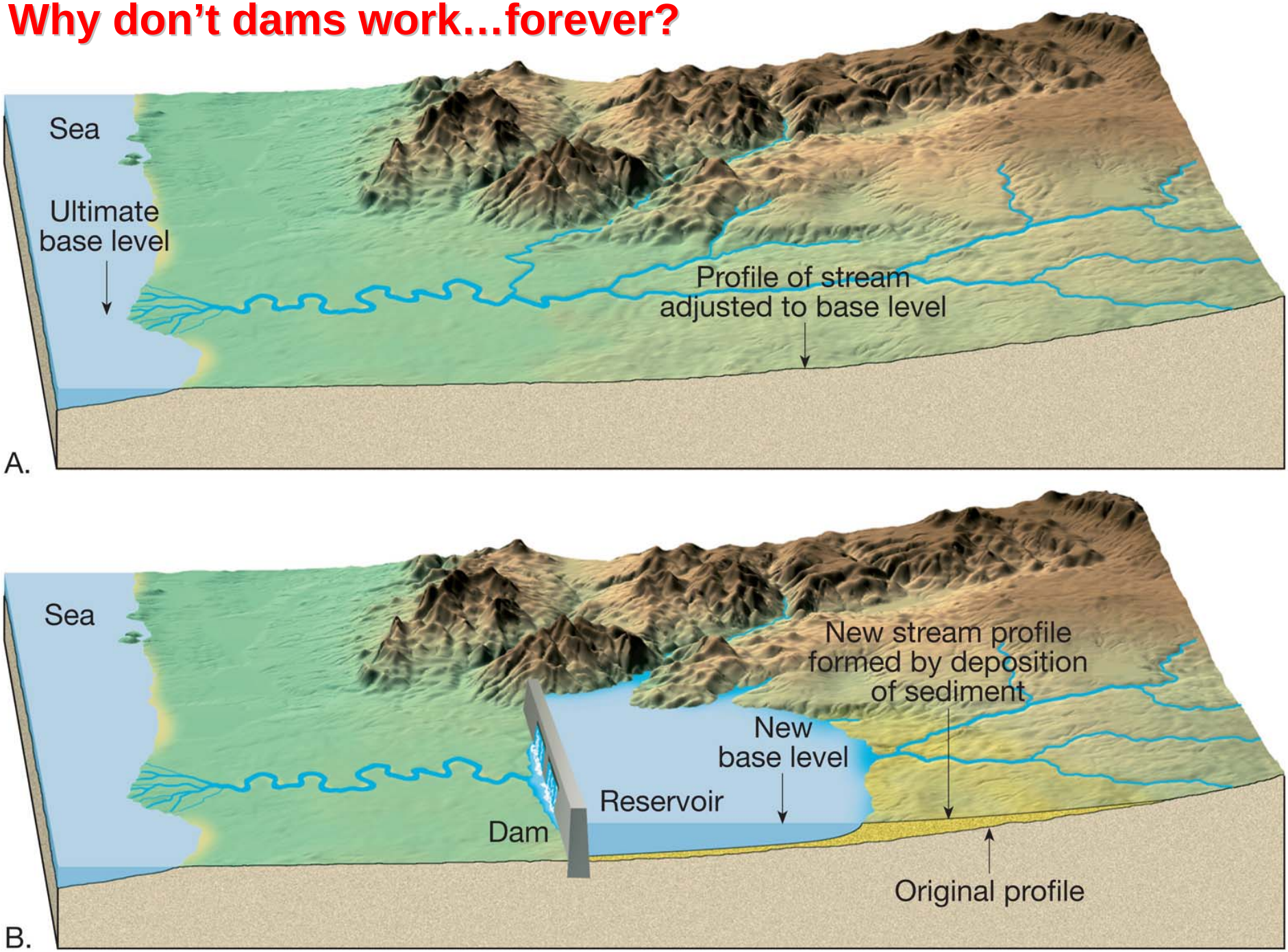
Flash flooding:

1. Intense rainfall
2. Steep topography
3. Paved surfaces



4. Rapid rise in flow levels
5. Dangerous flow velocities

Why don’t dams work…forever?



300 million gallons





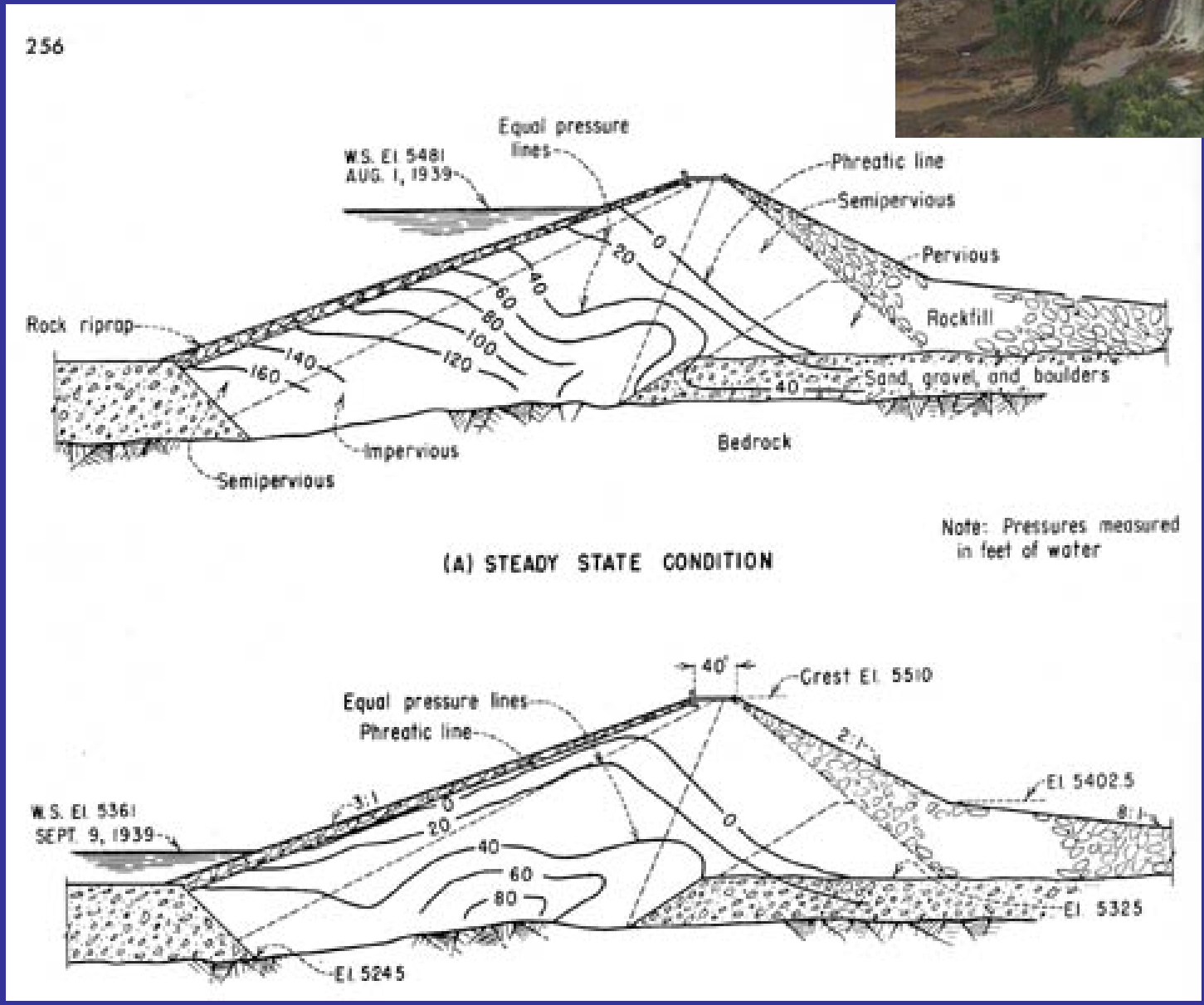


The Honolulu Advertiser

Ka Loko Reservoir Dam Break, 2005

Rising waters increased pressure on earthen dam

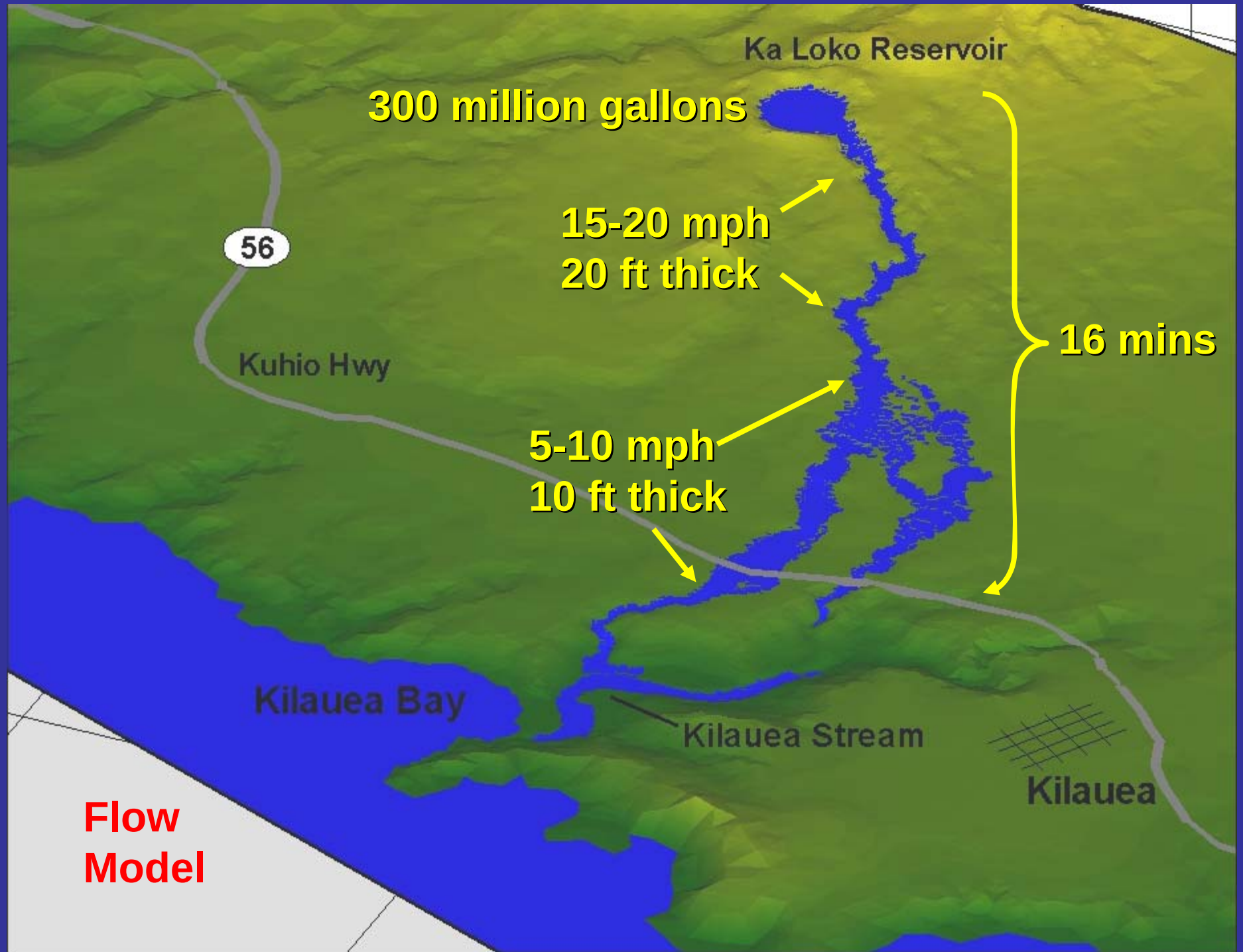




High water

increasing stress

Normal water


Ka Loko Reservoir
300 million gallons
15-20 mph
20 ft thick
56
Kuhio Hwy
16 mins
5-10 mph
10 ft thick
Kilauea Bay
Kilauea Stream
Kilauea
Flow
Model



Floodwaters destroyed property

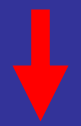
Killed 7 plus unborn infant





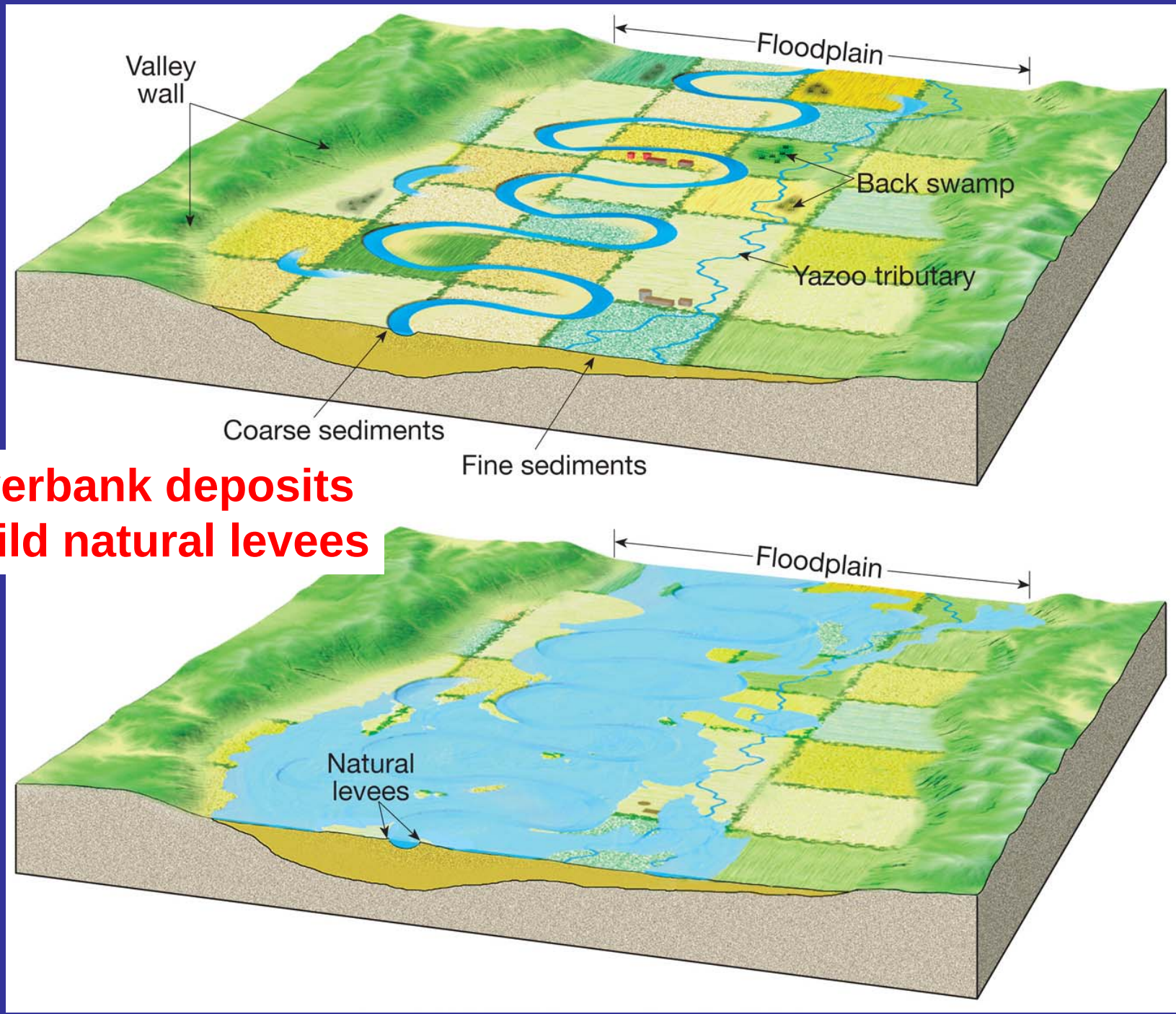
Dam break flooding:

1. High rainfall
2. Increased water pressure
3. Dam structure inadequate



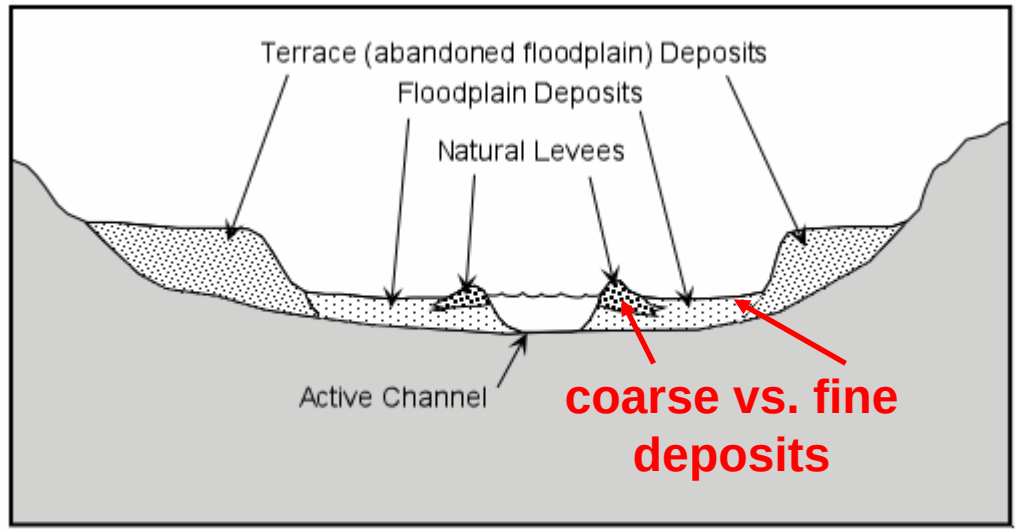
4. Dam overtopped/undermined
5. Rapid erosion/destruction of dam
6. Dangerous flow volumes/velocities


How did these alluvial fans form?



Overbank deposits build natural levees

Natural levees



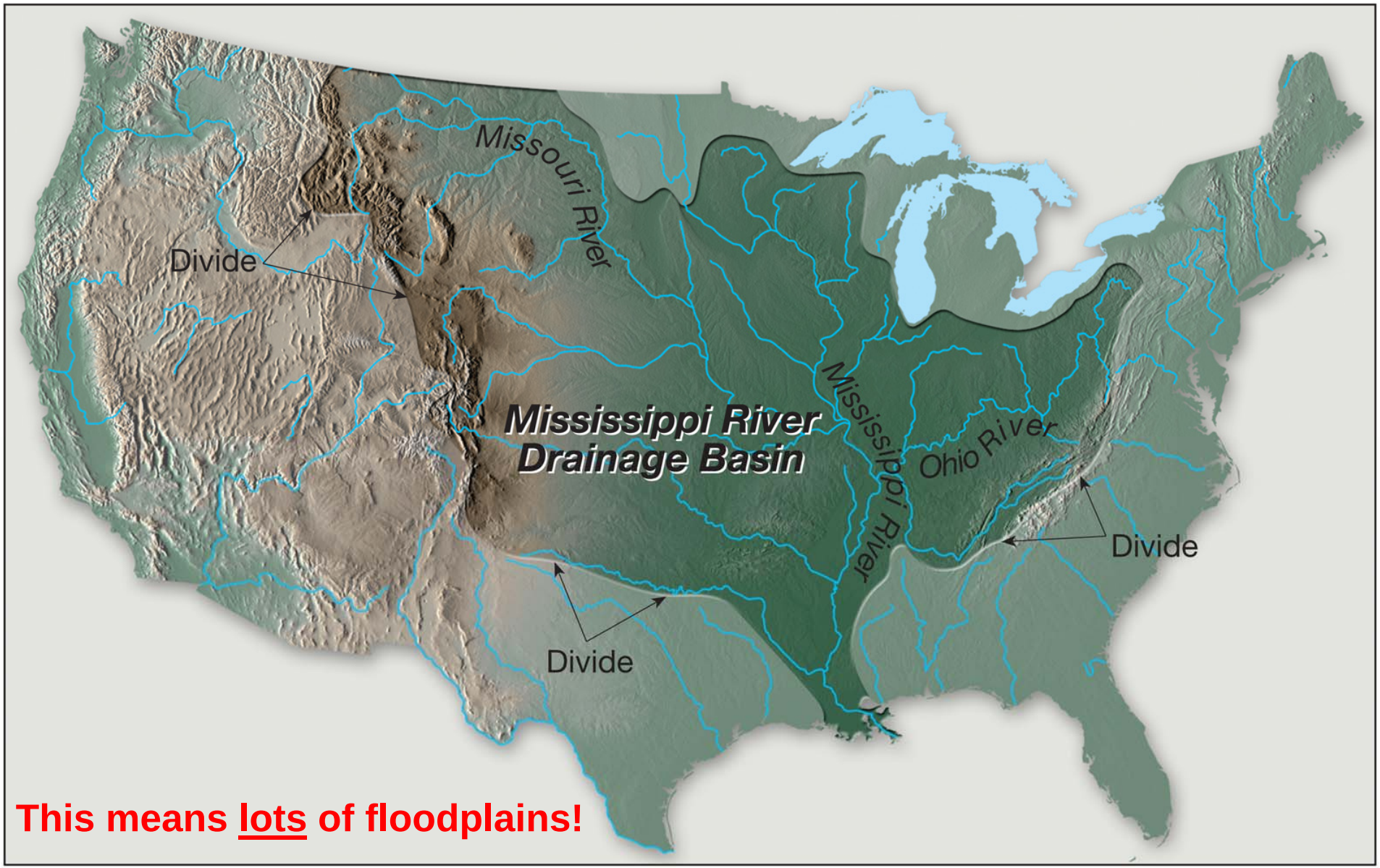
(natural/man-made) Levee breaks cause floods



What's the biggest river in the U.S.?

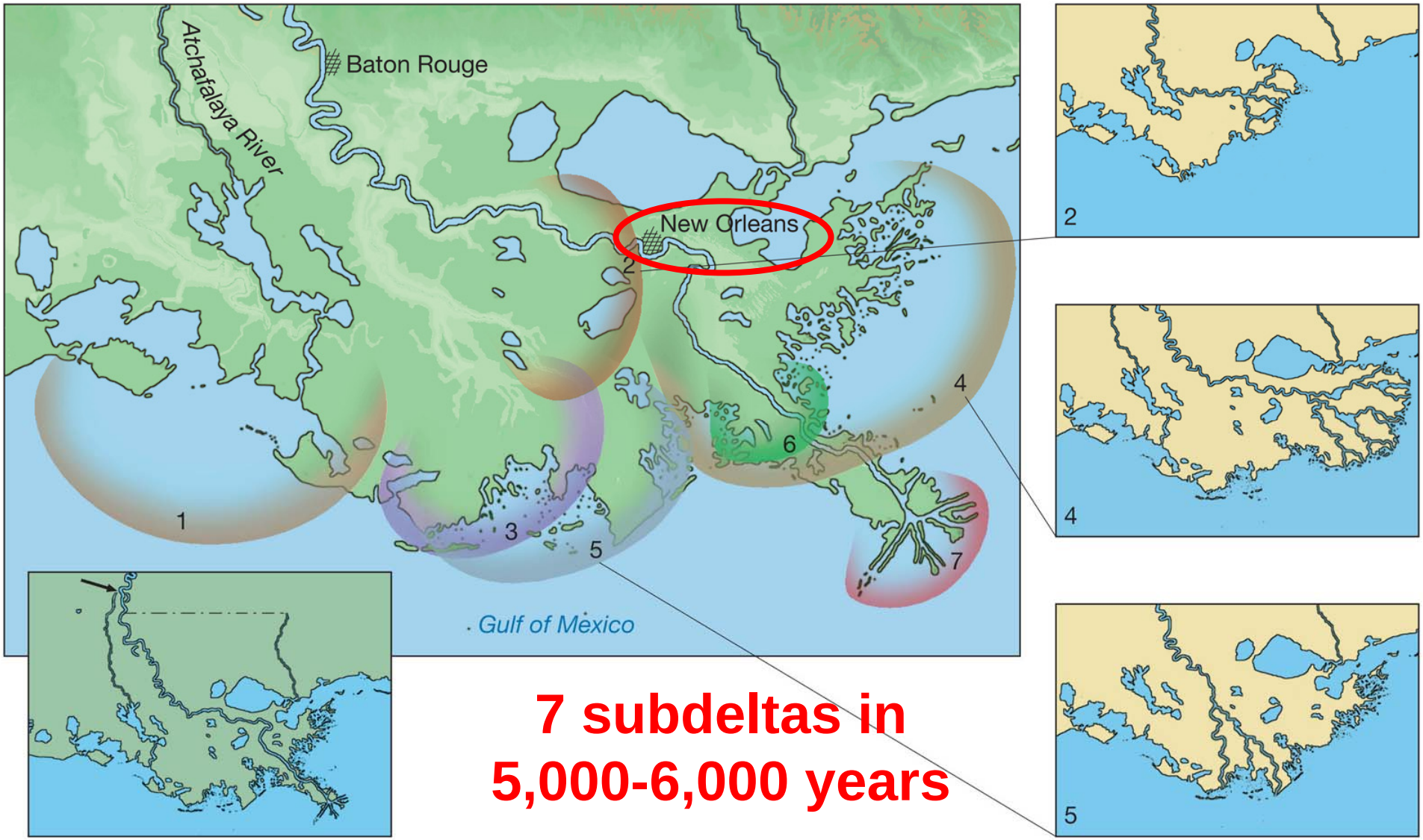


Mississippi drainage covers 3 million square kilometers



This means <u>lots</u> of floodplains!


Where is the original coastline?



7 subdeltas in 5,000-6,000 years

What is the shortest (i.e. steepest) route to the sea?



Old River control structure built 1950s

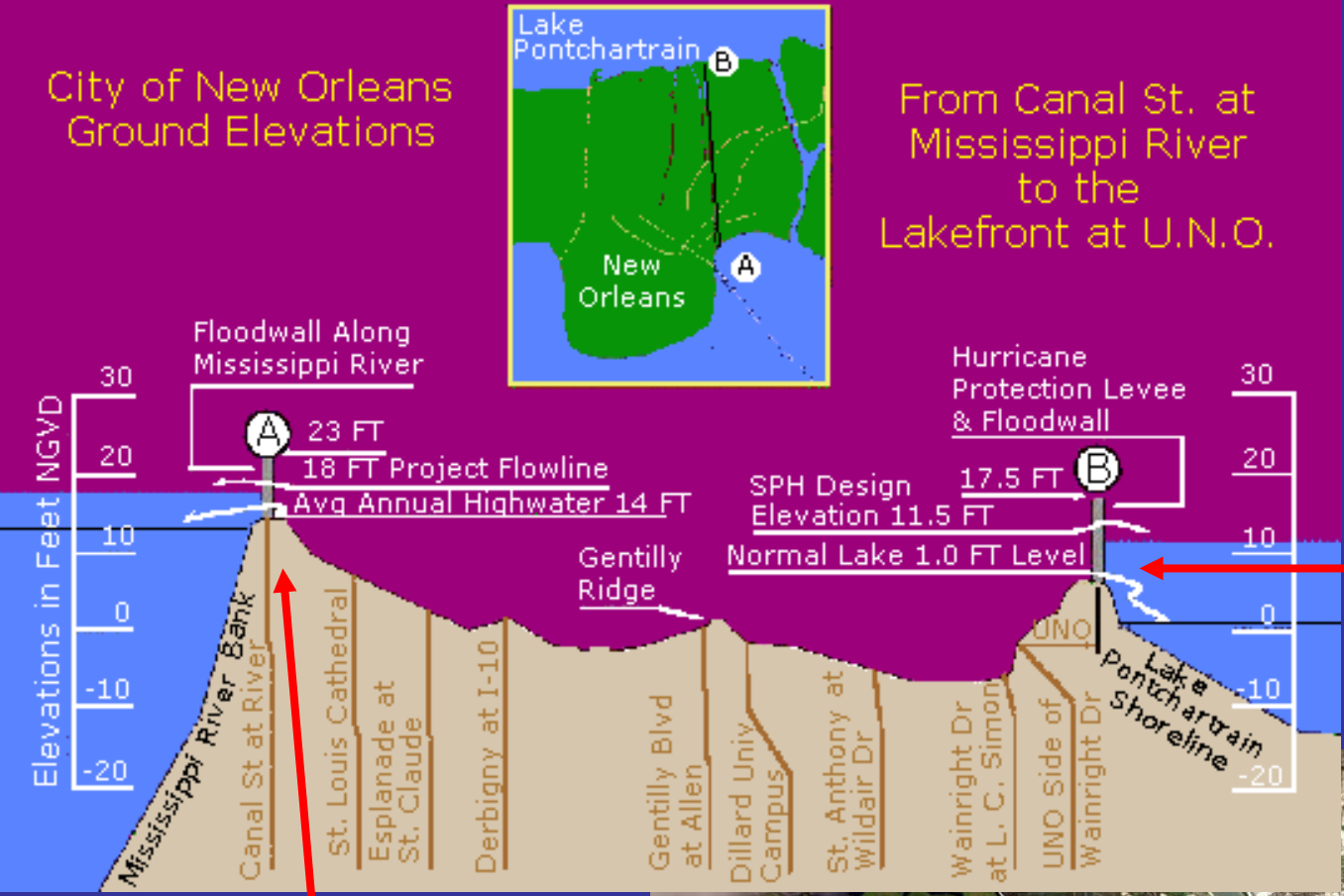
Prevents Mississippi shifting to Atchafalaya

Total cost > $1 billion





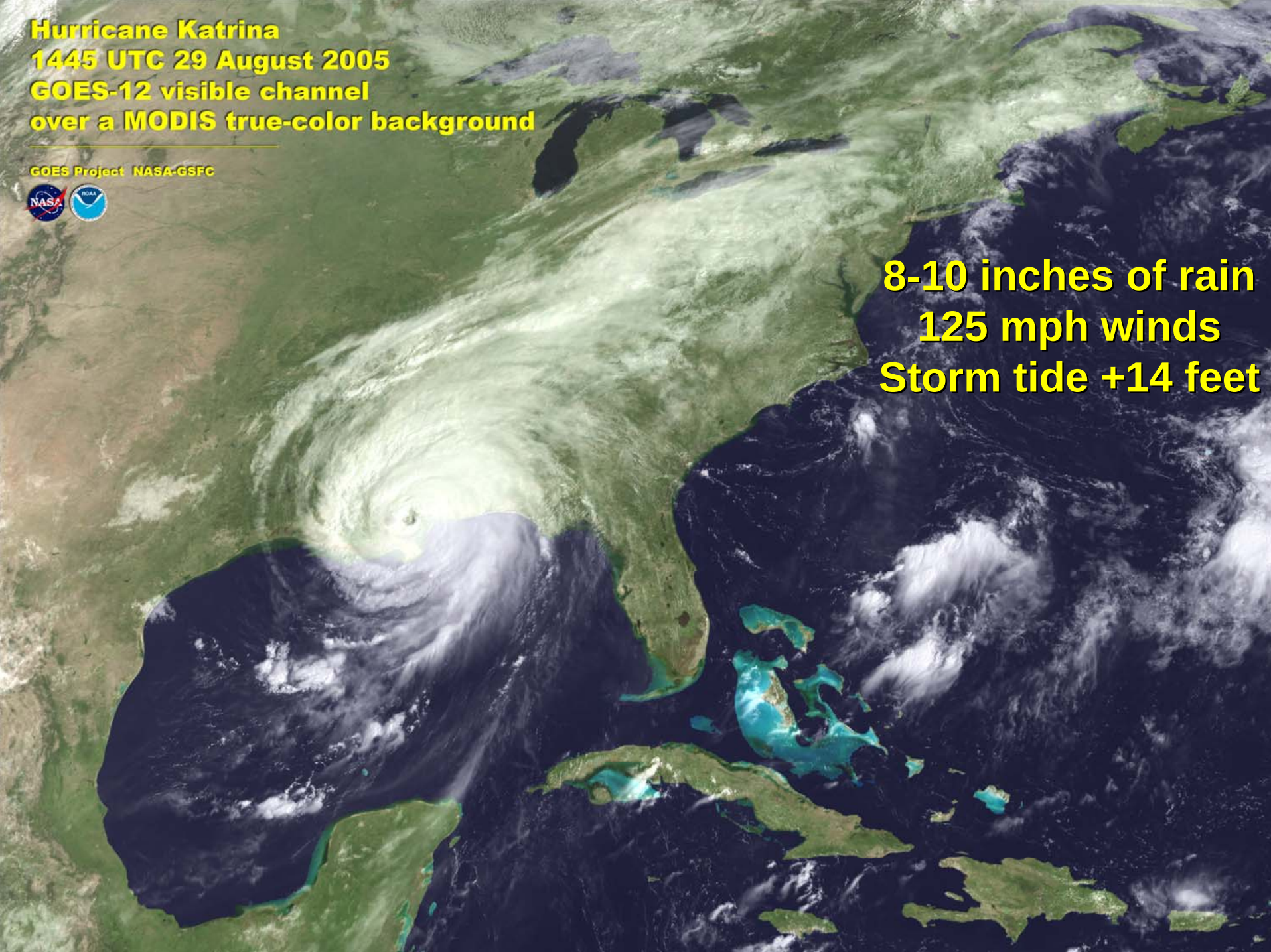
NEW ORLEANS TOPOGRAPHY



Lake Pontarchtrain Levee

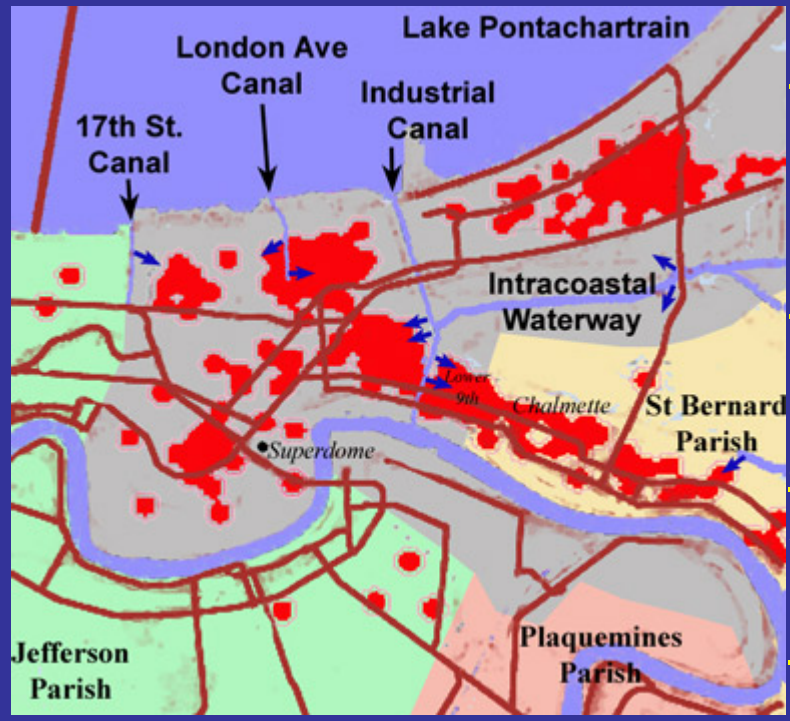
Mississippi River Levee




Hurricane Katrina
1445 UTC 29 August 2005
GOES-12 visible channel
over a MODIS true-color background
GOES Project NASA-GSFC
8-10 inches of rain
125 mph winds
Storm tide +14 feet



Levee Failures

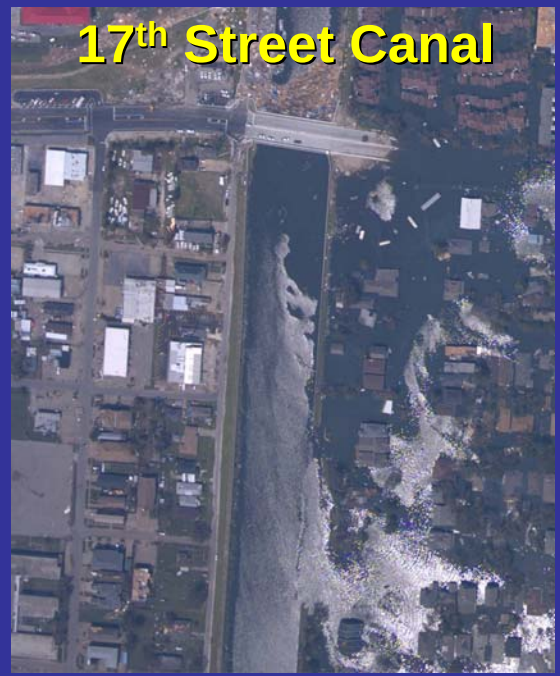


9:00am
Industrial Canal
First pump

12:00pm
17th Street Canal

8:30pm
All pumps

12:00am
London Ave Canal



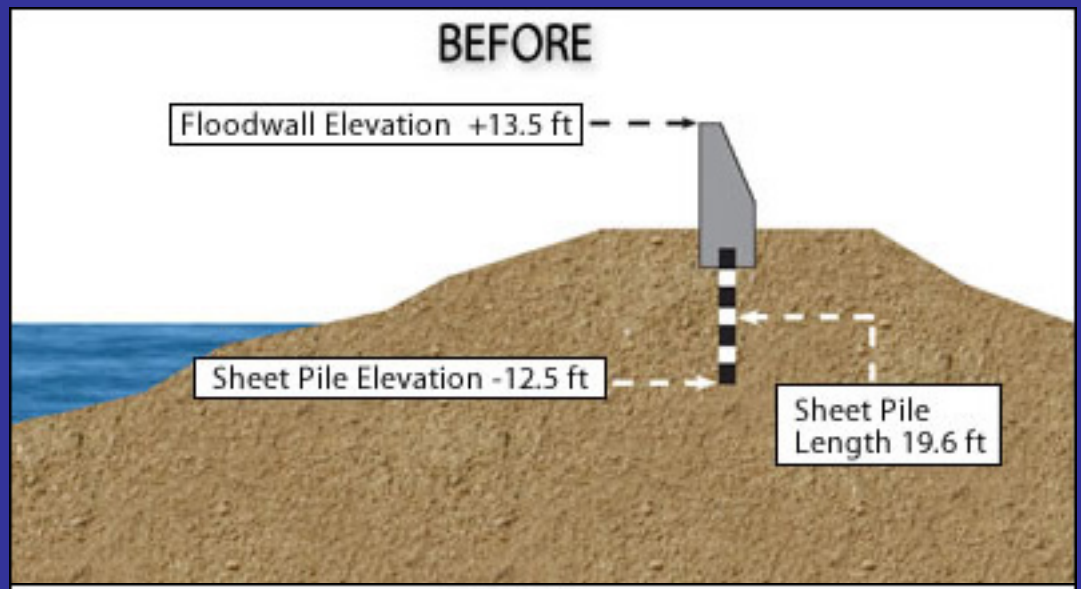


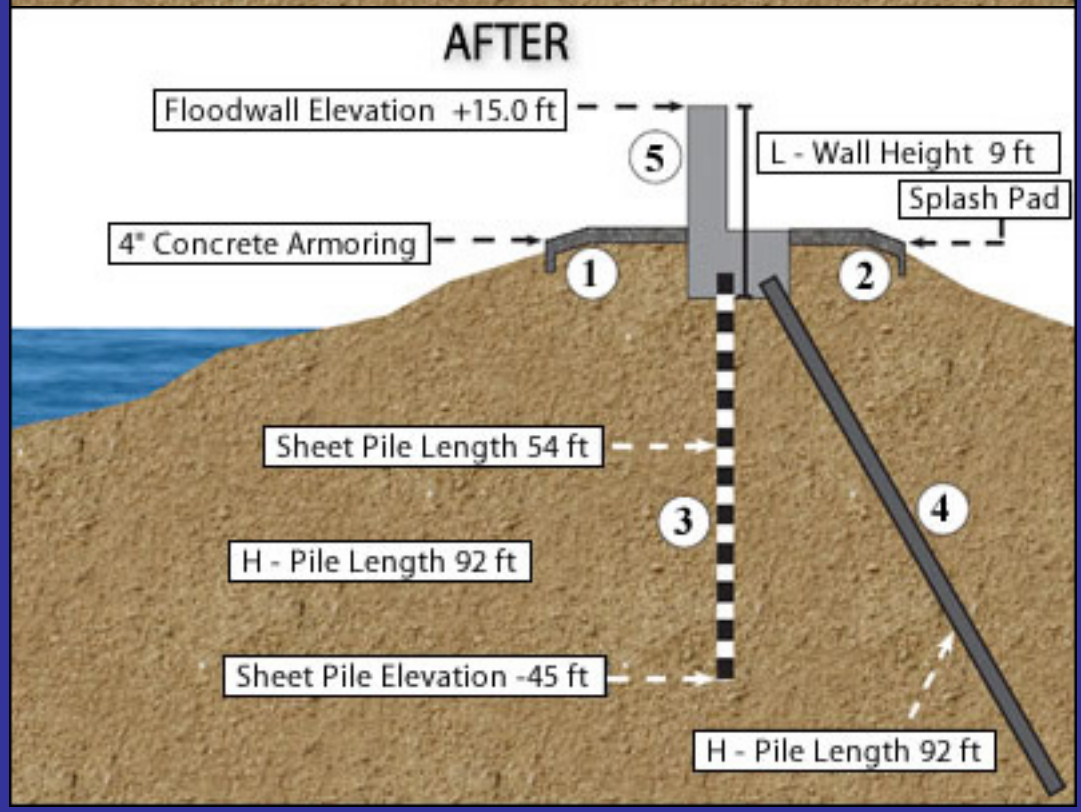


Aftermath

1,836 killed, 705 missing
$86 billion in damage
30 oil platforms destroyed
9 refineries closed
Massive environmental damage







Would you move back to New Orleans…?
A) Yes, B) No



