

## **TOPIC 1: WHO SURVEYS STREAMS? and TOPIC 2: WHAT DO THEY MEASURE?**

Many geographers, hydrologists and civil engineers are involved in surveys of natural stream cross-sections. Their goal is to understand the geometry of the river channel and what's associated with the river, most often plants and the sizes of river rocks that might get carried in a flood. This photo shows ASU geography students learning how to survey a stream cross-section to measure the cross-sectional area.



These ASU geography students are measuring the velocity of the stream at different depths.



These students are measuring the vegetation and the sizes of rocks that a flooding river might flow over.



### TOPIC 3: Example of Channel Change at the Salt River

These aerial photographs from 1935 and 2002 show dramatic changes in the Salt River at ASU as a result of channelization. In 1935, the Salt River had a very wide channel that changed positions during flooding. But by 2002, the Salt River had been narrowed and now only flows between artificial berms called levees.



This is a photograph of the 1931 flood of the Salt River at the Mill Avenue Bridge and the view in 2003.



You can see that narrowing of the channel has permitted new development, protected by the artificial levees. Photos are courtesy of Tempe Historical Society and Richard Stumpf.



## TOPIC 4: COMPARE DAMAGES (OUT OF CHANNEL vs IN CHANNEL)

Dams along Arizona's major rivers keep the channel dry most of the time, but in very wet years the dams cannot store enough water. This happened in 1993 when lots of winter rains and snowmelt supplied more water than the dams could hold.

This aerial photograph of Winkelman, Arizona, shows the Gila River that has gotten out of its channel and flooded low parts of the town.



This aerial photograph of Tempe, Arizona, shows the Salt River in the same time period, and the Salt River has not gotten out of its channel. This is because the channel had enough area to move the flood waters. But construction in the river bed was not strong enough to withstand the forces and a lot of damage to the new Mill Avenue Bridge took place.



This photograph from the U.S. Geological Survey shows a flood moving through the Sant Cruz River in Tucson in 1973. The river discharge exceeded the capacity of its narrowed channel.



The same thing happened in North Carolina when Hurricane Floyd flooded streams that got out of their narrowed channels.



## TOPIC 5: PEOPLE CAN BE CREATIVE IN DESIGNING CHANNELS

A good example of careful design in flood channels is Indian Bend Wash in Scottsdale. This is a stream channel that is dry most of the time. Skateboarders like the skateboard park there. Golfers like the golf courses. Bikers and rollerbladers like the pathway.



However, most of these people do not understand that these parks are really a flood channel, narrowed and deepened to let flood waters through fast.

This is a view of Indian Bend Wash as it entered the Salt River in the 1993 flood. All of the Golf Courses and Parks were underwater. The City of Scottsdale then repaired the flood damage and the parks were returned to normal a few weeks later. It is a lot less expensive to repair parks than flooded buildings.

# TOPIC 6: DON'T BE A STUPID MOTORIST



**DO NOT DRIVE THROUGH FLOODWATERS!**

Water 1 foot deep → 500 pounds lateral force **Extremely dangerous**

1,500 pounds buoyancy force

Water 2 feet deep → 1,000 pounds lateral force **Fatal**

Vehicle begins to float when the water reaches its chassis, which allows the lateral forces to push it off the road.

Muddy water hides washout → **Fatal**

Washed-out roadway can be hidden by muddy water allowing a vehicle to drop into unexpected deep water.

Muddy water can easily float your car and make it move down a flooded river. Thanks to a new law, the driver will pay to be rescued.