River Scientists

in *Restoring Streams in Cities*
by Ann L. Riley

Chapter Outline

- Hydrologists and Hydraulic Engineers
- Types of Stream Channels
- Concept of Stream Equilibrium
- Drainage Areas and Channel Shapes, Sizes and Discharges
- How Urbanization Can Change Watersheds and Streams
- Challenges of Urban Stream Restoration

River Scientist

- Hydrologists
- Fluvial Geomorphologists
- Hydraulic Engineers
- Physical & chemical characteristics of streams within watershed system
- In addition, land forming processes of water
- Modeling behavior of water flow under controlled conditions

Types of Stream Channels

- Streambed material (geology)
  - bedrock, armored, alluvial
- Sinuosity
  - meandering or straight
- Width and depth
  - wide, narrow, deep, shallow, braided

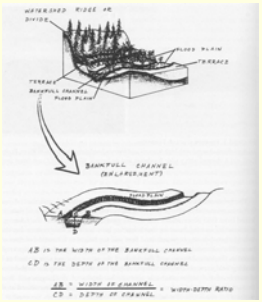
Watershed Influences

from a U.S. Army Corps of Engineers report:[16]

Major Watershed Parameters	Major Processes	Major Storages and Outputs
Precipitation	Interception	Soil moisture
Solar radiation	Evapotranspiration	Groundwater
Temperature	Infiltration	Water discharge
Vegetation and land use	Throughflow	Sediment
Discharge	Overland flow	
Soils	Soil erosion	
Geology		
Topography		

Source: R... Press.

Floodplains, Terraces & Bankfull Channels



Source: Riley, A. L. 1998. River Scientists. In Restoring Streams in Cities, 118. Washington, D.C.: Island Press.

Concept of Equilibrium

- Balance among variables within an ecosystem
- Dynamic, not steady-state
- Stream without excessive erosion or excessive deposition

Drainage Areas and Channel Shapes, Sizes and Discharges

- Uniformity among streams in diverse settings
- Stream discharge = width x depth x velocity
- Meander to stream width
  - Length, amplitude and radius of curvature

How Urbanization Can Change Watersheds and Streams

- Land use impacts hydrologic conditions
- Stream channel adjustments to urbanization
- Flood-control channel flows

The Challenges of Urban Stream Restoration

- Highly degraded systems
- Three problems to focus on:
  - Identifying bankfull channel width and depth that mirrors urban stream equilibrium
  - Matching channel length and sinuosity design to the existing channel and valley slopes
  - Establishing a floodplain capable of handling flash flooding and dynamic channel adjustments

Conclusions

- Focused more on river science than river scientists
- Informative and encouraging for participants in stream restoration

River Scientist

???Questions???

Brian Thatcher

What's the difference between a Hydrologist and a Hydraulic Engineer?

- Hydrologist concentrate on the descriptions, measurements, and analysis of precipitation and flow of water on the earth and underground.
- Hydraulic Engineer is mainly concerned with the influences of water and rivers on the erosional cycle of land deposition and degradation over time.

What are some obvious factors in distinguishing stream types?

- The geology or soils making up the bed stream.
- The gradient or steepness of the stream slope.
- The degree to which a stream meanders or is straight.

Why is the watershed important to a stream restorationist?

- It can be used to diagnose a stream's problems and to find solutions.
- Its land forms, geology, soils, etc. determines the amount of runoff and transport of sediment to stream channels.
- The knowledge of nearby streams that appear balanced and that drain similarly sized watersheds can help in the restoration process.

Why are historic maps and aerial photos important in stream restoration?

- They can provide important information on how the watershed and streams appeared before urbanization impacts.
- Helps to figure out the percentage of the watershed that has been urbanized.
- Using topographic maps you can find the size of the drainage area affecting the site you hope to restore.
- They provide guidelines and restoration objectives.

What is the concept of stream equilibrium?

- When the variables of the rivers and landscapes are in balance with each other causing the amount of sediment coming into the stream to equal the amount leaving the stream.

What are some of these variables?

- The size of the watershed
- The amount and size of sediment transported in the river channel.
- The channel shape, size, slope, and roughness.
- The amount and frequency of flow discharges.

What is the difference between a subcritical and supercritical flow?

- A subcritical flow is a stream flowing fairly slowly with eddies near banks and not a lot of visible surface disturbance or rapids.
- A supercritical flow is a stream with very high velocity and turbulence caused by structures or culverts obstructing the channel. Such obstructions are used for such things as freeing up more developable property.
- Supercritical flows can be undesirable due to the amount of potential erosive power it produces in the channel.

What is a Froude Number and what is it used for?

- It's a formula that represents the ratio of inertial forces to gravitational forces.
- It's used to indicate if a channel is going to have supercritical flows.
- Engineers can use this when building structures in the river to make sure they don't create a supercritical flow that can be dangerous.

Thank You

Any other questions?