



457.309 Hydraulics & Laboratory

.01 Introduction to Hydraulics



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Introduction

“...*Hudour* (in Greek) means ***water*** .

Hydraulics is a topic in engineering dealing with the mechanical properties of liquids, in particular civil engineering, water.

At rest: (Hydrostatics)

- Forces and energy

In motion: (Hydrodynamics)

- Momentum and energy

Hydrostatics + Hydrodynamics = Hydraulics

In both states:

- Water surface elevation in channels, Flood plains
- Discharge or velocity, Fluid potential



Hydraulics, Hydrology and Fluid mechanics

Fluid mechanics:

is the study of fluids under all conditions of rest and motion

- The fluid may be gaseous or liquids
- Basic principles of science rather than empirical relationship
- Hydraulics deals primarily with water (fluid does fluids of all types)
- Hydraulic is more empirical (practical) comparing fluid mechanics

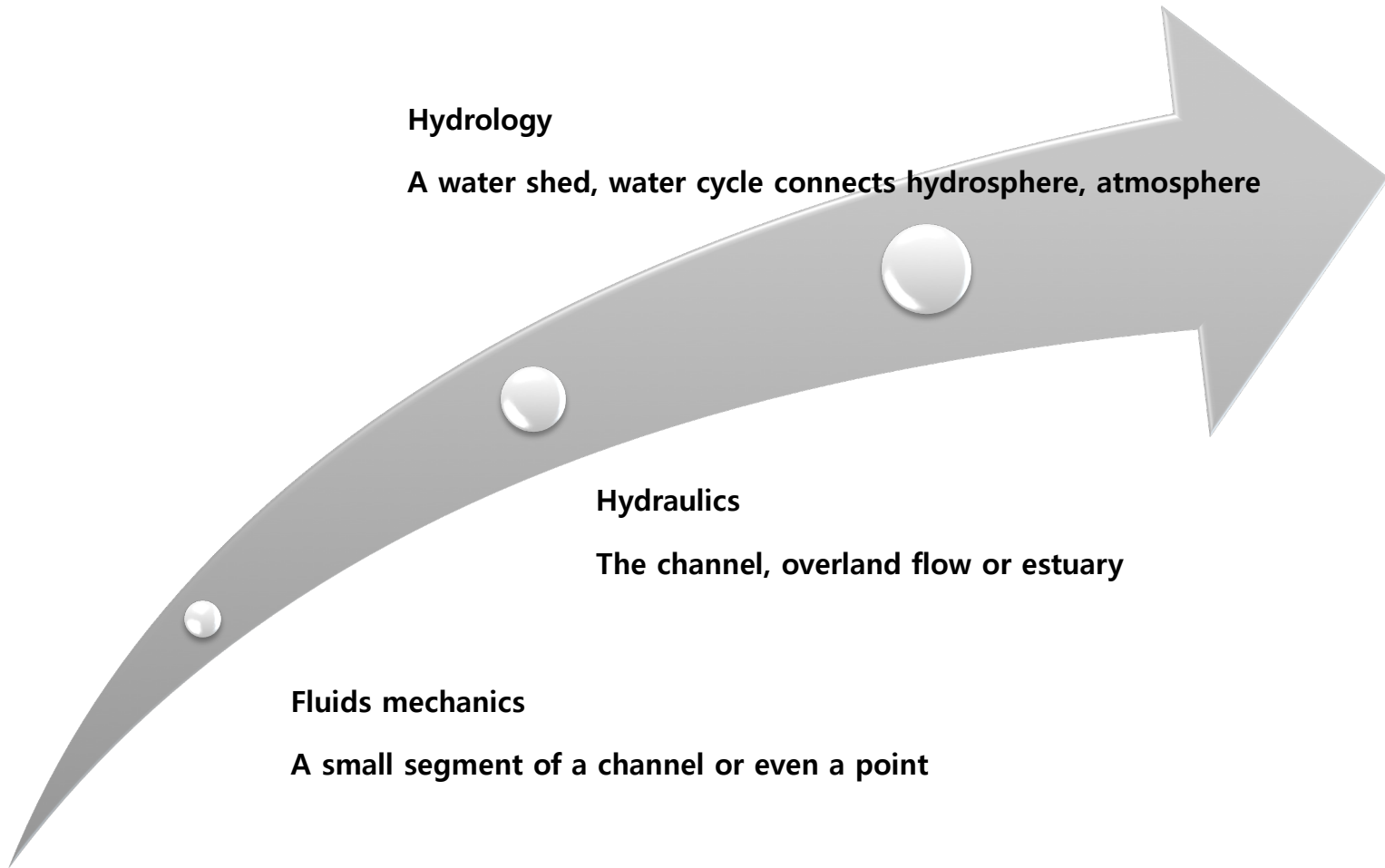
Hydrology:

is the study of space, time, and frequency

- Deals with fluid, solid, ice and snow, and water vapor
- Hydraulics does not deal with occurrence



Scales

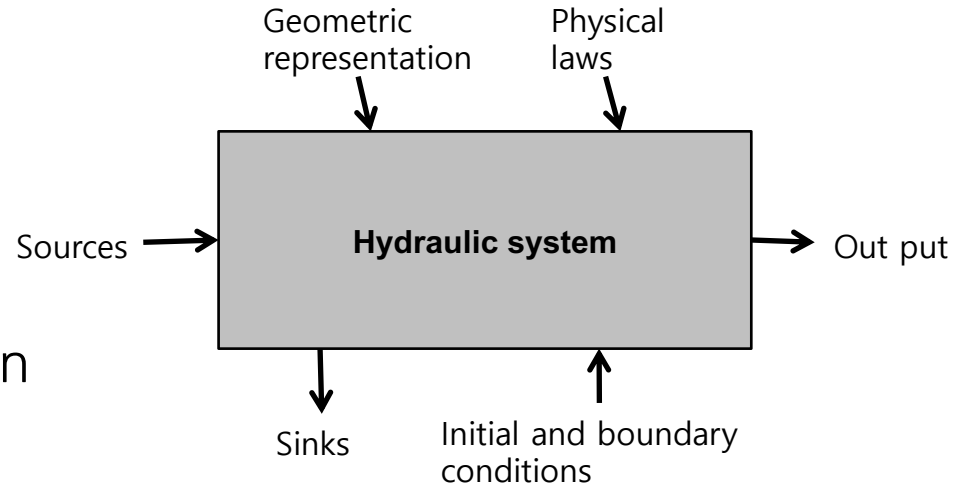




Scientific Approach to Investigating Hydraulic Problems

- Three elements for solving a hydraulic problem

1. Hydraulic system representation
 - I. Geometry
 - II. Physical law
 - III. Initial and boundary conditions
2. Input (or sources)
3. Output (or sinks)





Geometry for representation of hydraulic system

- Conduit-pipe, channel, estuary, plane, aquifer, etc
 - Open channel flow
 - Different types of sections, such as rectangular, trapezoidal, triangular, circular, and irregular sections
 - Ground water flow takes place in the pores of underground media
- The geometry of the conduits
 - may vary with space
 - Close boundary or not, changeable boundary



Governing Equations (physical laws)

- All hydraulic processes are governed by a set of basic principles
 - External constraints on the process
 - Conservation of mass
 - Continuity equation or mass balance equation
 - Conservation of momentum
 - Newton's second law
 - Momentum equation
 - Conservation of energy
 - Energy can be neither created nor destroyed
 - The first law of thermodynamics
 - Bernoulli equation
 - Internal mechanics
 - Law of entropy increases
 - Law of space-time-mass dimensionality



Showing off

