

Raw Water Sources and Intake Systems

Course: Water Resources Engineering


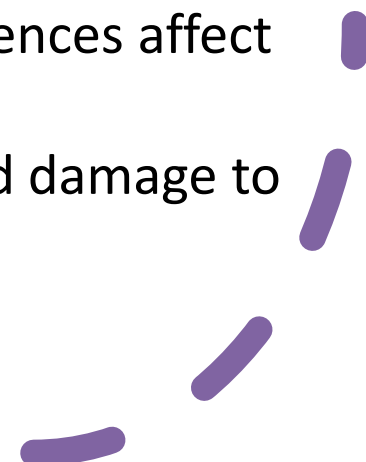
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What is Raw Water?

- Raw water refers to **untreated water** found in natural sources such as rivers, lakes, reservoirs, and groundwater aquifers. Before use for drinking, irrigation, or industrial purposes, water must be **collected, conveyed, and treated** to meet quality standards.

- **Major Sources of Raw Water**
- **1. Surface Water Sources**
 - Rivers and streams
 - Natural lakes and man-made reservoirs
 - Runoff collected from catchments
- **2. Groundwater Sources**
 - Shallow wells and deep boreholes
 - Infiltration galleries and springs
- **3. Rainwater Harvesting**
 - Collection of direct precipitation from rooftops or land surfaces for local use

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- **Factors Affecting Source Selection**
 - **Quantity:** Must meet demand for domestic, industrial, and agricultural needs.
 - **Quality:** Lower levels of pollutants and turbidity preferred to reduce treatment costs.
 - **Reliability:** Consistency throughout seasons and years.
 - **Accessibility:** Feasibility of construction and maintenance.
 - **Topography:** Elevation differences affect pumping and gravity flow.
 - **Environmental impact:** Avoid damage to ecosystems and habitats.
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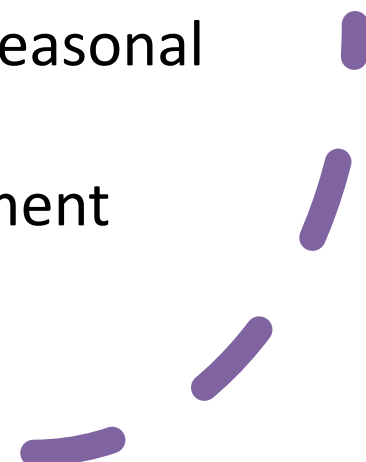


- **Surface Water Sources (Advantages and Disadvantages)**

- **Advantages:**

- Easy to locate and access.
- Often provide large quantities of water.
- Simple to collect and measure flow.

- **Disadvantages:**

- Subject to pollution from domestic and industrial waste.
 - High sediment load and seasonal variations.
 - Requires extensive treatment before use.
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Estimation of Water Quantity / تقدير كمية المياه

- Before designing a water supply system, engineers estimate daily water demand.
- قبل تصميم نظام إمداد المياه، يقدر المهندسون كمية المياه المطلوبة يومياً.
- Formula:
- $Q = \text{Per Capita Demand} \times \text{Population}$
- عدد السكان \times استهلاك الفرد = الكمية: المعادلة
- Example:
- $30,000 \text{ persons} \times 150 \text{ L/day} = 4,500,000 \text{ L/day}$

Water Intake / مأخذ المياه

- An intake structure withdraws raw water from its source and conveys it to the treatment plant.
- منشأة المأخذ تسحب المياه الخام من المصدر وتنقلها إلى محطة المعالجة.
- Functions:
 - • Maintain continuous flow.
 - • Prevent debris and contamination.
 - • Facilitate pumping operations.

Location of Intake / موقع المأخذ

- Factors affecting intake location:
- عوامل تؤثر على موقع المأخذ:
 - • Near treatment plant (close distance reduces cost)
 - • قريب من محطة المعالجة لتقليل التكلفة
 - • Away from pollution sources
 - • بعيد عن مصادر التلوث
 - • Accessible during floods and droughts
 - • يمكن الوصول إليه أثناء الفيضانات والجفاف

Design Considerations / اعتبارات التصميم

- An intake structure must:
- يجب أن تكون منشأة المأخذ:
 - Strong enough to resist hydraulic forces.
 - قوية بما يكفي لتحمل قوى الماء.
 - Heavy enough to resist buoyancy.
 - ثقيلة بما يمنعها من الطفو.
 - Equipped with screens and valves for cleaning and control.
 - مزودة بشبكات وصمامات للتحكم والتنظيف.

Pumps and Applications / المضخات وتطبيقاتها

- Pumps are used throughout the water supply system.
- تُستخدم المضخات في مراحل متعددة من نظام المياه.
- Applications:
 - • Lifting groundwater رفع المياه الجوفية
 - • Delivering treated water نقل المياه المعالجة
 - • Maintaining pressure الحفاظ على الضغط
 - • Firefighting systems أنظمة مكافحة الحرائق

Types of Pumps / أنواع المضخات

- 1. Displacement Pumps → مضخات الإزاحة
Reciprocating, Rotary
- 2. Velocity Pumps → مضخات السرعة
Centrifugal, Turbine
- 3. Buoyancy Pumps → مضخات الطفو
Air-lift
- 4. Impulse Pumps → مضخات النبض
Hydraulic Ram

Pump Efficiency / كفاءة المضخة

- Efficiency determines how well a pump converts energy.
- الكفاءة تُظهر مدى تحويل المضخة للطاقة.
- Formulas:
- $H.P. = (w \times Q \times H) / 75$
- $E = (w \times Q \times H) / \text{Brake H.P.}$
- Typical efficiency: 70–90%