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

- **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.

- **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.

Estimation of Water Quantity / تقدير كمية المياه

- Before designing a water supply system, engineers estimate daily water demand.
- قبل تصميم نظام إمداد المياه، يقدّر المهندسون كمية المياه المطلوبة يومياً.

- Formula:
- Q = Per Capita Demand × Population
- المعادلة: الكمية= استهلاك الفرد ×عدد السكان

- Example:
- 30,000 persons × 150 L/day = 4,500,000 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 × Q × H) / 75
- E = (w × Q × H) / Brake H.P.

- Typical efficiency: 70–90%