



Water Crisis Due to Dam Sedimentation

For Prelims: Sedimentation, Dredging, Climate Change, Central Water Commission, Environmental Impact Assessment.

For Mains: Water Crisis, Dam Sedimentation and Consequences.

Why in News?

The **United Nations Institute for Water, Environment and Health** showed in its report that about 50,000 large dams across the world will lose **24-28% water storage capacity** by **2050** due to sediment trapped in them.

- These **water reservoirs** have already lost about **13-19%** capacity to sedimentation.
- The **United Kingdom, Panama, Ireland, Japan and Seychelles** will experience the highest water storage losses by **2050 from 35-50% of their original capacities**.

What is Sedimentation with Respect to Dams?

- **Sedimentation** in dams refers to the **accumulation of sediments**, such as **sand, gravel, and silt**, at the **bottom of a reservoir** created by a dam.
- This sediment can build up over time, **reducing the overall storage capacity of the reservoir**.
- To maintain the **capacity of the reservoir**, the sediment may need to be removed through a process called **dredging**.

What is Dredging?

- Dredging is the **process of removing sediments**, such as **sand, gravel, and silt**, that has accumulated at the **bottom of a reservoir**.
- It can be done using various methods, such as **mechanical dredging** with a **dredge machine** or **hydraulic dredging** with a **high-pressure water jet**.
- The sediment removed during dredging is typically disposed of in a designated area away from the dam.

What are the Causes of Sedimentation?

- **Erosion Upstream of the Dam:** When soil and rock is washed away from the area upstream of the dam, it can be carried downstream and deposited in the reservoir.
- **Runoff from Urban and Agricultural Areas:** The increased use of land for human activities, such as **urbanization** and agriculture, can lead to increased runoff of sediment into the reservoir.
- **Natural Processes:** Sedimentation can also occur naturally through processes such as weathering and erosion.
- **Climate Change:** **Climate change** causes more intense and frequent rainfall events and also causes **snowmelt** earlier which can lead to increased erosion and sediment runoff into the reservoir.

- **Deforestation:** Trees help to hold the soil together and prevent **erosion**, so when forests are removed or degraded, there is a greater risk of sediment runoff into the reservoir.
- **Poor Dam Maintenance:** Lack of maintenance and repairs can also lead to sedimentation, as the dam's structure can become damaged, allowing sediment to enter the reservoir.

What are the Consequences of Dam Sedimentation?

- **Environmental:**
 - **Reduced water storage capacity** in the reservoir, which can lead to water **shortages for downstream users** and the loss of habitat for aquatic species.
 - Increased risk of **dam failure** as the sediment can cause the **dam to become unstable**.
- **Economic:**
 - Increased cost of maintenance and **dredging** to remove the sediment.
 - Loss of **hydroelectric power generation** due to **reduced water flow** through the dam.
 - **Reduced irrigation and water supply** for **agriculture** and industry.
 - Loss of revenue from recreational activities such as fishing and boating if the reservoir is no longer able to support them.
- **Damage to Dam Structure and Turbines:**
 - The accumulation of sediment at the bottom of the reservoir can cause **scouring, or erosion**, of the dam's foundation, which can weaken its structural integrity and increase the **risk of failure**.
 - Sediment can also **clog the turbine intake**, which can **reduce the efficiency of hydroelectric power generation** and require costly maintenance to remove the sediment.
 - The sediment can also cause **abrasion on the turbine blades** which can lead to damage and reduce their efficiency.
 - While sediment helps maintain the **aquatic ecosystem**, **poor management** can lead to **nutritional imbalances** causing **eutrophication** and other disruptions in the water pool of the dam, as well as damages in habitations downstream.

Way Forward

- **Regular Inspections and Monitoring:** Dams are required to be regularly inspected and monitored for signs of structural weakness, erosion, and other potential issues. This includes both visual inspections and instrument-based monitoring, such as monitoring the dam's foundation for movement.
- **Emergency Action Plans:** Dams are required to have emergency action plans in place to respond to potential incidents, such as dam failure or excessive flooding. These plans outline the actions to be taken in the event of an emergency, including evacuation procedures and emergency response procedures.
- **Environmental Impact Assessment:** Dams are required to undergo **environmental impact assessments (EIA)** to evaluate the potential impacts of the dam on the surrounding environment. This includes assessing the impact on wildlife, aquatic species, and downstream communities.
- **Public Consultation:** Dams are required to involve public consultation and participation in the decision-making process, including providing information and opportunities for public comment on the proposed dam.

UPSC Civil Services Examination, Previous Year Questions (PYQs)

Q. Suppose the Government of India is thinking of constructing a dam in a mountain valley bound by forests and inhabited by ethnic communities. What rational policy should resort to in dealing with unforeseen contingencies? **(2018)**

Source: DTE

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