

UNIT – V

Saline Water Intrusion in Aquifers

1. Introduction

Saline water intrusion occurs when seawater enters freshwater aquifers.

Common in

- Coastal regions
 - Over-pumped aquifers
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2. Causes of Saline Water Intrusion

- Excessive groundwater pumping
 - Reduction in freshwater recharge
 - Sea level rise
 - Drought conditions
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3. Effects of Saline Water Intrusion

- Drinking water contamination
 - Soil salinity
 - Reduced crop productivity
 - Ecosystem damage
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4. Occurrence of Saline Water Intrusion

Freshwater and seawater remain in equilibrium due to density difference.

- Freshwater density $\approx (1000, \text{kg/m}^3)$

- Seawater density $\approx (1025, \text{ kg/m}^3)$
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5. Ghyben–Herzberg Relation

$$z = 40h$$

Where:

- z = Depth of freshwater below sea level
- h = Height of water table above sea level

Interpretation

A 1 m rise in freshwater head supports approximately 40 m of freshwater below sea level.

6. Shape of Interface

The interface between freshwater and saltwater is curved due to mixing.

Factors Affecting Interface

- Pumping rate
 - Recharge
 - Aquifer permeability
 - Tidal effects
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7. Control of Saline Water Intrusion

Methods

a) Controlled Pumping

Reduce excessive groundwater withdrawal.

b) Artificial Recharge

Increase freshwater recharge.

c) Barrier Wells

Inject freshwater near coastal regions.

d) Subsurface Barriers

Construct impermeable barriers.

8. Groundwater Basin Management

Groundwater basin management involves sustainable utilization of groundwater resources.

Objectives

- Prevent overexploitation
 - Maintain water quality
 - Balance recharge and withdrawal
 - Protect aquifers
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9. Sustainable Groundwater Management Strategies

- Rainwater harvesting
 - Artificial recharge
 - Regulation of pumping
 - Efficient irrigation methods
 - Watershed management
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10. Case Studies – Coastal Aquifer Management

Measures Adopted

- Recharge ponds
- Controlled pumping
- Monitoring wells
- Desalination support

Results

- Reduced salinity
 - Improved groundwater quality
 - Stabilized water table
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Important Definitions

Aquifer

A geological formation that stores and transmits water.

Water Table

Upper surface of saturated groundwater zone.

Permeability

Ability of soil or rock to allow water flow.

Porosity

Percentage of void spaces in soil or rock.

Drawdown

Lowering of water level due to pumping.

Transmissivity

Rate of groundwater transmission through aquifer thickness.

Storage Coefficient

Volume of water released from storage per unit decline in head.