

## **1. Hydrological Principles & Techniques**

### **1.1 Introduction**

- 1.1.1 Scientific development of hydrology
- 1.1.2 Hydrological development in Nepal
- 1.1.3 Hydrologic cycle and hydrologic budget
- 1.1.4 Application of hydrology in national development

### **1.2 Basic Hydrologic Principles**

- 1.2.1 Precipitation
  - 1.2.1.1 Meteorological aspects
  - 1.2.1.2 Temporal and spatial variation of precipitation
  - 1.2.1.3 Storm analysis
  - 1.2.1.4 Precipitation data sources and interpretation
- 1.2.2 Hydrologic abstractions
  - 1.2.2.1 Interception
  - 1.2.2.2 Infiltration
  - 1.2.2.3 Surface and depression storage
  - 1.2.2.4 Evaporation
  - 1.2.2.5 Evapotranspiration
- 1.2.3 Runoff
  - 1.2.3.1 Runoff components
  - 1.2.3.2 Effects of catchment characteristics on runoff
  - 1.2.3.3 Stream types
  - 1.2.3.4 Rainfall-runoff relations
  - 1.2.3.5 Streamflow hydrographs
  - 1.2.3.6 Streamflow variability

### **1.3 Snow Hydrology**

- 1.3.1 Snow formation and accumulation
- 1.3.2 Melting of snowpack
- 1.3.3 Snowmelt indexes
- 1.3.4 Snowmelt runoff

### **1.4 Hydrologic Measurements**

- 1.4.1 Precipitation measurements
  - 1.4.1.1 Ordinary and recording precipitation gauges
  - 1.4.1.2 Precipitation measurements using telemetry
  - 1.4.1.3 Errors in measuring precipitation data
- 1.4.2 Snowpack measurements
  - 1.4.2.1 Snow courses
  - 1.4.2.2 Radioisotope snow measurements
  - 1.4.2.3 Determination water equivalent
- 1.4.3 Evaporation and evapotranspiration measurements
  - 1.4.3.1 Class A pan

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- 1.4.1.2 Evaporimeters
- 1.4.1.3 Lysimeters
- 1.4.4 Infiltration and soil-moisture measurements
  - 1.4.4.1 Infiltrometers
  - 1.4.4.2 Measurements of soil moisture
- 1.4.5 Streamflow measurements
  - 1.4.5.1 Stage measurements
  - 1.4.5.2 Discharge measurements
  - 1.4.5.3 Indirect determination of peak discharge
- 1.4.6 Structural design
  - 1.4.6.1 River gauging structure
  - 1.4.6.2 Hydro-meteorological stations
- 1.4.7 Hydrological network design

**1.5 Erosion and Sedimentation**

- 1.5.1 Sediment properties
- 1.5.2 Sediment production
- 1.5.3 Upland erosion and universal soil loss equations
- 1.5.4 Sediment Yield
- 1.5.5 Sediment-delivery ratio
- 1.5.6 Empirical formulas for sediment yield
- 1.5.7 Sediment transport
  - 1.5.7.1 Sediment transport mechanics
  - 1.5.7.2 Sediment rating curves
- 1.5.8 Sediment deposition in reservoirs
  - 1.5.8.1 Reservoir trap efficiency
  - 1.5.8.2 Reservoir design life
- 1.5.9 Sediment measurement techniques
  - 1.5.9.1 Sediment sampling equipment
  - 1.5.9.2 Suspended-sediment discharge measurements
  - 1.5.9.3 Bed load measurement

**1.6 Water Quality**

- 1.6.1 Properties of water
- 1.6.2 Water pollution
- 1.6.3 Water quality sampling
- 1.6.4 Water quality simulation

**1.7 Ground Water Hydrology**

- 1.7.1 Stream aquifer interaction
- 1.7.2 Base flow and physiographic characteristics

**2. Hydrological Responses**

**2.1 Hydrology of Small and Medium Catchments**

- 2.1.1 Rational method
- 2.1.2 Runoff curve number method
- 2.1.3 Unit hydrograph techniques

**2.2 Frequency Analysis of Hydrological Extremes**

- 2.2.1 Statistical series and return periods
- 2.2.2 Adjustment of data
- 2.2.3 Flood frequency analysis
- 2.2.4 Low flow frequency analysis

**2.3 Regional Analysis of Hydrological Variables**

- 2.3.1 Regional distribution of precipitation
- 2.3.2 Regional distribution of runoff
- 2.3.3 Regional parameters of
  - 2.3.3.1 Flood flows
  - 2.3.3.2 Low flows
  - 2.3.3.3 Long terms flows

**3. Hydrological Tools, Application & Management**

**3.1 Reservoir and Stream Channel Routing**

- 3.1.1 Muskingum method
- 3.1.2 Kinematic method

**3.2 Catchment Modeling**

- 3.2.1 Classification
  - 3.2.1.1 Black-box model
  - 3.2.1.2 Conceptual model
  - 3.2.1.3 Stochastic model
- 3.2.2 Model components and construction
- 3.2.3 Model calibration and verification

**3.3 Flood Forecasting**

- 3.3.1 Forecast formulation
- 3.3.2 Statistical approach
- 3.3.3 Physical approach
- 3.3.4 Flash floods
- 3.3.5 Verification of forecast
- 3.3.6 Dissemination of forecast
- 3.3.7 Glacier lake outburst flood

**3.4 Remote Sensing**

- 3.4.1 Study of hydrological regime
- 3.4.2 Snow and glacier survey

**3.5 Project Management**

- 3.5.1 Project development planning
- 3.5.2 Stakeholder requirements
- 3.5.3 Role of hydrology in IWRM
- 3.5.4 Project Management Information Systems, Network models; CPM, PERT