Government of India | Ministry of Jal Shakti
Department of Water Resources, River Development and Ganga Rejuvenation

STANDARD OPERATING PROCEDURE (SOP) FOR SPRINGSHED MAPPING & MANAGEMENT

FOREWORD

Springs, the visible manifestation of groundwater on the earth's surface, serve as the primary source of water for millions of inhabitants in the mountain ranges across India. A gross estimate indicates that nearly 200 million Indians depend on spring water, mainly in the Indian Himalayan Region, Western Ghats, Eastern Ghats, and Central Indian highlands. These springs are not only the most cost-effective means of providing relatively pure water for drinking and domestic needs but also sustain the base flow of several major rivers. They are vital for aquatic ecosystems, biodiversity, agriculture, and the socio-economic well-being of communities.

Climate change, deforestation, rapid urbanization, and unsustainable land-use practices have placed immense pressure on these fragile systems. Over the past few decades, many perennial springs have either dried up or become seasonal, exacerbating water scarcity, particularly for women and children who bear the burden of water collection. Despite their critical importance, springs have historically remained "invisible" in water resource planning due to the lack of systematic data. As the adage goes, "You can't manage what you don't measure." The absence of a robust springs database has hindered the integration of these vital sources into policy and management frameworks.

Recognizing this gap, the Department of Water Resources, River Development & Ganga Rejuvenation, Ministry of Jal Shakti, Government of India, has prioritized the conservation and rejuvenation of springs through scientific and participatory approaches. In line with the Hon'ble Prime Minister's emphasis on accelerating springshed management in mountainous regions, the Department constituted a Steering Committee on 'Springshed Mapping of the Indian Himalayan Region (IHR) Including Mountainous Regions of the Country and Springshed-based Watershed Management Plan'. One of the key outcomes of this initiative was the development of the comprehensive "Resource Book for Springshed Management in the Mountainous Regions of India," which consolidates scientific knowledge, field methodologies, and community-based management practices.

While the Resource Book serves as an essential reference, its detailed and technical nature can be challenging for field practitioners, community stakeholders, and implementing agencies who require clear, actionable guidelines. To bridge this gap, the present document distills the core operational elements from the Resource Book into a focused Standard Operating Procedures (SOP). This SOP has been carefully curated to provide step-by-step guidance across six chapters:

1. **Comprehensive Spring Mapping** – systematic identification and inventory of springs.
2. **Data Monitoring System** – scientific measurement of spring parameters.
3. **Springshed/Recharge Area Identification** – hydrological and geological assessment of springshed/recharge areas.
4. **Springshed Treatment Measures** – planning and implementation of revival interventions.
5. **Impact Assessment : Socio-Economics and Hydrological**– evaluating hydrological, ecological, and socio-economic outcomes.

6. **Social and Governance Aspects**– ensuring community participation, equity, and institutional sustainability.

Each Chapter has been designed to be practical, field-friendly, and aligned with the principles of inclusive governance and evidence-based management. By extracting and simplifying the most relevant content from the larger Resource Book, this compilation aims to empower field teams, water user groups, NGOs, and government agencies with readily applicable tools for on-ground implementation.

This SOP is meant to complement the Resource Book, offering a streamlined pathway for action. It emphasizes the integration of traditional knowledge with modern science, community-led monitoring, gender-sensitive planning, and adaptive management, all critical for the sustainability of springshed interventions.

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CHAPTER 1

COMPREHENSIVE SPRING MAPPING

NEED OF THE SPRING MAPPING

ADVANTAGES OF SPRING MAPPING

WATER BODIES TO BE MAPPED/ NOT MAPPED AS SPRING

SPRING PARAMETERS TO BE COVERED IN SPRING MAPPING

COMMUNITY PARTICIPATION IN SPRING MAPPING

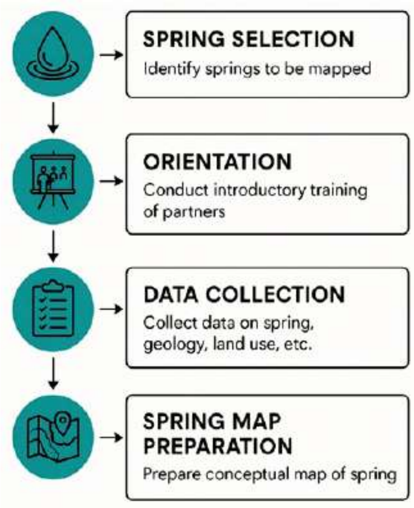
NEED FOR THE SPRING MAPPING

Springs, being smaller in size compared to other water bodies such as rivers, lakes, and reservoirs, have lacked a systematic database in the past. Due to the unavailability of data, these crucial water sources could not be integrated into our policies and hence were least addressed, despite being the most vital water resources of mountain areas. Therefore, comprehensive spring mapping is the first and foremost step to manage the springshed.

" YOU CAN'T MANAGE WHAT YOU DON'T MEASURE "

ADVANTAGES OF SPRING MAPPING

- ✓ Facilitates the thorough comprehension of the current state of springs.
- ✓ Vulnerable springs can be identified based on the information collected during spring mapping.
- ✓ Springs having high social importance can be protected during expansion of developmental activities, such as, road cutting, tunnelling, etc.
- ✓ Funds and priorities can be decided for implementing the springshed activities.
- ✓ Developed spring inventory can be used as base document to assess the impact of springshed programme.



WATER BODIES MAPPED AS SPRING

Before undertaking spring mapping activities an enumerator must be clear about which water body will be mapped as spring. Any ambiguity in identification of spring may lead to development of incorrect spring inventory. Springs in simple words can be defined as follows:

A spring is a focused discharge of naturally occurring groundwater on the Earth's surface." Normally two different types i.e., **Free flow** and **Seep** type of spring are seen in the field.

Free Flow Spring

Seep Spring

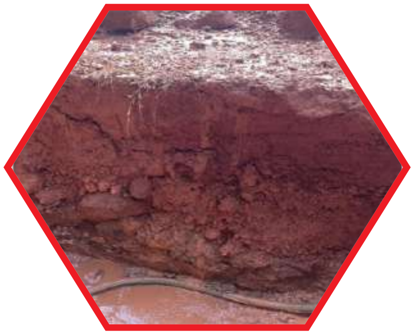
Enumerator must consider the following condition during spring mapping:

- ✓ Not all naturally occurring groundwater flows with diffuse/discreet discharge over a larger area can be classified as springs.
- ✓ Spring mapping does not include ponds and artificial Nature pools, viz. dug wells, artesian wells, and groundwater that appears in excavations.
- ✓ Pipes installed at their outlets solely to direct/guide their flow will be considered as springs. Ensure that pipes are not connected to artificial tanks, pumping schemes, or used for drawing water from adjoining or nearby streams, rivulets, or nallahs.

WATER BODIES NOT TO BE MAPPED AS SPRING

Diffused discharge developed as a Step well

Accumulated surface /subsurface runoff at foothills



Seepage water appeared on excavation of drain

Groundwater under pressure oozing out through a guided pipe as Artesian Well

A stream falling from a topographical height as a Waterfall

Rainwater accumulated at hilltop due to topographical depression

SPRING PARAMETERS TO BE COVERED IN SPRING MAPPING

The selected parameters for spring mapping will yield invaluable insights into springs and facilitate the formulation of subsequent management strategies. The selection of these parameters will depend on the purpose of the spring mapping. Once the parameters are finalized, it is recommended to adopt the mobile application based survey through open-source tools or dedicated android applications given their advantages over traditional paper-based methods in terms of efficiency, accuracy, and data integration.

✓ **Advantage of Mobile App-Based Spring Mapping:**

- App works on ***less-typing-more-clicking*** based approach, that reduces the inconsistencies due to hand-written/typed entries.
- Collected data can be ***analysed more frequently*** from the admin dashboard.
- Spring information can be made ***readily available on web-GIS portal*** more frequently while reducing the cumbersome process of data entry.

Mobile application for spring survey:

✓ Structure of the Information

The following points encompasses data collection structure for spring surveys, ensuring a comprehensive spring inventory:

1. Identification particulars

A unique identifier for individual spring is essential to assign. Unique identifier can be on the basis of either administrative unit or micro-watershed. The hierarchical may be as follows.

Spring UID	S	R	19	664	2926	307086	01
Description of UID	Spring	Rural	LGD Code of State	LGD Code of District	LGD Code of Block	LGD Code of Village	Spring number in the village

- Administrative Unit (Using LGD Code): State/District/Block /Village/spring
- Micro-watershed Unit (Using Micro-watershed code): Water Resource Region/Basin/ Catchment/Subcatchment/Watershed/Sub-watershed/Micro-watershed/spring

2. Spring description

This section may cover the following fields:

Locational information (Lat/Long/Altitude) with spring close-up and wide-angle photo, Nature/type, ownership, hydrogeological information (typology/rock type/aquifer type), topographical features, accessibility etc.

Geo-tagging of Spring using Mobile app

Close-up shot

Wide-angle shot

Close-up shot	Wide-angle shot
• Shows spring outlet/emergence point • Includes scale reference (measuring tape/ruler) • Captures flow pattern clearly	• Shows spring in relation to surrounding landscape • Includes nearby structures/ landmarks • Provides context for spring location
Important considerations: ✓ Ensure proper lighting (avoid shadows on spring) ✓ No unnecessary objects (buckets, people, etc.) in close-up shots ✓ Use landscape orientation ✓ Include spring ID in field notes/app entry ✓ Avoid blurry or obscured images	

3. General physical characteristics of the spring

This section necessitates the collection of specific information such as:

- Spring discharge, trend, and variability,
- Physical parameters (colour, odour, taste, temperature, pH, EC, TDS, DO),
- Months of lean discharge,
- Check list pertaining to the information of samples to be collected for carbonates and bi-carbonates, major cation/anion, trace metal and isotope etc. for the lab analysis.

Spring discharge measurement

pH, EC, TDS meter (handheld)

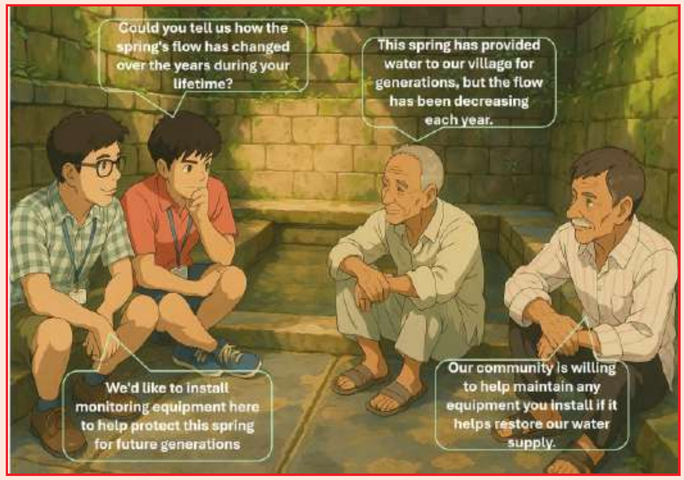
4. Other information

The comprehensive assessment of springs requires the inclusion of various ancillary information that can greatly enhance the understanding of their dynamics and contribute to informed decision-making. This additional information encompasses several key aspects, such as:

- Land use and land cover in and around spring and upstream,
- Resource threats: Stressor (Natural and anthropogenic) responsible for threat,
  Natural stressor: Forest fire, Erosion, Climate on reduced rainfall change, etc.
  Anthropogenic stressor: Unregulated development, road construction, etc.
- Usage of spring water, Dependency type and level, alternate sources of water,
- Information about the SSM project or community initiatives, if any, carried out for the revival of the spring.

The Do's ✓ and Don'ts ✗ for spring mapping	
✓ Map during calm weather	✗ Map during heavy rainfall or monsoon season
✓ Take clear photographs	✗ Include unrelated elements in photos
✓ Measure discharge with sufficient quantity of water to reduce the error of measurement	✗ Estimate discharge without measurement
✓ Involve local communities	✗ Taking discharge average of less than three readings
✓ Record any seasonal information	✗ Assume seasonality without asking locals
✓ Document Spring structures accurately	✗ Confusing infrastructure with natural flow
✓ Follow consistent protocols	✗ Spring mapping through paper-based survey
✓ Make sincere interaction with locals	✗ Rush in data collection

COMMUNITY PARTICIPATION IN SPRING MAPPING



To ensure the accuracy and relevance of this ancillary information, enumerator must actively engage with local residents and stakeholders. Engaging with local residents during the data collection process promotes inclusivity, integrates local perspectives, and contributes to the overall accuracy and relevance of the survey findings. This participatory approach fosters a sense of ownership among the local stakeholders and benefits scientific research, strengthens community relationships, and empowers local stakeholders in the sustainable management of springs.

Community participation is essential for comprehensive and accurate spring mapping:

✓ **Why involve communities?**

- Local people have historical knowledge of springs
- Communities understand seasonal variations
- Local engagement creates ownership of data
- Community members can become field partners

✓ **Key community contributors:**

- Village elders and traditional knowledge holders
- Regular spring users (especially women)
- Village watershed committee members
- Local youth who can be trained for mapping

Stakeholders and community members

CHAPTER 2

DATA MONITORING SYSTEM

DEFINITION
&
SCOPE

TEAM MEMBERS
AND
RESPONSIBILITIES

EQUIPMENT AND
INSTRUMENTATION
REQUIREMENTS

PROCEDURE:
SITE SELECTION,
INSTALLATION
AND
DATA COLLECTION

DATA ANALYSIS
AND
INTERPRETATION

DEFINITION & SCOPE

Springshed instrumentation and monitoring refers to the systematic deployment of scientific equipment and protocols to measure, record, and analyze the hydrological, meteorological, and water quality parameters of mountain springs and their contributing springsheds. This SOP provides standardized guidelines for establishing, maintaining, and operating monitoring systems to generate high-quality data for informed decision-making and effective springshed management.

Springshed instrumentation for high-frequency integrated monitoring approach described in this SOP enables:

- Installation, operation and maintenance of critical zone mountain observatories
- Quantification of spring discharge and its seasonal/ diurnal variability
- Assessment of rainfall-discharge relationships within springshed
- Evaluation of hydro-meteorological controls on spring response
- Monitoring water quality parameters in high spatio-temporal resolution
- Understanding of springshed aquifer dynamics.
- Long-term data collection for trend analysis and climate impact studies

TEAM MEMBERS AND RESPONSIBILITIES

Hydrogeologist/Hydrologist

- Selection, installation, calibrations, and maintaining the field instrumentation and monitoring systems
- Identifies appropriate spring monitoring locations and typology
- Interprets hydrogeological data and correlates with observed spring behavior
- Develops hydrogeological conceptual models of springshed response functions
- Ensures proper quality control, functioning, cloud subscriptions and data reliability of sensing devices
- Conducts periodic field O&M visits for equipment maintenance, recalibration and upkeep

Hydrometeorologist/Data Analyst

- Oversees weather station, flux tower installation and operation
- Manages data collection, validation, and storage protocols
- Processes raw data into usable formats for analysis
- Analyzes meteorological data in relation to spring hydrology
- Estimate evapotranspiration and water balance components
- Correlates weather patterns with spring discharge trends

Field Technician/Field Worker/CRP

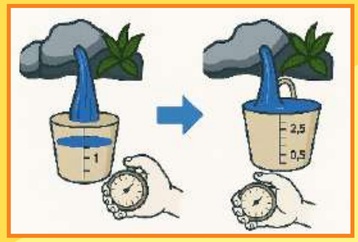
- Conducts regular field measurements and observations
- Maintains field installations and security arrangements
- Collects manual water samples for laboratory analysis
- Update records of site conditions and coordinate monitoring visits
- Acts as local steward for monitoring installations and observatory upkeep
- Assists with regular maintenance, basic troubleshooting and data relay
- Facilitates engagement and build community accord
- Reports any issues with monitoring equipment

EQUIPMENT AND INSTRUMENTATION REQUIREMENTS

SPRING DISCHARGE MONITORING

Manual Measurement of Discharge

- Perform manual discharge measurements using volumetric methods (known collected volume/time recorded)
- Record the average of three measurements
- Conduct bi-monthly field visits and bi-weekly during critical seasons (monsoon/lean)
- Time of measurement must be fixed as diurnal cycle of evapotranspiration can affect the spring discharge
- If there are multiple openings, measure the total discharge of each separately and then sum the flow rates to estimate the spring's total discharge
- Document daily readings in standardized filed log sheets



Instrumentation for Discharge Measurement

- HS and Parshall Flumes: 0.5 to 1-foot size HS for small springs and Parshall Flumes for higher discharge springs
- Capacitance based Water Level Probes: For automated water level logging and continuous stage monitoring
- Pressure Transducers: For water level measurement in stilling wells
- Data Loggers: Rugged and weatherproof, with minimum 1-year of battery life

HYDROMETEOROLOGICAL MONITORING

• Automatic Weather Station (AWS):

- Tipping Bucket Rain Gauge: 0.2-0.5mm least count
- Air Temperature and Relative Humidity Sensors: With radiation shields
- Wind Speed and Direction Sensors: Cup anemometer or ultrasonic
- Solar Radiation Sensors: Pyranometers
- Barometric Pressure Sensors
- Data Logger with telemetry capabilities

• Flux Tower Components

For advanced monitoring in pilot springsheds:

- Eddy Covariance System
- Net Radiometer
- Soil Heat Flux Plates
- Temperature Profile Sensors

WATER QUALITY MONITORING

• Multi-Parameter Water Quality Sonde:

- pH Sensor: Range 0-14, accuracy ±0.2 units
- Temperature Sensor: Range 0-50°C, accuracy ±0.1°C
- Electrical Conductivity (EC) Sensor: Range 0-2000 μS/cm, accuracy ±1% FS
- Dissolved Oxygen (DO) Sensor: Optical type preferred, Range: 0.1 to 20 mg/L

Supporting Tools

- Handheld GPS and Topographic Survey Equipment: For location mapping and site characterization
- Telemetry System: GSM/GPRS or satellite communication
- Solar Panels and Batteries: For remote power supply
- Field Tablet/Smartphone: With sensor integration apps

PROCEDURE: SITE SELECTION, INSTALLATION AND DATA COLLECTION

SITE SELECTION CRITERIA

Spring Monitoring Locations

- Ensure stable channel geometry for accurate flow measurement
- Consider accessibility for regular maintenance visits
- Avoid areas prone to flooding, landslides, or excessive sedimentation
- Select sites with community relevance and involvement
- Prioritize perennial springs with significant discharge variation

Weather Station Placement

- Should be devoid of canopy cover and electricity distribution lines while being situated in open spaces to facilitate unhindered exposure to wind, rainfall, and sunlight
- The site should be true representative of the springshed's micro-climatic conditions
- Consider elevation gradients for representative coverage
- Secure location with minimal risk of vandalism or animal disturbance
- Consider solar exposure for power requirements

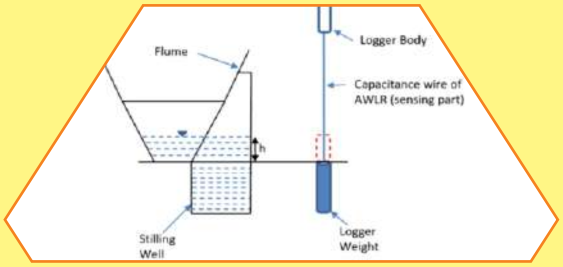
INSTALLATION METHODOLOGY

Flume Installation Protocol

1. Prepare the channel by removing debris and irregularities
2. Construct a level base platform (<2% slope) using concrete or compacted soil
3. Install the flume with its approach section aligned with flow direction
4. Ensure the flume is perfectly level in both longitudinal and transverse directions
5. Seal all gaps between flume and channel banks to prevent bypass flow
6. Stabilize upstream and downstream channel sections to prevent erosion
7. Install staff gauge or reference marks for manual measurements
8. Construct and secure a stilling well adjacent to the flume
9. Install water level sensor in the stilling well at prescribed location
10. House data logger in weatherproof, lockable enclosure nearby
11. Program data logger for desired recording interval (typically 30 minutes to 1 hour)
12. Calibrate the system using volumetric measurements for verification

Weather Station Installation

1. Clear and level the installation site, ensuring good drainage
2. Install mounting pole/tripod with secure anchoring to withstand the dynamic forces exerted during high wind events
3. Mount Rain Gauge on separate pole at standard height of 1.5 m above ground
4. Install temperature and humidity sensors in radiation shields at 2 m height
5. Mount wind sensors at standard height of 10 m (or 2-3 m for simplified stations)
6. Orient wind vanes correctly to geographic north
7. Install solar radiation sensors on horizontal mount without shading and clean southern exposure (sites in Northern Hemisphere). Account for valley shading and ridge line obstructions.
8. Mount data logger and telemetry system in weatherproof enclosure
9. Connect solar panel and battery backup system
10. Program data collection intervals (typically 30 minutes to 1 hour)
11. Calibrate all sensors according to manufacturer specifications
12. Secure the site with appropriate fencing if necessary



DATA COLLECTION PROTOCOL

Automated Data Collection

1. Program data loggers for appropriate sampling intervals:
   - ✓ Spring discharge: 30 minutes to 1 hour intervals
   - ✓ Meteorological parameters: 30 minutes to 1 hour intervals
2. Configure telemetry systems for daily data transmission
3. Establish automated quality control flags for data validation
4. Set up centralized data server with backup systems
5. Implement automatic notification system for equipment malfunction
6. Configure dashboard for real-time data visualization

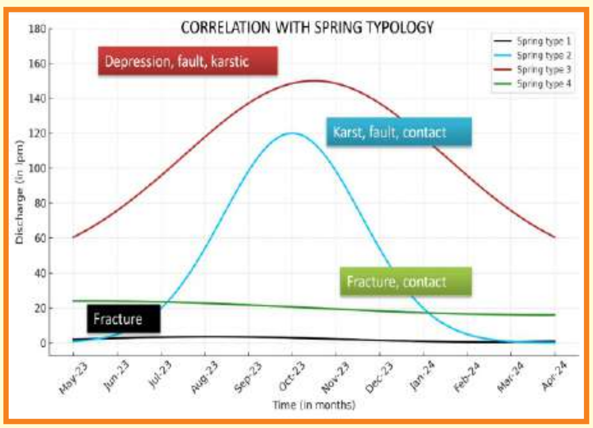
DATA ANALYSIS AND INTERPRETATION

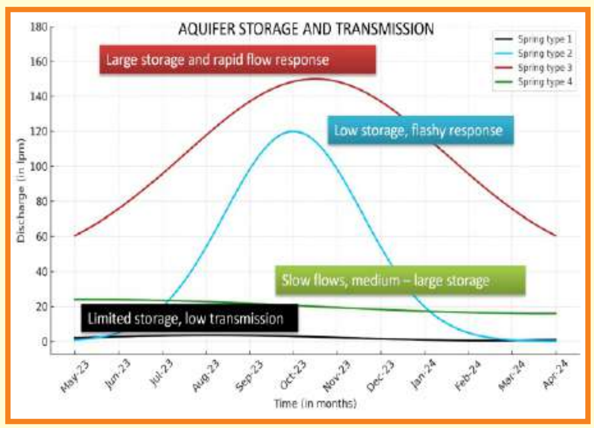
DATA PROCESSING AND QUALITY CONTROL

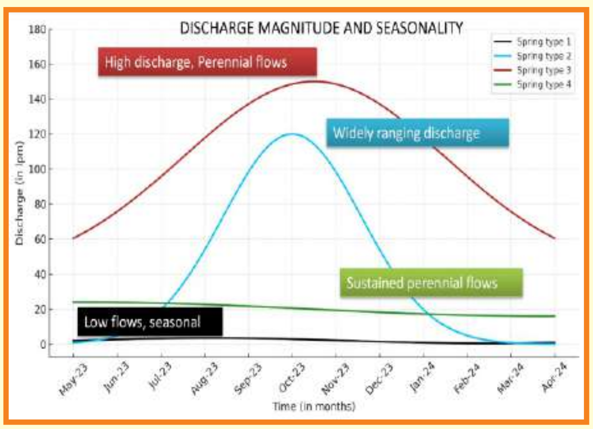
1. Download and collate data from all monitoring stations
2. Screen for outliers, data gaps, and instrument errors
3. Apply quality control flags according to standardized protocols
4. Correct for known sensor biases and seasonal drifts
5. Fill data gaps if any using appropriate statistical methods where justifiable
6. Convert raw stage data to discharge using established rating curves/flume discharge equation
7. Calculate derived parameters (evapotranspiration, water balance components)

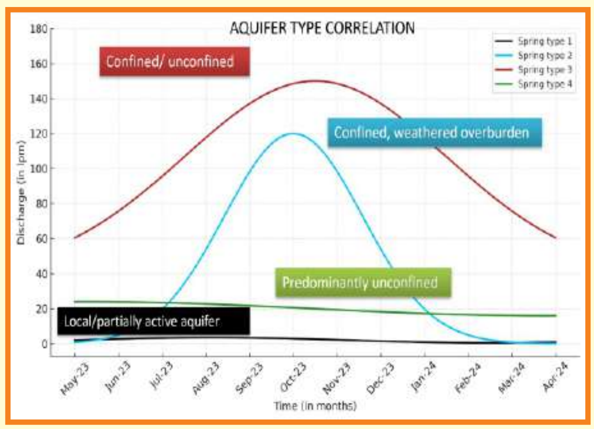
ANALYSIS METHODOLOGIES

1. Generate time series of spring discharge, rainfall, and other key parameters
2. Establish rainfall-discharge relationships through correlation, flow duration and regression analysis
3. Perform recession curve analysis to determine aquifer characteristics
4. Evaluate seasonal and interannual variability in spring discharge and correlate water quality with flow conditions
5. Integrate Hydro-meteorological analysis results with geological analysis to characterize the springshed.



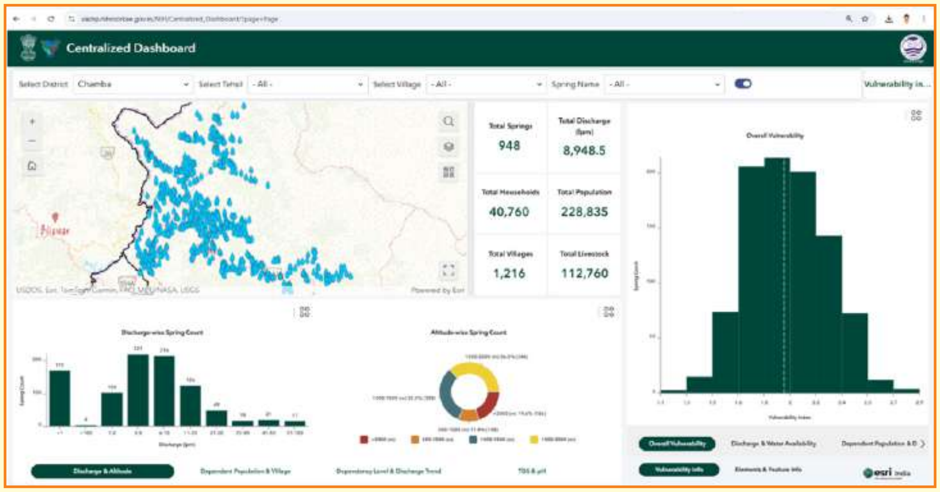






DATA INTEGRATION AND VISUALIZATION

1. Establish a centralized database for all monitoring data and implement cloud-based access for authorized users
2. Develop interactive dashboards for real-time data visualization
3. Create standardized reporting templates for different stakeholders and generate automated alerts for threshold exceedances
4. Design GIS integration for spatial analysis of monitoring data
5. Develop mobile applications for field data collection, reporting and cloud relay



MAINTENANCE AND CALIBRATION SCHEDULE

Sl.No	Maintenance Activity	Frequency	Responsible Personnel
1	Visual inspection of all field installations	Bi-weekly	Field Technician
2	Calibration of water level sensors	Monthly	Hydrologist
3	Data download and backup (for non-telemetry systems)	Monthly	Hydrometeorologist
4	Verification of stage-discharge relationships	Quarterly	Hydrologist
5	Cleaning of solar panels and external equipment	Quarterly	Field Technician
6	Complete system maintenance and battery replacement	Bi-annual	Hydrologist/Hydrometeorologist Instrumentation Specialist Third Party Vendor
7	Calibration of rain gauges and weather sensors	Bi-annual	Hydrometeorologist
8	Comprehensive calibration of all sensors	Annual	Instrumentation Specialist/ Hydrologist
9	Software updates and telemetry system check	Annual	Data Analyst
10	Review and upgrade of monitoring parameters if needed	Annual	Team Lead
11	Equipment repair and replacement	As needed	Instrumentation Specialist/ Vendor
12	Maintenance of secure data backup systems	As needed	Data Analyst
13	Training refreshers for field personnel	Annual	Team Lead

CHAPTER 3

SPRINGSHED/RECHARGE AREA IDENTIFICATION

DEFINITION
&
SCOPE

TEAM MEMBERS
AND
RESPONSIBILITIES

TOOLS AND
EQUIPMENT
REQUIREMENT

PROCEDURE:
RESEARCH,
SURVEY &
DATA COLLECTION

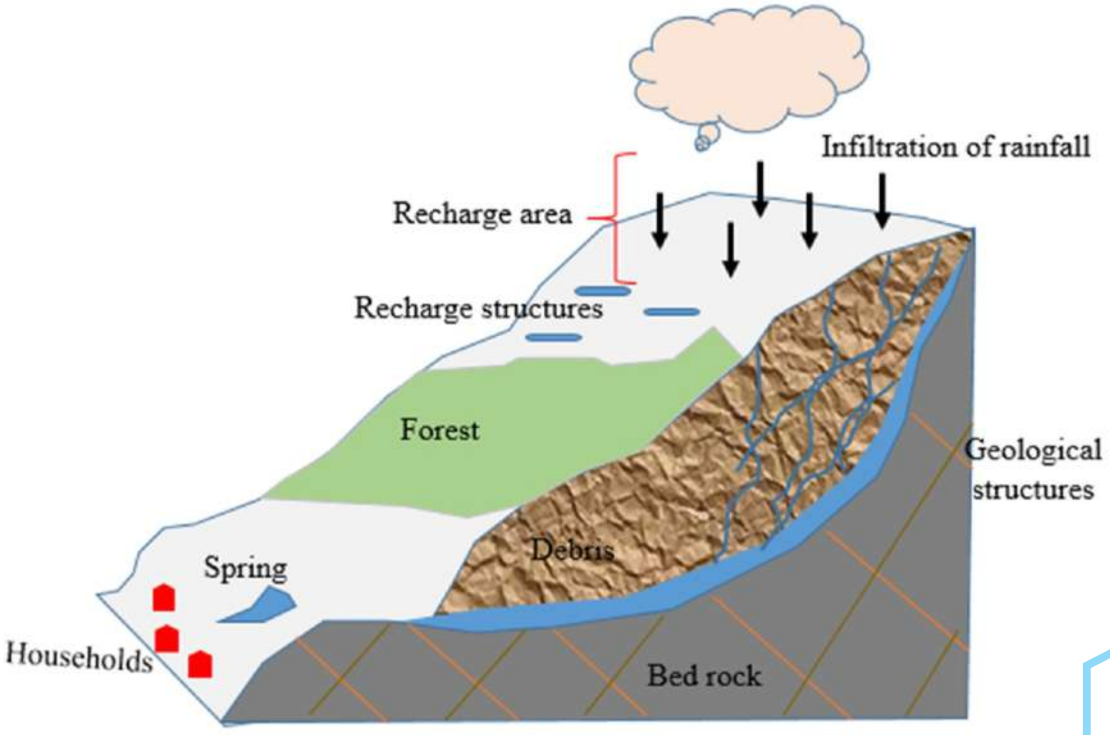
DATA ANALYSIS
AND
INTERPRETATION

DEFINITION & SCOPE

This SOP describes the process for identifying the springshed and recharge area of a spring, focusing on the interaction between geology, land use, topography, and aquifer geometry. Understanding these factors is vital for informed decision-making to protect and restore mountain springs.

A springshed is the land area where rainfall infiltrates, replenishes groundwater, and subsequently contributes to spring discharge. Typically, a springshed links geographically distant units, including the following:

- ✓ A particular spring (outlet) or cluster of springs,
- ✓ The underlying aquifers (or transition zone) from which these spring emerge, and
- ✓ The patches of land (recharge area) where rainwater gets infiltrated and contributes to the aquifer, which feeds these springs.



TEAM MEMBERS AND RESPONSIBILITIES

Hydrogeologist

- ✓ Investigates the hydrogeology, including rock types, structures, streams, and spring typology within the springshed.
- ✓ Creates geological cross-sections and analyses the orientation of geological structural planes to evaluate groundwater movement and storage.
- ✓ Delineates the springshed boundary by assessing the configuration of structures, fracture density, aperture, and persistence.
- ✓ Creates conceptual layouts and visualizations using Google Earth imagery.
- ✓ Collaborates with the GIS Specialist for advanced spatial data analysis and sharing of results.

GIS Specialist

- ✓ Manages spatial data and mapping, including plotting the orientation of geological planes and performs a spring inventory.
- ✓ Identifies potential recharge zones within the defined springshed boundary.
- ✓ Uses GIS analysis to delineate sites for effective groundwater recharge.

Hydrochemist

- ✓ Examines the physical and chemical properties of spring water and local water sources.
- ✓ Analyzes the relationship between water quality and underlying geological formations.

TOOLS AND EQUIPMENT REQUIREMENT

FIELD INSTRUMENTS

GPS/Mobile Device with A-GPS

- ✓ For geotagging and location mapping.

Geological Survey Tools

- ✓ Brunton Compass (or Rocklogger app)
- ✓ Geological Hammer, Lense
- ✓ Base maps (Topographic Sheet, Google Map, Geological Map)
- ✓ Field diary, Scale/Protractor, Pen/pencil etc.

Flow Measuring Devices

- ✓ Flumes
- ✓ Weir/ V-notch
- ✓ Graduated bucket and stopwatch, etc.

Water Testing Field Kit

- ✓ **Physical Parameters**: Colour, odour, taste, pH, electrical conductivity (EC), total dissolved solids (TDS), dissolved oxygen (DO).
- ✓ **Chemical Parameters**: Alkalinity, major anions, and cations.

SOFTWARE REQUIREMENTS

Spreadsheet Software

- ✓ For data curation and analysis:
  Microsoft Excel, LibreOffice Calc, Google Sheets, etc.

Geographic Information System (GIS) Software

- ✓ For Thematic map preparation (Geologic, Topographic, Soil, LULC, etc.) and spatial analysis:
  Google Earth Pro, QGIS, MapWindow, ArcGIS Pro, etc.

Tools for Analysing Water Quality

- ✓ GW_Chart, AquaChem, etc.




PROCEDURE: RESEARCH, SURVEY & DATA COLLECTION

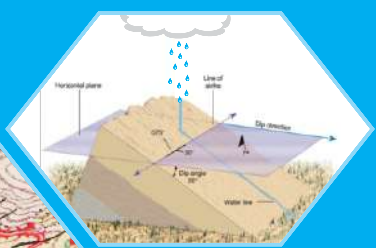
PRELIMINARY RESEARCH AND PLANNING

Data Mining

- ✓ Gather information from existing literature and online resources.
- ✓ Utilize platforms such as BHUVAN, BHUKOSH, EarthExplorer, and Google Earth Pro for spatial and hydrological insights.
- ✓ Collect historical data on spring flow and rainfall trends.

Initial Mapping

- ✓ Use secondary data to develop a base map of the spring and its surrounding area.



FIELD SURVEY AND DATA COLLECTION

GPS Data Collection

- ✓ Record GPS coordinates of the spring outlet and all data collection points.

Geological Observations

- ✓ Identify and record the material type (e.g., consolidated/unconsolidated).
- ✓ Document planar features such as faults, bedding, joints, and fractures, including their attributes like dip direction, dip amount, and strike direction in relation to the geographic slope (e.g., escarpment, dipslope).
- ✓ Record linear features (e.g., lineaments) along with their attributes.

Spring Discharge Measurement

- ✓ Use a suitable method to measure the flow rate.
- ✓ Conduct measurements at periodic intervals (fortnightly or monthly).
- ✓ Maintain a regular record of the data.

Water Quality Analysis and sampling

- ✓ Assess the quality of spring water and nearby water bodies.
- ✓ Perform physical, chemical, and biological analysis as required.
- ✓ Collect water sample with proper labelling for lab analysis.

Community Interaction

- ✓ Engage with the local community to understand seasonal variations in spring discharge.
- ✓ Gather insights on land use changes, rainfall/snowfall trends, and their impact on spring flow.
- ✓ Document key observations related to water quality and quantity.

POINTS TO CONSIDER DURING FIELD SURVEY AND DATA COLLECTION

Geological Information

- ✓ Collect geological data from a minimum of three sites near the spring.
- ✓ If rock exposures are not available near the spring, identify at least three exposures around the hill where the spring originates.

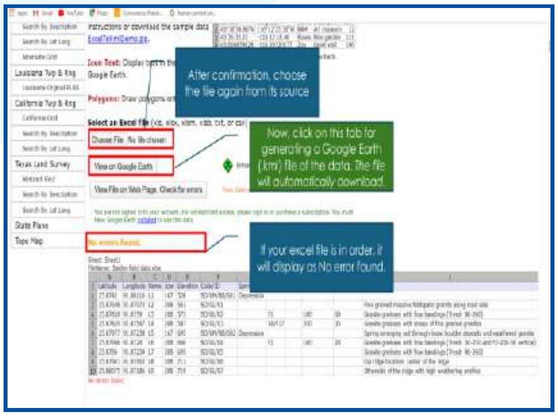
Water Testing

- ✓ Follow standardized protocols for water testing in the field.
- ✓ Regularly calibrate the water testing kit using standard buffer solutions.

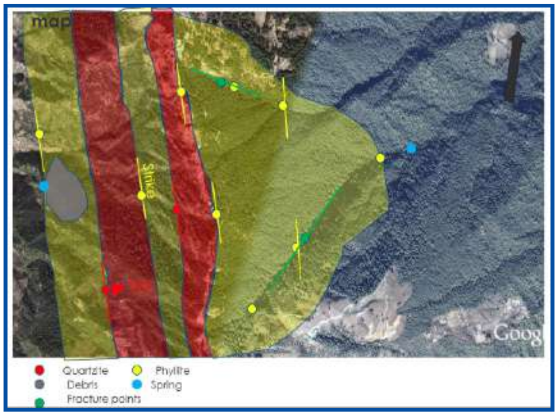
DATA ANALYSIS

Geological Investigation

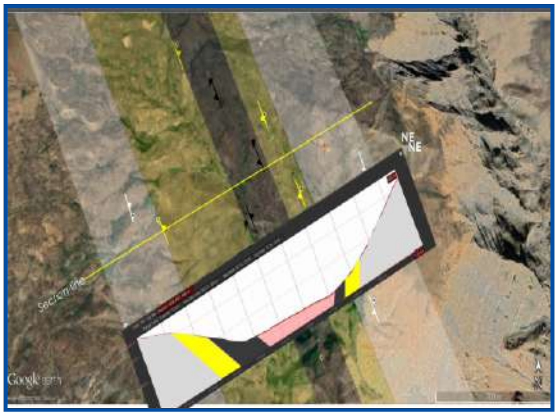
- ✓ Enter all geological and structural data with coordinates into an Excel sheet, then convert the file to KML format and open it in Google Earth for data visualization



- ✓ Plot the data to identify hydrogeological contact boundaries on the map, using GIS tools for greater accuracy. Ensure dip and strike symbols follow the right-hand rule and are oriented correctly with respect to geographic north.

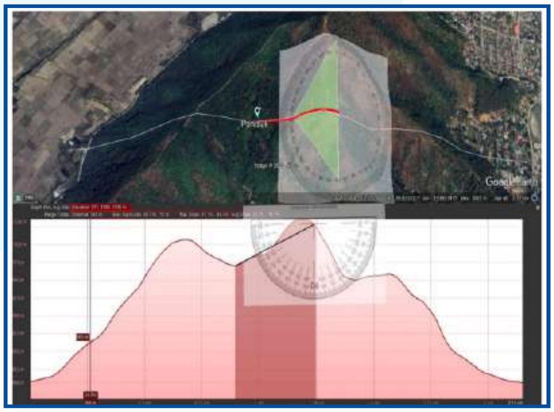


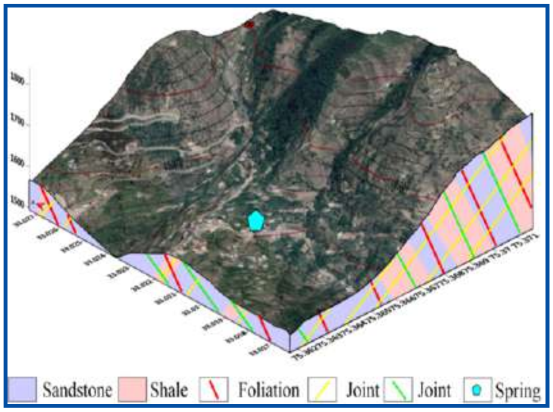
- ✓ Define the section line direction perpendicular to the strike direction of lithounits.



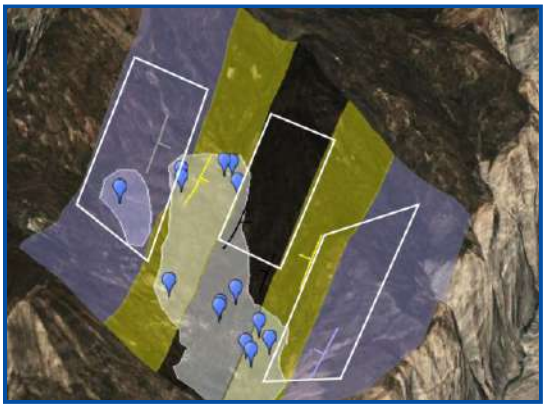
- ✓ Identify the top three fracture planes from the Excel sheet based on spacing and opening for plotting.
- ✓ Establish the relationship between the dip direction of the structural planes and the slope aspect, which facilitates surface water accumulation for recharge and its movement along the dip towards groundwater discharge as a spring .

- ✓ Draw the dip angle from the spring location to the surface and identify where the dip line intersects. Mark this point on Google Earth, indicating the springshed boundary for the plane contributing to the spring's recharge. Repeat for the other two planes, with the springshed boundary defined by the three markers.
- ✓ These contributing planes play a crucial role in determining the recharge dynamics of the spring system.
- ✓ Vertical infiltration planes are also thought to be important in the process of groundwater recharge.
- ✓ The spatial extent of these contributing planes is conceptualized and overlaid on google earth imagery to delineate the spring recharge zone.
- ✓ Develop a 3D conceptual model using the geologic data observations.





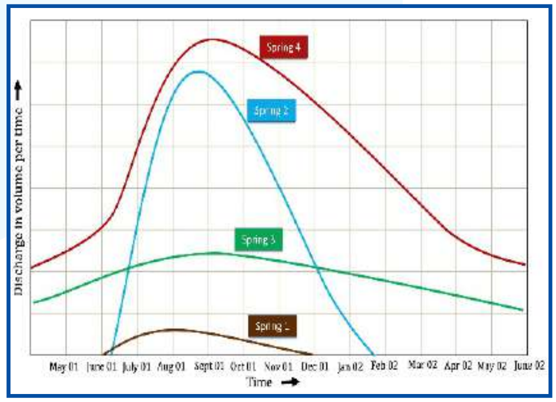
- ✓ Overlay land use, land cover, and slope maps to identify microlocations within the recharge zone and plan interventions within the springshed boundary.



Hydrological Investigation

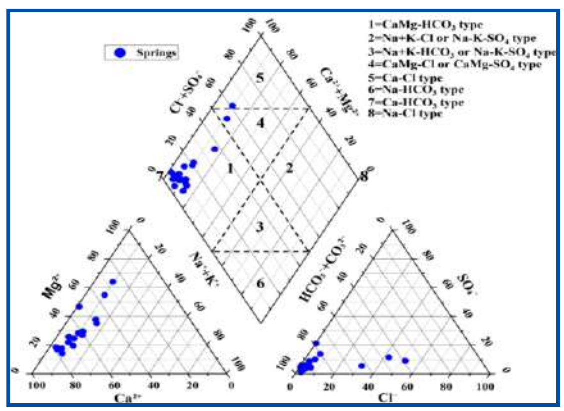
- ✓ Discharge is the key parameter in spring hydrology, as it reflects the combined influence of various visible and invisible processes affecting the overall water yield.
- ✓ Aquifer characteristics, such as storativity and transmissivity, can be inferred from different hydrograph patterns.

- ✓ These derived insights serve as valuable supplements for conducting efficient geological investigations in targeted areas.



Geochemical Analysis

- ✓ Each spring water has distinct physical characteristics and chemical properties.
- ✓ These properties are influenced by factors such as: Atmospheric precipitation, mineralogy of rocks along the flow path, residence time of water in the aquifer, topography of the region, and climatic conditions.
- ✓ The chemical processes and the evolution of the groundwater in the aquifers due to the residence and the flow can be evaluated using the hydrochemical facies.



Note: The accuracy of the identification of the recharge area and springshed boundary fully depends on how effectively the inputs from the geological, hydrological and, geochemical and community sources have been integrated by the investigators. It is recommended that investigators explore all these analyses carefully and cross-check with the other investigators. In some special cases where the recharge mechanism is complicated, it is recommended to perform isotope analysis for the identification of the recharge source and its altitude.

CHAPTER 4

SPRINGSHED TREATMENT MEASURES

SPRING INVENTORY

SPRINGSHED TREATMENT

SPRING IDENTIFICATION

SPRINGSHED TREATMENT

TREATMENT METHODOLOGY 1

TREATMENT METHODOLOGY 2

PRECAUTIONS

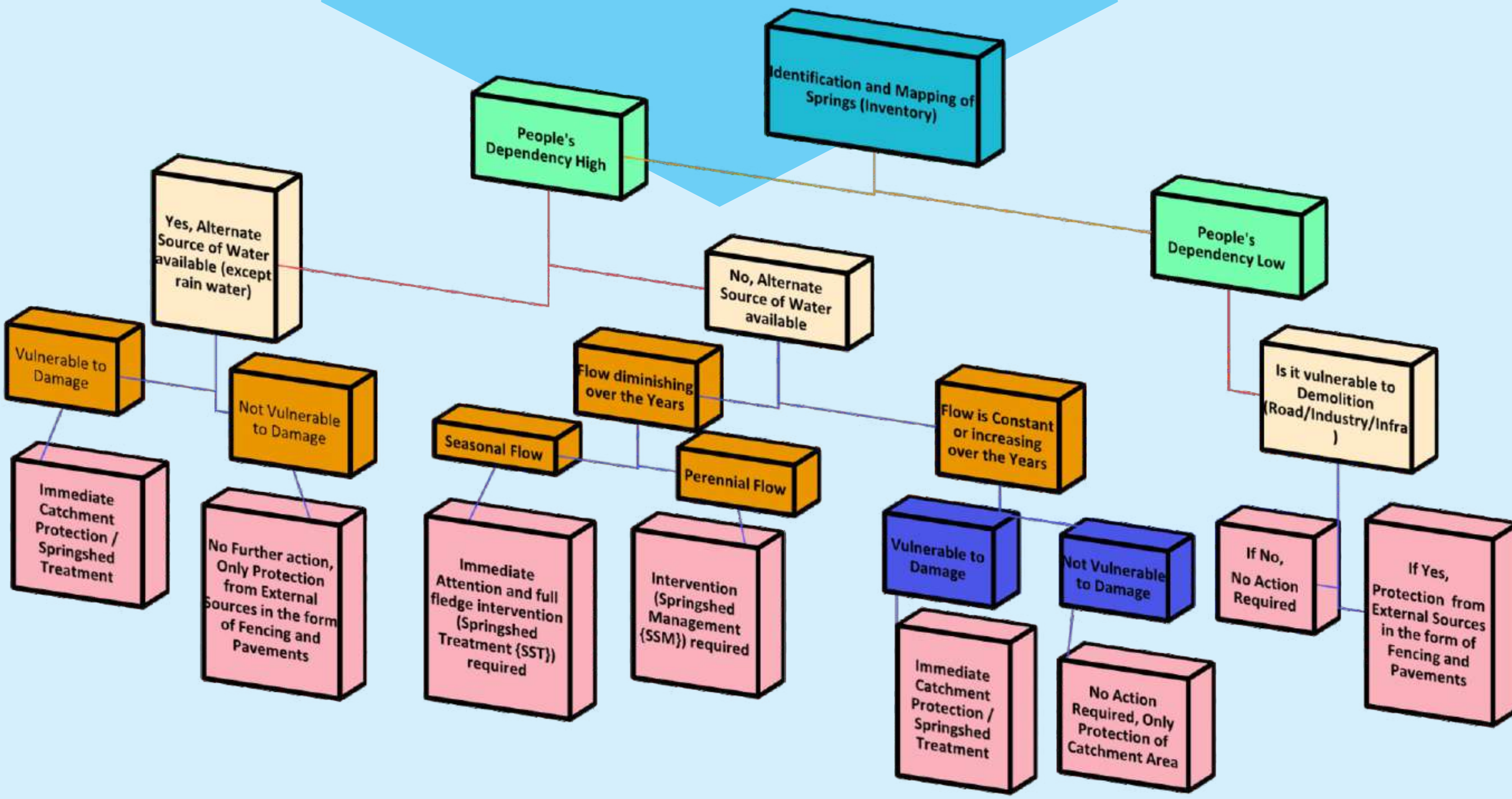
SPRING INVENTORY

- Basic inventory & Mapping as per the Protocol given in Chapter-1
- Validation of its dependency.
- Account for other sources of potable water in that area.
- What is the Water Quality, is it potable as per norms?
- Consistency of flow over the years.
- Is the Spring vulnerable?
- Identification of its Recharge Area
- Is intervention required? If Yes, is it feasible?
- Type of intervention required!
- Precautions.

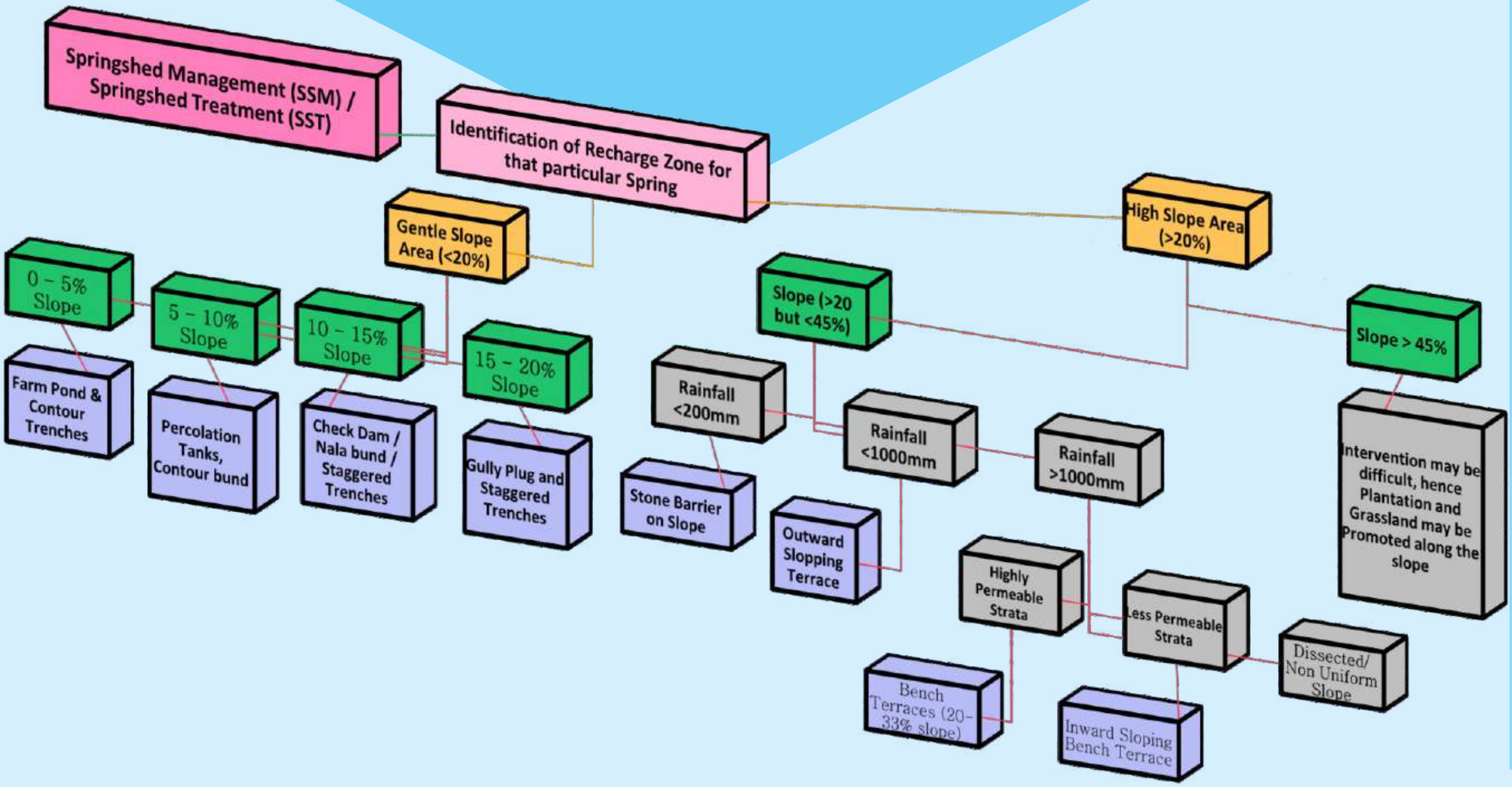
SPRINGSHED TREATMENT

- Demarcation of Its Recharge Area. The area may not be in near vicinity.
- Ownership of the recharge area.
- Validation of recharge worthiness.
- Vulnerability of anthropogenic activity in the recharge area and its way out.
- Finalization of springshed treatment based on the Location, Slope, Gradient, Soil Cover, Soil Type, expected Runoff, Rainfall etc. of the recharge Area.

SPRING IDENTIFICATION



SPRINGSHED TREATMENT



TREATMENT METHODOLOGY

1. VEGETATIVE & SOIL MOISTURE RETENTION MEASURES

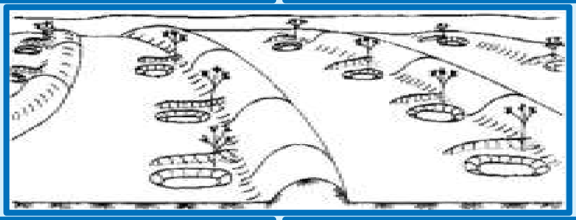
- *Reduces Surface runoff*
- *Increasing retention time*
  Increases Water percolation.
- *Traps Pollutants.*
- *Increases Soil Infiltration*
- *Soil Moisture retention*
- *Slope stabilization*
- *Stope sheet erosion.*

Vegetative Measures

- Contour Cultivation.
- Strip Cropping.
  - Contour strip, Field strip, Buffer strip, Wind strip
- Tillage Practice.
  - Milch Tillage, Vertical Mulching, Minimum Tillage, Conventional Tillage,Listeening
- Soil Management Practice
- Supporting Practice

Soil Moisture Measures

- Plantation of Local and native Shrub, Herbs, Grass, and small trees.
- Combination of these are better than opting for one pure type.
- The plantation of Shrubs, Herbs and Grass can be done along the contours.



TREATMENT METHODOLOGY

2. ENGINEERING MEASURES

- To be implemented in Flat or Moderate slope (<45%) areas.
- To be selected based on available Land, its type, Rainfall, Slope, Soil etc of the area

Flat Land / Gentle Slope

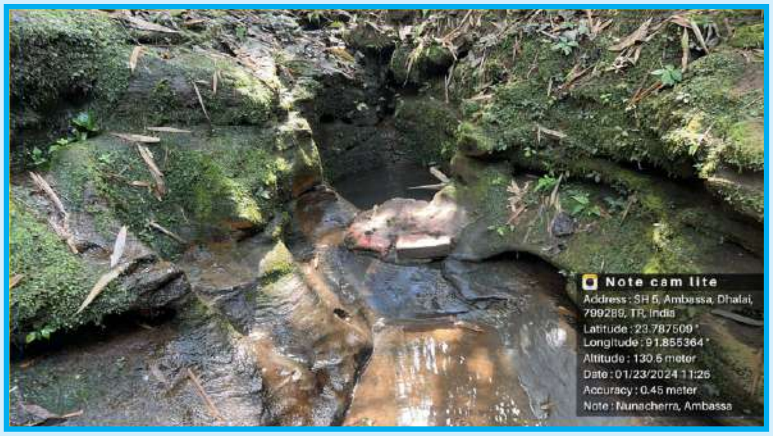
- Farm Pond
- Percolation Pond
- Check Dam
  - Brushwood Check Dam
  - Loose Boulder Check Dam / Gabions
- Gully Plug
- Nalabund

Moderate Slope (<20%)

- Trenching
  - Contour
  - Staggered
- Terraced Field
  - Diversion
  - Retention
  - Bench Terrace
- ContourBunding
  - Broad or Narrow
  - Side or Lateral
  - Supplemental
  - Marginal or Shoulder

PRECAUTIONS

- ➢ Attention may be given to important factors like Slope, Gradient, Soil Cover, Soil Type, expected Runoff, Rainfall etc. for selection on interventions/measures for Springshed Treatment.
- ➢ Engineering intervention should be avoided in Landslide or erosion prone areas. Vegetative measures may be adopted.
- ➢ Engineering intervention should be avoided in high slope area. Vegetative measures may be adopted.
- ➢ Grazing and other Anthropogenic activities must be avoided in the Springshed (Spring Recharge) areas.
- ➢ Deforestation or felling of trees must be avoided.
- ➢ New constructions, shifting cultivation, use of pesticide, fertilizers etc. in the recharge area should be prohibited.
- ➢ Waste dumping and latrines/Sanitary tank should avoided within 30m upstream or downstream of a spring
- ➢ Quarrying of sand/rocks etc. should be banned in catchment area.
- ➢ Maintenance of all interventions must be ensured for both engineering or vegetative.



CHAPTER 5

IMPACT ASSESSMENT: SOCIO-ECONOMIC AND HYDROLOGICAL

INTRODUCTION

DEFINITION & SCOPE

BASELINE SURVEYS

HYDROLOGICAL IMPACT ASSESSMENT

ECOLOGICAL IMPACT ASSESSMENT

SOCIO-ECONOMIC IMPACT ASSESSMENT

IMPLEMENTATION TIMELINE

INTRODUCTION

Spring water is a critical resource for many communities in mountainous and hilly regions, providing water for domestic use, irrigation, and sustaining local ecosystems. The Springshed Management Programme (SSM) aims to rejuvenate springs through scientific interventions. Impact assessment is essential to evaluate the effectiveness of these interventions and ensure sustainable water security for communities.

BACKGROUND & SCOPE

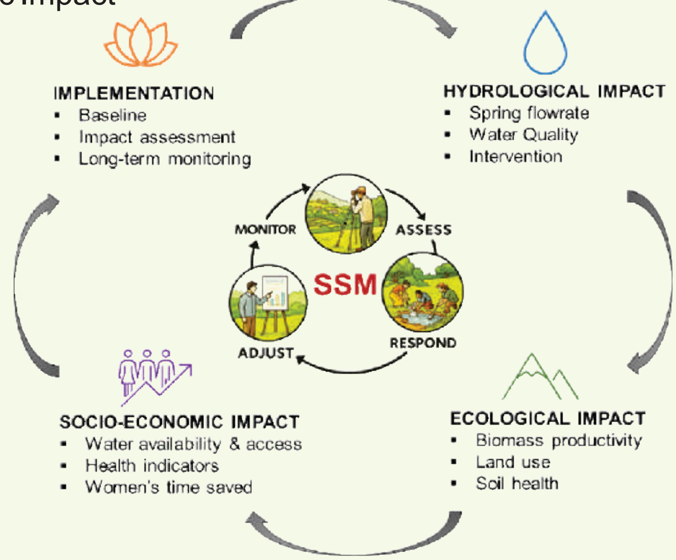
Impact assessment, though the final step in a Springshed Management Programme (SSM), holds utmost importance in the entire process of spring rejuvenation. It extends beyond financial auditing to enable proper monitoring, ensure community involvement at every stage, and allow for adjustment of site-specific activities by mapping interim outcomes against implemented measures.

The SSM program delivers both short-term and long-term benefits.

Short-term benefits	Long-term benefits
• Increased biomass productivity • Reduced soil erosion • Improved groundwater recharge • Enhanced soil moisture • Increased spring discharge	• Improved spring water quality • Healthy spring system • Enriched ecosystem services • Prosperous communities

This SOP provides a standardized framework for conducting impact assessment of SSM programmes. It covers the process of baseline data collection, analysis, and measurement of SSM programme impacts across three key areas:

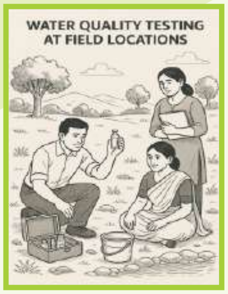
- Hydrological Impact
- Ecological Impact
- Socio-Economic Impact



BASELINE SURVEYS

Before initiating any project, a baseline survey must be conducted to assess the initial conditions of the springshed area. Key parameters include:

- Spring discharge
- Spring water quality
- Agricultural and biomass productivity
- Socio-economic status



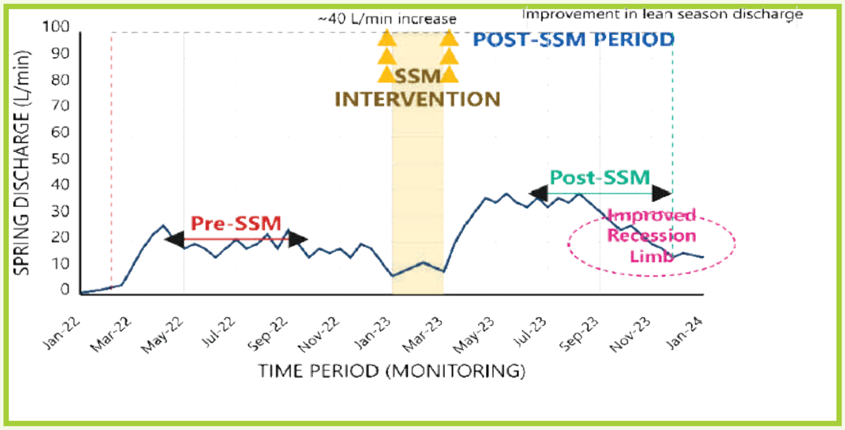
The baseline survey provides a reference for mid-term and end-term impact of the implementation of SSM interventions.

HYDROLOGICAL IMPACT ASSESSMENT

Spring discharge range	Primary method	Measurement frequency
<2 lpm	Volumetric (1 L – 2 L graduated container)	Bi-weekly/Weekly
2-5 lpm	Volumetric (5 L -10 L graduated container)	Daily/Weekly
5-25 lpm	Volumetric (10 L - 20 L graduated container)/ 90° V-notch weir (for > 10 lpm	Daily/Weekly
25-100 lpm	90° V-notch weir	Daily/Weekly
>100 lpm	Flumes	Daily/Weekly

Spring Flow Variability:

- **Visual inspection:** Comparing the hydrograph of pre- and post- SSM gives a fair representation of the impact of the SSM activities at first hand. Investigator should be more focused on the recession limb of the hydrograph as it is the true representation of the aquifer characteristics which govern the yield of the aquifer that feeds the spring.



Spring Hydrograph Analysis: Pre- and post- SSM Implementation

- **Variability Indices calculation**

Variability Indices	Formula	Classification
Index of Variability (I_v)	Q_{max}/Q_{min} Q_{max}= Maximum discharge Q_{min}= Minimum discharge	$I_v < 2$: Constant/steady spring (Class I reliability) $2 \le I_v < 5$: Moderately variable spring (Class II reliability) $5 \le I_v < 10$: Variable spring (Class III reliability) $I_v \ge 10$: Highly variable spring (Class IV reliability)
Meinzer Variability Index (V)	$[(Q_{max}-Q_{min})/Q_{av}] \times 100$ Q_{av}= Average discharge	V < 25%: Constant spring (High storage capacity) 25% ≤ V < 50%: Sub-constant spring 50% ≤ V < 100%: Variable spring V ≥ 100%: Highly variable spring (Limited storage)
Discharge Variability Ratio (DVR)	$Q_{10\%}/Q_{90\%}$ $Q_{10\%}$ = high flow exceeded 10% of the time and, $Q_{90\%}$= low flow exceeded 90% of the time	1.0 ≤ DVR < 2.5: Extraordinarily balanced spring 2.6 ≤ DVR < 5.0: Well balanced spring 5.1 ≤ DVR < 7.5: Balanced spring 7.6 ≤ DVR < 10.0: Moderately unbalanced spring DVR >10.0: Highly unsteady DVR = ∞: Ephemeral spring

Note: Daily discharge measurements are required for accurate variability indices calculation. If daily measurements are not feasible, ensure consistent measurement intervals.

✓ **Impact Assessment:** Variability to be measured before and after implementation of SSM. The purpose of analyzing variability employing three different methods is to avoid any biases adhered to a particular variability estimation method. Reduction in variability indicates increased reliability of the spring discharge and indicates the success of the interventions

Depletion Time:

✓ **Definition:** Depletion time represents how long a spring takes to empty its aquifer storage once it gets recharged. It's a key indicator of spring sustainability during dry periods. Any spring can be considered reliable source of water in a particular region if depletion time is more than the driest spell of that region.

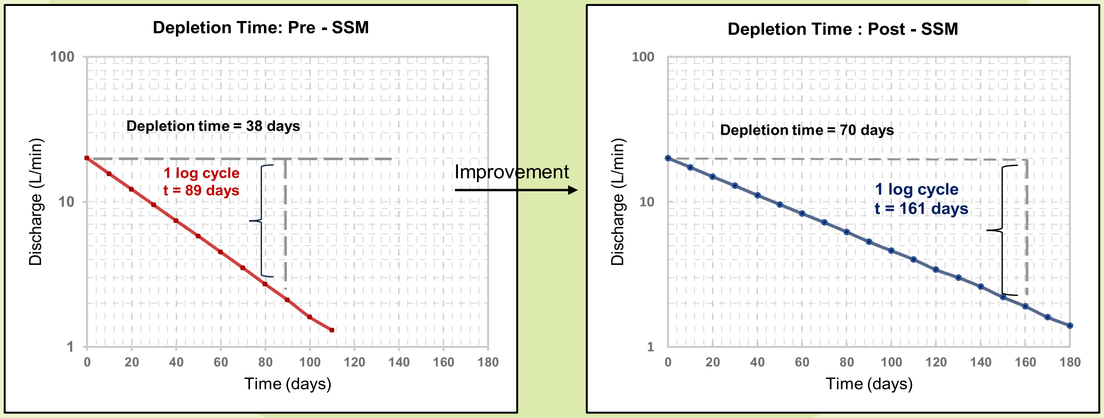
✓ **Objective:** To Increase depletion time to enhance spring sustainability during dry spells.

✓ **Methodology:**

i) Plot the recession part of the spring hydrograph on a semi log paper (flow on a log scale)

ii) Draw a straight line through the plotted points and read the time (in days or months) it takes for discharge to drop by one log cycle.

iii) Then calculate depletion time by dividing this time value by 2.3. Figure below shows the depletion time of a spring during pre- and post- SSM project.



PRE - POST-

Depletion time = t/2.3, where t is the time for discharge to decrease by one log cycle

Note: Longer depletion time (70 days vs 38 days) indicate improved aquifer storage capacity

- ✓ **Impact Assessment:** Compare depletion time pre- and post-SSM implementation. An increase in depletion time indicates successful enhancement of the aquifer's storage capacity. A flatter recession curve after intervention shows improved spring sustainability.

Aquifer Recharge:

- ✓ **Definition:** Recharge refers to the replenishment of the aquifer feeding the spring, critical to maintaining continuous water flow.
- ✓ **Methodology:** A simple water balance approach can be used for the estimation of the aquifer recharge in one hydrological cycle.

$$AR = Q_2 t_2 - Q_1 t_1 + \int (Q\,dt) \text{ between } t_1 \text{ and } t_2$$

Where:

t_1, t_2 = instances at end of one dry season and beginning of the next

Q_1, Q_2 = spring flowrate at time t_1 and t_2

AR = aquifer recharge during the period

Q dt = Total volume of water discharged from the spring between t_1 & t_2

- ✓ **Impact Assessment:** An increase in recharge volume after SSM implementation. Improved capacity for the aquifer to store water and is evidence of successful intervention.

Recharge Coefficient (RC) Determination:

- ✓ **Definition:** It defines the part of the rainfall which contributes to the aquifer recharge (AR) i.e., AR/P (where P is precipitation)
- ✓ **Methodology:** Estimate recharge using pre- and post-SSM spring discharge and rainfall data.
  - RC = AR/P (expressed as %)
  - AR= Aquifer Recharge (volume)
  - P = Precipitation over the springshed area (volume)
- ✓ **Impact Assessment:**
  - RC < 10%: Poor recharge efficiency; intensive intervention required
  - 10% ≤ RC < 20%: Moderate efficiency; targeted intervention needed
  - RC ≥ 20%: Good efficiency; enhancement and protection recommended

Water Quality:

- ✓ **Objective:** Improve the quality of spring water, particularly when used for household purposes.
- ✓ **Methodology:** Estimate pre- and post-SSM water quality data using regular water testing.

Parameters	Methodology	Temporal frequency
Physicochemical: pH, EC, TDS temperature	Multi-parameter probe or individual parameter testing kits for field use	Quarterly or each season
Major ions: Ca^{2+}, Mg^{2+}, Na^{+}, K^{+}, HCO_3^{-}, Cl^{-}, SO_4^{2-}, NO_3^{-} etc.	Ion chromatography (IC) or titration	Quarterly
Microbiological: Total coliform, E. coli	MPN Test	Quarterly
Heavy metals (if indicated)	Mass Spectrometry (ICP-MS) or colorimetric field kits for screening	Bi-annual

- ✓ **Impact:** Improvements in water quality (BIS 10500:2012) signify success, especially in terms of reducing contaminants and ensuring safe drinking water.

ECOLOGICAL IMPACT ASSESSMENT

Ecological impacts of SSM interventions are critical indicators of overall program success. Key parameters to monitor include increased soil moisture, enhanced biomass productivity, reduced soil erosion, reduced desertification, halted biodiversity loss and improved biodiversity within the springshed area.

Parameters	Methodology	Temporal frequency
Biomass productivity	Fixed plot (1 sq.m) sampling with photo documentation	Annual (peak growing season)
Soil moisture	Time-Domain Reflectometry (TDR) or soil moisture meter at fixed points	Monthly (15, 30, 60 cm soil depths)
Soil erosion	Erosion pins or sediment collection traps	Pre and Post monsoon
Land use/land cover	Fixed-point photography + visual assessment	Annual

- ✓ **Field Tips:**
  - Mark permanent photo points for consistent before/after comparisons
  - Take measurements at the same time of day and season for valid comparisons
  - Include local community members in ecological monitoring for better engagement
- ✓ **Practical Assessment:** Compare pre-intervention and post-intervention data for each parameter. Visible improvements in vegetation cover, soil conditions, and reduced erosion are good indicators of successful ecological impacts from the SSM intervention.

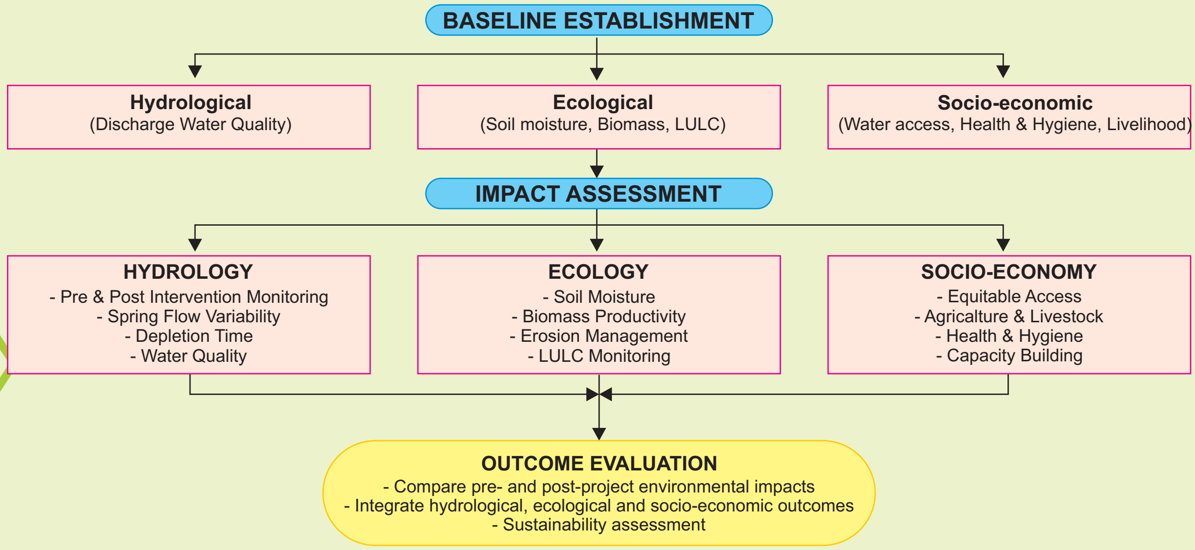
SOCIO-ECONOMIC IMPACT ASSESSMENT

Effective SSM programs create significant positive changes in community well-being. Key outcomes include increased drinking water availability and access, improved agricultural productivity, better health, and reduced women drudgery (time and effort spent by women in fetching water). These impacts can be measured through simple, practical assessment methods during pre- and post- SSM implementation.

Sl.no	Monitoring Indicators	Means of Verification
1	Per capita increased availability of drinking water	Water consumption survey, Flow measurement at collection points
2	Fodder availability and increased livestock	Household surveys, Livestock inventory and biomass assessment
3	Enhanced agriculture productivity	Crop harvesting data, Agricultural yield measurements, Cropping pattern
4	Better health indicators due to better water quality	PRAs and Health Records, Water quality testing reports
5	Reduction in the drudgery of women	Household surveys, Time-motion studies, School/training enrollment for girls and woman
6	Per capita water accessibility	Water point functionality assessment, Community mapping
7	Participation of weaker sections of society and women in institutions	Attendance and profile of attendees in village meetings, Monthly meeting register
8	No. of cadre trained in Springshed development and knowledge levels	Impact of training to be assessed, Pre/post training evaluations and skill demonstration assessments
9	Strong village level institutions - social actions, participation	Case studies on social/collective action by communities, Institutional capacity assessments
10	Roadmap for future springshed development	Consultative meeting, Impact assessment, Sustainability planning

IMPLEMENTATION TIMELINE

Assessment Phase	Timing
Baseline Survey	Prior to SSM implementation
Mid-term Assessment	1-2 years after implementation
Final Impact Assessment	3-5 years after implementation
Long-term Monitoring	Every 2-3 years thereafter



Impact Assessment methodological flow for SSM

CHAPTER 6

SOCIAL AND GOVERNANCE ASPECTS

OVERVIEW

OBJECTIVE & SCOPE

KEY STAKEHOLDERS

SOCIAL ASPECTS OF SPRINGSHED MANAGEMENT

GOVERNANCE ASPECTS OF SPRINGSHED MANAGEMENT

MONITORING, EVALUATION, AND LEARNING

CAPACITY BUILDING AND TRAINING

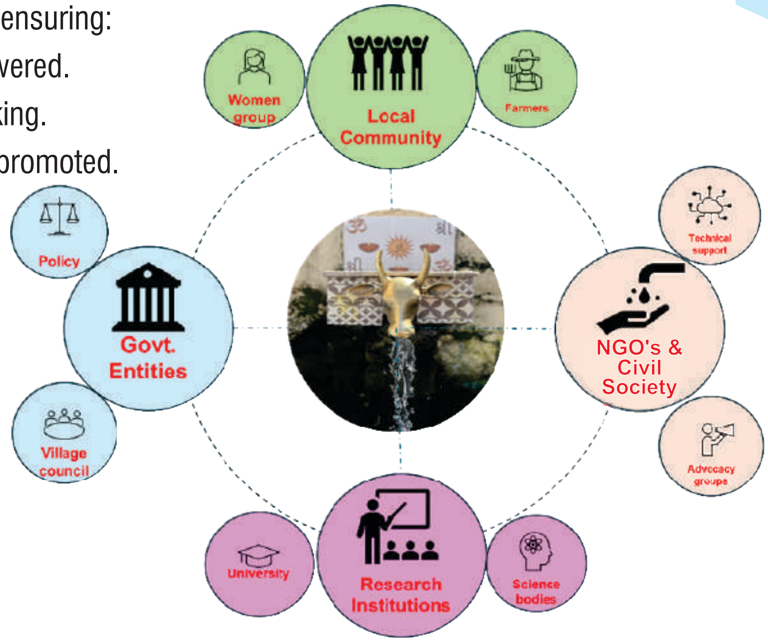
OVERVIEW

Springshed management (SSM) is the process of managing and conserving the area that contributes water to a spring for the wellbeing of the local community. In the context of India, springs are crucial for water security, especially in mountainous and hilly regions like the Himalayas, Western Ghats, Eastern Ghat and parts of central India. Effective springshed management integrates both hydrological understanding and community-driven governance structures. Besides technical interventions, effective SSM requires a deep understanding of social dynamics, traditional knowledge systems, and governance mechanisms. This SOP outlines the social and governance aspects that are critical for the sustainable of springshed management and collective stewardship.

OBJECTIVE & SCOPE

The objective of this SOP is to provide a framework for managing the social and governance aspects related to springshed management in India. This will help in ensuring:

- Communities are actively engaged and empowered.
- Local institutions are involved in decision-making.
- Equitable access to spring water resources is promoted.
- Traditional and scientific knowledge are combined for sustainable practices.
- Inclusive and participatory processes for springshed management
- Equitable access to springshed resources/ ecosystems across communities
- Community capacity building for spring stewardship
- Conflict resolution and benefit-sharing
- Integration of gender equality and social inclusion in springshed governance



Integrated Springshed Management

This SOP applies to all stakeholders involved in SSM, including local communities, non-governmental organizations (NGOs), governmental bodies, water user groups, and other local governance institutions. It focuses on the integration of social participation and governance models to enhance the conservation, equitable use, and long-term sustainability of spring ecosystems.

KEY STAKEHOLDERS

Local Communities

Primary stewards who maintain, monitor, and beneficiaries of springs; contribute traditional knowledge; participate in decision-making

Water User Groups

Monitor spring health; manage water distribution; resolve disputes; collect maintenance funds

Village Panchayats/Local Governments

Integrate springshed management into development plans; support funding; facilitate multi-stakeholder coordination

NGOs

Provide technical support; build capacity; facilitate knowledge exchange

State and Central Governments

Develop supportive policies; provide funding; align with broader water management frameworks

Research and Academic Institutions

Study spring systems; document outcomes; support evidence-based decision-making

SOCIAL ASPECTS OF SPRINGSHED MANAGEMENT

INCLUSIVE PARTICIPATION

Ensure that all community members, including women, marginalized groups, and indigenous populations, are involved in decision-making processes related to SSM.

AWARENESS PROGRAMS

Conduct workshops, training sessions, and awareness campaigns on the importance of spring conservation and the impacts of climate change, deforestation, and over-extraction.

CAPACITY BUILDING

Train community members in techniques such as water budgeting, monitoring of spring flows, and sustainable agricultural practices to maintain water balance.

KNOWLEDGE SHARING

Promote the sharing of traditional water management practices and combine them with modern scientific knowledge for holistic SSM.

KNOWLEDGE INTEGRATION

Document traditional water management practices through participatory methods and combine indigenous knowledge with scientific understanding of hydrogeology, while respecting the traditional water use rights and enhancing equity.

Community engagement and participatory management

CONFLICT RESOLUTION MECHANISMS

MEDIATION COMMITTEES

Establish local-level committees for the resolution of conflicts arising from water use, particularly in times of scarcity

EQUITABLE DISTRIBUTION

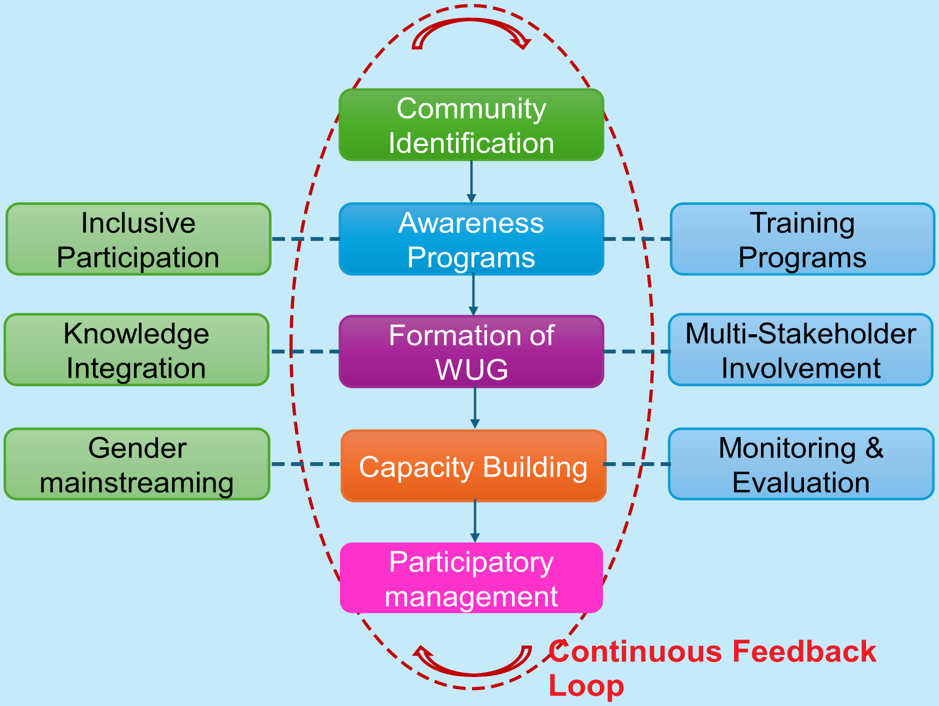
Develop guidelines for the equitable distribution of water among households and agricultural activities, prioritizing drinking water security

INTER-COMMUNITY COOPERATION

Encourage collaboration between neighboring communities that share springsheds for collective management and conflict prevention

CONFLICT PREVENTION AND RESOLUTION

Establish clear water sharing agreements during normal and scarcity periods and create a stepwise approach to dispute resolution (local mediation → committee review → external facilitation). Conduct regular review of agreements with participation of all stakeholders



Community Engagement Process for SSM

GENDER MAINSTREAMING

WOMEN'S ROLE IN MANAGEMENT

Recognize the crucial role women play in water collection and management by involving them in decision-making process, preferably in leadership positions within water user groups.

CAPACITY BUILDING FOR WOMEN

Provide specific training for women to enhance their participation in technical and decision-making processes.

GENDER-SENSITIVE POLICIES

Ensure that policies related to SSM address the specific needs and vulnerabilities of women and other marginalized groups.

GENDER-RESPONSIVE MONITORING

Collect gender-disaggregated data on participation, benefits, and outcomes and monitor changes in women's time spent on water collection, while documenting changes in women's influence in community water governance.

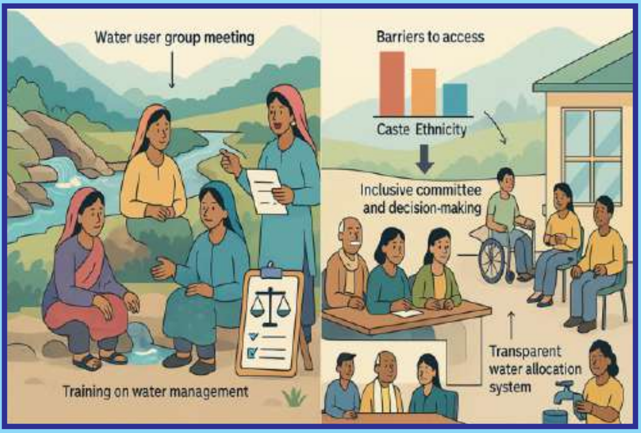
SOCIAL INCLUSION FRAMEWORK

EQUITY ANALYSIS

Map existing power dynamics and access patterns, identify barriers facing marginalized groups (caste, ethnicity, landless), assess differential impacts of spring degradation on various social groups

INCLUSIVE DESIGN ELEMENTS

Establish quotas for representation of marginalized groups in decision-making bodies; Create transparent water allocation systems based on needs rather than social status; Design infrastructure that accommodates the needs of people with disabilities; Ensure that timing and location of meetings enable participation by all groups



Gender mainstreaming and social inclusion

GOVERNANCE ASPECTS OF SPRINGSHED MANAGEMENT

INSTITUTIONAL FRAMEWORK

WATER USER GROUP FORMATION

Establish inclusive membership criteria ensuring representation across geographical locations (upstream/downstream users), social groups (caste, ethnicity, economic status), and gender balance with minimum 50% women.

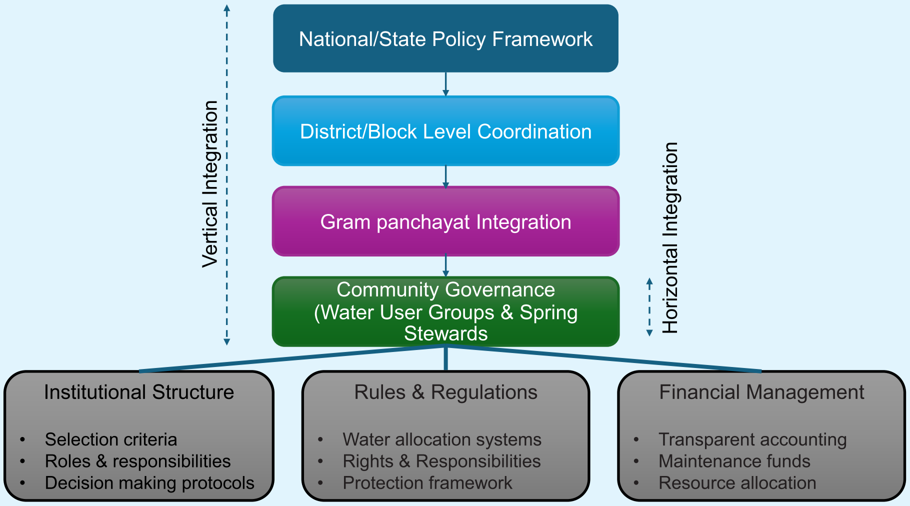
MULTI-STAKEHOLDER PLATFORMS

Facilitate platforms where local communities, Panchayats, NGOs, and government departments can come together to discuss springshed governance issues and solutions.

INTEGRATION WITH PANCHAYATI RAJ INSTITUTIONS

Ensure that springshed management is part of local governance through the inclusion of water conservation measures in Gram Panchayat Development Plans (GPDP).

Springshed governance stakeholder interaction



Governance structure for effective SSM

POLICY AND LEGAL FRAMEWORK

SPRINGSHED PROTECTION FRAMEWORK

Develop community-based regulations for: Protection of recharge areas (no deforestation, controlled grazing), Prohibition of contaminating activities (waste disposal, chemical use), Sustainable land management practices and restrictions of construction activities in critical zones.

WATER ALLOCATION SYSTEM

Create transparent water use prioritization (Drinking and domestic needs, Livestock requirements, Subsistence agriculture, Commercial uses); Develop seasonal water budgeting systems with community participation and establish special provisions for dry periods and emergencies.

RECOGNITION OF SPRINGS AS COMMON PROPERTY

Advocate for policies that recognize springs as common property resources, ensuring they are protected from privatization and overuse.

LEGAL MANDATES FOR CONSERVATION

Ensure legal frameworks are in place to mandate springshed conservation practices, such as banning harmful activities (deforestation, overgrazing, etc.) in recharge zones.

Springshed governance stakeholder interaction

INCENTIVES BASED MECHANISM (IBM) FOR SUSTAINABLE MANAGEMENT

Create government schemes that provide financial or non-financial incentives to communities and individuals who actively participate in springshed conservation efforts.

RIGHTS AND RESPONSIBILITIES FRAMEWORK

Clearly document water access rights for all users and define corresponding responsibilities for conservation and maintenance, create balance between traditional rights and equitable access while developing mechanisms to address changing needs and conditions.

MONITORING AND ACCOUNTABILITY

WATER FLOW MONITORING

Establish a community-based system for monitoring spring flow rates and water quality using both traditional methods and modern technology.

REPORTING AND TRANSPARENCY

Ensure transparent reporting mechanisms where community members can access information related to water availability, usage, and any challenges in springshed management.

THIRD-PARTY AUDITS

Advocate for policies that recognize springs as common property resources, ensuring they are protected from privatization and overuse.

Spring Water Quality Monitoring

FINANCIAL MANAGEMENT AND SUSTAINABILITY

FUNDING MECHANISMS

Secure funding through tailored government schemes for spring rejuvenation and springshed management. Additionally, involve NGOs and corporate social responsibility (CSR) funds.

FINANCIAL MANAGEMENT

Create transparent accounting systems accessible to all community members and establish collective decision-making on resource allocation. Also develop annual budgeting processes tied to maintenance and conservation plans.

INFRASTRUCTURE MAINTENANCE AND CAPACITY BUILDING

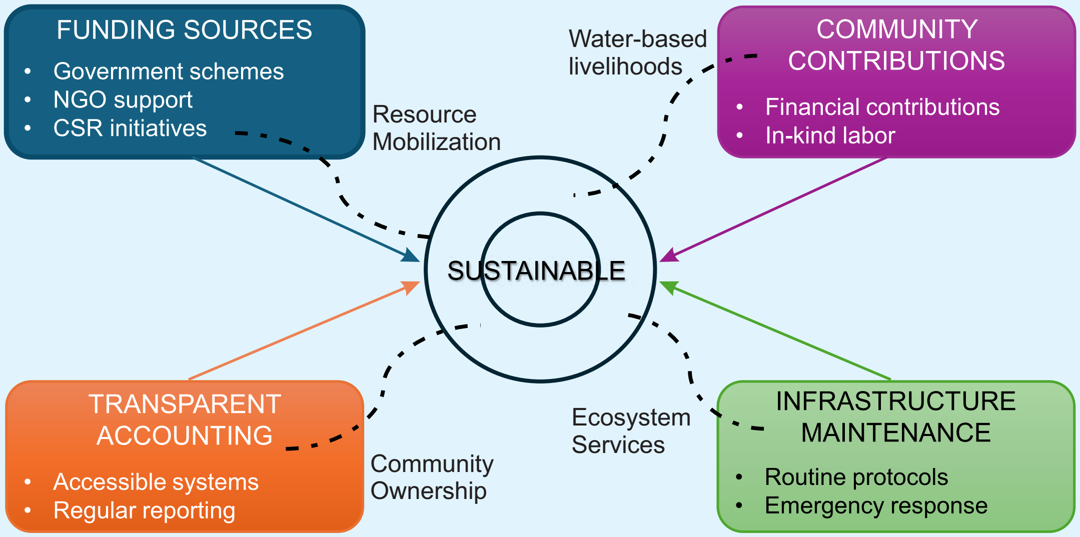
Develop clear protocols for routine maintenance and create emergency response procedures for infrastructure damage. Establish responsibility rotation systems among user groups and document all maintenance activities and costs.

COMMUNITY CONTRIBUTIONS

Encourage voluntary community contributions, either financial or in-kind (e.g., labor), to enhance the ownership and sustainability of springshed management practices.

COST-BENEFIT SHARING

Develop fair mechanisms for sharing the benefits and costs of springshed management, ensuring that all stakeholders are aware of their roles and responsibilities.



Financial Sustainability framework for SSM

MONITORING, EVALUATION, AND LEARNING

PERIODIC EVALUATIONS

Implement regular evaluations of springshed management activities to assess social, economic, and environmental impacts

PARTICIPATORY MONITORING SYSTEM

Train community members to measure Spring discharge (daily or bi-weekly measurements), Basic water quality parameters (monthly), Rainfall and climate data (daily), Social outcomes (participation, benefits distribution)

ADAPTIVE MANAGEMENT

Based on evaluation findings, revise management strategies to address emerging challenges such as climate variability, water scarcity, or social conflicts

SCALING STRATEGY

Document successful models for replication and create demonstration sites for peer learning. Develop simple guidelines in local languages, build networks of community practitioners and engage with policy makers for broader adoption.

CAPACITY BUILDING AND TRAINING

REGULAR TRAINING

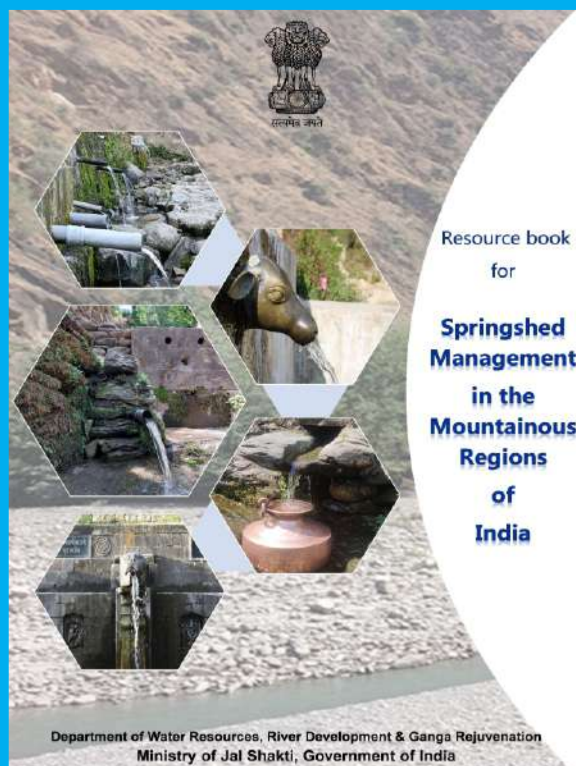
Provide ongoing training for community leaders, water user groups, and local governance bodies on the governance and technical aspects of springshed management.

PEER LEARNING NETWORKS

Establish peer learning networks where communities managing springsheds can exchange knowledge and experiences.

Refer the Resource Book for SPRINGSHED MANAGEMENT IN THE MOUNTAINOUS REGIONS OF INDIA for detailed information on:

- ✓ Spring Mapping and Spring Classifications
- ✓ Springshed Monitoring and Data Collection
- ✓ Spring Hydro-chemical, Hydrological and Isotopic analysis
- ✓ Treatment measurement for Spring Rejuvenation
- ✓ Sustainable Springshed Management and Impact Analysis



To view/download the RESOURCE BOOK scan the QR code or click the link below

https://mowr.nic.in/core/WebsiteUpload/2024/Resource%20book_Springshed_Management_Final.pdf

सत्यमेव जयते

जल शक्ति मंत्रालय
जल संसाधन, नदी विकास और गंगा संरक्षण विभाग
भारत सरकार
Ministry of Jal Shakti,
Department of Water Resources, River Development and Ganga Rejuvenation
Government of India