Provision of Potable Drinking Water in Mountains through participatory Springshed Management

JAL JEEVAN MISSION

Har Ghar Jal

सत्यमेव जयते

Government of India
Ministry of Jal Shakti
Department of Drinking Water and Sanitation
National Jal Jeevan Mission
New Delhi 110 003

February, 2020

VISION

"Every rural household has drinking water supply in adequate quantity of prescribed quality on regular and long-term basis at affordable service delivery charges leading to improvement in living standards of rural communities."

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... And so I declare from the Red Fort today that in the days to come, we will take forward the Jal Jeevan Mission. The central and the state governments will jointly work on this **Jal Jeevan Mission**. We have promised to spend more than **Rs. 3.50 lakh crores** on this mission in the coming years...

...in the next five years, we have to do more than four times the work that has been done in the last 70 years...

Shri Narendra Modi
Prime Minister of India
(Extract from the Independence day address of Hon'ble Prime Minister from rampart of Red Fort on 15th August, 2019)

गजेन्द्र सिंह शेखावत
Gajendra Singh Shekhawat

जल शक्ति मंत्री
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Minister for Jal Shakti
Government of India

18 FEB 2020

MESSAGE

Hon'ble Prime Minister of India, Shri Narendra Modi, from the ramparts of the Red fort brought water to the centre of the agenda. He announced the "Jal Jeevan Mission", a time bound, Mission mode effort to ensure "Functional Household Tap Connections" in each rural household in the country by the year 2024.

Water availability is critical in the hilly regions especially along the hill tops. In most of the mountainous States, water supply is dependent upon springs. Therefore, in all mountainous regions of the country, a proper springshed management is absolutely essential. A spring is a place where water from beneath the ground naturally flows out to the surface. The word originates from the German word 'springer,' which means "to leap from the ground". However, spring water supply in Himalayan villages is becoming increasingly uncertain due to the impact of climate change on precipitation patterns, leading to rise in rainfall intensity, reduction in temporal spread and marked decline in winter rain.

Together with climatic factors, anthropogenic causes and the topography, vegetation cover, soil and geology of an area also affect water availability in a region. These factors control the rainfall runoff and groundwater recharge and storage.

Loose boulder check dams constructed for springshed management has prevented both soil and water runoff, increasing the rate of infiltration of water and enhancing water discharge from springs. The dams have also helped to reduce landslides due to peak flow (run off).

Water supply scheme from the spring having gravity or pumping is most cost effective and both capital as well as operation and maintenance and involvement of community will leverage the scheme long term and directly improve the '**Ease of Living**' of the mountainous community.

I am sure that this document will be very useful to the Engineers/Hydro-geologists working in the hilly areas of the country. This document can also serve as a proper reference manual to various sectors including the panchayati raj institutions, NGOs, voluntary organizations, etc.

(Gajendra Singh Shekhawat)

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12th February 2020

Foreword

Mountains are the water towers of the world, supplying a substantial part of both natural and anthropogenic water demands. Highly sensitive and prone to climate change, there is an urgent requirement to quantify their importance and vulnerability at the national and global scale. Furthermore, the United Nations' Sustainable Development Goals (SDGs) are targeted towards the year 2030 and mountains play a key part in achieving the SDGs for water (specifically SDG 6).

In accordance with the Hon'ble Prime Minister's vision for an integrated approach in the water sector and an overall water secure nation, the Government of India has recently restructured and subsumed the National Rural Drinking Water Programme (NRDWP) into the Jal Jeevan Mission (JJM) to provide Functional Household Tap Connections (FHTCs) to every rural household by 2024. To this end, springs play a key role in the context of the mountain region of India to provide the service level of 55 litres per capita per day (lpcd) required under the JJM.

Springs are the main source of drinking water for many local communities. In the mountain region, they represent a typology of 'mountain aquifers', with a large degree of variability and complexity attributed by the geology, terrain and hydrological factors, and spring water is important in such terrains as they emanate from localised unconfined aquifers.

State governments, Civil Society Organizations (CSOs) and Non-Governmental Organisations (NGOs) are actively contributing towards programmes to promote awareness of the importance of springs, and to build capacities to protect, develop and manage "springsheds" across the country.

Capacity building at the community level, including for PRIs (water committee), on springshed management is essential to improve groundwater literacy, and help in long term management of springs and sustainability of interventions. Springshed Management, thus, is integral for the Jal Jeevan Mission and can be achieved through coordinated national, state and local level initiatives involving all possible stakeholders and partners like governments, civil society, community and people at large.

It is hoped that document would be of immense help for the practitioners, planners and communities in the mountain region of India for efficient planning, implementation and operation and maintenance of springs under the Jal Jeevan Mission.

Parameswaran Iyer

ParameswaranIyer

भरत लाल
Bharat Lal

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Preface

Since ages, springs are lifeline of the mountain community. They have been the source of clean water. Traditionally, spring water was used for drinking and household purpose. The variations in discharge and seasonality of water sources arose from the hydro-geological, ecological and climatic diversities of the region. These water resources have played a significant and dominant role in socio-economic, cultural and environment related activities in mountains of the country.

2. Spring water is usually free from contaminants (i.e. pathogens, chemicals, metals, etc.) and considered safe by the local community. It's due to the natural filtering that occurs during infiltration and its movement through shallow and deep aquifers. Springs exist in some of the most bio-diverse regions of the country. Looking at springs from bio-geographical perspective, they often function as a permanent source of water. They are important for ecosystem services as they improve the base flow in rivers and support biodiversity.

3. Mountain region has a glorious tradition of water harvesting. The local communities have developed their own spring-based hydraulic technology, which is quite unique in its usefulness and spring revival. The traditional wisdom of water management is similar in the mountainous areas of the country. The inherent technological simplicity and cost effectiveness, both in capital as well as operation & maintenance of spring-based gravitation flow, make them the preferred drinking water option in mountains. For long term sustainability of such spring sources, springshed management has to be accorded high priority to achieve water security.

4. A scientific springshed management approach helps in preparing effective Village Water Security Plan. Such participatory Village Water Security Plan (VWSP) not only lead to efficient execution of springshed measures of enhancing recharge but also help in reducing costs through efficient planning and appropriate implementation.

5. Springshed management needs a multi-dimensional approach and integrated action. The objective has to be to successfully integrate natural science with social sciences, hydrogeology with engineering & biotic measures and capacity of the springs. Springshed management in the mountain region holds key to enable every rural household to have potable water in adequate quantity and of prescribe quality on long-term basis as envisaged under Jal Jeevan Mission. Springshed recharge work should be done through convergence with existing programmes like MGNREGA, Finance Commission grants, IWMP, CAMPA, NABARD, NRLM, SRLM, etc.

6. I sincerely believe that this document on Springshed Management will be immensely useful in implementing the Jal Jeevan Mission in mountainous areas to provide FHTCs to every household and in achieving long-term water security at a very low recurring cost and ease of maintenance. This will help in integrating local wisdom and practices of managing springs as dependable source of clean water to every household on long-term basis as envisaged under Jal Jeevan Mission.

[Bharat Lal]

Contents

Abbreviation

BEES	Barefoot Environmental Educators
CAMPA	Compensatory Afforestation Fund Management and Planning Authority
DIW	Deep Infiltration Well
DTR	Detail Technical Report
GFWSS	Gravity Fed Water Supply System
GPS	Global Positioning System
MGNREGA	Mahatama Gandhi National Rural Employment Guarantee Act
NABARD	National Bank for Agriculture and Rural Development
NBR	Nilgiri Biosphere Reserve
NITI	National Institution for Transforming India
NRLM	National Rural Livelihood Mission
PCCF	Principal Chief Conservator of Forest
PRA	Participatory Rural Appraisal
SMC	Springshed Management Consortium
SRLM	State Rural Livelihood Mission
UWSC	User Water and Sanitation Committee
VDC	Village Development Council
VWSC	Village Water and Sanitation Committee
VWSP	Village Water Security Plan

Springs in the Indian Mountain Region

1.1 Spring:

In the mountain region of India, groundwater naturally discharges in the form of springs, which occur where a water bearing layer (perched aquifer) intersects with a hill slope and groundwater seeps.

1.2 Springshed:

Springshed is the unit of land where rain falls (recharge area), and then emerges at discharge points of the spring. It is the natural unit for revival and management of spring.

1.3 Importance of Springs:

Springs have provided water to the mountain communities for centuries and the revival of this traditional source of water is extremely important for the region's sustainable growth. Springs are the main source of water for millions of people in the mountainous region of India. At a larger national scale, a gross estimate of nearly 200 million Indians depending upon spring water across the Himalayas, Western Ghats, Eastern Ghats, Aravallis and other such mountain ranges - implies that more than 15% of India's population depends on spring water. (Niti Ayog).

Photo 1: Spring is the life line of mountain people

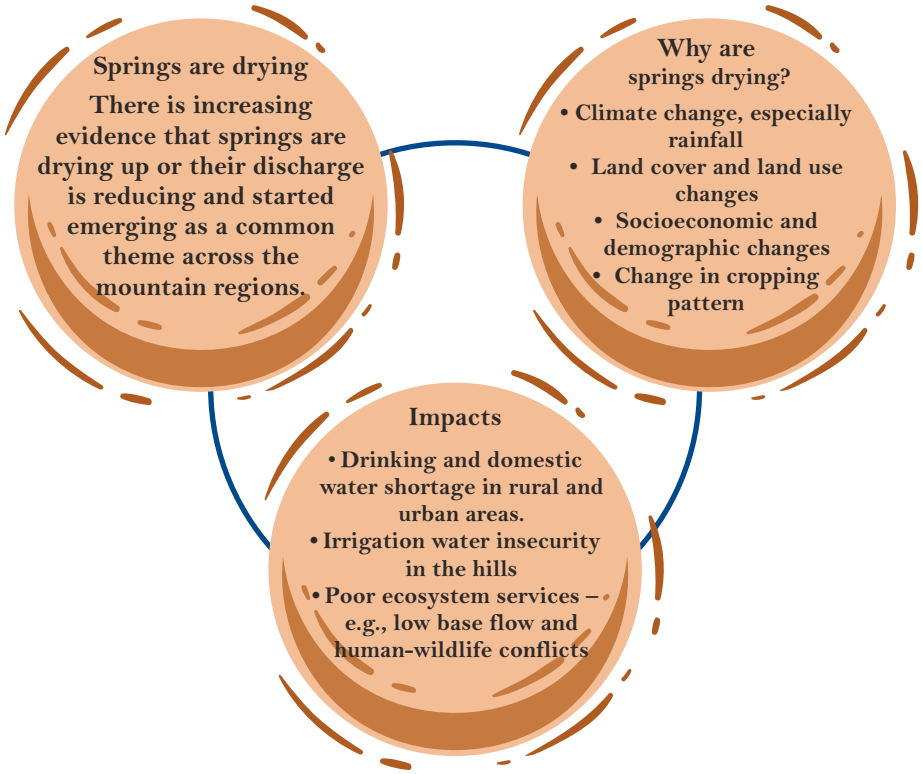
1.4 Challenges:

Changing climatic scenario especially the erratic rainfall pattern, seismic activity and ecological degradation associated with land use change for infrastructural development is posing huge pressures on mountain aquifer systems a marked decline in winter rain, the problem of dying springs is being increasingly felt across the mountain regions of the country.

Emerging trend: Water Security to Scarcity

Perennial Spring → **Seasonal Spring** → **Dried Spring**

Water Security in Changing Climatic and Socio-Economic Scenarios



There is an urgent need to expand the scope and scale of science based participatory springshed programmes in the mountain ranges with complex scenario of changing socio-economic conditions under the footprint of climate change and variability.

Photo 2 : Spring in Almora district of Uttarakhand

Objective

Ensure drinking water security in the mountain regions of India through Science based participatory Springshed Management approach under Jal Jeevan Mission.

- Science based planning, designing and Monitoring & Evaluation
- To strengthen the capacity of communities
- Sensitisation and awareness of different stakeholders
- Sustain water security through community participation

Map-1: Springs in Indian Mountain Region

States	Area (Sq.km)
Jammu & Kashmir	222,236
Himachal Pradesh	55,673
Uttarakhand	53,483
Sikkim	7,096
Arunachal Pradesh	83,743
Nagaland	16,579
Manipur	22,327
Mizoram	21,081
Tripura	10,486
Meghalaya	22,429
Total	515133

States	Area (Sq.km)	Western Ghats (sq.km)
Gujarat	196,021	TBD
Maharashtra	307,713	TBD
Karnataka	191,791	TBD
Tamilnadu	130,058	TBD
Kerala	38,863	TBD

States	Area (Sq.km)	Eastern Ghats (sq.km)
Jharkhand	79,714	TBD
Orissa	155,707	TBD
Chhattisgarh	135,191	TBD
Andhra Pradesh	160,205	TBD
Karnataka	191,791	TBD
Tamilnadu	130,058	TBD

Data Requirement

Web based platform for database- National Spring Information System (NSIS)

- Spring Coordinate for Atlas & Inventory
- Springshed data (Slope % and slope aspects, Landuse/ Land Cover, Vegetation, soil type, Rock type, Household dependence etc.)
- Rainfall
- Spring discharge
- Water quality
- Water demand Vs availability calculation

Table-1: Stepwise Methods for Springshed Management

Steps	Activity	Objective	Equipment	Outcome
Step-1	Spring Mapping	To locate spring emergence point/ geo-tagging	GPS device/ Android phone	Spring Atlas/Inventory
Step-2	Spring Discharge	To measure spring discharge	A bucket whose volume is known, Stop Watch	Spring Hydrograph
Step-3	Rainfall	To measure rainfall	Rain gauge	Spring Hydrograph
Step-4	Water Quality	Water quality monitoring	Tracer, on spot water quality testing kit	Water quality Report
Step-5	Base line (Socio-economic)	Base line survey	Formats, Structured Questionnaire	Village water resource map, Demand & Supply status, Vulnerable springs
Step-6	Hydrogeological mapping	To collect Hydrological and Hydrogeological data from the field survey	GPS, Brunton, Clinometer, Hammer, Google earth and Sketch up (Softwares)	Hydrogeological conceptual lay out & Spring site cross section
Step-7	Designing recharge interventions and management protocols	Physical and biological measures, social fencing Behaviour change	Tools for community mobilisation experts as SARAR kit	Spring recharge and protocols for springshed management
Step-8	Impact Assessment of Springshed works	Measurement of benefits from springshed works with other socio-economic aspects	A bucket whose volume is known, Stop Watch, Tracer, on spot water quality testing kit, Formats, Structured Questionnaire	Improvement in Water availability water quality

Hydrogeology: Scientific understanding of Springs and Springsheds

Photo 3: Handholding support to Springshed para professionals in Meghalaya

Mountain region of India has diverse physiography, geology and structural setting which further leads to complexities in the hydrogeological properties of springs. Hydrogeology is the science of groundwater can lead us to a scientific understanding of springs with a forward linkage to the aquifer systems that sustain such springs.

- **Spring shed management Approach through Hydrogeological techniques:**
  - Hydro geological mapping of spring shed
  - Delineation of the mountain aquifer
  - Classification of the spring
  - Secondary data collection and interpretation
  - Identification of recharge area based on local geology and its structural setting
  - Setting up a monitoring system for periodic spring discharge and water quality.
  - Conceptual layout of spring

Photo 4: Hydrogeological survey by the para professional in Shillong, Meghalaya

❑ Spring Classification

On the basis of Hydrogeological and topographical properties Springs can be classified into 5 types. There are variations in Hydrological and hydrogeological characteristics as well as its treatment measures of every spring type.

Fracture springs occur as a result of permeable fracture zones appearing in low permeability rocks. Movement of groundwater is mainly through the fractures which tap both shallow and deep aquifers.

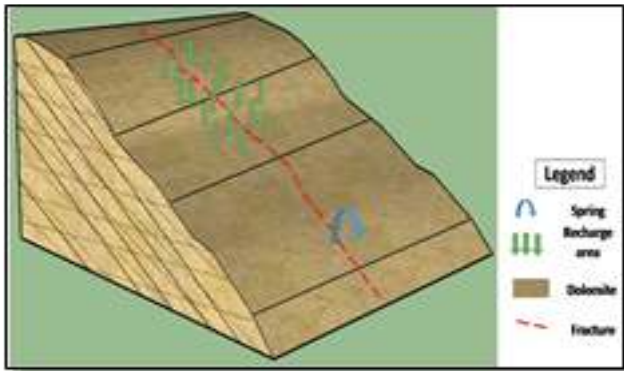


Figure 1: Cross Section of Fracture Spring

Photo 5: Hydrogeological Survey through Brunton

Contact springs emerge at places where relatively permeable rocks overlie rocks of low permeability.

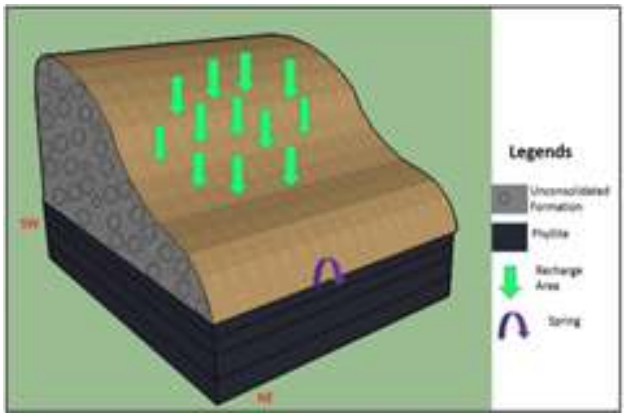


Figure 2: Cross Section of Contact Spring

Photo 6: Handholding support to Forest Department Officials in Uttarakhand

Depression springs emerge at topographic lows where the water table intersects the ground surface.

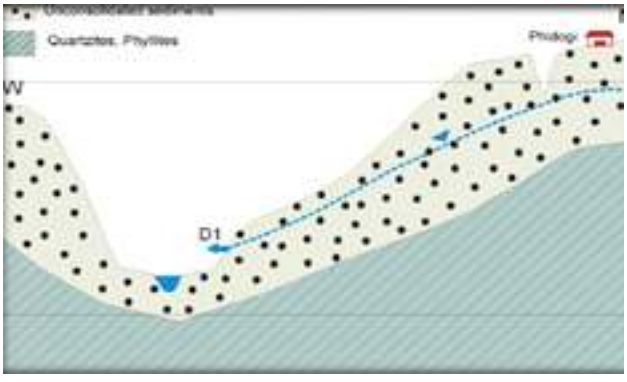


Figure 3: Cross Section of Depression Spring

Photo 7: Groundwater leap out from fractures

Fault springs are found where groundwater at depth is forced up a fault to the fault opening by hydrostatic pressure

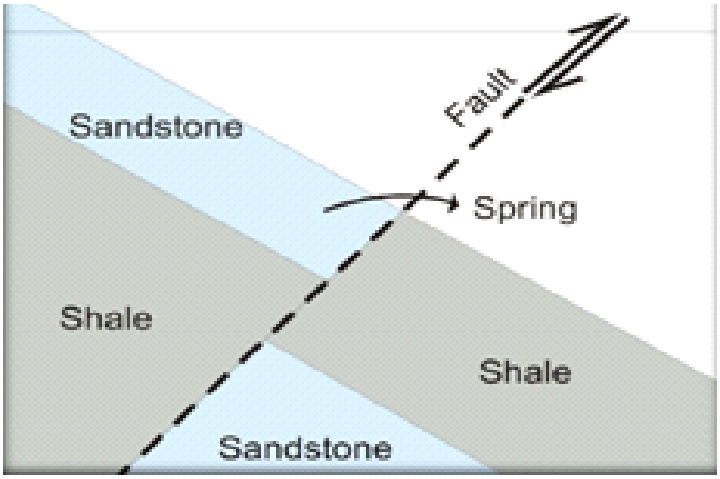


Figure 4: Cross Section of Fault Spring

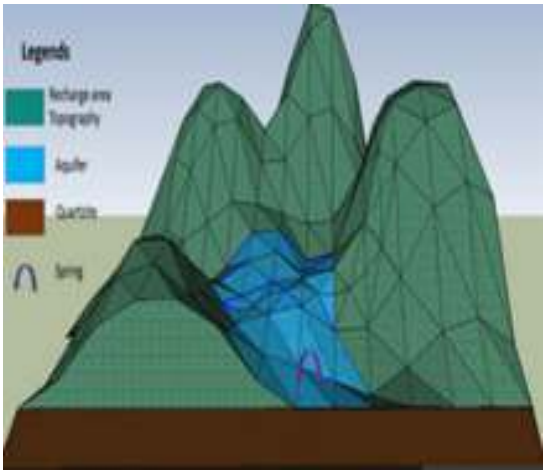


Figure 6: 3-Dimensional Section of Spring

Karst springs occur where water flows through the cavities and openings in limestone that form as a result of dissolution of rock material and then emerges at the base of the limestone layer.

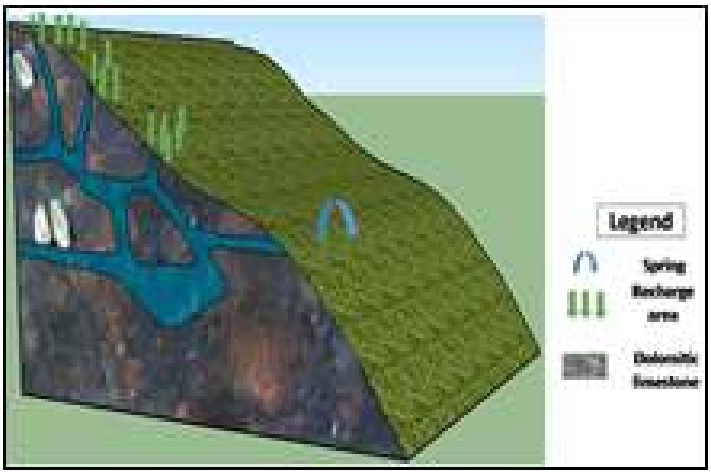


Figure 5: Cross Section of Karst Spring

Figure 7: Recharge area demarcated for Springshed recharge works in Namchi, Sikkim

Spring as part of Culture and Heritage

There is a deep-rooted culture around springs in the mountain region of India. Over the centuries mountain people have developed its own hydraulic technologies, which is quite unique in its usefulness. The ancient people of this region evolved the hydraulic technology taking into consideration all the necessary factors which suit the environment of the region. Naulas and Bawari the most important hydraulic structures, which are unique and commonly found in some particular parts of the Uttarakhand and Himachal Pradesh.

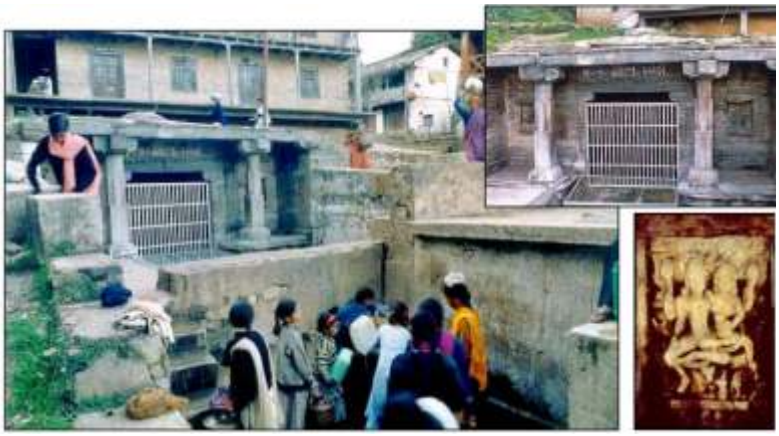


Photo 8: Jahnavi Naula of Gangolihat, Pithoragarh of Uttarakhand providing water since last 700 years

Photo 9: Bawari: A traditional drinking water source in Bilaspur, Himachal Pradesh

Photo 10: Traditional water source in Cherapunji, Meghalaya

Photo 11: Historical Spring Chasma E Shahi in Srinagar, Jammu & Kashmir

❑ Traditional Water Wisdom

- ❑ Over the centuries mountain people have developed their own spring based hydraulic technology, which is quite unique in its usefulness.
- ❑ The ancient people of this region evolved the hydraulic technology taking into consideration all the necessary factors which suit the environment of the region.
- ❑ The people are well aware of the importance of water; they treated water sources as sacred and many rituals are performed around the water sources.
- ❑ Deterioration of traditional water wisdom has been noticed in the recent decades hence use of traditional water wisdom is required for effective water management.

Spring: Water Quality

Traditionally, spring water is considered clean and pure due to the natural filtering that occurs during infiltration and its movement through shallow and deep aquifers, as per local hydrogeological conditions. Water quality is influenced by the local practices of waste disposal and wastewater discharge, cattle grazing and defecation in the recharge area or nearby the spring, hence there should be complete ban on these practices in the recharge area. Community based water quality management should be promoted. On the basis of past experiences social fencing helped in reducing bacteriological contamination in spring water.

Photo 12: On spot based water quality testing by User water and Sanitation Committee's members in Tehri distict of Uttarakhand

Springshed Recharge: Physical and Biological measures

- Implementation Springsheds recharge works will be carried out through VWSC/UWSC and community participation.
- Engineering measures and structures combined with vegetative measures and management are need for revival.

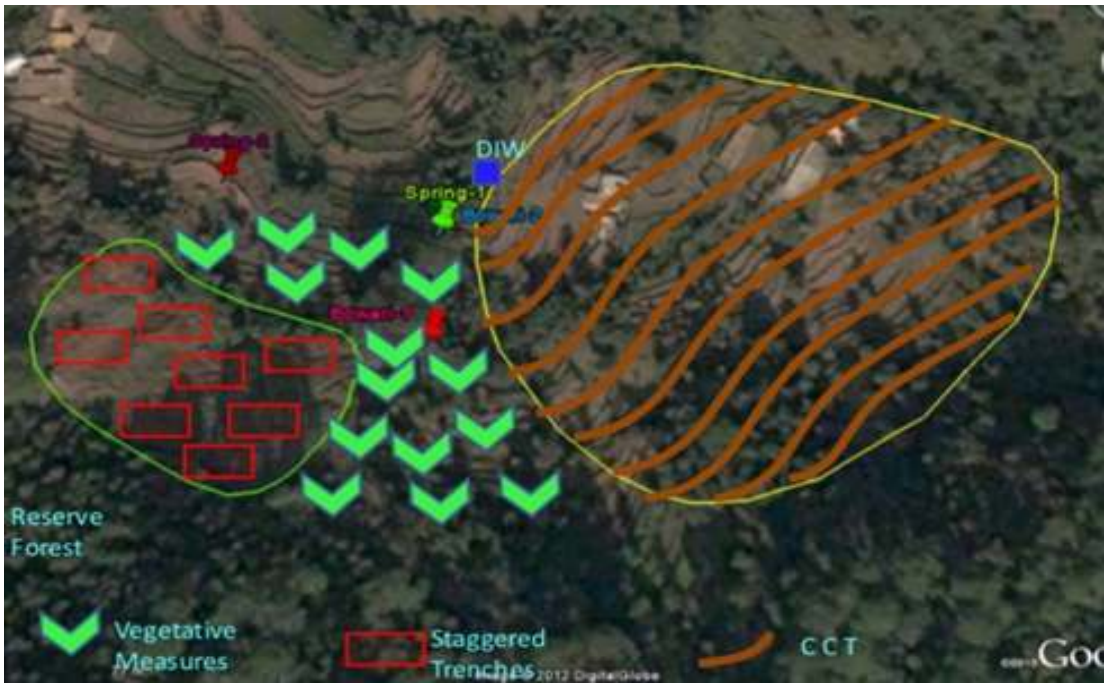


Figure 8: Physical and vegetative measures for Springshed Recharge works

- **Main Springshed Recharge Structures:**

i) **Recharge Pond:** It is a rectangular dugout structure, constructed usually in a natural depression area on sloping land. Digging pond in natural depressions, will collect maximum runoff.

ii) **Trenches:** It is small rectangular structure of size constructed on sloping land in a staggered manner. Like in the pond it is connected by feeder channels. The slope of the walls should be not more than 45 degrees. It has been experienced and observed that recharge structures on higher slope more than 45 degrees will be unstable and also might be cause of landslide.

iii) **Feeder Channel:** Feeder channel from both side of the trenches and ponds will collect maximum runoff and feed into the pond and trenches.

iv) **Terraced fields:** Terraced fields reduce the surface runoff as the steps help in slowing down the speed of water and increase the ground water recharge.

v) **Staggered Contour Trenches: Figure:** Recharge trench design[1]. If the slope is less than 50% and there is no trail or natural depression area, then Staggered Contour Trenches is the best recharge structure for groundwater recharge. In higher slope (slope 35° to 50°), it is advisable to dig trenches with lesser depth.

Photo 13: Recharge works through community participation in Tehri district of Uttarakhand

Photo 14: Groundwater recharge through contour trenches

Table-2: Trenches Design on sloping land (On the baisis of past experiences)

Slope	Size of trench			Volume of trench	Total trenches per ha	Storage of water per ha
	Length	Width	Depth	cum	numbers	cum
%	m	m	m			
<30	2.00	1.00	0.60	1.2	150	180
30-40	2.00	0.60	0.60	0.72	180	130
40-50	2.00	0.60	0.45	0.54	200	108

❑ Vegetative measures:

Plantation of fruit and fodder trees and grasses should be implemented in the identified and mapped recharge areas for spring rejuvenation.

1 (Source: RMDD, Sikkim)

Community Participation for Springshed Management

Photo 15: Water resource mapping by the community members in Pithoragarh, Uttarakhand

Community Participation for Springshed Management Planning of treatment measures in the recharge should be carried out area with the help of community participation. All the measures must be understood and managed by the involved communities. Hence there is requirement of good community mobilization to ensure the sustainability of the Springshed management. Social mobilization is also necessary for ensuring gender and social equity and for conflict resolution during the process of designing and implementing protocols.

❑ Participatory Rural Appraisal (PRA)

PRA for participatory water resource relies heavily on participation by the communities, as the technique is designed to enable local people to be involved, not only as sources of information, but as partners with the PRA team in gathering and analyzing the information. Following process/approaches will be used for water resource planning at village level:

Photo 16: Measurement of Spring Dimensions in Tuli Mokokchung district, Nagaland

i) **Water Resource Mapping :** With participation of community, mapping of all the water resources of the village with timeline & trends approach, location of households, location of water tanks, water supply pipes, rivers, lakes, springs, streams, forest, cultivable land, barren land, roads and any other land mark.

ii) **Transect Walk :** Transect walks should be carried out across the springshed and local water tower noting down the locations of springs using Global Positioning System (GPS) and gathering further information on each spring from the local community. Transect walks can also be used to understand the overall layout of the springshed and presence of other water sources.

iii) **"Pani Pe Charcha" (Discussion on Water) :** The format for discussion is a free flowing discussion guided by some key questions. By conducting separate discussion with different groups of people (5-12 people) such as local leaders, women representatives from marginalized communities, it is also possible to capture differences in perception among different groups of stakeholders.

iv) **Key informant interviews:** Key informant interviews are interviews conducted with individuals who are thought to be particularly knowledgeable about the issue under discussion, and hence have to be chosen carefully.

v) **Questionnaire surveys:** Questionnaires must be properly designed and pre-tested, and respondents must be selected in such a way that they are representative of the population for which data is being collected. Data collected using questionnaire surveys can be analysed quantitatively using statistical analysis.

❑ Protocols for Springshed recharge works:

- ❑ Recharge area should be free from waste disposal and defecation.
- ❑ No application of chemicals (fertilizers, pesticides) in the recharge area or near the spring; replace with eco-friendly methods like composting and integrated pest management.
- ❑ No cutting of trees in the demarcated 'Protection and Recharge' area
- ❑ Management should catalyse community action.
- ❑ Community contribution for Springshed works
- ❑ All castes and groups of different social/economic status should be included in the group, and women's participation encouraged.
- ❑ Springshed management should integrate formal and peoples' knowledge.

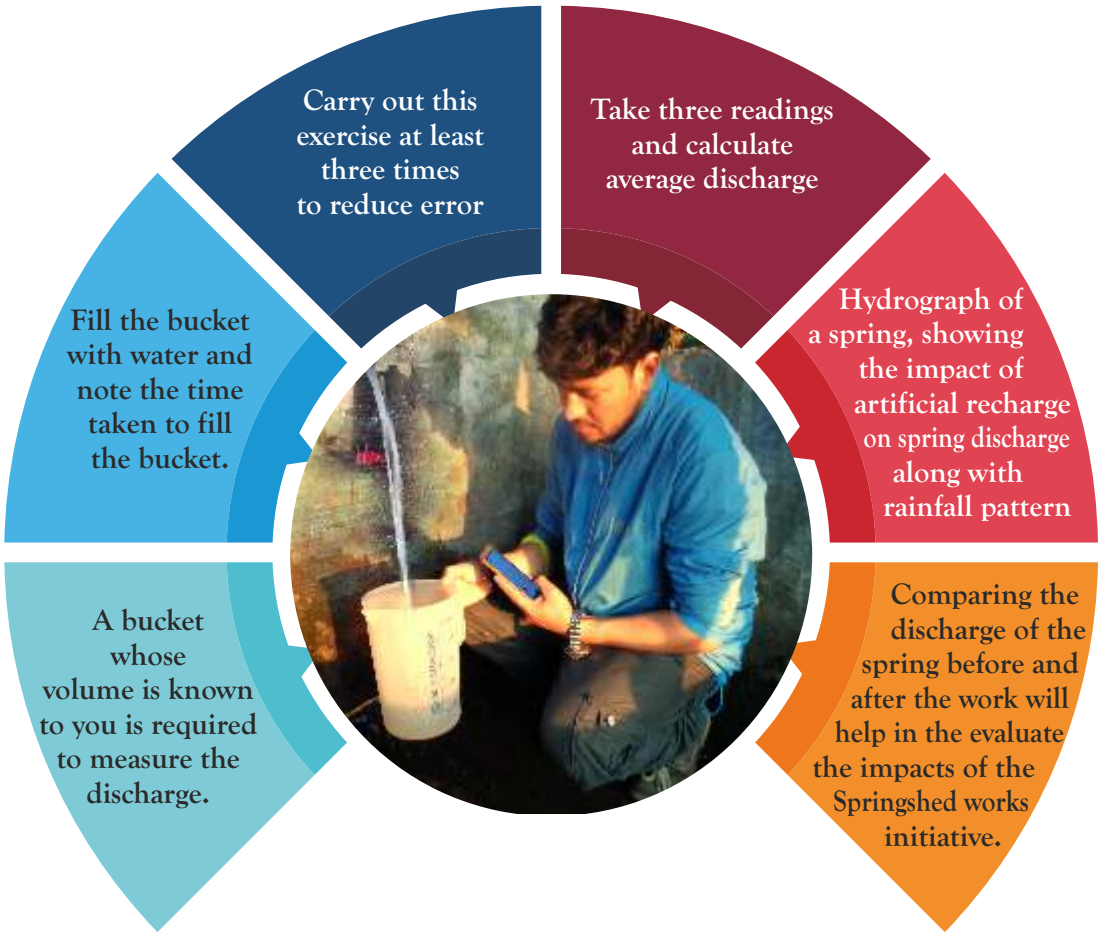
Photo 17 : Water collection chamber at Spring in Chureddhar village of Tehri district of Uttarakhand

Governance for Springshed Management

- Decentralized water governance for sustainable water management.
- Village Water Security Plans (VWSPs) preparation.
- All water management works should be implemented through VWSC which is a sub-committee of Gram Panchayat.
- Awareness and Behaviour change communications will be done through Implementation Support Agencies at village level.
- A group of capable people/ para-workers will be developed who will manage their Springsheds on their own in the long and also ensure social responsibility.
- A community fund should be established with a nominal monetary contribution from each household. This is important to ensure that the recurrent costs for maintenance and management of springs and recharge structures can be covered in a sustainable manner.
- District Water and Sanitation Mission (DWSM) will help in formation of sub-committee of Gram Panchayats, i.e. VWSCs/ Paani Samitis/ User Groups, etc. and handhold to ensure implementation of Springshed management.
- District Water and Sanitation Mission (DWSM) will identify Implementation Support Agencies (ISA) and individuals to be trained as master trainers at State level who will in-turn build capacities of Gram Panchayat and/ or its subcommittee, i.e. VWSC/ Paani Samiti/ User Group, etc.

Photo 18: Community awareness for springshed management through folk media (puppetry) in Pithoragarh district of Uttarakhand

Impact assessment of Springshed Management



Way Forward: Springshed management works in the mountain region is gigantic, this can be achieved through co-ordinated national, state and local level initiatives involving all possible stakeholders and partners like governments, civil society, community and people at large. Recharge works should be done through convergence with existing programmes like MGNREGA, Finance Commission fund, CAMPA, NABARD, NRLM, SRLM etc.

Annex

Springshed Management Data Sheet

State
District
Block
Gram Panchayat
Village
Spring Name:
Spring ID

Spring Coordinate (GPS Survey):

Date of measurement	Latitude	Longitude	Elevation

Household dependence:

Spring water use? (Please Tick)

- ❑ Domestic
- ❑ Irrigation
- ❑ Community water supply
- ❑ Others

Approximate distance of source from the habitat: m

Other Alternate Source type :-

Land use pattern in spring catchment area (Please Tick)

Agriculture / Forest / Barren land/ Pasture/ others

Spring recharge area Land ownership? (Please Tick)

- ❑ Community land
- ❑ Individual
- ❑ Government
- ❑ Others

Land owner's name in the recharge area if individual /clan?

Seasonality of spring: Seasonal/Perennial (Please Tick)

If seasonal, what are the months of flow?

Variation in discharge: - Yes/No (Please Tick)

From Last (Time period) :-

Discharge measurement in Litres per minute (LPM):

Date	Time of measurement	Discharge in litres per minute

Dimension of Collection Chamber If Available
(length × breadth × Depth) (if any):
Rough sketch of the springshed:

Turbidity: Yes/ No
Quality Related Issues: -
If Yes: From Last.....

Information compiled by:
Date:

Success Stories

Case Study : Participatory Springshed Management in Khliehshnong village, East Khasi hills district of Meghalaya

Springsheds initiative was launched by Govt. of Meghalaya with additional support is provided by the National Springs Initiative Network.

Issue: In the pre-project scenario, the area was devoid of any vegetation and the top soil was completely eroded with only skeletal remains of gravel and sand. The land was severely degraded due to mining activities and led to water scarcity during the dry season. In March 2015, the discharge of the spring – a key source of drinking water supply in the area - was 5 Litres/minute. Springsheds initiative was participatory based, hence the social objectives around Springshed rejuvenation include:

- The first intervention was community mobilization to prevent the catchment area from mining activities. Capacity building and training workshops were organized for local community.
- Barefoot Environmental Educators (BEES) were identified from these communities to be the whistle blower for forest fires, unwanted grazing and other damaging occurrences.
- The next step involved the creation of Soil and Moisture Conservation works like silt retention dam, staggered boulder bunds, box terraces, contour trenches and afforestation with local indigenous species in the entire degraded catchment area.
- The last step was the construction of Water Harvesting Structures integrated with a filtration tank, storage tank and fencing off of the catchment.

Photo 19: Para-professionals training on Springshed Management in Shillong, Meghalaya

Outcome : The positive change in the water body has been reported post the 3 levels of interventions detailed above. The intervention has ensured year round water security for about 225 households in this area. Soil loss through erosion has been tremendously controlled and water conserved. The monthly discharge of the spring is being continuously monitored to compare the flow rate before and after the spring rejuvenation intervention. A comprehensive impact assessment is being currently conducted and results will be disseminated across stakeholder groups.

Case Study : Springshed management through community involvement and convergence in Kotagiri town of Nilgiri district of Tamilnadu

Keystone organization has been working exclusively with Indigenous communities in the Nilgiri Biosphere Reserve (NBR) for two decades. Keystone designed a Springs project for the spring revival and conservation of springs and sprinshed for the region. The project focused on the upper areas in the Nilgiris where the dependence on springs was considerable. Over time, the intervention was expanded to include the tribal pockets in the NBR, enabling it to build on the work already done by Keystone over the last two decades.

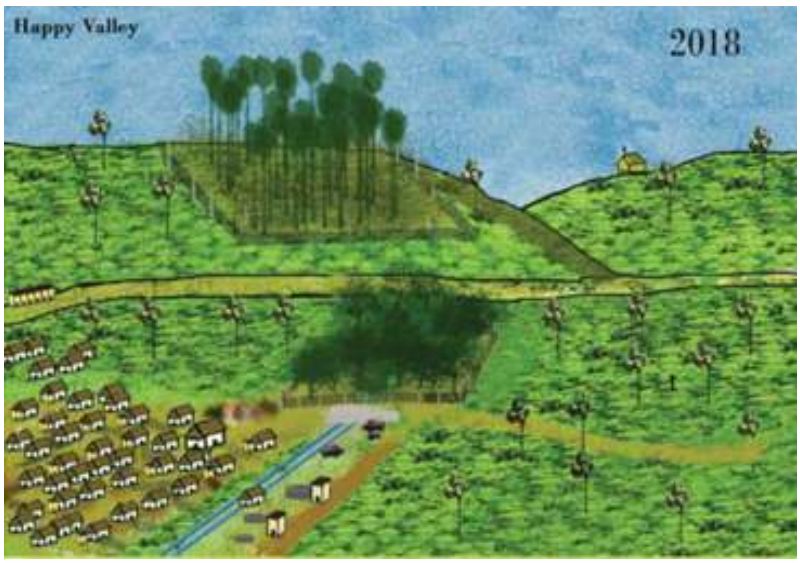


Figure 9: Community based springshed management in Happy valley, Kotagiri, Tamilnadu

Keystone conducted a baseline survey of 40 wetlands in and around the Nilgiris. Of the 40 wetlands, the ones that were primary source of drinking water to the communities and were under threat were identified. The small hill wetlands mostly fell under the waste land category in the government records and were being used by communities to direct their sewage into or dump their waste. The Happy Valley spring and the adjoining wetland is an important water source for a part of Kotagiri town. A patch of 1acre land that belonged to the panchayat just above the spring and wetland area was being used by the local communities for open defecation and dumping solid waste leading to feacal contamination of groundwater. Keystone identified this as a critical space for intervention. After sustained discussions with the panchayat and communities, Keystone decided to restore the patch of panchayats land with native shola forests. With Keystone's assistance and motivation, community build toilets for which Keystone helped in buying materials and the community volunteered manpower. Bushes and weeds were cleaned and fenced by the panchayat. In 2006, Keystone raised a nursery and planted saplings with the participation of community, panchayat and a local school which have grown into a small patch of forests by now. The spring which used to go dry in summers, has now become perennial. The community has responded positively to the intervention and are happy with the water availability in their springs and wells even during the lean seasons.

Case Study : Participatory Springshed Management in Thanaksoga Panchayat of Sirmour district of Himachal Pradesh

Thanakasoga Gram Panchayat is located in Nahan block of Sirmour district of HP. The villages selected by PSI for spring rejuvenation under this panchayat were - Luhali, Dhyali and Thanakasoga having a total of 152 households. The major issues in these villages were inadequate drinking/domestic water availability and poorly maintained baoris, especially with low discharges during summers. The peak discharge in the baoris was between 15-18 lpm during monsoon, which would fall to as low as 1 lpm during summer. Some of the s prings would even dry up in summers.

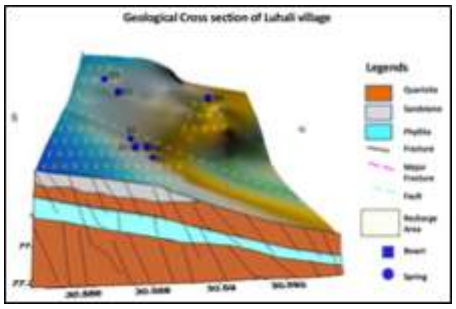


Figure 10: Hydrogeological lay out of Springshed

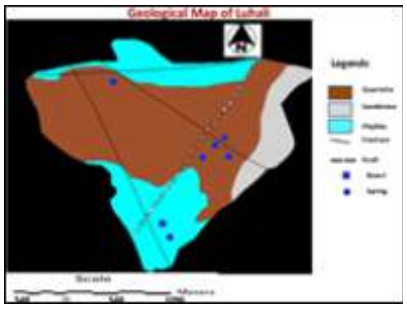


Figure 11: Geological map of village

Photo 20: Recharge structure planning in the field

People Science Institute had developed scientific understanding of groundwater besides understanding the social structure of the villages. Use of hydrogeology helped us to identify the recharge area of the critical springs more accurately. Understanding the social structure helped to determine the water needs of the concerned communities and livestock population, ensuring involvement of all the categories of people in the programme and in formulating and implementing sanitary protocols for protecting the recharge areas. PRA exercises, time trend analysis and household surveys helped to determine the status of water demand and supply in these villages. Regular water quality monitoring and spring discharge measurements were carried out for all the Figure 19: Comparative assessment for demand and availability selected sources of water on a monthly basis. Awareness about groundwater, spring rejuvenation and its maintenance was carried out. People were actively involved in all the stages of the programme.

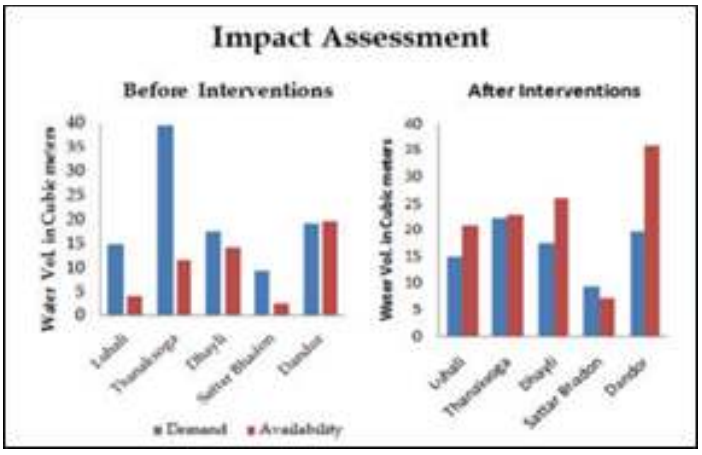


Figure 12: Comparative assessment for demand and availability

Impacts

- There was increase in availability of water.
- Enhanced spring discharge led to a more equitable water sharing amongst communities.
- Increased spring discharge resulted in reduction of geo-genic contaminants like iron.

Case Study : Improved water quality through Gravity-fed Water Supply System (GFWSS) in the villages of Narsipatanam (Eastern Ghats) Andhra Pradesh

Photo 21: GWFSS system in Narsipatanam, Andhra Pradesh

The Eastern Ghats are a series of discontinuous low ranges running generally northeast-southwest parallel to the coast of the Bay of Bengal. An extremely old system, the hills have been extensively weathered and eroded over the years. The land is inhabited by quite a few tribes which include Savara, Jatapu, Konda Dora, Gadaba, Khond, Manne Dora and Mukha Dora. These indigenous people have their own unique cultural heritage.

The Issue

Several seasonal and perennial springs dot the landscape on which the locals depend on for their water security. However, access is serious issue since these springs are located far off from the habitation and also at higher altitudes making it difficult for the tribal community to access them with ease. The hand pumps set up by the Govt were either defunct or had poor quality water (high Iron).

The Solution

Photo 22: Participatory planning for Springshed management

Visakha Jilla Nava Nirmana Samithi (VJNNS) is setting up gravity-fed water supply system (GFWSS) by identifying the perennial springs closer to the habitations, safeguarding them by constructing spring walls, bringing the water closer to the habitation through HDPE pipes, passing through a robust purification system and finally providing water at stand posts in every street is how the issue was tackled by VJNNS. Community involvement by way of Shramadan, formation of a village development committee (VDC) for O&M, awareness and education on WASH are integral parts of the capacity enhancing initiatives. The Village Development Committees are formed and trained by VJNNS. There are women SHGs who are also trained. The operation and maintenance is taken care by the VDC. The primitive tribes and other tribes are the target group in GFWSS who are backward and vulnerable sections of the society. VJNNS has ensured water security to 2930 households with Arghyam support.

Case Study : Water security through science based participatory springshed management in Uttarakhand

Himmotthan society, has demonstrated spring-shed participatory model in the State and above 300 springs were augmented, through various recharge measures. Himmotthan's works demonstrate participatory model for water management in sustainable manner in the Himalayan region. Various efforts were made to strengthen the community institutions, sharing and building knowledge on water governance, ownership and not treating spring water as ecosystem subsidy. A community based mechanism is developed for the distribution of water resources for social, economic and environmental purposes in sustainable and equitable manner.

Photo 23 : Springshed Recharge works in Pokhari village Pithoragarh Uttarakhand

Efforts for Springshed Management by Himmotthan Society:

- Springshed management has been an integral part of the WaSH programme since 2002.
- Photo 20 : Springshed Recharge works in Pokhari village Pithoragarh Uttarakhand
- A more proactive and scientific approach has been adopted from 2009 onwards by adopting scientific approach for identifying the Springshed recharge area through Hydrogeological techniques, thus ensuring efficiency and long term sustainability of water schemes.
- All Springshed works under the initiative are owned and managed by the village communities.
- Participatory water management through local community and User Water and Sanitation committees.
- Equal opportunity is given to village committee to apply traditional wisdom for water management at the same time sensitize them in hydrogeology and other scientific approaches in simple and friendly manner useful for water conservation.
- Strengthen a decentralized water governance system who would manage their water resources on their own in the long run.

Hydrograph analysis were made to assess the impacts of Springsheds and a significant increase up to five folds in the discharge was noticed in the springs of those areas where recharge activities were carried. An analysis of spring shed work implemented at Gangolihaat. On an average each spring shed covers 2-4-hectare area, focusing on vegetative measures. That on an average water discharge during peak summer (May and June) has increased by 48% against a base year May 2016 and assessment May 2018. Participatory springshed management based on hydrogeological and water quality studies can help in effectively rejuvenating springs in the Indian mountain region, which is the need of the hour considering the growing water demands and increasing scarcity.

Figure 13: Springshed hydrograph for Impact assessment

Case Study : State wide Springshed Management program through Springshed Management Consortium (SMC)in Uttarakhand

Photo 24: Springshed Management Consortium's meeting in Dehradun, Uttarakhand

In Uttarakhand, it is essential to revive and rejuvenate springs in the state considering their importance for biodiversity and meeting the water requirements of the people (more than 94% rural water supply is driven through spring fed systems). With 71% of the state's geographical area categorized as forest area, the recharge zones of most of the springs are located in forest areas. The forest department is undertaking elaborate measures for groundwater recharge and aquifer management which is essential for spring-shed management. Considering the importance of springs in local context whilst, referring the NITI Aayog's recommendation Springshed Management Consortium had constituted on 2nd November, 2018 in Uttarakhand to take springshed initiative at state level. The SMC is headed by the Principal Chief Conservator of Forests (PCCF), Uttarakhand. The consortium has 18 members which included civil society organizations, line department and experts of the fields. Coordinator Water and Sanitation from Himmotthan Society is Member Secretary and responsible for taking forward the SMC objective in a planned manner. Springshed Management Consortium has analysed Spring data and identified most vulnerable springs of Uttarakhand in 11 hill district. Detail Hydrogeological surveys of these springsheds were conducted and Detail Technical Reports (DTR) has been prepared. Recharge works of these springsheds are in progress. Different capacity building trainings are also being conducted in different districts/ forest divisions.

Har Ghar Jal

सत्यमेव जयते

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