

Scoping Study and Policy Imperatives on Green Jobs and Eco-Entrepreneurship Opportunities for Women in Select States in India.

WATER MANAGEMENT



Green jobs and Eco-Entrepreneurship has been integral to the discourse on green growth/economy for over a decade and has assumed greater significance of late. This study - Scoping Study and Policy Imperatives on Green Jobs and Eco-entrepreneurship Opportunities for Women in Select States in India was initiated in early 2020 and draws upon the learnings from the United Nations Development Programme (UNDP)'s project "Creating Employment and Entrepreneurship Opportunities for Women in India" (Disha) project. The intent of the study is to identify areas for and promote greater women's workforce participation in renewable energy, green construction, green transport, water management and carbon sinks (forests and marine fisheries). Given the vastness of its scope and geographies, the study was confined to the UNDP's Inclusive Growth project states of Delhi, Haryana, Maharashtra, Karnataka, Telangana, Uttarakhand and Odisha.

The report, prepared by KPMG, is based on secondary sources and stakeholder interactions, as the study was initiated just prior to the COVID-19 pandemic and lockdown, that greatly limited access to primary research, physical consultations and data collections. Even though virtual stakeholder interactions, online consultations and peer review provided information across thematic areas, it is likely that there may be some gaps due to unavailability of gender disaggregated data or restricted information.

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List of Abbreviations

ADB	Asian Development Bank
ASCI	Agriculture Skill Council of India
BCM	billion cubic metre
CGWA	Central Ground Water Authority
CGWB	Central Ground Water Board
CWC	Central Water Commission
DDP	Desert Development Programme
DDU-GKY	Deen Dayal Upadhyaya Grameen Kaushalya Yojana
DPAP	Drought Prone Areas Programme
GIS	Geographical Information System
GVS	Gram Vikas Sanstha
ha	hectare
IGNOU	Indira Gandhi National Open University
ILO	International Labour Organization
IPSC	Indian Plumbing Skills Council
IWMP	Integrated Watershed Management Programme
JJM	Jal Jeevan Mission
m ³	cubic metre
MFI	microfinance institution
MGNREGS	Mahatma Gandhi National Rural Employment Guarantee Scheme
NABARD	National Bank for Agriculture and Rural Development
NGO	non-government organization
NOS	National Occupational Standards
NRDWP	National Rural Drinking Water Programme
NSDC	National Skill Development Corporation
QP	Qualification Pack
RWH	rainwater harvesting
SCGJ	Skill Council for Green Jobs
SDG	Sustainable Development Goal
SHG	self-help group
SIAST	Sri Sri Institute of Agricultural Sciences and Technology Trust
SSC	Sector Skill Council
UNEP	United Nations Environment Program
WALMI	Water and Land Management Institute
WASSAN	Watershed Support Services and Activities Network
WDC-PMKSY	Watershed Development Component-Pradhan Mantri Krishi Sinchayee Yojana
WOTR	Watershed Organisation Trust

Foreword

Climate change is perhaps the biggest challenge of our times and it is forcing all of us to define the kind of economy that works for everyone. The effects of climate change will undoubtedly alter the structure of employment; new jobs and new job families will emerge, others will evolve or become unsustainable. Economies must find ways to reorganize work and production differently.

According to ILO, at least half of the global workforce, around 1.5 billion people will be affected by the transition to a greener economy. The challenge lying ahead of us is the urgent need to equip the people with the right skills that will help them adapt to this transition. Skills gaps have already started emerging across a number of sectors, such as renewable energy, energy and resource efficiency, renovation of buildings, construction, environmental services and manufacturing.

Moreover, the exclusion of women and their needs in decision-making process for mitigation or adaptation measures can pose challenge to achieving gender equality at work. This will have a deep impact on the larger economies. Given that women make up a little over half of the world's population (WEF 2013), their untapped talent could significantly alter our economic development (UNDP 2013).

Nearly 60 percent of India's population is directly dependent on climate-sensitive sectors such as agriculture, fisheries and forestry for its livelihoods, and 80 percent of economically active women are in the agriculture sector. Hence the climate crisis severely affects the women who are dependent on these climate-sensitive livelihoods and who do not have any alternative livelihoods.

Keeping in mind these multiple challenges and based on our learnings from Disha Project that UNDP implemented in partnership with IKEA Foundation, to create employment and entrepreneurship opportunities for women, a study was commissioned to assess the green jobs and eco-entrepreneurship opportunities for women in India. The study focused on five major sectors identified by the Skill Council for Green Jobs: renewable energy, green transport, green construction, forestry, fisheries and water management. It covered Delhi NCR (National Capital Region), Haryana, Maharashtra, Karnataka and Telangana as well the potential states such as Uttarakhand and Odisha.

Although we faced the challenge of lack of gender-disaggregated data, and the study being conducted during the COVID-19 pandemic, the sector-specific reports present some promising prospects for a greener skilling and livelihoods ecosystem. The Government of India and some of the state governments are already moving in the right direction. For instance, the International Solar Alliance in the Renewable Energy space has already gained momentum and the cost of the solar panels in India has reduced in the recent years.

While substantial work has been done to build capacities of people and communities on water management, forest or fisheries, to promote climate-resilient practices, women are often left out and mostly under-represented in such initiatives. As we recover from the pandemic, we must ensure that women are given equal opportunities to be part of our green recovery. Only when we tap into their talents and the huge demographic dividend that is often left out, can we achieve our Sustainable Development Goals at the end of this decade.

UNDP has been working closely with the Government of India and other key partners for an inclusive and climate-sensitive response to COVID-19 that paves the path to greener pathways for recovery. India, as an emerging economy, holds immense potential, given its demographic dividend. But it can never recover fully, or reach its full potential, if half of the population – the women- are not part of its green recovery.



Shoko Noda
Resident Representative

Acknowledgement from Lead Facilitator

UNDP India has undertaken a study on the “Scoping Study and Policy Imperatives on Green Jobs and Eco-Entrepreneurship Opportunities for Women in Select States in India”. The report takes into cognizance the climate crises and its implications on lives and livelihoods of the people, and provide some pathways in terms of nature-based livelihoods, that can often be turned into opportunities for more decent work. Be it renewable energy, green transport, green construction water management, forest or fisheries, strides are being made by the Governments at national and state levels to build the capacity of the people and promote climate-resilient practices. And it is but appropriate to bring in the women to partake in the development and be part of the dynamic workforce in the country. And this forms the basis of the study.

This report has been made possible with contributions from many individuals and experts, who took out time and helped put this study together. This report was initiated just prior to the onset of pandemic and was drafted virtually through the lockdown period. A number of virtual consultations with thematic and regional experts were held between April and November 2020, and inputs received on each of the chapters drafted.

In this endeavour, we owe our deepest gratitude to Dr. Sunita Sanghi (Additional Secretary and Senior Advisor, Ministry of Skill Development and Entrepreneurship, Government of India), Dr. Praveen Dhamija (Advisor, Sector Skill Council on Green Jobs), Vandana Bhatnagar (Chief Programme Officer, NSDC), Sudipta Bhadra (Senior Programme Officer, ILO), and Anubha Prasad (National Coordinator, PAGE) for their guidance while discussing our findings, assessing the quality of analysis, the reliability of data, and the soundness of the recommendations emerging from the study.

The support provided by our collaborators in the formulation of background papers needs a special mention. We express our utmost appreciation for the hard work put in by the KPMG team lead by Manpreet Singh and Vivek Panda.

We would like to thank and acknowledge the inputs received during the peer review of the draft chapters by Dr. Srinivas Shroff Nagesha Rao (CEO, REC Foundation), Hitesh Vaidya (Director, NIUA), Suneel Padale (Director Programs, CARE India), Vishaish Uppal (Livelihoods Specialist, WWF India), Moho Chaturvedi (Independent Consultant) and Ramya Rajagopalan (Independent Researcher).

Our gratitude to UNDP colleagues for their insightful comments during the peer review process. Our heartfelt appreciation for the overall insight and guidance by Harsh Singh, Amit Kumar, Alka Narang, and the contributions by UNDP India team, especially Sushil Choudhury, Saba Kalam, Dilip Singh, Abha Mishra, Rashmi Bajaj, Manisha Choudhury and colleagues from the Inclusive Growth team.

We are eternally grateful to Ms. Shoko Noda, Resident Representative, UNDP India and Ms. Nadia Rasheed, Deputy Resident Representative, UNDP India for their inspiration, encouragement and guidance throughout the process. None would have materialised without the faith that they reposed in our endeavours.

We thank all the experts and colleagues for their support and contribution.



Swayamprabha Das
Inclusive Growth

Executive Summary

The role of water in sustaining life is undeniable; in fact, the two are considered synonymous. We all also know that the earth comprises 71 percent water but only about 3.5 percent of this is fresh water, suitable for most purposes. Nonetheless, until a few years back, water was considered to be a resource that would always be in abundant supply. Today, it is apparent that water cannot be easily replenishable and needs to be managed for equitable distribution. Nearly 600 million of 1.3 billion Indians today face extreme water stress as do people across the globe. Several cities are already counting down time to 'day zero' when they will run out of water. In India, our per capita water availability has fallen from 1,816 cubic metres in 2001 to 1,545 cubic metres in 2011¹. Our water demand is expected to double by 2030. In this context, planning and implementation of actions for sustainable management of water resources and mapping various services provided by the water sector, including livelihood opportunities, will be a vital area of intervention.

Sustainable management of water resources offers a great opportunity to create 'green jobs'. International Labour Organization's (ILO's) study to investigate sectoral job creation, using an input-output model, states that the green sector currently contributes to employment of less than 1 percent of the Indian workforce but green sectors need to be nurtured since they are dynamic and have potential. In agreement with this observation, another ILO report, Skills for Green Jobs in India, projects cumulative jobs in water management to increase to 19 million by 2030 as opposed to 3 million in 2020. With the increasing growth of the construction sector, rooftop rainwater harvesting also has a potential to grow by an estimated 7 percent due to the regulatory push being given by the government. Scarcity of the resource will also lead to an increasing focus on newer technologies such as desalination and wastewater reuse. These technologies have the potential to contribute positively to employment generation in this sector. As part of the Atmanirbhar Bharat Abhiyan, the economic stimulus of an additional budget allocation of INR 400 billion in the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) leading to a 65 percent increase in budget will help provide employment in areas such as watershed construction to unskilled and semiskilled migrant workers returning to their villages in a post COVID-19 world.

Despite its tremendous potential, the sector faces its own share of challenges. Water management is a crucial part of multiple sectors such as agriculture, textile, plumbing, food processing, manufacturing, and many others. It is also a part of multiple Sector Skill Councils (SSCs). However, jobs mapped to the sector are limited; those that are defined are limited to areas of wastewater treatment and watershed management. Considering the limited number of jobs that are currently categorized under water management, skill gap identification for the sector is only possible through assumptions. Also, the sector supports a significant number of indirect jobs. Water can thus be considered as more of a job enabler than a job creator. Data availability in the level of detail required for projections is a challenge for water management. Even reports of government institutions such as the Central Water Commission for consecutive years (2014-17) are found to use the same data year-on-year. In such a scenario, predicting the potential of existing as well as future jobs for women has been conducted via stakeholder interaction and information obtained in silos.

Disclaimer: All the estimations that have been made in this report are suitable for a pre-COVID scenario.

¹ Som <https://pib.gov.in/newsite/printrelease.aspx?relid=119797>, accessed 15 January 2020.

The multitude of challenges also presents huge potential for the sector. However, it is important to first conduct a need assessment study across SSCs to identify the potential job roles that are not defined at present. This study could serve as a stepping stone in defining the skills and qualifications required for these job roles through development of Qualification Packs (QPs) and National Occupational Standards (NOS). This should be followed by the development of suitable training infrastructure. Evidence-based decision support for a green skill environment will go a long way in improving employment growth in the sector. Since the sector is a job enabler, the employment contribution of women is not yet accounted for. Consequently, challenges being faced by women in this sector are the same today as in many other sectors and specific enabling actions promoting women's employment at this stage are critically required. Women are, however, the larger consumers of water, at times travelling long distances to obtain their daily family quota of fresh water. Improving water management in terms of water supply and wastewater management will increase the time they can contribute towards improving their literacy and financial status. Simple interventions in terms of providing them opportunities for entrepreneurship will be most beneficial in helping improve their status in society.

1.

Overview

1.1 SETTING THE CONTEXT

The planet is warming and the conversation on climate change is gaining its share of heat as well. In the past decade, as the reality of resource scarcity and climate change have become apparent, emphasis is being placed on 'going green'. The relationship between changing climate and its impact on lives and income sources of people across the planet has been gaining momentum with each passing global conference. The emergence of the green sector has led to a focus on the importance of green jobs.

BACKGROUND

This scoping study on Green Jobs and Eco-entrepreneurship opportunities for women in select states, draws its strength and learning from the UNDP-IKEA Foundation project 'Creating Employment and Entrepreneurship Opportunities for Women in India (Disha)'. This project focused on enhancing opportunities for marginalized women in jobs and entrepreneurship and enabled development of models and curriculum like the Biz Sakhi and Women Sourcing Managers. Though some of the pilots under Disha did include components of green initiatives, but a full pledged pilot/programme could not be developed majorly because of lack of information and the potential for growth. But as the conversations around jobs/entrepreneurship - climate change nexus gathered

attention, a need was felt to design a study to fill this gap in data/information and develop sector specific pathways with a focus on marginalised women.

While the discourse on Green Economy/Green Growth is huge and covers a range of sectors, the study focuses on addressing the following two-fold objectives:

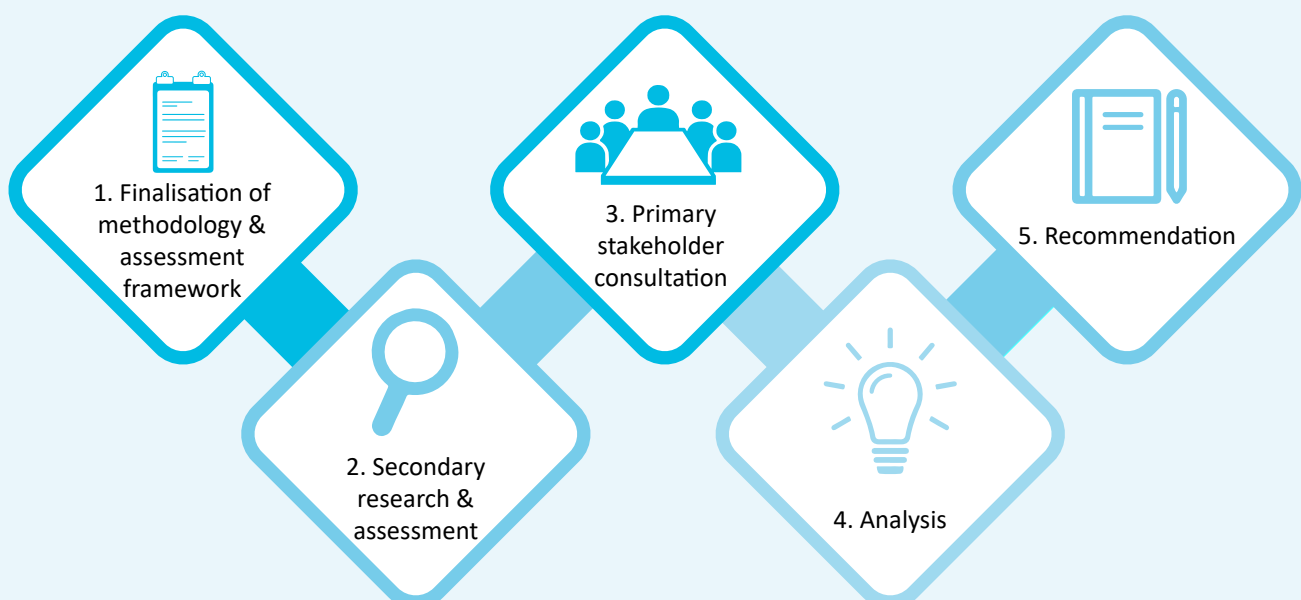
- Gap assessment of existing and potential green jobs and mapping the availability of skilled workforce for the identified job roles in the RE sector; and
- Development of an implementation roadmap and provision of recommendations to enable women to leverage the existing and potential opportunities.

Given the limitation and the acceptance that many of the Green Jobs sector is still evolving and maybe in nascent stage, the geographic scope of the study was limited to the states of Delhi NCR, Haryana, Maharashtra, Karnataka, Telangana, : Uttarakhand and Odisha.

SCOPE AND METHODOLOGY

This study was conducted in the following five phases: finalization of methodology and assessment framework, secondary research and assessment, primary stakeholder consultation, analysis and report writing. In each phase, various tasks as suggested in the scope were performed to ensure completion.

Figure 1: Scope of the study



The geographic scope of the study includes the states of Delhi NCR and Haryana, Maharashtra, Karnataka, Telangana, and two potential states: Uttarakhand and Odisha. In case of unavailability of data pertaining to these geographies, pan-India level data have been referred to.

The sectoral scope of the current report is water management. This report presents a sectoral analysis of **water management** in India and outlines policies in place and eco-entrepreneurship opportunities, especially for women, in the selected states.

DEFINITION OF GREEN JOBS

International Labour Organization (ILO) defines green jobs as those that are, *“decent jobs that contribute to preserve or restore the environment, be they in traditional sectors such as manufacturing and construction, or in new, emerging green sectors such as renewable energy and energy efficiency.”*

According to ILO, decent work involves “opportunities for work that is productive and delivers a fair income, security in the workplace and social protection for families, better prospects for personal development and social integration, freedom for people to express their concerns, organize and participate in the decisions that affect their lives and equality of opportunity and treatment for all women and men”².

The United Nations Environment Programme (UNEP) defines green jobs as “work in agricultural, manufacturing, research and development (R&D), administrative, and service activities that contribute substantially to preserving or restoring environmental quality. Specifically, but not exclusively, this includes jobs that help to protect ecosystems and biodiversity; reduce energy, materials, and water consumption through high efficiency strategies; de-carbonize the economy; and minimize or altogether avoid generation of all forms of waste and pollution”³.

Green jobs can be existing or may require recognition of prior learning (RPL), reskilling, upskilling or development of new skills

For the purpose of this study:

‘Green’ implies:

- Limiting or preventing negative environmental impacts, such as pollution, of ecosystem components such as air, water and soil;
- Being climate friendly via minimization of resource wastage;
- Maximizing resource efficiency; and
- Focusing on resource conservation.

‘Green jobs’ include social considerations such as improvement of working conditions, promotion of health and well-being, better livelihood generation, community development, etc. Green jobs can be existing or may require, reskilling, upskilling or developing new skills.

LIMITATIONS OF THE STUDY

The uniqueness of this assignment is an opportunity to explore and find a way forward, but it also presents its own set of challenges, particularly in terms of paucity of data. A few of them are listed below:

1. Data availability in the level of detail required for projections is a challenge. Even ministry reports for consecutive years are found to use the same data year-on-year.
2. According to ILO,⁴ while direct jobs in the water sector, or water jobs, account for a minor share of total employment, they support a significant number of other jobs. Water can thus be considered as more of a job enabler than a job creator.
3. State-specific data availability: states of Telangana and Delhi
 - Telangana being a newly developed state, as compared to other states considered for this study, data availability on green sectors and related employment is a challenge. Also, most stakeholders who have worked in the region in the past are associated with Andhra Pradesh; and
 - Availability of Delhi-specific data is a challenge since all the employment data published by various ministries reflect nationwide

² <https://www.ilo.org/global/topics/decent-work/lang--en/index.htm>

³ <http://www.fao.org/rural-employment/work-areas/green-jobs/en/>

⁴ https://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---sector/documents/publication/wcms_729058.pdf, accessed 20 April 2020.

scenarios. In general, data specific to Delhi are unavailable.

4. Availability of government studies on the status of female employment in India: While there are data available on women's employment for different states at the country level and even for conventional sectors, data related to green sectors, especially water management, in study states are unavailable.
5. Women-related data: Since water management is not a sector in itself, the Sector Skill Councils (SSCs) do not have occupational maps defined in greater details in comparison with conventional sectors. In that scenario, data on job roles that are currently taken up by women are not well-documented.
6. Unskilled green jobs: Data availability for unskilled jobs in the green sector is also limited. As per current stakeholder interactions, unskilled jobs do not require any specific knowledge set or skills to classify them as 'green'. Current occupational mapping for some of the green sector does not include unskilled jobs.

water for multiple needs and life without water seems impossible to manage. However, with changing times, water availability is becoming more and more of a real challenge and many cities across the globe today are facing situations where 'day zero,' a day when cities will run out of water supply, is fast approaching. Today, about 1.2 billion people globally do not have access to drinking water and twice that number does not have access to sanitation.⁵ With this context, water management practices become extremely relevant.

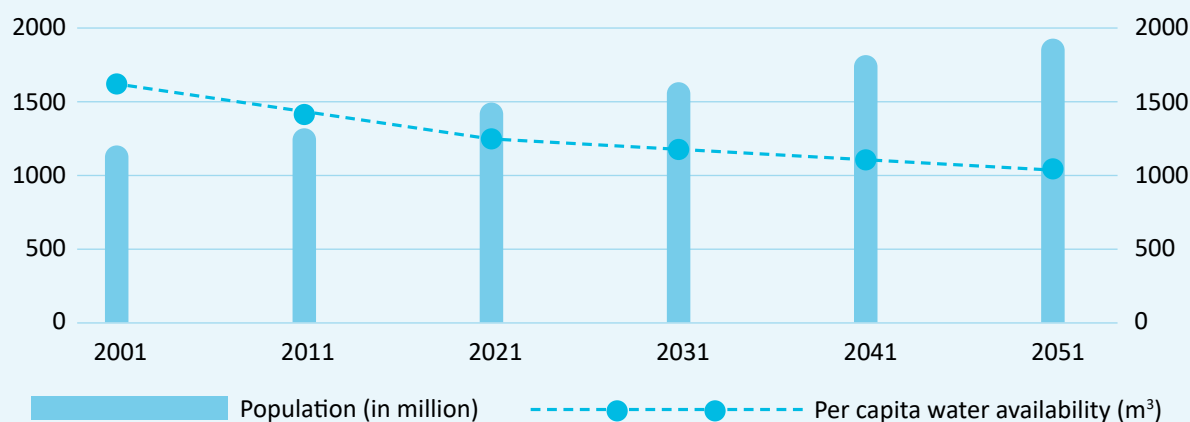
While Indians constitute about 16 percent of the world's population, our geographical area is only 2 percent, creating but natural stress on available resources.⁶ Nearly 600 million of our 1.3 billion people face extreme water stress today.⁷ In India, the per capita water availability has fallen from 1,816 cubic metre (m³) in 2001 to 1,545 m³ in 2011.⁸ India's water demand is expected to double by 2030. To exacerbate the situation, nearly 70 percent of the water is contaminated contributing to India's 120th rank in the Water Quality Index calculated for 122 countries.⁹ Most drinking water supply in both rural and urban areas as also agriculture is highly dependent on groundwater, the country's demand exceeds replenishment. This results in groundwater resources depleting rapidly. Table 1 and Figures 2 and 3 give an overview of the status of our water resources.

Low employment rates and increasing unviability of agriculture due to water shortages increase urban migration of un-skilled and less-educated men and women from rural region. This creates tremendous

1.2 INTRODUCTION TO THE WATER MANAGEMENT SECTOR

Water has been a major factor in the development of civilization since times immemorial. We require

Figure 2: Per capita water availability projection



Source: CWC

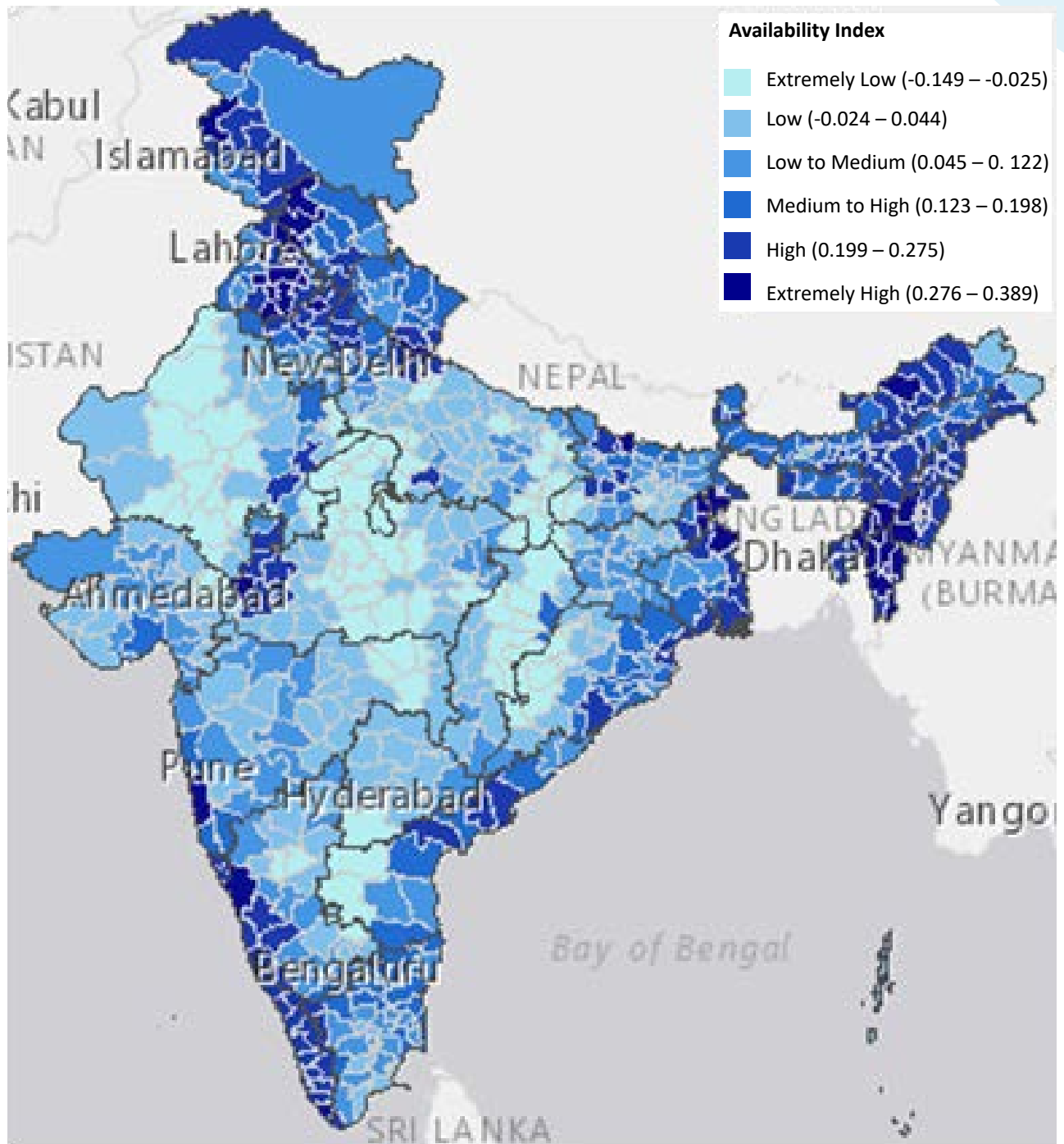
⁵ Ministry of Urban Development, August 2013. Advisory on Conservation and Restoration of Water Bodies in Urban Areas.

⁶ <https://dolr.gov.in/integrated-wasteland-development-programme>, accessed 18 February 2020.

^{7, 8} NITI Aayog, June 2018. Composite Water Management Index .

⁹ <https://pib.gov.in/newsite/printrelease.aspx?relid=119797>, accessed 15 January 2020.

Figure 3: India's groundwater availability status



Source: India water tool 3.0

Table 1: Overview of water resources in India

Average annual rainfall	4,000 billion cubic metre (BCM)
Annual rainfall (2016)	3,560 BCM
Mean annual natural run-off	1,869 BCM
Estimated utilizable surface water potential	690 BCM
Total replenishable groundwater resources	433 BCM
Groundwater resources available for irrigation	369 BCM
Groundwater potential available for domestic, industrial and other purposes	71 BCM (approx.)
Ultimate irrigation potential	140 million hectare (ha)
• From surface water	76 million ha
• From groundwater	64 million ha
Storage available due to completed major and medium projects (including live capacity less than 10 million m ³)	253 BCM
Estimated additional likely live storage available due to projects under construction/ consideration	155 BCM

Source: CWC Annual report 2017-18

pressure on the urban ecosystem. Hence it is very important to address this issue by formulating and implementing various initiatives along with skill development and awareness, which would also create opportunities for livelihood generation in rural and urban areas.

It is evident that proper utilization and management of natural resources through watershed and other water management programmes will help in achieving sustainable development through ecological benefits and thus accelerate community development. These measures include recharging of groundwater level, increasing crop production, restoring dried-up rivers and ponds, improving livelihoods, reversing the process of migration, protecting the environment, boosting women's empowerment, ensuring food security, to name a few.

DEFINITION AND BOUNDARY

The water sector encompasses an industry, including drinking water supply, wastewater collection and treatment. Water management can be defined as the control and movement of water resources to minimize damage to life and property and to maximize efficient beneficial use.¹⁰ In the face of a growing water crisis, water management can be considered as the 'green' component of the water sector and categorized into two parts: treatment and conservation.

For the purpose of this study, basis discussions with UNDP and stakeholder interactions, **focus areas** considered include **rooftop rainwater harvesting (RWH) and watershed management** (see annexure for definitions). All activities in the process flow of these areas, excluding those related to actual construction, have been considered as green.

1. 3: IMPLICATIONS OF COVID-19 ON THE WATER MANAGEMENT SECTOR

The global pandemic, COVID-19, has affected the human population globally. Full or partial lockdown measures implemented by most countries affected almost 2.7 billion workers, representing around 81 percent of the world's workforce (Source: ILO Monitor: COVID-19 and the world of work, second edition). Going forward, it is difficult to predict if recovery from the pandemic will happen quickly (V shaped) or take time (U shaped or L shaped). The fact is that as difficult it is to predict the turn this pandemic will take in terms of the people directly affected, it is even more difficult to predict its impact on the economy and employment.

This unprecedented situation is already having a catastrophic effect on jobs particularly in the micro, medium and small enterprises and semi-skilled and unskilled workforce; most vulnerable being the informal economy. In India the non-manufacturing sector, which includes construction, mining, electricity, water and gas employees about 59 million people.¹¹ While tourism and

¹⁰ www.nrcs.usda.gov

¹¹ <https://www.livemint.com/news/india/136-million-jobs-at-risk-in-post-corona-india-11585584169192.html>

hospitality are and will continue to remain the worst hit even in the second quarter of FY20-21, utilities such as water and electricity are also expected to see a fall in their revenue as an impact of the pandemic.¹²

MGNREGS, the largest rural employment scheme in the world, provides employment in various activities including water management such as development of water conservation and water harvesting structures to augment and improve groundwater levels, watershed management works, micro and minor irrigation works and renovation of traditional water bodies. While the average per day wage rate for unskilled work under MGNREGS has increased 11 percent in the fiscal year 2020-21 (figure varying slightly between states),¹³ the impact of COVID-19 has resulted in the loss of jobs to the extent of only 1 percent of the usual employment during the same time last year.¹⁴

Among a plethora of suggestions, all indirectly impacting the water management sector, the ray of hope is that returning unskilled migrants will be the beneficiaries if the scope of MGNREGS is increased to include them as well. It is also suggested that the government consider paying advance wages to those with authenticated MGNREGS accounts. Water management works could be resumed in less impacted areas before the end of the first quarter. The effect of the sudden epidemic has placed greater stress on the importance of water availability in the context of hygiene and sanitation. The government may even consider increasing funds to strengthen the water supply systems across the country, both urban and rural. However, the actual impact is yet to be determined.



¹² <http://www.businessworld.in/article/COVID-19-Impact-On-Jobs/21-03-2020-186788/>

¹³ <https://www.thehindubusinessline.com/economy/mgnrega-wages-up-about-11-yet-at-least-40-lower-than-minimum-wages/article31197140.ece>

¹⁴ <https://www.thehindu.com/news/national/coronavirus-mgnrega-jobs-crash-to-1-of-normal/article31334478.ece>



2.

Sectoral Analysis

Water management is multi-sectoral in nature. Skills under this sector are split across skill councils such as the Indian Plumbing Skill Council (IPSC), Agriculture Skill Council of India (ASCI), Skill Council for Green Jobs (SCGJ).

SECTOR CHALLENGES

It has been acknowledged that finding sustainable solutions to water management is a function of adequately trained personnel. Training could be at the highly skilled level but also includes training given to communities and other stakeholders of the sector.

Water a scarce resource: As of 2018, approximately 49 percent of India's rural population had access to safely managed water (NITI Aayog, 2018). Also, only about 20 percent of rural households had access to tap water in their homes.¹⁵ Providing access to clean drinking water and sanitation facilities is a priority for every government and India's commitment under Sustainable Development Goal (SDG) 6. However, this involves substantial investment and infrastructure development. In the present COVID-19 situation where hand washing is recommended frequently and at least for 20 seconds, it is extremely challenging to meet the water needs of our population.

Limited coverage: Data availability is a challenge for critical sectors such as domestic and industrial use where only aggregate data are available. Details required to be able to formulate policies or carry out projections are not available.

Cross-border water ecosystem management: As more and more industries are being set up and per capita water availability is reducing, state policies need to be constantly updated to ensure equitable distribution of this scarce resource. While the National Water Policy is being updated with this objective, most states do not have an updated water policy at present. Maharashtra and Meghalaya are the only states where the policy has been updated in recent times.

Unreliability: The quality of available data is also a challenge due to use of dated methodologies for data collection. Examples include:

- a) Groundwater data in India is based on an inadequate sample of ~55,000 wells out of a

total ~12 million in the country (NITI Aayog, 2018); and

- b) CWC reported the same water resources statistics for three consecutive years 2014-2017 except for annual rainfall (CWC, Annual reports).

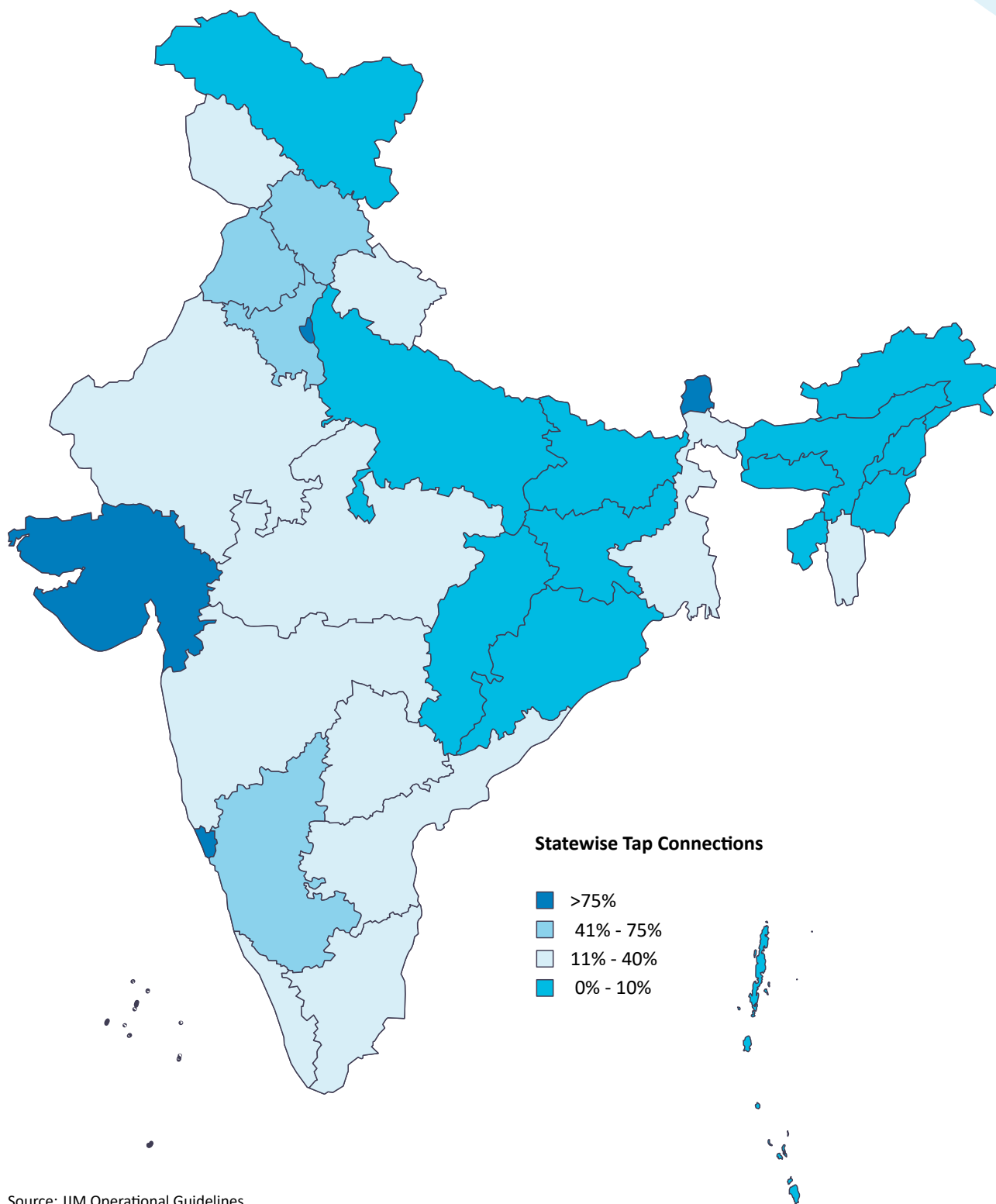
Information silos: Inter-state or centre-state data collection and sharing are limited thereby resulting in siloed information which further leads to inefficiencies. This also cascades into challenges in identifying the current and projected workforce in the sector. For the purpose of this report, MGNREGS data are being considered for the development of job projections in the sector. However, employment being offered by MGNREGS is hardly representative of the employment potential of the entire water management sector.

Component of multiple sectors: What works as an advantage in some ways is also a disadvantage in others. Water is multi-sectoral in nature, which means that skilled professionals in the field are also suited for work in certain other sectors (such as construction, textile, agriculture) and often make the switch as required. This has a two-fold impact on the sector.

- a. **Floating workforce:** The sector workforce for highly skilled professional as well as unskilled labour is itinerant, making it difficult to account for the number of people employed by the sector. Examples of this floating workforce include Geographical Information System (GIS) experts (highly skilled), plumbers (semiskilled) and construction labour (unskilled and semiskilled). Assumptions will have to be made to assign employment numbers to the sector; when accounting is done.
- b. **Allied area knowledge:** The skilled professionals working in the sector need to have knowledge of not only their own area of expertise but also allied areas. As an example, a geologist and limnologist working in watershed management will need to identify the effect of their suggested intervention in allied areas as well. In the absence of multi-sectoral knowledge, sustainability of the project may be impacted.¹⁶ The impact may most be seen in cases where only one of these experts is on board.

¹⁵ https://jalshakti-ddws.gov.in/sites/default/files/JJM_Operational_Guidelines.pdf
³⁵ Stakeholder consultations conducted for this study.

Figure 4: Status of household tap connections as on 1 April 2019



Source: JJM Operational Guidelines

COVID-19 pandemic impact: Advisories relating to the current pandemic include washing of hands with soap regularly to avoid contracting infection by touching any infected surfaces. This advisory may also soon become part of the hygiene protocol of the general public and rightfully so. While water availability is a

luxury for many, the resultant wastewater (with soap content) generated, if untreated, could be a source of eutrophication of water bodies and could also affect groundwater.^{17,18} Treatment of such water is crucial.

Also, excessive use of water in cleaning during such times may be a cause for concern (Table 2).

Table 2: Challenges and opportunities presented by COVID-19

Personal Use	Running tap 6 litre/ min	30-40 second wash 4 litre/wash	Washes per day per person 10	Family of 5 200 litre/day
Public places	Sanitization of public places and utilities consumes large amounts of fresh water			
Challenges	Water wastage		Wastewater leading to eutrophication Contamination of groundwater	
Opportunities	Smart water systems Sensor taps		Wastewater treatment	

GROWTH DRIVERS FOR EMPLOYMENT OPPORTUNITIES

Challenges that confront the sector today can also be viewed as growth opportunities. A few drivers, trends and opportunities are listed here:

Market drivers

- **Rise in residential construction activities.** The real estate sector is expected to grow at a rate of 7 percent increasing employment generation in rooftop RWH.

- **Need for community participation:** Our constitution gives the responsibility of water resource management to the respective states. With changing times and the realization that large-scale projects such as watershed development cannot be fully sustainable without community participation, there has been increasing focus in central and state water policies in involving the community and other stakeholders in project planning as well as implementation. This has resulted in a higher number of jobs for local communities.



¹⁷ <https://www.downtoearth.org.in/blog/water/COVID-19-outbreak-more-hand-washing-can-increase-india-s-water-woes-69900>, accessed 30 April 2020.

¹⁸ http://cpcbenvs.nic.in/cpcb_newsletter/sewagepollution.pdf, accessed 24 April 2020.

- **Government mandates:** With the implementation of model building byelaws and subsequent state mandates for installing RWH systems in all existing structures above a certain area in addition to newly constructed structures, there is demand for experts as well as contractors. RWH experts have limited certification courses at present. Having a certification requirement in place and listing certified professionals on government websites is an opportunity which could help encourage young professionals in picking this up as a lucrative career option. While jobs in this area would show an exponential growth in the first few years, it needs to be noted that once all existing structures have RWH systems installed, the demand of professionals will only be limited to newer constructions and will stabilize.
- In a post COVID-19 world, and even during the pandemic, maintaining hygiene has emerged as the most effective barrier to the spread of the disease. In rural areas as well as informal settlements, water may not be easily accessible to maintain the desired hygiene levels. Provision and management of water kiosks may be a potential opportunity to increase employment.
- **Government stimulus:** As part of Atmanirbhar Bharat Abhiyan, the Government of India, in May 2020, announced an increased investment of INR 400 billion in MGNREGS which had been cut by 13.4 percent in the budget, announced earlier in the year. The consequent increase in budget is 65 percent. Since one of the components of work in rural areas under MGNREGS is watershed construction, the benefit to unskilled and semiskilled migrant labour is anticipated in terms of income as well as helping create assets such as those for water conservation.

Trends

- **Rainwater harvesting:** There has been increasing use of RWH for groundwater recharge. Reports suggest that the RWH market is forecast in India to grow at a compound annual growth rate of 6.56 percent during the period 2017-2021.¹⁹
- **Technology:** Technologies for activities such as desalination and wastewater reuse have the

potential to contribute positively to employment statistics:

- a. Desalination units are a potentially viable solution in freshwater stressed areas. The units are capable of providing employment during not just operation and maintenance but also construction; and
- b. Similar is the case with wastewater treatment plants. The country currently generates 140 BCM of wastewater every year.²⁰ Treated wastewater has been found to be utilizable for multiple purposes. UNEP (2002) points out that wastewater reuse systems for aquaculture (stabilization ponds) have the potential to provide increased employment for local communities. Wastewater that is fit-for-purpose can also be considered for use in the livestock sector. Treated wastewater irrigation in fields has also been seen to provide employment to the tune of 130 million person-days for agricultural labourers (assuming the potential to annually irrigate 1 to 1.5 million hectare of farmland in India).²¹ The achievement of irrigation of 1 million hectare of agricultural land with treated wastewater is being considered by the Government of India by 2020.

Challenges and Opportunities

- **Water availability:** With increasing water stress and consequent reducing per capita availability, water could soon become more valuable than oil. Managing water availability can be seen as an opportunity for growth in employment.
- **Ongoing projects:** Considering their magnitude and nature, watershed projects require a completion time of four to seven years. According to the Standing Committee on Rural Development (2017-2018) report,²² only 849 of 8,214 projects sanctioned (between 2009-10 and 2014-15) have reported completion as in October 2017. The ongoing projects have potential to create employment in addition to the newly sanctioned ones.
- **Infrastructure development:** Currently about 20 percent of the rural population has access to piped drinking water. Setting up of rural water

¹⁹ <https://www.prnewswire.com/news-releases/rainwater-harvesting-market-in-india-2017-2021-300485759.html>

²⁰ NITI Aayog, 2018. Strategy for New India @ 75.

²¹ ILO, 2017. Wastewater and jobs: The Decent Work approach to reducing untreated wastewater, Working Paper No. 314.

²² http://www.indiaenvironmentportal.org.in/files/file/Watershed%20Development%20Component%20of%20Pradhan%20Mantri%20Krishi%20Sinchayee%20Yojana_0.pdf, accessed: 25 March 2020.

supply systems is an opportunity for increasing employment as well as boosting women’s participation in employment.

- **Setting up wastewater treatment and reuse ecosystems:** Meeting growing demand for industrial water and wastewater treatment plants and setting up functioning (read sustainable) infrastructure, especially at the rural level, is a challenge.^{23,24} Also, scaling up of wastewater reuse in agriculture would include challenges such as locating wastewater plants closer to irrigated land, creating a balance between wastewater composition and

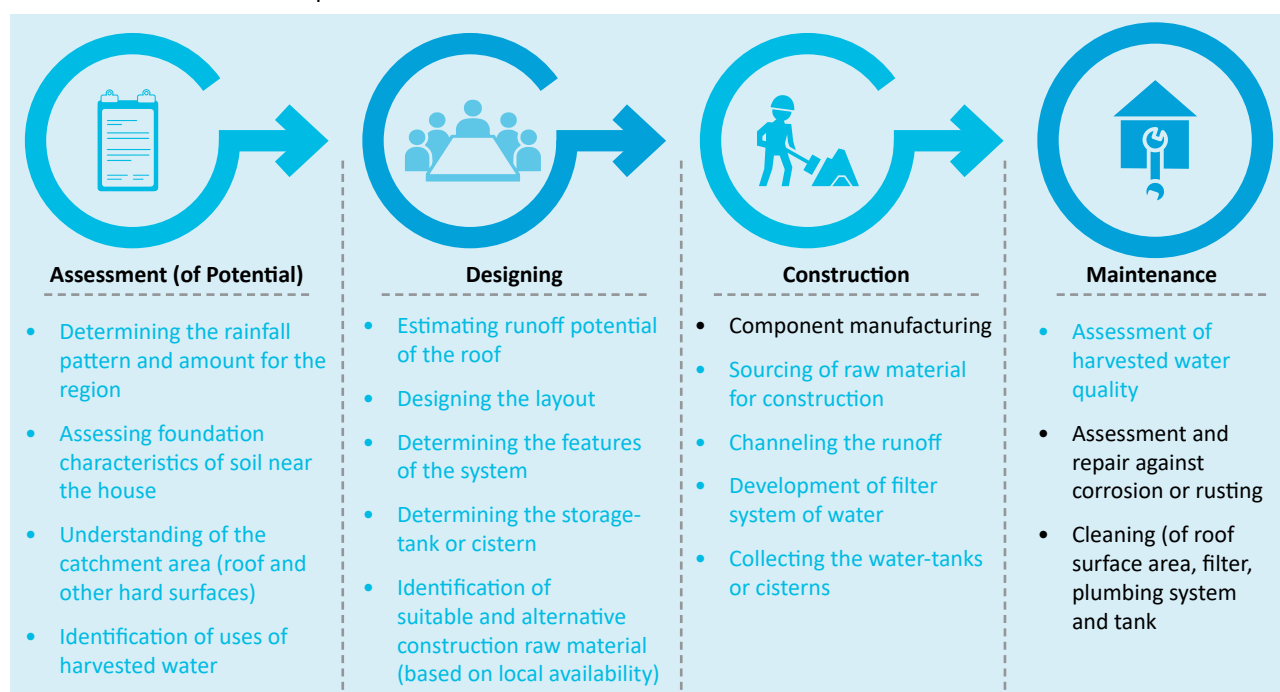
crop nutritional requirements and risks of over-application, among others.

POTENTIAL JOB ROLES

Process Flow: Rooftop Rainwater Harvesting

Setting up a rooftop RWH includes multiple phases. The first stage is the conceptualization and assessment of potential. Upon successful assessment, designing is carried out followed by construction of the system. Regular post-construction maintenance is a requirement for efficient functioning of the system. Table 3 lists the activities under each phase; green activities are highlighted in blue.

Table 3: Process flow: rooftop RWH



Process Flow: Watershed Management

Watershed projects are managed by the central and state governments. At the rural level, the Panchayati Raj system is responsible for their implementation and maintenance. The process flow for watershed projects involves four stages: recognition, restoration, protection and improvement. Construction activities, as mentioned subsequently in the report, form part of the engineering/structural measures and include (with possibility of variation from watershed to watershed) the following as per MGNREGS:²⁵

- Water conservation and water harvesting;
- Drought proofing, including afforestation and tree plantation;
- Irrigation canals, including micro and minor irrigation works;
- Provision of irrigation facilities to land owned by households belonging to the scheduled castes and scheduled tribes, or to land owned by the beneficiaries of land reforms or of Indra Awas Yojana;
- Renovation of traditional water bodies, including de-silting of tanks;
- Land development;
- Flood-control and protection works, including drainage in waterlogged areas; and
- Rural connectivity to provide all-weather access. The construction of roads may include culverts where necessary, and within the village area may be taken up along with drains.

²³ <https://www.reportlinker.com/p04988888/Rainwater-Harvesting-Market-in-India.html>

²⁴ UNESCO-UNEVOC International Centre for Technical and Vocational Education and Training, 2012. Skills Challenges in the Water and Wastewater Industry.

²⁵ https://nrega.nic.in/Netnrega/Data/SPS_Watershed_Works_Manual_Eng.pdf

Table 4: Lists the activities under each phase; green activities are highlighted in blue colour.

Recognition	Restoration	Protection*	Improvement
<ul style="list-style-type: none"> Selection of watershed area Conduct diagnostic study Identify Issues 	<ul style="list-style-type: none"> Develop solutions/ watershed development plan Selection of best solution Design, materials, costs, permits 	<p>On-site measures</p> <ul style="list-style-type: none"> Pollution control (physical, chemical and biological) Vegetative/agronomical measures Engineering / structural measures <p>Off-site measures</p> <ul style="list-style-type: none"> Engineering / structural measures 	<p>Implementation of best practices</p> <ul style="list-style-type: none"> Community awareness/ education Initiating conservation & land management programs Ordinances/ Regulations

*Includes land, soil, water, vegetation

POTENTIAL JOB ROLES ACROSS THE PROCESS FLOW

Watershed management: Seven roles have been identified by ASCI under watershed management. In addition to the job roles already defined, Table 5 provides an indicative list of the job roles across the

process flow, identified through literature review and stakeholder interactions. The green roles have been defined first followed by ‘other roles’ which are more conventional in nature such as construction work related roles. For the purpose of this study, all activities in the process flow excluding the actual construction related ones have been considered as green.

Table 5: Job roles in watershed management

Recognition	Restoration	Protection	Improvement
<ul style="list-style-type: none"> Intergrated watershed management expert Hydrologist/water resource expert Natural resources/ Environmental expert Geologist/ Soil expert Limnologist Social science expert GIS/ remote sensing/ IT expert Watershed community mobilizer Water policy expert Water quality testing expert 	<ul style="list-style-type: none"> Integrated watershed management expert Watershed consultant Biodiversity expert Agronomist Landscape ecologist Aquaculture expert 	<ul style="list-style-type: none"> Watershed development contractor Service technician-watershed Stormwater management expert Water use surveyor Watershed engineer Watershed assistant Watershed manager Watershed supervisor 	<ul style="list-style-type: none"> Watershed community mobilizer Water policy expert Micro irrigation expert Aquaculture technician
Other roles			
<ul style="list-style-type: none"> M&E specialist Statistician/data analyst Documentation specialist 		<ul style="list-style-type: none"> Watershed Construction roles Plumber Mason 	

Table 6 shows the status of existing qualification packs (QPs) and roles with potential for QP development. Allied QPs have been referred in addition to the existing roles defined under watershed management

Table 6: Status of existing QPs and roles with potential for QP development in watershed management

Recognition	Restoration	Protection	Improvement
Roles with existing QPs	Roles with existing QPs	Roles with existing QPs	Roles with existing QPs
<ul style="list-style-type: none"> • Soil and water testing lab analyst (NSQF 5) • Soil and water testing lab assistant (NSQF 4) • Soil sampler/collector (NSQF 3) • Watershed community mobilizer (NSQF 5) 	<ul style="list-style-type: none"> • Watershed consultant (NSQF 8) • Aquaculture technician (NSQF 4) 	<ul style="list-style-type: none"> • Service technician-watershed (NSQF 4) • Watershed engineer (NSQF 6) • Watershed assistant (NSQF3) • Watershed manager (NSQF 7) • Watershed supervisor (NSQF 5) 	<ul style="list-style-type: none"> • Micro irrigation technician (NSQF 4) • Watershed community mobilizer (NSQF 5) • Aquaculture worker (NSQF 3)
Roles with potential for QP development	Roles with potential for QP development	Roles with potential for QP development	Roles with potential for QP development
<ul style="list-style-type: none"> • Integrated watershed management expert • Hydrologist/water resource expert • Natural resources/ Environmental expert • Geologist/soil expert • Limnologist • Social science expert • GIS/remote sensing/IT expert • Watershed policy expert 	<ul style="list-style-type: none"> • Integrated watershed management expert • Biodiversity expert • Agronomist • Landscape ecologist • Aquaculture expert 	<ul style="list-style-type: none"> • Watershed development contractor • Stormwater Management expert • Water use surveyor • Watershed construction roles 	<ul style="list-style-type: none"> • Watershed policy expert

Rooftop RWH: Job roles in rooftop RWH are not available in the public domain yet. Table 7 provides an indicative list of the job roles across the process flow that have been identified through literature review and stakeholder interactions. The green roles have

been defined first followed by ‘other roles’ which are more conventional in nature such as construction work related roles. For the purpose of this study, all activities in the process flow excluding the actual construction related ones have been considered as green.

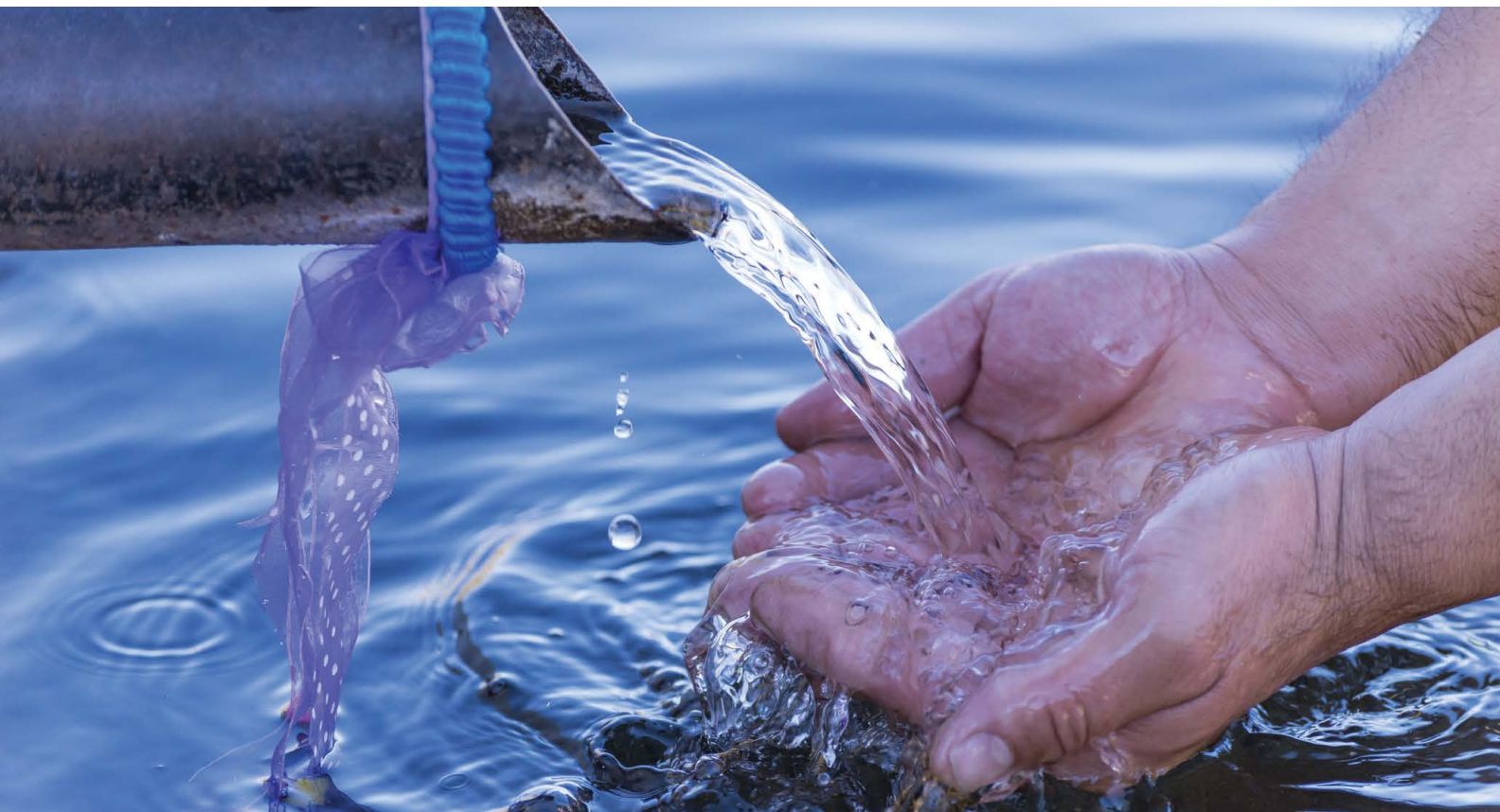
Table 7: Job roles in rooftop RWH

Assessment (of Potential)	Designing	Construction	Maintenance
<ul style="list-style-type: none"> • RWH Systems design & operations engineer • Soil testing analyst • Rooftop RWH surveyor • Rooftop RWH consultant • Rooftop RWH community mobilizer 	<ul style="list-style-type: none"> • RWH systems design & operations engineer • Sourcing executive (supply chain & logistics) • Rooftop RWH consultant • Rooftop RWH surveyor 	<ul style="list-style-type: none"> • Rooftop RWH surveyor • Technical expert (Roofing system design) • Rooftop RWH installer • Supervisor (plumbing & assembly) • Maintenance supervisor (RWH assembly) 	<ul style="list-style-type: none"> • Rooftop RWH consultant • Water quality testing expert • Maintenance supervisor (RWH assembly) • Rooftop RWH community mobilizer
Other roles			
		<ul style="list-style-type: none"> • Mason • Plumber • Assembler 	<ul style="list-style-type: none"> • Mason • Plumber • Cleaner

Table 8 shows the status of existing QPs and roles with potential for QP development. In the absence of QPs directly associated with rooftop RWH, only allied QPs have been referred to.

Table 8: Status of existing QPs and roles with potential for QP development - rooftop RWH

Assessment (of Potential)	Designing	Construction	Maintenance
Roles with existing QPs	Roles with existing QPs	Roles with existing QPs	Roles with existing QPs
<ul style="list-style-type: none"> • Soil and water testing lab analyst (NSQF 5) • Soil and water testing lab assistant (NSQF 4) • Soil sampler/ collector (NSQF 3) 	<ul style="list-style-type: none"> • No QP available 	<ul style="list-style-type: none"> • No QP available 	<ul style="list-style-type: none"> • Soil and water testing lab analyst (NSQF 5) • Soil and water testing lab assistant (NSQF 4) • Soil sampler/ collector (NSQF 3)
Roles with potential for QP development	Roles with potential for QP development	Roles with potential for QP development	Roles with potential for QP development
<ul style="list-style-type: none"> • Rooftop RWH consultant • Rooftop RWH community mobilizer • RWH Systems design & operations engineer • Rooftop RWH surveyor 	<ul style="list-style-type: none"> • Rooftop RWH consultant • RWH systems design & operations engineer • Sourcing executive (supply chain & logistics) • Rooftop RWH surveyor 	<ul style="list-style-type: none"> • Rooftop RWH consultant • Rooftop RWH surveyor • Technical expert (Roofing system design) • Rooftop RWH installer • Supervisor (plumbing & assembly) • Maintenance supervisor (RWH assembly) 	<ul style="list-style-type: none"> • Rooftop RWH community mobilizer • Rooftop RWH consultant • Maintenance supervisor (RWH assembly)



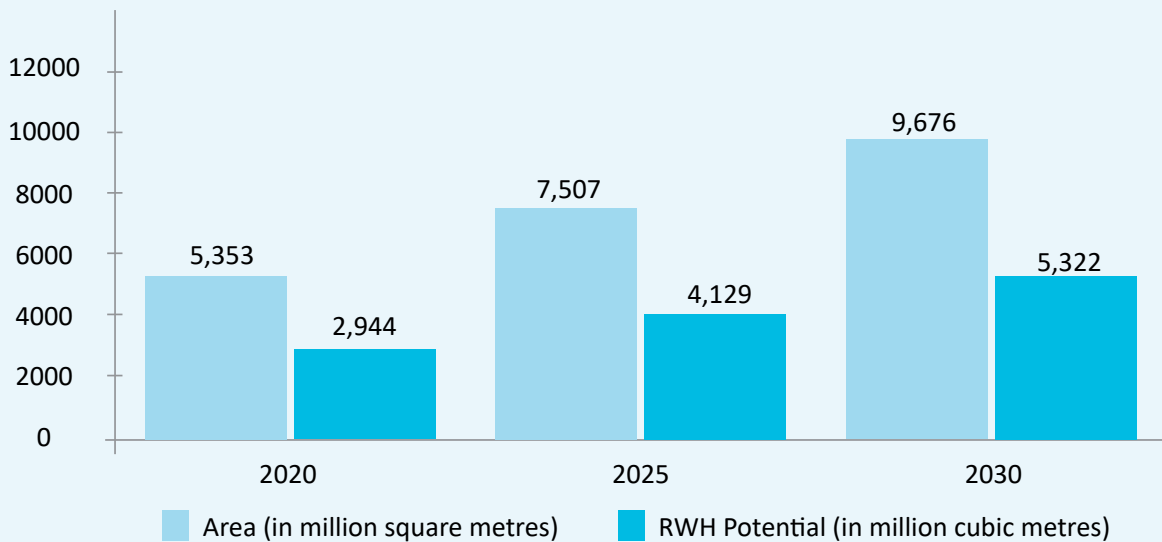
PROJECTIONS FOR GREEN JOBS IN INDIA

Growth Projection for Rooftop Rainwater Harvesting

RWH is a very popular technique of water conservation across the globe. Earlier, people were reluctant to use this technique for various reasons including lack of awareness. However, due to water scarcity, many countries are now promoting this concept through legislation. In India, rooftop RWH has been traditionally practiced but mostly in the low rainfed areas such as

those that receive rainfall less than 500 millimetres per year. In this technique, rainwater that falls on a roof surface is channelized to bore wells or pits through small diameter pipes to recharge the underground water. It has been estimated that around a 100 square metre area can yield up to 55,000 litres per year (Athavle, 1998). Potential for rooftop RWH in India has been outlined on this basis. The given figure estimates rooftop RWH system increases with an expansion of built-up areas.

Figure 4: Potential of Rooftop RWH in India

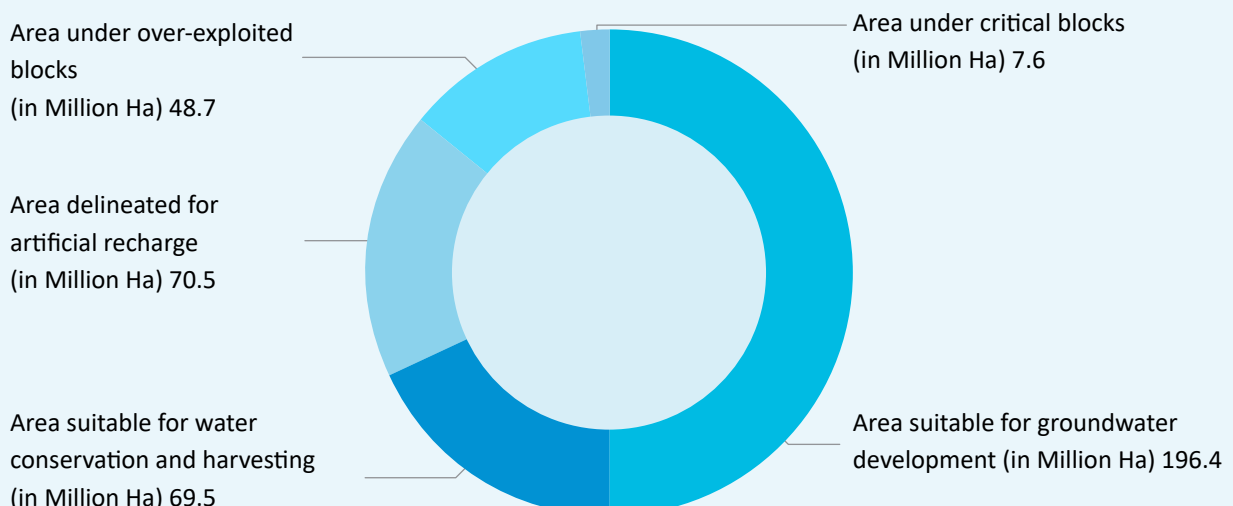


Growth Projection for Watershed Development

According to the report on the status of Indian aquifers 2012 by CGWB, the total area available for groundwater development and management is around 196.4 million ha, and the area available for water conservation and harvesting is around 69.5 million ha where micro

irrigation systems shall be promoted for agricultural usages. This report also highlights the fact that 70.5 million ha area is delineated for artificial recharge and 48.7 million ha and 7.6 million ha areas are over-exploited and critical, respectively. Hence critically affected and over-exploited areas should be managed on priority.

Figure 5: Potential for watershed development

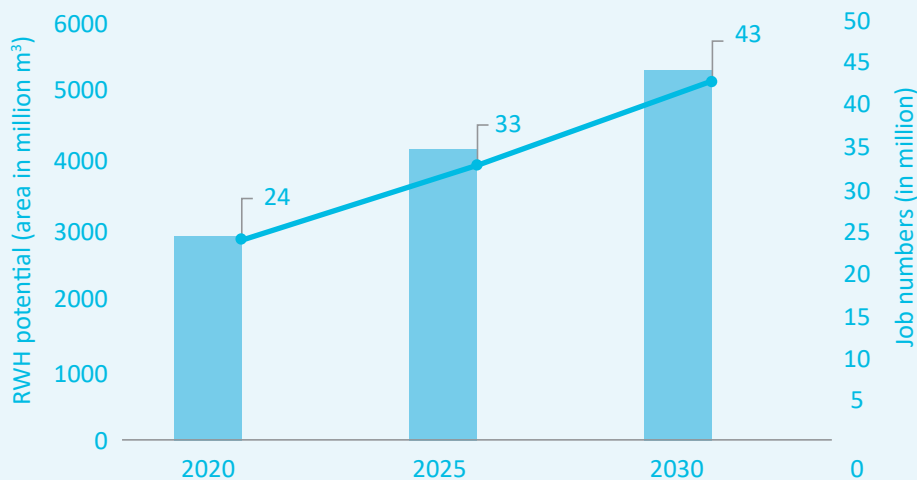


Job Projections for Rooftop Rainwater Harvesting

Based on consultations with the stakeholders involved in working on installation and procurement of RWH systems and experts in water management, an estimated six persons are required, i.e., two mason

and four helpers for 120 person-days for constructing a RWH system with a collection area of 100 square metre. Estimating one person works for 270 person-days, the total number of persons that will be required at a growth rate of 7 percent is provided in Figure 6.

Figure 6: Job projections for rooftop RWH

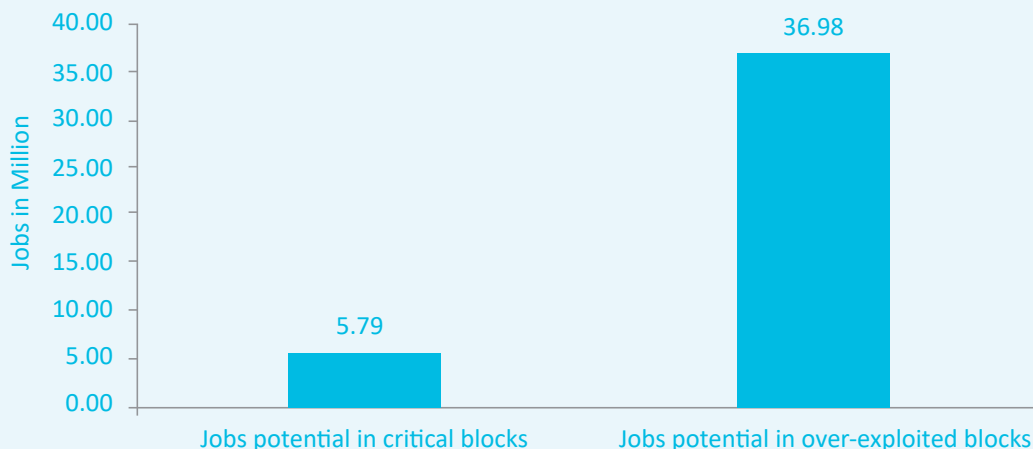


Jobs in Watershed Management

According to the CGWB 2012 report on the status of Indian aquifers, around 7.6 million ha and 48.7 million ha areas are under critical and over-exploited blocks, respectively. An average watershed programme helped in generating one-time employment, i.e., 76 person-day per ha (Biswajit Mondal and N. Loganandhan, 2013). It is also known that all labour-oriented works are done only

under MGNREGS which increases livelihood security in rural areas by providing at least 100 days of guaranteed wage employment a year to every household whose adult members volunteer to do manual works in soil and water conservation, afforestation and land development, etc. Considering these facts, the total number of jobs that can be generated in critical and over-exploited area have been estimated and shown in Figure 7

Figure 7: Job potential in critical and over-exploited areas

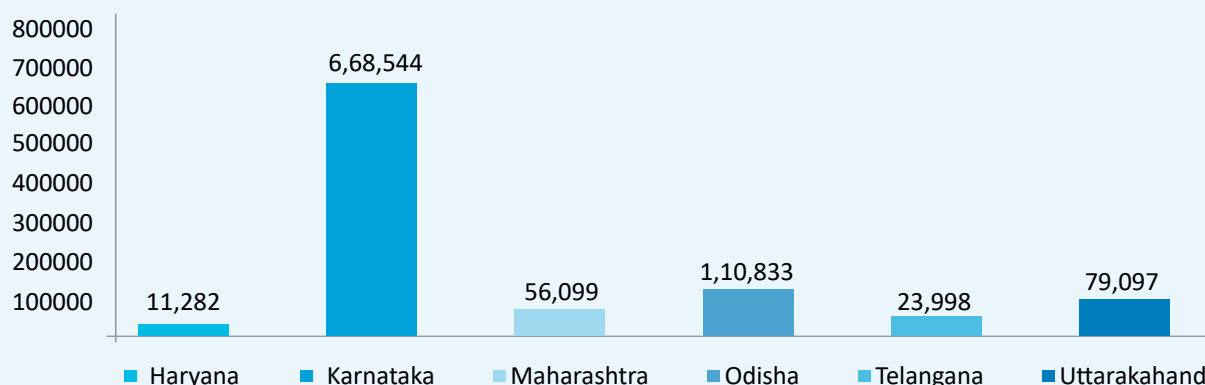


Total Jobs Generated in Watershed Development Projects in India and in Selected States

According to WDC-PMKSY, around 5.69 million jobs have been generated by watershed development activities

from 2009 to 2020. The jobs generated in this period by watershed development activities in Haryana, Karnataka, Maharashtra, Odisha, Telangana and Uttarakhand are shown in Figure 8.

Figure 8: Total jobs generated in watershed development in selected states 2009-2020



SKILL GAPS

Moving towards a greener future also means that jobs related to greening would be created. While growth in employment is sorely needed, it cannot be realized without skills. Skill gaps are a major impediment to growth of green sectors today. SSCs in coordination with the National Skill Development Corporation (NSDC) develop sector-specific reports. However, water management has not been defined as a skill sector in itself. While water is an essential component for almost all 24 industry skill reports developed by NSDC, standalone skill gap studies or projections for this sector are not available. Consequently, it is difficult to decide which roles require training or development of a training plan.

It is estimated that water management has the potential to grow from 3 million jobs till 2020 to 19 million jobs till 2030.²⁶ It is difficult however to predict the number of people employed in water management in an informal sector setting and perform an even more difficult task of skill measurement.

There is a huge combined potential of jobs, i.e., 42.77 million in critical and over-exploited blocks in watershed management and around 5.69 million jobs have already been generated from 2009 to 2020. Hence there is a significant skill gap of around 37 million jobs in terms of employment growth. Similarly, in rooftop RWH, there is

huge skill gap in terms of employment growth, i.e., 24 million jobs in 2020 to 33 million jobs in 2025.

In order to bridge these huge skill gap potentials, the Government of India shall encourage relevant skill development in this sector under its various initiatives including the aspirational PMKVY.

At present, the water management mandate primarily falls under the jurisdiction of SCGJ, ASCI and IPSC. Currently QPs are available for watershed management (seven), micro-irrigation (one) and wastewater treatment. However, according to NSDC, training partners have only been identified under the Skill India Mission for the job roles/QPs of micro-irrigation technician by ASCI.

Available QPs (Watershed Management)

- Watershed engineer (NSQF-6)
- Watershed assistant (NSQF-3)
- Watershed consultant (NSQF-8)
- Watershed manager (NSQF-7)
- Watershed supervisor (NSQF-5)
- Service technician-watershed (NSQF-4)
- Watershed community mobilizer (NSQF-5)

Available QPs (Micro irrigation)

- Micro-irrigation technician (NSQF-4)

²⁶ ILO, 2018. Skills for Green Jobs in India.

WOMEN AND GREEN JOBS

The Economic Survey 2017-18 mentions an Organization of Economic Cooperation and Development analysis that indicates that women's participation in the workforce has steadily declined over time, from 36 percent to 24 percent in a decade (when examined in 2015-16) signaling a decline of 33.3 percent in female labour force participation in 10 years. It also showed

that the gender gap in the labour force participation rate is more than 50 percentage points in India.

However, women's participation in this sector can be improved by various means including skill development and social awareness. To identify where women can actively participate in the entire value chain of the watershed management programme, we need to understand the modus operandi of IWMP.

Table 9: Value chain of the watershed management programme

1. Ministry of Rural Development, Department of Land Resources	PMKSY amalgamated the Accelerated Irrigation Benefit Programme, River Development & Ganga Rejuvenation, IWMP of the Department of Land Resources and the On Farm Water Management schemes
2. State-level Nodal Agency	It is the implementing authority to implement and plan the activities in the state with relevant departments in the ministry
3. District-level Watershed Cell/ Data Centre	At the district level, watershed cell/data centre supervises and coordinates the IWMP projects, set up in district rural development agencies/Zilla Parishad of the state governments
4. Project-level Project Implementing Agency	Project implementation is supervised by the project implementing agency as per the Common Guidelines for Watershed Projects 2008 (revised in 2011)
5. Watershed Development Team	Panchayats, government and NGOs function as project implementing agencies by constituting a Watershed Development Team comprising technical experts
6. Village-level Watershed Committee	Gram Sabha constitutes a Watershed Committee to implement the project at the field level. This Committee consists of at least 10 members, comprising members representing SHGs, user groups, marginalized communities, plus one member from the Watershed Development Team.

From Table 9, it is evident that women can participate in all the steps shown. However, they can play a significant role in in the village level watershed committee where they can form SHGs to carry out resource mobilization and community awareness.

EXISTING JOB ROLES FOR WOMEN

Watershed Management

Most job roles in the sector are generic and a switch between sectors is possible, e.g., construction roles for

structures (such as check dams or reservoirs or water harvesting structures) are involved in development and management of the watershed in semiskilled, labour force in unskilled and even specialist roles such as geologist. Also, watershed management is mainly driven by women at the community level. Only seven

roles related to watershed are defined by various SSCs at present and, consequently, information on other roles (identified through literature and stakeholder interaction) with reference to women’s participation is partially available and indicative.

Table 10: Roles with women’s participation: watershed management

Recognition	Restoration	Protection	Improvement
Roles with women's participation	Roles with women's participation	Roles with women's participation	Roles with women's participation
<ul style="list-style-type: none"> Watershed community mobilizer 	<ul style="list-style-type: none"> Watershed consultant 	<ul style="list-style-type: none"> Watershed construction roles 	<ul style="list-style-type: none"> Watershed community mobilizer
Other Roles	Other Roles	Other Roles	Other Roles
<ul style="list-style-type: none"> Integrated watershed management expert Hydrologist/water resource expert Natural resources/ Environmental expert Geologist/soil expert Limnologist Social science expert GIS/remote sensing/IT expert Watershed policy expert Water quality testing expert 	<ul style="list-style-type: none"> Integrated watershed Management expert Watershed consultant Biodiversity expert Agronomist Landscape ecologist Aquaculture expert 	<ul style="list-style-type: none"> Watershed development contractor Service technician – watershed Stormwater management expert Water use surveyor Watershed engineer Watershed assistant Watershed manager Watershed supervisor 	<ul style="list-style-type: none"> Watershed policy expert

Rooftop RWH

Note: Information on other roles (identified through literature and stakeholder interaction) with reference to women’s participation is partially available and indicative.

Table 11: Roles with women’s participation: rooftop RWH

Assessment (of Potential)	Designing	Construction	Maintenance
Roles with women's participation	Roles with women's participation	Roles with women's participation	Roles with women's participation
<ul style="list-style-type: none"> Rooftop RWH consultant RRWH community mobilizer 	<ul style="list-style-type: none"> Rooftop RWH consultant 	<ul style="list-style-type: none"> Rooftop RWH consultant 	<ul style="list-style-type: none"> Rooftop RWH community mobilizer RRWH consultant
Other roles	Other roles	Other roles	Other roles
<ul style="list-style-type: none"> RWH systems design & operations engineer Soil testing analyst Rooftop RWH surveyor 	<ul style="list-style-type: none"> RWH systems design & operations engineer Sourcing executive (supply chain & logistics) Rooftop RWH surveyor 	<ul style="list-style-type: none"> Rooftop RWH surveyor Technical expert (Roofing system design) Rooftop RWH installer Supervisor (plumbing & assembly) Maintenance supervisor (RWH assembly) 	<ul style="list-style-type: none"> Water quality testing expert Maintenance supervisor (RWH assembly)

CASE STUDIES

There have been many case studies across the world on women's participation and entrepreneurship in water management. An indicative list is shown in Table 12.

Table 12: Women in water management: success stories

Initiative	Location	Description
RWH by women's groups ²⁷	Rakai and Masaka districts, Uganda	This project enables vulnerable women in Uganda to tap clean and safe water sources. It has trained women affected by HIV and tuberculosis to construct rainwater collection systems. These women have the chance to turn this into a business, besides receiving the life-changing benefits of water.
Promotion of the practice of RWH at the household level among women in the Bedouin community ²⁸	Qatrana, Karak Governorate, Jordan	Women neighbours install a main reservoir and connect it to their home tanks of water collected from rooftops and prepare a common land for crop production using this water.
Youth and women employment creation for water security in Keiskammahoek ²⁹	Keiskammahoek, South Africa	The local government of Keiskammahoek, one of the poorest areas in the country, launched the Working for Water programme in 1995 to combat the devastating effects of alien species in waters on biological diversity and water security, supported through a partnership with the South African Department of Water and Environmental Affairs. The programme places special emphasis on creating jobs for and training unemployed women and youth and requires 60 percent of workers to be women, 38 percent youth, and 2 percent physically challenged. Up to 2013, the programme had cleared more than 1 million ha of invasive alien plants, providing jobs and training to approximately 30,000 people per year, of which 52 percent were women.
Community participation in procurement as a tool for poverty alleviation in Ghana: Ghana Social Opportunities Project ³⁰	Accra, Ghana	<p>The project has developed a toolkit for the use of a local resources-based method for climate change adaptation strategies. It comprises a thematic manual on integrated watershed management and a technical manual on soil and water conservation. These relatively labour-intensive soil and water conservation schemes may have high labour absorption during their construction and subsequent maintenance phases. At the same time, they contribute towards improving the infrastructure for increased food production. Specific community participatory watershed development planning exercises have been piloted in six communities.</p> <p>Community participation in procurement as practiced by the project allowed the communities to select their own project, provide labour to carry out the work, use their local materials but not their local knowledge. The roles they play contributed greatly on alleviation of poverty.</p>

²⁷ <https://unfccc.int/climate-action/momentum-for-change/activity-database/rainwater-harvesting-by-women-groups-in-rakai-and-masaka-districts-uganda>

²⁸ <https://www.ciheam.org/uploads/attachments/936/BOX2.pdf>

²⁹ ILO, Green jobs for women and youth.

³⁰ https://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---sector/documents/publication/wcms_729058.pdf, accessed 20 April 2020.

Initiative	Location	Description
Jal Sahelis: How women across Bundelkhand are reviving water harvesting techniques ³¹	Chandrapur village, Uttar Pradesh, India	The network of Jal Sahelis across 200 villages in Uttar Pradesh and Madhya Pradesh is reviving water harvesting structures and traditional water bodies through community participation. A check dam, built by Jal Sahelis in Chandrapur village (Talbehat tehsil, Lalitpur) has helped save rainwater which is now used for agriculture and household use.
Jal Sanchaya: A joint programme of Gramonnati and TERI for low-cost roof-top RWH tanks ³²	Rajouri and Poonch districts, Jammu and Kashmir, India	Gramonnati has partnered with TERI to set up low-cost rooftop RWH solutions in the remote areas of Rajouri and Poonch districts. Three local youth, selected as Udyam Trainees for Gramonnati's Path-to-Entrepreneurship Programme, are being trained by the TERI team to eventually take up these projects all by themselves as they are developed into rural entrepreneurs for water solutions.
Small agro entrepreneurship in Kadwanchi Watershed: group farming and marketing of pomegranate and grapes ³³	Kadwanchi village, Jalana district, Maharashtra, India	Concept of group farming in horticultural crops so that the water is utilized effectively.
Participatory watershed management at Ralegan Siddhi village	Ralegan Siddhi village, Ahmadnagar district, Maharashtra	Ralegan Siddhi, despite its difficult geographic terrain, is a unique example of transformation from poverty to plenty and a living model of people's participation in natural resource management in a watershed. Through this initiative which has a special focus on women's participation and empowerment, groundwater level in the village was raised from 20 metre depth to 6.5 metre leading to better agricultural prospects thereby improving standards of living. Major elements responsible for successful people's participation in watershed management are: emergence of local leadership, underpinning of moral sanctions for all, voluntary moral codes, e.g., ban on uncontrolled grazing and tree cutting, etc., government/NGO partnership, involvement of all sections of society, holistic and sustained development over long time (10-20 years), use of simple, appropriate but efficient technology, primacy of village assembly in decision making, etc. ³⁴

³¹ <https://www.firstpost.com/long-reads/jal-sahelis-how-women-across-bundelkhand-are-reviving-water-harvesting-techniques-6548851.html>

³² <https://www.gramonnati.org/blogs/jal-sanchaya-a-joint-program-of-gramonnati-and-teri-for-low-cost-roof-top-rain-water-harvesting-tanks-in-rajouri-and-poonch-districts/>

³³ <http://www.publishingindia.com/GetBrochure.aspx?query=UERGQnJvY2h1cmVzfC8xMTk5LnBkZnvvMTE5OS5wZGY=>

³⁴ <http://www.fao.org/3/X5669E/x5669e06.htm#lessons,%20achievements,%20weaknesses%20and%20constraints>

Initiative	Location	Description
Effective irrigation management: Rajasthan's integrated irrigation solutions ³⁵	Rajasthan	<p>The Government of Rajasthan has implemented a comprehensive package of solutions in Sanchore along the Narmada river where micro-irrigation technology has been made mandatory for farmers.</p> <p>Further, there has been a huge push towards actualization of participatory irrigation management through the formation of ~2,200 water users' associations. Finally, other watershed development tasks, such as tree plantation and bio drainage have also been implemented.</p> <p>The focus on irrigation solutions has resulted in a strong participatory irrigation management system .</p>
Women-led watershed construction ³⁶	Jajota village, Ajmer district, Rajasthan	<p>When the staff of an NGO approached them, the community was indifferent towards the restoration of Jajota nadi (rivulet). Ganga Ma was the only one who showed interest in this initiative. She, along with seven friends, demarcated the land and started the digging manually. Village members discouraged her saying that she would not be paid for her work and all her efforts would be futile. At the end of the first two weeks, the first instalment of funds was transferred to a specific bank account opened for this project and Ganga Ma withdrew cash and paid her friends for their work. This motivated other women in the village and many joined the work. Towards the end of the earth works, there were 146 women and 15 men who reported daily for the restoration of the rivulet.</p>
Empowering women to become effective players ³⁷	Gujarat	<p>The commitment of the Aga Khan Rural Support Programme, India, an NGO working in Gujarat, to bringing women into both the organization and implementation of all its programmes, led to a very different outcome in one of its watershed projects. During a gender sensitization exercise with village women and men in one of the watershed villages, the amount of labour contributed by household women and men on private land development under the watershed project was calculated. The men themselves concluded that women were contributing roughly 50 percent of the labour and that 50 percent of the wages paid for the work should legitimately be paid to the women instead of the entire wage money being paid to the men simply because they were the owners. Empowered by such public acknowledgement of their normally invisible work, the women started depositing their share of the wage money in the common fund of their women's association. They used the money to undertake collective activities in accordance with their own priorities.</p>

³⁵ NITI Aayog, 2018. Composite Water Management Index.

³⁶ <https://aif.org/women-of-the-watershed/>

³⁷ <https://www.jstor.org/stable/resrep01732>

Initiative	Location	Description
Supporting livelihoods within watersheds ³⁸	Andhra Pradesh, India	The Department for International Development, UK, is supporting the Andhra Pradesh Rural Livelihoods Project in partnership with the Government of Andhra Pradesh and the Ministry of Rural Development. The purpose is to enable the Government of Andhra Pradesh comprehensively to implement pro-poor watershed-based, sustainable rural livelihoods approaches in five districts (Anantapur, Mahboobnagar, Prakasam, Nalgonda and Kurnool). The project consists of three components: watershed-plus and sustainable rural livelihood initiatives; capacity-building of primary and secondary stakeholders; and lesson learning and policy influence. This approach is likely to be of more interest to women than the watershed programme in its present form. By paying greater attention to non-land-based activities and seeking to redress inequities in the present programme, it is hoped that involvement of women in the watershed programme, especially by taking account of their needs and interests (food crops versus cash crops, fruit trees versus timber, water for drinking versus water for irrigation, etc.), will be promoted.
West Bengal drinking water sector improvement project	Bankura, North 24 Parganas and Purba Medinipur districts, West Bengal	The project intends to provide safe and sustainable drinking water as per the standards set by the Government of India to about 1.65 million people in the arsenic, fluoride and salinity-affected selected areas of Bankura, North 24 Parganas and Purba Medinipur districts of West Bengal (project districts). ³⁹ It will introduce an innovative and sustainable institutional framework and advanced technology for smart water management to enable efficient service delivery in project districts. The project being implemented through ADB is based on a co-financing model.

TRAINING INFRASTRUCTURE

Across the country, there are government and private institutes providing regular degree programmes in water management and its conservation. Industrial Training Institutes and universities such as the Indira Gandhi National Open University (IGNOU), Uttar Pradesh Rajarshi Tandon Open University and Vardhaman Mahaveer Open University offer diploma courses in watershed management. Apart from the regular programmes, non-governmental organizations (NGOs) and organizations working in on-ground implementation are also providing training in rural areas. Table 5 lists a few institutions. It is noted that despite seven watershed management job roles being listed with SSCs,

no training provider has been designated by the SSCs yet to provide training for these job roles.

Skilling, however, requires that the training centres are closer to the villages of residence of women particularly or group transportation is provided.⁴⁰ This requires a thorough assessment of the technical possibilities of a particular activity being carried out and then utilizing the existing infrastructure to provide skill development training to local inhabitants. Organizations working in rural areas serve as an asset to this knowledge dissemination. It is also extremely important in a country like India that skilling is directly linked to income generation activities.

³⁸ <https://www.jstor.org/stable/resrep01732>

³⁹ <https://www.adb.org/projects/49107-006/main#project-pds>

⁴⁰ UNDP- Sattva Consulting, 2018. Female Work and Labour Force Participation In India – A Meta-Study.

Table 13: Training providers - indicative list

Sr. No	Name of Institute	Place of Operation	Training Area (specific to the study)	Target Audience	About the Organization
1	Institute for Watershed Development and Management, Kerala (IWDM-K)	Chadayamangalam, Kollam District, Kerala	Watershed management	Government officials, people's representatives, farmers, students, on need basis	<p>The institute, a state-level training and extension centre of the Department of Soil Survey and Soil Conservation, is playing a key role in enriching the awareness of conservation of natural resources of various functionaries associated with watershed programmes, eco-restoration and conservation of the environment.</p> <p>It also extends training facilities to the needy even in remote areas of districts Thrissur, Kasaragod, Kozhikode, Malappuram, Palakkad, Ernakulam, etc., based on different focal themes such as Jala Saaksharatha⁴¹</p>
2	Watershed Organisation Trust (WOTR)	Maharashtra, Madhya Pradesh, Telangana, Andhra Pradesh, Rajasthan, Jharkhand, Odisha	Watershed-based natural resource management, community mobilization	<p>Since 2002 WOTR conducts regular programmes that anyone can attend. It provides customized training programmes to organizations as well. It also provides sponsored training to NGOs, government officials, corporates or even individuals⁴²</p>	<p>Training programmes provided by WOTR include design and implementation of demand-based training modules in watershed-based natural resource management, community mobilization, application of technology to project management, entrepreneurship development, etc.</p>
3	Watershed Organisation Trust (WOTR)	Odisha	Watershed management, women's empowerment	<p>Since 2002 WOTR conducts regular programmes that anyone can attend. It provides customized training programmes to organizations as well. It also provides sponsored training to NGOs, government officials, corporates or even individuals²⁴</p>	<p>WOTR has been working in the Odisha Tribal Empowerment and Livelihoods Programme Plus, across the thematic areas of watershed management, natural resource management, livelihoods, agriculture and women's empowerment.</p> <p>The organization has implemented, through its 5 partner NGOs, over 50 watershed development projects covering an area of 25,773 hectares thus, impacting over 29,256 people in 118 villages</p>

⁴¹ <http://www.keralasols.gov.in/index.php/institutions-under-the-dept/iwdmk>

⁴² <https://wotr.org/trainings-wotr>

Sr. No	Name of Institute	Place of Operation	Training Area (specific to the study)	Target Audience	About the Organization
4	National Water Academy	Maharashtra	Aspects of water resources development and management including watershed management, participatory irrigation management, integrated water resources development & management, RWH	Water sector professionals	National Water Academy (formerly known as Central Training Unit) was set up under CWC in 1988. It addresses training needs of in-service engineers of various central/state organizations involved in the development & management of water resources. It also concentrates on conducting training courses for all water sector personnel, in the specialized and emerging areas, for which existing state or other institutes are not adequately equipped to meet the needs ⁴³
5	TERI School of Advanced Studies	New Delhi	Water science and governance and water resources management	General	TERI School of Advanced Studies was established in 1998. It provides multiple courses in the environment and sustainability domain including masters, diploma and doctoral programmes ⁴⁴
6	Centre for Science and Environment	New Delhi	Urban rainwater management Advanced RWH	General	The centre is a research organization in the environment domain and conducts training workshops for various stakeholders, including NGOs, researchers, residents' welfare associations, engineers, architects, urban planners, civic body officials and industry consultants. One of its training areas includes urban rainwater management ⁴⁵
7	National Institute of Agricultural Extension Management ⁴⁶	Hyderabad	Water management, agriculture	Women, general	Established in 1987, the institute responds to challenges of agricultural extension in a rapidly growing and diverse agriculture sector. With changing and technologically updating modern agricultural practices, its aim is to transform the existing set up through professional guidance and training of critical manpower. It provides management training and education in agricultural practices through various courses including watershed management and water management. It also conducts online courses some of which are specifically focused on women.

43 <https://nwa.mah.nic.in/index.htm>

44 <https://www.terisas.ac.in/>

45 <https://www.cseindia.org/urban-rainwater-management-452>

46 <https://www.manage.gov.in/>

Sr. No	Name of Institute	Place of Operation	Training Area (specific to the study)	Target Audience	About the Organization
8	Gram Vikas Sanstha (GVS)	Marathwada, North Maharashtra region	Watershed management & sustainable rural development	Schools, colleges, residential areas, NGOs, labourers, people's representatives	GVS has taken the initiative in the villages of Marathwada region by providing watershed facility, RWH, bunds on rivers, small ponds in farms, etc. It conducts workshops for stakeholders in the water sector and also creates awareness through exhibitions and competitions at ground level, rallies, poster and pamphlet distribution, free books on water management, programmes on Akashwani radio station, local channels, etc ⁴⁷
9	Arpan Seva Sansthan	Rajasthan	Drinking water and sanitation, skill building and education	Rural youth, women	Arpan Seva Sansthan ⁴⁸ , a non-profit organization, registered under the Rajasthan Societies Registration Act 1958, was set up in 1996 by a team of young professionals who had the dedication and commitment to serve rural communities and bring about positive societal change. It has been involved in training and capacity-building programmes for different stakeholders and has trained women and youth through skill building programmes in areas such as masonry and plumbing.
	Watershed Support Services and Activities Network (WASSAN)	Andhra Pradesh, Telangana	Watershed management, participatory groundwater management	Partner agencies, general	The core mandate of the WASSAN group of institutions ⁴⁹ is to build capacities of partners for development action. Participatory methodologies, enabling organizational and institutional architecture, supportive policy support (including adequate budgets) are the cornerstones of capacity-building inputs. WASSAN believes that diversity in capacity-building inputs is essential for not only building capacities but also for utilizing them. Training programmes, workshops/ seminars, communication campaigns, hand holding support (post training support services), advisory services by experts, appropriate institution development/ community organizations, systematic project planning/ review systems, research and innovation (pilots/ experiments) are some of the essential ways of building capacities

47 http://www.gvsngo.com/jal_pher_abhiyan.php

48 <https://arpansevasansthan.org/>

49 <https://www.wassan.org/>

Sr. No	Name of Institute	Place of Operation	Training Area (specific to the study)	Target Audience	About the Organization
10	Water and Land Management Institute (WALMI) ⁵⁰	Aurangabad, Maharashtra	Irrigation water management	Officers, employees, farmers, women farmers and farmers in irrigation project commands	WALMI is an autonomous body under the Ministry of Soil and Water Conservation Department, Government of Maharashtra. The institute provides in-service interdisciplinary training to staff engaged in irrigation water management and land development in irrigation and agriculture departments. WALMI conducts about 152 training courses of one to 15 weeks' duration (with potential of about 50,000 trainee-days) every year for different target groups of professionals. It also organizes specially designed courses on demand from other states/organizations and for other countries.
11	AROH Foundation	18 states of India including Haryana, Odisha, Delhi NCR and Maharashtra	Skill development under the Deen Dayal Upadhyaya Grameen Kaushalya Yojana (DDU-GKY) leading to income generation and improved livelihood opportunities encouraging rural entrepreneurship	Youth and women, rural youth, marginalized communities	AROH focusses on skill development leading to income generation and improved livelihood opportunities and targeting marginalized communities encouraging rural entrepreneurship. ⁵¹ It receives support through the National Council on Vocational Training and SSCs and is also working on Government of India schemes such as DDU-GKY. Sectoral work includes farm, non-farm and allied activities and developing infrastructure and conservation of natural resources with activities such as pond rejuvenation.
12	Sri Sri Institute of Agricultural Sciences & Technology Trust (SIAST)	Bengaluru, Karnataka	Watershed management, water harvesting and management	Farmers, rural youth	SIAST (IGNOU study centre (13150P)) conducts six agricultural programmes including a diploma in watershed management and certificate in water harvesting and management. Among other areas, the organization envisions skilling 1 million rural youth.

⁵⁰ <http://walmi.org/index>.

⁵¹ <https://www.aroh.in/asp.aspx>

CASE STUDY

The Wasundhara project is financed by the Ministry of Rural Development and implemented by GVS. Its project area, located about 12 kilometre south from

Aurangabad city, spans 6,427 hectare of land and covers 25 villages with a population of 15,000. The key activities of GVS under this programme are listed in Table 14.



Farm pond constructed under Wasundhara – IWMP-17 by GVS
Source: http://www.gvsngo.com/Pro_WaterShad_Vasundhara.php

Table 14: Activities undertaken by GVS

Sl. No	Activity	Type of work	Number	Beneficiaries	Outcome
1	Capacity- building training	Training	60	3,000	People's participation in village development Increase in awareness among the village level authority
2	Natural resource management	Construction work including farm ponds	11	All farmers of the project area	Increase in groundwater level, availability of clean drinking water, creation of self-employment
3	Livelihoods	Formation of self-help groups (SHGs) and user groups, financial and training support for livelihoods	101SHGs, 68 landless households, 624 farmers	All landless households, women and farmers	Completed

3.



Policy and Regulatory Frameworks

POLICIES AT NATIONAL AND STATE LEVELS

Water management practices are receiving focussed attention by the government and multiple organizations in the face of the looming crisis.

The Government of India has taken important steps towards effective water governance and sustainable management of water resources. Some of the key policies/programmes/schemes of the Government are elaborated below:

National Water Mission (NWM) is one of the eight National Missions of the Government of India under the National Action Plan on Climate Change. The main objective of NWM is “conservation of water, minimizing wastage and ensuring its more equitable distribution both across and within states through integrated water resources development and management”. Five goals identified under NWM include: 1) a comprehensive water data base in the public domain and assessment of the impact of climate change on water resource; 2) promotion of citizen and state actions for water conservation, augmentation and preservation; 3) focused attention to vulnerable areas including over-exploited areas; 4) increasing water use efficiency by 20 percent; and 5) promotion of basin level integrated water resources management.

Pradhan Mantri Krishi Sinchai Yojana (PMKSY) has been formulated with the vision of extending the coverage of irrigation and improving water use efficiency in a focused manner with end-to-end solutions on source creation, distribution, management, field application and extension activities. The major objective of PMKSY is to achieve convergence of investments in irrigation at the field level, expand cultivable area under assured irrigation, improve on-farm water use efficiency to reduce wastage of water, enhance the adoption of precision-irrigation and other water saving technologies (more crop per drop), enhance recharge of aquifers and introduce sustainable water conservation practices by exploring the feasibility of reusing treated municipal wastewater for peri-urban agriculture and attract greater private investment in precision irrigation system.

National Hydrology Project (2016-17 to 2023-24): The project aims to improve the extent, quality and accessibility of water resources information, decision support system for floods and basin level resource assessment/planning and to strengthen the capacity of targeted water resources professionals and management institutions in India. The project aims:

- Establish monitoring networks in new project states, with a focus on deploying new sensors, data storage and telemetry technologies across

the whole country, to establish comprehensive, modern, automated, real-time monitoring systems for surface and groundwater;

- Develop and demonstrate tools for water resources assessment, hydrologic and flood inundation forecasting, water infrastructure operations, groundwater modeling, and river basin and investment planning;
- Build on the dramatic advances in cloud computing internet, mobile devices, social media and other communication tools to modernize access to and visualization of customized water information by different stakeholders; and
- Complement technology investments with investments in people and institutional capacity.

Jal Jeevan Mission (JJM): The mission aims to provide functional household tap connections to every household with service level at the rate of 55 litres per capita per day. The mission targets to benefit 14.6 crore rural households. Key components of the mission include: in-village water supply infrastructure for tap water connection to every household; reliable drinking water source development/ augmentation of existing sources; transfer of water (multi-village scheme, wherever local water sources face quality and quantity issues); technological intervention for treatment to make water potable (where water quality is an issue, but quantity is adequate); retrofit completed and ongoing piped water supply schemes to provide functional household tap connections and raise the service level; grey water management; and capacity building of various stakeholders and support activities to facilitate the implementation

Atal Bhujal Yojana: The scheme aims to improve groundwater management in priority areas (aspirational) in the country through community participation. The scheme focuses on activities such as: strengthening the institutions responsible for groundwater governance; encouraging community involvement for improving groundwater management to foster behavioural changes that promote conservation and efficient use of water; water budgeting; formation of water user associations; monitoring and disseminating groundwater data; preparation and implementation of Gram Panchayat-wise water security plans and information, education communication activities related to sustainable groundwater management; and facilitate convergence of ongoing government schemes in the states by incentivizing their focused implementation in identified priority areas. The scheme aims to benefit 8,350 Gram Panchayats

in 78 districts in Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan and Uttar Pradesh.

Namami Gange: This national flagship programme aims at effective abatement of pollution, conservation and rejuvenation of River Ganga. The programme focusses on creating sewerage treatment plants and infrastructure, river front development, river surface cleaning, collection of floating solid waste from the surface of the ghats and river and its disposal, biodiversity conservation and maintenance of ecological flow, afforestation, public awareness, industrial effluent monitoring, sanitation in villages along main stem of Ganga. The programme is implemented in the states of Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal.

National River Conservation Plan: The main objective is to improve the water quality of polluted stretches of rivers by reducing the pollution load reaching the rivers by undertaking various pollution abatement works, such as setting up sewage treatment plants, laying of sewerage systems, construction of toilets, river front development works, public participation and awareness and capacity building, etc.

Swachh Bharat Mission-Gramin: The programme aims to achieve universal sanitation coverage, improve

cleanliness and eliminate open defecation in the country. Having achieved Open Defecation Free (ODF) status, the programme is being implemented to ensure sustainability of ODF status in all the rural areas and to cover all the villages of the country with Solid and Liquid Waste Management arrangement.

Policy linkages with watershed development and management programmes/schemes are mentioned below:

Watershed development falls under the Watershed Development Component (WDC) of PMKSY. Implementation of watershed projects is carried out by the Department of Land Resources, Ministry of Rural Development. WDC-PMKSY subsumes former watershed management programmes such as Drought Prone Areas Programme (DPAP), Desert Development Programme (DDP) and Integrated Wastelands Development Programme (IWDP).

A snapshot of policies, initiatives and guidelines undertaken by various institutions relating to watershed development and RWH in India are listed in Table 15. As can be seen, policies have been updated to make them more inclusive over the years through community participation and promotion of gender-sensitive planning and decision making.

Policies at the Centre

Table 15: Policies at the centre

Policy/Initiative	Prime Objective(s)	Relevant Institution
Common Guidelines for Watershed Development 2001	Improved the 1994 watershed development guidelines for a more participatory and project- specific focus with greater flexibility in implementation. Applicable to IWDP, ⁵² DPAP, ⁵³ DDP ⁵⁴ and other programmes notified by the Government of India	Ministry of Rural Development
Hariyali Guidelines 2003	Integration of community institutions effectively into DPP, DPAP, and IWDP and simplification of procedures. Aimed to strengthen the role of local self-government bodies in watershed management	Ministry of Rural Development
Mahatma Gandhi National Rural Employment Guarantee Scheme 2005	Increase livelihood security in rural areas by providing at least 100 days of guaranteed wage employment a year to every household whose adult members volunteer to do manual works in soil and water conservation, afforestation and land development, etc.	Ministry of Rural Development
Integrated Watershed Management Programme 2009	Consolidated three programmes: IWDP, DPAP and DPP. IWMP sought improvement of rural livelihoods through participatory watershed development focusing on integrated farming systems for enhancing incomes and livelihood security in a sustainable manner ⁵⁵	Ministry of Rural Development

⁵² Integrated Wasteland Development Programme

⁵³ Drought prone areas programme

⁵⁴ Desert development programme

⁵⁵ http://www.swaniti.com/wp-content/uploads/2014/05/IWMP-v1_edited_formatted.pdf , accessed 14 March 2020

Policy/Initiative	Prime Objective(s)	Relevant Institution
Common Guidelines for Watershed Development 2008 (revised in 2011)	<p>Promoted a fresh framework to guide all watershed development projects in all departments and ministries. This guideline was revised in 2011 with addition of features to ensure momentum to the IWMP while strengthening its innovative features. Watershed Guidelines 2011 were based on the principle of equity including the following:</p> <ul style="list-style-type: none"> — enhanced livelihood opportunities for the poor — improved access of the poor, especially women to the benefits — enhanced role of women in decision making processes and their representation in the institutional arrangements — ensure access to usufruct rights from the common property resources for the resource poor 	Ministry of Rural Development
National Water Policy (2012)	<p>Advocates RWH and conservation of water and highlights the need for augmenting the availability of water through direct use of rainfall. It also, inter-alia, advocates conservation of river, river bodies and infrastructure should be undertaken in a scientifically planned manner through community participation.</p> <p>In view of the challenges pertaining to water scarcity in recent years, revision of National Water Policy 2012 has been envisaged by the Department of Water Resources, River Development and Ganga Rejuvenation, Ministry of Jal Shakti and a drafting committee has been constituted on 5 November 2019 to revise the National Water Policy⁵⁶</p>	Department of Water Resources, River Development and Ganga Rejuvenation
Guidelines on watershed management works taken up independently under MGNREGS or in convergence with IWMP 2014	<p>Watershed management works can be taken up independently under MGNREGA where there is no IWMP project sanctioned. Watershed management works under MGNREGS in convergence with IWMP, i.e., wherever a IWMP project is already sanctioned, it shall ensure that material-intensive projects must be taken up under IWMP and all other labour-oriented works shall be done only under MGNREGS</p>	Ministry of Rural Development
Watershed Development Component of Pradhan Mantri Krishi Sinchai Yojana	<p>On approval of PMKSY in 2015, IWMP was subsumed as one of its components. At present IWMP is implemented as WDC-PMKSY. The Department of Land Resources is implementing 8,214 watershed development projects in 28 states covering an area of about 39.07 million ha under WDC-PMKSY principally for development of rainfed portions of net cultivated area and culturable wastelands.⁵⁷</p> <p>PMKSY has four sub-components: Watershed development, Accelerated Irrigation Benefits Programme, Har khet ko pani and Per Drop More Crop⁵⁸</p>	Ministry of Rural Development – Department of land resources
Neeranchal, World Bank 2016 ⁵⁹	<p>Neeranchal is a World Bank-assisted national watershed management project. It has been designed and implemented to further strengthen and provide technical assistance to WDC-PMKSY. The programme is being implemented in nine participating states: Andhra Pradesh, Chhattisgarh, Gujarat, Jharkhand, Madhya Pradesh, Maharashtra, Odisha, Rajasthan and Telangana. Its components focus on institutional strengthening, capacity building and improving rural livelihoods, among others</p>	Ministry of Rural Development and World Bank

⁵⁶ <https://pib.gov.in/PressReleasePage.aspx?PRID=1607166>, qccessed 20 March 2020.

⁵⁷ <http://mowr.gov.in/sites/default/files/MeasuresForGW-Depletion.pdf>, accessed 20 March 2020.

⁵⁸ <https://pmksy.gov.in/AboutPMKSY.aspx#s1>, accessed 20 March 2020.

Policy/Initiative	Prime Objective(s)	Relevant Institution
Model Building Bye-laws 2016 ⁶⁰	Mandate RWH for all types of buildings with plot size 100 square metre or more. The byelaws detail qualification and competence of technical personnel who would plan, design and supervise such buildings/ development work as registered professionals (including plumbers); 32 states and union territories have incorporated the provisions in their respective building byelaws	Ministry of Housing & Urban Affairs
Revised guidelines for groundwater extraction, 2018 ⁶¹	The guidelines introduce a water conservation fee which is variable depending on the groundwater category of the area (safe to over-exploited), type of industry, quantum of extraction, etc. Among other features, the guidelines focus on mandatory water audit by industries (depending on the quantum of extraction and category of area) and mandatory roof top RWH except for specified industries thereby facilitating requirement of professionals in these areas	Central Ground Water Authority, Ministry of Water Resources, River Development and Ganga Rejuvenation

In addition to the policies detailed in Table 2, some good practices, initiatives or schemes undertaken by the government are listed below:

1. Passing of the Inter-State River Water Disputes (Amendment) Bill and Dam Safety Bill in 2019
2. Preparation of a draft National Water Framework Bill and draft River Basin Management Bill, 2018 by the Ministry of Jal Shakti. It is currently under review by the states.
3. Establishment of the National Water Informatics Centre under the National Hydrology Project.
4. Completion of a study by the Central Water Commission (CWC) on 'Reassessment of Water Availability in India using Space Inputs.'
5. The Central Ground Water Board (CGWB) Master Plan for Artificial Recharge to Ground Water in India, 2013 envisaging construction of different types of artificial recharge and RWH structures in the country.
6. A web-based Water Resources Information System (called India WRIS) has been set up where all unclassified data from CWC and CGWB has been uploaded.
7. Institution of National Water Awards by the Department of Water Resource, River Development and Ganga Rejuvenation to incentivize good practices in water conservation and groundwater recharge.
8. During the 12th five-year plan, the Aquifer Mapping and Management Programme started quantifying groundwater availability and assessing its quality to formulate aquifer management plans.
9. The National Rural Drinking Water Programme was launched by the Ministry of Drinking Water and Sanitation in 2009 (updated in 2013), modifying the Accelerated Rural Water Supply Programme, with the aim of providing safe and adequate water for drinking, cooking and other domestic needs to every rural person on a sustainable basis. This scheme was further subsumed into JJM in 2019.

Policies in the States: Rooftop Rainwater Harvesting

1. **Delhi:** The Central Ground Water Authority (CGWA) has directed group housing societies, institutions, schools, hotels, industrial establishments and farm houses in south and south west districts and group housing societies located outside the notified areas of the national capital territory of Delhi where groundwater levels are more than 8 metre below the ground surface to adopt roof top RWH systems on their premises.
2. **Karnataka, Bengaluru:** Every owner or occupier of a building with a site area 2,400 square feet or above or every owner who proposes to construct a building with a site area more than 1,200 square feet shall provide RWH structures in such a manner as provided in the regulations.

⁵⁹ <https://dolr.gov.in/programme-schemes/neeranchal-national-watershed-management-programme>, accessed 20 March 2020.

⁶⁰ <http://mohua.gov.in/upload/uploadfiles/files/MBBL.pdf>, accessed 15 January 2020.

⁶¹ [https://pib.gov.in/PressReleaselframePage.aspx?PRID=1555824#:~:text=6140%20\(E\)%2C%20which%20will,Water%20Conservation%20Fee%20\(WCF\)](https://pib.gov.in/PressReleaselframePage.aspx?PRID=1555824#:~:text=6140%20(E)%2C%20which%20will,Water%20Conservation%20Fee%20(WCF)), accessed 20 March 2020.

3. **Maharashtra, Mumbai:** The state government has made RWH mandatory for all buildings that are being constructed on plots that are more than 1,000 square metre in size.
4. **Telangana, Hyderabad:** RWH has been made mandatory in all new buildings with an area of 300 square metre or more irrespective of the roof area. It has been made mandatory to provide RWH in all group housing and commercial complexes.
5. **Haryana:** Haryana Urban Development Authority has made RWH mandatory in all new buildings irrespective of roof area. The CGWA has also banned the drilling of tube wells in notified areas.

6. **Odisha:** The formulation of a comprehensive water law is under active consideration by the competent authorities.

Key Ongoing Projects in the Sector

The Ministry of Water Resources, River Development and Ganga Rejuvenation helps state governments and union territories receive funding from multilateral agencies to ensure that the current resource gap does not hamper growth. The funds also help utilize state-of-the-art technology being used across the globe. As of January 2019, there are 15 ongoing projects that are receiving external aid across states.⁶² Some of these projects pertaining to the states of focus in this report are listed in Table 16.

Table 16: Status of ongoing externally-aided project in the water sector as on January 2019 – select states' extract

Sr. No	Funding Agency	Project name	State of Implementation	Agreement/ Effective/ Closing date	Project cost (US\$ in million)
1	World Bank	7897-IN (IBRD): Water Sector Improvement Project	Andhra Pradesh and Telangana	14.8.2010/ 28.7.2018	988.97
2	World Bank	7943-IN (IBRD): Dam Rehabilitation and Improvement Project 4787-IN (IDA): Dam Rehabilitation and Improvement Project	CWC, Madhya Pradesh, Odisha, Kerala, Tamil Nadu	18.4.2012/ 30.6.2020	437.5
3	Asian Development Bank (ADB)	Sustainable Coastal Protection and Management Investment Programme – 2	Karnataka	15.12.2017/ 28.9.2020	150
4	ADB	3172-IND: Karnataka Integrated and Sustainable Water Resources Management Investment Programme – 1	Karnataka	7.5.2015/ 31.3.2019	48
5	ADB	3265-IND: Orissa Integrated Irrigated Agriculture and Water Management Investment Programme Tranche-2	Odisha	7.6.2016/ 17.9.2018	109.56
6	Japan International Cooperation Agency	IDP-244: Rengali Irrigation Project Phase 2 IDP-244A: Rengali Irrigation Project Phase 2	Odisha	30.3.2015/ 30.3.2023	22,550

Source: Ministry of Water Resources, River Development and Ganga Rejuvenation Annual Report 2018-19

⁶² Ministry of Water Resources, River Development and Ganga Rejuvenation Annual Report 2018-19, accessed 8 April 2020.

Rooftop Rainwater Harvesting and Watershed Development Projects

Both central and state governments have made rooftop RWH compulsory for all new government buildings.

Approvals are issued to new constructions subject to the provision of RWH in building designs. Watershed development projects are run by the states too. In the three years between 2015-18, watershed projects can be summarized for select states as in Table 17.

Table 17: Selected state-wise number of projects sanctioned, amount sanctioned and families covered under watershed development programmes in India (2015-2016 to 2017-2018)

States	2015-2016			2016-2017			2017-2018		
	No. of Projects Sanctioned	Amount Sanctioned (INR 10 million)	Families Covered (No.)	No. of Projects Sanctioned	Amount Sanctioned (INR 10 million)	Families Covered (No.)	No. of Projects Sanctioned	Amount Sanctioned (INR 10 million)	Families Covered (No.)
Haryana	2	2.4	600	0	0.0	0	0	0.0	0
Karnataka	2	2.4	600	5	6.0	1,500	5	6.0	1,500
Maharashtra	8	9.6	2,400	1	1.2	300	2	2.4	600
Odisha	6	7.2	1,800	13	15.6	3,900	4	4.8	1,200
Telangana	0	0.0	0	5	6.0	1,500	1	1.2	300
Uttarakhand	0	0.0	0	0	0.0	0	0	0.0	0
India	48	57.6	14,400	57	68.4	17,100	57	68.4	17,100

Source: Lok Sabha Starred Question No. 70, dated on 14 December 2018

4.



Potential Pathways

Water resources management has a long way to go in India. Since water is a shared resource, skill building and increasing women’s participation will be key in helping the community become self-reliant and governance bodies achieve their goals. Outlined below are a few recommendations to help achieve these goals:

- **Conducting skills need assessment:** Job roles pertaining to water management are currently split into three SSCs. Also, water is multi-sectoral in nature. It is important to conduct a need assessment study across SSCs to identify potential job roles that are not defined at present. This study could serve as a stepping stone in defining the skills and qualifications required for these job roles through QPs and National Occupational Standards (NOS) development. Also, as skill building is extremely dynamic, progress studies would have to be conducted regularly to ensure training remains relevant to requirements.

Job roles listed in Table 18 are not mapped at present and have the potential for QP development.

- **Training infrastructure:** Once the job roles and QPs are finalized, training partners should be

selected. Educational institutions providing water-related courses, foundations with water as one of their themes and NGOs working in the watershed or rooftop RWH areas would be a good fit for selection of training partners, though the list is not exhaustive.

- **Monitoring:** A centralized system such as a dashboard should be developed for monitoring green jobs activities adopted by the implementing agencies and training partners. This would ensure evidence-based decision support for a green skill environment. The development and management of the dashboard could be carried out by SSCs such as SCGJ under the supervision of the Ministry of Skill Development and Entrepreneurship.
- **Decentralized training:** While most roles are suitable for both men and women, one of the reasons for lower participation of women in the workforce is their inability to stay away from their homes for extended periods of time due to family responsibilities. Identifying potential areas where water management activities are required and providing training closer home could help increase participation rates. Similarly, work that could be

Table 18: Roles with potential for QP development

Roles with potential for QP Development	
Watershed Management	Rooftop Rainwater Harvesting
NSQF level 4 and above ⁶³	
<ul style="list-style-type: none"> • Integrated watershed management expert • Hydrologist/water resource expert • Natural resources/environmental expert • Geologist/soil expert • Limnologist • Social science expert • GIS /remote sensing/IT expert • Watershed policy expert • Biodiversity expert • Agronomist • Landscape ecologist • Aquaculture expert • Watershed development contractor • Stormwater management expert • Water use surveyor 	<ul style="list-style-type: none"> • Rooftop RWH consultant • Rooftop RWH community mobilizer • RWH systems design & operations engineer • Rooftop RWH surveyor • Sourcing executive (supply chain & logistics) • Technical expert (roofing system design) • Rooftop RWH installer
NSQF Level 4 and below	
<ul style="list-style-type: none"> • Watershed construction roles 	<ul style="list-style-type: none"> • Supervisor (plumbing & assembly) • Maintenance supervisor (RWH assembly)

⁶³ Suggested levels based on stakeholder interactions and secondary research: a full-scale study would need to be conducted by the respective SSCs in coordination with industry professionals to determine the actual skill level.

either done from home or does not require them to travel to far off locations would have lower attrition rates.

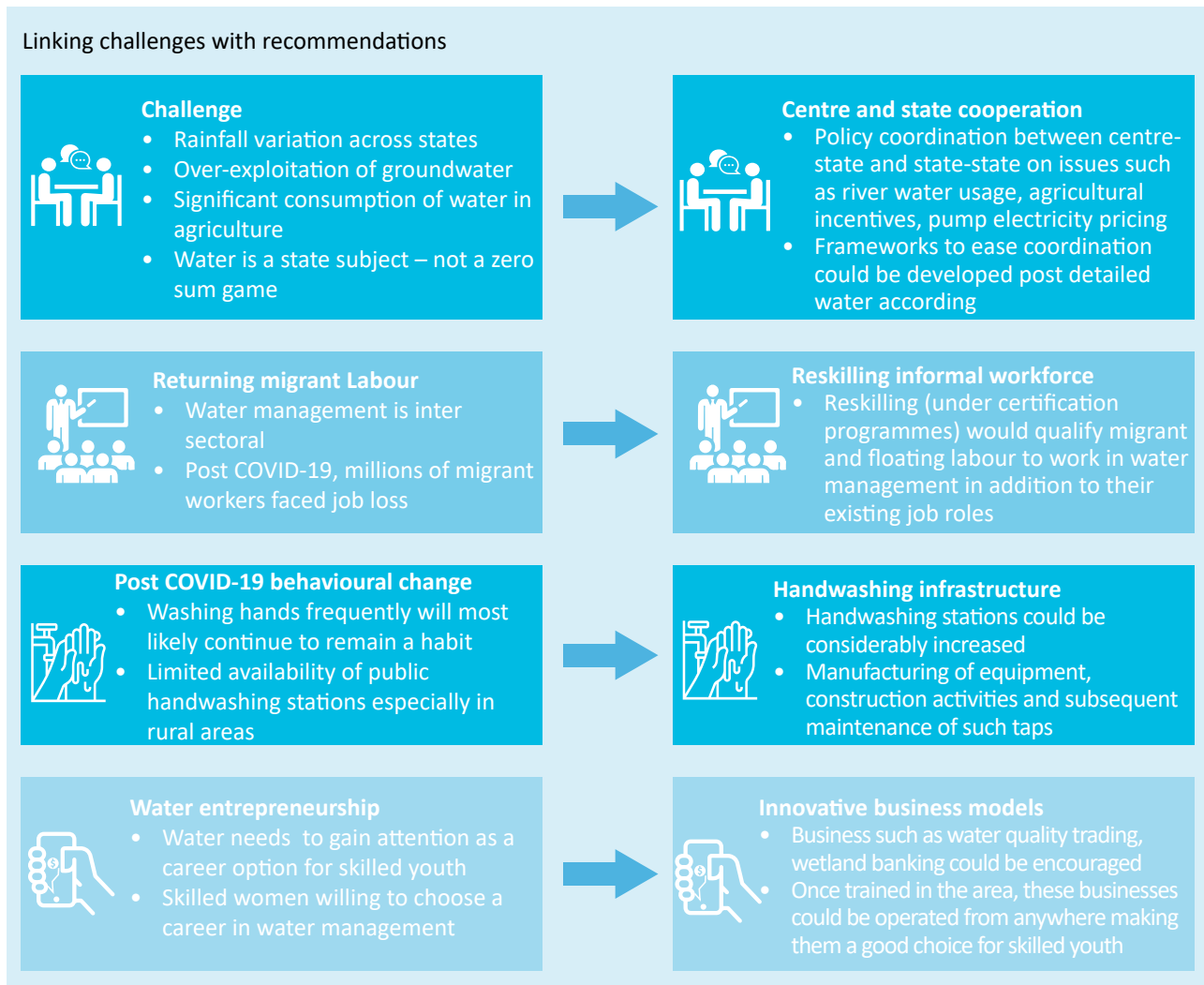
- **Encouraging business models:** Businesses such as water quality trading, wetland banking could be encouraged. The resultant competitive spirit would not only help better the services in the sector but would introduce the much-needed concept of assigning value to water which was once seen as a perpetually available resource. Once trained in the area, these businesses could be operated from anywhere making them a good choice for skilled youth, including women, willing to choose a career in water management.
- **Reskilling the informal workforce:** A significant population of unskilled workers exists in the Indian market with different informal skills and knowledge. Since water management has been part of one sector or the other, reskilling of the existing informal workforce would qualify them

to work in water management in addition to their existing job roles. These workers should be encouraged to gain certification under various certification mechanisms developed by the Government of India. This would, on one hand, enhance their employability and help industry meet the desired standards, on the other.

POLICY IMPERATIVES

- **Tax incentives:** The government could incentivize organizations that employ a higher percentage of women by giving them tax subsidies.
- **Financing toward entrepreneurship:** Women-led SHGs could be offered increased access to credit under schemes such as the Pradhan Mantri MUDRA Yojana and Credit Guarantee Trust Fund for Micro and Small Enterprises along with interest subvention plans.

Figure 9: Details the challenges and links them to the proposed recommendations.



4.1 SUGGESTED ACTION PLANS FOR CONSIDERATION: ENTREPRENEURS FOR WATERSHED DEVELOPMENT-RELATED CONSTRUCTION ACTIVITIES

Case Studies

Empowering Women to Become Effective Players, Gujarat

During a gender sensitization exercise by the Aga Khan Rural Support Programme (India) with village women and men in one of the watershed villages, men themselves concluded that women were contributing roughly 50 percent of the labour and that 50 percent of the wages paid for the work should legitimately be paid to the women instead of the entire wage money being paid to the men simply because they were the owners of private land.

Woman-led watershed construction, Jajota village, Ajmer, Rajasthan

Ganga Ma, along with seven friends, demarcated the land for restoration of the Jajota nadi and started the digging manually facing constant discouragement from the community. Post receipt of payment, other women and many others joined the work. Towards the end of the earth works, there were 146 women and 15 men who reported daily for the restoration of the nadi.

Current Situation and Gap

Between 2015 and 2018 the number of watershed projects sanctioned in the study states was: two for Haryana, 12 for Karnataka, 11 for Maharashtra, none for Uttarakhand and six for Telangana.

The immediate perceived benefit of watershed development is wage employment. However, land-based watershed projects are seen by most agencies as men's projects.⁶⁴ There is a significant disparity in the wages of men and women when it comes to agricultural labour. In multiple cases, women have been known to receive less than half the wages paid to men.^{65,66,67}

When it comes to private land falling under the watershed development zone, women often contribute to the development, but payment is made only to owners of the asset which are men in most cases.

Proposed Model

Entrepreneurs for watershed development-related construction activities

Description

The model involves the development of women entrepreneurs leading watershed development-related construction activities. Existing women's SHGs can be targeted during the initial stages, scaling up to training individual women and facilitating dissemination of knowledge

Steps to Implement the Model

1. Identification of watersheds through a targeted approach to sources such as Panchayats and other government bodies.
2. Identification of existing women's SHGs in potential watershed areas.
3. SHGs to be trained in watershed development activities in addition to interested individual women.
4. Tie-ups with existing training centres and NGOs working towards women's empowerment.

⁶⁴ <https://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/5148.pdf>

⁶⁵ <http://icar-ciwa.org.in/gks/Downloads/Technical%20Bulletins/GenderMainstreaming-WatershedManagement.pdf>, Accessed 20 April 2020

⁶⁶ <https://www.jstor.org/stable/resrep01732>, accessed 12 April 2020.

⁶⁷ Empowerment of women for equitable participation in watershed management for improved livelihoods and sustainable development: an analytical study, 2007

5. The scope of the training would initially involve only watershed construction work. Modules would be developed and training would be conducted in existing infrastructure such as nearby schools (after school hours or weekends).
6. Linkages to financial institutions such as microfinance institutions (MFIs) and government institutions such as the National Bank for Agriculture and Rural Development (NABARD) which would provide support to the women in taking up leadership roles as contractors and

managing the money for those engaged in labour-related roles.

Potential Implementation States

States with a greater number of sanctioned projects thereby enabling short-term scale-up: Karnataka and Maharashtra.

Types of Partners Involved

The project would require partners at every stage of its implementation for sustained impacts. Table 19 shows an indicative list.

Figure 10: Implementation steps of the model

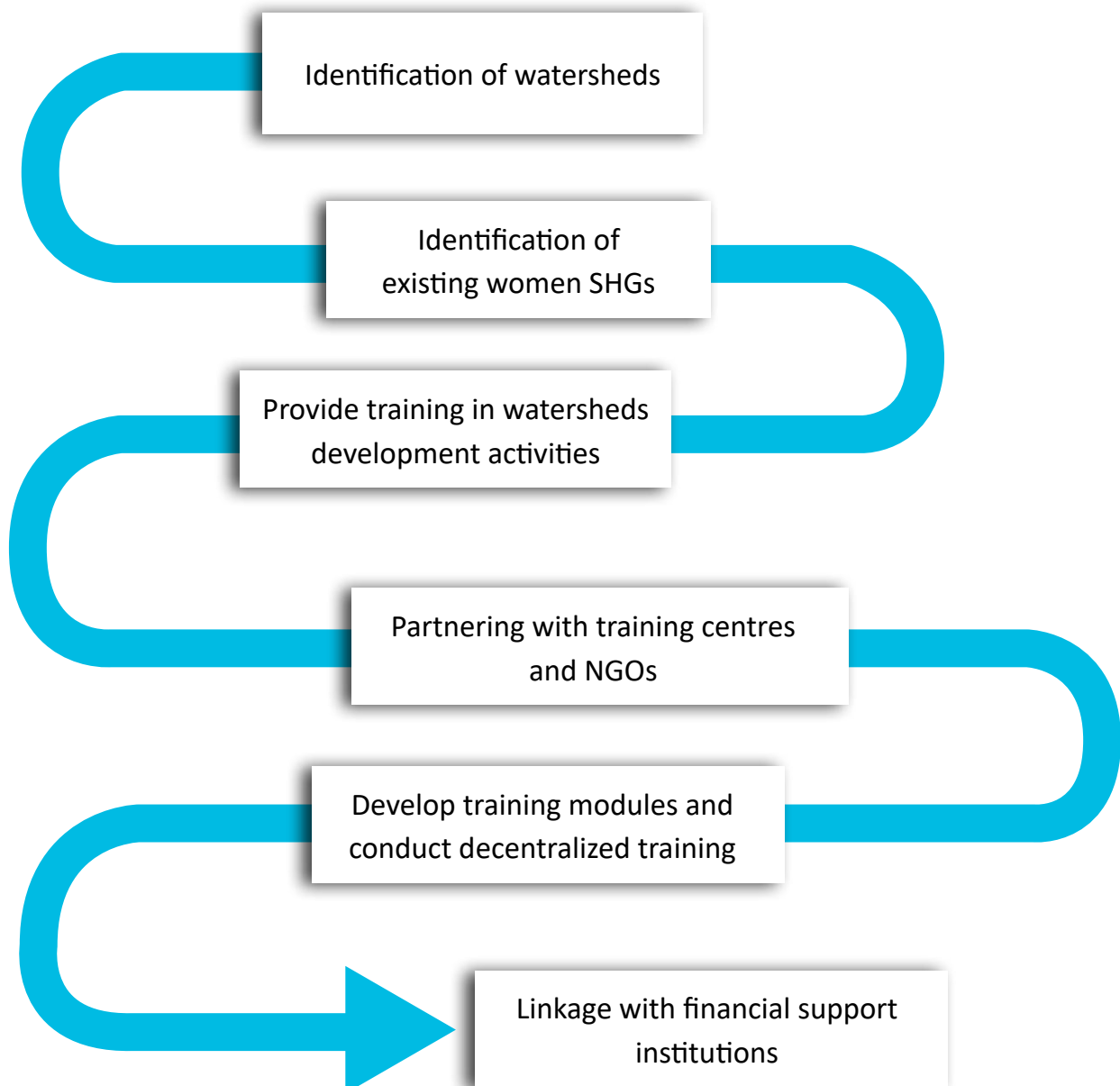


Table 19: Indicative list of partners

Partner type	Partner name (examples)	Contribution
Government	State Rural Development Department – training centres WALMI Krishi Vigyan Kendras (Those providing trainings in relevant areas such as that in Nagpur)	Training providers
National level educational institutes	National Water Academy, Maharashtra National Institute of Agricultural Extension Management Rajendranagar, Hyderabad	
NGOs	WOTR Gramin Vikas Trust WASSAN SIAST ⁶⁸	Rural facilitators
Government/ Private	NABARD MFIs, corporate foundations	Funding

Income Improvement

The wage list for project states as suggested by MGNREGS can be referred to.

Table 20: MGNREGS wage list

State/UT	2019-20 Wage List (INR)
Haryana	284
Karnataka	249
Maharashtra	206
Odisha	188
Telangana	211
Uttarakhand	182

Women would be eligible for wages as approved for the state in which watershed development is taking place. In addition, SHGs would facilitate saving and investment of the earned money.

⁶⁸ Sri Sri Institute of Agricultural Sciences & Technology Trust

Intended Impact

Table 21: Overall impact of the initiative

Social	Economic	Environment	Institutional
<ul style="list-style-type: none"> Women's empowerment Contribution of women in participatory development activities Improvement of social status of women 	<ul style="list-style-type: none"> Increase in income of women (INR 182- 284 per day) Resultant income from these activities can enable women to think about other activities for the SHG when watershed works are not ongoing Agricultural wages tend to be higher (assuming favourable agro-meteorological conditions), post-development of the watershed 	Watershed development	Formation of watershed committees and SHGs with major participation of women, thereby establishing sustainable community organization

Expected Challenges

- 1 The initiative on its own will still not generate consistent income for the women since watershed development activities are not an ongoing concern. This initiative will have to be coupled with alternate income generation activities.
- 2 While women will begin formal employment and earn wages for their work, the community mindset that does not easily approve of a woman going out of the house to work and get paid will take its own time to change.

Feasibility of the Model

Table 22: Overall feasibility of the Model

Time Feasibility	Cost Feasibility	Policy Feasibility	Overall Feasibility
Short	Medium to high	Yes Common Guidelines for watershed development (2011) DDU- GKY MGNREGS	Medium to high

4.2 SUGGESTED ACTION PLANS : POTENTIAL JOB CREATION OPPORTUNITIES FOR WOMEN IN RURAL WATER SUPPLY ECOSYSTEM

Case Study

West Bengal Drinking Water Sector Improvement Project, Bankura, North 24 Parganas and Purba Medinipur districts of West Bengal, India

The ADB project intends to provide safe and sustainable drinking water to about 1.65 million people in the arsenic, fluoride and salinity-affected selected areas of West Bengal (three project districts). It deploys an innovative and sustainable institutional framework and advanced technology for smart water management. The project is ongoing and based on a cofinancing model.

Current Situation and Gap

Ready access to drinking water is a distant dream for a large percentage of women across the country who travel long distances to bring the daily water supply for themselves and their families. It is also a stark reality for many living in urban India having to wait in long queues at community taps to obtain their daily requirement of water.

As of 2018, approximately 49 percent of India's rural population has access to safely managed water (NITI Aayog, 2018). Also, only about 20 percent of rural households have access to tap water in their homes.⁶⁹ Providing access to clean drinking water and sanitation facilities is a priority for every government. It is also one of India's targets as per SDG 6 to have piped water supply in 90 percent of habitations by 2022 including 80 percent household coverage.⁷⁰ However, setting up of a water supply and sanitation system involves substantial investment and infrastructure development.

It is easy to assume where ample water is available that the status quo would be maintained in perpetuity. Community management (with special emphasis on women's participation) of water supply would be effective to ensure the water is available and functional when needed.

Proposed Model

Potential job creation opportunities for women in the rural water supply ecosystem

Description

The initiative would work together with the development of a rural water supply system. Construction activity required for the system would involve women labourers. Taps would be installed in every household and a water meter set up. Women would be trained to work as collectors and managers of water bills with a graded pricing based on usage. They would also be the contact point for the village in case of escalation of any issues. The initiative could be funded by a multi-lateral organization in addition to receiving contributions from the centre and state. The collected fund could be used as seed fund for SHG-related entrepreneurship activities or used in development of the village.

Steps to Implement the Model

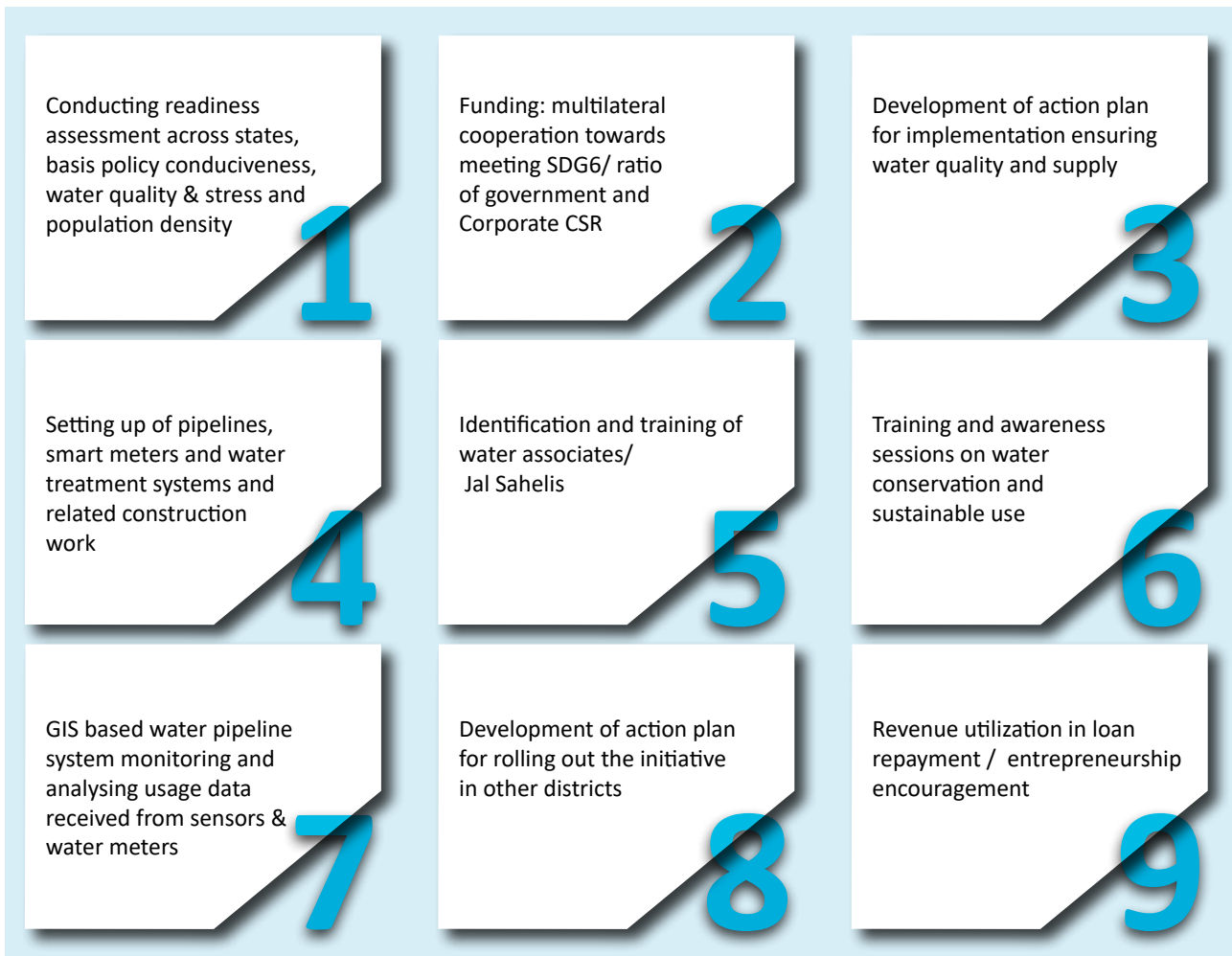
- 1) Readiness assessment to be conducted across states using a third party organization. The assessment would rate states based on criteria such as policy conduciveness of states, water quality and stress and population density of the region, pilot districts where implementation would be initiated.
- 2) Upon finalization of the project states, funding would be procured. Organizations across the world are funding targeted efforts towards meeting SDG 6: Clean water and sanitation for all. In addition, a ratio of government and corporate CSR (Corporate Social Responsibility) funding could be considered.

⁶⁹ https://jalshakti-ddws.gov.in/sites/default/files/JJM_Operational_Guidelines.pdf

⁷⁰ https://niti.gov.in/writereaddata/files/Report_SDG-6_v1.pdf

- 3) Development of an action plan for implementation would be carried out basis the readiness assessment report. Water quality and supply both need to be ensured as part of the project.
- 4) Setting up of pipelines, smart meters and water treatment systems and related construction work (such as canals) would be carried out through a project implementation agency.
- 5) Water associates/Jal Sahelis: Women would be trained to work as collectors and managers of water bills with a graded pricing based on usage, maintenance of records and trouble shooting. SHGs and door-to-door survey activities would help identify interested women. Financial assistance would be given to women members interested in training in semiskilled and skilled roles of the project such as plumbing (e.g., Water for People Foundation uses mobile mechanics called Jalbandhus; Punjab has a good revenue collection system managed by the Panchayats).
- 6) Training and awareness sessions on water conservation and sustainable use would be conducted with the local communities.
- 7) GIS-based water pipeline system monitoring, interlinking data received from women water associates and analysing usage data received from sensors and water meters would help track the progress of the initiative.
- 8) An action plan for rolling out the initiative in other districts would be developed or resolution of issues if any would take place basis reports and databases of existing projects.
- 9) While a percentage of the revenue could be utilized towards repayment of the loan and infrastructure maintenance, a fixed percentage would be utilized in encouraging women-led entrepreneurship activities in the region. Local NGOs and MFIs could help facilitate the process.

Figure 11: Implementation steps of the model



Location of Possible Implementation

Nearly 90 percent of the rural population uses groundwater for drinking purposes. This water however is contaminated and non-potable due to various reasons such as salinity, arsenic and fluoride presence. While arsenic is not a major problem in the project states considered for this study, salinity and fluoride could be factors.

Basis salinity: Arid and semi-arid states such as Haryana where increased inland salinity is an issue and states such as Odisha where coastal salinity affects quality of water.

Basis fluoride⁷¹: Of the selected states, Odisha, Karnataka and Haryana have the highest number of districts where water is affected by fluoride.

Table 23: States and districts with highest fluoride contamination

State	Number of Fluoride Affected Districts
Odisha	18
Karnataka	14
Haryana	11
Maharashtra	8
Delhi	7
Telangana	NA

Basis iron: Groundwater contaminated with iron is seen to be a challenge in states such as Odisha and Karnataka.

Types of Partners that could be Involved

Table 24 shows an indicative list of partners that could be involved.

Table 24: Indicative list of possible partners

Partner Type	Partner Name (Examples)	Contribution
Government	State Rural Development Department training centres	Training providers
National level educational institutes/ NGOs/private institutes	<ul style="list-style-type: none"> National Water Academy, Maharashtra Training partners associated with IPSC such as IL&FS India Pvt. Ltd. Government and private industrial training institutes Water and Sanitation Management Organization 	

⁷¹ <http://cgwb.gov.in/WQ/GROUND%20WATER%20QUALITY%20SCENARIO%20IN%20INDIA.pdf>

Partner Type	Partner Name (Examples)	Contribution
Government	State and central governments	Infrastructure development funding
Multilaterals	ADB, World Bank, UNDP	
Private	Corporate foundations	
Private	Survey organizations, consulting firms in water supply/ infrastructure/ community participation	Surveys, assessment reports, action plan project implementation management
Private	Suppliers	Water meters, sensors, reverse osmosis systems, taps and pipes
Government	<ul style="list-style-type: none"> Public health engineering departments Panchayats State and central governments 	Maintaining and collating data to track progress and facilitating implementation
NGOs	Naandi Foundation WaterAid India Water For People	Rural facilitators
Government/ private	NABARD MFIs, corporate foundations, NGOs, SHGs	Fund management Facilitating entrepreneurship opportunities for women

Intended Impact

Table 25: Overall impact of the model

Social	Economic	Environment	Institutional
<ul style="list-style-type: none"> Availability of potable water supply Women's empowerment Contribution of women in participatory development activities Improvement of social status of women 	<ul style="list-style-type: none"> Resultant savings in time and income generated from these activities can enable women to think about other activities for the SHG when watershed works are not ongoing Consistent source of income (in the form of monthly salary) for women employed in plumbing maintenance, and as water associates 	Reduced groundwater exploitation	<ul style="list-style-type: none"> Formation of water supply committees at village level (Paani Samiti) and SHGs Development of community led ecosystem ensuring sustainability of initiative

Expected Challenges

- 1) Involuntary resettlement: Since the project involves setting up of a water supply system, involuntary resettlement may be expected.
- 2) The concept of water use efficiency will have to be promoted aggressively in addition to the graded pricing.
- 3) The initiative will require large investments but the results would be visible only after the entire system has been set up.
- 4) Water supply systems, once successfully set up, will need to immediately be followed up with wastewater treatment systems; their absence might lead to increased contamination of groundwater or any nearby water bodies.

Feasibility of the Model

Table 26: Overall feasibility of the model

Time Feasibility	Cost Feasibility	Policy Feasibility	Overall Feasibility
Medium to long term	High cost. The funding is expected to be a combination of grants, loans and technical assistance	Yes. 1) SDG 6 and India's commitment 2) NRDWP	Medium

**Note that while water supply falls under the conventional water sector and has not been considered 'green' yet, sustainable water supply using sensor-based technology has been considered as the way forward, thereby making the proposed initiative 'green.'*



5.

Annexures

ANNEXURE 1: GLOSSARY

- 1 Rainwater harvesting** is the accumulation and storage of rainwater runoff for various purposes.⁷² The harvested water can be then routed to subsurface in a process called ground recharge through infiltration ponds, trenches, and dams. There are two kinds of RWH methods: rooftop-based RWH and surface-based RWH.
- 2 Rooftop RWH** is the technique through which rainwater is captured from the roof catchments and stored in reservoirs.⁷³ The harvested rainwater can be stored in sub-surface groundwater reservoirs by adopting artificial recharge techniques to meet usage needs through storage in tanks.
- 3 Watershed management**⁷⁴ is the process of guiding and organizing the use of land and other resources in a watershed to provide the desired goods and services without adversely affecting soil and water resources. The approach adopts a common strategy of multi resource management involving all stakeholders within the watershed who, together as a group, co-operatively identify the resource issues and concerns of the watershed as well as develop and implement a watershed plan with solutions that are environmentally, socially and economically sustainable.

⁷² <https://www.reportlinker.com/p04988888/Rainwater-Harvesting-Market-in-India.html>

⁷³ <http://cgwb.gov.in/>

⁷⁴ <https://vikaspedia.in/social-welfare/rural-poverty-alleviation-1/schemes-department-of-land-resources/watershed-management-programmes>

ANNEXURE 2: LIST OF STAKEHOLDERS CONSULTED

Peer Reviewers to the sectoral studies

Sectoral Chapters	Peer Reviewer
Renewable Energy	Dr. Srinivas Shroff Nagesha Rao, <i>Chief Executive Officer, REC Foundation</i>
Green Construction	Suneel Padale, <i>Director Programs, CARE India</i>
Green Transport	Hitesh Vaidya, <i>Director, NIUA</i>
Water Management	Moho Chaturvedi, <i>Consultant Water Resources and Environment</i>
Carbon Sinks- Forests	Vishaish Uppal, <i>WWF India</i>
Carbon Sinks- Marine Fisheries	Ramya Rajagopalan, <i>Independent Researcher</i>

SN.	Name of Stakeholder	Organization	Designation
1.	Mr. Ankit Magan	Retas Enviro Solutions Pvt. Ltd.	Director
2.	Mr. Ankur Gupta	International Association for Human Values	Project Management
3.	Mr. Deepak Awari	DHI India Water & Environment Pvt. Ltd.	Director – Strategy and Development
4.	Dr. Manoranjan Hota	Ministry of Environment, Forest & Climate Change	Advisor
5.	Dr. Parveen Dhamija	Skill Council for Green Jobs	Advisor
6.	Mr. Harsh Singh	UNDP	Programme Advisor
7.	Mr. Satender Arya	Agriculture Skill Development Council	Chief Executive Officer
8.	Mr. S.M. Misra	Tetra Tech	Technical expert
9.	Ms. Sreenita Mondal	South Asia Consortium for Interdisciplinary Water Resources Studies	Project Coordinator (SAWA)
10.	Ms. Sumita Singhal	Centre for Science and Environment	Wastewater expert
11.	Ms. Vandana Bhatnagar	National Skill Development Council	Chief Programme Officer

Disclaimer:

Due to COVID 19 pandemic and the travel restrictions, the report is purely based on secondary sources and information obtained by KPMG from organisations, experts and through stakeholder interactions. This report sets forth information based on the completeness and accuracy of the facts stated and any assumptions. The comments in the report are not intended, nor should they be interpreted to be legal advice or opinion.




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