GOVERNMENT OF KARNATAKA

Evaluation of Multi-Village Water Supply Schemes implemented by RDWSD in Karnataka during 2015-2020

KARNATAKA EVALUATION AUTHORITY
DEPARTMENT OF PLANNING, PROGRAMME MONITORING AND STATISTICS
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FOREWORD

Water scarcity in Karnataka is mainly concentrated in the Bayaluseeme (24 districts) region. The total basin area covered under the east flowing rivers such as Godavari, Krishna and Cauvery comprise 76% of total geographical area and are contributing approximately 42% of water yield of Karnataka. The study titled "Impact Evaluation of Multi-Village Water Supply Scheme Implemented by Rural Drinking Water and Sanitation Department (RDWSD) in Karnataka during 2015 to 2020", implemented by Department of Rural Development and Panchayat Raj (RDPR) has been evaluated by the NABCONS-NABARD Consultancy Services. The Study mainly focused on assessing the delivery performance in terms of frequency, regularity, adequacy, and quality as per the prescribed standards at household level.

To achieve the defined objectives, both secondary and primary data has been used. Secondary data on physical and financial information by districts has been analysed. Primary farm household data has been collected from 2462 beneficiaries of Multi-Village Water Supply (MVS) from 74 Gram Panchayats (GPs) of 17 districts.

Results clearly indicate that the Scheme has increased delivery performance in terms of frequency, regularity, adequacy. Around 75% of the beneficiaries are receiving water for more than one hour daily (60%) which accounts to 56 LPCD from MVS against GoI norms of 55 LPCD, quality check is done once a month or more, it is also highlighted that the consumer demand is more than what MVS supply and gap is met by the GPs arranging additional supply of water from groundwater. Since rural water supply in Karnataka has not yet applied incremental block tariff and volumetric pricing, there is no evidence for demand control at GP level. The study also highlighted that in spite of sufficient water supply form MVS, use of borewell sources has not reduced. To increase the efficiency of the Multi Village Water Supply Scheme, Study suggests for scheduled water quality check, recharge defunct borewells, automation of water supply, introduce incremental block tariff for bulk water supply, develop a Training of Trainers (ToT) team and synchronization of water supply.

I am sure that the findings of evaluation report and recommendations will provide useful insights for improving the efficacy of the Multi Village Water Supply

scheme. The guidance from the Director (Evaluation) throughout the study and inputs from the ACEO-KEA and experts is greatly appreciated and acknowledged.

The study received support and guidance of the Additional Chief Secretary, Planning, Programme Monitoring and Statistics Department, Government of Karnataka. The report was approved in 56th Technical Committee Meeting. The review of the draft report by KEA, members of the Technical Committee, and an Independent Assessor, has provided useful insights and suggestions to enhance the quality of the report. I duly acknowledge the assistance rendered by all in successful completion of the study.

Chief Evaluation Officer
Karnataka Evaluation Authority

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Director (Evaluation), Karnataka Evaluation Authority and officials of KEA provided administrative support starting from the commencement to the conclusion of the assignment.

Chief Engineer, Karnataka Rural Water Supply and Sanitation Department (Department) and officials at the state headquarters, Executive Engineers of 18 divisions; Assistant Executive Engineers (AEEs), Assistant Engineers (AEs); Junior Engineers (JEs); other officials of RDWSD allotted their valuable time for detailed discussions, provided data on 60 multi-village water supply schemes and introduced the MVS operators and officials of 74 Grama Panchayats (GPs) to us. We place on record our appreciation and gratitude to RDWSD and all its officials at HQ, Divisional and Sub-divisional level.

Presidents and Members of Gram Panchayats Panchayat Development Officers, Secretaries, Bill collectors, Computer Operators and Watermen across all the 74 GPs cooperated and extended their full support for undertaking field visits and data collection. PDOs organized meetings with communities, households and consumers. Computer Operators offered great support by providing us data at GP level. Watermen accompanied us during the household level data collection. We are very grateful to GP level elected representatives, officials and other staff for supporting us and extending cooperation in field level enquiries.

In addition to the above interactions, we held detailed discussions with sectoral experts: (1) Mr. Shree Padre, renowned water journalist and activist; (2) Shri. R. R. Mohan, former senior social development specialist at the World Bank; (3) Dr. S.S.Meenakshi Sundaram IAS (Retd.) and currently Executive Vice Chairman, MYRADA; (4) Dr. Suryanarayana Satish, Coordinator in the Social Sustainability and Inclusion Unit of the World Bank at Almaty for Central Asia and (5) Dr. R. Vishal IAS, Commissioner for Public Instruction, Government of Karnataka and former Commissioner, Rural Drinking Water and Sanitation Department, Government of Karnataka. We are grateful to all the above sectoral experts for sparing their time and inputs.

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Abbreviations used in the report

AAP	Annual Action Plan
AEE	Assistant Executive Engineer
ARWSP	Accelerated Rural Water Supply Programme
BCC	Behaviour Change Communication
bcm	Billion cubic meters
BPS	Booster Pumping Station
BWSSB	Bangalore Water Supply and Sewerage Board
CBOs	Community Based Organizations
CDD	Community Driven Development
CPHEEO	Central Public Health & Environmental Engineering Organization
CSP	Community Service Providers
CWR	Centre for Water Resources
DBOT	Design Built Operate and Transfer
DDWS	Department of Drinking Water and Sanitation
DFID	Department for International Development
DHO	District Health Office
DRA	Demand Responsive Approaches
EE	Executive Engineer
FGDs	Focus Group Discussions
FHTC	Functional Household Tap Connection
FTK	Field Test Kits
GLSR	Ground Level Storage Reservoir
GO	Government Order
GoK	Government of Karnataka
GP	Grama Panchayat
GRM	Grievance Redressal Mechanism
HHs	Households
HO	Head Office
HTC	House Tap Connections
IEC	Information, Education & Communication
IIM	Indian Institute of Management
IWMI	International Water Management Institute
IR	Impounding Reservoir
ISA	Implementation Support Agency
IVDN	In-Village Distribution Network
JJM	Jal Jeevan Mission
KEA	Karnataka Evaluation Authority
KEQ	Key Evaluation Question
KL	Kilo litres
KPCB	Karnataka Pollution Control Board
KRDWSD	Karnataka Rural Water Supply and Sanitation Department
KRWSSA	Karnataka Rural Water Supply and Sanitation Agency
KUWSDB	Karnataka Urban Water Supply and Drainage Board

LPCD	Litres Per Capita per Day
M&E	Monitoring & Evaluation
MBR	Master Balancing Reservoir
MBT	Master Balancing Tank
MCM	Million cubic metre
MDBs	Multilateral Development Banks
MIS	Management Information System
MIVS	Multi Village Schemes
MLD	Million Litres per day
MNP	Minimum Needs Programme
MoDWS	Ministry of Drinking Water and Sanitation
MVS	Multi Village Scheme
MWS	Mini-Water Supply schemes
NABARD	National Bank for Agriculture and Rural Development
NABL	National Accreditation Board for Testing and Calibration Laboratories
NDWM	National Drinking Water Mission
NGO	Non-governmental organization
NH	National Highway
NHAI	National Highway Authority of India
NRDWP	National Rural Drinking Water Programme
O&M	Operation and Maintenance
OHT	Over Head Tank
PDO	Panchayat Development Officer
PforR	Program for Results
PHC	Public Health Centre
PHED	Public Health Engineering Department
PMU	Project Management Unit
PRA	Participatory rural appraisal
PRED	Panchayat Raj Engineering Department
PRIs	Panchayat Raj Institutions
PSP	Public Stand Post
PWS	Piped Water Schemes
RDPR	Department of Rural Development & Panchayat Raj
RDWSD	Rural Drinking Water and Sanitation Department
RGNDWM	Rajiv Gandhi National Drinking Water Mission
RO Plant	Reverse Osmosis plant
RWSB	Rural Water and Sanitation Board
RWSG	Regional Water and Sanitation Group
RWSS	Rural water supply and sanitation
RWSSP-LIS	Rural Water Supply and Sanitation Project for Low Income State
SBM-G	Swachh Bharat Mission-Gramin
SC	Schedule Caste
SCADA	Supervisory Control and Data Acquisition
SDGs	Sustainable Development Goals

SE	Superintending Engineer
SO	Section Officer
SLSSC	State Level Scheme Sanctioning Committee
SPV	Special Purpose Vehicle
SRP	Sector Reforms Program
ST	Scheduled Tribe
STA	State Technical Agency
SVS	Single Village Scheme
SWAp	Sector Wide Approach
TAC	Tender Approval committee
TDS	Total Dissolved Solids
ToR	Terms of Reference
TSC	Tender Scrutiny Committee
TWAD Board	Tamil Nadu Water Supply and Drainage Board
UNDP	United Nations Development Programme
VWSC	Village Water Supply Committee
WBD	Water Borne Disease
WCED	World Commission on Environment and Development
WHO	World Health Organisation
WPP	Water Purification Plants
WQMSP	Water Quality Monitoring and Surveillance Programme
WQT	Water Quality Test
WTP	Water Treatment Plant
ZBR	Zonal Balancing Reservoir

1 Executive Summary

1.1 Introduction

Karnataka Evaluation Authority under Department of Planning, Statistics and Programme Monitoring, Government of Karnataka launched a study to evaluate the functioning and delivery performance of Multi Village Rural Water Supply Schemes (MVS) implemented during 2015-2020. The study was awarded to NABCONS- NABARD Consultancy Services and commenced in December 2021. Detailed investigation into the delivery performance and functioning of a sample of 60 MVSs implemented during 2015-2020 was undertaken. The MVS sample schemes were selected from 17 districts of Karnataka, from the Bayaluseeme region (North and South Interior Karnataka). Besides surveying 60 sample MVSs, the study also held interactions and data collection in 74 Gram Panchayats falling in the beneficial area of the above sample MVSs and surveyed 2462 households. Three case studies of Multi Village (Single GP Schemes) rural water supply schemes from Karnataka, Kerala and Maharashtra are presented as part of this study. The Executive summary provides the study objectives, key findings including takeaways from case studies and recommendations for further follow up.

1.2 Objectives of the study

Following are the objectives of the evaluation of MVS implemented in Karnataka during 2015-2020.

a) To assess functionality of water supply schemes implemented in Karnataka during the period from 2015-16 to 2019-20.
b) To estimate the delivery performance in terms of frequency, regularity, adequacy of supplyof water at household level in all the habitations at all the times and under all circumstances.
c) To examine adherence to quality standards as per the prescribed norms (WHO Standards).
d) To assess the coverage of villages such as not covered, partially covered and quality affected.
e) Demand and supply analysis of water supply scheme in all the villages and habitations.
f) To assess impact on rural communities with focus on indicators and targets related to SDG 6 on ‘Clean Water and Sanitation’ and SDG -3 on ‘Good Health and Well Being’.
g) To analyze the impact of covid on functioning of MVWSS
h) To study functioning of similar schemes in other states and suggest measures for improvement for Karnataka

1.3 Approach to the study

The evaluation of MVS and O&M of Rural Water Supply Schemes is viewed from an angle of a sustainability pentagon consisting of : (1) Natural capital-Water source-resource; (2) Physical capital- water supply infrastructure which includes built assets together with operation and maintenance; (3) Finance Capital: income and sufficient cash flow to manage the expenditure and contingencies;(4) Human and social capital- capacity building of stakeholders, IEC, social aspects, mobilization of community including leadership and their knowledge, skills and

experience to operate and maintain the drinking water supply schemes, and finally (5) Institutional & Governance capital (legal, policy, institutional & governance aspects including legislations, government orders and the institutional network for the management of O&M). Findings and recommendations are grouped under the above five capital framework.

1.4 Rural water supply sector in Karnataka during the last decade

Rural water supply sector in Karnataka has witnessed significant events during the last decade. Rural Drinking Water and Sanitation Department (RDWSD) was raised as a department of the Government of Karnataka under the Rural Development Department in 2014. Government of Karnataka opted to raise an exclusive department to look after rural water supply after World Bank supported Karnataka Rural Water and Sanitation Project (KRWSSP) and Jal Nirmal Project concluded. RDWSD took off from the void left by Karnataka Rural Water Supply and Sanitation Agency (KRWSSA), which was managing the implementation of World Bank aided RWSS projects. This turned out to be a significant step for the sector from the state government, despite losing the rich institutional memory accumulated while implementing the 'KRWSSP and Jal Nirmal Project'. The second most significant step was the focused investment in Multi Village Schemes that draw water from surface sources. What began on an experimental basis during the Jal Nirmal Project became the central focus of investment in rural water since raising RDWSD as a separate department in 2014. Government of Karnataka became a facilitator in the O&M of MVS by drawing in the private sector operators to manage, operate and maintain MVS. Two centrally planned mega programmes were launched during this period: (1) Swachh Bharat Mission- Gramin, launched in 2014 to address sanitation issues and (2) Jal Jeevan Mission (JJM) with an objective of providing treated potable water through Functional Household Tap Connections (FHTC), launched in 2019. Major part of SBM-G is completed, while implementation of JJM is still underway. An approximate amount of Rs.6000 crores has gone into building MVS in the state during the last decade. The evaluation of MVS has taken place against this background of major sectoral interventions and substantial investment in MVSs.

1.5 Findings

a) Looking at water from the resource perspective, Karnataka experiences a spatial (regional) imbalance in the distribution of water resources, rainfall and population, compelling the state to live with water stress. Karnataka has been experiencing climate change, manifested by recurrent droughts and flash floods in the last two decades. Government of Karnataka attempted to address drinking water scarcity with an approach, which is heavy in terms of technology, energy and finance. As predicted by IWMI[1], "by 2025, the world will not have sufficient water to maintain 1990 levels of food production" (Seckler, Barker, & Amarasinghe, 1998) as a part of the water meant for irrigation will have to be diverted for drinking water purpose and will apply to Karnataka as well.
b) The problem in rural water sector has to be seen at a macro (State) level and at a local level. At the macro level, Karnataka is most part of its geographical area is a water stressed state. Climate change, droughts and floods are more telling in the lives of people than before.

[1] International Water Management Institute - Colombo

Regional imbalance of water resource distribution in the State is a non-negotiable reality. The State has responded to the water stress with planning and creating Multi Village Water Supply Systems, drawing water from surface sources. At the local level (GP level) twin water sources- both surface and groundwater sources-are used. Borewells and its resource intense technology have largely replaced traditional water sources and water harvesting-cum management practices that were evolved through centuries of trial and experiments.

c) Governmental response to water stress has focused more on creating water infrastructural schemes that can cater to large number of villages. This approach is heavy in terms of technology, finance, energy and involvement of private sector. When one looks at the village level, there is an abundance of water assets, which are really not synchronized to each other and hence act in silos. Systemic and integrated response to water stress is yet to get evolved into a smooth functioning system. Parallelism in water supply has to end and badly needs to be integrated at local (GP) level. Asset creation, operations and maintenance of water supply assets is only one side of the solution, which is getting lot of focus today at the macro and micro level. The other side of the solution lies in focusing on institutions, governance, human capital and attempts to recover cost of operations. This side, which we would like to term as the soft side of operations is weak and not focused in the State. Focusing on the soft side needs to be based on a participatory process that needs strong political and social support, ownership and commitment. Capacity building at RDWSD, Operator, PRIs, especially GP, VWSC and Staff across the levels is one of the key activities that need to be in the focus. RDWSD itself needs to be strengthened by way of human resources, skills, technologies and knowledge development. Rural water supply in Karnataka needs to be liberated from its present 'low level equilibrium trap' to become sustainable in terms of finance, human capital, institutional and governance capitals that contributed to the sustainability pentagon, where policy instruments, GRM, MIS, improved contract management approaches and local level institutions in the like of VWSC need to be the urgent focus to salvage rural water supply sector in Karnataka.

d) Comparison of Objectives and Findings

Table 1: Summarised objectives and Key Findings

No	Summarised objective	Key Findings
1	To assess functionality of water supply schemes implemented in Karnataka during the period from 2015-16 to 2019-20	1. 60 MVS surveyed 2. 57 of 60 MVSs are functional 3. 01 MVS (MVS Doddakavalande- Mysore) is partly functional 4. 02 MVS (MVS Adrallai (Gadag) and MVS Hullur (Raichur) are not functional 5. Functionality means, MVS is operational and distributing water to Gram Panchayats at Village OHTs.
2	To estimate the delivery performance in terms of frequency, regularity, adequacy of supplyof water at household level in all the habitations at all the	The delivery performance is assessed at consumer level a. **Frequency** – Frequency of water supply at consumer end varies from less than 30 minutes to two hours plus on the day of water supply; (4.86% of households get water for less than 30 minutes; 22.5% of households get water supply for half an hour

No	Summarised objective	Key Findings
	times and under all circumstances	to one hour. 34% gets water for 1 to 2 hours; 38% of households get water supply for more than 2 hours of water supply) b. **Regularity**: 60% of HHs receive water supply daily; 40% of the HHs receive water supply once in 2 to 4 days c. **Adequacy**: Adequacy is assessed against the GoI norm of 55 lpcd. It is found that HHs in general receive 94 lpcd, of which 56 lpcd comes from the MVS source on a gross output base and the balance of 38 lpcd comes from groundwater sources maintained by GPs. However, MVS experience NRW- Non-Revenue Water to the tune of 20% on an average and would thus reduce adequacy of water to 45 lpcd and the GPs make up for the remaining supply from its borewell sources. d. Adequacy, Regularity and Frequency of water supply for the Control group: Considering the comparative cost incurred for the construction of MVS and SVS (control group draws water from non-MVS sources), 77 lpcd is very impressive in terms of quantity of water supplied to households. The result of the control group actually poses a challenge on the whole efforts, energy, investment made on MVS. e. Comparing the performance under 'Frequency' parameter of 'Experimental' and 'Control' Groups, it is found that the experimental group is faring better in lower level of frequency, while Control Group is better poised at a higher frequency service level. However, higher duration or frequency of supply, does not mean that adequacy, quality and sustainability is adhered. Although under the control group, water available is not treated, source is not sustainable and the pressure of supply is not adequate for the households to fill the needs within an hour such that they can carry on with their routine work. f. Control group households get water supply every day when the SVS systems are functional.
3	To examine adherence to quality standards as per the prescribed norms (WHO Standards).	a. There is no scope for any comparison of water quality parameters against WHO standards and those maintained in the State of Karnataka. WHO suggests testing 90 parameters in 'chemical', while BIS-10500 suggests testing 29 parameters normally under physical, chemical and bacteriological parameters. Water sample from MVSs surveyed are testing 12 parameters under chemical and physical category and bacteriological parameter is not tested. b. Frequency of water quality testing is either monthly or along with the submission of bills for payment by the Operator. c. Not all water quality parameters are uniformly tested across all RDWSD labs; Regularity of water quality testing is monthly; physical and chemical parameters of water quality are found within permissible limits in general. However, bacteriological parameter of water quality, which is a critical component of

No	Summarised objective	Key Findings
		water quality is not found in any of the MVS water quality test reports.
4	To assess the coverage of villages such as not covered, partially covered and quality affected.	a. Focus of water supply is to satisfy the quantity of water at consumer and GP levels. b. Comparison in the study has been between villages that are covered by MVS and those that are covered by GP based borewell sources. The study did not find any village or habitation that falls under the 'not covered' category. c. Villages/Households with and without MVS water supply have been covered in the study. Quality aspects of water are of secondary priority at the consumer and GP levels.
5	Demand and supply analysis of water supply scheme in all the villages and habitations.	a. Consumer demand is more than what MVS supply and the gap is met by GPs arranging additional supply of water from groundwater based schemes. b. There is not much gap between demand and supply, considering the water supply from all sources at GP level. If supply from MVS alone is considered, it may be stated that MVS is supplying approximately 50% of the total demand at GP/ consumer level. c. Pricing of water, especially considering Incremental Block Tariff for the volume of water consumed, will control the demand for water. However, rural water supply in Karnataka has not yet applied incremental block tariff and volumetric pricing. Hence, there is a clamour for more water always, which the GP manages to supply from its own sources as well as from the MVS. Since pricing has not been applied at the GP level, there is not yet any evidence for demand control at the level of GP. Since flat tariff system is followed at the consumer level, pricing does not control the volume of water consumed.
6	Impact on rural communities with focus on indicators and targets related to SDG 6 on 'Clean Water and Sanitation' and SDG -3 on 'Good Health and Well Being'.	Percentage of population affected by Water Borne Diseases (WBD) varies from zero (0) to 13.13% at selected GPs during the year 2021. Data on Incidence of the occurrence of Cholera, Diarrhoea, Gastroenteritis, Jaundice and Typhoid have been collected and analyzed. a. 15 GPs (20.27% of 74 GPs.) have not reported any incidence of water borne diseases b. 36 GPs (48.65%) have 0.01 to 0.99% WBD incidence. c. 12 GPs (16.22%) have 1 to 5% incidence of WBDs d. 8 GPs (10.81%) have 5.01% to 10% of WBD occurrence. e. 2 GPs (2.7%) have WBDs ranging above 10.01% to 13.13%. In one of the cases, ie., Nellihankalu in Channagiri taluka, Davanagere district, the health data received from PHCs indicate the number of Gastroenteritis cases on higher side. Hence, the data is in the process of re-checking in consultation with health department and GP. f. Average annual occurrence of WBD during 2013-14 was 8,050 in the GPs sampled for study, while average annual occurrence

No	Summarised objective	Key Findings
		of WBDs in the same sampled GPs is to the tune of 11,337 during 2015-2021. g. SDG-6:- Ensure Availability and Sustainable Management of Water and Sanitation for All (1) % of population having safe and adequate drinking water in rural areas for Karnataka is 52%; (2) % of annual ground water withdrawal against net annual availability for Karnataka is 70%. h. SDG-3:- SDG3 on 'Good Health and Well Being' 1. Current MMR- 92/100000 live births 2. Under Five Mortality Rate (U5MR)- 29.5/1000 3. % of children aged 12-23 months fully immunized- 69% 4. Annual Notification of Tuberculosis cases/per 1 lakh population 103 5. Number of governmental physicians, nurses and midwives per 1,00,000 population- 276.
7	Analyze the impact of covid on functioning of MVWSS	2 MVS out of 58 MVS were affected by 'Covid 19' and were not functional for one week each. There was no impact for 56 MVS due to covid. Two MVS are not functional due to infrastructure related issues.
8	Study functioning of similar schemes in other states and suggest measures for improvement for Karnataka	Two schemes outside Karnataka and one scheme within Karnataka were studied and the case studies are attached. Measures that can be adopted in the Karnataka context from these case studies are proposed below.

No	Takeaways	Nenmeni	Shiraguppi	Banavadi
1	**Natural Capital**- Sustainable Water Source	Yes	Yes	Yes
2	**Physical Capital (Infrastructure and Operations)**			
2.1	Automated pumping systems (Mobile/ Sensor based) at Jack well/WTP/SVS	Yes	Yes	Yes
2.2	Solar energy generation at WTP and connecting to State Grid	-	-	Yes
2.3	Fusion Technology used to join pipes in IVDN	-	-	Yes
3	**Finance Capital**			
3.1	Incremental Block Tariff for consumer categories	Yes	-	Yes
3.2	Multiple payment options for consumers	Yes	-	Yes
3.3	Incentive for regular payment by consumers	-	Yes	-
3.4	Software based accounting and book keeping systems	Yes	Yes	Yes
3.5	Software based Billing and Collection system	Yes	Yes	Yes
3.6	Levying penalties for illegal connections and non-payment of water tax	Yes	Yes	Yes
3.7	Promoting transparency in billing and collection	Yes	Yes	Yes
4	**Human and Social Capital**	Yes	Yes	Yes
4.1	Inclusion of Experts in GPWSC/VWSC and reducing the number of GP members in the VWSC/CWU	Yes	Yes	-
4.2	Rationalizing the number of watermen at GP level	-	Yes	Yes
4.3	Fewer staff with skill, knowledge and professionalism	Yes	Yes	Yes

No	Summarised objective	Key Findings		
5	**Governance and Institutional Capital**			
5.1	Inclusive rule making and enforcement	Yes	Yes	Yes
5.2	Converting VWSC / GPWSC/SLEC into a Community Water Utility (CWU) with clear definition of roles and responsibilities for CWU and GP	Yes	Yes	-
5.3	Field Water Schools in collaboration with case study GPs/ CWUs	Yes	Yes	Yes
5.4	Community based GRM and mechanism for monitoring resolution of Grievances.	Yes	Yes	Yes

1.5.1 Findings on the basis of sustainability pentagon

Findings and conclusions of the MVS evaluation study is grouped under the above five sustainability capitals. Rural water supply schemes are categorized into Multi Village Schemes (MVS) and Single Village Schemes. MVS in the context of the present study will mean Multi-GP water supply schemes, as except two MVSs studied, all schemes supply water to multiple Gram Panchayats. Though described as Single Village Schemes (SVS), it generally means the rural water supply system at the GP level and therefore really means Single GP schemes. Hence MVS and SVS are looked at from a conjunctive angle, treating state level, scheme level and local level resources, potential and issues in conjunction. The following table summarises findings under sustainability pentagon.

Table 2: Summary of findings – MVS level and SVS / GP level

Name of Capital	MVS	SVS/GP level
Natural capital-Water Resource/ Water Source	1. Water sources based on rivers, reservoirs and natural lakes are found perennial, considering the experience of last five years. 2. Water sources based on canal fed (especially high-level canal fed) Impounding Reservoirs are beset with a sustainability problem coupled with severe competition for water from the farming community.	1. Parallel sources of water from MVS and SVS available at GP- MVS supply has not reduced use of borewell sources; 2. GP's own water sources are groundwater based Borewells; Due to normal to above normal rainfall received in Karnataka during the last 4 years, borewells yield water. 3. WPPs are available in all GPs surveyed and people purchase WPP water at nominal tariff and consume the same. 4. MVS supply water to Gram Panchayats at village level OHTs 5. Water is available at reasonable levels for the GP population, with a selected category people resorting to usage above reasonable levels as per Indian norms and standards' 6. Traditional and community owned water sources are neglected and face abandon.

Name of Capital	MVS	SVS/GP level
Physical capital- Water Supply Infrastructure	1. MVS assets are built reasonably well. 2. 57 MVSs are functional; 01 is partially functional while 02 are not functional 3. Operations based data is not fully available at the MVS level. 4. Maintenance needs improvement. 5. Synchronization between MVS, SVS, WPP needs improvement. 6. Administration and management of MVS contracts needs improvement. 7. Rural water sector is still focused on asset creation and not on reforms, institutional arrangements, human capital with community participation. 8. Private Operators are engaged by RDWSD and they were envisaged to bring technology and skills from the market to operate MVS. However, what has actually happened on ground is that small time and small-scale operators without calibre have canvassed all MVS contracts and state of the art technology and management in rural water supply is not at all seen across the sample of MVS, except in the large MVSs. Even in the large MVSs, SCADA, data management, coordination with GPs, etc., need improvement. 9. Large scale Investment in MVS. quality of construction is good. Schemes of the order of Multi-Village to Multi-GP to Multi-Taluk dimensions are seen in the field. The nomenclature, 'Multi Village Schemes' appears to be anachronistic.	1. Village level OHT storage is substantial, sufficient to store @43LPCD for the population 2. Aged distribution network needs rehabilitation. New concrete village streets and concrete drainage have pushed the IVDN beneath the concrete layer. 3. Water supply from MVS has not reduced use of borewell sources; 4. Multiple water assets- SVS-WPP-MWS-OHTs-Cisterns-PSPs-IVDN 5. Informal Farm settlements (Thotta Vasathi) increasing and posing new challenges for rural water supply. 6. Technical and Managerial capacity needs improvement 7. Mixing treated (MVS) and raw water (Bore well) at Village OHTs and is a quality threat. 8. Improvement required w.r.t. Regularity, Adequacy, Frequency and Quality of water at GP/ Village level. 9. Resistance to Metering from community 10. Lack of O&M Plan 11. Unauthorized HTCs/Tullu pumps/ Double connections exist.
Finance Capital	1. RDWSD dependent on government grant/ budgetary allocation for the sector- doesn't generate any income. 2. Neither ULBs nor GPs pay for the bulk water supply made from MVS.	1. Financial position of GPs is precarious and will find it difficult to pay for MVS bulk water at the rate of Rs.5/kL. 2. There is no annual O&M plan at the level of GP

Name of Capital	MVS	SVS/GP level
	3. Annual O&M cost on behalf of MVS limited to 74 GPs is 4.22 cores and the O&M expenses for 74 GPs works out to 27.62 crores, which together makes it 31.85 crores, with an annual average O&M cost households works out to Rs.2874, while the annual average revenue from household level by way of tariff collection is only Rs.145.46 and needless to mention that the way things are, there are miles to travel down to the path of sustainability.	3. Low O&M tariff at consumer end 4. Over-consumption of water at consumer level is assumed. 95 LPCD on an average. But from available consumer water meters, the lpcd is seen going up to 250 lpcd. 5. GP in low level equilibrium trap- Poor recovery of tariff from consumers notified. 18% of GP level opex is towards salary of watermen, 67% is towards power charges and 15% is towards repair and maintenance. GPs collect 5% of the total operational expenditure incurred by them by way of consumer tariff. 6. Salary of watermen, power charges for operation of borewells, repair and maintenance are major expenditure heads at GP level. 7. O&M at GP level is heavily dependent on Government Grants. 8. GP is finance stressed to meet all water sector requirements.
Human and social capital		1. Team of Watermen are available at GP level and acts as the water bureaucracy at GP level 2. Community not mobilized and not involved in operations, maintenance and management of GP level water supply/ distribution management. 3. More and more watermen are added to the army of watermen.
Institutional & Governance capital		1. MIS not available at GP level 2. GRM systems and arrangements are not known to consumer public
State level		
Finance Capital	RDWSD dependent on government grant/ budgetary allocation for the sector- doesn't generate any income.	
Human and social capital	1. Nascent RDWSD- with an average of 50% vacancies-Substantial vacancies exists in the field positions of RDWSD. Number of vacancies range from 50 to 75% of the sanctioned posts. Field level engineers, especially Section Officers are badly needed at the divisional and sub-divisional level. 2. Poor Sectoral & Institutional capacity-	

Name of Capital	MVS	SVS/GP level
Institutional & Governance capital	1. Policies and GOs are prepared and are not implemented 2. Rural water supply does not focus on reforms, institutional arrangements, human capital improvement with community participation. 3. Focus of RDWSD is not on sectoral reforms 4. Inadequate clarity on institutional mechanism- No unit of command. 5. Still very weak on O&M 6. No synchronization of water resources, institutions, schemes, operations, finances 7. Technology upgradation in O&M not attempted 8. No reform focus 9. No O&M payment from GP to RDWSD 10. WPPs introduced as an interim measure to provide purified good quality potable water in certain districts like Gadag- got scaled up to reach an enormous 18500 units today and add to the concentration of contaminants in soil, the ultimate natural storage of water. Short Term solution gets scaled up. However, people are spending money to purchase RO- WPP water, while they are hesitant to pay the regular water tariff to GP. 11. Strengthening of RDWSD- fresh recruits- training- good practices not happened.	

Key Recommendations

Table 3: Key Recommendations - MVS and State level

Name of Capital	MVS/ State level
Natural capital- Water Resource/ Water Source	1. **Water Quantity**: MVS drawing water from High Level Canals (HLC) need to be augmented. Since Raichur and Vijayapura districts are proposed to be included in largescale MVS that covers the entire district, problems related to water quantity will get addressed. Judicious use of water at consumer end and reducing the evaporation loss from the Impounding reservoirs are two measures that may be adopted. 2. **Water Quality**: (1) Prepare a schedule for water quality testing; large and medium schemes to test water quality every day; smaller MVS to undertake weekly water quality testing every day, using FTK, if the WTP does not have a water quality testing lab. (2) RDWSD to carry out independent water quality testing other than that of the Operator 3. GoK to provide a direction to all GPs of the State to recharge all defunct borewells and monitor the impact of recharging, with the support of apps like the 'Bhujal App' and develop Borewells as a standby source across the State.
Physical capital- Water Supply Infrastructure	1. **Operations**: Introduce Key performance Indicators (KPI) in MVS Contract Management to achieve technical sustainability where operators are paid for achieving indicators under KPIs. See Annexure 8.1 for details. 2. Introduce solar energy generation units over IR open space as it will generate energy and reduce evaporation loss. 3. Provide automation devices to achieve automation of pumping and control water levels at OHT. 4. Award O&M contracts for 10 years under Design Build Operate Contracts (DBOT) initially 5. RDWSD may prepare an O&M plan for each MVS

Name of Capital	MVS/ State level
	6. Include the private contracting industry in rural water sector in training and capacity building so as to improve their skills, knowledge and capacity to manage operations and maintenance of MVS. 7. Prepare a Punch List before handing over O&M contract from the current contractor to the next contractor; O&M Contract should include cost towards repair, maintenance and augmentation and replacement as part of the annual/ five year O&M contract. 8. FIR to be registered against third party damages and Illegal tapping of water, making it applicable even to government departments and public and private sector stakeholders. 9. Prepare a detailed checklist and SOP for each of the MVS with regard to existing conditions and improvements required to be brought about in O&M, site-wise and asset-wise.
Finance Capital	1. Notify and implement draft O&M Policy of 2021 2. Revisit the Bulk Water Tariff proposed in the GO of December 2020. The Bulk water tariff may be fixed at Rs.2/kL to begin with and to achieve the habit of payment from the side of GPs and ULBs. 3. Introduce Incremental Block Tariff for bulk water supply to GPs and ULBs, increasing 10% of the bulk water tariff annually, with an objective of achieving 50% of cost recovery in 10 years.
Human and social capital	1. Introduce capacity building programmes for all Small and Medium level MVS Operators and prospective private sector operators. 2. Introduce capacity building programmes for RDWSD officials 3. RDWSD to develop a ToT Team / Team of Master Trainers; Introduce provision of online training courses- RDWSD to prepare training content and course materials. An indicative listing of topics and contents are proposed in Annexure 8.1. 4. RDWSD may provide accreditation to Operators (firms) and technical personnel, who can be accredited as Managers of schemes. Accreditation of Managers and operators shall be a condition to become eligible to bid for O&M contracts. Similarly, Operator Firms can also be considered for accreditation in operations and maintenance
Institutional & Governance capital	1. Notify and implement Karnataka State Water Policy-2019 2. Institutionalize District Coordination Committee 3. Prepare and introduce Management Information System (MIS), including provisions for GIS based MIS, online reporting, geo-tagging of assets and real time data generation on operations and maintenance and apply the same in the case of all MVS and SVS including entire GP level operations. 'No-data- no payment' provision may be introduced to ensure updated database and made applicable for RDWSD, Operators, GPs, VWSC and Watermen. 4. District O&M Cell to be introduced, which shall subsequently be scaled up to the status of a District Water Utility- Special Purpose Vehicle (SPV) for Operations and Maintenance. 5. ZP and TP need to monitor the rural water supply schemes. District level officers of RDWSD should report and work in coordination with CEO-ZP

Table 4: Key Recommendations - SVS and GP level

Name of Capital	SVS/GP level
Natural capital- Water Resource/ Water Source	1. **Water Quality Testing**: (1) Watermen shall undertake water quality testing using FTK, collecting samples from Village OHT and HTCs. 2. **Water Resource Management**: (1) Recharge Borewells that are dry or defunct and monitor water level by introducing the 'Bhujal App'[2] to monitor impact of groundwater levels; (2) Do a listing of water sources in the GP area including traditional water sources and prepare a plan to recharge these sources, making provisions under MGNREGS. (3) Aquifer mapping[3] may be done and ring-fencing of certain aquifers for meeting drinking water needs may be set apart exclusively; (4) Community institutions and practices that have sustained traditional sources also shall be documented and published.
Physical capital- Water Supply Infrastructure	1. **Service level**: (1) 55 LPCD service level may be considered fixed for domestic needs; (2) additional water may be allocated to meet livelihood needs of a household, depending livestock keeping, pottery or other calling should be accounted and factored in deciding the LPCD level. (3) make arrangements for supplying water for the livestock at village or habitation level. 2. **Operations**: (1) prepare plan for synchronization of water supply from small MVS/large MVS as well as between SVS (borewell supply) and MVS supply. Scheduling of water supply from MVS and SVS shall support to avoid mixing treated (MVS) and raw water (Bore well) at Village OHTs. Where separate distribution network is available, supply SVS water at Cisterns; 3. **Maintenance**: (1) prepare a maintenance schedule for the water assets – village-wise and GP-wise. 4. **Water Assets, Ownership and Transfer of Assets**: (1) additional or new WPPs may not be installed in the GPs; (2) Metering of village OHTs for the inflow of water from MVS and Borewell sources shall be made mandatory; (3) Handover Single GP- small MVS to GPs for O&M (MVS Boggur) 5. **House Tap Connections (HTC):** (1) disconnect HTCs without Taps; (2) include stringent penal provisions for the use of Tullu pumps; (3) illegal and unauthorized connections, bypassing water meters, etc., may be leagalized by charging a penal fees; (4) introduce penal provisions/guidelines henceforth to deal with unauthorized HTCs, use of tullu pumps and double connections. After payment of penal charges, unauthorized connections may be legalized. 6. **Power connections at GP level**: (1) disconnect power connection of borewells that are defunct which are still being billed by ESCOMs to the GPs

[2] To address ground water challenges, Waterlab, a recently formed start-up headquartered at Pune, has developed a Borewell Monitoring App (Bhujal), the first of its kind globally, for tracking water levels in borewells. Bhujal App is a user friendly android based multilingual App, applying sound-wave technology for monitoring water levels in borewells/boreholes. It is a demand side solution to manage borewells for individuals, group of farmers, communities, institutions, commercial and industrial establishments. The Bhujal App has substantial potential for application in the context of rural Karnataka to monitor water level in borewells and make decisions on using borewells for either pumping of water or monitoring the impact of recharging borewells. Gram Panchayats of the water stressed districts in the State may adopt and use the App to monitor water level in borewells and make a knowledge based decision on abstraction of water. It is simple to use and does not require any supporting tool or/equipment or dismantle the borewell assembly to measure the water level.

[3] "Aquifer mapping is a process wherein combination of geologic, geophysical, hydrologic and chemical field and laboratory analyses are applied to characterize the quantity, quality and sustainability of ground water in aquifers. There has been a paradigm shift from "groundwater development" to "groundwater management"- http://cgwb.gov.in/AQM/documents/Concept-NoteonAquifermapping2015.07.2012.pdf.

Name of Capital	SVS/GP level
Finance Capital	1. Reduce the bulk water tariff to Rs.2/kL to start with. GoK and GPs may make a plan to achieve 50% cost recovery in five to ten years. 2. Develop Annual O&M Plan at GP level 3. Revise O&M tariff at consumer end with provision to increase tariff at the rate of 5 to 10% per annum and achieve partial cost recovery. 4. Introduce Incremental Block Tariff for bulk water supply to consumers to dissuade households from excess consumption. 5. Make attempts to reduce expenditure on account of salary of watermen, power charges for operation of borewells, repair and maintenance. 6. Commence water meter reading every month after the installation of water meters. Ensuring HTCs are leakage free before handing it over to the household. 7. Financial analysis to be undertaken to understand the pattern of revenue and expenditure and take steps to achieve financial sustainability at GP level by reducing O&M expenditure and enhancing water tariff collection
Human and social capital	1. **Recruitment of watermen**: (1) Freeze any further appointment of watermen; (2) bring clarity on recruitment of watermen and make it strictly applicable at the GP level; (3) replace salary with honorarium for watermen; (4) develop a policy on educational qualifications, training, gender equal opportunities, refresher training, output and outcome based remuneration, etc., for watermen; (5) Salary and service conditions of all watermen to be appointed henceforth be redefined. (6) GP may ascertain the work load of all existing watermen and decide if additional watermen are required; (7) watermen to undertake minor repairs and maintenance on SVS and IVDN. 2. **Training**: Train GPs to do an assessment of water resources in the GP; (2) develop a methodology for assessment of water resources; (3) Training in fixing Meters shall be provided to watermen; (4) Training women of households to read meter data and appreciate the volume of water being used on a daily, monthly basis; (5) Develop local level barefoot experts in water supply management and involve SHGs in O&M; (6) provide refresher training to all Watermen in the GP; (7) test which includes an examination of skill sets, knowledge, attitude and aptitude to work may be undertaken at the end of the refresher training; (8) those who fail in the test may be discontinued from service; (9) all fresh recruits as watermen shall have a minimum qualification of SSLC and shall go through an intensive training for a period of two weeks. Only those who successfully complete the training and clear the test alone shall be confirmed; (10) Include political/ local level leadership in training with reference to planning, designing, implementing, operating and maintaining of rural water supply schemes. 3. **IEC**: (1) undertake IEC/BCC campaigns on Metering, meter reading, water user education and payment of bills; (2) practical and demonstrative IEC on water quality, using FTK. (3) IEC activities to be undertaken to overcome resistance to Metering from community and to develop habitual payment of water tariff.
Institutional & Governance capital	1. **Database development and Monitoring**: (1) prepare and install MIS on rural water sector; (2) Water Quality monitoring and surveillance results from the

Name of Capital	SVS/GP level
	GP shall be put on the database of MIS and public domain and monitored to ensure drinking water security at the household level; (3) prepare baseline on all water sources in the GP, including borewells –functional and non-functional; 2. **Rural Water Institutions** (1) Reconstitute VWSC; (2) VWSC may consist of GP Members with local water experts; (3) empower VWSC with substantial powers and functions relating to local water supply management-define functions of VWSC and bring role clarity; (4) watermen shall report to VWSC; (5) Empower VWSC by (a) organizing VWSC meeting every week/fortnight/month, (b) giving ownership, power and responsibility over SVS and IVDN, (c) providing power for operations and maintenance of water assets, (d) preparing O&M Plan with the participation of GP council, VWSC and Watermen- Village-wise and GP-wise O&M plan, (e) delegating responsibility to SHGs for billing and collection at Village level under the VWSC. 3. **Field water school- Jaladhare Pathashala:** RDWSD/ RDPR may take initiative to establish field water schools- one each in every district of the State. (1) select model GPs who are managing SVS/MVS very well to pilot field water schools- Shiraguppi GP in Belgaum district may be selected as a pilot case for a field water school. Similarly, the good cases documented in this evaluation study also can be partnered to establish field water schools in the adjacent districts in Karnataka. Similarly Dakshina Kannada district has several GPs which are managing their water supply schemes with community professionalism. They may also be roped into support the adjacent districts. 4. **Broaden the scope of GRM**: (1) publish the availability and application of PARIHARA, as a Grievance Redressal Mechanism 5. RDWSD and RDPR to develop a concept on Community Water Utility. 6. Ensuring participatory process in preparing VAP under JJM. VAP consultants take short-cut and collect data from watermen and prepare VAP without consulting GP President, elected representatives and PDO.

1.6 Conclusion

As elsewhere in the country, water is institutionally fragmented in Karnataka resulting in 'hydro-schizophrenia'. There is a need for drastic improvement in terms of institutional and resource convergence, enhanced roles for community, PRIs and local level institutions, reforms, policy instruments, change of mindset and approach at state level, digitization, information systems and grievance redressal mechanisms. Opportunities provided by programmes like JJM have to be utilized to the maximum, moving from project to service delivery, giving up adhocism in approaching water supply management.

2 Introduction to Water Resources and the State of Karnataka

2.1 Introduction

Karnataka State was formed on 1st November 1956. Karnataka is situated on the western edge of the Deccan region of India, with its geographical contours as 11.5° North and 18.5° North latitudes and 74° East and 78.5° East longitudes. Physio-graphically, Karnataka consists of three well defined regions: (1) Deccan Plateau (Bayaluseeme), (2) Highlands (Malenadu) and (3) Coastal Plains (Karavali). The Bayaluseeme zone is the largest region of Karnataka consisting of 76.40% of the state's geographical limits, while the Highlands (Malenadu) comprise 13.85% and the Coastal plains is approximately 9.75% of the State. The State has a total area of 191,791 sq. km, and has a population of 6.11 crores with a density of 319/ sq. km (2011). The rural-urban population distribution of Karnataka is approximately 61%:39% (2011 Census). Karnataka is divided into thirty-one districts and 230 Taluks. Karnataka State comprises of 6,021 Gram Panchayats, 230 Taluk Panchayats and 31 Zilla Panchayats[4].

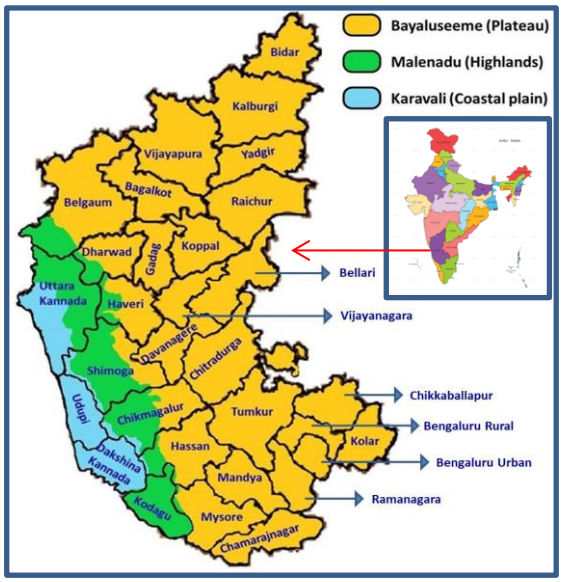


Figure 1: Physical divisions of Karnataka

2.2 Water Resources of Karnataka

Water scarcity in Karnataka is mainly concentrated in the Bayaluseeme region. 24 of the 31 districts fall into the Bayaluseeme region, besides certain portions of the districts like Hassan, Haveri, Dharwad, Uttara Kannada and Belagavi. The total basin area covered under the east flowing rivers such as Godavari, Krishna and Cauvery comprise 76% of the total geographical area of Karnataka and contribute approximately 42% of the water yield of Karnataka. The following table provides a comparative data on the total area, population and total water yield of Karnataka.

Table 5: Water yield in different geographic zones of Karnataka

Geographic Zone	Area (%)	Population (%) (2011)	Total Water Yield in %
Bayaluseeme	76.40	83.75	42.49
Malenadu	13.85	8.55	57.51
Coastal Plains	9.75	7.70	
Total	**100**	**100**	**100**

[4] https://aboutkarnataka.com/districts-in-karnataka/. When Karnataka was formed, it had 19 districts. Subsequently 12 districts were added by bifurcation of existing districts. (1986-1); (1997-7); (2007-2); (2009 -1); (2020-1)

2.3 Surface Water

Predominantly, there are seven east flowing river systems in Karnataka, namely Godavari (1.44%[5]), Krishna (27.90%), Cauvery (12.23%), North Pennar, South Pennar, Palar (1%), and thirteen (13) west flowing rivers (58%). 16 districts of Bayaluseeme region drain into River Krishna, while 8 districts drain into River Cauvery. The chart given below makes a comparison of the drainage area of rivers and the percentage of water yield in the State of Karnataka.

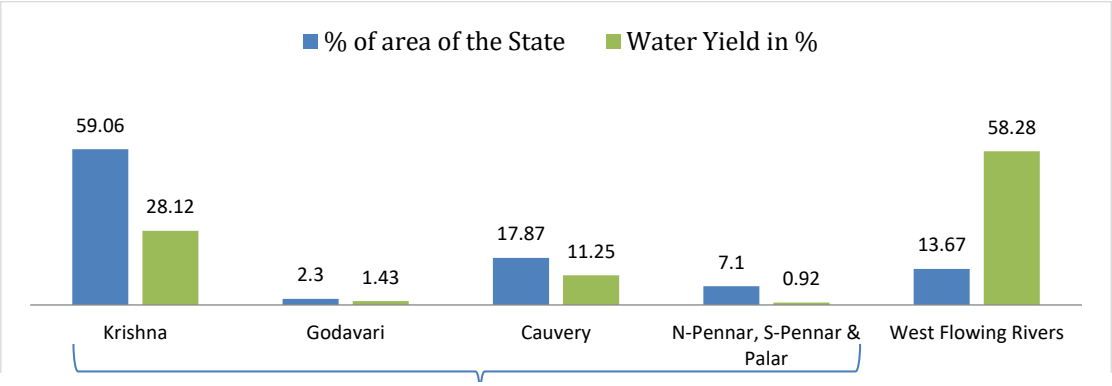


Figure 2: Comparison of surface water yield

2.4 Karnataka and water yield in percentage.

The average annual per capita availability of freshwater in Karnataka is calculated at 1500 cubic meters, considering all purposes (2030 Water Resources Group, 2014)[6]. There is significant temporal and spatial disparity in the availability of water in the State. The average figure of water availability is misleading as west flowing rivers of Karnataka account for 14% of drainage area of the State, contributing 58% of the water resources. In terms of spatial distribution of rainfall, Agumbe and Hulikal (Shimoga district) Amagaon (Belgaum) and Talakaveri (Coorg district) receive the highest rainfall in Karnataka; the quantum of rainfall some years have touched 10000 mm. On the other hand, Bagalkot, Chitradurga, Koppal and Vijayapura receive the lowest rainfall in Karnataka. There exists substantial gap in supply and demand of water between different geographical regions of the State. What is particularly of concern in Karnataka is the fact that most of the domestic, agricultural, industrial and urban demand for water is concentrated in the dry Deccan belt (Bayaluseeme), where water availability is much less compared to the demand as explained above, while water availability is abundant in the Western Ghats (Highland-Malenadu) and Coastal region of Karnataka. Applying the 'Falkenmark[7]' indicator, Karnataka would be classified into 'water stressed' category.

[5] Percentage of water yield in the river system
[6] Creating a Sustainable Water Future for Karnataka - Urban and Industrial Sector-Nov 2014 Page-5/para-4. 2030 Water Resources Group
[7] Malin Fredrika Sofia Sundberg-Falkenmark, born 21 November 1925 in Stockholm, is a Swedish hydrologist. Falkenmark is best known for her long-standing work and expertise on the sustainable use of water resources to meet human and ecosystem needs. Her work is characterized by an integration of both natural- and social-science approaches. She is particularly known for developing what is now known as the Falkenmark Water Stress Indicator, an indicator used to measure and describe the water available for human use.

2.5 Surface Storage of Water

The total live water storage of 22 reservoirs spread in 11 districts of Karnataka is 26,599[8] MCM. Total estimated population of Karnataka at the end of 2021 is 6.95[9] crores, of which approximately 50% (3.50) crores live in the rural areas. Karnataka has turned to draw water from these surface storage reservoirs, and implement Multi Village Schemes, catering to large number of GPs. 467 schemes that have been completed/commissioned, which have totally covered one crore population. Therefore, rural population that remains to be covered is 2.50 crores. Since GoK has decided to provide 55 LPCD, there is an annual requirement of 2.50 crores @55LPCD for 365 days= 502 MCM. This works out to 2.00% of the total live storage of the 22 reservoirs.

2.6 Ground Water

Karnataka's annual groundwater recharge has been assessed as 16.84 bcm, and annual extractable ground water resource is 14.79 bcm. It was observed that 70% of 14.79 bcm has already been annually extracted (utilized) from groundwater resource. According to a study carried out by Karnataka State Natural Disaster Monitoring Centre, 26 districts of Karnataka have recorded depletion in groundwater level. Karnataka has 176 groundwater blocks in which 97 (55%) have been categorized as '**Safe**', 26 (15%) as '**Semi critical**', 8 (4.5%) as '**Critical**' and 45 (25.5%) as '**Over-exploited**', with respect to the utilization of ground water resources[10]. The groundwater-based water supply schemes present two major issues: (a) groundwater sources fluctuate seasonally and do not provide assured supply of adequate quantity of water; (b) the second issue is with regard to water quality. Presence of excessive chemical contaminants like fluoride, iron, nitrate etc. is identified in the groundwater and makes the water not safe for human consumption. Simultaneous distribution of untreated groundwater and treated MVS water through the same distribution network (IVDN) in the rural areas of the State pose a serious challenge to the health of rural population.

2.7 Traditional Water harvesting system (TWHS) in Karnataka

Karnataka has been a pathfinder of traditional water harvesting structures named locally as 'Kere'. arakere, holakere, devikere, katte, kunte and kolla. Tanks (Keres) formed the majority of traditional water harvesting structures (Raju, Das, & Manasi S, 2003-2004) (as quoted from CSE 1997). In the wake of finding modern solutions to drinking water crisis, traditional water sources and methods have largely been replaced by these modern systems that include Borewells with Hand pumps or energized pumps, Mini Water Supply Scheme or Piped Water Supply Schemes of the category of SVS or MVS in Karnataka (ibid). Vatsala Iyengar observes in the article, 'Tanks of Karnataka- A historical perspective' that "while commoners built small water bodies for the benefit of the community, kings and rulers undertook large irrigation works as part of their religious and social obligations". (Iyengar, https://www.indiawaterportal.org/sites/default/files/iwp/tanks_of_karnataka_a_historical_perspective_vatsala_iyengar_2004.pdf, 2004). Substantial investments in terms of human effort, money, material, royal patronage and commoner support have gone into developing and

[8] Waterrosources.kar.nic.in

[9] https://www.indiacensus.net/states/karnataka

[10] Groundwater Yearbook India-2017-18, Central Ground Water Board

maintaining traditional water harvesting structures in Karnataka. These were developed over several centuries of effort in the drier regions of Karnataka, which received lesser precipitation even in those ages. The following section briefly captures information on some important traditional water harvesting structures in Karnataka.

2.7.1 Kere

The concept of traditional water resource management, especially as it applies to 'Kere' in Karnataka is very simple; the practice of traditional water resource management is centered around: (a) collect rainwater; (b) store the collected water in a locally appropriate structure such as the 'Kere'; (c) use the stored water subject to community governance and (d) recharge the groundwater (Kamble)[11]. Tanks are called 'Kere' in Karnataka. Besides harvesting water from rains, 'Kere's also were fed with water from streams in the valleys or water diverted from anicuts (check dams). Overflow from one 'Kere' was diverted to another 'Kere' built downstream, in a cascading approach[12].

2.7.2 Kalyanis

Kalyanis (U T & Murthy, 2013) is another Traditional Water Harvesting system (TWHS) in Karnataka. Kalyanis are traditional tanks, which are used to store rain water for domestic use such as drinking, bathing and washing. These are ponds paved with stones on the sides/banks and gradually slope towards the centre. The water is thus in contact with soil only for half its area. Kalyanis constructed near temples are called Pushkaranis. These TWHS helps to recharge wells in its vicinity. Kalyanis attracted royal patronage and funding as it was considered a socially beneficial water resource structure. The Pushkarni at Santhennur[13] in Davangere district is a classic example of a Pushkarni.

2.7.3 Kattas

Kattas' (Paloor, 2020) is a temporary check dam built across a stream and usually built at the end of the monsoon season. This structure is usually found in the districts of Dakshina Kannada, Uduppi and Uttara Kannada in Karnataka. Kattas are usually found in the coastal districts. Storage capacity of Kattas varies from a few lakhs to few crores of litres. Constructing these kattas requires skill and experience as these kattas need to be breach-free. A breach in the Kattas can be disastrous for several connected structures downstream[14].

Madakka

Madaka[15] is a traditional method of water conservation, typically constructed on the upper parts of undulating topography. Natural slopes with bottlenecks are identified. Earthen wall or even a cement-concrete bund is constructed to hold the rainwater from running off to the sea. The Madaka structure is usually identified on the upper reaches of the landscape. Madakka has twin benefits from the water harvesting angle; first it can act as a 'percolation pond', it collects the rainwater which percolates to the water table – thus augmenting the groundwater of the foothill region; secondly, Madakka stores water that can be used to irrigate second (post-monsoon)

[11] https://www.slideshare.net/rajkamble/rainwater-harvesting-7133082
[12] In depth interview with Shree Padre- renowned water journalist and activist.
[13] https://www.deccanherald.com/content/557286/a-masterpiece-stone.html
[14] https://www.deccanherald.com/spectrum/spectrum-top-stories/helping-rural-women-become-better-entrepreneurs-1101076.html.
[15] https://www.gktoday.in/topic/katta-and-madaka/

paddy crop. Madakas[16] are one of the fast disappearing traditional rainwater harvesting structures found in the laterite belts of Karnataka and Kerala. They are naturally occurring depressions with high terrain on the three sides where water from the surrounding laterite slopes, mainly runoff from the rains, is accumulated. These have been traditionally used to harvest rainwater by constructing bunds on the open fourth side of the depression to check this runoff from the slopes. Madakkas aid in groundwater recharge and contribute to higher water table downstream.

Though known in different names, traditional water harvesting, storage and use received royal patronage and active community participation. Historical evidences for water harvesting and management are available from the districts of Chitradurga, Shivamogga, Vijayanagara (Munirabad inscription near Hospet), Kolar (1,000-year-old inscription found in Bethamangala), Hassan (Bolakyatanahalli inscription in Arakalagudu 1371) and Ballari (cowherds of Kokkasamudra built a tank). (Iyengar, Tanks of Karnataka- A Historical Perspective, 2004). Households and small communities built smaller tanks, while larger tanks were built royal patronage. The royal families provided generous financial support towards building tanks and temples. Construction of tanks in the regions of Dharwad, Bellary, Chitradurga and Shimoga witnessed a golden era during the reign of the Kalyana Chalukyas (973-1336), especially Tailapa II, Vikramaditya IV. Hoysalas, popular as master builders, contributed in building water structures in the regions of Hassan, Chikamagalur, Tumkur and Mandya. Some of these tanks were so large and expansive that they were often compared to the seas and named as Hoysala Samudra, Vishnu Samudra etc (ibid). Apart from the Hoysalas, the Rashtrakuta, Ganga, Chalukya, and Vijayanagara empire also gave high priority to the construction of 'tank' water bodies. (ibid) There are also many village names today ending in the suffix, 'sandra' which is nothing but a derivation of the word, 'samudra'[17]. Brahmasandra and Mayasandra in the district of Tumkur are examples. Management of water harvesting structures consisted of three aspects; (1) the structures- which in this case is the tank structure; (2) annual practices relating to operation and maintenance of the structures and (3) the institutional arrangements for operation and maintenance of the structures. Key difference between these ancient water harvesting structures and the modern water supply schemes is that the practices and institutional arrangements have become dormant, while all the focus is on building structures, where low- energy, finance and technology and high on community participation is getting replaced by high energy, high capital, complex technology and low on community participation.

2.7.4 Persian wheel

Persian Wheel (Acharya & S Vishwanath, 2008) (Rahat-in Urdu), is a simple water lifting device, where a number of small pots are attached to a long chain. Two gear wheels make up the system and as the first one is revolved, the pots each dip and fill water from the well/source and soon after pours itself out to a metallic shaft which in turn empties into an intricate network of troughs that distributes water adequately through the cropped area. It is believed that the technology originated in Egypt and as world shrunk through extensive trading, it spread to

[16] https://www.indiawaterportal.org/articles/madakas-less-known-and-fast-disappearing-traditional-rainwater-harvesting-structures-kerala

[17] Personal conversation with Shree Padre, renowned water journalist from Padre Village, Enmakaje GP, Kasaragod district, Kerala

India and China. The district of Kolar stands out, as it has the highest number of wells and tanks in Karnataka. Historic records indicate that at one point of time around 60,000 water bodies existed in the district, out of which 25,000 Persian wheels had been attached to them.

2.8 Institutional arrangements under the water sector in Karnataka

Multiple institutions exist in the water sector under Government of Karnataka. These include the Water Resource Department and the River Basin Authorities in the State, KUWSDB, BWSSB and RDWSD. Water Resources Department is the over-arching department in-charge of water resources, including management, governance, research and conservation. Four special purpose vehicles (SPVs) have been constituted under the WRD to implement various schemes under the respective river basins; these SPVs include (1) Krishna Bhagya Jala Nigam (1956); (2) Karnataka Neeravari Nigam (1998); (3) Cauvery Neeravari Nigam (2003) and (4) Vishveshwariah Jala Nigam (2013) and are generally in-charge of planning and completing projects in the water sector. Karnataka Urban Water Supply and Drainage Board (KUWSDB) designs and implements water supply and sewerage schemes in all urban areas of Karnataka, except Bangalore. The operation and maintenance of water supply schemes including assets are to be undertaken by the respective ULBs. Bangalore Water Supply and Sewerage Board (BWSSB) is an autonomous body formed to design, implement, and maintain water supply and sewerage schemes in Bangalore area for domestic, commercial and industrial customers. RDWSD was raised in 2014 to cater to drinking water supply sanitation requirements in the rural areas of Karnataka.

2.9 History and background of RDWSD

Public Health Engineering Department (PHED) was looking after the drinking water sector of both urban and rural Karnataka since the formation of the State in 1956. The Mysore Urban Water Supply and Drainage Board Act was passed by the Karnataka Legislature in 1973 and the Act received the assent of the President on 14th August, 1974. Consequent to the Act, The Minor Irrigation and PHE Department was bifurcated into two institutions in 1974; (1) The Mysore (Karnataka) Urban Water Supply and Drainage Board; and (2) The Minor Irrigation and Public Health Engineering Department. The Bangalore Water Supply and Sewerage Board Act was enacted on 10-09-1964 for Water Supply & Sewage disposal.

Government of Karnataka enacted an independent legislation on Panchayat Raj Institutions in 1983. Consequent to the pioneering initiative of Government of Karnataka on Panchayat Raj institutions, Panchayat Raj Engineering Department was created under Rural Development and Panchayat Raj Department in 1987. The Panchayat Raj Engineering Department thus replaced the PHED and began to look after planning and implementation of rural water supply schemes. Government of Karnataka successfully negotiated and concluded a rural water supply and sanitation project with the World Bank in 1992-93. A Special Purpose Vehicle (SPV) by name, 'Karnataka Rural Water Supply and Sanitation Agency (KRWSSA)', was raised in 1992 to implement the World Bank aided project. The first World Bank aided project was implemented during 1993-2000. A follow-up project to the first World Bank aided project was negotiated and launched in 2002. This project, more popular by its local name, 'Jal Nirmal Project' was concluded in 2014. With the closure of Jal Nirmal Project, Government of Karnataka

considered five different institutional options for the rural water sector. These included: (1) Strengthening of existing institutions and Expansion of scope including strengthening of PRED and KRWSSA; (2) Creation of a dedicated WSS division in PRED with expansion of KRWSSA; (3) Formation of a new Rural Water and Sanitation Board (RWSB); (4) Expansion of existing KUWSDB into KU&RWSB (Karnataka Urban & Rural Water and Sanitation Board) and expansion of KRWSSA; (5) Expansion of existing KRWSAA to undertake all RWSS activities. However, GoK raised an exclusive department, by name 'Rural Water Supply and Sanitation Department- (RDWSD) on 4th March 2014 under Rural Development & Panchayat Raj Department Karnataka, to look after rural water supply and sanitation. RDWSD under Rural Development and Panchayat Raj Department is mandated to manage both groundwater and surface water-based schemes in rural Karnataka. (Deloitte, 2013).

When the original World Bank assisted Jal Nirmal project started, it was thought that devolution of WSS functions to the Gram Panchayats and building their capacity to manage the O&M activities would be adequate for them to sustainably maintain the assets created and provide high quality services to the users. It was, however, realized that such an assumption is valid andworks well in respect of ground water based single village schemes but not really so in case of larger and complex schemes dependent on surface sources from far away locations. It was also observed that such schemes are not only technically complex but also have difficulties in ensuring singular collective actions from widely spread villages with diverse background. (ibid Page -22/250). By now, capacity of GPs to manage even SVS has declined as is evident from field level enquiries. Issues in this regard include: (1) parallelism between MVS and SVS and lack of synchronization and coordination between MVS and SVS water supply; (2) watermen focused O&M arrangements with poor skills, knowledge, attitude, education together with excess number of watermen forming into a syndicate and controlling GP level water supply function; (3) low level community ownership; (4) poor Cost recovery from Households to GP; (5) dormant VWSC- VWSC as an institution does not seem to be working, needs more clarity on roles and responsibilities and an apparent power struggle between VWSC and GP, with GP having an upper hand; (6) very high expenditure to maintain GP level water supply arrangements due to salary of watermen, repair and maintenance expenses and erratic power bills and (7) lack of MIS, GRM and monitoring on the functioning of local level water supply arrangements.

GoK adopted the concept of Multi-Village Drinking Water SupplySchemes (MVS) to provide drinking water to the rural area by following the guidelines of National Rural Drinking Water Supply Programme (NRDWP). Rural water supply schemes have traditionally been, groundwater-based, the source of water being bore wells or open wells. However, there have been several instances where either the quantity of water available from the sources was not adequate or the water was not meeting thestandards of potable water because of the presence of fluorides, nitrates, arsenic or salinity. Insuch cases, water supply schemes have been conceived with surface water sources. They are designed to cater to several villages from a single source to make the schemes viable operationally and economically.

Earlier thrust was for single village schemes, the present thrust is on multi-village schemes. Historically viewed, Karnataka has a rich tradition and practice of local level water resource management. Communities survived in the arid and drought-prone areas of Karnataka, by adopting, innovating and sustaining structures, practices and institutions. When the governance of water resources moved from community to government departments, practices, institutions and innovations experienced a slow decline and consequent loss of knowledge, which were replaced by standard and uniform designs, schemes and assets. Schemes and assets can be built with funds, which are donated by a public or private source. However, building water assets doesn't lead to sustainable asset management and service level maintenance. That probably needs a redefining of the ownership of assets and their management at scheme and community level.

2.10 Background and Context of the study

Draft State Water Policy- 2019 for the State of Karnataka lists major concerns in water management ranging from regional imbalances in 'rainfall, surface and ground water resources, demography, livelihood system and economic activity' (KJA (Karnataka Knowledge Commission), 2019). The report further mentions issues specific to the water sector such as declining summer flows in rivers, especially flowing through the Bayaluseeme, declining water levels in surface tanks (Keres), dropping groundwater levels and increase in the number of over-exploited groundwater blocks, pollution of surface water bodies and consequent decline in water quality, continuous drought years and climate change. In the above context, provision of drinking water to the population of the State is a joint-responsibility shared by the State Government and the PRIs (Panchayat Raj Institutions). Community-led local water resource management suffered a setback, when governmental interventions increased in local water supply. Local water supply shifted from community managed and locale-specific surface water sources to groundwater based borewells with hand pumps and further moved to borewells with energised pumping. These systems were largely known as Mini-Water Supply schemes (MWS) and Single Village Schemes (SVS), when integrated at the village level. Very soon, groundwater resource suffered a setback in terms of quantity and quality. Governmental investment in water supply arrangements shifted from groundwater-based schemes to surface water-based water supply schemes that were designed to cover multiple villages and came to be known as Multi Village Schemes (MVS), increasing the distance from source to consumer point.

'A total of 467 Multi Village Schemes were completed by 2021 against a total cost of Rs.5,831crores, covering 6,152 habitations and a population of 1.14 crores[18] in the State of Karnataka'. Rural drinking water sector is experiencing several challenges in ensuring availability of drinking water on a sustainable basis because of ever increasing population, demand for higher service, high maintenance cost and the 'low-level equilibrium trap' (Singh B. , et al., 1993)[19]. MVS supplements groundwater based smaller schemes in in rural areas for drinking water supply. There is a need for studying the functioning of the multi-village water

[18] RDWSD

[19] Rural water supply in Kerala, India: How to emerge from a low-level equilibrium trap-Bhanwar Singh, Radhika Ramasubban, Ramesh Bhatia, John Briscoe, Charles C. Griffin, Chongchun Kim First published: July 1993.

supply schemes, delivery of service level, coverage of villages under all circumstances throughout the year and ability to meet the state, national and international commitments in view of meeting the targets under SDG-3 and SDG-6. Karnataka Evaluation Authority[20] engaged NABCONS (NABARD Consultancy Services) in December 2021 for undertaking an evaluation of Multi Village Water Supply Schemes in the rural water sector of Karnataka.

2.11 Multi Village Schemes

Government of Karnataka adopted the concept of Multi-village Schemes to provide drinking water to the rural population from perennial sources with potable quality. Rural Drinking Water and Sanitation Department (RDWSD) under Rural Development and Panchayat Raj Department was created at the State level to manage both groundwater and surface water based rural water supply schemes in the State. Bore well based water supply schemes face twin challenges of quantity and quality; in the event of continuous droughts in the State, water table in the borewells dwindle and is not able to supply sufficient quantity of water to serve the design population. Yet another issue is geo-genic contamination of groundwater which has a direct and adverse impact on the health of the people. Anthropogenic interventions also cause contamination of groundwater. Hence, Government of Karnataka adopted a paradigm shift, by focusing investments in rural water schemes to MVS, sourcing water from surface sources. MVSs are designed to cater to several villages from a single source to make the schemes viable technically, operationally and economically.

Objectives of MVS include: (1) To ensure drinking water security in rural area by augmenting existing water resources; (2) To serve desired quantity of water to large and dense settlements in rural and dry areas; (3) To provide adequate quantity of water for all needs at household level in all habitations at all times under all situations at affordable rates without commercialization; (4) To maintain quality of water as per prescribed standards; (5) To ensure all schools and Anganwadis and habitations dominated by SC, ST, BackwardClasses, Minority, etc., have access to safe drinking water; (6) To gain increased revenue by adopting modern IT techniques, like online monitoring ofleakages and wastage, pressure management systems, quality monitoring, automated water -reading, etc., and (7) To enable communities to monitor and maintain surveillance on drinking water source and supply system[21].

2.12 Components of Multi Village Schemes

Components of MVS generally include: (a) water source; (b) water treatment plant (WTP); (c) storage systems and (d) distribution network.

a. **Water Source**: As mentioned above, water for MVS in Karnataka is sourced from surface sources, which generally include rivers, reservoirs of dams and canal based impounding reservoirs. Intake point and Jackwell are the key sub-components of water source. Water is drawn from the source to the WTP, using pumping systems housed in a pump house. There are also instances where a floating barge is used to house the pumping apparatus.

[20] Government of Karnataka formulated an Evaluation Policy during the year 2000 vide No.IFS 42 EVF (1) 1999 Bangalore dated 17th November 2000 and placed the KEA under Planning, Programme Monitoring and Statistics Department.
[21] RDWSD

b. **Water Treatment Plant:** In very simple terms, water treatment consists of aeration, sedimentation, filtration and disinfection. The following flow diagram captures the key processes involved in treating water at a MVS in Karnataka State.

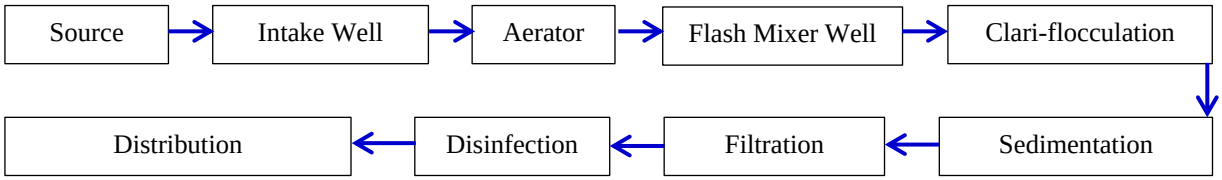


Figure 3: MVS components

c. **Distribution System**: The purpose of distribution system is to convey treated water to the consumer at adequate residual pressure, in sufficient quantity and potable quality. The requirements for the distribution system may be classified as functional and hydraulic. The geometric configuration of pipes, reservoirs and boosters, selection and location of valves, specials, etc., for efficient operation and maintenance and overall economy in cost, constitute functional aspects. Adequate residual pressure at the maximum demand depends upon the hydraulic characteristics and design of the system. Considering substantial demand for house service connections, the pipe network in the form of loop system has to be planned. For the benefit of households which do not opt for house connections, stand posts have to be provided at appropriate locations in the village. Another important element of the distribution system is the storage reservoir at the WTP, zonal network locations and villages. Depending on the height of the location, either a GLSR or an OHT is usually constructed and commissioned. Installation of instruments for leakage detection, and water meter to measure volume of water supplied at consumer end also form part of the distribution system.

2.13 Scope of the Evaluation

Since significant investment in terms of financial resources has already gone into planning, designing, implementation, operation, and maintenance of MVS, it is necessary to assess the delivery performance in terms of frequency, regularity, adequacy and quality as per prescribed standards at household level across habitations covered by MVS. The scope of the evaluation is to assess the functioning of 60 sample MVSs implemented during 2015-2020 covering 406 habitations. The study is conducted with MVS samples picked up largely from the Bayaluseeme region of Karnataka.

2.14 Objectives of MVS Evaluation

1. To assess functionality of Multi Village Schemes implemented in Karnataka during the period from 2015 to 2020.
2. To estimate the delivery performance in terms of frequency, regularity, adequacy of supplyof water at household level in all habitations at all times and under all circumstances.
3. To examine adherence to quality standards as per the prescribed norms (WHO Standards).
4. To assess the coverage of villages such as not covered, partially covered and quality affected.
5. Demand and supply analysis of water supply scheme in all villages and habitations.
6. To assess impact on rural communities with focus on indicators and targets related to SDG 6 on ‘Clean Water and Sanitation’ and SDG -3 on ‘Good Health and Well Being’.

7. To analyze the impact of covid-19 on functioning of MVWSS
8. To study functioning of similar schemes in other states and suggest measures for improvement for Karnataka.

2.15 Description of the Evaluation Assignment

With the creation of a new department, 'RDWSD', by Government of Karnataka, to focus on the needs of rural drinking water and sanitation sector in 2014, an approximate amount of Rs. 6,000 crore has been invested in planning and implementing Multi Village Water Supply Schemes. Government of Karnataka through Karnataka Evaluation Authority (KEA) under department of Planning, Programme Monitoring and Statistics decided to undertake an evaluation of Multi Village Rural Drinking Water Supply Schemes in the State.

Data available from RDWSD indicate that 467 MVSs are currently operational in the State in the rural water supply sector. Of these, 235 schemes (MVS) have been constructed before 2015. Subsequent to raising RDWSD as a separate department, 232 MVS were completed during 2015-2021. The ToR for the current assignment suggests that a total of 60 MVSs out of 220 (study period ie 2015 to 2020) may be selected on a stratified random sampling basis for detailed investigation.

2.16 Achievement in data collection

The table given below captures the target, achievement and percentage of achievement against the specific use of each instrument under the MVS evaluation.

Table 6: Status of data collection

Primary Data Collection Tools – Quantitative	**Target**	**Achievement**	**% of Achievement**
1. Data on Multi Village Schemes- Baseline and Operations and Maintenance	60	60	100%
2. Data on GP level linkage with Multi Village Schemes	74	74	100%
3. Household level survey-experimental category	1,810	2,244	124%
4. Household level survey-Control category (10% of Household level experimental category)	181	218	120%
5. Grand Total Household survey	1,991	2,462	123.66%
Primary Data Collection Tools – Qualitative			
In-depth Interviews- FGD			
1. State level officers[22]	2	2	100%
2. Rural Water Sectoral Experts[23]	2	3	100%
3. District level officers	18	18	100%
Focus Group Discussions			

[22] (1) Dr. S. S. Meenakshi Sundaram, IAS Retd. and currently Vice Chairman, MYRADA and (2) Dr. Vishal R IAS, currently Commissioner, Department of Public Instruction, Govt of Karnataka and formerly, Commissioner RDWSD, Govt of Karnataka.

[23] (1) Shri R. R Mohan, Senior Social Development Specialist, World Bank (Rtd)- B-9, Grasmere Apartments, 57/58, Osborne Road, Bangalore-560042; (2) Dr. S. Satish, Senior Social Development Specialist, World Bank, currently working as Coordinator for Central Asian Republics (Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan and Kazakstan) at Almaty; (3) Mr. Shree Padre, renowned water journalist and activist, Post: Vaninagar, Via: Perla–671552, Kasaragod, Kerala; Ph: 0499-866148; E-mail: shreepadre@sancharnet.in

Primary Data Collection Tools – Quantitative	Target	Achievement	% of Achievement
1. Gram panchayat level officials	18	18	100%
2. Members of Village Water Supply & Sanitation Committee.	18	18	100%
3. Members of Standing Committee in G P.	18	18	100%
4. Beneficiaries	18	18	100%
Case Studies	18	18	100%
5. Internal Case Study from within Karnataka	2	2	100%
6. External Case Study from neighboring States	2	2	100%
7. Circles covered by the study	4	4	100%
8. Districts proposed to be covered under the study	12	17	100%
9. Divisions proposed to be covered under the study	12	18	100%

Going through the scheme visits, it was found that two MVS included in the study sample were in fact commissioned prior to 2015. The original table of MVS list provided by RDWSD indicated the renewed O&M contract year in the column titled, 'commissioning year'. These two schemes are: (1) MVS Hukkeri from Chikkodi division of Belgaum district and (2) MVS Basarakod and 22 villages in Muddebihal Taluk of Vijayapura district. Of these two MVS, the MVS Hukkeri was originally constructed by KUWSDB for Hukkeri Sankeshwar and 27 villages in Hukkeri Taluka. MVS Hukkeri- Sankeshwar has been delinked from the urban segment it was serving, and was handed over to RDWSD in 2017 for operation and maintenance, limiting scope of the scheme exclusively to rural areas. The year, '2017' has been recorded as commissioning/ completion year of MVS Hukkeri in the list provided to the study team. Similarly, MVS Basarakode was marked as commissioned in 2019, while it was actually commissioned in 2012. The error in selection has been inadvertent and the above two MVS may be permitted to be included into the scope of the study.

2.17 Limitations of data collection and Analysis

The study team would like to place on record that data collection was extremely difficult and challenging owing to lack of proper and updated record and data maintenance. There is no centrally maintained 'Management Information System' (MIS) in the RDWSD. Hence, data on MVS had to be organized by referring to scheme files, DPRs, completion reports with regard to the design, planning and implementation phases of respective MVS. The Team collected the baseline data on MVS from files, in consultation with the departmental engineers. However, it was a challenge to gather even baseline data on certain schemes, as engineers who were involved in the planning, design and implementation stage had been transferred or retired and the new incumbents were unfamiliar with the dynamics and how the MVS evolved to its present status. Both the MVSs, selected for study in Ballari[24] district are classic examples for incomplete data and information.

Another serious challenge was gathering data on the Operations and Maintenance aspects of MVS. O&M data needs to be provided by Operators. In most cases of sampled MVS, the legal

[24] MVS Boggur and MVS Nadavi

Operator was unavailable for meeting, providing data and clarifying issues. We place on record our genuine concern that sub-contracting of O&M may have occurred possibly without officially informing RDWSD. The issue with regard to sub-contracted O&M is that, answers to queries are standardized and are available with the legal contractor, who is not available on the day of visit or through other means of communication.

Record keeping, maintenance and updating are either incomplete or absent. There is no compulsion on the Operator for maintaining records. Representatives available at the MVS WTP, Jackwell Pump House and other asset locations are more of the 'labour' category, who are only familiar with the day to day operations as mechanical and routine tasks. Such persons are not aware of record keeping and are probably not trained or sensitized on the necessity of maintaining records. Log Books are usually not maintained and available at the Pump House. The Team is informed that Log Book has been taken away by the Contractor and there is no alternative provision for recording operations. Where Log Books are maintained and available, the entries of data are all standard and uniform: Day after day, starting time and closing time of the Pump is the same; down time due to various reasons is not recorded; power failure is not recorded; One cannot analyze down time, duration of pumping, generation of raw water supply to the WTP, etc., with such incomplete and inconsistent data.

At the WTP level, there is no Bulk Flow Meter to indicate volume of water supplied to the village OHTs. Even SCADA based information was either not available or the historical data safely stored at MVS Gundlupete. SCADA system was available at MVS Nargund and Mundargi (Multi Taluk Schemes in Gadag district, operated and maintained by Tahal and L&T groups respectively), Operators were extremely cautious and hesitant to part with the data. Senior Management of TAHAL group delayed the information flow to the Team by several days after the visit to the MVS. It was made available after several reminders and interventions by the Executive Engineer of the RDWSD division. All Village level OHTs, connected to the MVS are not provided with Bulk Water Meters to derive data on volume of water supplied to the Village/GP. The Operator has overcome this by getting PDOs of the respective GP to certify that water was supplied by the Operator, though no one has any clue to the volume of water supplied. Therefore, at the generation point (WTP) and at the distribution point (Village OHT), reliable data was conspicuous by its absence on volume of water supplied. Therefore, data on adequacy is estimated and provided in the report. There is an urgent requirement for putting together a MIS, whereby data is entered online and the provision of 'no-data-no-payment' implemented forthwith, making it applicable to RDWSD officials and Operators. Conclusions in the report are based on estimations by the study team and the team would like to transparently record the same in the Draft Final Report.

2.18 Organization of the Report

The Draft Final Report for the MVS Evaluation Study deals with the evaluation of MVS as per the ToR issued by KEA. This is divided into Nine (9) chapters. Chapter One provides an Executive Summary of the study. Chapter Two provides a brief introduction to the State of Karnataka, focusing on its water resources and background information to the study. Chapter Three presents briefly the methodology of the MVS Evaluation. Chapter Four briefly presents

the interventions in Rural Water Supply Sector in India- Karnataka and review of literature relating to the rural water supply schemes, their sustainability and study gaps with regard to the evaluation of Multi Village Schemes. Chapter Five is a presentation of the findings based on the primary data on completing the field work. This chapter mainly presents the assessment of delivery performance of MVS with reference to 'Frequency', 'Regularity', 'Adequacy' and 'Water Quality'. Delivery performance has been assessed at the level of the MVS, besides looking at the drinking water supply scenario at the GP and Household level. Again, the report presents a comparison of the frequency, regularity and adequacy aspects between the experimental group and control group of households surveyed under the study. Secondary data analysis is also provided in Chapter-five. Chapter Six summarises the findings and conclusions emerging from the study. Chapter Seven presents the Theory of Change (ToC) in the context of the evaluation of MVS. Chapter Eight presents the detailed recommendations as part of the study. Chapter Nine presents four case studies, two from Karnataka and two from outside Karnataka; one external case study is from Nenmeni Gram Panchayat of Wayanad district of Kerala and the other case study is from Banavadi Gram Panchayat of Sattara district in Maharashtra. Certain good practices that the study team has noticed during the field level processes are also included in Chapter Nine.

3 Methodology of the MVS Evaluation

3.1 Introduction

Evaluation of Multi Village Schemes in Karnataka State was conducted as a summative evaluation study[25]. 60 MVS samples selected for the study was all completed, commissioned and were under operation and maintenance. Generally, the MVS evaluation study went through three stages: (1) Planning of Evaluation; (2) Implementation of Evaluation and (3) Reporting. The planning process for the evaluation study commences with the preparation of the Terms of Reference (ToR) by Karnataka Evaluation Authority (KEA). The focus of the evaluation is on Multi Village Rural Water Supply Schemes (MVS), their delivery performance, with special reference to the adequacy, regularity and frequency of water together with quality (potability) of water supplied. The following illustration summarizes the key events in the MVS evaluation study process.

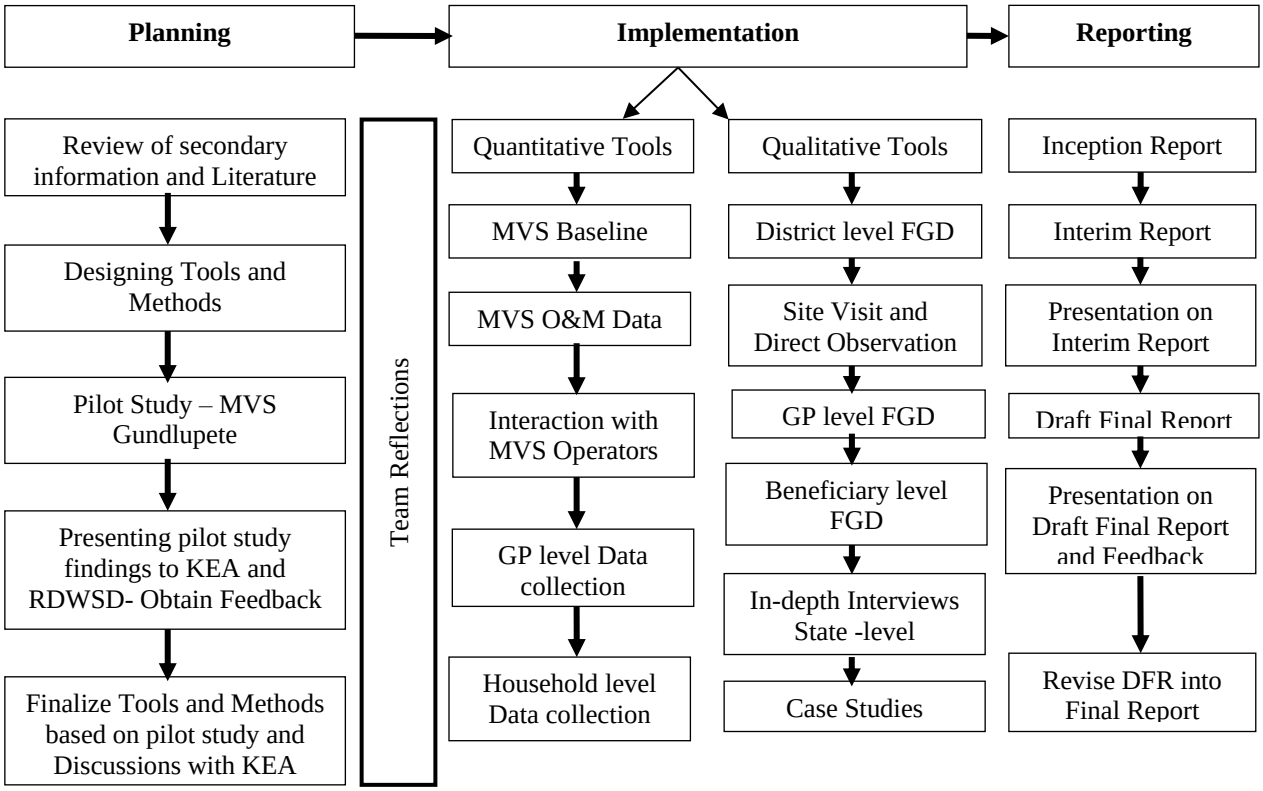


Figure 4: MVS evaluation study process - key events

3.2 Research problem in the MVS evaluation study

MVSs are implemented by Government of Karnataka with an objective to ensure drinking water security in rural area, in adequate quantity and desired quality as well as to ensure sustainability of investments, systems and services. The key evaluation question is to assess whether MVS has lived up to the above said objective. An assessment of the delivery performance of MVS is central to the evaluation study. Delivery performance is assessed on the basis of three significant variables: (1) adequacy of water supplied from MVS; (2)

[25] Summative evaluation study occurs at the end of a programme

frequency of water supplied and (3) regularity of water supplied. Adequacy is the volume of water as per designs, considering overall demand at community and individual level. Frequency refers to the duration of water supply at the consumer end and village community level. Regularity is about the predictability of water supply; whether the MVS is able to supply water at a regular, fixed time and whether the timing of supply is convenient for the consumer community.

There are three levels for the current evaluation study: (a) study of Multi Village Schemes focusing on the functionality and delivery performance; (b) study of sample Gram Panchayats which are receiving water supply from MVS and constitutionally mandated to ensure local level drinking water supply; and (c) study of consumer households from GPs receiving water supply from MVS.

3.3 Universe of the study

The state of Karnataka has gone through multiple paradigm shifts in its attempt to organize water supply for its rural population. The last of these shifts is the adoption of the model of Multi Village Water Supply Schemes (MVS). During the last three decades, a total of 467 MVSs have been planned, implemented and pressed into operation and maintenance.

Following table summarises the number of Multi Village Schemes implemented in the State since 1995.

Table 7: Number of MVSs in Karnataka

Year	Belagavi	Kalaburgi	Bangalore	Mysore	Total
1995	-	1	-	-	1
1996	-	1	-	-	1
1997	-	-	-	-	-
1998	-	-	-	-	-
1999	-	-	-	-	-
2000	-	2	-	-	2
2001	-	3	-	-	3
2002	1	1	-	-	2
2003	4	3	-	-	7
2004	3	1	-	-	4
2005	-	2	-	-	2
2006	1	7	-	-	8
2007	-	-	-	-	-
2008	2	1	-	-	3
2009	12	4	9	1	26
2010	10	10	2	-	22
2011	9	7	-	2	18
2012	14	9	3	2	28
2013	10	33	5	4	52
2014	19	25	8	4	56
Total before 2015	**85**	**110**	**27**	**13**	**235**

Year	Belagavi	Kalaburgi	Bangalore	Mysore	Total
2015	16	9	12	5	42
2016	11	12	3	11	37
2017	30	8	10	7	55
2018	12	9	5	10	36
2019	14	8	3	9	34
2020	4	2	6	4	16
Total 2015-2020	**87**	**48**	**39**	**46**	**220**
2021	6	-	-	6	12
Grand Total	**178**	**158**	**66**	**65**	**467**

RDWSD is yet to develop an automated and software based MIS (Management Information System). Lack of MIS posed substantial difficulties for the Evaluation Team as data was inconsistent between the State and Division levels. During the initial years after raising the RDWSD as an independent department, some schemes that were still under planning and implementation as part of the World Bank aided Jal Nirmal Project continued. Full-fledged planning and implementation of MVS is assumed to commence from 2016. Thus during the period 2016-2020, a total of 178 MVS were initiated by RDWSD. During 2015-2020, a total of 218[26] MVS were commissioned. A total of 50 MVS are under work-in-progress (WIP) category. Division-wise distribution of MVSs under WIP are captured below.

Table 8: Division-wise list of MVSs under work-in-progress

Circle	Division / District	MVS under WIP	Circle	Division / District	MVS under WIP
Bangalore	Davangere	1	Gulbarga	Yadgir	1
	Chitradurga	5		Koppal	4
	Ramnagara	2		Bidar	3
	Chikkaballapura	1		Ballari	4
	Tumkur	2		Vijayangara	2
Mysore	Uduppi	3	Belgaum	Belgaum	2
	Chamarajanagara	2		Vijayapura	3
	Chikkamagalluru	1		Uttara Kannada	2
	Hassan	2		Bagalkote	3
	Mandya	7			
	Total	**26**		**Total**	**24**

A detailed list of these schemes is enclosed as Annexure 8.6.

[26] Though it was initially considered that 220 MVS were commissioned during 2015-20, subsequent field visits and enquiries revealed that 2 MVS (MVS Hukkeri in Chikkodi division of Belgaum district and MVS Basarakode in Vijayapura district) were commissioned prior to 2015. Commissioning dates of these two MVSs were wrongly documented in the list provided to the Evaluation Team. Therefore, total MVS commissioned during 2015-20 is frozen at 218, instead of 220.

3.4 Comparison of samples proposed in the ToR and Actual Samples Implemented in MVS Study

The ToR for the MVS evaluation proposed to cover 60 MVS in 12 districts. However, on examining the distribution of samples across districts and categories, the study team proposed to KEA to broaden the number of districts. KEA agreed to the suggestion of the study team. Thus, the number of districts rose to 17 from 12, retaining the total number of MVS samples to 60. The sample of 60 MVS has been distributed more systematically through stratified random sampling, providing proportional representation to small, medium and large category of MVSs. This has made the study more systematic in terms of geographical and category-wise representation. Following table provides a comparison of MVS proposed in the ToR and as actually implemented in the field.

Table 9: Comparison of MVS samples proposed in the ToR & actual field level evaluation

No	District/Division	Total Schemes	Sample schemes proposed in the ToR	Actual distribution of samples in the MVS study	Sample HH proposed in the ToR	Actual distribution of samples in the MVS study
	Bengaluru	**58**	**11**	**11**	**410**	**354**
1	Shivamogga	5	1	1	30	38
2	Davanagere	26	5	5	165	164
3	Tumakuru	27	5	5	215	152
	Belagavi	**163**	**23**	**23**	**630**	**783**
4	Belagavi	68	12	7	260	219
5	Vijayapura	30	5	5	200	177
6	Bagalkot	36	6	4	170	153
7	Gadag	13	0	5	0	168
8	Haveri	16	0	2	0	66
	Mysuru	**49**	**8**	**10**	**360**	**687**
9	Mysuru	25	5	5	290	237
10	Hassan	8	1	1	65	152
11	Chikkamagaluru	2	1	1	5	36
12	Mandya	12	0	1	0	36
13	Chamarajanagara	2	0	2	0	226
	Pilot study MVS		1			
	Kalburgi	**130**	**18**	**16**	**410**	**638**
14	Ballari	62	12	2	180	72
15	Vijayanagara	21	0	7	0	281
16	Koppal	09	2	1	110	43
17	Raichur	38	4	6	120	242
	TOTAL	400	60	60	1,810	2,462

3.5 Samples drawn from the universe of MVSs for field level Survey

Given below was the sample used for detailed investigation during the study.

Table 10: Universe and Selection of Sample MVSs

	2015	2016	2017	2018	2019	2020	Total
Belagavi Circle	16	11	30	12	14	4	87
Belagvi Samples	*3 (18.75%)*	*3 (27.27%)*	*5 (16.67%)*	*5 (41.67%)*	*5 (35.71%)*	*2 (50.00%)*	*23 (26.44%)*
Gulbarga Circle	9	12	8	9	8	2	48
Gulbarga Samples	*4 (44.44%)*	*3 (25.00%)*	*2 (25.00%)*	*3 (33.33%)*	*4 (50.00%)*	*0 (0.00%)*	*16 (33.33%)*
Bengaluru Circle	12	3	10	5	3	6	39
Bengaluru Samples	*2 (16.67%)*	*1 (33.33%)*	*4 (25.00%)*	*1 (20.00%)*	*1 (33.33%)*	*2 (33.33%)*	*11 (28.21%)*
Mysuru Circle	5	11	7	10	9	4	46
Mysuru Samples	*1 (20.00%)*	*1 (9.09%)*	*2 (28.57%)*	*3 (30.00%)*	*1 (11.11%)*	*2 (50.00%)*	*10 (21.74%)*
Universe - All Circles	42	37	55	36	34	16	220
Total samples	***10***	***8***	***13***	***12***	***11***	***6***	***60***
% of Total Samples	23.81%	21.62%	23.63%	33.33%	32.35%	37.50%	27.27%

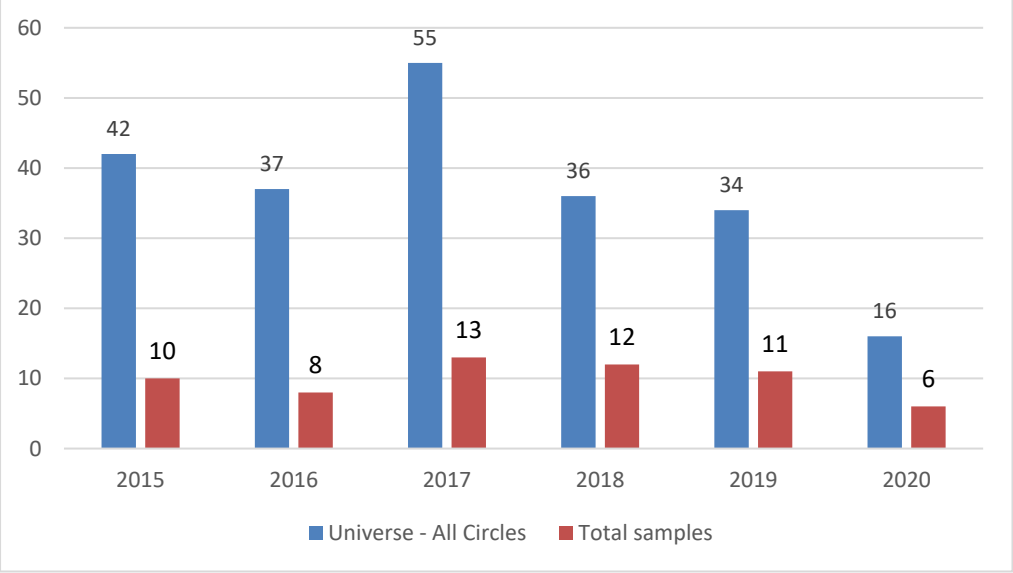


Figure 5 Universe of MVS and proposed sample for evaluation

3.6 Rationale for selection of sample

The categories based on the size of sampling are as under: (a) Small MVSs- cover 1 to 30 Habitations; (b) Medium MVSs – cover 31 to 100 Habitations; (c) Large MVSs- covering 101 to 250 Habitations and (d) Very Large MVSs – covering 250+ Habitations.

Table 11: Rationale for selection of samples – size and coverage of villages

Circle	Small	Medium	Large	V Large	Total
Belagavi	79	6	2	-	**87**
Gulbarga	47	1	-	-	**48**
Bangalore	38	1	-	-	**39**
Mysore	33	9	3	1	**46**
Total	197	17	5	1	220
% of Category	89.55%	7.72%	2.27%	0.45%	100.00%
Number of Sample MVS	44	10	5	1	60
% of Sample	73.33%	16.67%	8.33%	1.67%	100.00%

3.7 Instruments used during the study

Two types of survey instruments have been used in the MVS evaluation: (1) Quantitative instruments included survey questionnaires on MVS- Baseline and O&M; GP level and Household level data collection schedules have also been used. The household level data collection was done using a Mobile App and accessing the data base into MS Excel sheet. (2) Qualitative tools used in the MVS evaluation study included Focus Group Discussion and In-depth Interviews. A Check list was developed and used for these interviews. Besides FGDs, direct observation and site visits were the other qualitative tools applied in the MVS evaluation. Following table provides the key questions under quantitative and qualitative aspects of enquiry.

Table 12: Quantitative and Qualitative tools

Quantitative Tools	Qualitative Tools
MVS Baseline - contents • Location and Coverage • Administrative Approval, construction/O&M cost • Time and Cost over-runs • Contract details • Population and designs including LPCD • Components of MVS- Source, WTP, Storage, Energisation details • System capacity, • Treatment Technology	**District level FGD** • Water supply schemes at district level- MVS • Water supply assets including WPPs at district level • Operations and Maintenance aspects of MVS • Major water sources in the district and issues relating to them • Staffing- total positions approved and available strength; • Major issues faced in operating and maintaining MVS in the district
MVS O&M Data • O&M Contract details • Operations of Jackwell, WTP, IPS, Storage systems • Delivery Performance in terms of Adequacy, Frequency and Regularity • Water Quality Management • Down-time in operations • Finance- Billing &Collection for MVS water	**Site Visit and Direct Observation** • Checking and collecting data on operations • Cleanliness and upkeep of assets • Functionality of components • Assessing delivery performance in terms of adequacy, frequency and regularity

Quantitative Tools	Qualitative Tools
• Staffing • Energy consumption details	
GP level Data collection • Location details • Office bearers at GP level • Water requirement-for human, livestock and institutions • Details of VWSCs • Trainings provided • Water supply coverage- HTCs- Cisterns- PSPs • Delivery Performance in terms of Adequacy, Frequency and Regularity • Finance aspects- Revenue and Expenditure- Total annual expenditure at GP level for maintaining water supply service- manpower, repair and maintenance, and energy cost • Water quality • JJM in the GP • Involvement of RDWSD, ISA, NGOs in the water sector of the GP • Convergence of programmes in water sector	GP level FGD- Checklist • **Source**-Quantity and Quality aspects of water available from Borewells/ MVS • **Infrastructure and Operations**-Major issues with SVS?-; Frequency, Regularity and Adequacy of Water Supply of Water Supply • Household investment in developing water assets • **Governance and Institutions- Difference in** availability between now and 2000; Role of VWSC in Village level water supply management. Role of Watermen in managing local water supply schemes and IVDN, Relationship between VWSC and Watermen
Household level Data collection • Location Details • Details of Household Members • Occupation- • Social and Economic Category of HH • Water supply details- HTC • Delivery Performance in terms of Adequacy, Frequency and Regularity • Drinking water source used by the household Water borne diseases in the last one month • Water Tariff details Wealth Ranking of the Household, using proxy indicators	Beneficiary level FGD • **Source**-Quantity and Quality aspects of water available from Borewells/ MVS • **Infrastructure and Operations**-Major issues with SVS and MVS?-; Frequency, Regularity and Adequacy of Water Supply of Water Supply; satisfaction levels. **Governance and Institutions**-Role of VWSC in Village level water supply management. Role of Watermen in managing local water supply schemes and IVDN, Relationship with VWSC and Watermen
	In-depth Interviews State –level **Source** 1. Enhancement of water resources- State level 2. Resilience against climate change induced droughts, floods and water quality management 3. Water quality management 4. Traditional water sources, structures, practices and institutions **Infrastructure, Operations and Maintenance**

Quantitative Tools	Qualitative Tools
	1. Enhancing performance of SCADA and automation systems in O&M such as IoT, Web based service level monitoring, introduction of AMR meters 2. Operations and Maintenance Plan for each MVS and scheme specific O&M Manual 3. Consumer water metering and volumetric pricing of water 4. Preference for SVS or MVS 5. Is 55 LPCD a fair service level **Finance** 1. Tariffing 2. Life Cycle Cost approach (LCCA) for MVS 3. Viability Gap Funding to cover the gap between cost recovery and water revenue 4. Contractor accountability mechanism in O&M 5. Payment to Operator on the basis of KPI 6. Automation and software in Billing and Collection 7. Revenue collection from GP to RDWSD and from Consumers to GP 8. Cost of safe water production vs Revenue **Institutions and Governance, Staffing and Capacity Building** 1. Improving institutional capacity and human resources of RDWSD, GPs and VWSCs 2. Performance based incentives for PRIs/ VWSC 3. Regular Online trainings- to RDWSD and Operators; TNA 4. Professionalizing the rural water supply service 5. MIS and GRM 6. Community mobilization and IEC activities to build local level ownership
Case Studies • Two case studies from Karnataka- (1) Success and (2) Failure • Two case studies from outside Karnataka	

3.8 Evaluation Framework

An Evaluation Framework was developed for the study. The overall essence of the ToR for the evaluation study, its objectives and sectoral context in the State of Karnataka has been considered while preparing the Evaluation Matrix. The Table given below provides the criteria for evaluation proposed by the Study Team.

Table 13: Proposed criteria for evaluation

Evaluation Criteria	Key Evaluation Question
Organization objectives & Actual requirements	Has RDWSD succeeded in providing clean drinking water to the rural areas of Karnataka?
Inputs & Process of implementation	What instruments of procurement have been used in selecting bidders for planning, designing and implementing Rural Water Supply Schemes; Time over-runs and cost over-runs in implementation of 60 MVSs under study are also considered under these criteria?
Cost Benefit Analysis	What are the costs and benefits of an investment in Multi-Village Rural Water Supply Scheme in Karnataka? Cost and benefit analysis 60 MVS will be considered. The cost analysis will look at both capex and opex. On the side of benefits, number of population and households benefitted will be analyzed. The benefits will be both tangible and intangible. Time saved per day per household, health benefits indicated by reduction in incidence of water borne diseases and water related drudgery through the gender lens will be analyzed.
Fund utilization and capacity building	(1) Annual allocation of funds to RDWSD and its commensurate utilization; (2) Details of Training provided to RDWSD, Operators, PRIs, VWSCs, field level personnel like Watermen.
Output produced	How many MVSs have been implemented during 2015-2020 by RDWSD; Related sub-questions under these evaluation criteria will include Number of Grama Panchayats and Habitations covered by MVSs in a temporal-spatial comparison for the State of Karnataka. The Study shall also look at the total quantum of treated water produced in MLD/kL and the potential per capita availability of the same against actual availability
Outcomes- Short Term	How much water is available from the MVS? What is the distribution arrangements made to reach the treated water to consumer end? What are the institutional arrangements for local distribution and management?
Outcomes--LongTerm	Has the MVS succeeded in resolving water crisis in the selected villages and realized objectives of MVS? The following sub-questions will be considered: (1) What is the difference between pre and post project with regard to Frequency, Regularity, and Adequacy of water supply at consumer end? (2) What is the affordability of rural households to pay for

Evaluation Criteria	Key Evaluation Question
	water? (3) What is the tariff system followed in the MVS between RDWSD and GP and between GP and Consumer? (4) Has RDWSD/GP succeeded in providing prescribed quality of water as per BIS. (5) Has RDWSD introduced modern IT/ICT techniques, in the O&M of MVS? (6) Has RDWSD enabled GPs and communities to monitor and maintain surveillance on drinking water source and supply system?
It may be observed that the difference between Outcomes (Immediate) and Outcomes Short Term are very narrow. Similarly, Outcomes Medium Term and Long Term are also very thin for a water supply scheme. Hence, we propose to use Outcomes Short Term and Long Term for the evaluation of MVS.	
Sustainability of the project in the long run	What is the overall sustainability of MVS vis a vis its objectives Sustainability of MVS in terms of: a) Water Source; b) Water Infrastructure; c) Cost recovery and tariff systems; d) Institutional arrangements for operating, maintaining and managing local water supply system and e) Capacity of GP, VWSC and RDWSD in operating, maintaining and managing Multi Village Schemes
Sustainability of the Multi Village Water Supply Scheme will be assessed on the basis of a Sustainability Pentagon, consisting of five key elements. These include: (1) Sustainability of water source to supply water during summer months without down time; (2) Capacity of the System (Water Supply Infrastructure with availability of energy) to supply adequate quantity of water; (3) Percentage of cost recovery from GP to RDWSD and from Consumers to GP; (4) Role, Capacity as well as involvement of VWSC and GP to operate, maintain and manage In-Village Distribution Network (IVDN); (5) Training and Capacity building of RDWSD, Operator, GP, VWSC and Watermen in water supply management. Sustainability of MVS will be evaluated.	

The relevance of using the original Evaluation Matrix was considered while preparing the Interim Report. The question of redesigning the Evaluation Framework was considered and was found that the original Evaluation Framework designed, still holds good and does not need elaborate modification. Couple of questions was added to the Evaluation Matrix at Interim Report level. The Evaluation Framework used for the MVS evaluation is given below.

Table 14: Evaluation criteria: Key Evaluation Question

Evaluation criteria **Key Evaluation Question**	**Specific sub questions for each Key Question**	**Indicators /success standards / KPI**
Relevance		
(1) *Organization objectives & Actual requirements* 1.1 Has RDWSD succeeded in providing clean drinking water to the rural areas of Karnataka?	a) What is the coverage of population/ households with access to safe and potable water (2011) b) Rate of morbidity due to water borne diseases in the State. c) What are the interventions from the part of RDWSD to resolve water scarcity in rural Karnataka d) How many policy instruments and guidelines have been provided by the RDWSD in water and sanitation	1 What % of Habitation are covered by PWS in Karnataka in 2021-22 2 Number of Water-borne related morbidity cases in Karnataka 3 Number of Projects implemented by RDWSD 4 Amount of funds allocated to RDWSD for development of new RWSS (2014-2021). 5 Amount of funds allocated by GoK to operate and maintain RWSS in Karnataka (2014-2021). 6 Number of Policy Instruments developed and notified by RDWSD through the due process of governance. 7 Number of GOs issued by GoK/ RDWSD relating to Operation and maintenance
Effectiveness		
Inputs & Process of implementation What instruments of procurement have been used in selecting bidders for planning, designing and implementing RWSS?	1 What are the procurement Methods used by RDWSD in procuring consultants for preparing PSRs / DPRs? 2 What are the procurement methods for implementation of MVS? 3 Time over-runs if any in implementation of RWSS for 60 Schemes under study 4 Cost over-runs if any in implementation of RWSS for 60 Schemes under study	1 Type of procurement as per KTPP Act and Rules - Empanelment / Services 2 Type of procurement as per KTPP Act and Rules - Works tender - DBOT / EPC/ Turnkey 3 Duration of time over-runs in project commissioning for 60 Schemes under study 4 Amount of cost over-runs in project implementation for 60 Schemes under study

Evaluation criteria **Key Evaluation Question**	**Specific sub questions for each Key Question**	**Indicators /success standards / KPI**
Efficiency		
Cost benefit analysis **Key Evaluation Question** What are the costs and benefits of an investment in Multi-Village Rural Water Supply Scheme in Karnataka	What are the costs of a Rural Water Supply Scheme? **Limited only to 60 Schemes** • What are the capital costs and per capita capex? • What is the O&M Cost and per capita capex? How many households/ population will be benefitted by the project **Limited only to 60 Schemes** • What are benefits / day/ household due to reduced distance to alternate water source (Tangible and Intangible) • Reduced incidence of water borne diseases at the Hh/ community level –Annual Basis	• Amount of money invested in building the rural water supply scheme / per capita cost of building water infrastructure • Per capita and per household O&M cost • Total time saved per day/month/year on account of water available through HTC/PSP – **Scheme Specific** • Percentage reduction in water borne diseases/year at the Hh/Community level – Office of DHO for 2013 to 2021 • **Tangible benefits** to be arrived by considering the total time saved in terms of person month multiplied with the MGNREGS wages – Economic value of time • **Intangible benefits** to be in terms of leisure time or drudgery of women, health benefits by way of reduced incidence of water borne diseases.
Fund utilization and capacity building [27] What is the fund utilization capacity of RDWSD per year?	1. Total funds allocated for RDWSD since 2015 and commensurate expenditure 2. What is the various training programmes organized by RDWSD since its inception	• Percentage of funds expended against allocation • Percentage of funds expended towards capacity building
Output produced How many schemes have been implemented during 2015-2020	What is the coverage of GPs/ villages and Habitations during 2015-2020? What is the coverage of Population and Households during 2015-2020	1. No. of MVS (1) Large (2) Medium and (3) Small MVSs implemented 2. Total quantity of treated water produced in MLD 3. Per-capita volume of treated water produced and distributed
Impact		
Outcomes- Short Term	1. What is the capacity of 60 MVS in terms of	1. Base, Intermediate and Ultimate year Installed and Actual

[27] Fund utilization and capacity building of RDWSD assumed here

Evaluation criteria **Key Evaluation Question**	**Specific sub questions for each Key Question**	**Indicators /success standards / KPI**
How much water is available from 60 MVS? What are the distribution arrangements made to reach the treated water to consumer end?	MLD production? 2. Availability of treated potable water across the distribution network in MLD 3. Who is responsible for Bulk distribution, (Source to Village level OHTs,) and its O&M Who is responsible for In Village distribution, operation, maintenance and management? 4. What are the institutional arrangements for local distribution and management	capacity Measured in terms of MLD and LPCD. 2. Clear definition of roles and responsibilities in Operation and Maintenance of MVS. 3. Institutional arrangements available and functional for distribution of water – GP or VWSC and administrative monitoring of Watermen by VWSC or GP 4. Capacity built for operation and maintenance at local level
Outcomes--Long Term Has the MVS succeeded in resolving water crisis in the selected villages and realized objectives of MVS?	1. What is the difference between pre and post project with regard to Frequency, Regularity, and Adequacy of water supply at consumer end? 2. What is the affordability of rural households to pay for water? 3. What is the tariff system followed in the MVS between RDWSD and GP and between GP and Consumer? 4. Has RDWSD/GP succeeded in providing prescribed quality of water as per BIS? 5. Has RDWSD introduced modern IT techniques, like online monitoring of leakages and wastage, pressure management systems, quality monitoring, automatic water reading etc. in its MVS? 6. Has RDWSD enabled communities to monitor & maintain surveillance on drinking water source and supply system?	1. Frequency / Number of Hours of water supply –Daily 2. Regularity / Timing of water supply of water supply 3. Adequacy of water supply 4. Affordability of consumers to pay water tariff. 5. Bill raised by RDWSD to GP and GP raising to Consumer. 6. Water quality Test reports at WTP or source of MVS/ consumer HTC 7. Availability of Online monitoring system, SCADA, Laboratory 8. Role of VWSC in local level water supply management

Evaluation criteria **Key Evaluation Question**	**Specific sub questions for each Key Question**	**Indicators /success standards / KPI**
Sustainability		
Sustainability of the project in the long run What is the overall sustainability of MVS vis a vis its objectives	Sustainability of MVS in terms of (a) Water Source; (b) Water Infrastructure; (c) Cost recovery and tariff systems; (d) Institutional arrangements for operating, maintaining and managing local water supply system and (e) Capacity of GP, VWSC and RDWSD in operating, maintaining and managing Multi Village Schemes	A – Capacity of source to supply required for supply during summer months B – Pumps/ WTP / Storage and major distribution lines – Design Period and if there is any replacement under pumping machineries, WTP, storage and major distributions. C – % of cost recovery from GP to RDWSD and from Consumers to GP D - Role of VWSC in local level water supply management E – Training data from RDWSD – ISA

Schedule of Field level visits and data collection: The following table provides details of field visits to MVS and other water supply schemes selected under the 'good practice' case studies.

Table 15: Schedule of Field level visits and data collection

Date	Districts covered till date	No. of MVS covered	No. of GPs covered	No. of HHs surveyed
7th to 12th Feb 22	Gadag District	5	10	168
14th to 16th Feb 22	Bagalkote district	4	4	153
17th to 21st Feb 22	Vijayapura district	5	5	177
22nd to 24th Feb 22	Raichur District	6	6	242
25th Feb 22	Koppal district	1	1	43
28th Feb-2nd Mar 22	Ballari District	2	2	72
3rd to 7th Mar 22	Vijayanagara District	7	7	281
8th to 11th Mar 22	Belgaum district (including Chikodi division)	7	7	219
19-21 April 22	Tumkur District	5	5	152
22-25 April 22	Davangere district	5	5	164
26-27 April 22	Haveri District	2	2	66
28 April 22	Shivamogga District	1	1	38
29-30 April 22	Chikmagaluru	1	1	36
03-05 May 22	Hassan District	1	4	152
06-07 May 22	Mysore District	5	6	237
09-11 May 22	Chamarajanagar	2	7	226
13 May 22	Mandya District	1	1	36
Grand Total	**17 Districts & 18 Divisions**	**60**	**74**	**2,462**

Table 16: Trips undertaken for case studies

Date	Districts covered till date	No. of MVS covered	No. of GPs covered	No. of HHs surveyed
12th Mar 22	Shiruguppi Water Supply Scheme (Chikkodi division)	1	1	-
3-4 Apr 2022	Nenmeni RWSS case study- Kerala	1	1	-
18-19 May 2022	Banvadi RWSS- Sattara district Maharashtra State	1	1	-

4 Interventions in Rural Water Supply Sector in India-Karnataka and Review of Literature

4.1 National level Rural Water Supply Programmes

Accelerated Rural Water Supply Programme (ARWSP-1972-73) was the first major intervention in the rural water sector at the national level and was launched during the fourth five-year plan (1969-1974). During the fifth five-year plan (1974-78), rural water supply programme was brought into the scope of the Minimum Needs Programme (MNP). National Drinking Water Mission (NDWM) was launched in 1986 during the 7th five-year plan as part of the Technology Missions. NDWM was renamed as Rajiv Gandhi National Drinking Water Mission (RGNDWM) in 1991. ARWSP underwent certain reform experiments with the launch of Sector Reforms Program (SRP) (Sriroop, Roy, McDonald, & Emendack, 2020) in 1999 and the Cochin Declaration in the same year. During 2004, SRP was renamed as Swajaldhara, drawing the name from the World Bank funded 'Swajal' rural drinking water supply project implemented in the State of Uttarakhand and Uttar Pradesh. 'Swajal' in Uttarakhand is an acclaimed success story for community owned drinking water supply schemes. Swajaldhara was again re-christened 'National Rural Drinking Water Programme' (NRDWP) in 2009. Department of Drinking Water and Sanitation (DDWS) was established in 1999 under the Ministry of Rural Development, GoI. DDWS was subsequently elevated to the status of a Ministry (Ministry of Drinking Water and Sanitation- MoDWS) in 2011. Following the completion of the first phase of Swachh Bharat Mission- Gramin (SBM-G) in 2019, Jal Jeevan Mission (JJM) was launched in the same year with a goal to provide a Functional Household Tap Connection (FHTC) to every rural household in India by 2024. There has been some efforts in integrating water sector affairs by introducing Jal Shakti Ministry, merging Ministry for Water Resources and Rural Drinking Water and Sanitation, under Government of India.

4.2 Involvement of the World Bank in Indian Rural Water Sector

The World Bank has been a significant institutional partner in the Indian efforts to reorient the rural water supply and sanitation sector. Commencing in the mid-1990s, a few Indian States experimented with the first-generation rural water supply and sanitation projects that are founded on the principles of 'Demand Responsive Approaches (DRA) and Community Driven Development (CDD)'. Uttar Pradesh and Uttarakhand provided the stage for launching the first World Bank funded Rural Water Supply and Sanitation Project. Second generation RWSS projects scaled up the PRI-led institutional models. States such as Maharashtra, Karnataka and Kerala partnered in the second generation set of RWSS projects. Third generation of RWSS projects adopted sector-wide approaches for decentralized service delivery systems, integrating water supply, sanitation, and source sustainability programs, along with higher levels of service delivery, including metered 24/7 water supply.

Over the last thirty years, the World Bank has partnered with GoI (World Bank, 2011) and eleven states, implementing 14 RWSS projects in India: First Maharashtra (1991-1998), First Karnataka RWSS (1993-2000), First Uttar Pradesh and Uttarakhand RWSS (1996-2002), First Kerala RWSS (2000-2008), Second Karnataka RWSS (2002-2014), Second Maharashtra

RWSS (2003-2009), Second Uttarakhand RWSS Project (2006-2012), First Punjab RWSS project (2007- 2012), Andhra Pradesh and Telangana RWSS (2009-2014), and Second Punjab RWSS Project (2015-2021). RWSSP-LIS project was launched in 2014, partnering GoI and the States of UP, Bihar, Assam and Jharkhand. The RWSSP-LIS was closed incomplete, in June 2020 and was subsumed into the Jal Jeevan Mission.

4.3 Contributions by the World Bank to Rural Water Supply Sector in India

World Bank supported RWSS to demonstrate decentralization and demand responsive approaches, women empowerment, VWSCs, SWAp, M&E systems and MIS, institutional strengthening. Each World Bank project unbundled a project methodology and successfully contributed in addressing sector challenges. These projects moved from 'build-rebuild' formula and demonstrated service delivery improvements. On the technical front, World Bank supported projects experimented with Single Village Schemes (SVS) and complex Multi Village Schemes (MVS). Both pumping and gravity-based schemes were implemented as well as piloted innovative technologies such as SCADA for operation and maintenance of MVS. These projects also demonstrated governance and accountability measures such as grievance redressal mechanisms, innovative independent reviews, third-party quality checks, beneficiary assessments, sustainability evaluation exercises and comprehensive MIS for project governance. Maharashtra and Uttarakhand partnered in implementing 'PforR'- Program for Results, approach in RWSS projects.

4.4 Role of PRIs and NGOs in Rural Water Sector

Yet another significant sectoral event that acted as a game changer was the 73rd Constitutional Amendment Act which made it mandatory for states to devolve powers and responsibilities from state departments and agencies to elected local governments at the village, sub-district and district levels. Rural water and sanitation were two of the 29 items devolved to local governments. Also, the contribution of the NGO sector to community mobilization and participation methodologies in RWSS was recognized since 1990s. There was an increasing trend of applying the participatory methodologies to development programmes which attracted the attention of the world bodies and national governments. The role of the government began to be looked at from different perspectives from that of a supplier –provider to that of a facilitator, focusing more on policymaking, regulation, training, and monitoring, in a wide spectrum of development, including that of water supply and sanitation (PMU, 2009).

4.5 Externally Supported Rural Water Supply Projects in Karnataka

Government of Karnataka began implementing rural water supply projects with the support of external aid agencies during the International Decade for Water and Sanitation (1981-1990). A rural water and sanitation project was implemented in the districts of Dharwad, Bellary, Raichur and Bijapur (Now Vijayapura) in Karnataka under the Indo-Dutch Bilateral Cooperation Programme (Netherlands. Embassy (India) -New Delhi, IN, 1990). The project commenced in 1986 and supported 364 problem villages of the above districts with a project cost of INR- 250 million. This was followed by a DANIDA (Regional Water and Sanitation Group (RWSG), South Asia, UNDP-World Bank Water & Sanitation Program and IIM Ahamedabad-Public Systems Group) assisted programme covering 492 villages of Chitradurga

and Kolar districts. Commencing the project in 1992, its objective was to improve the health standards of selected rural communities. Collaboration with the World Bank began in 1993 (Cr. 2483-IN). 'Karnataka Integrated Rural Sanitation and Water Supply Project', funded by the World Bank, covered 1,104 villages in 12 districts of the State and was implemented during 1993-2000. SRP was implemented in the districts of Mysore, Bellary and Dakshina Kannada districts in Karnataka during 1999-2004.

Based on the encouraging results of the 1st World Bank project, GoK took up the Second World Bank Assisted Karnataka Rural Water Supply and Sanitation Project (JNP-II) to cover a target of 2,500 villages coming under 700 Gram Panchayats (GPs) of 11 districts in North Karnataka. Considering Jal Nirmal Project very successful, GoK sought additional financing from the World Bank for implementing the demand of community for additional schemes. The additional financing project covered another 1,600 villages in the same 11 districts of north Karnataka. The Jal Nirmal Project ushered the state into a new era of reforms in the rural water supply sector especially in terms of demand-response approach, community participation, and devolution of responsibilities to the Panchayat Raj Institutions (PRIs), 100% cost-recovery in operation and maintenance (O&M) and ensuring sustainability of services, among others (World Bank, 2011)[28].

4.6 Review of Literature- Sustainability of Rural Water Supply Projects

Multi Village Schemes in the context of Karnataka means a water supply scheme supplying water to multiple villages, by drawing raw water from a sustainable surface source such as river or reservoir and treating the same to potable standards and delivering the same as per design volume to village over-head tanks for Gram Panchayats to distribute to consumers through the In-Village Distribution Network (IVDN). Multi Village Schemes in Karnataka stand apart as a class by itself. MVS does not distribute water directly to the community. It generates treated bulk water and supplies the same to GPs at Village level OHTs. From there on, it is the responsibility of GP to manage distribution to consumer households either through a HTC or through a PSP. GPs manage distribution by engaging watermen, who are largely from non-technical background. Service level measurement, adequacy, frequency and regularity of water supply really matter at the consumer end, notwithstanding the volume of water generated at the MVS treatment plant. Hence the concept of sustainability has to be further simplified and analyzed by looking at sustainability capitals at the level of MVS (scheme level) bulk distribution point at GP level and at consumer end.

[28] Implementation Completion and Results Report (IDA-35900, IDA-47680) ICR-00003124. The World Bank. Jal Nirmal Pilot phase was implemented during 1993-1999. Jal Nirmal- Phase-I was implemented during 2002-2010 and the Additional Financing phase under Jal Nirmal-I was implemented during 2010-2014. ICR Evaluation Summary (June 2001) for the pilot phase of Jal Nirmal observed that, "Karnataka RWSSP (Jal Nirmal Pilot Phase) was the first project in India which applied the tripod for sustainable environmental health: providing potable safe water, sanitary excreta disposal, and health education. The project was the first rural water supply and sanitation project in India to require beneficiaries to contribute towards the costs of construction, pay for the costs of operations and maintenance, and form VWSCs. Its success should have an important demonstration effect for similar projects in India. The substantial NGO participation was another significant outcome of the project"

Sustainability assessments on Multi Village Schemes in India are fewer in number than compared to studies on Single Village Schemes or sustainability assessments on rural water supply schemes in general. The purpose of the review is to examine sustainability issues relating to rural water supply schemes in general and specifically Multi Village Rural Water Supply Schemes in India and outside. The ToR for the current study lays emphasis on delivery performance with regard to adequacy, frequency and regularity of water supply.

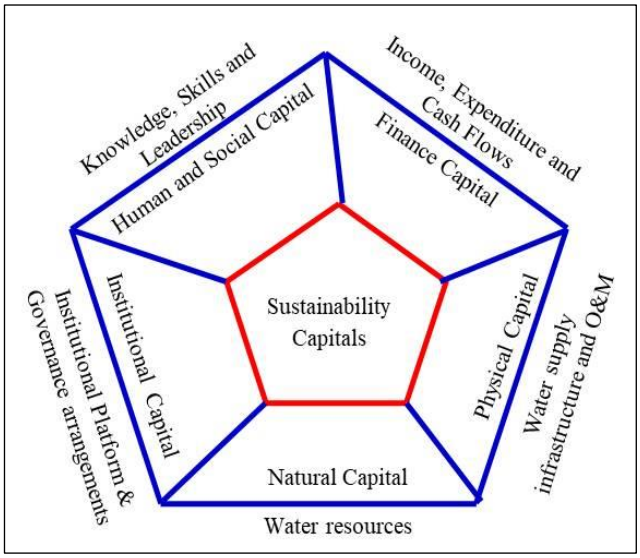


Figure 6: Sustainability Capitals in RWSS

Delivery performance of MVS is considered part of sustainability in this review, where delivery performance is an everyday function and hence in the short run, while sustainability is addressed in the long run.

One of the first noteworthy definitions of sustainability came forth in the report of the World Commission on Environment and Development (WCED) titled 'Our Common Future' published in 1987, which defined sustainable development as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (World Commission on Environment and Development, 1987). This definition of sustainable development is more from the environmental and resource use angle. The environmental aspect of sustainability applies to MVS as it draws on the water resource, falling under the natural capital. The adequacy function of delivery performance is also linked to the natural capital. However, as regards MVS is concerned, it will require a slightly different method of analyzing sustainability, as it is under the management of RDWSD and is not directly under community management. There is substantial participation of the private sector in the 'design, build, operate' tripod of MVS. A different framework is necessary for MVS to assess its sustainability. This new sustainability framework is a modification of the sustainable livelihood framework to which Dr. Robert Chambers, DFID, UNDP and CARE besides other experts have contributed. Sustainability of MVS is analyzed, using an integrated multi-dimensional framework, consisting of five different sustainability capitals (Kurian, 2021). These include natural capital (water resource), physical capital (water supply infrastructure), finance capital (income and cash flows to cover opex and the means to meet finance contingencies), human capital (staff, leadership, knowledge, skills, experience and management) and finally the governance capital (rules, bylaws, institutional arrangements, information systems and arrangements to address grievances) The framework on sustainability capitals combine environmental (water), service delivery (function of the physical capital through operations) finance and institutional platforms. Using this framework, it will be possible to assess sustainability of MVS and where the strength and weaknesses lies.

4.7 Sustainability Capitals

Sustainability is a function of Sustainability Capitals. There are a large number of studies that deal with sustainability and the sustainability pentagon capitals. Neva R Godwin considers five capitals such as finance, Natural, Manufactured, Human and Social (Godwin, 2003) in economic development. Similarly, the sustainable livelihood analysis framework (William, 2003) mentions human capital, social capital, natural capital, physical capital and finance capital. (Ida Christensen and Pamela Pozarny, 2008). Drawing the concept of sustainability capitals from SLA Framework, an attempt is made to identify the sustainability capitals for a rural drinking water supply scheme and analyse its sustainability. To undertake the sustainability analysis of a rural drinking water supply scheme, sustainability capitals such as natural capital (water), physical capital (infrastructure), human capital, finance capital and governance capital are proposed to be used. In this analysis model, four capitals are adopted as such from the Sustainable Livelihood Analysis framework and a fifth capital in the form of governance capital is added to arrive at the sustainable capital pentagon for rural water supply sector.

Sustainability in the context of a scheme that provides a service is the availability of the service during the design period of the scheme. Water is the resource capital in the context of MVS. Water (Natural Capital) should be sufficiently available at the source of the scheme for year-round pumping. The physical capital in the case of MVS is the manufactured assets and the operational system that helps in reaching water from the source to the consumer households and should satisfactorily function during the design period of the scheme. The next sustainability capital is the human capital which includes the leadership, staff, their knowledge, skills and experience to operate and maintain the drinking water supply scheme. The concept of human capital is applicable to the RDWSD (the technical department) and the contractor-operator. The human capital needs to be locally available to the extent possible, as it helps in developing a sense of ownership. The fourth sustainability capital is the finance capital, which includes income and sufficient cash flow to manage the expenditure and the contingencies. The finance capital needs to be realized through cost recovery of the O&M. Overall governance arrangements in the form of rules, regulations, bylaws, community platforms, together with the information systems, GRM, etc., constitute the governance capital and needs to be available and active as long as service delivery is available.

How did government of Karnataka (RDWSD) try to achieve sustainability with regard to MVSs in the state is an interesting topic to be examined. The following table presents a summary of such attempts in the context of MVS.

Table 17: Summary of efforts to achieve sustainability by Govt of Karnataka

Name of Capital	Sustainability Defined	Intervention by GoK to achieve sustainability
Natural capital (water resource)	Make water available throughout the year in quantity specified by GoK/ GoI	• Shift from groundwater to surface sources such as that of rivers and reservoirs and allocating water for MVS.

Name of Capital	Sustainability Defined	Intervention by GoK to achieve sustainability
Physical capital (water infrastructure)	Water infrastructure remains functional and operational throughout the design period of the MVS as well as operational downtime remains less than 1%.	• RDWSD introduced DBOT procurement instrument, whereby the contractor who design and build the MVS operates it for the first five years after commissioning. • In order to overcome inefficiencies in direct operation and maintenance by the department, private sector participation is introduced into O&M of MVS with regulatory, oversight and monitoring responsibilities for the RDWSD.
Human capital	Competent and sufficient number of human resources available along with knowledge, skills, experience and management capabilities to operate and maintain MVS; sufficient number of competent staff resources available with RDWSD for monitoring, oversight and management of MVS.	• Private sector operators brought into O&M of MVS so as to make available up-to-date knowledge, skill sets and experience in rural water sector, especially O&M.
Finance capital	Partial cost recovery for capex and full cost recovery for opex of MVS	• O&M policy of 2013 stipulated partial cost recovery for opex at the rate of Rs.5/kL of treated water from GPs. • Cost recovery for opex at the level of GP from consumers/community.
Governance capital	Make available governance systems and structures for operating and administering MVS	• O&M policy 2013 notified(not implemented) • GO regarding Bulk Water Tariff of December 2020 notified (not yet implemented) • O&M Policy 2021 draft uploaded on website, (not yet notified and implemented) • Grievance Redressal Mechanism (GRM) available in the form of PARIHARA (Not widely used by consumer public) • O&M contracts with private sector operators • Management Information System (MIS) is still file based and manually tabulated (software based MIS not available as a full-fledged system).

Journey of MVS on sustainability pathway will be presented and analysed in chapter six on the basis of quantitative and qualitative data obtained from field level interactions.

Conventional engineering approach limits sustainability of a MVS to technical aspects consisting of the natural and infrastructural capital. Vaishali Bharambe and Dr.A.S.Wayal observe that 'the challenges of providing sustainable access to rural water services in developing countries often go far beyond that of the technology itself'. (Bharambe & A. S , 2016). Though MVS has lot of support among water engineers, other water sector professionals feel that multi-village schemes are not an appropriate option in rural India, despite technical advantages. They point out that multi-village schemes require significant investment, substantial technical capabilities and involve coordination and cooperation between large and diverse groups (Robbinson, 2001). In many rural communities, particularly in the drier areas of India, competition for local water resources is intense. In a context of rising demand, these resources are often unable to provide the stipulated minimum level of service. As a result, planners tend to turn to more plentiful but more distant water sources, and multi-village schemes become attractive as a means of sharing the high investment and production costs of the bulk water supply system (intake, treatment plant, pump station, pipeline), and thus of reducing per capita costs and increasing affordability (ibid). Despite the difficulties attached to MVS, almost all donor institutions finance and support MVS in externally aided projects. Adoption of MVS in Karnataka state is due to the lack of availability of local perennial sources of water. Several problems related to implementation, operation and maintenance of MVS in Karnataka include: 'significant higher average per capita costs, lack of institutions to manage local level operation and maintenance or poor institutional capacity, poor experience and skills in mobilizing and training groups of communities, poor capacity of contractors/ operators and lackluster implementation of policies'(ibid).

Kalayom G Tsadik (Tsadik, 2010) considers a rural water supply system sustainable when it is maintained and managed with an 'acceptable level of services throughout the design life of the water supply system'. The service level in the long term is considered significant in this approach. Zemenu Awoke (Awoke, 2012) quotes Mukherjee et al (2003) and other sources such as WSP and IRC (2003) who simply consider sustainability as "satisfactory functioning and effective use of services and equity as everyone having equal access to benefits from projects".

Infrastructural capital is in a way equivalent to technical system and its sustainability refers to the functioning of infrastructure and technology which makes water available to the user community. Infrastructural sustainability is linked to the physical capital and directly depends on the quality of construction, materials used in construction, quality and quantity of water supplied, and equitable distribution. There are scholars who consider very simple technical sustainability parameters such as operational functionality which ensures distribution of water. "If the water flows, then all of the many elements which are required for sustainability must have been in place." (L J, 1998). However, the focus of this above definition is very narrow.

There are authors who look at the aspect of sustainability on the basis of scheme typology; 'community managed' and 'utility managed' rural water supply schemes. Kennedy Musonda is of the opinion that sustainability in a community managed rural water supply system will be achieved if there is : (a) an effective community organization; (b) communities have the ability

to operate and maintain; (c) communities are able to raise adequate user fees for purchasing spare parts and (d) there is a strong backup at the district level to carry out major repairs (Musonda, 2009). A recent study conducted by the World Bank, (Sustainability Assessment of Rural Water Service Delivery Models-Findings of a Multi-Country Review-Water Global Practice-August 2017) cite five building blocks of sustainability and these include (a) institutional capacity, (b) financing, (c) asset management, (d) water resources management and (e) monitoring and regulatory oversight. (World Bank, 2017). The study quotes (Whaley and Cleaver 2017) that the new trend emerging in rural water supply sector is a 'service delivery approach', which recognizes the importance of 'wider systems of governance and the enabling environment, political economy aspects, life cycle costs and the role of local institutions'. With demand-responsive approaches (DRA) the focus of sustainable operations of water supply systems is shifting to participation of local institutions, consumer stakeholders and a wider context of enabling environment.

Though there is almost unanimous agreement among scholars and sectoral experts about having a broader approach to the sustainability of rural water supply schemes, at the ground level, we find lot of evidence for focusing on water infrastructure and not on service delivery. As observed in the Report of the Working Group on Rural Domestic Water and Sanitation, (chapter 9, Operation, Maintenance and Service Delivery), MoDWS, GoI (Twelfth Five Year Plan-2012-2017), (MoDWS, 2011) traditional approach to construction of rural water supply schemes worked on a project mode and focused on creating infrastructure. Public water utilities or departments dealing with water supply such as PHED are mainly concerned with creation of infrastructural assets, physical progress and financial disbursement. Focus on service delivery and long-term sustainability is very hard to find. There is no interaction with communities during planning, implementation and O&M. The communities avail low level of services from such schemes and after the 'build-neglect-abandon' phase, the demand for rebuilding schemes surfaces.

Paul Hutchings et al make a comparative analysis of three MVS: (1) Amaravati MVS-Maharashtra; (2) Morappur, Tamil Nadu, (TWAD Board), (2004–7) and (3) Nenmeni RWSS-Wayanad district, Kerala, rehabilitated under WB aided Jalanidhi Project. In the Maharashtra case, management of both bulk water and the village-level distribution network is the responsibility of the state agency supported by the district level offices and the role for the community is purely participatory through its oversight water committee. Maharashtra case study shows a top-down approach whereby communities are no longer required to manage the scheme with all of the system taken on by the state agency. With regard to the Tamil Nadu case study, community plays both a participatory and management role through the water committees, but the management element is limited only to the distribution system, which is nested in the larger bulk system. In the Kerala case, community is able to develop more sophisticated institutional systems to take on the management of MVSs. The Kerala case is an example for a bottom-up approach as communities have sufficient social and human capital to develop the more sophisticated institutional systems to manage the services (Hutchings, Franceys, Jasthi, & Saraswathy, 2020). In the above three cases cited, the Tamil Nadu model almost resembles the Karnataka rural water supply situation, where the common infrastructure

and bulk water generation is with the RDWSD- the state department, while the distribution is with GPs. One major point of departure between all three cases quoted above and the Karnataka situation is the near absence of oversight and management committees representing community.

Luis Andres et al present their findings about a comparative assessment of sustainability of water supply schemes implemented under conventional approach and demand responsive approach in the State of Kerala. "The study found that participatory community driven water supply schemes were more successful in delivering adequate, regular, and quality water supply, experienced fewer breakdowns and water shortages, and enjoyed higher consumer satisfaction with the quality of service delivery. The findings of this paper suggest that the community-based approach can be a superior alternative to traditional supply driven models in expanding and improving water service delivery in rural areas" (Andres et al, 2017).

Both MVS and Community managed water supply schemes require an institutional format to make schemes operational, ensure enforcement of rules and regulations as well as accountability to the users, local self-government bodies and government. In trying to make services work for the poor people, Dorte Peters argues that a lack of sound institutional framework is the root cause of many failures in service delivery. (WSP Peters, Dorte, 2002) Junaid Ahamed recognizes the importance of institutional sustainability, when he recommends, "don't fix the pipes; fix the institutions that fix the pipes**"** (Ahamed, 2004). Brazil is one country that has experimented and innovated with institutional models to support rural water supply schemes including multi village schemes. The model available from Ceará province of Brazil is known as SISAR (Sistema Integrado de Saneamento Rural-Integrated Rural Water Supply and Sanitation System). SISAR[29] is a Federation of Community Associations created specifically with the purpose of self-managing local level water supply schemes. SISAR is founded as a registered NGO and acts as federation, supporting institutional, financial, technical and administrative functions of the community water associations. (Meleg, 2012) SISAR helps community organizations in 'fixing the pipes'. Whenever the local water supply schemes or local water supply institutions face difficulties in terms of technical, management related, institutional and human resource related, they approach SISAR for professional support. SISAR charges for its services from the local water supply institutions/communities.

Government of Karnataka also appreciated the importance of institutional architecture to coordinate and integrate the functioning of MVS. With this objective, GoK notified a Government Order[30], forming a Joint Committee for each MVS, especially for the management of MVS assets from Jackwell to WTP, Storage Reservoirs and transmission mains. However, though the GO was notified towards the closure of Jal Nirmal Project, the team did not come across any evidence of having such JC functioning around a MVS, except at Hirenandi village as part of Hirenandi Multi Village Scheme (Rao M S & Raviprakash, 2015).

[29] https://www.gwp.org/en/learn/KNOWLEDGE_RESOURCES/Case_Studies/Americas--Caribbean/Brazil-An-innovative-management-model-for-rural-water-supply-and-sanitation-in-Ceara-State-411/

[30] Government Order No.RDP/240/RWS/2015 Dated 13.05.2016

Karnataka has lot of experience in implementing rural water supply scheme based infrastructural assets for SVS and MVS. Funds for implementing RWSS came from own state allocations, assistance from GoI and externally funded RWSS projects. There has been a major shift from groundwater-based schemes to surface water source based multi village schemes. Private sector participation in constructing, operating and maintaining Multi Village Schemes has been 100%, with policy level approvals for such approach. There is an institutional dichotomy in rural water supply sector, as bulk water generation for drinking purposes is governed by RDWSD, a technical department with low level sectoral capacities because of nascent origins of the department. On the other hand, Gram Panchayats are responsible for management of IVDN and distribution of water. GPs in Karnataka are dependent on watermen, 'barefoot local water technicians' to manage the local water supply.

Early optimism that emerged since the early 1990s considering community managed water supply schemes as a panacea for the rural sector has suffered a setback due to substantial number of community-led schemes getting defunct. The current realization is that community management model needs wider governmental support and regulation. It is true that there has been lot of success stories emerging from the field with regard to small community schemes, often referred to as SVS- Single Village Schemes. The sector has to approach the investments in MVS with utmost care. Current experiments in the RWSSP-LIS project supported by the World Bank spread in the low-income states of Assam, Bihar and Jharkhand is a pointer in this respect. The infrastructural assets will be created; but their operation and maintenance using instruments such as DBOT is yet to emerge into a clear practice with clarity on roles of stakeholders. New management models are required with regard to MVS. Co-management by the Utility and the Community can be considered as a management model for MVS, with clear definition of roles and responsibilities. Participatory Action Researches on O&M needs to be undertaken so as to evolve knowledge on success models and practices.

A key question that emerges here is what can then make MVS and community management model sustainable and scalable? Paul Hutching and others argue for Community Management Plus model. There is a study[31] series in which the Community Plus factors in O&M have been examined from 20 different rural water supply projects in 17 States of India[32]. These studies have been funded by AusAID to document community plus factors in successful community-managed rural water supply programmes and approaches across India. Studies and documentation of selected rural water supply schemes have been undertaken by: (1) Xavier Institute of Social Sciences; (2) Centre of Excellence for Change, Chennai; (3) Malaviya National Institute of Technology; (4) Administrative Staff College- India; (6) Cranfield University, UK and (6) International Water and Sanitation Centre (IRC) . The authors (individually and severally) included: (1) Stef Smits, Ruchika Shiva and Depinder Kapur; (2) Srinivas Chary Vedala, Swapna Uddaraju and Shaili Jasthi; (3) Paul Hutchings; (4) Matthias

[31] The project has been implemented by a consortium of partners, including: the Administrative Staff College of India (ASCI), the Centre of Excellence for Change (CEC), Malaviya National Institute of Technology (MNIT), the Xavier Institute of Social Service (XISS) and IRC, The Netherlands with overall project coordination provided by Cranfield University, UK.

[32] States included in the study are: (1) Jharkhand; (2) Madhya Pradesh; (3) Odisha; (4) Chhattisgarh; (5) Meghalaya; (6) Rajasthan; (7) West Bengal; (8) Telangana; (9) Karnataka; (10) Himachal Pradesh; (11) Punjab; (12) Uttarakhand; (13) Kerala (Kodur) and (Nenmeni); (14) Gujarat (Gandhinagar) and (Kutch); (15) Tamil Nadu (Morappur) and (Kathirampatti); (16) Maharashtra; and (17) Sikkim

Javorszky, Prakash C. Dash Pramil K. Panda; (5) Dr M.S. Rama Mohan Rao, M S Raviprakash; (6) Dr Rema Saraswathy and G Vijayaram and (7) Benjamin Harris, Dr Urmila Brighu Rajesh Poonia. The 'Plus' factors were categorized under broad headings of: (1) Governance & Institutional Capital; (2) Human Capital; (3) Finance Capital and (4) Infrastructure Capital and Operations. A list of community plus factors categorized under Human capital, governance and institutional capital, finance capital, infrastructure and operational capitals is summarised and presented below:

Table 18: Details of 'community plus' factors in sustaining RWSS

No	**Community Plus Factors under Human Capital**
1	Involve local technicians in O&M with handholding support
2	Community service providers (CSP) is crucial; CSP trained in O&M; Competency development for staff; Support of NGO to CSP towards professionalism.
3	Community participation
4	Effective leadership
5	Social Mobilization for community management and O&M
6	Involvement of GPs in O&M at operational and knowledge level; Technical support to GPs
	Community Plus Factors under Governance & Institutional Capital
1	VWSC - active, vibrant, trained, with gender balance, experienced (old) and young persons to be involved; Platforms for democratic participation, watchdog function of the VWSC.
2	Experiment and study the functioning of Joint Committees
3	Effective linkage and networking between CSP and GP
4	Transparency and accountability systems and arrangements
5	Facilitation support from Technical and Administrative departments
6	GP has to remain active and in leadership roles
7	Enabling Support Entity is required.
8	Role change of the Technical Dept moving from an engineering body, focused on building infrastructure, to one committed to service delivery.
9	Focus to move to professionalized and sustainable services as the future pattern.
10	Sector Wide Approach (SWAp) to rural water supply.
11	Development of 'role model' villages in RWSS
12	Created Community Change Management Groups
13	Civil Society Organization Network and linkages for RWSS
14	Efficient complaint redressal system by VWSCs
15	Institutional arrangements and community platform very desirable where bulk Transfer of water to villages is arranged.
	Community Plus Factors under Finance Capital
1	Improve revenue by increasing the number of HTCs by improving community trust
2	Operational enterprises in water and sanitation
3	O&M cost recovery through Tariffs
4	Stringent water tariff collection system.
5	Full O&M cost recovery; 100% user charge collection and billing arrangements
6	Insurance coverage against damages
7	Partial cost-recovery at least from GP to Technical Dept (Tamil Nadu)

No	Community Plus Factors under Human Capital
8	Willingness to pay improves when people see a transformative change in the service delivery-a service people feel is aspirational.
	Community Plus Factors under Infrastructural Capital & Operations
1	Efficient service levels lead to consumer satisfaction
2	Demystified Operations and Operational Manuals
3	Efficient water distribution and management system
4	Good monitoring from the part of Technical Department of Schemes and Operations
5	24x7 water supply in Rural water supply in Punjab

Annexue-4.1 presents a journal of community plus factors summarised from the entire 20 case studies. Most number of 'Plus' factors are included under governance and institutional category. Operations and maintenance of MVS in Karnataka can be improved with stringent monitoring, administrative and political support and capacity building of stakeholders. What is clueless in Karnataka is the GP level water supply system sandwiched between MVS, local SVS, the battalion of watermen, the consumers and the local level institutional arrangements which is more on the paper and less on ground. The community plus factors is a sure pointer towards sustainability at the GP level. Paul Hutchings and other consider long term external support, financial subsidies, technical and managerial advice (Hutchings, et al., 2015) as community plus factors for sustainability. However, community management in the traditional sense as such is not practical in the case of MVS in Karnataka due to size, scale and complexity of system on one side and the multiple number of GPs to be served on the other side. Innovations in community management have to evolve to address needs of MVS as well.

Though studies overwhelmingly support community management, there are a few studies that do not support community management in rural water supply. Eleanor Elizabeth Chowns in her paper, 'Community management in Malawi: part of the sustainability problem, not the solution' argues that community management is frequently inefficient and disempowering. Chown's study challenges the assumptions of efficiency and empowerment that underpin community management model (Chowns, 2016). Another observation on the flip side of participation, community management and sustainability come from Stephen Jones in his paper, 'Participation as citizenship or payment? a case study of rural drinking water governance in Mali'. (Jones, 2011). Jones argues that institutions created to promote 'participation as citizenship' limit their focus to 'participation as payment', which in effect makes water neither sustainable nor equitable. Dr. Rema Saraswati attributes Technical and managerial competencies developed during the implementation of the Jalanidhi during 2005-2007 have paved the way for the success and sustainability of NRWSS (Saraswati, 2016). However, NSJVS has made substantial progress in various operations and maintenance related attributes during its O&M phase and cannot be attributed to the presence of support organisation or other planning and implementation related capacity building. The sustainability of NRWSS is the result of developing sustainability capitals during the post commissioning phase of the scheme. Thus, real challenge to sustainability lies in the post commissioning phase, where funding, technical support, handholding and capacity building get diminished. During the post-commissioning phase, sustainability capitals such as the finance capital, human capital,

governance and institutional capital should be developed and matured, so that rural water supply schemes become sustainable. Karnataka State Water Policy 2019 (KJA Task Group; (Karnataka Knowledge Commission), 2019) (Draft) recommends a hybrid management model for MVS in the State; (1) common facilities managed by professional agencies and (2) interactive and participatory management with GPs for the distribution network (Page 92-KSWP-2019). At the GP level, the KSWP -2019 calls for active involvement of primary stakeholders such as women in water supply management (ibid). The Joint Committee proposed under Government Order No.RDP/240/RWS/2015 Dated 13.05.2016, and the GO on VWSC are particularly relevant here.

4.8 Conclusions

MVS in Karnataka is typically in a kind of 'low level equilibrium trap'[33]. Though originally used to describe the water supply situation in rural Kerala (Singh B. , et al., 1991 April), it very well applies to MVS in Karnataka. MVS provide a service level which is not properly monitored and generating authentic data on service levels. MVS are constructed, operated and maintained by subsidy financing from Government of Karnataka. MVS is still not able to generate any income from its bulk water supply service. On the other hand, at GP level, tariff is mostly kept low, and the expenses towards energy, repair and maintenance and salary for watermen is well far beyond whatever tariff revenue generated. Water tariff is not realized fully in any GP. Again, heavy rate of subsidy finance keeps the IVDN and local water supply going. MVS water is supplemented by borewell based supplies wherever MVS water supply is available in Karnataka. Judicious use of water should be the rule in Karnataka as it is drought prone and water stressed. As groundwater sources dry up and are experiencing geo-genic contamination, more and more public investment is going into develop surface source based MVS. The entire capex for MVS is met by Government of Karnataka from own budgetary allocations and financing from GoI. All MVSs are operated by private sector operators against a tariff and RDWSD does not receive any water tariff from GPs which are responsible for distribution. Tariff collection at GP level is inefficient and is not sufficient to meet the salary of watermen, whose number in most GPs is in excess of the actual requirement. Hence, one can only conclude that Karnataka rural water sector is in a 'low level equilibrium trap'. The rural water supply arrangements including MVS and IVDN need to go in for a thorough overhaul and re-organizing with an objective to take the sector to 'high level equilibrium' and sustainability.

The rural water sector in Karnataka needs to liberate itself from the infrastructural mode to a 'service delivery approach', which recognizes the importance of 'wider systems of governance and the enabling environment, political economy aspects, life cycle costs and the role of local institutions'. Between GP and MVS and within GP between GP and consumer households, a paradigm shift in favour of demand-responsive approaches (DRA) is the need of the hour. Participatory Action Researches on O&M needs to be undertaken so as to evolve knowledge on success models and practices.

[33] The theory of Low Level Equilibrium Trap has been developed by R.R. Nelson for underdeveloped countries. It states that when per capita income increases above the minimum specific level, population tends to increase

4.9 Gaps in research

There is very little evidence for sustainability assessment studies for the category of Multi Village Schemes as they exist in Karnataka in the literature. Therefore, two types of sustainability assessments become necessary: (1) Sustainability of MVS as a system that produces and distributes bulk water to GPs; (2) Intermediary level of sustainability assessments as to the operation of water supply functioning at GP/Village level and how these provide service to the household level consumer community. The second level sustainability assessment has to integrate system functionality of SVS and IVDN functioning as well as service level provided. Finance, Human and Governance capital assessments cut across MVS and SVS. Sustainability studies on MVS has to look at the administration of O&M contracts in Karnataka and how they affect the service level, besides independently looking at each of the sustainability capital under the sustainability pentagon.

Annexure 4.1

Summary of Community Plus Factors in Rural Water Supply Schemes of Selected Indian States
https://www.ircwash.org/projects/india-community-water-plus-project

Table 19: Summary of 'Community Plus' Factors in RWSS of Selected Indian States

No	State	Authors & Institution	Year of study	Community plus factors observed
1	Chhattisgarh (Javorszky Et al, 2015)	1.Matthias Javorszky, 2.Prakash C. Dash 3.Pramil K. Panda • XISS- Ranchi	July 2015	1. PHED staff and engineers operate the schemes and involve local technicians during initial three to six months after construction. 2. community service providers are crucial to the support arrangement as it ensures the functioning of the system 3. Communities have the capacities to run the scheme after handover.
2	Odisha (Javoroszky et al, 2015 July)	1.Matthias Javorszky, 2.Prakash C. Dash 3.Pramil K. Panda • XISS- Ranchi	July 2015	1. Support of NGO (Gram Vikas) to community service providers towards professionalism, scheme implementation, 2. Consumers receive high levels of service and very satisfied, 3. Water Committees manage the schemes effectively 4. Impressive community participation throughout service delivery cycle. Programme commence only when every household agree to participate 5. O&M cost recovery through Tariffs 6. High quality solutions that are 'cost effective' than 'low-cost'. 7. Schemes are intentionally kept simple and operational manuals and designs are 'de-mystified', with explanations in a local language.
3	Jharkhand (Dash Et al, 2015 July)	Prakash C. Dash, Pramil K. Panda, Ragini Sinha and Matthias Javorszky • XISS- Ranchi	July 2015	1. Functioning Village Water and Sanitation Committees (VWSC) 2. Community involved in decision-making through village meetings. 3. VWSCs have effective mechanisms for accounting and managing cash, VWSC assisted by a 'Jal Sahiya' (water volunteer), selected from the daughters-in-law of the village, who acts as a treasurer and is responsible for water quality testing.
4	Karnataka Belagavi District (Mohan M S &	Dr M.S. Rama Mohan Rao M S Raviprakash	Sept 2015	1. Well-designed water supply system 2. Efficient water distribution and management system and 3. Stringent water tariff collection system.

No	State	Authors & Institution	Year of study	Community plus factors observed
	Ravi Prakash, Understanding the resource implications of the 'plus' in community management of rural water supply systems in India: Belagavi District, Karnataka, 2015 September)	• CEC Chennai		4. VWSC consisted of experienced elders and enthusiastic youth and professionals 5. Efficient functioning of Joint Committee 6. Proactive steps to increase the number of HTCs to increase revenue
5	Kerala Nenmeni GP Wayanad District (Saraswathy, Investigating the resource implications of the 'plus' in community management of rural water supply systems in India: Nenmeni Sudha Jala Vitharana Society (NSJVS),	Dr Rema Saraswathy • CEC Chennai	Feb 2016	1. NSJVS- metamorphosis of a SLEC into an operational entrepreneur 2. Community contracting during implementation phase 3. Efficient support organisation playing vital role in community capacity building 4. Maintains transparency within the organisation 5. Effective leadership 6. Governing body and General Body- Platforms for democratic participation 7. Community Trust in the scheme with HTCs increasing from 727 to approximately 5000 in 2022[34] 8. Full O&M cost recovery 9. Effective linkage and networking with Nenmeni GP

[34] Sustainability Capitals in NRWSS-NSJVS by P K Kurian

No	State	Authors & Institution	Year of study	Community plus factors observed
	Kerala, 2016 February)			
6	Meghalaya (Saraswathy & G, 2016 February)	Dr Rema Saraswathy and G Vijayaram CEC Chennai	Feb 2016	1. PHED and S&WCD work intensively at capital investment hardware, in building the necessary infrastructure for the community. 2. No software input at the implementation or pre-implementation stage to involve the community or to educate them about the operation and maintenance of the facilities.
7	Madhya Pradesh Dhar District (Mohan M S & M S, 2015 October)	Dr M S Rama Mohan Rao & M S Raviprakash CEC Chennai	Oct 2015	1. Safe Water Supply coverage attempted in challenging villages with groundwater sources having dangerous levels of fluoride. 2. Community management model with DWSCs in villages that carry out day to day operation and minor maintenance activities of the system. 3. PHED plans to develop a public bulk water supply system for fluoride affected areas in the future. 4. Partnership and complimentary work of the NGO (Vasudha Vikas Sansthan) and PHED to tackle fluoride issue in a few villages. 5. PHED has also recently started its own Social Mobilization Teams to strengthen the DWSCs for community management in O&M
8	Sikkim (Saraswathy & G, 2016 February)	Dr.Rema Saraswathy & G Vijayaram CEC-Chennai	Feb 2016	1. Providing technical support to the GPs 2. Department has trained a local person (Barefoot Engineer) on essential fitter/plumber techniques and water quality monitoring, as well as the VWSC and GP 3. Village Water and Sanitation Committee as part of the GP existing 4. Active GP
9	Tamil Nadu (Saraswathy, 2015 April)	Dr.Rema Saraswathy CEC-Chennai	April 2015	1. The Panchayat maintain a high level of service with reliable potable water of more than 80 lpcd, and 80% Household Service Connections as well as a higher level of community participation with 90% user-charge collection. 2. TWAD Board ensures good quality treated bulk water from the Combined Water Supply Schemes to the GP tapping point. Supply driven mode meeting costs of finance, infrastructure design & implementation, and quality monitoring. 3. Panchayat pays for the water drawn from the CWSS at INR 3 per m^3.

No	State	Authors & Institution	Year of study	Community plus factors observed
				4. Panchayat operates and maintain the IVDN 5. RD&PR Department provide a mixed model of support, holding more responsibility for capital maintenance, major repairs, etc., 6. Community ownership thus created sustained over time and perpetuated to other villages, under the efficient Panchayat leadership.
10	Kerala Kodur GP Malappuram Dist (Vedala Et al, Understanding the resource implications of the 'plus' in community management of rural water supply systems in India: decentralisation for efficient service delivery, Kodur Gram Panchayat, Kerala, 2015 December)	Srinivas Chary Vedala, Shaili Jasthi Swapna Uddaraju ASCI Hyderabad	Dec 2015	1. 'Big bang' approach in transferring functions, functionaries and funds to local governments by Govt of Kerala. Kerala is frontrunner in Devolution Index in India. The decentralization policy in Kerala has empowered the communities to operate and maintain their own water schemes efficiently.
11	Maharashtra Amravati district, (Vedala et al, 2015 December)	Srinivas Chary Vedala, Shaili Jasthi and Swapna Uddaraju, ASCI Hyderabad	Oct 2015	1. VWSC role limited to 'Watch Dog' eye on MJP's performance. 2. VWSCs checks misuse of metered connections at household levels. 3. VWSC supports in tariff collection in difficult habitations 4. Efficient complaint redressal system by VWSCs

No	State	Authors & Institution	Year of study	Community plus factors observed
				5. High service levels in terms of the quantity, quality and continuity of supply. Role for real community involvement in rural water supply to ensure sustainable services to all even in a Professionalized' service delivery approach, which is likely to be the future pattern.
12	Gujarat (Vedala Et al, 2015 June)	Srinivas Chary Vedala, Shaili Jasthi Swapna Uddaraju ASCI Hyderabad	June 2015	1. WASMO building strong relationships with community; Enabling Support Entity; 2. Transfer of bulk water from Narmada Project to villages. 3. First Cycle- Participatory Village Action Plan is 4. Pani Samiti is the 'Community Service Provider' 5. Second Cycle- Implementation of Village Action Plan 6. Pani Samiti trained in O&M, levys the water tariff. 7. Third cycle, ESE extends handholding support to the CSP. Competency development is the crucial driving force for the success of WASMO and in increasing its employee effectiveness.
13	Punjab (Benjamin, 2015 July)	1. Benjamin Harris, 2. Dr Urmila Brighu 3. Rajesh Poonia Malaviya NIT, Jaipur	July 2015	1. 24x7 water supply in Rural water supply in Punjab- has undergone a substantial change due to the World Bank funded Punjab Rural Water Supply and Sanitation project. 2. Communities taking full ownership and responsibility in 24x7 supply villages 3. DWSS gone through a process of change, moving from an engineering body, focused on building infrastructure, to one committed to service delivery. 4. High quality infrastructure investment 5. Better willingness to pay when people see a transformative change in the service delivery-a service people feel is aspirational. 6. High level of transparency and accountability with the water committees: 'transparency boards' located outside the pump-house. 7. State-wide implementation of the programme- Sector Wide Approach (SWAp) to rural water supply. 8. Considerable political leadership and support for the programme Development of 'role model' villages to inspire others, 500+villages.

No	State	Authors & Institution	Year of study	Community plus factors observed
14	Rajasthan Jaipur District, Swajaldara programme: (Harris, 2015 July)	Benjamin Harris, Dr Urmila Brighu Rajesh Poonia Malaviya NIT, Jaipur	July 2015	1. Community management can work with minimal support, but is susceptible to failure: 2. PHED provides minimal technical, support to communities 3. Community service providers manage water supply successfully, and sustainable. 4. Water source is the limiting factor in the service level, and providing complex treatment or establishing new sources is beyond the technical and financial capabilities of community service providers. 5. Water systems must keep pace with economic development-urbanisation- improved household wealth status and a corresponding increase in demand for water for domestic purposes. Public water utilities must adapt to changing funding patterns. GoI is moving to channeling the majority of funding through PRIs; Rajasthan PHED remains focused on centralised, engineering-focused interventions rather than supporting community service providers. This shift needs to happen with support from government and polity.
15	Tamil Nadu Morappur, (Hutchings, 2015 June)	Paul Hutchings Cranfield University, UK	June 2015	1. VWSC as the service provider 2. VWSC-Gram Panchayat network carries out the O&M functions 3. Created Community Change Management Groups Significant support from TWAD Board and the Block Development Office
16	Telangana & Andhra Pradesh (Vedala Et al, 2015 September)	Srinivas Chary Vedala, Swapna Uddaraju and Shaili Jasthi ASCI Hyderabad	Sept 2015	1. Complementarity of support from Bala Vikasa, the Nandi Foundation and the Safe Water Network. Reverse Osmosis Technology for purifying the water
17	Uttarakhand (Smits Et al, 2015 December)	Stef Smits, Ruchika Shiva and Depinder Kapur IRC, The Netherlands	Dec 2015	1. Civil Society Organization Network- (Himmotthan Society-an associate organization of Tata Trusts), Village Empowerment Committees (VECs), Himalayan Institute and Hospital Trust (HIHT) acting as the (ISA) 2. The second category of organisations is the government entities; 3. The third category is the private sector, in the form of an independent agency that provides technical and oversight support to the programme.

No	State	Authors & Institution	Year of study	Community plus factors observed
				4. Communities availing insurance coverage against damages caused by floods and landslides as in 2013.
1. XISS- Ranchi 2. CEC-Chennai 3. Malaviya NIT, Jaipur 4. ASCI Hyderabad 5. IRC, The Netherlands				1. Xavier Institute of Social Sciences 2. Centre of Excellence for Change, Chennai 3. Malaviya National Institute of Technology 4. Administrative Staff College- India 5. International Water and Sanitation Centre (IRC)

5 Findings based on primary data from field work

5.1 Water Assets

RDWSD, Government of Karnataka has invested heavily in creating water assets by implementing Multi Village Schemes (MVS), Single Village Schemes (SVS), Piped Water Schemes (PWS), Mini Water Schemes (MWS), Water Purification Plants (WPP) and Borewells. Among the above, large investments have been towards implementing Multi Village Schemes and Water Purification Plants in the recent five years.

When it comes to MVS, water assets include civil structure (intake/jackwell, water treatment plant, raw water balancing tank, back wash tank, clear water reservoir, major balancing reservoir, zonal balancing reservoir, pipeline network for major distribution and overhead tanks at villages), pumping machineries, mechanical and electrical equipment and electrical sub-station.

District-wise data regarding MVS is presented in the table below.

Table 20: Distribution of MVS – district-wise

No	District	No of Functional MVS	No of partially functional MVS	Total	Percentage against total
1	Bagalkot	32	4	36	7.71%
2	Belagavi	26	-	26	5.57%
3	Bellary	65	3	68	14.56%
4	Bengaluru Rural	NA	NA	0	0.00%
5	Bengaluru Urban	NA	NA	0	0.00%
6	Bidar	4	-	4	0.86%
7	Chamarajanagara	2	-	2	0.43%
8	Chikkaballapur	1	-	1	0.21%
9	Chikkamagaluru	3	1	4	0.86%
10	Chikkodi	40	-	40	8.57%
11	Dakshina Kannada	7	-	7	1.50%
12	Davangere	27	-	27	5.78%
13	Dharwad	4	-	4	0.86%
14	Gadag	13	-	13	2.78%
15	Gulbarga	11	8	19	4.07%
16	Hassan	11	1	12	2.57%
17	Haveri	16	-	16	3.43%
18	Kodagu	1	-	1	0.21%
19	Kolar	NA	NA	0	0.00%
20	Koppal	2	8	10	2.14%

No	District	No of Functional MVS	No of partially functional MVS	Total	Percentage against total
21	Mandya	10	-	10	2.14%
22	Mysore	28	2	30	6.42%
23	Raichur	25	11	36	7.71%
24	Ramanagara	1	2	3	0.64%
25	Shivamogga	9	-	9	1.93%
26	Tumkur	15	11	26	5.57%
27	Udupi	1	-	1	0.21%
28	Uttar Kannada	6	-	6	1.28%
29	Vijayanagara	15	-	15	3.21%
30	Vijayapura	36	-	36	7.71%
31	Yadgir	5	-	5	1.07%
	Total	**416**	**51**	**467**	100.00%
Source: RDWSD					

Of the 467 schemes, 416 are fully functional and 51 are partly functional. 232 MVS have been implemented since 2015. This emphasizes the significant step taken by the RDWSD in terms of moving from ground water source to surface water source based schemes. It may also be noted that majority of MVS have a sustainable source[35]. As MVS has multiple components the civil structure is designed for 30 years and the pumping machineries are generally designed for intermediate period of 10 - 15 years. While the WTP is designed for ultimate year population, the service level considered in 60 schemes vary from 30 LPCD to 85 LPCD. The table below gives a presentation of the schemes designed considering LPCD category.

Table 21: Coverage of population by MVS

LPCD designed	Population covered under Scheme	Number of Schemes
30	53,894	1
40	11,81,317	23
55	23,03,399	31
70	11,80,984	4
85	9,219	1
Total	47,28,813	60

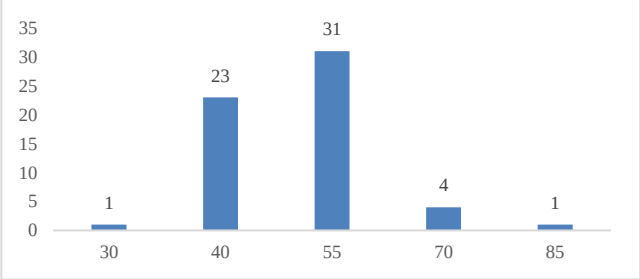


Figure 7: Coverage of population by MVS

Government of India has recommended the LPCD norm for the rural and urban areas. Under JJM, the water proposed to be supplied is 55 LPCD across rural areas. In this regard the MVS schemes

[35] Sources of MVS include: (1) River Source – 38 MVS; (2) Canal + Rainfed Impounding Reservoir- 13 MVS; (3) Reservoir- 7 MVS and (4) Natural Lakes- 02 MVS

that were designed earlier with 30 and 40 LPCD would fall under the category of not meeting the norm with respect to quantity or adequacy. Therefore, 24 schemes would need to be augmented such that the per capita of 55 LPCD is met. However, before considering the augmentation it is essential to assess if the network, pumping machineries, treatment facility is able to meet the supply through increase in pumping hours and also if there are other schemes that can meet the balance requirement with proper synchronization.

Water Purification Plants: Water Purification Plant (WPP) is based on Reverse Osmosis (RO) technology, installed in villages to provide treated drinking water against payment-based system. This is one of the most efficient treatment processes for removing excess chemicals, biological contaminants, suspended solids, and gases from water. The source for the RO plants is the local borewell.

Table 22: Distribution of WPPs in the selected 17 districts of Karnataka

Divisions	Working	%of WPPs working	Not working	% of WPPs not working
Bagalkote	659	5.80%	61	0.54%
Ballari	515	4.53%	21	0.18%
Belagavi	594	5.23%	21	0.18%
Chamarajnagara	130	1.14%	60	0.53%
Chikkamangaluru	205	1.80%	4	0.04%
Chikkodi	657	5.78%	55	0.48%
Davangere	845	7.43%	6	0.05%
Gadag	446	3.92%	2	0.02%
Hassan	455	4.00%	0	0.00%
Haveri	687	6.04%	6	0.05%
Koppal	587	5.16%	122	1.07%
Mandya	726	6.39%	14	0.12%
Mysore	601	5.29%	21	0.18%
Raichur	668	5.88%	51	0.45%
Shivamogga	253	2.23%	3	0.03%
Tumkur	1,404	12.35%	108	0.95%
Vijayanagara	505	4.44%	40	0.35%
Vijayapura	180	1.58%	655	5.76%
Total	10,117	89.00%	1,250	11.00%
Grand Total				**11,367**
Source: Executive Engineer Office (District), RDWSD				

Currently, 11% of the WPPs are not functioning due to following reasons:

- Source getting dried, No sustainable source
- Smart card is introduced at certain WPPs, while households preferred coin-based system

- Close proximity installation leading to competition and villagers prefer the ones which are closer
- Demand assessment and participatory interactions not done before installing WPP. WPPs are installed in the locality where community was already consuming filtered water
- Hygiene factor: Location of WPPs ie., next to a Nala or a dump yard
- Some of the WPPs are outside the village limits
- Power supply is irregular

5.1.1 Number of Villages Covered

The total number of villages to be covered under all the 467 MVSs as per the design is 6530. However, 6,225 villages are currently covered by all these 467 MVS, 305 villages lesser than estimated. Similar case was also observed during the study of 60 schemes. Reasons for difference in coverage are presented below for illustration.

Table 23: Difference in number of villages proposed to be covered and actually covered

Name of the Scheme	Total Villages to be covered asper DPR	No. of villages actually supplied	Reasons
Mayasandra & other 11 villages	12 villages	5 villages	Distribution network is damaged during road works
Doddakavalande and 55 villages	56 villages	32 villages	Raw water raising main is made of glass compound and experiences repeated failures; Distribution network is damaged during road works.
Inchageri & other 41 habitations in Indi taluka	42 villages	46 villages	Excess demand from other surrounding four villages
DBOT Gadag, Mundargi and Shirahatti of Gadag District - Package 2	213 villages	243 villages	Water is tapped without consent from the authority and is considered illegal connections.

Out of 60 schemes, 2 schemes were not able to supply water to some of the villages as proposed during the design stage. 2 schemes are supplying to additional villages/locations.

5.1.2 Water assets handed over to GPs

Of the 60 MVSs, none of the schemes are handed over to the GPs to operate and maintain. However, once the scheme is completed and the contractor has to sign out to indicate that the work is completed satisfactorily, the GPs expressed that they are not giving any consent / approval because the GPs are not taken into confidence during the execution of the project. Some GPs such as Boggur (Ballari), Nadavi (Ballari) and Papinayakanahalli (Vijayanagara) expressed their desire to take over the MVS assets, operate and maintain MVS assets on their own provided the GPs are

trained in operations and maintenance activity. The GPs expressed their desire to take over the O&M as all three GPs were thoroughly dissatisfied by the performance of the current MVS Operators.

Apart from the 60 MVSs, the team came across two Multi village single GP schemes (Sringasagara Scheme – Tumkur district and Shiraguppi Scheme – Belagavi district) where the assets are handed over the GPs for operation and maintenance. In Sringasagara scheme - Huliyuru Durga GP is operating and maintaining the assets. The Sringasagara scheme caters to one more GP (Haleooru GP). Huliyuru Durga GP charged a fixed fee from Haleooru GP against the supply of treated water. However, Haleooru GP stopped payment and therefore the supply is temporarily suspended currently. Huliyuru Durga GP is managing the entire expenses including the plant operation, salary to valve man, cost of chemicals and power charges. The pumping machinery in this scheme needs replacement and the same is proposed to be included under the next phase of JJM.

Shiraguppi water supply scheme is handed over to the GP long back and a detailed case study is presented in chapter nine of this report. This is one of the model schemes which could be replicated across the state due to its efficient performance, empowered VWSC, coordination between the GP and VWSC, the entrepreneurial functioning of the WPP and out of the box transparency in functioning of the GP and VWSC.

5.1.3 Power Supply to MVS

Power supply is one of the most critical factors for the successful operation of MVS. It was noted during the field visit that MVS components receive power supply from multiple sub-station of Escoms, leading to lack of synchronization and consequent delay in pumping and treatment operations. Even though there is 11 KVA dedicated feeder main, Escoms divert the power supply from the dedicated feeder main meant for the water supply to non-MVS consumers. In large MVSs, 33 KVA sub-stations have been installed and with additional stand-by feeder arrangements in case of emergency and failure of one sub-station.

This is very common in districts of Vijayapura, Raichur, Bellari, Gadag, Belagavi, Mysuru and Vijayanagar. The total number of dedicated feeder main across 60 schemes is presented in table below.

Table 24: Availability of dedicated Feeder lines across 60 MVSs

Dedicated Feeder main	Number of schemes	Percentage
Installed	53	88.33%
Not Installed	7	11.67%
Total	60	100.00%

5.1.4 Supply during breakdown

During the breakdown or routine maintenance period, the MVS operators inform GPs about the interruption in power supply and the duration of downtime thereof. During such time, it was noted

that all GPs depend on borewell sources to meet their daily demand. During floods when the MVS plants were shut down for a short duration of time, GPs depended on their own source ie., borewells to meet the demand for water.

5.1.5 Mapping of water resources

Currently, there is no use of digital technology at MVS level or at the GP level. In large MVS also the SCADA systems are not put to optimum utilization. Also, the SCADA data in Gundlupet was not available, and as per the operator the data was hacked and no backup taken from the time of commissioning. At the MVS level, especially in the small and medium MVSs, ie., 54 schemes there is no computerization or digitalization of data. It was also noted that there are no log books, stock register, maintenance record, etc., to monitor operations. With respect to quantification of water, no bulk meters were installed as there was no provision made during the implementation stage. However, the RDWSD has insisted on installing the Bulk meters under JJM to quantify the volume of water supplied to all GPs. At the central office or district level offices of RDWSD, the data is still available in the form of hard copy in files. Therefore, there is lot of potential for computerization of data at state, district, scheme and GP level.

5.1.6 Synergy with Urban water board and RDWSD

Out of 60 MVSs, synergy with urban water board in supply of water has been observed in 4 MVS. MVS i.e Hukkeri & 27 villages in Belgaum District, was constructed by KUWSDB in 1998-99 to supply water to Hukkeri town and also the 27 villages. As the demand from the Hukkeri town increased, KUWSDB built a scheme exclusively dedicated to Hukkeri town and thereby handed over the 'MVS Hukkeri and 27 villages' to RDWSD in 2017. MVS Kadur- Tarikere in Chikkamangalur has another type of urban linkage as the WTP is managed and operated by the municipality and water is supplied to 26 villages in addition to the ULB. The ULB is demanding more water and RDWSD has not agreed to the enhanced demand. Two other schemes, i.e MVS Mundargi in Gadag district and MVS Channagiri in Davangere district are supplying 8 MLD and 3 MLD of water to respective towns. These ULBs do not pay any water charges to the RDWSD till date.

5.1.7 Water Quality

Rural Drinking Water and Sanitation Department (RDWSDD) is providing significant focus on water quality monitoring. The department has a specific programme by name Water Quality Monitoring and Surveillance Programme (WQMSP) to monitor water quality in the State. Three aspects of water quality are generally tested: these include: (1) physical; (2) chemical and (3) bacteriological parameters. It is important to test chemical and bacteriological parameters for all drinking water sources used by community. Physical parameters generally refer to (1) colour, (2) odour, (3) taste, (4) pH value, (5) turbidity and (6) total dissolved solids (Standards, 2012). BIS-10500 as amended in 2012 lists 24 chemical parameters. However, under normal circumstances,

9 chemical parameters[36] are usually tested. Under bacteriological parameters, E.coli or thermotolerant coliform bacteria shall not be detected in a 100 ml sample of treated water. Water quality for all the above three broad parameters (physical, chemical and bacteriological) need to be maintained for treated drinking water distributed to community. Indicative water quality tests can be conducted using Field Test Kits (FTK) where it is generally possible to test Fluoride, Arsenic, Nitrate, Iron, pH, Chloride and E.coli bacteria. RDWSD has provided directions that "If the chemical elements are higher than the specified standards in the water samples tested in Taluk and District level laboratories, those water samples are tested at the state level with the help of Karnataka Pollution Control Board which is the referral laboratory under an agreement (RDWSD, 2022)". On the basis of the reports provided by KPCB, if the water sample in a particular area is found unsafe, a Water Purification Plant will be installed by the department in that area as a temporary solution (ibid).

There are 31 district level water quality testing labs and 45 sub-division level water quality test labs distributed across the State of Karnataka. MVS evaluation was undertaken in 17 districts (18 divisions) of Karnataka. Following table provides details of WQTs existing in the 17 districts included in the MVS evaluation.

Table 25: Distribution of water quality testing labs across selected 18 divisions of RDWSD

No	Circle	Division	Total No of WQT Labs	NABL[37] accredited	Without NABL accreditation
1	Bangalore	Davanagere	2	1	1
		Shivamogga	3	1	2
		Tumakuru	3	0	3
2	Belgaum	Bagalkot	3	0	3
		Belagavi	3	0	3
		Chikodi	2	0	2
		Gadag	1	0	1
		Haveri	2	2	0
		Vijaypura	2	1	1
3	Gulbarga	Ballari	2	0	2
		Koppal	2	0	2
		Raichur	3	0	3
		Vijayanagara	2	0	2
4	Mysore	Chamarajanagara	2	1	1
		Chikkamagaluru	3	0	3
		Hassan	3	0	3
		Mandya	2	1	1

[36] (1) Chloride (as Cl), mg/l, Max; (2) Total alkalinity (as Ca CO3), mg/l, Max; (3) Total hardness (as Ca CO3) mg/l; (4) Sulphate (as SO4), mg/l, Max; (5) Iron (as Fe), mg/l, Max; (6) Total arsenic (as As), mg/l, Max (in hot spots); (7) Fluoride (as F), mg/l, Max; (8) Nitrate (as NO3) mg/l, Max; (9) Residual free chlorine, mg/l, Max.

[37] National Accreditation Board for Testing and Calibration Laboratories (NABL) is an accreditation body, with its accreditation system established in accordance with ISO/ IEC 17011. The NABL is an autonomous body under the guidance of the Dept. of Science & Technology, Govt. of India whose purpose is to provide accreditation to testing and calibration of clinical laboratories in the country.

No	Circle	Division	Total No of WQT Labs	NABL[37] accredited	Without NABL accreditation
		Mysore	3	2	1
		Total	**43**	**9**	**34**

The MVS evaluation team collected water quality test results from the MVS Operators or from the RDWSD sub-divisional offices. The water quality report for all the 60 MVS was collected even though 2 of the schemes were non-functional on the day of visit. The test results provided by the schemes that were non-functional is for the functional period and hence the same has been considered for analysis.

The test results are presented along with the pass and fail criteria under desirable and permissible limits. The desirable limits provide a strict and specific range or fixed number to check for pass or fail, whereas the permissible limits have a higher range and if the same is met, it is considered potable in the absence of alternative sources of water. In case, the parameters fail the permissible limits, then water from such sources is declared non-potable.

Table 26: Summary of WQT results – Desirable and Permissible limits

Testing criteria	Test Done	Test Not Done	Desirable limit			Permissible limit		
			Pass	Fail	Pass %	Pass	Fail	Pass %
PH Value	59	1	59	-	100%	-	-	-
Turbidity (NTU)	52	8	33	19	63%	17	2	-
TDS (mg/L)	57	3	54	3	95%	3	-	-
Total Alkalinity	59	1	56	3	95%	3	-	-
Total Hardness	59	1	54	5	92%	5	-	-
Chloride	58	2	58	-	100%	-	-	-
Nitrate (NO2)	51	9	51	-	100%	-	-	-
Iron (Fe)	46	14	46	-	100%	-	-	-
Fluoride	52	8	51	1	98%	1	-	-
Sulphate	45	15	45	-	100%	-	-	-
Calcium	49	11	47	2	96%	2	-	-
Magnesium	49	11	43	6	88%	6	-	-

Observations on Water Quality based on size category of MVS. None of the 60 schemes had done the Bacteriological tests.

Table 27: Summary of WQT results (scheme size-wise)

	No. of MVSs Test Results conducted			No. of MVS Test Results Not conducted			Within Desirable Limit			Within Permissible limit		
Testing criteria	Small	Medium	Large	Small	Medium	Large	Small	Medium	Large	Small	Medium	Large
Physical												

pH Value	43	10	6	1	-	-	43	10	6	-	-	-
Turbidity	34	10	5	10	-	1	23	5	5	11	5	-
TDS	42	10	5	2	-	1	39	10	5	3	-	-
Chemical												
Total Alkalinity	44	10	5	-	-	1	43	10	3	1	-	2
Total Hardness	44	10	5	-	-	1	43	10	1	1	-	4
Chloride	43	10	5	1	-	1	43	10	5	-	-	-
Nitrate (NO2)	39	9	3	5	1	3	37	9	3	2	-	-
Iron (Fe)	31	9	6	13	1	-	31	7	4	-	2	2
Fluoride	39	10	3	5	-	3	30	9	3	9	1	-
Sulphate	32	9	4	12	1	2	32	9	3	-	-	1
Calcium	36	9	4	8	1	2	32	9	3	4	-	1
Magnesium	37	9	3	7	1	3	30	9	3	7	-	-
Arsenic	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Residual free chlorine	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Bacteriological												
E.coli or thermo-tolerant coliform bacteria	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Legend	Small (out of 44); Medium (out of 10); Large (out of 6); NT – not tested											

5.1.8 Summary of observations on Water Quality aspects in MVSs under evaluation

Water quality parameters tested: Even where WQTs are undertaken, a uniform set of parameters (physical, chemical and bacteriological) are not tested across all the 60 MVSs. It was also noted that not all physical and chemical parameters were tested as per the CPHEEO guidelines. Therefore, one or more parameters are found missing in all water quality test reports.

Periodicity of water quality test reports: It is observed that water quality tests are conducted on a monthly basis in all the small and medium schemes at RDWSD laboratory, because such MVSs do not have in-house laboratory facility. In case of large MVSs, a dedicated laboratory is functional and the tests are done on a daily basis, besides which samples are also tested on a monthly basis in the RDWSD laboratory.

Issues with water quality testing: Two most significant issues with water quality as shown above are: (1) Bacteriological analysis of water sample is not done in any scheme; (2) assuming that water is chlorinated to address bacteriological presence, presence of residual chlorine is not tested in the water samples. Considering the possibility that MVS-SVS sources confluence at Village level OHT or in the IVDN, it is required to test the strength of chlorine in water. This is on the

ground that chlorine is extremely volatile and will evaporate out of water, thus will decline in strength by the time it reaches the consumer end.

Rationale for water quality testing: Yet another observation is with regard to the periodicity of water quality testing. Since the O&M Contract stipulates water quality report as an attachment to the bill submitted by the Contractor for getting O&M payment released, testing of water quality is commensurate with the submission of bills for payment. It is observed that water quality needs to be tested frequently and constantly monitored, as quality of raw water may also be subject to changes due to a host of factors, external to the MVS. In most of the MVSs (except the large ones), tests are done in line with the billing requirements and test results are submitted to RDWSD along with O&M bills. Apart from this, water quality tests are not done periodically, except in case of large schemes (either the operator has an in-house lab or does the tests from the nearby recognized labs). Water Quality Test (WQT) is mostly done by MVS operator. There are also instances where Grama Panchayats and Zilla Panchayat conduct water quality tests when quality related issues are reported or as a precautionary measure before the onset of monsoons. It is suggested that in small and medium MVSs where there is no dedicated laboratory, the samples can be tested for 7 parameters using Field Test Kits (FTK).

ToR suggests making a comparison of water quality parameters in comparison with the parameters suggested by World Health Organization (WHO). The following table captures the parameters proposed for testing by WHO and by BIS-10500, as well as the number of parameters actually tested by MVS operators in the State.

Table 28: Parameters proposed for testing by WHO and BIS

No	Parameters	Standard limits- WHO	BIS	MVS Tested
1	Aluminium (as Al), mg/l, Max	NA	Y	
2	Acrylamide	0.0005		
3	Alachor	0.02		
4	Aldicarb	0.01		
5	Aldrin and Dieldrin	0.00003		
6	Ammonia	1.5	Y	
7	Antimony	0.02		
8	Anionic detergents (as MBAS) mg/l, *Max*	NA	Y	
9	Arsenic	0.01		
10	Atrazine	0.002		
11	Barium	0.7	Y	
12	Benzene	0.01		
13	Benzo(?)pyrene	0.0007		
14	Boron	0.5	Y	

No	Parameters	Standard limits- WHO	BIS	MVS Tested
15	Bromate	0.01		
16	Bromodichloromethane (BDCM)	0.06		
17	Bromoform	0.1		
18	Cadmium	0.003		
19	Carbofuran	0.007		
20	Calcium (as Ca), mg/l, *Max*	NA	Y	Y
21	Chloramines (as Cl_2), mg/l, *Max*	NA	Y	
22	Carbon tetrachloride	0.004		
23	Chlorate	0.7		
24	Chlordane	0.0002		
25	Chloramines	0.5 - 1.5		
26	Chloride	200 - 300	Y	Y
27	Chlorine	5	Y	
28	Chlorite	0.7		
29	Chloroform	0.3		
30	Chlorotoluron	0.03		
31	Chlorpyrifos	0.03		
32	Chromium	0.05		
33	Colour in drinking water	NHBGVP	Y	
34	Copper	2	Y	
35	Cyanazine	0.0006		
36	Cyanide	0.07		
37	1,2-Dichlorobenzene	1		
38	1,4-Dichlorobenzene	0.3		
39	1,2-Dichloroethane	0.03		
40	Dichloromethane	0.02		
41	2,4-Dichlorophenoxyacetic acid	0.03		
42	DDT and metabolites	0.001		
43	Di(2-ethylhexyl)phthalate	0.008		
44	1,2-Dichloroethylene	0.05		
45	1,2-Dichloropropane	0.04		
46	Dimethonate	0.006		
47	1,4-Dioxane	0.05		
48	Dissolved oxygen	NHBGVP		
49	Edetic acid (EDTA)	0.6		
50	Endrin	0.0006		
51	Epichlorohydrin	0.0004		
52	Ethylbenzene	0.3		
53	Fenoprop	0.009		

No	Parameters	Standard limits- WHO	BIS	MVS Tested
54	Fluoride	1.5	Y	Y
55	Hexachlorobutadiene	0.0006		
56	Iron	NHBGVP	Y	Y
57	Isoproturon	0.009		
58	Lead	0.01		
59	Lindane	0.002		
60	Manganese	0.4	Y	
61	Magnesium (as Mg), mg/l, *Max*	NA	Y	Y
62	Mercury	0.006		
63	Methoxychlor	0.02		
64	Metolachlor	0.01		
65	Microcystin-LR	0.001		
66	Mineral oil, mg/l, *Max*	NA	Y	
67	Molinate	0.006		
68	Molybdenum	0.07		
69	Monochloroacetate	0.02		
70	*N*-Nitrosodimethylamine	0.0001		
71	Nickel	0.07		
72	Nitrate	50	Y	Y
73	Nitrilotriacetic acid (NTA)	0.2		
74	Nitrite	3		
75	Pendimethalin	0.02		
76	Pentachlorophenol	0.009		
77	Permethrin	0.3		
78	pH	NHBGVP	Y	Y
79	Phenolic compounds	NA	Y	
80	Pyriproxyfen	0.3		
81	Selenium	0.01		
82	Simazine	0.002		
83	Silver	NA	Y	
84	Sulphate	NHBGVP	Y	Y
85	Sulphide (as H_2S), mg/l, *Max*	NA	Y	
86	Styrene	0.02		
87	Terbuthylazine	0.007		
88	Tetrachloroethylene	0.04		
89	Toluene	0.7		
90	Total dissolved solids (TDS)	NHBGVP	Y	Y
91	Total alkalinity as calcium carbonate,	NA	Y	Y
92	Total Hardness	NA	Y	Y
93	Trichloroacetate	0.2		

No	Parameters	Standard limits- WHO	BIS	MVS Tested
94	Trichloroethylene	0.02		
95	2,4,6,-Trichlorophenol	0.2		
96	Trifluralin	0.02		
97	Turbidity	NA	Y	Y
98	Trutuim	10000 Bq/L		
99	Uranium	0.015		
100	Vinyl chloride	0.0003		
101	Xylenes-total	0.5		
102	Zinc	NHBGVP	Y	
103	E. coli or thermotolerant coliform bacteria-Shall not be detectable in 100 ml sample (Treated Water)	NA	Y	
104	Total coliform bacteria -Shall not be detectable in any 100 ml sample (Treated Water)	NA	Y	
	Total	90	29	12
	Y- Yes (Included) or Tested			
	NHBGVP-No health-based guideline value is proposed			

As shown in the above table, WHO suggests testing 90 parameters in 'chemical', while BIS-10500 suggests testing 29 parameters under physical, chemical and bacteriological parameters. Water sample from MVSs surveyed are testing 12 parameters under chemical and physical category and bacteriological parameter is not tested. It is recommended that MVS test parameters proposed by BIS atleast.

5.1.9 Water quality testing in GP

Out of 74 GPs surveyed, only 2 GPs i.e Binkadakatti GP in Gadag District and Kaginele GP in Haveri District were found using Field Test Kits (FTK) to check the quality of water supplied. Generally, the quality of water is tested only in case of borewell water and not for MVS water. These tests are conducted by Gram Panchayat

Table 29: WQT results using FTK in Binkadakatti GP, Gadag District and Kaginele GP, Haveri District

	Jan-22		In PPM				
		PH	TH	Chloride	Fluoride	Iron	Nitrate
Kaginele	BW 1	7.0	300	380	0.5	0.0	10
	BW 2	7.0	370	360	0.5	0.0	10
	BW 3	7.0	300	350	0.5	0.3	10
	BW 4	6.0	410	430	1.0	0.0	20
	BW 5	7.0	360	300	0.5	0.3	0
	BW 6	4.0	300	38	0.5	0.2	10

	Jan-22	In PPM					
		PH	TH	Chloride	Fluoride	Iron	Nitrate
	BW 7	6.0	430	400	0.6	0.3	0
	BW 8	7.0	300	360	0.5	0.0	10
	BW 9	7.6	390	496	0.6	0.2	25
	BW 10	6.0	400	500	0.5	0.5	10
	BW 11	7.5	440	280	0.8	0.1	0.0
	BW 12	7.2	300	410	0.6	0.3	30
	BW 13	7.0	300	350	0.5	0.0	10
	BW 14	6.0	330	300	0.5	0.5	30
	BW 15	7.0	390	250	0.5	0.2	20
	BW 16	7.5	460	500	0.6	0.5	10
	BW 17	7.0	380	300	0.5	0.2	30
	BW 18	7.5	300	360	0.5	0.5	10
	BW 19	6.0	450	380	0.6	0.3	30
	BW 20	7.5	300	360	0.5	0.5	10
Binkadakatti	BW 21	7.5	615	300	1.5	0.2	20
	BW 22	7.5	600	285	1.5	0.2	20
	BW 23	7.0	375	400	1.0	0.0	20
	BW 24	6.5	300	320	1.5	0.2	20
	BW 25	6.0	150	60	0.0	0.0	20
	BW 26	6.0	315	320	1.0	0.0	10
	BW 27	7.0	390	280	1.0	0.2	10
	BW 28	6.5	270	340	0.5	0.0	30
	BW 29	6.5	225	320	0.5	0.2	30
DL		6.5-8.5	200	250	1.0	0.3	45
BDL		8	28	27	3	5	0
% of BDL		31%	97%	93%	10%	17%	0%
DL Number		20	1	2	26	24	29
% of DL		69%	3%	7%	90%	83%	100%
DL-Desirable Limits; BDL- Beyond Desirable Limits; TH- Total Hardness							

In addition to the GPs, the Zilla panchayat and taluk panchayat take samples for testing twice in a year. However, such test results are not available with the GPs. These tests are carried out by the watermen or other trained personnel in the GP. In case of other GPs, although the training with respect to using the FTKs have been provided to the watermen, they have not carried out tests.

Advantages of carrying out water quality tests with FTK include: (1) FTK test results generate awareness among people who conduct them; (2) The Test results can be subjected to on the spot analysis and can be used as a good IEC / BCC tool to work on behaviour change. For the 29 borewells, where the FTK test has been conducted, total hardness (97%) and chloride (93%) are above Desirable Limits. There are also test results which are beyond Desirable Limits with regard

to pH, Fluoride and Iron, though in smaller number. It is pointed out that though other GPs have been trained in using FTKs, test results are not available and hence it is assumed that FTK based tests are not conducted. Water Quality Tests must be taken with religious seriousness as it has a direct bearing on the health of the people.

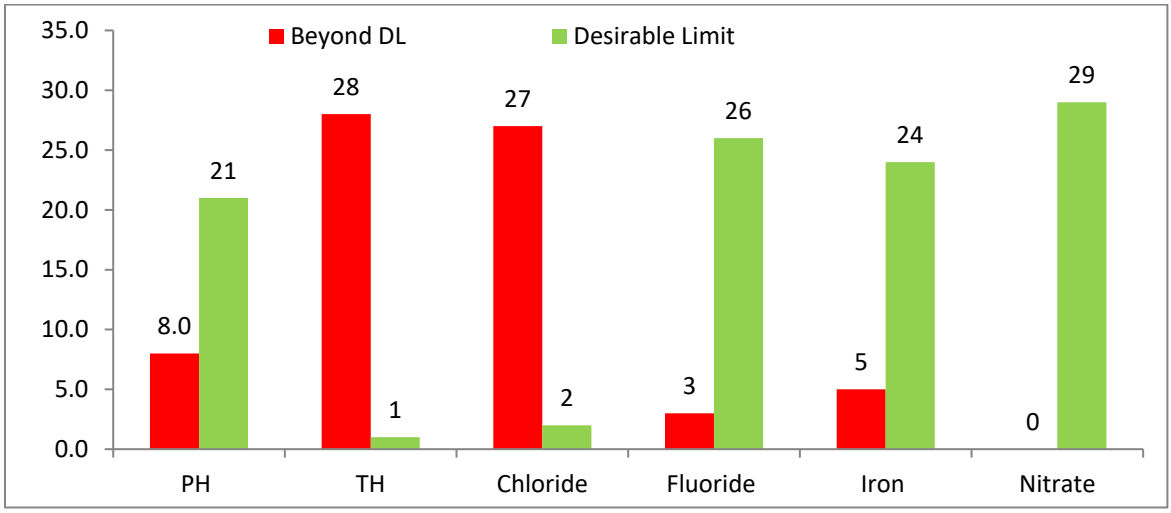


Figure 8: Water Quality Test Results from FTK Tests in Binkadakatti and Kaginele GPs

5.1.10 Bacteriological Analysis of water samples conducted

The Technical Evaluation Committee of KEA, met on 8th August 2022, under the chairmanship of Additional Chief Secretary (ACS) to Government of Karnataka, (Dept of Planning, Programme Monitoring and Statistics) and reviewed the Draft Final Report submitted by NABCONS. During this meeting, ACS instructed Director (Evaluation) KEA, to collect certain water samples and get the bacteriological test conducted from a NABL accredited lab. This was communicated by KEA through their proceedings of the 56th Technical Evaluation Committee meeting, dated 30th August 2022. Though, the ToR does not include samples tests for bacteriological water quality analysis, the evaluation team collected water samples from two different districts covering five MVSs as detailed below:

No	Name of the MVS	District
1	Santhekadur	Shivamogga
2	Holebenavalli	
3	Doddanaramangala	Tumkur
4	Brahmasandra	
5	Mayasandra	

Water samples from five MVS were collected. Three samples for each of the MVS were collected. Thus a total of 15 samples were collected for five MVS. The location of samples collected included: (1) raw water; (2) treated water; and (3) water from the village OHT's outflow pipe. Water samples were collected in sterilized containers supplied from the NABL accredited lab. The samples were collected by the Evaluation Team from 15 different locations and the same were handed over to Sneha Test House (NABL accredited lab) located at Nagarbhavi, Bangalore-560072.

Results obtained for the bacteriological water quality analysis are provided below.

Table 30: Bacteriological test results done in select MVSs

No	District	Name of the MVS	Source	Units	Escherichia coli	Total coliforms
1	Shivamogga	Santhekadur	Raw water	*MPN/100 ml*	21	22
2			Treated water	*MPN/100 ml*	<1	<1
3			OHT water	*MPN/100 ml*	<1	<1
4		Holebenavalli	Raw water	*MPN/100 ml*	54	54
5			Treated water	*MPN/100 ml*	<1	<1
6			OHT water	*MPN/100 ml*	<1	<1
7	Tumkur	Doddanaramangala	Raw water	*MPN/100 ml*	<1	24
8			Treated water	*MPN/100 ml*	<1	12
9			OHT water	*MPN/100 ml*	<1	10
10		Brahmasandra	Raw water	*MPN/100 ml*	<1	28
11			Treated water	*MPN/100 ml*	<1	<1
12			OHT water	*MPN/100 ml*	<1	<1
13		Mayasandra	Raw water	*MPN/100 ml*	35	28
14			Treated water	*MPN/100 ml*	<1	<1
15			OHT water	*MPN/100 ml*	<1	<1

Observations on the results of Bacteriological Water Quality Analysis

a. All the five raw water samples contained E-coli or Total coliform bacteria.
b. Water samples from MVS Doddanaramangala in Tumkur district, for raw water, treated water and village level OHT water sample show presence of Total coliform bacteria.
c. No presence of E-coli is found in any of the treated water samples.
d. RDWSD may counter check the water quality of MVS Doddanaramangala, scientifically collecting water samples from multiple locations and conduct rigorous water quality analysis.
e. It is necessary to undertake an audit of the water treatment processes at MVS under O&M contract as well as analyse the quality of water supplied directly by Gram Panchayats from sources under their direct control.

5.1.11 Impact Due to Covid-19

Out of the 60 schemes, only 2 schemes (MVS Badali & 16 villages and MVS Yargatti & other 22 villages) were affected due to covid 19. Operations of these two MVS had to be suspended for a week as operator staff working in the plant got infected with Covid -19 and the plant was shut down for a week. Concerned GPs were informed that the water would not be supplied and were advised to make alternative arrangements for ensuring water supply.

5.2 Commissioning / Time overruns

The construction period varied for each of the Multi Village Schemes. Generally, the commissioning of a MVS is done once the successful trial run is completed within the defined construction period. However, the construction period for the 60 MVS ranged from 12 months to 36 months. Smaller MVS with a project cost of less than Rs.25 crore had a construction period of 12 – 18 months and 24 – 36 months for medium and large schemes. However, the date of commissioning varied due to delays on account of various reasons. Out of 60 schemes, 48 schemes had time over-run i.e delay in commissioning. Summarised details of time overruns are presented in the table below.

Table 31: Time over-runs in MVS implementation

Time overrun in months	No. of Schemes	Size-wise Time over-runs			Percentage
		Small	Medium	Large	
1 – 12 months	20	10	5	5	33.33%
13 – 24 months	9	7	2	-	15.00%
25 – 36 months	11	10	1	-	18.33%
37 – 48 months	2	2	-	-	3.33%
49 – 60 months	3	2	1	-	5.00%
More than 60 Months	3	3	-	-	5.00%
No Delay	12	10	1	1	20.00%
Total	**60**	**44**	**10**	**6**	**100.00%**

33.33% of MVS had time overrun of 1-12 months, 33.33% MVS had time overrun of 13 – 36 months and 13.33% schemes took more than 36 months. Only 20% of the schemes were completed on time. Major reasons for the time-overruns include: (1) delay in land acquisition; (2) change of location of WTP/IR; (3) delayed clearance from Forest department, NH Authority and Indian Railways.

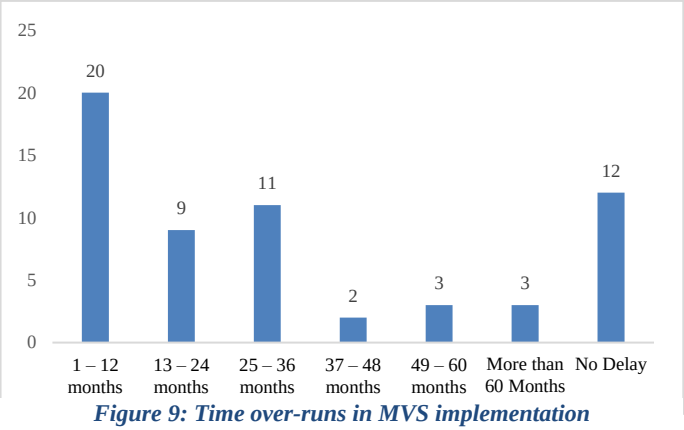


Figure 9: Time over-runs in MVS implementation

5.2.1 Design Period

Generally, the water supply schemes are designed for 30 years considering the life of the civil structure. However, the pumping machineries are designed for 10-15 years. In the 60 schemes, the project design life varies from 15 to 30 years. About 63.33% of the schemes have been designed for 20 years (38 MVS of 60), 28.33% of the schemes have been designed for 30 years (17 MVS out of 60). 3.33% of the schemes fall under 25 years of design life which is 2 schemes and balance 1 scheme under 15 years. Data for 2 MVS i.e MVS Nadavi and other 15 villages and MVS Hukkeri

& 27 villages was not available at the district level. The table below represents the number of schemes with their project design life.

Table 32: MVS - design life

Design life of the plant	Number of Schemes	Percentage
15 years	1	1.67%
20 years	38	63.33%
25 years	2	3.33%
30 years	17	28.33%
Not Available	2	3.33%
Total	60	100.00%

5.2.2 Balance Active Life of the assets

Based on the date of commissioning, the balance life is calculated. There are 5 categories under which the balance number of years of sampled MVS fall and these are: (1) 5 -10 Years (2) 11- 15 years (3) 16-20 years (4) 21 to 25 years; and (5) 26 to 28 years. About 35% of the schemes have an active balance life between 11 to 15 years, 28.33% of the schemes have active balance life between 16 to 20 years, 18.33% of the schemes have active balance life between 26 to 28 years. The table below represents the number of schemes spread across the balance life categories.

Table 33: Balance Active Life of MVS in years

Balance no. of years	No. of schemes	Percentage (%)
5 – 10	2	3.33%
11 – 15	21	35.00%
16 - 20	17	28.33%
21 to 25	7	11.67%
26 to 28	11	18.33%
Not available	2	3.33%
Total	60	100.00%

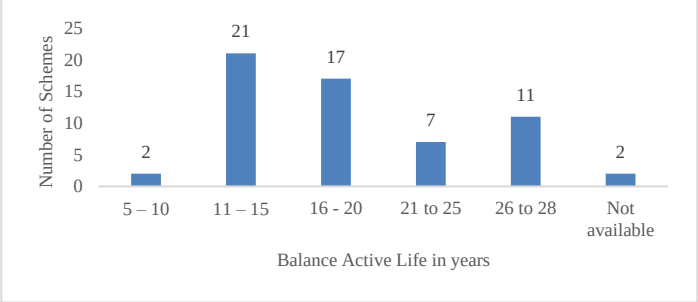


Figure 10: Balance Active Life of MVS in years

The implication of the above table is that RDWSD must provide budgetary allocation so to augment and modernize the MVS facilities so as to retain desired service level.

5.2.3 Cost overruns

Cost over-run is one of the biggest challenges facing the infrastructure sector and rural water supply sector is no exception. Out of 60 schemes, 32 schemes experienced cost overruns. Major reasons for cost overruns included (1) delay in providing the identified land (2) change of location of MVS components (3) rise in material price (4) delay in obtaining approvals from various departments such as Forests, NHAI, Indian Railways etc. Details of cost overruns are presented below.

Table 34: Cost over-runs of MVS

Details of MVS Cost Over-runs		
Category (Rs. in Crores)	No of MVS	%
No cost over-runs	28	46.67%
Less than 1 Crore	15	25.00%
1 to 6 crores	9	15.00%
6 to 34 crores	8	13.33%
Total	60	100.00%

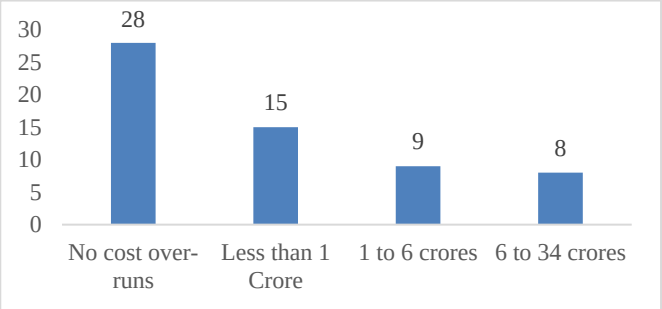


Figure 11: Cost over-runs of MVS

5.3 Per Capita Capex and Opex

Two important aspects under financial factor are the cost per unit incurred towards the capital expenditure and the operational expenditure. An amount of Rs. 2,879.85 crores have been spent towards the capital expenditure of the 60 MVS covered under this report. Of this, approximately Rs.1,822 crores have been spent on 6 schemes, MVS Nargund and Ron (DBOT Pkg-1-Gadag district), MVS Mundargi, Gadag and Shirahatti (DBOT Pkg-2-Gadag district), MVS Chamarajanagara (166 villages), MVS Gundlupet (131 villages), MVS Hullahalli & 123 villages (Mysuru district) MVS Arisikere (530 Habitations in Arisikere taluka of Hassan district). Remaining Rs.1,057.85 crores have been expended on 54 MVSs in the seventeen districts listed in the report. It is observed that the opex cost is calculated for the non-power category of expenses only. Following table makes a comparative per-capita cost assessment towards capex and opex.

Table 35: Distribution of MVS under per-capita capex and opex

Per-capita Cost-Capex	No. of MVS	Per-capita Cost-Opex/ year	No. of MVS
Rs.1,000 to 2,000	8	Rs.10 to 30	6
Rs.2,001 to 4,000	24	Rs.31 to 50	17
Rs.4,001 to 6,000	17	Rs.51 to 70	15
Rs.6,001 to 10,000	5	Rs.71 to 100	7
Rs 10,000 plus	2	Rs.101 to 200	8
Data Not available [38]	4	More than Rs.201	3
		Data Not available	4
Total	**60**	**Total**	**60**

[38] [1] Adaralli (Gadag district); [2] Markonahalli (Tumkur district); [3] Hanchipura (Mysuru district); and [4] Boggur (Ballary district)

Per-capita cost of DBOT Ron and Nargund - Package 1 in Gadag district stands at Rs.12,931 and is the highest among 60 MVSs included in the evaluation study. Similarly, MVS Arisikere taluka of Hassan district (530 Habitations) has a per capita cost of Rs.10,028. Other 5 schemes Brahmasandra and other 10 villages, DBOT Gadag, Mundargi and Shirahatti of Gadag District –

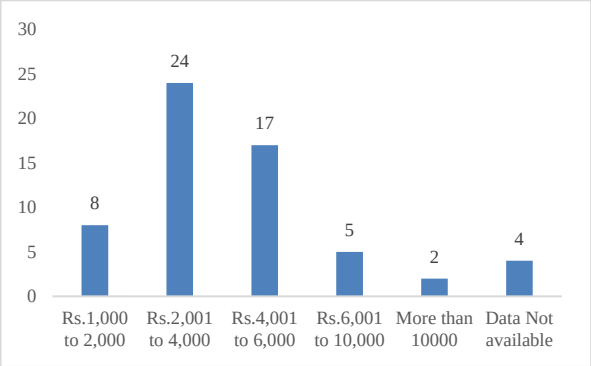


Figure 12: Distribution of MVS under per-capita capex

Figure 13: Distribution of MVS under per-capita opex

Package 2, Nagathan & other 53 habitations in Vijayapura taluka, Vijayapura district have a per capita cost in the range of Rs.8,000 – Rs.10,000. 49 Schemes out of 60 have per capita cost in the range of Rs.1,000 – Rs.6,000.

It is also noted that the per-capita cost towards O&M is very reasonable in 45 of 60 MVSs. But the per capita O&M is found to be higher in three MVS; Kanathur & 7 Villages, Tumkuru (Rs.225), Brahmasandra and other 10 villages, Tumkuru (Rs.227) and Inchageri & other 41 habitations in Indi taluka – Vijayapura (Rs.218).

5.4 Functionality of the Schemes

The Team assessed the functionality and operational status of all 60 MVS. Out of 60 MVS, 57 were functional and operational on the day of visit and I MVS was partially functional. During the survey it was observed that 2 schemes were not functioning: MVS Adralli and 37 villages in Gadag division and MVS Hullur & 5 villages in Raichur division were not functional on the date of visit. MVS Doddakavalande and 55 villages in Mysuru district was partially functional.

MVS Adralli (38 villages) has a floating barge to act as the Pump House and the same was damaged during the 2021 flood and has not been restored to working condition, seven months after the flood event. MVS Hullur & 5 villages in Raichur division was not functioning as the IR was under renovation. Water quality tests for the scheme source indicated the water to be non-potable. The quality issue emerged as water from the Impounding Reservoir seeped and

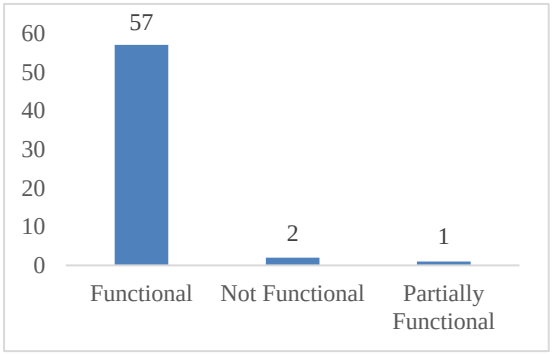


Figure 14: Functionality of schemes

mixed with groundwater. RDWSD is attempting to provide a polyethylene sheet cover at the bottom and sides of the IR so that seepage is arrested. MVS Doddakavalande and 55 villages is partly functional, as its pumping is alternative day based, as there is only one functional pumping unit, although the MVS was commissioned for more than 10 years. It was considered fully operational when all the villages were covered. Currently, the MVS Doddakavalande is not supplying to all 55 villages as the distribution network is damaged by other department while laying road and some of the villages have indicated that they would not take the MVS water. But there is no official record to certify that the GPs have communicated about their non-willingness to consume MVS water.

5.5 Assessing Delivery Performance of MVS

Parameters such as Frequency, Regularity and Adequacy are critical in assessing the delivery performance of MVS. It is necessary to develop an understanding of the meaning and implication of these three terms in the context of study, before proceeding to the analysis of the data.

Adequacy of Water Supply: Adequacy of water supply refers to design volume of water supplied on a per-capita basis. Design volume of water varies from 40 to 85 lpcd in the schemes studied. When adequacy is verified, one will examine the design capacity in terms of volume of water proposed to be supplied as per DPR and the demand in terms of population to be served. JJM has now recommended a national norm of 55 lpcd as a general norm of LPCD to be supplied through FHTC.

5.5.1 Frequency of Water Supply

Frequency is used in the context of study to mean number of hours (duration) of water supply. One has to examine, the timing of water supply and the duration of water supply in this context. People move out of their residences in the morning to their farms, work location, office or school, before which every household requires water supply. Under the parameter of ‘frequency’ how long and how often water is available gets examined.

Regularity of water supply

Regularity of water supply is used in the context of the study to mean the timing of supply of water and daily assured supply of water. It will also mean whether water is regularly supplied at a predictable time during the day. Regularity is the quality of being stable and predictable. Regularity is applicable at the level of Gram Panchayat and Households. At the level of the GP, the watermen need to know the timing of water availability from MVS sources, so that they can supplement MVS water from local water sources such as Borewells and in certain cases, rivers or lakes if such supplementary supply is required. At the level of the households, those who collect daily household requirement of water should have information on the timing of supply, so that they can be present at the household to collect and store water.

5.5.2 Adequacy of supply of Water from MVS

As mentioned above, of the 60 schemes, 44 are of small category, 10 are of medium category, 6 schemes are of large category. Large MVSs are distributed in four districts: (1) Gadag district has two large MVS; (a) MVS Nargund, catering to Ron and Nargund Taluks, is built and operated by Tahal Consulting Engineers Ltd; (b) MVS Mundargi covering Gadag, Mundargi and Shirahatti Taluks and is built and operated by L&T Infrastructure Development Projects Ltd. Chamarajanagar District has two large MVS: (a) MVS Gundlupet covering 131 villages and (b) MVS Chamarajanagara covering 166 villages. Both these MVSs are built and operated by Mega Engineering & Infrastructure Limited. MVS Arisikere in Hassan district supplying water to 530 Habitations in Arisikere taluka is the fifth large MVS, which is also built and operated by Mega Engineering & Infrastructure Limited. The sixth large scheme is MVS Hullahalli (124 villages in Nanjangud Taluk of Mysore district) and is built and operated by Mega Engineering & Infrastructure Limited.

Data with respect to these large schemes are available with the Operators to an extent. Both MVSs in Gadag district have installed Bulk Flow Meter at the Jackwell and WTP. But when it comes to metering of Village level OHTs, one village level OHT per village was metered and the original design was to supply water to the concerned village through the metered OHT and hence it becomes possible to generate data on water pumped, treated and distributed, whereas similar data for small and medium MVSs are not available to make a meaningful assessment. However, after commissioning of the MVSs, pressure mounted and the Operator firms were compelled to open supplies to all village OHTs, whether metered or not. Therefore, even in the case of large MVSs built under DBOT procurement instrument, there exists quite a bit of gap between planned designs and actual field level operations. Bulk flow meters are installed in all the other four MVSs in Hassan, Mysore and Chamarajanagar districts as well.

However, as no metering is available at the medium and small MVS, an attempt was made to assess the quantity of water supplied to the GPs through the qualitative data based on the number of pumping shifts per day, duration of one Shift (Hours), total pumping hours and the number of villages served. The details are as below.

Table 36: Duration of pumping in hours

Duration of pumping in hours	No. of Schemes	No. of GPs Covered	No. of Villages Covered	Volume of water supplied (MLD)*
Less than 8 hours	3	17	67	8.68
9 – 15 Hours	15#	140	406	41.44
16 – 20 hours	37	286	1493	181.79
21 – 24 hours	5	80	204	33.53
Total	60	523	2170	265.44

Source:* MVS operator, # 2 schemes are currently not functional due to repair and maintenance

The charts below indicate the category i.e Hours of pumping against number of schemes covered, number of Villages covered, Number of Schemes and Volume of water supplied per day. Data on adequacy of water for the two non-functional MVS was estimated based on operations during the functional period.

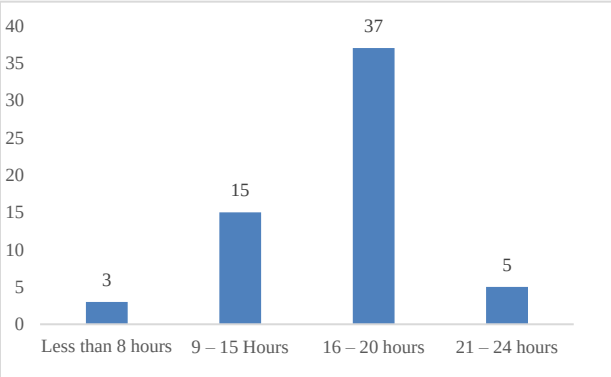


Figure 15: Duration of pumping in hours across 60 MVS

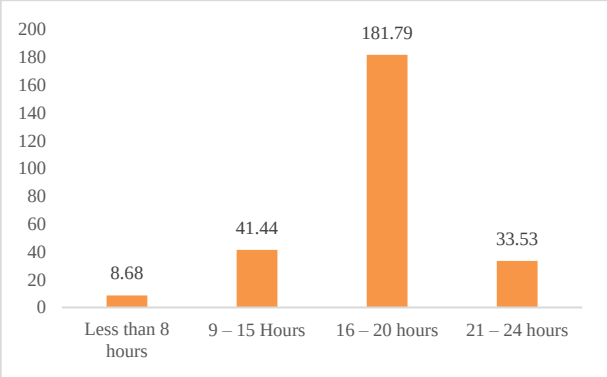


Figure 16: Volume of water supplied (MLD) against duration of pumping in 60 MVSs

From the above table and charts, it is inferred that the total water supplied is 265 MLD from 60 MVS covering a population of 4.7 million. The average per capita volume of water generated from these 60 MVS is estimated at 56 LPCD. This indicates that the MVS water supplied to GPs with respect to adequacy from the MVS is considered to be 100%. Though this statistical database points to generation of water equivalent to 56 lpcd and satisfies the norm of 55 lpcd of treated water proposed by JJM, the actual supply depends on the quality of infrastructure and operational management. Water supply engineering considers NRW- Non Revenue Water, treated water lost between the point of generation and distribution. Scheme design engineers in the State estimate an approximate loss of 15 to 20% between generation and distribution points. If the distribution loss is managed within 20%, it can be considered to be functioning quite well. Considering 20% loss, the average lpcd supply will fall down to 45 lpcd and the adequacy norm of 55 lpcd of treated water at FHTC will fail. Examining the generation, treatment and distribution data at MVS Gundlupet, it is found that the loss of water in treatment, processing and distribution can be greater. MVS Gundlupet, which has a SCADA system installed and functional, there is substantial loss between pumping and treatment locations, which are within 50 meters from each other, drawing raw water from perennial river Kabini. The table given below provides details of pumping, output in MLD at Jackwell and output from Clear Water Reservoir (CWR) for MVS Gundlupet for the month of February 2022.

Table 37: Details of pumping, output at Jackwell & CWR - MVS Gundlupet

Date of pumping (Feb 2022)	Duration of pumping in hours	Jackwell output in MLD	CWR output in MLD	Difference between Jackwell and CWR output	% of water loss	Daily loss on account of power (per MLD Power cost estimated @ Rs.2,956)	Daily loss on account of non-power (per MLD non-Power cost estimated @ Rs.2,294)	Total Financial loss per day (Rs.)
1	16.40	17.210	14.664	2.546	14.79%	7,526	5,841	13,367
2	16.30	17.926	14.939	2.987	16.66%	8,830	6,852	15,682
3	10.20	12.559	8.944	3.615	28.78%	10,686	8,293	18,979
4	16.30	17.433	14.911	2.522	14.47%	7,455	5,785	13,241
5	15.30	15.977	13.650	2.327	14.56%	6,879	5,338	12,217
6	17.20	18.410	15.729	2.681	14.56%	7,925	6,150	14,075
7	17.20	17.444	14.929	2.515	14.42%	7,434	5,769	13,204
8	17.00	17.553	14.902	2.651	15.10%	7,836	6,081	13,918
9	16.10	17.135	14.643	2.492	14.54%	7,366	5,717	13,083
10	15.10	16.390	13.493	2.897	17.68%	8,564	6,646	15,209
11	16.20	16.562	14.469	2.093	12.64%	6,187	4,801	10,988
12	15.20	16.294	13.676	2.618	16.07%	7,739	6,006	13,745
13	17.10	17.975	15.695	2.280	12.68%	6,740	5,230	11,970
14	17.20	18.200	15.671	2.529	13.90%	7,476	5,802	13,277
15	16.30	17.095	14.530	2.565	15.00%	7,582	5,884	13,466
16	17.10	17.698	15.671	2.027	11.45%	5,992	4,650	10,642
17	16.40	17.703	14.901	2.802	15.83%	8,283	6,428	14,711
18	16.10	17.330	14.719	2.611	15.07%	7,718	5,990	13,708
19	16.30	17.300	14.439	2.861	16.54%	8,457	6,563	15,020
20	17.05	17.783	15.179	2.604	14.64%	7,697	5,974	13,671
21	16.25	17.870	13.963	3.907	21.86%	11,549	8,963	20,512
22	17.10	18.071	15.441	2.630	14.55%	7,774	6,033	13,808
23	16.20	17.226	14.735	2.491	14.46%	7,363	5,714	13,078
24	16.20	17.330	14.633	2.697	15.56%	7,972	6,187	14,159
25	17.20	17.953	15.631	2.322	12.93%	6,864	5,327	12,191

Date of pumping (Feb 2022)	Duration of pumping in hours	Jackwell output in MLD	CWR output in MLD	Difference between Jackwell and CWR output	% of water loss	Daily loss on account of power (per MLD Power cost estimated @ Rs.2,956)	Daily loss on account of non-power (per MLD non-Power cost estimated @ Rs.2,294)	Total Financial loss per day (Rs.)
26	17.10	18.476	15.579	2.897	15.68%	8,564	6,646	15,209
27	17.20	18.246	15.642	2.604	14.27%	7,697	5,974	13,671
28	15.20	16.462	13.953	2.509	15.24%	7,417	5,756	13,172
Total	**454.50**	**483.61**	**409.33**	**74.280**	**15.36%**	**2,19,572**	**1,70,398**	**3,89,970**

However, the MVS have lot of potential to improve the service levels by maintaining records with respect to operations. The operational data with respect to number of hours pumped, power failures/shut downs, number of shifts, volume of raw water treated, volume of treated water supplied, inventory of alum and chlorine, stock register, etc., can be maintained by the operators which includes log books, stock registers or records. This would enable the department to monitor and make prudent decision while making payments. On the basis of the above table, annual financial loss on account of MVS Gundlupet alone will be to the tune of Rs.13928/day and Rs.50.835 lakhs per year and the cumulative loss in five year O&M contract would be to the tune of Rs. 2.54 crores. This conclusion is drawn from data available from Jackwell and WTP of MVS Gundlupet. The loss at the distribution level also needs to be accounted. Accurate and automated data records and book keeping is recommended on the basis of financial prudence. The data maintained at the MVS also could be erroneous and therefore, it has to be verified. MVS Gundlupet was studied as part of the pilot level investigation in December 2021 and the team revisited the MVS in May 2022 after almost 6 months and SCADA system, data maintenance and data storage, etc., were all as it was in December. Neither the Operator nor the department could explain the data maintained at the MVS. The above is an indicative case and needs to be investigated further.

5.5.3 Adequacy of MVS water at GP

The adequacy of water supplied in the GP was only limited to MVS water during the GP level discussion. Although the GP has other sources of water to provide to the villages / habitations, the dependency on MVS water is high. It is observed that the water supplied from MVS is partially adequate in all districts and to meet additional requirements they utilize the existing SVS or MWS that are still functional. Whenever the MVS water is inadequate, GP utilizes the existing SVS/MWS system to meet the demand gap. The Survey indicated that only 47% i.e 35 GPs opined that they get adequate supply of water from MVS.

5.5.4 Adequacy of water supplied to HHs (experimental Group)

Table 38: HH rating of satisfaction

MVS, Borewell, WPP		
Satisfied	1,917	85.43%
Not Satisfied	327	14.57%
Total	2,244	100.00%

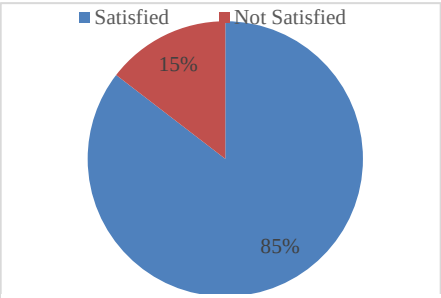


Figure 17: HH rating of satisfaction

As JJM is under implementation and the meters are being installed along with the house tap connection, the quantum of water consumed on daily basis was not assessable. However, based on the assets used by the households, attempt was made to assess the quantum of water consumed/stored. The assets used for storing water are mainly

of three categories that include drum and drum equivalent containers, sump or 'thotti'[39] and overhead tanks. It was noted that Households consumed water from multiple sources, such as MVS water, panchayat operated borewell, (SVS/ MWS/ PWS), WPPs for drinking and open wells / rivers (in case accessible). The drum and drum equivalent could store about 200 liters of water, sumps or thotti could store about 1000 liters of water and overhead tank about 500 liters of water. On this basis the per capita water consumption across 2,244 households surveyed (experimental group only) with a population of 11,213 the total water consumed per day is estimated to be 1.051 MLD, which translates to 93.81 Liters per capita per day. When it comes to satisfaction on adequacy of water at the household level (including borewell, WPP, MVS) the households survey indicated 85% satisfied, which is further split based on the basis of 'source of water'. The table below indicates the level of satisfaction with respect to 2,244 households in the experimental group.

Table 39: Satisfaction vis à vis source of water supply at household level

Source of Drinking Water	Number of Households	Percentage	No. of Households satisfied	% of satisfaction against total	Not satisfied	% of non-satisfaction against total
MVS Water	903	40.24%	852	37.97%	51	2.27%
Bore well water	248	11.05%	379	16.89%	75	3.34%
Bore well water + Water from WPP	21	0.94%	45	2.01%	38	1.69%
MVS Water + Bore well water	454	20.23%	209	9.31%	39	1.74%
MVS Water + Bore well water + Water from WPP	83	3.70%	19	0.85%	2	0.09%
MVS Water + Water from WPP	334	14.88%	160	7.13%	41	1.83%
Water from WPP	201	8.96%	253	11.27%	81	3.61%
Total	2,244	100.00%	1,917	85.43%	327	14.57%

The MVS alone serves 40% of the households surveyed, 20% is through MVS + borewell, 15% through MVS + WPP, 11% through borewells alone, 9% from WPPs, 4% from MVS + Borewell + WPP and 1% from borewell + WPP. Based on the field assessment, it was learnt that the households use MVS and Borewell for cooking and other household purposes but use WPP for drinking purpose.

[39] Thotti is a Kannada word for a water structure made of concrete. It is an open tank which can store water, built inside the house or on the backyard of the house or verandah.

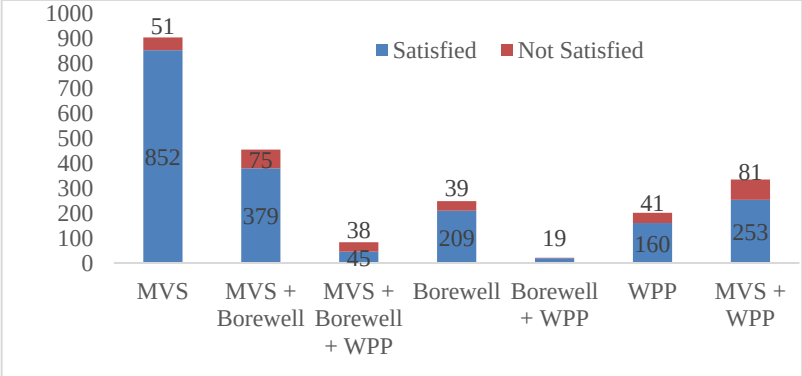


Figure 18: Satisfaction vis à vis source of water supply at household level

38% are satisfied with the adequacy of MVS water supplied, 30% who depend on multiple sources such as MVS, WPP and borewell water are satisfied when all three sources are made available, balance 17% are satisfied with the adequacy based on WPP and borewell water. 15% of the households informed that the water is not adequate. Satisfaction rating provided by consumer households raise a question on the relevance and utility of investment on MVS, as rate of satisfaction from exclusive MVS water consumers is limited to 38% of the total respondents. This calls for measures to improve service level, water quality and delivery performance of MVS in general.

With JJM (Jal Jeevan Mission) in progress, households are getting metered connections now. However, meter reading of water consumption, billing and collection are yet to commence at the GP level. The Team came across some villages, where household taps have been metered, though no reading is taken yet. The household level water meter has raised an alarm in the villages as villagers fear that water consumption is going to be measured and charged volumetrically. Hence, GPs and Households do not favour metered connections due to fears of being charged heavily. However, from a sectoral point of view, the time now is perfect for commencing meter reading and volumetric billing.

The Team came across three villages[40] where the meter was installed at household level three to four months prior to the village visit. Data from the household level meters are recorded and presented in the table given below.

5.5.5 Sample Water consumption data from Metered House Tap Connections

Water Consumption Trends (based on water consumption data) for a selected 49 households were taken from the GPs of Zalaki (Mailar village of Vijayapura district), Pattihal KB (Belgaum district) and Bagivalu (Hassan district) were taken and the following analysis was done.

[40] Mailar Village (Vijayapura district), Pattihal KB (Belgaum) and Bagivalu (Hassan)

Table 40: Analysis of metered water consumption from 49 households

No	Category of consumption in Litres per day per household	No. of Households in each category	Category Percentage
1	Less than 25 LPDH	4	8.16%
2	26-50 LPDH	1	2.04%
3	51-100	3	6.12%
4	101-200	8	16.33%
5	201-300	10	20.41%
6	301-500	8	16.33%
7	501-1000	3	6.12%
8	1001-2000	8	16.33%
9	2001+	4	8.16%
	Total	**49**	**100.00%**
	LPDH-Litres Per Day per Household		

Considering average consumption of 275 litres per day (for a 5-member family@55 LPCD), it is found that 25 households are consuming less than 275 LPDH, while 24 households are consuming much more than what is admissible as per the LPCD norms established by GoK/GoI. The following table makes a comparison of actual consumption and average consumption of the categories consuming less and more water than the LPCD norms prescribed by GoI/GoK.

Table 41: Analysis of metered water consumption in terms of LPCD

Category of Consumption	Total Number of Households in the category	Actual consumption in Litres	Actual LPCD consumption	Admissible consumption @55 LPCD for the category
Less than 55 LPCD	25	3,651	29	6,875
More than 55 LPCD	24	29,854	249	6,600

Against an allocation of 55 LPCD, average LPCD consumption in the 'more than 55 LPCD category' is 249 LPCD. Pricing of water is one sure way of controlling consumption and thus reducing expenditure and any possible wastage. Incremental Block Tariff may be introduced to dissuade households from excess consumption.

5.5.6 Adequacy of water supplied to HHs. (Control Group)

Similarly, an effort was made to find out the adequacy of water for the control group. In the context of the study, 'control group' is a group of households, distributed in 36 Gram Panchayats, who do not receive water from any MVS. The control group also had the similar water assets wherein they used to store water. Sources for water for the control group are from SVS/MWS/PWS with GP owned Bore well water, Water from WPP (RO) and own borewell or open well. A total of 218 households fall under the control group where the MVS water is not supplied. The table below gives the representation of the satisfactory levels across the sources that they are using.

Table 42: Adequacy of water supplied to HHs (Control Group)

Source of water	Satisfied	Percentage category wise	Not Satisfied	Percentage category wise	Total
Bore well water (SVS/MWS/PWS/Own)	142	82.08%	31	17.92%	173
Water from WPP (RO)	12	36.36%	21	63.64%	33
Bore well water (SVS/MWS/PWS/Own) + Water from WPP (RO)	10	83.33%	2	16.67%	12
Total	164		54		218

The drinking water source for majority (79.36%) of the control group is borewell (SVS/MWS/PWS/Own), WPP contribute to about 15.14% and balance is combination of borewell water and WPP. Based on the water assets the total water storage/ consumption, is estimated to be 79,000 litres per day for a population of 1,021 distributed into 218 households. The per capita water availability estimated is 77.37 liters per day. Though, this is below the 95 LPCD found under satisfied group in the MVS category, even the control group households also enjoy a service level above the 55 LPCD national norm. Considering the comparative cost incurred for the construction of MVS and SVS (control group draws water from non-MVS sources), 77 lpcd is very impressive in terms of quantity of water supplied to households. The result of the control group actually poses a challenge on the whole efforts, energy, investment made on MVS. Though the 'control group' shows a rosy picture, it faces an uncertainty in terms of adequacy of water supply. In the event of a below-normal rainfall, borewells which supply water to the control group may not yield desired quantity of water and may thus face a greater risk than the experimental group.

5.5.7 Frequency of Supply at WTP and GP/OHT

At the WTP level the number of hours of supply varies from 5 hours to 24 hours per day depending upon the network, number of MBRs and the terrain. It is observed that 37 of 60 MVS (61.67%) are pumping for 16 - 20 hours. Frequency of supply by MVS to Village OHTs is presented in the table below.

Table 43: Frequency (duration) of water supply from MVS

Frequency supplied by MVS (per day)			
5 – 8 Hours	9 – 15 Hours	16 – 20 Hours	21+ Hours
3	15#	37	5

Note: # 2 schemes are not functional due to repair and maintenance

Although 57 MVS are operating for more than 9 hours to 21 hours, there are no log books or water flow meters to record the data on frequency of supply. Whatever Log Books maintained do not have proper and specific data on operations including records of power failure during the day and actual duration of the operation of water pumps. The WTP operator and RDWSD officials are aware of this predicament. Therefore, frequency has been estimated, based on the inputs provided

by MVS operator. There is lot of scope for improvements in terms of operation and management of the WTP especially with respect to maintaining log books, records and documents. From the table above, the number of hours of supply to the GP/OHTs appears to be on the higher side, however, during the discussion with the GP members and the watermen, it was noted that although the flow of water is continuous, the pressure is not adequate to fill the overhead tank in a short duration. The villages which are closer to the MBR and the WTP get sufficient water and do not turn off the valves even after their quota for the day is over, which is leading to lack of supply or reduced supply at upstream and tail-end villages with reduced pressure. In villages where the MBR/WTP is at a closer proximity, the pressure is good enough to fill the village OHT in less than an hour. Example is the Sambra GP (MVS-Sulebhavi-Belgaum district).

5.5.8 Frequency of supply at Household level (Experimental Group)

Based on the observation at the household level, there are 5 categories of frequency irrespective of the water source. The water source as indicated above comprises of MVS water, Borewell water through piped connections of MWS, PWS, etc. The 5 categories of supply frequency are (1) less than 30 mins (2) Half an hour to one hour (3) One to Two hours (4) Two to Four Hours (5) More than Four Hours. Table below represents the frequency under each of the category.

Table 44: Category of Frequency in water distribution and Number of HHs in each Frequency Category

< 30 minutes	Half an hour to one hour	One to Two hours	Two to Four Hours	More than Four Hours	Total
109	505	765	308	557	2,244
4.86%	22.50%	34.09%	13.73%	24.82%	100.00%

From the table above it can be inferred that the frequency of supply between "One to Two hours" is the highest group with 34.09%, followed by supply of "More than four hours" category with 24.82% and 22.50% gets water for "Half an hour to one hour".

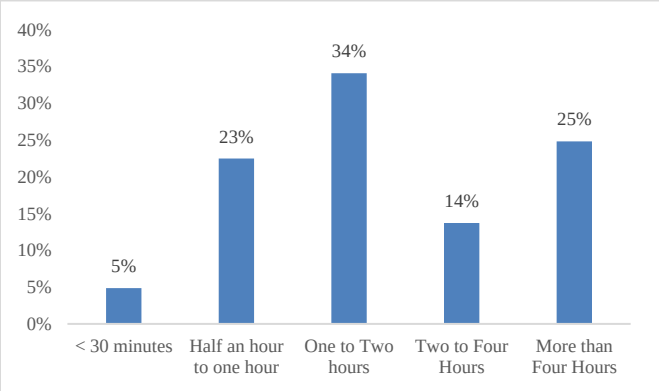


Figure 19: Category of Frequency in water distribution and Number of HHs in each Frequency Category

Although the frequency of supply to the village OHTs are on the higher side, the rate of consumption is much higher and the peak period of consumption is between 6 AM to 9 AM and 5 PM to 7 PM. In addition to the above, the frequency factor depends on the operation of zonal valves by watermen, terrain characteristics, quality of the distribution network (age / leakages) and disciplined water behaviour of the people at lower elevations or plains.

5.5.9 Frequency of supply at Household level (Control Group)

Even under the control group there are 5 categories of frequency. The water source as indicated above comprises of Borewell water through piped connections of MWS, PWS and cisterns, etc. The 5 categories of supply frequency are (1) less than 30 mins (2) Half an hour to one hour (3) One to Two hours (4) Two to Four Hours (5) More than Four Hours. Table below represents the frequency under each of the category.

Table 45: Category of Frequency in water distribution and Number of HHs in each Frequency Category

< 30 minutes	Half an hour to one hour	One to Two hours	Two to Four Hours	More than Four Hours	Total
20	24	65	33	76	218
9.17%	11.01%	29.82%	15.14%	34.86%	100.00%

From the above table, it is clear that 35% of households are in the highest frequency category with "More than four hours" of water supply, followed by 15% of households getting water for "Two to four hours" and 30% households get water for "One to Two hours". Improved duration of supply is however accompanied by complaints of low pressure at the tap and longer duration to collect daily requirements of water. The study team also noticed that some households were using energized mechanical devices such as tullu pumps to suck water out of the pipe network and reach water to storage assets such as drums, tanks, sumps, containers, etc.

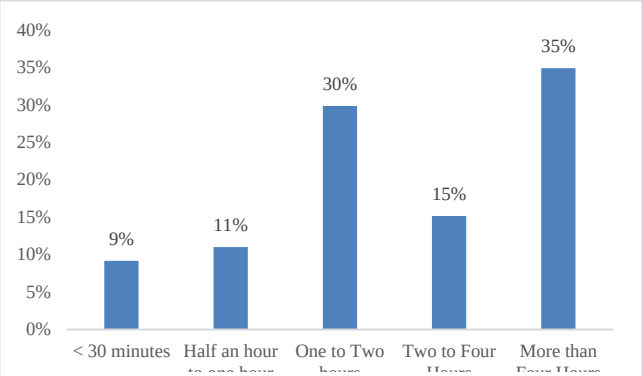


Figure 20: Category of Frequency in water distribution and Number of HHs in each Frequency Category

Comparing the performance under 'Frequency' parameter of 'Experimental' and 'Control' Groups, it is found that the experimental group is faring better in lower level of frequency, while Control Group is better poised at a higher frequency service level. However, higher duration or frequency of supply does not mean that adequacy, quality and sustainability are adhered. Although under the control group, water available is not treated, source is not sustainable and the pressure of supply is not adequate for the households to fill the needs within an hour such that they can carry on with their routine work. As already mentioned, while discussing the 'adequacy' factor, the 'control group' face the risk and uncertainty of seasonal variations in water yield due to below-normal rainfall.

Table 46: Category of Frequency in water distribution experimental and control group

	< 30 minutes	Half an hour to one hour	One to Two hours	Two to Four Hours	More than Four Hours	Total
Experimental Group	109	505	765	308	557	2244
	4.86%	22.50%	34.09%	13.73%	24.82%	100.00%
Control Group	20	24	65	33	76	218
	9.17%	11.01%	29.82%	15.14%	34.86%	100.00%

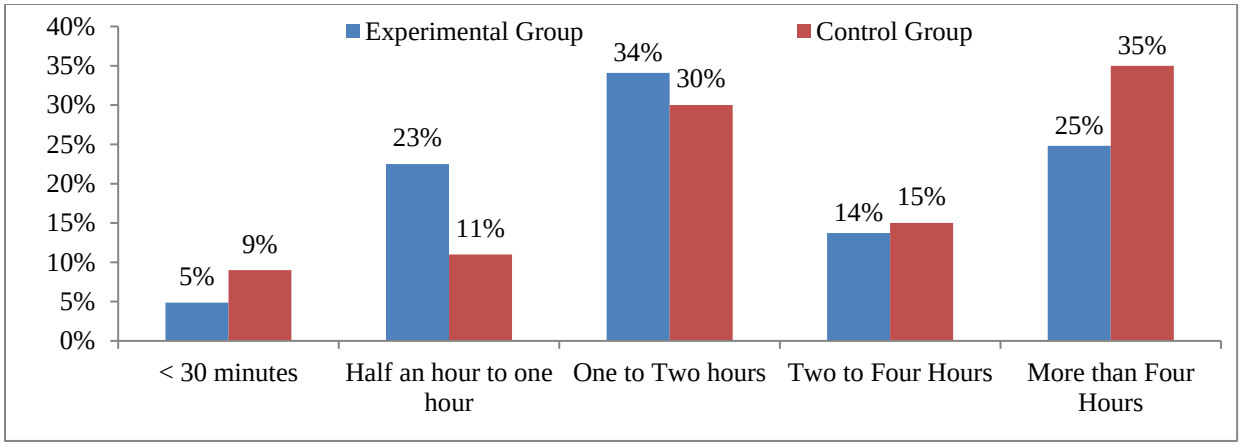


Figure 21: Category of Frequency in water distribution experimental and control group

5.5.10 Regularity of Water Supply from MVS

Out of 60 MVS, two (2) MVS are supplying on alternative days as the facilities are not adequate to supply on daily basis due to wear and tear of machineries and intermittent power supply. Two (2) more schemes are under repair and maintenance and they were supplying regularly on daily basis.

5.5.11 Regularity of Water Supply at GP level

Discussion with the GP members, VWSC, beneficiary community and watermen, 57 GPs confirmed the availability of MVS water on a regular basis. For example, if a village is getting water for 4 hours in a day from 10.00 am to 2.00 pm, then water is supplied day by day at the defined time by the MVS operator. The MVS operator informs the GP / watermen to make alternative arrangements in case of any breakdown in the network. 23% of the GPs confirmed that the MVS water is not available on regular basis.

5.5.12 Regularity of Water Supply at household level (experimental group)

At the household level 60% of the respondents informed that they get MVS water daily and 26% informed that they get MVS water on alternative days. Whereas 3% of the respondents informed that they get MVS water once in 3 days, while 11% get MVS water once in 4 days. Watermen by their experience of water distribution over the years, make distribution arrangements so as to reach water to every household as per frequency and regularity arrangements already decided informally by them. It was informed that as the distribution network is old and when all the valves are

simultaneously opened, the distribution network does not have the capacity to equitably distribute water. In addition to the above, the watermen informed that as the households are spread across, they have to ensure that all the households get water uniformly and hence operates valves as per a pre-determined schedule. Equitable distribution of water to a large extent depends on consumer behaviour also. Households at higher elevations and tail end villages will get water with good pressure only if the households near the OHTs/ plains/ lower elevations close their tap after collecting daily requirement of water volume. Such a behavioural tendency will happen only if water is volumetrically priced. Data on all households from 60 schemes across 17 districts with respect to regularity of supply is presented in the table below.

Table 47: Regularity of Water supply – Experimental and Control Group

Regularity of supply	MVS level	Experimental Group		Control Group	
		No. of HHs	Percentage	No. of HHs	Percentage
Daily	56	1,352	60.25%	171	78.44%
Once in Two Days	02	590	26.29%	10	4.59%
Once in three Days		65	2.90%	23	10.55%
Once in four Days		237	10.56%	14	6.42%
Not Functional	02				
Total	60	2,244	100.00%	218	100.00%

Regularity of Water Supply at household level (control group): With respect to regularity, 78.44% of the control group respondents informed that they get daily water. 21.56% of the respondents get water supply once in 2-4 days. From the above table it may be inferred that regularity of supply is much better in control group than experimental group. However, the source of supply is not sustainable and is not treated. Therefore, all parameters have to be considered to assess the supply of water. It may also be noted that once the JJM program is implemented then the entire villages will be covered with the same network and under the ambit of MVS supply.

5.5.13 Demand and Supply

To assess the actual water demand a bottom-up approach was adopted to assess the actual consumption. Although the volume of water supplied is not metered or there is no data to substantiate, an effort was made to assess based on the storage capacity in each of the households (2,462). The table below gives the representation of demand and supply.

Table 48: Demand - Supply gap

Demand		Supply	
Total water stored in all households (Liters)	Population (Nos)	Total water supplied from 60 MVS (Liters)	Population (Nos)
10,51,900	11,213	26,54,40,000	47,28,813
Per-capita Demand (Liters)	93.81 (94)	Per capita supply (Liters)	56.13

Gap between Demand and Supply (Liters)	94-56=38. But if a 20% NRW is calculated on the MVS supply, its share of LPCD will drop to 45 and consequently the gap will increase to 49 lpcd.

Based on the storage capacity, the total water stored is 1.051 Million liters and the total number of population served across 2,244 households is 11,213. Therefore the per capita consumption works out to be 93.81 liters, say 94 litres.

On the supply side, based on the quantum of water pumped is 265 MLD from the 60 MVS covering a population of 4.7 million. The average per capita volume of water generated from these 60 MVS is estimated at 45 LPCD after deducting NRW to the tune of 20%. Therefore, the difference between demand and supply per day is 49 LPCD is met by other sources such as borewells, panchayat cisterns, WPP etc. The above demand does not include any institutions, Anganvadis or any other establishments. However, considering 20% loss in the system, the total quantum of water pumped would be 212 MLD. Therefore the per capita consumption for a population of 4.7 million would be 45 LPCD.

5.6 Coordination between RDWSD and Gram Panchayats

There is lot of scope for improved coordination between RDWSD and GPs. Some areas for coordinated functioning of both the institutions include: (1) guidance to GPs in managing water quality related issues, especially with regard to borewell sources; GPs have been trained to undertake periodic testing of water quality using FTKs and in case of any 'beyond-limit' findings from FTK tests, the RDWSD needs to be informed and advice sought to address the issue; (2) GPs pay fixed power charges and other punitive fees towards power connection from ESCOMs. RDWSD may make an assessment of the water requirement and advice GP on operating the optimum requisite number of borewells, disconnection of defunct borewells and an aggressive IEC/BCC campaign undertaken on judicious and disciplined use of water; (3) Currently, RDWSD and GPs are in close contact and coordination with regard to planning and implementation of JJM, under which VAPs have to be prepared and subsequently implemented; (4) RDWSD and MVS operator need to provide advance information to GPs when MVS is shut down due to various reasons and water supply is disrupted, so that GP makes alternate arrangements from its sources to resume water supply as well as advice consumer public regarding storage, judicious and disciplined use of water; (5) RDWSD and GP need to coordinate for the constitution, strengthening, capacity building and empowerment of VWSCs in the GPs.

5.7 District Coordination Committee

Draft O&M Policy 2021 for the rural water supply sector of Karnataka envisages RDWSD as a Technical Backstopping institution for the GPs. However, on a practical level, due to acute shortage of staff in the RDWSD, day to day coordination of rural water sectoral activities has become difficult. Hence, the coordination between RDWSD and GPs currently is limited to the implementation of JJM as well as to respond to emergency support requests from GPs. Institutional

dichotomy between RDWSD and GP need to be addressed for smooth institutional coordination. This is on the ground that GPs are under the administrative control of Taluk Panchayats, Zilla Panchayats and the department of Panchayat Raj, while RDWSD is under the administrative control of Rural Development Department. This makes it necessary to have an institutional coordination arrangement at the district level. The Draft O&M Policy for rural water sector-2021 proposed a Coordination Committee at District level to coordinate rural water supply related functions and to sort out issues that occur from time to time between departments. The DCC may consist of Deputy Commissioner as chairperson, CEO of ZP and EE of RDWSD as members. The CEO is the convener of the committee. Key function of the committee is to resolve issues relating to operation and maintenance of MVS in the district. It will be desirable to invite district level chiefs of the ESCOM, KRDCL, NHAI, Groundwater department, Water Resources Department, Forest department and District Police (both law & order and traffic divisions) into this committee to discuss and sort out issues that occur from time to time. EE- RDWSD needs to work in close coordination with CEO-ZP and may be nominated the member secretary of DCC.

There is a strong need for such coordination arrangements as incidence of damages to existing water supply system such as raw water rising main, clear water transmission mains, major distribution network, etc., are caused by third party interventions including other departments, contractors/ agencies. The damage causing agency needs to pay adequate compensation for restoration of infrastructure and water supply service, for which the cost shall be borne by the damage causing institution/ party/ department/ contractor. Support of the district police and DCC are required to address unauthorized tapping of water, illegal connections and vandalism, which affect uninterrupted supply. Another relevant role of DCC is for resolving issues in making sure that there is uninterrupted supply of power to MVS from express feeder line of ESCOM. Clear definition of roles and responsibilities of RDWSD, ESCOMs and KPTCL or such other power distribution company or agency needs to be defined to support smooth operation of MVSs. Thus District Coordination Committee shall be an institutional mechanism at the district level to resolve issues relating to the uninterrupted power supply.

5.8 Mechanism for charging water tariff based on type of consumer and collection method

Water tariff is a price assigned to water supplied by a public utility, a PRI or a community water supply institution, measured in lump sum or units such as kilo litre which when notified needs to be collected. Government of Karnataka issued Policy for operation and maintenance of Rural Water Supply Schemes through a Government Order vide GO No: RDP 12 RWS (4) 2011(p) dt: 12.03.2013. Subsequently, a Government Circular No: RDP 128 RDWS (4)13 dt: 29.08.2013 was issued whereby Gram Panchayats are empowered to fix water tariff, collect and revise rates from domestic and commercial users. In order to ensure that schemes are effectively operated and maintained, GoK decided to outsource O&M of MVSs for bulk supply to private operator firms vide GO issued on 12.03.2013. Further, GoK vide reference Government Order No: RDP 215-RWS (5) 2013 Bengaluru, dt: 22.07.2014 and Government Circular No: RDP/14 RWS (5) 2016

Dated 18.03.2016 notified RDWSD to fix Bulk Water Meters and collect bulk water tariff from GPs towards the supply of water from MVSs and further empowered GPs to collect tariff from various users as per rates fixed. Over and above the previous Government Orders and Circulars issued by RDWSD, a fresh GO has been notified vide (Government Order No: RDW&SD/121/CE/Technical/2020, dated 30.12.2020) with regard to charging bulk water tariff from GPs for the bulk water supply GPs are receiving from Multi Village Schemes.

There is a provision to collect water tariffs for providing drinking water and other purposes under Karnataka Panchayat Raj act 1993 section 199(2). The respective gram panchayats are remitting O&M and energy cost for piped water supply & MWS in their respective villages. But the O&M cost for the MVS is been remitted by the panchayat raj & engineering department. No rates are fixed for Non-Domestic Bulk water Supply. While NRDWP was under implementation, 15% of the total grants were set apart for O&M. NRDWP guidelines also had another condition that at least 50 % MVS O&M cost need to be paid by users. To monitor water usage of MVS, the GO issued in 2014 (GO No: RDP 215-RWS (5) 2013 Bengaluru, dt: 22.07.2014) advised to install bulk water meters to the village OHTs or GP near main water distribution valves. Entrepreneurs, hospitals, schools / colleges & industries for drinking water purpose are also required to pay water tariffs. GO No: RDP 215-RWS (5) 2013 Bengaluru, dt: 22.07.2014 directed to charge water tariff as per details below.

Table 49: Water tariff as per GO issued in 2014

No	Category of Consumer	Tariff Rs. Per kL.
1	Gram Panchayat supply for Family Housing	Rs. 05
	Tariff for bulk consumers	
2	Orphanages, Old age homes, Physically Challenged Residence, Ashrams, Specially with meters.	Rs. 02
3	Government schools & Training institutes with meter.	Rs. 10
4	Private schools & Institutes uses particularly Bulk Water Meters.	Rs. 15
5	Government Hospitals with meter.	Rs. 20
6	Private Hospitals with meter.	Rs. 50
7	Entrepreneurship and Industry uses with meter.	Rs. 60

The above referred GO, though issued in 2014, was not implemented as installation bulk water meters did not make progress. Besides the above, a further GO was issued (Government Order No: RDW&SD/121/CE/Technical/2020, dated 30.12.2020) in December 2020, and fixed bulk water tariff at Rs.5/kL. Installation of bulk water meters is being estimated and included in JJM estimates and it is hoped that bulk water tariff will get implemented, atleast subsequent to the implementation and completion of works under JJM. However, as shown above with regard to GO issued in 2014, differential tariff rates were introduced for various category of users. However, GO issued in December 2020 has fixed a flat charge of Rs.5/kL from all consumer categories. GO issued in 2014 required Taluk Panchayat and RDWSD to collect tariff amount and deposit the same in

District Drinking Water & Sanitation Mission Account. The DWSM was to utilize funds from this account for O&M activities of the MVS.

Further to the above GOs (issued in 2014 and 2020), a comprehensive draft O&M policy was prepared by RDWSD in 2020-2021. This draft O&M policy was discussed with various government departments, sectoral experts and was uploaded on the websites of RDPR and RDWSD for public review and feedback. However, the policy document remains in draft form and has not been notified till date.

5.9 Procurement in rural water supply sector

The Karnataka Transparency in Public Procurements Act, 1999 and its subsequent amendments are followed in procuring goods, services and consultancies by RDWSD. Adherence to the above Act ensures transparency. On a day to day basis, revenue and expenditure are maintained in RDWSD, following procedures established under business of transaction rules. Further to the KTTP Act, E-Procurement (Electronic Procurement) has been introduced in procurement in Government of Karnataka. E-Procurement began with seven departments under Government of Karnataka and has been extended to all government departments by 2010 and has done away with irregularities in the processing of tenders and public transactions. E-governance department of the Government of Karnataka is the nodal agency implementing E-procurement for all the departments of the state. RDWSD is following KTPP Act and E-Procurement system for its tendering process.

5.10 Administrative Approval Limits

Government Order No. RDD/RDWSD/192/2019-20 dated 20.06.209 has been issued by GoK with regard to Administrative Sanction (AS) and Technical Sanction (TS). Following table provides details of approval limits

Table 50: Financial limits of approval authorities

Administrative Approval		
No	Administrative Authority	Financial Limits
1	Cabinet	More than Rs.10 crores
2	Principal Secretary – RDPR Dept	More than Rs.5 crores and up to Rs.10 crores
3	Commissioner- RDWSD	More than Rs.2.5 crores and up to Rs.5 crores
4	CEO- Zilla Panchayat	Up to Rs.2.5 Crores
Technical Sanction		
1	Chief Engineer	Above Rs.5 Crores
2	Superintendent Engineer	More than Rs.100 lakhs and up to Rs.5 crores
3	Executive Engineer	More than Rs.10 lakhs and up to Rs.100 lakhs
4	Assistant Executive Engineer	Up to Rs.10 lakhs

RDWSD is following the above procedures and processes in procurement and awarding of contract.

5.11 Subsidy and concession

Availing subsidy and other concessions available under various policies meant for poor, SC, ST and other weaker sections of the society.

JJM guidelines issued by Ministry of Jal Shakti, Government of India have made certain special provisions towards the benefit of SC and ST communities. The JJM Guidelines assures that the component towards SC and ST indicated in the sanction orders shall be used by States/ UTs for execution of rural water supply schemes to provide FHTCs to rural villages/ habitations having majority of SC/ ST population in the proportion prescribed. Under criteria for allocation of funds to States/UTs, rural SC and ST population is included as criteria and weightage thereof, and 10% of fund allocation under JJM both for budgetary and extra budgetary resources will be allocated as per figures of last Census (2011). It lays down other provisions such as allowing washing and bathing complex for poor, landless and in SC/ ST habitations as per need. Drinking water needs at the Habitation level with a group of minimum 20 households and/ or 100 persons or in hilly/ tribal and forested areas, and SC/ ST dominant habitations having lower number of households and/ or persons, are also to be covered with FHTCs.

5.12 Institutional aspects

5.12.1 State Water and Sanitation Mission – Apex and Executive Committees

The concept of State Water and Sanitation Mission (SWSM) started in 1999 for coordination, convergence and policy guidance at the State level, headed by Chief Secretary of the State. The SWSM would have two sub-committees: (1) The Apex Committee, and (2) The Executive Committee[41]. As per GO No-RDP/19/RDWSD/JJM/2019-20 dated 1303.2020, three State level committees have been formed to facilitate and support the implementation of JJM. These committees include: (a) Apex Committee; (b) Executive Committee; and (c) State Level Scheme Sanctioning Committee (SLSSC). Development Commissioner, GoK is the chairperson for Apex committee and commissioner- RDWSD will act as the member secretary to the Apex committee. The executive committee is headed by Commissioner RDWSD and Chief Engineer- RDWSD acts as the Member Secretary of the Executive Committee. The Apex committee is responsible for the overall planning, strategizing and implementation of JJM in the State. The Executive committee is expected to support in the creation of DWSMs, ensure necessary capacity building, regular monitoring of the functioning of DWSMs, coordination, collation of information and finalize Annual Action Plans (AAP). The Executive Committee also shall monitor the physical and financial performance and management of the water supply projects. The SLSSC approves such water supply schemes which are not under the purview of DWSM as well as provides Administrative Approval to project proposals. The SLSSC also accords approval for the Annual Action Plan (AAP).

[41] JJM Guidelines- Page-28

5.12.2 State Technical Agency

STA was constituted with experts from State rural water sector for evaluating the technical and economic viability of proposals. STA provides approval to the technical design of schemes. The STA examine the rural water supply proposals referred to it by RDW&SD. STA also acts as a State Referral Committee to give necessary technical advice to the State of Karnataka, besides associating with Research & Development programs of Rural Water Supply sector under the Support Activities component of JJM. Please clarify the same.

5.12.3 Other Committees

Other committees and institutional arrangements include Tender Accepting Authority as per financial limits for approval. Tender Approval Committee is headed by Principal Secretary RDPR Department. Tender Scrutiny Committee is also constituted to scrutinize works costing more than Rs.5 crores. The Tender Acceptance Authority will constitute the Tender Scrutiny Committee (TSC) and the Tender Approval committee (TAC). The Tenders evaluated by RDWSD as per the evaluation criteria set out in the tender document and will prepare the technical evaluation report. The technical scrutiny committee will review the technical evaluation report, while Tender Approval committee (TAC) gives final approval. Besides the above, there is also a variation committee in place and was formed to examine variations in project cost and accord approval against sufficient justification.

5.12.4 Village Water and Sanitation Committee (VWSC)

Government of Karnataka issued a notification having No. RDP 507 GPD2019 dated 09-09-2020 and is in accordance with Karnataka Gram Swaraj and Panchayat Raj (Rural Water Supply and Sanitation Committee) Rules, 2020 framed under the provisions of Karnataka Gram Swaraj and Panchayat Raj Act, 1993 (Karnataka notification No. 14 of 1993) read with section 58 -E, 61 (A) 75, 76, 77, 78 and 79 and exercising the powers vested under sub section (1) of Section 311. This notification is regarding the constitution, roles and responsibilities of VWSC. It is noted that the powers and functions of VWSC under the above notification is more of advisory nature. VWSC is expected to assist the Gram Panchayat in functions relating to water and sanitation. Involvement of women in decision making like planning, implementation and management of water supply system is very limited in the scope of the rules issued as above. The VWSC, according to the above rules notified shall have 50% of women members.

5.12.5 Joint Committees

Government Order No. RDP/240/RWS/2015 Dated 13.05.2016 is about establishing Joint Committees for MVS. The Preamble to the GO referred above mentions laudatory principles guiding the functioning of RDWSD under GoK. Such principles include: (1) provision of water and sanitation services is demand driven; (2) participatory approach; (3) decentralized decision making process; (3) inclusiveness; (4) accountability of stakeholders and (5) integrated planning and implementation of water supply, health and sanitation services for sustainable operations and maintenance and ensuring maximum health benefits to people. RDWSD considers the Gram

Panchayat as the focal point for all water delivery systems at the local level and VWSC as a sub-committee of GP will perform the water and sanitation functions for the GP.

An arrangement similar to VWSC at GP level was envisaged for Multi Village Schemes and the GO No. RDP/240/RWS/2015 Dated 13.05.2016 has been issued to facilitate the formation of Joint Committees for MVS. The Joint Committee shall consist of: (1) All GP Presidents in the MVS area; (2) EE – RDWSD/PRED; (3) TPO/s; (4)AEE –RDWSD; (5) AEE- ESCOM; (6) Three experts from the MVS area from health/sanitation/education//social service; (7) AEE- RDWSD, where the head-works of the MVS is situated to act as the Member Secretary of JC; (8) All PDOs of participating GPs, with the PDO of the GP where the headworks are located acting as the Joint Member Secretary.

Key functions of the JC include: (1) to look after planning, implementation and post-implementation O&M; (2) to own and manage the MVS assets and to act as the Apex Management body of the MVS and coordinate the stakeholders; (3) to assess the techno-economic feasibility of the MVS during initial planning and to consult all VWSCs falling in the MVS area; (4) to look after the quality and quantity of water supplied to villages under the MVS jurisdiction; (5) to levy bulk water tariff from the participating GPs; and (6) to resolve disputes that may arise between or within the GPs in the MVS area;

It was proposed to have two standing committees for the JC and these include: (1) standing committee on works and (2) standing committee on finance.

One of the objectives of Multi Village Scheme is to enable communities to monitor and maintain surveillance on drinking water source and supply system. The Joint Committee was a good institutional mechanism to facilitate participation of stakeholders atleast at a representative level and to open channels of dialogue with VWSCs. None of the MVS visited by the Team appeared to have a functional Joint Committee. Though participation of stakeholders is stated as an objective of MVS, it is not realized at a practical level, as there is hardly any participation for communities in monitoring MVS functioning as well as in exercising surveillance on drinking water supply system. Planning, implementation, operation and maintenance of MVS is more of a technical function and responsibility of RDWSD, with hardly any involvement or participation of communities.

5.13 Strengthening of PRIs and communities

Strengthening of PRIs and communities and enabling them in planning, operating and maintaining the entire system of water supply is a dire need as the long term intention of the Government is to hand over the entire water supply system to these institutions.

Though the intention of the government is laudatory and genuine, there has been little follow on steps to realize the intention. Hence, it remains as a good intention statement and does not go

beyond that in practice. The current situation at the level of Gram Panchayat itself is not very much in the 'participatory' mode in the operation, maintenance and management of SVS and in-village distribution of MVS water supply. Instances for MVSs being handed over to GP was found as detailed under 6.1.2 page 78 of this document. Participatory management in local level water distribution at GP level has to travel very far on the practical pathway.

5.13.1 Role of NGOs

Role of NGOs, Civil Society Organizations (CSOs) to assist community participation in planning, implementation, operation and maintenance was examined. Involvement of NGO is envisaged under JJM for facilitating the implementation, operation and maintenance of in-village water supply infrastructure[42]. NGOs shall work as 'Implementation Support Agency (ISA)' under JJM. Roles and Responsibilities of ISA under JJM will include: (1) preparation of model management contract at village level for in-village water supply services; (2) act as partners in mobilizing and engaging the communities to plan, design, implement, manage, operate & maintain in-village water supply infrastructure; (3) undertake IEC campaigns on judicious water use and O&M support; (4) facilitate women participation at all levels of planning, implementation, management, operation and maintenance of in-village water supply systems and contribution; (5) facilitate constitution of VWSC and build its capacity; (6) handhold GP and VWSC with regard to the JJM; (6) motivate households to adopt and own FHTCs; (7) use PRA tools for community mobilization and undertake IEC/BCC campaigns. ISAs are appointed in all districts of the State and mainly focus on IEC and capacity building. IEC activities undertaken by ISAs in Karnataka include: (1) Street play; (2) workshops; (3) rejuvenation of small water bodies; (4) exposure visits; (5) SHG rallies; (6) Awareness activities and screening of short film on health and hygiene in community; (7) campaign for community contribution; and (8) School level competitions such as essay writing, painting and debates. Besides undertaking these IEC activities as above, ISA is also expected to support in organizing Special Gram Sabha for JJM, Training PRI members from GP, TP and ZP, training VWSC members and grassroots workers from GPs. Involvement of NGOs (ISAs) is limited to the support in planning and implementing JJM in Karnataka. NGOs or CBOs have no involvement in planning and implementing MVS.

5.14 Infrastructural Capital, Operations and Maintenance - MVS

Water Assets- Design, Planning and Implementation of MVS: There is substantial investment in all surveyed districts with respect to water assets, which include Multi Village Schemes (MVS), Single Village Schemes (SVS) Mini Water Supply Schemes (MWS) and Water Purification Plants (WPP). MVSs are of different sizes in terms of their coverage (Small, Medium and Large). There is lot of asset focus than service level focus. Gadag district for example has two large MVSs covering the entire district. Parallel to these large MVSs, small and medium MVSs also are operating. MVSs sourcing water from surface sources have become common in the new millennium. There are cases in the field, where smaller MVSs are functional in part, as certain

[42] JJM Guidelines (Page-42)

components of the WTP such as Aerator, Chlorinator and Flash Mixer, etc., are not operated. Since the operations of MVS are not fully satisfactory, community turns to WPP to purchase water at a rate that appears insignificant in a single event occurrence. But on a monthly basis, even price of WPP water also adds up to an amount probably higher than the monthly water tax households pay to GP. Construction of MVS generally have got into time over-runs, the reasons for which include: (1) delay in getting land for construction of MVS infrastructure; (2) Variation of design; (3) Change of location of infrastructure; and (4) Poor capacity of Contractors. It is also pointed out that participation of the community, GPs and VWSCs is not ensured in planning, implementing, operating, maintaining, managing and monitoring MVSs. The study team also noticed that certain work items included in the contract do not appear to have been implemented: (1) Road from Jackwell to WTP at MVS Kanavi- Vijayanagara; and (2) Compound Fencing with barbed wire for MVS MM Vada in Vijayanagara; compound fencing with barbed wire for MVS Nadavi in Bellary district

5.14.1 MVS Contracts

Government of Karnataka took a bold decision to engage private sector contractors to operate and maintain MVS, mostly adding the O&M responsibility to EPC or DBOT contracts. However, except larger players in the market, the quality of services provided by local level MVS contractors needs substantial improvement. Hence, capacity building of the private contracting industry in rural water sector also needs to be strengthened and supplemented. The study team has come across instances of sub-contracting of the O&M contracts, for which there is no documentary evidence. Billing and payment requests are made in the name of the legal contractor, though actual ground level operations are undertaken by another informal entity. Yet another observation is that there is a lack of technical expertise in the operations and maintenance of MVSs. RDWSD favours a 10-year initial O&M contract instead of the current five-year O&M contract. Strengthening of O&M contracts is very much required and need to include Key Performance Indicators (KPIs), adding stringent conditions of O&M, accountability, penalty, reporting, documentation, qualification of staff and data maintenance provisions. No decent facilities such as toilets at the WTP, chairs, tables, cots and beds, are provided to the staff that operates MVS. In the next O&M contract, a punch list on works that are to be undertaken to improve the system are to be prepared and the same shall be made part of the O&M contract estimate and it becomes binding on the MVS operator to address items listed in the Punch List.

5.14.2 Challenges in the O&M of MVS

Challenges of MVS and GP level are summarised below in the framework of sustainability pentagon consisting of Natural Capital, Physical Capital, Finance Capital, Human and Social Capital and Governance and Institutional Capital

Table 51: Challenges in O&M of MVS

No	Components of Sustainability Pentagon	Challenges at MVS level
1	Natural Capital	1. **Water Quality:** Iodised salt used in the chlorine generation units of MVS. Though, there was no recommendation to this effect from any authorized quarter, many MVS operators had stocked iodised salt packets at WTP. RDWSD doesn't have a mandate to recommend chlorination of water from iodised salt. 2. Sourcing water for MVS from unhygienic locations (Shimoga and Mantralaya) 3. Sustainable supply of water for MVS with Impounding Reservoir based on High Level Canals is a challenge.
2	Physical	1. Focus of MVS is still on building technical infrastructure and not service delivery and sustainability 2. Illegal connections and illegal tapping of water 3. Frequent third-party damages on the major distribution network 4. 'Breaking of Air Valves' for feeding livestock 5. Natural disasters like flooding adversely affect the MVs operations by chocking pipes and slow sand filters in smaller 6. Non-synchronization of power supply for various components of MVS; ESCOMs share power supply from dedicated express feeder lines meant for MVS. 7. Timely support is not provided in rectifying power failures and fluctuations. 8. Bulk water meters are not installed at WTP and Village OHTs so as to measure volume of water supplied to villages/ GPs. Where Bulk water meters are installed, large number of them is not functional. 9. Social conflicts between RDWSD and Farmer groups over sharing of water from irrigation canals especially for drinking water purposes. 10. Maintenance of records and documents (Log Book, Stock Registers and Attendance register) is poor and require improvement; power failure and subsequent disruption of pumping is not recorded in the Log Book; 11. Tail end villages experience insufficient supply of water and low pressure 12. MVSs built under Jal Nirmal Project need improved and full-fledged WTP (MVS Basarakode); 13. WTP is operated at a lower level capacity than provided for in the O&M contract; 14. Pollution of IR/ Water Source from Rice Mill in the surroundings of the WTP (MVS Boggur); 15. Lack of hygienic maintenance of WTP: (1) operator staff maintaining livestock in the WTP premises; (2) operator and family do not have a Toilet at the WTP and resort to open defecation; (3) free and unrestricted entry for people, vehicles and animals that have no connection to the

No	Components of Sustainability Pentagon	Challenges at MVS level
		WTP; (4) villagers are drawing more water than the designed capacity of 55 LPCD, considering the requirement of livestock. (Shivamogga) 16. Water is not disinfected before distribution at MVS-WTP. 17. Poor maintenance of WTP (a) Manhole on the CWR open, inviting insects, rodents, reptiles, etc., inside); (b) unhygienic maintenance of CWR, filter beds, clari-flocculators, sedimentation tank and water channels in the WTP; (c) Algal growth by the side of the CF was noticed, indicating that cleaning has not been undertaken for several months at a stretch. 18. Filter media is not replaced periodically. Replacement of filter media is usually not included in the O&M estimate and hence results insufficient filtration and affects water quality. 19. ESCOM maintains Transformers upto 100 KVA, while beneficiary establishments like RDWSD or MVS Operator have to maintain Transformers above 100 KVA. In the event of Transformer breakdown, replacement of transformers takes 90 to 120 days and water supply gets affected; 20. Efficiency of operations (Frequency, Regularity, and Adequacy of water supply) could not be verified or assessed in the absence of data, records and documents.
	Finance Capital	1. MVS operated and run purely on governmental subsidy. Does not generate any revenue by way of bulk water charges, despite O&M Policies and Government Orders to this effect notified. Neither ULBs nor GPs pay bulk water tariff to RDWSD.
	Human and Social Capital	1. Political pressure on the Operator to engage labourers at the WTP from among the followers of the leaders. If the Operator fails to comply with the request, various agitation measures such as holding dharna, putting a siege on the WTP and blocking staff from entering the WTP premises, etc., are resorted to and hamper the functioning of MVS.
	Governance and Institutional capital	1. Delayed Bhumi Pooja and commencement of work due to lack of coordination between political leaders/ elected representatives and contractors.

Table 52: Challenges at GP / SVS Level

No	Components of Sustainability Pentagon	Challenges at GP/ SVS level
1	Natural Capital	1. WPP discharging reject water to the ground, enhancing concentration of contaminants in the soil.

No	Components of Sustainability Pentagon	Challenges at GP/ SVS level
		2. Most GPs have instances of treated MVS water and untreated local water (Borewell/River/Pond) getting mixed at the village OHT and in the IVDN. 3. Supplying potable quality water is critical and how the quality can be maintained between MVS and SVS is a challenge.
2	Physical	1. House Tap Connections (HTC) without the tap. 2. Inappropriate material components such as PVC and Steel specials are used at the HTCs. 3. Household water meters moving because of water leaks from HTC. 4. Not all HTCs have a proper concrete stand post and make the HTC unstable. 5. Illegal tapping of water from the distribution network, by installing tullu pumps. 6. JJM faced protests from people due to the fear of metering, volumetric supply and pricing of water. 7. Village OHTs are not metered and hence the inflow and outflow from MVS and SVS sources cannot be determined. 8. Distribution network in the villages is aged. IVDN is mostly under concretized village streets and village drains. Repair and reconstruction of distribution network difficult and costly. 9. Household water meters fixed vertically and reading becomes extremely difficult. 10. Long gap between fixing meters and taking meter readings of water consumption, which virtually gives an impression to people, that there are no differences between metered and unmetered HTCs. 11. Social resistance to Metering 12. Regularity of water supply is in the range of daily to once in four days or more. 13. Valve based and street (lane) based distribution arrangements have been worked out by watermen who control, coordinate and manage the water supply. 14. Cleaning of Village OHT is not regular and is not monitored. 15. Synchronization of water supply from small MVS and large MVS (Gadag) as well as between SVS (borewell supply) and MVS supply has not happened and needs to be addressed to achieve adequacy, regularity and frequency in desirable levels at the consumer end.
3	Finance Capital	1. WPPs installed both under public and private sector, charging differential pricing. 2. Many villages visited have defunct borewells which are still being billed by ESCOMs to the GPs, adding up to the financial burden of the GP.

No	Components of Sustainability Pentagon	Challenges at GP/ SVS level
4	Human and Social Capital	1. Watermen not adequately trained or educated. Getting watermen to deliver services at desirable level is really a challenge in human resource management.

5.15 Cost Benefit Analysis

It is critical to analyse the costs and benefits of water supply schemes. In the context of Karnataka as elsewhere, "water has an economic value in all its competing uses and should be recognised as an economic good"[43]. As pointed out by IWMI studies, water will have physical and economic scarcity. Southern countries generally experience both these types of scarcities. Karnataka is no exception to the water scarcity scenario. For the cost benefit analysis, the per capita cost for Capex and Opex is calculated. In case of Capex, the parameters considered for arriving at the per capita cost is capital cost incurred for all schemes with the population designed to be served vis a vis the per capita benefit from the scheme through either direct income benefits or equivalent income-equal benefits in terms of time saved due to availability of water. The table below presents the details of cost- benefit comparison, considering 60 MVS.

Table 53: Cost - Benefit Assessment

Cost	Value	Savings/Earning	Value
Total Capital cost (60 Schemes) Rs Crore	2879.85	Total number of hours saved in a year (No) per household	548
Population estimated to benefit	47,28,813	Total number of days saved in a Year	68.5
Per Capita cost (Rs)	6090	MGNREGS Wages per day per person (Rs per Day per person)	296.45
Per household cost (Rs)	30450	Assuming an earning per household @ MGNREGS wages of Rs.296.45, = Total earnings in a year (Rs) for one household size of 5 persons (assuming that only one person spends time in collecting and bringing water for the household)	4,061
		Break-even Year	**7.5**

In a market driven scenario, assuming that the households are paying for the infrastructure i.e the capex, it would take 7.5 years to repay the capital cost with a balance active life of 22.5 years (total life of assets – 30 years). This is only limited to savings in time. On the other hand, intangible benefits would include leisure time, improvement of health due to reduction in physical labor for fetching water, reduced emotional stress in standing for long time etc. Tangible benefits would

[43] Principle No- 4 Dublin Conference 1992

also include reduced expenditure for treatment of water borne diseases, lesser loss of employment days due to water-borne illness and a potential to enhanced livelihood security by converting the saved time for economically productive purposes. There are instances where women have used the opportunity to work under MGNREGS and earn an enhanced income, because water became available at home during summer months[44].

In case of Opex, the parameters considered are: (1) opex cost incurred by all MVS per year and (2) cost incurred by the GPs towards opex expenditure (salaries, electrical charges and repair and maintenance towards water supply). Against the cumulative opex from MVS and GP level, the total revenue collected by way of water tariff and government grants and subsidies are considered. Table below presents the details of opex for MVS and GP level.

Table 54: Calculation of Opex – MVS, GP and household level

Opex Cost Break down- MVS level	
MVS - 5 Year O&M Cost (Rs. in Crores)	180.24
MVS – Annual O&M Cost (Rs.in Crore)	36.05
Total Households benefitted from 60 MVS (4728813/5)	945763
Average Annual Household Opex towards MVS water supply Rs.36.048 crores/945763=	381.17
Hence Average Annual Opex for 110797 Households in 74 GPs@ Rs.381.17 in Crores =	4.22
Average Monthly Household Opex towards MVS water supply Rs.381.17/12	31.76
GP level Opex (considering 74 GPs surveyed) Rs. In crores	
GP - Salaries Per year for 401 watermen	5.00
GP - electrical charges Per year for 74 GPs for water supply	18.48
GP - Repair & Maintenance Per year for 74 GPs for water supply	4.14
Total Opex at GP level per year	27.62
Cumulative Opex per year Rs. In Crores	
MVS level expenditure towards Opex for population in 74 GPs = Rs.381.15x 110797 (Rs.Cr)	4.22
GP level Opex (considering 74 GPs surveyed) Rs. In crores	27.62
Total Opex at MVS and GP level per year, considering Opex of 60 MVS for 74 GPs	31.85
Average per household opex per year = 31.85 crores/ 110797 (553985/5) in Rs.	2875
Average per household opex per month = 2875/12	240
Earning from Water tax	
Total Water Tax collected per year (Rs) in Crores	1.61
Number of Households	110797
Average Household Revenue (Rs) per year	145.31
Average per household revenue per month = 1.61 crores/ 110797/12 in Rs.	12.11
Percentage of Revenue against Opex per Household = (2875/145.46)	5.06%

[44] Kavassery Grama Panchayat, Palakkad district, Kerala- rapid assessment of the impact of Jalanidhi scheme

Revenue versus expenditure comparison at household level is tilted heavily towards the expenditure as only about 5% of the expenditure is collected as revenue and is not sustainable. Governmental subsidy towards opex is approximately 95%. Again, between the MVS opex cost and the opex cost at GP level, the MVS level O&M cost is 13.25% of the total O&M cost.

5.16 Institutions and Governance Capital

5.16.1 Role of VWSC

VWSCs have been constituted in all GPs as per the Government order. However, the functioning of the VWSC under the GP is not active and no regular meetings have taken place to address the actual issues faced in water supply at the village level. It was observed that in case of any issues with respect to water supply, most of the households inform the watermen directly and the issue is resolved. VWSC members include elected GP members and other nominated members from the GP area Constitution of the members in the VWSC is as presented in the table below.

Table 55: VWSC member details – category-wise

Women	Men	SC	ST	General
1,672	1,843	738	321	2,456
47.57%	52.43%	21.00%	9.13%	69.87%

From the table above, 47.57% of the members are women members and majority of them are from the general category. 21.00% of the members are SC and 9.13% are ST category. 23 out of 74 VWSCs (31.08%) of the VWSCs have undergone training related to water supply either at the Taluk level or Zilla panchayat level or by health department or RDWSD on field test kits.

VWSC is constituted and exist only on paper. There have been no further meetings of VWSC after the formation meetings. VWSC as a separate local institution does not exist. Members of the GP consider VWSC as a parallel institution to GP council. Functions of VWSC as per the current Government Order are largely advisory in nature. VWSC needs to be bestowed with powers and ownership over local level water assets. Government Order No. RDP 507 GPD2019, Dated 09-09-2020 has envisaged the following responsibilities and functions of VWSC.

Table 56: VWSC - responsibilities and functions

Water Supply	Sanitation
1. Assist the GP in supplying pure and required quantity of water to the public. 2. Shall provide support to GP in keeping drinking water source, flowing river, stream clean and good condition. 3. Help the GP, as and when, for repairs and draw water from water tanks, wells, -- and other	1. Issue notice to the owner of a structure, hut or shop who do not maintain the toilets in clean condition, and insist them to maintain cleanliness within a specified time and in case the concerned person does not clean then, that area shall be cleaned by the GP and the expenditure incurred towards that shall be

Water Supply	Sanitation
water ways facilities within the GP jurisdiction. 4. Prevent pollution of water from bathing, washing of clothes, washing of animals in front of water facilities created and at water sources or from any other activity. 5. Provide assistance to GP in the maintenance of drinking water supply works, protecting plants and machinery. 6. With prior approval from the GP provide requisite support to a person or agency with whom contract /agreement is made for supply of water. 7. In case of arising of scarcity of drinking water, assistance shall be given to GP for motivating and entering into an agreement with private owners of borewells for supplying water to the village from these borewells . 8. This committee shall assist the GP in managing the responsibility of all activities pertaining to village water supply. 9. Generate awareness among the community to judiciously use water and not to waste drinking water. 10. Involve actively for collecting tariff for water supply from the beneficiary community. 11. Facilitate GP for construction, operation and maintenance and monitoring related to water supply and sanitation. 12. Facilitate the GP for arranging supply of pure drinking water to every house hold, taking safety actions for purity of water, cleaning water tanks, repairs to water treatment. 13. Help GP in conducting water quality tests every year before kharif and after rabi season and publish the results in public places and accordingly maintain the quality of water. 14. Provide help to GP in the preparation of operation and maintenance plan for the village drinking water supply.	recovered from the concerned area owner in the form of outstanding tax. 2. Any person carrying activities or dumping materials which are detestable and harmful to health, and involved in trouble giving activities in the neighborhood and or stagnating water continuously in vacant sites, such owners shall be cautioned and insisted for cleaning such sites. 3. Insist the owner of the vacant site to remove shrubs and snails or otherwise unpleasant and dangerously grown waste plants in his site which are posing threat to the public. 4. In case of refusal to the notice issued by the committee such area shall be cleaned by the GP and the expenditure incurred towards cleaning the area shall be recovered from the beneficiary of the site in the form of outstanding tax. 5. In the event of fairs and jathras organized in places of worship by the temple or church or mosque authorities etc., an advance money shall be taken from these trusts for cleaning the area. 6. In such related cases, if required, advise the GP in getting mediation from Tahsildar or Deputy Commissioner to collect the amount. 7. Facilitate GP in creating drainage facility in the panchayat land and or in the private persons land with consent or by having an agreement for smooth flow of waste-water. If any person in the village obstructs the flow in the drain in front of his house, he shall be made aware about cleanliness. If the unhygienic behaviour is continued, then bring it to the notice of the GP to take necessary action. 8. Prepare a plan to collect waste from hotels, shops and other eateries established in the populated area and on main roads and dispose scientifically at a designated place(s) out of village boundary.

Water Supply	Sanitation
15. Ensure every household/ward is getting water supply facility in correct proportion and such facilities /resources are safe. 16. Whenever need arise advice GP in preparing and revising O&M monitoring plan.	9. Facilitate GP in preparing a plan for collection, storage and disposal of waste generated from poultry stall, fish and meat stall established in the populated area and on main roads scientifically. 10. Provide essential assistance to GP for collection of tariff from all consumers as per the Karnataka State Sanitation and Waste Management policy, --- 11. Carcass of any dead animal due to an accident found on main roads of the village shall be removed and buried in the nearby government or private land. 12. This committee shall assist the GP in managing the responsibility of all activities pertaining to village sanitation. 13. Create awareness in the people on water, sanitation, especially on health and hygiene. 14. To raise awareness in the community about the adverse impact of using plastic and provide support to ban plastic. 15. Involve actively for collecting tariff for sanitation project from the beneficiary community. 16. Ensure every household build toilet and all members of a house hold use the toilet. 17. Create awareness in segregation of waste generated from households and commercial establishments into wet and dry garbage and suitably disposing off. 18. Take responsibility for preparing the village Open Defecation free and keeping it in clean condition. 19. Provide help to GP in the preparation of operation and maintenance plan for the village sanitation. 20. Support the GP for monitoring the usage and maintenance of toilets built for community, schools, Anganwadis, government hospitals and other public places. 21. Assist the GP in the collection of tariff from the consumers for sustainable O & M and

Water Supply	Sanitation
	monitoring and keeping in good condition the basic infrastructure facilities created in the village. 22. Ensure every household/ward is getting sanitation facility in correct proportion and such facilities /resources are safe.

A careful examination of the contents of the above GO reveals that the VWSC has largely advisory and facilitation functions relating to water supply and sanitation. The functions and responsibilities are largely without teeth and power. Therefore, an attempt is made to redefine the role of VWSC and Watermen with regard to water supply at the village level.

Table 57: Role of VWSC and Watermen

Role of VWSC and Watermen-Natural Capital		
	VWSC	**Watermen**
Monitoring Water Quality	Campaign on Water Quality; Advising community not to use water from sources which does not have quality level with in permissible limits	Testing Water Quality using FTK Documenting Results of WQT Reporting Results to VWSC and GP
Monitoring Water Quantity	Recharging Borewells Decision on How much water to be pumped from Borewell sources On the spot Analysis of data from Bore well monitoring	Measure water level in BWs Decide whether it is safe to pump water from BW Maintain Log Books
Role of VWSC and Watermen-Physical Capital and O&M		
	VWSC	Watermen
Asset Inventory	Maintain Asset and Stock inventory	Update records reg- Assets/Stocks
Asset Repair & Maintenance	Decide on undertaking repair and maintenance	Report need for repair and maintenance to VWSC
Pumping	Monitor pumping duration	Maintain Log Books for Pumping
Treatment	Monitoring Chlorination	Chlorinate Water- Record Chlorine level in Water
Storage/Tanks	Fix a schedule for cleaning OHTs	Clean OHTs

Distribution of MVS Water	Decide on (1) Adequacy How much- kL; (2) Frequency Duration – Hours/Minutes and (3) Regularity– How many days & Timings of water supply	
Supplementary Distribution of SVS Water	Decide Total requirement – less – MVS water supplied in volume and understand the gap	Pump and supply volume equivalent to the GP from Borewells
Monitoring Operations	Decide zone/ village/ Street-wise distribution and prepare a schedule for distribution	Maintain a Log Book on distribution, noting volume, timing, duration of water supplied
Monitoring Maintenance	Decide maintenance schedules Monitor schedule of maintenance	Preventive Maintenance Corrective Maintenance
Role of VWSC and Watermen-Finance Capital and O&M		
O&M Plan and Budget	Prepare O&M Plan and Annual O&M Budget in consultation with GP	Support in preparing O&M Plan
Fix Tariff	Recommend Tariff slabs to GP	
Billing and Collection	Make arrangements for meter reading, billing and collection of Tariff Monitor income- inflows	Undertake Meter Reading, provide bills and collect payment
Expenditure		
Salary	Recommend salary for watermen	
Energy	Monitor energy consumption	Record Energy Consumption units
Chemicals and Consumables	Monitor use of stock & expenditure incurred	Maintain Stock Register
Maintenance	Monitor expenditure incurred for maintenance	Undertake minor maintenance activities
Repair	Decide on Repair; Maintain a list of experts and skilled persons who can support in maintenance	Undertake minor repairs; Facilitate major repairs
Accounting and Auditing	Prepare accounts and auditing of accounts	Support in vouching and accounting
Role of VWSC and Watermen-Human and Social Capital and O&M		
Mobilize Community	Mobilize Community/ Consumers; organize meetings, inform details of water	Support VWSC in community mobilization, house visits, serving notices and information

	situation and discuss key issues on water supply at community meetings	
IEC/BCC	Identify issues and problems which need to be addressed in the IEC/BCC	Support in IEC/BCC campaign
Staffing	Assessment of Staff requirements Appoint Staff in consultation with GP	
Training	Facilitate Training for Staff, VWSC, GP Council, GP level Officials and Watermen	Support in Training Programmes
Governance and Institutional Capital		
MIS	Facilitate collection of data for MIS and data entry	Collect data for MIS
GRM	Monitor resolution of Grievances	Support in resolving complaints
Stakeholder Mapping	Identify different stakeholders	Support in identifying stakeholders
Bylaws	Prepare, Amend and Modify and Implement Bylaws	
Reporting	Review reports prepared by VWSC secretary	Support in preparing annual reports

5.17 RDWSD Staffing

Substantial vacancies exist in the field positions of RDWSD. Number of vacancies range from 50 to 75% of the sanctioned posts. Field level engineers, especially Section Officers are badly needed at the divisional and sub-divisional level. RDWSD has attempted to overcome the situation by recruiting technical staff following outsourcing method. However, those technical staff that is selected through outsourcing method are neither exposed nor experienced in water sector. With the launch of JJM, there is substantial work load for the available staff on ground.

Table 58: Current staff vacancy in RDWSD (17 Districts)

No	District	Sanctioned position	Current staff numbers	Vacant position
1	Bagalkot	90	39	51
2	Belagavi & Chikodi	101	32	69
3	Bellary	57	26	31
4	Chamarajanagara	68	27	41
5	Chikkamagaluru	101	26	75
6	Davanagere	79	35	44

No	District	Sanctioned position	Current staff numbers	Vacant position
7	Gadag	79	26	53
8	Hassan	112	36	76
9	Haveri	101	28	73
10	Koppal	68	38	30
11	Mandya	101	38	63
12	Mysore	101	44	57
13	Raichur	79	44	35
14	Shivamogga	101	24	77
15	Tumakuru	79	34	45
16	Vijayanagara	86	31	55
17	Vijaypura	79	30	49
	Total	1,482	558	924
	Percentage		37.65%	62.35%

MVS operators largely do not employ engineers and technical personnel in O&M. WTP and MVSs are operated by skilled labourers and not by technically qualified personnel.

5.18 GP level staff

GP level staff who deal with water sector include: (1) PDO; (2) Bill Collector; and (3) Watermen. Watermen used to be recruited by GP council till 2018. Since 2018, the power to confirm watermen has been given to CEO of the Zilla Panchayat. GP's power of appointing watermen has been restricted to proposing names of persons to ZP for confirmation. Due to paucity of funds, the GP is unable to pay regular and timely salary to watermen. Salary backlog for watermen in some GPs is for 12 to 20 months. On the whole, GPs have hired more watermen than required. The following table provides details of watermen in the GPs surveyed by the Team:

Table 59: Educational qualification of existing watermen

Educational Qualification	No. in each category	Percentage
• Graduation	12	2.99%
• PUC	50	12.47%
• High School	234	58.35%
• Primary School	62	15.46%
• ITI	7	1.75%
• Illiterate	36	8.98%
Total	401	100.00%

Educational qualification of watermen is not uniform, ranging from primary school education to graduation. There were also many watermen who do not have any formal schooling. Watermen are directly responsible for distribution of water. Watermen are paid a monthly salary which on an average is approximately Rs.10,400 per month.

Exact volume of work of watermen could not be ascertained despite an attempt to undertake a daily routine analysis of watermen. The gaps in the listing of daily routine indicate that in villages with lesser number of valves and borewells, the work of watermen is nominal and routine. There are no monitoring systems and arrangements to monitor the work delivery of watermen. The volume of work claimed by the watermen is not convincing. Also, PDOs and GP members have claimed in private conversation that there is no substantial work for watermen as claimed by them. Anganwadi Teacher and Waterman are trained in conducting water quality tests, using FTK. However, there are no records of water quality tests. There are instances where salary of watermen is pending for 12 to 20 months in several GPs.

5.19 Capacity building of the Human Capital

Considering the RDWSD as a nascent department, its capacity, skill sets and knowledge base need to be continuously updated and improved. Field level interactions with the officials of RDWSD at divisional and sub-divisional levels have convincingly brought home the realization for continuous capacity building. Following topics have been proposed for basic and refresher training of the RDWSD officials

1. Planning and Designing of Multi Village Schemes- Hydraulics and Water GEM- Water Distribution Analysis and Design Software.
2. Tender Evaluations
3. Construction Management
4. Contract Management
5. Community Mobilization and Consumer Relations
6. The Karnataka Gram Swaraj and Panchayat Raj Act, 1993, PRI system, Role of Gram Panchayat in water supply and sanitation.
7. Management Information System- Baseline on MVS; O&M data on MVS
8. Grievance Redressal Mechanism (GRM)
9. SCADA- Supervisory Control and Data Acquisition- Operation of SCADA and analysis of data
10. Water Quality Testing- Training on Water Quality standards- compare BIS and WHO standards in terms of water quality
11. Budgeting and Finance Control- How to prepare an annual O&M Plan and O&M Budget
12. Concept of Sustainability in water supply- meaning of the concept of sustainability- How to plan and conduct a Sustainability Evaluation Exercise (SEE) for MVS.
13. Concept of Sustainability Capitals/ Sustainability Pentagon for water supply
14. GP level assessment and planning of water resources management
15. The concept of participation; Participatory processes and platforms in water supply management
16. Water Literacy and Water supply scheme
17. Problem Solving Clinics- Raise problems actually faced in the field and conduct workshops to resolve the problems

5.20 Capacity Building of Watermen

Similarly, capacity of watermen, VWSC and GP Council needs to be improved. The following capacity building programmes are proposed at the GP level for watermen

Training Topics for the Watermen:

1. Plumbing
2. Cleaning of OHT- Frequency, Scheduling and Monitoring
3. Meter Reading
4. Meter Repairing
5. Log Book Maintenance
6. Chlorination- How to prepare bleaching powder solution to chlorinate water
7. Checking Residual Chlorine using a Chloroscope
8. Water Quality Testing using FTK
9. Bacteriological water quality testing using H2Svials[45]
10. Preparing and maintaining Consumer Ledger
11. Operations of Water Purification Plants
12. Billing and Collection
13. Water Literacy
14. Operations and Maintenance of SVS, IVDN
15. Water Tariff
16. Accounting
17. Participatory processes for GP level water resource assessment and planning

All Watermen in the State are to be provided with refresher training. At the end of the refresher training, a test which includes an examination of skill sets, knowledge, attitude and aptitude to work may be undertaken. Those who fail in the test may be discontinued from service. All fresh recruits as watermen shall have a minimum qualification of SSLC and above; and shall go through an intensive training for a period of two weeks. Only those who successfully complete the training and clear the test alone shall be confirmed.

5.21 Finance Capital

In general, there have been very little discussions on the finance capital in the field. Following observations are summarised with regard to finance capital.

1. GPs are incapable of making any contributions towards the opex of MVS or for that matter bulk water charges, though there has been an O&M policy notified in 2013 and a Government Order regarding bulk water tariff issued in December 2020. Policies and GOs are prepared and notified but are not implemented.

[45] These strips are used for detection of hydrogen sulphide production by microorganisms. Hydrogen sulphide can be produced in small amounts from sulphur containing amino acids like cysteine by a large number of bacteria in carbohydrate media. Hydrogen sulphide produces on contact with lead acetate a black precipitate, indicated by a visible black-coloured reaction on the hydrogen sulphide paper strip. The lead acetate procedure is more sensitive than any other method for detecting hydrogen sulphide production

2. There are no contributions from the side of GP towards building MVS under capex.
3. Gram Panchayats are struggling to make both ends meet in terms of income and expenditure for operating and maintaining water supply pertaining to in-village generation and distribution of water. There is no annual O&M plan at the level of GP.
4. O&M tariff is in the range of Rs. 30 to Rs.100 per month. Madlur GP (Belgaum district) charges Rs.1,200 per household per year towards the water tariff and is the highest among the GPs surveyed by the Team.
5. Revision of water tariff at household level is neither regular nor frequent. The O&M charge is fixed unilaterally by GP council and is not linked to the O&M expenses nor any attempt made towards cost recovery.
6. General conclusion at GP level is that there is no correlation between the revenue and expenditure. All GPs have huge arrears to be collected from consumer households on account of O&M payment to GP.
7. One good practice observed from Binkadakatti GP is that it is maintaining a separate bank account to manage income and expenditure on behalf of WPP. The WPPs generate excess funds and is self-sufficient.
8. Billing Gram Panchayats: In pursuance of the GO issued by Government of Karnataka in December 2020, AEE for Vijayapura sub-division of RDWSD attempted to generate an O&M bulk water consumption bill for 14 GPs under MVS Thikotta and issued bills for the period of June 2020 to January 2021.

Table 60: Details of GPs on which bills raised in MVS Thikotta, Vijayapura sub-division

MVS Thikotta and 24 Villages; Vijayapura Taluk; Vijayapura District						
No	Name of GP	No. of Villages	Billing Period	Water Consumption kL	Water Tariff Demand in Rs.	Rate/kL
1	Sidhapura	5	June 2020 to January 2021	51589	2,57,945	5
2	Bijjarani	1		29614	1,48,070	
3	Babanagara	1		23030	1,15,150	
4	Lohagaon	3		16181	80,905	
5	Gonasani	3		14652	73,260	
6	Chikkalare	3		20952	1,04,760	
7	Liggoravi	1		4136	20,680	
8	Kochala	3		35748	1,78,740	
9	Nidoni	3		31,533	1,57,665	
10	Chalageri	3		23,542	1,17,710	
11	Anchapura	1		13,693	68,465	
12	Tajpur	2		31,944	1,59,720	
13	Sonavada	2		28,934	1,44,670	
14	Aakotta	2		32,413	1,62,065	
	Total	33		3,57,961	17,89,805	

The total consumption of water in the above 14 GPs was to the tune of 358 million litres. The average monthly consumption was to the tune of 60 million litres. The above volume of water would have generated Rs. 17.90 million, calculating the tariff at the rate of Rs.5/kL as envisaged in the GO. The potential for generating revenue is tremendous and would have contributed to make schemes.

Table 61: Potential of water tariff generation

Water Consumption kL	Rate/kL	Water Tariff generation potential in Rs.
3,57,961	5	17,89,805
	4	14,31,844
	3	10,73,883
	2	7,15,922
	1	3,57,961

Water Consumption Trends Water consumption data for a selected 49 households were taken from the GPs of Zalaki (Vijayapura), Pattihal KB (Belgaum) and Bagivalu (Hassan) and the following analysis was done. Following table provides consumption category in terms of Litres Per Day per Household.

Table 62: HH category of consumption (LPDH)

No	Category of consumption in Litres per day per household	No. of Households in each category	Category Percentage
1	Less than 25 LPDH	4	8.16%
2	26-50 LPDH	1	2.04%
3	51-100	3	6.12%
4	101-200	8	16.33%
5	201-300	10	20.41%
6	301-500	8	16.33%
7	501-1000	3	6.12%
8	1001-2000	8	16.33%
9	2001+	4	8.16%
	Total	49	100.00%

Considering average consumption of 275 litres per day (for a 5 member family@55 LPCD), it is found that 25 households are consuming less than 275 LPDH, while 24 households are consuming much more than what is admissible as per the LPCD norms established by GoK/GoI. The following table makes a comparison of actual consumption and average consumption of the categories consuming less and more water than the LPCD norms prescribed by GoI/GoK.

Table 63: HH category of consumption (LPCD)

Category of Consumption	Total Number of Households in the category	Actual consumption in Litres	Actual LPCD consumption	Admissible consumption @55 LPCD for the category
Less than 55 LPCD	25	3,651	29	6,875
More than 55 LPCD	24	29,854	249	6,600

Pricing water is one sure way of controlling consumption and thus reducing expenditure. Incremental Block Tariff may be introduced to dissuade households from excess consumption.

5.22 Water and Health

5.22.1 Sustainable Development Goals

Sustainable Development Goals (SDG) is a plan of action for people, planet and prosperity by the community of nations. It also seeks to strengthen universal peace, besides eradicating poverty in all its forms and dimensions. All countries and all stakeholders, acting in collaborative partnership, will implement this plan. SDGs consist of 17 Goals and 169 targets. The targets are measured in 304 indicators. SDG seeks to build on the Millennium Development Goals (MDG). SDG was launched in 2015 and is expected to close by 2030 (UN Department for Economic and Social Affairs, 2015). Broad scope of SDGs includes 'people', 'planet', 'prosperity', 'peace' and 'partnership' (ibid). India was among the 193 countries that adopted the SDGs on 25th September, 2015. The implementation of these SDGs began on 1st January 2016. (ibid).

SDG-3 and SDG-6 have been included in the scope of the MVS evaluation in a broad way. SDG -3 sets a goal to 'ensure healthy lives and promote well-being for all at all ages', while SDG-6 aims to 'ensure availability and sustainable management of water and sanitation for all'. The following table captures the targets set by Government of Karnataka under SDG-3.

Table 64: SDG-3:- Comparison of achievement between India and Karnataka

Indicator	Raw Data			
	Karnataka	India	Target 2030	Current Achievement
Maternal Mortality Ratio (MMR)- Reducing Maternal Mortality Ratio (MMR) to 50 from 97 per lakh live births (2019)	108	130	70	92/100000 live births[46]
Under-Five Mortality Rate (U5MR)- Reduce under five mortality rates to 11 from 32 per 1000 live births (2019) by providing maternity benefits to BPL women registered in Reproductive and Child Health (RCH) portal.	32	50	11	29.5/1000[47]
Percentage of children aged 12-23 months fully immunized and three doses of Pentavalent Increase preventive care and awareness building by promoting AYUSH enabled handholding, active of Village Health Sanitation and Nutrition	62.6	62	100	69.00%[48]

[46] https://www.pib.gov.in/PressReleasePage.aspx?PRID=1697441

[47] Karnataka Economic Review 2021-22

[48] https://www.thehindu.com/news/national/karnataka/child-covid-vaccination-only-23-of-eligible-children-in-12-14-years-group-fully vaccinated/ article65440467.ece

Indicator	Raw Data			
	Karnataka	India	Target 2030	Current Achievement
Committees (VHSNCs) and Rogi Kalyan Samitis (RKSs).				
Annual Notification of Tuberculosiscases per 1 lakh population	123	138.33	0	103[49][50]
Number of governmental physicians, nurses and midwives per1,00,000 population-Increase the number of physicians, nurses, and mid-wives to 88 from 72 per 10000 population (2019) through various stakeholder involvement.	452.93	220.96	549.96	276[51]
Source: NITI Aayog, 2018; T-Target				

Table 65: Performance of Karnataka and India for SDG3 on 'Good Health and Well Being'

Indicator	Score		
	Karnataka	India	Target for 2030
Maternal Mortality Ratio (MMR)	77	64	100
Under-Five Mortality Rate (U5MR)	69	42	100
Percentage of children aged 12-23 months fully immunized and three doses ofPentavalent	42	41	100
Annual Notification of Tuberculosiscases per 1 lakh population	76	74	100
Number of governmental physicians, nurses and midwives per1,00,000 population	82	39	100
SDG 3 Index Score[52]	**69**	**52**	**100**

"For the SDG-3, India stands at 52, Kerala leading with a score of 92 and Uttar Pradesh at the bottom with a score of 25. Karnataka is a front runner with a score of 69 on account of low maternal mortality and under five mortality on the one hand and availability of health staff on the other. The pressing challenge for the state is to reduce cases of Tuberculosis (TB) to zero by 2030 adopting "the end TB strategy". The goal for the state is to reduce Under 5 Mortality Rate from 32 to 11 and Neonatal Mortality Rate (NMR) from 18 to 12 by 2030. The state has also garnered support of NGOs towards improving the quality of mass public health programmes such as polio

[49] https://www.indiacensus.net/states/karnataka - Population projection of Karnataka is 6.96 crores for 2022.

[50] https://tbfacts.org/tb-statistics-india/ TB Patients Actually Notified in the Public Sector (52922) and private sector (19513) totals to 72435. Hence 72435TB patients divided by /705 lakh population gives 103 TB patients for one lakh population.

[51] Department of Health and Family Welfare, Government of Karnataka

[52] Sustainable Development Goals- Vision 2030 - Strategies and Action Plan for Karnataka -page 26

eradication (Nava Karnataka Vision 2025) (Karnataka Evaluation Authority, Government of Karnataka, 2020)"[53]

Way forward for achieving the target for 2030 has been prepared by Government of Karnataka and key interventions and strategies include: (1) Rapid situation analysis to assess the public health infrastructure; (2) Bottleneck analysis of planning and implementation processes; (3) Improvement of preventive care and awareness building; (4) Coordinated, holistic implementation of different national health programmes; (5) Intensify Community-based Management of Acute Malnutrition (CMAM) with screening and treatment of illness for children less than 6 months; (6) Increasing availability of quick TB diagnostic tests; (7) Documentation of the life course or lifecycle-based, life stage-specific, age-appropriate critical best practices across interventions and target populations; (8) Strengthen and transform Civil Registration and Vital Statistics (CRVS) systems; (9) Streamline existing national/state/district-level health and nutrition surveys to improve disaggregated tracking of goals and objectives, and use the results for monitoring, evaluation and decision-making; and (10) Impact assessments of safe transport and land-use plans; providing visible, crash-protective "smart" vehicles; setting and securing compliance with key road safety rules; and delivering post-crash care (ibid).

5.23 SDG 6: Ensure availability & sustainable management of Water & Sanitation for all

The Government of Karnataka under SDG-6 aims to ensure universal and safe drinking water and proper sanitation facilities for all. Karnataka is drought prone and hence effective and efficient water resource management becomes critical for the State. (Karnataka Evaluation Authority, Government of Karnataka, 2020) "The state aims at conservation of the water resources, adoption of alternative methods of augmenting supply of water and reducing water losses by pricing of water"[54] In this section, component of SDG-6 as it pertains to water alone is addressed. The water sector goal recognizes conservation needs in addition to provision of drinking water and sanitation. Two national level indicators have been identified that capture two (2) targets under SDG 6. Karnataka's score under SDG-6 with regard to water is approximately 62.

Table 66: SDG-6: Comparative performance of Karnataka and India

SDG-6:- Ensure Availability and Sustainable Management of Water and Sanitation for All				
Indicator	**Raw Data**		**Target 2030**	**Current Achievement**
	Karnataka	**India**		
Percentage of population having safe and adequate drinking water in rural areas	**48.72**	**71.8**	100	52.00%[55]

[53] Page 27 of 408- Vision 2030- Strategies and Action Plan for Karnataka

[54] Revised SDG Introduction- Page -6/11 (2019)

[55] https://english.swachhamevajayate.org/ (4905870 HTCs are shows as progress under JJM in the RDWSD website. Assuming population to be 7.05 crores as projected by Census India, and 61% being rural population, rural households are assumed to be 94,09,190, of which 49,05,870 HTCs have been achieved and this works out to 52%.)

Percentage annual ground water withdrawal against net annual availability	**65.81**	**61.53**	70	69.87%[56]
Source: NITI Aayog, 2018; T-Target				

Way forward proposals under SDG 6 for water sector in Karnataka include the following: (1) Adoption of an integrated approach to tap overall sources of water and extend to areas with no rivers; (2) Implement strong legal and administrative measures to curb over exploitation of groundwater along with promotion of decentralized water harvesting; (3) Adopting measures to check negative externalities of over exploitation through rejuvenation ofsurface water bodies, watershed management and quality control measures and (4) Efficient demand management of water through incentives, pricing, taxing, and subsidies.

Water Borne Diseases in Gram Panchayats surveyed under MVS Evaluation Study.

74 Gram Panchayats spread in 17 districts of the State have been surveyed under the MVS Evaluation study. Following table presents the district-wise number of GPs surveyed.

Table 67: District-wise number of GPs surveyed

No	Name of Districts	No. of GPs surveyed	No	Name of Districts	No. of GPs surveyed
1	Bagalkot	5	9	Haveri	1
2	Ballari	2	10	Koppal	1
3	Belgaum	7	11	Mandya	1
4	Chamarajanagar	7	12	Mysore	6
5	Chikmagalur	1	13	Raichur	6
6	Davangere	5	14	Tumkur	5
7	Gadag	10	15	Shimoga	1
8	Hassan	4	16	Vijayanagara	7
			17	Vijayapura	5
	Sub-total	**41**		**Sub-total**	**33**
	Grand Total- 74				

Data on water borne diseases were collected for all the above 74 Gram Panchayats. A letter of request was submitted to Department of Health & Family Welfare, Government of Karnataka, through Karnataka Evaluation Authority, requesting for data on water-borne diseases. The data on water borne diseases have been shared to the study team, by email considering Gram Panchayat as a unit. Thus data on water borne diseases for 74 GPs for the period 2013 to 2021 was received. Data on water borne diseases such as Cholera, Diarrhoea, Gastroenteritis, jaundice and Typhoid have been made available. The study period is 2015 to 2020. Therefore, to appreciate the impact

[56] Groundwater Year Book- Page 56, published by Central Groundwater Board-2019-20

of the availability of treated potable water on the health of the consumer community, health data for two years prior to the study period has been collected. Following table captures the data on water borne diseases for the period-2013-2021.

Table 68: Year-wise incidence of water borne diseases (2013 to 2021)

Disease	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
Cholera	7	-	-	-	-	-	-	7	-	**14**
Diarrhoea	2,413	3,269	6,517	5,608	5,350	5,785	6,481	4,612	3,799	**43,834**
Gastroenteritis	1,175	1,419	1,450	1,497	1,282	1,478	1,502	1,607	1,586	**12,996**
Jaundice	50	56	45	69	150	95	73	59	59	**656**
Typhoid	3,089	4,621	4,514	4,632	4,544	4,274	4,743	4,142	3,402	**37,961**
Total	6,734	9,365	12,526	11,806	11,326	11,632	12,799	10,427	8,846	**95,461**
	2013-2014		**2015-2021**							
Grand Total	**16,099**		**79,362**							
Average cases	**8,050**		**11,337**							

Against an average of 8,050 cases under the category of water-borne diseases during the pre-MVS years of 2013 and 2014, the average number of water-borne diseases for a seven year period (2015-2021) has registered an increase and is to the tune of 11,337, registering an increase of 40.84% cases of water borne diseases.

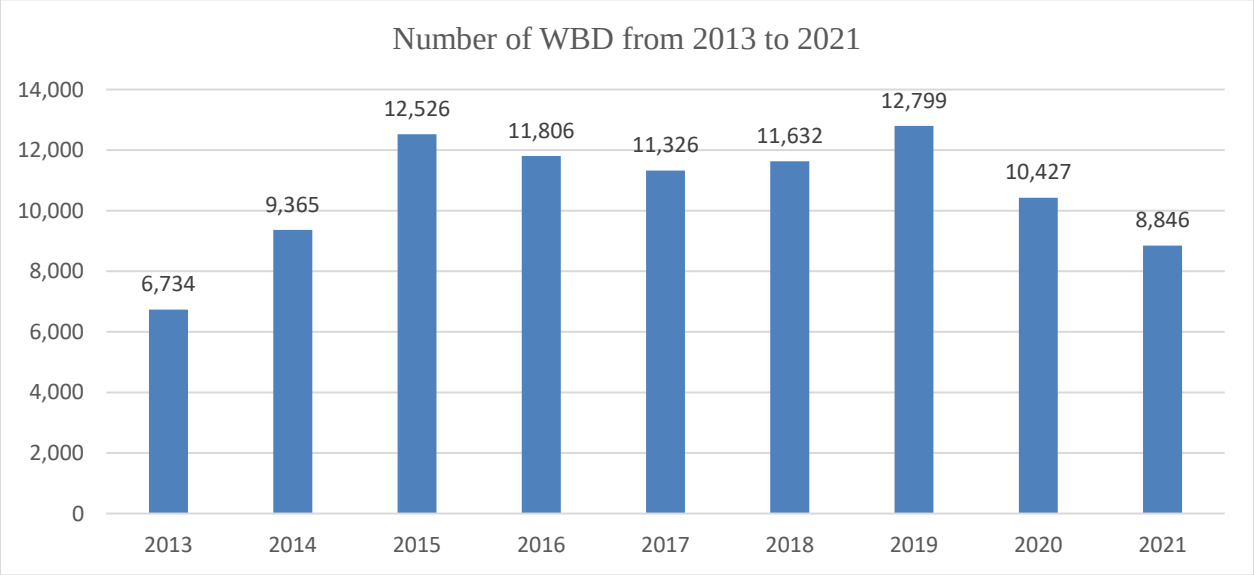


Figure 22: Year-wise incidence of water borne diseases (2013 to 2021)

As is clear from the above chart, it is observed that there is no significant reduction in the incidence of water borne diseases after 2015, the year in which MVSs under the study have been commissioned. It raises a serious concern here that incidence of water borne diseases has recorded

a slight increase during 2015-2020, compared to the incidence of WBDs prior to commissioning of new MVSs.

Table 69: Percentage of population affected by Water Borne Diseases – 2013 to 2021

% of population affected by WBD	No. of GPs	% distribution of Category
Zero (0) %	15	20.27%
0.01% to 1%	36	48.65%
1.01% to 5%	12	16.22%
5.01% to 10%	8	10.81%
10.01% to 13.13%	2	2.70%
13.13% to 50 %	1	1.35%
More than 50%	0	-
Total	74	100.00%

Percentage of population affected by Water Borne Diseases (WBD) vary from zero (0) to 100%+. There is no incidence of water borne diseases in 15 GPs (20.27% of 74 GPs.) There is 0.01 to 1% WBD incidence in 36 GPs (48.65%). 1.01 to 5% incidence of WBDs is observed in 12 GPs (16.22%). 8 GPs have 5.01 to 10% of WBD occurrence. However, the next three categories have reported higher incidence of WBDs ranging from 10% to 50%.

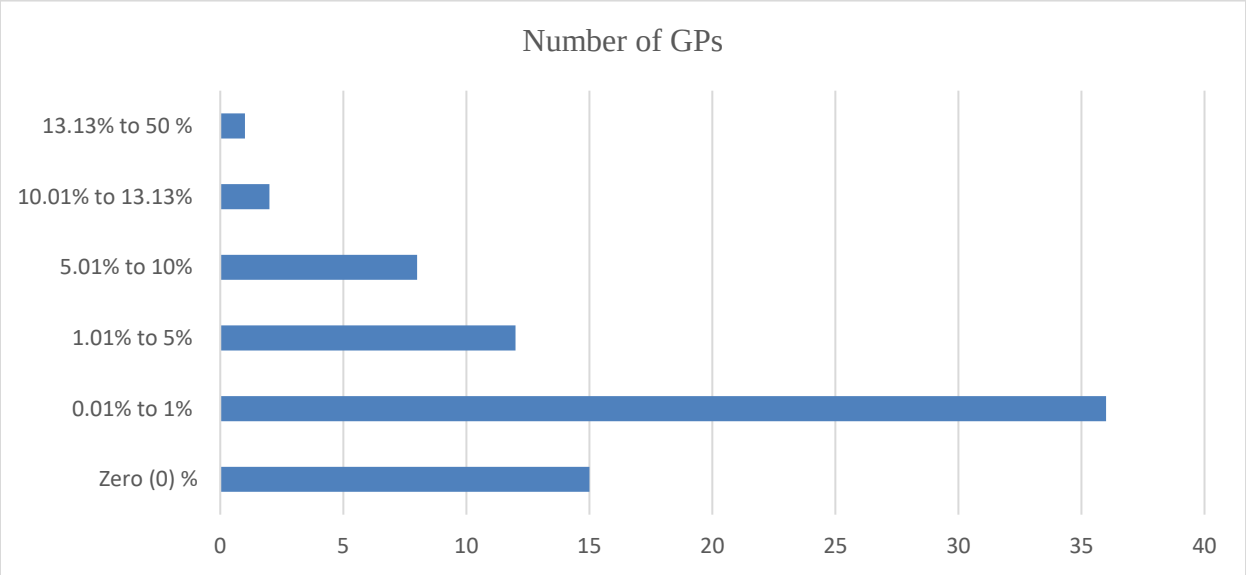


Figure 23: Percentage of population affected by Water Borne Diseases – 2013 to 2021

General Health Index in Karnataka: Demographic and Key health indicators of Karnataka is presented in the table below:

Table 70: Demographic and key health indicators of Karnataka (per 1000 population)

Population (2011 census)	6,10,95,297[57]
Projected Population 2021 in Crores	7.05[58]
Birth Rate *(per 1000 population)*	16.9 (2019)[59]
Death Rate *(per 1000 population)*	6.2 (2019)
Infant Mortality Rate(IMR) *(per 1000 population)*	21 (2019)
Maternal Mortality Rate (MMR) *(per 1000 population)*	92 (SRS 2016-18 by Registrar General of India)[60]
Neo-Natal Mortality Rate (NNMR) *(per 1000 population)*	15.8 (2019)[61]
Under 5 Mortality Rate (U5MR) *(per 1000 population)*	29.5 (Karnataka Health Profile)

Maternal Mortality Rate (MMR): Maternal Mortality Ration (MMR) is considered as the number of women who die as a result of pregnancy and childbirth complications per 100,000 live births in a given year. It is heartening that the Maternal Mortality Ratio of India has declined over the years as indicated in the graph below:

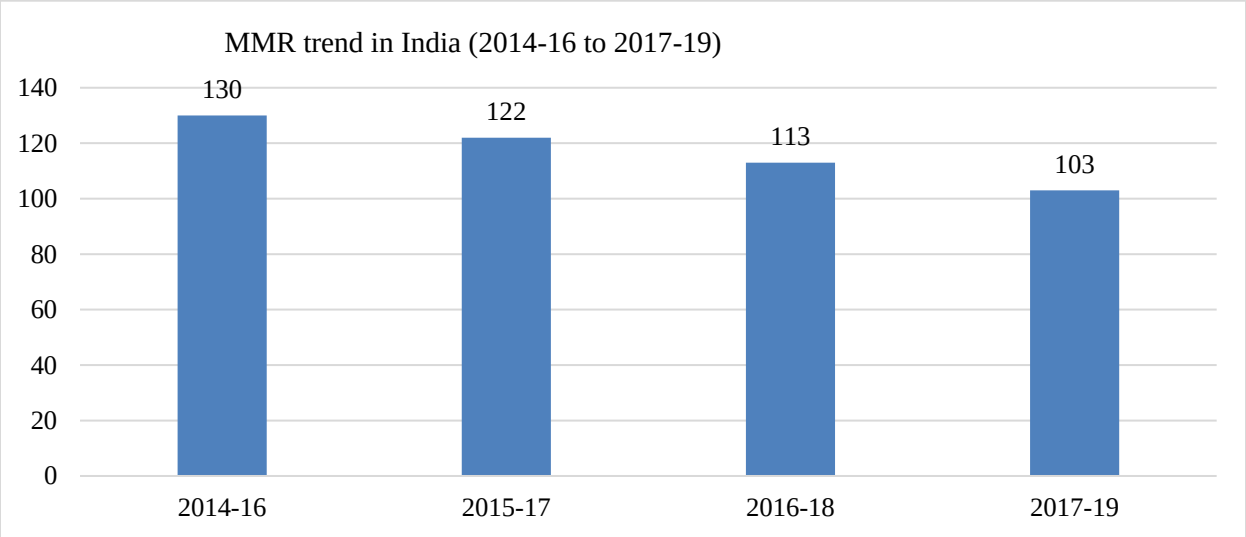


Figure 24: MMR trend in India (2014-16 to 2017-19)

[57] Census 2011

[58] https://english.swachhamevajayate.org/ (4905870 HTCs are shows as progress under JJM in the RDWSD website. Assuming population to be 7.05 crores as projected by Census India, and 61% being rural population, rural households are assumed to be 94,09,190, of which 49,05,870 HTCs have been achieved and this works out to 52%.)

[59] https://www.indiabudget.gov.in/economicsurvey/doc/stat/tab82.pdf

[60] https://www.pib.gov.in/PressReleasePage.aspx?PRID=1697441

[61] https://nhm.karnataka.gov.in/page/NHM+COMPONENTS/RMNCH%20-%20A/Child+Health/en

While the national MMR is standing at 103 in 2017-19, Karnataka is 83 for the same period, which is much below the national average.

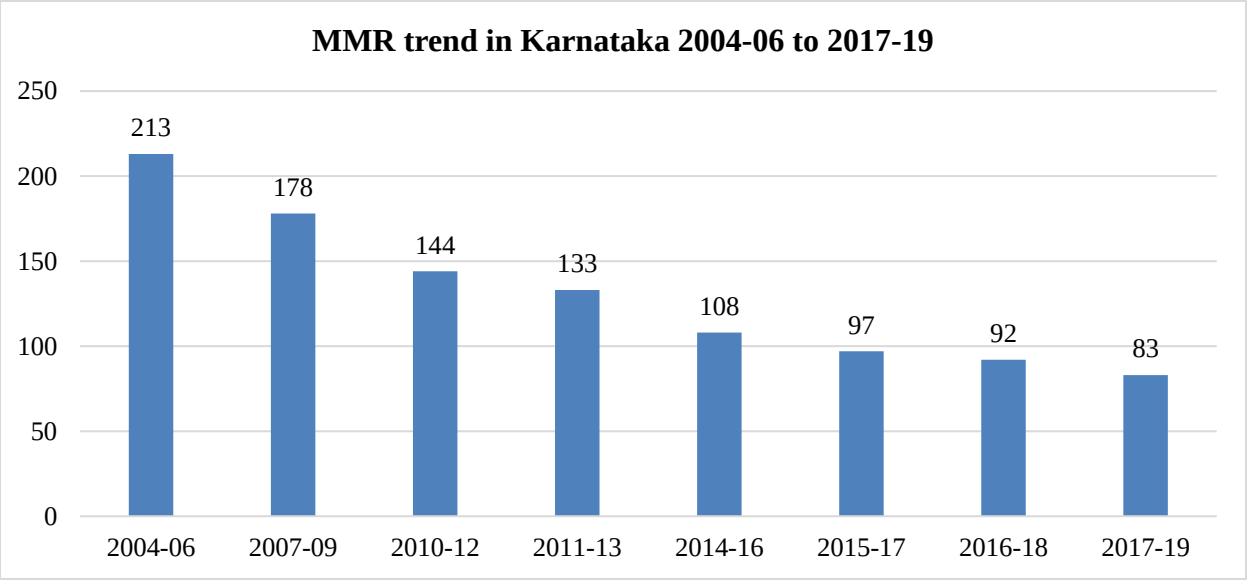


Figure 25: MMR Trend in Karnataka from 2004-06 to 2017-19

Source- Karnataka Health Profile Document- Directorate of Health & Family Welfare Services, GoK

Neonatal Mortality Rate (NNMR): NNMR is the probability that a child born in a specific year or period dies during the first 28 completed days of life if subject to age-specific mortality rates of that period, expressed per 1000 live births. Neonatal deaths (deaths among live births during the first 28 completed days of life) may be subdivided into early neonatal deaths, occurring during the first seven days of life, and late neonatal deaths, occurring after the seventh day but before the 28th completed day of life. The number of children who died during the first 28 days of life is expressed as a rate per 1,000 live births.

Table 71: Neonatal Mortality Rate

	Karnataka			India		
	Rural	**Urban**	**Total**	**Rural**	**Urban**	**Total**
2015-16	-	-	18	-	-	-
2016-17	-	-	-	-	-	-
2017-18	-	-	16	-	-	-
2018-19	-	-	-	-	-	-
2019-20	16.2	15.1	15.8	27.5	18	24.9
2020-21	-	-	-	-	-	-
Source: Karnataka Health Profile document issued by Directorate of Health & Family Welfare Services, Govt of Karnataka						

Karnataka's NNMR is 15.8 for the year 2019-20 as compared to the national average of 24.9. Infant Mortality Rate (IMR): Infant Mortality Rate (IMR) is considered as the number of infants dying under one year of age in a year per 1,000 live births of the same year. The Infant Mortality Rate (IMR), which is considered as a crude indicator of the overall health scenario of a country, is defined as the infant deaths per thousand live births in a given time period and for a given region. The present level of IMR (30 infant deaths per thousand live births, for the year 2021) is less than one-fourth as compared to 1971 (129 infant deaths per thousand live births).

Table 72: Infant Mortality Rate

	Karnataka			India		
	Rural	**Urban**	**Total**	**Rural**	**Urban**	**Total**
2015-16	34	19	28	44	27	40
2016-17	27	19	24	38	23	34
2017-18	27	19	24	38	23	34
2018-19	25	20	23	36	23	32
2019-20	25	20	23	36	23	32
2020-21	23	18	21	34	20	30
Source: 1 Karnataka Health Profile document issued by Directorate of Health & Family Welfare Services, Govt of Karnataka 2 Sample Registration System (SRS)-Bulletin 2020 Volume 55-I, Census of India						

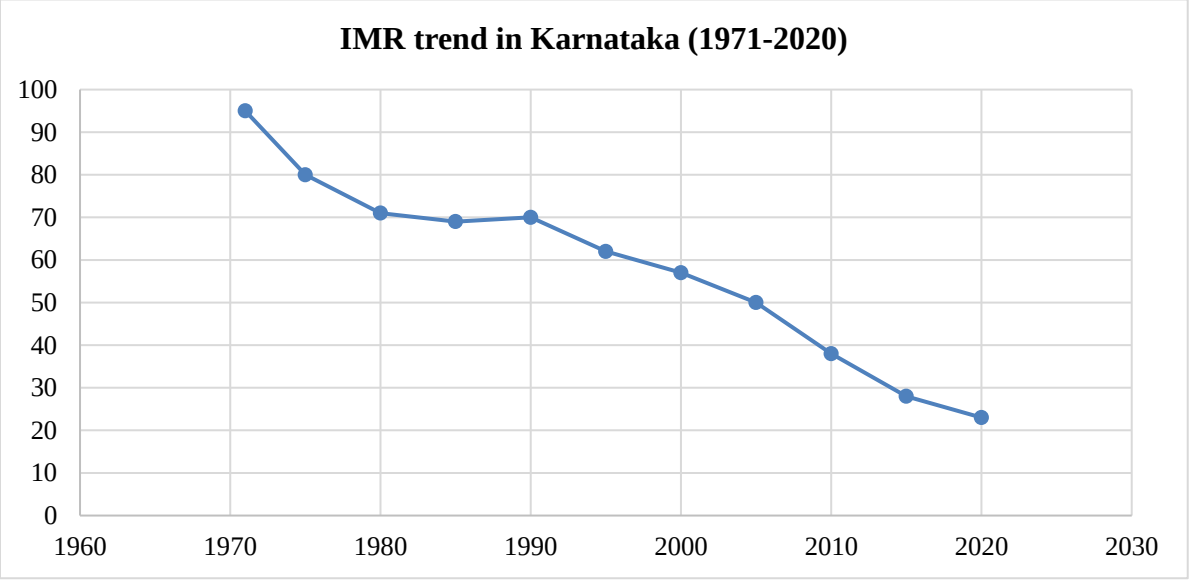


Figure 26: IMR trend in Karnataka (1971-2020)

Under-5 Child Mortality Rate (CMR): The under-five mortality is the probability that a child born in a specific year or time period will die before reaching the age of five. It is expressed as a rate per 1,000 live births. Following is the U5CMR published by National Health Mission.

Table 73: Under-5 Child Mortality Rate

	Karnataka			India		
	Rural	**Urban**	**Total**	**Rural**	**Urban**	**Total**
2015-16	-	-	-	-	-	-
2016-17	-	-	-	-	-	-
2017-18	-	-	-	-	-	-
2018-19	-	-	-	-	-	-
2019-20	32.5	24.5	29.5	-	-	-
2020-21	32.5	24.5	29.5	45.7	31.5	41.9
Source: Karnataka Health Profile document issued by Directorate of Health & Family Welfare Services, Govt of Karnataka						

5.23.1 Conclusion

Karnataka has made steady progress in its health indicators in general and that of under-5 Child Mortality rate, bringing down Under 5 MR to 29.5.

5.24 Exploitation of ground water

The MVS evaluation team undertook field visits to 44 talukas in 17 districts. Though, Government of Karnataka has invested money to create assets for treating water and is in the process of supplying treated water, many GPs continue to draw groundwater. The purpose of planning and implementing surface source based MVS is to supply water from sustainable sources in terms of quantity and quality. However, groundwater poses problems on both the grounds of quantity and quality. Many groundwater sources go dry or experience a decline in water volume, while at the same time exposing consumers to serious health risks due to various types of contamination in groundwater. A summary of the status of ground water exploitation is prepared, based on the data published by Govt of Karnataka[62] is detailed in the table below:

Table 74: Status of ground water exploitation - talukawise summary

District	**Number of Taluks by category groundwater exploitation**				**Total Taluks covered in MVS Evaluation**	**Total Taluks in the district**
	Over Exploited	Critical	Semi Critical	Safe		
Bagalkote	1	1	1	-	3	11
Ballari	-	-	-	1	1	5
Belagavi	2	-	2	1	5	14
Chamarajanagara	2	-	-	-	2	5
Chikamagaluru	-	-	-	1	1	8
Davangere	1	1	-	1	3	6
Gadag	2	1	3	-	6	7
Hassan	1	-	-	-	1	8
Haveri	-	-	1	1	2	8

[62] source: Dynamic Groundwater Resources of Karnataka - March 2020, https://antharjala.karnataka.gov.in/storage/pdf-files)

District	Number of Taluks by category groundwater exploitation				Total Taluks covered in MVS Evaluation	Total Taluks in the district
	Over Exploited	Critical	Semi Critical	Safe		
Koppal	-	-	-	1	1	7
Mandya	-	-	-	1	1	5
Mysuru	-	-	-	3	3	8
Raichur	-	-	-	3	3	7
Shivamogga	-	-	-	1	1	7
Tumkur	1	-	-	2	3	11
Vijayanagara	2	-	1	1	4	6
Vijayapura	-	-	1	3	4	13
Total	12	3	9	20	44	142
	27.27%	**6.82%**	**20.45%**	**45.45%**		

Of the total of 142 taluks in the 17 districts, only 44 taluks have been visited by the evaluation team. Of these 44 taluks, 45.45% of the talukas are included in the "safe" category, while 54.55% taluks are not considered to be 'safe'. From the above table, it is evident that 27.27% of the talukas are "**over-exploited**", 6.82% of the talukas are "**critical**", 20.45% of the talukas are "**semi-critical**". Taluks as categorized above in groundwater situation is not providing a very promising picture. Therefore, all taluks which have implemented MVS, should adopt groundwater replenishing activities under all possible programmes, so that groundwater reserves improve and be regarded as an alternative option for drinking and domestic water.

5.25 Display board

Out of the 60 MVS visited only 28 MVS had a Display board indicating the name and the basic details about the scheme. The display board was either in the form of painting on the wall at WTP/ Jackwell.32 schemes did not have any display board.

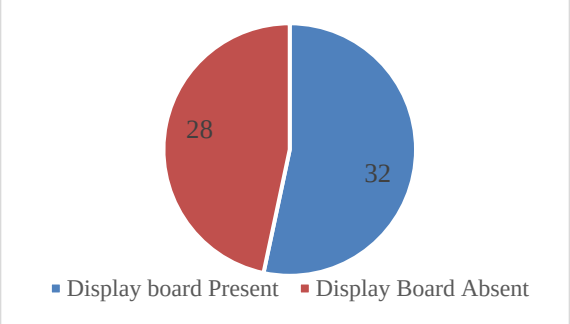


Figure 27: MVSs with display boards

5.26 WTP Technology

Based on the field visit there are primarily 4 kinds of treatment technology implemented across 60 MVS. (1) slow sand filter, (2) Pressure Sand Filter (3) Lamella Clarifier with Pressure sand Filter (4) Clariflocculator with Rapid Sand Filter. Almost 57% of the MVS had Clariflocculator with Rapid Sand Filter treatment technology. 35% had slow sand filter, 7% had Lamella Clarifier with Pressure sand Filter. The size of the treatment plant varies depending on the technology adopted. In case of Lamella Clarifier, area required is less than 0.5 acres whereas in case of slow sand filter and Clariflocculator, the area required is more than 0.5 acres depending upon the size of the WTP. The table below gives details of technology adopted across 60 schemes

Table 75: Treatment Technology used in MVSs

Treatment Technology	Number of Schemes	Percentage
Clari-flocculator	34	56.67%
Slow Sand Filter	20	33.33%
Lamella Clarifier with Pressure Sand Filter	5	8.33%
Pressure Sand Filter	1	1.67%
Total	**60**	**100.00%**

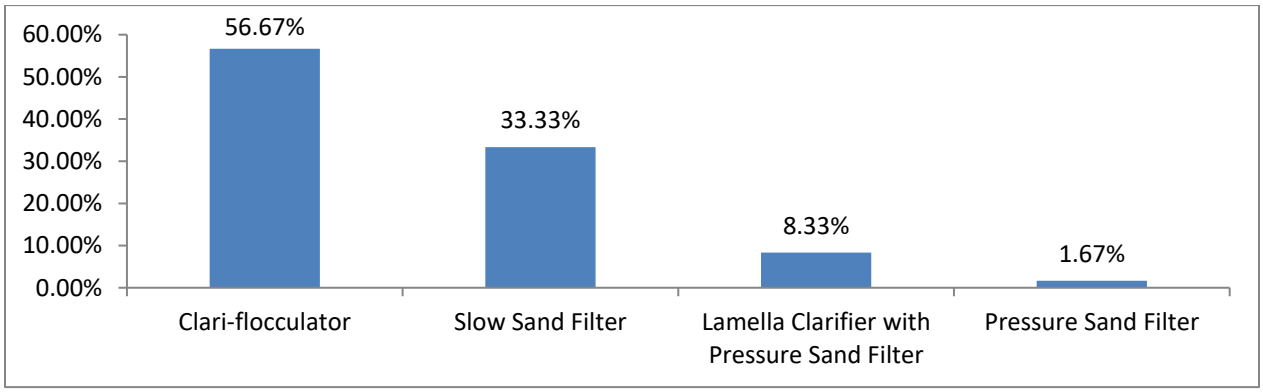


Figure 28: Treatment Technology used in MVSs

6 Findings and Conclusions

The study on 'Evaluation of Multi Village Schemes implemented during the 2015-2020 period' on a sample basis is completed. This chapter provides a summary of findings from the MVS evaluation study.

Rural water supply sector in Karnataka has witnessed significant events during the last decade. Rural Drinking Water and Sanitation Department (RDWSD) was raised in 2014 as a department of the Government of Karnataka under the Rural Development Department. This turned out to be a significant step for the sector from the state government, despite losing the rich institutional memory accumulated while implementing the 'Jal Nirmal Project', funded by the World Bank that concluded in 2014. The second most significant step was the focused investment in Multi Village Schemes that draw raw water from surface sources. What began on an experimental basis during the Jal Nirmal Project became the central focus of investment in rural water since 2014. Government of Karnataka became a facilitator in the O&M of MVS by drawing in the private sector operators to manage, operate and maintain MVS. Two centrally planned mega programmes were launched during this period: (1) Swachh Bharat Mission-Gramin, launched in 2014 to address sanitation issues and Jal Jeevan Mission (JJM) with an objective of providing treated potable water through Functional Household Tap Connections (FHTC). Major part of SBM-G is completed, while JJM is still underway. An approximate amount of Rs.6000 crores has gone into building MVS in the state during the last decade. The evaluation of MVS has taken place against this background of substantial investment in MVSs. The study records its key finding that O&M of MVS and SVS needs to improve, moving from investment in infrastructure to service delivery, methodology development, reforms, capacity building, governance and institutional improvement.

Looking at water from the resource perspective, Karnataka suffers from a non-negotiable spatial (regional) imbalance in the distribution of water resources, rainfall and population, compelling the state to live with it. Climate change, manifested by recurrent droughts and flash floods have visited the State several times in the last two decades. Government of Karnataka attempted to address drinking water scarcity with an approach, which is heavy in terms of technology, energy and finance. As predicted by IWMI three decades back, a part of the water meant for irrigation is being diverted for drinking water purpose in the state.

Living in the 21st century, one cannot survive and sustain with water supply management methods and models of the 19th century. As elsewhere in the country, water is institutionally fragmented in Karnataka resulting in 'hydro-schizophrenia'. There is a need for drastic improvement in terms of institutional and resource convergence, enhanced roles of community, role of PRIs and local level institutions, reforms, policy instruments, change of mindset and approach at state level, digitization, information systems and grievance redressal mechanisms. Opportunities provided by programmes like JJM have to be utilized to the maximum, moving from project to programmes and processes, giving up Adhocism in approaching water supply management.

The problem in rural water sector has to be seen at a macro (State) level and at a local level. At the macro level, Karnataka is most part of its geographical area is a water stressed state. Climate change, droughts and floods are more telling in the lives of people than before. Regional imbalance of water resource distribution in the State is a non-negotiable reality. The State has responded to the water stress with planning and creating Multi Village Water Supply Systems, drawing water from surface sources. At the local level (GP level) twin water sources- both surface and groundwater sources-are used. Borewells and its resource intense technology have largely replaced traditional water sources and water harvesting-cum management practices that were evolved through centuries of trial and experiments.

Governmental response to water stress has focused more on creating water infrastructural schemes that can cater to large number of villages. This approach is heavy in terms of technology, finance, energy and involvement of private sector. When one looks at the village level, there is an abundance of water assets, which are really not synchronized to each other and hence act in silos. Systemic and integrated response to water stress is yet to get evolved into a smooth functioning system. Parallelism in water supply has to end and badly needs to be integrated at local (GP) level. Asset creation, operations and maintenance of water supply assets is only one side of the solution, which is getting lot of focus today at the macro and micro level. The other side of the solution lies in focusing on institutions, governance, human capital and attempts to recover cost of operations. This side, which we would like to term as the soft side of operations is weak and not focused in the State. Focusing on the soft side needs to be based on a participatory process that needs strong political and social support, ownership and commitment. Capacity building at RDWSD, Operator, PRIs, especially GP, VWSC and Staff across the levels is one of the key activities that need to be in the focus. RDWSD itself needs to be strengthened by way of human resources, skills, technologies and knowledge development. Rural water supply in Karnataka needs to be liberated from its present 'low level equilibrium trap' to become sustainable in terms of finance, human capital, institutional and governance capitals that contributed to the sustainability pentagon, where policy instruments, GRM, MIS, improved contract management approaches and local level institutions in the like of VWSC need to be the urgent focus to salvage rural water supply sector in Karnataka.

Findings from the study on 'Evaluation of Multi Village Schemes' is summarised against: (1) Objectives of MVS evaluation and (2) Sustainability Capitals in MVS. The following were the objectives of the MVS evaluation study:

a) To assess functionality of water supply schemes implemented in Karnataka during the period from 2015-16 to 2019-20.
b) To estimate the delivery performance in terms of frequency, regularity, adequacy of supply of water at household level in all the habitations at all the times and under all circumstances.
c) To examine adherence to quality standards as per the prescribed norms (WHO Standards).

d) To assess the coverage of villages such as not covered, partially covered and quality affected.
e) Demand and supply analysis of water supply scheme in all the villages and habitations.
f) To assess impact on rural communities with focus on indicators and targets related to SDG 6 on 'Clean Water and Sanitation' and SDG -3 on 'Good Health and Well Being'.
g) To analyze the impact of covid on functioning of MVWSS
h) To study functioning of similar schemes in other states and suggest measures for improvement for Karnataka

Table 76: MVS - Key findings against objectives

No	Objective of MVS Evaluation	Key Findings
1	To assess functionality of water supply schemes implemented in Karnataka during the period from 2015-16 to 2019-20	1. 60 MVS surveyed 2. 57 of 60 MVS are fully functional 3. 01 MVS (MVS Doddakavalande- Mysore) is partly functional 4. 02 MVS (MVS Adralli (Gadag) and MVS Hullur (Raichur) are not functional 5. Functionality means, MVS is operational and distributing water to Gram Panchayats at Village OHTs.
2	To estimate the delivery performance in terms of frequency, regularity, adequacy of supplyof water at household level in all the habitations at all the times and under all circumstances	The delivery performance is assessed at consumer level a. **Frequency** – Frequency of water supply at consumer end varies from less than 30 minutes to two hours plus on the day of water supply; (4.86% of households get water for less than 30 minutes; 22.5% of households get water supply for half an hour to one hour. 34% gets water for 1 to 2 hours; 38% of households get water supply for more than 2 hours of water supply) b. **Regularity**: 60% of HHs receive water supply daily; 40% of the HHs received water supply once in 2 to 4 days c. **Adequacy**: Adequacy is assessed against the GoI norm of 55 lpcd. It is found that HHs in general receive 94 lpcd, of which 56 lpcd comes from the MVS source on a gross output base and the balance of 38 lpcd comes from groundwater sources maintained by GPs. However, MVS experience NRW- Non-Revenue Water to the tune of 20% on an average and would thus reduce adequacy of water to 45 lpcd and the GPs make up for the remaining supply from its borewell sources. d. **Adequacy, Regularity and Frequency of water supply for the Control group**: Considering the comparative cost incurred for the construction of MVS and SVS (control group draws water from non-MVS sources), 77 lpcd is very impressive in terms of quantity of water supplied to households. The result of the control group actually poses a challenge on the whole efforts, energy, investment made on MVS.

No	Objective of MVS Evaluation	Key Findings
		e. Comparing the performance under 'Frequency' parameter of 'Experimental' and 'Control' Groups, it is found that the experimental group is faring better in lower level of frequency, while Control Group is better poised at a higher frequency service level. However, higher duration or frequency of supply does not mean that adequacy, quality and sustainability is adhered. Although under the control group, water available is not treated, source is not sustainable and the pressure of supply is not adequate for the households to fill the needs within an hour such that they can carry on with their routine work. f. Control group households get water supply every day when the SVS systems are functional.
3	To examine adherence to quality standards as per the prescribed norms (WHO Standards)	a. There is no scope for any comparison of water quality parameters against WHO standards and those maintained in the State of Karnataka. WHO suggests testing 90 parameters in 'chemical', while BIS-10500 suggests testing 29 parameters under physical, chemical and bacteriological parameters. Water sample from MVSs surveyed are testing 12 parameters under chemical and physical category and bacteriological parameter is not tested. b. Frequency of water quality testing is either monthly or along with the submission of bills for payment by the Operator. c. Not all water quality parameters are uniformly tested across all RDWSD labs; Regularity of water quality testing is monthly; physical and chemical parameters of water quality are found within permissible limits in general. However, bacteriological parameter of water quality, which is a critical component of water quality is not found in any of the MVS water quality test reports.
	To assess the coverage of villages such as not covered, partially covered and quality affected.	a. Comparison in the study has been between villages that are covered by MVS and those that are covered by GP based borewell sources. The study did not find any village or habitation that falls under the 'not covered' category. b. Villages/Households with and without MVS water supply have been covered in the study. Quality aspects of water are of secondary priority at the consumer and GP levels.
	Demand and supply analysis of water supply scheme in all the villages and habitations.	a. Consumer demand is more than what MVS supply and the gap is met by GPs arranging additional supply of water from groundwater based schemes. b. There is not much gap between demand and supply, considering the water supply from all sources at GP level. If supply from

No	Objective of MVS Evaluation	Key Findings
		MVS alone is considered, it may be stated that MVS is supplying approximately 50% of the total demand at GP/ consumer level. c. Pricing of water, especially considering Incremental Block Tariff for the volume of water consumed will control the demand for water. However, rural water supply in Karnataka has not yet applied incremental block tariff and volumetric pricing. Hence there is a clamour for more water always, which the GP manages to supply from its own sources as well as from the MVS. Since pricing has not been applied at the GP level, there is not yet any evidence for demand control at the level of GP. Since flat tariff system is followed at the consumer level, pricing does not control the volume of water consumed.
	Impact on rural communities with focus on indicators and targets related to SDG 6 on 'Clean Water and Sanitation' and SDG -3 on 'Good Health and Well Being'.	Percentage of population affected by Water Borne Diseases (WBD) varies from zero (0) to 13.13% at selected GPs during the year 2021. Data on Incidence of the occurrence of Cholera, Diarrhoea, Gastroenteritis, Jaundice and Typhoid have been collected and analyzed. a. 15 GPs (20.27% of 74 GPs.) have not reported any incidence of water borne diseases b. 36 GPs (48.65%) have 0.01 to 0.99% WBD incidence. c. 12 GPs (16.22%) have 1 to 5% incidence of WBDs d. 8 GPs (10.81%) have 5.01% to 10% of WBD occurrence. e. 2 GPs (2.7%) have WBDs ranging above 10.01% to 13.13%. In one of the cases, ie., Nellihankalu in Channagiri taluka, Davanagere district, the health data received from PHCs indicate the number of Gastroenteritis cases on higher side. Hence, the data is in the process of re-checking in consultation with health department and GP. f. Average annual occurrence of WBD during 2013-14 was 8,050 in the GPs sampled for study, while average annual occurrence of WBDs in the same sampled GPs is to the tune of 11,337 during 2015-2021. g. SDG-6:- Ensure Availability and Sustainable Management of Water and Sanitation for All (1) % of population having safe and adequate drinking water in rural areas for Karnataka is 52%; (2) % of annual ground water withdrawal against net annual availability for Karnataka is 70%. h. SDG-3:- SDG3 on 'Good Health and Well Being' 1. Current MMR- 92/100000 live births 2. Under Five Mortality Rate (U5MR)- 29.5/1000 3. % of children aged 12-23 months fully immunized- 69% 4. Annual Notification of Tuberculosis cases/per 1 lakh

No	Objective of MVS Evaluation	Key Findings
		population 103 5. Number of governmental physicians, nurses and midwives per 1,00,000 population- 276.
	Analyze the impact of covid on functioning of MVWSS	2 MVS out of 58 MVS were affected by 'Covid 19' and were not functional for one week each. There was no impact for 56 MVS due to covid. Two MVS are not functional due to infrastructure related issues.
	Study functioning of similar schemes in other states and suggest measures for improvement for Karnataka Two schemes outside Karnataka and one scheme within Karnataka were studied and the case studies are attached. Measures that can be adopted in the Karnataka context are proposed below.	

Table 77: Sustainability capitals - compared across case study samples

No	Takeaways	Nenmeni	Shiraguppi	Banavadi
1	**Natural Capital**- Sustainable Water Source	Yes	Yes	Yes
2	**Physical Capital (Infrastructure and Operations)**			
2.1	Automated pumping systems (Mobile/ Sensor based) at Jack well/WTP/SVS	Yes	Yes	Yes
2.2	Solar energy generation at WTP and connecting to State Grid			Yes
2.3	Fusion Technology used to join pipes in IVDN			Yes
3	**Finance Capital**			
3.1	Incremental Block Tariff for consumer categories	Yes		Yes
3.2	Multiple payment options for consumers	Yes		Yes
3.3	Incentive for regular payment by consumers		Yes	
3.4	Software based accounting and book keeping systems	Yes	Yes	Yes
3.5	Software based Billing and Collection system	Yes	Yes	Yes
3.6	Levying penalties for illegal connections and non-payment of water tax	Yes	Yes	Yes
3.7	Promoting transparency in billing and collection	Yes	Yes	Yes
4	**Human and Social Capital**	Yes	Yes	Yes
4.1	Inclusion of Experts in GPWSC/VWSC and reducing the number of GP members in the VWSC/CWU	Yes	Yes	
4.2	Rationalizing the number of watermen at GP level		Yes	Yes
4.3	Fewer staff with skill, knowledge and professionalism	Yes	Yes	Yes
5	**Governance and Institutional Capital**			
5.1	Inclusive rule making and enforcement	Yes	Yes	Yes
5.2	Converting VWSC / GPWSC/SLEC into a Community Water Utility (CWU) with clear definition of roles and responsibilities for CWU and GP	Yes	Yes	

5.3	Field Water Schools in collaboration with case study GPs/ CWUs	Yes	Yes	Yes
5.4	Community based GRM and mechanism for monitoring resolution of Grievances.	Yes	Yes	Yes

The Tor for the MVS evaluation study lists the following objectives of Multi Village Schemes (MVS). A brief examination of the objectives and their achievement is made in this section of the Findings and Conclusions.

Table 78: Key findings against MVS objectives

No	Objectives of MVS	Key Findings
1	To ensure drinking water security in rural area by augmenting existing water resources.	MVS has definitely contributed to the water security in rural areas which are brought under the MVS. Though GP level sources have been augmented with MVS water supply, there exists a clear lack of synchronization in terms of quality, regularity and frequency.
2	To serve desired quantity of water to large and dense settlements in rural and dry areas.	'Desired quantity of water' needs to be defined. MVSs are designed for 40 to 85 lpcd range, while JJM has fixed the desired quantity of water at 55 lpcd. A tendency of excess-use of water (94 lpcd on an average) and wastage are noticed in the villages.
3	To provide adequate quantity of water for all needs (especially when groundwater is depleted and contaminated) at household level in all habitations at all times under all situations at affordable rates without commercialization.	1. Adequacy of quantity needs to be defined. The objective statement does not state what quantity is adequate. However, JJM definition of adequacy has been fulfilled across households in the GPs. 2. Since Karnataka received normal rainfall since 2018, groundwater sources at GP level were also actively used to supplement water supply from MVS. 3. MVS water has been supplied free of charge to the users, as no GP has paid any bulk water tariff to RDWSD.
4	To maintain quality of water as per prescribed standards.	Quality aspect of water supply is neither getting the focus and attention it should be given at the MVS level nor at the GP level.
5	To ensure all schools and Anganwadis and habitations dominated by SC, ST, Backward Classes, Minority etc. have access to safe drinking water.	Habitations with SC, ST, Backward Classes, Minority communities etc. have access to safe drinking water and are not discriminated on the basis of these socially divisive characteristics.
6	To gain increased revenue by adopting modern IT techniques, like online monitoring of leakages and wastage, pressure management	1. No revenue is realized for any of the 60 MVS surveyed

No	Objectives of MVS	Key Findings
	systems, quality monitoring, atomised waterreading etc.	2. Modern IT techniques are not adopted by RDWSD to monitor leakages, wastage, pressure management, quality monitoring, and measurement of water volumes.
7	To enable communities to monitor and maintain surveillance on drinking water source and supply system.	Communities, Community Institutions or for that matter even Gram Panchayats are not enabled or facilitated to conduct surveillance on drinking water source, water quality and water supply system.

6.1 Achievement of MVS Objectives under Sustainability Pentagon

The evaluation of MVS and O&M of Rural Water Supply Schemes is viewed from an angle of five capitals/components: (1) Natural capital-Water Resource; (2) Physical capital- Water Supply Infrastructure which includes built assets together with operation and maintenance; (3) Finance Capital: Income and sufficient cash flow to manage the expenditure and contingencies;(4) Human and social capital- capacity building of stakeholders, IEC, social aspects including leadership and their knowledge, skills and experience to operate and maintain the drinking water supply schemes and finally (5) Institutional & Governance capital-Legal, Policy, Institutional & Governance aspects including legislations on water, government orders and the institutional network engaged with the management of O&M.

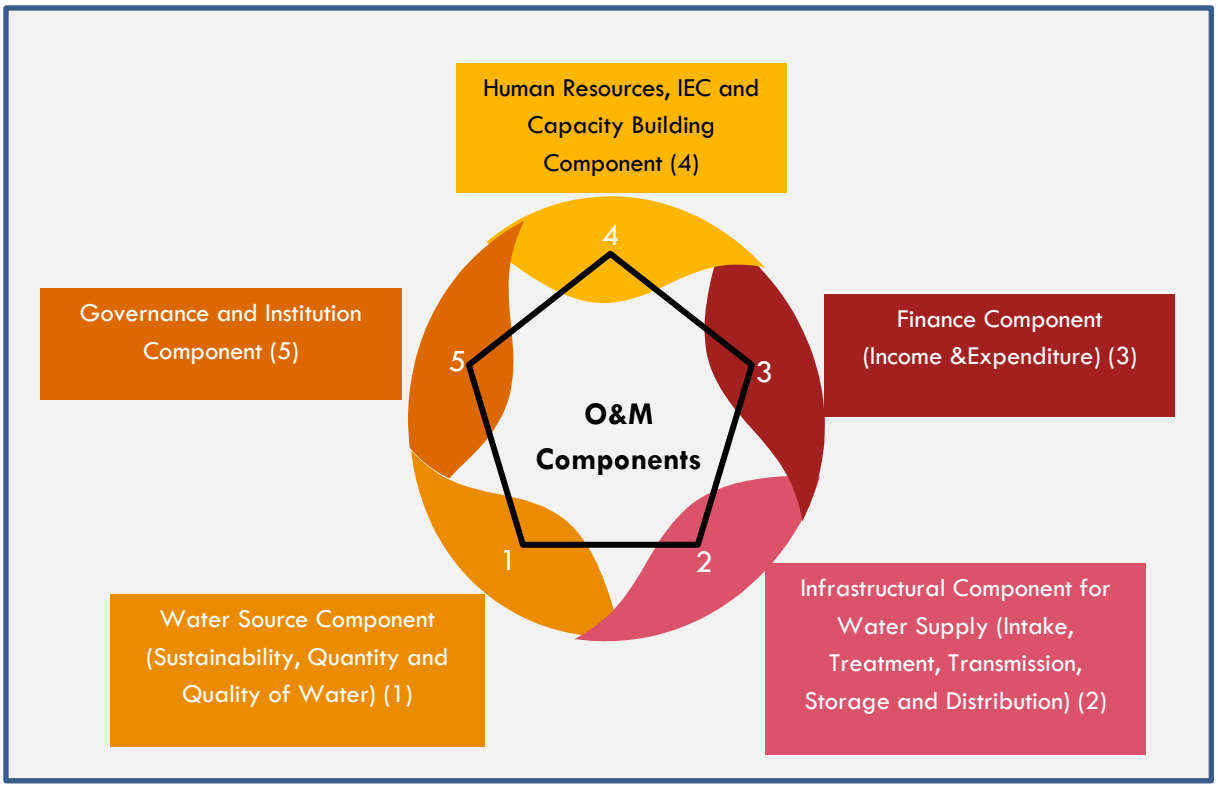


Figure 29: Components of MVS and its Operation and Maintenance

Findings and conclusions of the MVS evaluation study is grouped under the above five capitals. Rural water supply schemes are categorized into Multi Village Schemes (MVS) and Single Village Schemes. MVS in the context of the present study will mean Multi- GP water supply schemes, as except two MVSs studied, all schemes supply water to multiple Gram Panchayats. Though described as Single Village Schemes (SVS), it generally means the rural water supply system at the GP level and therefore really means Single GP schemes. Hence MVS and SVS are looked at from a conjunctive angle, treating state level, scheme level and local level resources, potential and issues in conjunction.

Table 79: Summary of Key Findings under sustainability pentagon - MVS and SVS/GP level

Name of Capital	MVS	SVS/GP level
Natural capital-Water Resource/ Water Source	1. Water sources based on rivers, reservoirs and natural lakes are found perennial, considering the experience of last five years. 2. Water sources based on canal fed (especially high-level canal fed) Impounding Reservoirs are beset with a sustainability problem coupled with severe competition for water from the farming community.	1. Parallel sources of water from MVS and SVS available at GP- MVS supply has not reduced use of borewell sources; 2. GP's own water sources are groundwater based Borewells; Due to normal to above normal rainfall received in Karnataka during the last 4 years, borewells yield water. 3. WPPs are available in all GPs surveyed and people purchase WPP water at nominal tariff and consume the same. 4. MVS supply water to Gram Panchayats at village level OHTs 5. Water is available at reasonable levels for the GP population, with a selected category people resorting to usage above reasonable levels as per Indian norms and standards' 6. Traditional and community owned water sources are neglected and face abandon.
Physical capital- Water Supply Infrastructure	1. MVS assets are built reasonably well. 2. 57 MVSs are functional; 01 is partially functional while 02 are not functional 3. Operations based data is not fully available at the MVS level. 4. Maintenance needs improvement.	1. Village level OHT storage is substantial, sufficient to store @43LPCD for the population 2. Aged distribution network needs rehabilitation. New concrete village streets and concrete drainage have pushed the IVDN beneath the concrete layer.

Name of Capital	MVS	SVS/GP level
	5. Synchronization between MVS, SVS, WPP needs improvement. 6. Administration and management of MVS contracts needs improvement. 7. Rural water sector is still focused on asset creation and not on reforms, institutional arrangements, human capital with community participation. 8. Private Operators are engaged by RDWSD and they were envisaged to bring technology and skills from the market to operate MVS. However, what has actually happened on ground is that small time and small-scale operators without calibre have canvassed all MVS contracts and state of the art technology and management in rural water supply is not at all seen across the sample of MVS, except in the large MVSs. Even in the large MVSs, SCADA, data management, coordination with GPs, etc., need improvement. 9. Large scale Investment in MVS. quality of construction is good. Schemes of the order of Multi-Village to Multi-GP to Multi-Taluk dimensions are seen in the field. The nomenclature, 'Multi Village Schemes' appears to be anachronistic.	3. Water supply from MVS has not reduced use of borewell sources; 4. Multiple water assets- SVS-WPP-MWS-OHTs-Cisterns-PSPs-IVDN 5. Informal Farm settlements (Thotta Vasathi) increasing and posing new challenges for rural water supply. 6. Technical and Managerial capacity needs improvement 7. Mixing treated (MVS) and raw water (Bore well) at Village OHTs and is a quality threat. 8. Improvement required w.r.t. Regularity, Adequacy, Frequency and Quality of water at GP/ Village level. 9. Resistance to Metering from community 10. Lack of O&M Plan 11. Unauthorized HTCs/Tullu pumps/ Double connections exist.
Finance Capital	1. RDWSD dependent on government grant/ budgetary allocation for the sector- doesn't generate any income. 2. Neither ULBs nor GPs pay for the bulk water supply made from MVS. 3. Annual O&M cost on behalf of MVS limited to 74 GPs is 4.22 cores and the O&M expenses for 74 GPs works out to 27.62 crores, which	1. Financial position of GPs is precarious and will find it difficult to pay for MVS bulk water at the rate of Rs.5/kL. 2. There is no annual O&M plan at the level of GP 3. Low O&M tariff at consumer end 4. Over-consumption of water at consumer level is assumed. 95 LPCD on an average. But from available

Name of Capital	MVS	SVS/GP level
	together makes it 31.85 crores, with an annual average O&M cost households works out to Rs.2874, while the annual average revenue from household level by way of tariff collection is only Rs.145.46 and needless to mention that the way things are, there are miles to travel down to the path of sustainability.	consumer water meters, the lpcd is seen going up to 250 lpcd. 5. GP in low level equilibrium trap- Poor recovery of tariff from consumers notified. 18% of GP level opex is towards salary of watermen, 67% is towards power charges and 15% is towards repair and maintenance. GPs collect 5% of the total operational expenditure incurred by them by way of consumer tariff. 6. Salary of watermen, power charges for operation of borewells, repair and maintenance are major expenditure heads at GP level. 7. O&M at GP level is heavily dependent on Government Grants. 8. GP is finance stressed to meet all water sector requirements.
Human and social capital		1. Team of Watermen are available at GP level and acts as the water bureaucracy at GP level 2. Community not mobilized and not involved in operations, maintenance and management of GP level water supply/ distribution management. 3. More and more watermen are added to the army of watermen.
Institutional & Governance capital		1. MIS not available at GP level 2. GRM systems and arrangements are not known to consumer public

Table 80: Summary of sustainability related observations – State Level

State level	
Finance Capital	RDWSD dependent on government grant/ budgetary allocation for the sector- doesn't generate any income.
Human and social capital	1. Nascent RDWSD- with an average of 50% vacancies-Substantial vacancies exists in the field positions of RDWSD. Number of vacancies range from 50 to 75% of the sanctioned posts. Field level engineers, especially Section Officers are badly needed at the divisional and sub-divisional level. 3. Poor Sectoral & Institutional capacity-

Institutional & Governance capital	1. Policies and GOs are prepared and are not implemented 2. Rural water supply does not focus on reforms, institutional arrangements, human capital improvement with community participation. 3. Absolutely no focus on reforms 4. Inadequate clarity on institutional mechanism- No unit of command. 5. Still very weak on O&M 6. No synchronization of water resources, institutions, schemes, operations, finances 7. Technology upgradation in O&M not attempted 8. No reform focus 9. No O&M payment from GP to RDWSD 10. WPPs introduced as an interim measure to provide purified good quality potable water in certain districts like Gadag- got scaled up to reach an enormous 18500 units today and add to the concentration of contaminants in soil, the ultimate natural storage of water. Short Term solution gets scaled up. However, people are spending money to purchase RO- WPP water, while they are hesitant to pay the regular water tariff to GP. 11. Strengthening of RDWSD- fresh recruits- training- good practices not happened.

6.2 Sustainability of Multi Village Schemes (MVS) in Karnataka

Sustainability of MVS under the evaluation study can be viewed from two angles: first from the angle of objectives of the study and second from the angle of sustainability pentagon. Viewed from the first angle, objectives 1 to 3, 5 and 6 cover certain aspects of sustainability, as these deal with (1) functionality of MVS; (2) delivery performance of MVS; (3) adherence to quality standards for the water supplied from MVS; (5) demand and supply analysis of water supplied from MVS and (6) impact of MVS on rural communities with regard to SDG 3 and 6. Conclusions and insights related to sustainability on the basis of the above objectives are presented below:

Table 81: Summary of sustainability related observations against ToR objectives

Objective	Insight /conclusion regarding sustainability of MVS
1. To assess functionality of water supply schemes implemented in Karnataka during the period from 2015-16 to 2019-20	95% of the MVS samples are found functional 1.67% of MVS sample is partly functional 3.33% of MVS sample are not functional. On the basis of functionality, MVS samples are doing excellent. Functionality is considered equivalent to operational status of MVS, which otherwise means the systems and infrastructural assets created for the MVS are functional and operative on the day of the Team Visit.
2. To estimate the delivery performance in terms of frequency, regularity, adequacy of supply of water at household level in all the habitations at all the times and under	The delivery performance is assessed at consumer level 1. **Frequency** – 72% of households get water for above one hour daily and 28% of households get water supply for less than an hour per day

all circumstances. a. Providing access to specified quantity of water on daily basis.	2. **Regularity**: 60% of HHs receive water supply daily; 40% of the HHs received water supply once in 2 to 4 days 3. **Adequacy**: Volume of water supplied is found adequate as households on an average receive approximately 94 lpcd, against the GoI norm of 55 lpcd. a. Specified quantity (volume) of water can be provided to community on the basis of following arrangements: 1. Water supplied from MVS to Gram Panchayats at Village OHTs shall be metered, recorded and documented on a daily basis. 2. GP shall undertake a survey of all households and update its consumer base data. 3. GP shall inform the RDWSD and the MVS Operator the daily requirement of water to meet the norm of '55 LPCD potable water' for the population of all villages and habitations within the geographical limits of the GP. 4. GP shall be issued a bill for the water consumed in the previous month by the 10th of the subsequent month by RDWSD. 5. The Tariff for bulk water supply to the GP shall be as per tariff fixed vide the Government Order issued in December 2020 or subsequent amendments to the order of December 2020. 6. Gram Panchayat on its own shall prepare a list of all consumer households with a HTC and do the needful to fix all such HTCs within the GP with a functional water meter as per standard specifications. 7. Water consumption data as per meter reading shall be taken 30 days after fixing and installing the domestic water meter and thereafter every month. Each of such HTC shall be issued a water bill by the fifteenth of the subsequent month. 8. The consumer household with an HTC shall make the payment of water tariff within seven (7) days of receiving the water bill without penal charges and with penal charges for late payment as decided by the GP council. 9. Punitive provisions shall be introduced if the MVS Operator fails to supply the requisite volume of water with specified quality parameters under BIS-10500.

	10. Incremental Block Tariff shall be applied for water consumed by the GP and consumer households. 11. Pricing of water, especially considering Incremental Block Tariff for the volume of water consumed will control the demand for water. However, rural water supply in Karnataka has not yet applied incremental block tariff and volumetric pricing. Hence there is a clamour for more water always, which the GP manages to supply from its own sources as well as from the MVS. Since pricing has not been applied at the GP level, there is not yet any evidence for demand control at the level of GP. Since flat tariff system is followed at the consumer level, pricing does not control the volume of water consumed. 4. Delivery performance in terms of 'Frequency', 'Regularity' and 'Adequacy' cannot be entirely attributed to MVS, since GPs are supplying water to households from borewell sources. Since water metering and measurement of volume of water available at Village level and household are not uniformly available and functional, it is difficult to conclude that delivery performance is satisfactory along with sustainable service levels. Conclusions arrived at by the team is on the basis of a composite estimation of delivery performance considering MVS supply and GP level supply.
3. To examine adherence to quality standards as per the prescribed norms (WHO Standards)	1. Water sample from MVSs surveyed are testing 12 parameters under chemical and physical category and bacteriological parameter is not tested. 2. Presence of residual chlorine is not tested in the water samples. 3. Considering the possibility that MVS-SVS water supply confluence at Village level OHT/IVDN, water quality is not given the kind of focused attention that is obligatory under BIS specifications.
4. Demand and supply analysis of water supply scheme in all the villages and habitations. a. Mention the percentage of surplus water provided to citizens.	1. Community across the study area appeared to be consuming water beyond 55 LPCD norm prescribed by GoI. LPCD availability from MVS could not be calculated precisely in the absence of measuring devices and consumption data at village and household level. Based on the Team's estimation, it is found that MVS supply at LPCD level is approximately 58% and GP level supply is 42% of the actual supply. After considering losses and non-revenue water in the conventional sense, MVS is

	supplying approximately 50% of the total demand at GP/ consumer level. Hence there is not much gap between demand and supply, considering the water supply from all sources at GP level. a. If 20% of Non-Revenue Water (Loss) is considered, then the MVS supply per capita will come down to approximately 44 LPCD. Considering 55 LPCD as the base norm for supply of water, 11 LPCD has to be provided from GP level sources. Our calculations have shown that an approximate 94 LPCD is supplied and therefore, the surplus supply is equivalent to 39 LPCD, ie, 71% of surplus supply is effected at the domestic/ household level.
5. Impact on rural communities with focus on indicators and targets related to SDG 6 on 'Clean Water and Sanitation' and SDG -3 on 'Good Health and Well Being'.	1. Water borne diseases in general have declined in the GPs surveyed under the study. a. 15 GPs (20.27% of 74 GPs.) have not reported any incidence of water borne diseases, while 36 GPs (48.65%) have less than 1% WBD incidence. b. 12 GPs (16.22%) have 1 to 5% incidence of WBDs and 10 GPs (13.51%) have WBD occurrence in the range of 5 to 13 %. c. SDG-6:- Ensure Availability and Sustainable Management of Water and Sanitation for All (1) 52% of population are assumed to have safe and adequate drinking water in rural areas of Karnataka

6.3 Sustainability assessment of MVS under Sustainability Pentagon

Sustainability assessment of MVS under the Sustainability Pentagon takes a broader and holistic approach to sustainability. The sustainability pentagon consists of natural capital (water resources), physical capital and operations (water infrastructure and operations), finance capital (revenue and expenditure), human and social capital (staff, leadership, community base, skills and knowledge of stakeholders) and finally institutional capital (governance tools, organizational platforms, information systems and grievance redressal mechanisms). Sustainability of MVS is viewed from these above angles.

Table 82: Summary of sustainability related observations against Sustainability Pentagon

Natural Capital	MVSs have shifted to surface water sources. Water sources of the 60 MVS that were studied consisted of River (38), Canal+Rainfed Impounding Reservoir (13), Reservoir (7) and Natural Lake (2). Water sources of MVS were generally perennial and were able to source water throughout the year. Impounding Reservoir drawing water from Canals, especially High Level Canals face a problem of sustainability. Otherwise, water sources are perennial and sustainable. However, this has to be

	viewed against the annual climatic calendar of the State. The rainfall in Karnataka has been more or less normal since 2018 and thus water is available in the surface sources. In the event of an extreme climatic calendar, even surface sources will experience resource constraints.
Physical Capital	Physical capital refers to the water infrastructure built for the MVS and consists of assets at water source, transmission, treatment, storage and distribution. All the focus of the water supply appears on the infrastructure. During the post commissioning stage, operational efficiency of MVS depends on the quality of the physical capital as well as the skill-sets, efficiency and commitment of the operator and the cooperation of stakeholders. Physical assets are fairly built, while there are deficiencies in its operation and maintenance, applying largely to small and medium type of MVSs. Database on operations, maintenance, water quality monitoring, etc., require substantial improvement.
Finance Capital	MVS does not generate any revenue from the distribution of water. Government of Karnataka has to take a policy decision, considering long term sustainability of rural water supply sector and assets. RDWSD dependent on government grant/ budgetary allocation for the sector- doesn't generate any income. Currently, financial sustainability is nil.
Human and Social Capital	Human and social capital is applicable at the level of RDWSD, Operators, Gram Panchayats, consumer community and staff across all levels. Knowledge, skill sets, approach to sustainability, etc., needs substantial improvement across the sector. 50 to 70% of Staff positions in RDWSD remain vacant. MVS operators, especially small and medium category of MVS do not engage professionally qualified and experienced personnel to operate and maintain the physical capital. Quality of staff at GP level also requires substantial improvement. The focus is more on building assets than on mobilizing community and building appropriate behaviours in them. Hence human and social capital is also not considered sustainable.
Institutional Capital	VWSC at Village level, Joint Committees at the level of MVS and institutional platforms in general are dormant or inactive. At the GP level, the GP council considers itself as the VWSC and there is no representation from the community, experts, NGOs and activist volunteers. Hence the community base is rather inactive at GP and lower levels. When looked at from the State level, it is found that there is no MIS available at State, MVS (Scheme) and GP level and hence need improvement in terms of monitoring and knowledge generation. Though there is a GRM system, it is largely not known to consumer public and is not commensurately used. One definite weakness under the institutional and governance capital includes political deficit, as policies, government orders and guidelines are prepared and notified, though not implemented. There is no focus on reforms in the rural water supply sector. The Team considers the institutional capital not sustainable.

In general, there is no synchronization of water resources, institutions, schemes, operations, and finances at the rural water supply sector. Physical assets for Multi Village Schemes are fairly built. A water supply system should perform well in operations, maintenance and service delivery and that should become the criteria for measuring success and sustainability. Viewed from such an

angle, MVS in Karnataka have to travel miles to reach levels of sustainability. The focus of the rural water supply sector on O&M (operation and maintenance) is very weak. Technology upgradation especially in O&M of small and medium MVS is not attempted. Management of O&M contract is weak and not governed by key performance indicators. GPs and ULBs do not make any O&M payment to RDWSD and that destroys financial sustainability. Viewed from the angle of sustainability pentagon, all the focus is on developing natural capital and physical capital in the sector and RDWSD. There is hardly any focus on developing finance, human and institutional capitals, which are largely the software side of any water supply scheme, while all focus is on the hardware aspects of water supply. This approach is neither holistic, sectoral and future oriented and hence not sustainable.

7 Theory of Change

ToC is a results Chain, building the context, problems, inputs, activities, outputs, outcomes and impact of an intervention. Carol H. Weiss (Born 1927 and died 2013) made substantial contribution to develop Theory of Change. Theory of Change (ToC) is a methodology which can be used for planning and evaluation of development programmes. It explains the process of change by outlining the causal linkages in an intervention, project or a programme. In the context of the MVS evaluation, it is noted that the ToC was not considered along with the intervention, ie, planning, designing, implementing and operating Multi Village Water Supply Schemes. The ToR for MVS evaluation includes a presentation of the results of evaluation, applying the framework of '**Theory of Change**'. Therefore, what is attempted under the MVS evaluation is to recreate the ToC in retrospect, articulating clearly what changes were expected and what changes have actually happened and what are the outcomes of changes.

Application of Theory of Change to understand delivery of performance of MVS in terms of frequency, regularity and adequacy along with an analysis of outcomes and impacts is an interesting enquiry into a governmental programme and how the programme has impacted the lives of community in the rural Karnataka. Theory of Change is attempted at two levels: (1) at a macro and sectoral level, focusing on Multi Village Schemes (MVS); and (2) at micro and GP level, focusing on Single Village Schemes (SVS)

The ToC framework begins by developing in retrospect the problem context that the MVS/SVS would like to change. The rural water supply context together with certain problems facing the sector is captured below

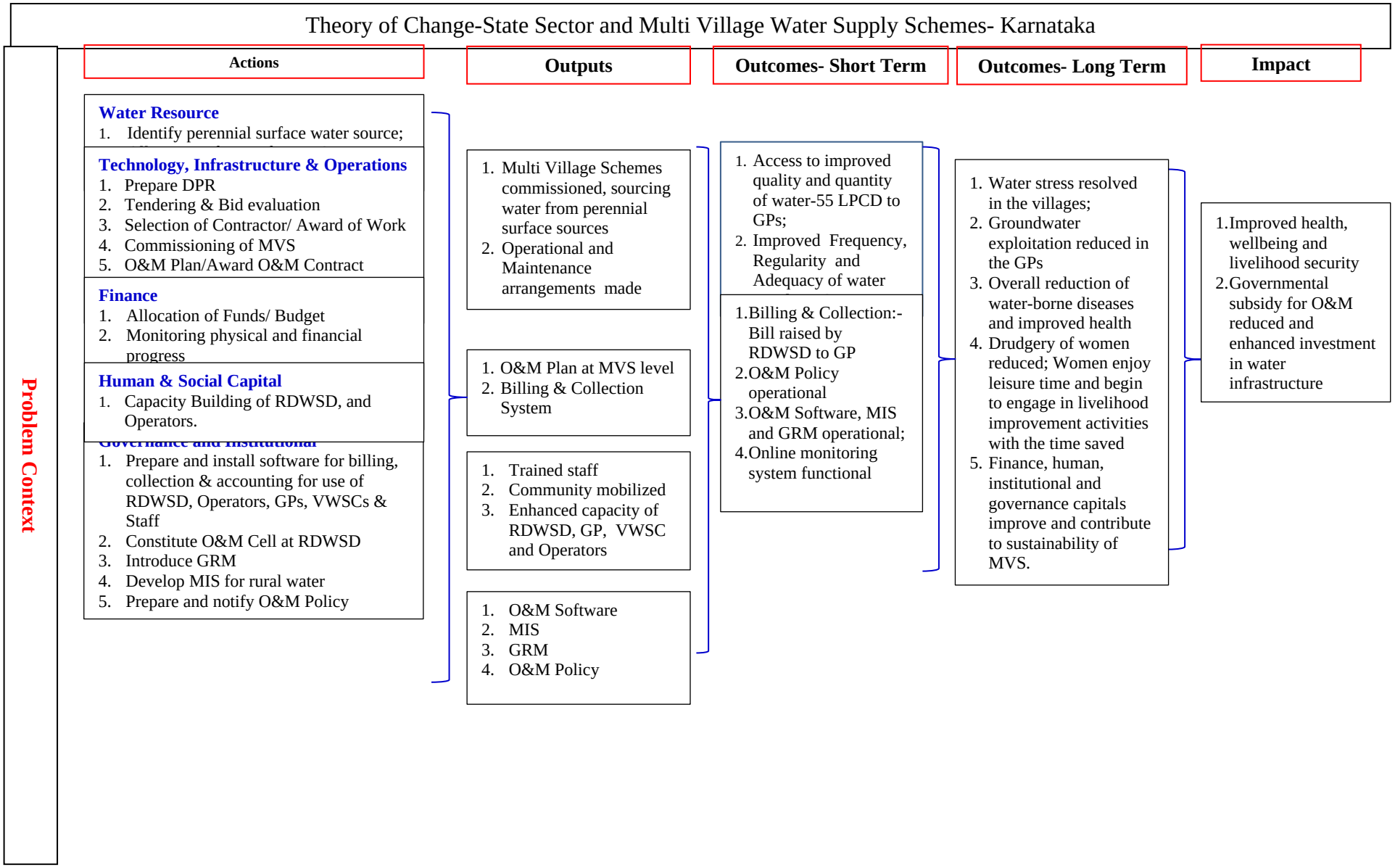
Table 83: Theory of change: context of MVS and SVS/GP under sustainability pentagon

	MVS context	SVS and GP context
Natural Capital	1. Water Scarcity – Quantity and Quality 2. Regional Imbalance in water resources of Karnataka 3. Climate Change- Drought and Floods and irregular monsoon calendar 4. Irrigation water partly diverted for drinking water purpose and conflicts between farmer community and RDWSD 5. Water Sourcing shift to larger surface sources	1. Declining groundwater quantity and quality 2. Neglect of Traditional water sources and water harvesting-cum management practices resulting in water scarcity at local level 3. Borewell- Technology replacing traditional water practices 4. Water for livestock not considered in 55 LPCD allocation by JJM- a nation-wide programme in rural water supply, envisaged to ensure 55 lpcd of potable water through FHTC.
Physical Capital	1. More Focus on Asset Creation/ Infrastructure 2. Less Focus on Operations and Service Delivery 3. Technology Energy and Finance capitals heavily used to address water scarcity. 4. Invisible official MVS Operator	1. In- Village Distribution Network, based on piped network introduced. 2. Informal Farm settlements (Thotta Vasathi) increasing and posing new challenges for rural water supply 3. Aged distribution network needs rehabilitation 4. Parallel sources of water from MVS and SVS available at GP. 5. MVS supply has not reduced use of borewell sources; Mixing treated (MVS) and raw water (Bore well) at Village OHTs; 6. Multiple water assets- SVS-WPP-MWS-OHTs- Cisterns-PSPs-IVDN- 7. Poor Technical and Managerial capacity 8. Improvement required w.r.t. Regularity, Adequacy, Frequency and Quality of water 9. Low pressure at HTCs and tail end villages 10. Resistance to Metering from community 11. Lack of O&M Plan (Annual / Scheme/ GP-wise) 12. Poor maintenance of water assets 13. Unauthorized HTCs, illegal tapping of water, sucker pumps installed in the distribution network 14. Need to move from asset creation to reforms, capacity building, Sustainability, efficient O&M of assets. 15. Need to develop local level barefoot expertise in water supply management

	MVS context	SVS and GP context
Finance Capital	1. Poor Cost Recovery and Low level Equilibrium Trap[63] 2. RDWSD has established an informal precedent that water supplied to GP and ULB is tariff-free.	1. Poor recovery of tariff from consumers 2. Low level Equilibrium Trap 3. Salary of watermen, power charges for operation of borewells, repair and maintenance are major expenditure heads at GP level 4. O&M at GP level is heavily dependent on Government Grants. Of the total O&M expenditure, about 95% is through government subsidies and 5% is the cost recovery achievement from consumer community 5. GP is finance stressed to meet all water sector requirements
Human Resource and Social Capital	1. Poor Sectoral & Institutional capacity- 2. Nascent RDWSD- with 50% vacancies 3. Capacity needs improvement.	1. Cartel of Watermen 2. Community not mobilized and not involved in operations, maintenance and management of GP level water supply/ distribution management
Governance & Institutional Capital	1. Poor Monitoring & Information Systems 2. Lack of Comprehensive policy on O&M. Poor implementation of Government Orders and earlier policies on O&M. 3. Poor Institutional coordination RDWSD-ESCOMs-RDPRD-Operators- GP- VWSC-Consumer Community 4. Poor baseline on MVS. Mismatch of data provided by RDWSD –HQ and Divisional Offices of RDWSD.	1. Poor Institutional arrangements – Local level 2. Dormant VWSC; 3. Poor local level ownership 4. Poor monitoring and information systems 5. Lack of Management Information System 6. Poor GRM arrangement

Based on the above problem context of MVS in Karnataka, the study team created a Theory of Change in retrospect. The Theory of Change for MVS and SVS/ GP level context in Karnataka is captured in the following flow diagrams.

[63] Richard R. Nelson- Theory on Low Level Equilibrium Trap


Theory of Change-State Sector and Multi Village Water Supply Schemes- Karnataka
Problem Context
Actions
Outputs
Outcomes- Short Term
Outcomes- Long Term
Impact
Water Resource
1. Identify perennial surface water source;
Technology, Infrastructure & Operations
1. Prepare DPR
2. Tendering & Bid evaluation
3. Selection of Contractor/ Award of Work
4. Commissioning of MVS
5. O&M Plan/Award O&M Contract
Finance
1. Allocation of Funds/ Budget
2. Monitoring physical and financial progress
Human & Social Capital
1. Capacity Building of RDWSD, and Operators.
1. Prepare and install software for billing, collection & accounting for use of RDWSD, Operators, GPs, VWSCs & Staff
2. Constitute O&M Cell at RDWSD
3. Introduce GRM
4. Develop MIS for rural water
5. Prepare and notify O&M Policy
1. Multi Village Schemes commissioned, sourcing water from perennial surface sources
2. Operational and Maintenance arrangements made
1. O&M Plan at MVS level
2. Billing & Collection System
1. Trained staff
2. Community mobilized
3. Enhanced capacity of RDWSD, GP, VWSC and Operators
1. O&M Software
2. MIS
3. GRM
4. O&M Policy
1. Access to improved quality and quantity of water-55 LPCD to GPs;
2. Improved Frequency, Regularity and Adequacy of water
1.Billing & Collection:- Bill raised by RDWSD to GP
2.O&M Policy operational
3.O&M Software, MIS and GRM operational;
4.Online monitoring system functional
1. Water stress resolved in the villages;
2. Groundwater exploitation reduced in the GPs
3. Overall reduction of water-borne diseases and improved health
4. Drudgery of women reduced; Women enjoy leisure time and begin to engage in livelihood improvement activities with the time saved
5. Finance, human, institutional and governance capitals improve and contribute to sustainability of MVS.
1.Improved health, wellbeing and livelihood security
2.Governmental subsidy for O&M reduced and enhanced investment in water infrastructure

Theory of Change- Gram Panchayat level Village Water Supply Schemes- Karnataka

Problem Context

Actions	Outputs	Outcomes- Short Term	Outcomes- Long Term	Impact
Water Resource 1. Identify Groundwater source; 2. Develop Borewells 3. Receive MVS water 4. Test water quality of Borewells and MVS supply 5. Make arrangements to supply water for Livestock	1. GPs receive water from MVS 2. GPs supplementing groundwater 3. O&M arrangements 4. Water Quality Test Reports 5. Water for livestock arranged	1. Access to improved quality and quantity of water-55 LPCD to consumer households; 2. Improved Frequency, Regularity and Adequacy of water supply at consumer level 3. Time spent for fetching household level water requirement reduced to less than 30 minutes per day/household. 4. GPs manage and control village level distribution	1. Water stress reduced / resolved in the villages; 2. Groundwater exploitation reduced. 3. Overall reduction of water-borne diseases and improved health 4. Drudgery of women reduced; Women enjoy leisure time and begin to engage in livelihood improvement activities with the time saved 5. Finance, human, institutional and governance capitals improve at GP level and contribute to sustainability of local level water supply system.	1. Improved health, wellbeing and livelihood security 2. Improved partial cost recovery at GP level 3. Governmental subsidy for O&M reduced and enhanced investment in water infrastructure
Technology, Infrastructure, O&M 1. Development of MWS/SVS 2. Operation of Borewells to supplement MVS water 3. Distribute MVS water through Cistern based PSPs and HTCs 4. Metered HTCs	1. O&M Plan at GP level 2. GP level Billing& Collection System introduced. 3. Improved cost recovery.			
Finance 1. Using Grants from State Budget and 15 FC 2. Monitoring physical and financial progress 3. Fix volumetric water Tariff 4. Formulate Billing & Collection system 5. Prepare O&M Finance Plan	1. Trained Watermen 2. Community mobilized 3. IEC undertaken 4. Enhanced capacity of, GP, VWSC and GP level Staff. 5. Watermen reports to VWSC.	1. Billing & Collection:- GP Pays to RDWSD partial bulk water charges 2. Consumers pay water tariff to GPs 3. Partial O&M cost recovery GP level; 4. GP applies O&M Policy at local level 5. O&M Software, MIS and GRM operational; 6. Online monitoring system functional 7. VWSC in driving seat in local level water supply management		
Human & Social Capital 1. Capacity Building of GP Council, VWSCs, Watermen, Bill Collectors, GP level staff 2. Social Mobilization 3. IEC focusing on judicious use of water, metered connections and regular	1. O&M Software 2. MIS 3. GRM 4. O&M Guidelines 5. Active VWSCs			
Governance and Institutional 1. Prepare and install software for billing, collection & accounting for use of GPs, VWSCs & Staff 2. Constitute VWSC & activate the same. 3. Develop MIS for rural water sector 4. Develop local level GRM				

7.1 Analysis of Theory of Change: MVS

7.1.1 Activity level

Five different types of capitals are required for a water supply scheme: These include: (1) Natural Capital – equivalent to water resource; (2) Technology and Infrastructural equivalent to physical capital; (3) Finance capital; (4) Human and social capital and (5) Governance and Institutional capital. The following table examines the achievement under each capital.

Table 84: Theory of change – activity level

No	Activities	Remarks on Achievement
1	**Water Resource** 1. Identify perennial surface water source; Allocation of water for MVS. 2. Test water quality	Surface water sources have been identified in the State for Multi Village Schemes. Most of the surface sources such as rivers and reservoirs in Karnataka have water now after a long gap of 15 drought years and water scarcity. WRD is responsible for governing water resources in Karnataka and has allocated water for rural water supply schemes. Largely, being surface water, quality of raw water from the reservoirs is in acceptable limits. Typology of sources for the 60 selected samples under the study include: (River-38)[64]; (Reservoir07) (Canal+Rainfed Impounding Reservoir 13) (Natural Lake 02)
2	**Technology & Infrastructure** 1. Prepare DPR 2. Tendering & Bid evaluation 3. Selection of Contractor 4. Award of Work 5. Commissioning of MVS 6. Preparation of O&M Plan 7. Award O&M Contract 8. Formulate KPIs 9. Monitoring of O&M Contract	Preliminary Scheme Reports (PSR) are prepared by Consulting Firms. Tender process commences on the basis of PSR. Recent trend has been to award MVS contracts under the DBOT instrument of procurement. The DBOT firm prepares the DPR. O&M contract is in-built in the DBOT or even EPC contracts. There are also instances where O&M contract is separately awarded. Preparation of MVS-wise O&M plan doesn't seem to have been done, under DBOT MVS or in other MVS where the O&M contract has been renewed as a fresh contract. KPIs are not included as part of the O&M contract management.

[64] Rivers: 38 (Cauvery 5; Tungabhadra-14; Tunga-1; Bhadra-1; Hemavathi-1; Kabini-4; Bhima-1; Malaprabha-4; Ghataprabha-7)

No	Activities	Remarks on Achievement
3	**Finance capital** 1. Allocation of Funds/ Budget 2. Monitoring physical and financial progress 3. Fix volumetric water Tariff 4. Formulate Billing & Collection system 5. Prepare O&M Finance Plan	Allocation of funds under the State Budget and Central assistance under schemes like NRDWP/JJM has been done. Physical and financial progress monitoring during construction phase has been undertaken. Government Order No: RDW&SD/121/CE/Technical/2020, dated 30.12.2020 is notified on 30th December 2020 where bulk water tariff is fixed at the rate of Rs.5/kL from GPs and ULBs. The GO also provides details of billing and collection system between RDWSD and GPs/ULBs. Asst. Executive Engineer for Vijayapura sub-division prepared bills for O&M payment and submitted the same to 14 GPs. No GP has made the payment, nor responded to the communication. Preparation of O&M finance plan has not been done under any of the MVS studied. All 60 MVS under the study currently run on the basis of budget allocation, totally subsidized by State Government.
4	**Human & Social capital** 1. Capacity Building of RDWSD and Operators	Scheme specific training in O&M has not been done. Young RDWSD Engineers who accompanied the MVS evaluation team informed that they are not exposed to Operations and Maintenance as well as how to monitor the O&M.
5	**Governance and Institutional capital** 1. Prepare and install software for billing, collection & accounting for use of RDWSD, Operators, GPs, VWSCs & Staff 2. Constitute O&M Cell at RDWSD 3. Introduce GRM 4. Develop MIS for rural water sector 5. Prepare and notify O&M Policy	1. Software for billing and collection is neither prepared nor made available to RDWSD/ Operators 2. O&M Cell is constituted at RDWSD 3. GRM is prepared and available. Out of 74 GPs visited under 60 MVS, only one GP has exhibited the PARIHARA contact number (9480985555) on a notice board in the GP office in big bold letters. During the 26 months from March 2020 to April 2022, total number of complaints handled by PARIHARA call centre at RDWSD is 20018, of which 18972 have been resolved with outstanding unresolved complaints of 1046 as on 30.04.2022. Average daily inflow of complaints is 25 and average daily resolution of complaints is 24. The rate of complaint resolution is impressive. However, it is a matter of concern that for approximately 40 million rural population, only one complaint per 1.6 lakh population is being raised. Hence it is assumed that people in general are unaware of the existence of PARIHARA, the GRM system in RDWSD-Karnataka. 4. MIS for rural water sector in Karnataka is still a far cry. 5. O&M policy is drafted but not yet notified. It is available in the RDPRD website.

7.1.2 Output level

Outputs are the results of activities. These outputs are again examined under five different types of capitals as mentioned above. The following table examines the achievement of outputs under each capital.

Table 85: Theory of change – Output level

No	MVS- O&M Capital	Outputs anticipated	Remarks on Achievement
1	**Water Resource**	1. 60 Multi Village Schemes commissioned, sourcing water from perennial surface sources 2. Operation and Maintenance arrangements made	1. MVS – sourcing water from perennial surface sources, are commissioned and made functional 2. O&M arrangements have been either in-built into DBOT/EPC/Turnkey contracts or separate O&M contracts have been awarded
2	**Technology, Infrastructure & Operations**		
3	**Finance capital**	1. O&M Plan at MVS level 2. Billing and Collection System	1. O&M Plan at MVS level is not prepared and available 2. Automated and software based Billing and Collection System is not prepared and available
4	**Human & Social capital**	1. Trained staff 2. Enhanced capacity of RDWSD and Operators	1. Staff not trained in O&M- No evidence 2. There is no evidence for enhanced capacity of RDWSD.
5	**Governance and Institutional capital**	1. O&M Software 2. MIS 3. GRM 4. O&M Policy	1. O&M Software- Not available 2. MIS- Not available 3. GRM – available, but very little awareness 4. O&M Policy – Not available

7.1.3 Outcomes- Short Term

Outcomes are the results of outputs**.** These outcomes are again examined under five different types of capitals as mentioned above and are categorized into short term outcomes and long-term outcomes. The following table examines the achievement of outcomes under each capital.

Table 86: Theory of change – short-term outcomes

No	MVS- O&M Capital	Short Term Outcomes anticipated	Remarks on Achievement
1	**Water Resource**	1. Access to improved quality and quantity of water-55 LPCD to GPs; 2. Improved Frequency, Regularity and	1. Partially achieved. But access to improved quality of water from MVS is not assured as GPs mix untreated borewell water with treated MVS water. Yet another issue is that Operators in certain MVS-WTPs, do not chlorinate water, clean the assets and devices and maintain all components of WTP in good working condition. Frequent testing of water quality also is not
2	**Technology & Infrastructure**		

No	MVS- O&M Capital	Short Term Outcomes anticipated	Remarks on Achievement
		Adequate of water supply at GP & consumer level 3. Time spent for fetching household level water requirement reduced to less than 30 minutes per day/household.	found. Only very few GPs have arrangements for supplying treated MVS water through the Village OHTs to HTCs and untreated borewell or river water through cisterns & public taps. 2. Partially achieved. Regularity of supply on an everyday basis was found in 60% households. 26% of households get water on alternate days and 14% once in 3 to 4 days a week. 69% of GPs are satisfied, 31% of GPs are not satisfied with regard to frequency of supply. When the frequency of supply comes to the level of households, 5% of households receive water for less than 30minutes per day; 23% gets water for upto one hour, 34% up to two hours, 14% up to four hours and 25% gets for more than four hours. When frequency of supply is considered for control group households, 9% of households get water for less than 30 minutes a day, 11% gets water for upto one hour, 30% up to two hours, 15% up to four hours and 35% gets for more than four hours. When it comes to the question of Adequacy of supply, it is 93% at MVS level, declines to 50% at GP and 85% at Household level. Household level adequacy has gone up as GPs supplement water supply from its borewell sources. 3. Partially achieved. But where water is supplied through HTCs and Cistern based PSPs on alternate days, households have to travel several times and collect required quantity of water, standing in the queue at the PSP. It will definitely take more than 30 minutes.
3	**Finance capital**	1. Billing & Collection: Bill raised by RDWSD to GP 2. Partial O&M cost recovery at MVS and GP level; 3. O&M Policy operational 4. O&M Software, MIS and GRM operational;	1. Out of 17 districts and 44 sub-divisions covered under RDWSD, only one sub-division raised bills on GPs. But GPs did not respond to the bills nor attempted any payment for the bulk water. 2. 0% O&M cost recovery achieved by RDWSD at MVS level. 3. O&M policy is not operational. GO issued in December 2020 regarding Bulk Water Tariff is also not operational 4. O&M Software, MIS and GRM are not operational 5. Online monitoring system not developed yet
4	**Human & Social capital**		
5	**Governance and Institutional capital**		

No	MVS- O&M Capital	Short Term Outcomes anticipated	Remarks on Achievement
		5. Online monitoring system functional	

7.1.4 Outcomes- Long Term

Table 87: Theory of change – long-term outcomes

No	MVS- O&M Capital	Long Term Outcomes anticipated	Remarks on Achievement
1	**Water Resource**	1. Water stress resolved in the villages; 2. Groundwater exploitation reduced and groundwater level improve 3. Overall reduction of water-borne diseases and improved health 4. Drudgery of women reduced; Women enjoy leisure time and begin to engage in livelihood improvement activities with the time saved 5. Finance, human, institutional and governance capitals improve and contribute to sustainability of MVS.	1. Water stress mostly resolved; 2. Groundwater exploitation continues as 1197 number of borewells are still under operation in 74 GPs. (16 Borewells/GP on an average) 3. Direct correlation between MVS supply of water and water-borne diseases is not established. Data collected from department of health for 74 GPs showed occurrence of diarrhea, typhoid and Jaundice in the GPs where MVS water is available., Average data on water borne diseases for 2013 and 2014 was 8050, while during 2015-2021, average number of water borne diseases is to the tune of 11341. 4. Drudgery of women reduced substantially; 5. There is no evidence for finance, human, institutional and governance capitals improved. MVS do not seem to be moving on the sustainability pathway.
2	**Technology & Infrastructure**		
3	**Finance capital**		
4	**Human & Social capital**		
5	**Governance and Institutional capital**		

7.1.5 Impact of MVS

Table 88: Theory of change – Impact of MVS

No	MVS- O&M Capital	Impacts anticipated	Remarks on Achievement
1	**Water Resource**	1.Improved health, wellbeing and livelihood security. 2.Governmental subsidy for O&M reduced and	1. The study has found that water stress in the villages in general is reduced and has contributed to the wellbeing of community.
2	**Technology & Infrastructure**		
3	**Finance capital**		
4	**Human & Social capital**		

5	**Governance and Institutional capital**	enhanced investment in water infrastructure.	2. O&M of MVS is solely dependent on governmental subsidies and there is no cost-recovery at the level of MVS.

7.1.6 Concluding remarks on Theory of Change with regard to MVSs

Achievements under theory of change are limited at the level of activities and outputs and partly at the level outcomes and impacts.

7.2 Analysis of Theory of Change: SVS and GP level

7.2.1 Activity level

Five different types of capitals are required for a water supply scheme: These include: (1) Natural Capital – equivalent to water resource; (2) Technology and Infrastructural equivalent to physical capital; (3) Finance capital; (4) Human and social capital and (5) Governance and Institutional capital. The following table examines the achievement under each capital.

Table 89: Theory of change – activity level (SVS and GP)

Activities	Remarks on Achievement
1. Water Resource	
1. Identify Groundwater source, Receive MVS water and Develop Borewells for supplementary water supply	1. Gram Panchayats are simultaneously using MVS water and Bore well water. There are a total of 1197 functional Borewells in 74 GPs visited by the MVS Evaluation Team which are currently operated.
2. Test water quality of Borewells and MVS supply	2. Field Test Kits are available in GPs and training has been provided to few persons in each GP. However, FTK based tests were available in two GPs (Binkadakatti GP- Gadag District, Kaginele GP – Haveri District). This brings up the issue that treated water from MVS is getting mixed at IVDN, where untreated water from bore wells and other local sources are pumped and distributed, exposing community to health risks.
3. Make arrangements to supply water for Livestock	3. Though there are isolated cattle troughs available in GPs, these numbers are not proportional to the number of Cattle/Livestock in the GP. The Cattle Toughs also must be distributed, considering spatial/ geographical distribution of livestock.
2. Technology & Infrastructure	
1. In-Village Distribution Network	1. GPs have an In-Village Distribution Network (IVDN) through which water from MVS and SVS is distributed. Distinct distribution network is available for few Gram Panchayats, while in a vast majority, same network is used for distribution of water from MVS and SVS.
2. Number of Borewells Operational	2. 74 GPs have a total of 1197 of Borewells, with an average of 16 Bore wells per GP, which works out to an average of one borewell for 455 persons
3. Number of WPPs installed and functional	3. There are a total of 204 WPPs available in the 74 GPs, which work out to one WPP for an average 2670 population.

Activities	Remarks on Achievement
4. Storage facilities for water- OHTs in the GP	4. There are a total of 409 OHTs with an installed capacity of 23315 kL, with an average storage capacity of 43 litres of storage facility per capita.
5. Number of HTCs, PSPs and Cisterns	5. There are a total of 54,841 HTCs, catering to an approximate 2,57,753 persons and 8,855 PSPs spread across the 74 GPs, each PSP catering to an average of 33 persons.
3. Finance capital	
1. Using Grants from State Budget and 15 FC	1. Income of GPs with regard to water supply comes from three sources: (1) State Budget allocation; (2) 15th Finance Commission Grants; and (3) Tariff collection from consumer households.
2. Fix volumetric water Tariff	2. No GP surveyed has introduced volumetric tariff for water supply.
3. Formulate Billing & Collection system	3. Billing and collection system followed by GPs is conventional, as the Bill Collector visits households to serve bills and collect taxes.
4. Prepare O&M Finance Plan	4. No GP has prepared an O&M Finance Plan among the 74 GPs surveyed
5. O&M Expenditure	5. O&M expenditure consists of honorarium to watermen, power charges and repair and maintenance expenses. Average per household expenditure for the 74 GPs covered works out to Rs 2132 per annum. If the O&M expenses on account of MVS (Non-power O&M expenditure) is considered, per household average annual O&M expenses works out to Rs. Average Annual tariff collection for 74 GPs works out to Rs.145.31 per household and Rs. 12.11/month/household.
4. Human & Social capital	
1. Capacity Building of GP Council, VWSCs, Watermen, Bill Collectors, GP level staff	1. Training achievement across GPs is as follows: a. GP Council b. VWSCs c. Watermen d. Bill Collectors e. GP level Staff
2. Social Mobilization	2. Some attempts have been made at social mobilization and IEC by ISAs under JJM. Since a pattern of behaviour has been set already, substantial efforts need to go into IEC and social mobilization.
3. IEC focusing on judicious use of water, metered connections and regular payment of tariff	
5. Governance and Institutional capital	
1. Prepare and install software for billing, collection & accounting for use of GPs, VWSCs & Staff	1. Software for billing and collection is neither prepared nor made available to GP

Activities	Remarks on Achievement
2. Constitute VWSC and activate the same	2. VWSC is constituted in all 74 GPs. VWSC is dormant and is not active in any GP. GP members who are also members of the VWSC consider themselves solely the members of VWSC. PDOs claim that VWSC meetings are held, but no minutes of VWSC were available and GP members alleged that the VWSC is a mechanism parallel to the GP. However, GP council members were not able to discharge any effective function of the VWSC
3. Develop MIS for rural water sector	3. MIS for rural water sector in Karnataka is still not available.
4. Develop local level GRM	4. GRM is prepared and available. Out of 74 GPs visited under 60 MVS, only one GP has exhibited the PARIHARA contact number (9480985555) on a notice board in the GP office in big bold letters. However, the number of complaints coming to PARIHARA is quite less and hence it is assumed that people in general are unaware of the existence and functioning of PARIHARA.

7.2.2 Output level

Outputs are the results of activities**.** These outputs are again examined under five different types of capitals as mentioned above. The following table examines the achievement of outputs under each capital.

Table 90: Theory of change – output level (SVS and GP)

No	SVS- O&M Capital	Outputs anticipated	Remarks on Achievement
1	**Water Resource**	1. GPs receive water from MVS 2. GPs supplementing groundwater 3. O&M arrangements 4. Water Quality Test Reports 5. Water for livestock arranged	1. No. of GPs receiving MVS water – Frequency and Regularity 2. O&M arrangements have been either in-built into DBOT/EPC/Turnkey contracts or separate O&M contracts have been awarded
2	**Technology, Infrastructure & Operations**		
3	**Finance capital**	1. O&M Plan at MVS level 2. Billing and Collection System	1. O&M Plan at MVS level is not prepared and available 2. Automated and software based Billing and Collection System is not prepared and available
4	**Human & Social capital**	1. Trained staff	1. Staff not trained in O&M- No evidence

No	SVS- O&M Capital	Outputs anticipated	Remarks on Achievement
		2. Enhanced capacity of RDWSD and Operators	2. There is no evidence for enhanced capacity of RDWSD.
5	**Governance and Institutional capital**	1. O&M Software 2. MIS 3. GRM 4. O&M Policy	1. O&M Software- Not available 2. MIS- Not available 3. GRM – available, but very little awareness 4. O&M Policy – Not available

7.2.3 Outcomes- Short Term

Outcomes are the results of outputs**.** These outcomes are again examined under five different types of capitals as mentioned above and are categorized into short term outcomes and long-term outcomes. The following table examines the achievement of outcomes under each capital.

Table 91: Theory of change – Short-term outcomes (SVS and GP)

No	MVS- O&M Capital	Short Term Outcomes anticipated	Remarks on Achievement
1	**Water Resource**	1. Access to improved quality and quantity of water-55 LPCD to GPs; 2. Improved Frequency, Regularity and Adequate of water supply at GP & consumer level 3. Time spent for fetching household level water requirement reduced to less than 30 minutes per day/household.	1. Partially achieved. But access to improved quality of water from MVS is not assured as GPs mix untreated borewell water with treated MVS water. Yet another issue is that Operators in certain MVS-WTPs, do not chlorinate water, clean the assets and devices and maintain all components of WTP in good working condition. Frequent testing of water quality also is not found. Only very few GPs have arrangements for supplying treated MVS water through the Village OHTs to HTCs and untreated borewell or river water through cisterns & public taps. 2. Partially achieved. Regularity of supply on an everyday basis was found only in 60% households. 26% of households get water on alternate days and 14% once in 3 to 4 days a week. Achievement of Frequency of supply is mixed, with 5% of Households getting water supply for less than 30 minutes per day, 23% upto one hour, 34% up to two hours, 14% up to four hours and 25% get water for more than four hours a day. Adequacy of supply is 93% at MVS level, declines to 50% at GP and enhances to 85% at Household level. 3. Partially achieved. But where water is supplied through HTCs and Cistern based PSPs on alternate days, households have to travel several times and collect required quantity of water, standing in the
2	**Technology & Infrastructure**		

No	MVS- O&M Capital	Short Term Outcomes anticipated	Remarks on Achievement
			queue at the PSP. It will definitely take more than 30 minutes.
3	**Finance capital**	1. Billing & Collection: Bill raised by RDWSD to GP 2. Partial O&M cost recovery at MVS and GP level; 3. O&M Policy operational 4. O&M Software, MIS and GRM operational; 5. Online monitoring system functional	1. Out of 17 districts and 44 sub-divisions covered under RDWSD, only one sub-division raised bills on GPs. But GPs did not respond to the bills nor attempted any payment for the bulk water. 2. No O&M cost recovery achieved by RDWSD at MVS level. 3. O&M policy is not operational. GO issued in December 2020 is also not operational 4. O&M Software, MIS and GRM are not operational 5. Online monitoring system not developed yet
4	**Human & Social capital**		
5	**Governance and Institutional capital**		

7.2.4 Outcomes- Long Term

Table 92: Theory of change – Long-term outcomes (SVS and GP)

No	MVS- O&M Capital	Long Term Outcomes anticipated	Remarks on Achievement
1	**Water Resource**	1. Water stress resolved in the villages; 2. Groundwater exploitation reduced and groundwater level improve 3. Overall reduction of water-borne diseases and improved health 4. Drudgery of women reduced; Women enjoy leisure time and begin to engage in livelihood improvement activities with the time saved 5. Finance, human, institutional and governance capitals improve and contribute to sustainability of MVS.	1. Water stress mostly resolved; 2. Groundwater exploitation continues as 1197 number of borewells are still under operation in 74 villages. 3. Direct correlation between MVS supply of water and water-borne diseases is not established. Data collected from department of health for 74 GPs showed occurrence of diarrhea, typhoid and Jaundice in the GPs where MVS water is available., Average data on water borne diseases for 2013 and 2014 was 14906, while during 2015-2021, average number of water borne diseases is to the tune of 20674. 4. Drudgery of women reduced partially; 5. There is no evidence for finance, human, institutional and governance capitals improved. MVS do not seem to be moving on the sustainability pathway.
2	**Technology & Infrastructure**		
3	**Finance capital**		
4	**Human & Social capital**		
5	**Governance and Institutional capital**		

7.2.5 Impact of SVS and GP level Water Supply Arrangements

Table 93: Anticipated Impact: SVS and GP

No	MVS- O&M Capital	Impacts anticipated	Remarks on Achievement
1	**Water Resource**	1. Improved health, wellbeing and livelihood security. 2. Governmental subsidy for O&M reduced and enhanced investment in water infrastructure.	1. The study has found that water stress in the villages in general is reduced and has contributed to the wellbeing of community. 2. O&M of MVS is solely dependent on governmental subsidies and there is no cost-recovery at the level of MVS.
2	**Technology & Infrastructure**		
3	**Finance capital**		
4	**Human & Social capital**		
5	**Governance and Institutional capital**		

8 Key Recommendations

The ToR for the MVS evaluation study includes a clause on providing recommendations, based on the findings and reads as follows; 'the study shall provide strategies for modification/improvement of the existing mechanism to increase the supply capacities, both in terms of quality and quantity as per standard norms prescribed by WHO and reduce the slippage'. As followed throughout the study, the sustainability pentagon model is followed in making recommendations as well. Therefore, recommendations are grouped under the five sustainability capitals: (1) Natural capital- Water Resource, including quantity and quality aspects: (2) Physical capital – water infrastructure, operations and maintenance; (3) Finance capital- revenue and expenditure related aspects; (4) Human capital – staffing and capacity building of stakeholders including RDWSD, Operators, GP, VWSC, Watermen and social mobilization; (5) Governance and Institutional capital, which among other things include, policies, government orders, MIS, GRM, institutional arrangements at district, GP and Village level. Yet another significant aspect under recommendations is that recommendations are made at the level of MVS and GP level. Since rural water supply is a continuum from the source of a MVS till the HTC of a consumer household, it is not advisable to restrict the evaluation to MVS exclusively. Both these levels of recommendations are again grouped under the sustainability pentagon.

Table 94: Key recommendations - MVS and State level

Name of Capital	MVS/ State level
Natural capital- Water Resource/ Water Source	1. **Water Quantity**: MVS drawing water from High Level Canals (HLC) need to be augmented. Since Raichur and Vijayapura districts are proposed to be included in largescale MVS that covers the entire district, problems related to water quantity will get addressed. Judicious use of water at consumer end and reducing the evaporation loss from the Impounding reservoirs are two measures that may be adopted. 2. **Water Quality**: (1) Prepare a schedule for water quality testing; large and medium schemes to test water quality every day; smaller MVS to undertake water quality testing every day, using FTK, if the WTP does not have a water quality testing lab. (2) RDWSD to carry out independent water quality testing other than that of the Operator; (3) Water quality shall be made a Key Performance Indicator in the proposed new MVS O&M contracts and shall be compulsory and binding on the O&M contractor as per schedule provided in the O&M contract.
Physical capital- Water Supply Infrastructure	1. **Operations**: Introduce Key performance Indicators (KPI) in MVS Contract Management to achieve technical sustainability where operators are paid for achieving indicators under KPIs. See Annexure 8.1 for details. 2. Introduce solar energy generation units over IR open space as it will generate energy and reduce evaporation loss. 3. Provide automation devices to achieve automation of pumping and control water levels at OHT.

Name of Capital	MVS/ State level
Physical capital- Water Supply Infrastructure	4. Award O&M contracts for 10 years under Design Build Operate Contracts (DBOT) initially 5. RDWSD may prepare an O&M plan for each MVS 6. Include the private contracting industry in rural water sector in training and capacity building so as to improve their skills, knowledge and capacity to manage operations and maintenance of MVS. 7. Prepare a Punch List before handing over O&M contract from the current contractor to the next contractor; O&M Contract should include cost towards repair, maintenance and augmentation and replacement as part of the annual/ five year O&M contract. 8. FIR to be registered against third party damages and Illegal tapping of water, making it applicable even to government departments and public and private sector stakeholders. 9. Prepare a detailed checklist and SOP for each of the MVS with regard to existing conditions and improvements required to be brought about in O&M, site-wise and asset-wise.
Finance Capital	1. Notify and implement draft O&M Policy of 2021 2. Revisit the Bulk Water Tariff proposed in the GO of December 2020. The Bulk water tariff may be fixed at Rs.2/kL to begin with and to achieve the habit of payment from the side of GPs and ULBs. 3. Introduce Incremental Block Tariff for bulk water supply to GPs and ULBs, increasing 10% of the bulk water tariff annually, with an objective of achieving 50% of cost recovery in 10 years.
Human and social capital	1. Introduce capacity building programmes for all Small and Medium level MVS Operators and prospective private sector operators. 2. Introduce capacity building programmes for RDWSD officials 3. RDWSD to develop a ToT Team / Team of Master Trainers; Introduce provision of online training courses- RDWSD to prepare training content and course materials. An indicative listing of topics and contents are proposed in Annexure 8.1 4. RDWSD may provide accreditation to Operators (firms) and technical personnel, who can be accredited as Managers of schemes. Accreditation of Managers and operators shall be a condition to become eligible to bid for O&M contracts. Similarly, Operator Firms can also be considered for accreditation in operations and maintenance
Institutional & Governance capital	1. Notify and implement Karnataka State Water Policy-2019 2. Institutionalize District Coordination Committee 3. Prepare and introduce Management Information System (MIS), including provisions for GIS based MIS, online reporting, geo-tagging of assets and real time data generation on operations and maintenance and apply the same in the case of all MVS and SVS including entire GP level operations. 'No-data- no payment' provision may be introduced to ensure updated database and made applicable for RDWSD, Operators, GPs, VWSC and Watermen.

Name of Capital	**MVS/ State level**
	4. District O&M Cell to be introduced, which shall subsequently be scaled up to the status of a District Water Utility- Special Purpose Vehicle (SPV) for Operations and Maintenance. 5. ZP and TP need to monitor the rural water supply schemes. District level officers of RDWSD should report and work in coordination with CEO-ZP
Name of Capital	SVS/GP level
Natural capital- Water Resource/ Water Source	1. **Water Quality Testing**: (1) Watermen shall undertake water quality testing using FTK, collecting samples from Village OHT and HTCs. 2. **Water Resource Management**: (1) Recharge Borewells that are dry or defunct and monitor water level by introducing the 'Bhujal App'[65] to monitor impact of groundwater levels; (2) Do a listing of water sources in the GP area including traditional water sources and prepare a plan to recharge these sources, making provisions under MGNREGS. (3) Aquifer mapping[66] may be done and ring-fencing of certain aquifers for meeting drinking water needs may be set apart exclusively; (4) Community institutions and practices that have sustained traditional sources also shall be documented and published.
Physical capital- Water Supply Infrastructure	1. **Service level**: (1) 55 LPCD service level may be considered fixed for domestic needs; (2) additional water may be allocated to meet livelihood needs of a household, depending livestock keeping, pottery or other calling should be accounted and factored in deciding the LPCD level. (3) make arrangements for supplying water for the livestock at village or habitation level. 2. **Operations**: (1) prepare plan for synchronization of water supply from small MVS/large MVS as well as between SVS (borewell supply) and MVS supply. Scheduling of water supply from MVS and SVS shall support to avoid mixing treated (MVS) and raw water (Bore well) at Village OHTs. Where separate distribution network is available, supply SVS water at Cisterns; 3. **Maintenance**: (1) prepare a maintenance schedule for the water assets – village-wise and GP-wise. 4. **Water Assets, Ownership and Transfer of Assets**: (1) additional or new WPPs may not be installed in the GPs; (2) Metering of village OHTs for the inflow of

[65] To address ground water challenges, Waterlab, a recently formed start-up headquartered at Pune, has developed a Borewell Monitoring App (Bhujal), the first of its kind globally, for tracking water levels in borewells. Bhujal App is a user friendly android based multilingual App, applying sound-wave technology for monitoring water levels in borewells/boreholes. It is a demand side solution to manage borewells for individuals, group of farmers, communities, institutions, commercial and industrial establishments. The Bhujal App has substantial potential for application in the context of rural Karnataka to monitor water level in borewells and make decisions on using borewells for either pumping of water or monitoring the impact of recharging borewells. Gram Panchayats of the water stressed districts in the State may adopt and use the App to monitor water level in borewells and make a knowledge based decision on abstraction of water. It is simple to use and does not require any supporting tool or/equipment or dismantle the borewell assembly to measure the water level.

[66] "Aquifer mapping is a process wherein a combination of geologic, geophysical, hydrologic and chemical field and laboratory analyses are applied to characterize the quantity, quality and sustainability of ground water in aquifers. There has been a paradigm shift from "groundwater development" to "groundwater management"- http://cgwb.gov.in/AQM/documents/Concept-NoteonAquifermapping2015.07.2012.pdf

Name of Capital	MVS/ State level
	water from MVS and Borewell sources shall be made mandatory; (3) Handover Single GP- small MVS to GPs for O&M (MVS Boggur) 5. **House Tap Connections (HTC):** (1) disconnect HTCs without Taps; (2) include stringent penal provisions for the use of Tullu pumps; (3) illegal and unauthorized connections, bypassing water meters, etc., may be leagalized by charging a penal fees; (4) introduce penal provisions/guidelines henceforth to deal with unauthorized HTCs, use of tullu pumps and double connections. After payment of penal charges, unauthorized connections may be legalized. 6. **Power connections at GP level**: (1) disconnect power connection of borewells that are defunct which are still being billed by ESCOMs to the GPs
Finance Capital	1. Reduce the bulk water tariff to Rs.2/kL to start with. GoK and GPs may make a plan to achieve 50% cost recovery in five to ten years. 2. Develop Annual O&M Plan at GP level 3. Revise O&M tariff at consumer end with provision to increase tariff at the rate of 5 to 10% per annum and achieve partial cost recovery. 4. Introduce Incremental Block Tariff for bulk water supply to consumers to dissuade households from excess consumption. 5. Make attempts to reduce expenditure on account of salary of watermen, power charges for operation of borewells, repair and maintenance. 6. Commence water meter reading every month after the installation of water meters. Ensuring HTCs are leakage free before handing it over to the household. 7. Financial analysis to be undertaken to understand the pattern of revenue and expenditure and take steps to achieve financial sustainability at GP level by reducing O&M expenditure and enhancing water tariff collection
Human and social capital	1. **Recruitment of watermen**: (1) Freeze any further appointment of watermen; (2) bring clarity on recruitment of watermen and make it strictly applicable at the GP level; (3) replace salary with honorarium for watermen; (4) develop a policy on educational qualifications, training, gender equal opportunities, refresher training, output and outcome based remuneration, etc., for watermen; (5) Salary and service conditions of all watermen to be appointed henceforth be redefined. (6) GP may ascertain the work load of all existing watermen and decide if additional watermen are required; (7) watermen to undertake minor repairs and maintenance on SVS and IVDN. 2. **Training**: Train GPs to do an assessment of water resources in the GP; (2) develop a methodology for assessment of water resources; (3) Training in fixing Meters shall be provided to watermen; (4) Training women of households to read meter data and appreciate the volume of water being used on a daily, monthly basis; (5) Develop local level barefoot experts in water supply management and involve SHGs in O&M; (6) provide refresher training to all Watermen in the GP; (7) test which includes an examination of skill sets, knowledge, attitude and aptitude to work may be undertaken at the end of the refresher training; (8) those who fail in the test may be discontinued from service; (9) all fresh recruits as watermen shall have a minimum qualification of SSLC and shall go through an intensive training

Name of Capital	MVS/ State level
	for a period of two weeks. Only those who successfully complete the training and clear the test alone shall be confirmed; (10) Include political/ local level leadership in training with reference to planning, designing, implementing, operating and maintaining of rural water supply schemes. 3. **IEC**: (1) undertake IEC/BCC campaigns on Metering, meter reading, water user education and payment of bills; (2) practical and demonstrative IEC on water quality, using FTK. (3) IEC activities to be undertaken to overcome resistance to Metering from community and to develop habitual payment of water tariff.
Institutional & Governance capital	1. **Database development and Monitoring**: (1) prepare and install MIS on rural water sector; (2) Water Quality monitoring and surveillance results from the GP shall be put on the database of MIS and public domain and monitored to ensure drinking water security at the household level; (3) prepare baseline on all water sources in the GP, including borewells –functional and non-functional; 2. **Rural Water Institutions** (1) Reconstitute VWSC; (2) VWSC may consist of GP Members with local water experts; (3) empower VWSC with substantial powers and functions relating to local water supply management-define functions of VWSC and bring role clarity; (4) watermen shall report to VWSC; (5) Empower VWSC by (a) organizing VWSC meeting every week/fortnight/month, (b) giving ownership, power and responsibility over SVS and IVDN, (c) providing power for operations and maintenance of water assets, (d) preparing O&M Plan with the participation of GP council, VWSC and Watermen- Village-wise and GP-wise O&M plan, (e) delegating responsibility to SHGs for billing and collection at Village level under the VWSC. 3. **Field water school- Jaladhare Pathashala:** RDWSD/ RDPR may take initiative to establish field water schools- one each in every district of the State. (1) select model GPs who are managing SVS/MVS very well to pilot field water schools- Shiraguppi GP in Belgaum district may be selected as a pilot case for a field water school. Similarly, the good cases documented in this evaluation study also can be partnered to establish field water schools in the adjacent districts in Karnataka. Similarly Dakshina Kannada district has several GPs which are managing their water supply schemes with community professionalism. They may also be roped into support the adjacent districts. 4. **Broaden the scope of GRM**: (1) publish the availability and application of PARIHARA, as a Grievance Redressal Mechanism 5. RDWSD and RDPR to develop a concept on Community Water Utility. Ensuring participatory process in preparing VAP under JJM. VAP consultants take short-cut and collect data from watermen and prepare VAP without consulting GP President, elected representatives and PDO.
Recommendations from case studies	Three case studies were carried out (1) Shiraguppi in Belgaum District; (2) Nenmeni in Wayanad district of Kerala; and (3) Banavadi in Satara district, Maharashtra. Findings and unique features of these three case studies were covered in detail under chapter 9. These projects could be used as reference points for any future training to

Name of Capital	MVS/ State level
	RDWSD, GPs and / or any other officials or employees. Recommendations from case studies are provided in detail under chapter-9, sections 9.5 and 9.6 page -250 to 252.
Recommendations regarding village level conservation of water resources	Water sources other than Borewells in the 74 GPs that were surveyed as part of the MVS evaluation included 60 open wells, 85 ponds, 149 lakes (keres) and 34 rivers. Of these water sources, open wells, ponds and lakes can be recharged with rainwater. The following recommendation is made for recharging of water sources. 1. Mapping of water sources in all Gram Panchayats and develop a base data on all water sources. (Base data may include area, category, seasonality, water depth, ownership status and current condition) 2. Prepare a micro plan for recharging each water source. The plan shall be made with the participation of the local community, synthesizing techno-scientific aspects. 3. Create a benchmark data prior to intervention. 4. Include the recharge activity as part of the work plan under MGNREGS 5. Periodic participatory monitoring of the impact of recharge activities on the water source. 6. Community institutions and practices that have sustained traditional sources also shall be documented and published.
Recharging of Borewells (Details of borewells that are to be recharged)	There is a total of 1,197 Borewells in the 74 GPs surveyed as part of the study. (1) Recharge Borewells that are dry/defunct/ functional and monitor water level by introducing the 'Bhujal App' to monitor impact of groundwater levels; (2) Number of Borewells in 74 GPs surveyed as part of the MVS evaluation study is listed vide Annexure 8.5 (Page- 200)

Annexure 8.1

Key Performance Indicators for MVS O&M Contracts

O&M contract for a MVS will be awarded for a five-year term with year on year renewal of contract. The O&M contract for MVS shall be assessed, on the basis of Key Performance Indicators (KPI). Remuneration for O&M contractor, applying KPIs is worked out as below. The Operators will get 50% of the O&M contract amount as fixed pay-out and 50% payment against achievement of key performance indicators as Variable pay-out. **Key Performance Indicators** for the O&M Contract of MVS shall be as under:

Key Performance Indicators shall consist of (1) Quantity, (2) Quality and (3) Power consumption. The following table provides details of breakup of O&M payment to the contractor under fixed and variable pay category.

Table 95: O&M Contract - Payment terms based on KPIs

O&M Contract Payment (100%)				
Fixed Pay-out	Key Performance Indicators "Variable Pay-out"			
	Quantity	Quality		Power consumption
		WTP	OHT	
50.00%	25.00%	5.00%	20.00%	Excess energy amount is deducted from the monthly bill

Definition of KPIs:

Table 96: Definition of KPIs

No	Key Performance Indicator	Definition of KPI
1	Quantity of treated water	• Total Quantity of Treated Water to be supplied to each OHT covered under the scheme at minimum of 55 LPCD for the design population • Weightage is 25.00% from O&M Contract Payment of 100.00%
2	Quality of treated water	• All water samples tested in the previous month at WTP and OHTs to meet quality standards as defined and summarized in the contract and O&M Policy • Weightage is 25.00% from O&M Contract Payment of 100.00%
3	Power consumption	• Maintaining optimum power consumption in the pumping and treatment functions of the water supply scheme • No Weightage. However, Excess energy charges is deducted from the monthly bills

Operationalization of O&M Contract Payment:

A. Contractor shall submit the data for KPIs monthly to the EE, RDWSD. Payment to the contractor shall be made on a quarterly basis.

Illustration of implementing KPIs

1. Quantity of treated water:

The volume of water supplied by the operator will be measured and captured daily and this will be compared with the required quantity of water to be supplied by the operator. Penalty will be levied for the shortfall of water supply i.e. if the quantity of water supplied to the sum total of village OHTs individually and collectively is less than the required quantity, then penalty will be levied.

25.00% weightage against achievement of performance indicator - 1 will be considered under this head. Separate considerations are provided for the New MVS and Existing (commissioned and functional) MVS. Following Table provides the assumptions for calculation of payment under the variable payment for Quantity factor.

Table 97: KPI - Quantity of Treated Water

Basis for assumptions	New MVS[67]	Existing MVS/ Legacy MVS[68]
Calculation of Water consumption for an OHT	(1) Take readings from Bulk Water Meters installed at Village level OHT. (2) Bulk Water Meter Readings will be taken by the representative of the Contractor and the GP Waterman. (3) Readings will be taken on a Village OHT based Log Book and will be confirmed by the PDO with his signature on a daily basis. (4) Format for recording readings / data to be developed. (5) Format for consolidating water consumption data on a Monthly basis to be developed. (6) If SCADA is implemented, SCADA readings will be captured by the Operator. Irrespective of SCADA	(1) Take readings from Bulk Water Meters installed at Village level OHT. (2) Bulk Water Meter Readings will be taken by the representative of the Contractor and the GP Waterman. (3) Readings will be taken on a Village OHT based Log Book and will be confirmed by the PDO with his signature on a daily basis; i.e. frequency of data collection will be on daily basis. (4) Format for recording readings / data to be developed. (5) Format for consolidating water consumption data on a Monthly basis to be developed.

[67] New Multi Village Schemes (MVS) are those schemes that are planned, implemented, operated and maintained, under the DBOT Framework.

[68] Legacy Schemes are such schemes that have been implemented under EPC Framework prior to O&M Policy notification 2021 and are currently under operation and maintenance

Basis for assumptions	New MVS[67]	Existing MVS/ Legacy MVS[68]
	implementation, manual meter readings have to be carried out by Waterman at same time point every day. (7) SCADA readings and manual readings of water consumption shall have to be taken at same time point every day. (8) Manual readings from Waterman shall be used as backup for verification of payment in case of SCADA downtime. In case of difference between SCADA and manual readings, SCADA readings shall supersede.	(6) If/when SCADA is implemented, SCADA readings will be captured by the Operator. Irrespective of SCADA implementation, manual meter readings have to be carried out by Waterman at same time point every day. (7) SCADA readings and manual readings of water consumption shall have to be taken at same time point every day. (8) RDWSD will issue detailed guidelines for the administration of KPIs after the notification of O&M policy for O&M of legacy MVS. There shall be no difference on the basis for calculating variable payment under KPIs, when Legacy schemes are provided with instrumentation/ automation like New Schemes.

Water consumption data at Village level OHT will be recorded on a daily basis. If there are no Village level OHTs, readings from the Bulk Water Meter at the entry of the Village will be recorded. Basis of calculation of variable payment will be daily supply of water against required quantity of supply as per design or agreement. Calculation of Penalty for shortfall in water supply at individual Village level OHT is as follows:

a. If 100.00% quantity of water is supplied - *No penalty is levied*
b. If quantity of water supplied is between 70.00% to 100.00% of required supply any day, *proportionate (pro-rata) linear penalty shall be applicable for such OHTs where there is a shortfall on a daily basis.* For example, if there is 1.00% drop in water supply then 1.00% amount assigned for that OHT will be penalized.
c. If quantity of water supplied is below 70.00% of full supply any day - *Zero payment will be made for the quantity component of that OHT for that day.*
d. If quantity of water supplied is below 70.00% of full supply consecutively for 3 days - *Zero payment will be made for the quantity component of that OHT for the entire month*.

Calculation of Collective Penalty for shortfall in water supply considering all the OHTs in the particular contract is as follows:

a. If monthly volume of water supplied is below 70.00% of required volume of supply for all OHTs collectively - *Zero payment will be made to the contractor for that month. Entire 100.00% of O&M Contract Payment for that month will not be paid.*

Operationalization:

A. Format for assessment of KPIs for making payment to the contractor is provided in the O&M policy/ O&M manual.
B. The format shall be used by the O&M contractor for submission of invoices to the department. JE/ AE shall use the same format for verification. The invoices / bill shall be authorized by AEE at Taluk Level or EE at Divisional level.
C. Waterman shall fill details of water supply/ consumption in the logbook daily and shall be verified and confirmed by PDO daily, subsequently approved by AEE at Taluk Level or EE at Divisional level every month.

2. Quality of treated water

Quality related KPI shall be administered, and incentive payouts shall be done for New MVS. In case of existing MVS / Legacy MVS, Quality KPIs shall be administered from the commencement of the fresh contract after notification of O&M policy.

Table 98: KPI - Quality of Treated Water

Basis for assumptions	MVS WTP	Village level OHT
Weightage for payment under KPI	5.00%	20.00%
Parameters for water quality testing	Water supplied to the scheme should be tested at Water Treatment plant (WTP) with all the 17 water quality parameters.	Four water quality parameters will be tested at Village level OHT: (i) Colour (Hazen units, Max); (ii) pH- value, (iii) Turbidity in NTU, and (iv) Free Residual chlorine- mg/l, *Min*.
Testing of water quality	1. 17 parameters will be tested at WTP lab by Contractor daily. 2. The tests shall be deemed compliant if all 17 parameters are within acceptable limits. Even if one parameter falls outside the acceptable limits, the contractor shall be deemed to be non-compliant and shall be penalized.	1. OHT testing by Waterman (PDO) using FTKs in the presence of the representative of the contractor at OHT. 2. The tests shall be deemed compliant if all 4 parameters are within acceptable limits. Even if one parameter falls outside the acceptable limits, the contractor shall be deemed to be non-compliant and shall be penalized.
Testing of water quality by RDWSD and	1. Random counter checks to be carried out by AE/ AEE/ EE twice a month. Two sampling shall be	1. Random sampling shall be carried out at 5% of OHTs in a scheme, in a month.

<table>
<tr><th>Basis for assumptions</th><th>MVS WTP</th><th>Village level OHT</th></tr>
<tr><td>Penalty imposed for non-compliance</td><td>collected during each counter check.
2. First sampling set shall be taken in the first fortnight of the month. In the first sampling set, two samples namely ‘sample A’ and ‘sample B’ are collected. Second sampling set shall be taken in the second fortnight of the month. In the second sampling set, two samples namely ‘sample C’ and ‘sample D’ are collected.
3. In the first sampling (i.e. during first fortnight of the month),
a. If test results of ‘sample A’ is found to be within acceptable limits, ‘sample B’ shall be discarded and payment shall be contingent on results of second sampling check (carried out in the second fortnight of the month).
b. If test results on ‘sample A’ is not in compliance, ‘sample B’ shall be tested. If ‘sample B’ is also not in compliance, entire 50.00% of the O&M contract payment for the month (i.e. fixed plus variable) shall be penalized.
4. In the second sampling (i.e. during second fortnight of the month),
a. If test results on ‘sample C’ is found to be within acceptable limits, ‘sample D’ shall be discarded, and no penalty is imposed on WTP’s 5.00% weightage.
b. If test results on ‘sample C’ is not in compliance, ‘sample D’ shall be tested. If ‘sample D’</td><td>2. Sample selection shall be at the discretion of EE. Prioritization shall be made to sample OHTs that receive higher number of complaints through GRM. No Village OHT based water sample shall be tested consecutively unless specifically asked by EE.
3. The sampled results shall be extrapolated to represent the total number of OHTs in the scheme.
4. No. of OHTs to be tested,
a. For a MVS scheme which has less than 100 Nos. of OHTs, then minimum 5 OHTs shall be tested.
b. For a MVS scheme which has more than 100 Nos. of OHTs, 5% of the OHTs shall be tested.
<table>
<tr><th colspan="2">OHTs non-compliant</th><th rowspan="2">Penalty Imposed</th></tr>
<tr><th>In 5 OHTs</th><th>In 5% of samples</th></tr>
<tr><td>0</td><td>0.00%</td><td>No Penalty</td></tr>
<tr><td>1</td><td>0.10% (or at least one OHT) to 1.00%</td><td>Penalize for 20.00% of total OHT quality variable amount</td></tr>
<tr><td>2</td><td>1.10% to 2.00%</td><td>Penalize for 40.00% of total OHTs quality variable amount</td></tr>
<tr><td>3</td><td>2.10% to 3.00%</td><td>Penalize for 60.00% of total OHTs quality variable amount</td></tr>
<tr><td>4</td><td>3.10% to 4.00%</td><td>Penalize for 80.00% of</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Basis for assumptions</th><th>MVS WTP</th><th>Village level OHT</th></tr>
<tr><td></td><td>is also not in compliance, O&M contract payment for the entire month (fixed plus variable) shall be penalized.</td><td>
<table>
<tr><td></td><td></td><td>total OHTs quality variable amount</td></tr>
<tr><td>5</td><td>4.10% to 5.00% and above</td><td>Penalize for 100.00% of total OHTs quality variable amount + Fixed Pay</td></tr>
</table>
5. Samples (of the OHTs) needs to be taken and tested uniformly every week over the month. The objective of taking the samples every week is to avoid a situation where in much before the month end, all the samples have been tested and found non-compliant. In this scenario, it is possible that the contractor can completely ignore the OHT water quality standards for the rest of the month, as he becomes aware that he has been penalised for the full OHT quality incentive.</td></tr>
<tr><td>Cost towards testing by RDWSD</td><td>Cost of all tests is to be paid by the department and charged to the contractor.</td><td>Testing is carried out by using FTKs available in Village / GP level. Cost is not borne by the operator.</td></tr>
</table>

3. Power Consumption

Key Performance Indicator (KPI) for Power Consumption shall be administered and incentive payouts shall be done for New MVS. In case of Existing MVS / Legacy MVS, KPI on power consumption shall be administered from the start of a new contract after notification of O&M policy.

No Weightage for the KPI on power consumption. However, excess energy charges will be deducted from the monthly O&M contract amount.

Maximum Power Guarantee: - The Contractor has to provide power guarantee for all the equipment to ensure optimal power consumption throughout the contract period. It is also the responsibility of the contractor to ensure all motors and pumps function to their maximum power

factor. Any reduction in the efficiency of the motor will lead to reduced power factor and levy of penalty by ESCOM. The operator shall be liable to bear the expenses of any charges towards additional power consumption beyond the maximum power guarantee provided by the operator and all penalties levied by ESCOM towards reduction in power factor on monthly basis. The following norms will appear in administering the KPI on power consumption:

1. The Contractor/Operator and EE will agree on the optimum power consumption (based on the DPR/ assessment from the trail run period) of the scheme as Maximum Power Guarantee either during the signing of contract or subsequent to the beginning of O&M period.
2. In case of excess power consumption (i.e. more than the Maximum Power Guarantee) the operator shall be liable for deductions from monthly O&M contract payment amount (fixed plus variable).

Annexure-8.2

Training Topics for RDWSD Officials

1. Planning and Designing of Multi Village Schemes- Hydraulics and Water GEM- Water Distribution Analysis and Design Software.
2. Tender Evaluations
3. Construction Management
4. Contract Management
5. Community Mobilization and Consumer Relations
6. The Karnataka Gram Swaraj and Panchayat Raj Act, 1993, PRI system, Role of Gram Panchayat in water supply and sanitation.
7. Management Information System- Baseline on MVS; O&M data on MVS
8. Grievance Redressal Mechanism (GRM)
9. SCADA- Supervisory Control and Data Acquisition- Operation of SCADA and analysis of data
10. Water Quality Testing- Training on Water Quality standards- compare BIS and WHO standards in terms of water quality
11. Budgeting and Finance Control- How to prepare an annual O&M Plan and O&M Budget
12. Concept of Sustainability in water supply- meaning of the concept of sustainability- How to plan and conduct a Sustainability Evaluation Exercise (SEE) for MVS.
13. Concept of Sustainability Capitals/ Sustainability Pentagon for water supply
14. GP level assessment and planning of water resources management
15. The concept of participation; Participatory processes and platforms in water supply management
16. Water Literacy and Water supply scheme
17. Problem Solving Clinics- Raise problems actually faced in the field and conduct workshops to resolve the problems

Annexure-8.3

Training Topics for MVS Operators

1. Contract Management
2. Management Information System- Baseline on MVS; O&M data on MVS
3. Grievance Redressal Mechanism (GRM)
4. SCADA- Supervisory Control and Data Acquisition- Operation of SCADA and analysis of data
5. Water Quality Testing- Training on Water Quality standards- compare BIS and WHO standards in terms of water quality
6. Concept of Sustainability Capitals/ Sustainability Pentagon for water supply
7. Water Literacy and Water supply scheme
8. Problem Solving Clinics- Raise problems actually faced in the field and conduct workshops to resolve the problems
9. Operations and Maintenance of MVS
    a. **Operations and Maintenance of Civil Works** (Intake Well, Jack Well pump house, Water Treatment Plant, Master Storage Reservoirs / Master Balancing Reservoirs / Tanks (MSRs/MBRs/MBTs), Zonal Balancing Reservoir / Tanks (ZBRs/ZBTs), Over Head Tanks (OHTs) Village level, Intermediate booster sumps and pumping stations, Pipe line Works, Raw water pipeline, Treated water pipeline, Gravity pipeline from MBT to ZBTs, Gravity pipeline from ZBTs to OHTs, Pressurized line)
    b. **Operations and Maintenance of Pumping Machine / Mechanical Works** (Jackwell, Water Treatment Plant, Master Storage Reservoirs / Master Balancing Reservoirs / Tanks (MSRs/MBRs/MBTs), Zonal Balancing Reservoir / Tanks (ZBRs/ZBTs), Over Head Tanks (OHTs) Village level, Intermediate booster sumps and pumping stations)
    c. **Operations and Maintenance of Electrical works & SCADA** (Jackwell, WTP, IPS, Scada @ WTP or control room, All electrical Instrumentation and Metering)

Annexure-8.4

Training Topics for the Watermen

Training Topics for the Watermen:

1. Operations and Maintenance of SVS and IVDN (indicative details are provided in
2. Table 99: Details of Technical Operations and Maintenance under SVS/***IVDN***)
3. Plumbing
4. Meter Reading
5. Meter Repairing
6. Log Book Maintenance
7. Chlorination- How to prepare bleaching powder solution to chlorinate water
8. Checking Residual Chlorine using a Chloroscope
9. Preparing and maintaining Consumer Ledger
10. Operations of Water Purification Plants
11. Billing and Collection
12. Water Literacy
13. Water Tariff
14. Accounting
15. Participatory processes for GP level water resource assessment and planning

Table 99: Details of Technical Operations and Maintenance under SVS/IVDN

Details of Technical Operations and Maintenance under SVS/IVDN	
	Technical
No	**Asset**
I	**Civil Works**
1	**OHTs- Village level (***Cleaning OHT; Minor civil maintenance works)*
II	**Pipe line Works**
1	**Treated water pipeline** (Joint Leakages, Breakages in pipeline, Replacement of Pipeline for other reasons and Valves and other appurtenances)
2	**Pressurized line (**Joint Leakages, Breakages in pipeline, Replacement of Pipeline for other reasons, Valves and other appurtenances)
III	**Pumping Machine / Mechanical Works Details**
1	**Water Source - Borewell, open well, lake or other sources** (water pumps, Valves and interconnecting pipeline)
IV	**Electrical works & SCADA**
1	**Water Source - Borewell, open well, lake or other sources** *(Transformer, LT Panels)*
2	**All electrical Instrumentation**
V	**Metering** (House service connection, Institutional Connection, Commercial Connection, Cisterns)
VI	**Water Quality Testing**

Annexure-8.5

Details of Borewells, Kere(s) and Open Wells across 74 GPs surveyed under MVS Evaluation study

S No	District	Name of the GP	No of Public Borewells	No of Kere(s)	No of Open Wells
1	Bagalkot	Laxanatti	8	-	-
2		Nagur	10	-	4
3		Sulebhavi	20	1	5
4		Sulikeri	9	3	4
5	Ballari	Bagguru	7	-	1
6		Nadavi	15	1	7
7	Belagavi	Bambarga	13	8	11
8		Hosur	8	2	-
9		Karagaon	40	1	-
10		Madlur	9	2	2
11		Pattihal K B	26	3	-
12		Rudrapur	8	2	-
13		Sambra	20	1	3
14	Chamarajanagara	Bagali	17	-	3
15		Erasavadi	34	3	1
16		Kabba Halli	7	-	-
17		Kannegala	21	-	1
18		Maleyuru	21	-	15
19		Mangala	20	-	-
20		Venkataiahana Chatra	26	-	-
21	Chikkmangaluru	Kudaluru	20	12	6
22	Davanagere	Bulusagara	14	2	6
23		Jigali	32	-	-
24		Kadlebalu	55	1	10
25		Nellihankalu	20	19	-
26		Muthathadi	21	1	-
27	Gadag	Bannikoppa	20	-	2
28		Benakanakoppa	5	2	-
29		Binkadakatti	20	1	2
30		Hesrur	12	-	-
31		Korlahalli	3	-	4
32		Mallappura	3	1	-
33		Mushigeri	18	4	-
34		Ranathur	9	3	2
35		Shantageri	16	-	-
36		Yavagal	2	-	2
37	Hassan	Bagivalu	9	7	8

S No	District	Name of the GP	No of Public Borewells	No of Kere(s)	No of Open Wells
38		Lalanakere	16	7	4
39		Mududi	14	2	-
40		Shanegere	49	28	40
41	Haveri	Chikkounchihosur	21	16	1
42		Kaginele	20	8	-
43	Koppal	Siddapura	16	-	-
44	Mandya	Banangaadi	15	-	5
45	Mysuru	Badanavalu	16	-	-
46		Duggahalli	17	-	3
47		Hanchipura	19	6	-
48		Heggadahalli	15	2	11
49		Mavathuru	15	-	9
50		Munjanahalli	25	-	7
51	Raichur	Ankushdoddi	16	-	16
52		Badarli	3	5	1
53		Bichali	8	-	-
54		Jegarkal	11	2	15
55		N Malkapur	-	-	3
56		Udabal U	8	2	6
57	Shivamogga	B Beeranahalli	19	8	-
58	Tumkur	Doddanaravangalam	17	4	-
59		Kanathur	23	5	10
60		Kora	13	6	2
61		Markonahalli	29	4	16
62		Mayasandra	18	6	-
63	Vijayanagara	Beerabbi	20	2	1
64		Bennekallu	15	3	-
65		Hagaranur	-	-	-
66		K. Kallahalli	24	-	-
67		Nelkundri	12	3	22
68		P K Halli	13	1	-
69		Sovenahalli	18	2	7
70	Vijayapura	Aheri	19	3	1
71		Basarakod	11	-	-
72		Ingaleshwar	17	4	4
73		Padanur	7	-	-
74		Zalaki	-	-	3
			1,197	209	286

Annexure-8.6

List of MVS under work-in-progress

No	District	MVS- WI P	Name of MVS (WIP) - Work in Progress
1	Davangere	1	WSS to Hirekogalur and other 22 villages of Channagiri Taluk (85 LPCD)
2	Chitradurga	5	MVS Imangala and other 37 villages in Hiriyur Taluk (70 LPCD)
3			MVS Javagondanahalli and other 38 villages in Hiriyur Taluk (40 LPCD)
4			MVS Pavagada Taluk of Tumkur Dist & Villages in Molakalmuru & Challakere Taluk, Chitradurga Taluk Turuvinur Hobalii of 59 villages of Chitradurga Dist. (85 LPCD)
5			MVS to Hosadurga Town and Other 346 Habitations(Phase 1) PART-A
6			MVS to Hosadurga Town and Other 346 Habitations (Phase 1) PART-B
7	Ramnagara	2	MVS Sathanur & other 33 villages Extension Work (Addl. works of Chudahalli & Somedyapanahalli G.P of 29 Villages) Phase-II (40LPCD)
8			MVS Kodihally & other 298 villages (70LPCD)
9	Chikkaballapura	1	MVS to Mylappanahalli and other 4 enroute habitations from Jakkalamadagu Reservoir in Chikkabllapur taluk
10	Tumkur	2	MVS Biligere and other 12 villages of Tiptur Taluk (70 LPCD);
11			MVS Pavagada Taluk In Tumkur District, Rural Habitations and Town of Molakalmuru Taluk In Chitradurga District, Rural Habitations of Challakere Taluk In Chitradurga District, Ujjini & 216 Habitations of Kudligi Taluk In Ballary District, Chilakanahatti & 14 Habitations of Hospet Taluk In Ballari District and Additional Turuvanur & 59 Habitations of Chitradurga Taluk (85 lpcd)
12	Yadgir	1	MVS Arkera-K and other 5 villages of Shorapur Taluk
13	Koppal	4	MVS Heroor & other 14 villages
14			MVS Hulihyder & other 12 villages
15			MVS Chikkamadinala & Other 11 villages
16			MVS Kushtagi & Yelburga Taluk 331 habitations (DBOT)
17	Bidar	3	MVS Chowdary Belkuni and other 5 villages of Aurad taluka in Bidar District under the Combined Water Supply Scheme of KUWS&DB to Aurad town including 6 enroute villages
18			MVS Kohinoor and other 20 villages of Basavakalyan taluka
19			MVS to Enroute 23 Habitations in 18 villages of Bhalki taluka
20	Ballari	4	MVS Nelludi & other 6 villages (40 LPCD)
21			MVS Kodalu and 28 other villages in Sandur Taluka
22			MVS Devasamudra & other 3 villages
23			MVS Bukka sagara & other 3 villages
24	Vijayangara	2	MVS Ujjani & 216 villages in Kudligi Taluk (85 LPCD)

No	District	MVS- WI P	Name of MVS (WIP) - Work in Progress
25			MVS Teligi and other 56 village in Harapanahalli taluk in Vijayanagar Dist (55 LPCD)
26	Belgaum	2	MVS Balobal and other ***3*** villages of Gokak Taluk in Belagavi district
27			MVS Palabhavi and other 4 villages of Raibag Taluk in Belagavi
28	Vijayapura	3	MVS Tikota and other 23 habitations in Vijayapura Taluk (55 LPCD)
29			MVS Alamatti and other 10 Villages of B. bagewadi taluka (85 LPCD)
30			MVS Kuntoji & other 17 villages in Muddebihal Taluk (70 LPCD
31	Uttara Kannada	2	MVS Honnavar Town & Enroute 9 GPs
32			MVS Gangavali River at Honnalli for Karwar-Ankola town and Enroute Villages
33	Bagalkote	3	MVS Aihole & other 14 villages of Hunagund taluk
34			MVS Ilhal & 17 villages of Hunagund taluk
35			MVS Hulyal and other 8 villages of Jamakhandi taluk
36	Uduppi	3	MVS Nitte & its 31 Habitations (phase 1) 55 LPCD
37			MVS Nitte & its 10 Hamlets (phase-2)
38			MVS Hebri & other 138 Habitations (phase-2) 55 LPCD
39	Chamarajanagara	2	MVS Hanur for 291 Habitations in Kollegala Taluk, (Phase-I Works) 85 LPCD - DBOT)
40			MVS Tagarapura & 19 Villages of Kollegala taluk and 45 Villages of Yalandur Taluk, ,85 LPCD (DBOT)
41	Chikkamagalluru	1	MVS Belenahalli & other 20 villages (ph-1)LPCD 25
42	Hassan	2	MVS Anekere and other 65 Villages In C R Patna Taluk
43			MVS Shanthigrama and other 195 villages in Hassan Taluk
44	Mandya	7	MVS Navile, Thoreshettihalli and other *53* villages of Madduru TQ (55 LPCD)
45			MVS Koppa and other *49* villages of Madduru TQ (55 LPCD)
46			MVS Besagarahalli and other 37 villages of Madduru TQ (55 LPCD)
47			MVS KIRUGAVALU and other 46 villages of Malavalli Taluk (85 LPCD)
48			MVS Adichunchanagiri and other 128 Habitation in Nagamangala TQ (55 LPCD)
49			MVS Mahadevapura, Chikkankanahalli, K.Shettahalli and 16 villages of Shrirangapattana Taluk (85 LPCD)
50			MVS Gamanahalli and other 13 villages of Srirangapatna Tq (85 LPCD)
	Total	**50**	

9 Case Studies

Three case studies have been undertaken under the present study. These case studies provide certain keys to achieve sustainability in rural water supply scheme. These case studies are: (1) Shiraguppi multi village- Single GP scheme from the Chikkodi division of Belgaum district in Karnataka; (2) Nenmeni multi village single GP rural water supply scheme from Wayanad district of Kerala and (3) Banavadi multi village- single GP scheme from Karad Taluk, Sattara District, Maharashtra. All three cases are chosen because of their journey towards sustainability. The analysis of the cases has opened opportunities of learning in the areas of Physical Capital, Finance Capital, HR Capital and Institution and Governance Capital areas that are implemented and demonstrated by these GPs over the years.

9.1 Shiraguppi Water Supply Scheme

Key to Sustainability in a rural water supply scheme: A case note on the experiences of Shiraguppi Water Supply Scheme.

Shiraguppi is a village Panchayat in Kagawad Taluk of Belagavi District of Karnataka State. The Village is located 75 KM North of Belagavi District headquarters. Shiraguppi GP has a population of 9,683[69] and 3,155 households. Though Kannada is the official language, majority of population speak Marati in Shiraguppi GP. Overall literacy rate of the GP e is 69.40%, while the Female Literacy rate is as low as 30.20%. The following table provides snapshot information on the social characteristics of the demography in Shiraguppi GP.

Table 100: Shiruguppi GP - Social Category of Families

SC Families	ST Families	General Families	Total
662	2	2,491	3,155

The Village Shiraguppi was formerly known as Shikkarguppa, which over the years got deduced into Shiraguppi. The area of GP is 22.51sq.km. Geographical contours of the GP are 16^0 37'42"N and $74^0$2'49.97"E with an elevation of 546 Metres, MSL. Of this geographical area, 21.42 sq.km is farmland, while the GP has a barren land of approximately 40 hectares. River Krishna separates Shiraguppi from Maharashtra State. River Krishna spreads into Shiraguppi during heavy monsoon months and causes damage to agricultural crops and built assets, as it happened in 2019.

The Shiraguppi Gram Panchayat was formed in 1953. The GP built its new office and moved in there during 2005-06. The Gram Panchayat Council consists of 25 elected representatives, from 8 wards. Shiraguppi GP was always water stressed and had very little water resources. River Krishna was four kilometres away and people had to walk the distance, carrying pots of water by headload,

[69] Source Gram Panchayat Development Plan Award-2017

several times to meet various domestic water needs. The only other water source in the village was an open well. There was a time when the major concern of local population was 'water', causing great hardships and anguish to the community. People who have slipped into their old age remember that there was a resistance to send girls in marriage to the Shiraguppi village due to acute water stress during the two decades from 1960s.

A small water supply scheme was planned in 1982-83, to cater to the water needs of Shiraguppi and Jugul Village Panchayats. The source of the scheme was River Krishna. An intake structure was built towards the middle of the river, while a Jackwell was constructed on the river bank. Two Overhead Tanks, with an overall capacity of 3.0 lakh litres were constructed at an elevated location of the village, from which water was supplied to both the villages, once in 15 to 20 days. The first World Bank funded Karnataka Rural Water Supply Programme (1993-2001), funded a Water Treatment Plant (WTP) and a superstructure for the Jackwell, besides new pipelines and additional pumping capacity. The WTP consisted a Slow Sand Filter system with four compartments. Further investment of Rs.24 lakhs was made to the Shiraguppi scheme from Jal Nirmal Project (World Bank funded Karnataka Rural Water Supply Programme (2004-2014).

The intake structure constructed at the middle of the river was damaged in the 2019 flood and temporary arrangements had to be made to resume water supply. Pending fresh investments from JJM in the ensuring years, the GP introduced a floating barge into river Krishna to act as the pump house. Flood waters in 2019 August was unprecedented and had risen almost 12 feet inside the jack well.

9.1.1 What is so special with Shiraguppi Water Supply Scheme?

This is a question that comes to our mind before visiting Shiraguppi village Panchayat. However, that question vanished into the thin air once we saw the innovations introduced into the operations and management of the Shiraguppi Water Supply Scheme. 'Myths of the Rural Water Supply Sector'[70] lists 7 myths relating to rural water supply schemes. Shiraguppi Water Supply Scheme breaks four of these seven myths. These myths include: There is no doubt regarding the importance of operations and maintenance in the sustainability of a rural water supply scheme. What contributes to the sustainability of rural water supply scheme is a question that haunts development practitioners all over the world. To become sustainable, owners and managers of rural water supply schemes need to break the myths.

Table 101: Shiraguppi Scheme – method to break myths

No	Myth	Method to break myths
1	Myth 1: The best way to utilize public funds is to	Community participation, in sharing capital cost however miniscule it is, building sense of ownership by participating in planning, designing, supervision of implementation, operations and maintenance by local level

[70] Myths of the Rural Water Supply Sector- RWSN Perspectives No-4 available at Rural Water Supply Network (ircwash.org)

No	Myth	Method to break myths
	heavily subsidize hardware.	community group and personnel will need to be part of building a rural water supply scheme. Building local level ownership of the rural water supply scheme is part of the success secret of the Shiraguppi Water Supply Scheme. In comparison, all MVSs of the State have been built with 100% subsidy and their sustainability is partial.
2	Myth 2: Building water supply systems is more important than keeping them working.	Operation of the water supply scheme is much more important than building a scheme. Shiraguppi VWSC has focused its attention to make the scheme function and deliver water, through continuous efforts, despite all challenges. Elsewhere in the Karnataka rural water sector, one comes across good infrastructure built through DBOT /EPC/Turnkey contracts. Operation of MVS is managed by a Contractor, who in many cases is invisible and inaccessible. Actual operation is done by a sub-contractor, mostly based on informal agreements with the dejure contractor, and engages labourers to operate the scheme and distribute water. O&M is in a way, a set of behaviour, of the operator and consumer, and needs to be evolved through trials, experiments and innovations. Shiraguppi Water Supply Scheme is managed by the VWSC on behalf of the GP. VWSC consists of experienced and skilled professionals and local water champions contributing their knowledge in reducing cost and managing the systems effectively.
3	Myth 3: Communities are always capable of managing their facilities on their own.	Communities that develop post- construction sustainability capitals alone will be capable of managing assets, facilities and operations of the rural water supply scheme. These sustainability capitals include: (1) Finance Capital; (2) Human Capital and (3) Governance and Institutional Capital. These capitals can only be developed through community participation at the local level, post-commissioning of the scheme. Shiraguppi Water Supply Scheme is a model for building post-construction sustainability capitals.
4	Myth 7: There is a quick fix for rural water supplies.	There are no quick- fix solutions for problems faced by Rural Water Supply Schemes. The rural community/institution needs to continuously innovate to solve problems and challenges. Shiraguppi Water Supply Scheme should be known for the innovative thinking and application of mind by its VWSC and other individual human capital.

Governmental investment goes into two of the five sustainability capitals; these include investment in the (1) water resource capital and the (2) water infrastructure capital. There has to be constant efforts to build post-construction sustainability capitals which include: (3) Finance capital; (4) Human Capital and (5) Governance-cum-institutional capital.

It is interesting to make a comparison of the operation and maintenance of MVS and Shiraguppi Water Supply Scheme in the backdrop of the sustainability capitals mentioned above.

Table 102: Shiraguppi Scheme – sustainability capitals

Sustainability Capital	Multi Village Schemes	Shiraguppi Water Supply Scheme
Water Source	Based on surface sources such as rivers, reservoirs of Dams and Canal based Impounding Reservoirs. Government of Karnataka has turned to the last resource as mentioned above and needs to give thoughts on sustainability of the resource and how the dynamics between competing demand emerge, develop and become mutually compatible in the long run.	River Krishna – Surface Source. 'Krishna' is an inter-state river system. Not much can be done to the sustainability of the water source. Four to five years back, River Krishna had completely dried up. But due to improved monsoons since 2018, the source has sufficient water. There is competition between the water supply scheme and the farming community which draw water for irrigation and domestic purposes from the same source. However, as an alternative, Borewells are being recharged by the GP to have an alternative water source in place.
Water quality		Water samples were tested as per request of the Team on 17.03.2022. Both raw sample and treated samples were tested and the results are found within desirable limits. However, the test has been held only for chemical and physical parameters. Biological parameters have not been tested. Quality of water is good. Even the raw water sample shows parameters within desirable / permissible limits.
Water Infrastructure, Operations and Maintenance	Water infrastructure mostly include Intake structure, Jackwell, WTP, MBR, ZBR and IPS, delivering water to Village level OHTs, which under the control and management of Gram Panchayats. Operational responsibility has been contracted either to the Construction Firm or Contractor through an O&M contract. Large MVSs have been provided with SCADA systems. Weaknesses in MVS O&M include poor monitoring by department, treating SCADA as a decoration under the contractual obligation and not really using it to supervise and control operations, sub-contracting of operations, 'O&M Schizophrenia' through lack of coordination between departments, Operator, Gram	**Pump House:** Pumps and Pump house were damaged and washed away in the 2019 Flood. Floating barge has been introduced as a temporary measure to sustain pumping of water **WTP** consists of Slow Sand Filter. Due to heavy silt load and organic matter in the raw water, the Slow Sand Filter Beds get clogged frequently. VWSC has introduced routine cleaning of the top layer of the sand from the SSF and washes the same using a mechanized cleaning system and places cleaned sand back into the SSF. **Automation of Operations**: Pumping, Treatment and storage of treated water has been auto synchronized by introducing censors and automatic electronic devices. Pumps at the Floating Barge, WTP and CWR are electronically synchronized through

Sustainability Capital	Multi Village Schemes	Shiraguppi Water Supply Scheme
	Panchayats, VWSCs, Watermen and Consumers. Lack of coordination results in poor service delivery, despite heavy investment in infrastructure and tall claims in DPR. Broadly stated, MVSs in general have impressive infrastructure with inefficient service delivery.	automatic switching-on and switching-off, considering voltage and power availability. SCADA is a much more costly and advanced technology and does not function well in the MVSs surveyed by the Team in Belagavi and Gulbarga circles of RDWSD. Auto-synchronization has saved man power, improved life of equipment and cost of operations. **Household Tap Connections**- All (3,302) Houses are provided with a House Tap Connection in the GP. **Distribution of Water**: Water is distributed to the Households every alternate day with unfailing regularity. **WPP**: VWSC also operates the Water Purification Plant (WPP); The VWSC provides treated and purified water at the rate of Rs.5/20 litres. Cooled water is also available at the WPP, with temperature-controlled containers. Total output of the WPP is approximately 15-17 kL/day. Tanker based purified water is also available from the WPP, supplying purified water @ Rs.200 for 500 litre is delivered to door steps in the village. The WPP has been donated to the GP by Janashakti Foundation, while Jal Nirmal Project sanctioned a water supply vehicle to provide WPP generated filter water to households in the village.
Finance Capital	MVS Operations are sustained through subsidies from the Government. Though a GO (Government Order No: RDW&SD/ 121/CE/ Technical/ 2020, dated 30.12.2020) was issued by RDWSD to raise demand on GPs supplied with water from MVS, it was found that AEE- Vijayapura sub-division of RDWSD alone had raised bills to the GP, based on bulk water meter readings and no payment has been received from GPs or ULBs till date. Other Sub-divisions have not even	**Water Tariff**: Rs.1000 is the special water tariff for House Tap Connections (HTC) in the GP per annum. Flat tariff system is followed in the GP. **Billing**: HTCs are being metered now through JJM. At present the households have to voluntarily come to GP office and raise their water bills. A challan is created at the GP office for the consumer in triplicate. The water tariff amount is recorded on the challan. The Consumer has to go to the Bank and make the payment at the Bank. Two of the three challans are returned to the consumer, of

Sustainability Capital	Multi Village Schemes	Shiraguppi Water Supply Scheme
	raised the bills. Some divisions of RDWSD were even unaware of the GO issued a year back.	which one is submitted to the GP office as proof of payment and the other is retained by the Consumer for proof of payment. The bill is raised through computerized software, making accounting easier. **Collection**: Annual collection of water charge on an average is 85-90%. 10-15% of Households delay the payment of water tariff, though ultimately it gets paid and there is hardly any water bill that is written off.
Human Capital	**RDWSD Officials**: Substantial percentage of vacancies exists in the RDWSD at divisional and sub-divisional level. JJM has added to the work pressure further and hence are not able to supervise the functioning of the MVS. However, despite refuge in the above arguments, it is also observed supervision visits to MVSs have been rare and irregular. Bills submitted by Operators may not be scrutinized thoroughly and no penalties seemed to have been imposed on Operators. Capacity of RDWSD to supervise Operations and Maintenance needs substantial improvement. **Operations Team**: Except in the DBOT based large MVSs implemented in Gadag district, Operator Teams largely consisted of persons with low level of education, training and basic understanding of the dynamics of water supply schemes and its operations. **VWSC-GP**: GP level ownership of	**VWSC** is a vibrant institution, which has been constituted with ten members. 3 of them are from the GP council, four (4) members represent the consumer community, while the last three include (a) Junior Engineer-RDWSD, (b) Medical Doctor from PHC and (c) PDO. The VWSC is balanced and includes informed, educated and professional members. Elsewhere, the VWSC is dominated by GP members. In Shiraguppi, VWSC and GP go hand in hand and speak the same voice. VWSC goes hand in hand with GP in Shiraguppi, while the situation in other GPs is one in which GP members do not see any difference between GP and VWSC. Active VWSC is seen as a threat by traditional minded GP members elsewhere in the State. The VWSC in Shiraguppi was able to attract human resources including those with higher technical and engineering education and apply their technical knowledge into the operations of the scheme. The VWSC meets every month to discuss operation, maintenance and management of the water supply scheme. **Strong and committed leadership:** VWSC has succeeded in attracting

Sustainability Capital	Multi Village Schemes	Shiraguppi Water Supply Scheme
	VWSC is not yet at desirable levels. GP members of VWSC consider themselves as VWSC and argue why a separate meeting of VWSC has to be convened. In a vast majority of GPs visited by the Team, it was found that the VWSC has not met after its initial formation meeting. VWSC meeting itself can be a good tool for information sharing and capacity building, which is conspicuous by its absence at the GP level. **Water Bureaucracy in GPs**: Village level water distribution is controlled by Watermen. In Villages which have large number of zonal Valves, the watermen have higher level of work involvement. In other Villages, their responsibility is to turn on the pumps at the Bore well pump houses and open the valves from OHT. Large number of watermen had only preliminary formal education, and the understanding on the water supply system appeared low. Watermen are not generally trained well in operation and maintenance. There is more focus on the number (quantity) and least focus on quality of watermen. The Team has come across a waterman who is engaged to operate water distribution system for 60 households. The Team has the impression that watermen are not engaged completely in operation	persons with professional qualification in engineering disciplines such as mechanical, electrical and electronics to support the O&M of Water Supply Scheme. Though not formal members of the VWSC, such professional support is available, free of professional fees, at call and short notice. **Fewer workforces:** VWSC in Shiraguppi follows the principle, 'less is more'. There is no pump operator at the Pump House, and there is only one operator at the WTP and one waterman in the entire GP. **Capacity** The VWSC-GP combine has built its leadership and capacity to manage, operate and maintain the Water Supply Scheme through continuous learning iteration. Over the years of facing challenges, the VWSC has built high level of confidence in operations and maintenance of rural water supply schemes.

Sustainability Capital	Multi Village Schemes	Shiraguppi Water Supply Scheme
	and maintenance and have other personal engagements in various other callings. Salary to the watermen is not regularly paid and this has a telling effect on their commitment to work. On the whole, there is a severe capacity gap with the human capital engaged in rural water supply right from top to bottom.	
Governance & Institutional Capital	**MIS**: There is no centralized Management Information System (MIS) under the department of RDWS, in which details of water supply schemes are available and tailor-made reports can be generated. Hence it is difficult to prepare customized reports and dig deep into the dynamics of RWSS and their functioning. **Bylaw in O&M**: Bylaws for operation and maintenance at GP level is not available. O&M contract at MVS level is not comprehensive and there are no provisions on performance based key indicators in O&M. **GRM:** Grievance Redressal Mechanism is centralized and managed by PARIHARA at the State level. Very few complaints come to the PARIHARA system and there is strong need for a local level GRM, involving GP, Operator and lower level of officials from RDWSD.	**MIS:** The VWSC maintains a MIS on finance capital, billing and collection. **Valve Operation Schedule**: The Waterman has been provided with a valve operation schedule, which is verified by VWSC to ensure that valves are operated as per schedule. **Transparency systems**: The GP has made arrangements for live telecast of GP council meetings. Voters of the GP can come to the GP council hall and watch the proceedings of the GP council meetings. GP has introduced CCTV cameras at several public places and junctions in the Village, which has reduced crime rates and undesirable behaviour. Another important contribution of the GP is that it has installed about 200 loud speakers all over the Village. Public announcement are made from the office of the GP and any such information directly reaches the public instantaneously. The GP has a high Human Development Index and is ranked 2470 among approximately 28000 Villages in Karnataka State. **GRM**: Grievance Redressal Mechanism is de-centralized and managed by VWSC.

Sustainability Capital	Multi Village Schemes	Shiraguppi Water Supply Scheme
	GOs and Policy Documents on O&M: Though O&M policy documents have been prepared and notified even as early as 2013, these have not been implemented. **Joint Committee on MVS**: Government Order No. RDP/240/RWS/2015 dated 1305.2016 has been issued to facilitate the formation of Joint Committee, which will function like a Multi Village Water Committee. Zilla Panchayat has been given responsibility for facilitating the formation of JC. Though this would have provided an opportunity for sharing information and monitoring the functioning of the MVS, the JC has still not been formed nor seen in the field.	Most complaints are resolved on the same day. **VWSC** plays pivotal roles in operations and maintenance. It works in sync with the Gram Panchayat. There is no competittion between GP and VWSC. **Extraordinary Incentive System**: Shiraguppi GP has instituted an extraordinary incentive system. If there is a death in any family in the GP and if that family has cleared all water dues before the death of the family member, such families will be given an incentive ex-gratia payment of Rs.10,000 to meet the funeral or after-death expenses. **Politics of development**: Members of the VWSC belong to various streams of political parties and belief systems. However, they stand united while discussing and considering the development of the GP and that of water specially. Political capital of the GP is thus very high and there is no political deficit towards development.

Governments are mostly clueless about building these sustainability capitals mentioned above. As it happens in the rural water supply sector of Karnataka, 'sustainability thoughts' are restricted to the first two capitals. It is interesting to examine how Shiraguppi Water Supply Scheme and Shiraguppi Gram Panchayat has solved the problem and has sustained their water supply scheme which has outlived its period of utility. In the rest of the State, modern water supply schemes are delivering poor to moderate services, while the Shiraguppi GP delivers excellent service, still employing aged and dilapidated water infrastructure. This is a pointer as to where the focus should be. The focus in rural water supply needs to move away from water source and water infrastructure to all five sustainability capitals.

9.1.2 Plans for the future

Considering the vast experience and professionalism of the VWSC at Shiraguppi GP, the following recommendations are made.

1. Convert the Shiraguppi Water Supply Scheme to 24x7 after the implementation of JJM, which will include metered household connections, new Jackwell and new pumping system along with WTP.
2. A detailed documentation of the innovative systems in the GP including that of the Water Supply Scheme may be made, both in print and video mediums as part of knowledge sharing.
3. Develop a Website for the GP, including all key information on Water Supply Scheme, baseline information on households and integrate the land and building information already collected by the GP in digital formats.
4. Prepare an Operation and Maintenance Plan for the Shiraguppi Water Supply Scheme including an O&M budget
5. Develop a Field Water School at Shiraguppi GP. Provide training to aspiring VWSCs, GP Councils and Watermen at the Field Water School in operations, maintenance and management of rural water supply schemes.

9.1.3 Conclusion

Sustainability of rural water supply schemes is the function of sustainability capitals. Of the five sustainability capitals mentioned above, two are built under projects or regular departmental funding. The other three sustainability capitals are left open by the department/government, not giving sufficient thought. Sustainability capitals such as Finance Capital, HR and Governance cum Institutional capital are the results of post-commissioning efforts by scheme owners and other participant stakeholders. 'Continuous Innovations' to overcome challenges is a key method to achieve sustainability and is required across all capitals. It is also equally important to recognize and foresee challenges as and when they emerge. Shiraguppi Water Supply Scheme has been proactively responding to its challenges and that's how it has reached its impressive status.

Result of Water Electrolysis experiment by VWSC: Sample '1' above is the raw water before treatment; Sample '2' above is filtered water from the MVS and sample '3' is the water generated by WPP. VWSC uses an Electrolysis precipitator apparatus to test water TDS in the water from Water Supply Scheme. Electrolysis is a process of electrical current flow through a liquid which causes chemical changes. Due to movement of ions the dissolved solids separate itself due to the chemical reaction. Testing results - if the dissolved solids are yellow in colour then it implies that the liquid contain - Silicon compounds, organic materials, fluoride and other organics. Water from the Water Supply Scheme is generally used for domestic purposes and water from WPP is used for drinking.

A proud and happy Mother shows the Thumps Up sign for the Shiruguppi Water Supply Scheme. She compared the time she came to this village and current times in terms of water. Shiruguppi has made her happy with sufficient water.

9.1.4 Source of Information

1. Direct Observation of the Water Supply Scheme and its components

2. Discussion with GP Council, Officials and VWSC
3. House Visit and interaction with families
4. Document of GP- Gram Panchayat Development Award-2016-17
5. Data provided from the GP Office

9.1.5 O & M of Shiraguppi Water Supply Scheme - Chikkodi Division

Table 103: Shiraguppi Scheme - O&M details

1	Location Details (District; Taluk)	Belagavi District; Athani Taluk
2	Name of the GP	Shiraguppi
3	Number of Villages covered by Scheme	1
4	Number of Habitations covered by Scheme	1
5	Number of Zonal Valves	75
6	Commissioning History /Year/ Month	1978 / 1998
7	Details of VWSC (No./Name/ Designation/ Gender/ Age/ Social Category of Members)	See list; 10 Members- 03 from GP Council and 07 are Non-GP Members
8	Total Population in the Village	9,683
9	Total Households in the Village	3302
	Natural Capital (Water)	Data/ Narration/ Remarks
1	Name of Water Source	River Krishna
2	Type of Water Source	Surface
3	Is the water source perennial	Yes; However, River Krishna completely dried up five years back.
4	Water Quality Testing Done	Available- See Table No10.1.5
5	Is GP receiving water from any MVS?	No
6	Recharging of any water sources done in the Village//GP	Yes; Bore well near the WTP / WPP /Crematorium is recharged with the reject water from WPP.
	Infrastructure and O&M	Data/ Narration/ Remarks
1	Jackwell – Depth	Not applicable. Jackwell has been abandoned as it is dilapidated.
2	Is there a WTP	Yes
3	Number of OHTs/GLSRs with capacity and location	Two; 1 x 2.5 lakh litres; 1 x 3.0 lakh litres
4	New House Service Connections- How (Process)	HTC to FHTC 1667 in 2020-2021 Proposed New FHTCs – 1240 in 2021-22 Total – 2907 (source – AEE- Nippani-Athni)
5	Is HTC metered	Not Applicable
6	Is there a Log Book at the Pump House	Automated Pump House. It is unmanned. Needs to check if data on operations is maintained.
7	Is the Log Book updated daily	See 6 above
8	Is water chlorinated	Yes

9	Maintenance of Pump House, OHT, WTP- Hygiene- Cleanliness	Not Applicable; Pump is installed on a floating barge in river Krishna
10	List of major breakdowns and issues experienced	No breakdowns in the last five years with regard to Pumping Machinery after automated systems have been installed.
11	Who repairs Water Meter	Not applicable as Water Meters are proposed to be installed under JJM.
12	LPCD in the Water Supply Scheme	55
13	Cleaning of OHTs/GLSR- Who/ Periodicity/ charges	Once in 40 days
14	Is bulk water supplied to any one	No
15	Technical backstopping by RDWSD	No
	Finance Capital	Data/ Narration/ Remarks
1	Number of HTCs - Tariff	3302 - @ Rs.1000/Household/ Annum
2	Number of Institutional connections- Tariff	21
3	Number of Commercial connections - Tariff	0
4	Water Tariff Revisions (History)	?
5	Is it Increasing Block Tariff	No; Flat Tariff
6	Is there a Bank Account for the VWSC	Yes
7	Is the VWSC accounts audited	Part of the GP Accounts; No separate accounts for VWSC
8	Who does the water meter reading	No Water Meters available
9	Billing and Collection	Consumer has to come to Gram Panchayat Office; raise a filled in Triplicate Challan and make the payment at the Bank. No cash is collected at the GP office. Of the Triplicate Challan, one copy is retained at the Bank, one copy by the Consumer and the third copy is given to Gram Panchayat office.
10	Billing and collection cycle	Annual
11	Who takes water meter reading	Not applicable
12	O&M Budget prepared	No
13	Consumer Bill	Yes
14	Consumer Ledger	Available in the software/ Computerized
	Governance & Institutional	Data/ Narration/ Remarks
1	Legal Status of VWSC – Who constituted VWSC and When	Constituted by Gram Panchayat Get History from Gram Panchayat
2	Is there a Bylaw for the VWSC	No.
3	Is there a Bylaw for O&M	Yes
4	Relationship with GP/ Gram Sabha/PDO	Part of GP; Cordial relationship
5	Staff of VWSC- Watermen- Qualifications- Age- experience- salary	One Waterman; Rajendra Narayanan 9945453384

6	Does VWSC support GP in any way	Lot many ways
7	Authority to provide New House Service Connections- How (Process)	GP and VWSC
8	Monitoring of staff performance	VWSC
9	Community consultations held- General Body Meeting	Gram Sabha
10	Is there a MIS	Yes – Financial
11	Is there a Grievance Redressal Mechanism (GRM)	Yes; Oral Complaint to VWSC/ GP
12	Is 'PARIHARA' used by VWSC or member consumers?	No
13	Information, Education and Communication (IEC)	Mike Announcement, CCTV Cameras installed Wall Writing, Live telecast of GP Council Meetings
	HR Capital	Data/ Narration/ Remarks
1	Staff of VWSC- Watermen- Qualifications- Age- experience- salary	One Water man One Operator at WTP
2	Training provided to VWSC/ Members/ Staff	Yes
5	Leadership in VWSC/ Rotation of Office Bearers/ Election of Office Bearers	Yes; Strong leadership exists in the community.

Table 104: Shiraguppi Scheme – WQT results

No	Parameters	Unit	BIS		Test Results	
			Desirable Limits	Permissible Limits	Raw Water	Treated Water
1	pH value		7.0	6.5 to 8.5	8.00	7.80
2	Turbidity	NTU	1	5	0.09	0.07
3	Total Dissolved Solids (TDS)	mg/L	500	2000	334	243.0
4	Electrical Conductivity	mS/cm	-	2500	587	426.0
5	Total Hardness	mg/L	200	600	216	136.0
6	Total Alkalinity	mg/L	200	600	120	52.0
7	Chloride	mg/L	250	1000	65	38.0
8	Nitrate (NO2)	mg/L	45	NR	4.1	2.3
9	Iron (Fe)	mg/L	1	NR	0.07	0.06
10	Fluoride	mg/L	1	1.5	0.6	0.3
11	Sulphate	mg/L	200	400	26.3	20.4
12	Calcium	mg/L	75	200	48.0	28.0
13	Magnesium	mg/L	30	100	23.3	15.5
	Date of Testing	17.03.2022				
	Name of Testing Lab	RDWSD Lab- Athni				

9.2 Nenmeni Rural Water Supply Scheme, Wayanad, Kerala State

Development of Sustainability Capitals in a Community owned Rural Drinking Water Supply Project: A Case Study of Nenmeni Rural Water Supply Scheme, Wayanad district, Kerala State.

9.2.1 Introduction

Following the International Decade for Drinking Water Supply during 1980-90, substantial investment happened in rural water supply globally and nationally. Government of India made a significant intervention in rural water supply sector with the launch of ARWSP (Accelerated Rural Water Supply Programme) in 1973. Rural drinking water supply received further impetus with the launch of NDWM (National Drinking Water Mission) in 1986. The Cochin Declaration was issued by the Ministerial Conference held in Cochin in 1999, and the declaration included reform principles to be adopted by States in India. The SRP- (Sector Reforms Project) was experimentally implemented in 67 districts of the country and the SRP was based on Demand Responsive Approaches (DRA). The SRP was followed by National Rural Drinking Water Supply Programmes (NRDWP) such as Swajaldhara in 2003 and NRDWP in 2009. Government of India came up with an ambitious rural water supply programme, by name JJM- Jal Jeevan Mission in 2019, under which it is proposed to provide 55 LPCD of treated potable water to all rural households in the country through a Functional Household Tap Connection (FHTC).

State	Kerala
District	Wayanad
Taluk	Sulthan Bathery
Block	Sulthan Bathery
Gram Panchayat	Nenmeni
Revenue Villages	Cheeral and Nenmeni

The State of Kerala also made some significant interventions in rural water supply sector from the dawn of the 21st Century. The intervention came in the form of a rural water supply project, popular by its name, 'Jalanidhi', with funding support from the World Bank. 'Jalanidhi' was implemented in two phases: Phase-I commenced in 2000 and closed in 2008, while Phase-II was launched in 2011 and concluded in 2020. Jalanidhi is an acclaimed model for community and Gram Panchayat based Demand Responsive Approach. There were two categories of rural water supply schemes under Jalanidhi: (a) New Water Supply Schemes and (b) Rehabilitation of existing water supply schemes owned and operated either by the Kerala Water Authority or by Gram Panchayats. Nenmeni Rural Water Supply Scheme (NRWSS) was planned and implemented by Kerala Water Authority during 1988-1991 in Nenmeni Gram Panchayat of Wayanad district in Kerala. NRWSS was subsequently rehabilitated under Jalanidhi Project. This document is a case study of NRWSS.

9.2.2 Location of NRWSS: Details of the location of NRWSS are as follows.

Longitude: 11035'37"00 N
Latitude : 76021'26"68 E
Altitude : 953 M-MSL

Nenmeni Gram Panchayat, lies at the south-eastern corner of Wayanad district. The Wayanad district was formed in 1980 and has a total area of 2130 sq.km, 40% of which is forest areas. The district is landlocked and shares boundary with the States of Tamil Nadu and Karnataka, besides having borders with Kozhikode, Malappuram and Kannur districts of Kerala. Wayanad is divided into two physiographic zones, the plateau and the hills. Altitude of the district ranges from 700 m to 2100 m. The District has only one river, Kabani, originating in the eastern side of Western Ghats and drains into the Cauvery River, flowing from west to east. Nenmeni Gram Panchayat falls into the Plateau portion of Wayanad district. Nenmeni GP has a population of 48035, distributed into 11272 households (2011). The GP has an area of 69.39sq.km. 16% of the households belong to Scheduled Tribe category and 5% of households belong to Scheduled Caste category. Nenmeni GP is divided into 23 wards.

9.2.3 History and background of NRWSS

KWA began to plan and design the NRWSS to serve Nenmeni Gram Panchayat in 1988. NRWSS was commissioned in 1991 and had a capital investment of Rs.144.21lakhs. The NRWSS sourced its water from Noolpuzha, a small but perennial tributary of River Kabini, originating in the Panthallur hills of Tamil Nadu. The source- based infrastructure included a check-dam, an infiltration gallery and a Jackwell. Water was pumped from the Jackwell to a GLSR located at Kallumukku, 5.5 km from the Source. The GLSR has a capacity of 3.75 lakh litres. Distribution network was laid in Nenmeni Gram Panchayat and included approximately 400 House Tap Connections and 250 PSPs (Public Stand Posts). KWA managed the Operation and Maintenance (O&M) of NRWSS from 1991 to 2005. NRWSS was taken over by Nenmeni Gram Panchayat from KWA in 2005. Government of Kerala made it a condition on Gram Panchayats opting to be included in Jalanidhi project, to take over all single GP KWA water supply schemes and rehabilitate the same under Jalanidhi. Hence Nenmeni GP was also mandated by its inclusion in Jalanidhi project, to take over the Nenmeni KWA water supply scheme. However, the Nenmeni Gram Panchayat council realized the uphill task in rehabilitating a KWA scheme and took a resolution to hand over the Nenmeni RWSS back to KWA. The GP council sent a delegation to meet the then Minister for Water Resources and press the request of the GP to hand over the NRWSS back to KWA. Government of Kerala did not agree to the request of Nenmeni GP and directed it to proceed with the rehabilitation process.

9.2.4 The Jalanidhi Project:

The Jalanidhi project was loan financed by the World Bank. It was implemented in two phases: Phase-I expenditure was Rs.381 crores, while the phase-II project had an outlay of Rs.1022 crores. Phase–I of Jalanidhi commenced in 2000 and closed in 2008 and Phase-II was implemented during 2011-2019. During phase-I, 3710 schemes (3694 small water supply schemes and 16 medium sized water supply schemes) were implemented in 112 Gram Panchayats, benefitting approximately 1.92 lakh households (11.09 lakh population). Jalanidhi –II is implemented in 115 Gram

Panchayats and benefitted 17.46 lakh population through 2173 water supply schemes. Thus, Jalanidhi Phase-I and II benefitted a total of 227 GPs and 2.86 million population. "Jalanidhi project represented a paradigm shift from the traditional top down, engineering approach to demand responsive approach in order to bring key decision-making responsibilities throughout the project cycle to the GP and community" (The World Bank, 2011).

9.2.5 Salient Features of Jalanidhi Project

Salient features of Jalanidhi project included: (1) Demand Responsive Approach; (2) Cost sharing in Capex and Opex (15% during Jalanidhi-I and 10% during Jalanidhi-II of the capital cost by community); (3) 100% cost recovery for O&M by the beneficiary community; (4) participation of the beneficiary community in planning, implementation, operation and maintenance; (5) community contracting; (6) inclusive policies in favour of the socially backward communities; (7) social empowerment of the communities; (8) enhanced role of women in Jalanidhi; (9) uniform policies in drinking water supply within a GP; (10) rehabilitation of KWA and GP owned water supply schemes and (11) facilitation and cost-sharing role of GPs in planning and implementation of Jalanidhi project; and (12) role change of government and gram panchayat from an implementing agency to a facilitating institution.

9.2.6 Types of Water Supply Schemes implemented under Jalanidhi

Three types of water supply schemes were implemented under the Jalanidhi project: (1) New Water Supply Schemes; (2) Rehabilitation of KWA schemes and (3) Rehabilitation of GP schemes. Table-1, given below summarizes the number of schemes implemented during phase-I and phase-II of Jalanidhi.

Table 105: Nenmeni – types of water supply schemes implemented

KWA Rehab Schemes		GP Rehab Schemes		New Water Supply Schemes		Grand Total
Phase-1	Phase-II	Phase-1	Phase-II	Phase-1	Phase-II	All Phases
147	55	253	410	3310	1709	5884

9.2.7 Rehabilitation of NRWSS – Milestones and processes

Rehabilitation of a KWA scheme involves technical, social, political and institutional processes. On the technical side, a DPR for rehabilitation has to be prepared, got approved and implemented. On the social side, new households aspiring to get an HTC need to be mobilized; there are existing household connections and new household connections in a rehabilitation scheme and a social integration is necessary between these two categories of beneficiaries. Politically, consensus needs to be built among various political stakeholders about rehabilitation and the need for the same; this is a significant step in Kerala society, which is highly politically polarized. On the institutional side, beneficiary groups and a federated apex body are also required to be formed, registered and got matured to take over the ownership of the scheme from the GP. The following table captures the key processes involved in the rehabilitation of NRWSS as a KWA scheme to community owned NRWSS.

Table 106: Nenmeni scheme – milestones

No	Year	Milestone/ Event
1	1988	Planning and construction of NRWSS by KWA commence.
2	1991	NRWSS commissioned by KWA
3	1991-2005	Operation & Maintenance by KWA
4	2004	Nenmeni Gram Panchayat selected under Jalanidhi Project.
5	2005	Nenmeni Gram Panchayat takes over NRWSS as per provisions of agreement under Jalanidhi project[71].
6	2006	Nenmeni Sudha Jala Vitharana Society (NSJVS) registered under SRA 1860 as the community platform for Nenmeni Rural Water Supply Scheme
7	2007	Rehabilitation of NRWSS completed; 727 House Tap Connections are available; 389 are from the KWA legacy. 338 HTCs were newly added under Jalanidhi project
8	2008	Nenmeni GP Transfers NRWSS to NSJVS
9	2009	Number of domestic connections in NRWSS reaches 1000 HTCs. Community develops trust and confidence in NSJVS and service level of NRWSS.
10	2010	Reorganized distribution network into 9 zones.
11	2012	Reorganized the community platform; Registered Beneficiary Groups (BGs) originally envisaged under practices in Jalanidhi project replaced by Zonal committees. Two District Metering Areas, (Cheeral and Koliyadi) organized
12	2013	Karunya Family Support Scheme (KFSS) launched. KFSS provides finance support to buy medicines and essential provisions for selected destitute or very poor families, who are members of the NSJVS/ NRWSS network. KFSS is considered as CSR activity undertaken by NSJVS
13	2014	NSJVS gains confidence of Nenmeni Gram Panchayat. The Nenmeni GP decides to support extension of water distribution network to new areas and provide an initial financial support of Rs.3.10 lakhs by way of a grant to NSJVS.
14	2015	Second grant from Nenmeni GP to the tune of Rs.2.00 Lakhs for extension of distribution network; Total number of HTCs reach 2000.
15	2016	NSJVS recognized as a Support Organization (SO) under Jalanidhi Project. Third grant from Nenmeni GP to the tune of Rs.15.00 Lakhs for extension of distribution network;
16	2017	Fourth grant from Nenmeni GP to the tune of Rs.10.00 Lakhs for extension of distribution network; NSJVS introduces Online Software for Billing, Collection, Accounting, Operations and Management.
17	2018	Government of Kerala supports NSJVS to build a WTP for NRWSS. An approximate amount of Rs.200 lakhs provided towards the cost of building WTP and WTP commissioned.

[71] Taking over KWA includes the following steps: (1) GP requests the EE-KWA to transfer the ownership of single GP KWA scheme to GP through a resolution; (2) Prepare a status report of the scheme jointly by the SO, GP and KWA Officials; (3) Prepare a status report of the scheme jointly by the SO, GP and KWA Officials; (4) KWA shall run and manage the transferred scheme for a period of five months after signing a STM. During this five months' period, KWA shall Pay up the dues to KSEB, Hand over all relevant documents of the scheme to the GP, Transfer the Electricity connection ownership to the GP and Pay back security deposit collected from individual KWA consumers if any; (5) Rehabilitation- Technical, Social and Institutional aspects; (6) Transfer ownership of the water supply scheme to NSJVS by Nenmeni Gram Panchayat

No	Year	Milestone/ Event
18	2019	NSJVS enters into an entrepreneurial venture. It enters into a contract with Thondernad, Panamaram and Adimali GPs for O&M of large Rural Water Supply Schemes.
19	2021	NSJVS opens a Rural Water Quality Testing Lab at Cheeral. House Tap Connections reach 3000.
20	2022	House Tap Connections reach 4700; 650 Water Samples Tested at NSJVS Water Quality Testing Lab. Nenmeni GP hands over a large open well, which was originally developed to support local lift irrigation. Applications for new HTCs invited from prospective households interested in obtaining a HTC.

9.2.8 Sustainability Capitals in Nenmeni Rural Water Supply Scheme

9.2.8.1 Sustainability Capitals

Sustainable development is the continuous enhancement of sustainability capitals. Sustainable livelihood analysis framework *(William, 2003)* mentions Human capital, Social capital, Natural capital, Physical capital and Finance capital. *(Ida Christensen and Pamela Pozarny, 2008)*. Drawing from the Sustainable Livelihood Analysis Framework model, an attempt is made to identify the sustainability capitals for a community-based drinking water supply scheme and analyze its sustainability. To undertake the analysis of sustainability in a rural drinking water supply scheme, sustainability capitals identified include: (1) Natural capital (water), (2) Physical capital (infrastructure), (3) Human and Social capital, (4) Finance capital and (5) Institutional-Governance capital. In this analysis model, four capitals are adopted as such from the Sustainable Livelihood Analysis framework and a fifth capital in the form of Institutional-Governance capital is added to arrive at the sustainable capital pentagon.

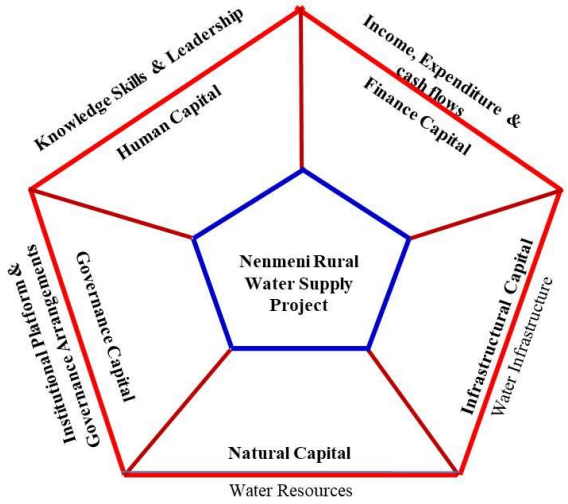


Figure 30: Sustainability Capitals

Sustainability in the context of a scheme that provides a service is the availability of the designed service during the design period of the scheme. Water is the resource capital in the context of NRWSS. Water (Natural Capital) should be sufficiently available at the source of the scheme for year-round pumping. The physical capital in the case of NRWSS is the manufactured assets and the operational management that helps in reaching water from the source to the HSCs and should satisfactorily function during the design period of the scheme. Finance capital, which includes income and sufficient cash flow to manage the expenditure and the contingencies. The finance capital needs to be realized through cost recovery of the O&M. The human and social capital includes the leadership, staff, their knowledge, skills and experience to operate and maintain the

drinking water supply scheme and the social network among the community of beneficiaries. The human capital needs to be locally available to the extent possible, as it helps in developing a sense of ownership. The community platform that looks after the operation, maintenance and management of the drinking water supply scheme along with the governance arrangements constitute the Institutional cum Governance Capital and this capital needs to be available and active as long as service delivery is available. An effort is made here to analyze the sustainability of the NRWSS, choosing appropriate indicators for each of the sustainability capital.

A total of 35 Indicators have been developed to assess the sustainability of NRWSS. (Three indicators under Natural capital; nine indicators under Infrastructural capital; Eight indicators under the Finance capital; Eight indicators under Human and Social capital and Seven indicators under Governance capital). Indicators are verifiable under the Natural, Infrastructural, Finance capitals and to a large extent the Governance capital. However, certain sub-indicators under the human and social capital are subjective and perceptional. A total score is attributed to each indicator and a score is awarded against each indicator to NRWSS. Following table does a listing of sustainability indicators, grouped under the five sustainability capital categories.

Table 107: Nenmeni Scheme – sustainability score under indicators

Sustainability Capital	**Total Score**	**Score Awarded**
Natural Capital		
1. Perennial Water Source (No downtime in summer due to lack of water at source)	10	10
2. Water Quality between Desirable-Permissible Limits for all parameters	7	7
3. Regular water quality test reports are available for verification	3	3
Sub Total	**20**	**20**
Infrastructural Capital (Physical Capital)		
1. Frequency of supply= water supplied to all Households every day	3	3
2. Regularity of Supply = water supplied with predicted schedule	3	3
3. Adequacy of Supply = 70 LPCD of treated water is available on a daily basis	3	3
4. NRW is less than 25.00%	3	2.5
5. Treated and chlorinated water is supplied	2	2
6. Down time is less than 2.00%	2	2
7. All Water Supply Connections are metered and operational	2	2
8. Good Maintenance Efficiency with Mobile Maintenance Units	1	0.75
9. Stand-by Pumps are available	1	1
Sub Total	**20**	**19.25**
Finance Capital		
1. Incremental Block tariff	3	3
2. Breakeven Income for 14 years of operations;	3	2.25
3. Software based Billing & Collection System.	3	2.75

4. 90.00% of regular tariff payment.	3	2.75
5. Revised Tariff thrice	3	3
6. Audited accounts for all 14 years	2	2
7. Online Tariff Collection Tracking System	2	2
8. Transparent procurement/Quotation system	1	1
Sub Total	20	18.75
Human Capital		
1. Good Staff morale (Local staff, Low staff turnover, Sound technical skills, Staff welfare and discipline, Gender balanced staffing (8 Women & 9 Men)	5	4.25
2. Innovations & Methodology Development	5	4.5
3. Stable community leadership- Champions key to success	3	2.75
4. Crisis Management/Conflict resolution capacity of NSJVS	2	1.5
5. Sensitivity of Inclusiveness- BPL /SC-ST inclusive and pro-poor approach	2	2
6. Diversifying into other roles such as:-SO and Operational Contractor	1	1
7. Capacity Building Support to medium and large rural WSS in Kerala	1	1
8. Karunya Kudumba Sahaya Nidhi	1	1
Sub Total	**20**	**18.00**
Governance Capital		
1. Platforms of Participation and Accountability (Transparency systems)- Regular Meetings and interventions of GC/GB; Present the income and expenditure account of NSJVS in the GC every month. Printed copy of the statement of accounts given to members of the GC; Advisory Committee constituted (6 Members)	3	2.75
2. Rule of Law **(**Bylaws to govern NSJVS as well as O&M)	3	2.5
3. Rule-making and rule enforcement.	3	2.5
4. Responsiveness: Efficient GRM (complaints book-2007) to Software (2019)	3	2.75
5. Management Information System (MIS) (Transparency)	2	2.00
6. **Effectiveness (**HTC provided to approximately 5000 households against less than 400 HTCs while NRWSS was under the stewardship of KWA);	2	2.00
7. **Inclusiveness** (Differential enrolment fees defined and implemented for SC and ST as well as BPL category of families in obtaining an HTC from NRWSS)	2	2.00
8. **Efficiency (**Net present cost for including one household into the distribution network works approximately to Rs.18,000[72], while inclusion cost for a household in Jalanidhi-phase-II was beyond Rs.50,000/Hh).	2	1.50
Total Score	**20**	**18.00**

[72] Initial capital cost of NRWSS is 144.00 lakhs and an annual interest rate of 10% is added for 30 years. Hence net current value is to the tune of Rs.5.76 crores (1.44 crores+ 4.32 crores). Rehabilitation cost was to the tune of 46.3 lakhs and an annual interest rate of 10% is added for 14 years. Hence net current value is 111.12 lakhs; (46.3 +64.82 lakhs). Cost of WTP was approximately 200 lakhs and an annual interest rate of 10% is added for 4 years. Hence net current value is 280.00 lakhs (200+80 lakhs). Hence grant total net current value is assumed as 9.67 crores. Total number of families benefitting from the NRWSS is assumed as 5500. Average per household cost = 9.67 crores/5500=17582, say Rs.18000/Hh. This is one third of the average per household cost of Rs.50000, being the implementation cost during Jalanidhi-Phase-II and hence the investment is effective

Following table summarizes the total score for each sustainability capital and the score awarded against each sustainability capital to NRWSS. The overall sustainability score of NRWSS is 94 out of 100 (94.00%). NRWSS is strongly moving on the sustainability path.

Table 108: Nenmeni Scheme – summary of sustainability score

Sustainability Capital	Score Awarded	Total Score
Natural Capital	20.00	20
Infrastructural Capital	19.25	20
Finance Capital	18.75	20
Human Capital	18.00	20
Governance Capital	18.00	20
Total	94.00	100

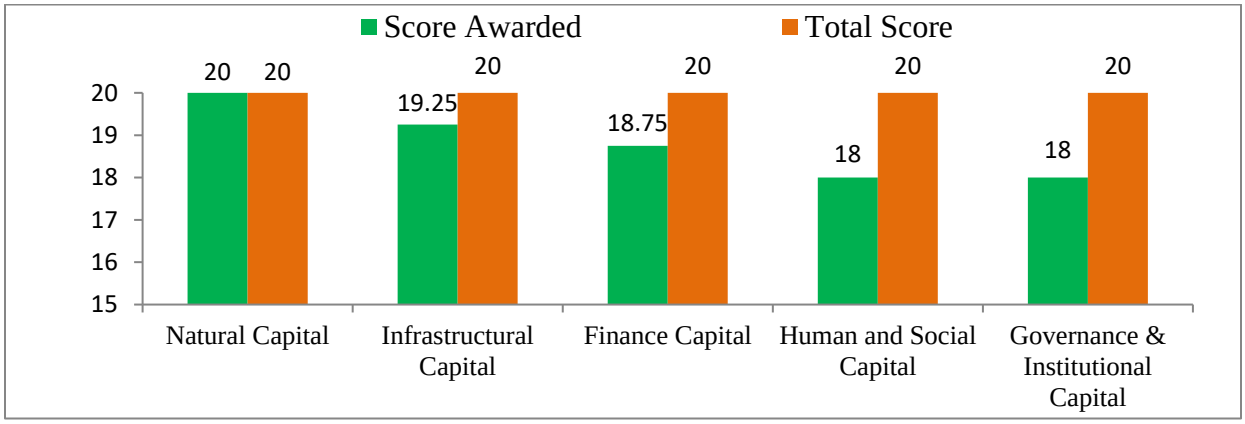


Figure 31: Nenmeni Scheme – summary of sustainability score

9.2.9 NRWSS- behind its achievement of sustainability

An attempt is now made to look into the sustainability capitals of NRWSS.

9.2.9.1 Natural Capital

Noolpuzha River is the water source for NRWSS. It is a tributary of Kabini river and is perennial. The river originates in the Panthallur hills of Tamil Nadu, flows down to Kerala and finally confluences with river Kabini. The water in Noolpuzha River is turbid throughout the year with varying intensity of turbidity, higher during monsoon season and lower during summer months. After the establishment of WTP for the NRWSS, NSJVS is able to provide potable quality water, conforming the BIS norms. Also, NSJVS has now established a Water Quality Testing Lab at Cheeral Village Centre and is supported by Nenmeni GP and Dept of Health. The Lab has facilities to test 17 parameters including the bacteriological aspects. Thus, under the natural capital, the NRWSS is considered sustainable as it has sufficient summer flows to enable requisite pumping,

treating water to potable quality standards and a water quality testing facility for regular quality tests. Following table provides the test results pertaining to raw and treated water.

Table 109: Nenmeni scheme - WQT test results

No	Parameters		BIS		Testing Dates and Results	
		Unit	DL	PL	24.3.22	24.3.22
1	pH value		7	6.5 - 8.5	6.3	6.4
2	Turbidity	NTU	1	5	7	1
3	Total Dissolved Solids	mg/L	500	2000	61	67
4	Electrical Conductivity	mS/cm	-	2500	111	122
5	Total Hardness	mg/L	200	600	30	40
6	Total Alkalinity	mg/L	200	600	42	40
7	Chloride	mg/L	250	1000	10	6
8	Nitrate (NO2)	mg/L	45	NR	BDL	BDL
9	Iron (Fe)	mg/L	1	NR	0.23	0.1
10	Fluoride	mg/L	1	1.5	BDL	BDL
11	Sulphate	mg/L	200	400	BDL	10
12	Calcium	mg/L	75	200	8	9.6
13	Magnesium	mg/L	30	100	2.4	4.3
14	Acidity		0	0	10	10
15	Ammonia		0.5	0.5	Nil	Nil
16	Residual Chlorine		0.0	0.2	Nil	0.2
17	E-Coli				Nil	Nil
Name of Testing Lab					NRWSS Lab	
DL Desirable Limit					Raw	WTP
PL – Permissible Limit						
BDL Below Detectable Limit						

9.2.9.2 Infrastructural (Physical) Capital

Infrastructural Capital consists of facilities and assets for pumping, treatment, storage, distribution, besides the functions of operation and maintenance (O&M). Of these, the O&M shall focus on the delivery performance of NRWSS in terms of: (1) Frequency of Supply (duration of water supply); (2) Regularity of water supply (fixed timings for supply of water- DMA-wise) and (3) Adequacy of water supply. All these performance indicators have remarkably improved under the management of NSJVS. Frequency of water supply improved from alternate days to everyday supply for a few hours. Regularity of supply improved, with each DMA receiving water for minimum duration as per schedule every day. The NRWSS is able to provide 70 LPCD of assured water supply every day.

The following table provides a summary of the assets under NRWSS

Table 110: Summary of the assets under NRWSS

No	Name of Asset and location	Quantity/ Specification	Remarks
1	River bank infiltration well -	6m dia; 10m depth	
2	Padiparambu Open Well	15M dia x 9 M depth	
3	Pumping Machinery at Noolpuzha Pump House	5 Pumps (60 HPx2 & 50 HPx3 -New)	
4	Pumping Machinery at Padiparambu Open Well	2 Pumps (30 HPx1 & 20 HPx1-New)	
5	Water Treatment Plan - Kallumukku	Aerator Flash Mixer Clari-flocculator Sedimentation Tank Chlorination Unit	Capacity of WTP is 1.5 MLD and is extendable to 2.5 MLD
6	Storage Reservoir	1. Clear Water Reservoir at WTP– 3.75 lakh litres 2. Over Head Tank at Thovarimala – 50000 Litres	
7	In-house Water Quality Testing Lab	Facilities to test 17 parameters; 700 WQ Tests done so far	
8	House Tap Connections	5000 Metered House Tap Connections	
9	Public Stand Posts	70; Nenmeni GP pays O&M tariff for these @ Rs.5250/year/ PSP	
10	Down time in Operations	Less than 2.00% in 14 years	
11	Land Assets	15 Cents of Land purchased at Cheeral Village Centre 05 Cents of Land and office available at Karinkalikunnu	
12	Distribution based on Zoning &DMA Maintenance Efficiency using Mobile Maintenance Units Operations	9 distribution Zones; 2 DMAs Mobile Maintenance Service Van& 2 Scooters NRW less than 20.00% Installed Mobile remote pump operation device for 8 small WSS taken over by NSJVS	

Least inconvenience is caused to the consumer households due to disruption of water distribution, as NSJVS announces through local print and visual media of any scheduled or upcoming disruption of water distribution in advance so that the consumer public takes precautionary measures such as storage of additional water to meet contingencies. NSJVS has ensured availability of standby pumps and pumping disruption is absolutely minimal due to mechanical failure. If there are major faults or leakages in the distribution network, NSJVS sends its technicians with necessary spares and equipment in their own service vehicle. This has improved the response time for repairs. NRWSS has gained the confidence of the community because of these types of rapid and timely responses to repair and maintenance issues. After several rounds of iterative praxis, NSJVS devised schedules for pumping of water, DMA-wise distribution of water and meter reading in a monthly operational cycle. NSJVS has introduced visits to households to collect data on water consumption from the water meter and issues bills to consumer households. There are also provisions for making spot payment of water bills to the meter readers. When NRWSS was under KWA management, it was experiencing a Low-level Equilibrium Trap)

(Nelson, 1956) (Rural water supply in Kerala, India : how to emerge from a low-level equilibrium trap, 1991). Cost recovery was absolutely low and hence there was no financial backing for repairs, timely maintenance, improvement of service level, equipment and machinery. After the rehabilitation of the NRWSS, technically, operationally and institutionally, NRWSS emerged out of its KWA baggage of low-level equilibrium trap and became self-reliant, energetic and sustainable.

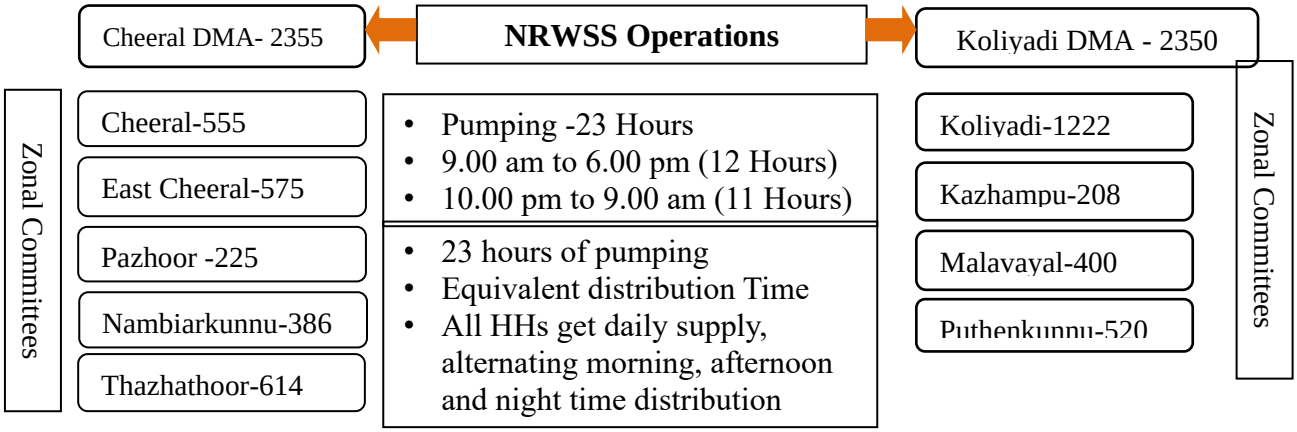


Figure 32: Nenmeni scheme distribution system

After a series of initial setbacks with regard to defunct motors in the first five years of O&M, NSJVS has purchased and stocked sufficient number of new stand-by motors/pumps so as to face any eventuality arising from defunct motors. Now the NSJVS has a stock of seven motors/pumps all installed and in working condition. NSJVS has learnt that motor repair and maintenance plan is needed. Mobile Service Unit has been introduced to manage repair and maintenance efficiently. 95% of the households have installed small storage tanks ranging from 500 to 2000 litre capacity. Number and size of the Tanks are proportional to the wealth status of the consumer household and water needs. Mobile communication has helped in enhancing communication on water leakage, pilfering of water and other issues. When leaks are detected, people communicate such information at the earliest. Mobile communication is also being used efficiently to make complaints and register complaints on the GRM.

NRWSS has moved from small community-based distribution network to distribution zones which are slightly larger and have divided the entire distribution network into two district metering areas (DMAs). These two DMAs are further organized into 9 distribution zones. The number of HTCs has increased to approximately 5000 (2022 May). Through 'trial and experimentation', NSJVS has devised a distribution time schedule between the DMAs. Water is distributed in two time slots; from 9.00 am to 9.00 am switching the DMAs alternatively in the distribution time slots and ensuring water distribution to all households in both DMAs every day. The distribution arrangement is such that it gives NSJVS enough time to take care of repair and maintenance on the distribution network, prior to or after the distribution. Repair /Maintenance Team move into

field after distribution. Changes in organizational/institutional arrangements also become necessary in the light of field realities. NSJVS covers 20 of the 23 wards of Nenmeni GP and further covers 45% of population and households in Nenmeni GP through its water supply scheme.

9.2.9.3 Demand for new HSCs

NSJVS made splendid success in increasing the number of House Tap Connections during 2008-2022. From 727 HSCs in 2007, the number of HSCs has gone up to 4705 in 2022. Demand for new HSCs is indicative of the success of the scheme and the community trust in it. When the number of HSCs increased, the number of PSPs went down. The GP decided to retain such PSPs in poor neighborhoods so as to ensure water supply to economically backward households not opting for a HTC. Credibility of the Scheme is very important in attracting more households to opt for HTCs as well as the operations become viable at scale. One can surely say that NRWSS has emerged from the Low level Equilibrium Trap (Nelson, 1956); (Rural water supply in Kerala, India : how to emerge from a low-level equilibrium trap, 1991) to sustainable and economically viable operations.

9.2.9.4 Finance Capital

NRWSS is run on the cost recovery principle. It has generated sufficient revenues to meet the expenditure and has not incurred loss due to operation and maintenance. The most important source of revenue was the water tariff collected from the HTCs. NSJVS has developed online software to manage the finance and accounting aspects including billing and collection. The software has also been improvised to address the finance management needs of the scheme comprehensively. NSJVS has also succeeded in saving a surplus amount in each year of its operations. NSJVS has also entered into a negotiation with Cheeral Branch of Sulthan Bathery Urban Cooperative Bank with an overdraft facility to meet contingencies and cash flow gap.

Most community based rural water supply schemes in the Jalanidhi project have followed a practice of charging a higher charge for availing new HTC than was paid by most households during planning and implementation of the scheme. Following table shows the charges for availing new HTCs, followed by NSJVS during the post-commissioning period.

Table 111: Nenmeni scheme - House Connection Charges

Year	House Connection Charge in INR		
	General Category- New HSC	BPL Category- New HSC	SC-ST Category New HSC
2007-2016	1,500	750	300
2016-2018	2,000	1,000	500
2019	3,000	1,500	750

NSJVS kept the new HTC charges at affordable rates and followed an inclusive policy in adding new house connections. Enrollment fee was kept socially and economically sensitive, low and affordable. BPL and SC-ST households are offered concessional enrollment charges than general category households. NSJVS follows an inclusive policy and exhibits a sense of social sensitivity.

NSJVS didn't punish those households who applied for an HTC after the rehabilitation of the scheme, as was done by several other water supply schemes in Kerala, for various grounds of justification. NSJVS revised the water tariff four times during 2008-2022. NSJVS began with Rs.50/household for a minimum consumption of 10 KL in 2008. This was enhanced to Rs.60 in 2012, Rs.75 in 2014 and Rs.100 in 2018. The following table provides details of incremental volumetric water tariff followed by NSJVS.

Table 112: Nenmeni scheme water tariff evolution (Rs.)

Volume in Litres	2008- Oct 2012	Nov 2012 – Sep 2014	Oct 2014 -Oct 2018	Nov 2018 till date
0-10,000	50	60	75	100
10001-15000	10/for addl KL	15/for addl KL	15/for addl KL	15/for addl KL
15001-20000	15/for addl KL	25/for addl KL	50/for addl KL	50/for addl KL
20000+			100/ for addl KL	100/ for addl KL
20000 -25000	25/for addl KL	50/for addl KL		
25001-30000	50/for addl KL			
25000+		100/for Addl KL		
30000+	100/for addl KL			
PSP Tariff from GP	1750	2250	3750	5250

Details of Power Charges by Kerala State Electricity Board (KSEB)

Year	Power Charge /Unit
2008	1.50
2013	2.20
2014	2.80
2016	2.90
2020	3.15
2022	3.30

Against an appeal by a group of GP Presidents to GoK in 2004, KSEB decided to charge Jalanidhi and other community managed drinking water supply schemes with power tariff at the domestic rate of LT-1A, considering water distribution under Jalanidhi schemes as a non-commercial activity.[73]

Though KSEB had provided power to community-based drinking water supply schemes at LT-1A tariff rate, irrespective of the size of the scheme for nearly a decade, power charges were revised since 2013 and NSJVS was served with huge bulk bill and was forced to revise the tariff. There were many power tariff revisions, which put pressure on NSJVS and consequently was compelled to revise the tariff. The tariff revision in 2014 created a debate in the local community, with various political factions giving notice of strike against NSJVS. The political agitation was handled well by NSJVS and there was no other option, but to enhance the tariff. The WTP was completed and commissioned in 2018 and it involved additional manpower and power consumption. The water tariff was revised again in 2018 from Rs. 75 to Rs.100. Since the water quality improved substantially, the enhanced tariff was accepted by the community.

[73] Distribution Profit Centre, B.O (FM) No.3194/2004(TCI)N/3944/2001, Dated 15.12.2004, Read along with Note No.CM/101/Jalanidhi/04 dated 07.12.2004

Revenue of NSJVS consists of water tariff, enrollment charges from new HTCs, fines and penalties. Following table provides details of income and expenditure of NSJVS during the last 14 years.

Table 113: Nenmeni: Comparative Income and Expenditure Details during 2008-2021

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
No. of Hhs	924	1122	1240	1415	1655	1818	1961	2069	2194	2421	2638	2827	2947	3043
Energy Bill INR (Lakhs)	1.00	1.14	1.2	1.36	1.63	2.61	2.92	7.38	7.13	8.7	7.5	10.7	12.3	12
Per Hh Energy cost (Annual)	109	102	96	96	99	143	149	357	325	359	284	380	417	395
Salary Cost INR (Lakhs)	1.16	3.96	4.74	5.41	6.19	8.95	10.1	11.7	12.8	16	20.7	25.3	27.1	33.3
Per Hh Salary Cost (Annual)	126	353	382	382	374	492	515	565	583	660	786	894	918	1093
Repair & Maintenance Expenses	1.09	3.65	4.02	5.38	3.78	4.93	7.75	8.63	10.6	10.3	8.08	5.48	8.33	14.1
Per Hh Maintenance cost (Annual)	118	325	324	380	228	271	395	417	482	424	306	194	283	462
Grand Total per Hh cost (Annual)	**353**	**780**	**802**	**858**	**701**	**906**	**1059**	**1339**	**1390**	**1443**	**1376**	**1468**	**1618**	**1950**
Total Expenditure/year (lakhs)	3.25	8.75	9.96	12.1	11.6	16.5	20.8	27.7	30.5	35	36.3	41.5	47.7	57.5
Total Income (Lakhs)	3.45	9.92	10.8	13.6	14	19.3	22.8	29.2	31.2	38	36.9	42.2	53.4	60.9
Per Hh income (Annual)	**373**	**884**	**873**	**961**	**847**	**1064**	**1161**	**1411**	**1422**	**1571**	**1400**	**1492**	**1813**	**2000**
Surplus income/year (lakhs)	**0.2**	**1.16**	**0.87**	**1.46**	**2.42**	**2.85**	**1.99**	**1.51**	**0.7**	**3.07**	**0.63**	**0.67**	**5.71**	**3.42**

As is clear from the above table, NSJVS made a surplus in all years of operation and maintenance. NSJVS has succeeded in introducing consumer discipline through monitoring and surveillance. All HTCs and other institutional connections are metered and Incremental Block Tariff is in place. NSJVS has an impressive history of finance management.

Table 114: Comparison of major expenditure heads in NSJVS during 2008-2021

Year	Energy Cost	Energy Cost %	Salary Cost	Salary Cost %	Maintenance & Other Expenses	Maintenance Cost %	Total Cost
2008	1.00	30.77%	1.16	35.69%	1.09	33.54%	3.25
2009	1.14	13.03%	3.96	45.26%	3.65	41.71%	8.75
2010	1.20	12.05%	4.74	47.59%	4.02	40.36%	9.96

2011	1.36	11.19%	5.41	44.53%	5.38	44.28%	12.15
2012	1.63	14.05%	6.19	53.36%	3.78	32.59%	11.60
2013	2.61	15.83%	8.95	54.28%	4.93	29.90%	16.49
2014	2.92	14.06%	10.10	48.63%	7.75	37.31%	20.77
2015	7.38	26.65%	11.68	42.18%	8.63	31.17%	27.69
2016	7.13	23.38%	12.79	41.93%	10.58	34.69%	30.50
2017	8.7	24.89%	15.99	45.74%	10.27	29.38%	34.96
2018	7.5	20.65%	20.74	57.10%	8.08	22.25%	36.32
2019	10.74	25.87%	25.30	60.93%	5.48	13.20%	41.52
2020	12.30	25.77%	27.10	56.78%	8.33	17.45%	47.73
2021	12.03	20.24%	33.30	56.03%	14.10	23.73%	59.43

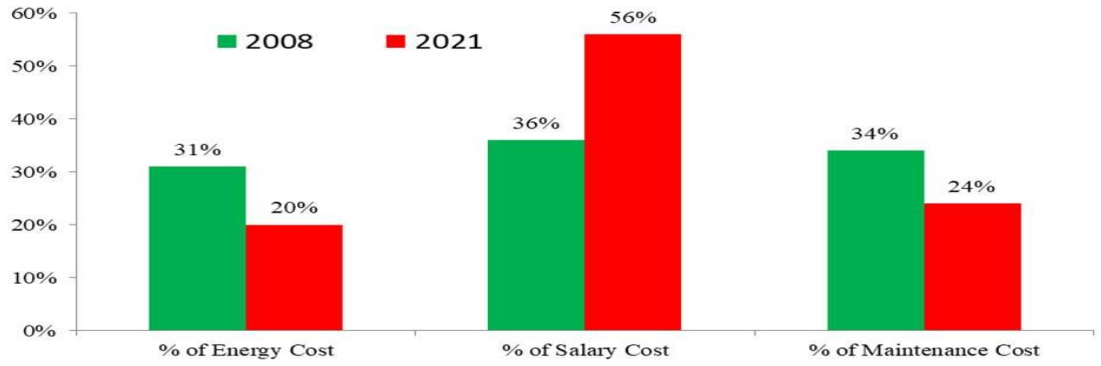


Figure 33: Comparison of major expenditure heads in NSJVS during 2008-2021

Table 115: Summary of Finance Capital in NRWSS

1 Inclusive Enrolment Fees for New HTCs; 2 Incremental Block tariff 3 Breakeven Income for 14 years of operations; 4 Disconnection notice issued 3 months after defaulting tariff payment. 5 Software based Billing and Collection System 6 90% of regular tariff payment. 7 Revised Tariff thrice 8 Billing & Collection System 9 Financial Support from Nenmeni GP towards extension of distribution network 10 NSJVS operates Adimali RWSS on an 'Operate and Transfer' mode of contract.	11 Tariff Payment is part of Consumer behaviour 12 Transparency arrangements in procurement/ Quotation system 13 Regular annual auditing of accounts 14 Professional Fin Management- 15 Online Tariff Collection Tracking System 16 Zone Sequencing in meter reading and Exchange of Meter Reading Route among Meter Readers every month 17 Three tariff payment options for the Household: - (1) spot billing and payment; (2) payment at the NSJVS office and (3) payment at the NSJVS WQ Testing Lab. 18 About 200 disconnections in 14 years

9.2.9.5 Human Capital

Whether it is an enterprise or an institution, the most significant success factor will be the leadership. NRWSS was driven by NSJVS. NSJVS had a steady and continuous leadership since 2008. The President of NSJVS and one lady member of the EC have been getting re-elected and holding office in NSJVS since 2008. All other members of the EC were changing and getting elected every three years. The current EC is the fifth[74] EC in 14 years of NSJVS. 45 individual members are there in the general body of NSJVS (5x9=45). 35 individuals have been in the EC and have understood the dynamics of NSJVS and NRWSS from close quarters. Members of the EC are 'informed individual consumers. Their availability in the NSJVS clientele has also been a positive factor for NRWSS.

Another leadership factor is the presence of Executive Secretary. Mr. K.C. Biju has been in the EC as an ex-officio member without voting rights and has continued in that role for 14 years. He comes from an ordinary and humble background. He was identified by the Team Leader of the Support Organization[75] during the planning phase of Jalanidhi in Nenmeni GP and brought into the SO Team as a Community Facilitator. This provided to be advantageous to NRWSS subsequently as he got insider knowledge of Jalanidhi project and NRWSS during planning and implementation. When the NRWSS was handed over to NSJVS for operation and maintenance, the NSJVS inducted Mr. Biju as Executive Secretary, the key staff leader to manage NRWSS. His experience, initiatives, open mindedness and ability to interact with sectoral leaders, staff and clientele have been success factors for NRWSS. He has also grown in the process and got exposed to other schemes and sectoral people. The author considers the Executive Secretary as the champion leadership factor in NSJVS/NRWSS and would like to attribute the leadership factor of NSJVS as the key success element in the sustainability journey of NRWSS.

The Staff of NSJVS have been selected locally and trained to become barefoot professionals. The staff is in the age group of 30-64. Staff Qualifications range from Class X to Graduation. Most employees have skill based education and experience. Given the kind of political influence in Kerala, it is difficult to maintain staff discipline. Trade unionism has been quite active in all enterprises, small and big, in Kerala. It is difficult to keep politics out of any enterprise, whether it is left or right wing factions in the State. NRWSS has been supported by political parties of all colours, considering it an essential enterprise for the welfare of the local populace. The NSJVS was strict and uncompromising with regard to staff discipline. Staff related disciplinary activities include: (1) termination of employee from service due to indiscipline (2008); (2) staff movement register (July 2008) to control unauthorized movement during duty time; (3) dies-non (no work no-pay) introduced for Pump Operators (2008); (4) plumber fined a penalty for giving

[74] NSJVS was registered as a charitable society under Societies Registration Act 1860 in 2006. The General body of NSJVS elects an Executive Committee (EC) every three years

[75] Shreyas, a local NGO based at Sulthan Bathery was the Support Organization (SO) for Nenmeni Gram Panchayat for planning and implementing Jalanidhi project. Shreyas has been SO in two GPs during Jalanidhi-phase-I and has had successful experience in planning and implementing Jalanidhi. Nenmeni GP was already in the operational area of Shreyas before becoming the SO for Nenmeni GP. This made its task easier

unauthorized HTC (2009); (5) members of the EC issued memo for irregular participation in meetings and removed from EC (2009/2011); (6) pump operator suspended from service for one month and penalty introduced for failure to report regularly for duty (2009); (7) employees made accountable for losses incurred to NSJVS due to negligence and made to pay compensation (2010); (8) three plumbers fined Rs.1700 each and issued show cause notice (2011); (9) office staff issued memo and levied fine for failure to perform duties (2014) and (10) employees staying away from staff meeting are marked absent and staff meeting considered part of duty (2015).

NSJVS has also introduced small welfare measures for the Staff and these include: (1) converting daily wage workers to regular contract employees and providing permanent status to staff (2007); (2) salary enhancement at regular intervals with salary revisions in 2008, 2009, 2012, 2014, 2015, 2016; (3) introduced festival allowance during Onam (2009) and enhanced in 2010, 2012, 2013, 2014 & 2016. (Rs.350 in 2009 to Rs.1350 in 2016); (4) introduced and enhanced Staff TA; (5) introduced a RD deposit for the staff since 2012; (6) additional payment for overtime work introduced since 2013; (7) interest free loan up to Rs.10,000 to tide over contingencies and to be recovered in 10 EMIs (2013); (8) introducing the provision to advance 50% of monthly salary to meet contingencies (2013); (9) phone allowance to Staff @Rs.50/month/person (2013); (10) purchased raincoat by NSJVS and provided to field staff since 2014 and (11) travel allowance allowed for Meter Readers (2014). Non-finance related welfare measures included maternity leave for lady staff since 2010 and with salary (2015) and 10 more approved leaves were sanctioned for staff since 2016. NSJVS is a village water utility with many limitations. Yet it has introduced small welfare measures within its limitations. When the staff erred, NSJVS took a tough stand on discipline related matters, while it introduced generous, pro-staff and sensitive welfare measures.

What are the challenges the scheme leadership faced in operating and maintaining a rural water supply scheme? Conflicts will occur and the leadership will be called up on to resolve them. During the last 14 years of O&M, NSJVS faced a few crises which could blow up NRWSS and throw it out of gear. The following table lists the major crises faced by NSJVS and the responses adopted by it to overcome crises.

Table 116: List of major crises faced by NSJVS

Crisis	Response
Huge Electricity Bill for Rs.2.25 lakhs received by NSJVS. (2011)	NSJVS applied to KSEB to pay up arrears in instalments and cleared energy arrears.
Strike notice from Political Parties in the wake of revising tariff from Rs.60 to Rs.75;	1. Convened meeting of Political Parties to discuss water tariff hike and explained the circumstances leading to tariff hike (2014). 2. Prepared ten Flux Boards to inform the community about Power tariff hike. 3. Announced a Press Conference regarding Power charge hike. (2014).

Crisis	Response
	4. NSJVS offered to withdraw from management of O&M. Requested GP to take over O&M or financially support O&M.
GP suspended payment for PSPs	NSJVS responded by issuing a notice of disconnection to GP informing it of disconnecting water supply through 68 PSPs (2015)
Damage to Pipeline due to road repair	NSJVS took up the matter with the District Collector and put pressure on the Contractor; Revised estimate was prepared with provisions for replacing/ relaying pipeline. Elsewhere, as road work is under execution, it invariably damages the pipeline and distribution network of the water supply scheme. NSJVS has found a way out to deal with this kind of issues.

Any rural water utility must have technical skill sets and ability to predict threats. Such technical capacity is built through experience over the years and by converting experience into knowledge. Training and exposure have played key roles in professionalizing local human resources. Another key recipe for success is innovations & methodology development**.** Sustainability is achieved through continuous innovations and methodology development as well. The role played by scheme leadership in this regard is critical.

9.2.9.6 Capacity Building Support to medium and large rural WSS in Kerala and outside

NSJVS has hosted exposure visits from PMU, State and district level officials from Assam, UP, Bihar and Jharkhand during 2013-2020. A select group of journalists from the low income states (UP/Bihar/Jharkhand and Assam) visited NRWSS. The tour was organized by WB in 2013 June. Uttarakhand SWSM Team led by Project Director- Ms. Sowjanya, IAS, visited Nenmeni SJVS in November 2014. NSJVS hosted large number of delegations from Gram Panchayaths for exposures. Representatives of 85 GP Boards visited Nenmeni RWSS. Members of 20 SLECs from other Large Water Supply Schemes of Jalanidhi project visited NRWSS for cross learning and sharing of experience.

9.2.9.7 Governance Capital

The fifth sustainability capital discussed here is the Governance Capital. Governance is the way rules, norms and actions are structured, sustained, regulated and held accountable" (https://en.wikipedia.org/wiki/Governance). In the context of NRWSS, we refer to NSJVS-Nenmeni Shudha Jala Vitharana Society (Nenmeni Drinking Water Supply Society) as the institutional platform that coordinates the operations, maintenance and management of NRWSS. For the purpose of the section in this paper, we refer to water governance and its institutional arrangements with regard to NSJVS, in a 'pluralist' view. NSJVS as an organization has membership, administrative bodies, office bearers, office, bylaws and legal status. The Gram Panchayat is responsible and constitutionally mandated to provide drinking water. The GP is not able to fulfill that function entirely on its own due to resource and capacity constraints. Therefore, it creates or facilitates other subsidiaries within its boundary to support drinking water supply

arrangements. NSJVS is thus viewed here as an autonomous institution that fulfills the water mandate for a few thousand families. NSJVS is thus part of the local social capital in a broader sense. Since it is beyond the reach and capacity of a GP to provide for drinking water supply to all households within its territorial limits, community organizations have been formed to plan, implement, operate and maintain community owned water supply schemes of varying sizes, thus moving away from governmental function to governance (Lievens, 2014) of water supply arrangements. Also, in another view, having an alternative institution is seen as a counterweight to arbitrary state, or local self-government action. (https://www.ucl.ac.uk/dpu-projects/drivers_urb_change/urb_economy/pdf glob SAP/ BWP Governance World Bank.pdf).

Literature on Governance describes eight characteristics of governance. The following table tries to capture the practice of governance in the context of NRWSS/NSJVS.

Table 117: Practice of governance in the context of NRWSS/NSJVS

Characteristics of Governance	Meaning of the Characteristics	Application in NRWSS/NSJVS
Participation	• Opportunity and platforms to voice opinions, representing gender, social and economic class interests	• Executive Committee of NSJVS • General Body of NSJVS • Zonal Executive Committee and General Body
Rule of Law	• Legal Framework for impartial enforcement of rights and legal obligations	• Written and approved Bylaws of NSJVS • Bylaws on Operation and Maintenance of NRWSS. • NSJVS under the Legal framework of SRA-1860. • Renewal of Registration**:** NSJVS has renewed its registration every year from 2007, submitting :(1) Application for renewal of registration; (2) list of members of the Executive Committee and (3) a copy of audited statement of accounts. • Various types of membership along with respective privileges explained
Inclusiveness	• Opportunity to get included, take part and benefit in a development process or project	• Differential enrollment fees defined and implemented for SC and ST as well as BPL category of families in obtaining an HTC from NRWSS.
Effectiveness	• Processes and institutions should be able to produce results that meet the needs of their community	• HTC provided to approximately 5000 households against less than 400 HTCs while NRWSS was under the stewardship of KWA

Characteristics of Governance	Meaning of the Characteristics	Application in NRWSS/NSJVS
Efficiency	• Resources of the community should be used effectively for the maximum output	• Net present cost for including one household into the distribution network works approximately to Rs.18,000[76], while inclusion cost for a household in Jalanidhi-phase-II was beyond Rs.50,000/Household.
Accountability	• Authority or Government or sectoral institution is answerable and accountable to the community/people	• Regular meetings of NSJVS GB and EC. 27 GB and 262 EC meetings have been held in 14 years. Detailed reports and statement of accounts are presented to all GB and EC meetings. All decisions are taken at GB and EC meetings. • Nenmeni GP President is an ex-officio member of the NSJVS EC.
Transparency	• Information should be accessible to the public and should be understandable and monitored	• Management Information System (MIS created) and data is available regarding all aspects of operation, maintenance and management of NRWSS. • Software for O&M of NRWSS/ NSJVS • Website and Monitoring systems for NSJVS
Responsiveness	• The office bearers of the institution shall respond to issues and complaints raised by the clientele and resolve the complaints at the earliest so as to gain confidence of the consumer community. • Grievance Redressal Mechanism primarily covers the receipt and processing of complaints from citizens and consumers. (Wikipedia, 2020)	• Grievance Redressal Mechanism (GRM) implemented in the O&M of NRWSS. It has received 21316 complaints in 14 years and all these have been resolved. Software based GRM is developed and functional. • NSJVS as a Water Support Organization to Nenmeni GP, Jalanidhi project and other GPs implementing similar projects. • NSJVS has taken over the management of 8 small (micro) community water supply schemes, operate and maintain them against the request from Nenmeni GP.
Rule-making and Rule enforcement	• Rules made by social associations or organizations that are not part of the State system	• Rules made by NSJVS mainly relate to: (1) disconnection of HTC, penalty for misappropriation of water connections, theft and illegal connections, fixing

[76] Initial capital cost of NRWSS is 144.00 lakhs and an annual interest rate of 10% is added for 30 years. Hence net current value is to the tune of Rs.5.76 crores (1.44 crores+ 4.32 crores). Rehabilitation cost was to the tune of 46.3 lakhs and an annual interest rate of 10% is added for 14 years. Hence net current value is 111.12 lakhs; (46.3 +64.82 lakhs). Cost of WTP was approximately 200 lakhs and an annual interest rate of 10% is added for 4 years. Hence net current value is 280.00 lakhs (200+80 lakhs). Hence grant total net current value is assumed as 9.67 crores. Total number of families benefitting from the NRWSS is assumed as 5500. Average per household cost = 9.67 crores/5500=17582, say Rs.18000/Hh. This is one third of the average per household cost of Rs.50000, being the implementation cost during Jalanidhi-Phase-II and hence the investment is effective

Characteristics of Governance	Meaning of the Characteristics	Application in NRWSS/NSJVS
		reconnection charges, over-use of water, disruption of water meter reading, replacement of damaged water meter, work assignment to staff and concessional tariff deserving households.

9.2.10 Conclusion

NRWSS has an institutional memory of a methodology for technical, social and institutional rehabilitation of single GP-KWA schemes and is a strong live-lab for rehabilitation of KWA schemes into community ownership and management. Stable community leadership is key to success and sustainability. Even when the rural water supply scheme is under community ownership and management, it is required to achieve community professionalism and continuously innovate in operations, maintenance and management. NRWSS is particularly noteworthy, because it remains proactively pro-poor, inclusive and retains a humane face throughout its post rehabilitation history. Yet another methodological contribution is the development, use and improvisation of software for management of operation and maintenance of rural water supply schemes.

On the technical side, NRWSS has facilitated access to improved quality and quantity of treated water through metered HTCs. NRWSS has improved frequency, regularity and adequacy of water supply at consumer level. Time spent for fetching household level water requirement is reduced to less than 30 minutes per day/household. On the financial side, NRWSS has achieved 100% O&M cost recovery. It has developed an excellent billing & collection system. Metered connections, incremental block tariff, habitual payment of water tariff etc. have contributed to the success of NRWSS.

On the social side, NRWSS has resolved water stress in the villages and has reduced the drudgery of women. Besides guiding GP in the water supply sector, NSJVS has also ventured into operational enterprises outside Nenmeni GP. The local community has trust in the leadership and management of NRWSS and is evident from the 10-fold increase in the number of domestic water supply connections. Continuous innovations and improvement in operations, maintenance and management has been the key to sustainability in NRWSS. Sustainability is achieved through a methodology, which involves innovations, action and reflection process. Methodologies and knowledge get developed in this process. This process contributes to sustainability of water supply schemes and commences in the post-commissioning stage. It is largely a socio-political and human process. Serious enquiries into the development and formation of sustainability capitals are yet to happen, deviating from the traditional research procedure into sustainability. Providing satisfactory services to consumers and evolving appropriate consumer behaviour is a primary key to sustainability. NSJVS has been continuously learning and innovating in this context. It is also

equally important to actively retain the organizational platform and ensure its democratic functioning. NSJVS has done this, treading the political path carefully and cautiously, yet not compromising on the premise of community professionalism.

9.3 Banavadi Single Panchayat Water Supply Scheme, Sattara, Maharashtra

Sustainability through devolution arrangements: The case of Banavadi Single Panchayat Water Supply Scheme, Karad Taluk, Sattara District, Maharashtra

9.3.1 Project Location

Banwadi Village is located in Karad Taluka of Satara District, Maharashtra State. It is located 53 KM south of Satara District. The village has an area of 6.8 Square Kilometres (km^2) and has a population of 16,962 with 3774 households (2021 Anganwadi data).

9.3.2 Project History:

Banwadi village was covered under a groundwater based Multi Gram Panchayat Water Supply Scheme which was implemented by Government of Maharashtra. However, this scheme experienced shortfalls in service delivery, poor coordination between State level agencies and GPs, political interferences between GPs, the quantity of water supplied was inadequate and irregular, the untreated water supplied had issues of contamination impacting the health of end users and there was no grievance redressal system in place, leading to dissatisfaction of the consumers.

9.3.3 Details of Water Supply Scheme:

The people of Banwadi and the GP council demanded uninterrupted supply of water. In response to this demand, the GP submitted a proposal to the State Government for designing and building an exclusive Water Supply Scheme with its own WTP facilities with an aim to provide 24x 7 water supply to its citizens with efficient service delivery.

The GP with the support of Maharashtra Jeevan Pradhikaran[77] (MJP) prepared a DPR for a 2 MLD water supply scheme at a cost of Rs 4.5 crores. Government of Maharashtra met 90% of the project cost and Beneficiaries contributed the balance of 10% cost. The beneficiary contribution per HH amounted to Rs.5000 towards the capex in 2012, against which a House Tap Connection (HTC) was provided. The water supply project is designed for 24x7 supply. The scheme is designed for a period of 20 years, considering 70 LPCD of service level for 3774 HHs. HTCs are metered. The project was conceived and implemented during 2010 - 2012 and was commissioned in 2013. It is observed that the same contractor who built the water supply scheme also undertook the construction of In-Village Distribution Network, thus ensuring complementarity between the water treatment system and the IVDN Banwadi.

[77] Maharashtra Water Supply and Sewerage Board (MWSSB) was established as per MWSSB Act 1976 for Rapid development and proper regularization of water supply and sewerage services in the State. MWSSB was subsequently named as Maharashtra Jeevan Pradhikaran in 1997

The water source for the project is Krishna River which is 2 kms away from the Village. The Jackwell is located on the banks of the river. Components of WTP include Aerator, flash mixer using Poly Aluminium Chloride, Clari-flocculator, Rapid Sand Filter and 2 OHTs acting as clear water storages, having capacity of 400 KL and 225 KL respectively. The raw water rising main is of Ductile Iron (200 mm dia), while the distribution network is of HDPE.

To manage leakage of chlorine gas cylinder at WTP a small water tank is constructed at the ground level. The leaking cylinder is immersed in the water to prevent any harmful effects to the watermen. In order to prevent breeding of mosquitoes at the tank, larva eating fishes are used in this tank.

9.3.4 Operations and Maintenance:

There are 2 submersible pumps at the Jackwell 15 HP and 20 HP respectively. The pumps are operated alternatively for a total of 18 hours a day. The pumps are operated through automated system by the watermen through mobile phone based remote starters. There are 2 separate power supply feeder lines provided by ESCOM to Jackwell and WTP. Non-return valves are installed at Jack well to prevent the surge effect.

The village OHTs are designed with adequate staging height, so as to delivery water with requisite pressure at delivery point which also include four storey flats.

The PDO of Banwadi GP informed that power supply is steady throughout the year with minimum fluctuations/ interruptions. The scheme is directly operated by the Gram Panchayat. The following measures are introduced by the GP into operations.

For the purpose of service delivery, the Banwadi village is divided into two blocks for the ‘A’ and ‘B’ blocks. There are 6 watermen employed to manage the water supply scheme. Their role includes operating Jackwell and WTP, disinfection of water, testing PH value of the water on daily basis, collection of monthly water quality report from PHED, undertaking repairs in the distribution network using the fusion machine, cleaning of OHTs every month and daily back wash of filter beds at WTP. The watermen work in 3 shifts of 8-hour duration i.e., 2 watermen per shift. The GP has invested Rs 1.5 lakhs to purchase a fusion machine to join HDPE pipes in case of leakages. Leakage related repairs are carried out immediately, taking 20 minutes to fix one leakage by the watermen.

Water supply is shut down for the purpose of maintenance on every Tuesday and the HHs are aware of this process and are prepared to manage water usage accordingly. Ferrule valves are set for the right pressure based on altitude and topography, Zonal valves in the distribution network are not operated on daily basis as pressure at HTC is ensured through adjustment of ferrule valve at HTC. Zonal valves are operated during cleaning of the OHTs every Tuesday (weekly once).

9.3.5 Metering, Billing and Collection:

Itron's simple multi-jet meters are installed for consumer connections. All HTCs are provided with analog meters and in case of meter repair, the GP undertakes repair at its own cost. Meter reading, billing and collection commenced two months after installation as trial run of meters for a period of 60 days. Post rectification of errors, the bi-monthly billing procedure was introduced without any delay. Bi-monthly meter readings are taken through photo software. The barcode of the meter is first scanned by the meter reader after which the meter reading is photographed. Readings are sent directly to server. The bill is processed and a photo of the meter reading is also printed on the customer's bill to ensure transparency. This process has helped build the trust of people in service delivery. Any consumer bill can be verified using the barcode, meter number, customer name and the mobile phone number. Payment options include down payment of cash, Paytm, Debit and Credit Card and online payment through internet banking. The Customer can choose to make part or full payment. The excess or differential amount is adjusted in the next bill automatically.

Billing activity is outsourced by the GP to a private agency, which has developed a software for generating bills every 2 months at one time cost of Rs 2.5 Lakhs and annual maintenance of Rs 1 Lakh. The bill is designed in such a way that it displays the customer ID, meter number, current meter reading, volume of water used in litres, status of the meter and the bill amount. Besides, the bill also contains month-wise meter reading for the last twelve months. Bill has provisions for advertisements, photo of the meter reading and water tariff structure applicable for residential and commercial connections are also displayed. GP earns nominal revenue from advertisements printed on the bills.

The software developed for billing has the ability to search a HH data based on barcode, meter number, or previous bill number. The GP can extract the backend data day wise, month wise or year wise for the purpose of analysis.

The handheld devices used for billing is simple and easy to operate. The backend data is retrieved at the end of each day in excel format. The device stores transaction data for 2 months so this helps the billing person to clarify/resolve any grievances raised by HHs. This also helps the GP to keep a check on its collection efficiency. The GP claims to have 90% tax collection efficiency annually.

The GP has deployed 2 dedicated persons for billing collection. Their responsibility is to distribute the hard copy of the water bill to HHs and also collection of the billed amount. The Hard copy of the bill is delivered to the consumer along with a SMS to the registered mobile numbers of consumers.

9.3.6 Institution and Governance:

GP Council is hands-on and takes timely administrative decisions for efficient service delivery:

1. The GP Council has constituted VWSC as a sub-committee for water supply. The VWSC reports to the GP Council on water supply related aspects based on concerns from field and appropriate decisions are taken in the Gram Sabha meeting. It consists of 13 members of which 50% are women. The VWSC meets once in 3 months to discuss water supply related matters and also carries out monitoring of specific projects related to water supply.

2. **Use of Solar Energy:** The GP Council along with the Village Development Officer decided to reduce the electricity consumption of the water supply scheme. This led to the installation of solar roof at the WTP. 40 KW of solar energy is installed on a grid system. On an average 1KW solar system generates 4.2 units daily. Therefore 40 KW generates 168 units. Average daily consumption is 415 units. Daily saving of units is 40.57%. Average monthly electricity bill is Rs 85,000 (per unit rate is Rs 6.8). Solar energy generated per day is to the tune of 168 units and is equivalent to Rs.1150 daily. Annual solar energy generated is approximately equivalent to Rs.419750.

3. **Levying of penalties/fines and discounts:** The GP Council has strictly banned all illegal connections and has imposed a hefty fine of Rs. 1,00,000 to curb illegal connections with immediate disconnection of the illegal connection. Customers who pay their bills before the due date get 5% discount on their bill amount payment after due date attracts 2.5% penalty on their bill amount.
4. **Fixing and Approval of Water Tariff Structure:** The GP has set the following tariff structure:

Table 118: Banawadi GP scheme: water tariff structure

Category of users	Consumption category	Water Tariff/KL in Rs
Residential	0 to 25000 Litres	04
	25001 to 45,000 Litres	06
	45,001 to 55,000 Litres	08
	55,001 and above Litres	10
	For apartments in flat complexes	08
Commercial	Hotel and other business centres	16

There has been no revision in tariff till date since the commission of project.

1. The council has introduced bulk water connections to residential flat complexes instead of individual HTCs with effect from 2020. The Banwadi GP has fixed new House Tap Connection cost at Rs 11,000 since 2020 irrespective of an individual HH or apartment. New SC/ST Household connections are charged Rs 2500.

9.3.7 Annual O&M (expenses and revenue) for 2021

Table 119: Banavadi annual O&M Income and Expenditure - 2021

No	Heads of Expenditure	Amount in Rs	Revenue	Amount
1	Chlorination Gas Cylinder	1,44,000	By advertisement	4,000

No	Heads of Expenditure	Amount in Rs	Revenue	Amount
2	Poly Aluminium Chloride	13,5000	Water tax	32,09,970
3	Electricity Bill	8,85,450		
4	Repair and Maintenance	2,95,000		
5	Billing & data management	1,00,000		
6	Salary expenses	10,32,000		
	Total	**25,91,450**		**32,13,970**
	Surplus Amount in 2021			**6,22,520**

Water Tax collection for last 3 years: The water tax collection efficiency of Banwadi GP for the years 2019 – 2022 is given below. However, the data provided by the GP was only for 10 months instead of 12 months. Analysis has been done using 10 months data for the last 3 years. It is assumed that the collection efficiency is 100%, considering average collection for 10 months approximately 90%.

Table 120: Banwadi GP: Water tax collection 2019 to 2022 – target VS achievement

No	Water Tax	2019-20	2020-21	2021-22
1	Total Demand (In Rs)	36,81,707	33,04,691	41,55,984
2	Total Collection (In Rs)	34,04,177	29,72,365	36,21,301
3	% of collection efficiency	92.46%	89.94%	87.13%

9.3.8 Innovations and good practices in Banwadi water supply scheme:

- Software based Billing and Collection system.
- Water supply is 24x7 with a pre-fixed shut down for repair, maintenance and cleaning on Tuesdays.
- Automated distribution system.
- Volumetric pricing and tariff system.
- Excellent water pressure maintained at consumer tap connections including on 3rd floor apartments.
- Over a period of time the scheme has achieved self-sustainability in terms of financial saving and service delivery.
- Trainings for the watermen are done every 6 months once through an online platform from ZP.

9.3.9 Awards and recognitions received by the GP

Banwadi GP has received a lot of awards and recognition in the water supply and other sectors. Some of the awards and recognitions are listed below:

Table 121: Banwadi GP Awards and recognitions

No	Name of Award/ Recognition	Given by
1	Nirmalgram Award 2006-07	DDWS- GoI
2	Environmentally balanced prosperous village (2010-11)	Govt of Maharashtra
3	Smart Village – First in Tehsil 2017-18	Govt of Maharashtra

No	Name of Award/ Recognition	Given by
4	Smart Village – First in District 2017-18	Govt of Maharashtra
5	Saint Gadge[78] Baba Village Cleanliness Mission – First in Tehsil 2016-17	Govt of Maharashtra
6	Saint Gadge Baba Village Cleanliness Mission – Third in District 2016-17	Govt of Maharashtra
7	Bima Gram Award[79] 2015-16 Bima Gram Award 2016-17 Bima Gram Award 2017-18 Bima Gram Award 2018-19 Bima Gram Award 2019-20	Government of India
8	Lokmat – Sarpanch Payabhut Suvidha Award – 2017-18 (for Basic Infra services)	Govt of Maharashtra
9	Lokmat – Sarpanch Swachhata Award – 2018-19 (Cleanliness Award)	Govt of Maharashtra
10	Environment Conservation Award 2018-19	Government of India
11	All Anganwadi's in the GP are ISO certified in 2017-18	
12	Clean Toilet Beautiful Toilet competition-2018-19	Government of India
13	Pandit Deen Dayal Upadhyay Panchayat Empowerment Mission 2019-20	Government of India
14	Saint Tukadoji Maharaj Clean Village Competition Award First in Tehsil and District 2018-19	Govt of Maharashtra

9.3.9.1 Crisis experienced by Banwadi Water Supply Scheme

The Jackwell of the Water Supply Scheme was flooded in 2020 and subsequently water pumping, treatment and distribution was non-operational for 3 days. During the flood related natural calamity, two borewells in the GP are used for supplying water through cisterns and public taps.

9.3.9.2 Proposal for further investment

The Banwadi GP has submitted a proposal for additional facility of the water supply scheme, considering under semi urban category proposing the requirement to meet demands of newly developed areas at a cost of Rs 6 Crores under JJM.

9.3.9.3 Analysis from sustainability capital framework:

Natural Capital: Krishna River is the source of Banavadi rural water supply scheme. The water quality test of the 17 parameters is carried out by the PHED. However, the water quality test report was not available with the GP. The GP checks PH value of raw water on a daily basis at the WTP. Water is disinfected with chorine at the WTP as per the prescribed norms.

[78] Government of Maharashtra launched the Sant Gadge Baba Gram Swachhata Abhiyan in 2001. (Village cleanliness programme). Sant Gadge knew that social revolution for cleanliness must be launched in the villages. Sant Gadge Baba was born on 23rd February 1876 and died on 20th December 1956

[79] Sampoorna Bima Gram (SBG) Yojana was launched on 13 October 2017. SBG is an initiative for expansion of client base of Postal Life Insurance to provide banking services through the postal network with affordable life insurance services to people living in rural areas of the country

Infrastructural (Physical) Capital: Infrastructural Capital consists of facilities and assets for pumping, treatment, storage, distribution, besides the functions of operation and maintenance (O&M). Frequency of water supply has improved from intermittent untreated water supply to 24x7 treated supply. Regularity of supply improved, and the GP is able to supply 70 LPCD of assured water supply every day. There is no inconvenience caused to households due to disruption of water distribution, as the GP has a fixed schedule for maintenance every Tuesday. The GP also has 2 express feeder lines which supplies electricity on continuous basis. Good staging design with effective water pressure, automation of pump operation, introduction of transparent and efficient billing system, improved response time for repairs has minimised grievances and has increased the confidence of the community.

Human Capital: The Banavadi scheme has employed 6 watermen. All of them are trained and are effectively and efficiently engaged for various services in O&M of water supply through shifts for 24x7. Separate skilled staff has been hired for billing and collection increasing the efficiency of collection of water tax throughout the year. The GP council is hands on and is aware of the requirements and supports the VDO in arriving at quicker and feasible solutions in the direction of effective service delivery. The staff is constantly trained by the MJP every 6 months. The GP also proactively sources the knowledge available in private sector for providing technology solutions in water supply.

Finance Capital: The GP is able to generate sufficient revenues to meet the expenditure and has not incurred loss due to operation and maintenance. The most important source of revenue is the one-time cost for new connection and the volumetric water tariff collected from the HTCs. The GP with the support of private operator has developed online software to manage the billing and collection bi-monthly. The GP has succeeded in saving a surplus amount in each year from its operations. The GP has only increased the one time charged from Rs 5000 to Rs 11000 from 2020 and has not increased or revised the water tariff structure since commissioning 2013. The new connection fee is inclusive and subsidies are given to SC/ST.

Initiatives under Finance Capital by the GP:

- Implementation of solar pumps and generation of solar energy to reduce electricity consumption
- Inclusive enrolment fees for new HTCs
- Software based billing and collection system
- Levying of penalty and fines
- Provision of discount to encourage timely payment of bills
- Volumetric pricing and tariff system.
- Transparency in billing and collection
- Different modes of bill payment for the comfort of the consumer

Governance Capital: The GP Council along with the VWSC/Sub-committee participates in the decision-making process related to water supply. All administrative and financial related decisions are taken in the monthly meetings of GP council and are implemented with immediate effect. Phone numbers of the GP Council and VWSC members are published and are accessible to public in case of any grievances. Inclusiveness is achieved by levying a lesser fee towards one-time new connection for SC, ST and BPL families. The GP ensures the effective and efficient service delivery since 2013, which is evident from the awards and recognitions the GP has received. Transparency and Accountability is maintained by keeping the data accessible to public as and when needed.

9.3.10 Conclusion

The initiatives and efforts undertaken by the Banavadi GP, for providing 24X7 water supply service delivery is commendable. The automation of pump operations, convenient and easy billing and collection system, transparency has facilitated trust and confidence of the consumer community in the GP. However, there is scope for improvement in data management, book keeping, record maintenance and safe keeping of water quality.

The following takeaways from the above three case studies are proposed to RDWSD. These suggestions may be considered part of the recommendations.

Table 122: Takeaways from three case studies

No	Takeaways from the case studies	Nenmeni	Shiraguppi	Banavadi
1	**Natural Capital**- Sustainable Water Source	Yes	Yes	Yes
2	**Physical Capital (Infrastructure and Operations)**			
2.1	Automated pumping systems (Mobile/ Sensor based) at Jack well/WTP/SVS	Yes	Yes	Yes
2.2	Solar energy generation at WTP and connecting to State Grid			Yes
2.3	Fusion Technology used to join pipes in IVDN			Yes
3	**Finance Capital**			
3.1	Incremental Block Tariff for consumer categories	Yes		Yes
3.2	Multiple payment options for consumers	Yes		Yes
3.3	Incentive for regular payment by consumers		Yes	
3.4	Software based accounting and book keeping systems	Yes	Yes	Yes
3.5	Software based Billing and Collection system	Yes	Yes	Yes
3.6	Levying penalties for illegal connections and non-payment of water tax	Yes	Yes	Yes
3.7	Promoting transparency in billing and collection	Yes	Yes	Yes
4	**Human and Social Capital**	Yes	Yes	Yes
4.1	Inclusion of Experts in GPWSC/VWSC and reducing the number of GP members in the VWSC/CWU	Yes	Yes	
4.2	Rationalizing the number of watermen at GP level		Yes	Yes

No	Takeaways from the case studies	Nenmeni	Shiraguppi	Banavadi
4.3	Fewer staff with skill, knowledge and professionalism	Yes	Yes	Yes
5	**Governance and Institutional Capital**			
5.1	Inclusive rule making and enforcement	Yes	Yes	Yes
5.2	Converting VWSC / GPWSC/SLEC into a Community Water Utility (CWU) with clear definition of roles and responsibilities for CWU and GP	Yes	Yes	
5.3	Field Water Schools in collaboration with case study GPs/ CWUs	Yes	Yes	Yes
5.4	Community based GRM and mechanism for monitoring resolution of Grievances.	Yes	Yes	Yes

9.4 Other Good Practices from the Field

During field visit, the MVS Evaluation Team came across some good practices at the MVS and GP level. These good practices include: (1) Operations Manual & Innovations by Operator at MVS Anwal-Kategeri- Badami Taluk, Bagalkote district; (2) Issuing Bills to GPs by AEE- Vijayapura Sub-division; (3) Convergence of MGNREGS and MVS Budrakatti at Pattihal KB GP- Social Forestry, Recycling of backwash water, pathway at the WTP and fencing of WTP and (4) Socially responsible waterman at Sambra GP, Belagavi district.

9.5 Operations Manual at MVS Anwal-Kategiri and other 23 villages

District-	Bagalkote
Taluk-	Badami
Total GPs in MVS	9
Villages included	24
Habitations included	25

MVS Anwal-Kategiri is situated in Badami Taluk of Bagalkote District. WTP capacity is 2.3 MLD and is supplying treated water to 25 villages including Anwal and Kategiri. WTP is located at Simikeri Village, Badami Taluk (around 10 km from Bagalkote town) and Jackwell is located at Gadankeri Cross, Badami Taluk (around 10 km from Bagalkote town and 6 km from WTP location). The MVS was constructed by Shikara Consultants (the "Contractor") and commissioned in February 2015. Currently the Contractor is carrying out the operation and maintenance (O&M) of the MVS. The Plant is operating with 14 staff members in two shifts of 8 hours each. This plant is fairly well managed with all records available at the MVS office. Apart from the contractual obligations, the Contractor has introduced a few good practices to improve the quality of service. One such good practice preparation of an Operations Manual for the MVS.

9.5.1 Preparation of a Guidance Manual

1. The Contractor has prepared a Manual on Operations and Maintenance, mainly meant for the staff engaged in operations and maintenance. The Manual provides comprehensive instructions for carrying out operation and maintenance activities including those at the Jackwell, WTP and distribution network. The Manual is in Kannada language. The manual provides an insight on various aspects and importance of drinking water that inspires the staff to follow methodical steps in maintaining and operating the WTP.

The Contractor submits a monthly progress report to the RDWSD providing the following key information with photographs: (a) Key activities undertaken at the WTP; (b) Important events occurred during the reporting month which among other things include meetings held with department officials and site visits by stakeholders; (c) Details of major/minor repair and maintenance activities undertaken; (d) Satisfactory report from Gram Panchayats for having supplied the requisite quantity of water and (e) Water quality test reports.

2. The operator holds meetings with all Gram Panchayats at regular intervals to address any issues in quality and quantity of water supplied.
3. The Operator maintains a JCB in the project area so as to cater to any pipe laying and repair works forthwith, without causing inordinate delays.

The above practices have enabled the Contractor to provide services to the satisfaction of Department and Gram Panchayats. The submission of monthly progress reports is quite handy for department in tracking the history of maintenance works carried throughout the contract period.

9.6 Issuance of bills to GPs in Vijayapura sub-division, Vijayapura District

District- Vijayapura
Taluk- Vijayapura
GPs issued bills 14
Villages in GPs 33
Contact person- B.B. Jangamshetty, AEE-RDWSD, Vijayapura Sub-division. 9448235925
MVS Thikotta and 24 Villages; Vijayapura Taluk; Vijayapura District

Rural Drinking Water and Sanitation Department, Government of Karnataka issued a Government Order in December 2020 (Government Order No: RDW&SD/121/CE/ Technical/2020) whereby the Gram Panchayats receiving bulk water supply from Multi Village Schemes (MVS) were required to pay water tariff at the rate of Rs.5/kL. Substantial investment towards creating assets for bulk water supply in the form of MVS has been made by Government of Karnataka. Besides the capital costs, Government of Karnataka incurs recurring cost towards operation and maintenance of MVSs. Currently, GPs do not share the cost of water supplied from MVSs and the entire O&M cost is met by RDWSD, despite O&M policy of 2013 and subsequent GO issued in 2014 towards cost recovery.

Table 123: Details of water bill issued to GPs under MVS Thikkotta

No.	Name of GP	Water Consumption in kL	Water Tariff Demand in Rs.	Rate/kL
1	Sidhapura	51,589	2,57,945	5
2	Bijjarani	29,614	1,48,070	5
3	Babanagara	23,030	1,15,150	5
4	Lohagaon	16,181	80,905	5
5	Gonasani	14,652	73,260	5
6	Chikkalare	20,952	1,04,760	5
7	Liggoravi	4,136	20,680	5
8	Kochala	35,748	1,78,740	5
9	Nidoni	31,533	1,57,665	5

Table 123: Details of water bill issued to GPs under MVS Thikkotta				
No.	Name of GP	Water Consumption in kL	Water Tariff Demand in Rs.	Rate/kL
10	Chalageri	23,542	1,17,710	5
11	Anchapura	13,693	68,465	5
12	Tajpur	31,944	1,59,720	5
13	Sonavada	28,934	1,44,670	5
14	Aakotta	32,413	1,62,065	5
	Total	**357961**	**17,89,805**	

The MVS study team visited 60 MVS spread across 17 Districts in 18 Divisions of Karnataka. Several officials of the RDWSD- sub-divisions were not aware of the GO issued in December 2020. The Team found one exception in the district of Vijayapura, (Sub-division – Vijayapura) where the Assistant Executive Engineer, Mr. B.B. Jangamshetty issued water tariff bills to Gram Panchayats for the bulk water supplied from MVS. 14 Gram Panchayats were issued water tariff bills. The total consumption of water during six months, ie, June 2020 to January 2021 in these 14 GPs totaled 357961 kilo Litre. The water tariff fixed by the GO of December 2020 was Rs.5/kL of bulk water supplied to the Village level OHTs. However, none of the 14 GPs responded to the bill issued by the sub-division, nor paid any amount towards water. Capital costs and operational costs are met by the State Government. Neither bulk consumers such as the Gram Panchayats nor domestic consumers share the cost of operational cost. It will be difficult for any government to completely subsidize operational costs indefinitely. The GO was issued to make GPs aware of the necessity to pay bulk water tariff as well as to commence making payment towards the operational cost of supplying water. The Vijayapura sub-division deserves an appreciation for taking the right step to initiate the billing system.

9.7 Convergence of MGNREGS and MVS Budrakatti- Pattihal KB GP and WTP

The study team noticed a convergence between Pattihal KB GP and MVS Budrakatti under the MGNREGS platform. Following works have been attempted.

1 Pavitra Vana – 2650 trees are planted in the land around the WTP. It was a barren piece of land and the GP supported social forestry on this land. The GP has termed the work as development of 'Pavitra Vana'-Sacred Forest. The saplings have grown a bit and the water for irrigating the saplings has been provided from the back-wash water of the WTP.

a)	District-	Belgaum
b)	Taluk-	Bailhongal
c)	GPs included in MVS	11
d)	Capacity of WTP	5.72 MLD
e)	Type of Contract	EPC
f)	O&M Contract	5 year; in-built with EPC
g)	Cost of construction	19.64 crores
h)	O&M contract amount	0.90 crores
i)	Contractor	CRG Infratech Pvt ltd
j)	Pumping and Operation	22 hours in summer

2 Kere development- at the valley portion surrounding the WTP, a small lake has been developed. Backwash water from the WTP is used to irrigate the plants in the Pavitra Vana and the excess water from Backwash is diverted to the Kere.

3 Cattle Proof trenching undertaken under the convergence works; Cattle-proof trenching has been developed around the Pavitra Vana to prevent cattle moving into the plantation and grazing inside the plantation.
4 Rainwater pits; using the manpower available under the MGNREGS, rainwater pits have been constructed to harvest rainwater and thus will help in recharging the groundwater table.
5 Pathway in the WTP: The walk way inside the WTP compound has been paved with concrete blocks under the MGNREGS. The pathway looks beautiful now and is protected.
6 Road to the WTP: There is a distance of 1750 metres from the last motorable road to the WTP. This distance of 1750 Metres has been laid with metal and asphalt, thus making all weather-motorable road to the WTP.
7 Fencing protection for the WTP; The Pattihal KB GP has proposed to construct a fence for the protection of WTP in its 2022-2023 MGNREGS estimates of works.

The study team would like to place on record its appreciation for the imaginative convergence of works, appropriately using resources under various schemes. The entire WTP surroundings will have an aesthetic and panoramic view after a few years. It will also produce natural resources in the form of fuel, food, fodder and timber material. Backwash water, which otherwise would have been wasted is put to good purpose use. WTP Budrakatti is the only place where such good convergence has been noticed in 60 MVSs.

9.8 Socially responsible waterman at Sambra GP, Belagavi district:

Sambra Grama Panchayat is situated at Belagavi Taluk in Belagavi district. Sambra GP has a population of 15,157 (2021 anganwadi data) with 3,476 households. The GP is closer to the MVS Sulebhavi and is the first habitation in the MVS bulk water distribution network, thereby, Sambra enjoys good pressure of water flow among the 12 villages. Water Treatment Plant of MVS Sulebhavi is situated at Bharmyanatti village, which is 15 KM from Sambra. Sambra GP has three village OHTs, as detailed in

Table 124: No of village OHTs and their size (Sambra GP).

Table 124: No of village OHTs and their size (Sambra GP)

OHT number	Capacity (Ltrs)	Source of water to the OHT
Sambra village OHT-1	2,00,000	Treated water from MVS Sulebhavi
Sambra village OHT-2	1,50,000	Untreated water from local borewell
Sambra village OHT-3	50,000	Untreated water from local borewell

The MVS water to the village is available for 16 hours in a 24 hour clock. However, it takes only 60 minutes to fill OHT-1 dedicated for MVS water supply which has a capacity of 2,00,000 litres. Thereafter the distribution of the same takes 180 minutes. There are two watermen working for Sambra GP, viz., [1] Mr Basavaraj Kamble aged 32 years, with PUC level of education; and [2] Mr B S Gavimatt, aged 52 years with primary school education. . Basavaraj Kamble handles water supply to 797 households by operating 14 valves on a daily basis; Gavimatt handles water supply

to 1,000 households by operating 30 valves on a daily basis. Basavaraj Kamble is working as a contract employee drawing a monthly salary of Rs.9,000 since his joining in 2017; Gavimatt is a permanent employee of the Grama Panchayat, currently drawing a monthly salary of Rs.12,500.

9.8.1 Availability of alternate water sources

In addition to the GP owned two borewells, there are several borewells and open wells in the habitation (owned by individual households). According to villagers, the water from these borewells and open wells are "**sweet water**" and they use only this water for drinking. MVS water is used for cooking and other purposes like washing cloth, washing vessels, taking bath, etc. WPP is also available in the GP.

9.8.2 Good practice by the waterman

Treated water from MVS is pumped for almost 16 hours a day. However, being socially responsible and sensible waterman, Mr Basavaraj Kamble keeps the inlet valve "open" to OHT-1 only for one-hour in a day. According to him, if he does not close the inlet valve after an hour (ie. once the OHT is filled), there will be continuous inflow of water from MVS. If he does not close this inlet valve, 12 other villages in downstream distribution network of MVS will suffer either with less pressure or without water. As per Basavaraj Kamble, every waterman should understand the requirements of all those villagers in the entire network and operate valves accordingly. During GP level Focus Group Discussions (FGD), Sambra's PDO, Ms. Usha had proudly explained these details to the visiting team. It was also noted that he is very well known in the Sambra GP as people were cordial and respectful when he introduced us to households for the survey. Therefore, the good practice which is very rare in the GPs that the team visited is that the waterman because of his social concern takes a purposive and informed decision to close the inlet valve into the OHT under his charge and diverts water into the major distribution network, so that pressure and water availability are both ensured. Timely closure of valve saves water volume to the tune of 3000 kL which is equivalent to 3000 kl@Rs.5/kL = Rs.15,000 /day, which when valued is equivalent to Rs.55 lakhs. It may be a good idea to showcase Basavaraj Kamble as a champion and his skillsets may be utilized during regular trainings to other watermen in the state.

9.9 MVS Nadavi and MVS Boggur - Case Studies

Case Study on MVS Nadavi and MVS Boggur as examples of poor and inefficient performing MVS

MVS Nadavi and MVS Boggur were studied under the MVS evaluation study. Both these MVSs belong to Ballari district. (1) MVS Bogur covers 6 Villages, while MVS Nadavi covers 16 Villages. Functioning of both MVSs are totally unsatisfactory and hence are included in the negative model case studies

9.9.1 Observations from MVS Bogur

1. MVS Boggur is based on water supplied from an Impounding Reservoir (IR)

2. There is only one shift of pumping from the IR to the WTP, situated side by side.
3. Though there is Chlorinator system procured and available in the WTP, it is not used and look as if it has never been used.
4. Rice Mills exist in the surroundings of one km radius and this causes lot of pollution as finer dust particles from the Rice Mill reach the IR.
5. The Operator is maintaining livestock in the WTP premises and is a direct threat to the hygiene of the WTP.
6. There is no Toilet for the Operator and his family at the WTP and resort to open defecation
7. The CWR is not cleaned
8. The IR was constructed in 2008-09. Rice Mill has come up recently. Though the GP made a complaint to the Pollution Control Board of the State regarding pollution caused by the Rice Mill and no action has yet been initiated against the polluter.
9. There is a struggle for obtaining water from the Canal that supplies water to the IR. The IR has never been full since it was commissioned.
10. The MVS provide water to the Boggur GP twice during a week. No HTC is getting MVS water, which is provided only through Cisterns and PSPs.
11. The GP council raised their concern that the Contractor does not pay heed to their complaints or suggestions.
12. The GP has WPPs which source its raw water from Borewells. People take WPP water and use it for drinking purpose. WPP water costs Rs.5/20 litres.
13. Rs. 30 is the special water tax for a household in the GP.
14. Six VAPs have been proposed and the AEE assured the GP Council that new additional pipeline has been proposed for the GP under JJM. SMEC is the consultant for preparing VAP. Two representatives of SMEC came to GP and consulted watermen to collect information for VAP. The GP council, President, PDO, etc., were not consulted by the VAP Consultant.
15. There is a VWSC in paper. Its last meeting was held in July 2021.
16. There are three watermen in the GP[80]. Their salary is pending for 12 months. Salary is not regularly paid. Main task of Watermen is Pump Operations. The GP has installed six pumps at three different locations in the GP on the banks of Vedavathi river, from which water is pumped every day. Water need of the GP community is mainly met from the river source from which water is pumped directly. All three watermen look after 482 households (122+180+180) and six pump sets.
17. The GP members opined that if the GP and VWSC are trained in operations and maintenance, the GP is ready to take over the O&M of MVS Boggur.

9.9.2 Observations from MVS Nadavi

1. Water Treatment Plant of MVS Nadavi is located on a small hill by the side of Kambili - Siruguppa road. There is no signage at the plant or by the road side. The WTP compound

[80] 1) Nagabhushana Swamy; (2) Nagaraja Gowda and (3) Sharana Basavana Gowda are the watermen

is not fenced nor protected. The WTP has no office room, nor a toilet. WTP components do not have protective roof and facilities lie exposed to sun, rain, dust, insects and flying objects. Since the plant has no roof and is left open, it is possible that birds, insects, rodents or even smaller animals may fall into it and contaminate water.

2. It was extremely difficult to obtain data on the MVS either from the RDWSD or from the Operator. Responsible representative of the Operator gave a slip and was not available for interaction or data sharing. Proper and updated data is not available and hence not shared. When the Team reached the WTP, there was not a human soul available at the WTP. The plant was not functioning at the time of the Team's arrival at the WTP.
3. Current condition of Nadavi WTP
   a. The WTP is poorly maintained, appeared dirty and unhygienic.
   b. The "aerator" appears not cleaned for years.
   c. The channel through which water flows from aerator to "sedimentation and filter bed" is full of cob-webs and it appears that it was not cleaned for a longer time.
   d. There are five circular tanks to be used as sand filter beds. All these tanks are "roofless" and kept open. The filter beds are filled with sheets of "moss" and algal growth.
   e. Water from sand filter beds flows to a sump, which has a vent on top and is not covered.
   f. Team could not find any chlorination facility. What appeared like a Chlorination facility was not functional. The Team was given a strange clarification on chlorination that the Operator sends bags mixed with chlorine and alum by bus from Siruguppa to the WTP day by day. Every day one packet is sent by local bus and the same is collected by the pump operator near the WTP. Operating staff mix the contents of this packet into five litre water and make a solution, which is manually deposited into the clear water sump.
   g. There is no flow meter installed to measure the inflow of water from Jackwell to WTP and there is no meter to measure the outflow from WTP.
   h. Log book is not maintained.
   i. Backwash facility looked inadequately designed.
   j. Work order was issued to the selected contractor, M/s. Sharana Construction Pvt Ltd Bellari on 20th April 2012. Department handed over the site on 28th January 2013. Though the MVS was to be made operational by 7th November 2013, Sharana Construction Pvt Ltd, Bellari completed construction later and the completion date is shown as 10th March 2017. Though there was in-built O&M contract for five years, the contractor gave up operation and maintenance after two years.
   k. Fresh tenders were called for and a new O&M contract was signed with Mr G Prahaladha Reddy (Class-I contractor) for a three-year period of O&M. This O&M commenced w.e.f. 28th August 2019 for an amount of Rs.98,83,440.
   l. As per the original contractor's quote, total O&M amount for five years was Rs.48,38,013, which means annual O&M amount estimated and approved was

Rs.9,67,603. The current O&M contract is awarded for Rs.98,83,440 for three-year period and the annual O&M contract will be Rs. 3294480.

m. Nittur not getting MVS Nadavi water**:** Nadavi and Siruguppa road is through Nittur village, where three new bridges are under construction. During construction of these bridges, the existing pipelines were removed and hence water supply to Nittur is currently disconnected for more than one year. Nadavi GP got three Borewells drilled as an interim measure in Nittur village, from which water is pumped directly to village OHT for distribution. When Borewell water is not available, water from Thungabadra river is pumped directly to Nittur village OHT. In other words, for more than one year, Nittur villagers are getting untreated water either from local Borewell or from the river.
n. Other observation**:** The distribution main line is laid through paddy fields owned by individual farmers by the Nadavi to Siruguppa road. Team noticed heavily leaking air valves on this line with water heavily flowing into the adjoining paddy fields.
o. Both MVS of Ballari district that the Team visited was functioning inefficiently and did not follow any of the good industry practices in operation and maintenance, in terms of water treatment, distribution, data maintenance and responsible management.

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Evaluation of Multi-Village Water Supply Schemes implemented by RDWSD in Karnataka during 2015-2020

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