Review of State Water Policy of Goa in line with National Water Policy-2012 with regard to Climate Change

INDIA WATER PARTNERSHIP

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Executive Summary

Context

National Water Policy 2012 lays emphasis on the role of climate change in the context of water resources. With regard to climate change, the National Water Policy-2012 vide para 4.1 states that, "***Special impetus should be given towards mitigation at micro-level by enhancing the capabilities of community to adopt climate resilient technological options"***. This was in recognition of the profound impact that climate change is now predicted to produce on socio-economic life of people. Since water is viewed as a state subject in India, it is the state governments which have been playing a crucial role in the water sector in this country. It will, therefore, be more useful if the policy measures, which are included in the National Water Policy-2012, are also taken into account in the state level water policies.

Realizing this need, India Water Partnership (IWP) commissioned a project in 2014 to review state water policies with special reference to climate change in line with the National Water Policy-2012 and entrusted the task to one of its network partner; Institute for Resource Management and Economic Development, Delhi.

Measures dealing with adverse effects of climate change will have better chances of success, if people and functionaries at the grassroots level are fully aware of these measures and are associated with the preparatory measures taken to mitigate them especially the rural community, which are dependent on agriculture and allied activities which, in turn, are most vulnerable to climate change impacts because of their greater dependence on climatic parameters.

In this context, the IRMED as a first task reviewed water policies of all the States/Union Territories (UTs), which are in either draft or final stage. The review revealed that there are only 14 States/UTs which have announced their water policies starting from 1994, while 2 UTs namely; Daman & Diu and Dadra & Nagar Haveli which have adopted National Water Policy-2012. The remaining States/UTs are in the process of formulating their water policies, while some of the States/UTs are in the process of revising their earlier policies.

For selection of two states, the IRMED and IWP study team had detailed discussions with senior officials of Government of India, as well as the State Government officials and officials of other departments/agencies. These included Ministry of Water Resources, River Development and Ganga Rejuvenation (Policy Planning Division), Central Water Commission (Chairman, and Chief Engineer, Basin Planning and Management), and NITY Aayog (Adviser, Water Resources and Joint Adviser, Water Resources).

Discussions with these officials revealed that various states are at different stages with respect to formulation or revision of their state water policy. Hence, the states were selected based on three parameters. Firstly, as far as possible, states should be in different agro-climatic zones so as to capture the diversity that characterize India. Secondly, states likely to be more receptive and cooperative with respect to interaction pertaining to water policy, may get preference and lastly, states, where water policies had been formulated quite early, might be more willing to revise them and may, therefore, be considered for selection.

Criteria for Selection of State

A review of situations prevailing in different states in the light of the above considerations provided a case for the selection of Goa for the present study. Goa's water policy is also quite old, announced in 2000. Hence, this state too was expected to be receptive of the idea of revising its policy. Goa is a state which is highly susceptible to the effects of global warming associated with climate change because of the dominance of coastal influence. Hence, this provided scope for dispassionate discussion.

State Water Resources of Goa at a Glance

There are nine river basins in Goa, all of which are usually clubbed together with all the west flowing rivers from Tapti in Gujarat to Tadri in Karnataka. The basin area of all the rivers in Goa constitutes only 6.62% of the basin area from Tapti to Tadri and 0.115% of river basins of the country as a whole. Five of the nine rivers in the state originate and flow exclusively within the state boundaries while the other four namely Terekhol, Chapora Mandovi and Zuari are inter-state rivers. Unlike many rivers of North India, rivers in Goa are not snow-fed. There is very limited scope for generating hydro power in Goa and in spite of a heavy annual rainfall (higher than the national average), rivers have very little water flowing for half of the year i.e. summer months due to factors such as quick drainage due to steep slope, porous substratum, deforestation in high ranges, non-uniform distribution of rainfall etc. Rivers tend to go dry during summer months and ground water level also declines. As a result, as emphasized in the Goa State Water Policy 2000 document, the state has one of the lowest per capita fresh water availability in the country even though it is situated in one of the highest rainfall zones of the country. However, Goa has a good network of inland waterways. It has a large number of manmade and natural freshwater lakes, tanks, ponds including temple ponds and backwater bodies. These have great potential for inland fisheries as well as for aquatic sports facilities. But unfortunately, many of these are in dilapidated condition.

The state also has considerable Khazan lands i.e., those reclaimed from the inundation of the tidal waters through the rivers and creeks by constructing embankments. These lands in Goa are made of saline alluvial soils. Khazan lands are estimated to cover an area of about 18,500 ha. Because of its location, the state has excessive exposure to effects of global warming and potential sea level rise such as intrusion of salinity on upstream sides which has adverse effects on quality of groundwater. Also, rivers and other water bodies are much affected by mining activities in the region. Because of over pumping of water and abandoning pits in mining areas, water level in certain parts goes even below the sea level creating adverse effect on ground water regime, drying of springs, open wells, reducing flow in streams etc. Goa has limited groundwater potential and increasing contamination of the ground water has further exacerbated the situation of depleting ground water quality.

Salient Features of Goa State Water Policy- A distinguishing feature of Goa State Water Policy lays in its awareness of the probable adverse effects of global warming and potential sea level rise. It, therefore, recommends taking up measures in advance like construction of Vasant Bandharas/Kolhapur type Bandharas on all important rivers/rivulets at suitable places. With respect to Khazan lands, the Goa Policy underlines the need for having proper records with full details of the bunds which protect the Khazan lands, of bringing about legislation for Khazan areas protection, conservation, development and management traditional techniques of construction of bunds by using marine clay to red-mooreem and providing inspection roads over the bunds parallel to the banks of the streams. Further, according to the State Water Policy 2000, an Integrated Estuarine and Khazan Area Development Plan should be formulated and a Khazan Lands Management Board should be constituted. It is stated in the policy that the ground water development should be done with caution and resorted to only where it is inevitable.

The need for ground water regulation legislation has been recommended in the policy. The policy advocates both short term and long term strategies to arrest and conserve as much water as possible. It also calls for continuous monitoring of quality of water of rivers, important fresh water lakes and backwater bodies, (ii) development of fisheries, (iii) development of hydel potential to the maximum extent with minimum disturbance to environment, (iv) effective and economic shore protection of coastal areas which are prone to erosion, (v) technological upgradation of the department , (vi) establishment of a Water Resources Control Board (WRCB) to oversee the implementation of State Water Policy and (vii) promotion of specialized training and research on water resources development and management and related subjects.

It has been found that there are several aspects on which there is a broad similarity (with some differences in emphasis and details) between the state policy and the National Water Policy-2012. These include need for a basin approach and a master or integrated plan for development of water resources, need for augmentation of water resources and types of measures to be adopted for that purpose, concern on over-exploitation of ground water, introduction and strengthening of community participation in irrigation projects, controlling water pollution and improving water quality, emphasis on water conservation, adoption of improved water application devices and water pricing, improvement in data collection, processing and storage, more emphasis on technological upgradation etc.

Several important features of the National Water Policy, 2012 are, however, missing in the Goa State Water Policy, 2000. These include aspects related to good governance through transparent informed decision making, need for multi-disciplinary organizations for water resources management, including ground water to be managed as a common pool community resource held by the state under public trust doctrine to be followed by modification of existing Acts, recognition of minimum ecological needs for water, emphasis on managing demand for water through changes in cropping pattern, avoiding wastage of water and raising water use efficiency, recognition of the principle of equity and social justice, focus on access to a minimum quantity of potable water for essential health and hygiene to all the citizens, emphasis on recycling and recuse of water, integrated watershed development activities, differential pricing of water, giving statutory powers to water users associations to collect and maintain a portion of water charges and manage water allotted to them, legally empowered dam safety measures, better planning of projects with due emphasis on social and environmental aspects in consultation with project affected and beneficiary families along with concurrent monitoring, involvement of panchayats, municipalities etc. in planning of projects, simultaneous execution of urban water supply and sewage treatment schemes, need for a forum at state level to evolve consensus among water users, associating private sector in Public Private Partnership (PPP) mode etc.

After several consultations and stakeholders meetings, the draft of the new Goa State Water Policy carries forward many of the features of the earlier policy of 2000. It also reiterates the salient features of the recently announced Goa State Ground Water Policy of 2015. At the same time, it also contains some new features which are in line with the National Water Policy-2012; such as adaptation to climate change. As per the National Water Policy of 2012, the draft of Goa State Water Policy also refers to enhancing the capabilities of the community to adapt to climate change by putting emphasis on mitigation measures such as increase of water storage in ponds, lakes, rivers, ground water, small or large reservoirs, revival of traditional water harvesting structures and bodies, adaptation of better demand management like adoption of better cropping patterns, water application techniques, sprinkler and drip irrigation, taking into account the expected impacts of climate change in planning and

regulation of water resources structures such as dams, flood embankments, tidal embankments etc. as well as bunds and ponds etc. in Khazan land.

Mention may be made of ardent need to make necessary amendments in the existing Acts and draft new Acts to plan, manage and regulate utilization of water resources in the state; to assign higher role to ecological needs of rivers and going to the extent of earmarking a portion of river flows as e-flows for sustaining the ecological needs; to resort to pricing of water to ensure its efficient use and conservation; to set up an independent Water Regulatory Authority in the state; to repair, rejuvenate and restore water bodies by removing encroachments and increasing their capacities, remodeling them or improving them for utilization; to strengthen maintenance by setting aside a suitable percentage of cost of infrastructure for repair and maintenance; to give more emphasis on water supply and sanitation through evolving proper sewerage system or providing septic tanks throughout the state; to try to supply treated and re-used water in two different pipelines with proper universal color codes.

The draft certainly provides an improved version of the earlier Goa State Water Policy of 2000.

Major Recommendations of the Review

The recommendations include the suggestions made by the district level officers in South Goa district, the participants of the workshop held in Goa on 24th November 2015, suggestions provided in the questionnaire filled in by the participants and the suggestions by the study team. In order to avoid duplication, only those points are included which are not found in the existing State Water Policy document. Even then, there may be some overlap which is unavoidable. These recommendations were sent to Chief Engineer and other senior officers of Water Resources Department of Government of Goa on 23rd December, 2015

Climate Change

- There is need for a full understanding of the meaning of climate change and its implications as well as for long term data on the effect of climate change on rainfall pattern.
- The impact of climate change should be analyzed at sub- basin level such as Zuari sub- basin, for example.
- A roadmap for urban climate resilience policy should be prepared.
- High priority should be assigned to (i) strengthening and creating adequate facilities for studies and research on hydrological, hydro-metrological and geomorphologic aspects related to climate change within the Department of Water Resources, WALMI, Universities and other institutions including creating new institutions; (ii) modernizing and expanding instrumentation and measurement techniques and (iii) revising existing courses of studies, creating new subjects and introducing programmes as well as in post-graduate diplomas and degrees.
- There is need to take up massive programmes of awareness generation among people at all levels about adverse effects of climate change and the mitigation measures to be taken to deal with them so as to enhance their coping capacity.
- There is need for integrated salinity control mechanism to deal with the problem of increasing salinity and ground water exploitation in coastal areas of Goa.

- There is need for a system of suitable water pricing to deal with increasing water scarcity in future due to the adverse effects of climate change.
- The different departments of the state government, whose work are related to water and climate change should have a common forum which should meet at frequent intervals to take an integral view of knowledge base and policy options. For this purpose, the Department of Water Resources should have an effective cell headed by a Chief Engineer level officer.

Water and Agriculture

- Plantation of more water consuming plant species like acacia, nilgiri should be avoided, while crops which consume less water should be promoted.
- Water meter should be made compulsory in command areas.
- There is need for engineers to interact with farmers.
- Farmers should be advised to stop flood irrigation.
- Mulching for conservation of soil moisture should be promoted.
- Water holding capacity of soil should be increased by adding more organic manures while avoiding excessive use of chemical fertilizers.
- Use of micro-irrigation should be encouraged specially in horticulture and vegetables.
- Farmers should be persuaded to adopt shorter duration crop varieties such as paddy varieties of Vaisaleha and Makome and pulse variety of Alsand.
- Less water consuming traditional organic agriculture practices need to be encouraged while ensuring for higher productivity. For this purpose, higher funds may be allocated for Research and Development.

Water Policy Formulation and Implementation Process

- Awareness should be generated about state water policy among people at the grass roots level through meetings, campaigns, posters, displays etc.
- State water policy, should be people and farmers friendly and should emerge from below. Hence there should be involvement of common citizen, community, NGOs, academia etc. in its formulation.
- Basin-wise, region-wise considerations should be taken into account while framing policies.
- After formulation, state water policy should be made readily available at the level of village, Panchayat, Block, School, Libraries and other public places.
- All stakeholders' role should be clearly specified in state water policy.
- State water policy should be implementable. Hence the policy should deal also with aspects related to its implementation at the ground level.
- Description of water resources scenario as well as water policy should also include socio-economic, institutional and management aspects which are missing in the present policy

document. Socio-economic aspects should also be specifically mentioned in the sections dealing with research and data.

Ground Water

- There should be proper implementation of ground water policy.
- Panchayats should be empowered to regulate extraction of ground water in over exploited and critical areas.
- Illegal extraction and sale of ground water should be prohibited.
- Ground water in drought prone areas should be kept as a reserve for drought management.
- Planting of certain trees such as Australian Acacia, which use considerable ground water resulting in its depletion, should be discouraged.
- Mining pits and water pumping ought to be restricted and charged.
- Recharging of ground water should be given more emphasis. Abandoned mining pits should also be used for recharge. Construction of bandharas and check dams be encouraged to help recharge during post monsoon period.

Controlling Water Pollution

- Contamination of water should be avoided. There should be proper sewage system to stop water pollution. Sewer schemes should be executed along with urban water schemes.
- Penalty should be imposed on those polluting water in accordance with Polluter Pays Principle.
- Role of Pollution Control Board in preventing water pollution should be strengthened.
- There should be adequate measures to control the prevailing dumping of solid waste in canals in order to maintain the quality of water.
- Measures should be taken to control intrusion of sea water which is affecting the quality of ground water in the state.
- Efforts should be made to control the contamination of well water in urban areas.
- Need for reuse and recycling of waste water. In particular, treatment of waste water from hotels & industries is essential. Waste water treatment should be done on greater scale in residential complexes also.
- Motivate public to use the recycled water for car washing, gardening, sanitation, etc. While doing so, problems, if any, associated with reuse of water should also be taken into account.
- Raw and recycled water usage by industries should be promoted.

Water Use Efficiency

- Water use efficiency should receive adequate emphasis to ensure optimum utilization of water for crops as well as for all other uses.
- Mechanisms to increase water use efficiency in different sectors such as use of micro irrigation should be put in place.
- There should be stringent laws for wastage of water.
- Much emphasis should be given on conservation of water resources.

- Documentaries of best practices developed by communities over the years should be compiled to be used for sustainable management of water in Goa.
- There is need for training not only for water resources engineers but also for mining staff and the general public. Capacity development training on water use should be provided to all stakeholders.
- There should be a mechanism to transfer research findings to functionaries at lower levels as well as to the public.
- The existing gap between hydrological researchers and practitioners should be removed.

Public awareness

- Efforts should be made to improve awareness level in schools and other educational institutions about the importance of water and need for its conservation
- There is need to sensitize and educate stakeholders on better water use practices.
- People should be sensitized on critical aspects related to water such as water policy, rainwater harvesting, cropping pattern, crop rotation and ground water recharge.

Community Participation in Water Governance

- Community participation should be promoted for conservation and effective management of water and for formulating water harvesting schemes, ground water usage and recharge.
- Participatory management of irrigation and drinking water should be introduced/ strengthened.
- Committees should be formed at panchayat level to oversee use of water at village level.
- Greater stress should be laid on decentralization of water governance within the overall framework of the doctrine of public trust to create a feeling of community ownership and involvement in management of water resources.
- Laws should be amended to provide adequate power and funds to such decentralized bodes for adequate development and proper management of local water bodies such as lakes, ponds, canals, common wells etc. so as to sub-serve the goal of providing safe drinking water to all within easy reach.
- Women are the primary users of water. Hence, there should be adequate emphasis on women participation in management of water at local levels.

Water Harvesting

- Rain water harvesting should be given more importance and conserved seriously. There should be mandatory roof top rain water harvesting for all mega projects specially in some parts of the State like Canacona, Sanguem which face acute water shortage.
- Water recharge structures should be constructed in an integrated and holistic manner in place of the prevailing fragmented manner by different agencies.
- Consolidated data on recharge structures in an area along with the relevant data for the catchment area should be made easily available.

Water bodies

- Inland water bodies such as temple ponds, which are in dilapidated condition, should be rejuvenated.
- Abandoned mine pits should be used water conservation and for supplying water for irrigation as well as industries.
- Artificial lakes, which are present in the state, should be used for water conservation.

Management of Water Resources

- Demand for water should be ascertained from all the sectors in Goa through collection of data on water consumption from both primary and secondary sources.
- Management implications of treating water as a community asset should be explained.
- The desirability of PPP projects in water supply should be reviewed.
- There should be collaborative approach among different agencies concerned with management of water.
- Both demand management as well as supply management approaches are needed.
- Illegal drawing of water from mines should be restricted.
- There should be a mechanism for monitoring of impacts on water of all development activities.
- Stringent action should be taken against encroachments into catchment areas of water bodies by private agencies.
- Proper attention should be paid for maintenance of all types of existing water bodies such as dams, canals, tanks, ponds etc.
- Traditional technologies should be tapped as one of the methods of augmenting water resources.

Chapter 1

Introduction

1.1 Background

The role of water for our life and livelihood is too obvious to require any elaboration. It is the basic requirement for survival and growth of all types of lives. However, due to fast rate of urbanization, industrialization and rapid growth of population, coupled with climate change, there is a serious threat to water security . Hence, there is an urgent need for managing water in a sustainable manner so as to ensure water security to all, not only at present but in future also, is being articulated throughout the world including India. Efforts to develop and manage this crucial resource have to be guided by clearly defined perspectives, which should be known to all the water users. Water policy, which provides a framework of such perspectives, is therefore, a very useful tool for optimum utilization of this precious resource.

It was in this context that the National Water Policy for India was announced for the first time in September 1987. Thereafter, a revised version of the National Water Policy came out in 2002. And in 2012, the latest version of the National Water Policy has come into force. A distinguishing new feature of the 2012 National Water Policy is the emphasis laid on the role of climate change in the context of water resources. This was in recognition of the profound impact that climate change is now predicted to produce on socio-economic life of people. Water is a principal medium through which this impact of climate change would take place. Drawing attention to likely increase in the variability of water resources due to climate change and its effects on human health and livelihood, the National Water Policy of 2012 also suggests measures to deal with them. These include enhancing the capability of community to adopt climate resilient technological options, increasing water storages in various forms including water harvesting and revival of traditional water bodies, better management of demand for available water, stakeholders' participation in land-soil-water management etc.

Since water is viewed as a state subject in India, it is the state governments which have been playing a crucial role in the water sector in this country. It will, therefore, be more useful if the policy measures, which are included in the National Water Policy-2012, are also taken into account in the state level water policies. Recognizing this need, the National Water Policy-2012 ended up with the observation that "The State Water Policies may need to be drafted/revised in accordance with this policy keeping in mind the basic concerns and principles as also a unified national perspective".

The States, however, have been lagging behind in this respect. There are only 14 states, which have announced their state water policies so far, while two Union

Territories namely Daman & Diu and Dadra & Nagar Haveli have adopted the National Water Policy-2012. The remaining states are still in the process of formulating their state water policies, while some of the states are in process of revising their earlier policies. The state of Tamil Nadu was the first state to announce its state water policy in 1994 followed by Uttar Pradesh in 1999, Goa in 2000, Chhattisgarh in 2001, Karnataka in 2002, Madhya Pradesh and Maharashtra in 2003, Himachal Pradesh in 2005, Orissa in 2007, Andhra Pradesh and Kerala in 2008, Sikkim in 2009, Rajasthan in 2010 and Jharkhand in 2011. But, Himachal Pradesh is the only state to bring out a revised state water policy in 2013, which has included climate change which is more or less in line with the National Water Policy- 2012. A formidable task, therefore, lies ahead. It is in this context that a study designed to a review of the state water policies in line with the National Water Policy-2012, was called for.

Realizing this need, India Water Partnership (IWP) formulated a project in 2014 to review state water policies with special reference to climate change in line with the National Water Policy-2012 and entrusted the task to the Institute for Resource Management and Economic Development, Delhi. Two states namely; Bihar and Gujarat were selected for the study in 2014. With the cooperation of the respective state governments, both the studies were completed within time during 2014. As a result, a draft of the state water policies in both the states was reported to have been prepared after taking into account the recommendations made by the study. In 2015, a similar exercise was undertaken for two more states viz; Goa and Tamil Nadu.

With regard to climate change, the National Water Policy-2012 vide para 4.1 had laid special emphasis on preparedness at micro-level. According to it, "***Special impetus should be given towards mitigation at micro-level by enhancing the capabilities of community to adopt climate resilient technological options***".

While there is a growing literature on dimensions of climate change, and it's probable effects in different parts of the world including India, there is little literature available on extent of awareness as well as perceptions of grass root level functionaries and the public with respect to adverse effects of climate change and the preparatory measures that can be taken at the local level for mitigation of these effects. Hence, an enquiry at the micro level also forms a part of this study.

Measures dealing with adverse effects of climate change will have better chances of success, if people and functionaries at the grassroots level are fully aware of these measures and are associated with the preparatory measures taken to mitigate them especially the rural community, which are dependent on agriculture and allied activities which, in turn, are most vulnerable to climate change impacts because of their greater dependence on climatic parameters.

1.2 Rationale for selection of Study states

In order to select two states for the study, discussions were held by IRMED study team with central government departments/agencies dealing with water resources which usually interact with their state level counterparts. These included Ministry of Water Resources, River Development and Ganga Rejuvenation (Policy Planning Division), Central Water Commission (Chairman, and Chief Engineer, Basin Planning and Management), and NITY Aayog (Adviser, Water Resources and Joint Adviser, Water Resources). They indicated some of the considerations which should be kept in view for the selection of the two states for the study. These are as below:

i. As far as possible, states should be in different agro-climatic zones so as to capture the diversity that characterize India.
ii. States likely to be more receptive and cooperative with respect to interaction pertaining to water policy, may get preference.
iii. States, where water policies had been formulated quite early, might be more willing to revise them and may, therefore, be considered for selection.

A review of situations prevailing in different states in the light of the above considerations provided a case for the selection of Goa for the present study. Goa's water policy is also quite old, announced in 2000. Hence, this state too was expected to be receptive of the idea of revising its policy. Goa is a state which is highly susceptible to the effects of global warming associated with climate change because of the dominance of coastal influence. Hence, this provided scope for dispassionate discussion.

1.3 Objective

The objective of the study was to review the Goa State Water Policy of 2000 and provide recommendations for modifying it in line with the National Water Policy- 2012, in the context of the ensuing climate change (involving awareness, preparedness, coping mechanism at the state level and down below).

1.4 Methodology

An appropriate methodology was developed in the context of the above objective. Information was collected from both secondary and primary sources. The first step was to review the different versions of the National Water Policy as well as water policy of several states to prepare a tentative list of state specific issues for further deliberation with the stakeholders. Thereafter, background information on the salient features of water resource scenario and state water policy of Goa was collected and analyzed. This information, collected mainly from secondary sources, is presented and analyzed in Chapter 2.

As a second step, discussion on issues pertaining to Goa state water policy was held in Delhi in August, 2015 between the study team and three top level state officers namely Chief Engineer, Additional Chief Engineer and Adviser of Water Resources

Department of the Government of Goa. The purpose was not only to get feedback of state level officers on issues related to state water policy, but also to motivate them to modify the earlier state water policy. The findings are presented in section 3.1 of Chapter 3.

Because of the negligible information available from secondary sources on micro level situation, the main reliance was placed on primary sources, mainly through survey by way of structured-cum-open ended schedules. Four schedules were developed and administered one each to (i) The participants of the state level workshop, (ii) Officers of the departments of Agriculture/ Horticulture and Krishi Vigyan Kendra (KVK) (iii) Officers of other departments of the concerned district and (iv) Farmers. The structured part of the schedules comprised of questions related to awareness and preparedness about climate change and suggestions for improvement. The schedules are provided in Annexures C, D, E, F, at the end. In addition, there were Focus Group Discussions at village level for which separate guide points were developed (Annexure – G). Enquiries were made at the district level and down below during September 30 to October 10, 2015 in South Goa district. This district was selected in consultation with state officials. Interactions were held with district and taluka level functionaries concerned with development and management of water resources as well as Krishi Vigyan Kendra (KVK). Interactions were also held with people's representatives, NGOs, Panchayats, Municipalities and public in two villages namely Cavre Pirla (a panchayat level village) and Kajur in Quepem taluka of South Goa district. The villages were selected in consultation with officials of Water Resources Department at the district level. Both the villages are water stressed and situated far from the district headquarter. The number of villagers participating in the interactive sessions was 34 in one village (Cavre Pirla) and 23 in another village (Kajur). The objective was to have a realistic picture of the micro level perceptions about the national and state water policies and about awareness and effects of climate change. The findings and suggestions are presented in Section 3.2 of Chapter 3.

Since water is every body's concern, it was considered important to get inputs from diverse sources. Hence, the final step was to hold a workshop of different types of stakeholders, such as senior officers of the state government, leading state level water resources professionals, NGOs, farmers, women etc. The workshop was held on 24th November 2015 in Seminar Hall of the Secretariat, Government of Goa at Porvorim, Bardez-Goa. The principal objective was to review the existing Goa State Water Policy and give suggestions for its revision in the light of changes which had taken place in the water resource scenario as well as socio-economic and environmental conditions since 2000, when the earlier State Water Policy had been announced. A copy of the proceedings of this workshop is enclosed as Annexure A while the suggestions are presented in section 3.3. of Chapter 3. A questionnaire was also filled in by the participants to capture their perceptions, views and suggestions on issues related to state water policy and climate change. These are presented in section 3.4 of Chapter 3.

Chapter 2

Water Resources Scenario and State Water Policy of Goa

2.1 Water resources scenario of Goa

In order to be useful for the public, water policy for any administrative unit such as a state should take into account the water resources scenario of the relevant area. Hence, information on salient features of the water resources scenario of Goa is presented below.

The water resources scenario in Goa is much different from the overall national water resources scenario. There are nine river basins in Goa, all of which are very small - so small that they are usually clubbed together with all the west flowing rivers from Tapti in Gujarat to Tadri in Karnataka. The basin area of all the rivers in Goa constitutes only 6.62% of the basin area from Tapti to Tadri and 0.115% of river basins of the country as a whole. Mandovi with a basin area of 1580 sq.kms. is the largest river basin followed by that of Zuari with basin area of 973 sq.km., while Baga is the smallest river basin with basin area of only 50 sq.km. Five of the nine rivers in the state originate and flow exclusively within the state boundaries while the other four namely Terekhol, Chapora Mandovi and Zuari are inter-state rivers. Unlike many rivers of North India, rivers in Goa are not snow-fed. There is very limited scope for generating hydro power in Goa. Yet, another peculiar feature of the state is that in spite of a heavy annual rainfall (higher than the national average), rivers have very little water flowing for half of the year i.e. summer months due to factors such as quick drainage due to steep slope, porous substratum, deforestation in high ranges, non-uniform distribution of rainfall etc. Rivers tend to go dry during summer months and ground water level also declines. As a result, as emphasized in the Goa State Water Policy 2000 document, the state has one of the lowest per capita fresh water availability in the country even though it is situated in one of the highest rainfall zones of the country.

Another peculiarity of Goa lies in a good network of inland waterways. Goa has a large number of manmade and natural freshwater lakes, tanks, ponds including temple ponds and backwater bodies. These have great potential for inland fisheries as well as for aquatic sports facilities. But, many of these are in dilapidated condition. Another unique feature is that the state also has considerable Khazan lands i.e., those reclaimed from the inundation of the tidal waters through the rivers and creeks by

constructing embankments. These lands in Goa are made of saline alluvial soils. Khazan lands are estimated to cover an area of about 18,500 ha. Because of its location, the state has excessive exposure to effects of global warming and potential sea level rise such as intrusion of salinity on upstream sides which has adverse effects on quality of groundwater. Goa has geographical area of 3702 sq.kms. and a long coastline of about 105 kms. As pointed out in the Goa State Water Policy 2000 document, there is greater concentration of economic activities in coastal areas which have also higher density of population. A major part of the coastline, however, is prone to moderate to severe shore erosion resulting in loss of precious land and threats to tourist places along the coast. The Goa State Water Policy 2000 has also drawn attention to the fact that the cropping pattern, land use, hydrological status and environmental needs of Goa are different from other states.

As highlighted repeatedly in the Goa Sate Water Policy 2000, rivers and other water bodies are much affected by mining activities. The resulting pollution of water is a major problem. Because of over pumping of water and abandoning pits in mining areas, water level in certain parts goes even below the sea level creating adverse effect on ground water regime, drying of springs, open wells, reducing flow in streams etc. Goa has limited groundwater potential and increasing contamination of the ground water is further exacerbating the situation of depleting ground water quality. One reason for this is unplanned growth of urban areas leading to contamination of well water in urban areas. Another reason is the over exploitation of ground water in the narrow coastal belt. This also leads to the problem of saline water intrusion to the fresh water aquifers. Even canal water is getting polluted as people use canals for dumping solid waste and disposal of waste water which also provide fertile ground for growth of weeds making the water unfit for many purposes.

2.2 Salient Features of Goa State Water Policy, 2000

The Goa State Water Policy which came out in 2000 was framed especially in light of the several special features of the water resource scenario in this state. The Policy aims, (i) to prepare Integrated Master Plan for Water Resources Development for the Goa state consisting among other things, Integrated River Basin Development Plan with due regard for environmental and socio-economic impacts, (ii) to assign topmost priority to drinking water schemes, (iii) to make suitable provision for drinking water supply in existing and future irrigation and hydel schemes, (iv) to regulate uncontrolled extraction of sand from river beds in consultation with the concerned agencies, (v) to take adequate protective measures against the damage caused by mining activities, (vi) to explore the possibility of using mining pits for storing water for ground water recharging needs, (vii) to educate people and create awareness about pollution of

surface and ground water and need for controlling it, (viii) to avoid, as far as possible, any large scale submergence and displacement of human habitations while taking surface water schemes, (ix) to locate the schemes for water supply for domestic use higher up in the river basin where there are no mines, industries polluting the sources of water, (x) and to create a state level central facilities for collection, processing and storage of hydro-meteorological data.

A distinguishing feature of Goa State Water Policy lies in its awareness of the probable adverse effects of global warming and potential sea level rise. It, therefore, recommends taking up measures in advance like construction of Vasant Bandharas/Kolhapur type Bandharas on all important rivers/rivulets at suitable places. With respect to Khazan lands, the Goa Policy underlines the need for having proper records with full details of the bunds which protect the Khazan lands, of bringing about legislation for Khazan areas protection, conservation, development and management traditional techniques of construction of bunds by using marine clay to red-mooreem and providing inspection roads over the bunds parallel to the banks of the streams. Further, according to the State Water Policy 2000, an Integrated Estuarine and Khazan Area Development Plan should be formulated and a Khazan Lands Management Board should be constituted. It is stated in the policy that the ground water development should be done with caution and resorted to only where it is inevitable. The need for a ground water regulation legislation has been recommended in the policy. The policy advocates both short term and long term strategies to arrest and conserve as much water as possible. Short term strategies include drip and other water saving irrigation technology, desilting of tanks and ponds, deepening of community wells, construction of contour trenches and check dams, better maintenance and upkeep of household compound wells and repair of tube wells and leakages in pipes. The long term strategies include development of possible storage sites, adoption of massive soil and water conservation measures, control over further deforestation and encouragement to afforestation, integration of fresh water lakes having good quality water with water supply schemes, preservation of fresh water bodies, and selective and judicious ground water development.

The Policy also calls for (i) continuous monitoring of quality of water of rivers, important fresh water lakes and backwater bodies, (ii) development of fisheries, (iii) development of hydel potential to the maximum extent with minimum disturbance to environment, (iv) effective and economic shore protection of coastal areas which are prone to erosion, (v) technological upgradation of the department , (vi) establishment of a Water Resources Control Board (WRCB) to oversee the implementation of State Water Policy and (vii) promotion of specialized training and research on water resources development and management and related subjects.

2.3. A Critical Review of Goa State Water Policy 2000.

An in-depth study of the Goa State Water Policy 2000 has been done in the light of the provisions in the National Water Policy, 2012. It has been found that there are several aspects on which there is a broad similarity (with some differences in emphasis and details between the state policy and the National Water Policy-2012. These include need for a basin approach and a master or integrated plan for development of water resources, need for augmentation of water resources and types of measures to be adopted for that purpose, concern on over-exploitation of ground water, introduction and strengthening of community participation in irrigation projects, controlling water pollution and improving water quality, emphasis on water conservation, adoption of improved water application devices and water pricing, improvement in data collection, processing and storage, more emphasis on technological upgradation etc. It is not surprising to find these similarities in view of the frequent interaction which takes place among the water resource professionals working at state and national levels, apart from the fact that most of such policy suggestions have been in the air for a long time. Besides, many of the policy measures included in the National Water Policy-2012 have been carried forward from the earlier versions of the national water policy which might have been used as benchmark while formulating water policy of the state of Goa.

Aspects of Goa Water Policy which take care of its peculiar features include proposals to regulate extraction of sand from river beds, to check damage caused by mining activities, to avoid pollution of drinking water in the upstream of the river basin where there are no mining activities by taking up schemes for water supply for domestic use to bring a legislation for protection of Khazan lands, to formulate an integrated estuarine and Khazan area development plan, to take measures for effective and economic shore protection and to build up appropriate organizational structures to optimally develop state inland waterways.

Several important features of the National Water Policy, 2012 are, however, missing in the Goa State Water Policy, 2000. These include aspects related to good governance through transparent informed decision making, need for multi-disciplinary organizations for water resources management, including ground water to be managed as a common pool community resource held by the state under public trust doctrine to be followed by modification of existing Acts, recognition of minimum ecological needs for water, emphasis on managing demand for water through changes in cropping pattern, avoiding wastage of water and raising water use efficiency, recognition of

the principle of equity and social justice, focus on access to a minimum quantity of potable water for essential health and hygiene to all the citizens, emphasis on recycling and recuse of water, integrated watershed development activities, differential pricing of water, giving statutory powers to water users associations to collect and maintain a portion of water charges and manage water allotted to them, legally empowered dam safety measures, better planning of projects with due emphasis on social and environmental aspects in consultation with project affected and beneficiary families along with concurrent monitoring, involvement of panchayats, municipalities etc. in planning of projects, simultaneous execution of urban water supply and sewage treatment schemes, need for a forum at state level to evolve consensus among water users, associating private sector in Public Private Partnership (PPP) mode etc.

As regards climate change related aspects, the National Water Policy-2012 has a separate section wherein coping strategies to be adopted to deal with the challenge of climate change are indicated. In addition, references to climate change are made at several different places in the policy document. These throw light on water related impacts of climate change and the need to keep these impacts in mind while taking decisions related to planning and management of water resources. The Goa State Water Policy also stresses upon the need to take account of global warming and potential sea level rise for planning water resources development. The policy document also throws light on the long term adverse effects of global warming on the hydrology of the Western Ghats region. In order to prevent further intrusion of saline water on the upstream side due to expected rise of sea water level, the Goa Water Policy indicates the need to take measures in advance. But the only measure that is suggested is construction of Vasant Bandharas/Kolhapur type Bandharas at appropriate places on all important rivers/rivulets. Goa may, however, be the only state in the country which included climate change related aspects in its State Water Policy, even much before it was included in the National Water Policy-2012.

2.4. Goa State Ground Water Policy 2015

According to the Goa State Ground Water Policy, passed recently in the middle of 2015, (i) all ground water structures in the state will be registered, (ii) awareness camps and meetings etc. will be held at the village levels, (iii) all existing as well as new wells will be metered at the earliest, (iv) owners will install meters on the wells at their own cost, (v)all tankers and other carriers engaged in transportation of ground water will have to be registered and issued passes to be displayed on their wind shields for easy identification, (vi) action will be taken against those tankers and carriers not following this provision, (vii)technological aids will be used for keeping track of ground water extraction and transportation as already in use by mining companies to eliminate malpractices, (viii) well owners shall get the quality of ground water tested bi-yearly through approved water testing laboratories, (ix) quality of ground water will

be taken into consideration in granting or refusing to grant registration of an existing well or for permission to sink a new well, (x)need based micro level estimation of ground water availability will be undertaken specially in water stressed areas, (xi) stringent action should be taken against the violators of the Goa Ground Water Regulation Act, 2002, (xii) proper arrangements should be made by mining companies for dewatering, which should be monitored by the ground water officers, (xiii) rain water harvesting and recharging of ground water resources as well as water conservation measures should be encouraged, (xiv) conjunctive use of ground water along with surface water resources should be adopted, (xv) training on scientific technologies and tools should be imparted to officers, (xvi) proper coordination among different departments and agencies of the government dealing with ground water will be established to avoid overlapping of jurisdictions and bring about uniformity in regulation, (xvii) abandoned mining pits will be used to serve as a means of ground water conservation and recharge.

The important question is whether and to what extent this policy will be implemented. It may be mentioned in this connection that Goa is one of the few states in India, which passed a law for regulation of ground water namely the Goa Ground Water Regulation Act, 2002, several years ago. ***But, it has very limited impact due to poor implementation. Goa should, therefore, take adequate steps to make the new policy really effective.***

Chapter 3

Findings and Suggestions

3.1. Interactions with State Level Officers

An initial discussion on the present status of water resources development in Goa as well as Goa State Water Policy took place in August 2015 in a meeting of the study team with some government officers. The study team included Professor Kamta Prasad, Project Director and Shri D. Routray, Coordinator, Shri S.T.Nadkarni, Chief Engineer, Water Resources Department & Ex-Officio Additional Secretary, Government of Goa, Shri P.J.Kamat, Additional Chief Engineer and Shri Chetan Pandit, Adviser, Water Resources Department, Government of Goa. The Chief Engineer drew attention to several peculiar features of water resources scenario of Goa (already mentioned in section 2.1) such as heavy precipitation, quick drainage due to steep slope, water stress during summer months, problems due to tides, Khazan land etc. He pointed out the salient features of the existing Goa State Water Policy 2000 and mentioned that a number of policy measures enumerated there had been implemented such as, the database of water bodies has been strengthened, a master plan has been prepared, there was a Supreme Court ban on extraction of sand from river beds, mining agencies to be charged for the extent of dewatering, improved Bandhwaras have been constructed, a Goa Khazan Land Development Bill has been formulated, ground water policy has been announced and Water Resources and Control Board has been constituted.

Shri S.T.Nadkarni also mentioned that the water resources scenario in the State is dynamic and is noticeably changing since 2000. Hence there is the need to revise the Goa State Water Policy of 2000 accordingly. To start with, a policy on ground water had been announced by the state government in mid-2015. Other aspects of the water policy would also be taken up in due course. In this context, he considered that the IWP study is quite timely as the findings and suggestions of the study would be of help the department while revising the state water policy. He also spelt out the lengthy procedure involved in formal announcement of the policy as it has to be cleared by several agencies including the state legislature. The Project Director IWP study team requested the Chief Engineer to expedite the process of formulation of the draft policy so that it could be made available to all the participants of the workshop to be held in due course. The Project Director also indicated the need to have the new draft in line with the National Water Policy 2012 especially in the context of climate change. The

response of the Chief Engineer was positive. The study team kept on reminding the senior officers of the state government about this aspect from time to time. In the meeting of the Project Director with the Chief Engineer on 5th November 2015 in New Delhi, the Chief Engineer fixed the date of the workshop on 24th November and gave the assurance that the draft of the revised water policy would be ready by that date.

3.2 Status assessment in a district

An attempt was made to obtain information about status of awareness among local level functionaries and public with regard to National and State Water Policies and also about climate change in South Goa district of the state. The gist of interaction with officers and public has already been indicated in Chapter 1. Hence, only the findings are presented below.

D. Routray, Team Leader, interacting with villagers of Kajur.

Most of the officers interviewed at the district level (12 out of 13) were aware, of the state water policy, especially as this was under revision. Few officers also gave some suggestions for inclusion in the draft water policy. These are provided below. As regards, content of the State Water Policy e.g. the year in which it had been announced and provisions related to climate change in it, a majority were not aware. Knowledge about National Water Policy 2012 was perceived to be somewhat less as only 9 out of 13 officers interviewed were aware of it.

D. Routray, Team Leader, interacting with villagers of Cavre Pirla.

A view of the participants of Cavre Pirla Village.

Awareness among farmers/villagers was, however, nil, with respect to both the policies. Almost all the district level officers contacted were found to be aware of climate change as well as its effects on water resources and agriculture. Ten of them (out of 13) were also aware of the mitigation measures taken by the government to counter the effects of climate change. Such measures mentioned by them included water harvesting in hilly areas by Forest Department, drilling near bore wells for groundwater recharge, construction of anti-sea erosion structures, canal bank protection walls and Bandaras to check draining out of water, planting of more trees to maintain ecological balance, implementation of green fodder cultivation scheme, recycling of H_2O in aqua form, public awareness about judicious use of water and revival of traditional water bodies to increase storage capacity. Four of the district level offices had even attended awareness camps about climate change during the last five years. Those from the departments of agriculture including horticulture, Krishi Vigyan Kendra, animal husbandry and ground water, Executive Engineers overseeing minor, medium and major irrigation were found to be much concerned about climate change. But, a few of them dealing with rural and urban drinking water (from PWD) were not much concerned. Four of the officers concerned with agriculture mentioned about appropriate crop varieties developed by the government and of field demonstrations carried out by the department to meet the challenge of climate change.

A view of the participants of Kajur Village.

Awareness about climate change among farmers/ villagers was, however, found to be nil. Most of the farmers were also found to be not following the advice given by government officials. The majority of them were under the impression that climate change had no effect on the economy as a whole including agriculture and other

livelihood activities. But, a few villagers had some idea of the effect of climate change on agriculture, fodder, fishery, horticulture and animal husbandry.

Some of the district level officers gave the following suggestions to tackle adverse effects of climate change.

- Advising farmers to stop flood irrigation.
- Mulching for conservation of soil moisture.
- Increasing water holding capacity of soil by adding more organic manures while avoiding excessive use of chemical fertilizers.
- Conserving water in different forms even at individual level.
- Encouraging use of micro-irrigation in horticulture and vegetables.

In addition, the Department of Agriculture in association with the scientists of KVK had developed the following varieties of crops for mitigating the adverse effects of climate change.

- Paddy varieties such as Vaisaleha, Makome of duration of 135 days in the place of Jyoti and Karjat having duration of 150 days.
- Promotion of short duration pulses (Alsand etc.) under dry condition.
- Promotion of short duration sugarcane.
- Introduction of new varieties of cashewnut and
- Propagation of Coconut Vengulla variety

3.3 Issues and suggestions during the state level multi-stakeholders workshop

A multi-stakeholders' workshop on the new draft State Water Policy of Goa was organized by the India Water Partnership, IRMED and Department of Water Resources, Government of Goa on 24th November, 2015 at Bardez – Goa. It started with a welcome address by the study Project Director. He raised several issues for deliberation in the workshop. These issues were related to raising of canal water use efficiency with a focus on incentives to farmers for saving water, need for establishing water resources regulatory authorities, proliferation and spillover of projects, measures for tackling the adverse effects of climate change in different parts of Goa, how to move from mere supply augmentation to demand management in the water sector, specific measures for promoting equity, efficiency and environmental sustainability in management of water resources, how to make decentralized institutions like panchayats and municipalities as effective partners in management of water resources, how to ensure supply of a fixed quantum of water for irrigation and drinking purposes to community based associations, need for a well-documented regime of water rights, need for

consolidation of state water laws into a legal document, how to develop a more reliable data system and to streamline and strengthen procedure for formulation and clearance of projects, how to ensure evaluation of completed projects by independent agencies, how to make women a part of local decision making process related to water, need for awareness generation on water policy (both State and National) with regard to climate change, need to involve academic institutions, civic societies and public in general in formulation of state water policy. He ended by calling upon participants to raise additional issues and give suggestions which should be implementable.

Prof. Kamta Prasad welcoming the participants. On the Dias from L to R Dr. Veena Khanduri, Mr. R. Srivastava, Mr. Chetan Pandit, Mr. A.C.Tyagi, Mr. S.T.Nadkarni, and Mr, B.P.Sarath Chandran

Shri S.T.Nadkarni, Chief Engineer, Water Resources Department, Government of Goa, while delivering his key note address, mentioned that, as before, the proposed Draft State Water policy assigned highest priority to drinking water followed by ecology, other uses and navigation. Due importance was given to adaptation to climate change. Other aspects covered in the draft policy included strengthening water resource data base, enhancing water availability, better management practices, regulation of ground water, water pricing, flood and drought management. He also mentioned that the State Water Resources Control Board, as envisaged in the State Water Policy of 2000, had been established and functioning.

The inaugural address by Shri Avinash Tyagi, Secretary General, International Commission on Irrigation and Drainage, underlined the need for a full understanding of the meaning of climate change and its implications as well as for long term data on the effect of climate change on rainfall. He mentioned about the need to remove the existing gap between hydrological researchers and practitioners. Water use efficiency should be looked not only from irrigation point of view but from all angles. He emphasized the role of demand-management, conservation of water bodies and multi-stakeholders forum for water policy. He also mentioned about the need for implementing drip irrigation, interaction between engineers and farmers and conservation of ground water as a reserve for drought management. He emphasized the need for advanced

Mr. A.C Tyagi delivering inaugural address On the Dias from L to RDr. Veena Khanduri, Mr. R. Srivastava, Mr. Chetan Pandit, Mr. S.T.Nadkarni,Prof. Kamta Prasad and B.P.Sarath Chandran.

training programs not only for water resources engineers but also for mining staff and the general public. He pleaded that there should be a mechanism to transfer research findings to functionaries at lower levels as well as to the public.

Shri Chetan Pandit, Adviser, Water Resources Department, Government of Goa, in his presidential address, focused on aspects related to implementation and impact of policies at the ground level. He observed that one should not tinker much with the policy but bother more about its implementation. He mentioned that how the earlier recommendations regarding river basin organization and public private partnership have not been implemented.

Suggestions from the workshop participants:

- Demand for water should be ascertained from all the sectors in Goa through collection of data on water consumption from both primary and secondary sources.
- The impact of climate change should be analyzed at sub- basin level such as Zuari sub- basin.
- A roadmap for urban climate resilience policy should be prepared.
- Management implications of treating water as a community asset should be explained.
- The desirability of PPP projects in water supply should be reviewed.
- Inland water bodies such as temple ponds, which are in dilapidated condition, should be rejuvenated.
- Abandoned mine pits should be used for supplying water for irrigation as well as industries.
- Efforts should be made to improve awareness level at school and educational institutions on the need for water conservation
- Roof top rainwater harvesting should be encouraged in some parts of the State like Canacona, Snaguem which face acute water shortage.
- Illegal drawing of water by mines should be restricted.
- Planting of certain species of trees such as Australian Acacia, which intakes considerable ground water for growth resulting in its depletion, should be discouraged.
- Traditional practices should be tapped as one of the methods of augmenting water resources.
- Artificial lakes, which are present in the state, should be used for water conservation.
- Adequate measures should be taken to control dumping of solid waste in canals and other water bodies in order to maintain the quality of water.

- Measures should be taken to control intrusion of sea water which is affecting the quality of ground water in the state.
- Documentaries of best practices developed by communities over the years should be compiled to be used for sustainable management of water in State.
- Efforts should be made to control the contamination of well water in urban areas.
- Community participation should be promoted for conservation and effective management of water.
- There is need to sensitize and educate stakeholders on better water use practices.
- Waste water should be treated and reused for secondary purposes such as car washing and gardening. While doing so, problems, if any, associated with reuse of water should also be taken into account.
- There should be involvement of common citizen in formulation of state water policy.
- As far as possible, increasing use of water should be made as economic instrument like water tariffs in influencing/changing peoples' behaviour related to use of water.
- Rain water harvesting should be made compulsory in all the mega projects.
- There is a need for collaborative approach among different agencies concerned with management of water.

3.4 Perceptions and Views of Workshop Participants on new Draft State Water Policy and Climate Change

During the workshop on new draft of Goa State Water Policy, held at Bardez-Goa on 24th November, 2015, a schedule on the subject prepared by the study team was administered to 37 workshop participants. The filled in schedules throw light on the status of awareness of the workshop participants on national and state water policies, climate change as well as their perception of awareness of the above at district, block, village and town levels. The responses also included their suggestions for mitigation measures which should be taken into account while finalizing the new Goa State Water Policy.

It was expected that invited participants would be aware of national and state water policy and impact of climate change on water resources, but it is surprising to note that a few members were not aware of the above and a sizable number were not aware of the details of both the national and state policies. The complete analysis of the filled questionnaires is presented below along with the tables.

Table 3.1
Participants Awareness about Water Policy and Climate Change

(No. of responses)

Type of awareness	Yes	No	No response
Awareness about National Water Policy 2012	33	4	-
Awareness about provisions related to climate change in National Water Policy	19	13	5
Awareness about Goa State Water Policy-2000	34	1	2
Awareness about Goa Ground Water Policy	26	11	-
Awareness about provisions related to climate change in Goa State Water Policy-2000	20	17	-
Awareness about water supply schemes in Goa, being taken at higher ups in river basins.	28	5	4

As regards the participant's perception on the extent of awareness and preparedness with respect to impacts of climate change at district, block, village and town levels, the findings given in Table 3.2 below, indicate that the extent of awareness was perceived to be not much at any level, even at the district. The extent of preparedness was perceived to be still less. This highlights the task that lies ahead for policy makers and administrators.

Table 3.2
Participants Perception of Extent of Awareness and Preparedness at different levels

(multiple responses)

Levels	Extent of awareness			Extent of preparedness		
	Nil	Not much	Adequate	Nil	Not much	Adequate
District	1	38	6	3	22	6
Block	2	27	6	6	19	5
Village	5	25	6	7	19	5
Town	5	24	7	8	20	5

In response to a question regarding their perception on major impacts of climate change, several participants mentioned adverse effects on agriculture such as lower crop yields and production due to increase in water scarcity, higher crop damages due to increased frequency and intensity of floods, adverse effects on inland fishery, increased possibility of sea water intrusion due to rise of sea level as a result of global warming, and increased storm intensities in coastal areas leading to damages. Some of them have mentioned adverse effects on cattle rearing, tourism and industrial development in the state. Effect was expected to be considerable in coastal areas.

Their views on certain peculiar features of Goa's water resources scenario and water policy, presented in Table 3.3 below, show that almost half of the participants opined that they do not observe potential sea level rise due to global warming in recent years in Goa. They were mostly interested in inclusion of bandhwaras and inland fisheries in the new Goa State Water Policy.

Table: 3.3

Issues	**Yes**	**No**	**Non-Resp--onses**
Whether Kolhapur type bandhwaras are better than Vasant type ones	22	8	7
Is there potential sea level rise due to global warming	16	15	6
Whether in favour of up scaling inland fisheries.	27	4	6

The participants also indicated climate change related mitigation measures which should be included in Goa State Water Policy (see Table 3.4).

Table 3.4

Mitigation Measures to deal with Climate Change

(No. of responses)

Types of mitigation measures	**Yes**	**No**	**No response**
Increased water storage	33	2	2
Demand management	31	5	1
Improved water application methods	34	3	-
Suitable water pricing	30	5	2

The first three responses were as per usual expectations. Increased water storage in various forms such as soil moisture, pond, ground water, small and large dams, demand management through use of less water intensive crops in drought prone areas and growing flood resistant crops in flood prone areas, improved water application methods such as use of sprinkler or drip irrigation, rescheduling of crop activities etc. are the well accepted methods for dealing with water scarcity on which there is virtually no controversy. With regard to water pricing, participants were of the view that suitable water pricing would have greater role in future in mitigating the effects of climate change.

Other suggestions given by the participants related to water policy in the context of mitigating the adverse effects of climate change are as below:

- Need for conservation of water resources
- Water should be used efficiently to ensure its optimum utilization for crops e.e. use of minimum water with maximum yield.
- Mechanisms to increase water use efficiency in different sectors, such as use of micro – irrigation in agriculture should be put in place.
- There should be stringent laws for wastage of water.
- Need for awareness about importance of water conservation at school/college and individual levels.
- Raw and recycled water usage by industries should be promoted.
- Rain water harvesting should be given more importance and implemented seriously. There should be mandatory roof top water harvesting for every new construction project.
- Participatory management of water should be introduced.
- Committees should be formed at panchayat level for overseeing use of water.
- There should be proper implementation of ground water policy with emphasis on recharging of ground water
-
- Use and digging of bore wells should not be allowed as far as possible.
- Mining pits and water pumping ought to be restricted and charged.
- There should be storage of water in abandoned mining pits for recharge.
- Capacity development training should be provided to stakeholders on water use efficiency.
- There should be a mechanism for monitoring impacts of all development activities on water.
- Need for water storage structures of appropriate sizes e.g. construction of bandharas and check dams, to help recharge during post monsoon period.
- Both demand management as well as supply management approaches are needed.
- Community, public/NGO participation is needed in formulating water policy
- Role of all the stakeholders in water sector should be clearly specified in state water policy.
- Need for reuse and recycling of waste water. In particular treatment of waste water from hotels & industries is essential. Motivate public to use the recycled water for gardening, sanitation, etc. Waste water treatment should be done on greater scale in residential complexes.

- Sensitization of people is required on water policy, rainwater harvesting, water efficient cropping pattern, crop rotation and ground water recharge.
- There should be SMS based climate/rainfall information system for farmers as started by IIT Mumbai.
- Contamination of water should be prevented. There should be proper sewage system to stop water pollution.
- Need for adequate pricing of water.
- Water resources department/agriculture department should decide about the crops which could be grown by the farmers in the command area in Goa as per available water.
- Water meter should be made compulsory in command areas.

Chapter 4

The Outcome

4.1 New Draft Goa State Water Policy, December 2015

The frequent dialogues between the India Water Partnership study team and Water Resources Department of the Government of Goa from August 2015 onwards resulted to expedite the process of formulation of a new draft of Goa State Water Policy in line with the National Water Policy 2012. Accordingly, the new draft of the State policy was discussed during State level workshop organized at Baldez – Goa on November 24, 2015. The Chief Engineer, while responding to a suggestion made by the Project Director, India Water Partnership Study team to seek public opinion before finalizing the state water policy, announced that the draft of the revised Goa State Water Policy would be put on the website for soliciting comments from the public. In accordance with this commitment, the draft of a new policy was actually uploaded on the website of the department in the first week of December 2015 thereby signifying the success of the persistent efforts made by the IWP study team.

The draft of the new Goa State Water Policy carries forward many of the features of the earlier policy of 2000. It also reiterates the salient features of the recently announced Goa State Ground Water Policy of 2015, as already described in Section 2.4. At the same time, it also contains some new features which are in line with the National Water Policy-2012; such as adaptation to climate change. As per the National Water Policy of 2012, the draft of Goa State Water Policy also refers to enhancing the capabilities of the community to adapt to climate change by putting emphasis on mitigation measures such as increase of water storage in ponds, lakes, rivers, ground water, small or large reservoirs, revival of traditional water harvesting structures and bodies, adaptation of better demand management like adoption of better cropping patterns, water application techniques, sprinkler and drip irrigation, taking into account the expected impacts of climate change in planning and regulation of water resources structures such as dams, flood embankments, tidal embankments etc. as well as bunds and ponds etc. in Khazan land.

There are several other new aspects included in the new draft policy of Goa which are also in line with the National Water Policy 2012. Mention may be made of ardent need to make necessary amendments in the existing Acts and draft new Acts to plan, manage and regulate utilization of water resources in the state; to assign higher role to ecological needs of rivers and going to the extent of earmarking a portion of river flows

as e-flows for sustaining the ecological needs; to resort to pricing of water to ensure its efficient use and conservation; to set up an independent Water Regulatory Authority in the state; to repair, rejuvenate and restore water bodies by removing encroachments and increasing their capacities, remodeling them or improving them for utilization; to strengthen maintenance by setting aside a suitable percentage of cost of infrastructure for repair and maintenance; to give more emphasis on water supply and sanitation through evolving proper sewerage system or providing septic tanks throughout the state; to try to supply treated and re-used water in two different pipelines with proper universal color codes.

The draft certainly provides an improved version of the earlier Goa State Water Policy of 2000. Further improvements may take place after the comments are received from other stakeholders. The following set of recommendations were sent to the concerned department for consideration. These recommendations are given below.

4.2 Recommendations for New Goa State Water Policy

The recommendations include the suggestions made by the district level officers in South Goa district, the participants of the workshop held in Goa on 24th November 2015, suggestions provided in the questionnaire filled in by the participants and the suggestions by the study team. In order to avoid duplication, only those points are included which are not found in the existing State Water Policy document. Even then, there may be some overlap which is unavoidable. These recommendations were sent to Chief Engineer and other senior officers of Water Resources Department of Government of Goa on 23rd December, 2015

Climate Change

- There is need for a full understanding of the meaning of climate change and its implications as well as for long term data on the effect of climate change on rainfall pattern.
- The impact of climate change should be analyzed at sub- basin level such as Zuari sub-basin, for example.
- A roadmap for urban climate resilience policy should be prepared.
- High priority should be assigned to (i) strengthening and creating adequate facilities for studies and research on hydrological, hydro-metrological and geomorphologic aspects related to climate change within the Department of Water Resources, WALMI, Universities and other institutions including creating new institutions; (ii) modernizing

and expanding instrumentation and measurement techniques and (iii) revising existing courses of studies, creating new subjects and introducing programmes as well as in post-graduate diplomas and degrees.

- There is need to take up massive programmes of awareness generation among people at all levels about adverse effects of climate change and the mitigation measures to be taken to deal with them so as to enhance their coping capacity.
- There is need for integrated salinity control mechanism to deal with the problem of increasing salinity and ground water exploitation in coastal areas of Goa.
- There is need for a system of suitable water pricing to deal with increasing water scarcity in future due to the adverse effects of climate change.
- The different departments of the state government, whose work are related to water and climate change should have a common forum which should meet at frequent intervals to take an integral view of knowledge base and policy options. For this purpose, the Department of Water Resources should have an effective cell headed by a Chief Engineer level officer.

Water and Agriculture

- Plantation of more water consuming plant species like acacia, nilgiri should be avoided, while crops which consume less water should be promoted.
- Water meter should be made compulsory in command areas.
- There is need for engineers to interact with farmers.
- Farmers should be advised to stop flood irrigation.
- Mulching for conservation of soil moisture should be promoted.
- Water holding capacity of soil should be increased by adding more organic manures while avoiding excessive use of chemical fertilizers.
- Use of micro-irrigation should be encouraged specially in horticulture and vegetables.
- Farmers should be persuaded to adopt shorter duration crop varieties such as paddy varieties of Vaisaleha and Makome and pulse variety of Alsand.
- Less water consuming traditional organic agriculture practices need to be encouraged while ensuring for higher productivity. For this purpose, higher funds may be allocated for Research and Development.

Water Policy Formulation and Implementation Process

- Awareness should be generated about state water policy among people at the grass roots level through meetings, campaigns, posters, displays etc.

- State water policy, should be people and farmers friendly and should emerge from below. Hence there should be involvement of common citizen, community, NGOs, academia etc. in its formulation.
- Basin-wise, region-wise considerations should be taken into account while framing policies.
- After formulation, state water policy should be made readily available at the level of village, Panchayat, Block, School, Libraries and other public places.
- All stakeholders' role should be clearly specified in state water policy.
- State water policy should be implementable. Hence the policy should deal also with aspects related to its implementation at the ground level.
- Description of water resources scenario as well as water policy should also include socio-economic, institutional and management aspects which are missing in the present policy document. Socio-economic aspects should also be specifically mentioned in the sections dealing with research and data.

Ground Water

- There should be proper implementation of ground water policy.
- Panchayats should be empowered to regulate extraction of ground water in over exploited and critical areas.
- Illegal extraction and sale of ground water should be prohibited.
- Ground water in drought prone areas should be kept as a reserve for drought management.
- Planting of certain trees such as Australian Acacia, which use considerable ground water resulting in its depletion, should be discouraged.
- Mining pits and water pumping ought to be restricted and charged.
- Recharging of ground water should be given more emphasis. Abandoned mining pits should also be used for recharge. Construction of bandharas and check dams be encouraged to help recharge during post monsoon period.

Controlling Water Pollution

- Contamination of water should be avoided. There should be proper sewage system to stop water pollution. Sewer schemes should be executed along with urban water schemes.
- Penalty should be imposed on those polluting water in accordance with Polluter Pays Principle.

- Role of Pollution Control Board in preventing water pollution should be strengthened.
- There should be adequate measures to control the prevailing dumping of solid waste in canals in order to maintain the quality of water.
- Measures should be taken to control intrusion of sea water which is affecting the quality of ground water in the state.
- Efforts should be made to control the contamination of well water in urban areas.
- Need for reuse and recycling of waste water. In particular, treatment of waste water from hotels & industries is essential. Waste water treatment should be done on greater scale in residential complexes also.
- Motivate public to use the recycled water for car washing, gardening, sanitation, etc. While doing so, problems, if any, associated with reuse of water should also be taken into account.
- Raw and recycled water usage by industries should be promoted.

Water Use Efficiency

- Water use efficiency should receive adequate emphasis to ensure optimum utilization of water for crops as well as for all other uses.
- Mechanisms to increase water use efficiency in different sectors such as use of micro irrigation should be put in place.
- There should be stringent laws for wastage of water.
- Much emphasis should be given on conservation of water resources.
- Documentaries of best practices developed by communities over the years should be compiled to be used for sustainable management of water in Goa.
- There is need for training not only for water resources engineers but also for mining staff and the general public. Capacity development training on water use should be provided to all stakeholders.
- There should be a mechanism to transfer research findings to functionaries at lower levels as well as to the public.
- The existing gap between hydrological researchers and practitioners should be removed.

Public awareness

- Efforts should be made to improve awareness level in schools and other educational institutions about the importance of water and need for its conservation
- There is need to sensitize and educate stakeholders on better water use practices.

- People should be sensitized on critical aspects related to water such as water policy, rainwater harvesting, cropping pattern, crop rotation and ground water recharge.

Community Participation in Water Governance

- Community participation should be promoted for conservation and effective management of water and for formulating water harvesting schemes, ground water usage and recharge.
- Participatory management of irrigation and drinking water should be introduced/ strengthened.
- Committees should be formed at panchayat level to oversee use of water at village level.
- Greater stress should be laid on decentralization of water governance within the overall framework of the doctrine of public trust to create a feeling of community ownership and involvement in management of water resources.
- Laws should be amended to provide adequate power and funds to such decentralized bodes for adequate development and proper management of local water bodies such as lakes, ponds, canals, common wells etc. so as to sub-serve the goal of providing safe drinking water to all within easy reach.
- Women are the primary users of water. Hence, there should be adequate emphasis on women participation in management of water at local levels.

Water Harvesting

- Rain water harvesting should be given more importance and conserved seriously. There should be mandatory roof top rain water harvesting for all mega projects specially in some parts of the State like Canacona, Sanguem which face acute water shortage.
- Water recharge structures should be constructed in an integrated and holistic manner in place of the prevailing fragmented manner by different agencies.
- Consolidated data on recharge structures in an area along with the relevant data for the catchment area should be made easily available.

Water bodies

- Inland water bodies such as temple ponds, which are in dilapidated condition, should be rejuvenated.
- Abandoned mine pits should be used water conservation and for supplying water for irrigation as well as industries.

- Artificial lakes, which are present in the state, should be used for water conservation.

Management of Water Resources

- Demand for water should be ascertained from all the sectors in Goa through collection of data on water consumption from both primary and secondary sources.
- Management implications of treating water as a community asset should be explained.
- The desirability of PPP projects in water supply should be reviewed.
- There should be collaborative approach among different agencies concerned with management of water.
- Both demand management as well as supply management approaches are needed.
- Illegal drawing of water from mines should be restricted.
- There should be a mechanism for monitoring of impacts on water of all development activities.
- Stringent action should be taken against encroachments into catchment areas of water bodies by private agencies.
- Proper attention should be paid for maintenance of all types of existing water bodies such as dams, canals, tanks, ponds etc.
- Traditional technologies should be tapped as one of the methods of augmenting water resources.

Chapter – 5

Conclusions

5.1 Backdrop

The present study is the outcome of the need to review state water policies in line with the National Water Policy, 2012, in the context of climate change. Its objective was to review the Goa State Water Policy, 2000 so as to provide suggestions for modifying it in line with the National Water Policy-2012 in the context of the ensuing climate change, involving awareness, preparedness, coping mechanism at the state level and down below. Apart from collecting information from secondary sources, the study relied mainly on primary sources for required data and information. For this purpose, the study team conducted wide ranging interactive sessions with government departments and other stakeholders at the state, district and panchayat levels followed by state level workshop to get suggestions for modifying the earlier state water policy of 1994. There was a continuous dialogue between the study team and the state government.

5.2 The Process

The state of Goa was selected for the study on the basis of certain criteria which were evolved after considerable discussion of the study team with central government departments/ agencies dealing with water resources such as the Ministry of Water Resources, G.R and R.D, the Central Water Commission, the Planning Commission, etc. A critical review of Goa State Water policy, 2000, was made with respect to the water resources scenario of the state as well as the National Water Policy, 2012. Considerable discussion on issues pertaining to Goa State Water Policy took place between the study team of India Water Partnership and state level senior officers of Water Resources Department of Government of Goa in August, 2015. Members of the study team also interacted with relevant district level and other officers, Panchayat representatives, Krishi Vigyan Kendra and general public in two villages of South Goa district of the state from September 30 to October 10, 2015. Finally, a multi-stakeholders workshop on Goa State Water Policy was held on 24th November, 2015 at Bardez – Goa which was attended by 49 participants. Findings of the schedules filled in by the participants of the workshop, giving their perceptions, views and suggestions on issues related to climate change and water policy, were processed and analyzed. Thereafter, the recommendations emerging from different sources including those of the study team

were finalized and communicated to the Government Goa for taking them into account while revising its earlier policy of 2000.

5.3 The Outcome

The frequent dialogues between the study team and Water Resources Department of the Government of Goa from August 2015 onwards resulted in expediting the process of formulation of a new draft of Goa State Water Policy which contains several features which are in line with the National Water Policy 2012 especially in the context of climate change. And the workshop on Goa State Water Policy, organized by the study team as an integral part of this study, led to the uploading of the new draft policy on the website of the State Water Resources Department in the first week of December 2015 to seek comments and suggestions from the public, thereby signifying the success of the persistent efforts made in this direction by the India Water Partnership study team.

The recommendations which came out as a result of the study were sent by E-mail to the Chief Engineer, and other senior officers of Water Resources Department, Government of Goa, on December 23, 2015 to be considered for inclusion in the revised version of Goa State Water Policy. The aspects covered by the recommendations include climate change, water and agriculture, water policy formulation and implementation process, ground water, controlling water pollution, water use efficiency, public awareness, community participation in water governance, water harvesting, water bodies and management of water resources.

Thus, the tasks assigned for the study were successfully completed and the objective of the study is fully achieved.

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Annexure - A

Proceedings of the Workshop on Goa State Water Policy held on 24th November, 2015

As mentioned in Chapter 1, a workshop on Goa State Water Policy with Special Reference to Climate Change was organized by the India Water Partnership study team with the support of Goa State Water Resources Department on Nov 24, 2015 from 10.00 AM to 2.30 PM as a part of the study. The venue was the Seminar Hall of the Secretariat, Porvorim, Bardez-Goa. Advance intimation was given to the participants to go through the National Water Policy 2012 as well as Goa State Water Policy 2000, both of which were shown to be easily accessible on the websites of the Ministry of Water Resources, R.D. and G.R., Government of India and Department of Water Resources Govt. of Goa, respectively. In addition, a Background and Issue Note was circulated by the Study Team during the workshop giving the rationale and context of the workshop and raising a number of relevant issues on which the views of the participants were solicited. Another note circulated by the Study Team provided the salient features of the Goa State Water Policy 2000, to be discussed in the workshop. Number of participants, comprising of different stakeholders, was 49. Water Resources Department of the Government of Goa was well represented by several officers, which included the Chief Engineer and the Additional Chief Engineer. Other relevant departments of Government of Goa such as Agriculture, Fishery, Horticulture, and Pollution Control Board were also represented by senior officers. Besides, representatives from Central Water Commission and Central Ground Water Board of Government of India, senior faculty members of University of Goa such as Principal, Goa College of Engineering, Professors of Economics etc., as well as a few farmers and several female members also participated.

The workshop started with a welcome address by Professor Kamta Prasad, Project Director, India Water Partnership study team. He provided the background to the workshop, and indicated its importance. He also underlined the urgent need for a review of the existing Goa State Water Policy in view of several changes in water resource scenario and socio-economic situation which had taken place since 2000 when the State Policy was announced. He then raised a number of pertinent issues on which the views/ suggestions of the participants were solicited. This was followed by a keynote address on National Water Policy 2012 by Shri Rishi Srivastava, Director, Central Water Commission, Government of India, who was representing the Chairman Central Water Commission as he could not come due to some problem at the last moment. During his

presentation, Shri Srivastava highlighted the changes made in National Water Policy-2012 as compared to the earlier version of the National Water Policies. Thereafter, Shri S.T.Nadkarni, Chief Engineer, Water Resources Department, Government of Goa delivered a key note address on the draft of a revised version of Goa State Water Policy. He submitted that the draft, after being approved by the competent authority, would be notified in the press and uploaded on the website of the Water Resources Department for eliciting comments and suggestions from public before being finalized . Thereafter, Shri A.C.Tyagi, Secretary General, International Commission on Irrigation and Drainage, New Delhi and former Director General World Meteorological Organization, Geneva, delivered the inaugural address. The inaugural session was presided over by Shri Chetan Pandit, Adviser, Water Resources Department, Government of Goa and former Member, Central Water Commission. The inaugural session ended with a vote of thanks by Dr. Veena Khanduri, Executive Secretary-cum-Country Coordinator, India Water Partnership.

Thereafter, Goa State Water Policy was discussed in a long technical session which was presided over by Dr. P. Mukhopadhyay, Professor and former Head of the Department of Economics, University of Goa. The discussion was initiated by Dr. (Mrs.) Ashvani Pai Panandikar of TERI Goa. Other participants who took part in the discussion and gave their views and suggestions included Shri Ravindra R Yaragathi, Dr.Mohan Girap, Shri Larry Barreto, Shri Anant. P.Hoble, Dr. Mericio Travassos, Shri S.T. Nadkarni, Shri S.H. Nagarajaioh, Shri Rajan Kamble, Dr.Purnanand Savojkar, Dr.Ulhas G.Sawonker, Shri Chetan Pandit, Professor Pranab Mukhopadhayay, Shri A.C.Tyagi, Shri P.J.Kamat and Dr.Veena Khanduri. The suggestions made by them are provided in chapter 3.

The workshop ended with concluding observations by Professor Kamta Prasad, Project Director, India Water Partnership study team. He expressed his happiness that the draft of a revised policy was ready and would come up shortly on the website. He suggested that newspaper advertisements can also be given about the framing of water policy and soliciting comments and suggestions from the public. He thanked the participants for making useful suggestions and assured them that these would be analyzed with special reference to their relevance and implementability will be taken into account while finalizing the recommendations to be sent to the state government. He also requested them to send any further suggestions by email to him.

List of Participants

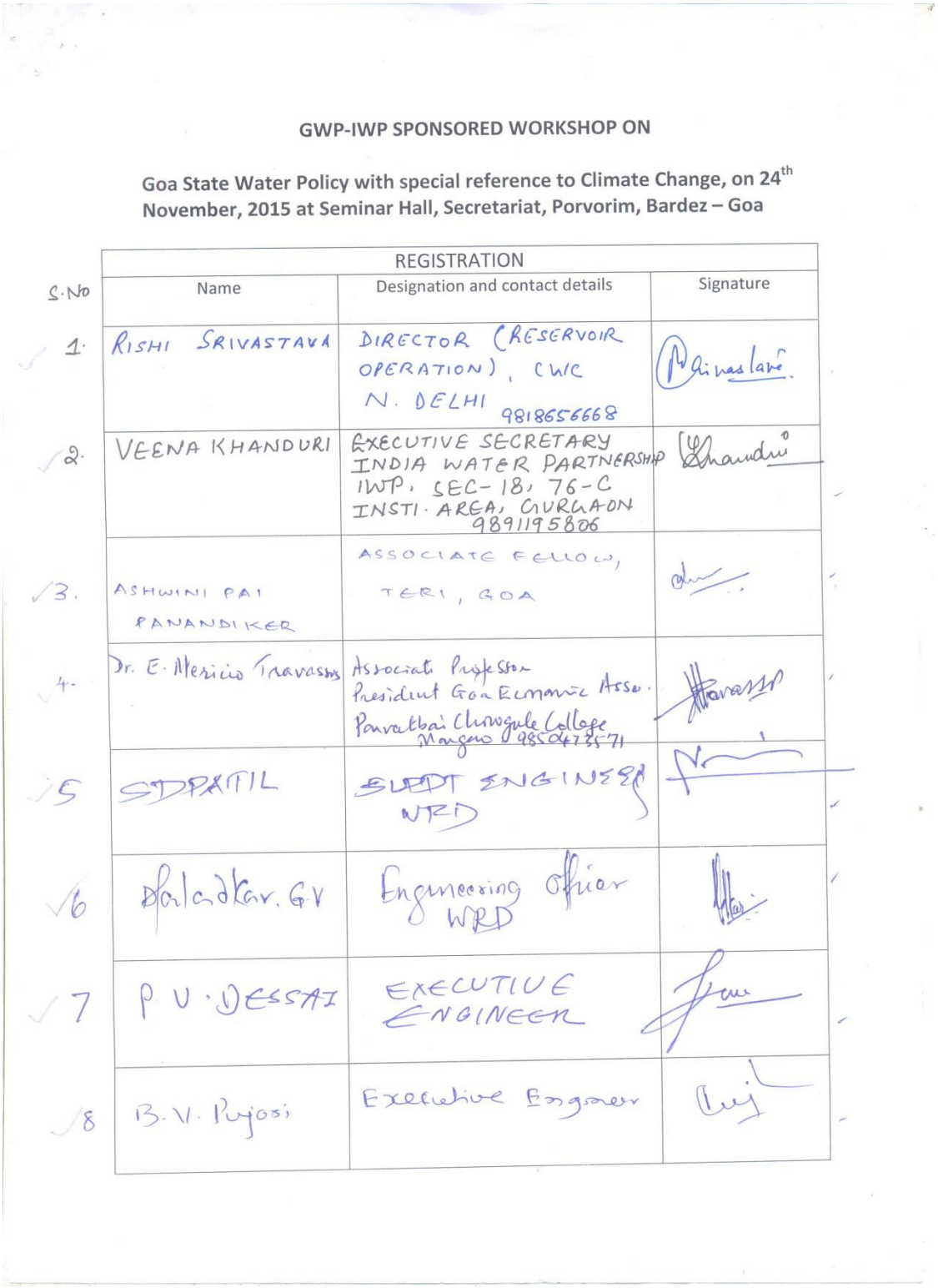
1. Shri A.C Tyagi, Secretary General, international Commission on Irrigation and Drainage New Delhi.
2. Shri Chetan Pandit, Advisor, Water Resources Department, Government of Goa and former Member, Central Water Commission, Government of India.

3. Shri S.T. Nadkarni, Chief Engineer, Water Resources Department, Government of Goa.
4. Professor Kamta Prasad, Chairman, Institute for Resource Management and Economic Development and workshop coordinator, Delhi.
5. Shri Rishi Srivastava, Director, Central Water Commission, Government of India, New Delhi.
6. Dr.(Mrs.) Veena Khanduri, Executive Secretary-cum-Country Coordinator, India Water Partnership, Gurgaon.
7. Shri P.J .Kamat, Additional Chief Engineer, Water Resources Department, Government of Goa.
8. Dr (smt.) Shamila Monteiro, Director of Fisheries, Government of Goa.
9. Shri Larry Barreto, Managing Director, Horticulture corporation, Government of Goa
10. Shri Ulhas Pai Kakote, Director of Agriculture, Government of Goa.
11. Dr.Vinayak N.Shet, Principal, Goa College of Engineering.
12. Dr. Pranab Mukhopadhyay, Professor and former head of the Department of Economics, University of Goa.
13. Dr.E.M.Travassos, President, Goa Economic Association.
14. Shri Ravindra R.Yaragathi, Superintending Engineer, Water Resources Department, Govt. of Goa.
15. Dr.Ulhas G.Sawonker, Professor and HeaD, Mining Engineering Department Goa Engineering College.
16. Shri S.D.Patil, Superintending Engineer, Water Resources Department, Government of Goa.
17. Dr.B.P Sarth Chandran, Associate Professor and Head Department of Economics and Banking Shree Damoder college, Margao, Goa.
18. Dr.Purnanad Savojkar, Professor. Goa Engineering College
19. Ms.Megha S.Kerkar, Superintendent of Fisheries, Government of Goa.
20. Shri A.G Bhagwat, Surveyor of Works, Water Resources Department, Govt. of Goa.
21. Ms. Rakhi Raj , Asst. Professor, Carmel College for Women, Nuveni, Goa.
22. Shri Prashant P.Harmal, Farmer, Goa.
23. Shri Chandrakant R.Naik, Farmer, Goa
24. Shri Mukund B.Sadekor, Tilati, Iwuua – Phargal, Goa.
25. Shri K.M.Viswanth, Scientist, Central Ground Water Board, Government of India, SVO, Belgam.
26. Dr.J.Davithv Raj, Scientist, Central Ground Water Board, Government of India, SVO, Belgam
27. Dr (Mrs.) Ashwini Pai Panandikar, Associate Fellow, the Energy and Resources Institute (TERI), Goa.
28. Dr. Mohan Girap, Goa State Pollution Control Board.
29. Mrs. Jennica Sequiera, Goa State Pollution Control Board

30. Shri P.V. Dessai, Executive Engineer, Water Resources Department, Government of Goa.
31. Shri. B.V. Pujari, Executive Engineer, Water Resources Department, Government of Goa.
32. Shri S.H. Nagorajaioh, Executive Engineer, Water Resources Department, Government of Goa.
33. Shri S.G. Pattan, Executive Engineer, Water Resources Department, Government of Goa.
34. Shri R.B. Ghanti, Executive Engineer, Water Resources Department, Government of Goa.
35. Shri D.V.Salchar, Executive Engineer, Water Resources Department, Government of Goa.
36. Shri P.B. Badami, Executive Engineer, Water Resources Department, Government of Goa.
37. Shri P.R.Akki Executive Engineer, Agriculture Department, Govt. of Goa.
38. Ms. Maline R.Naik, Asst, Surveyor of Works, Department of Water Resources, Government of Goa.
39. Shri Rajan Kamble, Asst, Surveyor of Works, Department of Water Resources, Government of Goa.
40. Shri S.B.Ghanikar, Asst, Surveyor of Works, Department of Water Resources, Government of Goa.
41. Shri G.V.Dlaladkar, Engineering officer, WRD, Govt. of Goa.
42. Mrs. Jyoti Prabhudessa, Technical Assistant, WRD, Govt. of Goa.
43. Shri Neil N. Agshikar, Technical Assistant, WRD, Govt. of Goa.
44. Shri Nutan Masurke, Junior Engineer, WRD, Govt. of Goa.
45. Ms. Nayana G.Kulkarni, Junior Engineer, WRD, Govt. of Goa.
46. Shri Tripto Prabhu Gamber, Junior Engineer, WRD, Govt. of Goa.
47. Shri Arun M.Naik, Assistant Engineer, WRD, Govt. of Goa.
48. Shri N.M.S Anant P Hoble, WRD Govt. of Goa.
49. Shri Hemant Rane, WRD, Govt. of Goa.

Annexure – B

Scanned copy of list of registration sheets



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S.No	REGISTRATION		
	Name	Designation and contact details	Signature
1.	RISHI SRIVASTAVA	DIRECTOR (RESERVOIR OPERATION), CWC N. DELHI 9818656668	
2.	VEENA KHANDURI	EXECUTIVE SECRETARY INDIA WATER PARTNERSHIP IWP, SEC-18, 76-C INSTI. AREA, GURGAON 9891195806	
3.	ASHWINI PAI PANANDIKER	ASSOCIATE FELLOW, TERI, GOA	
4.	Dr. E. Mexicio Fravasss	Associate Professor President Goa Economic Asso. Parvatbai Chowgule College Margao 9850475571	
5	SDPATIL	SUPDT ENGINEER WRD	
6	Phaladkar. GV	Engineering Officer WRD	
7	P V JESSAI	EXECUTIVE ENGINEER	
8	B. V. Pujari	Executive Engineer	

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REGISTRATION			
	Name	Designation and contact details	Signature
9.	Premanand J. Kamat	A.C.E (WRD)	
10.	DR. B.P. SARATH CHANDRAN	ASSOCIATE PROFESSOR	
11.	Jyoti Prabhudessai	Technical Assistant	
12.	Nutan Masurekar	Junior Engineer	
13.	Arun. M. Naik	Assistant Engineer	
14.	Larry Barreto	M.S. Horti. Coop. 09860258977 gshel123@gmail.com	
15.	S.H. Nagarajaiah	EE, WD XI, WRD, Goa.	
16.	S.I. Pattan	EE X WRD Pajifond/Sanguem 9420694001 7	

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17.	RAVINDRA R. YARAGATTI	Superintending Engineer Circle-II, WRD, Karaswada	R.R. Yaragatti 24.11.15
18.	Dr. Shamila Monteiro	Director of fisheries Govt of Goa 0832-2227780/2226838	
19.	R.B. Ghanti	Executive Engineer WD III WRD Ponda	
20.	Meghashkerkar	Supdt. of fisheries	
21.	Malini R. Naik	Asst. surveyor of works. C.P.O. W.R.D. Porvorim Goa	
22.	RAJAN KAMBLE ASW, CPO, WRD	Asst. Surveyor of Works.	
23.	A. G. Bhagwat	Surveyor of works. WRD.	
24.	Neil N. Agshikar	Technical Assistant	

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26	A.S. Gaj	SE ICID. N-Delhi	
27	W.M.S. Anant P. Hoble.	WMS. WRD, WDV. Karjat Tal	
28	Hemant Rane	Porjem – Sattari	
29	Dr. Mohan Cuncolienkar	Sci-C-GSPCB 8390908202	
30	DR. Ulhas G. Sawarkar	Professor and Head in Mining Engg. GEC Farmagudi 9422456117	
31	D. Y. Salekar	Executive Engineer W.R.D. W.D V. Karjat Tal.	
32	JESSICA SEQUEIRA	Sci-C - GSPCB 9158008630	

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34.	Nayana G. Kulkarni	J.E. ACE(I)(P) WRD 9422439542	
35.	Trupti Prakash Gaonkar	J.E W.D VII 9420685485	
36.	Prashant P. Harmalkar	Farmer 9823187566	
37.	Chandrakant R. Naik	Farmer 9168393971	
38.	Mukund B. Sadekar	Tilali Ibrella-Pargal 9421536238	
39.	Dr Purnanand Savoikar	Professor, Goa Engg College Farmagudi 9922732822	
40.	K.M. Kiswanalk	Scientist, CGWB, SUO, Belgaum 9480216468	

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REGISTRATION			
	Name	Designation and contact details	Signature
41.	Dr. J. DAVITHURAJ	Scientist CGWB, SUO Belgaum.	
42	Prof. Prabir Mukhopadhyay	Goa University	
43	Ulhas Pai Kakode	Director of Agril	
44	P.B Akki E.E	Agriculture Dept	
45	P. B. BADAMI EE, WDI WRD – GOA	Addl. C.D GOA	
46	Dr. Vinayak N. Shet	Principal, Goa College of Engineering, Farmagudi, Ponda, Goa-403401 E-mail: vns@gec.ac.in	
47	Prof Kamta Prasad	Chairman IAMED, 2B Institutional Area, Karkardooma, Delhi-110092, kmedy@gmail.com	
48	S.T. Nadkarni	Chief Engineer Water Resources Deptt Govt. of Goa. chiefwrdgoa@rediffmail.com 0832-2413045	

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Name	Designation and contact details	Signature
49 Chetan Pandit	Adviser, Water Resources Department Goverment of Goa 09423174594	

Annexure – C

Review of Goa State Water Policy in the Context of Climate Change
Schedule for Workshop Participants

1. Name and contact details of the respondent:

2. Before being contacted for this Workshop, were you aware of the National Water Policy, 2012?
   Yes No

3. If yes, were you aware of the provisions related to climate change as per National Water Policy-2012?
   Yes No

4. Were you also aware about Goa state having a water policy?
   Yes No

5. Were you aware whether the state policy contained any provision dealing with climate change related issues?
   Yes No

6. Are you aware of recent Goa Ground water Policy announced by Govt. of Goa?
   Yes No

7. What is the extent of awareness and preparedness with respect to impacts of Climate Change related to water resources at local levels (District, Block, Village and Town). Please tick:

	Extent of awareness:			Extent of Preparedness:		
Levels	Adequate	Nil	Not Much	Adequate	Nil	Not Much
District						
Block						
Village						
Town						

8. Please indicate how the water related impacts of climate change will be different in different types of area such as flood prone, drought prone, coastal areas etc. and activities like agriculture, cattle rearing, fishery etc. in your state?

9. Are you aware that domestic water supply schemes in Goa are being initiated at higher ups in river basins where there are no mines?
   Yes No

10. Are Kolhapur type Bandharas better than Vasant type Bandharas?
    Yes No

11. Are you in favor of up-scaling in- land fisheries?
    Yes No

12. Do you find potential sea level rise due to global warming in recent years in Goa?
    Yes No

13. Do you agree that increased water storage in various forms i.e., soil moisture, pond, ground water, small and large dams will help to mitigate the effect of climate change?
    Yes No

14. Do you think that demand management i.e. growing less water intensive crops in drought prone areas in Goa will reduce the effect of climate change?
    Yes No

15. Do you think that the improved water application methods such as use of sprinkler or drip irrigation and / or rescheduling of crop activities will help in mitigation of climate change related impacts?
Yes No

16. Water pricing is a tool for dealing with water scarcity which is expected to increase due to climate change, in view of this, do you think that suitable water pricing will have greater role in future in mitigating the adverse effects of climate change?
    Yes No

17. What are the other appropriate coping strategies that you may suggest for your state?
    1.
    2.
    3.

Annexure – D

Review of Goa State Water Policy in the Context of Climate Change

Schedule for Krishi Vigyan Kendra (KVK) and district agriculture and horticulture officer

Respondent: KVK, DAO, BAO (Please tick)

Location: District:

Name, Designation and contact details:

1. Are you aware about of National Water Policy, 2012?
   Yes No

2. Does your state have state a water policy? If yes, in which year was it announced?
   Yes No

3. If yes, does it contain climate change related issues?
   Yes No Not sure

4. Are you aware that climate change due to global warming is going to pose a serious threat for water resources sector and thereby to agricultural activities?
   Yes No

5. If yes, what mitigation measures are taken by your agency to counter the adverse effect of climate change?
   Yes No

6. Are these measures adequate?
   Yes No

7. Have you developed appropriate crop varieties for adoption by farmers in anticipation of climate change?
   Yes No

8. If yes, what are these varieties?
   1.
   2.
   3.

9. Have you also carried out field demonstration of these varieties on farmers' fields?
   Yes No

10. If yes, what crops have been demonstrated?
    1.
    2.
    3.

11. Did farmers follow the advice given by you?
    Yes No

12. If no, why?

13. Will you suggest for adoption of improved water application methods (drip or sprinkler irrigation) to enhance water use efficiency?

    Yes No

14. What additional measures you think should be taken to minimize the adverse effect of climate change on agriculture?
    1.
    2.
    3.

15. Any other suggestion you would like to give.

Annexure – E

Review of Goa State Water Policy in the Context of Climate Change
Schedule to be canvassed at the level of other departments/ agencies at the District Level

Name of the district: State:
Name and contact details of government department/agency

1. Are you aware of the National Water Policy, 2012?
   Yes No

2. Are you aware of the state water policy?
   Yes No

3. If yes, in which year was it announced?

4. Has it any provision related to climate change?
   Yes No Not sure

5. Have you attended any seminars, workshop, training programmes etc. related to climate change during the past 5 Years?
   Yes No

6. Are you aware that Climate change due to global warming is going to pose a serious threat for water resources sector?
   Yes No

7. If yes, how much of the following are likely to be affected?

Source	Very much	To some extent	No effect	No idea
Surface irrigation				
Groundwater irrigation				
Drinking water, rural				
Drinking water, urban				
Flood Management				
Agriculture				
Fodder				
Fishery				
Horticulture				
Animal Husbandry				
Other (specify)				

8. Has your state/ agency adopted climate change resilient technological option to counter the adverse effects of climate change?

Yes No

9. If yes, what measures are being taken? Are these adequate?

	Measures	Adequate	Not adequate
1.			
2.			
3.			

10. What additional measures should be taken to minimize the effect of climate change in your area?

Annexure – F

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Review of Goa State Water Policy in the Context of Climate Change

Schedule to be canvassed at farmers level

Name of the farmer: Village:

Name of panchayat: Block:

District: State:

1. Are you aware of the National Water Policy, 2012?
   Yes No
2. Are you aware of the state water policy, 2000?
   Yes No
3. I yes, has it any provision related to climate change?
   Yes No Not sure
4. Are you aware that climate change due to global warming is going to pose a serious threat for water resources sector?
   Yes No
5. Do you know that climate change has adverse effect on agriculture and allied activities?
   Yes No
6. If yes, are you aware of coping measures?
   Yes No

7. How much of the following are likely to be affected?

Source	Very much	To some extent	No effect	No idea
Surface irrigation				
Groundwater irrigation				
Drinking water rural				
Drinking water urban				
Flood Management				
Agriculture				
Fishery				
Horticulture				
Others (Specify)				

8. Have you adopted any climate change related coping measures such as storing of water in various forms, re-scheduling of crop activities such as growing crops which need less of water, early/ late sowing of crop to escape water stress etc. to counter the adverse effects of climate change?
   Yes No

9. Are aware of improved water application methods such as drip or sprinkler irrigation:
   Yes No

10. If yes, are you adopting such methods?
    Yes No

11. Have you modified your crop and other activities to overcome the adverse effect of climate change?
    Yes No

12. If yes, what measures are being taken? Are these adequate?
    Measures Adequate Not adequate
    1.
    2.
    3.

13. What additional measures should be taken to minimize the effect of climate change in your area?

Annexure – G

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Review of Goa State Water Policy in the Context of Climate Change

Guide points for discussion with the villagers

a. Awareness about National Water Policy, 2012.
b. Awareness about State Water Policy.
c. Awareness about climate change.
d. Its effect on
    i. Agriculture and allied activities.
    ii. Drinking water.
e. Coping strategy
    i. Agriculture and allied activities
    ii. Drinking water.