



National Water Resources Framework Study

Roadmaps for Reforms

Submitted to the Planning Commission for the 12th Five Year Plan

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CEEW Report

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A report outlining roadmaps for reforms, based on a national water resources framework study for the Planning Commission, Government of India.

This report was prepared by the Council on Energy, Environment and Water with a research team comprising independent experts. The report was commissioned on the request of the Planning Commission of India to the 2030 Water Resources Group.

The views expressed in this report are those of the authors and do not necessarily reflect the views and policies of the Council on Energy, Environment and Water or of the 2030 Water Resources Group.

The Council on Energy, Environment and Water (CEEW) is an independent, not-for-profit, policy research institution. CEEW works to promote dialogue and common understanding on energy, environment and water issues in India, its region and the wider world, through high quality research, partnerships with public and private institutions, and engagement with and outreach to the wider public. For more information, visit <http://www.ceew.in>.

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FOREWORD

For India's economic growth and human development to become sustainable, the holistic management of the nation's water resources is critical. Two underlying trends underscore this imperative. First, looking forward over the next two decades, India's growing demand for water will fall short of available and planned increases in supply by a significant percentage. Secondly, while agriculture is the lifeblood for a large share of our population, trends in urbanisation and industrialisation will put pressure on the sectoral allocation of water. How do we manage these pressures in a fair and equitable way? How can we develop a framework for the sustainable management of India's national water resources? More importantly, how can we put our ideas into practice?

In September 2011, the Council on Energy, Environment and Water submitted a report to the Planning Commission of India titled *National Water Resources Framework Study*. The primary purpose of the report was to find the evidentiary basis for proposing reforms in the water sector. It was also important to answer questions that had direct relevance to policymakers. Through the 2030 Water Resources Group, CEEW had engaged with Dr Mihir Shah, Member, Planning Commission, to write a report that could serve as an input into the deliberations for the 12th Five Year Plan. Based on the *NWRFS* report, the Planning Commission requested detailed roadmaps for reforms to outline a phased approach to reforming institutions for managing and governing India's water resources. This is the resulting document. We are deeply grateful for Dr Shah's guidance during this project.

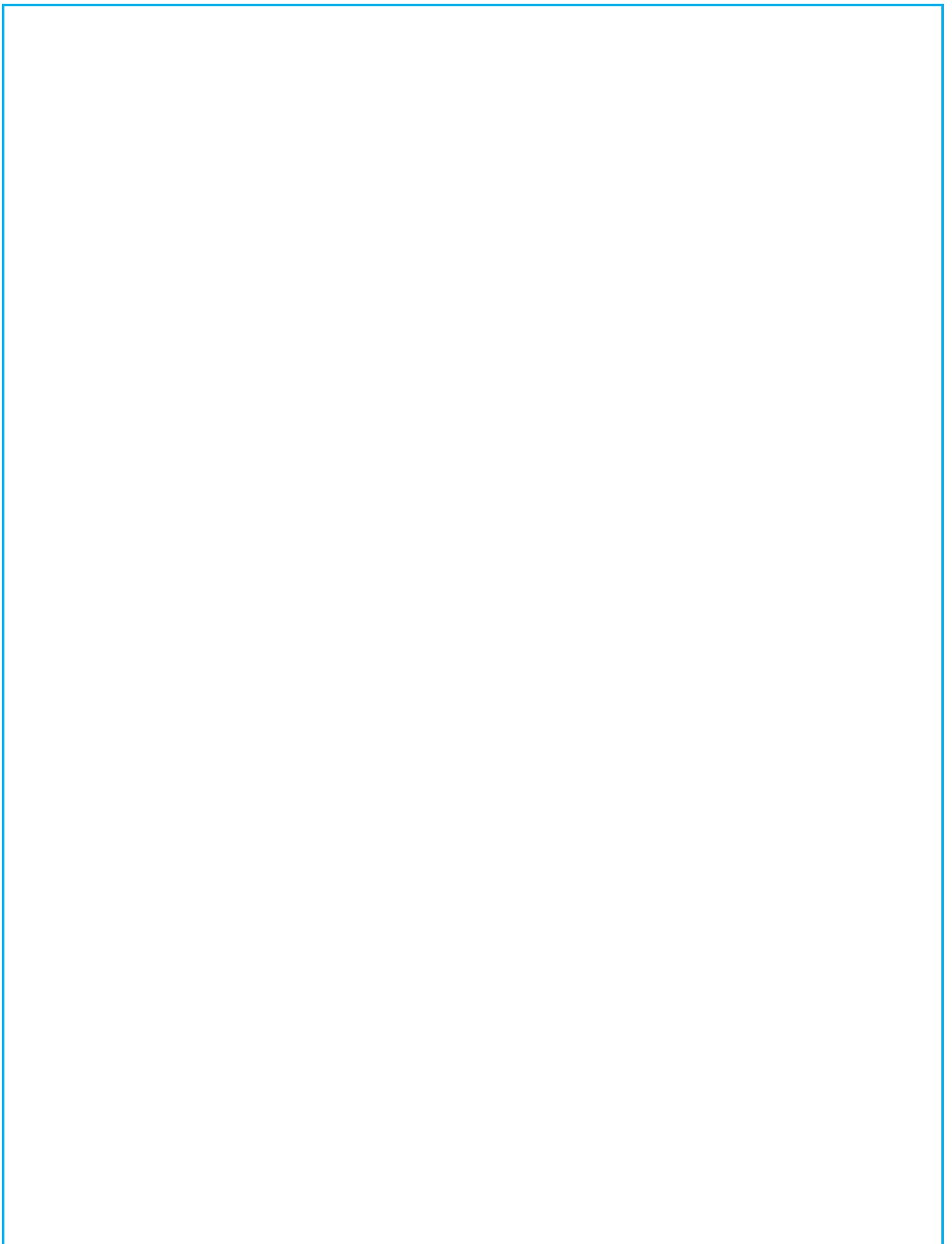
The *Roadmaps for Reforms* report focuses on four key areas. The first roadmap, proposing a national water management reform programme, underscores the importance of a multi-level approach to water management. It covers reforms at the state level for water resources management, main system irrigation management, and on-farm irrigation management. The roadmap on ground water management outlines key elements of reform, such as agricultural feeder separation, rationalised power tariffs, more efficient pump sets, participatory management, and strengthened laws and institutions. The third roadmap on water utility management emphasises principles for water utilities, increased autonomy and accountability, benchmarking combined with performance monitoring, better delegation to the private sector for access to technology, systems and capital, and improved regulatory capacity. The final roadmap on water conservation in industry proposes a detailed classification system for businesses, performance audits, water reclamation strategies, incentives and penalties, and greater public awareness. Each roadmap presents reforms that are needed immediately and over the longer term, at times offering step-by-step action plans.

I congratulate the team comprising senior and independent international and national water experts: Dr Martin Anthony Burton, Mr Simon Gordon-Walker and Mr Rahul Sen. The team's work was led and coordinated by CEEW's CEO, Dr Arunabha Ghosh, who also provided overall sector policy guidance. CEEW thanks the 2030 Water Resources Group for making the resources available to produce this document in a short span of time. I hope that the two reports can trigger nationwide debate – and action – on the sustainable management of our water resources.



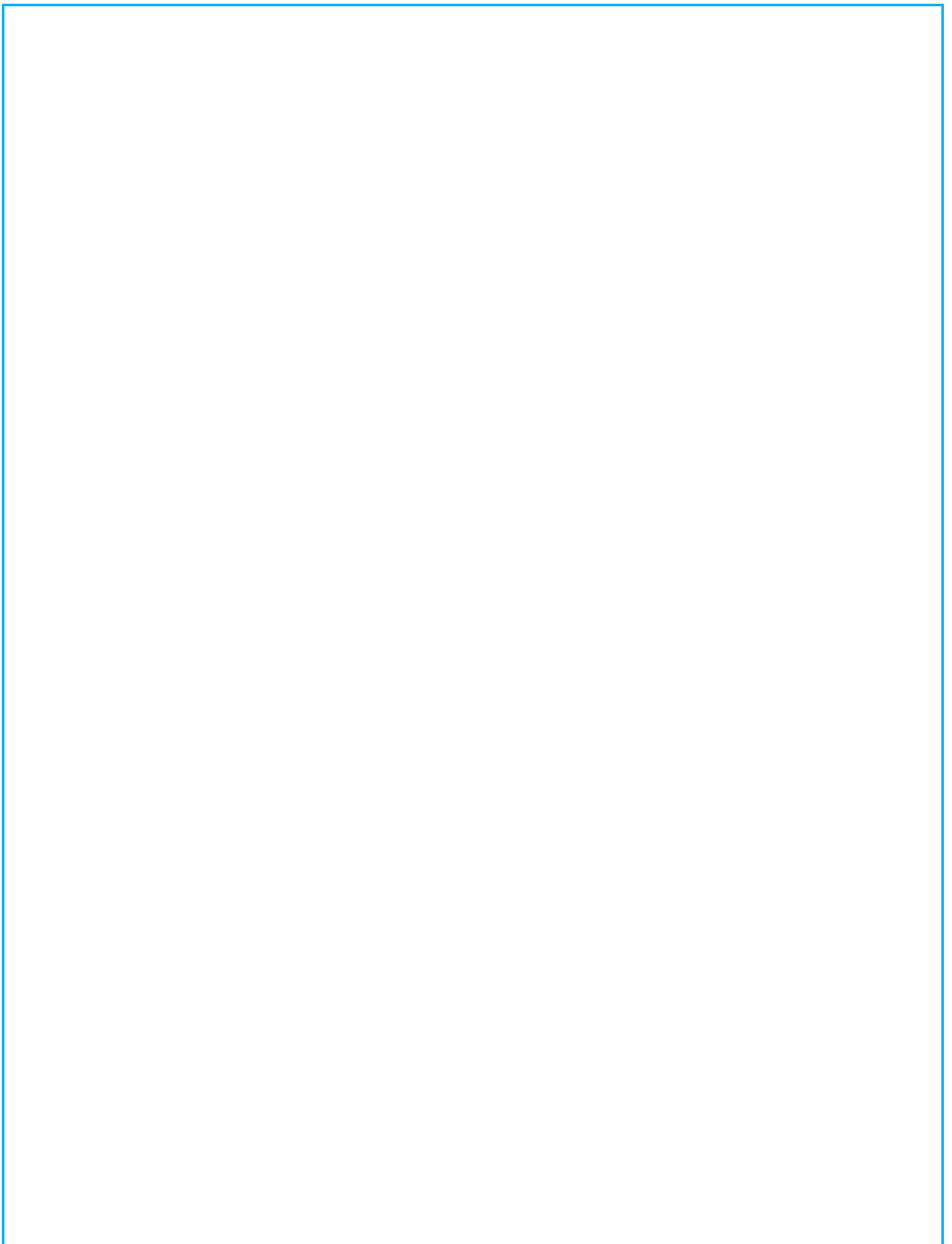
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10 October 2011



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National Water Resources Framework Study

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1. Introduction

This paper provides a detailed roadmap for reform of water management in India. The roadmap covers reform in the areas of water resources (both surface and groundwater), main system irrigation and on-farm¹ irrigation.

The paper is based on studies carried out at the request of the National Planning Commission.² These studies are summarised in a series of working papers as detailed in Appendix A1 which provide the background information, detail and arguments for the proposals set out in this paper.

The paper defines the problems to be addressed with regard to water management in India and then goes on to propose a vision for the future and an associated route to achieving this vision. The proposed route for reform is broken down into individual roadmaps for each component comprising identification of the problem, a concept and programme for reform and an action plan (with a logical framework) for implementation of the reform.

By its nature the reforms outlined will require concerted action in the short, medium and long-term. In this regard the individual roadmaps have been separated into work that can be commenced and completed within the 12th Five Year Plan and work that will take longer to complete.

It is hoped that the proposals detailed in this report can form the basis for a National Water Management Reform Programme (NWMRP) targeted at addressing the growing crisis in the water sector.

2. The National Water Management Reform Programme

2.1. Problem statement

India is fast running out of utilizable water resources. There is considerable room for improving the management and use of the available water supplies in order to close the growing gap between demand and supply. If measures are not put in place soon to close this gap it is anticipated that the level of conflict over water will increase and economic development of the country and individual states will be impaired. With increasing water scarcity the level of service provision to water users, whether in the irrigation, domestic or industrial³ sectors, is likely to deteriorate further unless early mitigation measures are taken.

¹ On-farm relates to the irrigation systems and command area managed by water users associations and farmers, namely minor and distributary canals and watercourses.

² The National Water Resources Framework Study was carried out under the rubric of the 2030 Water Resources Group (WRG), a coalition of international organisations, civil society organisations and private sector entities. The emphasis of the WRG is to develop an integrated factbase on the potential levers and costs for reducing water scarcity across all sectors. The NWRF Study focused on a detailed analysis of the institutional, legal, regulatory and capacity deficiencies in water-related sectors in India. The study covered large scale irrigation, groundwater management, river basin and water resources management, urban and industrial water supply and conservation, regulatory and legal reforms, and the role of a possible National Water Commission.

³ The Planning Commission foresees the need for industry to create 3-4 million additional jobs for a growing urban population, yet in many states water supply for industry is being constrained.

There is a failure of management of water at all levels, often because the focus has been on construction rather than management as the solution to water scarcity. Water resources management at the river basin, sub-basin and catchment levels is dominated by irrigation, with insufficient coordinated management of the surface and groundwater resources to ensure fair access for all uses and users.

In the irrigation sector there is waste of water which could be used more productively elsewhere.⁴ This waste occurs at the main system level in a failure to plan and manage systems for conjunctive use of surface and groundwater, and an inability to measure and quantify water delivery to accurately match irrigation demands. At the on-farm level water users associations are failing to schedule irrigation water and maintain the systems to provide reliable, timely and adequate water supplies to farmers. Farmers in their turn are using flood irrigation where other more efficient irrigation methods would be more applicable, and giving excessive application of irrigation to their crops. Though generally more efficient and productive than surface water, groundwater is being mined and groundwater levels are falling year-on-year due to a failure to manage the renewable and abstracted volumes in the aquifers.

In the domestic water supply sector few communities have a 24/7 water supply, rotation and rationing of supplies is the norm. Water is being lost in transmission, and through unauthorised abstraction. In the industrial sector water supplies are limited and polluted wastewater from industry is posing an increasing risk, both to the natural water environment and to the potential for reuse downstream.

In all sectors there are problems with the setting, recovery and use of water charges. In the irrigation sector the level of the water charge is often inadequate to cover the required expenditure on system management, operation and, in particular, maintenance. This low level is compounded by costly and out-of-date assessment and collection methods and by poor levels of fee recovery, often only 20-30 per cent of the assessed amount. As a result there are insufficient funds for maintenance; systems deteriorate, service delivery worsens and water users see little point in paying a service fee for a water supply that does not match their needs.

2.2. Vision

The nation's water resources will be properly managed at all levels for the benefit of all uses and users. Water resources allocation will be fair and transparent, with water users participating in the decision-making processes. Irrigation, the largest user of the available water resources, will be efficient and productive in its use of water, thereby releasing water for other productive uses in river basins. Water resources planning and management will be carried out by a cadre of water resources specialists supported by the latest technology including remote sensing, computer modelling, GIS and modern communication systems.

⁴ The "Water Footprint Assessment" methodology might be an important tool to measure the complete water use in a product across all steps in the supply chain. Moreover, this approach can help not only to calculate water use, but also assess the sustainability and risk of such use and the strategic responses necessary to mitigate the risks. See www.waterfootprint.org.

Though the proportion of water available for domestic and industrial use will increase, water distribution efficiency will be high and transmission losses minimised. In industry water use will be closely monitored, with on-site recycling of water and wastewater discharges to water bodies within stated norms.

The water environment, both surface and groundwater, will be protected from pollution and managed to protect the natural ecosystems.

In all cases service fees collected from users will cover the full economic cost of the service provision. Where appropriate, taxes will be levied by government on water utilities and/or water users to cover the operation costs of water resources management.

Water management will be based on the principles of *partnership, service delivery, transparency and accountability, and sustainability*, with users demanding good levels of service and willing to pay the service fees required to provide such service.

2.3. Reforms required

To achieve the vision the following reforms are required in the water resources, main system and on-farm irrigation sectors:

- | | |
|-----------------------------------|---|
| Water resources | <ul style="list-style-type: none">• Separate water resources management from irrigation;• Create a Water Resources Department which is focussed on water resources management for all uses and users equally;• Planning and management of water resources for all uses and users, based on hydraulic boundaries (river basins, sub-basins, catchments, groundwater aquifers)• Increase participation in decision-making by non-governmental organisations and civil society. |
| Main system irrigation management | <ul style="list-style-type: none">• Irrigation Department (ID) focussed on management rather than construction;• ID transformed into a service delivery organisation, viewing farmers as clients rather than beneficiaries;• ID working in partnership with Water Users Associations (WUAs);• ID focussed on performance management for increased agricultural production and productivity of water use. |
| On-farm irrigation management | <ul style="list-style-type: none">• Participatory Irrigation Management (PIM) transformed into Irrigation Management Transfer (IMT);• PIM Acts redrafted to reflect the move towards IMT;• WUAs discussing and agreeing their own charter;• WUAs setting, collecting and utilising irrigation service fees;• Separate roles for WUA governance and management; |

- WUAs appointing their own Secretary (not an ID Engineer);
- WUAs employing paid staff to manage water distribution and system maintenance.

2.4. Strategy and components

The strategy to achieve the vision comprises the following components:

- Improved water resources management at the state and river basin levels, taking account of environmental needs;
- Improved management and use of surface and groundwater resources at the irrigation scheme level, with attention focussed on management of the main system and management at the on-farm level;
- Improved management and control of groundwater resources⁵.

The fundamental element of the strategy is institutional reform which seeks to rationalise and modernise the approach to management of water, at all levels. In many river basins, sub-basins and states the utilisable water resources have been fully developed. River basins are closing, or have closed⁶, leaving few opportunities for creation of additional water supplies, with the result that the already developed resources have to be more efficiently and productively used, and therefore better managed.

The proposed institutional reforms seek to achieve a number of objectives: (i) to change the legal and institutional framework so as to provide an enabling environment that facilitates better management; (ii) to change attitudes and mindsets from a focus on construction to a focus on management; (iii) to broaden the focus on water resources planning, management and development to a process which covers all uses and users of water, not just irrigation; (iv) to move towards performance-based management in which key deliverables are identified, measured and delivered for all water systems.

It is recognised that institutional reform takes time and that a step-by-step approach is required if the proposed reforms are to be accepted and adopted. For this reason the reforms and actions for each component are divided into actions for the short, medium and long term.

It is proposed that a National Water Commission be created to provide for over-arching monitoring and management of the water management reform programme. This Commission will have the responsibility of monitoring each state's progress towards the required objectives and providing advice and guidance where required to keep the programme on track. A detailed description of the NWC's role and functions is available in Working Paper 13 of the National Water Resources Framework Study Report.

⁵ The roadmap for groundwater is provided in a separate paper.

⁶ A closed river basin is one in which all the utilisable water resources have been developed and allocated.

2.5. Actions required to achieve the strategy

To achieve the strategy a variety of activities are proposed in relation to water resources management, main system management and on-farm management as summarised in Table 1 and detailed in the following sections.

Table 1: Summary of National Water Management Reform Programme components, purpose, actions, outcomes, indicators and inputs

Component	Purpose	Action	Outcomes/Indicators	Inputs
Water resources management	Strengthen water resources management in each state	<ul style="list-style-type: none"> • Raise awareness and gain consensus on water resources management (WRM) amongst politicians and senior civil servants • Form State Water Councils (SWCs) • Form an adequately resourced water resources management wing in the Irrigation Department (ID) as interim measure. • Form River Basin Councils (RBCs) in each state and prepare River or Sub-Basin Plans • Prepare new legislation (Water Resources Act) • Implement the reforms as set out in the Water Resources Act. 	<ul style="list-style-type: none"> • Awareness raised and consensus reached on approach to water resources management • State Water Councils formed and constituted • WRD formed and functioning • RBCs formed and functioning, River Basin Plans produced. • State Water Resources Management Plans produced. • Water Resources Act drafted, discussed and enacted 	<ul style="list-style-type: none"> • Workshops organised by Planning Commission • Government Order to form SWC issued • New staff appointed and trained for water resources branch in the ID • Technical assistance provided for WRM • Technical assistance to form RBCs • Technical assistance (legal) in drafting Water Resources Act
Main system irrigation management	Enhance scheme and main system performance	<ul style="list-style-type: none"> • Form management wing within the ID with specified remit to enhance performance of built irrigation schemes • Sign service agreements with WUAs • Prepare scheme water management plans • Apply modern technologies in water management and maintenance • Establish discharge measurement network and collect service fees based on volume delivered • Prepare asset management plans for each system • Establish value of lost production due to inadequate maintenance and poor service delivery • Establish procedures for performance assessment and benchmarking 	<ul style="list-style-type: none"> • Management wing formed in ID and functions defined • Number of service agreements signed • Number of water management plans prepared • Discharges being measured and WUAs invoiced on basis of volume delivered • Number of asset management plans prepared and in use • Reports on value of lost production • Performance indicators defined, data collected, processed, analysed and report produced • Measurable change (improvement) in individual scheme performance over time 	<ul style="list-style-type: none"> • Training on: <ul style="list-style-type: none"> ○ establishing service agreements ○ water management plans ○ asset management plans ○ performance assessment processes and procedures, and benchmarking • Equipment and software (computers; remote sensing, GIS, MIS, etc. software) • Training in use and application of modern technologies. • Guidelines and participatory management tools for benchmarking scheme performance • Technical advisors
On-farm irrigation management	Formation of active and effective WUAs managing on-farm operation and maintenance	<ul style="list-style-type: none"> • Raise awareness of IMT within ID and gain consensus and support on way forward • Revised PIM/IMT legislation • Assist WUAs in preparing their Charters • Establish WUA Regulatory Authority (RA) • Strengthen WALMIs and train staff in IMT, water management and maintenance • Establish and train WUA Support Units (SUs) at Circle/District level in ID • Form and train WUA support team at Sub-Divisional level 	<ul style="list-style-type: none"> • Awareness raised and agreement reached on support for IMT and WUAs • Revised Act enacted • WUA RA formed and functioning • Number of WALMIs strengthened and trained • Number of WUA SUs formed • Number of WUA SU staff trained and active • Number of WUA support teams formed • Number of effective and functioning 	<ul style="list-style-type: none"> • Technical advisors (WUA formation and support, sociologists, water management) • Training for WALMI staff. • Technical assistance on revisions to the PIM Act, preparation of Charters, WUA Regulatory Authority • Staff for WUA Support Units • Staff for WUA support teams at Sub-Divisional level

		<ul style="list-style-type: none"> • Carry out awareness campaign with water users and re-engage with PIM/IMT • Establish chak-based representative system • Budgeting, fee setting and fee collection by WUAs • Establish procedures for progress and performance monitoring by WUAs • Implement improved water management procedures • Prepare and implement maintenance and asset management plans 	<p>WUAs that are:</p> <ul style="list-style-type: none"> ○ Setting budgets and fees ○ Collecting fees ○ Employing O&M staff ○ Identifying, costing and addressing maintenance needs ○ Assessing progress and performance ○ Implementing improved water management plans and procedures 	
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3. Component 1: Water resources management

3.1. Problem statement

Abstraction of water from surface and groundwater sources in river basins and aquifers across a number of states in India has exceeded or is nearing renewable limits. Water scarcity is common, and conflict over the allocation and use of water resources between sectors is growing. There is increasing demand for water for domestic and industrial use, and pressure on the irrigation sector to give up water for these other uses, including allowances for environmental flows.

As the level of water scarcity grows so too does the need for more holistic and integrated management of the resource. With growing urban populations⁷ working in the industrial and support services sectors it is no longer appropriate for one sector (irrigation) to dominate the discourse on water resources development and use.

3.2. Concept

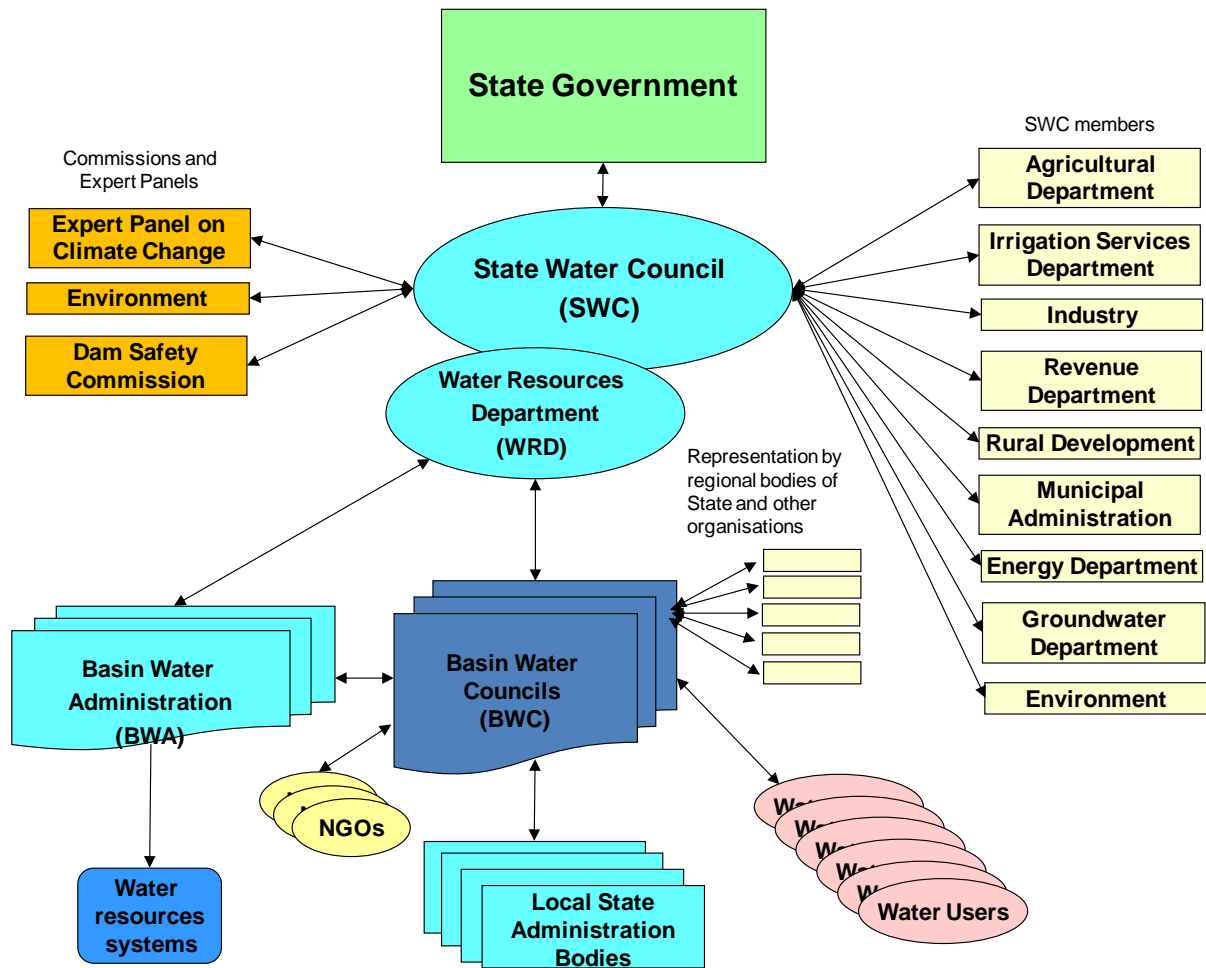
There is a need to separate the water resources development and management functions from the service delivery functions and to build capacity in water resources management. As the historically dominant institution in the water resources sector the Irrigation Department (ID) needs to reform and restructure itself into two separate entities – the Water Resources Department (WRD) and the Irrigation Service Department (ISD).

As outlined and discussed in Working Paper 6 (Water Resources Management), a new framework for water resources management is proposed whereby responsibility for water resources management will be a state function based on river basin planning and management principles. As outlined in Figure 1 it is proposed that each state establishes a State Water Council⁸ responsible for policy formulation and decision-making with an executive, the Water Resources Department (WRD), responsible for day-to-day water resources planning and management. The State Water Council (SWC) would comprise representatives from the key stakeholders involved with the water sector, including government, civil society and water users. The WRD would be responsible for establishing River Basin Councils (RBCs) on river basins, sub-basins (tributaries) or parts of river basins lying within the State boundaries, and would assist the RBCs with the preparation of River Basin Plans and liaison with neighbouring states' RBCs on the same river systems. Sub-offices of the WRD, termed Basin Water Administration (BWA) offices would act as the secretariat to the RBCs, and would also carry out the required functions of the WRD at the basin or sub-basin level. The RBCs would comprise basin level representatives of the key stakeholders involved in the water sector, including local government, civil society and water users.

⁷ It is anticipated that by 2030 40 percent of the population will be living in urban centres, increasing to between 48-60 percent by 2050.

⁸ Many states already have such a body. In Madhya Pradesh it is termed the State Water Utilization Committee, in Andhra Pradesh the Water Management Committee and in Maharashtra the State Water Council.

Figure 1: Proposed organisational framework for water resources management in each State



The WRD would be the professional body responsible for water resources planning and management within each State. The main functions of the WRD would include: assisting and coordinating RBCs in the preparation of River Basin Plans; collecting and maintaining records of river and stream flows, water abstractions and wastewater disposal into water bodies; determining of available water resources, including probability analysis; issuing of licenses for water abstraction⁹ and wastewater disposal; monitoring quantity and quality of river flows, water abstractions and wastewater disposal; maintaining registers of water use, wastewater discharge and hydraulic infrastructure; establishing and maintaining water resources information systems.

The WRD would be staffed with water resources professionals, including: water resources engineers; environmental scientists and engineers; hydrologists; hydrogeologists; civil engineers; IT specialists; remote sensing and GIS specialists; and water resources modellers.

⁹ Licenses (entitlements) would be issued for a fixed term and would be determined based on the dependable supply level of the water source. Licenses would be subject to certain conditions of use, including terms of use during drought periods.

To facilitate the proposed water resources management framework a Water Resources Act, separate from the current Irrigation Act, will be required in each state. The Water Resources Act will cover the use, protection and development of water resources to provide guaranteed, adequate and safe water for the population, protection of the environment and rational development of the water resources within or allocated to the state. To satisfy these objectives the Water Resources Act will: (i) establish principles for the development, use and management of water resources; (ii) define the competencies of government and other bodies in water resources planning, development and use; (iii) set in place the procedures to be followed for preparing a water policy, strategy and plan for the state; (iv) define the uses of surface and groundwater resources and how these will be regulated; (v) define procedures for licensing and charging for water use and wastewater disposal; (vi) define measures for the protection of water resources from pollution and depletion; (vii) define procedures for planning and management of emergency situations, such as floods and droughts; (viii) detail procedures and penalties for violations of the law; (ix) detail obligations and procedures for working with other states and national government on water resources.

3.3. Programme of proposed reforms

The proposed programme of reforms is divided into reforms for the 12th Five Year Plan and reforms over the longer term (Table 2). The programme foresees the establishment of separate branches for water resources management, irrigation management and irrigation development within the Irrigation Department, followed in due course by separation of the Water Resources Department from the Irrigation Department once the Water Resources Act is enacted.

Table 2: Proposed 12th Five Year Plan and longer term reforms in water resources management

Reforms to be included in the 12th Five Year Plan	Reforms to be initiated in the longer term
<ul style="list-style-type: none"> • Initiation of the National Water Management Reform Programme (NWMRP); • Separation of the Irrigation Department in participating states into three branches: (i) Water Resources Branch (WRB); (ii) Irrigation Services Branch (ISB); and (iii) Irrigation Development Branch (IDB); • Formation of State Water Councils, with the WRB as the secretariat with designated responsibility for water resources management in the state; • Capacity building of the WRB through recruitment and training; • Formation of River Basin Councils and preparation of River Basin Plans; • Drafting and consultation on a Water Resources Act and allied revisions to the Irrigation Act; • Support for education and training establishments to build capacity in the water resources sector; • Enactment of Water Resources Act and revisions to Irrigation Act. 	<ul style="list-style-type: none"> • Separation of the WRB from the Irrigation Department to become the Water Resources Department (WRD); • Implementation of the Act – licensing water abstractions and wastewater disposal, planning and management, monitoring, regulation, etc.

3.4. Logical framework

The logical framework for the proposed programme of reform in the water resources sector is presented in Table 3.

Table 3: Logical Framework for water resources management reform

	Indicators	Verification	Assumptions
<p>Goal Sustainable water resources management</p>	<ul style="list-style-type: none"> • Abstractions for surface and groundwater in balance with renewable water resources. • Pollution levels in rivers within specified standards. • Natural ecology of water bodies protected and flourishing • Developed water resources efficiently and productively used. 	<ul style="list-style-type: none"> • Annual reports by WRB. • Annual reports by Environment Department. • Annual reports by government departments (ID, Agricultural Dept.) • Reports by universities, research institutes and non-governmental organisations. 	
<p>Purpose To create an institutional and organisational framework capable of handling the challenges facing the water resources sector in India in the 21st Century.</p>	<ul style="list-style-type: none"> • Water resources being managed (plans prepared, water resources quantified, allocations made, abstractions regulated, etc.). • Conflicts over water reduced. • River quality improving. • Groundwater levels stabilised. 	<ul style="list-style-type: none"> • Annual reports by WRB/WRD. • Annual reports by Environment Department. • Government reports 	<ul style="list-style-type: none"> • Politicians support the process. • WRB/WRD performs to an acceptable level. • Civil society accepts the reforms and regulations.
<p>Outputs/Results</p> <ul style="list-style-type: none"> • NWMRP initiated and states participating. • Functioning water resources management (WRM) entities. • River basin and water resource management plans prepared. • Water resources legislation drafted, consulted on and enacted. • River basin and water resources management plans implemented. • Strengthened WRM education and training establishments 	<ul style="list-style-type: none"> • NWMRP guidelines issued. • Number of states participating. • Number of State Water Councils formed. • Number of Water Resources Branches formed. • Number of River Basin Councils formed. • Number and profession of new WRB staff employed. • Number of detailed River Basin Plans prepared. • Number of State Water Resources Management Plans prepared. • Number of State Water Resources Acts drafted. • Number of State Water Resources Acts enacted. • Number of WRM graduates employed in WRB/WRD 	<ul style="list-style-type: none"> • Planning Commission reports • NWC reports • WRB/WRD annual reports 	<ul style="list-style-type: none"> • Individual States see the benefits of participating in the NWMRP. • Politicians support/ do not block the reforms. • ID actively supports the reforms. • Adequate funds and resources committed to the process.

3.5. Action Plan

The action plan is based on the implementation schedule set out in Figure 2. The starting point is the participation of individual states in the NWMRP. Incentives may be offered by the programme to encourage early registration on the programme. Once a State has signed up they will be required to follow the programme set out below and in Figure 2:

- i) *Form the State Water Council.* The State Water Council (SWC) will be established by the state government. The Council should comprise both government and non-government organisations, including representatives of water users.
- ii) *Separate the Irrigation Department into three branches.* Following the formation of the SWC the Irrigation Department will restructure itself into three branches: (a) the Water Resources Branch (WRB); (b) the Irrigation Service Branch (ISB); and (c) the Irrigation Development Branch (IDB). The WRB will be responsible for water resources management, the ISB will be responsible for management of irrigation systems and the IDB will be responsible for further development of the irrigated area in the state. Under this structure both the ISB and the IDB will refer to the WRB for clearance on the availability of bulk water supplies for irrigation schemes.
- iii) *Prepare proposals for staffing and resourcing of the Water Resources Branch.* A core team within the newly formed WRB will be responsible for preparing a work plan for the WRB and assessing the human, financial and other resources required to carry out the WRB's prescribed functions. A report containing these proposals will be submitted to the SWC and to the National Water Commission (NWC).
- iv) *Agree funds for establishing the WRB.* The SWC will review the proposals made for resourcing the WRB and will submit a proposal for funding to the Planning Commission. If the proposals comply with the established criteria funds will then be provided through the National Water Management Reform Programme (NWMRP).
- v) *Recruit and train WRB staff.* Following agreement to the resourcing plan the WRB will recruit staff to implement its work plan. Professional staff will include water resource specialists, hydrologists, hydrogeologists, civil engineers, IT specialists, water resources modellers and social scientists. Technical and administrative staff will also be recruited. Whilst the main work of the WRB will be technical the branch will employ social scientists to work in river basins helping to form functioning River Basin Councils.
- vi) *Determine the state's water resources profile.* The initial work of the WRB will be to prepare a comprehensive profile of the state's water resources, covering both surface and groundwater. This will require the collection, processing and analysis of data for surface and groundwater, with the analysis providing information on dependable flows and abstractions from surface and groundwater resources. The work will also identify the current and future uses and users of water resources, and will begin the compilation of a comprehensive database for all uses and users.
- vii) *Form River Basin Councils.* The WRB will be responsible for initiating and establishing River Basin Councils under direction from the SWC. River basin and aquifer boundaries¹⁰ will be established and councils then formed from government and non-government organisations and representatives in these river basins.

¹⁰ For example in Madhya Pradesh there are ten river basins, of which nine are tributaries to inter-state rivers. In this case ten River Basin Councils will be formed, with responsibility for water resources management within

- viii) *Prepare River Basin Plans.* The main purpose of the RBCs is for stakeholders to work together on the planning and management of the water resources in their river basins or sub-basins. A fundamental component of this process is the preparation of a River Basin Plan for each basin or sub-basin. These plans will be prepared with the assistance of the WRB, both through the head office and through its basin offices, the Basin Water Administration (BWA). Once completed the River Basin Plan will be submitted to the WRB and the SWC.
- ix) *Prepare the State Water Resources Management Plan.* Based on the River Basin Plans the WRB will prepare a State Water Resources Management Plan providing a comprehensive account of the water resources in the state, together with its current and anticipated future use.
- x) *Prepare and consult on a draft Water Resources Act.* The WRB will draft and submit to the SWC a draft Water Resources Act. The SWC will consult on the draft and submit a proposal to the state government.
- xi) *Enact the Water Resources Act.* The state government will consult on and discuss the draft Water Resources Act submitted by the SWC and legislate on it.
- xii) *Form the Water Resources Department.* The Water Resources Act will legislate for the formation of a water resources planning and management unit separate from the Irrigation Department. Once the Act has been passed the Water Resources Department can be formed from the Water Resources Branch.
- xiii) *Implement River Basin Plans.* Following the approval by the SWC of the River Basin Plans the WRD and BWA offices will implement the plans, under the supervision of the River Basin Councils and the State Water Councils.
- xiv) *Implement the State Water Resources Management Plan.* Following the approval by the SWC of the State Water Resources Management Plan the WRD will implement the plan, under the supervision of the State Water Council.
- xv) *Strengthening water resources management in universities and training establishments.* To support the WRM programme more water resources graduates and specialists will be required. Selected universities and training establishments will be provided with funds to strengthen and develop courses in water resources management. These funds will be used to support capacity building of academics (such as through secondments to internationally renowned WRM institutes) and development of course curricula.

the State boundaries. The RBCs on inter-state rivers or tributaries of inter-state tributaries will be required to liaise with the RBCs in neighbouring states.

Figure 2: Water resources management reform implementation schedule

Activity	Five Year Plan Year	12th Five Year Plan					13th Five Year Plan					14th Five Year Plan				
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Component 1: Initiation and signing up to the NWMRP																
Initiate the National Water Management Reform Programme																
Gain agreement by states to participate in the NWMRP																
Component 2: Formation and strengthening of water resources management bodies																
Form State Water Councils																
Separate the ID into three branches - WRB, ISB, IDB																
Prepare proposal for staffing and resourcing WRB																
Agree funds for establishment of WRB																
Recruit and train water resources professionals for WRB																
Determine state's water resource's profile (supply and demand)																
Form River Basin Councils																
Strengthen universities and training institutes in WRM																
Component 3: Preparation of plans and legislation																
Prepare River Basin Plans																
Prepare State Water Resources Management Plan																
Prepare draft Water Resources Act																
Consult on draft Water Resources Act																
Component 4: Implement plans and legislation																
Enact Water Resources Act																
Form Water Resources Department																
Implement River Basin Plans																
Implement State Water Resources Management Plan																

4. Component 2: Main system irrigation management

4.1. Problem statement

With the growing water scarcity in many states there is an increasing need and interest in better management of water, at all levels. With over 70-80 per cent of the water abstracted in most States being used for irrigation, improvement in the management of irrigation systems is high on the agenda for action.

Reforms are underway in many states to increase the participation by water users in the management, operation and maintenance (MOM) of irrigation systems at the on-farm level with a view to improving the efficiency and productivity of water use. Allied to this is the need to reform and modernise the Irrigation Department in order that the main system water allocation and delivery matches the farmers' and crop needs, thereby leading to improved water use efficiency and productivity in the irrigation scheme as a whole. *Working in partnership, service delivery, transparency and accountability and sustainability* should be at the centre of the reformed approach to irrigation management within the Department.

With more efficient and productive water use in the irrigation sector abstractions of water can be reduced and utilized for other purposes, including domestic and industrial water supply, and the environment.

4.2. Concept

In order to achieve improvements in agricultural production and water use productivity it is proposed that under the National Water Management Reform Programme the Irrigation Department adopt a performance-based management approach.¹¹ This approach incorporates the following elements: (i) definition of service delivery for individual schemes and signing of service delivery contracts with water users; (ii) use of modern technologies for system management, operation and maintenance, including remote sensing, GIS, computer modelling and computerised databases; (iii) measurement, accounting and charging for water deliveries to water users; (iv) preparation of water management plans for individual schemes taking account of the conjunctive use of surface and ground water; (v) water auditing and performance assessment for individual schemes, including benchmarking; (vi) use of asset management planning techniques for sustainable system repair and maintenance; (vii) quantification of the lost production on individual irrigation schemes associated with below optimum levels of system maintenance.

Whilst strictly speaking the ID manager is only responsible for the water delivery in the main system, the decisions he makes in relation to water availability, authorisation of cropping patterns, irrigation scheduling, conjunctive use of surface and groundwater and system maintenance have a marked impact on the performance of irrigated agriculture in the scheme¹² as a whole. Working in partnership with water users the ID manager will be able to

¹¹ Background information and further details are provided in Working Paper 3 – Reforming Management in the Irrigation and Drainage Sector, and Working Paper 4 – Performance Management in the I&D Sector.

¹² The irrigation and drainage “system” is defined as comprising the irrigation or drainage canal network whilst the irrigation “scheme” comprises all components, including canal and drain network, fields, villages, roads, etc.

measurably improve agricultural production and water use efficiency and productivity¹³ for individual schemes, thereby contributing to the core objectives of the NWMRP.

4.3. Programme of proposed reforms

The proposed programme of reforms is divided into reforms for the 12th Five Year Plan and reforms over the longer term (Table 4).

Table 4: Proposed 12th Five Year Plan and longer term reforms in water resources management

Reforms to be included in the 12th Five Year Plan	Reforms to be initiated in the longer term
<ul style="list-style-type: none"> • Initiation of the National Water Management Reform Programme (NWMRP); • Separation of the Irrigation Department in participating states into three branches: (i) Water Resources Branch (WRB); (ii) Irrigation Services Branch (ISB); and (iii) Irrigation Development Branch (IDB); • Initiation of service delivery agreements on irrigation schemes; • Application of modern technologies for irrigation management (remote sensing, GIS, computer modelling, etc.); • Volumetric flow measurement and water charging; • Use of asset management planning for sustainable system maintenance and service provision; • Performance assessment and benchmarking. 	<ul style="list-style-type: none"> • Expansion of the programme to other states.

¹³ More “crop per drop”

4.4. Logical framework

The logical framework for the proposed programme of main system reform is presented in Table 5.

Table 5: Logical Framework for main system management reform

	Indicators	Verification	Assumption
Goal Improved and sustainable agricultural production and water productivity on irrigation schemes	<ul style="list-style-type: none"> • Crop yields and water use productivity at optimal levels, with little variation between similar types of scheme 	<ul style="list-style-type: none"> • Annual reports by ID and Agricultural Department 	
Purpose (i) To increase agricultural production and water productivity on ID managed irrigation schemes; and (ii) To quantify and provide justification for investment in maintenance, repair and capital replacement on irrigation systems.	<ul style="list-style-type: none"> • Crop yields and production increased over baseline. • Water productivity increased over baseline. • Expenditure on system maintenance in line with asset management plans. • Performance gap between better and less-well performing schemes reduced. 	<ul style="list-style-type: none"> • Annual reports by ID and Agricultural Department. 	<ul style="list-style-type: none"> • Politicians support/accept increases in service fees or provide additional funds for maintenance.
Outputs/Results <ul style="list-style-type: none"> • NWMRP initiated and states participating in main system management reform. • Irrigation management separate from construction • Service agreements in place and being adhered to. • Water management plans in place and being followed. • Modern technologies being applied to the management, operation and maintenance of irrigation schemes. • Service fees collected based on delivery of measured volumes of water. • Asset management plans prepared and in use. • Levels of lost production established and contributing to the setting of service fee levels. • Performance of schemes measured and benchmarked. 	<ul style="list-style-type: none"> • Number of states participating in the NWMRP. • New management-focused staff employed by the Irrigation Services Branch • Number of participating schemes. • Number of signed service agreements. • Number of water management plans prepared and in use. • Evidence of application of modern technologies (e.g. use of remote sensing for measuring crop areas). • Volumes delivered and fees recovered. • Number of asset management plans being used to set service fees. • Number of schemes where levels of lost production identified. • Number of schemes where performance has been measured and benchmarked. 	<ul style="list-style-type: none"> • Signed agreement by states to participate. • List of participating schemes. • Annual reports by ID. • Activity reports – water management plans, asset management plans, benchmarking reports, etc. • ID flow measurement and fee recovery records. 	<ul style="list-style-type: none"> • Water users cooperate in wanting to improve system performance. • Service fees increased in accordance with asset management plans. • Information provided by performance assessment and benchmarking acted on.

4.5. Action Plan

The action plan is based on the implementation schedule set out in Figure 3. Each part of the action plan seeks to contribute to improvement in the performance of individual irrigation schemes:

- i) *State agreement to participate in main system management reform programme.* The initial step is for states to register with the NWMRP for improving the management at the main system level.
- ii) *Separate irrigation management from construction.* The Irrigation Services Branch (ISB) within the Irrigation Department will be constituted to focus on the management, operation and maintenance of irrigation and drainage systems. The ISB will employ a cadre of management-focussed staff, including irrigation and agricultural engineers and social scientists (to work with WUAs).
- iii) *Decide on schemes to participate in NWMRP for improved scheme performance.* The ID will draw up a shortlist of possible schemes for inclusion in the programme.
- iv) *Agreement from ID and WUAs to carry out performance-based management.* The ID will discuss the programme with WUAs in the selected schemes and gain their agreement to the programme. Only schemes having support from WUAs will be included in the programme.
- v) *Define service delivery and sign service agreements for individual schemes.* The ID and WUAs will jointly identify service delivery criteria and standards and sign a service contract.
- vi) *Prepare water management plans for individual schemes.* Water management plans will be prepared for individual schemes. Though based on the existing water management procedures these water management plans will seek to modernise water allocation and distribution procedures by incorporating measures for conjunctive use of surface and groundwater, improved irrigation scheduling and water distribution arising from command area development and discharge measurement.
- vii) *Application of modern technologies for water management.* The use of modern technologies to support improved irrigation management will be initiated, including: the use of remote sensing for measurement of crop areas; computer based scheduling, data processing and analysis; GIS for recording and displaying system layouts, infrastructure inventories, WUA commands, crop types and areas, etc.; databases for maintenance management.
- viii) *Make assessment, design and install measuring facilities.* There is a need to intensify the degree of measurement carried out in irrigation systems, both to improve management and to quantify the water used. Assessments will be carried out to determine appropriate locations for installing discharge measurement structures. Particularly important locations will be at the handover point of irrigation water from the ID to WUAs, such as at the head of distributary and minor canals.
- ix) *Measure, account and charge for water on volumetric basis.* Steps will be taken to measure, account and charge for water on a volumetric basis at the hand over point from the ID to WUAs. Below this point it will be the responsibility of the WUA to charge water users for the water delivered. This will obviate the need

for the ID to measure the crop area within the WUA command area, and will enable both parties (ID and WUA) to quantify how much water is being delivered. The volume and timing of water delivered over the crop season will form an important part of the service agreement between the ID and WUAs.

- x) *Carry out asset surveys, prepare and implement asset management plans.* Adequate maintenance is a fundamental requirement for proper system operation. Asset management planning (AMP) provides a systematic procedure for assessing the maintenance, repair and capital replacement needs for an irrigation system over a 10-15 year time frame. The process also looks at the performance of the system for different levels of maintenance investment, the level of service required by water users and their ability and willingness to pay. Asset management plans will be prepared for irrigation systems and agreement reached with water users on the level of service to be provided and the service fees to be paid.
- xi) *Determine lost production related to inadequate levels of maintenance.* Inadequate levels of maintenance results in poor service delivery to parts of irrigation systems and a loss of agricultural production. Water use efficiency and productivity is also reduced as a result of inadequate maintenance. Guidelines will be developed to enable ID managers to quantify this lost production for their schemes. The information obtained can then be used as evidence to water users and others of the value of improved system maintenance.
- xii) *Measure performance of schemes.* Measuring and monitoring performance is a fundamental component of management. Guidelines will be developed for performance assessment and ID managers will work with water users to establish a set of indicators and associated programme of data collection, processing and analysis for individual schemes. Key indicators will be the quantity and value of agricultural production, the efficiency of water use, the productivity of water and the investment made in system maintenance.
- xiii) *Benchmark performance.* Comparative assessment (benchmarking) of similar schemes enables the identification of best practices and the quantification of the performance gap between well and less-well performing schemes. The subsequent process of diagnostic analysis can lead to identification of the causes of good and poor performance, and adoption of measures for improvement in the less well performing schemes. The benchmarking processes followed in Maharashtra serve as useful guidelines.

Figure 3: Main system management reform implementation schedule

Five Year Plan Year	12th Five Year Plan					13th Five Year Plan					14th Five Year Plan																	
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5													
Activity	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
Component 1: Initiation and signing up to the NWMRP																												
Decide on schemes to participate in NWMRP for improved scheme performance																												
Separate irrigation management from construction																												
Agreement from ID and WUAs to carry out performance-based management																												
Component 2: Service delivery standards and agreements																												
Define service delivery and sign service agreements for individual schemes																												
Component 3: Measures to improve water management																												
Prepare water management plans for individual schemes																												
Identification and application of modern technologies for water management																												
Make assessment, design and install measuring facilities																												
Measure, account and charge for water on volumetric basis																												
Component 4: Improving maintenance																												
Carry out asset surveys, prepare and implement asset management plans																												
Determine lost production related to inadequate levels of maintenance																												
Component 5: Scheme performance assessment																												
Measure performance of schemes																												
Benchmark performance																												

5. Component 3: On-farm irrigation management

5.1. Problem statement

Despite various initiatives participatory irrigation management (PIM) has not, to date, been overly successful in India, save for a few examples in Gujarat, Maharashtra, Andhra Pradesh and Madhya Pradesh. Though over 50,000 water users associations (WUAs) have been formed on paper, the vast majority of them are not functioning effectively. A key concern has been that the process has been more about organising the farmers rather than about creating viable farmer organisations. In many cases it has been a top-down rather than bottom-up approach.

A number of causes for the current situation have been identified,¹⁴ including: a failure to devolve sufficient responsibility to water users; failure to allow WUAs to prepare their own Charter setting out the operational rules for the WUA; resistance to the PIM concept from the Irrigation Department; WUAs not sufficiently independent from the ID, with the ID Engineer being designated the Competent Authority and appointed as the WUA Secretary; WUAs dependent on the ID for operation and maintenance (O&M) funds, rather than being able to set, collect and utilise their own O&M funds; lack of adequate training, handholding and support in the early stages of formation; a failure to separate governance from day-to-day management of the WUA; lack of paid WUA staff responsible for operation and maintenance of the irrigation system.

A key factor in the process, in comparison to examples of successful formation of WUAs in other countries, has been the failure to provide adequate training, support and handholding for the WUAs in the early stages of formation and establishment. Whilst WUA Acts have been prepared and enacted insufficient resources have been allocated by state governments to explain the principles, purpose and practices of PIM to both water users and ID staff.

5.2. Concept

The proposal is to move from participatory irrigation management (PIM) to irrigation management transfer (IMT), with more responsibility being transferred from the Irrigation Department to Water Users Associations. Core elements of the reform would be to: replace the ID engineer as the WUA Secretary with a WUA appointed member; allow water users to set their own charter and statutes; separate the WUA governance and management functions; facilitate the employment of paid staff for management, operation and maintenance (MOM) of the irrigation system; allow WUAs to set, collect and use an irrigation service fee to cover the MOM costs of their on-farm systems; grant WUAs an entitlement to water. These changes will require that PIM Acts be redrafted.

In addition to efforts to give WUAs and water users more responsibility and authority there is the need, in the short to medium term, to provide WUAs and water users with institutional support through WUA Support Units created within the Irrigation Department. These Support Units would comprise a mix of professionals, including irrigation/agricultural

¹⁴ See Working Paper No. 2 - Re-engaging with Participatory Irrigation Management

engineers, agriculturalists, and social scientists. These units would be trained by WALMI, which in turn will require additional capacity building in the short term from organisations experienced in establishing and supporting effective and functioning WUAs.

It is proposed that the existing CAD&WM programme be adapted to support these changes.

5.3. Programme of proposed reforms

The proposed programme of reforms is divided into reforms for the 12th Five Year Plan and reforms over the longer term (Table 6).

Table 6: Proposed 12th Five Year Plan and longer term reforms in on-farm irrigation management

Reforms to be included in the 12th Five Year Plan	Reforms to be initiated in the longer term
<ul style="list-style-type: none"> • Initiation of the National Water Management Reform Programme (NWMRP); • Separation of the Irrigation Department in participating states into three branches: (i) Water Resources Branch (WRB); (ii) Irrigation Services Branch (ISB); and (iii) Irrigation Development Branch (IDB); • Give more responsibility to water users by moving from Participatory Irrigation Management (PIM) to Irrigation Management Transfer (IMT); • Strengthen WALMIs by giving them more autonomy, better staffing and improved funding, whilst holding them more accountable for training outcomes and impacts; • Establish WUA Support Units at Circle/District level to provide ongoing support and handholding to WUAs; • Re-engage with WUAs to raise their capability to manage, operate and maintain on-farm systems by giving them greater responsibility (setting own Charter, budget setting, fee setting and collection, etc.), training and support; • Move towards volumetric supply and charging of water to WUAs. • Restructure the current CAD&WM Programme of the GoI MoWR to bring it in line with the proposed IMT approach. 	<ul style="list-style-type: none"> • Expansion of the programme to other states.

5.4. Logical framework

The logical framework for the proposed programme of on-farm irrigation management reform is presented in Table 7.

Table 7: Logical Framework for on-farm irrigation management reform

	Indicators	Verification	Assumption
<p>Goal</p> <p>Productive and sustainable on-farm water management</p>	<ul style="list-style-type: none"> • Crop yields and water use productivity at optimal levels, with little variation between head, middle and tail-end locations. 	<ul style="list-style-type: none"> • Annual reports by WUAs, ID and Agricultural Department. 	
<p>Purpose</p> <p>To create functioning and sustainable Water Users Associations efficiently and cost-effectively distributing irrigation water and maintaining canal and drainage networks</p>	<ul style="list-style-type: none"> • Crop yields at head, middle and tail of WUA command area. • Cropping intensity. • Area cropped each season (Rabi, Kharif, dry season) – total, head, middle and tail. • Productivity per unit of water. • Levels of fee recovery. • Expenditure per unit area on maintenance. 	<ul style="list-style-type: none"> • Annual WUA performance reports to WUA AGM. • Annual reports by WUA to WUA Regulatory Authority. • Annual reports by ID. 	<ul style="list-style-type: none"> • Available water supplies at start of the season properly quantified. • Main system well managed and maintained by the ID.
<p>Outputs/Results</p> <ul style="list-style-type: none"> • States participating in NWMRP initiative on IMT. • Irrigation management separate from construction • Redrafted PIM/IMT Act. • WUA Regulatory Authority established. • WALMIs strengthened in IMT and on-farm water management and maintenance. • WUA Support Units established, trained and functioning. • WUAs reformed, trained and actively and effectively carrying out core tasks. • WUAs setting budgets and irrigation service fees and collecting sufficient fees to cover WUA MOM costs. • Adequate levels of maintenance and system improvement carried out. System operation not limited by physical condition. • Measuring structures installed and being used to determine volume of water delivered and fees paid to ID by WUAs. 	<ul style="list-style-type: none"> • Number of states participating in NWMRP. • New management and participatory focussed staff employed by the Irrigation Services Branch • New IMT Act. • Regulatory Authority functioning. • Number of functioning WUA Support Units. • Number of WUAs employing O&M staff. • Numbers of WUAs assessed by 80percent of users as providing a satisfactory service. • Number of WUAs with target levels of fee collection. • Number of WUAs with target levels of maintenance expenditure. • ID invoices to WUAs based on volume delivered. 	<ul style="list-style-type: none"> • Planning Commission reports. • NWC reports • ID annual WUA reports. • WUA Annual Reports. • WUA Regulatory Authority annual report. • ID discharge and service fee records. 	<ul style="list-style-type: none"> • WALMIs given sufficient authority and independence to function effectively. • Adequate resources allocated to WALMIs (skilled staff, finances). • Regulatory Authority able to function effectively (adequate staff, financial resources, etc.). • ID supportive and actively engaged in supporting WUAs. • Funds available through CAD&WM programme for on-farm improvements. • WUA Members actively engaged with, and monitoring performance of, WUA management.

5.5. Action Plan

The action plan is based on the implementation schedule set out in Figure 4 and detailed in the sections below:

- i) *State agreement to participate in on-farm management improvement programme.* The initial step is for states to register with the NWMRP for improving the management at the on-farm level.
- ii) *Separate irrigation management from construction.* The Irrigation Services Branch (ISB) within the Irrigation Department will be constituted to focus on the management, operation and maintenance of irrigation and drainage systems. The ISB will employ a cadre of management and participatory focussed staff, including irrigation and agricultural engineers and social scientists to work with WUAs
- iii) *Restructure current CAD&WM programme.* The current CAD&WM programme will need to be restructured to bring it in line with the proposed approach for reforming on-line management.
- iv) *Review, discuss and redraft PIM Act.* Reviewing of the existing PIM Act in the state will start at an early stage but may take some time before revisions are drafted, discussed and agreed. A revised IMT Act should be in place by the middle of the second year into the FYP.
- v) *Prepare draft Charter for issuing to WUAs.* A draft Charter needs to be drafted early on and then issued to WUAs as a basis for them to prepare their own Charter. The Charter details the purpose, functions, structure and procedures of the WUA and its organs (such as the General Body, Committees, etc.), the rights and responsibilities of the members and the duties and responsibilities of the WUA Chairman and Committee members. It also details responsibilities for setting, collection and utilisation of service and other fees or charges, and sanctions which can be applied to members for breach of the rules of the Association. The revised PIM/IMT Act will incorporate a section on the purpose and application of the Charter.
- vi) *Establish WUA Regulatory Authority.* Under the revised IMT Act a WUA Regulatory Authority will be established to monitor and regulate WUAs. Functions will include: holding the establishment records of all WUAs, including the Charter, map of command area, register of landholdings; checking that WUAs are holding regular meetings with members, processing and analysing WUA Annual Reports; assessing WUA performance; monitoring WUA financial management. The WUA Regulatory Authority will be required to report each year on WUA performance to the State Water Council.
- vii) *Strengthen WALMIs and build capacity in IMT and water management.* WALMIs will be a key part of the programme for re-engaging with WUAs and water users. WALMIs will be strengthened in relation to their staffing and capabilities in PIM/IMT, water management and system maintenance. Regional Training Centres will be established by WALMIs in order that they can run field training schools (FTS) for WUAs and water users.
- viii) *Establish WUA Support Units at Circle/Divisional level.* WUA Support Units comprising 3-4 professional staff will be formed at Circle or Divisional level.

These professionals will have experience and knowledge of on-farm water management, system maintenance and social organisation and will include irrigation engineers, agricultural engineers, agriculturalists and social scientists.

- ix) *Train WUA Support Units.* The WUA Support Units will be trained by the WALMIs and will in turn train WUAs and water users. They will also train the ID Sub-Divisional engineers assigned to work with WUAs on a day-to-day basis in relation to system operation and maintenance.
- x) *Form and train WUA support team at Sub-Division level.* At least two engineers in each Sub-Division will be assigned to work on system O&M with WUAs and water users. These staff will be selected or appointed on the basis of their interest in on-farm management, operation and maintenance (MOM). They will be trained by the WUA Support Unit and will then work on a daily basis with the WUAs and water users to improve water management and agricultural productivity.
- xi) *Carry out awareness raising and training on PIM/IMT within ID.* Awareness raising will be carried out by the WUA Support Unit staff for ID personnel at Circle, Divisional and Sub-Divisional levels. The purpose of the training will be to explain the purpose, benefits and processes of PIM/IMT in order to change the attitude and behaviour towards WUAs
- xii) *Research and develop water management approaches for different types and sizes of irrigation system, then prepare training material.* In association with agricultural universities WALMI will carry out studies to establish appropriate water management procedures for different types¹⁵ of irrigation system. Training material will be prepared from these studies and used in the training for WUA Support Unit staff and WUAs.
- xiii) *Run awareness raising and re-engagement workshops in WUAs.* Having built capacity in the WALMIs and created and trained the WUA Support Units the programme to re-engage with WUAs and water users can commence. To gain credibility the programme will need to have several new concepts and key messages including: the WUA Charter, the right of the WUA to set a budget and levy services fees; employment of O&M staff; establishment of chak-based representation in the WUA; separate governance and management structures.
- xiv) *Individual WUAs discuss and agree their Charter.* A central part of the re-engagement and empowerment of WUAs will be for water users to discuss and agree their own Charter. Though there will be a model Charter WUAs will be able to make adjustments to suit their own conditions.
- xv) *Establish WUA management processes (meetings, committees, tasks, etc.) based on agreed Charter.* Following the agreement by the General Body on the Charter the WUA management can update the processes and procedures for the Association.
- xvi) *Establish chak-based representative system.* To increase the level of representation by water users in the Association each chak will nominate one of the farmers from the chak to represent the chak to the WUA Management Committee. This representative can liaise with the Management Committee on issues facing the chak, and on management issues related to water management and maintenance.

¹⁵ The types of scheme can be categorized according to key parameter such as size (major, medium and minor), water source (tank/reservoir supplied, run-of-the-river), level of in-field works (with/without field channels), predominant crop types, etc.

- xvii) *Establish revised budgeting, fee setting and collection procedures.* Allied to proposed changes in the PIM Act and associated legislation WUAs will prepare a budget and then set the irrigation service fees for the members. The budget will take account of the costs for WUA staff, system operation and maintenance. Maintenance should be set at levels sufficient to maintain the irrigation system over time at a level that ensures full and proper operation of the system. Following the setting of the budget and fees the WUA will be responsible for collection of the fee. The fee may include water charges made by the ID for main system MOM; these charges will be collected by the WUA and then passed on to the ID.
- xviii) *Develop procedures to measure performance and progress.* It is important that the WUA collect data and report back to the members on the performance and progress of the WUA as measured against a limited set of performance indicators. The WUA Support Units and the WUA support team at the Sub-Divisional level can assist WUAs in developing these indicators and procedures.
- xix) *Review, revise and apply improved water management procedures, incorporating conjunctive use of surface and ground water.* It is intended that WALMI, with the assistance of the ID and agricultural universities, will carry out research and studies into water management options for the different types of irrigation system (major, medium and minor) in order to prepare guidelines with options for ID and WUAs. These guidelines will include the conjunctive use of surface and groundwater. The WUA Support Team will use these guidelines in their training, whilst the WUA support team at the Sub-Divisional level will use the guidelines when providing advice to WUAs on improving water management and maintenance procedures.
- xx) *Plan, design and implement on-farm works (lining, field channels, etc.).* Some of the measures identified to improve water management may include physical works, such as the construction of in-field channels and lining of some canals in a WUA command. This work will be carried out under the CAD&WM programme.
- xxi) *Install measuring structures for volumetric supply.* In accordance with moves towards volumetric delivery and measurement of water supplies from the main system measuring structures will be required at the intakes to the WUA command area (either from tanks, or at the heads of distributaries or minors).
- xxii) *Prepare regulations and rules for water allocation and management in water short years.* The WUA Support Unit and the WUA support team at the Sub-Division level can assist WUAs to prepare contingency plans and rules for coping with periods of water shortage. These plans will be prepared by the WUA in consultation with the water users and then agreed by the General Body.
- xxiii) *Formulate maintenance and asset management procedures.* A key part of the WUA training and capacity building will be focussed on maintenance and asset management procedures. The WUA Support Unit will train the WUA management, and the Sub-Divisional support team. The Sub-Divisional support team will then work with the WUA in preparing the maintenance and asset management plans and costs for submission to the WUA General Body.

Figure 4: On-farm system management reform implementation schedule

Five Year Plan Year	12th Five Year Plan					13th Five Year Plan					14th Five Year Plan									
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5					
Activity	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
Component 1: Initiation and signing up to the NWMRP																				
State agreement to participate in on-farm management improvement programme	■																			
Separate irrigation management from construction	■																			
Component 2: Reform legislation																				
Review, discuss and redraft PIM Act		■	■	■																
Prepare draft Charter for issuing to WUAs	■																			
Establish WUA Regulatory Authority			■	■																
Component 3: Provide support and handholding																				
Strengthen WALMIs and build capacity in IMT and water management	■	■	■	■																
Establish WUA Support Units at Circle/Divisional level		■	■	■																
Train WUA Support Units		■	■	■																
Form and train WUA support team at Sub-Division level		■	■	■																
Carry out awareness raising and training on PIM/IMT within ID		■	■	■																
Research and develop water management approaches for different types and sizes of irrigation system, then prepare training material.			■	■	■															
Component 4: Re-engage with WUAs																				
Run awareness raising and re-engagement workshops in Individual WUAs discuss and agree their Charter			■	■	■															
Establish WUA management processes (meetings, committees, tasks, etc.) based on agreed Charter			■	■	■															
Establish chak-based representative system, if chosen by procedures			■	■	■															
Develop procedures to measure performance and progress			■	■	■															
Component 5: Improved operation and maintenance																				
Review, revise and apply improved water management procedures, incorporating conjunctive use of surface and ground water			■	■	■															
Plan, design and implement on-farm works (lining, field channels, etc.)			■	■	■															
Install measuring structures for volumetric supply			■	■	■															
Prepare regulations and rules for water allocation and management in water short years			■	■	■															
Formulate maintenance and asset management procedures			■	■	■															

Appendix A1: Working Papers

Table A1.1: List of Working Papers

No.	Title
WP1	Overview of Working Papers
WP2	Re-engaging with Participatory Irrigation Management
WP3	Reforming Management in the Irrigation and Drainage Sector
WP4	Performance Management in the I&D Sector
WP5	Managing Ground Water for Multiple Uses
WP6	Water Resources Management
WP7	The Role of the Water Regulator in Water Resource Management
WP8	Perspectives on Legal Frameworks for Water Resources Management
WP9	Developing a Water Conservation Strategy for Industry
WP10	Water Utility Management: Urban Water Supply Reform and the Use of Public Private Partnerships
WP11	Regulation of Water Supply and Wastewater
WP12	Governing the Entrepreneurial Sector Providing Water Services
WP13	National Water Commission

National Water Resources Framework Study

Proposed roadmap for

Ground Water Management

I. Key elements of reform

1. Agricultural feeder separation

Reforms for the 12th Five Year Plan

- Separation of agricultural feeders from rural domestic feeders
- Formulate special programme for small and marginal farmers to mitigate the adverse impact of shrinking groundwater market due to feeder separation on them – targeted credit for pump investment, collective groundwater irrigation facility, etc

Reforms over the longer term

- Continue with feeder separation programme
- Continue with the special programme for small and marginal farmers for accessing ground water for irrigation

2. HVDS conversion

Reforms for the 12th Five Year Plan

- Conversion of all agricultural feeder lines to HVDS
- Provide all new agricultural connections with HVDS lines

Reforms over the longer term

- Continue with HVDS conversion programme and provide all new agricultural connections with HVDS lines

3. Rationalised agricultural power tariff

Reforms for the 12th Five Year Plan

- Rationalise agricultural power tariff levels to make power utilities financially viable and reduce state subsidies on agricultural power supply – metered tariff if politically feasible or rational flat tariff with synchronised power supply to agriculture as per moisture stress and irrigation needs
- Develop the capacity of the power utilities to diagnose and manage power supply to agricultural users as per the specific needs of an area

Reforms over the longer term

- Power Finance Corporation / Rural Electrification Corporation could include feeder separation, HVDS conversion, inefficient pump replacement and rationalised agricultural power tariff under its Accelerated Power Development and Reforms Programme to financially support states keen on implementing the provisions

4. Agricultural demand side management (inefficient pump replacement)

Reforms for the 12th Five Year Plan

- Replace all the poor and most inefficient agricultural pump sets (replacement of which can save at least up to 30% of present power consumption) with BEE certified efficient pump sets

Reforms over the longer term

- Continue with inefficient pump replacement programme till all most inefficient pump sets are replaced
- GoI notifies pump sets as ‘an appliance’ under section 14 of Energy Conservation Act 2001 that would permit manufacture of pumps having the certified standards as under the BEE standards and labelling programme for energy efficient agriculture pumps already announced

5. Ground water Management Association and participatory ground water management

Reforms for the 12th Five Year Plan

- Formulate and implement participatory groundwater management (PGM) projects in endemic groundwater depletion areas
- Facilitate adequate training and capacity building of community to make projects sustainable
- Allocate adequate resources and trained personals in implementation of these projects

Reforms over the longer term

- Maintain extended support for PGM projects for an extended period through appropriate policies and legislations
- Develop capacity in groundwater and agriculture departments to support PGM projects

6. Agricultural extension services

Reforms for the 12th Five Year Plan

- Provide agriculture extension services and marketing infrastructure to assist farmers in moving from water intensive to other equally remunerative but less water intensive crops

Reforms over the longer term

- Continue providing agricultural extension services and marketing infrastructure to farmers

7. Improving water application efficiency

Reforms for the 12th Five Year Plan

- Scale up implementation of micro irrigation (sprinklers and drip) under the National Horticulture Mission of GoI

Reforms over the longer term

- Continue providing support for adoption of micro irrigation technology by farmers
- Move to supporting storage and packaging facility, supply chain support and value addition under NHM

8. Revision and enactment of ground water legislation

Reforms for the 12th Five Year Plan

- Revise the ground water regulation and control legislations to facilitate pro-active regulation not only in unsafe areas but in all areas
- Explore options under the Public Trust Domain and Easement Act to provide mandate for ground water regulation
- All states to enact such ground water (regulation) legislation as defined above and strictly enforce it

Reforms over the longer term

- Develop the capacity and resources of the authority designated under the ground water legislation to regulate ground water
- Enforcement of groundwater regulation legislations may be tightened using remote sensing and IT-enabled monitoring systems to track location of extraction devices and volume of water pumped through pre-installed electronic chips in the pump sets programmed to monitor duration of pump operation

9. Institutional strengthening and capacity building of ground water agency

Reforms for the 12th Five Year Plan

- CGWB and SGWB should develop the technical and institutional capacity and human resources for pro-active implementation of regulation and control of ground water under the various available legislative regimes
- CGWB & SGWB should establish partnership with research institutions and NGOs on ground water research to design a pilot project on Participatory Ground water Management and Ground water Management Associations
- Planning Commission and CGWB should issue national guidelines and initiate a National Pilot Project on Participatory Ground water Management and Ground water

Management Associations (in line with the RRR Project for MI tank restoration it did under the 10th Plan)

- CGWB & SGWB should develop the technical and institutional capacity and human resources to support implementation of Participatory Ground water Management and Ground water Management Association projects
- SGWB should formulate projects in partnership with NGOs and other technical agencies to pilot Participatory Ground water Management and Ground water Management Association in their states based on the national guidelines issued
- SGWB should establish partnership with NGOs and other civil society organisations to support mobilisation and organisation of ground water farmers
- SGWB should develop information and data management systems and capacity to service the ground water information requirements of PGM and AMA projects

Reforms over the longer term

- CGWB and SGWB should coordinate with legal experts and law department to reinforce its enforcement powers for regulation and control of ground water and also take up the study on need for legislative and other legal reforms to provide it with such a mandate
- CGWB and SGWB should establish effective coordination with the Power Department and DISCOMs to utilise the electricity ground water nexus as an effective ground water management tool
- CGWB & SGWB should initiate the process of formulation of required policy, legislative and programme support to incentivise Participatory Ground water Management and Ground water Management Associations
- SGWB should establish an information and data servicing centre to make available regular and updated ground water monitoring data to ground water user groups and Ground water Management Associations to facilitate decision making at their level
- CGWB & SGWB should carry out scientifically designed studies on the process and impact of participatory Ground water Management and Ground water Management Association pilot projects to identify the policy, legislative and programme support required to scale up the pilots

II. Programme/Project

a. Concept

Immediate measures to conserve power and ground water simultaneously are imperative for sustainability, safeguarding the livelihoods of people and food security. Efforts to save power and ground water through distribution reforms and agricultural demand side management are necessary to improve the efficiency of power and water use in the sector. A number of studies conducted and research reports indicate that most of the agriculture pump sets are operating far below their achievable efficiencies. Pumps may also face the risks of burning etc. if the quality of power supply is not optimal. This can put a heavy burden of repair on the farmer.

Therefore the supply side reforms like separation of agricultural feeders from rural domestic feeders and conversion to HVDS are necessary before going for the replacement of pumps to make the system sustainable. The efficient pumping system creates a risk of excess drawl of ground water and can cause environmental concerns. The Gujarat experience from separation of feeders shows that post separation, quality power supply was provided for 8 hours. The pumping hours were thus limited to 8 hours only, in contrast to the previous practice of using the phase splitter and using power for 15 to 18 hours. Thus, quality power supply for limited hours, which is sufficient for the crops, could save the ground water.

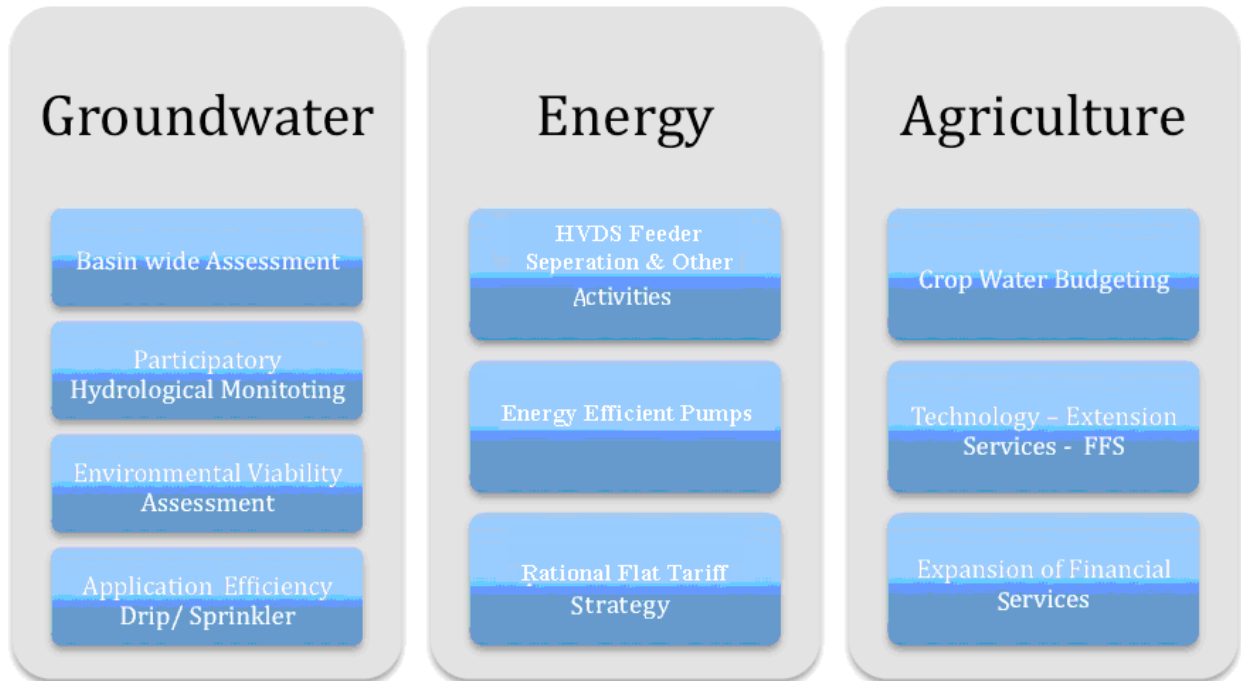
Power management goes beyond power supply alone. Advantages of conversion to HVDS are too visibly experienced to be ignored. Moreover, conversion to HVDS is one of the instruments to reduce distribution losses and thus assist substantially in fulfilling the regulatory requirement of reduction in T&D losses. Conversion to HVDS is now included as a standard activity under the Multi Year Tariff (MYT) filings by the utilities. HVDS conversion is thus institutionally owned by the utilities. Same is the case with the separation of the feeders.

A set of activities are also required to be taken up at the farmer's end to improve the overall efficiency of power utilisation. Adoption of frictionless foot valves and pipes, fixing of power factor correcting capacitors, use of energy efficient pump sets and use of appropriate capacity pumps are some of the activities required to be implemented by farmers for improving power efficiency. Farmers can also be involved in discussion for peak load management and rostering.

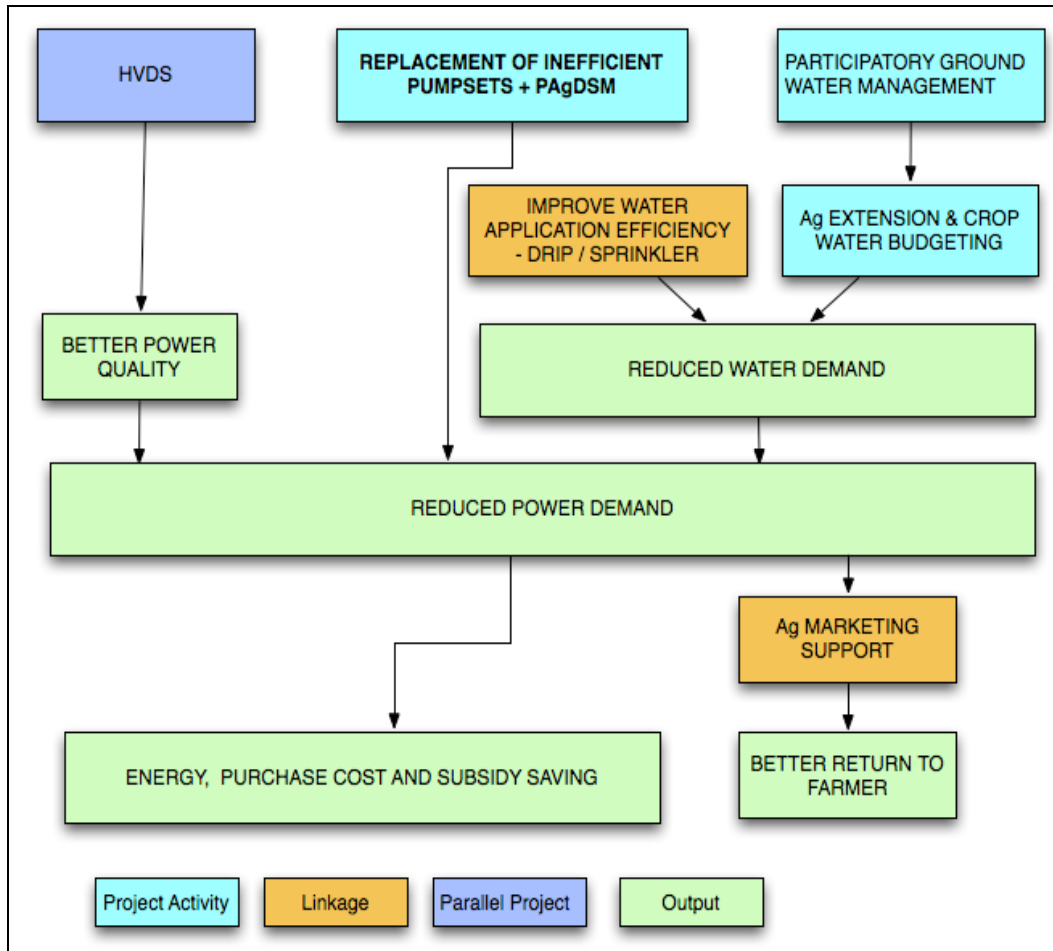
In case of ground water the farmer needs to be made aware of rainfall patterns and the fluctuations in ground water levels in a demystified way through the process of formation of Ground water Management Associations and Participatory Ground water Management. Ground water recharge and usage can also be assessed with the farmers as part of Environmental Viability Assessment to make them understand the viability of continuing existing practices like drilling of new bore wells and cropping patterns.

Other on-farm set of activities would include adoption of water efficient application methods like sprinkler/drips, adoption of water efficient agronomic practices and raising crop productivity according to crop water budgeting depending upon the availability of ground water.

Comprehensive Model for Ground Water, Energy and Agriculture Management



Conceptual design of comprehensive power and ground water management



b. Log frame

	Indicators	Verification	Assumptions
Goal			
To enhance energy use efficiency in selected ground water based irrigation areas, reduce ground water demand through ground water and crop management for sustainability	Reduction in agricultural power use by 40% in project area Stabilisation of ground water use for irrigation within sustainable limits for the ground water unit	Power Monitoring and Verification Protocol (Data record in micro-chip embedded in pump sets) PGM records Piezometric records of ground water monitored by Ground water Department	State government continued to support the project objectives
Outputs			
Component 1: Separation of agricultural feeders and conversion to HVDS			
Agricultural power feeder lines and domestic power feeder lines separated	Domestic power supply and agricultural power supply to villages on separate feeders	DISCOM Progress reports	State Electricity Regulatory Authority and DISCOMs willing to make the investment
Agricultural power feeders converted to HVDS	Agricultural pump sets connected to HVDS feeder lines	DISCOM Progress reports	State Electricity Regulatory Authority and DISCOMs willing to make the investment
Component 2: Rational flat tariff strategy			
Rational flat tariff strategy for agricultural power supply implemented	Power supply schedule for agriculture matched to the pattern of farmer demand Agriculture power supply schedule pre-announced and adhered to	DISCOM records Field studies	DISCOMs develop the capacity and human resources to plan rational scheduling of power as per farmer demand
Agricultural power supply quality improved	Agricultural power supply infrastructure maintained Power supply at uniform voltage and frequency Reduced incidences of pump or motor burn outs	DISCOM records Field studies	DISCOMs adopt a quality service provider attitude as its mission and vision

	Indicators	Verification	Assumptions
Progressive flat tariff structure implemented	Flat tariff structure based on pump power (HP)	DISCOM records	Farmers willing to accept the revised tariff structure
Component 3: Participatory Agricultural DSM			
Inefficient pumps replaced with efficient pumps	Replacement of poor quality agricultural pump sets with efficient agricultural pump sets	Contract signed between farmers and pump manufacturers	Farmers are willing to have their existing pump sets replaced
Enhanced awareness and capacity of the farmers in utilising power efficiently for ground water based irrigation in the intervention area	Number of Ag DSM awareness and training programs conducted for the farmers	Field studies	Farmers willingness to participate in the project Ag DSM awareness and training program
Proper operation and maintenance of efficient pump sets	Number of replaced pump sets working efficiently and showing requisite saving of power	Power Monitoring and Verification Protocol (Data record in micro-chip embedded in pump sets)	Farmers and pump manufacturers are carrying out proper O&M of replaced pump sets
Reduced power use in ground water based irrigation in the intervention area resulting in energy and funds saving	Amount of power saving showed by the replaced pump sets	Power Monitoring and Verification Protocol (Data record in micro-chip embedded in pump sets)	Farmers and pump manufacturers are carrying out proper O&M of replaced pump sets
Component 4: Participatory Ground water Management			
Enhanced capacity of the farmers in utilizing ground water efficiently in the intervention area	Number of PGM and PHM training program conducted for the farmers	Field studies	Concerned government department and NGOs have requisite capacity to conduct training
Sustainable exploitation and stabilization of the ground water aquifer in the intervention area through a suitable cropping pattern	Adoption of suitable crops by farmers based on crop water budgeting	Field studies	Farmers willing to shift to suitable cropping patterns
Increased ground water use efficiency in	Increase in duty in ground water irrigation (area	PGM records Piezometric records of	

	Indicators	Verification	Assumptions
irrigation in the intervention area	irrigated per unit of ground water)	ground water monitored by Ground water Department	
Component 5: Agricultural Extension Service			
Enhanced production and productivity of farm produce	Increase in productivity and production of main crops in project area	Annual agricultural survey Field studies	Farmers able to access good quality agri-inputs
Increased income to the farmers from farm produce through better marketing linkages for inputs and outputs	Increase in farm income	Annual agricultural survey Field studies	Farmers able to access and effectively utilise marketing information and linkage
Component 6: Improving water application efficiency			
On farm improved water application technologies adopted – micro irrigation methods, agronomic practices, etc.	Area under drip and sprinkler irrigation methods Increase in duty in ground water irrigation (area irrigated per unit of ground water)	Field studies PGM records Piezometric records of ground water monitored by Ground water Department	Farmers able to access available credit and subsidies for micro irrigation
Activities			
Component 1: Separation of agricultural feeders and conversion to HVDS			
Survey of rural power feeder lines and preparation of feeder separation plan	Procurement and financial plan for feeder separation	Detailed Project Report	
Implementation of feeder separation plan for rural power feeders	Domestic power supply and agricultural power supply to villages on separate feeders	DISCOM records	
Survey of rural agricultural feeder lines and preparation of HVDS conversion plan	Procurement and financial plan for HVDS conversion	Detailed Project Report	
Implementation of HVDS conversion plan for agricultural feeder lines	Agricultural pump sets connected to HVDS feeder lines	DISCOM records	

	Indicators	Verification	Assumptions
Component 2: Rational flat tariff strategy			
Prepare and implement power supply schedule for agriculture matched to the pattern of farmer demand	Cropping plan and crop water requirement Power supply schedule for agriculture	Rational flat tariff Plan of DISCOM	
Maintenance of agricultural power supply infrastructure	Power supply at uniform voltage and frequency Reduced incidences of pump or motor burn outs	Field studies	
Prepare and implement flat tariff structure based on pump power (HP)	Tariff collection records	DISCOM records	
Component 3: Participatory Agricultural DSM			
Performance Assessment & Baseline of Present Pumps	Rate of flow of water Static head Energy used in pumping water	Baseline record of existing pump sets	
Analysis of Financial Viability of Replacement	Units saved per Annum Project area viability	Baseline record of existing pump sets	
Selection List of Viable Pumps	Units saved per Annum Project area viability Willingness of farmer to replace pump set	Baseline record of existing pump sets Signed Contract between farmer and pump manufacturer	
Replacement of pump sets	Number of pump sets replaced	Work completion report of pump manufacturer Field verification	
Monitoring Performance of Replaced Pumps - chips	Power savings by replaced pump sets	Power Monitoring and Verification Protocol (Data record in micro-chip embedded in pump sets)	
Training Local Mechanics - Pump Repair	Number of O&M training programs conducted for the	Field studies	

	Indicators	Verification	Assumptions
	local mechanics		
Component 4: Ground water Management Association and Participatory Ground water Management			
Environmental Viability Assessment	Number of PPGM Groups conducting water balance studies	PGM records Project Annual Progress Report	
Participatory Hydrological Monitoring	Number of PPGM Groups conducting PHM	PGM records Field studies	
Crop Water Budgeting	Number of PPGM Groups conducting crop water budgeting	PGM records Field studies	
Capacity Building of Project Staff	Number of PGM training programs conducted for project staff - 6 modules	Field studies	
Mobilisation and Formation of Ground water Management Associations	Number of AMAs formed	Field studies	
Awareness, Training and Capacity Building of PPGM Groups	Number of PGM training programs conducted for PPGM Groups - 6 modules	Field studies	
Component 5: Agricultural Extension Service			
Farmers' Field Schools	Number of FFS conducted for farmers	Field studies	
Linkage for Better Market Information and Access	Number of Agreements signed between PPGM Groups and agri-service agencies	Field studies	
Component 6: Improving water application efficiency			
Supply of drip and sprinkler irrigation systems to farmers	Area under drip and sprinkler irrigation methods	Field studies	
Farmers' Field Schools on agronomic practices for on-farm water mgmt..	Number of FFS conducted for farmers	Field studies	

c. Action plan (Implementation arrangement)

The Ground water Management Programme will include two distinct components:

1. the ground water power management
2. the ground water use efficiency management

It is proposed that the activities of the ground water power management component (agricultural feeder separation, conversion of agricultural connections to HVDS, rationalisation of agricultural power tariff and agricultural demand side management) be taken up under the Accelerated Power Development and Reforms Programme with financial assistance to the States from the Power Finance Corporation and Rural Electrification Corporation.

For the activities of the ground water use efficiency management component (formation of Ground water Management Associations, participatory ground water management, agricultural extension service and improving water application efficiency) it is proposed that the Government of India notify a National Guidelines and initiate a new National Level Project for Ground water Management similar to the “Repair, Renovation And Restoration of Water Bodies Directly Linked to Agriculture Project”, which it had initiated for minor irrigation tanks during the 10th Plan and continued in the 11th Plan. Based on the Ground water Management Project Guidelines each state will formulate its state-specific project for participatory ground water management.

Implementation of a programme combining such diverse activities as agricultural feeder separation, conversion to HVDS, rationalisation of agricultural power tariff, agricultural demand side management, formation of Ground water Management Association, participatory ground water management, agricultural extension service and improving water application efficiency will require participation and coordination among a number of government departments and agencies both at Central and State Government level. These will range from the Planning Commission, Central and State Power Departments, Bureau of Energy Efficiency, State Electricity Regulatory Authorities, Central and State Ground water Authorities, State DISCOMs, State Agriculture Department, State Ground water Department, State Horticulture Department among others. This raises the question of the identity of the parent department who would be responsible for the overall implementation of the project.

In terms of financial costs involved maximum expenditure will be related to power (feeder separation, HVDS conversion, pump replacement, operation of rational agricultural tariff). On the other hand, in terms of operational aspects agriculture and ground water will dominate (AMA, PGM, agricultural extension, micro irrigation). It is hence proposed that a consortium of the concerned departments at the State level could be made responsible for implementation

of the project. Conversely, a Special Purpose Vehicle with an energy servicing company (ESCO) structure and mandate under the Power Department may be considered. The SPV-ESCO structure, which has been proposed in the JICA funded AgDSM project study for Andhra Pradesh, has the added advantage of being able to access finances resources through a PPP model. The SPV-ESCO can co-ordinate with the State Power, Agriculture and Ground water Departments and the DISCOMs in implementation of the project.

At the Central Government level, if feasible, the Planning Commission itself could be the coordination agency for the programme during the initiation phase (12th Plan Period) and later transfer it to the Central Ground water Board once the latter is institutionally strengthened and its capacity built to manage and implement the programme.

d. Implementation schedule

Sl. No.	Activities	Plan Period	12 th Five Year Plan					13 th Five Year Plan					14 th Five Year Plan				
		Year	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
1.	Component 1: Separation of agricultural feeders and conversion to HVDS																
i.	Survey of rural power feeder lines and preparation of feeder separation plan		===														
ii.	Implementation of feeder separation plan for rural power feeders			===	===	===											
iii.	Survey of rural agricultural feeder lines and preparation of HVDS conversion plan		===														
iv.	Implementation of HVDS conversion plan for agricultural feeder lines			===	===	===		===	===	===	===	===	===	===	===	===	
2.	Component 2: Rational flat tariff strategy																
i.	Prepare and implement power supply schedule for agriculture matched to the pattern of farmer demand		===	===	===	===	===	===	===	===	===	===	===	===	===	===	
ii.	Maintenance of agricultural power supply infrastructure		===	===	===	===	===	===	===	===	===	===	===	===	===	===	
iii.	Prepare and implement flat tariff structure based on pump power (HP)		===	===	===	===	===	===	===	===	===	===	===	===	===	===	

Sl. No.	Activities	Plan Period	12 th Five Year Plan					13 th Five Year Plan					14 th Five Year Plan				
		Year	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
3.	Component 3: Participatory Agricultural DSM																
i.	Performance Assessment & Baseline of Present Pumps		=====														
ii.	Analysis of Financial Viability of Replacement		=====														
iii.	Selection List of Viable Pumps			=====													
iv.	Replacement of pump sets				=====							=====	=====	=====	=====	=====	
v.	Monitoring Performance of Replaced Pumps - chips																
vi.	Training of Local Mechanics in Pump Repair				=====							=====	=====	=====	=====	=====	
4.	Component 4: Participatory Ground water Management																
i.	PGM and AMA project formulation		=====														
ii.	Mobilisation and Formation of Ground water Management Associations				=====							=====	=====	=====	=====	=====	
iii.	Awareness, Training and Capacity Building of PPGM Groups				=====							=====	=====	=====	=====	=====	
iv.	Environmental Viability Assessment				=====							=====	=====	=====	=====	=====	
v.	Participatory Hydrological Monitoring				=====							=====	=====	=====	=====	=====	

Sl. No.	Activities	Plan Period	12 th Five Year Plan					13 th Five Year Plan					14 th Five Year Plan				
		Year	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
vi.	Crop Water Budgeting																
vii.	Capacity Building of Project Staff																
5.	Component 5: Agricultural Extension Service																
i.	Farmers' Field Schools																
ii.	Linkage for Better Market Information and Access																
6.	Component 6: Improving water application efficiency																
i.	Supply of drip and sprinkler irrigation systems to farmers																
ii.	Farmers' Field Schools on agronomic practices for on farm water management																
7.	Revision and enactment of ground water legislation																
8.	Institutional strengthening and capacity building of ground water agency																

III. Accountability

Which department/ministry/other agency will be responsible for implementation?

Sl. No.	Key components	Responsible department / ministry / agency
1.	Overall programme implementation and coordination	Consortium of State Departments / SPV - ESCO
2.	Agricultural feeder separation	Power Department / State DISCOMs
3.	HVDS conversion	Power Department / State DISCOMs
4.	Rationalised agricultural power tariff	Power Department / State DISCOMs
5.	Agricultural demand side management (inefficient pump replacement)	State DISCOMs
6.	Ground water management association and participatory ground water management	Ground water Department / Agriculture Department / NGOs / AMAs
7.	Agricultural extension services	Agriculture Department
8.	Improving water application efficiency	Agriculture Department / Horticulture Department
9.	Revision and enactment of ground water legislation	State Government / State Ground water Department
10.	Institutional strengthening and capacity building of ground water agency	Central / State Ground water Agencies

IV. Enforcement

Which department/ministry will enforce sanctions for non-implementation?

Sl. No.	Key components	Responsible department / ministry / agency
1.	Overall programme implementation and coordination	Planning Commission
2.	Agricultural feeder separation	State Energy Regulatory Authority
3.	HVDS conversion	State Energy Regulatory Authority
4.	Rationalised agricultural power tariff	State Energy Regulatory Authority
5.	Agricultural demand side management (inefficient pump replacement)	Power Department
6.	Ground water management association	State Ground Water Authority

Sl. No.	Key components	Responsible department / ministry / agency
	and participatory ground water management	
7.	Agricultural extension services	State Government
8.	Improving water application efficiency	State Government
9.	Revision and enactment of ground water legislation	State Legislative Assembly
10.	Institutional strengthening and capacity building of ground water agency	State Government

National Water Resources Framework Study

Proposed roadmap for

Water Utility Management Improvement and Reform

Rationale

Urban water supplies in India are characterised by intermittent supplies, often for only 2 to 4 hours for few days in a week, a service standard further deteriorating during the summer months. Even though Government of India estimates put the coverage of urban population at 91% (2003), only about half the urban households have a tap inside the house and the remaining population is dependent upon public taps or local ground water sources. Even the population with access to house service connections need to cope with the limited low pressure water supplies with suspect quality forcing the households to supplement with indiscriminate exploitation of ground water. This is resulting in rapid depletion of resources and avoidable investments in household level pumping, storage and treatment systems.

Goal

Clean drinking water and effective sewerage services are critical to public health; they are vital to the maintenance of a safe environment; and they underpin sustainable economic activity and development. The services provided by the water industry depend on very expensive infrastructure in the form of water mains, sewers, reservoirs, and treatment works to ensure that the water supply is drinkable and that waste water is dealt with in a way which protects the environment from pollution. Hence the service relies heavily on long-term investment. It requires reliable and sustainable levels of funding, year on year.

A critical goal in the reform process is to achieve a political commitment to reform as the all important ingredient needed to initiate and sustain the process. Urban water supply has become a critical national issue. Population growth and declining water availability as a result of increasing new urban and industrial demands will lead to severe shortages in many of India's towns and cities. State Governments are responding in various ways, including investing in new water supplies, improving the management and delivery of urban water services, and allowing for greater innovation and more efficient water use.

However, the present arrangements do not provide a reliable source for the sustained investment programme that is needed over the medium to long term;

Financially, water sector investment requirements during 2012 - 2031 (at 2009-10 prices) are estimated to be around Rs.320,908 crore in water supply and Rs.242,688 crore in sewerage; and there seems little possibility of securing all these resources from the national or state Government funds. Therefore, a self-financing arrangement is needed to ensure that the water and sewerage investment programme can be delivered without compromising the necessary

levels of public expenditure in other key services such as health, education, roads and transport.

Purpose

This roadmap recommends key directions including:

- An agreed vision for the contribution of water to improving urban life for all dwellers, through the development of high quality water services that benefit all community needs, more specifically of the urban poor, improving the health of the urban environment and supporting economic growth and development
- Providing greater customer choice and innovation in water services on offer, the water charges they pay and their level of service
- Improved integration of urban and water planning through planning and building regulations that facilitate integrated water cycle management
- Better environmental and public health outcomes supported by clear regulations to ensure both customers of water services and the environment are protected
- Approaches to pricing that recognise the value of the water resource and reward customers for conserving water, such as by a tiered pricing structure
- Strengthened institutional and governance arrangements to hold service providers to account for their performance

Opportunities for better community outcomes will be lost if the State does not put in place more sustainable water management approaches

The roadmap does not provide detailed solutions or detailed prescriptive recommendations; rather it should be viewed in conjunction with the Working Papers 10, 11 and 11. It provides for the development of a process to lead policy makers and practitioners towards remedies that can improve water utility performance. This recognises the need to implement reform which is developed from within the sector, by people responsible for the services and attuned to the variety of customer needs. Being part of the process of reform is an important ingredient for the success of reform.

Objectives

The objective of reform in water supply utilities is straight forward enough - to improve performance and water services to citizens; though the route to doing this is fraught with difficulties of organisation and money. In doing so there is no “cut and paste” formula and the route to change for a given utility is unique, and there is no predetermined action plan of corrective measures that must necessarily be followed in sequence. However there is a broad process and some basic norms that are fundamental to success or, by contrast, similar actions that have caused organisations to fail. These are reforms that national and, more importantly, state governments can enact and support. This roadmap provides a proposed route for these reform policies to be implemented within both the 12th FYP and over the long term.

Accountability

Managing a water utility at any time is one of the most important jobs and function of government – be it at a national, state or local authority level. Ensuring that high standards of water quality which are safe and reliably provided for citizens and other users of water is a critical function for a society to prosper in a healthy environment; and to be able to provide enhanced livelihoods and economic prosperity.

Enforcement

In a decentralised country such as India there is a complexity in the institutional framework in urban water supply; and hence it is inappropriate to stipulate or recommend a “one size fits all” enforcement or regulatory solution.

Programme Strategies

1. Setting the institutional framework for improvement

1.1. Development and publication of a statement of “principles” for water utility management

Objective: The ambition for the Planning Commission is to promote effective water and wastewater utility management can help utilities respond to both current and future challenges and support utilities in their common mission of being successful 21st century service providers. Effective utility management can help water and wastewater utilities enhance the stewardship of their infrastructure, improve performance in many critical areas, and respond to current and future challenges. Addressing these challenges also requires on-going collaboration between government, industry, elected officials, and other stakeholders.

Strategy: The Planning Commission should provide a statement of its specific objectives for water utility management for the 21st century India and present an articulate statement of its ambition in order to encourage all water utility managers, regardless of their utility’s size, budget, and unique circumstances, to read, consider, and implement the strategies and approaches that represent its view of the principles of best management practice. This might be achieved by reviewing the current standards set by the Central Public Health and Environmental Engineering Organisation (CPHEEO) manual for water sector engineers; but it is important to ensure that the wider management processes of water utilities are embraced by these standards and not just engineering functions.

12FYP: Establish a Government, State and Utility Managers working group to prepare and consult on an “effective water utility management” document in which emphasis is given on the need to regard water service delivery as a “business-like” activity. Undertake consultations and dissemination workshops within States and municipalities.

Long term: Retain the working group to update and reissue the document and integrate with performance monitoring and benchmarking programmes. The work should be updated in a way that benefits from specific case studies and experience such as the support being given to business planning of water services in Maharashtra and Rajasthan.

1.2. Promoting autonomy and accountability of WSS utilities

Objective: To generate a widespread and consistent acceptance by politicians and senior government personnel that the water supply sector in urban and rural areas needs to adopt the principles of “sound business-like” management and planning for its water utility entities for ensuring autonomy in day-to-day functioning and accountability to the customers.

Strategy: Ring-fencing urban local bodies (ULBs) or state-owned utilities by separating the roles of the policymaker, owner and service provider; introducing “corporatisation” of large city or regional utilities may be explored, which would improve internal governance, increase their commercial nature and can induct professional management so that the service provider entity can transform into a professional managed utility. It is important to ensure that the ring fencing of water utility operations includes financial autonomy, which is balanced by improvements in governance and accountability of the management. Governance mechanisms to ensure that accountability to customers and elected representatives are transparent, fair and achieve improved service objectives will be paramount in developing an effective long term improvement in water delivery services.

The reforms under JNNURM, for ring fencing of water utilities needs to be strengthened to include “corporatisation” and has been underway in many states such as Orissa, Rajasthan, Gujarat and in some of the ULBs in Maharashtra; and there needs to be greater replication in order to support the achievement of well-run water utilities that will provide India’s citizens and all users with increasing service access and quality.

12FYP: Establish a target that by the end of 12FYP, at least half the cities with more than a million people are made more accountable to the customers either through accordingly higher autonomy or by “corporatisation”.

Long term: Ensuring professionalisation of services coupled with improved autonomy that would attract skilled managers into the sector and make service delivery more accountable while also promoting cost recovery

2. Enhancing water utility performance benchmarking system

2.1. Strengthening the policy role of the benchmarking system and use of performance monitoring

Objective: Strengthen the State SLB Coordination Cells into full-fledged Performance Monitoring Units to function within the respective Urban Development Departments or Directorates for monitoring the service standards and developing information database on all aspects of service and economic regulation. Also, introduce periodical rating of cities and institute awards for best performing cities, especially in the area of improved water

sanitation. Moving towards effective regulation is likely to require a long time period to establish baselines and even longer time in achieving the benchmarks considering the backlog in the sector.

Strategy: Review the current performance indicators of the benchmarking network to include “process benchmarking” activities. Indicators could include volume of water from different sources; volume supplied to residential, commercial, municipal and industrial properties; volume of sewage collected; total recycled water supplies; water mains repairs; number of connections established; water quality and service complaints; wastewater treatment; financial viability. The indicators should also promote the business-like planning approach to be adopted by water utilities and supporting activities needed for performance improvements, such as water quality monitoring, benchmarking, and external audits.

12FYP: The Planning Commission may include provision of a specific outlay as a proportionate percentage of the Plan funds to the sector towards operational norms and ensuring sufficient capacity of the state governments for continuous benchmarking.

Long term: Increased support for monitoring, enforcement, and mitigation of water quality issues; to be tied in to regulatory management of the sector’s providers, both public and private being treated in the same regulatory manner, with the same quality of service expectations.

2.2. Linking disburseable Plan Funds against achievement of targeted Service Level Benchmarks through a method of performance-based budgeting

Objective: To ensure that improved performance is considered the norm, and that policymakers in state and municipal settings are committed. They should also be given incentives to ensure that service improvements and expansion are their WSS priorities. It is important to ensure that improvement and commitment to improved management of water utilities are funded. This does not mean that the best WSS utilities would attract the bulk of funding but be geared towards those utilities that demonstrate through their actions and management performance that funding will be better allocated to achieving lasting performance improvement.

Strategy: Accelerate and consolidate the water utility performance monitoring scheme roll out so that each State achieves benchmarking in all cities and towns by, say, 2015; this would provide the baseline information and enable the future regulator to set periodical progressive performance targets for each utility for achieving the national benchmarks.

12FYP: A dedicated provision as a proportionate percentage of Plan funds towards strengthening of information and monitoring systems and embedding the monitoring mechanism into the regular planning and implementation processes.

Long term: Linking performance reporting with funding from central or state sources for infrastructure. The activity of the 12th FYP is also a long-term investment requirement. It

would also be useful to explore other forms of partnership investment to raise the level of performance in service delivery.

3. Developing an environment for diversifying water service provision

3.1. Adoption and mainstreaming of innovative opportunities to develop improved performance in water utilities

Objective: Municipalities and states need to embrace other approaches to improving water services. These approaches are characterised by decentralisation away from central state government and by greater autonomy. They include community water associations, town Water Boards, and possibly small-scale private water companies. Also, aggregated approaches are being tried, including existing, larger utilities absorbing smaller towns, and through creation of new regional entities. Entrepreneurship needs to be regarded in its widest context, to be adopted in the wider context of service delivery that could be more effectively provided by the NGO or private sector; and working in partnership with public authorities. This context includes maintenance, out-sourcing of services, suppliers of equipment.

Strategy: The Planning Commission should state the intent of diversifying service provision as part of the overall policy framework and support the sector with model service agreements.

12FYP: Development of simple, easy to use service agreements coupled with focussed vendor development to increase the attractiveness of the sector to the local entrepreneurs and NGOs.

Long term: Monitoring the diversification and supporting continuous improvement from learning from best practices.

3.2. Increasing the role of delegated management in all aspects of water utility management

Objective: The water supply sector reform process needs to embrace the opportunities and services that entrepreneurs could bring to improving water and sanitation services to people living in urban and rural situations.

Strategy: Entrepreneurship needs to be regarded in its widest context, to be adopted for services that could be more effectively provided by the NGO or private sector; and for working in partnership with public authorities. This context includes maintenance, out-sourcing of services, suppliers of equipment.

More functional autonomy and accountability can also be ensured through long term delegation of service provision. Hence, isolated efforts already under way in delegation of service provision can be up-scaled through policy and contract management support as has been in vogue in other infrastructure sectors. Once the government has accepted the concept of private sector involvement in water services, particularly its national private sector, it

should encourage its replication through legislation and by establishing an appropriate system of regulation.

12FYP: The Planning Commission could set up a core group to develop model contracts for long term delegation of water services. It could also encourage the national private sector with support from plan funds for bridging the viability gap (that is, move from a utility which is mostly state subsidised to one which is a viable self-financing operation achieving high levels of service) and to minimise shocks from steep tariff hikes.

Long term: Development of autonomous and accountable water utilities which can, in turn, delegate the service provision responsibilities on long term delegation. Once the sector is bankable, Government and the Planning Commission could supplement private investment through appropriate financial instruments and tax incentives for the sector.

3.3. Creating institutionalised structures for stakeholder engagement

Objective: Stakeholder engagement has to become a continuous and consistent part of the process of water reform.

Strategy: The primary purpose of stakeholder engagement has to be to reduce information deficits in the development of policies for water utility management. This approach will have three benefits: first, the final customers of municipal water will have a voice in designing public-private engagement based on expected but tangible benefits; secondly, a continuous process of consultation will ensure that even after reforms have been initiated, public accountability is proactive; and, thirdly, to ensure that the debate on water utility reform does not fall prey to pressure groups.

12FYP: The Planning Commission could facilitate participative deliberations with consumers in all major metropolitan areas. Local NGOs, already working on the ground and having detailed information about water supply provision, should be drafted into the process to convene consultations while providing easy-to-understand information. Water utilities and interested private parties should be required to submit information on costs, leakages, infrastructure investments, efficiency measures and planned technological interventions to the public.

Long term: By the end of the 12th FYP, all water utilities should be mandated to create public information and consultation departments. Information should be available online and also provided in utility bills. The National Water Commission, if established, could take the lead in supporting water utilities in their public consultations and also building capacity to undertake serious and regular consultations, rather than one-off workshop sessions.

4. Development of regulatory capacity for WSS

4.1. Developing regulatory expertise and knowledge

Objective: Sound principles of regulation need to be adopted to ensure there is no abuse of customers in the delivery of services, which will often be provided on a monopoly basis. Acceptance of entrepreneurial contributions through regulation will recognise their investment, protect them from unfair competition and provide them with the security to invest well, secure in their longer-term future. This also acts to the benefit of the customer base and society and the economy overall.

The regulatory role will also include the important work of generating better and credible data and information about water utility performance to allow effective long term benchmarking to take place.

Strategy: As initial steps towards ensuring sound regulation of the sector, the state governments and ULBs may assign the role of economic regulation (setting tariffs) to the existing water resources or electricity sector regulators as a transition measure in line with the recommendation of the Planning Commission encouraging multi-sector regulation. Further long-term delegated management through appropriate form of PPPs would ensure contractual regulation by way of ULBs committing to some fixed tariff adjustments linked to natural inflation. This can be achieved at very short time frame without the elaborate legal and legislative changes required for establishing independent regulators.

12FYP: The Planning Commission could support focussed capacity building initiatives for the existing water resources or electricity regulators so that a “Member-Water” within the regulatory commission can provide economic regulatory service to the willing ULBs or governments who seek independent support for tariff adjustments.

Long term: Ensuring independent regulation through appropriate legislative reform supported by bringing water sector into concurrent list under Constitution. This is important because it recognises the importance of national action to ensure an improved water supply sector across the country and its value to the economic well-being of the country. It also demonstrates that Government policy understands the gravity of the water supply crisis facing the country and is taking measures to support local communities and states to undertake actions to deliver long term solutions.

National Water Resources Framework Study

Proposed roadmap for

Water Conservation Strategy for Industry

Rationale

Evidence of wasteful water usage can be found in all water usage sectors throughout the country and the value of water seems largely unrecognised by most water users. The implementation of the principles of conserving water and using water wisely (rather than wasteful) is essential in meeting the national goals of basic water supply for all in society and the sustainable use of water resources.¹⁶ It is important to note that the goals and objectives of wise water use do not refer only to the objective of supporting efficient water resource management and ecological sustainability, but also to economic efficiency, social development and social equity.

Goal

Economic growth in India is essential to its development, and industry is expected to be one of the biggest contributors. Future industrial water use is therefore very significant for water resource planning purposes. In urban settings, household water use might be higher than for industry. Therefore, water conservation should be a goal not only for industry but to promote efficiency in agricultural, municipal and household uses as well.¹⁷ But the industrial sector is projected to have the greatest growth in water demand¹⁸ and much of the industrial development will occur in major urban centres and these may be areas that have limited water resources.

From the beginning of the industrial revolution, water conservation meant dams to capture and store water so it could be distributed as needed. These systems were designed to conserve water by preventing the waste of water to the ocean. Over the last two decades the meaning of water conservation became restricted to “use less water” and “protect the environment”. It is important to recognise that water conservation should be both an objective in water resource management and water services management as well as a strategy.

¹⁶ The “Water Footprint Assessment” methodology might be an important tool to measure the complete water use in a product across all steps in the supply chain. Moreover, this approach can help not only to calculate water use, but also assess the sustainability and risk of such use and the strategic responses necessary to mitigate the risks. See www.waterfootprint.org.

¹⁷ Strategies could include reducing non-revenue water losses, installing meters, residential water conservation programmes (with equipment manufactured to suit Indian conditions and water quality), and highlighting energy savings to utilities.

¹⁸ The Second Irrigation Commission in their report of 1972 recommended a provision of 50 BCM for industrial purpose for the country as a whole. However, a more recent assessment indicates that requirement for industrial use will rise to 120 BCM by 2025 AD (MoWR, 2007).

The availability and assurance of water supply at a reasonable cost to support industrial development is imperative, but it is also important to identify and recognise the need to include water availability and costs as part of the considerations in the geographical location and the nature of future industrial development.

This road map document has been developed on the premise that the industrial sector is well organised and structured with a full complement of Institutions and Chambers that represent all the interests of the various business categories. Furthermore, it is assumed that all interactions in terms of both the development and implementation of these strategies will take place with these business representative forums. During implementation of the strategies, appropriate business representatives will be urged to utilise existing forums, such as those established to fulfil environmental audit functions. Appropriate business representatives should be urged to form Water User Associations (WUA).

Purpose

The vision of all water conservation and demand management endeavours is the efficient use of water by water institutions and consumers in India. The cornerstone principles underlining the strategy framework are those governing the *“importance of water as a finite, though a renewable resource, must be clearly recognized; Land and water use are to be considered together, particularly in the context of recurring droughts and floods. Water conservation measures; discipline on use of water; economizing the consumption of water in households, agriculture and industry; and appropriate recycling would be essential”*.¹⁹

On 30 June 2008, the Prime Minister released India’s National Action Plan on Climate Change (NAPCC). Prepared by the specially constituted Prime Minister’s Council on Climate Change, the document was intended to provide a concrete road map detailing how India plans to move forward in combating climate change.

The ambitions for the National Water Mission²⁰ included:

Increasing water use efficiency at least by 20% by,

- Development of guidelines for incentivizing for recycling of water including wastewater by March 2011.
- Development of guidelines for incentives for water-neutral and water-positive technologies by March 2011.
- Development of guidelines for improving efficiency of urban water supply system by March 2011.
- Preparation of guidelines and manuals for mandatory water audit including those for drinking water purpose by March 2011.
- Review of financing policy and allocations by March 2010.
- Undertake Pilot studies in collaboration with States by March 2012.

The definition of wise water use and conservation proposed use in the Indian National Water Mission is *“...the minimisation of loss or waste, the preservation, care and protection of water resources and the efficient and effective use of water.”*

¹⁹ Government of India (1992) ‘National Conservation Strategy and Policy Statement on Environment and Development,’ *Ministry of Environment and Forests*, paragraph 5.2.13, June.

²⁰ Comprehensive Mission Document of National Water Mission, April 2009 http://www.indiaclimateportal.org/component?option=com_policybrief/view,policybriefdetail/id,8

Meeting the basic and essential water supply needs is an important duty of Government and with so many in India who do not have reasonable access to water services, this is a challenging objective for all parts of India's Government. Through water conservation measures to existing water services, water resources and bulk infrastructure can be reallocated for the provision of new services. Water conserving behaviours and demand management measures can help ensure that water remains affordable, that consumers budget for their water consumption, and that the distribution system is operated and managed in an effective and efficient way and will play an essential role in ensuring the provision of sustainable and affordable services and ensuring the fulfilment of the national objective of "water for all". The series of sectoral strategies will need to be developed through workshops involving representatives of each water sector.

There are a broad range of uses, and any one business may use water for one or more of the following functions

Domestic: Most office accommodation is fitted with kitchens, toilets and bathrooms, all of which can contribute significantly to the water use of a business. Furthermore, many larger businesses, such as mines, provide housing for their employees. The water requirements for day-to-day living purposes, such as health and hygiene, are the same as those in any other urban centre.

Irrigation: Certain businesses develop landscaped gardens and lawns which are maintained to provide a pleasant aesthetic environment and which promote a good corporate image. These tend to be well watered, on top of which, many of the gardens contain exotic plants which are thought to have substantially higher water requirements than indigenous plants.

Process: One of the major uses of water in the Sector is that related to the actual manufacturing processes and the end product. Water use may be consumptive, such as the water used to manufacture a product in a bottling factory that is then distributed for consumption. It may also be non-consumptive, such as the water used to die fabrics in a textile industry that is then discharged to a waste water system.

Cleaning: Although water use for cleaning can be related to a process, it is also used for non-process related cleaning purposes. The washing down of the floors of a premises or the cleaning of a fleet of vehicles are such examples, and which can result in significant usage.

Cooling: Cooling is often process related but there are a number of non-process related cooling requirements that utilise water (refrigeration and air conditioning are typical examples).

Fire fighting: Reticulation systems in businesses are often designed to meet the requirements of fire fighting, which often well exceed the requirements for the other water uses within a business, especially in terms of pressure. The levels of service for the others uses may therefore be excessive leading to excessive use.

Water treatment: Certain businesses treat their own water to achieve the standards necessary for their process requirements. Furthermore, some businesses also have to treat their effluent to a standard to meet receiving water quality objectives or the requirements to discharge into local sewer systems. Often these treatment facilities are inefficient which may lead to significant quantities of water being wasted.

Objectives

Create a culture of water conservation within all water management and water services institutions

- Educate and create awareness on water conservation objectives and principles for all officials and employees working in Government and water institutions
- Ensure that water institutions demonstrate efficient water usage and are not directly responsible for the inefficient use and wastage of water
- Promote and ensure regional co-operation and co-ordination amongst water institutions
- Ensure the implementation of water conservation principles by all public sector and parastatal institutions
- Ensure that tariffs implemented by water institutions promote water conservation

Develop a national political awareness and commitment on the principles and policies of water conservation

- Develop policies and guidelines for water institutions that will allow for the funding of water conservation initiatives
- Develop a database and library of knowledge, information and case studies and ensure easy access to all interested parties

Create a culture of water conservation and wise water use for all consumers and users:

- Create ongoing awareness on the value of water and the need for water conservation for all consumers and users in India
- Facilitate education strategies on water conservation
- Enable and promote the payment of water and water services by all consumers and users
- Enable consumers and users to understand how, where, the quantity and impact of water they use
- Introduce regulations that limit the wastage and inefficient use of water by consumers and users
- Enable the development of benchmarking for efficient water usage for all water usage sectors

Accountability

The programme strategies detailed below all require a joint effort from the national Government, State and water service providing authorities, and from business. The detail of specific actions and responsibilities for each stakeholder should be clearly articulated through joint working forums.

Enforcement

Enforcement will be a matter for the State Water Council where State regulation is considered the best means of achieving the water conservation objectives, particularly

through the management of water abstraction licences and tariffs. HOWEVER, it is considered appropriate to consider that many of the actions that relate to the delivery on effective strategies on water conservation in industry are likely to be through voluntary sector agreements, peer review benchmarking and best practice support for technology and behavioural solutions by providing incentives for improving water-wise practices.

Programme Strategies

Name	Objective	Strategy	12 th FYP	Long term
1. Classification of business types				
1.1. Classification system²¹	<p>It is unlikely that one generic water conservation strategy across the full spectrum of businesses will be appropriate. Should the assumption of specific adaptive strategies be valid, then one will have to consider the classification of the businesses. This is supported by the fact that the implications of water conservation will vary tremendously according to the type of business, the applicable processes and their water requirements. Furthermore, the extent to which a business, or group of businesses, is regulated, and the extent to which it will be expected to become actively involved in water resources management, will depend on the scale of its water utilisation and wastewater discharge.</p>	<p>A system will be developed to classify businesses in the industry, mining and power generation sectors based on individual water utilisation and wastewater discharge requirements. This will be the responsibility of Government and the business representatives and will take cognisance of the audit results mentioned below. The following aspects will be considered in the classification system:</p> <ul style="list-style-type: none"> • the type of business; • the purposes for which water is used; • the specific industry processes; • the water licence requirements of the business (i.e. self-serviced or serviced by a water services provider); • the metered quantity and quality of water utilised and wastewater discharged; • the extent to which water is recycled (i.e. the ratio of consumptive to non-consumptive use); and • the efficiency and effectiveness of water utilisation. <p>Although there could be a large number of categories based on the above criteria, the classification will need to be kept as simple as</p>	<p>- Design a classification system. - Classify the businesses according to the classification system.</p>	<p>Although the emphasis will be on self-regulation, businesses will be subject to varying degrees of regulation as described in the further strategies</p>

²¹ Those businesses which service their own water requirements will be classified by the State Water Commission when processing water licences, and those businesses serviced by Water Services Authorities will be classified by the Water Services Authorities. The Water Service Authorities will notify the State Water Commission. It should also be noted that the classification will depend to a large degree on the specific purpose of water use.

		possible. However, the primary purpose of the classification will be to identify those businesses that have the greatest impacts on the water resources in terms of water utilised, wastewater discharged and the efficiency and effectiveness thereof. The business categories will be classified and prioritised by the relevant river catchment or the relevant Water Services Authority.		
1.2. Database of businesses	Currently there are no databases of information regarding water services and water use within the industry, mining and power generation sector. The purpose of such databases would be to provide information to make informed decisions relating to water resources management. Following the classification of businesses, it makes sense that certain businesses be monitored and tracked according to their water use and wastewater discharge performance criteria which are discussed. The databases will provide a repository for this information and other audit results. The objective will be to facilitate self-regulatory performance monitoring.	National, regional and local levels of databases will be developed for the purposes of monitoring the water-related performance of businesses. It is obvious that there are too many businesses for all of them to be included in the databases, and only those businesses that have the greatest impacts on the water resources will be considered (i.e. the high priority categories). The State Water Commission or Water Services Provider will have the responsibility for monitoring the performance of these businesses.	- Design a simple pro-forma database, and develop individual regional databases to be adapted for local conditions and requirements of the industry sector. - Populate the individual databases, develop self-regulatory performance monitoring mechanisms, and set acceptable time related targets for data capture.	Maintain the individual databases according specific time related targets and ensure that data can be accessed by members of the industrial sector
2. Performance Management				
2.1. Water use and water balance	If one is serious about water conservation, as is the case here, then targets should be set and performance monitored. However, before targets can be set, the objective of a business should be to understand its use of water and	If not already understood, businesses will develop an understanding of the interactions between their business processes and their water utilisation and waste water requirements. Furthermore, businesses included in the databases mentioned in above will provide the relevant State Water Council or Water Services Provider	Determine the uses of water and the wastewater requirements for individual businesses. Project future water	Undertake pilot projects and commission research and development into the drivers of water demand (and wastewater) and into

	<p>waste water discharge requirements. Much in the same way that expenditure is analysed and budgeted, so too should the water related elements. They are, after all, items of expenditure. Furthermore, another objective of understanding the water use and wastewater discharge requirements is to determine the impact on the overall water environment, and to ensure that this is mitigated.</p>	<p>with an indication of their future water utilisation and wastewater discharge requirements. Further research and development into alternative processes that utilise less water and generate less wastewater will also need to be commissioned. Various pilot projects to assess the impacts of various water conservation measures in the various business sectors should also be commissioned</p>	<p>utilisation and wastewater discharge requirements, and capture on the individual databases.</p>	<p>alternative processes that utilise less water and generate less wastewater</p>
<p>2.2 Performance auditing²²</p>	<p>Once a business understands its water utilisation and wastewater discharge requirements, it will be in a position to monitor its performance in this regard. The setting of performance targets is always a sensitive issue since the implications of water conservation are not easily quantified. The first step is to determine what the performance indicators should be and then to determine the current levels of performance of these indicators. The focus here should be on the specific industry processes. Thereafter, achievable targets can be set and the performance monitored and reported. The objective of this exercise is to achieve the optimal balance between effective and efficient</p>	<p>Water utilisation and wastewater discharge performance indices for all appropriate business processes will be determined and published. Following this, all businesses will set targets and the performance indices will be monitored. It should be noted that certain infrastructure might have to be installed by businesses to enable them to monitor these indices. Businesses listed on the databases describe above will provide the relevant State Water Council or Water Services Provider with performance reports. The performance status of the businesses will then be entered into the database. Although self-regulation is being promoted, audits of those businesses listed on the databases will be undertaken on a regular basis. Ad-hoc audits of the other businesses should also be considered.</p>	<p>12th FYP: Determine water utilisation and wastewater discharge performance indices for individual industry processes.</p> <p>Set performance targets, install meters and monitoring systems and submit performance reports</p>	<p>Design and undertake performance management audits</p>

²² Performance auditing will be part of the on-going review process of water licensing, where these exist. The history of performance of either individual businesses or Water Services Providers, whomever is applying for a licence, should become a criterion in the granting of future licences.

	water utilisation and wastewater discharge.			
2.3. Benchmarking performance	Businesses are often unaware that they are performing above or below the norm in areas relating to water conservation. It is essential that some sort of feedback on performance be established. Ideally this feedback should be confidential, but it is important for businesses to get an indication of their relative performance for specific industry processes against established norms. This creates a competitive environment and provides a positive result of all of their efforts in setting targets and monitoring performance.	: Benchmarking of industry processes against similar operations elsewhere (both in India and abroad) will be undertaken to provide a relative indication of performance. The performance indicators will provide the basic information for the benchmarking, however, other parameters will also be taken into industry sector. For logistical purposes, benchmarking will be limited to those businesses listed in the databases. Performance norms and standards will also be developed and published so that the other businesses can compare their own levels of performance. Furthermore, industry norms and standards relating to best management practices in the various processes will be researched and developed. The emphasis will be on developing a system that embraces the range of standards reflecting international best practice and as well locally appropriate measures.	Develop benchmarking criteria and identify partners to be benchmarked against; together with industrial sector norms Undertake and report on the benchmarking exercise	Research and develop industry norms and standards.
3. Institutional measures to support wise water use				
3.1 Water conservation programme	When implementing water conservation measures, there are several important issues that must be taken into account. It is clear that reducing wastage in order to promote greater profit margins should be a fundamental issue that requires little additional motivation. This, however, is not normally the case. The measures required to reduce waste are often of a capital nature, whilst the savings will be reflected on an operating budget. Although such	With the help of the relevant State Water Council or Water Services Provider, businesses will develop a water conservation programme. The water balance analysis and the water audit will provide an indication of the extent of any water conservation problems and possible interventions. Typical technical interventions are: • Domestic: retrofitting water saving devices; • Irrigation: scheduling and application; use of indigenous plants; mulching. • Process: new technologies and processes which utilises less water. • Cleaning: alternative methods of cleaning; reclaimed water.	Determine the water conservation problems and define appropriate interventions. Determine the benefits and the costs of water conservation for individual businesses	Undertake cost-benefit analyses, develop and implement the water conservation programme.

	<p>actions generally pay for themselves over a relatively short period, it is often difficult for businesses to motivate for, and to secure the required capital budgets. Furthermore, the cost of water is often a rather small item on a business's operating budget. The objective is therefore to develop water conservation programmes that are a prioritised and scheduled suite of interventions for individual businesses.</p>	<ul style="list-style-type: none"> • Cooling: air cooling, multiple pass cooling; higher water quality tolerances; reclaimed water. • Fire fighting: pressure management; separate systems; reclaimed water. • Water treatment: management and de-watering of sludge; more efficient technologies and processes. <p>The elimination of leakage and measurement of water use are common interventions, no matter what the use. Education, awareness and marketing are also common and need to be undertaken. The costs of implementing water conservation interventions and the benefits of the reduced water utilisation will be determined and assessed by means of a cost-benefit analysis. Furthermore, businesses that generate wastewater will benefit in that the reduction in use will have a corresponding reduction in wastewater and therefore reduction in the treatment and disposal thereof. The savings in water use costs discussed above will give an indication of the level of funding that can be justified, on purely financial grounds, for allocation to water conservation. Once accepted by the State Water Council or Water Services Provider, a business will systematically implement its water conservation programme.</p>		
<p>3.2 Wastewater reclamation</p>	<p>More often than not, businesses that discharge wastewater incur greater expenses in this regard than they do in the purchase and/or purification of water. As a result, there is always the danger that the wastewater is diluted so that it meets receiving water quality objectives. Although not necessarily a consumptive use, this</p>	<p>Wastewater discharges will be monitored carefully by the relevant State Water Commission or Water Services Authority. Although both the quantity and quality of the discharges preferably should be monitored, the emphasis will be on routine sampling of water quality for the businesses with large discharges for compliance with the requirements of the discharge permit. The water balance analysis will also be evaluated to ensure that excessive water is not being used</p>	<p>Monitor wastewater discharges of those businesses identified from the regional databases.</p> <p>Assess water balances for excessive use relating to wastewater</p>	<p>Determine the potential for reclamation and develop alternative methods of recycling water.</p>

	<p>practice can influence water resources allocations. Furthermore, wastewater discharges either to sewer systems, or into an open river system, are notorious in terms of their water quality problems and pollution. The objective is therefore to promote the practise of businesses containing all their wastewater on site and recycling it as much as possible. The principle of waste minimisation and clean technology should be the principal objective here. Furthermore, the Waste Discharge Charge System, which will need to be developed will provide incentives to minimise waste.</p>	<p>for dilution purposes.</p> <p>Individual businesses will also determine the potential for wastewater reclamation, whilst the relevant State Water Commission or Water Service Authority</p>		
3.3 Incentives and penalties	<p>The savings realised can often cover the costs of implementing water conservation measures, but there is normally a need for some financial incentive or seed funding to initiate the process. The relevant authorities and the industry sector as a whole should strive to make water conservation a self-financing initiative.</p>	<p>The States working with local Water Services Authorities, along with the Business Representatives, will devise a system of incentives and penalties that reflect the performance of businesses as is discuss above. These incentives and penalties could comprise part of the catchment management charge that will be levied to all users in future. Consideration could be given to amending the charge so that businesses that perform well will be given a rebate, and those that do not perform well will incur the full charge. The costs of the rebates will be determined such that they balance with the income generated from the full charges.</p>	<p>Determine appropriate system of incentives and penalties.</p> <p>Implement the system along with the performance management aspects.</p>	<p>Review incentives and penalties according to current performance</p>
3.4 Water conservation forums	<p>An important aspect required for successful water conservation is the ability to network and share information, tactics and experience with colleagues. Workshops or</p>	<p>Water conservation forums should be set up, or existing forums will be expanded, so that the various issues concerning water conservation can be discussed within the various business sectors. These forums will be created on the lines of those</p>	<p>Determine the need for water conservation forums and the capacity within relevant State Water</p>	<p>Establish the forums and co-ordinate the activities</p>

	forums will provide an opportunity for managers and planners to discuss any problems and/or successes they have had in their quest to reduce wastage and pollution	envisaged for the State Water Commissions, within which specific focus should be provided on each of the industry sectors, representatives from State and National Government, and other relevant water user groups. The State representative should chair the individual forums and will be responsible for driving the various initiatives in the different business areas; arranging for presentations from various suppliers and/or specialists in the field of water conservation; and ensuring that all of the business sectors are aware of the latest developments and techniques in water conservation.	Commission to fulfil this requirement. Design the functional and resource requirements for the forums.	
3.5 Marketing and publicising water conservation	Government should promote self-regulation and increase effort on marketing water conservation to the industrial and commercial sector to communicate their requirements. On top of this, successful water conservation initiatives need to be publicised as do new technologies, processes and approaches to conserving water	A marketing campaign should be designed to promote water conservation amongst the industrial sector. The focus of the marketing campaign, however, will be on promoting self-regulation and communication; and be led by industry associations working with Government	Develop and design a national water conservation marketing campaign for the industrial sector Develop appropriate marketing material and media for the campaign	Implement the campaign