

## 4.1 Introduction

According to the National Water Policy (2012), there is a need to evolve a National Framework Law as an umbrella statement of general principles governing the exercise of legislative and/or executive (or devolved) powers by the Centre, the States and the local governing bodies. This should lead the way for essential legislation on water governance in every State of the Union and devolution of necessary authority to the lower tiers of government to deal with the local water situation. There is also a need to map the aquifers to know the quantum and quality of ground water resources (replenishable as well as non-replenishable) in the country. This process should be fully participatory involving local communities and may be periodically updated. There should be concurrent mechanism involving users for monitoring if the water use pattern is causing problems like unacceptable depletion or building up of ground water, salinity, alkalinity or similar quality problems, etc., with a view to planning appropriate interventions.

As per the Cabinet Committee on Economic Affairs (CCEA) note (June 2013), the scheme “Ground Water Management and Regulation” (GWMR) had been proposed for aquifer mapping and effective management of ground water with focus on vulnerable areas. GWMR scheme was a Central Sector Scheme of DoWR, RD&GR during the XII plan (2012-17) with an estimated cost of ₹ 3,319 crore to be implemented by Central Ground Water Board (CGWB). The Scheme had four components: (a) National Project on Aquifer Management (NAQUIM), (b) Participatory Ground Water Management (PGWM), (c) Technological up-gradation and (d) Ground Water Monitoring, Assessment, Regulation, Publication, Seminars, Awards, technical assistance to States and spill over work of the project of Artificial Recharge & Exploration. The scheme was recommended by the Expenditure and Finance Committee (EFC) in May 2013 and approved (August 2013) by the CCEA.

The scheme envisaged Aquifer mapping for an accurate and comprehensive micro-level picture of ground water in different hydro-geological settings of India by using modern techniques like heli borne geophysical surveys, Geographic Information System (GIS) based thematic maps, ground water modelling and real time digital water level monitoring. The scheme also sought for PGWM through collaborative approach, involving Central and State organisations, research institutes, Panchayati Raj Institutions (PRIs), Non-Governmental Organisations (NGOs) and local community to enable the community and stake holders to monitor and manage ground water themselves.

The broad objectives of the GWMR scheme (2012-17) were as under:

1. Aquifer mapping for delineation of aquifer disposition in three dimension along with their characterisation on 1:50,000 scale in 8.89 lakh sq.km and further detailing up to 1:10,000 scale in some of the vulnerable (Over-exploited, Critical, Semi-critical) areas. Prior to this, the mapping had been done (before May 2013) at a scale of 1:250,000 and in two dimension scale.
2. Formulation of Aquifer Management Plan to quantify water availability and water quality in various aquifers for facilitating sustainable management of ground water resources at regional and local level through participatory management approach.
3. Capacity building of functionaries of PRIs, local community and grass root workers.
4. Up-gradation of technological capabilities and infrastructure of the CGWB to align with proposed aquifer mapping and participatory management of ground water approach.
5. Regulate and control ground water development.

The EFC approved (March 2018) continuation of the scheme for 2017-20 at an estimated cost of ₹ 992 crore. However, PGWM<sup>62</sup>, which was one of the components of GWMR scheme during the XII Plan Period was dropped from the scheme. Activities to be carried out during 2017-2020 under GWMR scheme were (a) National Aquifer Mapping and Management Programme; (b) Ground Water Monitoring, Resource Assessment, Regulation, Information Dissemination, etc. including Workshops, Seminars, Technical assistance to State and Central Organisations, etc.; and (c) Strengthening of infrastructure for technological up-gradation (Machinery & Equipment) through procurement of Hydro-geological, Geophysical and Chemical equipment, Scientific Software, Computers, Drilling machines, Motor Vehicles and ancillary equipment.

Audit observations on the implementation of GWMR scheme are discussed in this chapter.

## **4.2 Financial performance of GWMRS**

The approved outlay, Budget Estimate (BE), Revised Estimate (RE) and Actual Expenditure under each component of the Scheme during 2012-19 are shown in Table 4.1.

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<sup>62</sup> The activities of PGWM were stated to be included under a proposed new scheme titled Atal Bhujal Yojana (ABHY). Thus, no activities were undertaken towards Participatory Ground Water Management.

**Table 4.1: Financial information of GWMR Scheme***(Amount in ₹ crore)*

Component	Approved outlays (2012-19)	Budget Estimate (2012-19)	Revised Estimate (2012-19)	Actual Expenditure (2012-19)
Aquifer Mapping	2,585.58	1,934.91	1,115.19	1,006.53
Ground Water Regime Monitoring, Assessment, Regulation, Publication, Seminars, Awards, etc.	543.73			
Technological Up-gradation	346.35	414.57	176.58	103.2
Participatory Ground Water Management	575	0	0	0
<b>TOTAL</b>	<b>4,050.66</b>	<b>2,349.48</b>	<b>1,291.77</b>	<b>1,109.73</b>

*(Source: Figures provided by CGWB)*

It is seen from Table 4.1 that against approved outlay of ₹ 4,050.66 crore, the actual expenditure under GWMR during 2012-19 was ₹ 1,109.73 crore which was only 27 per cent of the approved outlay. The limited expenditure and inability to meet the financial targets envisaged under the scheme indicates deficient performance. The achievement of physical targets set during the period 2012-19 is discussed in the subsequent paragraphs.

### 4.3 Aquifer Mapping

Aquifer mapping is a scientific process wherein a combination of geologic, geophysical, hydrologic and chemical field and laboratory analyses are applied to characterise the quantity, quality and sustainability of ground water in aquifers. An accurate and comprehensive micro-level picture of ground water in India through aquifer mapping in different hydrogeological settings would enable robust ground water management plans at the appropriate scale to be devised and implemented. This would help in achieving drinking water security, improved irrigation facility and sustainability in water resources development. CGWB had also published (2013) "Manual on Aquifer Mapping" which attempted to evolve uniform protocols for various activities such as collection and compilation of available information on aquifer systems, demarcation of their extents and their characterisation, analysis of data gaps, generation of additional data for filling the identified data gaps and preparation of aquifer maps at the desired scale. CGWB had identified an area of 24.8 lakh sq. km. for Aquifer mapping.

#### 4.3.1 Targets of aquifer mapping and achievements

(i) One of the key objectives of NAQUIM (2012-17) was delineation of aquifer disposition in three dimensions along with their characterisation on 1:50,000 scale in 8.89 lakh sq. km. and further detailing up to 1:10,000 scale in 0.67 lakh sq. km. of the vulnerable (Over-exploited, Critical, Semi-critical) areas. During the 4<sup>th</sup> meeting of National Inter-Departmental Steering Committee (NISC) held in September 2016, the

target areas for NAQUIM were revised and reduced from 8.89 lakh sq.km. to 5.25 lakh sq. km. to be covered by March 2017. Against this, CGWB covered an area of 6.31 lakh sq.km. during the XII Plan period.

During 2017-2020, CGWB targeted aquifer mapping and formulation of Management Plans on 1:50,000 scale for 6.60 lakh sq. km. The balance area of 11.90 lakh sq. km<sup>63</sup> was to be covered in subsequent years. The scheme aimed to cover the entire country with special focus on challenges confronting the ground water sector such as ground water depletion, water quality issues related to geogenic and anthropogenic factors, water stress areas in terms of volumetric availability, and other issues such as sustainability of springs particularly in the hilly areas, etc. As of September 2020, CGWB had covered an area of 13 lakh sq. km.

Audit observed that CGWB took eight years to cover 52 *per cent* of the total identified area of 24.8 lakh sq. km. Considering the time still required to complete aquifer mapping of the remaining 11.8 lakh sq. km, the Department needs to develop a strategy for completing the work within a reasonable time period.

DoWR, RD&GR stated (September 2020) that the remaining area of 11.8 lakh sq. km. was targeted to be covered by 2023.

(ii) CGWB had finalised Aquifer Mapping Reports in respect of only 6.5 lakh sq. km. (i.e. 50 *per cent* of the area of 13 lakh sq.km. covered) for 29 States/ UTs as of September 2020. The detailed mapping in 1:10,000 scale for 0.67 lakh sq. km. of the vulnerable (Over-exploited, Critical, Semi-critical) areas was not done at all. Audit also noticed that this scale of mapping was not included in the scheme for the period 2017-20.

(iii) It was also proposed to prepare micro level plans to facilitate implementation of various supply and demand side interventions to ensure long-term sustainability of local ground water resources. In the first phase, it was proposed to have detailed Aquifer Management Plans for 1,000 such representative Panchayats during 2018-20<sup>64</sup>. The selection of the Panchayats was to be made on the basis of the stage of ground water development, ground water contamination profile and ground water development prospects including requests of the State agencies to address any specific ground water related problems.

As of September 2020, only 329 micro level management plans had been prepared. Thus, the target to prepare micro level plans to empower 1,000 representative Panchayats for sustainable management of ground water resources during 2018-20 remained unachieved.

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<sup>63</sup> 24.8 lakh sq. km. minus area of 6.31 lakh sq. km. covered during XII Plan period and 6.60 lakh sq. km. targeted during 2017-20.

<sup>64</sup> 350 Panchayats during 2018-19 and 650 during 2019-20.

The Department stated (October 2019) that CGWB was trying to achieve the targets in spite of significant shortage of human resources. The Department had recently hired M/s WAPCOS Ltd.<sup>65</sup> as Project Monitoring Consultant to undertake some of the activities such as tendering/supervision, etc. in a time-bound manner, which was likely to help CGWB to concentrate more on R&D activities.

The issue of shortage of human resources has already been discussed in Chapter 2. As recommended by Audit at the end of Chapter 2, the Department needs to address these constraints by also engaging with other experts and going for strategic partnerships to ensure smooth functions in processes of ground water management and governance.

### 4.3.2 Incomplete aquifer mapping reports

The systematic mapping of an aquifer encompasses a host of activities such as collection and compilation of available information on aquifer systems, demarcation of their extents and their characterisation, analysis of data gaps, generation of additional data for filling the identified data gaps and finally, preparation of aquifer maps at the desired scale. As per the EFC (2012-17), the scientific work<sup>66</sup> had to be executed using available in-house resources and also be outsourced.

The GWMR scheme envisaged that CGWB (through its Regional Offices) would identify data gaps for 8.89 lakh sq. km. by 31 March 2015. Further, as per the Manual on Aquifer Mapping of CGWB, once the collection, compilation, data gap analysis and additional data generation to fill the identified data gaps are completed, the final and most important step was the preparation of the aquifer map, which brings together various aspects of the aquifers and their ground water resources in the form of a map, which can then be used by the stakeholders to plan their sustainable development and management.

Out of 18 Regional Offices of CGWB, only five had submitted the data gaps in time. The work to be executed through outsourcing was initiated only in April 2016 and was therefore badly delayed (discussed in detail in para 4.2.3). Consequently, though mapping reports for 6.3 lakh sq. km. were finalised, additional data<sup>67</sup> to fill the identified data gaps was not generated. As such, all these aquifer mapping reports were incomplete and their utility to the stakeholders to plan their sustainable development and management was limited. Moreover, CGWB did not furnish the details of the amount of data<sup>68</sup> required, data available and the data gaps in these aquifer mapping reports. Further, Audit noticed that the parameters as well as

<sup>65</sup> A Public Sector Enterprise under DoWR, RD&GR

<sup>66</sup> Geologic, geophysical, hydrologic and chemical field and laboratory analyses

<sup>67</sup> The data gaps indicate the data which is not available to prepare comprehensive aquifer mapping reports. The additional data is the data required to fill up such data gaps.

<sup>68</sup> Pertaining to number of wells, VES, Soil Infiltration Studies, Aquifer Parameters, Recharge Parameters etc.

number of monitoring stations were inadequate as illustrated in one case in Box 4.1 below.

**Box 4.1: Illustration from Report on Aquifer Mapping and Ground Water Management of Jodhpur, Rajasthan**

Para 1.4 of the Report on Aquifer Mapping and Ground Water Management of Jodhpur, Rajasthan prepared by CGWB documents that validation and geo-referencing of the location coordinates, lithologs and hydrogeological data is needed and State GWD data is lacking in aquifer parameters. It was also recorded that available data was limited largely to State Highways and main roads only. The report mentioned that in order to get a clear 3D hydrogeological geometry of the aquifer system and water level behaviour, there was a need to generate more data by Groundwater exploration, Vertical Electrical Sounding (VES) and to establish more numbers of monitoring stations for better understanding of the ground water regime behaviour in terms of quantity and quality.

DoWR, RD&GR stated (September 2020) that aquifer maps and management plans for the areas covered during 2012-17 were prepared using existing data and new data generated through in-house activities. Only the part of data generation envisaged through outsourced drilling was delayed due to various reasons. Thus, the maps and management plans were prepared with most of the relevant data like exploratory wells, water level, water quality, pumping tests etc. In view of above, though there was scope for further improvement, the reports can be considered complete. As regards generation of additional data through exploratory drilling, total data requirements in respect of number of exploratory boreholes for covering the entire country had been rationalised to nearly 18,000, of which about 15,000 had already been constructed or are at various stages of construction. Process for outsourcing of construction of the remaining approximately 3,000 wells had already been initiated.

The reply of the Department illustrates that there was scope for further improvement in the aquifer maps and management plans based on the generation of the additional data. However, the reply is silent about the timelines for revision of reports with additional data.

**4.3.3 Non preparation of Ground Water models**

Ground water models provide a tool to estimate ground water availability for various water use strategies and to determine the cumulative effects of increased water use and drought conditions. A ground water model is a numerical representation of the aquifer system capable of simulating historical and predicting future aquifer conditions. The purpose of the NAQUIM program was to provide an Aquifer Response Model that can be used to develop reliable and timely information on ground water availability for the region to ensure adequate supplies or recognise inadequate supplies over a 15 year planning period. As mentioned in para 4.2.1, CGWB had carried out aquifer mapping of an area of 13 lakh sq.km. as of September 2020. However, 3D modelling was completed only for an area of about three lakh sq. km. only.

CGWB had entered into a Memorandum of Agreement (MoA) with Indian Institute of Technology, Kanpur (IIT) and Indian Institute of Science, Bangalore (IISc) for

Development of Ground Water Flow Models and Preparation of Aquifer Management Plans as shown in Table 4.2 below.

**Table 4.2: Ground water modelling work undertaken**

Institution	Date of MoA	Sanctioned cost (₹ lakh)	Targeted date of completion	Areas to be covered
IIT	August 2017	93.22	September 2018	81,120 sq.km in Punjab and Haryana and 66,193 sq.km in Bundelkhand region in parts of Uttar Pradesh and Madhya Pradesh
IISc	September 2017	34.10	October 2018	48,294 sq.km in Karnataka

As per the MoA, IIT and IISc were to submit Inception Reports containing detailed work plan and timelines specific to the study area keeping in view the objectives, scope, methodology, timeline and deliverables outlined in the agreement, by November 2017 and December 2017 respectively. Further, Monitoring Committees were to be constituted by drawing officers from CGWB and the two institutions but the timelines for their constitution were not specified in the MoA. The committees would monitor the progress of the work, provide guidance in execution of the study and resolve all technical and administrative issues regarding implementation of the study. However, frequency of monitoring was not prescribed. The Monitoring Committees were constituted in November 2017. The progress of work was as follows:

Work undertaken in Punjab, Haryana and Bundelkhand region by IIT Kanpur:

IIT Kanpur submitted its inception report in April 2018 after a delay of more than five months. The first meeting of the Monitoring Committee was held in May 2018 in which it was observed that the work had not progressed beyond data compilation and conceptualisation stage in Bundelkhand region. The committee suggested that mid-term evaluation of the progress be undertaken at the end of two months from the date of the meeting i.e. in July 2018. The second meeting of the committee was held in December 2018 after a gap of six months, in which progress report of only Punjab region was submitted. The committee observed that the report did not cover all the objectives of MoA, therefore it was considered as an interim report.

Audit observed that one of the major roles of CGWB was to provide relevant data available to IIT Kanpur. Audit observed that there was delay on the part of CGWB in this regard, thereby affecting timely implementation of the project. Due to this, the modelling projects were extended on no cost basis in Punjab and Haryana till November 2018 and in Bundelkhand till February 2019. The final report was yet to be submitted by IIT Kanpur (February 2019).

Work undertaken in Karnataka by IISc:

IISc submitted its inception report in July 2018 i.e. after a delay of more than seven months. The report of IISc was evaluated by an Evaluation Committee and its

comments were sent to IISc (October 2018) with the request to revise the inception report. Some of the shortcoming noticed in the inception report were as follows:

- The inception report was very brief.
- Detailed work plan as per the MoA timelines and the conceptual model framework are missing in the inception report.
- The report does not include details of data availability, source, format, scale etc. as well.
- The document does not elaborate the work done and does not provide any insight into the future work plan or timelines.

Audit observed that CGWB was yet to receive the revised inception report from IISc (February 2019). There were two meetings of the Monitoring Committee in May 2018 and December 2018. However, progress of the project remained slow.

Thus, ground water modelling work undertaken by CGWB was not completed as scheduled. As such, CGWB could not provide a tool to estimate ground water availability for various water use strategies and to determine the cumulative effects of increased water use and drought conditions.

DoWR, RD&GR stated (September 2020) that ground water modelling for ~3 lakh sq. km was expected to be completed by 2022. The fact remained that CGWB would still be falling short in the preparation of 3D models for the remaining areas that had already been mapped.

#### 4.3.4 Delay in undertaking outsourcing works

In view of limited in-house human resources and infrastructure, CGWB had proposed (May 2013) the outsourcing of various tasks to take-up the physical targets envisaged in the XII plan. The year wise financial targets for outsourcing works under GWMR scheme are shown in Table 4.3.

**Table 4.3: Outsourcing works under aquifer mapping**

Activity	Years (Amount in ₹ crore)					
	2012-13	2013-14	2014-15	2015-16	2016-17	Total
Data Generation (Hydrogeological, Geophysical, Chemical, Hydrological etc)- In house and Outsourcing	-	16.57	61.86	273.62	390.92	742.97
Ground Water Exploration-through drilling agencies	-	34.95	80.99	176.61	496.53	789.08

During 2017-18, CGWB outsourced 14 works to various private firms and two works to WAPCOS at a total cost of ₹ 313.78 crore for construction of Exploratory and Observation wells.

Audit observed that CGWB initiated the file for outsourcing the work of exploration (wells) only in April 2016 i.e. in the last year of the XII plan period. For next 12 months

(till March 2017), CGWB could not finalise the proposal. As a result, the additional data required to fulfil the identified data gaps could not be generated on time and the targets stipulated by the CCEA for XII plan could not be achieved. Further, only one project was completed within original time schedule. Six works were completed after a delay of 86 to 558 days. One project was foreclosed by the Department and another was rescinded. Five works were still continuing with delay ranging between 92 to 626 days. A total amount of ₹ 194.39 crore was released for the 12 works as of October 2019. The details of the outsourced works are given in the **Annexure 4.1**.

Delay in completion of work identified under aquifer mapping would delay the assessment of ground water and therefore affect the development of ground water management plans.

The Department stated (October 2019) that the total data requirements were finalised after the reprioritisation of areas (5.25 lakh sq. km.) in September 2015 and completion of the data gap analysis. Department also attributed the delay to handing over of sites in phase wise manner as per the clearances received from the State government, non-commencement of works by the contractor, idle rigs for wanting of casing pipes, etc.

The reply was, however, silent about the delay (till April 2016) on part of CGWB in initiation of proposal for outsourcing works. The fact remained that delay in completion of outsourced works affected the achievement of targets of aquifer mapping under GWMR scheme.

#### **4.3.5 Designing of web-based system**

The Manual on Aquifer Mapping stipulated that the GIS data prepared under the project should be stored in such a way as to provide direct access to users without use of proprietary software through a suitably designed web-based system for easy dissemination of the information.

Audit observed that CGWB had published reports, but had not provided direct access to users by designing any web-based system for easy dissemination of the information regarding the aquifer mapping carried out during 2012-18.

The Department stated (October 2019) that the aquifer maps and management plans at present were being disseminated in the (i) Reports-that contain the maps and (ii) The AIMS<sup>69</sup> web-page (aims-cgwb.org) where the maps were posted and that CGWB was planning to develop web-based system for better dissemination of the outputs.

Audit however, noticed that the aquifer maps disseminated on the system were only in the form of single view three dimensional images. As such, the purpose of preparing the data in 3-D was defeated.

<sup>69</sup> Aquifer Information and Management System (AIMS) is being developed through the Rajiv Gandhi National Ground Water Training and Research Institute, Raipur.

DoWR, RD&GR acknowledged (January 2020) that aquifer mapping reports need to be published for public consumption and presented in a manner that is easily interpreted and utilised by even the common users and that efforts would be made in this direction.

#### **4.3.6 Supervision and guidance by Project Management Unit**

A dedicated Project Management Unit (PMU) was to be set up in CGWB to manage, supervise and provide technical guidance to help project implementation. The Terms of Reference of the PMU were to supervise and provide technical guidance in implementation of NAQUIM, monitoring of various activities envisaged under NAQUIM and to assist in matters related to project implementation. The PMU consisted of a Coordinator and three members and was to work under the overall supervision and guidance of Member, Survey, Assessment & Monitoring (SAM). Three officers of CGWB had to assist the PMU in day to day activities.

Audit observed that no timeline for constitution of the PMU was prescribed by CGWB. The PMU was constituted by CGWB in August 2015, i.e. after a delay of more than three years since initiation of the scheme in 2012.

CGWB informed (July 2018) Audit that all the three members were transferred/promoted (between September 2015 to November 2017) and one of the officers assigned to assist PMU was also deputed to another wing. The assignments of the PMU were undertaken by the coordinator of PMU with assistance from the remaining officers. Audit observed that no efforts were made to replace the officials for proper functioning of PMU. As a result, the PMU could not supervise and provide technical guidance in implementation of NAQUIM and get continuous feedback about constraints and bottlenecks in implementation of various activities and anticipated outsourcing work of data generation.

While DoWR, RD&GR reiterated (October 2019) that the members of PMU had been transferred/ promoted it remained silent about the action taken to provide substitutes for the transferred/promoted officials.

#### **4.3.7 Action by State Governments on Aquifer mapping reports**

The involvement of State machinery including various departments, was essential if the Aquifer Management Plans were to be implemented. CGWB was to involve State Agencies in Aquifer Mapping and implementation of Aquifer Management Plan activities. Of the 201 reports included in the programme, Aquifer mapping reports of only 168 districts were shared with District Administration till November 2019. From the information available in respect of 27 States/UTs, it was seen that no action was taken by 14 States<sup>70</sup> on the recommendations made in the reports. In one State

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<sup>70</sup> Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Dadra & Nagar Haveli, Jammu & Kashmir, Jharkhand, Maharashtra, Manipur, Meghalaya, Nagaland, Odisha, Telangana and Uttarakhand.

(Gujarat) the report of CGWB was yet to be approved by the State agency. A few States reported constraints such as map scale being too small to locate the areas, non-receipt of funds from CGWB or Central Government to implement the reports in the field (Karnataka and Maharashtra), insufficient information in the reports (Punjab, West Bengal), etc. due to which the States were unable to implement the recommendations made in the reports. The remaining States had reported partial implementation of the recommendations of CGWB. The State wise Audit observations in respect of sampled reports and constraints faced by the State agencies are given in the **Annexure 4.2**.

#### **4.4 Participatory Ground Water Management**

According to the National Water Policy (2012), declining ground water levels in over-exploited areas needed to be arrested by introducing improved technologies of water use, incentivising efficient water use and encouraging community based management of aquifers. The EFC Note for GWMR scheme, approved in August 2013, stated that Participatory Ground Water Management (PGWM) required a coordinated effort involving Government Departments, research institutes, PRIs, civil society organisations and the stakeholders at the village level who would guide collective sharing and use of ground water based on a careful understanding of the storage and transmission characteristics of different aquifer units. Two levels of programme implementation were envisaged namely, programme facilitation and participatory outreach programme for project delivery to the end users.

The programme facilitation role was to be played by DoWR, RD&GR, CGWB and State Ground Water Resource Centres (SGWRC). The focus of the facilitation would be to build the capacities of managers, planners, technocrats on the concept of PGWM and Demand Management. Facilitation included arrangements for project implementation involving the State Implementing Partners (SIPs) and District Support Organisations (DSOs). In both cases, the national and State level authorities were expected to act as facilitators for the delivery of project services. National State and District Level facilitation centres were envisaged so that community workers/volunteers would be trained in collection of primary hydro-geological data and periodic monitoring of wells. These grass root workers would also sensitise villagers about the ground water trends, optimal water usage and quality of ground water with the aim of planning water-use as per the water budget.

For the purpose, CGWB was to hire services of a Technical Support Agency (TSA) primarily to build capacities of SIPs which, in turn, were to form partner DSOs at District level through CGWB and TSA. The TSA was to deliver a set of consistent project management functions and technical services (activities, programmes, guidelines, farmer water school methodologies etc.) at State level.

The Participatory Outreach Programme for Project Delivery for the End Users was to consist of programmes such as National Level Brain Storming Programmes, State Level

Awareness Programmes, District Level Orientation Programmes, Skill Development Programmes for District Support Groups, Panchayat Raj Institution Sensitisation - Block level discussion for priority Aquifer Management Units/Blocks, Induction programmes for knowledge development of grass root level workers enabling them to understand the aquifer management plan and their implementation modalities, Skill development for handling and use of water level and quality monitoring equipment and organising Farmers Water School/Community participation Camps.

An outlay of ₹ 575.38 crore<sup>71</sup> was provided for the period 2013-17 but no expenditure was incurred. As per the approved CCEA note, during the year 2014-15, CGWA had to ensure selection of National level TSA, SIPs in 10 States, District Support Cell and Contractual Hiring of grass root ground water workers by SIP/DSO. However, even after lapse of four years (2014-18), CGWB could not finalise the proposal for selecting these agencies.

Audit observed that though approval of the scheme was communicated in September 2013, the proposal for PGWM was initiated only in March 2014. CGWB took 11 months to prepare the draft terms of reference (TOR) for hiring of TSA in 10 States and sent the same to DoWR,RD&GR in February 2015. DoWR,RD&GR sought (March 2015) some additional information for further consideration, which was provided by CGWB in March 2016, i.e. after 12 months. No further correspondence was done with DoWR,RD&GR on the proposal. CGWB initiated (March 2016) another proposal for implementation of PGWM in Lalitpur and Jhansi Districts of Bundelkhand Area of Uttar Pradesh, which was also not finalised. Eventually, the PGWM component was dropped for continuation in the GWMR scheme for 2017-20.

Due to slow progress of work by CGWB, no meaningful work was done under PGWM and the objective of ground water management at grass root level through sensitisation of villagers about the ground water trends, optimal water usage and quality of ground water, as envisaged by the National Water Policy (2012) could not be achieved.

The Department accepted (October 2019) that the envisaged activities under the Participatory Ground Water Management could not be completed but added that the component was dropped from the subsequent EFC memo of 2017-20 and was being taken up as a separate scheme on participatory ground water management through the Atal Bhujal Yojana (ABHY).

However, unlike the PGWM, the ABHY that has been launched by DoWR,RD&GR in December 2019 will be implemented only in selected locations in seven States<sup>72</sup> covering 8,350 Gram Panchayats in 78 districts. So, both in scale and size, the ABHY is

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<sup>71</sup> ₹ 332.15 crore for facilitation, ₹ 137.23 crore for outreach programme and ₹ 106 crore for travel, overheads, etc.

<sup>72</sup> Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan and Uttar Pradesh

not a replacement for PGWM. The fact remained that PGWM, though envisaged under GWMRS was not executed for more than seven years.

#### 4.5 Technological Up Gradation and Capacity Building

Keeping in view the emerging challenges of ground water in the country, CGWB felt the need to upgrade its techniques and equipment. The technological advancements being utilised worldwide were to be adopted by CGWB to upgrade its infrastructural and human resource capabilities and bring CGWB at par with international standards for better management of ground water resources. Accordingly, a benchmarking of various activities of CGWB with international best practices was done by international experts from the United States Geological Service (USGS) in 2012.

In December 2012, the Expert Group submitted its report to DoWR, RD&GR, which constituted a committee to review this benchmarking report and to accept or modify its recommendations. The committee submitted its report to DoWR, RD&GR in August 2013.

The recommendations were of considerable importance looking into future infrastructure and human resource requirements to improve upon the efficiency and output from CGWB. The major recommendations from this benchmarking exercise included technological up-gradation including use of advanced equipment, institutional strengthening and capacity building. However, it was observed that CGWB did not take adequate action in these areas as detailed in the paragraphs below.

##### 4.5.1 Procurement of equipment

On the basis of recommendations of benchmarking exercise, CGWB finalised technological up-gradation component in the GWMR Scheme (2012-17). As per the approved report of the EFC, funds amounting to ₹ 305 crore were approved for technological up-gradation in CGWB. Under this up-gradation, various equipment (Hydrological, Geophysical, Chemical, Drilling) and software were to be procured to help achieve the objectives of the scheme.

It was observed that as of March 2019, CGWB could procure equipment and software amounting to only ₹ 107.85 crore (35.34 per cent) against ₹ 305.17 crore allocated in the EFC (Details are shown in **Annexure 4.3**). Against proposed 37 Drilling Rigs, which were important for digging monitoring wells, only 17 rigs could be procured. Out of these 17 rigs, 15 were operational (October 2019).

The Department stated (October 2019) that there was a delay in tendering due to shortage of staff and lack of tendering skills. CGWB had earlier stated (October 2018) that the rest of the equipment/software would be procured by 2019-20.

As a result of the delay, the equipment/software intended to be used during XII Plan is now expected to be received only by 2019-20 i.e. end of the next plan (2017-20).

#### 4.5.2 Capacity Building

The Expert Group's Report on Benchmarking gave (December 2012) 12 recommendations relating to capacity building in CGWB. All the recommendations were accepted (August 2013) for implementation by the Review Committee. However, out of 12, no action was taken in respect of four recommendations by CGWB as shown in the Table 4.4.

**Table 4.4: Status of recommendations of Expert Group on capacity building**

Sl. No.	Recommendation	Remarks of the Review Committee	Status
1.	Selected CGWB officers/staff should attend international conferences and present important findings.	Accepted.	No such conferences were co-ordinated by CGWB's training institute.
2.	A mentorship programme should be developed between CGWB and international experts to provide one-on-one training for specialised hydro-geologic techniques and applications.	Accepted.	No such programmes undertaken.
3.	Attendance at scientific conferences is an especially important aspect of capacity building.	Accepted. A separate budget provision may be made for it.	No separate budget provision was made.
4.	CGWB should provide references on its website for self-training in the field of hydrogeology.	Accepted. In addition, references pertinent to Artificial Recharge and Drilling Technologies should also be put on website.	No references were found on CGWB's website.

Thus, in spite of these recommendations being of considerable importance for CGWB with respect to its future infrastructure and human resource requirements, CGWB failed to take action on some of the significant recommendations.

The Department accepted (October 2019) that recommendations were not implemented completely. It further added that CGWB would make all efforts to implement these recommendations.

#### 4.6 Schemes/initiatives of States/UTs for management of Ground Water

To tackle the problems affecting quality and quantity of ground water, States/UTs implemented various schemes for water supply, irrigation, ground water recharge, effluent treatment, etc. The initiatives of a few States such as Andhra Pradesh, Delhi, Gujarat and Telangana have been effective in management of ground water. These cases are discussed in the Box 4.2.

**Box 4.2: Successful initiatives of State Governments in management of Ground Water****Andhra Pradesh****Geo-tagging of existing borewells**

The State was monitoring the ground water levels in the 1,254 piezometers fitted with Digital Water Level Recorders (DWLRs) that provide data on a real time basis, which was available online<sup>73</sup>. Further, in view of the increased demands and stress on groundwater aquifers, the State Government had geo tagged all existing agriculture bore wells for planning site specific groundwater recharge plans and better regulation of ground water extraction.

The ground water availability increased during 2016-17 even though rainfall during 2016-17 was 29 *per cent* less than the normal. However, in the absence of data on net ground water availability and rainfall deviation for the previous years 2013-14, 2014-15 and 2015-16, Audit could not establish a relationship between the rainfall and the ground water quantity. the State Government stated (January 2019) that the reasons for change in ground water quantity were (i) implementation of Neeru-Chettu programme, i.e., water conservation activity and (ii) transfer of water from surplus to deficit basins.

**Delhi****Installation of Rain Water Harvesting System**

DJB installed 288 Rain Water Harvesting (RWH) systems in their own structures since 2003 up to March 2019. These RWH systems have annual ground water recharge potential of about 122 million litres. In order to promote RWH, DJB offered 10 *per cent* rebate in the water charges levied to consumers if RWH system was installed in their buildings having plot size of more than 100 sq. m. Further, DJB also provided rebate to the extent of 15 *per cent* in the water charges to the consumers who had installed both RWH system and recycling plant. However, in the buildings of plot size more than 500 sq. m, DJB levies penalty by increasing water charges to the extent of 50 *per cent* if consumers did not install RWH system. A penalty of ₹ 29.64 crore was imposed on 11,271 consumers on plots/ properties of 500 sq. meters for non-installation of RWH system. Total rebate of ₹ 14.24 crore had been given in monthly water bills to 1,007 consumers of DJB up to July 2018.

Thus, the scheme appeared to be effective to an extent in encouraging consumers to install RWH systems. However, the larger number of consumers paying penalty for not installing RWH systems indicates that DJB needs to take stern measures to impose implementation of RWH systems by its consumers.

**Utilization of treated effluent**

To discourage ground water utilisation by large institutions/public departments/private agencies, DJB issued public notices<sup>74</sup> whereby treated effluent could be taken by any institution/department by laying pipelines and making pumping arrangement from the Waste Water Treatment Plant to intended locations by the agencies/individuals at their own cost. DJB would facilitate the agencies to lay the conveyance systems at the cost of the beneficiaries. Operation and maintenance cost of the conveyance would also be borne by the beneficiaries at a nominal rate of ₹ four per 1,000 litres. At present, about 89 million gallons of treated effluent<sup>75</sup> was being utilized per day by various agencies such as Central Public Works Department (CPWD), DJB's STPs, Delhi Transport Corporation (DTC), Delhi Development Authority (DDA) etc. for irrigation, washing, horticulture and industrial usage.

Thus, the initiative by DJB has been effective to an extent in utilisation of treated effluents instead of ground water.

<sup>73</sup> <http://coreuat.ap.gov.in/cmdashboard/UserInterface/GroundWater/GroundWaterReports.aspx>

<sup>74</sup> DJB issued public notification on 18.01.2014, 25.04.2018, 12.05.2018 and 09.07.2019

<sup>75</sup> Out of a total of 490 million gallons of treated effluents generated per day (31 March 2019)

## Gujarat

### Construction of Khet Talavadi, Bori Bandh and check dams

The State Government has undertaken schemes for water conservation such as Khet Talavadi (farm ponds), construction of Bori Bandh (small dams using sand bags) and construction of check dams. As on March 2019, 3,21,722 Khet Talavadi, 3,59,657 Bori Bandh and 1,84,933 check dams had been constructed in the State. These initiatives have resulted in increase of recharge of ground water about 700 Million Cubic Meter/year in 2017 which is about 50 *per cent* increase in the Utilizable ground water recharge as compared to 2002. The Stage of Ground Water development has improved from 75 per cent to 64 per cent; Number of Over-exploited blocks have reduced from 30 in 2002 to 25 in 2017; number of Critical blocks reduced from 12 to 5 and Semi Critical blocks reduced from 63 to 11. The number of Safe blocks increased from 104 in 2002 to 194 in 2017.

### State wide drinking water supply grid

To reduce dependency on ground water and provide safe drinking water, the State Government implemented State wide drinking water supply grid, based on Narmada Water and other surface sources. A total of 17,843 villages and 350 towns were planned to be covered under Narmada based Water Grid and other source based Water Grids. Of this, 13,107 villages and 207 towns were covered as of March 2019.

Of the selected four districts viz. Mehsana, Banaskantha, Kutch and Dahod, all villages of Kutch and Mehsana districts; 1,112 villages (out of 1,234 villages) and 192 villages (out of 691 villages) of Banaskantha and Dahod districts were covered under Narmada Based and other surface sources water supply project. Grid based drinking water supply in 122 villages of Banaskantha district and 499 villages of Dahod district were still to be covered. Thus, the targets of Kutch, Mehsana and Banaskantha were largely achieved.

Installation of Micro Irrigation system (MIS) was made mandatory in March 2012 for getting electricity connection for agriculture purpose for better utilisation of water resources. The GWRDC had implemented MIS on 808 tube wells (December 2018) for irrigation purpose.

### Sujalam Sufalam Jal Abhiyan

The State Government has launched Sujalam Sufalam Jal Abhiyan in 2018 with an aim to spread water conservation activities with people's participation. The objectives of the schemes are to enhance storage capacity of existing water bodies like reservoirs, check dams, village tanks, forest ponds, farm ponds; and de-silting and construction/repairing of existing check dams, rejuvenation of rivers, recharging Ground Water, etc. Activities such as deepening of ponds, desilting & repair of check dams and cleaning of canals and drains have been undertaken, which have resulted in increase of ground water level up to 5-7 feet due to increase in water storage.

## Telangana

Telangana Government initiated (2014-15) "Mission Kakatiya" programme for revival and restoration of about 46,530 minor irrigation tanks in the state, in five phases. Impact assessment of the scheme was done in nine selected water basins categorised as over-exploited basins. It was seen that the ground water resources of these basins were increased to 11.4 TMC (as per GEC 2016-17) from 10 TMC in 2012-13. The stage of ground water development has also shown a decrease of eight *per cent* in the State. Further, after implementation of the scheme the overall categorisation of these 'Over-exploited' basins were changed to 'Critical'.

Deficiencies observed in schemes of four selected States are discussed below.

#### **4.6.1 Bihar**

##### **4.6.1.1 Incomplete schemes**

Work related to construction of eight Mini Water Supply Schemes in Arsenic affected villages of Begusarai was allotted to M/s Punj Lloyd Ltd. (April 2010) for a duration of 12 months at a sanctioned cost of ₹ 1.74 crore. An amount of ₹ 1.41 crore was paid to the agency till March 2014. Work was, however, rescinded by the department in January 2015 due to non-completion. Revised technical sanction of ₹ 1.41 crore for the remaining work was approved (September 2017) but the tender process was not initiated by the department as of February 2019. Thus, expenditure incurred on the schemes did not serve any purpose and the population of Arsenic affected habitations remained deprived of safe drinking water.

##### **4.6.1.2 Scheme for irrigation by using Ground Water**

With an aim to get more farmers to construct private tube wells by for irrigation purpose, the State launched subsidy based Nizi Shatabdi Nalkup Scheme in July 2015. As per one of the provisions of the guideline of this scheme, selection of blocks for construction of shallow/ deep tube well should be based on the data of ground water level provided by district administration and CGWB.

It was seen that 348 tube wells had been constructed (up to December 2018) in six<sup>76</sup> blocks that had been declared as semi-critical as per the Dynamic Ground Water Resource Report 2013. This indicates that ground water level data was not analysed before recommending the construction proposals of farmers.

Minor Irrigation Division stated (February 2019) that after getting information regarding semi-critical and critical zone of some blocks, applications were not sanctioned for boring/drilling of tube wells in these blocks.

The reply is not acceptable as the Division was to allow blocks for construction of shallow/ deep tube well duly considering the available data regarding ground water level. However, it did not follow the guidelines of the scheme while sanctioning subsidy.

#### **4.6.2 Delhi**

DJB submitted (August 2018) a Ground Water Recharge action plan to the National Green Tribunal (NGT). As per the proposed action plan, DJB would trap or stop sewage flow into 12 identified water bodies. It would either use the treated effluent from a nearby decentralised Sewage Treatment Plant (STP) plan for rejuvenation of water bodies or install bio-remediation<sup>77</sup> STP's to clean waste water flowing into the water

<sup>76</sup> Naokothi (15), Bhagwanpur (5), Gaya sadar (3), Nagarmausa (30), Rajgir (132) and Silao (163)

<sup>77</sup> The use of microorganism metabolism to remove pollutants.

bodies. No completion date was stipulated in the action plan to complete the proposed project and the project was still at the initial stage. Inclusion of time bound milestones in the project plan may serve to implement the plan in a more effective manner after its approval.

#### **4.6.3 Telangana**

Although the “Mission Kakatiya” programme of the Telangana Government resulted in increase of ground water resources and decrease in stage of ground water extraction as discussed in the Box 4.2, it was observed that certain other schemes of the State Government were actually promoting ground water extraction. As per the Annual General Report of Ground Water Department for the year 2017-18, there were 471 and 609 bore wells drilled under Scheduled Castes Special Development Fund (SCSDF) and Scheduled Tribes Special Development Fund respectively. Further, it was noticed that although WALTA Guidelines limits the depth of bore wells to 120 m, depth of 128 bore wells ranged between 122 m to 150 m. It was also seen that 36 out of 471 bore wells established under SCSDF Scheme were drilled in ‘notified’ villages.

The State Government needs to ensure that the objectives of its various schemes are consistent with the overall goal of improving the ground water scenario in the State.

The State Government stated (August 2019) that the drilling of bore wells beyond the permissible limit and in over-exploited areas was taken up after obtaining permission from the competent authority. The reply was not acceptable as the State Act/Rules or Guidelines did not provide for any exemptions to such provisions.

#### **4.6.4 Uttar Pradesh**

##### **4.6.4.1 State Ground Water Conservation Mission**

Government of Uttar Pradesh launched ‘State Ground Water Conservation Mission’ in the State from August 2017 to conserve ground water focusing on the stressed blocks through convergence/integration of the schemes run by the different departments. Ground Water Department (GWD) was nominated as nodal agency and it prepared a consolidated Master Recharge Plan for 271 identified stressed blocks which included activities viz. construction/renovation of check-dams, ponds, recharge structures, etc. During 2018-19, allocation of ₹ 2,059.98 crore was made, against which expenditure of only ₹ 946.42 crore was incurred. Scrutiny revealed that there was shortfall in the activities ranging between 18 *per cent* (renovation of ponds) and 91 *per cent* (construction of check dams). Due to non-completion of various activities, the objective of conserving ground water in stressed blocks was not fully achieved.

##### **4.6.4.2 Shortfall in distribution of sprinklers for drip irrigation**

With the objective of reducing groundwater consumption through sprinkler irrigation in over-exploited/critical/semi-critical blocks of the State, the State Government started a programme ‘per drop more crop’ in 2017-18 for distribution of sprinkler sets

for drip irrigation to the farmers of 48 out of 75 districts identified by the State on subsidised rates. Audit noticed that against the target (2018-19) of distribution of 9,135 sprinkler sets costing ₹ 55.63 crore to the farmers, only 3,934 (43 per cent) sprinkler sets amounting to ₹ 24.43 crore to the farmers of 47 districts could be distributed in 2018-19 due to lack of awareness and motivation amongst farmers for use of sprinklers. Thus, the State was falling behind its targets for implementing the use of sprinkle irrigation.

#### **4.6.4.3 Construction of tube wells in banned area for withdrawal of ground water**

On the basis of Ground water Estimation Report-2011, the State Government issued order (October 2014) prohibiting construction of new wells in 179 blocks declared over-exploited/critical by CGWB. However, test-check of records of Executive Engineer, Tube well Construction Division, Agra revealed that 28 tube wells were constructed in seven stressed blocks<sup>78</sup> after the date of issue of notification of the order. The State Government needs to take immediate action against the violation of its orders and also review the situation in the other blocks declared as over-exploited/critical.

## **4.7 Conclusion**

Implementation of Ground Water Management and Regulation Scheme was not accomplished as envisaged. Against an approved outlay of ₹ 4,050.66 crore, expenditure of ₹ 1,109.73 crore only was incurred. CGWB identified an area of 24.8 lakh sq. km. for aquifer mapping against which 13 lakh sq.km was achieved. Against this, Aquifer Mapping Reports for only 6.5 lakh sq. km. were finalised and ground water modelling for ~3 lakh sq. km. were completed as of September 2020.

CGWB had not provided direct access to users by designing any web-based system for easy dissemination of the information relating to aquifer mapping. Many States did not take action on the recommendations made by CGWB in the aquifer mapping reports due to constraints such as map scale being too small to locate the areas, non-receipt of funds from CGWB or Central Government to implement the reports in the field, etc.

The objective of ground water management at grass root level through sensitisation of villagers about the ground water trends, optimal water usage and quality of ground water through Participatory Ground Water Management (PGWM) was also not achieved. With the dropping of this component, activities under PGWM that were earlier planned across the entire country will now be implemented through the Atal Bhujal Yojana (ABHY) scheme only in selected locations in seven states.

<sup>78</sup> Shikohabad of District Firozabad, Chandaus, Khair of District Aligarh, Sasni and Mursan of Hathras, Nidhauri Kalan of Etah and Sahawar of Kasganj.

The report of an Expert Group that conducted benchmarking of various activities of CGWB with international best practices was reviewed by a committee, which made several recommendations in the area of infrastructure and capacity building. CGWB did not take sufficient action on the recommendations of this committee.

While some of the schemes implemented in the States were effective in improving the condition of ground water levels in the States, there were schemes in which the envisaged targets were not achieved and therefore, needed better control and implementation to ensure the desired results.

#### **4.8 Recommendations**

1. Given the targets of the Department and limited expenditure incurred vis a vis budget outlay, the Department may review its strategy for utilising the allocated funds and completing the planned activities under the Ground Water Management and Regulation Scheme. The Department may also consider putting in place a business continuity plan for the scheme.
2. The Department may develop a strategy for expeditious completion of aquifer mapping and modelling of the identified area within a reasonable time period.
3. Central Ground Water Board may take suitable action to develop the web-based system for easy dissemination of information regarding aquifer mapping on priority basis.
4. The Department may ensure proper coordination between Central Ground Water Board and State Governments for implementing the recommendations made in the National Aquifer Mapping project reports.
5. Participatory Ground Water Management, being one of the key activities for sustainable ground water management, may be executed in a time-bound manner through Atal Bhujal Yojana and this scheme may be considered for scaling up to the entire country, thus involving all the States.
6. Central Ground Water Board may take appropriate action to ensure that recommendations of the report of the Expert Group for augmenting its infrastructure, technological upgradation and for capacity building are implemented within a reasonable time frame.
7. The Department may impress upon the State Governments to review the performance of their ground water schemes and take measures to ensure that the envisaged results are achieved by adopting an integrated approach for recharge/augmentation of ground water.