

Safe water through state wide grid and community-led management and water quality issues in Gujarat state

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KEYWORDS

Water quality issues, State wide grid, community participation, capacity building, efficient service delivery

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ABSTRACT: (9 pt)

Safe water through state wide grid and community-led management and water quality issues in Gujarat state;

Dr. Rajiv Kumar Gupta, IAS), Principal Secretary (Water Supply) & Chairman Gujarat Water Supply and Sewerage Board

Gujarat State, which is spread over an area of 1.96 lakh square kilometre with the longest coastline of 1600 kilometres, is the dwelling place of about 6.0 crores people. The State has around 5 percent population but only 2.63 percent of country's water resources. The per capita fresh water availability in the State as per the study done in 2001 has been estimated at 1137 against in India 2000 cubic metre/ person/ annum and North Gujarat (342), Saurashtra (734) and Kutch (875) regions were the worst affected. In the past 75 years, 26 years were declared as drought years. The State Government spent about 125 to 150 crore rupees annually on making emergency arrangements for drinking water to overcome the scarcity during droughts upto 2002. People also spent about 700 to 800 crore rupees to have drinking water. As per the survey done in the year 2003, water in 7675 habitations were found chemically contaminated. The fluoride concentration in these villages ranged from 1.5 mg/ litre to as high as 18.90 mg/ litre. Fluoride was the cause of extensive teeth damages and bone deformities. With an aim to address water quantity and quality issues, Government of Gujarat took all possible measures and it established organisations equipped with powers to perform efficiently and at present three organisations i.e. Gujarat Water Supply & Sewerage Board, Gujarat Water Infrastructure Limited and Water and Sanitation Management Organisation are fully functional to shoulder their assigned roles and responsibilities. The State conceived and finally formulated an ambitious Narmada based water supply master plan to take up works in a mission mode to address on the long term basis through paradigm shift from ground water to surface water. It is planned to cover 75% population through State Wide Water Supply Grid and it already covered 11,235 villages and 131 towns. The grid supplies 2800 million litres water daily by laying down 2487 kilometre bulk pipelines, 120769 kilometre distribution pipelines, having in place 11,365 sumps, 11,640 Elevated Storage tanks and 156 filtration/ treatment plants. Efforts continue for strengthening of local sources, recharge works, water quality testing arrangements and community participation with our firm belief "Users are the best managers". Community involvement in association with WASMO made the significant achievements by completing scheme work in 9397 villages. 76.5% houses have tap water facility and water quality kits have been provided in 14,216 villages

Integrated approach and efforts has ensured access to adequate, regular and safe water at household level and it has brought tremendous socio-economic and health benefits to people. Safe water at household level through community participation led to reduction in water borne diseases and opportunities to people for income generation activities and the children especially girls to get education.

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1. GENERAL INSTRUCTIONS

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Safe water through state wide grid and community-led management and water quality issues in Gujarat state

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Gujarat State is spread over an area of 1.96 lakh square Kilometre. The State has 5.96% of nation's geographical area with the longest coastline of 1600 kilometers. Gujarat State is the dwelling place for about 6.0 crore people with demographic details based on Census 2011 as follows:

No. of Districts	26
No. of Talukas	226
No. of Villages	18225
No. of Towns	348
Total Populations	6.03 Crores
Rural Populations	3.46 Crores
Urban Populations	2.57 Crores



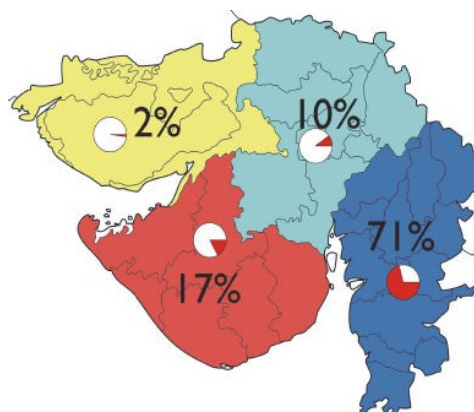
The State has diverse geological, hydrological, climatic and soil conditions, all of which have implications on the status of surface and groundwater resources in the State. The State has around 5 percent population but only 2.63 percent of country's water resources. The per capita fresh water availability in the State, as per the study done in 2001, has been estimated as follows:

National and Regional Variations in the State
(Cubic metre/person/annum)

India	2000
Gujarat	1137
South & Central Gujarat	1932
North Gujarat	342
Saurashtra	734
Kutch	875

Drinking Water Scenario and Crisis in the Past

Most part of Gujarat State is scarcity prone and the distribution pattern of rainfall in the State ranges from over 2000 mm in the Dangs in South Gujarat to about 200 mm in Kutch, which covers around one-fourth area of the State and is sparsely populated. The water scarcity had severely affected this region in the past and Saurashtra and North Gujarat also fall in water scarce regions. Typical geological formations across the State make water storage in the aquifers and percolation for ground water recharge difficult. Gujarat has long coastline with two huge gulfs – the Gulf of Cambay and the Gulf of Kutch. The entire Little Rann of Kutch and Greater Rann of Kutch are inundated with saline sea water for a long period of the year which deteriorates the ground water quality in adjoining areas. In a large area of the State over drafting of ground water mainly for agriculture and subsequent depletion of aquifers has had



Fresh Water Availability

a great impact on the water availability and its quality during the past.

The South and Central Zones, which have major rivers like Narmada, Mahi, Tapi, Ambica, Poorna, etc. and forested areas, have 1932 M³ per capita per annum fresh water. (This is equivalent to 71% of the total State freshwater availability).

In the past 75 years, 26 years were declared as drought years. The State Government spent about 125 to 150 crore rupees annually on making emergency arrangements of drinking water to overcome the scarcity during droughts upto 2002. People also spent about Rs 700 to 800 crore on water and social cost of paucity of water was estimated to be around Rs 2,000/- crore per annum.

Water quality issues before the year 2002

Over-extraction of ground water and long coastline severely affected water quality; mainly with excessive fluoride, nitrate and total dissolved solids (TDS) leading towards the following adverse impacts:

- Constant fall in water level due to over extraction of ground water affected water quality
- Water quality Issues in 25% habitations
- Spread of water borne diseases
- Drying up of water sources causing repeated failure of tube wells and need for re drilling
- Supply of safe water to scarce area especially in summer or drought period by tankers and trains
- Mass migration of human and cattle
- Drudgery of fetching potable water from long distance



As per the survey done in the year 2003, water in 7675 habitations were found chemically contaminated with the details as follows:

Year of Survey	Habitations in the State	Fluoride	TDS	Nitrate	Others	Total
		No of habitations affected with				
2003	34845	4187	2508	1335	29	7675

Note: Some habitations have multiple quality problems.

Overdrafting of ground water as compared to annual recharge caused serious water quality problems. 7675 habitations were found to be quality affected having high concentrations of fluoride, salinity and nitrates. The number of fluoride affected habitations increased from 2,826 in the year 1992 to 4,187 by the year 2003. The fluoride concentration in



Kasipura village in Surendranagar

these villages ranged from 1.5 mg/ litre

to as high as 18.90 mg/ litre. Fluoride was the cause of extensive health damages by permanent pigmentation of teeth and bone deformities in many parts of the State. Anemia, loss of appetite, nausea, thyroid malfunction and sometimes resulted into brain impairment, abortion or still birth. As per this survey, more than 50 percent of total



habitations were facing either low water availability or the water quality problems.

Aiming towards long term water security and safety

Government of Gujarat conceived and finally formulated an ambitious Master Plan to take up works in a mission mode to address both fronts; quantity as well as quality on a long term basis with the following approaches and reforms:

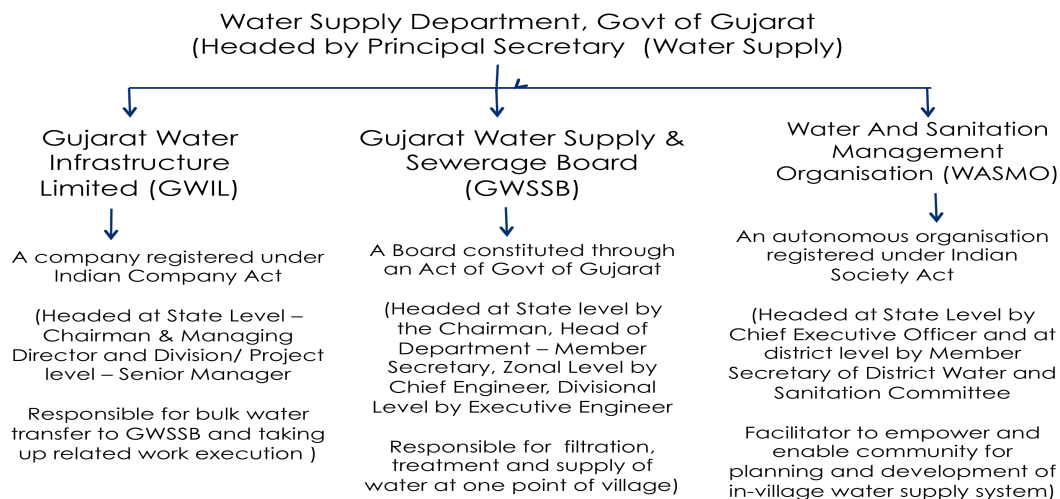
- Paradigm shift from ground water to surface water
- Water supply to scarcity and water quality affected areas through Statewide Water Supply Grid and as a last resort, adopting suitable options like RO system
- Focus on Infrastructure for service delivery of treated quality surface water in villages
- Strengthening of local water sources through recharge
- Active community participation by forming Pani Samiti and water quality team at villages and priority to household tap connectivity in the state
- Distribution of field test kits to villages, awareness raising on safe handling of water and training to village people on water quality testing with integrated approach by involving ASHA workers

Efforts and Achievements:

a) Division of work to maximize service efficiency and achieve quality service

Three independent organisations; Gujarat Water Supply & Sewerage Board (GWSSB), Gujarat Water Infrastructure Limited (GWIL) and Water and Sanitation Management Organisation (WASMO) have been established with exclusive roles and responsibilities. All these organisations are guided by Water Supply Department, Government of Gujarat and work in close coordination. The set-up is as follows:

Organisational Efficiency–Set up and Defining Roles



b) Creation of State Wide Water Supply Grid

With an aim to provide safe drinking water security in water scarce regions, State Wide Water Supply Grid has been created. It is planned to **cover 75% population** of the state, spread across 17 districts by creating bulk water transmission pipelines, water treatment plants, service reservoirs, distribution pipeline network and allied structures. The work is taken up in a mission mode to ensure sustainable water supply services in the rural and urban areas of Gujarat state for accomplishing socio-economic development, peace and happiness in the society.

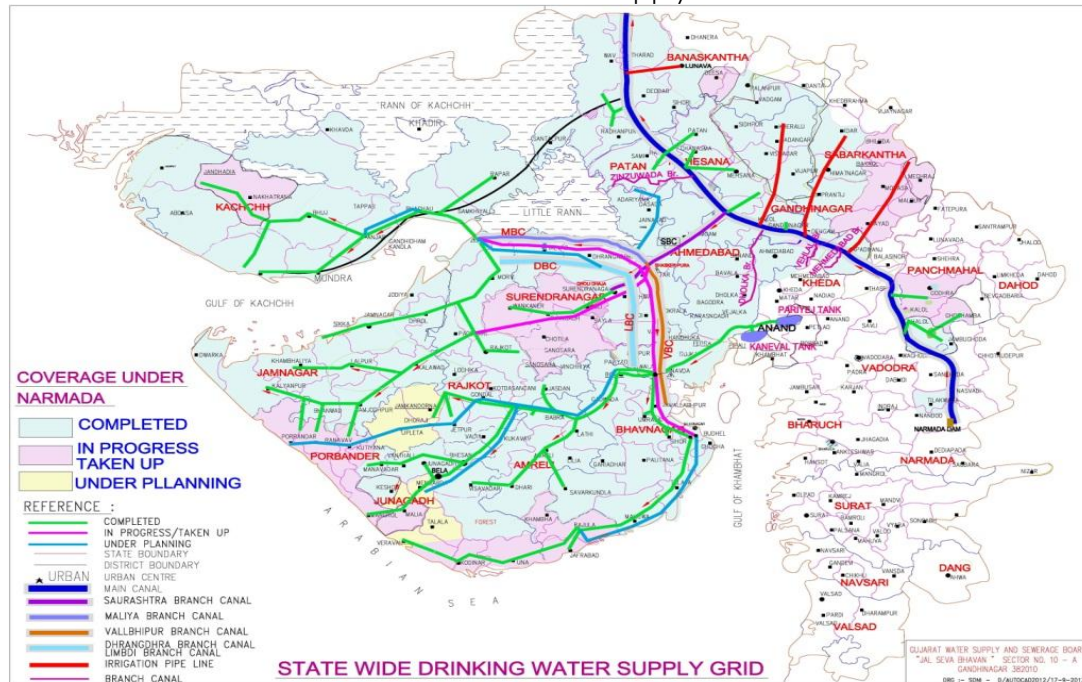
The State has 18225 villages and the Grid is planned to cover the following villages and towns benefiting 36.20 million people out of 60.30 million populations in the State (Census 2011).

The status of progress of Grid work as on December 31, 2012 is as follows:

Planned		Completed		In Progress	
Villages	Towns	Villages	Towns	Villages	Towns
15,007	145	11,235	131	2,604	7

Shift to augmented surface source through Grid has gone a long way to reduce ground water dependence. These efforts so far have resulted not only in water quantity augmentation to fulfil complete needs of people but also with chemically better quality, meeting higher safety standards.

State Wide Water Supply Grid



c) Creation and Augmentation of Infrastructures:

The following infrastructure has been created for improved water supply services to the people and average water supply through Grid arrangement is 2800 million litres/ day:

- Laid down 2,487 km bulk Pipeline and 1,20,769 km distribution Pipeline



- Developed storage capacity by creating 11,365 sumps (2627.40 million liters) and 11,640 Elevated Storage Reservoirs (1235.00 million liters)

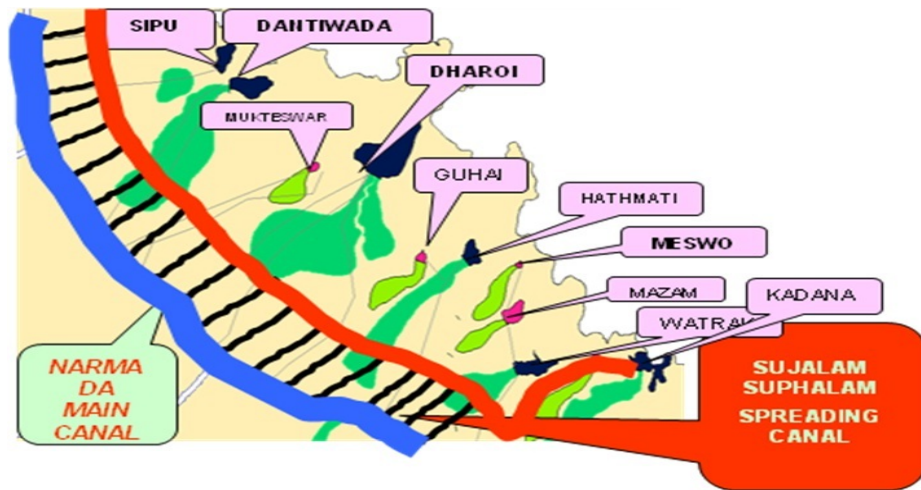


- Developed 156 Filtration / Treatment Plants (2810 million liters daily capacity)

d) Recharge works

Recharge works under Sujalam Suphalam or other Yojana have been taken up to maximise gains with the measures as follows:

- Flood water transfer to water scarce regions by interlinking of 27 rivers spread across 10 districts. It also helps in checking ground water level depletion.



- Constructing 1.30 lakhs small checkdams, even very small in rural areas, wherever useful



e) Community involvement for improved services in association with WASMO

Water and Sanitation Management Organization (WASMO) was established by Government of Gujarat as a Special Purpose Vehicle (SPV) in the year 2002 to facilitate the community in development of water supply facilities in rural areas of Gujarat. The organisation in addition to facilitating village Pani Samitis in hard core engineering, lays due emphasis on the following:



- Putting entire programme in public domain for seeking strong citizens' engagement
- Creating institutions like Pani Samiti and Water Quality Teams at the village level and strengthening them through continuous capacity building
- Social process based demand driven programme implementation for strong community participation and efficient service delivery
- Focus on information, education and communication (IEC) and social mobilisation processes before taking up development of infrastructure
- Emphasis on water quality pre & post monsoon sample testing, data analysis and sharing of test reports for corrective measures

Capacity building and quality conscious by community and other Stake Holders

Effective IEC activities are carried out to make the people aware of water related issues. Exposure visits as well as trainings are also imparted to concerned community to build up their capacity so as to manage the work efficiently.

- **Culture specific media mix using**
 - Slogan writing
 - Pamphlets, Posters etc.
 - Airing of messages and talks on radio and TV
 - Street plays
 - Popular folk forms
 - Mobile WATSAN Exhibition



- **Addressing various groups**

- School activities
- Village cleanliness
- Women's groups

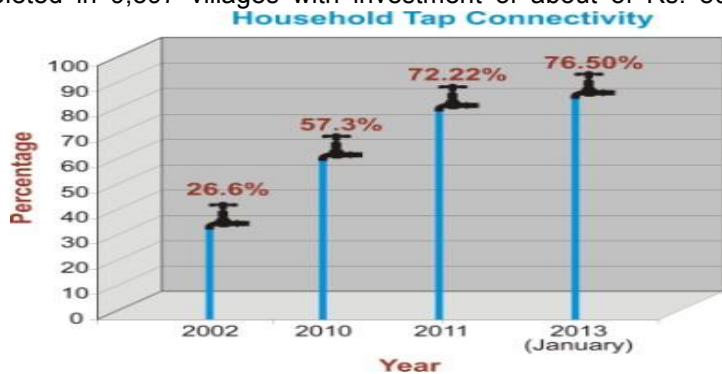
- **Training and capacity building activities**

Each of Pani Samiti is touched for atleast five trainings to enhance their capacity on Self Governance and quality service delivery, which is also useful for other Government programmes

- **Exposure visits**

Status of progress on community-managed programmes:

- Out of 18,225 villages in the State, Pani Samitis have been formed in 18,141 villages (99%)
- Scheme work has been completed in 9,397 villages with investment of about of Rs. 800 Crores and work is under progress in 3,375 villages. Field survey revealed that 3790 are self-sufficient villages, which do not wish for Government support.



- 76.50% people have access to tap water connections at household level.
- Adopting following measures for water quality improvements at all levels:
 - Supply of treated water at one point of 10,937 villages by GWSSB
 - Distribution of water quality field test kits and formation and capacity building of water quality teams at villages to prevent water contamination with the following measures:

Water quality testing kit



Particulars of Activities	Numbers
Village level water quality team formation	16,667 villages
Water quality field kit distribution	14,216 villages
Village level training	18,410 villages (1,36,754 participants)
Block level training conducted	2,580 (87,743 participants)
District level trainings conducted	460 (18,352 participants)
State level training conducted	41 (1570 Participants)
Sanitary survey conducted	80,136
H ² S vials distributed for bacteriological testing	1,422,500

Involvement of community on water quality testing



- Providing RO plants as a last resort in water quality problem villages, when other options are not available for safe water. Coastal and far flung tribal areas are given the priority. A total of 285 RO plants have been installed under different modes. Such plants are now made available to community under Build, Own, Operate and Transfer (BOOT) arrangements. The rates of treated water are fixed by WASMO and quality of treated water is ensured through regular and surprise checks.
- To provide safe water in schools, Ultra Violet (UV) plants have been provided in schools to take care of bacteriological contamination. As on date, 12030 UV plants have been commissioned. 550 RO plants are also provided in schools to purify chemical contamination.
- Awareness raising among community on safe handling of water and measures for prevention of source, system and household contamination
- **Roof top rain water harvesting:** Roof top rain water harvesting is promoted, where other source is not secured, safe and sustainable. The need is more in tribal and coastal areas for drinking water security. Govt provides 70% assistance to BPL families and 50% assistance to APL families for a structure of 10,000 litre capacity. The remaining cost is borne by the beneficiaries. As on January 31, 2013, 35,588 such structures have been provided to needy families. Some schools have also been provided with rooftop rain water harvesting structures. The water stored in such tanks with safe handling measures, remains fit for drinking purpose throughout the year.

WASMO believes “Users are the Best Managers” and they will only be able to achieve users’ satisfaction through efficient service delivery. Quantity and quality are equally important to satisfy drinking water needs of people.

Achieving Efficient Safe Service Delivery by calibrating Demand and Supply Side Management

Management on both supply and demand side for drinking water has been made in coherent manner so as to achieve the ultimate goal to have users' satisfaction with quality services, which is achieved when drinking water is supplied through taps.

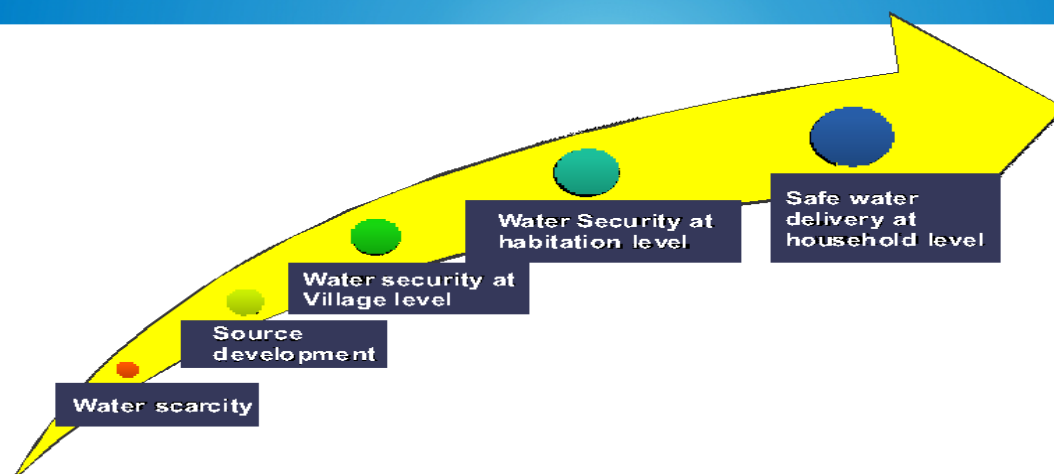
Access to safe water at village level



- **Supply Side Management:** Drought proofing of water supply sector through State Wide Drinking Water Grid
- **Demand Side Management:** Household level drinking water security through extensive community engagement for in-village water supply management. The community also evolves mechanism on water conservation, its optimum use and prevents water wastages.

The persistent efforts towards providing safe drinking water security have been taken up by the State from Water Scarcity to water security at household level.

Achieving Safe Drinking Water at Household level



Water quality impact and issues

- Efforts have been made to cover ground water dependent quality-affected villages with surface source under State wide water supply grid. It has impacted to drastic reduction in chemical contamination with the details as follows:

Year of Survey	Habitations in the State	Fluoride	TDS	Nitrate	Remarks
		No of habitations affected with			
2003	34845	4187	2508	1335	Increase in Nitrate parameter due to safe water limit reduction from 100 to 45 mg/l
2010	34845	1330	734	2807	
2011	34845	1203	660	2862	

Result of samples tested on bacteriological count is as follows:

Year	Samples tested	WQ unsafe Samples	Unsafe samples (%)
2008	99635	31512	31.63%
2009	74724	17036	22.80%
2010	69547	8184	11.77%
2011	64685	9721	15.03%

In recent years, services in public health centres have improved in Gujarat State with due attention and augmented State/ NRHM funding, hence patients with trust now prefer for public health services instead of paying handsome money to private hospitals. Secondly, there is influx of people and patients from other States. Thus, in spite of quality water, reported illness cases in public health centres for water borne diseases have analysis with major yearwise variations.

The community during interaction confirms the fact that water borne diseases have been significantly reduced, leading towards their better health and well being. Our efforts with community participation would continue to lower down bacteriological contamination trend.

Overall Impact and Outcome Achieved:

Integrated approach and efforts by Water Supply Department with its organisation has ensured access to adequate, regular and safe water at household level and has brought tremendous socio-economic and health benefits to people. Some of these impacts are as follows:

- Safe water at household level through community participation and it led to Reduction water borne diseases as well reduction in Infant Mortality Rate and Morbidity due to improved quality of water.
- Providing increased opportunities to the women for income generation and overall socio-economic development and the children especially girls to get education and reduction in dropout rate from the schools.
- Freedom from drudgery of fetching water for women and children and marked decrease in the seasonal migration of communities
- Overall improvement in quality of life in terms of social harmony, peace and economic prosperity bringing significant impact on Human Development Index (HDI)

The text should fit exactly into the type area (160 x 247 mm). For A4 size paper the margin settings are: Top: 2.5 cm; Bottom: 2.5 cm; Left: 2.5 cm; Right: 2.5 cm. Line spacing throughout the text to be maintained at Single line spacing.

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Use Arial 10 point size and single line spacing. Never use bold, except for the headings, as described below and never underline any text. Use the smaller font (9 points) for tables, figure captions and the acknowledgement and references.

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Paper length is to be not longer than 10 pages including abstract, main text, all images, figures, tables and references. Manuscript file in **.docx** (Microsoft Word 2007) format is to be not more than 15 MB.

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Use bold Arial 14 point size, centring and single line spacing for the title. The title has not be longer than 150 characters including blank spaces and should be fitted in the second and third two rows of the above table. The layout of the above table (rows heights and column widths) is fixed and must not be altered. This table will be used programmatically for extracting the paper information as well as the abstract text for print publication. Any tampering with the layout will render the paper unusable.

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Section headings are to be in 10pt bold and full caps. Number the headings consecutively. Leave two blank lines before Section Heading and one blank line between the heading and the first line of text.

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Between paragraphs of text leave one blank line gap. Paragraphs are not to have any indents. Text should be single spaced, alignment-justified.

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Define all abbreviations at their first mention in the text. Ensure consistency of abbreviations throughout the article.

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Footnotes must be avoided. Do not include footnotes in the reference list.

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References must be cited in the text in the brackets (Harvard style) for example: (Chisti,1989), (Gavrilescu and Roman, 1996), (Moo-Young et al.,1987). Reference list must be arranged in alphabetical order as per the first name of the author/book.

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Table 1. (9pt bold) Data for Analysis (9pt regular)

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4. ILLUSTRATIONS, DIAGRAMS AND PHOTOGRAPHS

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Illustrations are to be centred, with the caption below the figure having one blank line 9 pt. Type as follows: '**Figure 1.** Caption', Arial 9 pt. The lettering used in the illustrations should not be too small. Illustrations are to be referred to as figures, and must be quoted in the text, e.g. see Fig. 1. One blank line should be left between the text and figure, as well as the figure caption and the next paragraph. Please ensure that all figures are of the highest quality. Keep figures as simple as possible. Avoid excessive notes. Photographs must have a resolution of at least 250 dpi. All photos and scanned figures shall be in .jpg format and the size of the image should not exceed the typing area of a single page. Graphics which are disproportionately large shall not be accepted.

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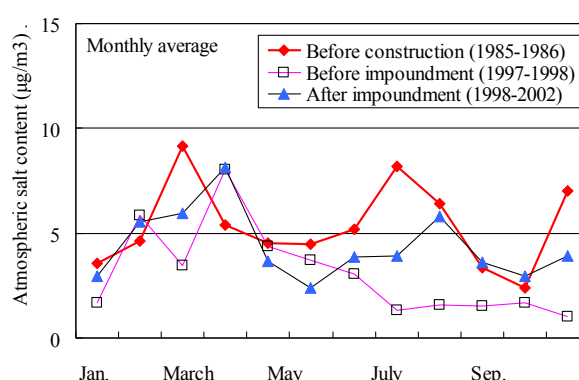


Figure 1. (9pt bold) Trend of salt content (9pt regular)

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5. EQUATIONS

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Use the equation editor of the selected word processing programme. Equations are indented 6 mm from the left margin. Number equations consecutively and place the equation number with the tab key at the end of the line, between parentheses. Refer to equations by these numbers. Leave one blank line above and also below any equation. Equation references are in the form of "equation number" and should be referred to in the text in the form Eq. 1. All symbols of equations should be explained within the text of your manuscript.

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$$(x + a)^n = \sum_{k=0}^n \binom{n}{k} x^k a^{n-k} \quad (1)$$

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REFERENCES (9PT BOLD AND ALL CAPS)

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Author name/s. (year): Paper title, Journal title, Journal volume: issue, pages.

Suzuki, H., Kim, D. and Hamada, S. (2004): Effect of dynamic water pressure acting on dam body upon behavior of dam during earthquakes, Journal of Dam Engineering, 24:2, pp. 123-136.

Author name/s. (year): Paper title, Conference title, Proceedings volume: pages.

Brown, A.D. and White, G.Y. (2004): Structural Retrofitting of A Dam, Fifth International Conference on Dam Structural Engineering, Vol. II: pp. 96-124.

Author name/s. (year): Book title, Publisher

Imai, D. and Tokunaga, A. (2003): Dam Engineering, Oxford, U.K.

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Burja C., Burja V., (2008), Adapting the Romanian rural economy to the European agricultural policy from the perspective of sustainable development, MPRA, Munich Personal RePEc Archive, On line at: http://mpra.ub.uni-muenchen.de/7989/1/MPRA_paper_7989.pdf

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