WATER SUSTAINABILITY

The document looks into the various problems faced in Water Management and tries to find the possible solutions.

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EXECUTIVE SUMMARY

The water is a scarce resource and is of utmost importance to human beings. However the availability of water is limited as 97% of water available is ocean water which is unfit for drinking. This makes the supply of water very limited. The people do not understand the importance of water and waste it unnecessary. The increasing demand of water will not be able to fulfill by the current supply of water. Thus we should change our approach to calculate the supply of water and then met our demand within that supply.

The major use of water is for irrigation and the people in northern region are doing mostly irrigation based farming which need a lot of water. This water need is currently fulfilled from the ground water while have made the ground water levels low. The farmers should stop using ground water for irrigation and instead use rainwater harvesting techniques to collect water and use it for irrigation.

The blocking of river flows poses another serious problem for the quality of water in the river and also the survival of the fauna and flora in the river. The government should determine the flow necessary to maintain a good quality of water in each river and apply the norms stringently to maintain that river flow.

The major use of water in irrigation is for the crops cotton, tobacco and rice. These crops are the major exported crops from India. The policy should be changed to produce these crops only necessary to meet the demands for the country, So that the water consumed in producing these crops can be saved. The farmers instead of these crops can produce other crops which need less water.

The waste from the cities is poured into the rivers untreated which have made many rivers unsuitable for bathing, swimming and recreation. The waste from the cities should be treated in the sewage treatment plans before pouring them into the rivers.

The humans do not understand the importance of water and hence use it excessively and unnecessarily. The government can look for privatization of the water sector or it can also increase the tariff on the water supply to reduce the consumption of water supply. The tariff charged should be more from commercial sector as the commercial sector produces more waste than the domestic sector. Also the current subsidy from the water supply should be removed in the 6 metropolitan cities.

The quality of water supplied in many states is unfit for drinking and below the permissible standards. The unhealthy water can cause different type of diseases in humans. The water quality monitoring committees should regularly monitor the water supply and report any deviations to the state government. The dual water supply can also be implemented with one line carrying the drinking water and the secondary line carrying the water for other usage.

The states are fighting over the river flows by building dams. The states should forget their individual interests and treat the water resource in benefit of the whole community

The water suitable for drinking is available in very small quantity. So techniques such as desalination which can convert ocean water to drinking water are of utmost importance. The desalination produces high quality water and can be implemented in water scarce areas. The desalination project has more energy requirements and is costly to implement. The desalination should be the last alternative used when all other non-costly alternatives have been tried

The big water resource projects needs rehabilitation of people and can also cause geographical change. The large capital intensive projects should be replaced by the small community driven water management projects.

INTRODUCTION

Water is a prime natural resource and a basic human need. The planning, development and monitoring of water resources need to be done in favor of the whole nation. Water is a scarce resource and its availability is uneven in nature. The current policies allow exploitation of the water resources and people are wasting water without knowing its consequences. The policies should be revised and people should be made aware of the most precious resource on earth. There are many problems associated with the current usage of water and we will look into each one of them with possible solutions:

1. WATER DEMAND AND SUPPLY

The total precipitation (including Snowfall) is 4000 billion m3. The total surface and ground water availability is 1869 cubic m3 but only 60% of this can be put to beneficial use. This means that 690 billion m3 surface water and 432 billion m3 of ground water is available for consumption. The supply of water is limited and the demand is increasing each year.

Traditional Approach: Forecasting the future demand for water and then matching it with the supply.

New Approach: Look for availability of fresh water (which is finite) and then match our demand within that supply. The basic need of water should be distinguished from the other usage of water. The above approach will help to restrict the growth of demand of water (other than basic needs).

2. GROUND WATER DEPLETION

The exploitation of groundwater will have to be severely restrained in the interest of resource-conservation as well as equity. The country has an annual exploitable groundwater potential of 26.5 million hectare-meters and 85% of currently exploited groundwater is used only for irrigation.

The irrigation of crops is done using groundwater which is being depleted at an alarming rate. The irrigation farming is practiced most heavily in North India which results in a

loss of 54 cubic kilometers of groundwater per year. The World Bank predicts that 60 percent of the country's groundwater blocks will be in critical condition by 2025.

Central Groundwater Board (CGWB) should take stringent steps to stop the use of groundwater for irrigations.

Suggestions:

Rainwater Harvesting: Rainwater harvesting is capturing and storing of rain water and use it later for irrigation. This practice should be encouraged among the farmers to reduce the burden of ground water.

The Rainwater harvesting can be used for groundwater recharge by holding the water on the ground and getting it absorbed by the ground.

The natural flow of groundwater can be blocked in aquifers by building a subsurface dyke.

Revival of traditional water conservation structures: The traditional water conservation structures like tanks, lakes, ponds served as sources of water for people by capturing rainfall and surface runoff. However in the past few decades many of these structures becoming dysfunctional. These structures are of utmost importance in dry arid regions and serve as a good source of water.

3. USE OF WATER FOR IRRIGATION

The major consumptive use of water has been for irrigation. The 92% off India's utilizable water is devoted to agriculture sector in form of irrigation. The 39% of water used in irrigation is supplied from groundwater. The rest is surface water use and often comes at the expense of industrial sector and domestic supply.

The gross irrigation potential is estimated to have increased from 19.5 million hectare at the time of independence to about 95 million hectare by the end of the Year 1999-2000.

Suggestions:

We should look for the crops which need maximum water supply and should stop exporting these crops to other countries and only produce the quantity needed to fulfill the country demand.

The major water usage for irrigation is done by Rice, Cotton, sugarcane and Tobacco.

The irrigation requirement and export quantity are given below:

Irrigation requirement of some common crops grown in India:

Crop	Growing Period (No. of days)	Total Water Requirement		Daily Water Requirement	
		in cm	in inches	in cm	in inches
Jawar	114	64.25	25.70	0.575	0.23
Maize	100	44.50	17.80	0.450	0.18
Rice	**93**	**104.50**	**41.80**	**1.075**	**0.43**
Wheat	88	37.00	14.80	0.425	0.17
Groundnut	124	65.25	26.10	0.525	0.21
Linseed	88	31.71	12.68	0.350	0.14
Cotton	**202**	**105.50**	**42.20**	**0.525**	**0.21**
Sugarcane	**365**	**237.50**	**95.00**	**0.650**	**0.26**
Tobacco	**132**	**98.00**	**39.20**	**0.750**	**0.30**
Onion	120	75.00	30.00	0.625	0.25
Potato	88	30.00	12.00	0.750	0.30
Pea	88	30.00	12.00	0.350	0.14
Mustard	88	25.20	10.08	0.300	0.12
Barley	88	25.20	10.08	0.400	0.16
Oat	88	36.00	14.40	0.400	0.16
Ragi	127	74.50	29.80	0.575	0.23

Export Quantity:

- India exports 25.3 million tons rice each year.
- India is the second largest cotton supplier and has upper limit on the cotton exports for the year 2011 to Sept. 30 at 5.5 million bales.
- Tobacco exports (comprising raw tobacco and its products) is 2,57,469 tons

4. BLOCKING RIVER FLOWS

The massive interventions in flows and maximal abstraction of waters should be stopped and the rivers should be allowed to flow by keeping interventions to the minimum. Instead of killing rivers and then trying to revive them, we must learn to keep rivers alive, flowing and healthy.

The Supreme Court of India in 1999 has directed the government to ensure a minimum flow of 10 m3/s in the Yamuna River as it flows through Delhi for improving its water quality. The Government of India constituted the Water Quality Assessment Authority

(WQAA) in 2001 and WQAA in 2003 constituted a Working Group (WG) to advise the WQAA on "minimum flows in rivers to conserve the ecosystem".

Minimum flow is the flow downstream from the dams to maintain the environment. The river flows are needed to maintain the river regime making it possible for the river to purify itself, sustaining aquatic life and vegetation, recharging groundwater, supporting livelihoods, facilitating navigation, preserving estuarine conditions, preventing the incursion of salinity, and enabling the river to play its role in the cultural and spiritual lives of the people. The reduced flow of water can led to depreciation of some religious place.

Suggestions:

1. **Change of Term from Minimal flow to Natural Flow:** The term should be change to natural flow from minimum flow. The minimum flow means that states are blocking most of the water through dams and will only be leaving minimal amount of water.
   Each river flow should be examined and a flow limit should be determined on it so that it maintains its water quality. That limit should be called as the Natural flow of each of the river and it should be maintained by each state.

2. **Rules on Flowing of Rivers:** The Rivers should be allowed to flow at the minimal rate for 6days and maximum rate for 1 day in the week so as to improve its water quality.

5. RIVERS TURNED INTO SEWERS OR POISON

The country has 14 major, 44 medium and 55 minor river basins. The major river basins constitute about 83-84% of the total drainage area. The major and medium river basins together constitute for 91% of the country's total drainage.

Yamuna River Pollution: The 14 million population of Delhi generates 1936 MLD of wastewater and total quantity of sewage generated in Delhi is 2871 MLD. The waste

water (sewage) treatment capacity of Delhi is 1523 MLD (512.4 MGD), So 1350 MLD remains untreated. The 2249 MLD wastewater is poured into Yamuna through 22 major drains in Delhi. Yamuna River should ideally lie in category 'B' (fit for bathing, swimming and recreation) whereas it actually lies in category 'E' (unfit for agriculture). Delhi's pollutes 50% of Yamuna River and has a catchment area of only 1% (22 km of the 1200 km stretch of Yamuna).

Suggestions:

Additional water treatment plans should be put in place so as improve the condition of Yamuna River and pour treated water into Yamuna.

There are many techniques available for water treatment. The working and benefits of one of the techniques is explained below:

SULABH EFFLUENT TREATMENT SYSTEM

Sulabh is operating 5500 public toilet complexes spread all over the country and 104 complexes are linked with biogas plants. These complexes use a technology is based on filtration of effluent through activated charcoal followed by ultraviolet (UV) rays. The filtration unit makes it colorless, odorless and free from organic particles and UV eliminates bacteria.

Uses:

- Biogas from human excreta is used for cooking, lighting, electricity generation and body warming.
- Liquid effluent is used as fertilizer, as it contains good percentage of nitrogen, potassium and phosphate.

6. INEFFICIENCY AND WASTE IN EVERY KIND OF WATER USE

The people do not understand the scarcity of water and waste it by using in more quantity.

The demand from the domestic sector accounts for 5% of the annual freshwater withdrawals in India and the demand will increase from 25 billion m3 to 52 billion m3. The 85% of the urban and 79% of the rural population has access to safe drinking water.

The demand from the industry sector is growing at 4.2% and will rise from 27 billion m3 to 228 billion m3 by 2025.

The government has given subsidies to the industrial and agriculture sectors where the water consumption is highest. The government is allowing these sectors to use more water at negligible prices which is leading to wastage of water.

The United Nations has warned that by 2025 if the current pattern of water consumption continues two-thirds of the world will face severe water shortages.

The possible solutions for Water wastage are:

1. Water-privatization.
2. Increase Tariff on Water Usage

Water Privatization: Water privatization involves transferring of water management services to private companies. The water management services include collection, purification, distribution of water and waste water treatment in a community. Traditionally these services have been provided by the local governmental infrastructure such as the municipality or local city council.

Advantages of Water Privatization:

1. The commodification of water will allow market forces (supply and demand) to set the water tariff, which in turn will reduce water consumption and promote water conservation.

2. The private providers will bring in capital needed for upgrading and development of infrastructure.

Disadvantages of Water Privatization:

1. Poor people may not be able to pay for hiked prices.
2. The private companies may extract more water or decrease the quality of water supply to increase their profit.
3. Privatization will lead to monopoly on this segment.

Suggestions of Water Privatization:

1. **Outsource Water Treatment:** The government can outsource the selective parts of Water Management to private players such as Water Treatment and pay them the necessary price. Also the government should set up committees to check the quality of treated water and should fine the private players if the water quality is not good

2. **Outsource the Meter Installation and Tariff Collection:** The government should outsource the meter Installation and tariff collection to private agencies, so that the collection can be done more judiciously.

Increase Tariff on Water Usage

Delhi Jal Board Water Charges: The Jal Board incurs a cost of Rs.24 per KL in sourcing, treatment and distribution of water in the city.

Domestic

Quantity of Water Used	Fixed Price	Variable price per KL
< 10 KL	Rs.50	Rs.2
10KL<Q<20KL	Rs.100	Rs.3
20KL<Q<30KL	Rs.150	Rs.15
>30KL	Rs.200	Rs.25

Commercial

Quantity of Water Used	Fixed Price	Variable price per KL
< 10 KL	Rs.400	Rs.10
10KL<Q<25KL	Rs.600	Rs.20
25KL<Q<50KL	Rs.700	Rs.50
50KL<Q<100KL	Rs.900	Rs.100

Sewer charges are 60 per cent of the total water volumetric charge.

Advantages of above Water Tariff's

1. The charges are least for the people consuming less water.
2. The commercial users are changed more than the domestic users as they produce much more waste than domestic users.

Suggestions:

1. **Water Meter in Every Household in Working Condition:** The meter hike is volumetric and hence the water meter should be put in every house hold. The households that are not having the water meter should be penalized

2. **Application of Similar Strategy in Six Metropolitans:** The similar kind of strategy should be followed in other metropolitans, so as to reduce the wastage of water.

3. **Wastage Charge based on Type of Industry:** The sewer charges for the commercial users should be revised, so that the industries creating more pollution should pay more.

4. **Remove Water Subsidy in 6 Metropolitans:** The water subsidy should be reduced and the people should be charged in incremental order of their usage as per the current policy.

7. INTERMITTENT, UNRELIABLE, UNSAFE AND INEQUITABLE WATER SUPPLY IN URBAN AREAS

The water supply in metros is intermittent and is only available in morning and evening for 2 hours. There is a shortage of about 100 MGD in Delhi unplanned areas during summer season. The water supplied many times is contaminated and unfit for drinking**.**

Ground Water Quality

The natural chemical content of ground water is influenced by depth of the soils and sub-surface geological formations through which ground water remains in contact.

- The ground water is of good quality and suitable for drinking, agriculture and industrial purpose in great part of the country.
- The ground water in both shallow and deep aquifers is suitable for use.
- There is salinity problem in the coastal tracts.
- The isolated pockets have high incidence of fluoride, Arsenic, Iron & heavy metals etc.

Drinking Water Quality

The below are the desirable and permissible limits for the drinking water.

S.No	Characteristics	Desirable Limit	Permissible Limit
	Essential Characteristics		
1	Color (Hazen Units)	5	25
2	Odor	Unobjectionable	
3	Taste	Agreeable	
4	Turbidity(NTU)	5	10
5	PH	6.5 to 8.5	-
6	Total Hardness	300	600
7	Iron(mg/l)	0.3	1.0
8	Chlorides(mg/l)	250	1000

9	Residual Free Chlorine	0.2	
	Desirable Characterstics (mg/l)		
10	Dissolved Sats	500	2000
11	Calcium	75	200
12	Magnesium	30	75
13	Copper	0.05	1.5
14	Manganese	0.1	0.3
15	Sulphate	200	400
16	Nitrate	45	100
17	Fluoride	1.0	1.5
18	Phenolic Compounds	.001	.002
19	Mercury	.001	
20	Cadmium	.01	
21	Selenium	.01	
22	Arsenic	.05	
23	Cyanide	.05	
24	Lead	.05	
25	Anionic Detergents	0.2	1.0
26	Chromium	.05	
27	PAH	-	-
28	Mineral Oil	.01	.03
29	Pesticides	Absent	.001
30	Alkalinity	200	600
31	Aluminum	.03	0.2
32	Boron	1	5

However the above standards are not followed and the water quality is worst in many places of India which is leading to many diseases.

Parameter	Maximum Permissible Limit	Health Impact	Affected States
Flouride	1.5 mg/l	• Immediate symptoms include Digestive disorders, skin diseases, dental fluorosis. • Fluoride in larger quantities (20-80 mg/day) taken over a period of 10-20 years results in crippling and skeletal fluorosis which is severe bone damage	Andhra Pradesh, Assam, Bihar, Chattisgarh, Gujarat, Haryana, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Tripura, Uttar Pradesh, West Bengal
Arsenic	.05 mg/l	Immediate symptoms of acute poisoning typically include vomiting, esophageal and Abdominal pain and bloody 'rice water' diarrhea. • Long-term exposure to arsenic causes cancer of the skin, lungs, urinary bladder, and kidney. There can also be skin changes such as lesions, pigmentation changes and thickening (hyperkeratosis)	Assam, Bihar, Chattisgarh, Jharkhand, Tripura, West Bengal, Uttar Pradesh
Iron	1 mg/l	A dose of 1500 mg/l has a poisoning effect on a child as it can damage blood tissues • Digestive disorders, skin diseases and dental problems	Arunachal Pradesh, Assam, Bihar, Chattisgarh, Jharkhand, Jammu and Kashmir, Karnataka, Kerala, Manipur, Meghalaya, Mizoram, Madhya Pradesh, Maharashtra, Nagaland,

			Orissa, Punjab, Rajasthan, Sikkim, Tripura, Tamil Nadu, Uttar Pradesh, West Bengal, A&N Islands, Pondicherry
Nitrate	100 mg/l	• Causes Methamoglobinemia (Blue Baby disease) where the skin of infants becomes blue due to decreased efficiency of hemoglobin to combine with oxygen. It may also increase risk of cancer.	Bihar, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh
Salinity	2000 mg/l	• Objectionable taste to water. • May affect osmotic flow and movement of fluids	Andhra Pradesh, Chattisgarh, Gujarat, Haryana, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal, Pondicherry
Heavy Metals	Cadmium – 0.01 mg/ l Zinc – 15 mg/ l Mercury – 0.001 mg/ l	Damage to nervous system, kidney, and other metabolic disruptions	Gujarat, Andhra Pradesh, Delhi, Haryana, Kerala
Persistent Organic Pollutants	None	High blood pressure, hormonal dysfunction, and growth retardation.	Delhi, Himachal Pradesh, Jharkhand, West Bengal,
Pesticides	Absent	Reproductive and endocrinal damage, weakened immunity, abnormal multiplication of cells leading to tumor formation.	

Suggestions:

Water Quality Monitoring: The water quality monitoring process and committees are implemented in both urban and rural areas and these committees should strictly check the water quality and report it to the state governments.

Government spending on Research and Development: The government should spend money for R&D of new techniques to test the quality of the water and also to improve the quality of the water.

Dual Water Supply: The dual water supply concept means that the drinking water will be supplied on a separate line and the water for other usage on the second line. The dual water supply concept can be tested in the metros with drinking water quality in the desirable limits and the secondary line water quality in the permissible limits.
Also the drinking water line will be charged a higher tariff as compared to the second line, so that people do not waste drinking water.

8. INTRACTABLE WATER-RELATED CONFLICTS STATES

The Cauvery Dispute

The Cauvery is an important river system in the southern India. The dispute is a conflict of interest between the downstream state of Tamil Nadu and upstream state of Karnataka. The essence of the dispute is that the Tamil Nadu state has long been using the Cauvery waters for irrigated agriculture the Karnataka state started later with irrigated agriculture but made a rapid progress. Later Kerala, an upstream state with a relatively modest demand and Pondicherry furthest downstream with a very small demand also became parties. The fair sharing would have to provide water in the legitimate interests of all four parties. The political parties in both the states have taken strong stand on this issue, making it risky for any party in power to show weakness which makes the dispute intractable.

Narmada Project

The Narmada River is an "inter-state river" for Madhya Pradesh, Maharashtra, and Gujarat. Each state wanted to make use of the river for planned projects. The dispute was later resolved by the tribunal agreeing and allocating flows among the three states with a small allocation to the state of Rajasthan. The project needed a large number of people to be displaced and become a concern for environment. The Supreme Court in 2000 ordered for a fresh examination and clearance for the project.

Suggestions:

The states should change their roles from sovereign powers of the state to the state as trustee holding natural resources in public trust for the community.

9. THE ENVIRONMENTAL/ECOLOGICAL IMPACTS OF BIG WATER-RESOURCE PROJECTS

The big water resource project like building dam displaces people and it is difficult to resettle and rehabilitate project-affected persons.

The large project also floods a large area destroying the natural environment and may also cause geographic change.

Suggestions:

Larger Projects to Small Projects: The large centralized and capital-intensive water resource development projects should be replaced by small, decentralized, local community led water-harvesting. The big projects should be undertaken only as projects of the last resort.

10. ALTERNATE SOURCES OF WATER

The oceans consist of 97% of the water supply on earth and the ocean water contains high quantity of salt which makes is unsuitable for drinking.

Desalination technique removes salt and other mineral from the water and make it suitable for drinking. Desalination facilities should be approved only where water agencies have implemented all cost-effective water conservation and efficiency measures.

Advantages:

1. The desalination can produce high quality water.
2. The desalination provides an alternative supply of water when other water supply is limited in nature.

Disadvantages:

1. The cost of desalination has fallen in recent years, but it remains an expensive water-supply option.
2. The desalination process needs more energy to produce water than from any other water-supply. Thus desalinated water cost is more sensitive to changes in energy.
3. Desalination may introduce biological or chemical contaminants into our water supply. The water supply from a desalinated plant must be regularly monitored.
4. Desalination can produce corrosive water which can damage the distribution systems.
5. Desalination produces highly concentrated salt brines and disposable of these salt brines is a problem.
6. The sea water desalination can impingement and entrain marine organisms.

Suggestions:

1. **Implement In Water Shortage Areas:** The cost effective and environmentally safe water desalination can be implemented into areas with water shortage.

2. **Research and Development:** More funding should be provided to the water desalination projects, so that the technology can be enhanced for future water demands.

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