ADMINISTRATIVE AND APPLIABLE SOLUTION PROPOSALS IN DRINKING WATER SUPPLY

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ABSTRACT

Introduction
Water is one of the most important natural sources for all living in the world. There are many sectors where water is essential such as humanitarian use, ecosystem use, economic development, energy production and national security. Water sources are becoming more and more polluted with domestic, industrial and agricultural wastes. Inadequate planning and diminishing rainfall effects increase the likelihood of experiencing water scarcity for our country in the coming years. Two main issues arise in the management of water resources. Additional contributions should be made to existing monitoring and control methods of water resources.

Results
This work was done to ensure the well management of limited water resources and to contribute if necessary to make the necessary arrangements that are considered incomplete for management. In our country, it is seen that it is necessary to start the pre-school education in the field of education and to make the addition of the preliminary water course to the existing course contents and to attach more importance to the urban water management of the local administrations in order to draw attention to the water problems existing.

Key words: Water, Surface water, Local management, Drinking water, Sustainability, Basin management.

INTRODUCTION

1. Introduction

Water is an indispensable source of life for all living things. Because of becoming a natural value, it is vital that water is managed very carefully. We need integral approaches to sustainable management of water resources. Protection of water sources, its supply, transportation of water are to be considered as integrated management system instead of seperated management system. In this context, it isn't possible to maintain economic and social development and even life without sufficient and good quality water.

1.1. Current Situation of Water Resources in Turkey

The total amount of water in the world is 1.4 bilion km^3. 97.5% of these waters are exists in the oceans and in the seas as salt water and 2.5% are in fresh water in the underground, rivers and lakes. It is understood that the amount of avaliable fresh water is very little which can be easily used by humans. The average annual rainfall in Turkey is approximately 643 mm and it equals an average of 501 bilion m^3 per year. Turkey is not a water rich country. On the contrary, it is accepted as a country with "water shortage" with a water amount of 1.519 m^3 per capita. Turkish Statistical Institute (TUIK) predicts that the population of Turkey will reach 100 milion by 2030. In this case, the amount of water per capita is expected to be 1.120 m^3 /year. Therefore, it is necessary to keep the resources very well and find realistic and effective solutions in order to leave healthy and sufficient water to the future generations of Turkey.

Table 1. shows that Turkey's Water Resources potential as the data of the General Directorate of State Hydraulic Works (DSI).

Table 1. Turkey's Water Resources Potential

Annual Average Precipitation	643 mm/year
Area of Turkey	783.577 km^2
Annual Precipitation	501 bilion m^3
Evaporation	274 bilion m^3
Underground Infilitration	41 bilion m^3
Surface Water	
Annual Surface Flow	186 bilion m^3
Avaliable Surface Water	98 bilion m^3
Ground-Water	
Anuual Amount of Towable Water	18 bilion m^3
Total Available Water	112.7 bilion m^3
Places of Usage	
Using in agriculture	32 bilion m^3
Using for drinking water	7 bilion m^3
Using in the industry	5 bilion m^3
Total Used Water	44 bilion m^3

1.2. Institutional Structure in Water Resources Management

In the water resources management, administrative boundaries (province, district, municipality, etc.) land uses (forest, agriculture, etc.) and institutional powers are determined by law. Therefore, management is transformed into a fragmented structure by being shared among several institutions. Institutions carry out their activities related to water resources within their authorities. The institutions and organizations involved in management have a

hierarchical structure which developed from the central scale to the local scale (provincial offices). There are two groups of institutions which are responsible for water resources, practitioner-investor and observer-controller.

Practitioner-Investor Institutions	Observer-Controller Institutions
Ministry of Foresty and Water Management Management.	Ministry of Forest and Water Management
Ministry of Interior	Ministry of Health
Ministry of Development	Ministry of Food, Agriculterel and Livestock
Ministry of Energy and Natural Resource	Ministry of Environmental and Urbanization

The duties and authorities of the institutions involved in water resources management are as follows :

Ministry of Forestry and Water Management :
- Protection and planning of water resources
- Designation and monitoring of water quality
- Flood management planning
- Development of water law and policy
- Security of water

The General Directorate of State Hydraulic Works
- Planning, designing and operating of water structures. (storage, fload, protection, irrigation, HEPP, water and wastewater treatment plants)

General Directorate of Meteorology
- Weather Forecast
- Obtaining, evaluating and publishing datas about climate and precipitation

Ministry of Health
- Monitoring of drinking water quality
- Physical, chemical and microbiological analysis of drinking water

Ministry of Development
- Developing prospective strategies for the social sectors
- Preparing a public investment programme
- Chasing public projects and carry out operations related to the revision within the year

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- Designing and financing of rainwater drainage, water and wastewater plant in urban areas.
- Ministry of Environment and Urbanization
- To prepare legislation about the prevention and control of pollution
- developing standarts
- determining measurement, detection and quality criterias
- determine and apply measurement and analysis criterias related to environmental pollution
- to set up laboratories to conduct all kinds of measurement, monitoring, analysis and controlling about the environment, and do their accreditation procedures
- determine the organizations who will measure the receiving environment
- to grant licenses to any type of waste disposal facility and monitoring and controlling them.
- to prepare, execute and coordinate national environment strategy.

Ministry of Food, Agriculture and Livestock
- Management of agricultural areas
- Monitoring the quality of area
- Legislation of fisheries and aquaculture
- Pesticide Control

Ministry of Interior

The Special Provincial Administrations, municipalities, villages and various associations (Drinking Water Association, Irrigation Association, Provincial Service Association) which are subsdiaries of the General Directorate of Local Authorities affilated to the Ministry, have the authority to protect water.

Metropolitan Municipalities
- Planning, construction and operation of urban infrastructure facilities
- Controlling of domestic and industrial waste discharges

Special Provincial Administration
- To provide drinking water, sewage and irrigation water services to areas which are outside of municipalities.

General Directorate of Mineral Research and Exploration (MTA)

It is responsible for investigation of geothermal waters and natural mineral waters.

Turkish Statistical Institute (TUIK)

It is responsible for keep statistic about water and ensuring production.

As we see, different institutions are doing different works about water. More than 70 laws and regulations have been since 1920s about water resources. Laws and regulations explain protection of water resources, utilization, planning, conducting, making necessary investments, determination of duty, responsibilities and authorities of institutions and organizations which take part in administration. And also, it sets punishment and sanctions against polluters of water resources. There are six priority laws which form the basis of water resources management;
- Environmental Law
- Law on Water
- Law on the drinking and using waters of peasants
- Law on underground waters
- Coastal Law
- Laws on Water Products

Current Regulations for Water and Water Resources Management;
- Regulation of Water Pollution Control
- Regulation on the quality of surface waters from which drinking water is obtained or to be obtained
- Regulation on Control of Water losses in drinking water supply and distribution systems
- Regulation on waters for human consumptions of water
- Regulation on the protection of water basins and preparation of management plans
- Regulation on the protection of underground waters from pollution and deterioration.
- Regulation on superficial water quality management

Although existing laws and regulations try to clarify the criterias required to comply with the authorities and responsibilities of different institutions, it is thought that all of the problems cannot be solved.

2. Current Status and Issues of Water Resources Management in Turkey

Current Status and Issues of Water Resources Management in Turkey are shown in Table 2.

Table 2. Current Situation Analysis of Water Resources Management in Turkey

Current Situation	Possible Problems
Boundaries	
- Water resources are managed according to administrative boundaries. - Water resources are evaluated as a point. (lake,stream etc.) - By DSI Turkey defined 26 main river basins. But the lower basins of these haven't been identified.	- Administrative boundaries will form a complex structure for the institutions which involved in management. - Administrative boundaries and basin boundary don't overlap so it causes the inability of the administrative activities to be executed effectively. - Because of the water resources can't be managed totally within the boundaries of the basin, it negatively affects the evaluation of data. - Surface and underground water are evaluated indepedently from each other
Corporate	
- Many central and provincial organizations are involved in the management of water resources. Each institution participates in the management as part of their own authorities. - There is complicated hierarchical structure in the management of water resources. - There isn't required cooperation between the participant institutions.	- Authority limits of institutions are not clear in terms of water management. - Cooperations between institutions are deficient. - Main authority can't fully defined at the local level.
Data Management	
- Institutions are researching and storing datas(control,observation,analysis,measurement, etc.) on water resources within their authorities. - There isn't a large databese about water resources in Turkey. However, DSI is performing studies to set "National Information System"	- A sufficiently large and accesible database about water resources and basins cannot be created. - Data on water resources aren't enough. - Especially, there isn't enough data(analysis,measurement,report) in local governments.
Monitoring-Inspection	
- Water resources are monitored by routine analysis according to the usage(drinking and use, aquatic products, etc.) - Inspections are made according to routine plans and warnings. - Groundwater resources cannot be inspected • Monitoring and supervision activities for non-point pollutant sources are not avaliable.	- Monitoring of water resources as pointwise, prevents effective control and supervising of all pollutant sources. - Su kaynaklarının noktasal olarak izlenmesi, tüm kirletici kaynaklarının etkili şekilde kontrolü ve denetlenmesini önlemektedir. - Monitoring and inspection aren't efficient due to the water ecosystems in Turkey aren't known enough

2.1. Taking Part of Drinking Water and Water Resources in MEB(MONE) Curriculum

Beginning from pre-school educaion, by supplying the content of current course which is about the protection of drinking water, water resources; the grip of subject must be ensured. "Lifelong Learning" concept must be accepted by all of us. "The Ecological Schools Program" should be more developed and disseminated. Efficiency and curriculum studies on water should be realized.

2.2 Drinking Water Management

With the establisment of Metropolian Cities, 91.3% of the population (TUIK,2013) live in municipal boundaries and almost all of the municipalities have water Networks. With the population growth, to Access to quality drinking water has become a major problem. Water insufficiency in metropolian cities is tried to averted by water transfers between basins and this method is accepted as a solution for securing water supply security. But, such a kind of interventions causes economical, ecological and social problems. These interventions are carried out without doing and evaluation of the integrated basin scale regardless of long-term possible results.

2.3. Local Government Services for Supplying The Needs of Drinking Water

Drinking water is usually delivered to the end costumer with the help of drinking water treatment plants. The most important parameters that make purification difficult in a standart drinkin water treatment plant are (pH, Nitrate, Fe^{+2}, Mn^{+2}, TOK, NH_3-N and low dissolved oxygen)

If these parameters exceed the values which are specified in the regulation, it will require new treatment plants or to invest milions of dollars by adding advanced treatment methods to existing treatment plants. It is understood from the current situation, preparation and implementation of the Integrated Watershed plans has vital importance.

Municipalities and local authorities are responsible for ensuring infrastructure services and providing of drinkin water in a healthy and sufficient quantity. There are three types of local government in Turkey; Municipalities, Special Provincial Administrations and Villages. In 2014 the number of municipalities serving with the Drinking Water Treatment Plant was 436. Turkey's total amount of water which was distributed in 2014 is 3.394.545.103 m³/year and number of subscribers(distributed water) was 25.713.691. Local authorities are obliged to set water resources, treatment plants, water storage facilities, reliable transmission and distribution lines for meeting future demands.

2.4. Reduction of Leakage Rate in Networks

In Turkey, surface and underground sources of drinking water are decreasing day by day because of decreasing rainfall. The Municipalities must reduce leakage rate in their Networks to below 25% which is a reasonable value in regulation standarts. Network system consists of water intake structures, transmission lines, storages, main and secondary distribution pipes, pressure increasing pumps, valves, fire taps, pressure crusher and stabilizer valves and subscriber connections. Truth is to control the amount of water between production and final destination point.

2.5. Disinfection of Water Shortage

Disinfection of water and destroying microorganisms before it is consumed is the most important process for the prevention of infectious diseases. Chlorine is a disinfectant which is widely used for disinfection. Chlorine gas and calcium or sodium hypochlorite are the most frequently using forms. Alternative disinfections are ozone, chlorine dioxide, chloramines and UV radiation.

Because of the seasonal changes in water resources, organic matter breakdown, reduction of oxygen level, dissolution of heavy metal can be occured. At such times, efficiency of disinfection

process decreases considerably. The most important drinking water problem that affects people in our country is insufficient disinfection. Diseases which are caused by insufficient disinfection process have increased especially in district and towns recently. The big reason of insuffcient disinfection is lack of qualifying employee and automation. In order to avoid from these problems, it is necessary to use automatic systems that operated automatically with solar energy, remoted controlled and online-monitored.

CONCLUSION

Water resources are getting more and more polluted with domestic, industrial and agricultural wastes. The probability of water shortage in the coming years is increasing due to inadequate planning and reducing of rainfall. In the management of water resources, the duties and authorities of institutions should be specified clearly and the coordination between institutions should be ensured. The protection, prevention and reduction policy of water resource should be implemented effectively. Ensuring the protection of drinking water basins is an another important issue.

The creation and implementation of integrated basin planning is necessary to ensure sustainable management of water resources. In our many classical drinking water treatment, there are seasonal odor and taste problems due to the inadequate practice of basin conservation plans. Making of new water law, fully functionalization of basin association and disorganization in water, removing of hierarchy and confusion of authority are required.

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