

Water Quality Management

Water is one of the many abundant natural resources used by all living things, including humans, animals, plants, and other organisms. The water demand is rising because of the growing population, expanding economic activity, and urban expansion. The decrease in water levels and the degradation of their quality, the overuse of surface water is threatening human life and its surrounding environment.

Therefore, the decline in surface water quality has become a serious problem and one of the main objectives of water resources conservation policy is to monitor water quality.

Water Quality Assessment Methods

Surface water quality assessment is a comprehensive process that involves using several variables that can have significant impacts on the overall quality of the water. Evaluating water quality by testing many parameters, each separately and for several samples, is a complex process, and it is not possible to get a final decision on the water quality based on it. Therefore, Various methods have been considered to analyze water quality such as statistical assessments of individual parameters and water quality indices. **The water quality assessment methods are:**

1. Comparing the measured water quality parameters with the permissible limits of the World Health Organization or with national standards.
2. Use water quality indicators such as:
 - National Sanitation Foundation Water Quality Index (NSF-WQI).
 - Canadian Council of Ministers of the Environment Water Quality Index (CCME-WQI).
 - The Weighted Arithmetic Water Quality Index (WA-WQI).
3. Use mathematical models developed for a specific body of water.

GIS and remote sensing can be used in conjunction with these methods to achieve the best results in monitoring the water quality of water bodies.

Water Quality Index (WQI)

WQI is a dimensionless number that aggregates together various parameters for any water body to evaluate its water quality. The WQI methods significantly reduce the amount of data and streamline and describe the state of the quality of water in a single number.

The WQI methods' goal is to categorize water bodies according to their chemical, physical and biological features, identify potential uses of them, and manage in a sound way.

Water Resource Management

1. Responsible Water Use:

- **Water Conservation:** reducing water consumption through awareness and efficient practices in homes, industries, and agriculture.
- **Efficient Irrigation:** precision irrigation methods to minimize water wastage in agriculture, such as drip irrigation and soil moisture monitoring.
- **Water Quality Protection:** safeguarding water quality through pollution prevention measures and proper waste disposal.

2. Water Recycling and Reuse:

- **Innovative Solutions:** advanced water recycling technologies, including greywater systems for residential use and industrial water treatment.
- **Freshwater Conservation:** recycling and reusing water can alleviate the strain on freshwater sources, especially in regions facing water scarcity.

Water pollution

Water pollution can be defined as the negative impact on water quality as a result of foreign substances entering its components. Water pollution includes the pollution of all water sources on the surface of the Earth, whether fresh water or sea water, such as: seas, rivers, oceans and groundwater.

Sources of water pollution

The sources of water pollution can be divided into two main parts:

- **Point sources:** They are a pipe or channel similar to those used in factories or sanitary drains, and they are easy to manage and control. Because it is a known source.
- **Non-point sources:** They are the biggest cause of water pollution, and they are one of the most difficult sources of pollution to treat. Because it comes from several sources, examples of which include: surface runoff from agricultural areas, or pollutants present in the atmosphere and transmitted through rain, and the remains of agricultural practices such as fertilizers and pesticides.



Figure: Point source of water pollution.

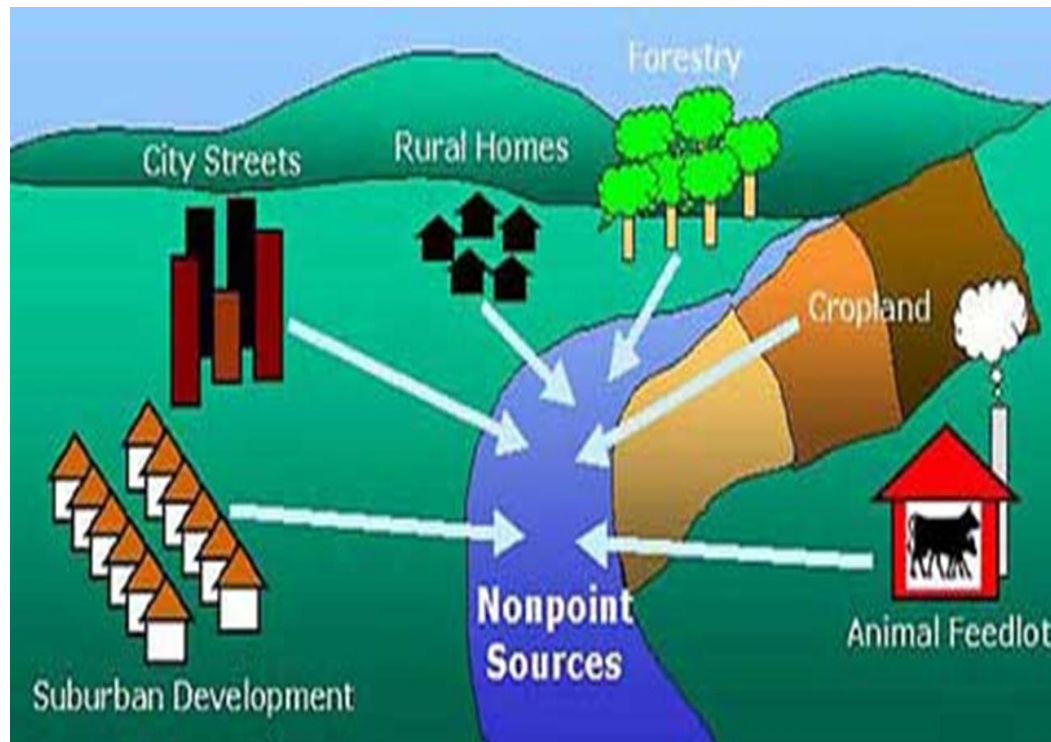


Figure: Non-point source of water pollution.

Causes of water pollution

1. Low efficiency of wastewater treatment systems in getting rid of waste
2. Industrial waste: includes waste from chemical factories, consisting of copper, aluminum, other chemicals, and sodium carbonate.
3. Use of fertilizers and pesticides, especially those containing phosphates and nitrates.
4. Rainwater, which contains a group of pollutants present in the air, the most important of which are: nitrogen oxide, sulfur oxide, and dust particles.
5. Radioactive materials and their waste resulting from weapons and wars, which are disposed of in water.
6. Medication residues that are difficult to dispose of during water treatment.
7. Sea transport of commercial materials on ships and tankers in the seas and oceans as a result of oil tanker accidents.

Effects of water pollution on humans and the environment

- Eutrophication, which leads to the growth of algae and other harmful plants, which negatively affects fish wealth because it prevents oxygen and sunlight from reaching these marine organisms.
- Helping the reproduction and spread of mosquitoes and snails that cause schistosomiasis.
- Increased chances of human poisoning.
- Suffering from some severe diseases; Such as typhoid, malaria, hepatitis, liver disease, and cholera.

Water pollution challenges in Iraq:

- Direct discharge of wastewater from health and industrial institutions and water from drainage networks into river streams.
- Absence of regulations and legislation concerned with monitoring the quantity and quality of river water
- Lack of financial allocations necessary to build and maintain water treatment plants and sewage plants.
- Effects of climate change



Figure: Water pollution challenges in Iraq.

Table: water quality limits of parameters for drinking uses according to Iraqi standards (2009) and WHO standards (2017).

No.	Parameter	Unit	Iraqi standards	WHO standards
1	Temp.	°C	25
2	pH	6.5 - 8.5	6.5 - 8.5
3	EC	μS/cm	2000	2000
4	TDS	mg/l	1000	1000
5	Turbidity	NTU	5	5
6	DO	mg/l	5	5
7	BOD5	mg/l	Nil	5
8	HCO ₃	mg/l	125
9	Alkalinity	mg/l	200	120
10	TH	mg/l	500	500
11	Ca	mg/l	150	75
12	Mg	mg/l	100	50
13	Cl	mg/l	350	250
14	NO ₃	mg/l	50	50
15	SO ₄	mg/l	400	250
16	TSS	mg/l	...	20
17	Na	mg/l	200	200
18	K	mg/l	10	12

التعليمات والأنظمة العراقية ذات الصلة:

1. المواصفة القياسية رقم ٤١٧ لمياه الشرب لعام 2009 (التعديل الثاني)
2. نظام صيانة الأنهار والمياه العمومية من التلوث رقم 25 لعام 1967

Relevant Iraqi instructions and regulations:

1. Standard Specification No. 417 for Drinking Water of 2009 (Second Amendment).
2. Regulations for the Protection of Rivers and Public Waters from Pollution No. 25 of 1967.