



# A PROPOSED CONCEPTION FOR THE ESTABLISHMENT OF A CENTRAL TREATMENT NETWORK TO PURIFY SEWAGE AND NUTRITION PIPES IN THE STATE OF KUWAIT

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## ABSTRACT

The study aimed to develop a proposal for the establishment of a central treatment network to purify sewage and feeding pipes in the State of Kuwait, by identifying some recent experiences in establishing central processing networks in purifying sewage pipes, by developing a proposal to allocate a plot of land about 30 acres in the Jahra area of the State Kuwait, and the researcher developed a preliminary scheme for this network as an attempt to implement it, and the researcher expects that this network will contribute to reducing some negative environmental phenomena in the use of sewage, and reducing the pollution of seawater in which sewage is discharged, in addition to recycling and using that water. In beneficial environmental uses such as agriculture and development in the new urban communities in the State of Kuwait.

## Introduction :

The sanitary engineering sector is considered one of the main and important sectors, due to its direct impact on the environment. The process of sewage disposal in healthy and safe ways is one of the processes necessary to provide a healthy environment for the community according to international conditions and the latest engineering and scientific methods to preserve the surrounding environment to be free of sewage pollutants.

The Department of Operation and Maintenance of Stations is considered one of the most important departments in the sewage system, as the Department of Operation and Maintenance of engineering stations undertakes the preparation of contracts and technical requirements for the operation and maintenance of this system, the most important of which is the supervision and follow-up on the operation and maintenance of pumping and treatment stations for sewage, and the flows are received from the wastewater network. The domestic health system in the main pumping stations and then pumped through a network of pressure pipes to the purification stations for triple and quadruple treatment according to environmental standards and specifications of the Ministry of Works, and then to make the maximum use of that treated water after it becomes suitable for the purposes of agriculture and development, and distribute it to the beneficiaries. [3]

The sanitary engineering sector suffers from many problems, including: infringements on sewage networks, and the large number of rains in terms of illegal connection to the drainage of rainwater from homes or by companies and factories, and what is negatively reflected on the efficiency of treatment and the flow of quantities that exceed the capacity of the stations, especially during heavy rains. Note that the sewage network is a closed network and is separate from the rain network, and it should not be affected by rainwater and its quantities, in addition to the sudden blockages that occur to sewage inspection rooms due to the entry of dirt and obstacles from rubble and leaves, which leads to the blockage of those sewage inspection rooms or its openings, and these reasons lead to network flooding and blockage. [2]

The sewage networks in the State of Kuwait are considered disasters created by humans with their own hands, due to several factors, the most important of which are: the deterioration of the infrastructure of sewage networks and their old, and the failure to renew them to keep pace with population pressures in the increase in population numbers and the expansion of alternative industries and their load on the sewage networks, and citizens' lack of commitment to environmental standards and conditions. Which is punishable by the government to reduce the wrong environmental practices of citizens in the misuse of sewage networks. [6]

Despite what the government of the State of Kuwait is doing, represented by the attempts of the Environment Public Authority, the Kuwait Society for Environmental Protection, voluntary teams, and associations working in the field of marine environmental protection; To raise awareness of the danger of dumping pollutants and garbage in sewage networks, on beaches, and in the sea, as some individuals and factories are still violating instructions without paying attention to penalties that reach imprisonment and heavy fines.

Untreated sewage, pollutants, organic and chemical materials contribute to reducing oxygen levels, increasing algae and toxic elements in sea water and changing its properties.

### **[1] Sewerage problems in the State of Kuwait :**

Kuwait ranks first in the Arab world and fifth globally in coverage of sewage services, and nearly 90% of the population receives water and sanitation services, and municipal sewage water flows to sewage treatment plants, which is received from residential, governmental and commercial buildings, as well as water surface. The leaked rainwater is also drained to a network separate from the sewage network, and it is discharged without treatment into the sea, and there are no fees for sewage collection in Kuwait, as sewage services are financed from the annual budget allocated by the government. [8]

Despite the numerous sewage plants in the State of Kuwait, there are many problems that affect the Kuwaiti environment, due to sewage water, including: Poor control of wastewater in the Sabhan Industrial Area, where the problem of dealing with sewage in the Sabhan area is The industrial area is one of the most important environmental problems due to the presence of (1105) industrial facilities that were established during the last 20 years, distributed over (21) industrial areas, and all of them suffer from severe environmental damage due to the illegal disposal of industrial wastewater into the sewers of the sewage system. Which caused many damages, especially to the Kuwait Bay and the efficiency of municipal wastewater treatment plants that operate on the basis of aerobic biodegradation using activated sludge. [9]

This is in addition to the findings of the Parliamentary Environment Committee's report on the sewage problem and ways to eliminate it, to the need to find solutions to sewage problems that have affected many areas in the country, as there are (56) sewage drains that flow into Kuwait Bay. [7]

She stressed the importance of the cooperation of all parties to eliminate environmental problems, whether in the Sabah Ahmad residential area, the Al-Sabah medical area or drainage Al-Ghazali, and indicated that the Kuwait Bay problem is eternal and has harmed living creatures and the environment, and that there must be executive steps to address it. [7]

Where Kuwait Bay faces a tragic reality, as a result of pollutants and sewage flowing into it from manholes originally designated for rain water around the clock, which leave black spots and unpleasant odors and cause the death of fish and marine life. There are many sources of environmental pollution in the State of Kuwait, including : [4]

#### **[1-1] Rain sewers :**

With the continuing problem of exploiting rainwater sewers and linking them to the sewage network, whether inside crowded residential areas, such as "Jleeb Al-Shuyoukh" or "Shuwaikh" garages, and other illegal connections that are placed on the rain network to leak untreated water directly into the sea, I tried The Environment Public Authority to stop this bleeding that directly affects the marine environment and its natural components, but the efforts that tried to implement them have not yet been implemented, and 50 rain estuaries distributed in Kuwait Bay have become the "real enemy" of marine creatures. [14]

#### **[1-2] Doha and Sulaibikhat :**

Over the years, it has been observed that fish deaths are linked to sites close to sewage estuaries located in Sulaibikhat Bay and other areas in Kuwait Bay, where they are used to drain untreated water, which led to an increase in the level of nutrients in the areas near the coast. [15]

Frequently, the coasts of Sulaibikhat and Doha witness rainwater sewers, which are dumped from chemicals issued by hospitals, according to reports announced by the Environmental Affairs Committee last February. [17]

By monitoring the results of the samples, it was revealed that there was an increase in the “microbiological” indicators associated with sanitation and in the numbers of “faecal coliform bacteria”, “elicoli bacteria” and “fecal streptococcus bacteria” above the rates permitted in international and national standards for the protection of the coastal environment from pollution, in addition. Therefore, the power stations in the Doha area are considered among the negatives that affect the Kuwait Bay and the marine environment, especially as they cause high water temperatures. [18]

### **[1-3] Chalets and Beaches :**

In the chalet areas, especially the southern ones, the Environment Public Authority teams monitored, through their repeated campaigns and reports, a number of violations of the marine environment that contribute to water pollution, including linking the discharge of untreated water directly to the sea or throwing construction and cement materials into it during construction operations. In addition to throwing waste, food, etc. into the water or on the beaches. [19]

Some beach-goers deliberately throw plastic waste and dirt on the beaches and into the sea every day while using their pleasure boats, which leads to the accumulation of dirt in an uncivilized view along the beaches, especially in the early morning hours, which requires an army of cleaners to remove it. [19]

### **[1-4] Contaminated rainwater drains :**

The number of rain drains is (49) manholes, which are supposed to be designated to drain torrential rains and torrential rains only so as not to flood residential areas and streets, but they have become a dump for dangerous pollutants that go directly to the bay, which resulted in complete pollution of the Kuwait Bay, which is Kuwait's livelihood and the largest. An incubator for fish, where it turned into a deadly enemy because of those pollutants that turn the john into “the largest toilet in the world,” as described by some environmental activists, especially that the john's environment is fragile and the water currents move very slowly, in addition to being subjected to continuous environmental pressures over years of Rain streams, which increased the rate of pollution, and would harm drinking water and fish, especially since Kuwait Bay is considered the largest breeder of fish and marine creatures in the world. [14]

There are also (49) rainwater drains in the jones, and there are uncivilized practices of emptying sewage (sewage) water in the bay without filtering it, and any day of delay in taking firm action to confront this phenomenon costs us a great deal of pollution in the bay of Kuwait. [9]

Manhula, the maternity hospital and Al-Ghazali Road are considered the most dangerous manholes ever, as a result of the dangerous and toxic pollutants they carry, emanating from the Kuwait rain drain to the Jleeb Al-Shuyoukh area, passing through the Al-Sabah medical area. [7]

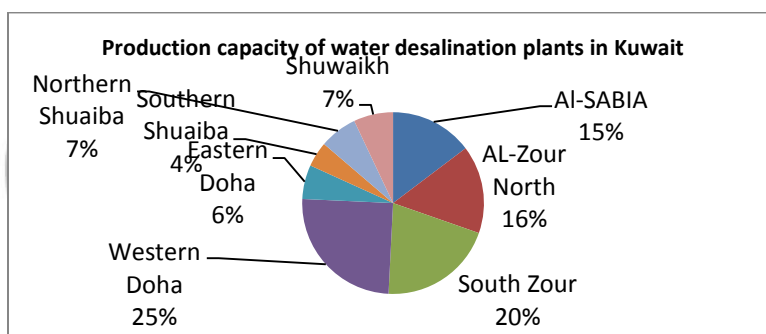
*In light of the foregoing, the study concluded that the sewage networks are weak in eliminating environmental pollutants, and their weak ability to cover sewage water resulting from human use in the State of Kuwait, and what requires the need to establish a sewage plant in line with sewage pollutants from medical and industrial pollutants. The current operating stations in the State*

of Kuwait were unable to address it, and this is what the researcher will try to implement through a proposed project using modern technology in sewage networks.

## [2] Sewage stations in Kuwait :

The problem of untreated sewage is considered one of the most serious problems for human health and the surrounding environment in most third world countries. Kuwait was one of the pioneering countries in the field of sewage treatment, in the interest of human health and environmental safety, and in 1967 it established the first plant for this The purpose is the Ardiya sewage purification plant to preserve public health as well as the environment. The presence of purification plants contributes to limiting environmental pollution damage to humans or marine organisms, because these pollutants contain a large amount of organic compounds and huge numbers of aerobic and anaerobic microorganisms, causing a shortage in Oxygen if thrown into the sea and causes the death of marine organisms, and originally sewage water contains a high percentage of water 99.9, and the rest is solid materials in the form of colloidal, suspended and dissolved substances. [16]

And thinking began to reuse treated water within the general plan for sewage in Kuwait in 1960, by irrigating the areas surrounding the Ardiya station with the increase in the produced treated water.



**Figure (1) Production capacity of water desalination plants in Kuwait [1]**

As shown in Table (1), there are currently sewage treatment plants in Kuwait, which are :

**Table (1): Capacity of wastewater treatment plants in Kuwait [5]**

	Al-Jahra	Al-Raqqa	Umm al-Hayman	Al-Khiran / Al-Wafraa	Alslibia	Kabd
Date created	1982	1982	2001	2003	2005	2012
Initial Capacity (m3/day)	65K	85K	27K	4K	425K	180K
Expanded/Max Capacity (m3/day)	86K	180K	-	-	600K	270K
Current flow (m3/day)	220K	220K	20K	3.84K	450K	180K
Tertiary treatment phase for treated fluids (m3/day)	-	166K	15.68K	-	-	180K
Reverse osmosis water (m3/day)	-	-	-	-	320K	-

It is evident from the previous table that :

## **[2-1] Al-Raqqa Sewage Treatment Plant :**

The Raqqa purification plant was established and operated in 1982 with a capacity of 85,000 cubic meters of sewage water per day using an activated sludge system for secondary treatment. For the purposes of agricultural irrigation in Kuwait, and through this project, a triple treatment phase was established with a capacity of up to 160,000 cubic meters of sewage water per day to be sufficient to accommodate the expected increase in sewage flow rates and to match the future expansion of the treatment system in the Raqqa plant, and given For the steady increase in sewage flows, the Raqqa purification plant was expanded and developed through a special project in the period from 1995 to 1999, so that the triple phase was able to treat effluent sewage at rates of up to 180,000 cubic meters per day in accordance with quality standards for the sanitary engineering sector In the Ministry of Works, and through this expansion, the primary treatment phase was developed by adding new operating systems, as well as increasing the number of secondary treatment units and developing the ventilation system. and treatment to improve efficiency and remove odor-causing gases, and the number of sludge drying troughs has also been increased. The main objective of establishing sewage plants in Kuwait is to preserve the integrity of the environment, especially the marine environment, and make maximum use of triple treated water in achieving greening projects and increasing green spaces in all areas. across Kuwait. [17]

And Al-Raqqa sewage purification plant of the Ministry of Works receives flows of up to 300,000 cubic meters per day of sewage, which is more than 60% above its design capacity. In addition to the residential areas between Sabah Al-Salem in the north and Ahmadi and Fahaheel in the south, the plant produces triple treated water according to environmental standards through several stages of water treatment to ensure a distinct level of treated water, then final sterilization is done before the water reaches the beneficiaries, by The road to the two main pumping stations (Al-Aqila) through (4) lines of different diameters (1000-1400) mm, which extend over a distance of approximately 5 km. The station produces self-treated water through the following three stages: [12]

[2-1-1] Initial treatment stage: It is the physical treatment through which large suspended and floating materials are removed, sand and surface suspended matter separated, gases (odors) removed, and pH equalization. [13]

[2-1-2] The dual treatment stage: It is the stage that is considered the most important in the sewage treatment process, where the water is transferred to aeration basins with a total capacity of (123) thousand cubic meters in which the sewage is supplied with the oxygen necessary to enable special types of wastewater treatment. Bacteria break down and digest the pollutants present in sewage water from germs and chemical and biological toxins and transform these pollutants into sedimentary materials that are not harmful to public health or the environment. Aeration to enhance the treatment process in those basins and the remaining part of it is treated by condensing these materials, increasing their concentration and reducing their volume, then digesting these materials to remove harmful pollutants from them, and drying them in basins (sludge drying), and here the solid materials are disposed of, while the pure water flows through sedimentation basins to the third stage. [10]

[2-1-3] The third treatment stage: the treated water flows from the sedimentation basins to this stage, and this water is injected into a channel with a solution of chlorine and water, and chlorine works to kill disease-causing bacteria present in the water, in order to prevent its proliferation within the sand filters. The water is filtered from micro-plankton using two systems of sand filters and ultra-fine disc filters, in order to ensure a distinct level of treated water, then the final sterilization is carried out before the water reaches the beneficiaries. It is used for a variety of purposes, such as cosmetic agriculture in the areas of Kuwait, "malls", highways, and irrigation of areas affiliated with the Ministry of Oil in the Ahmadi region. [17]

### **[2-2] Sulaibiya Wastewater Treatment Plant:**

The Sulaibiya plant covers the central region in Kuwait and its water treatment is quadruple to ensure water quality, while the water treatment in the rest of the plants is triple, and the water treatment and desalination plant in Sulaibiya began operating and reclamation in 2005 as the largest facility in the world applying reverse osmosis (RO) water treatment and ultra filtration (UF) to treat all wastewater flowing from Kuwait City and Hawalli. [15]

The Sulaibiya water treatment plant alone treats approximately (64%) of the wastewater in the country. The plant is divided into two parts: the biological treatment plant and the recovery plant. The pre-sorted effluent is subjected to a backwash process using ultrafiltration technology, then the resulting flow is distributed to nine aeration tanks with a total volume of (208,900) cubic meters. Ultrasound to the reverse osmosis section, which contains (21,000) membranes that filter the effluent through three successive stages, and as a result (85%) of the incoming is purified to the reverse osmosis/ultrafiltration plants, while the rest is dumped as brine and discharged into the sea. [15]

**The Sulaibiya purification plant is considered the largest in the world in terms of size and capacity, in which reverse osmosis is used to purify sewage. It was established through a partnership between the private and public sectors on a build-operate-transfer system. The plant was established in 2004 with a design capacity of 425,000 m<sup>3</sup> today to reach 600,000 m<sup>3</sup> Today, after carrying out the expansion works, the plant treats 60% of the total wastewater in the State of Kuwait. [14]**



***Figure (2) is a picture of the Sulaibiya purification plant***

### **[3] Kuwaiti environmental protection laws:**

With heavy penalties and continuous inspection tours between the environment and government agencies to ascertain the extent of compliance with the application of environmental law and its articles, daily observations and pollution on the marine environment, especially the Gulf of Kuwait, confirm the lack of awareness of many individuals, and the intentional dumping of liquid, solid, organic and chemical waste by others. and sewage in the sea, which contributes to changing the physical properties of water in particular, and affects the environment in the State of Kuwait in general. [20]

Since the issuance of the executive regulations, and until June 2021, the Environment Public Authority has issued more than a thousand violations against the marine environment of residential buildings, individuals, ships, facilities, and chalets. It has encroached on the sea and its marine creatures, as the Environmental Law sets penalties and fines for violators and trespassers on the

marine environment of no less than 10 thousand dinars, and up to one million Kuwaiti dinars, and despite this, individuals and government and private facilities continue to commit violations without any deterrent, for example The violations of the marine environment until June 2021 AD were as follows : [20]

- [673] in the jone of Kuwait
- [23] Infringement by individuals on the beaches
- [183] A ship dumped the waste in the sea
- Violation [25] of a chalet that polluted the sea
- Monitoring the encroachment of [34] persons on marine creatures.

### **[3-1] Penalties for violating the marine environment :**

Penalties for violating the marine environment are determined by: [21]

- Imprisonment for a period not exceeding 6 months and a fine between 50 and 200,000 dinars, or one of these two penalties, for anyone who intentionally pollutes the marine environment.
- A fine between 30 and 150 thousand dinars for anyone who unintentionally falls into any pollution in marine areas.
- A fine of between 20 and 50 thousand dinars for any ship that does not comply with pollution reduction equipment or fails to take adequate precautions to prevent pollution reduction before damage occurs on it.
- A fine of no more than 10 thousand dinars for anyone who throws garbage or waste on public beaches and islands.
- A fine not exceeding 10 thousand dinars for each small boat whose users dump garbage in the marine environment.
- A fine of no more than 30 thousand dinars for a medium-sized boat if its users dump garbage in the marine environment.
- A fine not exceeding one million dinars for the owner of oil or commercial vessels in the event of dumping garbage or waste in the marine environment.
- 15 floating water quality monitoring stations.

### **[3-2] Government practices to confront environmental pollution:**

The Environment Public Authority (EPA) monitors, measures and follows up on water quality and specifications for the marine environment in an instantaneous and continuous manner through floating monitoring stations. It is one of the development plan projects of the Government's Action Program. The authority owns 15 stations distributed from the north to the south of the Kuwait Sea. [22]

There is a parliamentary move to stop the encroachments on the marine environment accused by the Ministry of Health and the Ministry of Commerce, especially after it revealed violations recorded by the Environment Public Authority against each of the ministries of "Health, Commerce, and Works" in addition to the Industry Authority regarding the infringements on the Kuwait Bay.

A move was taken to stop the infringements that were discussed at the beginning of this year regarding the responsibility of the "Health" for the pollution of the air in the Al-Sabah health area, where the presence of radioactive materials was monitored and the concentration rate reached high levels. Kuwait. [22]



(Behzad, 2021) confirmed that the quality of sea water in the country has been affected by what it has been exposed to over the past years of negative discharges of sewage and industrial water and direct and indirect waste resulting from various activities, and that the discharges resulting from extensive urban and industrial development have negatively affected the quality of Sea water and sediments in it, indicating that one of the main sources of waste that affects the marine environment is "the main ports, marinas and urban facilities represented in tourist and recreational places, residential areas, and the hospital complex in the Al-Sabah health area, and others". [12]

The use of Kuwait Bay as a water body to dispose of thermal liquid wastes from the Doha East and West stations is considered to have a broad negative impact on the properties of sea water, in addition to the fact that Kuwait Bay receives 70% of the wastewater connected to its treatment plants, noting that the lack of implemented management and mitigation strategies They have also been identified as driving factors in the extent of pollution in Kuwait. [12]

Among the variables that affect the marine environment are the outcomes of climate changes in the world that are directly related to the rise in the water level that is expected to flood parts of Kuwait City and the northern islands based on the scenarios presented by Kuwait's second national communication, on the United Nations Framework Convention on Climate Change, under The minimum sea level rise, as it is expected that 185 square kilometers of land will be submerged in the absence of any coastal protection measures, and the reason is that the northern coasts of Kuwait Bay are characterized by low and shallow beaches. [16]

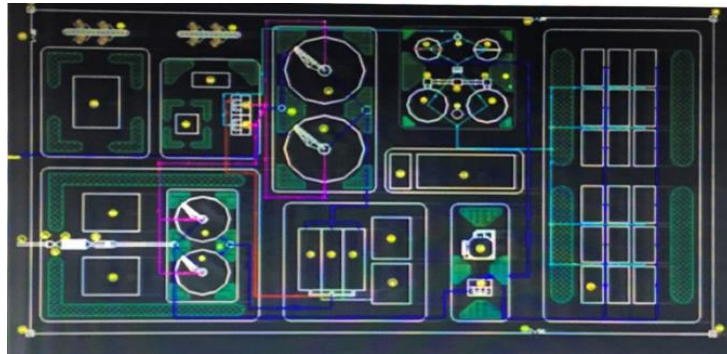
In light of the foregoing and observed problems due to poor sewage treatment, the researcher is trying to develop a proposal for a central treatment network project to purify sewage and feeding pipes in the State of Kuwait as follows :

#### **[4] A proposal for a central treatment network project to purify sewage and feed pipes in the State of Kuwait :**

The researcher suggests allocating an area of (30) acres in Jahra Governorate, for several reasons, including :

- Al-Jahra Governorate occupies (64%) of the total area of the State of Kuwait.
- It is one of the promising areas that will include urban communities in the future that need many aspects of human development.
- Its proximity to Bubiyan Island and Warba reserves, which need sewage networks to prevent them from being polluted and preserve them.
- Expansion in the Jahra area by establishing urban communities to reduce desertification.
- Expansion of the agricultural area in the Abdali area, and the establishment of other agricultural sites using the proposed sewage treatment plant.

**The following figure shows a blueprint of the proposed project before implementation, by designing it using the engineering drawing program (AutoCAD), as follows :**

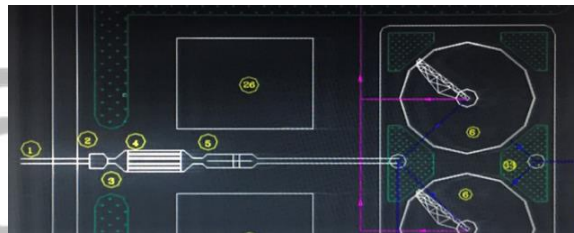


**Figure (3) The plan of the proposed station to be established in the Jahra area**

The researcher deals with it in detail as follows :

#### **[4-1] Entrance room (calm room) :**

It is placed at the beginning of the treatment works in order to calm the discharge coming from the ejection lines so that the flow system is changed from closed pipes to an open one to move by gravity. [22]



**Figure (4) Entrance room (cooling off)**

The purpose of the (cooling off) rooms at the entrance is to receive the water rushing towards the pipes and reduce its speed in order not to affect it negatively and cause them to break or exceed the limit.

#### **[4-2] Refineries :**

It is intended to seize floating materials such as wood, paper and other things that may affect the following processing operations and is also used to protect lifting stations. [24]

#### **[4-3] Sand Retention Basins :**

Its purpose is to precipitate inorganic substances of large size and density such as dust, sand, broken glass and metals that reach the drainage network from sanitary devices and rainwater, and are used to remove suspended solids in wastewater with a size of 0.2 mm or more such as sand, mud and dirt. [25]

#### **[4-4] Primary Sedimentation Basins :**

They mainly include primary sedimentation basins, the purpose of which is to deposit sedimentary materials in sewage water to reduce the organic load and suspended matter on the biological treatment units that follow the primary sedimentation. At this stage, about 40% of the absorbed biological oxygen is reserved, and this percentage decreases and increases according to the design principles adopted for the sedimentation basins. , as well as the characteristics of sewage water, and is used to remove suspended matter that can be deposited with wastewater, and it can be implemented either as rectangular or circular. [24]

#### **[4-5] Grease and Oil Retention Basins :**

It is sometimes used when sewage water contains an impressive percentage of grease and oils, and every factory, institution

or restaurant whose waste contains oils and grease is supposed to be obligated to seize these greases and oils before discharging its waste into the public sewage network. Therefore, the use of oil and grease sequestration basins is rare in A sewage treatment plant, but it is necessary if these substances are present in large concentrations that affect other treatment stages. [22]

#### **[4-5] Biological Treatment Ponds :**

Biological treatment ponds are rectangular troughs whose purpose is to remove organic water by bacteria and require an air source.

##### **[4-5-1] Perforated Filters :**

It is a group of perforated pipes connected to an air source outside, walking at the bottom of the basin, and the main pipes come out from them, branch pipes that have holes under the dish from which air comes out and creates air bubbles that take in oxygen. [25]

##### **[4-5-2] Ultra-fine Filters :**



**Figure (5) Ultra-fine Filters**

**[4-5-3] Grass filters (adherent growth) :** It usually consists of a circular tank supplied with coarse materials as a medium for the growth of microorganisms, the coarse materials usually used are large size rocks or stones. [21]

**[4-5-4] Activated Sludge Systems (suspended growth) :** In this process, microorganisms are mixed with the organic compounds present in the wastewater in conditions that stimulate their growth through their consumption of the organic compounds. [20]

**[4-5-5] Final sedimentation basins :** The basins are circular, used to remove the solid materials resulting from the biological units as a result of the treatment process. [25]

**[4-5-6] Purification :** It is performed as an independent process in specially designed tanks so in this process, pathogenic microorganisms are removed.

**[4-5-7] Weir :** Weirs enable to measure volumetric flow rate in small and medium waterways or at artificial discharge points in a simple way. Since the sill of the weir (at its apex) has a well-known geometry and all water flows above it, the depth of the water behind the weir can be converted into a rate of flow. If the water does not drift away from the weir after it has passed its top, this can make measuring the flow complicated or even impossible, And it works to control the speed of water leaving the basin after the treatment process. [24]

#### **[5] Discussion and Results :**

Huge efforts are being made, and projects are being established with the aim of providing the water needs of residential

and industrial gatherings and agricultural projects, and there are huge sums of money invested for the convenience of citizens and all its residents. Therefore, everyone must cooperate in rationalizing water consumption, and this is done through cooperation with the state. In the use of the drip irrigation system that delivers water to plants in calculated quantities and in a slow manner that allows them to make the most of the water, and works to save water by 30-40% of water compared to the regular irrigation system, rationalizing water consumption by using water levels for plants and crops as needed. The water necessary for the plant, and according to the emergence of the productive growth of the plant depending on the nature of the agricultural soils in the Wafra and Abdali farms, and rationalizing water consumption by irrigating home gardens and crops, the appropriate time for irrigation protects the crops and improves the quality of fruits and production.

This is in addition to the state's efforts to recycle water resulting from domestic and industrial uses resulting from rain, which contributes to maintaining a clean environment, and contributes to cooling and soothing the atmosphere and reducing the heat that characterizes the State of Kuwait. It also helps to use water in other uses from Recycled in agriculture, industry and development.

It contributes to moistening the desert sand to reduce sandstorms, reduce environmental degradation caused by desertification and increase the green agricultural area, in addition to civil uses in extinguishing and firefighting, spraying golf courses, construction projects, and development in general.

**It also contributes to reducing pollution of the marine environment by preventing the discharge of untreated sewage into the sea, and reducing unpleasant odors, diseases and epidemics resulting from sewage water.**

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