The Ministry of Water and Irrigation

Water Sector Policy For Wastewater Management and Reuse

2023

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for
Wastewater Management and Reuse

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This document is an integral part of the National Water Strategy and related policies and action plans.

1. National Water Strategy 2023-2040.
2. Water Sector Capital Investment Program (2023-2040).
3. Water Demand Management Policy.
4. Energy Efficiency and Renewable Energy in the water sector Policy.
5. Water Reallocation Policy.
6. Surface Water Utilization Policy.
7. Groundwater Sustainability Policy.
8. Wastewater Management and Reuse Policy
9. Climate Change Policy for a Resilience Water Sector
10. Water Sector Policy for Drought Management
11. Action Plan to Reduce Water Sector Losses (Structural Benchmark).

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FOREWARD

Jordan is a nation burdened with extreme water scarcity that has always been one of the biggest barriers to our economic growth and development. This crisis situation has been aggravated by a population increase that has doubled in the last decades because of refugees fleeing to Jordan from neighboring countries in addition to the transboundary and climate change issues affecting Jordan's water supplies.

In the face of these challenges, and to achieve our goal of successful integration of Jordan's water resources management, the Ministry of Water and Irrigation has been active in putting forward new policies that set clearly defined rules to manage the scarce water resources efficiently and sustainably. These new policies lay out the measures and actions required to achieve our national goals for long-term water security. These result-oriented policies are built upon and updated from previously adopted strategies, policies, and plans. Together, they are an integral and ongoing part of the overall management efforts that have already been achieved.

This policy "Wastewater Management and Reuse Policy" with the aim to improving wastewater management and reuse including the common centralized and future decentralized wastewater treatment plants, is the result of the efforts of working group to whom I am thankful. My team has been putting great efforts to enhance water governance that support these policies at all levels, which include enforcement of a suitable legal framework and regulatory tools, enhancing efficient institutional capacities, and supporting dynamic management plans that adapt the concepts of participation and decentralizations all under the umbrella of Integrated Water Resource Management which I am sure will show results in the near future.

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Minister of Water and Irrigation

1 INTRODUCTION

Jordan is one of the most water deprived countries in terms of freshwater resources. The water share per capita per year has fallen from 1000m^3 in 1960 to 126 m^3 in 2020.

Factors causing the reduced share are the population growth, climate change, socioeconomic, development and the influx of refugees due to political unrest in the region.

Population in Jordan over the last two decades has more than doubled, increased from 4.2 million in 1994 to more than 10 million in 2020 (DOS). The huge increase in numbers, despite the declined local growth rate from 3.7% to 2.2% between the two dates (DOS), is attributed to the influx of refugees from other countries mainly from Iraq and Syria following the occupation of Iraq in 2003 and the civil war in Syria 2011. The expanding population placed enormous pressures on the already scarce and depleted water resources. About 80% of the population is located in urban areas concentrated in five Governorates: Amman, Balqa, Zarqa, Mafraq and Irbid.

Given these facts, appropriate alternatives to water provision for various sectors had to be adopted through the reuse of treated wastewater for irrigation and industrial purposes to alleviate pressure on the scarce and already exploited freshwater resources.

The National Water Strategy (2022-2040) has emphasized on the need to increase the amount and improve the quality of treated wastewater available for the agricultural and industrial purposes. The strategy aimed to increase number of people connected to sewer networks to 85% by the year 2040 and hence the amount of treated wastewater from 186 m^3 in 2019 to 235 m^3 by 2030.

This Policy will be used by the decision-maker as the primary reference for deciding upon wastewater management and infrastructure projects that involve both centralized and decentralized wastewater management infrastructure and the reuse scheme that shall be adopted to ensure successful implementation of this policy and assure substitution of freshwater by using treated effluent in various sectors.

2 TREATED WASTEWATER USES

In 2021, the quantity of Treated Wastewater was about 186 MCM out of which, about 167 MCM reused constitutes approximately 90% of the total treated quantity.

These quantities are used after mixing with freshwater from flood and base flow for irrigation purposes in the Jordan Valley as they flow towards the dams. Small portion of these effluents are used directly in the areas adjacent to the WWTP in addition to small volume that is used for industrial uses in Aqaba governorate.

As for unused treated wastewater that estimated at 19 MCM, it released to wadies or store until it dries up.

Table 1: Quantities of TWW used by each sector according to locations.

Location	Municipal	Agricultural	Industrial	Total (MCM)
Jordan Valley	0	133	0	133
Highland	0	31	3	34
Total	0	164	3	167

The Jordanian standards and regulations specify the quality of treated effluents allowed to be discharged into wadis or destined for reuse in agriculture, where there will be a requirement for a secondary level of treatment. Quality specifications of JS should be consistent with WHO guidelines for the safe use of treated effluent in irrigation.

3 CURRENT WATER SUBSTITION PROCESS IN JORDAN VALLEY

In the 1980's, Amman and Zarqa urban areas were provided with additional water supply from the Jordan Valley. This water supply caused reduction in the available water resources used for irrigation in the Valley. The supply of water from the Valley to the cities of Amman and Irbid for domestic purposes started in mid-eighties after the completion of Deir Alla-Amman and Wadi Arab-Irbid Domestic Water Supply Projects. An average of 75 MCM per year is supplied to Amman from King Abdullah Canal in Deir Alla, and 20 MCM to Irbid from Wadi Arab well field.

In addition, about 10 MCM is supplied to Irbid from King Abdullah Canal through Wadi Arab -2 project which will be increased to 30 MCM during in the next years depending on water availability.

4 CONSTRAINTS FACING WATER SUBSTITION

Water substitution is more complicated than substituting other goods because water has exceptional characteristics. Water is a common resource, bulky and expensively stored and transported. These characteristics make water substitution somewhat problematic and complex in addition to economic, cultural, social, and political interrelationships considerations. Despite the facts illustrated earlier concerning the value of Treated Wastewater, little research has examined micro and macro policy interventions for water substitution. Many studies attempt to resolve water substitution issues and suggest market-based solutions for the constraints.

Cultural, political, environmental, and fiscal constraints make freshwater substitution more difficult than theories based on simplified assumptions. Following are some of the most recognized constraints which affect freshwater substitution:

1. Substitute water quality: Even though Treated Wastewater is rich in nutrients, its high salinity adversely affects the productivity of some crops.
2. Soils quality: differences in soils characteristics imposes some restrictions on effluent reuse. Alkalinity, sodicity, pH, salinity, SAR of soils could limit the reuse unless

effluent quality fits the soils and crops requirements.

3. Financial constraints: Considerable investment in Wastewater treatment infrastructure will be needed to meet future water needs. Policymakers need to consider the fiscal implications of such large investments.
4. Water prices: Prices are important part of the efficiency principle. Lack of information limits the market's ability to set a permanent and unified price for water. One of the conditions for market competition is setting a rational water price. Decision-makers must be able to find information about prices and cost-saving innovations in substitution projects.
5. Efficiency constraints: Efficiency is achieved when the marginal value of water among competing users is equal, which in reality difficult to valuate because of other constraints.
6. Incomplete information: Incomplete information will mislead decision- makers. Quantities of fresh ground water used are estimated and there are no definite figures that can be relied on.
7. Institutional constraints: There are formal constraints (e.g., rules, laws or regulations) and informal constraints (e.g., behaviors, or self-imposed codes of conduct) that limit the efficient substitution of freshwater resources. number of governmental entities (Ministries of Agriculture (MOA), labor (MOL), and Environment (MOEnv) in addition to the Ministry of Water and Irrigation-JVA and WAJ) involved in agricultural sector especially irrigated agriculture aggravates the control and management of water usage.

Moreover, decision makers must be able to learn about profitable opportunities in other water based and water related sectors and industries.

5 QUALITY CONSIDERATIONS

Limited water quantity in the Jordan Valley necessitates that irrigation water must be used more efficiently and therefore considerable percentage of farmers switched to drip irrigation systems. This means field-wide leaching is no longer possible and therefore salt accumulation became a potential risk. Furthermore, continuous drip irrigation leads to alkali soils formation in the absence of leaching / drainage water from the field.

Hence, it is important to manage the irrigation process to keep the soil salinity levels below the threshold. This can be done with enough water supply with acceptable quality to leach out the salts accumulated because of the drip irrigation.

Using Treated Wastewater with high Chloride concentration is another quality related limitation. Although its availability in trace quantities is essential for plant growth, high concentration of Chloride is very toxic to the plants. In alkaline soil conditions like the Jordan Valley soil, salts and chloride strongly interact to significantly decrease crop's yields.

6 POLICY OBJECTIVES

6.1 General

The objective of this policy is to provide details of measurements needed to maximize the treated wastewater reuse efficiency on technical, institutional, and legislative levels.

Hence, suitable wastewater treatment is indispensable for public health, sustainable water resources and the protection of the natural environment, all of which seriously impact economic and social well-being.

Following are Government's key objectives associated to wastewater management including the decentralized of wastewater management:

- **Sustainable Development** - to seek wastewater management infrastructure that allows Jordan to live within its environmental limits and that helps ensure a strong, healthy and just society balancing its environmental, social, and economic development.
- **Public Health and Environmental Protection** - to meet our commitments under the National Water Strategy and the Sustainable Development Agenda by providing suitable collection and treatment systems to protect public health and limit pollution of the environment.
- **Coping with Water Scarcity** - to use water efficiently across all sectors and ensure sustainable consumption of freshwater and to significantly reduce the number of people suffering from water scarcity.
- **Improving quality of life** - to improve overall living conditions especially in suburban and rural areas by enhancing local water availability by seeking opportunities to recycle and reuse water and to recover raw materials.
- **Improving Wastewater Services** - to establish efficient wastewater management services by continuously updating or developing, when is required, standards for network and technology performance, treated effluent quality, operation and maintenance of sewage networks as well as for disposal and treatment facilities including decentralized wastewater treatment units that could be adopted as a technical solution to address hot spot issues.
- **Public Participation** - to support and strengthen the participation and ownership of local communities in improving water and sanitation management, through enforcing as well the behavioral change mechanisms and engaging all society segments in the process, while stressing gender and women roles in the wastewater management.
- **Private Sector Participation** - to seek substantial involvement of the private sector in managing decentralized wastewater treatment units, as well as the centralized wastewater treatment plants, to improve the economic performance of the water sector.
- **Adaptation to Climate Change Impacts** - to seek adaptation measures to climate change effects, which are becoming more apparent in decreasing rainfall amounts, and changing its distribution and patterns across the kingdom. The sector shall ensure that all households, businesses, and government facilities have access to safe containment, transport, treatment,

and disposal/reuse of wastewater, improve sludge management to reduce environmental impacts and leverage opportunities for productive reuse (such as land applications, fertilizers, cement kilns or incineration with energy recovery), and Expand reuse of reclaimed water.

The major requirements for the sustainability of wastewater management infrastructures include the following:

- Capacities of the water sector to effectively plan, implement and operate wastewater management infrastructures.
- Reuse standards that will enable farmers to establish feasible and risk-free reuse practices.
- Efficient operation and timely maintenance of wastewater management infrastructure to assure effective and sustainable O&M schemes.
- Community ownership in the sense of taking direct and autonomous responsibility for their local wastewater solutions in the case of decentralized wastewater management.
- Effectively enforced building standards that preclude infiltration of wastewater through leaking cesspits and septic tanks.
- Effectively enforced regulations that end environmentally unsafe, underpriced and partly illegal alternatives of wastewater disposal. This includes: 1) Standards need to be revised and consistent with international best practices to expand sludge and reclaimed water reuse options by 2024 and 2025, respectively. 2) Build relevant staff capacity across the sector and secure the required support for regulations' enforcement and implement campaigns on illegal connected properties to sewerage system and discharge of wastewater by 2024. 3) Deploy appropriate technologies (e.g., tankers tracking) to identify and redress hot spots for illegal dumping and build capacity of utility staff to undertake their role as jurisdiction officers and build successful cases to take to court.

6.2 Purpose of Introducing the Decentralized Wastewater Management Systems

Despite that the centralized system is currently used for collecting and treating wastewater generated from fast-growing urban areas in Jordan, there is still the issue related to hotspot areas in urban and suburban areas where the decentralized wastewater treatment system emerges as a technical solution to tackle the wastewater treatment issue in these areas.

Following are the key purposes that accentuate the decentralized wastewater treatment systems as a reasonable solution.

Protection of Groundwater from pollution with untreated wastewater - to prevent untreated wastewater from polluting groundwater by way of improper disposal of wastewater by yet unconnected domestic, commercial, and industrial dischargers and entities in charge of wastewater disposal.

Provision of cost-efficient wastewater management options - to establish the best combination of decentralized and centralized wastewater management with the aim to provide most cost-efficient adequate wastewater collection and treatment systems covering to the best extent possible all types of wastewater management demands.

Provision of locally available alternative water resource for safe reuse - to provide alternative water resources for freshwater substitution especially in suburban and rural areas for local reuse.

Increase the connection rate - to expand connection to sewerage by implementing decentralized wastewater management where centralized sewerage cannot reach due to technical obstacles or where it is less economical than decentralized sewerage.

Cost-efficiency - to assess decentralized and centralized wastewater management options for the development of new infrastructure with the aim to design most cost-efficient solutions for all new wastewater infrastructure that are based on dynamic cost comparison considering investment and operation and maintenance cost over the new infrastructure's complete lifecycle.

7 POLICY STATEMENTS

7.1 On Substitution Priorities

1. MWI will expand the connection to sewerage system service to serve 85% of the kingdom's population by 2040. This will be achieved through investing in wastewater collection and treatment infrastructure. The treated wastewater amount is expected to reach 235 MCM in 2030.
2. Reclaimed water shall be used for industry and agriculture as much as possible to alleviate pressure on the freshwater.
3. In terms of agricultural use, priority shall be given to the crops with high economic return.
4. TWW reuse in the highland shall be directed to substitute the groundwater not to irrigate new areas.
5. Lands adjacent or close to the substitute water shall have priority in exchange for fresh groundwater.
6. Priority utilization and use shall apply to impounded waters in reservoirs; such waters shall be treated for its intended use.

However, Cultural, political, environmental, and financial constraints make freshwater substitution more difficult than theories based on simplified assumptions. There are some of the most recognized constraints, that need to be overcome to increase opportunities for freshwater substitution, including:

- Substitute water quality: Despite the availability of plant nutrients in treated wastewater and water impounded in dams, the treated wastewater however, may have high TDS values that affect many crops and plants.
- Soils quality: differences between soils characteristics imposes some restrictions on effluent reuse. Alkalinity, solidity, pH, salinity, SAR of soils could limit the reuse unless effluent quality fits the soils and crops requirements.
- Financial constraints: Considerable capital investment in wastewater management infrastructure will be needed to meet future water needs. Policymakers need to consider the financial requirements of such large investments.
- Transformation and transportation: There are a transformation process to convert untreated wastewater to treated water, for use in the agricultural sector. Water losses are associated with transformations and transportation and thus it is rarely that 100 % of water is retained during transformation and transportation processes specially when the water gravitates long distances.
- Water prices: Prices are an important part of the efficiency principle. Decision-makers must be able to find information about prices and cost-saving innovations in substitution projects.
- Efficiency constraints: Efficiency is achieved when the marginal value of water among competing uses is equal which in reality difficult to valuate because of other constraints.

- Incomplete information: Incomplete information will mislead decision- makers. Quantities of fresh ground water used are estimated and there are no definite figures that can be relied on.
- Institutional constraints: There are formal constraints (e.g., rules, laws, or regulations) and informal constraints (e.g., behaviors, or self-imposed codes of conduct) that limit the efficient substitution of freshwater resources. number of governmental entities involved in agricultural sector aggravates the control and management of water usage.
- Lack of national Programs that aim to enhance the social behavioral change towards national issue, such as wastewater management and its impact on the overall water scarcity in Jordan.

It is a must that decision makers must be able to learn about profitable opportunities in other water based and water related sectors and industries in order to set an efficient substitution plan.

7.2 On Institutional and Administrative Arrangements

A robust treated wastewater and blended water tariff restructuring mechanism shall be developed and agreed upon. The mechanism should take into consideration the fairness, operational cost recovery and economic activities support.

The technical, financial, and legal capacities of the institutions responsible for water substitution plans implementation shall be strengthened under strong administrative institute.

In cooperation with Ministry of Agriculture (MoA), farmers in the Jordan Valley shall be guided to abide by the TWW reuse guidelines in terms of crop patterns, irrigation practices and marketing.

Monitoring programs shall be developed and implemented. The treated wastewater reuse becomes more acceptable by government, farmers and communities. Nevertheless, there are areas within the regulatory processes that need to consider a uniform approach to acceptable guidelines, such as the requirements for disinfection and monitoring of indicators related to quality and characteristics.

The ministry will implement a National Plan for Operation and Maintenance of WWTP aiming at enhancing efficiency and reaching better quality of treated effluent. The plan will determine the best business model for M&O.

8 IMPROVEMENT OF WASTEWATER MANAGEMENT

Increase the connection rate by augmenting wastewater collection and treatment shall be expanded in all parts of the country and according to priorities; substitution requirements shall be developed as part of the action plan for implementation. Expanding connection to sewerage by implementing decentralized wastewater management where centralized sewerage cannot reach due to technical obstacles or where it is less economical than decentralized sewerage must be considered.

Cost-efficiency to assess decentralized and centralized wastewater management options for the development of new infrastructure with the aim of providing the most cost-efficient solutions for all new wastewater infrastructure that are based on dynamic cost comparison considering investment and operation and maintenance cost over the new infrastructure's complete life cycle.

Freshwater allocated to irrigated agriculture in the highlands shall be capped and eventually reduced according to medium- and long-term plans to be prepared and implemented after which the reallocation plan can be updated accordingly.

Decentralized wastewater treatment options for hotspots must be used to prevent risk of contaminating available resources and develop a new water resource that can be used locally which will eventually substitute usage of freshwater for certain purposes.

A dynamic and sustainable economic development plan coupled with investment program shall be formulated and implemented for the use of treated wastewater efficiently.

8.1 On Legislations

Treated Wastewater specifications and standards must be revised and where necessary shall be amended to ensure a safe reuse and to produce high economic return products since the current specs and standards to treat and dispose of water are incompatible with the substitution goals and development requirements.

Strict regulatory measures to manage the use of reclaimed water for agriculture or other purposes shall be followed.

The Integrated Water Resources Management Approach (lWRM), combined with locally appropriate and sustainable risk reduction measures, and the active engagement of stakeholders from different sectors shall be established.

Decentralized wastewater treatment options must be studied and legal framework for usage must be developed coupled with specific criteria related to quality, use, and operation scheme.

Urban planning of new cities is to consider greywater systems that separate greywater from wastewater.

8.2 On Public Acceptance and Awareness

Enhance stakeholder and public participation in planning, implementation and monitoring of decentralized wastewater treatment systems and the development of wastewater management plans on community, governorate and national level including safe reuse options, safe use of products irrigated with treated wastewater, health and hygiene, and the need for financial contribution to wastewater collection and treatment.

9 ENHANCE PRIVATE SECTOR PARTICIPATION

The involvement of the private sector in new wastewater management infrastructure investments and O&M services shall be enhanced and expanded with the objective to strengthen performance-based, consumer-oriented, and cost-efficient operations and to alleviate the burdens of the public and the public water sector through accounting for economic feasibility and financial viability (e.g., sustainability). A prerequisite to attracting the private sector is to enhance the environment as a whole, through addressing financial, operational, institutional and regulatory challenges.

9.1 On Technology, Research and Development

The effluent quality should be improved by adopting modern treatment technologies to comply with the environmental and reuse standards.

The Effluent quality standards shall be revised to suit various reuse purposes.

Domestic wastewater shall be treated and purified to a quality that fits full utilization for industrial, agricultural, and other uses.

The related data and information will be tabulated and organized for easy use and reference. It will be part of the information system that will facilitate research.