

Guidelines for Waste Water Reuse in the Gaza Strip, Palestine

Part I – Legal and Institutional Issues

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Guidelines for the Reuse of Wastewater in the Gaza-Strip, Palestine

Chapter I

Article 1: Scope

These guidelines apply to the reuse of treated wastewater from housing, municipalities, industry and commercial enterprises in the Gaza-Strip, Palestine. They are including the requirements for:

1. The collection, additional treatment and storage of treated wastewater.
2. The irrigation in agriculture as well as areas of public landscape.
3. The enrichment and the quality improvement of the ground water.
4. The monitoring of the treated wastewater quality and the specification of sampling analysis methods.
5. The monitoring to assess the long-term impact on water, soil and public health.

The discharge of treated wastewater into surface water and the sea is not regulated by these guidelines.

Article 2: Purpose and Objectives

The guidelines provide vital information for collection, additional treatment and storage of treated effluent in such a manner that the use of ground water can be replaced, the aquifer can be enriched and the inflow of saline water into coastal aquifer can be reduced.

1. The overall objective of the guidelines is to preserve the environment by sustainable management of the water resources.
2. The main objective is to reuse all treated wastewater to improve the water balance and the ground water quality as well as protecting soil and the public health.
3. The treated wastewater should be used for irrigation and groundwater recharge.
4. No effluent should cause harm to the environment or the public health.
5. A national co-ordination for the reuse of treated wastewater should be achieved before 2005.
6. For every project in the area of reuse of treated wastewater the participation of all relevant stakeholders should be achieved.

Article 3: Definitions

In this guideline:

1. **“Approval”** means an authorized consent to build and operate a water reuse facility.
2. **“Aquifer”** means permeable rocks (loose or solid rock) which can feed springs and wells. The aquifer contains a marginal amount of ground water that can be used in economically relevant quantities.
3. **“Drinking Water Protection Zone”** means a defined area in which specific facilities and activities which may endanger the water environment are forbidden or allowed only restrictedly. The drinking water protection zones are determined hydrological by the permeability of the ground, the filter effect and the flow speed of the ground water. Additionally the topographical conditions are taken into account.
4. **“Ground water”** means water in the cavities and pore spaces of layers in the ground that is subject only to gravity. Ground water is naturally replenished by rain water and surface water infiltrating into the ground.
5. **“Ground Water Enrichment”** means the infiltration of mostly treated wastewater by purpose to increase the quantity of ground water or to improve the ground water quality e.g. in saline zones while using the filter effect of the ground (loose sediment, e.g. sand, gravel, etc.) to further improve the quality of the infiltrated water.
6. **“Ground Water Stock”** means a defined deposit of ground water in an aquifer layer that is used or that is usable.
7. **“Licence”** means an authorized consent to build and operate a water reuse facility, e.g. wastewater treatment plants, storage basins, clarification plants combined with infiltration facilities.
8. **“Permission”** means the consent from the responsible authority to discharge or reuse treated wastewater or intake ground water.
9. **“Plant”** means a technical facility for the treatment, storage, irrigation or recharge of wastewater at a defined location.
10. **“Reclaimed Water”** means the share of the reused water from the total water consumption.
11. **“Reclaimed Wastewater”** means wastewater which, as a result of wastewater treatment, is suitable for direct beneficial use or a controlled use that would not otherwise occur.
12. **“Recharge”** means the natural infiltration of rain and surface water into the ground water.
13. **“Responsible Authority”** means the competent authority that has been appointed for a certain area of responsibility according to a law or regulation.

14. **“Standards”** means specific level or limit of water quality which, if reached, is expected to render a body of water suitable for its designated use. Standard can be international norms that follow the state-of-the art.
15. **“Stakeholder”** means any person in his natural or legal capacity with an interest in, or affected by, a project for reuse of wastewater
16. **“Treated wastewater”** means wastewater that has been treated with a certain treatment facility according to the relevant standards for discharge or reuse.
17. **“Water Consumption”** means the used or delivered water quantity that has been measured.
18. **“Water Demand”** means the needed water quantity for the domestic, commercial, industrial and agricultural use that is determined statistically.
19. **“Water Management Plan”** means an expert planning instrument to evaluate the water deposits in a catchment area applying uniform criteria for a sustainable, economical and efficient use of water resources on the basis of these data. Hereby it is required to observe the defined monitoring stations continuously and to adapt the water demand accordingly.
20. **“Wastewater”** means polluted water that is changed in its quality through domestic, commercial and agricultural use and that is discharged also during dry weather conditions
21. **“Wastewater Recycling”** means the use of wastewater which is captured and redirected back into the same water use scheme. Recycling is practiced predominantly in industries, such as manufacturing, and normally involves only one industrial plant or one user.
22. **“Wastewater Reuse”** means the use of treated wastewater for a beneficial use such as agricultural irrigation or aquifer enrichment.

Article 4: Legal Framework

1. These guidelines serve the translation into action of the “Palestinian Environment Law” by the Ministry of Environmental Affairs, dated 6th of July 1999, that became effective on 28 December 1999, particularly the Section 3 Water Environment, Article s 28 – 30.
2. These guidelines are in compliance with the “Palestinian Environmental Assessment Policy” by the Ministry of Environmental Affairs, dated 23 April 2000. The EIA policy has been approved by the Ministerial Council through resolution No: 27-23/4/2000.
3. The standards of the guidelines are according to the draft “Palestinian Executive Regulation for Wastewater Treatment and Reuse”.

4. The “Palestine - Master Plan for Sewerage and Storm Water Drainage in the Gaza Strip” developed by the Palestinian Ministry of Planning and International Cooperation has been taken into account.
5. These guidelines serve the integration of Gaza-Strip into specific international and regional guidelines and agreements with regard to the reuse of wastewater.

Article 5: General Regulation

These guidelines regulate:

1. The prerequisites for planning, building and operation of wastewater treatment plants.
2. The conditions for irrigation using treated wastewater for landscape and agricultural areas as well as the requirements on the quality of the wastewater to preserve the environment and protect public health.
3. The requirements for artificial recharge of treated effluent to the groundwater to improve groundwater quality and quantity in coastal aquifers.
4. Self-monitoring and state supervision of the plant operation, documentation, taking of samples, analytics and assessment.
5. Preliminary regulations and exceptions.

Article 6: Principles of the Water Reuse

1. Economic and financial principles

- 1.1 Water is not a usual commercial product but a scarce natural resource which must be protected, defended and treated correspondingly. Moreover, there is an imperative of providing a basic supply of safe water for all consumers. However, to promote the careful use of water a price should be attached.
- 1.2 Charging tariffs for services with treated wastewater is an important component of the successful implementation of the water reuse. To promote the widespread reuse of treated wastewater some incentives have to be given.
- 1.3 Demand management measures for treated wastewater have to be considered in conjunction with supply provision to maximise the usage of a given volume of treated wastewater.

2. Environmental Principles

- 2.1 Activities related to the reuse of wastewater need to be planned and implemented with due regard for all their environmental implications.
- 2.2 The protection of aquifer from pollution and overexploitation should be given particular attention as the aquifers are of outmost importance for the water supply in the Gaza-Strip and the effects are not visible.
- 2.3 The short- and long-term effects of the reuse of wastewater should be monitored so that the improvements can be encouraged and detrimental impacts minimised.

3. Institutional and management principles

- 3.1 The role of the responsible authorities and all official bodies at all levels should be clearly defined and the areas of responsibility officially established.
- 3.2 The structure and system of the wastewater reuse management should be designed in such a way as to facilitate the involvement by the responsible authorities at different levels.
- 3.3 The involvement of the private sector, farmers and consumers should be encouraged.
- 3.4 Capacity building should be an ongoing process in all institutions responsible for the reuse of treated wastewater. As a more active role of all stakeholders is envisaged, the capacity of intermediary bodies such as associations, NGOs and local councils has to be enhanced as well.

Chapter II

Article 7: Technical Principles

1. General Technical Principles

- 1.1 All wastewater shall be collected, treated and used according to these guidelines to minimise the deficit in the water balance.
- 1.2 The reuse of wastewater that is not in compliance with the standards is forbidden.
- 1.3 Treated wastewater has to be transported in closed pipes.
- 1.4 To reach the standards for reuse the dilution of wastewater with freshwater is forbidden.
- 1.5 The operator of plants for wastewater reuse has to provide information and test results concerning the quality of wastewater or any other information on request of the responsible authorities.

1.6 Direct injection into the aquifer is forbidden.

2. Technical Principles for Irrigation and Recharge

2.1 Industrial and commercial wastewater is allowed to be used for irrigation and ground water enrichment, only if the compliance with the standards is durably guaranteed during operation.

2.2 The use of wastewater for irrigation and ground water enrichment is forbidden in drinking water protection zones.

2.3 The reuse of wastewater for irrigation is only allowed if it follows the regulations and standards according to the relevant type of cultivation and irrigation technique.

2.4 The use of sprinklers is not allowed for irrigation.

2.5 All kinds of vegetables are not allowed to be irrigated by treated wastewater.

2.6 Irrigation with treated wastewater has to be stopped two weeks before harvest.

2.7 Fruits on the ground from trees that have been irrigated with treated wastewater are forbidden to eat, to process or to sell.

2.8 The ground water enrichment by wastewater is only allowed in facilities that are operated with a licence from the competent authorities.

Chapter III

Article 8: Competent Authorities and Responsibility Areas

1. National Water Council (NWC)

1.1 NWC is responsible for setting the policy for reuse of wastewater for Palestine and submitting it to the Council of the Palestinian National Authority for approval.

1.2 NWC is reinforcing regional and international co-operation in reuse of treated waste water.

1.3 NWC is determining the budget required for investment in reuse of wastewater.

2. Palestinian Water Authority (PWA)

- 2.1 PWA is responsible for the strategic planning for the reuse of treated wastewater, e.g., for setting up the water management plan.
- 2.2 PWA is issuing licenses related to the operation of facilities for the groundwater recharge.
- 2.3 PWA is giving permission for the use of ground water and irrigation with treated wastewater.
- 2.4 PWA is monitoring the quality and quantity of treated wastewater.
- 2.5 For the reuse of treated wastewater PWA is working in close cooperation with other stakeholders mainly the Ministry of Environmental Affairs, the Ministry of Health and the Ministry of Agriculture.
- 2.6 PWA can instruct the Coastal Municipal Water Utility with special defined tasks.

3. The Ministry of Environmental Affairs (MEnA)

- 3.1 MEnA is setting the standards, which are related to the conservation and protection of the environment
- 3.2 This includes the standards for reuse of treated wastewater and for discharge of treated wastewater into wadis, rivers, lakes and the sea.

4. Ministry of Health (MoH)

- 4.1 MoH is setting the standards which are related to the public health.
- 4.2 This includes the standards for treated sewage in the environment which affects the quality of products e.g., fish.
- 4.3 This includes the reuse of wastewater for irrigation which affects the agricultural products.

5. Ministry of Agriculture (MoA)

- 5.1 The MoA is supervising all activities which are related to the irrigation of agricultural products.
- 5.2 The MoA is responsible for selecting the appropriate locations for irrigation with treated wastewater.
- 5.3 The MoA is responsible to determine the appropriate technology for irrigation.

5.4 The MoA carries out public awareness campaigns for farmers and consumers.

6. Coastal Municipal Water Utility (CMWU)

6.1 CMWU will be formed within the Gaza-Strip.

6.2 The CMWU is responsible for design, construction, operation and maintenance of water services including facilities for wastewater collection and treatment for recharge and irrigation.

6.3 The CMWU is local government owned, with community representation on the board. CMWU will be administratively and fiscally autonomous, although tariffs will be reviewed and water abstraction and discharge will be licensed and monitored by PWA.

7. Committee for the reuse of wastewater

7.1 A committee for the reuse of treated wastewater should be established consisting out of representatives from NWC, PWA, MEnA, MoH, MoA, Palestine Institute for Standardisation and Measurement (PSI), Gaza Municipality, Rafah Municipality, Khanyounis Municipality, Islamic University of Gaza, El Azhar University and Birzeit University.

7.2 These guidelines shall be reviewed by the committee every four years taking into consideration the local conditions e.g., climate, topography, hydro-geological situation to assure the social and economical development in the Gaza-Strip.

Chapter IV

Article 9: Administrative Procedures

1. Application for approval

1.1 A proponent for water reuse facilities must first obtain initial approval from the appropriate Local Planning Committee.

1.2 The proponent has to submit an application for environmental approval to MEnA.

1.3 The approval process follows the Environmental Assessment administrative procedures as described in the “Palestinian Environmental Assessment Policy”.

2. Permission and Licence

- 2.1 After initial and environmental approval the proponent will receive permission or a licence from PWA to implement the water reuse project according to the requirements.
- 2.2 The permission for using treated wastewater for irrigation is issued by PWA in coordination with MoA. The required application forms and administrative procedures are prepared by PWA.
- 2.3 The licence for a recharge of groundwater facility is issued by PWA. The required application forms and administrative procedures are prepared by PWA.

Article 10: Supervision

1. PWA is responsible for the supervision of the technical, financial and operational issues of the water reuse facilities, especially the compliance with the conditions and requirements that have been issued in connection with the permission or the licence of the facility or generally stipulated by this guideline or other relevant laws and regulations.
2. PWA checks the compliance with the chemical and micro-biological standards of the wastewater used for irrigation or recharge at the place of the use or storage regularly. Samples have to be taken, stored and analysed according to **Article 13**.
3. As specified in the water management plan, the PWA has to control both groundwater measures through self controlled documentation and measure wells in the region and document the final results.
4. MEnA is responsible for the supervision of the environmental issues of the water reuse facilities.
5. MoH is responsible for the supervision of the public health with regard to the consumption of food products that have been irrigated with treated wastewater. It is also responsible for employees that are working in facilities for the treatment or reuse of wastewater.
6. Responsible authorities can enter companies and properties any time or enforce entrance with the use of public force. The operator of the facility has to give the required support and has to allow the authority to look at specified documentations.

Article 11: Monitoring of Wastewater, Groundwater, Soil, Products and Human Health

A comprehensive monitoring programme is required to ensure that a proper treatment of wastewater is achieved and environmental degradation is not occurring. Minimising adverse health impacts on concerned parties, and at the same time, increasing agricultural production

in a sustainable manner with complete health and environmental safety is the main objective of monitoring. The following need to be monitored:

1. Wastewater quality
2. Groundwater
3. Soil
4. Quality of products
5. Human health

Article 12 Monitoring of Facilities and Operations

1. Self-Monitoring.
2. Compliance with the regulations of facilities and operations.
3. Required control facilities and documentation.

Article 13: Sampling, Analysis and Conservation

According to Draft Palestinian Standards for Treated Wastewater **Annex I**.

Article 14: Water Management Plan

1. For the successful implementation of these guidelines PWA has to set-up and to implement a WMP according to **Annex II**.
2. The WMP is an expert planning instrument to guide the decision-making process and to enforce the regulations and standards for water use in the Gaza-Strip in an environmental and economical manner.
3. The purpose of the WMP is to assess the quantity and quality of the water resources and to monitor continuously the water balance. On the basis of these data, PWA can adapt the water demand and supply and intervene if necessary.
4. The WMP processes the data sheets presented by the operators of the different water facilities and the data for groundwater use.
5. PWA has to evaluate the generated data of the WMP and to publish the main results once a year.

Chapter V

Article 15: Exceptions and Provisional Regulation

This chapter takes into account the present situation in the Gaza-Strip, e.g., available water reuse facilities, conditions of the wastewater treatment plants, collection and storage facilities, social and economic development, etc. Therefore some temporary exceptions and provisional regulations may be appropriate to assure the practicable implementation of the guidelines. The following exceptions are suggestions and should be reviewed by the Palestinian Committee for water reuse:

1. To upgrade existing facilities to comply with standards for the reuse of wastewater over three years.
2. To tolerate temporarily lower standards for a certain parameters, e.g., heavy metals due to insufficient treatment.
4. To eliminate temporarily dangerous microbiological substances such as germs, pathogens or worm eggs by disinfection.
5. To allow a higher rate of pollutants in the plants during specific growth periods.
6. To place emphasis on ground water recharge through the proper operation of the wastewater treatment plants in the transition period.

Article 16: Entry into Force

1. These guidelines have to be published in national journals and will come into force after 30 days.
2. If these guidelines are into force all concerning parties have to follow the guidelines in their relevant areas of responsibility.

Annex I: Draft Palestinian Standards for Treated Wastewater

Annex II: Content and Requirements for Water Management Plan (WMP) according to Chapter IV, Article 10

1. General Conditions and Requirements

1.1 From the legal point of view, the WMP is an expert planning instrument to guide the legal decisions for water use in the Gaza-Strip, including:

- Groundwater supply,
- Groundwater desalination in the coastal areas,
- Groundwater preservation and protection,
- Drinking water supply and consumption,
- Irrigation,
- Groundwater recharge,
- Wastewater reuse,
- Use of surface water.

1.2 This plan is the basic of a sustainable management of the ground water management in Gaza-Strip under economic and social conditions.

1.3 The WMP has a binding impact to the competent authorities and the operators of water reuse facilities.

1.4 The WMP provides a framework for setting up the basic requirements and conditions that have to be fulfilled.

1.5 PWA is drawing up the WMP in close co-operation with MEnA, MoH and MoA under consideration of the following objectives:

- Palestinian Environmental Law,
- Palestinian Environmental Assessments Policy,
- Legislation for regional planning.

1.6 PWA has to make public the first draft of WMP one month before publication to the other concerned authorities and parties such as:

- Municipalities,
- Operators of wastewater treatment plants,
- Operators of facilities for irrigation, and
- Operators of facilities for infiltration with treated wastewater into the aquifers.

These parties can comment on this draft and the PWA in turn has to evaluate these opinions.

2. Background

2.1 Description of morphological, geo and geo-hydrological facts with special maps including:

- Soil,
- Groundwater stocks, situation of aquifers,
- Thickness of groundwater layers,

- Availability of groundwater, groundwater flow, groundwater quality and groundwater, regeneration,
- Salination zones.

2.2 Description of climatic factors with special maps including:

- Rainfall,
- Precipitation,
- Storm water,
- Temperature, evaporation rates, etc.,
- Seasonal conditions.

2.3 Description of geographical facts including:

- Population,
- Distribution of inhabitants in agriculture regions,
- Distribution of inhabitants in urban regions.

2.4 Description of the regional structure including:

- Structure of the different local use,
- Density of population,
- Soil using in the rural areas,
- Distributions of farmlands, pasture lands, park areas, prefer fruits and useful plants.

3. Water Balance

3.1 Description of water use including:

- Demand of freshwater.
- Consumption of freshwater for municipal, industrial and agricultural purposes.
- Drinking water consumption with dates of quantities and fresh water quality.
- Sewage water with dates of quantities and facts concerning the quality.
- Actual wastewater reuse with dates of quantities, applied sites and quality.

3.2 Actual water balance in:

- Groundwater availability in Mio m³.
- Groundwater intake in Mio m³ per year.
- Use of surface water (in case it is practicable) in Mio m³ per year.
- Salty water stocks in Mio m³.
- Total water consumption in Mio m³ per year.
- Specific consumption in litre per inhabitant and day.
- Wastewater reuse for irrigation in Mio m³ per year.

3.3 Actual demand for:

- Housing,
- Municipal (in urban and rural regions),
- According to the different purposes of water use,
- Total amount in Mio m³ per year.

3.4 Actual balance of ore deficit in Mio m³ per year

4. Description of Saving Measures for the Reduction of Water Consumption and Substitution of Freshwater

4.1 Saving measures:

- House and garden,
- Car washing,
- Avoiding leakage,
- Use of modern fittings,
- Water cycle systems in industry.

4.2 Substitution of freshwater through:

- Systems for reuse of storm water,
- Separation systems for freshwater and wastewater,
- Desalination of sea water, saline groundwater and brackish water,
- Reuse of treated wastewater for all permitted kinds of irrigation.

4.3 Governmental appointments of water reuse according to the different customers

4.4 Groundwater recharge: Locations and dimensions are to decide and represent, for:

- Infiltration wells,
- Infiltration galleries,
- Leaching slit trenches.

5. Action Plan with Descriptions for the Design and Operation of Wastewater Reuse Facilities

5.1 Sewage water collection

- Design, construction and extension,
- Determination of the investment and operational costs,
- Time schedule for implementation.

5.2 Sewage treatment plants

- Prescribe the sites, the design, construction and extending measures in the cities and towns.
- Provide small and local treatment facilities in rural fields, especially in irrigation centres.
- Provide a time schedule for implementation.

5.3 Determination of areas with intensive irrigation

- Authorised systems (e.g., drip irrigation systems).
- Irrigation quantities, period, quality standards etc.
- The permitted fresh water part and the necessary treated wastewater quantity.
- Applied system for specific crops and areas.

5.4 Determination of groundwater recharge facilities

Minimum requirements for the additional treatment of wastewater

Steps of treatment	<u>mandatory</u>	<u>optional</u>
- Mechanical – physical, e.g., sedimentation	ÿ	ÿ
- Physical– chemical, e.g., flocculation	ÿ	ÿ
- Sand or gravel filter	ÿ	ÿ
- Activated carbon filter	ÿ	ÿ
- Ozonizing	ÿ	ÿ
- Chlorination	ÿ	ÿ
- Other disinfections	ÿ	ÿ

5.5 Hydraulic barriers in the salination zone

Prescription of numbers and locations of wells for the lowering of water table as a gallery.

6. Monitoring

6.1 Sampling in directed manner with wastewater quality programme at:

- Sewage treatment plants (effluent),
- Storage basins, ponds before irrigation or infiltration,
- Delivery from clarification system to the infiltration facilities (additional treatment).

6.2 Appointment of flow measure methods to determine the quantities with a groundwater measure programme:

- Determination of the numbers of ground water-measure-locations.
- Distinction in ground water observation wells (to control quality and level) and groundwater gauche (to measure the level only).
- Determination and description of the method for the yearly balance investigation (through PWA or instructed institution).
- Determination of the minimum level, which trigger a prohibition for groundwater use.

7. It is required to plan and to implement measurements with same instruments at standardised methods for sampling and analysis. The network of groundwater observation wells is independent of the geo-hydrological conditions in the Gaza-Strip and the knowledge about aquifers in relation to the facilities to use and to enrich groundwater.

8. PWA is setting up a five-year plan with prognosis and goals according to the wastewater reuse, the groundwater preservation and protection.