Water Governance Benchmarking Criteria

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A. GOVERNANCE FUNCTIONS

1. **Organizing and building capacity in the water sector**
   - 1.1 Creating and modifying an organizational structure
   - 1.2 Assigning roles and responsibilities
   - 1.3 Setting national water policy
   - 1.4 Establishing linkages among sub-sectors, levels, and national sub-regions
   - 1.5 Establishing linkages with neighboring riparian countries
   - 1.6 Building public and political awareness of water sector issues
   - 1.7 Securing and allocating funding for the sector
   - 1.8 Developing and utilizing well-trained water sector professionals
2. **Planning strategically**
   - 2.1 Collecting, managing, storing and utilizing water-relevant data 1
   - 2.2 Projecting future supply and demand for water
   - 2.3 Designing strategies for matching expected long-term water supply an demand and dealing with shortfalls (including drought mitigation strategies)
   - 2.4 Developing planning and management tools to support decision making
3. **Allocating water**
   - 3.1 Awarding and recording water rights and corollary responsibilities
   - 3.2 Establishing water and water rights transfer mechanisms
   - 3.3 Adjudicating disputes
   - 3.4 Assessing and managing third party impacts of water and water rights transactions
4. **Developing and managing water resources**
   - 4.1 Constructing public infrastructure and authorizing private infrastructure development
   - 4.2 Forecasting seasonal supply and demand and matching the two
   - 4.3 Operating and maintaining public infrastructure according to established plans and strategic priorities
   - 4.4 Applying incentives and sanctions to achieve long and short term supply/demand matching (including water pricing)
   - 4.5 Forecasting and managing floods and flood impacts
5. **Regulating water resources and services**
   - 5.1 Issuing and monitoring operating concessions to water service providers
   - 5.2 Enforcing withdrawal limits associated with water rights
   - 5.3 Regulating water quality in waterways, water bodies, and aquifers (including enforcement)
   - 5.4 Protecting aquatic ecosystems
   - 5.5 Monitoring and enforcing water service standards 2

B. GOVERNANCE PROCESS CHARACTERISTICS

1. **Transparency.**

2. **Participation.**

3. **Accountability and Integrity**.

4. **Rule of law.**

5. **Coherency and Integration.**

6. **Responsiveness.**

C. CROSS CUTTING CATEGORIES

1. **Water Sources**
   - 1.1 Surface water
   - 1.2 Groundwater
   - 1.3 Derivative water (reclaimed, reused, desalinated)

2. **Water Uses**
   - 2.1 Irrigation
   - 2.2 Municipal 3
   - 2.3 Industrial
   - 2.4 Environmental
   - 2.5 Hydropower
   - 2.6 Fisheries, navigation, recreation
   - 2.7 Other uses (including social, esthetic, and religious uses)

Jordanian Standards 287: 1998 1, 2, 3

Drinking Water - Methods of Sampling

1. Content

These Jordanian Standards deal with sampling methods for the bacteriological, viral, biological, radioactivity, physical and chemical analysis of drinking water in addition to reporting requirements.

2. Sampling Methods for Bacteriological Analysis

2.1 Frequency of Sampling

2.1.1 Treated Water

Water should be bacteriologically analyzed after treatment and prior to its entrance into the water distribution system at least once per day. Water disinfection process should be monitored three times per day with large time intervals between the monitoring.

2.1.2 Untreated Water

Water that does not require treatment does not need to be bacteriologically analyzed once per day. It is sampled before its entry into the water distribution system with the sampling frequency that depends on the size of the served population and that is illustrated Table 1.

Table 1: Frequency of Sampling for Water that Does Not Require Treatment

Population Number	Frequency of Sampling
< 20,000	2 Weeks
20,000 - 50,000	1 Week
50,000 - 100,000	4 Days
> 100,000	1 Day

2.1.3 Distribution System

Sampling frequency and the number of samples required for water within the distribution system depends on the number of population served as illustrated in Table 2.

Table 2: Sampling Frequency for the Distribution Network.

Population Number	Sampling Frequency	Minimum Number of Samples to be Collected from Different points in the Distribution System
< 20,000	1 Month	1 sample / 5,000 persons / month
20,000 - 50,000	2 Weeks	

50,000 - 100,000	4 Days	
> 100,000	1 Day	1 sample /10,000 persons / month

2.2 Sampling Container

The sample container should be made either of neutral glass with a ground glass cap, or plastic screw cap, or a fitting disinfectable plastic cap. The capacity of the container should be less than 150 ml. Before actual sampling the following should be taken care of:

A) All containers should be disinfected either in a dry oven at 160°C for 1 hour, or in an autoclave at 121°C for 20 minutes.

B) The cap, neck, and the bottle that contains the sample should be covered with paper or foil paper.

C) In case the sample is collected from a well that is not equipped with a pump or from a certain depth of a lake the glass container should be technically equipped so that its cap opens only when the container reaches the required depth and closes immediately after the sample is collected.

D) If the sample is collected from water that has been chemically treated (with chlorine, ozone, or a hypochlorite compound) 0.09 ml of Sodium Thiosulfate ($Na_2S_2O_3.5H_2O$) at concentration 18 mg/l should be added to every 150 ml container.

2.3 Sampling Methods

Care should be taken to keep the sampling container sealed until the sample is collected. The cap should be taken off with care to insure that the inner wall of the cap and the bottle opening do not come into contact with any other object other than the sampling water. The glass container should be 100% filled after re-capping it.

2.3.1 Sampling Methods from a Tap

If the sample is to be collected from a primary distribution pipe through a tap, the tap should be connected to the primary distribution pipe through a secondary pipe. The outer and inner walls of the tap should be thoroughly cleaned. The tap should then be fully opened and water allowed to flow for 2-3 minutes then closed and its outer wall dried with a clean piece of cloth. After that the tap is disinfected with either a welding torch, or gas torch, or by sticking a peace of cloth saturated with methyl alcohol to the tap mouth and burning it till the tap is too hot to touch, then the tap should be opened once again and water allowed to flow for a few seconds, and finally the water sample may be collected from a moderate flow avoiding splashing.

2.3.2 Sampling Methods from a Well Equipped with a Manual Pump

Water is pumped and discharged for 5 minutes taking into account the disinfection procedures specified in item 2.3.1. After that a few liters of water are discharged then the sample is collected directly from the flow.

2.3.3 Sampling Methods from a Well Equipped with a Mechanical Pump

Water sample should be collected from the main water outlet which should be disinfected and the sample should be collected as specified in item 2.3.1.

2.3.4 Sampling Methods from a Well Not Equipped with a Pump

Capped glass bottle is brought down under water surface then the cap is opened and the sample is collected, then the bottle is quickly lifted and recapped.

2.3.5 Sampling Methods from Running Water

It is preferable to take the sample from the middle of the stream, or from one of its banks avoiding areas of stagnation. The bottle is dipped below water surface with its opening pointing downwards, then the cap is opened and the bottle is turned upside down to have the opening of the bottle pointing opposite to the direction of the stream flow. The bottle is horizontally pulled if the stream speed is not high. When the bottle is filled it is recapped immediately while it is still under water.

2.3.6 Sampling Method from a Spring

In case the sample is collected directly from a spring or from spring water that discharges into a wadi item 2.3.5 applies.

2.4 Sample Dispatch and Keeping

It is preferable to perform bacteriological analysis after a maximum period of 1 hour after taking the sample. If that is difficult to do then the sample should be kept in a refrigerator for not more than 6 hours from the time of sample collection, and no tests should be performed on a sample that has been collected over more than 24 hours period.

3. Sampling Methods for Biological Analysis

The following methods should be abided by when collecting samples from pipe water:

3.1 Collecting a Sample from a Tap

Install a special filter on the tap and after a significant amount of water has been filtered the filtrate may be examined either microscopically or through viewing.

3.2 Collecting a Sample from the Main Pipe

A large water sample is filtered through a cotton bag or a nylon net. The filter is then examined microscopically or with bare eye and results are reported as number of living creatures per volume unit of water or per area unit of pipe surface. In case that there are no pipes, it is possible to use a disinfected container of minimum capacity of 2 liters. Care should be taken not to change the sample temperature during its dispatch to the laboratory.

4. Sampling Methods for Viral Analysis

4.1 Sampling Frequency

It is not necessary to perform viral analysis as frequently as bacteriological tests for big population communities that use surface water or groundwater after it is treated to drinking water standards. Sampling frequency depends on local conditions and necessity.

4.2 Sampling Method and Sample Preservation

Same sampling methods as the ones used for bacteriological analysis may be utilized, and since disinfection is not important a clean plastic container of minimum capacity of 2 liters may be used for sample collection provided there are no delays in dispatching the sample to the laboratory.

5. Sampling Methods for Radioactivity Analysis

Sample collection method, sampling frequency and analysis depend on the oscillation in activity levels of nuclear nucleotides in water, the proximity of nuclear installations and other major sources of radioactive pollution to water sources, and their seriousness.

Due to the fact that many radioactive nucleotides adhere easily to surfaces and solid bodies care should be practiced to choose sampling locations from distribution systems and water sources in order to obtain a water sample that is representative of the water that is sampled. Sampling containers may be made of polyethylene to avoid radioactivity absorption by the container walls, and these containers should have a minimum capacity of 1 liter.

In case of presence of radioactive nucleotides with a short "half life", radioactivity analysis should be performed immediately following sampling.

6. Sampling Methods for Physical and Chemical Analysis

6.1 Sampling Frequency

A complete chemical examination of all water sources utilized for general purposes should be performed once per year. A brief chemical analysis should be performed once per month for all water sources that supply communities of 50,000 persons and twice per year for sources supplying less than 50,000 persons.

Poisonous substances' (such as cadmium, cyanide, lead, mercury, selenium, and arsenic) analysis should be performed at least once per year or more if they are found in concentrations close to the allowable limits in water sources (according to what has been stated in Jordanian Standards 286) or new industries are established in the area which waste may contain any of the above mentioned toxic substances.

A full chemical analysis should be conducted for any water source to be used. Analysis repetition should be dictated by local conditions and necessity.

6.2 Sample Container

For the purpose of chemical and physical analysis containers should be made of neutral glass with a minimum capacity of 2 liters. Caps should also be made of ground glass or plastic. Appropriate plastic containers may be used as well. If samples are collected for analysis of dissolved oxygen containers of 200 - 300 ml with necks that could be properly closed with ground glass caps.

6.3 Sampling Method

The same methods as specified for collection of samples for the bacteriological tests may be applied. It is not necessary to disinfect the tap or the pump discharge opening, container should be washed several times with source water before the sample is collected.

If the sample is collected for the purposes of dissolved oxygen analysis then water should be reached from the tap to the bottom of the glass container for 2-3 minutes before filling the container. A special apparatus is used to collect samples from a running water source or storage tank to make sure that the glass bottle is properly washed several times with required location or depth water before it is filled.

The amount of dissolved oxygen should be fixed by the addition of MnO_2 and basic iodide. Water temperature at the sampling location should be recorded.

Some tests and analysis should be performed at the sampling location such as temperature, pH, residual chlorine, and free CO_2. If there was difficulty in measuring free CO_2 at the sampling location a special sample should be collected by filling the sample container 100% with water and storing it in ice until analysis is performed.

Special containers should be used for collecting samples aimed for analysis of iron, nitrates, sulfur, and oxidizable organic matter. The sample's composition should be fixated through the addition of 1 ml of concentrated sulfuric acid per each liter of water.

6.4 Samples Dispatch and Preservation

Samples should be dispatched without delays to the laboratory. Meantime, they should be stored in a refrigerator. In any case the period between collection of samples and analysis should not exceed 72 hours.

7. Sampling Method Report

7.1 Name and address of the water source owner or responsible person.

7.2 Reason for analysis (new or routine)

7.3 Specify the location and place of sampling.

7.4 Type of water source (public or private wells, treated surface water).

7.5 Indicate whether the water has been treated and specify type of treatment.

7.6 Date and time of sample collection.

7.7 In case the sample is collected from a water tap indicate if the tap is connected directly to the main pipe or to a storage tank.

7.8 If the sample is collected from a well indicate the total depth of the well and the depth of still water.

7.9 Date of well construction and type of pump provided (manual or mechanical).

7.10 Indicate if there are any close by contamination source and its location relative to the well.

7.11 If the sample is collected from a spring indicate if the sample was collected directly from the spring or from a collecting chamber.

7.12 If the sample was collected from running water indicate:

- Was the sample collected from the middle of the stream or one of its banks?
- The depth at which the sample was collected and the height of water level.
- If any flood or heavy rain occurred recently to sample collection.
- Proximity to a pollution source and its location relative to the flow.

8. References

- Arab Standards 2:1971.
- Syrian Standards 45: 1973.
- Lebanese Standards 75: 1970.
- Oman Standards 8: 1978.
- International Standards for Drinking Water by World Health Organization.