



The Ministry of Water and Irrigation

Climate Change Policy For a Resilient Water Sector

2023



Ministry of Water and Irrigation

**Climate Change Policy
For a Resilient Water Sector**

2023

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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FOREWORD

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 has been aggravated by a population increase that has doubled in the last two decades alone because of refugees fleeing to Jordan from neighboring countries. We must then add to this the transboundary and climate change issues affecting Jordan's water supplies.

The global climate change crisis is inextricably linked to water. Climate change is increasing variability in the water cycle, thus inducing extreme weather events, reducing the predictability of water availability, decreasing water quality, and threatening sustainable development, biodiversity, and enjoyment of the human rights to safe drinking water and sanitation.

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 four 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 is the result of the efforts of the 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.

Eng. Raed Abu Soud

Minister of Water and Irrigation

1 INTRODUCTION

The Hashemite Kingdom of Jordan has issued its Climate Change Policy (CCP) of 2022-2050 (MoEnv, 2022a). This policy provides guidance to build a climate resilient society that aims to be part of the global movement that aspires to reach carbon neutrality by 2050 in alignment with the objectives set under the United Nations Framework Convention on Climate Change. The climate change policy for a resilient water sector is in line with the high-level strategic directives provided in CCP 2022-2050. The CCP 2022 -2050 is expected to contribute to (a) Climate change mitigation, through the reduction of GHG emissions and the promotion of a low carbon economy; (b) Climate change adaptation, through the adoption of practices that reduce climate vulnerabilities and increase climate resilience; (c) Sustainable development, through the promotion of inclusive and sustainable growth, the creation of employment and the overall improvement of the quality of life of individuals (i.e., food and water security, access to clean energy, health conditions etc.). These goals are considered as the main guidelines in developing the new policy for the water sector “Climate Change Policy for a Resilient Water Sector”.

Water scarcity is a severe constraint to Jordan’s development. Current annual precipitation ranges from about 30 – 570 mm per year. Less than 10% of total annual precipitation (ca. 7000 million m³) are turned renewable useable water resources, i.e., river discharge and groundwater recharge (less than 700 million m³). Water availability per capita is among the lowest in the world (ca. less than 100 m³ per person and year) and continues to decrease further with population growth and more refugees arriving. The flow of refugees across the Jordanian border can be interpreted as an inflow of additional water demand. On top of these growing water demands which have already led to severe declines in groundwater levels and river flows, water availability is simultaneously decreasing due to climate change. Climate change not only brings global warming, but in Jordan it also causes increase in the temperature and more infrequent and reduced total annual precipitation. According to temporal linear trends results, the historical climate station data indicates significant increase in all temperature variables by time, however the rate of increase is higher at daily minimum temperature (i.e., 0.026 C/y) as compared to maximum temperature (i.e., 0.007 C/y) (Ministry of Environment, 2022b). On the other hand, the overall seasonal precipitation is subjected to insignificant reduction trends with average rate of 0.6mm per year (Ministry of Environment, 2022b). The relative humidity and potential evapotranspiration showed significant trends of increase by 0.080 %/year and 17.1 mm/year, respectively (Ministry of Environment, 2022b; Abdulla, 2015).

The most recent state-of-the-art regional climate scenarios and impact assessments are carried out in the fourth national communication report (4NC) (Ministry of Environment, 2022b). In this study, six RCMs historical and future data till 2100 were calibrated. Among these models, “CYLNCAR-CCSM4” RCM showed the highest capabilities to represent the local historical weather station data. Based on future climate projection using the reference model, the country is predicted to witness clear climate change exposures based on two RCPs (RCP4.5 and RCP8.5). Although the changes are predicted at the optimistic scenario is expected to be few but more likely evident in terms of temperature, rainfall, and potential evapotranspiration, thus leading to moderate exposure trends with various spatial zoning. On the other hand, the exposure at the non-optimistic climate change scenario of RCP 8.5 is predicted to be harsh and

extends to cover the whole country. Climate change is expected to dramatically alter the climate paradigm in Jordan, particularly through (Ministry of Environment, 2022b).

- **Increase in temperature** - All models predict that average temperatures will increase. According to the Representative Concentration Pathway (RCP) for the 2070-2100 period the average temperature could increase by +2.1 °C [+1.7 °C to +3.2°C] to 4°C [3.8-5.5].
- **Decrease in precipitation and water availability** - Between 2070-2100 the cumulated precipitation could decrease by 15% (- 6% to 25%) in RCP 4.5, by -21% (9% to – 35%) in RCP 8.5. The decrease would be more marked in the western part of the country. Precipitation projections are highly variable but point to an overall decrease between 15–60% from 2011 to 2099.
- **Changing seasons (warmer summer, drier autumn and winter)** - The warming pattern is expected to increase more dramatically during the summer season, while the reduction in precipitation would occur most acutely during the winter and autumn. For instance, the median value for precipitation decrease could reach – 35% by the autumn of 2100.
- **Increase in severity and intensity of heat waves** - The analysis of summer temperatures monthly values and the inter-annual variability reveals that some thresholds could be exceeded. A pessimistic but possible projection for the summer months predicts that the average maximum temperatures for the whole country could exceed 42-44° C by 2100.
- **Increased drought occurrence and magnitude and increased uncertainty in the water cycle** - The maximum number of consecutive dry days would increase in the reference model to more than 30 days for the 2070-2100 period. In contrast annual values still show possible heavy rainy years at the end of the century. More intense droughts would be (partly) compensated by rainy years in the context of a general decrease in precipitation. Evapotranspiration would increase. The occurrence of snow would strongly decrease. This will complicate water management. With continuous climate change, the probability of multiple drought-type occurrences is expected to increase by more than three-fold, from eight droughts to 25 droughts every 30 years.

Several studies indicated that climate pressures and their water sector impacts will intensify over time, and the resulting decrease in water availability is projected to get particularly severe after about the year 2040 (Ministry of Environment, 2022b, Abdulla 2020).

Socio-economic scenarios, which include other drivers than climate change (in particular, increasing water demand) can be compared for their impacts with these climate scenarios by using WEAP (www/weap21.org). WEAP models are available for all major basins in Jordan and for the country as a whole and have been used for example for the National Water Master Plan and the Action Plan for the Substitution and Reallocation Policy as well as for the National Communications on Climate Change.

Figure 1 shows the unmet demand (red curves) as a result of decreasing water availability due to climate change (middle of the road SRES A1B scenario). The grey curves (Figure1) show

the unmet demand as a result of increasing water demand due to different socio-economic development pathways.

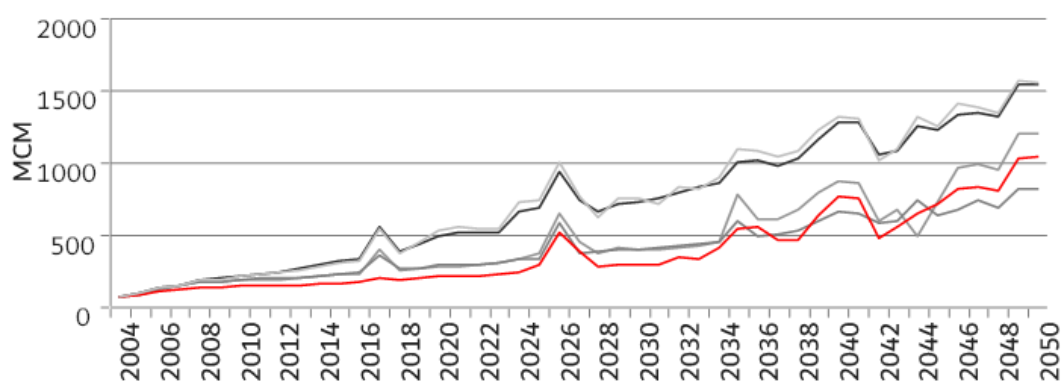


Figure 1: Comparison of unmet water demand (in MCM) in the Jordan basin due to climate change vs. due to socio-economic change, until the year 2050

The key conclusion of this WEAP-based analysis is that different from most other world regions, climate change (decrease in water availability) contributes to the future water gap about as much as the (socio-economically driven) increases in water demand.

The water sector will be most heavily affected by climate change. Water-related impacts include reduced total water availability, less reliable seasonal patterns, increasing intensity of droughts during which reservoirs are not refilled, groundwater is not recharged, and rain fed agriculture suffers damages, increasing intensity of flood events during which water and other infrastructure experiences overflow and damages. High rainfall events also increase erosion which causes losses of soil water storage and siltation of reservoirs. Higher temperatures cause higher evaporative demand and hence higher irrigation water demand. Higher temperatures also affect the efficiency of wastewater treatment plants.

Climate change acts as a threat multiplier (World Bank, 2014), aggravating already existing water problems. The increasing climate pressure over time sets the baseline for this Climate Policy and its implementation. The general principle is that those (particularly infrastructure) solutions with a long lifetime, will have to be resilient to more severe climate shocks and more severe changes in temperature and total water availability as projected after about the year 2040.

2 GUIDING PRINCIPLES

This Climate Policy responds to the challenges posed by climate change. It is based on **resilience as guiding principle**. Resilience means to absorb disturbances while maintaining structure and function (Rockstorm et al., 2014). The Jordanian water sector needs to build resilience in response to the combination of climate change and other disturbances and shocks. This Climate Policy for a Resilient Water Sector provides the background, concept and solutions and implementation mechanism for building resilience. The implementation is spelled out in more detail in the accompanying action plan to this Climate Policy. The three main levels of resilience are (World Bank, 2014):

- **Persistence**, i.e., the degree of disturbance which a system can be subject to, without changing state or structure,

- **Adaptability**, i.e., the ability of a system to adapt, self-organize and learn, while remaining in the same state,
- **Transformability**, i.e., the ability of a system to transform into a new state after crisis or shock.

These three levels of resilience present successively stronger responses to the increasing pressure of climate change (**Figure 2**). Take the example of irrigation: initially, under current climate variability and relatively mild climate change, *persistence* of irrigated systems can be achieved by applying more irrigation water, in order to compensate for increasing evaporation. If climate change intensifies over time and total water availability decreases, *adaptation* requires a shift to less water intensive crops and to water-smart drip irrigation. If climate change intensifies even further with more severe droughts and water deficits, *transformation* becomes unavoidable, and agriculture may need to be replaced by other less water-intensive and economic activities.

Note that transformations don't have to become a threat, since they can provide new opportunities for sustainable development, such as an energy transition to renewables. This requires early and pro-active planning and preparation, e.g., education and training of farmers to change to other employment and income opportunities.

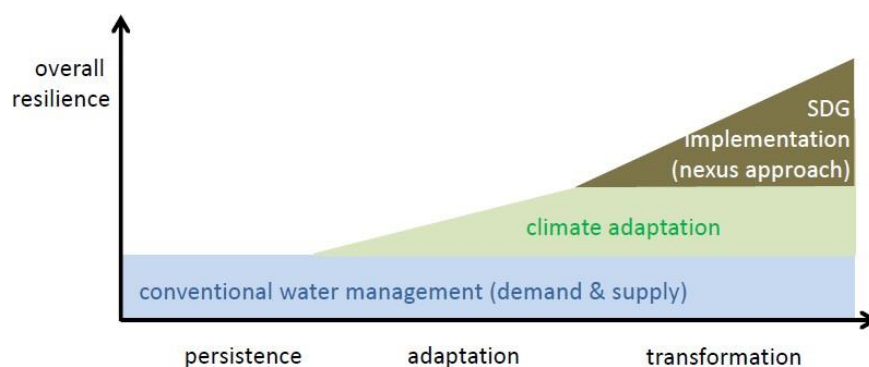


Figure 2: Conceptual representation of the different levels of resilience of the water sector: persistence, adaptation and transformation

Following the resilience concept with its increasingly stronger responses to climate change over time, a rigorous screening and prioritization of water sector solutions (see below) is necessary, according to their appropriateness under the expected severity of climate impacts during their respective lifetime (some water infrastructure may last for up to 100 years). Solutions will need to be more and more robust, as climate pressure increases over time. This Climate Policy outlines such a pro-active and adaptive process towards a resilient water sector. Building resilience enables the water sector to deal with the combination of climate and other pressures, including also for example price shocks on international energy markets that are likely to intensify in the future (the Jordanian water sector is very energy intensive and – like the energy sector as a whole - very dependent on fossil fuels and hence vulnerable to these price shocks). Building resilience must encompass and integrate climate adaptation and mitigation and other capacity building measures.

The guiding principle of resilience is also mentioned in the National Water Strategy, which requires Jordan to be more resilient to future pressures on its water supply. Resilience is also a main pillar in Jordan's Water Reallocation Policy. The long-term goal of the [National] Climate Change Policy is to increase the resilience of water. Jordan's Response Plan is built around a resilience-based comprehensive framework. So, this Climate Change Policy for a Resilient Water Sector can build on existing legislation and planning.

Integrated water resources management (IWRM) emphasizes the need to manage climate variability through data collection and management, infrastructure, planning and institutional coordination. These are the attributes required for adapting to climate change. Accordingly, **IWRM is another guiding principle** of this Climate Change Policy. Robust and resilient solutions for the water sector must be based on existing IWRM approaches, upon which Jordan’s National Water Strategy is also based. IWRM solutions must be implemented, enforced, and modified as required for climate adaptation, and for sustainable development as specified in the Sustainable Development Goals (SDGs) (UN, 2015) – see **Figure 3**.

The SDGs are by nature integrated and transformative. National implementation of the SDGs must take a comprehensive approach to environment and development-related goals and targets. Many of those goals and targets are relevant for the water sector, not only those directly related to Clean Water and Sanitation (SDG 6), but also those related to Zero Hunger (SDG 2), Good Health And Wellbeing (SDG 3), Affordable and Clean Energy (SDG 7), Decent Work and Economic Growth (SDG 8), Industry, Innovation and Infrastructure (SDG 9), Sustainable Cities AND Communities (SDG 11), Responsible Consumption and Production (SDG 12), Climate Action (SDG 13), Gender Equality (SDG 5) and Life on Land (SDG 15).

Jordan’s National Water Strategy explicitly refers to the SDG Targets 6.1 (Equitable access to safe and affordable drinking water for all), 6.2 (Access to adequate and equitable sanitation), 6.3 (Improve water quality), 6.4 (Substantially increase water-use efficiency across all sectors), 6.5 (Implement integrated water resources management at all levels), 6.6 (Protect and restore water-related ecosystems) and 11.5 (Substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters).

As for any new policy, it is important to integrate this Climate Policy with the existing policy context (see section on policy context). Under that heading this Climate Policy assesses climate (and other) water-related risks (see background section) for prioritizing options and implementing solutions and eventually monitoring outcomes (see section on implementation).

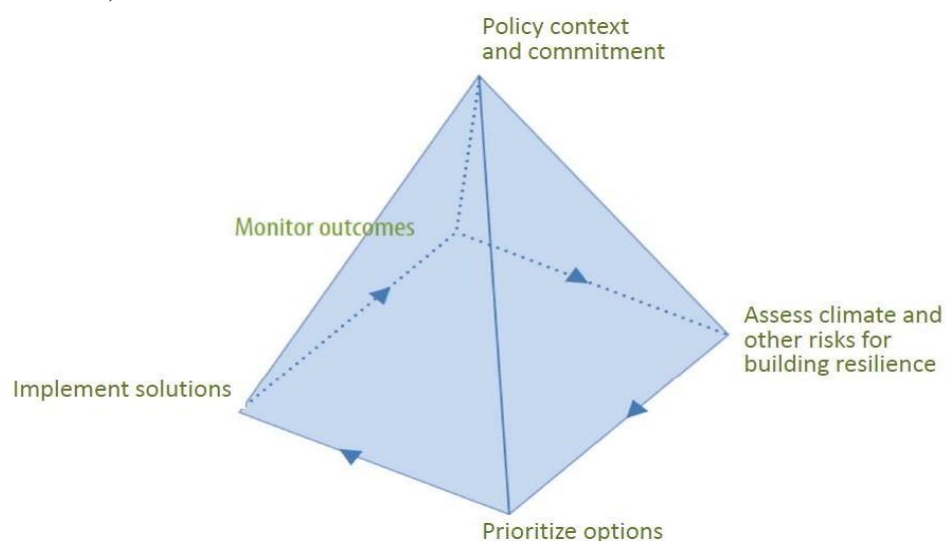


Figure 3: Structure of the Climate Change Policy for a Resilient Water Sector (Verner, 2012)

3 RATIONAL, OBJECTIVES AND POLICY CONTEXT

Given the large challenges resulting from climate change and other pressures, the rational of this Climate Change Policy is to provide a framework and methodology for strengthening the resilience of the Jordanian water sector, based on existing IWRM approaches. It does so in a systematic way by i) prioritizing solutions according to a combination of climate specific and other (already established) criteria, ii) applying climate proofing steps to solutions or investments, and iii) monitoring and evaluating the results based on indicators derived from i) and ii). These objectives enable a mainstreaming of climate adaptation (and mitigation) into the existing institutional framework.

Mainstreaming means that this Climate Policy builds upon and adds value to the objectives, goals, priorities, and solutions of existing strategies, policies and plans of the water related sectors, rather than developing new stand-alone activities. These will be modified as required from a climate change perspective. This Climate Change Policy complements and builds upon the following comprehensive set of documents that were developed by MWI for the water sector:

- **National Water Strategy (and Action Plan)**, which sets the goals and objectives for the water sector and provides an initial response to Jordan's commitment to the global Sustainable Development Goals, highlighting the need for stronger inter- sectoral coordination.
- **National Water Master Plan**, including Management Plans for managing water resources and water demand.
- **Surface Water (Utilization) Policy**, which addresses the interactions between the different resources of different qualities, especially treated wastewater, to reach the maximum amounts of supply fit for use and the optimal return per meter cube.
- **Ground Water Policy**, which aims at achieving sustainability for water resources through the management of water abstraction and the gradual decrease of abstraction to reach the safe yield to conserve the groundwater resources in the long run, which protects the watershed areas from pollution and allows for artificial recharge of ground water, which also includes the responsibility for awareness and water conservation, and which also refers to the principles of IWRM.
- **Water Reallocation Policy**, which prioritizes and re-allocates water from different sources (e.g., groundwater use considering safe yields) between the different sectors and governorates according to adaptive capacity, and at the same time at reducing non-revenue water.
- **Water Substitution Policy (and Action Plan)**, which aims at substituting freshwater with treated wastewater and possibly other non-conventional water sources, avoiding negative impacts on water and soil quality, and which also refers to the principles of IWRM.
- **Water Demand Management Policy**, which lists a wide range of capacity building, institutional, economic and technical measures for demand management.

- **Energy Efficiency and Renewable Energy Policy (and Action Plan)**, which aims at reducing the total energy consumption in water facilities by 15% and at increasing the share of renewable energy to 10% of overall energy used in the water sector.
- **Water Sector Capital Investment Plan**, which lists a broad range of infrastructure or hard solutions and economic and financial criteria for their prioritization.
- **Structural Benchmark Action Plan**, which lists options for improved cost-recovery in the water sector.
- **Drought management Policy**

In addition to the above water-sector documents, the Climate Change Policy also builds on strategies, policies and plans from other institutions, such as:

- National Climate Change Policy (MoEnv, 2022b)
- Fourth National Communications on Climate Change, which report Jordan’s climate adaptation and mitigation activities to UNFCCC (MoEnv, 2022a)
- Updated Nationally Determined Contribution (NDC) (MoEnv, 2021), which together with the National Climate Change Policy and the 3rd National Communications provides the link to the international climate change agenda and funding; Jordan’s intended national contribution will reduce national greenhouse gas emissions by at least 14%, and if international funding becomes available by another 12.5% by the year 2030
- National Adaptation Plan (MoEnv, 2021)
- Response Plan for the Syria Crisis
- Green Growth Plan (due in 2016), which will cover water as one of 6 focus sectors
- Sustainable Development Goals (SDGs), which Jordan will begin to implement in 2016

These strategies, policies and plans already contain most of the required elements or building blocks for a resilient water sector. The Climate Change Policy builds upon the relevant elements of each of them and integrates these with climate adaptation (and mitigation). That integration follows a **nexus** approach¹⁴ which will eventually also integrate water solutions with the SDGs (see nexus section of the National Water Strategy). Coordination with relevant institutions from the water sector and beyond as well as **policy coherence** will be important for developing robust solutions and building resilience for sustainable development. The Paris Climate Agreement on climate provides additional policy context. This agreement prescribes climate mitigation solutions to hold the increase in the global average temperature below 1.5°C.

It further assesses adaptation needs with a view to assisting developing countries and proposes climate finance programs [to] incorporate climate-proofing and climate resilience measures. The Jordanian Climate Policy for a Resilient Water Sector can build on this improved international policy context and use the new impetus for climate protection.

The principle of **adaptive management** also applies to this Climate Change Policy: rational, objectives and priorities need to be reassessed frequently and the monitoring of progress and actual performance need to be adapted to any new knowledge becoming available, in the water sector and in other sectors, including new results from climate science / climate services. This is similar to the iterative process of monitoring, evaluation and adaptation described in the

Capital Investment Plan. So, this Climate Change Policy will also frequently be iterated with the Capital Investment Plan. It can best serve its purpose as a living document (e.g., web-based) that is frequently amended and updated.

4 IMPLEMENTATION: PRIORITIZATION, CLIMATE PROOFING AND MONITORING

Building resilience to all climate and other pressures requires making use of (and coordinate) the full range of solutions, which together form a **continuum of solutions** from soft (e.g., capacity building) to hard (e.g., infrastructure) solutions.



Figure 4: Continuum of soft and hard solutions in the water sector

Integrated Water Resources Management (IWRM) provides the point of departure for this Climate Change Policy. IWRM encompasses many relevant solutions for climate adaptation (and mitigation). Below is a list of water-related solutions, starting from hard (mostly infrastructure) solutions, and moving down towards softer, e.g., economic and capacity building, solutions:

- Water storage, using all options, e.g., dams & reservoirs, ponds, cisterns, aquifer recharge and groundwater storage, soil water storage.
- New water, water harvesting (in combination with supplementary irrigation for drought- and climate-proofing and increasing the water use efficiency of primarily rain fed agriculture, which is practiced on 60% of Jordan’s cropland), water transfers, wastewater collection/treatment/reuse, desalination (for climate mitigation purposes, this option needs to be based on renewable energy).
- Water quality protection and improvement, to increase water availability for unrestricted use.
- Virtual water through imports of water-intensive products.
- Integrated water and land planning / management / zoning, water-smart land use, including urban planning - stop encroachment, loss of agricultural land¹⁷, overgrazing, desertification, land degradation, erosion and reservoir sedimentation, including conservation agriculture and soil conservation for improved soil water storage and soil filtering capacity, protection of groundwater recharge areas from pollution and water-smart afforestation.
- Economic incentives for reducing water (and energy) use and for utilizing more renewable energy in the water sector.

- Water (and energy) demand management: either via technical measures, e.g., infrastructure rehabilitation and reduction of transmission losses in the agricultural sector for example: drought resistant crops, use of brackish water, better use of rainfall, more efficient irrigation) or also economic measures (e.g., water pricing) or awareness raising and behavioral changes.
- Improvements in water use efficiency, e.g., driven by demand-management or water re-allocations, these generally also translate into energy savings.
- Improved climate data collection, monitoring, and early warning systems.
- Training and capacity development:
 - Public awareness and behavioral change, through working with existing networks such as the Highland Forum, in addition to collaborating with women led initiatives, as women and girls are considered a key part in contributing to the fight against climate change, as they play key role in managing resources and protecting the environment within the home, neighborhoods and the local community, which qualifies them to play a leading and influential role on the long run in reducing the climate change impact and developing and implementing sustainability and adaptation strategies. Additionally, through engaging youth and PWDs as they are mostly affected by impact of climate change and considered key active change agents in the climate change awareness.
 - Building political will to address climate change.
 - Mainstreaming climate expertise into water management, e.g., facilitating the use of climate data¹⁹ for planning and early warning (climate services).
 - Training of experts for writing successful proposals to international climate funds.

Given the expected decrease in total water availability that climate change brings to the region, particular emphasis needs to be on reducing demand (i.e., demand management). However, in order to bridge the rapidly increasing gap between demand and supply, all soft- and hard-path solutions have to be explored to the maximum extent possible in a coordinated way. Prioritization and climate-proofing of all solutions is important for meeting the challenges of climate change and eventually for making them integral part of national SDG implementation.

Prioritizing solutions requires additional new criteria on top of the existing ones, in order to address climate change and strengthen the overall resilience of the water sector. These criteria can for example be related to the appropriateness of solutions under the severity of climate change that is expected during the lifetime of the respective solution, or they can be related to synergies or trade-offs between climate adaptation and mitigation. These climate-specific criteria for prioritizing solutions need to be integrated with existing water-sector criteria (e.g., cost efficiency, feasibility, urgency) such as the criteria for investments listed in Jordan’s Water Sector Capital Investment Plan. Here is an integrated list of climate-related and other criteria for systematic prioritization of solutions:

- i) Cost efficiency – measured as either water savings or additional water supply per JD (adaptation) or CO₂ emission reductions per JD (mitigation) – this broadens cost effectiveness criteria as used in the Capital Investment Plan which has a strong focus on the supply side – or other criteria,

- ii) Feasibility of implementation– measured e.g., by donor funding availability or by the level of agreement that can be reached with other sectors and ministries, or other criteria,
- iii) Urgency – measured e.g., based on the priority criteria in the Capital Investment Plan such as sewer overload – or other criteria,
- iv) Number of jobs created,
- v) Total nation-wide potential for closing the gap between water demand and supply,
- vi) Appropriateness of solutions for the expected severity of climate change during their lifetime,
- vii) Synergies between climate adaptation and mitigation, and
- viii) Additional criteria for prioritizing solutions.

Such a more comprehensive set of climate-related and other criteria can go beyond the standard dichotomy of regret vs. no-regret or win-win solutions. Prioritizing solutions based on this set of criteria can help to build resilience to climate and other pressures, and with that contribute to the national SDG implementation. This set of criteria can be applied for prioritizing the full set of soft-to-hard solutions (see above). Following a nexus approach, such a prioritization will be done by an interdisciplinary team with a broad range of expertise and perspectives and representing all relevant sectors. It also needs to be updated frequently, as new (climate and other) data and information become available.

The **priority scores for each solution** can be presented e.g., as a table or in graphical form (note that the following table is tentative, pending elaboration and completion by an interdisciplinary team of experts).

Table 1: Prioritization Scores for Selected Solutions According to Different Climate-Related and Other Criteria

	Cost Efficiency*	Synergies or Trade-offs between Adaptation & Mitigation**	Climate Effects Addressed***	Lifetime of the Solution**** *	Resilience Levels Covered***** *
Desalination (Fossil Fuel Based)	-1	-1	Ads/ad	3	1,2
Desalination (Solar Energy Based)	+1	+1	all	3	1, 2, 3
Wastewater Reuse and Energy Recovery	+1	+1	Ads/m	3	1, 2, 3
Water Harvesting	+1	+1	all	3	1,2
Virtual Water Imports	0	0	Ads/ad	1	1, 2
Solar Energy Farming	0	+1	all	3	1,2,3

	Cost Efficiency*	Synergies or Trade-offs between Adaptation & Mitigation**	Climate Effects Addressed***	Lifetime of the Solution*** *	Resilience Levels Covered**** *
Afforestation	+1	-1	m	3	1, 2
Expert Training	+1	+1	all	2	1, 2, 3

* +1: high-cost efficiency, 0: medium cost efficiency, -1: low-cost efficiency

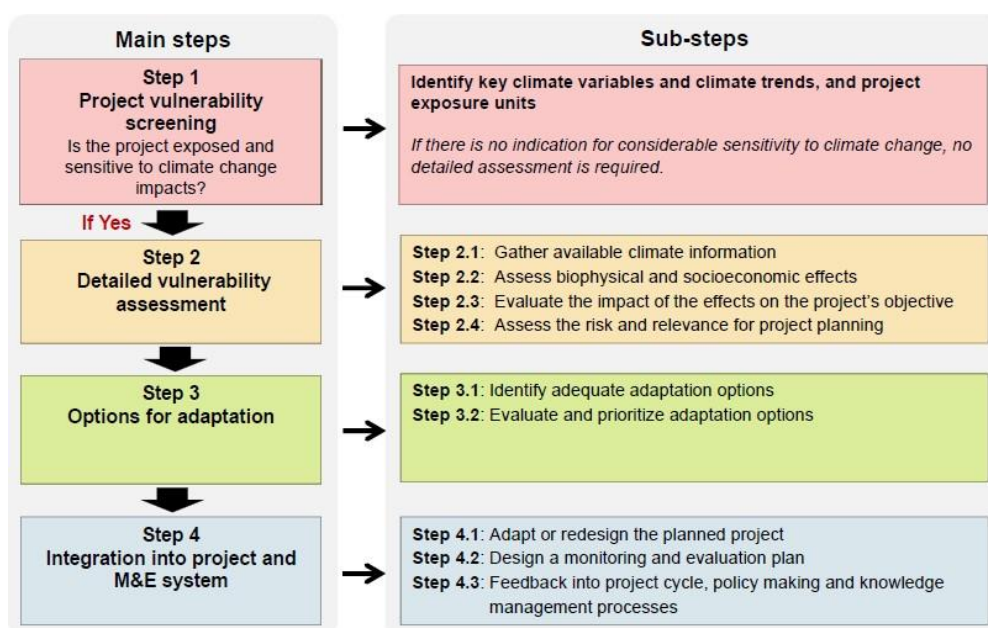
** +1: synergy between adaptation and mitigation, 0: only adaptation or mitigation is addressed, -1: negative effects on the other dimension

*** ads: adaptation to decreasing total supply, ad: adaptation to droughts, m: mitigation

**** 1: short term - few years, 2: medium term - up to 20 yrs., 3: long term - beyond 20years

***** 1: persistence (short term), 2: adaptability (medium term), 3: transformability (long term)

Climate proofing of solutions and investments is an additional implementation step of this Climate Change Policy which complements prioritization. As described above, this Climate Policy strongly relies on existing IWRM solutions and investments already planned in the water sector, such as the projects listed in the Water Sector Capital Investment Plan or in the Structural Benchmark Action Plan. The vulnerability to future climate change and other pressures and the potential contribution to building resilience (persistence, adaptation and transformation) varies among the different solutions. Individual solutions may need to be strengthened or otherwise modified, to be robust under future climate change conditions. New innovative solutions, beyond those already established, will be required to meet the additional challenges of climate change. A climate proofing procedure is required for implementing this Policy. This climate proofing procedure assesses for each solution or investment the relevant climate impacts, the biophysical and socio-economic context, and resulting vulnerability and risks²¹. From that it identifies modifications and required additional actions. **Figure 7** schematically presents the



steps of climate proofing.

Figure 5: Steps in climate proofing of solutions and investments

This Climate Change Policy for a Resilience Water Sector with its pro-active and systematic integration of climate adaptation (and mitigation) and other sustainability criteria with the current water sector priorities and activities is unique in the MENA region and beyond. It creates opportunities for using the increasing awareness of climate change (see Paris Agreement) for:

- i. implementing and enforcing IWRM measures that have long been overdue.
- ii. making significant climate funding available for the water sector.
- iii. making Jordan a leader in climate resilient green growth.

5 CLIMATE CHANGE ADAPTATION ACTION PLAN

An action plan complements this Climate Change Policy. This action plan specifies the implementation of the Climate Change Policy in terms of concrete activities and investments, timeframe, indicators for monitoring, and responsible actors. The adaptation policies and actions (Annex 1) support the adaptation policy statement of “reducing vulnerability and increasing resilience to the impacts of climate change and climate variability in a proactive manner” (MoEnv, 2022). The adaptation policies and actions are not meant to be exhaustive, but to serve as guidance for developing coherent cross-sectoral adaptation planning.

The point of departure for this action plan is the list of projects in the Water Sector Capital Investment Plan and in the Structural Benchmark Action Plan. Prioritization and climate proofing of these solutions follows the criteria and steps listed in the respective sections of the Climate Change Policy. Prioritization of projects will be modified as required by the additional climate-related criteria. Climate proofing is based on the respective project context and the climate impacts projected for the relevant (short, medium, and long term) time periods. From that the vulnerability will be assessed for each project listed in the two documents (Capital Investment Plan and Structural Benchmark ActionPlan).

From those climate proofing steps, required modifications of planned projects, and required new projects will be identified. Prioritization and climate proofing involves an interdisciplinary team of experts and can be supported by integrated water evaluation and planning tools, such as WEAP²².

Since the implementation of the Climate Change Policy is to be mainstreamed with existing strategies, policies and plans (see relevant documents listed in the Climate Change Policy), also the indicators for monitoring and evaluation of progress have to be aligned with and complement existing performance indicators, e.g. those listed in the National Vision Jordan 2025 (e.g. fraction of renewables in the energy mix, energy efficiency of water supply, increase of drip irrigation, forest area). Additional indicators that address climate adaptation (and mitigation) include for example: robustness to increasing climate variability / droughts / floods and to uncertainty, vulnerability to higher temperatures and extreme heat waves, synergies between adaptation and mitigation (e.g., energy intensity, renewable energy use), eligibility for international climate funding, and others.

Integrated Water Resources Management, which provides a good basis for the Climate Policy, has not yet been aligned well with policies and action plans of other sectors beyond the water

sector. For the Climate Change Policy, coordination and integration with other sectors becomes even more important, also for alignment with the Sustainable Development Goals.

The following strategic approaches should be considered in the implementation of this policy:

5.1 Incorporating climate risks in policy and institutional reforms in the water sector

- Structural integration of climate change impacts and adaptation in the new National Water Master plan,
- Strengthening the human, technical and administrative capacities of the Climate Change Directorate at Ministry of Water and Irrigation and related Authorities,
- Adopt risk-informed programming as an adaptation planning tool at Ministry of Water level,
- Combine the traditional approach of downscaling the GCMs with a bottom-up approach based on monitoring and assessment of actual trends. In this way, dependable climate-water scenarios show clear signals that will be developed and updated to enable robust decision making.

5.2 Building adaptive of water entities

- Ensure that the entities responsible for water management and governance are able to adapt effectively to changing climatic conditions,
- Implement awareness and communication programs to ensure water institutions and water users understand the water related climate change risks and how to respond to them,
- Enhancing performance and efficiency of water utilities through technological improvements and capacity development for reducing water loss,
- Enhancing community engagement and stakeholder management approaches through WASH, to strengthen social cohesion and trust between community and water utilities in service delivery and community climate adaptation initiatives.

5.3 Research and development

- Undertake focused monitoring and research to ensure the efficacy of water adaptation approaches over the long term,
- Monitoring and evaluation of water and climate data must be prioritized under the coordination and leadership of MWI and DOM and standardized reporting protocols must be agreed on and implemented under the leadership of MWI and DOM,
- The adequacy of the weather, environmental, hydrological, and hydro-geological monitoring system must be substantially improved,
- Research into existing gaps in scientific understanding such as the impact studies on sedimentation, groundwater, dam safety, flooding, and infrastructure sustainability should be initiated using the appropriate modeling tools,

- Impact studies should be conducted for all catchments and should cover other aspects that are not covered in the previous national communication reports.

5.4 Increasing water supply

- Enhancing water storage capacity in natural dams and water retention system,
- Implement water conservation, water demand management and reduce level of non-revenue water and improve efficiency in water use by all sectors,
- Promote desalination programs for drinking water and irrigation Promote rainwater harvesting in urban areas from rooftops and greywater reuse both at the institution level and at household level to support vulnerable households and communities,
- Promote the use of non-conventional water sources especially treated wastewater,
- Build infrastructure needed for aquifer storage and recovery.

5.5 Climate Finance

- Strengthen the capacity of the climate change unit at MWI to grasp financing for the climate adaptation and mitigation measure in the water,
- Establish and streamline monitoring and oversight systems for all sources of internal and external climate finance ,
- Improvement of the Government’s capacity to develop bankable project proposals and develop a pipeline of investment-ready project concepts,
- Encourage Jordan’s private sector to engage in green investment,
- Devise a resource mobilization strategy to raise finance for climate change adaptation and mitigation included in the above strategic objectives.

5.6 Promote Incorporation of Green Growth Actions

In year 2021, Jordan launched the " water sector green growth national action plan 2021-2025". This plan proposed various strategic actions for climate change adaptation and mitigation for the water sector. This strategy promotes the implementation of green growth actions as an integrated part of the water sector adaptation and mitigation to climate change. This strategy recognizes the importance of private sector engagement in developing and managing climate change adaptation and mitigation measures in the context of green growth and green economy.

5.7 Promote Circular Economy in Climate Change Adaptation and Mitigation

This strategy promotes the application of circular economy principles to water systems and incorporates sustainable water management principles in the circular economy initiatives in other sectors. It is important to explore the relationship between the principles of Circular Economy and Sustainable Water Management and to establish a common language that will enable effective communication between Circular Economy and Water Management practitioners.

6 CLIMATE CHANGE MITIGATION ACTION PLAN

Water extraction and management measures have an impact on carbon emissions due to the energy intensity of water treatment and distribution systems (Bates et al., 2008). For example, GHG emissions reduction activities often depend on a stable supply of adequate quality water, and it is noticed that better water management leads to GHG reductions. The role that governments and other actors, including the private sector, must play in water stewardship to achieve a sustainable, low-carbon future is acknowledged in SDGs and NDCs. The Ministry of Environment is responsible for updating and implementing NAPs, NDCs and national climate change strategies have fully taken water-related mitigation issues into account.

Technology-driven climate change mitigation options usually require investment in reducing emissions from powering water infrastructure, including for provision of drinking water, treatment of waste and storm water, and pumping water for agriculture and other uses. In this context, there are different water- and sanitation-related mitigation strategies that ought to be considered for planning and management processes in the extraction, distribution, and treatment of water. Among these strategies are increasing energy efficiency and production of renewable energy and recovery. These strategies are incorporated in the mitigation policy and actions (**Annex II**). These actions support the mitigation policy statement of “*towards achieving the vision of a global carbon neutral economy by 2050*” (MoEnv, 2022). The mitigation policies and actions are not meant to be exhaustive, but to serve as guidance for developing coherent cross-sectoral mitigation planning. For instance, as new technologies develop and mature or the country development context changes, the enabling factors will need to be established to pursue the mitigation policy statement.

- Ministry of Environment, in particular the Climate Change Directorate, but also others e.g., addressing water allocations to ecosystems
- Ministry of Agriculture
- Ministry of Energy and Mineral Resources
- Ministry of Planning and International Cooperation, e.g., for accessing international climate funds
- Ministry of Municipal Affairs
- Greater Amman Municipality (GAM)
- General Department of Statistics

So-called bridging institutions which have members from different sectors, such as the National Committee on Climate Change, can facilitate cross-sector coordination and climate mainstreaming.

The action plan for the Climate Change Policy can build on existing IWRM activities. However, IWRM implementation has been slow so far. In order to avoid such problems, the action plan needs to include incentives for effective implementation and enforcement of the Climate change Policy.

7 ENABLING FACTORS

Several enabling factors or drivers of change will be required to implement the adaptation and mitigation policy and actions:

7.1 Legal and Institutional Arrangements

In order to implement this policy and its action plan appropriate legal and institutional arrangements are required. In this regard the Climate Change Bylaw No. 79 of 2019 makes provisions for institutional arrangements, mainly at the national level, for carrying out stakeholder coordination related to climate change. It also lists the roles and responsibilities of stakeholders. The CCP 2020-2050 of Jordan proposed a set of policies and actions to improve climate governance in Jordan. These policies and actions should be considered when implementing this policy. Moreover, Jordan updated its National Water Strategy 2022-2040 in which the climate change adaptation and mitigation is one of the main chapters and one of its goals. In addition, the new institutional reform will facilitate the implementation of this policy. Also, all updated policies for the water sector are considering the climate change risks and its adaptation measures.

7.2 Institutional Roles and Responsibilities

Because climate change affects everything and must be addressed in a holistic and comprehensive way, entities from across the water sector as well as beyond the water sector will be critical in achieving the goal. The Ministry of Water and Irrigation will be central to the mainstreaming of climate change adaptation into policy, planning and oversight for the water sector. Civil society organizations must play a vital role in strengthening public awareness on the need for adaptation and in bridging gaps between scientific research and policy making. Donor agencies can contribute by mainstreaming adaptation into their development co-operation programs such as screening funded activities for climate risks, providing access to new adaptation technologies, and directing new resources to help absorb the additional costs of adaptation. The role of the key institutions in implementing this policy is shown in the Table below (Table 2).

Table 2: Role of Key Institutions in Implementing this Policy

Institutions	Key institutional roles
MWI	<ul style="list-style-type: none"> - The mainstream of climate change adaptation into the policy planning process - Establish, equip, and empower climate change unit - Implement climate change action plans - Seek fund for climate change adaptation measures
WAJ	<ul style="list-style-type: none"> - Supports executing the capital investment for water system restructuring - Explore increasing the monitoring programs for surface water, groundwater, water quality, and climatic variables
JVA	<ul style="list-style-type: none"> - Seek fund for capital investment - Improve regulatory environment
Water Compagnies	<ul style="list-style-type: none"> - Participate in capacity building programs - Lead the effort in the objectives related to water demand management, NRW, wastewater treatment
Donor Agencies	<ul style="list-style-type: none"> - Finance - Research and development - Capacity building

Institutions	Key institutional roles
Research Community	- Research and development for best practices - Capacity building
Ministry of Environment	- Follow up on climate change adaptation measures related to NDCs - Secure fund
Department of Meteorology	- Climate trends and predictions
Media	- Public awareness raising - Early warning dissemination
Civil Society and Non-Governmental Organizations	- Local expert - Capacity building

7.3 Human and Financial resources and Prerequisites

Sufficient human and financial resources to implement are required to implement this policy as shown in Table 3.

Table 3: Human and financial resources and prerequisites

Human resources	Financial resources	Pre-requisites
<ul style="list-style-type: none"> - Climate change unit at MWI will work to ensure implementation of the above objectives with other departments at MWI, WAJ, JVA and water companies - The implementation of this objective requires the involvement of several key agencies such as the MWI, JVA, WAJ, MoEnv and water companies - A number of cross-sectoral committees already exists such as the National Climate Change Committee (NCCC). - a more focused inter-sectoral task force to facilitate implementation of adaptation is recommended - This task force shall comprise of representatives from: the ministries concerned, socio-economist, climatologist, disaster expert, community leaders, NGO's, the media, and research institutions, and GESI Teams at water sector mainly the gender Focal points and Gender unit head at MWI. - The functions and mandate of this task force should be known. 	<ul style="list-style-type: none"> - Capital investment for water system restructuring - Sufficient fund from donor agencies - Seek fund from GCF and other climate funds 	<ul style="list-style-type: none"> - Climate change adaptation is given high priority by MWI - Full integration of climate change adaptation in other policies related to the water sector. - the ability of government to implement those identified actions. - availability of adequate human capacity, - financial capacity to implement and sustain those proposed adaptation options. - Protect, manage and use water resources in effective, equitable and sustainable manners, protecting them from the negative impacts of climate change

7.4 Technology Transfer and Financing

Jordan possesses certain national capabilities to implement the climate change policy for a resilient water sector. The CC Policy 2022-2050 lists several policies and actions

for Jordan to avail of the provisions made under Article 10 (technology development and transfer) and Article 9 (financing) of Paris Agreement (PA). These policies and actions should be considered when implementing this policy.

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ANNEX 1: ADAPTATION POLICY AND ACTIONS FOR WATER SECTOR (MOENV, 2022)

Policies	Action List	Time Frame
Support Water Supply, Conservation, and Related Infrastructure Development	W1.1. Integrating Climate adaptation and resilience in the policy and institutional reforms in the water sector (e.g. Structural integration of climate change adaptation in the new National Water Masterplan, and strengthening the human, technical and administrative capacities of the Climate Change Directorate at Ministry of Water and Irrigation and related authorities.	Medium Term
	W1.2. Improving water demand management and reducing the gap between water demand and supply (e.g. reducing non-revenue water loss in domestic and irrigation water supply systems, enhancing water storage capacity in natural dams and water retention systems, reducing groundwater use for irrigation and enhancing water recharge technologies, treated wastewater reuse in agriculture, industry greeneries, desalination plants in Aqaba, water conveyance, etc.)	Medium Term
	W1.3. Improve the adaptive capacity of water utilities (e.g. Conducting climate proofing studies for existing water utilities and integration of climate proofing tools for planned water utilities, creation of map for flash flood prone area as a tool for risk assessment, enhancing performance and efficiency of water utilities through technological improvements and capacity development, etc.).	Medium Term
	W1.4. Improve efficiency in water use for sustainable development (e.g. Promote water-harvesting techniques at all levels, introducing water saving technologies, enhancing the use of water efficiency technology at household and business levels in urban and rural settings, enhancing the adaptive capacity of small farmers in Jordan Valley through water user associations for increasing use of reclaimed water for irrigation purposes, etc.).	Medium Term
	W1.5. Improving contribution of non-conventional water resources to the national water budget (e.g. Promote the use of non-conventional water sources especially treated wastewater for non-domestic water use, increasing of the number and scope of use of decentralized wastewater treatment plants in rural areas, promote desalination programs for drinking water and irrigation, promote rainwater harvesting in urban areas from rooftops, etc.).	Medium Term
	W1.6. Water conservation incentives – incentivize water pricing systems that reward conservation, accounting for differences between ecological zones with regards to growing conditions, crops, and other agronomic needs.	Short Term
	W1.7. Floodplain Easements - Work with willing sellers to identify voluntary floodplain corridor protection (flowage) easements on agricultural lands to maintain agricultural production that is compatible with flood conveyance.	Medium Term
	W1.8. Improve rainfall early warning systems and reducing flood and drought risks (e.g. meteorological capacities in forecasting of long term and short term weather conditions as related extreme weather risks, flood and drought resilience through risk management measures, development of flood and drought risks maps for all impacted areas, improved infrastructure, emergency preparedness, mitigation, and recovery operations, etc.).	Medium Term

Policies	Action List	Time Frame
	W1.9. Support watershed and basin level management including trans-boundary water (e.g. vulnerability assessment of surface water and groundwater basins, preservation, rehabilitation and restoration of key watersheds in Jordan for enhanced retention of surface water and recharge to groundwater, enforcing laws to protect the quality of surface and groundwater prevent dumping/pollution, and/or incentives for cleanup and restoration of watersheds and basins, developing pragmatic management plans for trans-boundary watersheds by political agreements, etc.).	Long Term

ANNEX II: MITIGATION POLICY AND ACTIONS FOR WATER SECTOR (MOENV, 2022)

Policies	Action List	Time Frame
Promote a Circular Waste Economy	WM1.1. Promote renewable energy by replacing current pumping systems by solar pumping systems	Short and Medium Terms
	WM1.2. Develop the wastewater recovery network coupled with methane recovery for energy uses and composting of sludge.	Medium to Long Term
	WM 1.3 Methane recovery as per related global initiatives.	Medium to Long Term

