



Strategic Environmental and Social Assessment (SESA) of the Updated National Water Sector Strategy (NWSS) – Ministry of Energy and Water (MoEW)

Executive Summary

October 7, 2022



ECODIT Liban SARL

PREPARED FOR
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION (CDR)

EXECUTIVE SUMMARY

BACKGROUND

The water sector in Lebanon is facing detrimental challenges, hindering the ability of the government to supply adequate and reliable water services while conserving Lebanon's water resources. Although the national coverage of water networks is around 80%, the quality of the supplied public water is questionable due to the lack of protection of water resources, insufficient water treatment at the supply level, deteriorated distribution networks, and the absence of continuous monitoring. Untreated wastewater, which accounts for around 70% of the total generated wastewater, is being directly discharged into the environment, thus polluting the groundwater and surface water resources that supply a significant portion of Lebanon's potable water. The pollution of water resources, in addition to the poorly managed water supply networks, have impacted the quality of water at the household level. An estimated 65% of the population does not have access to safely managed drinking water services.

The absence of continuous Surface Water (SW) and groundwater (GW) resources quantity and quality monitoring, and adequate data collection and management in Lebanon translates into a lack of reliable national water balance that can be used for the development of effective water management plans. Estimates provided by MoEW suggest that the population relies mostly on GW supply (springs and wells), constituting 83% (~1,587 MCM/year) of the total supply, tapping on 58% (~1,595 MCM/year) of the total available GW on the national level. Private wells provide the highest percent supply (33%; ~631 MCM/year), followed by springs (31%; ~593 MCM/year) and public wells (18%; 344 MCM/year).

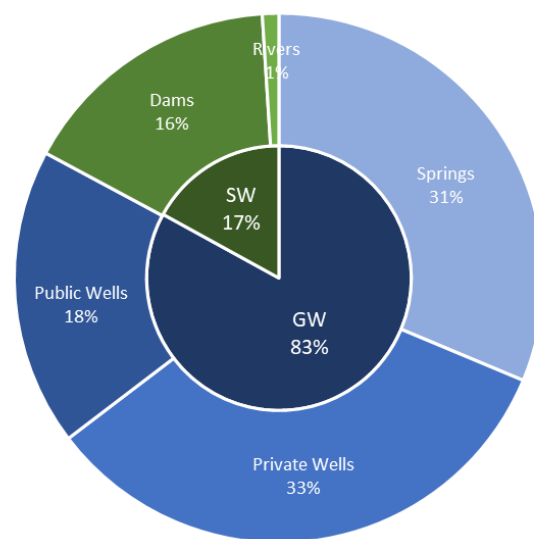


Exhibit 1. Current Water Supply Mix (2020)

Chronic water sector challenges are being exacerbated by the various crises that began in late 2019, including the economic collapse, fuel shortage, and the COVID-19 pandemic. UNICEF estimates that the price of water purchased from private water suppliers could increase by 200% a month, with more than 71% of people at immediate risk of losing access to safe water. As a result of the lack of sustainable water services and conservation of Lebanon's water resources, citizens lost trust in the governmental water authorities, resorting to unsustainable alternative private sources to secure potable water and irrigation needs and to manage their wastewater.

The governmental authorities currently managing the country's water sector are the MoEW and the public water investment institutions: the four RWEs (Beirut and Mount Lebanon, South, North and Beqaa water establishments) and the LRA. The four RWEs are not achieving cost recovery - a primary reason behind the insufficient provision of water services. The RWEs are being deprived of significant revenues considering that (1) the Non-Revenue Water (NRW) is more than 45% across Lebanon due to the lack of maintenance and presence of illegal connections, (2) customer-metered connections are around only 10% nationwide, (3) billing and collection rates are as low as 30% in some areas, (4) the flat tariff structure does not encourage a long-term water conservation behavior change among citizens, among other reasons.

To address structural changes in the water and wastewater sector and emerging challenges facing water resources management, the MoEW updated the 2012 National Water Sector Strategy (NWSS). In compliance with the Strategic Environmental Assessment (SEA) Decree 8213/2012 and funded by World

Bank (WB) Lebanon – Lake Qaraoun Pollution Prevention Project, the Council for Development and Reconstruction (CDR) contracted ECODIT Liban (henceforth “ECODIT”) to prepare, in collaboration with Ministry of Energy and Water, a Strategic Environmental and Social Assessment (SESA) for the Updated NWSS-MoEW (2020).

The report seeks to satisfy the following objectives: (1) Assess the environmental and social impacts of the Updated NWSS-MoEW (2020) with the necessary stakeholder engagement and (2) Provide recommendations and high-level policy advice to MoEW to optimize the Updated NWSS-MoEW (2020) and mitigate potential adverse environmental and social impacts.

SESA METHODOLOGY

Although the SESA Draft Report is considered as an update of the previous SEA (2015) for the NWSS-MoEW (2012), ECODIT applied a shift in its methodological approach to enhance the SESA’s impact in influencing the decision-making process. ECODIT adopted a “hybrid” overall approach that combines “policy” and “impact-centered” SESA approaches. The methodological steps conducted by the SESA team are presented below:

- (1) Assessment of physical, biological , and socio-economic baseline conditions to understand the state of the environment and specifically the current situation of the water sector in Lebanon.
- (2) Review of legal, institutional and policy frameworks governing the water sector – including legislation and regulations, multilateral agreements and conventions – as well as relevant national and regional plans, programs and projects.
- (3) Stakeholder Engagement through two phases: (1) focused consultation meetings and (2) public consultation meetings.
- (4) Assessment of the impacts of the Updated NWSS-MoEW (2020) based on specific and cross-cutting key themes (presented in the figure below).

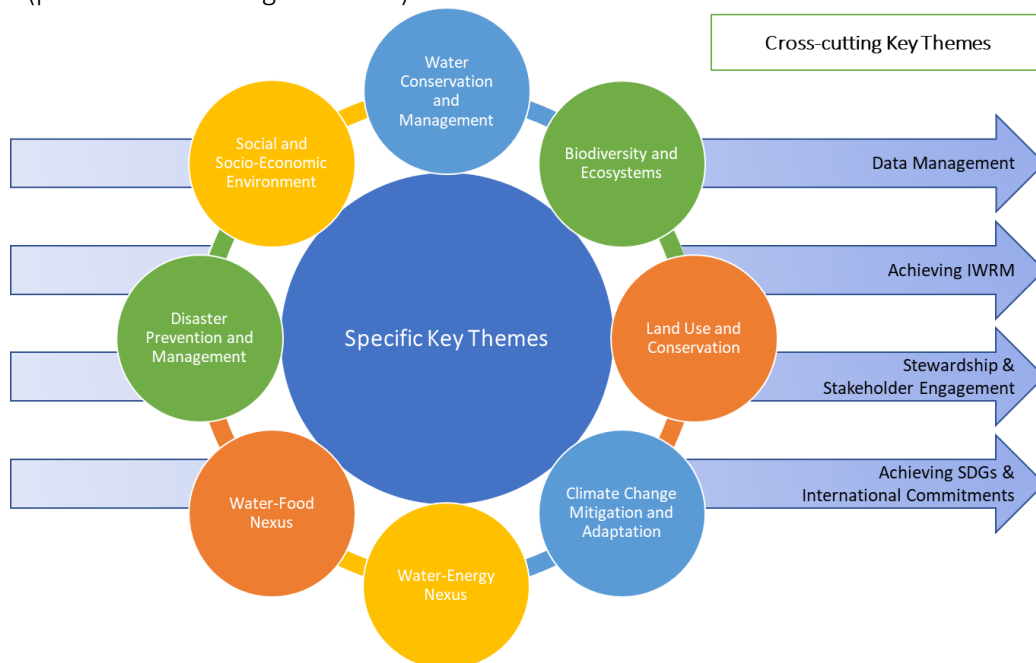


Exhibit 2. Specific and Cross-cutting SESA Key Themes

During the SESA preparation, ECODIT has been sharing with MoEW preliminary findings/recommendations to be integrated in the Updated NWSS-MoEW (2020). Accordingly, MoEW is reviewing the Updated NWSS-MoEW (2020) in parallel to the SESA preparation and finalization.

DESCRIPTION OF THE UPDATED NWSS-MOEW (2020)

The Updated NWSS-MoEW (2020) plans the water sector for the years 2020-2035 and aims to “Ensure equitable access to water and sanitation services for all”. It entails a wide range of legal, institutional, technical, and financial recommendations and actions. It also includes a list of proposed projects across the Lebanese territory, divided geographically under each RWE jurisdiction. The figure below illustrates the strategy’s vision, pillars, and overall objective.

All strategy initiatives are grouped under three pillars:

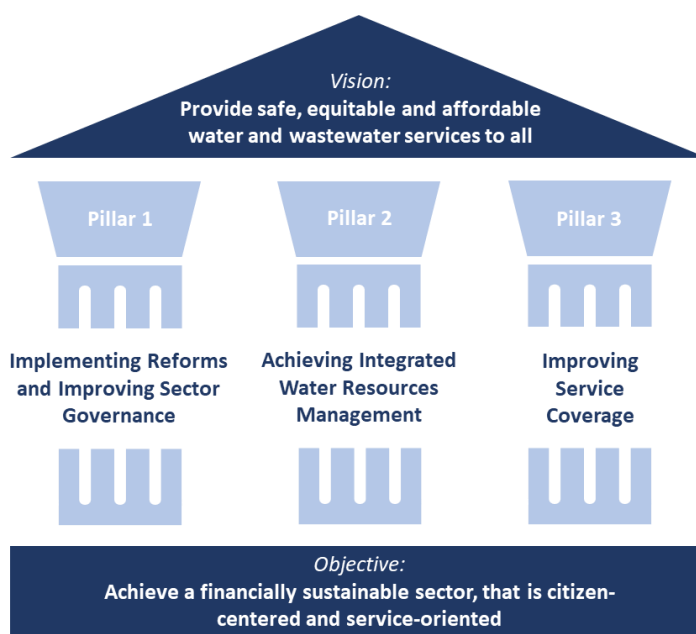


Exhibit 3. Updated NWSS-MoEW (2020) Vision, Pillars, and Objective

Pillar 1: Implementing Reforms and Improving Sector Governance

Exhibit 4. Summary of Pillar 1 Strategy Component in Updated NWSS-MoEW (2020)

Pillar 1 Aims	Pillar 1 Strategy Component	Summary of Key Initiatives	Cost Estimate (USD)
<p>-Build solid legal, institutional, financial, commercial, and monitoring frameworks.</p> <p>-Enhance communication mechanisms and increased transparency with stakeholders, as well as a shift in the data sharing culture.</p>	Legal and Institutional Framework	<ul style="list-style-type: none"> - Implementation of the legal and regulatory framework: Water Code and RWE organizational and operational decrees. - Establishment of mechanisms for performance monitoring within MoEW and RWEs. 	1,465,000
	Financial and Commercial	- Revision of the tariff structure and implementation of consumption-based tariffs.	6,750,000
	Reporting and Monitoring	- Set-up of monitoring and reporting mechanisms to facilitate public communication.	1,257,500
	Capacity Building	- Preparation and implementation of a training/capacity building plan.	2,950,000
	Operation and Maintenance of Facilities	<ul style="list-style-type: none"> - Development of performance-based contracts. - Preparation of study to propose framework for wastewater facilities management. 	660,000
Total Cost Estimate for Pillar 1			13,082,500

Pillar 2: Achieving Integrated Water Resources Management

Exhibit 5. Summary of Pillar 2 Strategy Component in Updated NWSS-MoEW (2020)

Pillar 2 Aims	Pillar 2 Strategy Component	Summary of Key Initiatives	Cost Estimate (USD)
-Improve infrastructure planning and water allocation among economic sectors.	Integrated Hydrological Information System (IHIS)	- Implementation, operation, and supervision of IHIS ¹ and Water Evaluation and Planning System (WEAP).	9,548,000
	Meteorological and Hydrometric Networks	- Expansion of meteorological and hydrometric network.	6,066,000
-Target continuous measurement and monitoring of the quantity and quality of available groundwater and surface water resources across the country and address environmental concerns.	Project Management Unit (PMU)	- Implementation of PMU for five-year period. - Monitoring of springs and public wells.	8,505,000
	General Geological and Hydrological Studies	- Geology and hydrogeological mapping, modelling, and studies.	21,800,000
	Drilling and Testing Exploratory Wells	- Drilling and testing 14 reconnaissance and exploratory wells to detect new potential aquifers.	6,150,000
	Artificial Aquifer Recharge (AAR)	- AAR studies at six identified sites.	31,750,000
	Water Quality Management and Monitoring	- Implementation of Water Safety Plan by all RWEs. - Publish 161:2016 LIBNOR water quality standards.	N/A
	Wastewater and Sludge Management	- Investigate and analyze the existing potential for sludge reuse.	N/A
	Strategic Environmental Assessment of the Updated NWSS-MoEW (2020)	- Development of an SEA in compliance with Decree 8213/2012.	N/A
Total Cost Estimate for Pillar 2			83,819,000

Pillar 3: Improving Service Coverage

Exhibit 6. Summary of Pillar 3 Strategy Component in Updated NWSS-MoEW (2020)

Pillar 3 Aims	Pillar 3 Strategy Component	Summary of key Initiatives	Cost Estimate (Million USD)
- Proposes infrastructure projects in the water, wastewater, and irrigation sectors	Potable Water	- Upgrade and/or rehabilitation of water distribution systems to meet 2035 water demands.	1,574.33
	Wastewater	- Construction of 182 WWTPs with a total design capacity of 1,196,875 m ³ /day	2,204.110

¹ A hydrological information system for all public and private water sector stakeholders to manage, publish and share their data, products, and services.

Pillar 3 Aims	Pillar 3 Strategy Component	Summary of key Initiatives	Cost Estimate (Million USD)
		- Rehabilitation, replacement, and upgrade of sewers	
	Irrigation	- Rehabilitation and/or upgrade of irrigation schemes.	1,142.975
	Dams and Hill Lakes	- 14 dams proposed with around 683 MCM/year of water storage. - Construction of hill lakes.	2,151.450
Total Cost Estimate for Pillar 3			7,072.865

The proposed initiatives are assigned a priority level based on the order of urgency according to general criteria. Section 3 of the SESA provides a detailed summary of all proposed Updated NWSS-MoEW (2020) initiatives.

LEGAL, INSTITUTIONAL, AND POLICY FRAMEWORKS

In the last five years, the most notable advancement in the water sector legal framework was the promulgation of the Water Code in 2018 and its amendment Law 192/2020. The amended Water Code aims to update and modernize the water sector's legal, financial, and institutional dimensions.

The main institutions involved in the water sector include: MoEW, four RWEs, LRA, CDR, the Ministries (Environment, Agriculture, Industry, Public Health, and Interior and Municipalities), and the Council for the South. Several other stakeholders support the water sector but do not have direct responsibilities mandated by law, including international donor agencies, the academic and research sector, non-Governmental Organizations, and the private sector.

Section 4 of the SESA reviews all relevant legislation and regulations, multilateral agreements and conventions, as well as plans, programs and projects in the water sector and relevant to the SESA assessment.

ASSESSMENT OF BASELINE CONDITIONS

Physical Environment

Despite all efforts, Lebanon still lacks a complete and inclusive long term annual average water balance that can be used for water management plans (MoEW, 2020). A summary of the water resources in Lebanon is provided below.

Exhibit 7. Water Resources in Lebanon (Source: MoEW, 2020)

Surface Water (Total available surface water is 1,475 MCM/year)	Rivers	<ul style="list-style-type: none"> Total of 40 rivers – 16 perennials and 24 seasonal Total exploitable surface water from rivers is around 1,475 MCM/year. Existing volume exploited from rivers is 14 MCM/year.
	Dams	<ul style="list-style-type: none"> Six operational dams/hill lakes: Chabrouh Dam (Mount Lebanon), Ballout Lake (Mount Lebanon), Qaysamani Lake (Mount Lebanon), Kouachara Lake (Akkar), Yammouneh Lake (Baalbek-Hermel) and Qaraoun Dam (Beqaa) with a total dynamic capacity of around 314 MCM/year mainly concentrated in Qaraoun and Chabrouh dams.
Groundwater	Springs	<ul style="list-style-type: none"> Total number of springs exceeds 2,000 with 275 tapped springs. Total exploitable spring discharge exceeds 2,050 MCM/year; maximum available discharge in dry months is 200 MCM/year.

(Total available groundwater resources is 2,750 MCM/year)		<ul style="list-style-type: none"> Average actual extraction volume from springs is 594 MCM/year; 315 MCM/year for irrigation and 280 MCM/year for potable water.
	Wells	<ul style="list-style-type: none"> Total exploitable renewable groundwater is 700 MCM/year Total number of public wells is 1,615. Total number of private wells is 85,000. Actual extraction volume from public wells is 350 MCM/year (based on 12 hours per day operation). Actual extraction volume from private wells is 640 MCM/year. Almost all existing public wells are used for potable water. An estimated 50% of extracted volume from private wells is used for irrigation.
Non-conventional Water		<ul style="list-style-type: none"> Re-use is being practiced in Ablah WWTP in Beqaa for the irrigation of 20 ha. Presence of minor hill lakes for irrigation and some household-level rainwater harvesting systems scattered across the territory.

In addition to the challenges associated with the proper and sustainable management of water resources to meet the national water demands, high pollution levels in many of Lebanon’s water sources have made them unusable or require high-cost treatment prior to use. Given that only 30% of wastewater is being treated (~292,918 m³/day), the open discharge of untreated domestic wastewater is reportedly the main source of contamination of surface water; while other sources include point sources from industrial, healthcare, quarries and touristic establishments, as well as agricultural run-off. Groundwater quality has been also deteriorating due to water contamination as a result of both over-pumping and human activities. Sewage seepage and agricultural sources have been reported to cause nitrate pollution in groundwater sources.

Moreover, climate change, which has led to high intra- and inter-annual climate variability in Lebanon, is also leaving a high level of uncertainty regarding projected changes in water availability and water quality. End-century climate change trajectories suggest an increase in temperature in Lebanon by up to 3.2°C and a decrease in precipitation by 4%-11%². The projected climate change impacts include, among others: a decrease in water availability by 29% in 2080, a decrease in agricultural activity, and an increase in droughts, floods and forest fires. Section 5.1 of the SESA describes the physical environment, including water resources and wastewater management, climate change, land resources, and natural hazards.

Biological Environment

Lebanon offers 3 Biosphere Reserves (Shouf Biosphere Reserve, Jabal Moussa, and Jabal El Rihane), 18 protected forests, 16 protected sites, 4 Ramsar Sites, 5 World Heritage Sites, 15 Important Bird Areas, and 26 Hima managed by Municipalities.

Riparian habitats in Lebanon are critical ecosystems; they extend from the edge of a water body to the edge of the upland community and constitute important habitats for wildlife, particularly for breeding birds. Moreover, river systems emptying into marine waters have very irregular flows, carrying high concentrations of sewage waste, sediment loads, and industrial and agricultural pollutants. Anthropogenic pressure on water resources from highly populated coastal urban areas (particularly the coastal area of

² Compared to the baseline period of 1986-2005. Projections conducted by the Regional Initiative for the Assessment of the Impact of Climate Change on Water Resources in the Arab Region (RICCAR).

Beirut and Mount Lebanon) Is threatening the life of sea birds, sea turtles, monk seals, dolphins, whales, and other globally threatened species.

Section 5.2 of the SESA describes the baseline biological and natural environment, specifically terrestrial, riparian, and coastal and marine ecosystems in Lebanon.

Socio-Economic and Cultural Environment

With the increased population growth (including influx of Syrian refugees), uncontrolled urban expansion, unprecedented economic, financial, monetary, and social crisis, blast of Beirut Port, COVID-19 pandemic and other factors, the following challenges with the provision of water services have been aggravated:

- Nearly 1.7 million people have access to only 35 liters of water a day, a decrease of almost 80% against the national average of 165 liters pre-2020.
- Blackouts and intermittent power supplies are threatening the capacity of the water system to treat, pump and distribute water.
- Public water utility providers can no longer afford essential spare parts for maintenance or fuel for their electricity generators as they had no access to hard currency due to the collapse of the Lebanese currency against the USD.
- Limited capacity to mobilize future required funds for capital investment purposes, including investments in the water sector

Section 5 of the SESA presents a baseline description of the socio-economic and cultural environment in Lebanon including population growth and urbanization, poverty and socio-economic crises, water consumption and expenditure patterns, and the agricultural, industrial, and touristic activities.

STAKEHOLDER ENGAGEMENT AND CONSULTATION ACTIVITIES

In compliance with SEA Decree 8213/2012, ECODIT conducted an extensive stakeholder consultation process, through focused consultation meetings and public consultation meetings. The aims of these consultations were to (1) gain key insights and opinions on the water sector in Lebanon and the Updated NWSS-MoEW (2020) (2) enhance strategic recommendations, and (3) solicit feedback on SESA process and outcomes.

ECODIT divided the SESA stakeholder engagement process into two phases:

Phase 1: Focused Consultation Meetings

The targeted stakeholders' meetings, which started in November 2021, involved virtual and in-person one-to-one or focus group meetings with more than 70 governmental and non-governmental stakeholders in the water sector, including water authorities and Ministries, active Non-Governmental Organizations (NGOs) and civil society, development and funding agencies, research centers and academic institutions, and other experts working in the field.

Stakeholders consulted in the focused consultation meetings provided diverse feedback regarding the Updated NWSS-MoEW (2020). Common technical concerns regarding the strategy were that it did not clearly tackle environmental components, particularly those related to the management of the wastewater sector and protection of resources. Out of the three strategy pillars, stakeholders tended to prioritize "Pillar 1: Implementing Reforms and Improving Sector Governance". Nevertheless, there was a common consensus that the three pillars of the strategy should be implemented in parallel, with focus on water resources management (data collection and storage, water demand management, and the protection of water resources) and institutional water sector reforms.

Phase 2: Public Consultation Meetings

Starting August 2022, ECODIT will organize several stakeholders' consultation meetings to solicit the feedback of the general public on the Updated NWSS-MoEW (2020) and inform them about the results and recommendations of the SESA Report. To maximize the participation of stakeholders from citizens, government, local authorities, international organizations, research and academic institutions, and the private sector, ECODIT will conduct four general consultation meetings divided by Water Establishment jurisdiction (Beirut and Mount Lebanon, North Lebanon, South Lebanon, and Beqaa).

Section 6 of the SESA compiles all information gathered from the stakeholder engagement process conducted.

ASSESSMENT OF POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS RESULTING FROM THE UPDATED NWSS-MOEW (2020)

ECODIT evaluated potential impacts of the implementation of the Updated NWSS-MoEW (2020) on the selected specific and cross-cutting key themes. The impacts are presented in the Exhibit 10 of this Executive Summary.

ANALYSIS OF ALTERNATIVES TO THE PROPOSED STRATEGIC ACTION

Section 8 of the SESA identifies five alternatives that aim to enhance the scientific dialogue regarding Lebanon's water sector and narrow the gaps between policy making and public opinion. In all alternatives, the percent reliance on GW is higher than that of SW knowing that not all available resources could be exploited as temporal distribution is not aligned with irrigation/agricultural season. On an international level, countries are implementing policies towards the sustainable use of water, reflected through the management of groundwater over-exploitation and increase in surface water exploitation and storage to meet domestic, industrial and agricultural water demand³. The alternative scenarios are summarized below:

Exhibit 8. Summary of Scenarios Considered

Scenario	Description
Do Nothing Alternative	The future baseline (2035 status) without the implementation of Updated NWSS-MoEW (2020) which entails the following: <ul style="list-style-type: none">- Challenges associated with the proper and sustainable management of water resources to meet the national water demands- Polluted water sources- Citizen relying on private water sources (private wells, water tankers) Accordingly, without effective action to increase supply and improve water quality, Lebanon would be in danger of facing severe water shortages in the near future.
Current Status 2020	Represents the baseline scenario; the general status of 2020.

³ (Semi)-Arid but also temperate example countries include:
Spain ~ 78% SW; 22% GW (OECD,2011),
Morocco ~ 80% SW; 20% GW (Hssaisoune et. al., 2020),
Greece ~ 58% SW; 42% GW (EASAC, 2010), and
France ~ 50% GW, 50% SW (Marechal & Rouillard, 2020)

Water Supply Mix Alternatives	Scenario 1: “Updated NWSS-MoEW (2020) Scenario”	Represents the general status of 2035 with the implementation of the Updated NWSS-MoEW (2020)
	Scenario 2: “Updated NWSS-MoEW (2020) Scenario with Addition of Non-conventional Water Sources	Represents a duplicate of Scenario 1 of the general status of 2035, but includes the use of non-conventional resources as a water supply source
	Scenario 3: “ Updated NWSS-MoEW (2020) Scenario with increase in supply from SW sources	Considers that all the proposed dams in the Updated NWSS -MoEW (2020) will be completed by 2035
	Scenario 4: “Updated NWSS-MoEW (2020) Scenario with increase in supply from GW sources	Considers that only the dams under construction will be completed and operational by 2035 (Janneh Dam, Mseilha Dam and Boqaata Dam)

Water Supply Mix Alternatives

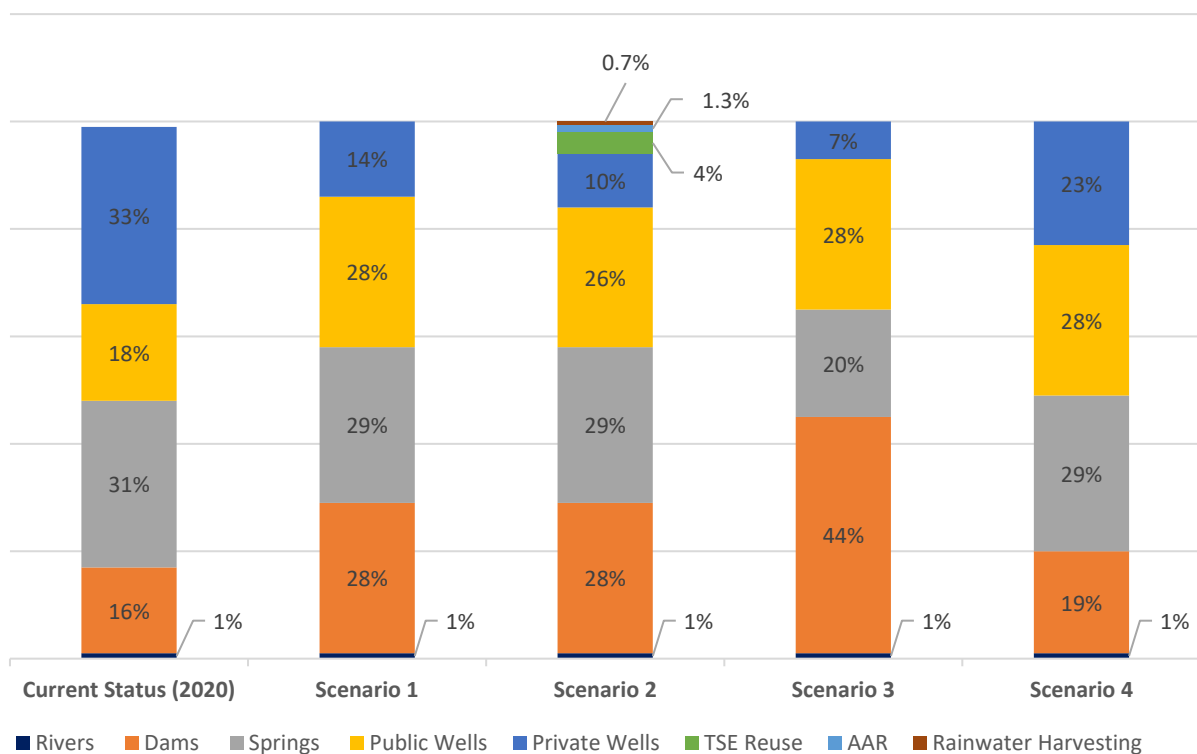


Exhibit 9. Water Supply Mix Alternatives

The scenario analysis showed that increasing supply from groundwater (Scenario 4) will exacerbate over pumping from aquifers, which necessitates to a certain extent the need for water storage in dams at the national scale (but does not justify the proposed dam locations or engineering design). The overexploitation and over-pumping of groundwater aquifers can lead to a drop in the groundwater level in most inland aquifers, seawater infiltration in coastal aquifers, and deterioration of the water quality. Furthermore, the construction of dams (Scenario 3) will significantly reduce direct costs associated with securing water supply from private sources incurred by the society. However, this does not necessarily indicate that dams, which are highlighted in the Updated NWSS- MoEW (2020) to compensate for the water supply in 2035, appear with no cost overruns. Moreover, large dam projects are heavy on the

government treasury (USD 2.12 Bn excluding Bisri Dam), and they result in ecological, economic, and social costs. Nevertheless, regardless of the adopted scenario, it is crucial to:

- Develop an integrated watershed management strategy prior to the implementation and completion of proposed dams in the Updated NWSS -MoEW (2020). This will minimize and mitigate risks and damages and reduce expenses incurred by the citizen.
- Focus on increasing network efficiency to 75%, as this is a main assumption in the Updated NWSS -MoEW (2020), which has a great impact on water demand and is a main condition for sustainable water management. Although this will not offset the need for additional dams, it will reduce groundwater pumping.
- Regulate abstraction from groundwater wells, including private ones.. However, under the current circumstances, water supply from private wells cannot be reduced to null as several agricultural schemes will still be relying on it.
- Promote additional R&D efforts to assess the potential of increasing the reliance on non-conventional resources.

SELECTION OF THE «MOST SUITABLE STRATEGIC OPTION »

Based on the above, the Updated NWSS-MoEW (2020) (Scenario 1) is “the most suitable strategic option” from an environmental and social perspective, in that it is a necessary strategy which does not have irreparable negative impacts and for which there are no clearly superior available alternatives. However, the Updated NWSS-MoEW (2020) must remain flexible and can be greatly enhanced by researching and adopting other options and/or complementary measures for achieving the same goals. More importantly, the strategy can be best improved by prioritizing the governance-related initiatives to strengthen the institutional capacities and ensure sustainability of projects. For these measures to unfold, it is important that MoEW continues to moderate an open-minded and transparent discourse on Lebanon’s water strategy with all relevant stakeholders. In other words, water planning must not end in 2020 when the Updated NWSS (2020) was compiled but, rather, should adapt to the growing uncertainties and emerging opportunities in the water sector. However, it is recommended that the Updated NWSS-MoEW (2020) is implemented taking into consideration the mitigation measures and policy responses outlined in the “Framework to Optimize the Environmental and Social Effects of the Strategy” and “Recommendations for Integrating Sesa Findings in the Updated NWSS-MoEW (2020)” sections of the SESA.

A FRAMEWORK TO OPTIMISE THE ENVIRONMENTAL AND SOCIAL EFFECTS OF THE STRATEGY

The SESA compiles a list of policy responses and mitigation measures with responsibilities distributed among all stakeholders involved in the water sector, including the MoEW, MoE, CDR, RWEs, and others (listed in the table below). It also outlines other required responses, including:

- (1) Advance the IWRM implementation through strengthening political will, enhance coordination between stakeholders, improving data and information sharing, and building capacity through IWRM-specific training.
- (2) Re-prioritization of projects classified as Priority 1 to identify the projects which have the most significant positive impact and are required to achieve the projected development in the sector.
- (3) Strengthen the EIA/EMP process as it is essential to ensure environmental compliance of the infrastructural projects proposed in the strategy.

- (4) Ensure that water resource allocation regime and water demand management takes into consideration not only gradual changes in water availability due to climate change, but also sudden changes due to unexpected climatic shifts.
- (5) Ensure that the MoEW develops a sector investment program, to ensure that viable financing is available for the implementation of the Updated NWSS-MoEW (2020) proposed projects and their operation.
- (6) Ensure that the MoEW enhances information sharing, communication, and coordination between the concerned stakeholders, including the public, on issues related to the water sector.

In addition, Exhibit 10 in this Executive Summary presents the mitigation strategies and policy responses recommended for the key themes discussed throughout the SESA report.

RECOMMENDATIONS FOR INTEGRATING SESA FINDINGS IN THE UPDATED NWSS-MOEW (2020)

ECODIT team attempts to highlight priority recommendations for integrating SESA findings in the Updated NWSS-MoEW (2020).

- (1) **Integration of Mitigation Strategies/Policy Recommendations into Updated NWSS-MoEW (2020):** It is advised to begin with the integration of the “priority” SESA policy responses and mitigation measures⁴ into the Updated NWSS-MoEW (2020) and continue with the integration of all other SESA policy responses and mitigation measures in the upcoming revised/updated strategies.
- (2) **Oversight and Monitoring:** There is an urgent need to clearly assign responsibility for oversight and monitoring of the Strategy.
- (3) **Research and Development (R&D):** Promote additional R&D efforts to assess the potential of increasing the reliance on non-conventional resources, as well as to address different water sector challenges.
- (4) **National Water Dialogue:** Transparency and stakeholders’ engagement is crucial for the successful implementation of the Strategy.
- (5) **Appraisal of the Updated NWSS-MoEW (2020) Implementation:** There is a strong need for a “mid-term appraisal” of the Strategy through which lessons from experiences could be learned, targets and methodologies could be re-assessed, and SESA safeguards could be implemented.
- (6) **Iterative Process for Revisions:** As stipulated in the Water Code, the strategy should be revisited every 5 years.

⁴ ECODIT has highlighted from the mitigation measures/policy recommendations listed in the table above the “priority” responses that could be integrated immediately into the Updated NWSS-MoEW (2020).

Exhibit 10. Summary of Impacts, Mitigation Strategies/Policy Responses, and Responsibilities

Main Impacts	Mitigation Strategies and Policy Recommendations to Optimize Environmental and Social Impacts	ID	Responsibility	
KT1. Water Conservation and Management				
Sustainable Resources Allocation and Efficient Water Use				
<p>⊖ Impacts on sustainable resource allocation:</p> <ul style="list-style-type: none"> - Absence of well-founded water balances due to data limitations, particularly estimations for evapotranspiration, snow cover contribution, and groundwater resources leaving Lebanon. - District-level water balances used to determine proposed infrastructure projects under Pillar 3 are not well optimized. Detailed quantification of demand and available water resources are yet to be done. - Lack of initiatives addressing the issue of uncontrolled groundwater extraction from private wells. <p>⊖ Estimation of demand across the various economic sectors does not seem to consider current and expected future sector productivity and the economic value derived from the productive uses of the available water, nor the strategies and plans of the concerned Ministries for the development of their respective sectors at the national or district level, and consequently their projected water needs.</p> <p>⊕ Proposed irrigation initiatives focus more on water demand management which will positively impact water resources.</p>	<ul style="list-style-type: none"> • Identify existing available water resources in each watershed basin based on best available scientific evidence (i.e., data collected from the IHIS proposed in the Strategy). 	KT1.1	MoEW, RWE's, LRA	
	<ul style="list-style-type: none"> • Revise the national water balance based on updated data following implementation of initiatives under Pillars 1 and 2. 	KT1.2		
	<ul style="list-style-type: none"> • Improve the inter-ministerial coordination to optimize current and future sectoral demands: <ul style="list-style-type: none"> - Align current and future Ministerial strategies/vision, particularly those of the MoI, MoA, and MoT. 	KT1.3		
	<ul style="list-style-type: none"> • Develop a well-designed water allocation regime with the following objectives: <ul style="list-style-type: none"> - Economic efficiency, by allocating resources to higher value uses, according to a National Economic Plan once set by GoL - Water use efficiency through innovation and investment in the sector. - Environmental performance by securing adequate flows to support ecosystems services. - Equity by sharing the risks of shortage among water users fairly. 	KT1.4		
	<ul style="list-style-type: none"> • Assess the impact of the proposed infrastructural projects (dams, hill lakes, wells, etc.) on water availability and aquifers and accordingly optimize the management (i.e., extraction rates, etc.). 	KT1.5		
	<ul style="list-style-type: none"> * Empower and define the role of the Lebanese Center for Water Conservation and Management within the MoEW to promote policies that aim to develop and implement water conservation initiatives in the sector. 	KT1.6		
	<ul style="list-style-type: none"> * Review Lebanon's dam experience to-date to inform the planning, design, construction, and operation phases of dam implementation. 	KT1.7		MoEW
	<ul style="list-style-type: none"> • Amend Building Regulations to include a requirement for a minimum standard of water efficiency in new facilities. 	KT1.8		DGUP, OEA
Water Demand Management				
<p>⊖ The following deficiencies identified in the strategy will hinder sustainable resource allocation:</p> <ul style="list-style-type: none"> - Initiatives that reduce water losses in domestic supply schemes do not consider Better Management Practices (BMPs). - The strategy does not consider ecosystem water demands (particularly with the new water-energy-food-ecosystems nexus). 	<ul style="list-style-type: none"> * Develop a long-term national strategy to promote social behavior change and encourage consumers to efficiently use water. 	KT1.9	MoEW	
	<ul style="list-style-type: none"> * Propose initiatives to curb the uncontrolled groundwater extraction from private wells. 	KT1.10		
	<ul style="list-style-type: none"> * Propose initiatives – with a defined budget and timeline – to reduce Non-Revenue Water (NRW). 	KT1.11		
	<ul style="list-style-type: none"> * Prioritize rehabilitation of the distribution networks to minimize losses. 	KT1.12		
	<ul style="list-style-type: none"> * Encourage investment in water loss reduction systems (i.e. active leak detection, pressure management, etc.). 	KT1.13		
	<ul style="list-style-type: none"> * Strengthen regular network maintenance programs. 	KT1.14		
	<ul style="list-style-type: none"> * Direct new funds towards installation, reading and maintenance of bulk and district meters, and ensure the availability of continuous funding for calibration and maintenance 	KT1.15		
	<ul style="list-style-type: none"> • Promote installation of water saving devices for domestic use. 	KT1.16		
	<ul style="list-style-type: none"> • Assess potential financial incentives to encourage residents and business owners to make investments in water efficiency. 	KT1.17 (KT1.9)		
	<ul style="list-style-type: none"> • Develop programs to promote water efficiency at the household level, through partnerships with manufacturers, retailers and distributors, homebuilders, and contractors and develop branding labels. 	KT1.18 (KT1.17) (KT1.9) (KT1.8)		
	<ul style="list-style-type: none"> • Establish minimum water efficiency specifications through codes and standards. 	KT1.19 (KT1.8)		
<ul style="list-style-type: none"> • Develop programs to build the capacity of contractors to retrofit facilities for water savings. 	KT1.20 (KT1.18) (KT1.17) (KT1.19)			
<ul style="list-style-type: none"> • Provide technical support for industries to improve water efficiency and wastewater management. 	KT1.21	MoEW, MoI		

Main Impacts	Mitigation Strategies and Policy Recommendations to Optimize Environmental and Social Impacts	ID	Responsibility	
	<ul style="list-style-type: none"> * Establish monitoring frameworks to track the quantities of water used per industrial sector. Accordingly, tailored water conservation programs can be developed. 	KT1.22		
	<ul style="list-style-type: none"> • MoEW to collaborate with MoA to advocate changes to agricultural practices to reduce the demand for water. 	KT1.23	MoEW, MoA	
	<ul style="list-style-type: none"> • MoA to produce irrigation best practices guide and water management toolkit for field crop growers. 	KT1.24		
	<ul style="list-style-type: none"> • Improve efficiency of bulk irrigation water supply. 	KT1.25 (KT1.23)		
	<ul style="list-style-type: none"> * Introduce appropriate water tariffs and incentives in order to promote water efficiency in irrigation and higher economic returns for irrigated agricultural products. 	KT1.26		
	<ul style="list-style-type: none"> * MoEW to collaborate with and encourage MoA to consider the use of targeted adaptation funds or temporary technological subsidies to support farmers in adopting on-farm measures to enhance water efficiency (such as crop rotation, adjusting planting times, etc.) 	KT1.27 (KT1.25) (KT1.23)		
Non-Conventional Water Sources				
<p>⊖ The strategy does not sufficiently address the potential of non-conventional water sources, hindering effective water management:</p> <ul style="list-style-type: none"> - No targets are set to pursue the development of non-conventional water resources for 2020-2035. - Expected volumes of water from non-conventional sources as a production component were not incorporated in the national water balance. 	<ul style="list-style-type: none"> • Assess the potential contribution of non-conventional water resources to the water balance as an available water source and set a realistic target for 2035 accordingly. 	KT1.28	MoEW, MoE, MoA, DGUP, OEA	
	<ul style="list-style-type: none"> • Promote alternative technologies such as rainwater harvesting to improve irrigation supply. 	KT1.29		
	<ul style="list-style-type: none"> • Amend Building Regulations to include a requirement for rainwater harvesting in new facilities. 	KT1.30		
	<ul style="list-style-type: none"> * Prioritize the exploration of the potential for Artificial Aquifer Recharge (AAR) and ensure that pilots are designed and implemented in areas where upscaling is needed to meet water deficit. 	KT1.31		
Reuse of Treated Wastewater and Sludge				
<p>⊖ The strategy lacks wastewater treatment and sludge re-use targets.</p> <p>⊕ The following proposed initiatives in the strategy will enhance water management:</p> <ul style="list-style-type: none"> - Commitment to developing the necessary legal framework for the reuse of treated wastewater. - A push for the adoption of standards and guidelines for wastewater reuse. 	<ul style="list-style-type: none"> • Identify realistic targets for increasing Treated Sewage Effluent (TSE) reuse and work towards achieving them. 	KT1.32	MoEW, CDR	
	<ul style="list-style-type: none"> * Require that the planned WWTPs, particularly those in rural/ agricultural areas or areas with significant water deficits, be reassessed in terms of the feasibility of TSE reuse and redesigned accordingly, taking environmental costs and benefits into account. 	KT1.33		
	<ul style="list-style-type: none"> * Study TSE reuse directly in irrigation or indirectly through AAR as an important source of water within the national water balance. 	KT1.34 (KT1.28)		
	<ul style="list-style-type: none"> * Require an assessment of the potential of wastewater reuse in the WWTP EIAs and regulate TSE reuse in different sectors. 	KT1.35 (KT1.33)	MoE, MoEW	
		<ul style="list-style-type: none"> • Develop necessary procedures to monitor TSE and sludge reuse in agriculture and land reclamation and put in place the necessary monitoring system to respond to any non-compliances. 	KT1.36	MoA, RWEs, municipalities
Water Quality				
<p>⊕ If all proposed WWTPs are successfully implemented and adequately operated, then 100% of the generated domestic wastewater will be treated and will allow Lebanon to achieve SDG 6.2, "By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations".</p> <p>⊕ Wastewater collection, treatment and disposal will have significant impacts on both the natural environment and public health. Inland WWTPs will help reduce surface and groundwater pollution and coastal WWTPs will also reduce land-based sources of pollution into the Mediterranean Sea.</p>	<ul style="list-style-type: none"> * Set the infrastructure initiatives to be contingent on achieving some progress on the governance end and successfully operating the existing WWTPs. 	KT1.37	MoEW, CDR	
	<ul style="list-style-type: none"> * Prioritize putting into operation the existing treatment plants at their design treatment levels over the construction of new WWTPs. 	KT1.38	MoEW, CDR, RWEs	
	<ul style="list-style-type: none"> * Abstain from the construction of additional WWTPs if the networks connecting to them are not complete and/ or if their long-term operation and maintenance are not secured by the concerned RWEs. 	KT1.39		
	<ul style="list-style-type: none"> * Develop a National Plan for the Operation and Maintenance of wastewater treatment plants. 	KT1.40		
		<ul style="list-style-type: none"> • Develop contingency plans for wastewater treatment plants (i.e., holding tanks, etc.). Allow raw sewage bypasses only upon approval from the MoE and MoEW as part of the EIA process. 	KT1.41	MoE, MoEW
		<ul style="list-style-type: none"> • Verify the conditions of the receiving water to ascertain if it is in a state to receive the volume of TSE to be discharged. 	KT1.42	
		<ul style="list-style-type: none"> • Ensure that the storm water network is separated from the wastewater network during the design of the WWTPs. If not, ensure that storm water runoff is accounted for in the WWTP design and capacity. 	KT1.43	
		<ul style="list-style-type: none"> * Ensure EMPs of the WWTP EIAs include: daily testing of TSE, and sampling of receiving environment. 	KT1.44 (KT1.41) (KT1.35)	
		<ul style="list-style-type: none"> * Empower MoE and MoEW to enforce the measures of the EMP on the RWE/WWTP operator. 	KT1.45	

Main Impacts	Mitigation Strategies and Policy Recommendations to Optimize Environmental and Social Impacts	ID	Responsibility	
	<ul style="list-style-type: none"> * Establish an adequate buffer zone for inland WWTPs either through MoEW/MoE/DGUP regulations or through the WWTP EIA process. 	KT1.46		
	<ul style="list-style-type: none"> • Implement the “Polluter Pays Principle” of Law 444/2002 and law 192/2020 to reduce the point and non-point sources of pollution affecting water resources. 	KT1.47	MoE, MoIM	
	<ul style="list-style-type: none"> • Continue with the efforts to ensure environmental compliance of industries, other classified establishments, health care centers etc., where wastewater is treated at the establishment level. 	KT1.48	MoI, MoIM, MoPH, MoE	
	<ul style="list-style-type: none"> • Develop a national plan/framework for agriculture point and nonpoint sources pollution prevention. 	KT1.49	MoA, MoE	
Governance				
⊕ Timely implementation of the various actions at the water governance level is expected to promote IWRM and ensure the sustainability of present and future initiatives.	<ul style="list-style-type: none"> * Interlink the implementation schedules of proposed water governance reform initiatives and infrastructure projects in the Updated NWSS-MoEW (2020). 	KT1.50 (KT1.37)	MoEW	
	<ul style="list-style-type: none"> * Aim to adopt the international frameworks for good governance (OECD Twelve Principles of Good Water Governance). 	KT.1.51		
	<ul style="list-style-type: none"> • Support the design and implementation of policies that are consistent with the long-term goals of water security, in a sustainable, integrated and inclusive way, at an acceptable cost, and in a reasonable time frame. 	KT1.52 (KT1.51)		
	<ul style="list-style-type: none"> • Assess the possibility of public-private partnerships (PPPs) to make water services more efficient and commercially oriented and enhance the creditworthiness of their public partner and the latter’s ability to raise finance – and thus contribute indirectly to financing. 	KT1.53		
	<ul style="list-style-type: none"> • Urge donors, and businesses to promote adequate funding for R&D and innovation in water, using research grants, challenge funds, prizes, support of pilot ventures, venture capital, and other means. 	KT1.54 (KT1.4)		
KT2. Biodiversity and Ecosystem				
Potential Impacts of man-made water bodies				
<p>⊖ Proposed dams can change the natural water conditions required for riparian, terrestrial and coastal and marine species and ecosystems by:</p> <ul style="list-style-type: none"> - Changing river flows, - Altering turbidity/sediment levels, - Increasing water levels, - Increasing the salinity of the coastal area at and near estuaries during the dry season. <p>⊖ Proposed dams create physical obstructions for riparian, terrestrial, coastal, and marine species.</p> <p>⊖ Proposed dams occupy riparian areas; riparian habitats play several roles in maintaining and conserving ecosystem functioning.</p> <p>⊖ Six dams listed in the Strategy are within a 500 m buffer zone from protected areas; Lebanon Law of Environment (444) imposes EIA reports for any project in or near protected areas.</p> <p>⊖ Several dams will inundate forests, especially dams located on river systems.</p> <p>⊕ Proposed hill lakes and ponds can promote wildlife, provide water for livestock and nearby flora, and provide helicopters and fire trucks with water to extinguish forest fires</p> <p>⊖ Proposed hill lakes and ponds have the following potential adverse impacts:</p> <ul style="list-style-type: none"> - Drowning of granivorous birds, reptiles, and mammals due to steep slopes. - They may collapse and consequently harm surrounding local communities. 	<ul style="list-style-type: none"> • Develop and implement a program for monitoring the ecological effect of dams prior to their construction (pre-monitoring) and after dam completion (post-monitoring). 	KT2.1	MoE	
	<ul style="list-style-type: none"> • Develop guidelines for the preparation of EIAs of dams projects in Lebanon. 	KT2.2		
	<ul style="list-style-type: none"> • Identify biodiversity hotspots, determine vulnerabilities and trends, and provide guidelines on the management of water bodies that include minimum environmental flows, turbidity/sediment levels, water quality patterns, and erosion-control measures. 	KT2.3		
	<ul style="list-style-type: none"> • Prepare restoration plans for degraded man-made water bodies and lakes. 	KT2.4		
		<ul style="list-style-type: none"> * Consider the ecosystem water demand and water quality requirement when allocating water sources. 	KT2.5 (KT1.4)	MoEW
		<ul style="list-style-type: none"> * Prepare guidelines for the construction, operation and maintenance of water and wastewater networks. 	KT2.6	
		<ul style="list-style-type: none"> • Increase household connectivity to the wastewater treatment networks to prevent contamination of ecologic. 	KT2.7	
		<ul style="list-style-type: none"> • Assess alternatives to infrastructure projects located in Important Biodiversity Areas. 	KT2.8	
		<ul style="list-style-type: none"> • Specify activity restrictions for recreational water users of water bodies. 	KT2.9	
		<ul style="list-style-type: none"> * Develop guidelines for the construction of dams and hill lakes, including buffer zones, requirements to facilitate the migration of animals and birds, etc. 	KT2.10 (KT2.2)	MoEW, MoE, MoA
		<ul style="list-style-type: none"> • Prepare guidelines for the restoration of riparian habitats around man-made water bodies. 	KT2.11 (KT2.4)	MoE
		<ul style="list-style-type: none"> • Coordinate with MoEW to review the dams’ program, particularly dams encroaching on protected areas or sites, to minimize the program’s cumulative impact on Lebanon’s ecology and natural heritage. 	KT2.12	
		<ul style="list-style-type: none"> • Review MoA’s policy on “alternative trees” to consider the restoration of riparian habitats and seedling requirements (including storage and transplanting requirements). <ul style="list-style-type: none"> - Require EMPs to include in this policy; the EMP should also assign an agency responsible for the monitoring of this activity. 	KT2.13	MoA, MoE

Main Impacts	Mitigation Strategies and Policy Recommendations to Optimize Environmental and Social Impacts	ID	Responsibility
Potential Impacts of Proposed WWTPs			
⊕ The proposed WWTPs (if well-operated) will reduce the growing pressure on natural ecosystems caused by the haphazard discharge of untreated wastewater.	* Prepare guidelines for the construction and O&M of WWTPs	KT2.14 (KT1.46) (KT1.40)	MoEW
	• Abstain from discharging treated wastewater into water bodies located in sensitive areas.	KT2.15 (KT1.42)	MoEW, CDR, RWEs
	• Ensure the regular maintenance of the infrastructure of the WWTPs to prevent leakages.	KT2.16 (KT1.46)	RWEs, CDR
	• Abstain from constructing WWTPs in protected areas (PAs) or their respective buffer zones; maintain a minimum distance of 1,000 meters	KT2.17	MoE
	• EIAs should assess project location alternatives to the proposed WWTPs located within sensitive areas.	KT2.18	MoE
KT3. Climate Change Adaptation and Mitigation			
Climate Change Adaptation			
⊖ Expected climate change impacts (changes in precipitation, temperature, evapotranspiration and sea level) can introduce a high level of uncertainty regarding the design and operation of proposed water, wastewater and irrigation infrastructure; failure to address this will impact the projects' climate change resilience. ⊖ The failure of the proposed water balances in the strategy to consider projected climate change impacts on water resources will hinder the efficacy of water development policies and projects. ⊕ The proposed IHIS in the Strategy will help improve knowledge on climate change impacts on water resources.	* Develop basin management plans that take into consideration climate change to achieve climate-resilient water resource management. Accordingly, the Strategy's proposed WEAP models that adopt an IWRM approach ought to: - Consider seasonal climatic changes - Consider intra-watershed climate variations	KT3.1	MoEW
	• Disseminate the proposed drought and flood management plans with the Climate Change Unit in the MoE to consider climate change forecast models.	KT3.2	MoEW, MoE
	• Take into consideration seasonal fluctuations in water resources during planning and calculation of water balance, which are expected to worsen due to climate change.	KT3.3	
	• Take into account climate change impacts on projected water availability in the proposed infrastructural projects.	KT3.4	
	• Conduct climate change risk assessment to be used as a tool to inform development policies and activities.	KT3.5	MoE
	• Develop a national adaptation framework to increase the resilience of existing and proposed water and wastewater infrastructure.	KT3.6	MoEW, CDR, MoE
Climate Change Mitigation			
⊕ Contribution of the Strategy towards achieving Lebanon's Nationally Determined Contribution (2020) through reducing GHG emissions from regulated and unregulated pumping processes. ⊕ The proposed impoundment projects will reduce the need for groundwater use, thus reducing GHG emissions from regulated and unregulated pumping processes. ⊖ The construction activities and operation of the proposed infrastructural projects will require significant energy demands. ⊖ Resulting land-use changes or deforestation activities of the proposed infrastructural projects will lead to an increase in GHG emissions. ⊖ Improper O&M of water reservoirs can result in water body eutrophication, which increases CH ₄ emissions.	• Prepare and adopt a Life Cycle Assessment for the proposed infrastructure projects to reduce GHG emissions.	KT3.7	MoEW
	• Measures to reduce GHG emissions should be identified at a project level.	KT3.8 (KT3.7)	MoEW
	* Develop a national-level solar water pumping plan: - Identify and prioritize areas suitable for solar water pumping (for potable water and irrigation use). - Allocate a budget for the implementation of solar water pumping systems.	KT3.9	
KT4. Land Use and Conservation			
Land Use			
⊖ The construction and operation of proposed dams and other impoundments may cause: - Changes/losses in forests, agricultural lands, wetlands, and built areas. - infringe on existing and/or planned protected areas. ⊕ Proposed irrigation schemes in the Strategy will provide water to water-scarce areas which may increase the agricultural land cover and diversify crops. ⊖ Several of the proposed infrastructural projects are located in areas with a high risk of soil erosion, landslides, and on areas with faults.	* Coordinate with DGUP to ensure that the proposed initiatives under the Updated NWSS-MoEW (2020) are in line with the national land use and management plans (i.e., buffer zones, protected waterside habitats, pollution point and non-point sources, agricultural and industrial zones, residential agglomerations, heritage sites and recreation/touristic areas).	KT4.1	MoEW, MoE, DGUP
	Land Conservation		
⊕ Establishing protection zones may alter the land use activities in the area, reduce the land use intensity, or halt some of the activities identified as major sources of pollution in this area.	• Prepare and adopt Life Cycle Assessment for the construction of the proposed infrastructure projects to use as a decision-making tool and to inform EIAs.	KT4.2 (KT3.7)	MoEW, MoE

Main Impacts	Mitigation Strategies and Policy Recommendations to Optimize Environmental and Social Impacts	ID	Responsibility
<p>⊖ Changes in land use can result in land degradation and impact freshwater systems; resulting soil erosion reduces water quantity and quality reaching water bodies.</p> <p>⊖ The construction of proposed infrastructure projects may cause an increase in quarrying and the generation of construction and demolition waste.</p>	<ul style="list-style-type: none"> Regulate and monitor raw material extraction throughout the duration of the projects' implementation. 	KT4.3	MoE
	<ul style="list-style-type: none"> Develop the delineation of buffer zones for man-made water bodies and springs in coordination with the Directorate General of Urban Planning. 	KT4.4 (KT4.1)	MoEW, MoE, DGUP
	<ul style="list-style-type: none"> Develop land use regulations for watersheds to protect catchment areas, specifying which activities are sanctioned, delineating buffer zones for man-made water bodies and springs, implementing erosion-control measures, and others. 	KT4.5 (KT4.4)	
Sustainable Urban Planning			
<p>⊖ Absence of comprehensive strategic urban plan has led to haphazard urbanization and development and unregulated construction activities; this will be exacerbated by the proposed infrastructural projects.</p>	<ul style="list-style-type: none"> Develop updated strategic National Land Use Master Plan that is aligned with all national sectoral strategies, including the Updated NWSS-MoEW (2020) and in coordination with other relevant parties. 	KT4.6	MoEW, MoE, DGUP, CNRS, MoPW, MoA, MoT
	<ul style="list-style-type: none"> * Promote water-sensitive urban and building design practices (i.e. green roofs, water-permeable pavements/roads, tree pits to drain roads, swales to collect and convey stormwater). 	KT4.7 (KT1.30)	DGUP, MoEW, MoE, MoPW, MoIM
KT5. Water-Energy Nexus			
<p>⊖ The operation of the proposed water and wastewater infrastructure projects will require additional energy demands.</p> <p>⊖ The additional energy demand needed to operate the proposed water and wastewater infrastructure should be carefully considered, as well as the billing system needed to recover the energy cost.</p>	<ul style="list-style-type: none"> Establish management information system to collect energy consumption data at RWE level by the water sector. 	KT5.1	MoEW
	<ul style="list-style-type: none"> Align hydropower (dams) initiatives with the hydroelectricity target in the 2020 Renewable Energy Outlook and review Lebanon's hydropower production potential. 	KT5.2	
	<ul style="list-style-type: none"> Remove barriers to hydropower production and clear-up the legal framework to incentivize the private sector. 	KT5.3	
	<ul style="list-style-type: none"> Assess the energy needs of the proposed infrastructural projects and identify energy efficient and sustainable methods for powering them. 	KT5.4	
	<ul style="list-style-type: none"> Improve energy efficiency in water facilities and further promote renewable energy technology. 	KT5.5	
	<ul style="list-style-type: none"> * Adopt strategic energy management in RWEs and other water utilities 	KT5.6	MoEW, RWEs
KT6. Water-Food Nexus			
<p>⊖ The prioritization criteria for proposed irrigation projects in the Strategy do not consider the sub-regional disparities in cropland sensitivity to natural and physical environmental changes, including the effects of projected changes in climate.</p> <p>⊖ MoA's National Agricultural Strategy (NAS) (2020-2025) doesn't specify the spatial distribution of the potential irrigated lands and their water needs. As such, irrigation infrastructure plans in the Updated NWSS -MoEW (2020) also doesn't consider the latter.</p>	<ul style="list-style-type: none"> * Enhance coordination between MoEW and MoA to ensure that the National Agriculture Strategy (NAS) and the Updated NWSS – MoEW (2020) are aligned. 	KT6.1 (KT1.23)	MoEW, MoA
	<ul style="list-style-type: none"> Enhance coordination between MoEW and MoA to prioritize the implementation of NAS initiatives that aim to reduce agricultural pollution at the farm-level in groundwater and surface water pollution-vulnerable regions. 	KT6.2 (KT1.49)	
	<ul style="list-style-type: none"> * Develop regional irrigation plans that aim to achieve more sustainable food production and that maximize water efficiency. 	KT6.3 (KT1.23) (KT1.25)	
KT7. Social and Socio-Economic Environment			
Cost Recovery			
<p>⊕ The proposed governance reforms will bridge the RWEs' deficit and allow for financial recovery. Thus, cost recovery will result in an increase in revenues which will allow RWEs to secure funds for future water investments.</p>	<ul style="list-style-type: none"> * Set a framework to control and monitor the water bottling industry in Lebanon. 	KT7.1	MoEW, MoPH, MoE
	<ul style="list-style-type: none"> Promote R&D in the water sector to implement innovative solutions for productive sectors to collect, use and re-use water. 	KT7.2 (KT1.4) (KT1.54)	MoEW, MoA, MoI, MoE
	<ul style="list-style-type: none"> * Prioritize the planned WWTPs and WTPs in the strategy based on their impacts on the coastal areas and rivers that will generate greater economic benefits. 	KT7.3	MoEW
	<ul style="list-style-type: none"> Develop a financing strategy for the RWEs enabling them to recruit highly qualified permanent staff to run water projects and oversee the operations. 	KT7.4	MoEW, MoF
	<ul style="list-style-type: none"> Introduce the water footprint tool on a household-level and on a national scale. 	KT7.5 (KT1.9) (KT1.17) (KT1.18)	MoEW, MoE, MoIM
	<ul style="list-style-type: none"> Enforce regulations to limit the illegal abstraction of groundwater and depletion of groundwater resources. 	KT7.6 (KT1.10)	

Main Impacts	Mitigation Strategies and Policy Recommendations to Optimize Environmental and Social Impacts	ID	Responsibility
	<ul style="list-style-type: none"> Introduce special tariffs charged for groundwater exploitation and use as part of the permitting scheme for drilling wells. 	KT7.7 (KT7.6) (KT1.10)	MoEW, MoPW, MoIM, WEs
	<ul style="list-style-type: none"> Strengthen monitoring and metering to eliminate illegal water connections. 	KT7.8	
	<ul style="list-style-type: none"> Implement accountability measures: for example, the accountability of administration at every level (regarding implementation of plans and their achievement or shortcoming). 	KT7.9	
	<ul style="list-style-type: none"> Strengthen the O&M of water infrastructure by developing systems that can enhance operational management, planning, or emergency response. 	KT7.10 (KT1.40)	
	<ul style="list-style-type: none"> Use digital water conservancy through the application of information and communication technology in infrastructure such as in monitoring stations, data centers, telecommunication, decision support systems, etc. 	KT7.11	
	<ul style="list-style-type: none"> Enforce regulations and impose penalties for water-usage payment violations. 	KT7.12	
	<ul style="list-style-type: none"> Use water allocation models to calculate water pricing. 	KT7.13	MoEW
	<ul style="list-style-type: none"> Use a life-cycle assessment tool to determine the best options for domestic water conservation method. 	KT7.14 (KT1.18) (KT1.17) (KT1.9)	
	<ul style="list-style-type: none"> Calculate shadow prices and integrate the environmental and social cost of water use in water pricing. 	KT7.15	
	<ul style="list-style-type: none"> Raise the priority of water in national investment and financing programs through the following: <ul style="list-style-type: none"> - Develop a communications strategy for spreading evidence of the link from water to growth. - Create joint initiatives that add weight to the case for water investment. - Engage corporate businesses in water development in communities - Develop indicators of “water risk” to the businesses’ operations to help quantify their dependence on water 	KT7.16 (KT7.2) (KT1.54) (KT1.4)	
Public Health & Livelihood Conditions			
⊕ The Strategy aims to improve collection, conveyance, and treatment of wastewater, followed by continuous monitoring, which will minimize the contamination of freshwater, soil, and agriculture products.	<ul style="list-style-type: none"> Promote awareness and education regarding water conservation, water issues, among the wider public, including businesses and industries. The campaign should also inform citizens and water users on their rights and responsibilities. 	(KT7.18) (KT1.18) (KT1.17) (KT1.9)	MoEW, MoI, MoEHE, MoE, NGOs and citizens
	<ul style="list-style-type: none"> Implement a monitoring and management program for surface water and wastewater to minimize the risk of water and soil contamination on public health. 	KT7.19	MoEW, MoPW, MoA, MoPH
	<ul style="list-style-type: none"> Monitor cases of waterborne diseases to reflect the efficiency of wastewater treatment projects. 	KT7.20	
Purchasing Power Capacity of Water Users			
⊕ The Strategy suggests the implementation of a volumetric tariff based on blocks that will take into account the most vulnerable populations in the lower blocks; this will help diffuse the impact of the new tariff on vulnerable groups. ⊕ The Strategy proposes to increase water supply, ensuring access to sufficient and safe water for households. This will result in increasing households’ savings on private water purchase and other indirect costs.	<ul style="list-style-type: none"> Advocate for transparency between users/consumers and the water establishments to attain common responsive grounds in understanding the link between water scarcity and new proposed tariffs. 	KT7.21	MoEW, MoSA, MoE, MoEW
	<ul style="list-style-type: none"> Assess the possibility to implement subsidized programs to help unprivileged households access drinking water supply at reduced costs (e.g., water filters, pumps, etc.). 	KT7.22	
	<ul style="list-style-type: none"> Align Strategy with national social protection programs to help underprivileged people afford to buy water or paying for water tariffs, given that more than 75% of the Lebanese population are living in poverty conditions. 	KT7.23	
	<ul style="list-style-type: none"> Align Strategy with other national strategies, such as the NAS, to collaborate on initiatives and projects that would help the farmers reduce their water consumption while maximizing their productivity. 	KT7.24 (KT6.1) (KT1.23)	
Land Expropriations			
⊖ Land expropriation affects landowners and changes the type of land uses and landscape.	<ul style="list-style-type: none"> Integrate requirement to optimize land-use in large scale water projects in the guidelines for the construction of dams and hill lakes; this will reduce the costs of expropriation. 	KT7.25	MoEW, CDR
Absorptive Capacity			
⊖ The proposed projects in the strategy will require large investments that exceed the capacity of the Lebanese economy.	<ul style="list-style-type: none"> Distribute the total estimated investment value in the Strategy across priority projects and different short, medium and long-term timeframes for an efficient allocation of investments, giving enough time for projects to be completed and operational. 	KT7.26	MoEW, CDR
Economic Resilience			

Main Impacts	Mitigation Strategies and Policy Recommendations to Optimize Environmental and Social Impacts	ID	Responsibility
<ul style="list-style-type: none"> - The water sector showcased its weak resilience to adapt to external shocks and implement efficient and responsive mitigation and contingency measures; highlighting the need for a new water strategy and immediate sector reforms. 	<ul style="list-style-type: none"> * Develop a water emergency fund to support the implementation of mitigation measures and adaptation plans in case of external unpredictable shocks affecting the water sector. 	KT7.27	MoEW, MoF, CDR
	<ul style="list-style-type: none"> • Plan restoration and rehabilitation programs for the areas impacted by the Beirut Port blast, particularly proposed wastewater infrastructure, water networks, etc. 	KT7.28	
KT8. Disaster Prevention and Management			
<ul style="list-style-type: none"> ⊖ Failure to address the below in the strategy has hindered efforts to integrate the water sector strategy with national disaster prevention and management efforts: <ul style="list-style-type: none"> - Risks of dam and hill lake failures, or forest fires. - Water sector disaster management with a strategic approach and a holistic overview that can prevent hazards and mitigate the impacts of disasters. 	<ul style="list-style-type: none"> • Set up a holistic plan at the MoEW to address the main types of water-related disasters (floods, droughts, dam breaks, fire) in alignment with the National Disaster Risk Management Strategy. 	KT8.1	MoEW, MoIM, MoD, CNRS, DRMU, MoE, MoPH
	<ul style="list-style-type: none"> • Ensure the proposed disaster risk monitoring unit is aligned with the National Disaster Risk Management Strategy. 	KT8.2	
	<ul style="list-style-type: none"> • Establish a dam safety program and dam break analysis. 	KT8.3	
	<ul style="list-style-type: none"> • Consider strategic locations of hill lakes and water reservoirs to support in the response to forest fires in coordination with the Lebanese Army and Green Plan. 	KT8.4 (KT2.10) (KT2.2)	
	<ul style="list-style-type: none"> • Include the MoEW in the inter-ministerial committee for forest fire management as a support institution. 	KT8.5	
	<ul style="list-style-type: none"> • Establish a communication protocol between the Disaster Risk Management (DRM) and the disaster monitoring unit of the MoEW and other institutions in the National Strategy for Forest Fire Management. 	KT8.6	MoEW, MoE
	<ul style="list-style-type: none"> • Develop guidelines for hill lake monitoring; ensure that the latter is integrated in Environmental Management Plans. 	KT8.7	
	<ul style="list-style-type: none"> • Define and allocate responsibility for hill lake water quality, quantity, and infrastructure monitoring for both public and private hill lakes. 	KT8.8 (KT8.7)	
KT9. Data Management			
<ul style="list-style-type: none"> ⊕ The generated data from the proposed IHIS can be used as soon as practicable to revise the adopted water flow numbers, re-assess the calculated water balances at the national and river basin levels as well as to reconsider the need for some of the proposed projects and their impact on the sustainability of the water resources. ⊖ Failure to address the development and implementation of water quality monitoring in the proposed IHIS will lead to lack of data required for developing pollution prevention and management strategies for surface and groundwater sources. <ul style="list-style-type: none"> - Water quality needs to be managed at two levels (1) water sources and (2) water supply and distribution. <ul style="list-style-type: none"> ⊖ The Strategy focused on water quantity monitoring with no mention of water quality monitoring stations along the rivers or the development and implementation of water quality monitoring programs. ⊕ The Strategy proposed groundwater monitoring that will have a positive environmental and public health impact if the collected data and the mapping results are used to protect groundwater resources. ⊖ Initiatives regarding the adoption of an operational water quality monitoring are neither given a priority of implementation, nor pegged to a timeline, or included in the overall budget. ⊖ The Strategy missed to mention an infrastructure monitoring system. 	<ul style="list-style-type: none"> • Develop technical assistance for data management. <ul style="list-style-type: none"> - Include staff training in the IHIS studies and timescale. - Elaborate inter-institutional coordination for better integrated management. - Establish a system that ensures the integration of the collected data as part of the IHIS into the decision-making process, to refine the proposed activities and improve water resources management. 	KT9.1	MoEW, MoA, MoPH, MoE, LRA, CNRS
	<ul style="list-style-type: none"> • Establish water quality monitoring within the IHIS for water resources (rivers, wells, springs) and water supply and distribution. 	KT9.2 (KT7.19)	MoEW, RWEs, LRA, LARI, MoPW – LMS, MoE
	<ul style="list-style-type: none"> • Prioritize building the capacity of the RWE laboratories to perform the needed water quality monitoring (human resources, equipment, QA/QC systems, reagents and other consumables, etc.). 	KT9.3 (KT7.4)	
	<ul style="list-style-type: none"> • Automation of water resources monitoring system. 	KT9.4 (KT7.11)	
	<ul style="list-style-type: none"> • Establish an infrastructure monitoring system within the RWE's and link it to the IHIS within MoEW. 	KT9.5	MoEW, RWEs, LRA
	<ul style="list-style-type: none"> • Establish water sector data collection standards and codes to be adopted across all institutions (e.g. ArcGIS requirements) to ensure consistent database formats. Set a framework for IHIS data collection: <ul style="list-style-type: none"> - Develop mechanism to update data, - Develop a legal framework for data sharing. 	KT9.6	MoEW
	<ul style="list-style-type: none"> • Develop data-sharing protocols to harmonize and standardize data collection and sharing methods and develop management and exchange protocols to allow subnational data to be interpreted and collated at the national level. 	KT9.7	
KT10. Achieving Integrated Water Resource Management (IWRM)			
<ul style="list-style-type: none"> ⊖ The Strategy's approach is not aligned with IWRM principles; thus, hindering its achievement: <ul style="list-style-type: none"> - The strategy proposed supply augmentation projects at the level of municipal supply systems using a simplified and unified demand across all geographic areas without showing considerations to socio-economic systems, nor showing the link between the proposed withdrawals and the basins/ catchment areas, nor looking at interlinkages with groundwater aquifers. - The Strategy didn't address the need for IWRM-specific training and capacity building including the creation and functioning of River Basin Organizations, other collaboration platforms as well as the communication with citizens and users, with due consideration of gender aspects and particular vulnerable groups. - The Strategy lacks the following: 	<ul style="list-style-type: none"> • Strengthen political will for IWRM by clearly communicating and demonstrating the value of implementing IWRM for achieving multiple sustainable development objectives to key stakeholders at all levels and across sectors. 	KT10.1	MoEW
	<ul style="list-style-type: none"> • Dedicate budgeting for IWRM activities and more efficient use of existing resources in a coordinated manner are needed to address the financing gap. 	KT10.2	MoEW, CoM, MoA, MoE, MoI, MoT, etc.
	<ul style="list-style-type: none"> • Coordinate budgeting across sectors for more efficient and transparent use of existing resources. 	KT10.3	
	<ul style="list-style-type: none"> • Integrate IWRM through considering the socio-economic system, water balance estimation at the river basin and interlinkage with groundwater aquifers and the quantitative impact of climate change on water availability as well as climate change adaptation and mitigation measures. 	KT10.4 (KT1.1) (KT1.2) (KT3.1) (KT3.6)	MoEW
	<ul style="list-style-type: none"> • Dedicate a unit at the MoEW to follow up on the progress towards achieving IWRM and ensure that the data collected and WEAP modelling conducted is feeding back into the strategy to refine the proposed projects. 	KT10.5	MoEW

Main Impacts	Mitigation Strategies and Policy Recommendations to Optimize Environmental and Social Impacts	ID	Responsibility	
<ul style="list-style-type: none"> ○ IWRM implementation plan, ○ Water needs by economic sector, ○ Monitoring, evaluation, or documentation to follow up on IWRM implementation. 	<ul style="list-style-type: none"> • Enhance and retain institutional and human capacity for IWRM planning, implementation, and enforcement. In conjunction with funded capacity development programs, it is important to create incentives to keep staff in government agencies and provide practical experience-sharing opportunities. 	KT10.6 (KT10.5)	MoEW, RWEs	
	<ul style="list-style-type: none"> • Prioritize issuing Water Code executive decrees related to the National Water Council and to watershed plans, to promote cross-sectoral coordination and management activities, particularly at the basin and aquifer levels, for sustainable and efficient water management. 	KT10.7	MoEW, MPs, CoM	
KT11. Achieving SDGs and International Commitments				
<p>⊖ The lack in addressing the below will hinder the timely achievement of SDG 6:</p> <ul style="list-style-type: none"> - The strategy focus is more on providing water rather than “safe” water. (refer to KT1 and KT9.) - Wastewater reuse is mentioned but not given needed focus. (refer to “Reuse of Treated Wastewater and Sludge” under KT1.) - Sustainability of withdrawals is not clear in the strategy. (refer to “Sustainable Resource Allocation” under KT1.) - Water allocation is at the administrative district level rather than the basin/ catchment level. (refer to KT10. and “Sustainable Resource Allocation” under KT1.) - Groundwater withdrawal appears to be unsustainable. (refer to “Sustainable Resource Allocation” under KT1 and KT5.) - Withdrawals by other sectors (industry, tourism, etc.) are not considered separately. (refer to “Efficient Water Use” under KT1.) - Climate change consideration is not elaborated. (refer to KT3.) - The implementation of IWRM is in its infancy. (refer to KT10.) 	<ul style="list-style-type: none"> • Establish a task force for coordinating and leading activities to work towards the achievement of SDG 6. This would bring together the key institutions and national focal points responsible for different elements of water resources management such as wastewater treatment and reuse, pollution control, ecosystems, clean water and sanitation, water-use efficiency, and water scarcity. 	KT11.1	MoEW, RWEs, MoE, MoA, MoIM, MoT, Mol...	
KT12. Stewardship and Stakeholder Engagement				
<p>⊕ The Strategy has committed to strengthening water stewardship through the implementation of the water code and governance-level initiatives that enhance information sharing, communication, and coordination between the concerned stakeholders and with the public.</p> <ul style="list-style-type: none"> - Lack of confidence and mistrust in the government’s actions have led to public opposition that have hindered the implementation of proposed projects. The following gaps with addressing this concern remain: <ul style="list-style-type: none"> ⊖ The strategy does not directly address citizens and primary users of the water sector. ⊖ The strategy does not outline the roles and responsibilities of the private sector in supporting governmental mandates. 	<ul style="list-style-type: none"> • Ensure that the data related to the water sector is accessible to the public and all stakeholders at no cost. 	KT12.1	MoEW	
	<ul style="list-style-type: none"> • Enforce Law 28/2017 (Access to information law) across water sector state administrations. 	KT12.2		
		<ul style="list-style-type: none"> * Propose water conservation and water-use optimization guidance actions directed towards water users, i.e. citizens (household/individual-level), industrialists and farmers in the Updated NWSS-MoEW (2020). 	KT12.3	MoEW, RWEs
		<ul style="list-style-type: none"> * Delineate the roles and responsibilities of citizens, civil society, local authorities and private sector for achieving strategy objectives in the Updated NWSS-MoEW (2020). 	KT12.4	
		<ul style="list-style-type: none"> • Engage civil society in strategy initiatives through organizing regular meetings with a committee of selected civil society representatives, academic and non-academic experts, and media representatives, and collaborating with educational institutions to engage youth in the implementation of proposed projects by providing learning opportunities through internships and site visits. 	KT12.5 (KT7.21)	
		<ul style="list-style-type: none"> • Establish a functional and efficient system for public-private partnership in the sector. 	KT12.6 (KT1.53)	
		<ul style="list-style-type: none"> * Outline public awareness campaign goals in the Updated NWSS-MoEW (2020): <ul style="list-style-type: none"> - Coordinate and collaborate with the public and private sector to implement national behavioral change and targeted awareness campaigns. - Endorse and build on existing community engagement initiatives, public awareness campaigns, and platforms in the water sector. - Develop a platform that can be used by the community to check ongoing projects and their status. 	KT12.7 (7.18) (KT1.18) (KT1.17) (KT1.9)	MoEW, MoEHE, MoE, Mol, NGOs
		<ul style="list-style-type: none"> • Conduct regular local workshops and information sessions to inform the public on water sector developments and to engage with water users. 	KT12.8 (KT12.5) (KT7.21)	MoEW, MoEHE, academic institutions

* Mitigation Strategies/Policy Recommendations for preliminary implementation (See Recommendations for Integrating SESA Findings in the Updated NWSS-MoEW (2020))