CONSULTANCY SERVICES FOR RIVER BASIN MANAGEMENT

ASSI RIVER BASIN

POLICY TARGET
AND
PROGRAMME OF MEASURES

MAY 2023

5 Assi Policy Targets and Programme of Measures

5.1 Policy Targets

When designing a PoM, each measure comes with an associated investment cost. On top of the results of any assessment of measures, additional socio-economic factors come into interplay, such as the readiness of the technological solution, social acceptability, equitability, any constraints related to the implementation of the measures, etc. which can facilitate or impede the uptake and effectiveness of the measure.

It is thus of paramount importance to stimulate a discussion with various stakeholders who bring in their local knowledge and expertise, and can verify the applicability of the findings, or highlight relevant constraints.

In this context, the objectives of the participatory approach in the ARB were:

- Assess the level of awareness of stakeholders within the basin on the problem of unmet demand and water quality, its drivers and root causes, and future projections (Step 1).
- Discuss and define, together with relevant stakeholders, a bundle of measures which are deemed adequate to tackle the issues of water supply reliability and water pollution in the basin, in order to safeguard their relevance and acceptability (Step 2).
- Define relevant policy targets and an associated Programme of Measures (PoMs) in ARB based on a participatory process with stakeholders from all levels (central, regional, local), and draft an Action Plan with their relevant roles. (Step 3).
- Discuss additional and follow-up actions needed.

As a result of the participatory process, a set of five (5) policy targets have been defined for the ARB. These policy targets would be subsequently addressed through a comprehensive action plan with relevant Programme of Measures. The primary purposes would be mitigating the issues of unmet demand and prevailing water stress conditions in the basin, as well as improving the water quality and limiting water pollution which can affect socio-economic growth and welfare. These are presented in Table 1 below.

Table 1 Policy targets resulting from participatory approach

Target Name	Target Code	No. of measures
Increase water use Efficiency and water Supply Reliability	ERS	13
Promote water Conservation	WCO	2
Protection of the Water resources and the Environment	PWE	10
PARticipatory water management	PAR	4
Socio-economic DEVelopment	DEV	2

To achieve these targets, a bundle of measures has been defined for each target, spanning from technical (infrastructure) and regulatory measures, to financial, educational and socio-economic measures, and addressing multiple sectors (i.e. the urban, agricultural, industrial, touristic, environmental). A total of 31 measures have been elaborated as presented in Table 4 below.

5.2 Detailed measures description

5.2.1 Urban sector

Measure ID and Name	ERS_U1: Actions to modernize the operation of water supply networks and improve water efficiency
Description	This measure focuses on modernizing the operation of water supply networks and improving water efficiency through the use of advanced technologies, upgraded infrastructure, and optimized operations. It aims to reduce water losses and enhance overall water management practices to achieve more sustainable water use. It includes: Leakage detection and control, rehabilitation of existing networks (incl. storage reservoirs), expansion of the BWE water supply network branches and connections. Improving network efficiency from 50% to 75%. The installation of solar panels in pumping stations is to be assessed.
Target	Residents, Municipalities, BWE
Activity Breakdown	In the Updated NWSS - 2020, there is a number of proposed rehabilitation/ expansion projects for BWE (see section **Error! Reference source not found.**). It includes the implementation of new distribution networks, wells, storage reservoirs, pumping stations, treatment plant, etc. until 2035. In summary, the proposed projects in Baalbek district include: • 131.5 km of transmission lines, • 346 km distribution network (priority 2) • 9 wells to be drilled and equipped, • 23 reservoirs to be constructed, • 63 old reservoirs to be rehabilitated, • 1 new tunnel, • 1 new WTP. The proposed projects in Hermel district include: • 22.5 km of transmission lines, • 100 km distribution network (priority 2) • 1 well to be drilled and equipped, • 1 well to be equipped and a new control room to be built, • 4 reservoirs to be constructed, • many old reservoirs to be rehabilitated, • 1 spring to be rehabilitated, • 1 well and PS to be rehabilitated. Moreover, the implementation of SCADA and DMA systems is suggested to connect all the components and facilitate the control and monitoring.
Timespan/Timeline	Medium - Long term, planned to be executed before 2035. Once the measure is implemented the expected results/impact will be immediate.
Budget breakdown	CAPEX Baalbek 69,485,000 USD Hermel 27,007,300 USD Total ARB 96,492,300 USD
Constraints	Financial constraints, Stakeholder resistance

<table>
<tr><th>Measure ID and Name</th><th>ERS_U2: Drafting / Updating of the BWE Water Supply Masterplan</th></tr>
<tr><td>Description</td><td>Drafting/updating of the BWE Water Supply Masterplan to meet water supply needs in the medium and long term</td></tr>
<tr><td>Target</td><td>Residents, Residential areas, households, BWE</td></tr>
<tr><td>Activity Breakdown</td><td>Both the MEW and BWE are responsible for establishing long term consolidated planning for water, irrigation and wastewater

Act 1: Review existing policies and regulations
Act 2: Conduct water demand assessment
Act 3: Evaluate water supply
Act 4: Develop wastewater management plan
Act 5: Engage stakeholders
Act 6: Develop implementation strategies</td></tr>
<tr><td>Timespan/ Timeline</td><td>Short term
Once the measure is implemented the expected results/impact will be immediate
<table>
<tr><th>Activity</th><th>Description</th><th>Month 1</th><th>Month 2</th><th>Month 3</th><th>Month 4</th><th>Month 5</th><th>Month 6</th></tr>
<tr><td>1</td><td>Review existing policies and regulations</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>Conduct water demand assessment</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>3</td><td>Evaluate water supply</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4</td><td>Develop wastewater management plan</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>5</td><td>Engage stakeholders</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6</td><td>Develop implementation strategies</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Budget breakdown</td><td>Cost of the Masterplan: internal work of the engineers of the BWE
Subcontracting cost for specific expertise</td></tr>
<tr><td>Constraints</td><td>Financial crisis, Stakeholder resistance, BWE shortage of staff</td></tr>
</table>

<table>
<tr><th>Measure ID and Name</th><th>ERS_M1: Water metering and subscription to BWE, flow meters for irrigation water</th></tr>
<tr><td>Description</td><td>Water metering is essential to identify how much water is actually used/ consumed in households, commercial or public buildings, etc., and thus better plan water allocation. Subscribing to the BWE can support better water supply management, and increase of the economic resources for the rehabilitation or expansion of water supply networks. Includes: installation of water meters in households, public buildings (e.g. schools), camps, commercial buildings.
This measure also includes the installation of district water meters to monitoring main transmission and distribution lines in order to better control the distribution and address leakage issues.
Approximately 38,000 meters have been installed within BWE, but billing made on a flat rate. Only 3,000 meters are read for monitoring purpose.</td></tr>
<tr><td>Target</td><td>Residents, farmers, cultivation schemes, BWE</td></tr>
<tr><td>Activity Breakdown</td><td>Act.1: Identify water users
Act.2: Conduct site assessments
Act.3: Design the metering system
Act.4: Procure equipment
Act.5: Install water meters and flow meters
Act.6: Train water users
Act.7: Integrate with billing system
Act.8: Monitor and maintain</td></tr>
<tr><td>Timespan/ Timeline</td><td>Medium term
Once the measure is implemented the expected results/impact will be immediate. Yet, this requires that the meters' measurements are read at regular basis and the respective volumes recorded are properly organized into a central database. Automatic data acquisition systems can be installed to facilitate the activity.
<table>
<tr><th>Activity</th><th>Description</th><th>Month 1</th><th>Month 2</th><th>Month 3</th><th>Month 4</th><th>Month 5</th><th>Month 6</th><th>Month 7</th><th>Month 8</th><th>Month 9</th><th>Month 10</th><th>Month 11</th><th>Month 12</th></tr>
<tr><td>1</td><td>Identify water users</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>Conduct site assessments</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>3</td><td>Design the metering system</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4</td><td>Procure equipment</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>5</td><td>Install water meters and flow meters</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6</td><td>Train water users</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>7</td><td>Integrate with billing system</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>8</td><td>Monitor and maintain</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Budget breakdown</td><td>Installation of 25,000 Service Connections + 75,000 Water Meters shall be foreseen.
The associated investment cost is 40,000,000$
O&M is the responsibility of the BWE.</td></tr>
<tr><td>Constraints</td><td>Financial, infrastructure limitations, cost implications, lack of awareness, lack of political will,</td></tr>
</table>

<table>
<tr><th>Measure ID and Name</th><th>ERS_M3: Regulating water tariffs, achieving cost recovery</th></tr>
<tr><td>Description</td><td>Water pricing reform usually involves a modification in the rate structure and/or the water tariffs in order to influence the consumers' water use. This economic instrument needs a very careful design as it can easily raise conflicts among users and trigger many disputes. It also must be noted that there is always a price elasticity that needs to be considered, and that beyond a certain threshold any further increase in water price might not bring any further decrease in the water consumption. Includes: Establishment of Volumetric water tariffs.</td></tr>
<tr><td>Target</td><td>BWE, MEW, NGOs, CSOs, Residents/Municipalities</td></tr>
<tr><td>Activity Breakdown</td><td>Act.1: Review existing tariff structure
Act.2: Conduct a cost-of-service study
Act.3: Develop alternative tariff scenarios
Act.4: Stakeholder engagement
Act.5: Establish volumetric water tariffs
Act.6: Monitor and evaluate</td></tr>
<tr><td>Timespan/Timeline</td><td>Medium term
Once the measure is implemented the expected results/impact will be immediate
<table>
<tr><th>Activity</th><th>Description</th><th>Month 1</th><th>Month 2</th><th>Month 3</th><th>Month 4</th><th>Month 5</th><th>Month 6</th></tr>
<tr><td>1</td><td>Review existing tariff structure</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>Conduct a cost-of-service study</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>3</td><td>Develop alternative tariff scenarios</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4</td><td>Stakeholder engagement</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>5</td><td>Establish volumetric water tariffs</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6</td><td>Monitor and evaluate</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Budget breakdown</td><td>The CAPEX is related to the installation of water meters in order to be able to apply volumetric pricing.
Also, a water pricing elasticity study to establish fair and equitable water tariffs, which also achieved costs recovery, is necessary, which has some associated cost if additional experts, outside the BWE staff, are used.</td></tr>
<tr><td>Constraints</td><td>Political consideration, resistance from stakeholders, legal and regulatory framework, lack of data,</td></tr>
</table>

<table>
<tr><th>Measure ID and Name</th><th>WCO_U1: Water saving in households and buildings (public, commercial)</th></tr>
<tr><td>Description</td><td>A variety of available technologies designed to deliver domestic water saving targeting the urban water uses (e.g. low flow flush, taps and showerhead, aerators, etc.) can be installed in households, offices, schools, hospitals, public buildings, etc.</td></tr>
<tr><td>Target</td><td>Residents, households, BWE</td></tr>
<tr><td>Activity Breakdown</td><td>The purchase and installation of the water saving fixtures in the households can be undertaken by the households, or the municipalities, or the BWE, or the MEW, or NGOs, depending on funding mechanisms (e.g. subsidies, reduction in water fees, donors' funds, etc.)

The operation and good maintenance of the fixtures is the responsibility of the household or public building operators and end-users (in case of schools, etc.)</td></tr>
<tr><td>Timespan/Timeline</td><td>Short-Medium term.
Once the measure is implemented the expected results/impact will be immediate.</td></tr>
<tr><td>Budget breakdown</td><td>CAPEX varies from 2.5 million USD to 129 million USD depending on the solution/ measures applied and target reduction in the unmet demand that is aimed to achieve.

The CAPEX needs to be paid up-front, either by each household or through Programmes, incentives, subsidies, etc.

<table>
<tr><th>Total CAPEX ($)</th><th>Water saving ($Mm^3$)</th><th>Water Saving per HH (%)</th><th>Shower Heads (1 Item)</th><th>Dual Flash Toilet</th><th>Low flow taps (2 Items)</th><th>Efficient Washing Machine</th><th>Dish Washer</th></tr>
<tr><td>$ 2,500,260</td><td>3.9</td><td>20.4%</td><td>X</td><td></td><td></td><td></td><td></td></tr>
<tr><td>$ 6,667,360</td><td>5.1</td><td>26.9%</td><td>X</td><td></td><td>X</td><td></td><td></td></tr>
<tr><td>$ 16,668,400</td><td>5.8</td><td>30.0%</td><td>X</td><td>X</td><td></td><td></td><td></td></tr>
<tr><td>$ 20,835,500</td><td>7.0</td><td>37.0%</td><td>X</td><td>X</td><td>X</td><td></td><td></td></tr>
<tr><td>$ 70,840,700</td><td>8.1</td><td>42.5%</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td></tr>
<tr><td>$ 129,180,100</td><td>8.9</td><td>46.5%</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td></tr>
</table>
Table 2 Annual Equivalent Cost (AEC) of the urban demand management measures based on a 7% discount rate
<table>
<tr><th>Water Saving Measure</th><th>Unit Cost $</th><th>N (Useful life in years)</th><th>AEC ($)</th></tr>
<tr><td>Dual Flush Toilet</td><td>$ 170</td><td>7</td><td>$ 32</td></tr>
<tr><td>Showerheads (1 item)</td><td>$ 30</td><td>3</td><td>$ 11</td></tr>
<tr><td>Low flow taps (2 items)</td><td>$ 50</td><td>3</td><td>$ 19</td></tr>
<tr><td>Efficient washing machine</td><td>$ 600</td><td>7</td><td>$ 111</td></tr>
<tr><td>Dishwasher</td><td>$ 700</td><td>7</td><td>$ 130</td></tr>
<tr><td>TOTAL</td><td></td><td></td><td></td></tr>
<tr><td>Per household (HH)</td><td>$ 1,550</td><td></td><td>$ 1,057</td></tr>
<tr><td>Per capita (cap)</td><td>$ 310</td><td></td><td>$ 264</td></tr>
</table></td></tr>
<tr><td>Constraints</td><td>Cost consideration, lack of awareness, resistance to change, lack of incentives</td></tr>
</table>

Toilet flushes, usually accounting for one third of the domestic water use on average can deliver reductions up to 50% of the water used. Common options include the replacement of older style single-flush models (14 lt/flush) with low-flush gravity toilets (6 lt/flush), dual-flush valve operated toilets (4 lt/flush), air-assisted pressurised toilets (2 lt/flush). Evidence exists that flush volumes down to 4 lt do not cause any problems in the drains and sewers in terms of the waste disposal.

Taps and Showerheads can be adjusted and render saving by installing water saving devices and inexpensive retrofits. Various options are available for retrofitting kitchen and bathroom taps, which are estimated to account for more than 15% of domestic indoor use, with respective savings of 20-30% and less than 2 years paybacks: fitting of new water efficient tap-ware (spray taps, push taps, etc.), low-flow aerators, durable tap washers, flow restrictors and regulators, automatic shutoff. Showerheads are usually gravity fed, electric or pumped (power showers). The average consumption of showers ranges across the households as it depends on many interrelated factors: frequency of use (from 0.75-2.5 showers/day) average shower time duration (2-5 minutes), type of shower, flow rate (6-16 lt/minute), etc. Yet, evidence exists that showers and baths account for 20-35% of the household water consumption and installing water saving devices (flow restricting devices, low-flow showerheads - aerating or laminar-flow, cut-off valves, etc.) can secure around 30-40% water savings. It worth mentioning that the expected savings from the installation of smart water saving devices in taps and showerheads is also highly influenced by the use patterns and habits of the users.

Washing Machines and Dishwashers can be replaced with more efficient ones delivering water and energy savings. Washing of clothes is probably the third largest consumer of domestic water, around 20%. Installing high-efficient washing machines can save up to 40% of the volume need per cycle. Modern washing machines use about 50 lt/cycle or 35 l/cycle for the most efficient ones, as opposed to 150 lt/cycle in the 1990's, due to technological advances (i.e. intelligent sensor systems, advanced and customized washing programmes, improved time functions, etc.). Dishwashers manufactured prior to the year 2000 typically consume 15-50 lt/load, while modern dishwashers consume 7-19 lt/load under normal setting and as low as 8-12 lt/load under the eco-setting, which means average water savings at the range of 40-60%. The share of water use consumed by dishwashers varies from 6-14% as it depends on the cycle time, the frequency of use and their degree of penetration in the households, the latter being influenced by e.g. lack of space, conception that this investment is not necessary due to small load of dishes feasible to be hand-washed, etc.

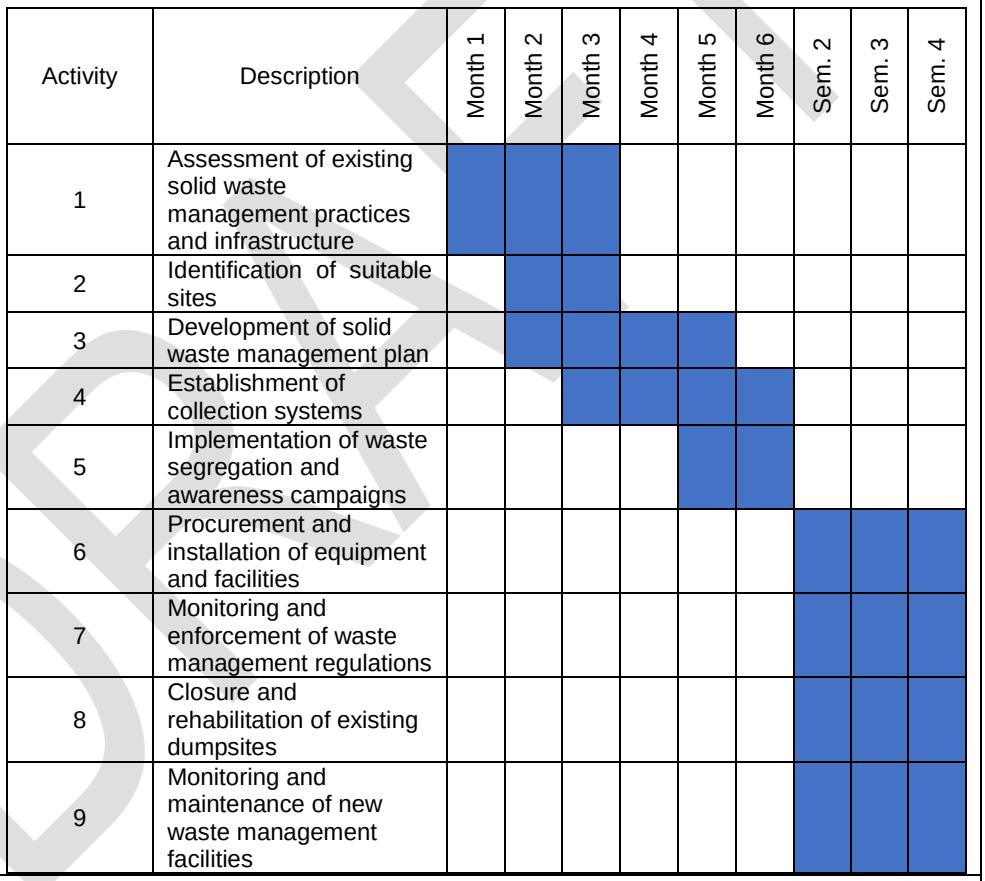
Water pricing reform usually involves a modification in the rate structure and/or the water tariffs in order to influence the consumers' water use. It often includes the shifting from decreasing block rates to uniform block rates, the shifting from uniform rates to increasing block rates, the increasing of rates during summer months, or the imposing excess-use charges during times of water shortage. This economic instrument needs a very careful design as it can easily raise conflicts among users and trigger many disputes.

Measure ID and Name	PWE_U1: Conduct necessary environmental studies
Description	Screening from Ministry of Environment, and conduct EIA studies where required
Target	MoE, BWE, MEW, Municipalities, NGOs/CSOs
Activity Breakdown	In reference to decree 8633/2012, principles of Environmental Impact Assessment studies, conducting screening for all new components of the water supply systems to be implemented; Conducting IEE and EIA for all required infrastructures (WTP, WWTP, Hill lakes, etc.)
Timespan/Timeline	Medium term Once the measure is implemented the expected results/impact will be immediate
Budget breakdown	Variable per study
Constraints	Time constraint, lack of awareness

Measure ID and Name	PWE_U2: Drinking water protection perimeters
Description	Detailed demarcation of protection zones around groundwater abstraction points (springs, wells) for water abstraction > 1,000,000m^3 per year
Target	MEW, BWE, NGOs/CSOs
Activity Breakdown	Act.1: Vulnerability and risk assessment Act.2: Demarcation of protection zones Act.3: Development of protection plans Act.4: Enforcement and control Act.5: Awareness-raising
Timespan/Timeline	Medium term Once the measure is implemented the expected results/impact will be immediate
Budget breakdown	Internal staff work of MEW Study costs if a relevant study is sub-contracted
Constraints	Legal and regulatory framework, lack of awareness

Activity	Description	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6
1	Vulnerability and risk assessment	■	■	■			
2	Demarcation of protection zones	■	■				
3	Development of protection plans		■	■	■		
4	Enforcement and control			■	■	■	■
5	Awareness-raising					■	■

Measure ID and Name	PWE_U3: Municipal solid waste management
Description	Solid waste management is limited to municipalities and usually in exposed dumpsites. Out of the 39 dumpsites, only 24 are operational, and out of the operational 9 are located in private lands and the remaining 15 are situated in communal land (e.g., Mashaa land belonging to the monasteries).

<table>
<tr><td>Target</td><td>BWE, Municipalities, MEW, MoE, MoA, MoH, NGOs/CSOs.</td></tr>
<tr><td>Activity Breakdown</td><td>Includes: Development of action plans for the rational management of municipal waste in settlements not served by central waste disposal facilities. Identification of financial resources for the implementation of the action plans
Act.1: Assessment of existing solid waste management practices and infrastructure
Act.2: Identification of suitable sites
Act.3: Development of solid waste management plan
Act.4: Establishment of collection systems
Act.5: Implementation of waste segregation and awareness campaigns
Act.6: Procurement and installation of equipment and facilities
Act.7: Monitoring and enforcement of waste management regulations
Act.8: Closure and rehabilitation of existing dumpsites
Act.9: Monitoring and maintenance of new waste management facilities</td></tr>
<tr><td>Timespan/Timeline</td><td>Medium term
Once the measure is implemented the expected results/impact will be immediate
 
</td></tr>
<tr><td>Budget breakdown</td><td>The budget for municipal solid waste management can vary widely depending on the specific needs and circumstances of the municipality, and the range of the budget breakdown provided earlier reflects this variability. The total budget for municipal solid waste management can range from 650,000 USD to 3,000,000 USD excluding the dumpsite construction.</td></tr>
<tr><td>Constraints</td><td>Limited facilities, lack of awareness, institutional and governance challenges, financial.</td></tr>
</table>

<table>
<tr><th>Measure ID and Name</th><th>PWE_UI1: Wastewater collection and treatment, maintenance of existing WWTP</th></tr>
<tr><td>Description</td><td>Expansion of the BWE wastewater collection network.
Assessment of the current operational status and capacities of existing WWTPs and identification of necessary actions for their proper operation. Building of new WWTPs.
There is no wastewater collection service within ARB except for Iaat WWTP collecting Baalbek sewer. However, residents use septic tanks or dispose waste directly in the streams.
Also, many of the septic tanks do not have proper technology and the cost of building one is very high for the people in this area (~ 15,000-20,000 $ for a 3-compartments tank), so there is need to find alternative cheap ways.</td></tr>
<tr><td>Target</td><td>Residents, Residential areas, BWE</td></tr>
<tr><td>Activity Breakdown</td><td>Act 1: Assessment of the current wastewater infrastructure, networks and WWTP and their operational status.
Act 2: Identification and prioritization of necessary actions
Act 3: Design of new collection networks and WWTP
Act 4: Rehabilitation and expansion of existing collection networks and construction of WWTP as cited in Error! Reference source not found. section Error! Reference source not found..</td></tr>
<tr><td>Timespan/Timeline</td><td>Medium term.
Once the measure is implemented the expected results/impact will be immediate.

<table>
<tr><th>Activity</th><th>Description</th><th>Year 1</th><th>Year 2</th><th>Year 3</th><th>Year 4</th><th>Year 5</th><th>Year 6</th></tr>
<tr><td>1</td><td>Assessment of the current wastewater infrastructure, networks and WWTP and their operational status.</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>Identification and prioritization of necessary actions</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>3</td><td>Design of new collection networks and WWTP</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4</td><td>Rehabilitation and expansion of existing collection networks and construction of WWTPs</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Budget breakdown</td><td>According to the Updated NWSS 2020, the total cost of the wastewater projects in the BWE District of Baalbek and Hermel amount to 303 million USD and will serve a population of 635,838 people. Thus, the ratio of projects cost per capita is estimated at 569 USD/capita.
O&M cost 11,5 million USD</td></tr>
<tr><td>Constraints</td><td>Financial, political resistance, operation and maintenance, lack of awareness</td></tr>
</table>

Measure ID and Name	PWE_UI2: Drafting/Updating of BWE Wastewater Masterplan
Description	Drafting/updating of the BWE Wastewater Collection and Treatment Masterplan to meet future needs in the medium and long term

<table>
<tr><td>Target</td><td>All main stakeholders agree on the institutional framework that is based on the responsibility of WE for managing wastewater system. However, the effective framework for wastewater management is not clear and needs to be refined. Several actors may be involved in wastewater management (WEs, municipalities, and private operators) but the process of identifying modalities of involvement and the financing method still needs to be defined.

MEW: According to Law 221 and its amendments by Law 241 (7/08/2000) and Law 377 (14/12/2001), the MEW has (among its other missions) to prepare and continuously update the National Water and Wastewater General Master Plan and submit it through the Minister for approval by the Council of Ministers

BWE: Develop and implement Wastewater Collection and Treatment Masterplan
Municipalities: provide data on any current municipal waste collection and treatment systems</td></tr>
<tr><td>Activity Breakdown</td><td>The activity breakdown for drafting/updating the BWE Wastewater Collection and Treatment Masterplan:
Act. 1: Data collection and analysis
Act. 2: Technical and financial feasibility studies
Act. 3: Stakeholder consultations
Act. 4: Development of wastewater treatment options
Act. 5: Development of wastewater collection options
Act. 6: Cost-benefit analysis
Act. 7: Drafting of the wastewater masterplan
Act. 8: Review and approval process</td></tr>
<tr><td>Timespan/Timeline</td><td>Medium term.
Once the measure is implemented the expected results/impact will be immediate

<table>
<tr><th>Activity</th><th>Description</th><th>Month 1</th><th>Month 2</th><th>Month 3</th><th>Month 4</th><th>Month 5</th><th>Month 6</th><th>Month 7</th><th>Month 8</th></tr>
<tr><td>1</td><td>Data collection and analysis</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>Technical and financial feasibility studies</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>3</td><td>Stakeholder consultations</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4</td><td>Development of wastewater treatment options</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>5</td><td>Development of wastewater collection options</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6</td><td>Cost-benefit analysis</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>7</td><td>Drafting of the wastewater masterplan</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>8</td><td>Review and approval process</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Budget breakdown</td><td>Internal staff resources of BWE
Subcontracting costs if the study needs to be supported by external consultants
In the NWSS, in the Water Governance Priority Action Plan the adoption of a shared wastewater management framework is planned, with goals to address the issue of the organization(s) responsible for managing the WW network and</td></tr>
</table>

	treatment plants (WEs, municipalities, private operators.) and determine the financing method (estimated cost 250,000$ for all Lebanese territory)
Constraints	Financial, stakeholder engagement, regulatory framework, lack of will,

5.2.2 Agricultural sector

The main options for reducing irrigation demand are linked to decreasing losses and increasing the irrigation efficiency, i.e. conveyance and field application efficiency. This is generally achieved by replacing open channels with closed pipes, by switching to drip irrigation and/or sprinklers from furrow irrigation systems, by implementing precision agriculture, and by applying deficit irrigation. However, besides the areas of formal collective irrigation networks, additional self-supplied irrigated areas often exist, and illegal abstractions (illegal wells) might also be a problem. The main options to increase water supply for agricultural purposes is to retain water in detention basins and retention ponds.

Replacing open channels with closed pipes targets to reduce leakage and increase conveyance efficiency. Water conveyance loss consists mainly of operation losses, evaporation, and seepage into the soil from the sloping surfaces and bed of the canal. Open channel networks are usually characterized by high levels of channel seepage, which lead to high water losses, and depends mainly on the length of the channel, the soil type or permeability of the channel banks and the condition of the canals. In large irrigation schemes more water is lost than in small schemes, due to a longer canal system. From canals in sandy soils more water is lost than from canals in heavy clay soils. The losses in channels lined with bricks, plastic or concrete are very small. If channels are badly maintained, bund breaks are not repaired properly and rats dig holes, a lot of water is lost. Indicative values of conveyance efficiency in opens canals range from 60-80% for long (>2,000 m) to short (<200 m) sand earthen canals, from 70-85% for long to short loam earthen canals, from 80-90% for long to short clay earthen canals, and around 95% for lined canals. These values do not consider the level of maintenance, which, in case of bad maintenance, may lower these values by as much as 50%.

Switching to drip irrigation and/or sprinklers from furrow irrigation systems targets to increase the field application efficiency. The field application efficiency mainly depends on the irrigation method, as well as on the level of the farmers' discipline. Irrigation water losses, illustrated include air losses, canopy losses, soil and water surface evaporation, runoff, and deep percolation. The magnitude of each loss is dependent on the design and operation of each type of irrigation system. Surface irrigation losses (furrow) include runoff, deep percolation, ground evaporation and surface water evaporation. Sprinkler irrigation losses include air losses (drift and droplet evaporation), canopy losses (canopy evaporation and foliage interception) and surface water evaporation. Indicative values of the average field application efficiency are around 60% for surface irrigation (basin, border, furrow), 70% for sprinkler irrigation (traveling gun, center pivot, etc.), and 80% for drip irrigation. Lack of farmers' discipline may lower these values.

Table 3**.** presents an overview of different literature values on the efficiency of irrigation methods. The values range, but in all cases, it is demonstrated that, when considering single field irrigation efficiencies, sprinkler systems are generally better than furrows, and drip irrigation systems are generally the best. In any case, attainable water application efficiencies vary greatly with irrigation system type, management practices and site characteristics. The analysis of the application efficiency of irrigation systems is thus important to identify potential places where improvements can be made and plan for interventions.

Table 3 Field application efficiencies of different irrigation methods. Source: Kossida, M., 2015 (adopted from Canessa et al., 2011)

Authors / Methods	Solomon, 1988	Tanji and Hanson, 1991	Morris and Lynne, 2006	Rogers et al., 1997	Howell, 2003	Hanson et al., 1999	Sandoval-Soli et al., 2013
Surface irrigation							Low/Mean/High
Furrow	60-75	60-90	60-80	50-90	50-80	70-85	60/73/85
Furrow with tailwater				60-90			
Border	70-85	65-80	55-75	60-90	50-80	70-85	62/73/83
Basin	80-90			60-95	80-65		72/83/93
Sprinkler							
Hand-more or portable	65-75						60/70/80
Periodic move		65-80	60-75	65-80	60-85	70-80	
Continuous move		75-85		70-95	90-98	80-95	
Traveling gun	60-70						
Center pivot	75-90		65-90		75-98		70/80/90
Linear move	75-90		75-90		70-95		73/82/90
Solid set or permanent	70-80	85-90	70-85	70-85		70-80	70/78/85
Drip/Trickle							
Trickle (point source emitters)	75-90						
Subsurface drip			85-95	70-95	75-95		77/86/95
Microspray			85-90		70-95		
Line source products	70-85						

Land use/ crop changes involve the changes in the existing crop mix in agricultural areas, either by abandoning some areas under agricultural cultivation, or by changing the mix of existing crops, and planting less water demanding varieties. Form an economic productivity point of view it may be more beneficial to plant crops which are more drought tolerant and do not require excessive irrigation. Such a land reform requires a thorough design process to investigate the full market potential of the new crops, and a long stakeholders' process in order to showcase the benefit of such an intervention and boost its acceptability.

Rainwater Harvesting (RWH) is defined as "the capture, storage and management of water flowing on the roofs of buildings and river basins that exist on the ground with the purpose of growing crops, regeneration of pasture for animal feed production and farming in general, horticulture and domestic use". Typical RWH systems consist of three basic elements: the collection system (area which produces runoff because the surface is impermeable or infiltration is low), the conveyance system (through which the runoff is directed, e.g. by bunds, ditches, channels, pipes) and the storage system (where water is accumulated or held for use). The storage system consists of tanks or impermeable soil and subsoil, as well as larger reservoirs.

Detention basins are part of the so-called Natural Water Retention Measures (NWRM) and Sustainable Urban Drainage Systems (SUDS). They are vegetated depressions designed to hold runoff from impermeable surfaces and allow the settling of sediments and associated pollutants. Stored water may be slowly drained to a nearby watercourse, using an outlet control structure to control the flow rate. Detention basins do not generally allow infiltration. The capacity to store runoff is dependent on the design of the basin, which can be sized to accommodate any size of rainfall event (CIRIA, 2007 identify up to a 1 in 100 year event as being not uncommon). Detention basins can provide water quality benefits through physical filtration to remove solids/trap sediment, adsorption to the surrounding soil or biochemical degradation of pollutants. Detention basins are landscaped areas that are dry except in periods of heavy rainfall, and may serve other functions (e.g. recreation), hence have the potential to provide ancillary amenity benefits. They are ideal for use as playing fields, recreational areas or public open space. They can be planted

with trees, shrubs and other plants, improving their visual appearance and providing habitats for wildlife. A detention basin should be designed to be appropriate for the contributing catchment area (as well as rainfall characteristics). In theory they can be designed to accommodate any volume of runoff, from any catchment area, desired, and CIRIA (2007) states that there is no maximum catchment area. However, in general, sustainable drainage principles promote managing runoff close to source, i.e. with a relatively small catchment area, and therefore it is not envisaged that a contributing area greater than 1 km_2 would be likely.

Detention basis are high land-take measures used within the urban environment. The primary cost is therefore the cost of land acquisition or the opportunity cost of not using that land for development. This will depend on the land values at the site under considerations and cannot be generically quantified. Due to the higher costs of land, it is usually more expensive to retrofit these basins to already developed areas as compared to constructing one in an undeveloped region. (Source: NWRM project (http://nwrm.eu/measure/detention-basins; for more information refer to the NWRM Detention Basins Factsheet)

Retention ponds (also including **Hill Lakes**) are part of the so-called Natural Water Retention Measures (NWRM) and Sustainable Urban Drainage Systems (SUDS). They are ponds or pools designed with additional storage capacity to attenuate surface runoff during rainfall events. They consist of a permanent pond area with landscaped banks and surroundings to provide additional storage capacity during rainfall events. They are created by using an existing natural depression, by excavating a new depression, or by constructing embankments. Existing natural water bodies should not be used due to the risk that pollution events and poorer water quality might disturb/damage the natural ecology of the system. Retention ponds can provide both storm water attenuation and water quality treatment by providing additional storage capacity to retain runoff and release this at a controlled rate. Ponds can be designed to control runoff from all storms by storing surface drainage and releasing it slowly once the risk of flooding has passed. Runoff from each rain event is detained and treated in the pond. The retention time and still water promotes pollutant removal through sedimentation, while aquatic vegetation and biological uptake mechanisms offer additional treatment. Retention ponds have good capacity to remove urban pollutants and improve the quality of surface runoff.

Ponds should contain the following zones: (a) a sediment forebay or other form of upstream pre-treatment system (i.e. as part of an upstream management train of sustainable drainage components); (b)a permanent pool which will remain wet throughout the year and is the main treatment zone; (c) a temporary storage volume for flood attenuation, created through landscaped banks to the permanent pool; (d) a shallow zone or aquatic bench which is a shallow area along the edge of the permanent pool to support wetland planting, providing ecology, amenity and safety benefits. Additional pond design features should include an emergency spillway for safe overflow when storage capacity is exceeded, maintenance access, a safety bench, and appropriate landscaping. Well-designed and maintained ponds can offer aesthetic, amenity and ecological benefits to the urban landscape, particularly as part of public open spaces. They are designed to support emergent and submerged aquatic vegetation along their shoreline. They can be effectively incorporated into parks through good landscape design.

The drainage area required to support a retention pond can be as low as 0.03-0.1 km^2 (Environment Agency, 2012), or possible smaller if the retention pond has another resource of water such as a spring.

There are no specific constraints on the maximum drainage area for retention ponds, although typically 3-7% of the upstream catchment area will be required for the pond (CIRIA, 2007). Larger retention ponds (>25,000 m_3 volume) require significant impoundment and may be subject to additional inspection and structural requirements (e.g. 1975 Reservoirs Act in UK). Ponds would

typically be sited at a low point in the catchment where it can receive drainage by gravity. Several ponds may be required at a large site, split into topographic sub catchments. The position chosen should allow safe routing of flows above the design event for the pond, and the consequence of any pond embankment failure considered.

Retention ponds reduce peak runoff through storage and controlled outflow release. They must be appropriately sized to the catchment area and critical storm depth. They do not infiltrate runoff and therefore provide very little runoff volume reduction (with the exception of evaporation and evapotranspiration, which can be significant in some cases). Typically, retention ponds will be designed to attenuate runoff for events up to at least the 1 in 30-year storm for the drainage area (sometimes greater), with the excess storm volume drained within 24 to 72 hours (CIRIA, 2007).

Retention ponds are high land-take measures used within the urban environment. The primary cost is therefore the cost of land acquisition or the opportunity cost of not using that land for development. This will depend on the land values at the site under considerations and cannot be generically quantified. Due to the higher costs of land, it is usually more expensive to retrofit these basins to already developed areas as compared to constructing one in an undeveloped region.

(Source: NWRM project (http://nwrm.eu/measure/detention-basins; for more information refer to the NWRM Retention Ponds Factsheet)

<table>
<tr><th>Measure ID and Name</th><th>ERS_A1: Irrigation network modernization and maintenance projects</th></tr>
<tr><td>Description</td><td>This measure targets to reduce canal leakage and increase conveyance efficiency. It includes: mapping and assessment of the status of the existing networks, rehabilitation of existing concrete channels, conversion from earth to concrete open channels or closed pipes and expansion of the BWE irrigation water supply network branches and connections.

The updated NWSS 2020 has proposed the following irrigation projects:
Rehabilitation of concrete channels: 44 km
Conversion of earth to concrete channels: 78 km
Construction of new irrigation networks: 7124 ha

In addition to the proposed projects, on farm infrastructure shall be rehabilitated including irrigation systems and storage reservoirs.</td></tr>
<tr><td>Target</td><td>Farmers, agricultural schemes, LARI, BWE, MoA, MWE</td></tr>
<tr><td>Activity Breakdown</td><td>Act. 1: Mapping and assessment of the status of the existing networks, of available resources and of irrigation demand.
Act. 2: Prioritization of activity areas
Act. 3: Rehabilitation and maintenance of existing irrigation systems (incl. storage reservoirs)
3.1 Irrigation water intake structure
3.2 Main channel
3.3 Secondary channel
3.4 On farm infrastructure:
3.4.1 Farm diversion structure (Pump)
3.4.2 Farm reservoir (Concrete tank or lined natural pond)
3.4.3 Pressurized farm irrigation system (conversion to closed pipe)
Act. 4: Construction of new irrigation networks</td></tr>
<tr><td>Timespan/Timeline</td><td>Medium-long term (approved and planned by the BWE)
Once the measure is implemented the expected results/impact will be immediate.
<table>
<tr><th>Activity</th><th>Description</th><th>Month 1</th><th>Month 2</th><th>Month 3</th><th>Month 4</th><th>Month 5</th><th>Month 6</th></tr>
<tr><td>1</td><td>Mapping and assessment of the status of the existing networks, of available resources and of irrigation demand.</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>Prioritization of activity areas</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>3</td><td>Rehabilitation and maintenance of existing irrigation systems</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4</td><td>Construction of new irrigation networks</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Budget breakdown</td><td>CAPEX: 186 million USD</td></tr>
<tr><td>Constraints</td><td>Financial crisis, lack of coordination between BWE, MEW, MoA on assessing the status of networks and their efficiencies and planning for rehabilitation and expansion projects.</td></tr>
</table>

Measure ID and Name	ERS_A2: Construction of Irrigation dams (Assi phase I & II, Younine)
Description	Construction of the irrigation dams Assi phase I, Assi phase II, and Younine.
Target	Farmers, BWE, LARI
Activity Breakdown	Assi Dam (Phase I) Capacity 63 Mm^3 Assi Dam (Phase II) Capacity 37 Mm^3 Younine Dam Capacity 5.8 Mm^3
Timespan/Timeline	Medium-long term Once the measure is implemented the expected results/impact will be immediate. Assi Phase I, Priority 1, needed in 2030, the construction of which should therefore start as soon as possible. Assi Phase II, Priority 2, needed in 2035, the construction of which should therefore start before 2030. Younine, Priority 1, needed in 2030, the construction of which should therefore start as soon as possible.
Budget breakdown	Younine Dam 69,960,000 USD Assi Dam (Phase 1) 52,000,000 USD Assi Dam (Phase 2) 150,000,000 USD
Constraints	Land availability, cost, financial crisis, environmental impact, stakeholder engagement, regulatory and permitting process, O&M.

Measure ID and Name	ERS_A3: Natural Water Retention Measures (NWRM) for agricultural, including Community Hill Lakes and flash floods retention lakes
Description	Detention/ Retention ponds are part of the so-called Natural Water Retention Measures (NWRM). They are ponds or pools designed with additional storage capacity to attenuate surface runoff during rainfall events. Includes: construction of NWRM - detention/retention ponds and Community Hill Lakes
Target	Farmers, Agricultural schemes, BWE, MoE, MWE, MoE
Activity Breakdown	Act.1: Feasibility study Act.2: Design and Planning Act.3: Land Acquisition Act.4: Construction Act.5: Operation and Maintenance Act.6: Community engagement and awareness
Timespan/Timeline	Medium term Once the measure is implemented the expected results/impact will be immediate.

Activity	Description	Year 1	Year 2	Year 3	Year 4	Year 5
1	Feasibility study	■				
2	Design and Planning	■	■			
3	Land Acquisition		■	■		
4	Construction			■	■	
5	Operation and Maintenance			■	■	■
6	Community engagement and awareness			■	■	■

Budget breakdown	Retention/ detention ponds are high land-take measures. The primary cost is therefore the cost of land acquisition or the opportunity cost of not using that land for agricultural or other purposes.

	The capital costs for the construction of detention basins, retention ponds, hill lakes of 100,000-150,000 m^3 capacity are about $30 per m^3 of volume provided for storage.
Constraints	Land availability, cost, financial crisis, environmental impact, Stakeholder Engagement, Regulatory and permitting process, O&M.

Measure ID and Name	**ERS_A4: Thresholds of the required quantities of irrigation water**
Description	Definition of the thresholds and ceilings of the required quantities of irrigation water per crop type (considering the local climatic conditions, the soil types, etc.). This measure intends to eliminate over-irrigation.
Target	Farmers, Agricultural schemes, MoA, BWE, MEW
Activity Breakdown	Act.1: Review Existing Regulations Act.2: Stakeholder Consultation Act.3: Data Analysis Act.4: Technical Assessment Act.5: Regulatory Framework Development Act.6: Public Consultation Act.7: Adoption and Implementation
Timespan/Timeline	Medium term. Once the measure is implemented the expected results/impact will be shown if these defined/ correct quantities are applied by the farmer and no over-irrigation or deficit irrigation are practiced.
Budget breakdown	The cost of a relevant study. The CAPEX is zero if this study is undertaken by existing staff of MoA, MEW, LARI, etc.
Constraints	Lack of awareness; stakeholder resistance, economic consideration, legal and institutional framework, climate change,

Activity	Description	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8
1	Review Existing Regulations	■							
2	Stakeholder Consultation		■						
3	Data Analysis		■	■					
4	Technical Assessment			■	■				
5	Regulatory Framework Development			■	■	■			
6	Public Consultation					■	■		
7	Adoption and Implementation						■	■	■

<table>
<tr><th>Measure ID and Name</th><td>ERS_M2: Reuse of treated wastewater for agricultural uses</td></tr>
<tr><td>Description</td><td>Reusing wastewater for irrigation helps achieve water efficiency and conservation, reduces the need for pumping from private wells, saving on energy and decreasing the cost of crops, and positively impacts the livelihood of farmers.</td></tr>
<tr><td>Target</td><td>Farmers, Agricultural schemes, MoA, MoE, BWE, MEW, MoPH.</td></tr>
<tr><td>Activity Breakdown</td><td>The proposed WWTP within ARB which effluent could be reused for irrigation are
BQ-WW A. District of Baalbek
Qaa 1 WWTP activated sludge
Ras Baalbeck 1 WWTP activated sludge
Chaat 1 WWTP activated sludge
Deir el Ahmar 1 WWTP activated sludge
Boudai 1 WWTP activated sludge
Chlifa 1 WWTP MBRR
BQ-WW B. District of Hermel
Hermel Phase 1 1 WWTP activated sludge
Hermel Phase 2 1 WWTP activated sludge

The actual annual flow of treated wastewater suitable for irrigation was estimated to 12 Mm^3/year from 8 WWTP over 6 months/year.

Act. 1: Feasibility Study;
Act. 2: WWTP upgrade to meet irrigation requirement;
Act. 3: Establish a distribution network for the treated wastewater to be used for irrigation network;
Act. 4: Implementing and testing of a monitoring plan;
Act. 5: Provide training and technical assistance to farmers and other stakeholders;
Act. 6: Conducting outreach and education campaigns to increase public acceptance and participation in the program;</td></tr>
<tr><td>Timespan/Timeline</td><td>Medium term.
Once the measure is implemented the expected results/impact will be immediate
<table>
<tr><th>Activity</th><th>Description</th><th>Sem.1</th><th>Sem.2</th><th>Sem.3</th><th>Sem.4</th><th>Sem.5</th><th>Sem.6</th></tr>
<tr><td>1</td><td>Feasibility study</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>Upgrading the WWTP for irrigation reuse</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>3</td><td>Implementing the distribution network for the treated wastewater</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4</td><td>Implementing and testing of a monitoring plan</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>5</td><td>Providing training and technical assistance to farmers and other stakeholders</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6</td><td>Conducting outreach and education campaigns to increase public acceptance and participation in the program</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Budget breakdown</td><td>-</td></tr>
<tr><td>Constraints</td><td>Water quality and safety, Public Perception and Acceptance, Regulatory Framework, Infrastructure and Distribution, lack of awareness, Institutional coordination</td></tr>
</table>

<table>
<tr><th>Measure ID and Name</th><th>WCO_A1: Subsidies for change of irrigation systems</th></tr>
<tr><td>Description</td><td>This measure targets to increase the field application efficiency through the change of irrigation systems. The field application efficiency mainly depends on the irrigation method, as well as on the level of the farmers' discipline. When considering single field irrigation efficiencies, sprinkler systems are generally better than furrows, and drip irrigation systems are generally the best.</td></tr>
<tr><td>Target</td><td>Farmers, Agricultural schemes, MoA, LARI, BWE, MEW</td></tr>
<tr><td>Activity Breakdown</td><td>Act.1: Feasibility and assessment study
Act.2: Capacity building and technical assistance to farmers
Act.3: Financial support
Act.4: Procurement and supply
Act.5: Monitoring and Evaluation
Act.6: Stakeholder collaboration
Act.7: Awareness and promotion</td></tr>
<tr><td>Timespan/Timeline</td><td>Medium-long term.
Once the measure is implemented the expected results/impact will be immediate
<table>
<tr><th>Activity</th><th>Description</th><th>Month 1</th><th>Month 2</th><th>Month 3</th><th>Month 4</th><th>Month 5</th><th>Month 6</th><th>Month 7</th><th>Month 8</th><th>Month 9</th></tr>
<tr><td>1</td><td>Feasibility and assessment study.</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>Capacity building and technical assistance to farmers</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>3</td><td>Stakeholder collaboration</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4</td><td>Awareness and promotion</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>5</td><td>Financial support</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6</td><td>Procurement and supply</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>7</td><td>Monitoring and Evaluation</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Budget breakdown</td><td>The total irrigated area in the ARB basin is expected to increase to 21,750 hectares with +15% conveyance efficiency, hence switching the total area to modern irrigation (drip, sprinklers) and the conveyance from open channels to closed pipes; According to Ostuan study; for the drip irrigation, the Annual Equivalent Cost (AEC) for a useful life of 20 years is 347$/ha and the CAPEX is 3680$/ha
Hence, to switch the overall ARB area to modern irrigation
AEC = 21,750 ha * 347$/ha = 7.5 mio $ or
CAPEX = 21,750 ha * 3680$/ha = 80 mio $

The purchase and installation of the drip irrigation at the parcel level can be undertaken by the farmers through subventions, or at municipal level, or the BWE, or the MEW, or MoA, or NGOs, depending on funding mechanisms (e.g. subsidies, reduction in water fees, donors' funds, etc.)
Farmers are responsible for the proper operation and maintenance of the drip irrigation systems.</td></tr>
<tr><td>Constraints</td><td>Financial Constraints, Limited Resources, Lack of Awareness and Knowledge, Resistance to Change, Policy and Regulatory Frameworks, Maintenance and Operation Costs, Implementation and Coordination Challenges</td></tr>
</table>

5.2.3 Other regulatory and mixed measures

<table>
<tr><th>Measure ID and Name</th><th>ERS_M3: Regulating water tariffs, achieving cost recovery</th></tr>
<tr><td>Description</td><td>Water pricing reform usually involves a modification in the rate structure and/or the water tariffs in order to influence the consumers' water use. This economic instrument needs a very careful design as it can easily raise conflicts among users and trigger many disputes. It also must be noted that there is always a price elasticity that needs to be considered, and that beyond a certain threshold any further increase in water price might not bring any further decrease in the water consumption.</td></tr>
<tr><td>Target</td><td>BWE, MEW, NGOs, CSOs/ Municipalities</td></tr>
<tr><td>Activity Breakdown</td><td>Act.1: Tariff analysis
Act.2: Cost assessment
Act.3: Stakeholder consultation
Act.4: Regulatory framework
Act.5: Tariff setting and tariff approval process
Act.6: Public awareness and communication</td></tr>
<tr><td>Timespan/Timeline</td><td>Medium term.
Once the measure is implemented the expected results/impact will be immediate
<table>
<tr><th>Activity</th><th>Description</th><th>Month 1</th><th>Month 2</th><th>Month 3</th><th>Month 4</th><th>Month 5</th><th>Month 6</th><th>Month 7</th><th>Month 8</th><th>Month 9</th></tr>
<tr><td>1</td><td>Tariff analysis</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>Cost assessment</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>3</td><td>Stakeholder consultation</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4</td><td>Regulatory framework</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>5</td><td>Tariff setting and tariff approval process</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6</td><td>Public awareness and communication</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Budget breakdown</td><td>Also, a water pricing elasticity study to establish fair and equitable water tariffs, which also achieved costs recovery, is necessary, which has some associated cost if additional experts, outside the BWE staff, are used</td></tr>
<tr><td>Constraints</td><td>Political resistance, Socio-economic, Lack of awareness, administrative and institutional capacity, technical and financial, Legal and regulatory framework</td></tr>
</table>

<table>
<tr><th>Measure ID and Name</th><th>ERS_M4: Monitoring and control of illegal abstractions and private wells, and definition of safe yield per groundwater body</th></tr>
<tr><td>Description</td><td>Illegal abstractions from groundwater cause drawdown of the aquifer, while jeopardize the safe yield. The measure includes: field surveys to register all illegal abstractions, measures to control these abstractions, as well as the installation of water meters in private wells for subsequent monitoring of the abstracted volumes. Creation and operation of a single registry of licensed water wells from the water permitting process, shared among the relevant authority. Definition/ update of groundwater safe yield for each groundwater body. Additionally, the requirements (regulatory framework) for granting permits for new wells need to be revised in view of the groundwater sustainability.</td></tr>
<tr><td>Target</td><td>Municipalities, BWE, MEW, CSO, NGOs</td></tr>
<tr><td>Activity Breakdown</td><td>Act.1: Review and update existing legislation and regulations
Act.2: Capacity Building and Training
Act.3: Illegal Abstraction Identification and Mapping
Act.4: Awareness and outreach
Act.5: Stakeholder Engagement and Collaboration
Act.6: Enforcement and compliance
Act.7: Regular monitoring and reporting</td></tr>
<tr><td>Timespan/Timeline</td><td>Medium term.
Once the measure is implemented the expected results/impact will be immediate
<table>
<tr><th>Activity</th><th>Description</th><th>Month 1</th><th>Month 2</th><th>Month 3</th><th>Month 4</th><th>Month 5</th><th>Month 6</th><th>Month 7</th><th>Month 8</th><th>Month 9</th></tr>
<tr><td>1</td><td>Review and update existing legislation and regulations</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>Capacity Building and Training</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>3</td><td>Illegal Abstraction Identification and Mapping</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4</td><td>Awareness and outreach</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>5</td><td>Stakeholder Engagement and Collaboration</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6</td><td>Enforcement and compliance</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>7</td><td>Regular monitoring and reporting</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Budget breakdown</td><td>Internal costs of the BWE. Additional staff (inspectors) is required</td></tr>
<tr><td>Constraints</td><td>Lack of legal framework, lack of coordination between stakeholders, Political and administrative challenges, Informal practices and resistance, Lack of awareness,</td></tr>
</table>

<table>
<tr><th>Measure ID and Name</th><td>ERS_M5: Technical specifications for wastewater reuse</td></tr>
<tr><td>Description</td><td>In Lebanon, there is no legal basis for reuse of wastewater. There are no regulations, guidelines and standards for the reuse of treated wastewater for different purposes. Two propositions for Lebanese Guidelines on Sewage Sludge Use in Agriculture and for Lebanese Wastewater Reuse Guidelines have been prepared by FAO in 2010. However, these have not been officially enforced yet.</td></tr>
<tr><td>Target</td><td>MEW, MoE, MoPH, MoA, BWE, Municipalities, NGOs/CSOs.</td></tr>
<tr><td>Activity Breakdown</td><td>Act.1: Review of Existing Standards and Guidelines
Act.2: Stakeholder Consultation and Engagement
Act.3: Identification of Reuse Scenarios
Act.4: Technical Assessment and Research
Act.5: Development of Technical Specifications
Act.6: Integration with Existing Regulations and Guidelines
Act.7: Documentation and Dissemination
Act.8: Training and Capacity Building
Act.9: Monitoring and Evaluation</td></tr>
<tr><td>Timespan/Timeline</td><td>Medium term.
Once the measure is implemented the expected results/impact will be immediate
<table>
<tr><th>Activity</th><th>Description</th><th>Month 1</th><th>Month 2</th><th>Month 3</th><th>Month 4</th><th>Month 5</th><th>Month 6</th><th>Month 7</th><th>Month 8</th><th>Month 9</th></tr>
<tr><td>1</td><td>Review of Existing Standards and Guidelines</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>Stakeholder Consultation and Engagement</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>3</td><td>Identification of Reuse Scenarios</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4</td><td>Technical Assessment and Research</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>5</td><td>Development of Technical Specifications</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6</td><td>Integration with Existing Regulations and Guidelines</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>7</td><td>Documentation and Dissemination</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>8</td><td>Training and Capacity Building</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>9</td><td>Monitoring and Evaluation</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Budget breakdown</td><td>Internal costs of the MEW, MoE, MoH, MoA
The development of the studies shall be done in a collaboration between MEW, MoE, MoPH, MoA. BWE shall support, as well as the Municipalities by providing specific data on irrigated areas and crops per Municipality</td></tr>
<tr><td>Constraints</td><td>Lack of consensus, water quality, regulatory framework, infrastructure and treatment capacity, public perception and acceptance, lack of awareness, monitoring and enforcement.</td></tr>
</table>

<table>
<tr><th>Measure ID and Name</th><td>PWE_E1: Flood protection and mitigation (check dams, reforestation, …)</td></tr>
<tr><td>Description</td><td>This measure aims to minimize the impacts of flooding on communities and ecosystems through a combination of proactive planning, infrastructure development, community engagement, and sustainable practices. Construction of hill lakes, check dams, NBS, soil conservation, reforestation, etc. Also, the implementation of Early Warning Systems (EWS)</td></tr>
<tr><td>Target</td><td>Municipalities, BWE, MEW, CSOs, NGOs</td></tr>
<tr><td>Activity Breakdown</td><td>Act.1: Flood risk assessment
Act.2: Infrastructure design and development (check dams, hill lakes, etc.)
Act.3: Ecosystem and Wetland restoration, floodplain
Act.4: Establish Monitoring and Early Warning Systems
Act.5: Awareness campaigns
Act.6: Stakeholder engagement</td></tr>
<tr><td>Timespan/Timeline</td><td>Medium term.
Once the measure is implemented the expected results/impact will be immediate
<table>
<tr><th>Activity</th><th>Description</th><th>Sem. 1</th><th>Sem. 2</th><th>Sem. 3</th><th>Sem. 4</th><th>Sem. 5</th><th>Sem. 6</th></tr>
<tr><td>1</td><td>Flood risk assessment</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>Infrastructure design and development</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>3</td><td>Ecosystem and Wetland restoration,</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4</td><td>Establish Monitoring and Early Warning Systems</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>5</td><td>Awareness campaigns</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6</td><td>Stakeholder engagement</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Budget breakdown</td><td>-</td></tr>
<tr><td>Constraints</td><td>Lack of awareness;</td></tr>
</table>

<table>
<tr><th>Measure ID and Name</th><td>PWE_E2: Quantitative and qualitative water resources monitoring programme, Meteorological and Hydrometric network expansion and improvement</td></tr>
<tr><td>Description</td><td>Procurement, purchase and installation of a monitoring network to monitor the quantitative status of surface and groundwater bodies, as well as their water quality. Operation and maintenance of the network, and entry of all collected data into a water database to be shared among the relevant stakeholders.
Implementation of the IHIS proposed in the Updated NWSS 2020</td></tr>
<tr><td>Target</td><td>MEW, BWE, LRA, LARI, Municipalities, NGOs/CSOs, Universities</td></tr>
<tr><td>Activity Breakdown</td><td>Act.1: Assessment study of the current situation of the hydrometric, climatic and water quality monitoring and stations
Act.2: Planning and design for the expansion and improvement of the monitoring networks
Act.3: Procurement
Act.4: Installation of the monitoring equipment and software
Act.5: Training of the staff for the monitoring and operation of the network
Act.6: Data Collection
Act.7: Analysis and Reporting
Act.8: Operation and Maintenance</td></tr>
<tr><td>Timespan/Timeline</td><td>Medium term.
Once the measure is implemented the expected results/impact will be immediate
<table>
<tr><th>Activity</th><th>Description</th><th>Sem. 1</th><th>Sem. 2</th><th>Sem. 3</th><th>Sem. 4</th><th>Sem. 5</th><th>Sem. 6</th></tr>
<tr><td>1</td><td>Assessment study</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>Planning and design</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>3</td><td>Procurement</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4</td><td>Installation of the monitoring equipment and software</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>5</td><td>Training of the staff</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6</td><td>Data Collection</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>7</td><td>Analysis and Reporting</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>8</td><td>Operation and Maintenance</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Budget breakdown</td><td>CAPEX
MH A. Meteorological and Hydrometric network expansions and improvements: 6,066,400 $
MH-B. Integrated Hydrological Information System 9,548,400 $</td></tr>
<tr><td>Constraints</td><td>Financial crisis, lack of awareness, priority,</td></tr>
</table>

<table>
<tr><th>Measure ID and Name</th><td>PWE_E3: Register of all pollution sources, estimation of pollution loads, assessment of significant pressures, and control of illegal dumping activities</td></tr>
<tr><td>Description</td><td>Many illegal wastewater outfalls exist within ARB. (i.e. direct disposal of untreated domestic sewage into the river). A first step is to identify and map all these outlets, and then to ban and control illegal wastewater discharges. Similarly, uncontrolled waste damping occurs in ARB. It is thus also relevant to identify and map all these uncontrolled sites, and then to ban and control illegal waste dumping.</td></tr>
<tr><td>Target</td><td>MoE, MEW, Municipalities, CSO, NGOs.</td></tr>
<tr><td>Activity Breakdown</td><td>Act.1: Mapping and recording of all wastewater outfalls (Licensed and illegal) and waste dumping sites (legal and uncontrolled)
Act.2: Estimation of all pollution loads, from point sources and agricultural
Act.3: Analysis of the discharged wastewater characteristics, including chemical and biological analysis
Act. 4: Monitoring and control of wastewater discharge into the river/ fields
Act. 5: Updating and reviewing of the relevant permits for waste disposal
Act. 6: Monitoring and control of waste dumping into the river/ landscape.</td></tr>
<tr><td>Timespan/Timeline</td><td>Medium term.
Once the measure is implemented the expected results/impact will be immediate
<table>
<tr><th>Activity</th><th>Description</th><th>Month 1</th><th>Month 2</th><th>Month 3</th><th>Month 4</th><th>Month 5</th><th>Month 6</th></tr>
<tr><td>1</td><td>Mapping and recording</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>Estimation of all pollution loads</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>3</td><td>Analysis of the discharged wastewater</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4</td><td>Monitoring and control of wastewater discharge</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>5</td><td>Updating and reviewing of the relevant permits</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6</td><td>Monitoring and control of waste dumping</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Budget breakdown</td><td>-</td></tr>
<tr><td>Constraints</td><td>Lack of awareness;</td></tr>
</table>

Measure ID and Name	PWE_E4: Support fish feed as alternative to contaminating feed
Description	Promoting the use of sustainable and environmentally friendly feed options for fish farming. This measure aims to address the issue of contamination in fish feed, which can have detrimental effects on aquatic ecosystems and human health.
Target	Fish farmers, MoA, BWE
Activity Breakdown	Act.1: Environmental assessment Act.2: Market assessment and funding Act.3: Collaboration with feed manufacturers Act.4: Education and training Act.5: Regulatory measures Act.6: Market support Act.7: Awareness campaigns
Timespan/Timeline	Medium term. Once the measure is implemented the expected results/impact will be immediate
Budget breakdown	-
Constraints	Lack of awareness;

Measure ID and Name	PAR_M1: Development of Al Assi River Basin Committee
Description	Define the modalities, roles and operational framework for the formation of a ARB committee, charged with safeguarding the water resources and the environment
Target	Municipalities, BWE, MEW, MoE, MoA, MoPH, NGOs/CSOs:
Activity Breakdown	-
Timespan/Timeline	Short - Medium term. Once the measure is implemented the expected results/impact will be immediate
Budget breakdown	-
Constraints	Legislation and regulatory framework, lack of engagement, lack of awareness,

Measure ID and Name	PAR_M2: Raising awareness and sensitizing the community on the water resources and environmental related issues in Al Assi
Description	Promote water conservation, educate people on water use efficiency, raise awareness on the impacts of illegal abstraction and over-abstraction, raise awareness on the impact of illegal wastewater discharge and waste dumping, sensitize people to act in favor of the river, build sense responsibility and ownership. Includes: awareness campaigns, outreach activities to the community
Target	BWE, Municipalities, NGOs/CSOs
Activity Breakdown	-
Timespan/Timeline	Medium term. Once the measure is implemented the expected results/impact will be immediate
Budget breakdown	Human resources and staff of the involved parties
Constraints	Limited data, lack of awareness, limited engagement, lack of coordination, socio economic conditions, resistance to change,

Measure ID and Name	PAR_M3: Strengthen environmental program actions in primary education
Description	Educate the youth on water conservation, the impacts of illegal abstraction and over-abstraction, the impacts of illegal wastewater discharge and waste dumping, Includes: education programmes in schools, students as "gradients" of ARB future
Target	NGOs/CSOs, Local Universities, Municipalities,
Activity Breakdown	-
Timespan/Timeline	Medium term. Once the measure is implemented the expected results/impact will be immediate
Budget breakdown	-
Constraints	Limited curriculum integration, teaching material, institutional support, funding, social and cultural factors,

Measure ID and Name	DEV_M1: Capacity building activities
Description	Capacity building mainly for the staff on the BWE and the technical staff of the municipalities
Target	BWE, MEW, NGOs/CSOs,
Activity Breakdown	-
Timespan/Timeline	Medium term. Once the measure is implemented the expected results/impact will be immediate
Budget breakdown	-
Constraints	Funding, community engagement, lack of awareness;

<table>
<tr><th>Measure ID and Name</th><th>DEV_T1: Promotion of eco-tourism</th></tr>
<tr><td>Description</td><td>Promotion of eco-tourism</td></tr>
<tr><td>Target</td><td>Municipalities, CSOs/NGOs, MoT, MoYS,</td></tr>
<tr><td>Activity Breakdown</td><td>Act.1: Assessment and inventory of natural and cultural resources
Act.2: Infrastructure development of eco-tourism sites
Act.3: Conservation and restoration of eco-tourism sites
Act.4: Stakeholder engagement
Act.5: Marketing and Promotion
Act.6: Visitor Experience engagement
Act.7: Monitoring and Evaluation</td></tr>
<tr><td>Timespan/Timeline</td><td>Medium term.
Once the measure is implemented the expected results/impact will be immediate
<table>
<tr><th>Activity</th><th>Description</th><th>Sem. 1</th><th>Sem. 2</th><th>Sem. 3</th><th>Sem. 4</th><th>Sem. 5</th><th>Sem. 6</th></tr>
<tr><td>1</td><td>Assessment and inventory of natural and cultural resources</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>Infrastructure development of eco-tourism sites</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>3</td><td>Conservation and restoration of eco-tourism sites</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4</td><td>Stakeholder engagement</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>5</td><td>Marketing and Promotion</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6</td><td>Visitor Experience engagement</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>7</td><td>Monitoring and Evaluation</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Budget breakdown</td><td>Variable</td></tr>
<tr><td>Constraints</td><td>Limited infrastructure, environmental, funding and investment, community engagement, lack of awareness, political and security factors,</td></tr>
</table>

5.3 Programme of Measures

Table 4 Programme of Measures for ARB

Measure ID	Name of the Measure	Category	Sector
Measures linked to the target "Increase water use efficiency and water supply reliability" (ERS)"			
ERS_U1	Actions to modernize the operation of water supply networks and improve water efficiency	Infrastructure	Urban
ERS_U2	Drafting / Updating of the BWE Water Supply Masterplan	Regulatory	Urban
ERS_A1	Irrigation network modernization and maintenance projects	Infrastructure	Agriculture
ERS_A2	Construction of Irrigation dams (Assi phase I & II, Younine)	Infrastructure	Agriculture
ERS_A3	Natural Water Retention Measures (NWRM) for agricultural, including Community Hill Lakes and flash floods retention lakes	Infrastructure	Agriculture
ERS_A4	Thresholds of the required quantities of irrigation water	Regulatory	Agriculture
ERS_M1	Water metering and subscription to BWE, flow meters for irrigation water	Infrastructure	Mix
ERS_M2	Reuse of treated wastewater for agricultural uses	Infrastructure	Mix
ERS_M3	Regulating water tariffs, achieving cost recovery	Regulatory	Mix
ERS_M4	Monitoring and control of illegal abstractions and private wells, and definition of safe yield per groundwater body	Regulatory	Mix
ERS_M5	Technical specifications for wastewater reuse	Regulatory	Mix
Measures linked to the target "Promote Water Conservation (WCO)"			
WCO_U1	Water saving in households and buildings (public, commercial)	Infrastructure	Urban
WCO_A1	Subsidies for change of irrigation systems	Financial	Agriculture
Measures linked to the target "Protection of the Water resources and the Environment (PWE)"			
PWE_U1	Conduct necessary environmental studies	Regulatory	Urban
PWE_U2	Drinking water protection perimeters	Regulatory	Urban
PWE_U3	Municipal solid waste management	Regulatory	Urban
PWE_E1	Flood protection and mitigation (check dams, reforestation, …)	Infrastructure	Environment
PWE_E2	Quantitative and qualitative water resources monitoring programme, Meteorological and Hydrometric network expansions and improvement	Infrastructure	Environment
PWE_E3	Register of all pollution sources, estimation of pollution loads, assessment of significant pressures, and control of illegal dumping activities	Regulatory	Environment
PWE_E4	Support fish feed as alternative to contaminating feed	Financial	Environment
PWE_UI1	Wastewater collection and treatment, maintenance of existing WWTP	Infrastructure	Urban, Industry
PWE_UI2	Drafting/Updating of BWE Wastewater Masterplan	Regulatory	Urban, Industry
Measures linked to the target "Participatory Water Management (PAR)"			
PAR_M1	Development of Al Assi River Basin Committee	Regulatory	Mix
PAR_M2	Raising awareness and sensitizing the community on the water resources and environmental related issues in Al Assi	Education	Mix
PAR_M3	Strengthen environmental program actions in primary education	Education	Mix
Measures linked to the target "Socio-Economic Development (DEV)"			
DEV_M1	Capacity building activities	Education	Mix
DEV_T1	Promotion of eco-tourism	Socio-Economic	Tourism

Target Name	Target Code	No. of measures
Increase water use Efficiency and water Supply Reliability زيادة كفاءة استخدام المياه وموثوقية إمدادات المياه	ERS	13
Promote water Conservation تعزيز الحفاظ على المياه	WCO	2
Protection of the Water resources and the Environment حماية الموارد المائية والبيئة	PWE	10
PARticipatory water management إدارة المياه التشاركية	PAR	4
Socio-economic DEVelopment التنمية الاجتماعية والاقتصادية	DEV	2

Measure ID	Name of the Measure	Category	Sector
Measures linked to the target "Increase water use efficiency and water supply reliability" (ERS)" زيادة كفاءة استخدام المياه وموثوقية إمدادات المياه			
ERS_U1	Actions to modernize the operation of water supply networks and improve water efficiency إجراءات لتحديث تشغيل شبكات إمدادات المياه وتحسين كفاءة المياه	Infrastructure بنى تحتية	Urban حضري
ERS_U2	Drafting / Updating of the BWE Water Supply Masterplan صياغة / تحديث المخطط الشامل لإمدادات المياه في مؤسسة مياه البقاع	Regulatory تنظيم / قوننة	Urban حضري
ERS_A1	Irrigation network modernization and maintenance projects مشاريع تحديث وصيانة شبكة الري	Infrastructure بنى تحتية	Agriculture زراعة
ERS_A2	Construction of Irrigation dams (Assi phase I & II, Younine) انشاء سدود للري (العاصي المرحلة الاولى والثانية، يونين)	Infrastructure بنى تحتية	Agriculture زراعة
ERS_A3	Natural Water Retention Measures (NWRM) for agricultural, including Community Hill Lakes and flash floods retention lakes التدابير الطبيعية لحفظ المياه الطبيعية لأهداف لزراعة ، بما في ذلك البحيرات الجبلية وبحيرات احتجاز السيول	Infrastructure بنى تحتية	Agriculture زراعة
ERS_A4	Thresholds of the required quantities of irrigation water دراسة الكميات القصوى المطلوبة من مياه الري	Regulatory تنظيم / قوننة	Agriculture زراعة
ERS_M1	Water metering and subscription to BWE, flow meters for irrigation water تعزيز الإشتراك بخدمات مؤسسة مياه البقاع وتركيب عدادات مياه (شفة + ري)	Infrastructure بنى تحتية	Mix مختلط
ERS_M2	Reuse of treated wastewater for agricultural uses إعادة استخدام مياه الصرف الحي المعالجة للري	Infrastructure بنى تحتية	Mix مختلط
ERS_M3	Regulating water tariffs, achieving cost recovery قوننة تعرفة المياه، تحقيق إسترداد الكلفة	Regulatory تنظيم / قوننة	Mix مختلط
ERS_M4	Monitoring and control of illegal abstractions and private wells, and definition of safe yield per groundwater body مراقبة والتحكم بعمليات السحب غير القانونية والآبار الخاصة، وتحديد الإنتاجية الآمنة لكل مصدر مياه جوفية	Regulatory تنظيم / قوننة	Mix مختلط
ERS_M5	Technical specifications for wastewater reuse دراسة المواصفات الفنية لإعادة استخدام مياه الصرف الصحي	Regulatory تنظيم / قوننة	Mix مختلط
Measures linked to the target "Promote Water Conservation (WCO)" تعزيز الحفاظ على المياه			
WCO_U1	Water saving in households and buildings (public, commercial) تركيب أدوات توفير المياه في المنازل والأبنية (أماكن عامة، متاجر...)	Infrastructure بنى تحتية	Urban حضري
WCO_A1	Subsidies for change of irrigation systems دعم لتطوير أنظمة الري	Financial مالي	Agriculture زراعة
Measures linked to the target "Protection of the Water resources and the Environment (PWE)" حماية الموارد المائية والبيئة			
PWE_U1	Conduct necessary environmental studies إجراء الدراسات البيئية اللازمة	Regulatory تنظيم / قوننة	Urban حضري
PWE_U2	Drinking water protection perimeters محيط حماية مياه الشرب	Regulatory تنظيم / قوننة	Urban حضري
PWE_U3	Municipal solid waste management إدارة النفايات الصلبة	Regulatory تنظيم / قوننة	Urban حضري
PWE_E1	Flood protection and mitigation (check dams, reforestation, …) الحماية من الفياضانات والتخفيف من حدتها (سدود فياضانات، تحريج...)	Infrastructure بنى تحتية	Environment بيئة

Measure ID	Name of the Measure	Category	Sector
PWE_E2	Quantitative and qualitative water resources monitoring programme, Meteorological and Hydrometric network expansions and improvement برامج مراقبة كمية ونوعية مصادر المياه، تحسين شبكات الأرصاد الجوية والهيدرومترية	Infrastructure بنى تحتية	Environment بيئة
PWE_E3	Register of all pollution sources, estimation of pollution loads, assessment of significant pressures, and control of illegal dumping activities تسجيل جميع مصادر التلوث، وتقدير كميات وتأثيرات التلوث، ومراقبة الأنشطة المضرة الغير قانونية	Regulatory تنظيم / قوننة	Environment بيئة
PWE_E4	Support fish feed as alternative to contaminating feed دعم إستخدام أعلاف الأسماك كبديل للملوثات العضوية	Financial مالي	Environment بيئة
PWE_UI1	Wastewater collection and treatment, maintenance of existing WWTP جمع ومعالجة مياه الصرف الصحي، صيانة محطات معالجة مياه الصرف الصحي الحالية	Infrastructure بنى تحتية	Urban, Industry حضري، صناعة
PWE_UI2	Drafting/Updating of BWE Wastewater Masterplan صياغة / تحديث المخطط الشامل لمياه الصرف الصحي في مؤسسة مياه البقاع	Regulatory تنظيم / قوننة	Urban, Industry حضري، صناعة
Measures linked to the target "Participatory Water Management (PAR)" إدارة المياه التشاركية			
PAR_M1	Development of Al Assi River Basin Coordination Committee لجنة تنسيق حوض نهر العاصي	Regulatory تنظيم / قوننة	Mix مختلط
PAR_M2	Raising awareness and sensitizing the community on the water resources and environmental related issues in Al Assi تعزيز توعية المجتمع حول الموارد المائية والقضايا المتعلقة بالبيئة في منطقة العاصي	Education تعليم	Mix مختلط
PAR_M3	Strengthen environmental program actions in primary education تعزيز البرامج البيئية في التعليم الابتدائي في المدارس	Education تعليم	Mix مختلط
Measures linked to the target "Socio-Economic Development (DEV)" التنمية الاجتماعية والاقتصادية			
DEV_M1	Capacity building activities مشاريع بناء القدرات	Education تعليم	Mix مختلط
DEV_T1	Promotion of eco-tourism الترويج للسياحة البيئية	Socio-Economic إجتماعي - إقتصادي	Tourism سياحة