LEBANON WATER PROJECT

COMMITMENT OF FARMERS AND INDUSTRIES TO PROTECT WATER RESOURCES

DELIVERABLE 98 – VERIFICATION OF COMMITMENT REPORT

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<td>Chamber of Commerce, Industry, and Agriculture in Zahle</td>
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INTRODUCTION

The Lebanon Water Project (LWP) is a five-year activity funded by the United States Agency for International Development (USAID) with the overarching objective of increasing access to clean, reliable, and sustainable sources of drinking water for Lebanese Citizens. LWP focuses on improving Lebanon’s capacity in the management of water resources, enhancing the efficiency and sustainability of the public water utilities, and addressing water challenges arising from the impact of the Syrian Refugee influx to Lebanon. The project is providing technical and capital assistance to relevant stakeholders and counterparts in order to enhance the performance of the water sector in Lebanon. LWP is promoting better water governance as means to help ensure long-term preservation of the Lebanon’s water resources.

LWP’s Objectives

- Improve service delivery and resource management capacity by the five public water utilities. LWP will strengthen the managerial and operational functions of the water utilities, while making the necessary infrastructure upgrades. The project supports the Government of Lebanon’s water sector strategy to further empower public utilities as legitimate water and wastewater services providers.
- Improve civic engagement in water management and advance citizens’ perception of water utilities’ role in providing a necessary and valuable service. The project promotes reform at the policy and regulatory level. It is a bottom-up approach that strengthens the role of civil society to effectively contribute and participate in democratic water governance. LWP also increases water users’ awareness and sense of ownership, improve citizens’ responsibilities vis-à-vis water service providers, and promote citizens’ roles and responsibilities with regard to protection of the environment.
- Improve private sector involvement in water management. LWP promotes private sector involvement in water management. The project identifies potential areas for public private and business-to-business partnerships to promote water supply service improvements, develop and fund innovative water conservation technologies.

OVERVIEW

In alignment with its objectives, LWP collaborated with private sector partners to engage farmers and industries in promoting water conservation and protection. LWP’s interventions with farmers and industries aimed at:

- Raising awareness on the benefits of using water conservation tools
- Providing financial incentives to adopt water conservation tools
- Serving as a model for behaviour change in water consumption, which could be replicated by other donors and entities.

This report provides details on sustainability of USAID investments that LWP made through grants and their impact on farmers and industries. Specifically, the report explains the different approaches used by LWP to promote water conservation and protection, the different perceived impacts, and the lessons learned.

Prior to drafting this report, LWP conducted field visits to gauge the reaction of individuals and entities who benefitted from LWP’s water conservation tools, verify the use of equipment LWP provided, and assess impact and sustainability of LWP’s interventions with farmers and industries. To support the field visits, a set of questions was devised (Annex A) and asked to beneficiaries. The results of field visits and responses to questionnaires were analysed and regrouped in two chapters, Chapter 1- Farmers’ Commitment, and Chapter 2 – Industries’ commitment.
It is worth noting that farmers and industries, although in varying contexts, had very similar experiences with LWP. The illustrations below explain the most cited concerns, challenges and opportunities as reported by the beneficiaries.

**FARMERS**

The word cloud below illustrates the discourse of interviewees and highlights the most frequent topics that emerged from LWP’s discussions with farmers. “Cost” and “Water” were identified as the biggest concerns: the cost of irrigation was the most preoccupying and critical topic, including cost of fuel, investment costs needed to utilize water saving tools, and cost of buying water. As water scarcity increases and wells are drying, the cost of water is becoming too high to afford, which is why many are coming to appreciate the benefits of drip irrigation. Cost was also highlighted because adopting water conservation tools requires a considerable initial investment that usually farmers do not have. However, lower cost of fuel was also highlighted as a result and benefit of using drip irrigation.

Other positive impacts of drip irrigation are the increase in farmers’ capacity to cultivate, the improvement of crop quality, and the decrease in manual labor experienced after using LWP’s supported water conservation tools. Awareness was also a prominent topic as farmers reported increase in experience and knowledge following LWP’s interventions. Further details regarding the results of interviews are discussed in Chapter 1.

**Farmers Word Cloud**

**INDUSTRIES**

A quick look at the industries’ word cloud shows that water was at the heart of the conversation and the most cited word in the discourse. It is also often followed by the adjective “clean”, which industrialists are now happy to have. Cost was another frequent word discussed as is explained later in this report. The cost of buying water treatment equipment is substantial and industrialists were oblivious to the volumes of water savings to be had. Compared to the traditional means used, water recycling equipment also decreases the amount of labor and space needed to manage their waste. Another positive impact for industrialists was the extended lifetime of their machinery as a result of utilizing clean water in their processes and resulting from the recycling process.
Additional details about the experiences of farmers and industries, their continuous commitment, and the impact they had on their neighboring peers is discussed in the following two chapters.
CHAPTER 1 – FARMERS COMMITMENT

SHORT DESCRIPTION OF LWP’S INITIATIVES

The agricultural sector in Lebanon consumes around 70% of the available water resources as per the water security analysis conducted by LWP. To respond to this great demand, LWP developed several approaches aiming at reducing water demand and increasing water efficiency. These initiatives presented viable and sustainable models of water conservation and water efficiency in the agricultural sector with hopes of being replicated through future investments.

LWP used financial and technical resources to entice farmers to conserve water, namely the project used two main approaches:

- The Stewardship and Incentive Rebate Program
- The Communal Water Services Program

These approaches will serve as models to be replicated when working with farmers towards a more sustainable water use in irrigation. To showcase results obtained and encourage replication, LWP in collaboration with relevant actors, also held a total of five farmers field days.

THE STEWARDSHIP AND INCENTIVE REBATE PROGRAM

LWP devised a water stewardship program, which consisted of engaging private sector entities in being water responsible partners. Through this program, LWP secured the commitment of three service providers in agricultural supplies in Lebanon, Debbaneh, Robinson Agri, and Unifert. The work of these companies was comprised of two main aspects: conduct farmer’s field days to raise awareness among farmers on the different water saving technologies and assist interested farmers in preparing a feasibility study and design for their planned investments that could qualify to receiving a rebate from LWP through an Incentive Rebate Program (IRP).

The IRP was designed by LWP under a grant fund with the primary purpose to provide an opportunity for Lebanese farmers willing to adopt efficient agricultural practices. Through the IRP, farmers collaborated with one of the three agricultural input suppliers and benefitted from LWP approved support activities that included technical assistance such as design and installation of equipment, as well as financial assistance. In fact, as detailed below, one of the challenges for farmers to adopt water conserving tools is financing in terms of capital investments needed. The IRP provided financial incentives in the form of cost sharing for farmers to switch to drip irrigation or hydroponics. More than fifteen farmers applied, ten of whom were found to be eligible to benefit from the IRP funds.

Through the IRP, LWP was able to address two key priorities in agriculture:

Salim Ghazzawi - Potato Crops
1. Enhanced sustainable water resources management: The program enticed farmers to adopt effective and efficient water resources management and achieve greater water security. Specifically, LWP contributed to protecting ground water from unnecessary pumping and to reducing pollution.

2. Improved irrigation water efficiency: the program enhanced water management capabilities of farmers and helped them with improving long-term competitiveness of products in the market. This, in turn, increases their ability to embrace wider business opportunities.

COMMUNAL WATER SERVICES GRANT

Under its grant fund, LWP launched a communal water services grant in April 2016, with the objective of supporting sustainable water conservation actions, improving water use efficiencies, reduce the pollution of rivers, and reduce non-productive uses of water.

Among the winners under this grant was the Chamber of Commerce, Industry, and Agriculture in Zahle (CCIAZ). CCIAZ, proposed a project for “Improving water availability, quality, and uses in agriculture and industry in the Bekaa”. This project raised the awareness of farmers on water use efficiency and provided a financial incentive to reduce investment costs. CCIAZ’s project was built on two components:

- Promoting irrigation efficiency.
- Working with lead farmers on pilot plots.

Below are the details of the two components.

Promoting irrigation efficiency

Affected by climate change, the Northern Bekaa areas are experiencing unprecedented droughts. According to grape farmers, precipitation is no longer sufficient anymore for high crop quality. While rain was enough to produce grapes with high quality a few years back, nowadays farmers have to irrigate once or twice per season to preserve the quality of their produce. With water becoming extremely scarce in the area, CCIAZ partnered with one of the most active cooperatives (COOPs), Coteaux Heliopolis, and submitted a proposal that included the establishment of a hill lake with the capacity of 17,000 m³ and the installation of drip irrigation on land of farmers members of the COOP. CCIAZ’s proposal aimed at ensuring a wider land area would benefit from irrigation water available in the hill lake. Investments made allowed farmers to cultivate 92.1 dunum (about 9.21 Ha.) of land. This initiative encouraged farmers to cultivate additional plots that were not being used previously for lack of water. It is worth noting that cultivation reduces land degradation and improves water infiltration in the soil and its recharge.

Working with lead farmers on pilot plots

Farmers’ traditional irrigation techniques tend to exceed actual needs of water by 25% to 40%. CCIAZ worked with two lead farmers in the Bekaa to showcase the most efficient irrigation models that allow water and energy savings while benefiting both the environment and the farmers. The purpose from the pilot plots was to raise awareness among farmers in the Bekaa on implementing the most efficient agricultural model. CCIAZ developed well-established selection criteria¹ and chose two farmers for the pilot plots. CCIAZ’s pilot project on implementing the most efficient agricultural model focused on several aspects:

¹ Annex H of this report
• **Photovoltaic solar panels:** introducing the benefits of green energy through installing photovoltaic solar panels on both lots selected.

• **Soil and water testing:** demonstrating to farmers the importance of soil and water quality testing in managing farmland and developing appropriate irrigation schedules based on test results.

• **Irrigation network efficiency using drip irrigation:** properly designing the drip irrigation network to show farmers how small modifications to irrigation systems allow for a 30 to 40% increase in irrigation efficiency.

• **Introducing tensiometers:** procuring tensiometers, which are a simple tool that detects soil moisture allowing farmers to maximize water efficiency and reduce risks of over irrigation.

The first participating farmer had 10 greenhouses for growing vegetables while the second farmer was growing grapes on 10 dunums of land. Investments made were cost shared between selected farmers and LWP.

In total, 21 farmers benefited directly from LWP’s approaches described above, with 10 farmers under the IRP and 11 from the communal water services grant to CCIAZ.

**FARMERS FIELD DAYS**

In addition, LWP’s activities extended beyond the direct beneficiaries through farmer field days. LWP held five Farmers Field Days in partnership with agricultural equipment suppliers and CCIAZ. Through these outreach activities, the latest technologies and tools were featured and their adoption was promoted among farmers. Through these filed days, suppliers and farmers used their plots to exhibit and validate the different technologies to other farmers. As a result, 177 farmers were engaged in awareness raising activities that were delivered at the field days.

**SUSTAINABILITY OF LWP ACTIONS IN AGRICULTURE**

To assess the operational status, the efficiency, and the sustainability of LWP’s investments, described in the previous sections, LWP conducted field visits to farmers after 6 months to a year from date of equipment installation. The visits had three main objectives: physical verification of the installations, sustainability of the operation and use of material, and interviews with beneficiaries to collect overall perception of the project. Findings are detailed below.

**FIELD VERIFICATION AND FARMERS INTERVIEWS**

LWP was able to physically verify the existence of the equipment procured and the fact that it was still being properly used on the farmers’ plots. The verification was possible at all sites and all farmers were interviewed except one who could not be reached. The schedule of visits extended between July 27, 2019 and August 16, 2019 as detailed in Annex A. Of the 21 farmers, 16 were fully operational at the time of
the visit, four had transported and installed their equipment at another location to benefit other crops, and one was not available for interview, and therefore, could not be assessed. These visits confirmed that 96% of the investments made were still being used efficiently. By the same token, the visits allowed LWP to interview farmers, assess their perception of the impact and benefits, and identify areas of for future improvement as lessons learned.

PERCEPTION OF BENEFITS

Based on the numerous interviews, below is a summary of perceived benefits as reported by the farmers. Benefits are divided into nine different areas: water saving, expanding cultivated land, reduced pollution, reduced cost, improved livelihood, easier operations, financial support, better quality, and easier maintenance.

Water Saving
The main three tools perceived to save water by farmers were the drip irrigation system, the hydroponics system, and the use of tensiometers. Farmers reported an average of 44.3% savings on water with drip systems, up to 90% with hydroponics, and 58% with tensiometers.

Expanding Cultivated Land
Farmers under the Coteaux Heliopolis COOP in Deir Al Ahmar had 92.1 dunum of newly irrigated land, which was previously uncultivated. They reported that, by using drip systems, an additional number of farmers was able to benefit from the same limited amount of water available in the hill lake. Also, the pilot plot farmer of vegetable greenhouses was very thankful as amounts of water saved have allowed him to expand his business operations and cultivate two additional greenhouses.

Reduced Pollution
Across all initiatives, farmers reported using less fertilizers and less fuel, which contributing to reducing pollution in ground water and air.

Reduced Cost
Across all initiatives, all farmers reported reduces costs for buying water, fuel, and fertilizers. Some farmers also reported a reduced need for pesticides and labor, and therefore reduced labor cost. All these combined have substantiated positive impact in reducing the cost of the produce and improve the product marketability.

Improved livelihood
Increased income was not the first thing that the IRP farmers considered. However, some potato farmers reported up to 45% increase in yield. Farmers of the Deir Al Ahmar Coteaux Heliopolis COOP reported having grapes of top quality and being able to sell them at a higher price. One greenhouse farmer that participated in the pilot plot mentioned that the holistic system installed at his farmland is a key factor in improving his livelihood.

Easier Operations
Most farmers agreed that water saving technologies in irrigation are easier to operate and require less labor than traditional irrigation methods. One Hydroponics farmer reported that system operation are easy as long as specific know-how is available in terms of rack installation and spacing and composition of nutrients.
Financial Support
This particular benefit was mostly visible by farmers under the IRP approach. 85% of farmers would not have been able to switch to water saving tools had it not been for the support provided through LWP.

As for farmers under the Coteaux Heliopolis COOP, they all installed drip irrigation to benefit from the constructed hill lake. While 75% of the COOP farmers were able to comply on their own dime, the remaining 25% were ecstatic to benefit from the CCIAZ-LWP support to install drip irrigation and cultivate their land.

Also under the CCIAZ project, the pilot plot farmers declared that they would have not been able to perform these activities without the financial aid and technical assistance provided by USAID/LWP.

Improved Crop Quality
Improved crop quality was not a top priority for the farmers, as they all had costs, savings, and revenue concerns in mind when participating in the program. Therefore, better quality was perceived differently among farmers interviewed. For instance, better quality was extremely important for Coteaux Heliopolis COOP farmers because it positively affects the selling price of their grapes.

As for the pilot plots, one of the two farmers mentioned that the quality of his crops improved as they became more resistant to diseases.

Last but not least, 42% of farmers participating in the IRP highlighted the improved quality as an important benefit from installing water saving technologies.

Maintenance
More than 90% of the farmers said that the maintenance is easy to perform and its cost is affordable.

EVIDENCE OF PROJECT IMPACT
The project had several benefits in terms of water savings, reduced need for labor, and increased yield. In this section, LWP discusses the impact of the project based on data gathered from agricultural equipment experts and service providers as well as water and agricultural engineers. This section also lays out the ripple effect of the project. Based on experiment reports, the feasibility studies conducted, and the internal M&E procedures at LWP, four main areas of benefits for farmers can be highlighted: water savings, energy savings, yield improvement, and profits. Highlights of the benefits are:

2 Unifert’s experiment
3 CCIAZ findings in pilot plots
4 LWP M&E report
5 IRP farmer’s grants proposals
EVIDENCE OF REPLICABILITY

Farmers interviewed were very pleased with the project in general, and because of their satisfaction, 57% of them reported that they are actively promoting the idea to neighboring farmers. Of the people promoting the idea, 75% said that their peers are encouraged but their financial limitations prevent them from switching to water saving tools. Others also mentioned that a similar project will help a great number of farmers. Meanwhile one farmer in Ainata was able to convince the entire village to follow his lead.

At the same time, farmers in Deir Al Ahmar, members of the Coteaux Heliopolis COOP, are reporting that the hill lake they built can provide for 10,000 dunums that are ready to be cultivated whenever a financing opportunity is available. Any similar initiative would improve the livelihoods of at least 16 additional farmers in the area.

Additionally, a farmer in Qaa came all the way to Taraya to learn about the integral irrigation system installed at the pilot plot and started replicating it. He went back and started with the installation of a photovoltaic system to be followed by drip irrigation and tensiometers. The key farmer in Taraya explained that if financial support is made available, more farmers would do the same.

Farmers now have a proven experience allowing them to demonstrate to peers that this investment is worthwhile, that it saves water, and that it is profitable. Most importantly, they now have a proof that these interventions apply to their environment and to the specific conditions of their land. Farmers now are more ready to jump on opportunities of switching to water saving technologies. However, given the needed initial investments, and the financial limitations of the farmers (many of them are not bankable), the replicability effect is now limited to farmers who can afford it, while others need additional support similar to USAID grants under LWP.

AINATA DRIP REVOLUTION

Rami Rahme, a beneficiary of the LWP IRP, in collaboration with UNIFERT is reaping the results of his investments and sowing seeds in Ainata all around him. Rami is cultivating grapes on uneven land, which under traditional irrigation would have had less than average yield. However, with drip irrigation, all of Rami’s crops are receiving the same amount of water. Seeing the results at hand, he reported that all the village bought into this well designed system. As a result, 40,000 new grape crops and 100 dunums of apples and grapes have now converted to drip. Even the mayor of Ainata, Michel Rahme, removed his old drip irrigation system and adopted the UNIFERT design after seeing its efficiency.
LESSON LEARNED FOR BEHAVIOR CHANGE

At the end of this verification exercise, LWP learned that to succeed in changing the behavior of farmers, three key ingredients must come together: Partnering with champions, providing access to financial support, and proving the theory through practice.

PARTNERING WITH CHAMPIONS

Leading farmers
Farmers learn most from their peers. Many of them reported that their interest was first sparked after a neighboring farmer installed drip irrigation and they saw the results. These farmers then seized the financing opportunity as soon as it appeared. While some of the interviewed farmers are agricultural engineers, the majority of farmers is not. These lay farmers heavily rely on what they personally witness and what they learn from one another. Farmers field schools, pilot plots, and experiments, become a key element in convincing farmers to do the switch. This is why engaging leading farmers, who are influential in their area, is a crucial aspect of raising awareness and spreading knowledge.

Successful Cooperatives
Partnering with leading cooperatives, who can entice members, was another key factor in the success of LWP’s initiatives to change farmers' behaviors in irrigation. The below case study provides highlights and details in this regards.

SUSTAINABILITY AND REPLICABILITY OF THE COTEUX HELIOPOLIS EXPERIENCE

Although, to date, there is no Lebanese law imposing water conservation on farmers in irrigation, the Coteaux Heliopolis in Deir Al Ahmar is doing it. Due to the scarcity of water and the need to irrigate grapes at least twice a year, the Coteaux Heliopolis cooperative constructed a hill lake to provide water for grapes farmers. The cooperative mandated its members to install drip systems to maximize the use of available water. Through this initiative, nine new farmers benefitted and 92.1 new dunums were cultivated, with a possibility of extending the service to more farmers and around 10,000 additional dunums. Additionally, farmers in the village are now convinced this is the way to irrigate, not only because water is scarce, but also because the grapes are of better quality and of the same grade, and the need for fertilizers is reduced.

In times of drought, the cooperative led the way, with a clear vision, and provided water to its members fairly: Coteaux Heliopolis made a decision on behalf of all farmers that drip is the most sustainable and equitable approach to irrigation in the area. Everyone abided by this decision. Adopting this type of irrigation has become a compliance matter, with the cooperative rules and regulations applicable to all members.

This model is definitely worth replicating with farmers that benefit from a common source of water.

PROVIDING ACCESS TO FINANCIAL SUPPORT

The vast majority of farmers stated that the primary incentive to switch to drip irrigation was the financial support provided. While many farmers understood the benefits of water saving techniques and had seen experiences of other farmers, they were not able to make this switch without the financial support. Most farmers have micro businesses that are not bankable. This prevents them from accessing any of the banking services, including available soft loans. Projects providing incentives, like the IRP, are one solution for pushing small farmers to switch to better irrigation practices. Cooperatives similar to the
Coteaux Heliopolis are another solution because they are bankable as an entity and they can help farmers. Informing these entities that financing facilities are available would pave the way for farmers to access soft loans or other possible solutions.

PROVING THE THEORY BY PRACTICE

Farmers are very risk averse as they cannot risk investing in solutions that are not applicable to their contexts. The various experiments and field schools contributed to proving that the theoretical benefits behind water saving systems like drip irrigation, including financial profitability, and increased yields, are real and valid within the different Lebanese local contexts.

Proving a theory by practice is not enough; awareness must be built around it. First, awareness is crucial as a learning tool about new technologies and available financing schemes. Second, more awareness is needed for some farmers to fully understand the operations and maintenance of the systems installed and to completely appreciate the benefits of the tools presented. Finally, it is important to spread this knowledge so that more farmers can benefit from it.

In conclusion, many farmers still opt for traditional irrigation techniques instead of the new water saving technologies. Leading initiatives similar to LWP’s approach will slowly, but surely, generate exponential results in increasing water use efficiency.

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6 Lebanese Law for Cooperatives Article 42.
CHAPTER 2 – INDUSTRIES COMMITMENT

SHORT DESCRIPTION OF LWP’S INITIATIVE

One of LWP’s objectives is to support the industrial sector in adopting best practices in water resources management and allow this sector to lead by example in showcasing the economic benefits of better water management. To achieve this goal, LWP collaborated with the Association of Lebanese Industrialists (ALI) on the “Water Efficiency in Lebanese Industries (WELI)” project. This project focused on an economically sustainable culture of water conservation through:

- Establishing a culture of water conservation in the stone-cutting sector.
- Becoming a role model for other sectors to promote economic efficiency in water conservation.

In alignment with the above mentioned objectives, and based on a clear set of selection criteria, LWP assisted nine Lebanese Industries in the implementation of water saving initiatives. The assistance was divided into five different phases:

1- Selecting and committing nine marble and granite industries.
2- Conducting a pre-water-audit assessment for these industries by an environmental consultant.
3- Organizing a workshop to recommend the most appropriate solutions for protection and conservation of water resources.
4- Implementing agreed upon solutions by the industries.
5- Conducting a post-water-audit by the same environmental consultant to show results of the implemented projects.

Through the WELI project, LWP and the nine selected industries agreed to share the costs of installing water treatment facilities: LWP invested 150,000 USD with the industries investing 135,000 USD. LWP provided two types of assistance.

- Assistance to marble and granite industries who did not have any water treatment equipment: LWP allowed them to install equipment to improve water conservation using best industry practices (type 1 assistance).
- Assistance to marble and granite, industries who already had basic water treatment equipment: LWP allowed these industries to upgrade their existing equipment and improve water conservation with Motor Control Center and Dewatering Press (type 2 assistance).
The map below provides a summary of the selected industries and their geographical spread (IMF, Rocky, Arts & Deco, ONYX, NMC, GNS, Usine Nationale, Jamal Yazda, AMG).

**Geographical distribution of WELI industries**

**SUSTAINABILITY OF LWP ACTIONS IN INDUSTRIES**

Similar to the farmers’ verification process, LWP conducted field visits with industries to physically verify installation of equipment, verify the sustainability of their operation/use, and to conduct interviews with beneficiaries to collect overall perception of the project. Findings are detailed below.
FIELD VERIFICATION AND INDUSTRY INTERVIEWS
LWP verified physically the existence of equipment procured under the grant and installed at the industries’ premises. The verification was possible at all sites, and LWP was able to interview all industrialists. The schedule of visits extended from July 18, 2019 until September 6, 2019, as detailed in Annex G. Through the visits, LWP made sure the water conservation equipment was being properly used and interviewed industries beneficiaries to assess their perception of the impact and benefits and identify areas for future improvement as lessons learned.

Water treatment equipment installed at all nine industries was fully operational and LWP thus confirmed that 100% of its investment was being used efficiently.

Mohamad Jaafar - Silo and Press

PERCEPTION OF BENEFITS
Based on numerous interviews, below is a summary of perceived benefits as reported by industries. Benefits are divided into seven different areas: water saving, reduced pollution, reduced cost, increased income, easier operations, financial support, and better quality.

Water saving
Industries were pleased and extremely grateful for the amount of water saved, recycled, and reused in their system. All of them mentioned that they do not need to buy water anymore. This was of additional relief to the few industries who had their own wells that were drying out or were being salinized by seawater intrusion. Also, up to 90% of water is now being saved across all industries and some industries reported saving up to 20 Million Lebanese Pounds in costs of buying water per year.
Reduced Pollution

Pollution is one of the major concerns for rock cutting industries due to several reasons: the cutting process itself produces a semi-liquid sludge that stagnates and is not easily accepted by dump sites, and the Ministry of Environment requires compliance with standards for treating the wastewater produced before discharge.

Many industries mentioned the process also produces a dust cloud that pollutes the area and is a potential health and safety hazard for employees. Installing this water conservation equipment has reduced this pollution because industries now have water to spray and cut down the dust. As such the workplace has become a safer space for employees.

Also, residue discharge of rock cutting industries is a challenge. Not many dump sites accept the sludge waste, and the only other alternative is discharging it permanently in a pond at the industry’s premises, which requires large areas of land and is not by itself an environment friendly solution. Having this treatment system in place has reduced pollution impact on the environment and freed up valuable space for the industries.

It is also worthy to note that the Ministry of Environment and the Ministry of Industry have been forcing industries around the Litani Basin to either comply with national environmental standards or face shut down. LWP’s initiative has allowed the industries to fulfill compliance requirements and stay in business. For this reason, 70% of LWP’s industries stated that compliance is an important factor contributing to their decision to install the treatment facilities. A very particular case was that of Yazda plant located near the Qaraoun lake as discussed later in this report.

Reduced Cost

66% of industrialists confirmed that they are saving on costs of buying water, cleaning and maintenance of the machinery. They also saved on space that they can now use for other purposes. However, 30% of industrialists mentioned no reduction in cost, especially type II industries who already had elements of the treatment systems in place.

Increased Income

Only one industrialist was able to increase his income because he is selling the calcic residues of the treated wastewater to paint factories. All others are not selling theirs currently but are aware of this potential business opportunity. More details are presented in the box below.
Easier Operations
Many industrialists (44%) experienced easier work processes with the new installed equipment. One industrialist only was having difficulties because he needed to pump his wastewater twice before it reached the recycling facility. As he is currently re-engineering installations so that the treatment process becomes easier, he is also thankful for the additional water saved.

Financial Support
Most industrialists (67%) already had plans to install water treatment equipment. However, due to the economic situation in the country, they were postponing such investments to a later stage. The LWP incentives allowed them to make these changes earlier than expected, as they all seized the financial opportunity to implement. Many others (33%) would not have installed the treatment facilities at all if it had not been for LWP’s initiative.

Better Product Quality
All industrialists agreed that their products are of better quality because of cleaner water obtained after treatment. They mostly emphasized two main elements: better water quality is producing a better quality marble (smoother marble), and better quality of water is extending the lifetime of the machineries at the industries.

EVIDENCE OF PROJECT IMPACT
The previous section showed clearly how the project had many benefits in terms of water savings, reduced cost, and improved quality. Geoflint, a geo-environmental consulting firm, assessed these benefits and documented their impacts in a report called: “water efficiency in Lebanese industries” (Annex I). The main impacts highlighted in this report are stated below:

• Treated wastewater can help stone cutting industries regain up to 90% of their water. This measure helps protect groundwater and reduces the cost of buying water.
• Adopting an efficient wastewater treatment system can help stone cutting industries save on maintenance costs and space and comply with government regulations.
• Six out of nine industries dumped their marble cutting waste in ponds located near rivers. Four of them were also located above karstic systems and had a high probability of leaching. The treatment equipment installed helps avoid leaching and protects rivers and groundwater.
- Industries saved around 67.7% of water used, resulting in \textbf{45,618 m}^3 \textit{saved per year}.
- Industries also improved suspended solid levels in water by \textbf{91.8%}.
- The reduced quantities of sludge are \textbf{on average 80.2%}.

Below is a table summarizing the specific impact on water consumption as noted in the Geoflint report.

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Pre-Development Audit</th>
<th>Post-Development Audit</th>
<th>Quantity of Water Saved per Year (m3/year)</th>
<th>Percent Water Saving (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ibrahim Mallah et Fils SAL</td>
<td>4800</td>
<td>1665</td>
<td>3135</td>
<td>65.3</td>
</tr>
<tr>
<td>Mohammaad Jaafar &amp; Co. “Rocky”</td>
<td>3000</td>
<td>885</td>
<td>2115</td>
<td>70</td>
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<tr>
<td>National Marble Company S.A.L.</td>
<td>21600</td>
<td>5193</td>
<td>16407</td>
<td>76</td>
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<tr>
<td>Onyx for Trade and Industry</td>
<td>4500</td>
<td>1200</td>
<td>3300</td>
<td>73</td>
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<tr>
<td>Ste. Georges Najem and sons - G.N.S. sarl.</td>
<td>4950</td>
<td>1512</td>
<td>3438</td>
<td>70</td>
</tr>
<tr>
<td>Usine Nationale Des Blocs Et Carreaux (Boustany, Mallah &amp; Co. S.A.R.L.)</td>
<td>19200</td>
<td>8961</td>
<td>10239</td>
<td>53</td>
</tr>
<tr>
<td>Yazda</td>
<td>1200</td>
<td>480</td>
<td>870</td>
<td>64.4</td>
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<tr>
<td>Abdessater Marble Group SARL (AMG)</td>
<td>600</td>
<td>210</td>
<td>390</td>
<td>65</td>
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<tr>
<td>Art &amp; Decoration</td>
<td>3000</td>
<td>2076</td>
<td>5724</td>
<td>73.4</td>
</tr>
</tbody>
</table>
Annual Fresh Water Consumption (m³/year)

Pre-Development: 67,800
Post-Development: 45,618

Pre-Development: 22,182
Post-Development: 22,864.5

Quantity of Sludge Produced per Year (m³/year)

Pre-Development: 28,425
Post-Development: 22,864.5

Pre-Development: 5,560.50
Post-Development: 5,560.50
**EVIDENCE OF REPLICABILITY**

Industrialists interviewed were pleased and thankful for the LWP initiative. All of them reported that they are informing others in the sector and most neighboring industries are interested in replication. The president of the Syndicate for rock cutting industries, informed LWP that 10 additional industries are ready to install water treatment equipment within the lifetime of LWP, in the event more funds become available. LWP’s work with ALI had such an impact that ALI is looking for opportunities to replicate this initiative with other donors, other sectors, and other types of industries. The success of this initiative is also allowing LWP to promote it, whenever possible, to other donor agencies.

**LESSONS LEARNED FOR BEHAVIOR CHANGE**

**Partnering with Champions**
Collaborating with the ALI was a key factor to the success of this initiative. ALI understood the importance of this project, identified the most feasible sector for intervention, and achieved results. As a leading entity for industries in Lebanon, ALI now has enough experience to replicate this model with other organizations and other sectors.

**Raising awareness among industrialists**
Following this initiative, several industries became aware of the numerous benefits of such projects on different levels; compliance, environment, cost, and machineries lifetime. Many others are following the lead.

**Providing access to financial support**
Many industrialists already had plans to install water treatment equipment. However, due to the economic situation in the country, they were postponing such investments to a later stage. Many others were not even considering this option because of a total lack of funds and limited technical knowledge. Soft loans and incentives similar to the WELI project would alleviate this financial burden and therefore, encourage water saving practices.

**Leverage the success**
Industries now have an operational model that proved its efficiency to conserve and protect water while complying with national environmental regulations. This model can be easily promoted to other donors. Additionally, through this initiative, rock-cutting industries identified a potential business idea for providing raw material to paint and construction companies. These small successes can be leveraged even further and become the change catalyzer with industries.

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**THE LITANI RIVER IS SLOWLY BUT SURELY RECOVERING**

Industries around the Litani are being pressured by the government and LRA to comply with the national environmental regulations.

Jamal Yazda, a rock cutting industrialist in the Bekaa, located right next to the Qaraoun lake was considering shutting down his company for lack of compliance. He lacked the knowledge needed on treatment options and the financial burden was too high for him to risk installing the wrong treatment option. Through the LWP funded WELI project, ALI was able to convince Yazda to take part in this initiative. He reported being hesitant at first and skeptical about the results.

"The system works like a charm, I am saving costs, space, and I am complying with the Ministry of Environment and Industry’s norms. I can now work in peace."

Jamal Yazda has become the strongest advocate for this initiative and is spreading his knowledge to neighboring industries. Jihad Dahrouj’s industry was convinced as he is Yazda’s neighbor and had even completed installations a few weeks before the LWP interview with Yazda.

Industries in the area are following Jamal’s footsteps and contributing to the protection of the Litani River.
CONCLUSION

LWP’s approaches had an obvious impact on farmers and industries. One year after implementation, LWP’s investments are still appreciated and their utilization has proven to be sustainable. Two factors were major contributors to this sustainability with farmers and industrialists: raising awareness and providing financial assistance.

Awareness raising was most beneficial when a continuous approach was adopted rather than a one-off event. This continuous approach allowed for the introduction of the most innovative tools for water conservation, and provided continuous flow of information and support after the adoption of these technologies. As per social psychologists, behaviour change requires conviction, and the ability to change⁷. These awareness raising efforts convinced farmers and industrialists of the importance of adopting water conservation tools. At the same time the financial incentives enabled them to take action and implement the change that leads towards more water saving behaviours.

This report ends with numerous quotes from the field.

FARMERS

“My farmer friend Assaad convinced me that drip would save water . . . after this experience I will be using drip for other lands” – Boutros Badran, Nahida’s husband / Grapes farmer in West Bekaa

“After the experiment conducted by Unifert I saw tangible results, and I was completely convinced to switch to drip irrigation” – Salim Ghazzawi / Potato and Corn farmer in West Bekaa

“It is very difficult to make this decision given the current financial situation of the country, the experiment convinced us that the investment is worthwhile” – Wadih Choubassi / Potato and Corn farmer in West Bekaa

“This project is very sustainable and requires minimal maintenance” – Tanios Chehade / Pilot plot beneficiary in Ferzol

“Even if I invest from my own money it is important for me to learn innovative technologies and keep up with the latest updates in my field” – Mohamad Hamieh / Pilot plot beneficiary in Taraya

“If it wasn’t for the USAID support, it would have taken us years to be able to expand our work” – Agritrust / Vegetables farmers in Byblos

INDUSTRIES

“Lebanon has a water shortage. We usually start buying water for our processes from August to October every year, because our water sources run out. This year, ever since the installation of the system, we did not run out of water”. Joseph Najem / GNS in Bchaleh

“We are ensuring a longer lifetime for our machinery because we are not using salt water that causes equipment to rust and decay quickly”. Nicolas Loucas /NMC in Beirut

“If it wasn’t for this project I would have stopped working and closed down my industry”. Jamal Yazda / Yazda, in Qaraoun

“10 more industries are ready to join the program should additional funds become available” Ibrahim Mallah / IMF in Maten

“This wastewater treatment facility has made the work safer for employees, it protects the environment, and gives a better quality product”. Mazen Hilal / Onyx in Hammana

“I used to stop my workshop for 3 days to clean the sludge, now I don’t need to lose any working day for cleaning”. Tony Abdul Sater / AMG in Maten
ANNEX A – QUESTIONNAIRE

1- What is your general impression?
2- What convinced you to invest / cost share?
3- What in your opinion are your benefits?
4- How sustainable you think is this investment?
5- Would you have done it without USAID support?
6- Are you convinced the investment was worthwhile?
7- Are you trying to convince others to do the same?
8- In what the investment was useful for?
   a. Facilitate work (less work)
   b. Reduce cost
   c. Better returns
   d. Better compliance (this is not applicable to farmers)
9- How are you sustaining the work?
## ANNEX B – VISITS SCHEDULE FOR FARMERS

<table>
<thead>
<tr>
<th>Farmer</th>
<th>Interviewee</th>
<th>Area</th>
<th>Type of Crop</th>
<th>Implementing Partner</th>
<th>Date of visit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nahida Badran</td>
<td>Husband</td>
<td>West Bekaa</td>
<td>Grapes</td>
<td>Unifert</td>
<td>July 27. 2019</td>
</tr>
<tr>
<td>Salim Ghazzawi</td>
<td>Himself</td>
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<td>Potatoes</td>
<td>Unifert</td>
<td>July 27. 2019</td>
</tr>
<tr>
<td>Wadih Choubassi</td>
<td>Himself</td>
<td>West Bekaa</td>
<td>Potatoes</td>
<td>Unifert</td>
<td>July 27. 2019</td>
</tr>
<tr>
<td>Georges Doummar</td>
<td>Himself</td>
<td>Zahle</td>
<td>Carrots</td>
<td>Robinson Agri</td>
<td>August 6. 2019</td>
</tr>
<tr>
<td>Ibrahim Smayle</td>
<td>Himself</td>
<td>West Bekaa</td>
<td>Corn</td>
<td>Unifert</td>
<td>August 8. 2019</td>
</tr>
<tr>
<td>Khaled Smayle</td>
<td>His Brother</td>
<td>West Bekaa</td>
<td>Corn</td>
<td>Unifert</td>
<td>August 8. 2019</td>
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<tr>
<td>Salah Ghazzawi</td>
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<td>Corn</td>
<td>Unifert</td>
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<td>Rami Rahme</td>
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<td>Northern Bekaa</td>
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<tr>
<td>Ghassan Antoun</td>
<td>Himself</td>
<td>North Lebanon</td>
<td>Lettuce</td>
<td>Robinson Agri</td>
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</tr>
<tr>
<td>Agri-trust SARL</td>
<td>Himself</td>
<td>Byblos</td>
<td>Lettuce</td>
<td>Robinson Agri</td>
<td>August 27. 2019</td>
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<tr>
<td>Toni Chehade</td>
<td>His Father</td>
<td>Ferzol</td>
<td>Grapes (Pilot Plot)</td>
<td>CCIAZ</td>
<td>August 6. 2019</td>
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<tr>
<td>Mohamad Hamieh</td>
<td>Himself</td>
<td>Taraya</td>
<td>Tomatoes (Pilot Plot)</td>
<td>CCIAZ</td>
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</tr>
<tr>
<td>Boutros Habchi</td>
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<td>Deir Al Ahmar</td>
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<td>CCIAZ</td>
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<td>Michel Imad</td>
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<td>Edmond Birkashi</td>
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<td>Farmer</td>
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<td>Area</td>
<td>Type of Crop</td>
<td>Implementing Partner</td>
<td>Date of visit</td>
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<td>Tanios Imad</td>
<td>Himself</td>
<td>Deir Al Ahmar</td>
<td>Grapes</td>
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<tr>
<td>Charbel Fakhry</td>
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<td>Naji El Berkashi</td>
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<td>Deir Al Ahmar</td>
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<td>Ramez Habchi</td>
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<td>Deir Al Ahmar</td>
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<td>August 16. 2019</td>
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<td>Moufid Habchi</td>
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<td>Deir Al Ahmar</td>
<td>Grapes</td>
<td>CCIAZ</td>
<td>August 16. 2019</td>
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## ANNEX C – VISITS SCHEDULE FOR INDUSTRIES

<table>
<thead>
<tr>
<th>Industry</th>
<th>Interviewee</th>
<th>Area</th>
<th>Type of assistance</th>
<th>Date of visit</th>
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<tr>
<td>Rocky</td>
<td>Mohamad Jaafar</td>
<td>Mount Lebanon</td>
<td>Type II</td>
<td>July 18, 2019</td>
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<tr>
<td>Art and Decoration</td>
<td>Hadi Jaafar’s Brother –</td>
<td>Mount Lebanon</td>
<td>Type II</td>
<td>July 18, 2019</td>
</tr>
<tr>
<td>Onyx</td>
<td>Mazen Hilal</td>
<td>Mount Lebanon</td>
<td>Type I</td>
<td>July 18, 2019</td>
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<tr>
<td>Usine Nationale</td>
<td>Daniel Boustani</td>
<td>Mount Lebanon</td>
<td>Type II</td>
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<tr>
<td>AMG</td>
<td>Tony Abdel Sater</td>
<td>Mount Lebanon</td>
<td>Type I</td>
<td>August 19, 2019</td>
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<td>GNS</td>
<td>Najem</td>
<td>North Lebanon</td>
<td>Type I</td>
<td>August 22, 2019</td>
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<td>NMC</td>
<td>Nicolas Lucas</td>
<td>Beirut</td>
<td>Type I</td>
<td>September 3, 2019</td>
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<tr>
<td>IMF</td>
<td>Ibrahim Mallah</td>
<td>Mount Lebanon</td>
<td>Type I</td>
<td>September 4, 2019</td>
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<tr>
<td>Yazda</td>
<td>Jamal Yazda</td>
<td>Bekaa</td>
<td>Type I</td>
<td>September 6, 2019</td>
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