



# Water Reuse and Environmental Conservation Project—Kingdom of Jordan



**Strong Environmental Enforcement**

**Efficient Industrial Water/Energy Use**

**Pollution Prevention and Cleanup**

**Integrated Water/Energy Planning**

**Badia Restoration/Enhanced Livelihoods via Biosolids/Water Reuse**

# Accountable, Sustainable Management of Water Resources

Jordan's water shortage is a complex and persistent issue that requires innovative and sustainable solutions from numerous agencies and organizations. The water challenge can by no means be solved overnight—it requires a big-picture long-term approach.

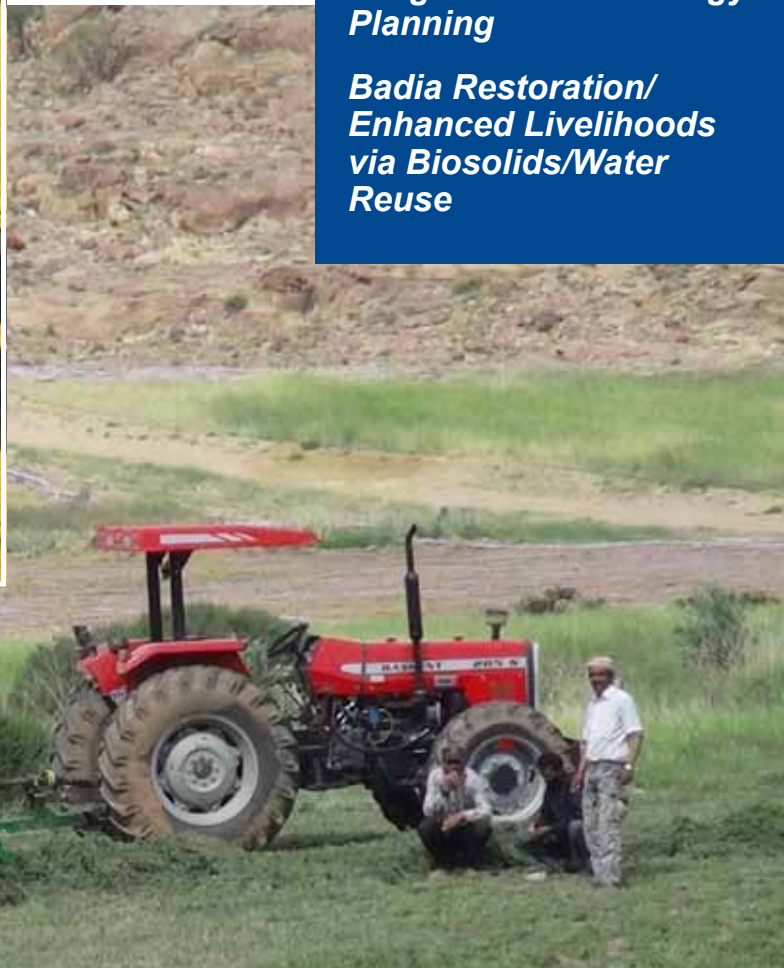
*Strong Environmental Enforcement*

*Efficient Industrial Water/Energy Use*

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*Badia Restoration/  
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via Biosolids/Water Reuse*



## Water Reuse and Environmental Conservation Project



### PROJECT SNAPSHOT

**Duration:** 2010-2015

**Total funding:**  
\$32.6 million

**Geographic coverage:**  
Kingdom-wide

**Implemented by:**  
AECOM

**Focus:** Industrial water and energy conservation, industrial waste management, and community-level water reuse

### Results Included:

- Industrial partners saved 1.38 Million JD in first year after P2 investments
- Trained 2,665 people in environmental protection
- Reused 790,000 m<sup>3</sup> of water annually
- The Network for Jordanian Sustainability
  - 1800 users
  - 1100 Facebook fans
  - 365 LinkedIn group members



## WRECP Overview

**USAID** and the Government of Jordan worked together to protect and conserve scarce resources through WRECP. The project supported the preservation of the environment, training on pollution prevention and environmental management, rehabilitation for landfills and polluted hot spots, and the reuse of water and biosolids to support community livelihoods.



## Water Reuse and Environmental Conservation Project

### Results:

- Increased the efficient use of water and energy by Jordanian industrial facilities, through training and technical support
- Improved environmental performance in industrial factories, so they pollute less and save money in the process
- Improved Ministry of Environment (MoEnv) capacity to enforce environmental regulations
- Strengthened ability of laboratories to analyze industrial wastewater samples
- Cleaned up polluted hot spots, improved industrial waste management practices, and strengthened industrial wastewater treatment
- Helped communities generate income through water reuse projects
- Increased public awareness of the benefits of water reuse and promoted the sustainable reuse of biosolids



## Project Partnerships

**WRECP** worked with communities, ministries, and many partner organizations to find cross-ministry, cross-sectoral, comprehensive solutions.

**Project beneficiaries** included the industrial sector, farmers, government ministries, and the general public.

### Primary partners:

- Ministry of Environment
- Aqaba Special Economic Zone Authority
- King Abdullah II Center for Excellence
- Jordan Investment Board
- Jordan Chamber of Industry
- Ministry of Agriculture
- Ministry of Municipal Affairs
- Ministry of Industry and Trade
- Ministry of Water and Irrigation
- Royal Scientific Society



Water Reuse and Environmental Conservation Project

# Pollution Prevention and Industrial Water Management

**WRECP** assisted industrial facilities in conserving water and energy and preventing pollution.

Partnered with 31 industrial partners to develop and implement P2 plans.

**Impact: As of fall 2014, facilities had saved 1.38 million JOD.**

Trained staff from 120 industrial facilities on environmental management systems/pollution.

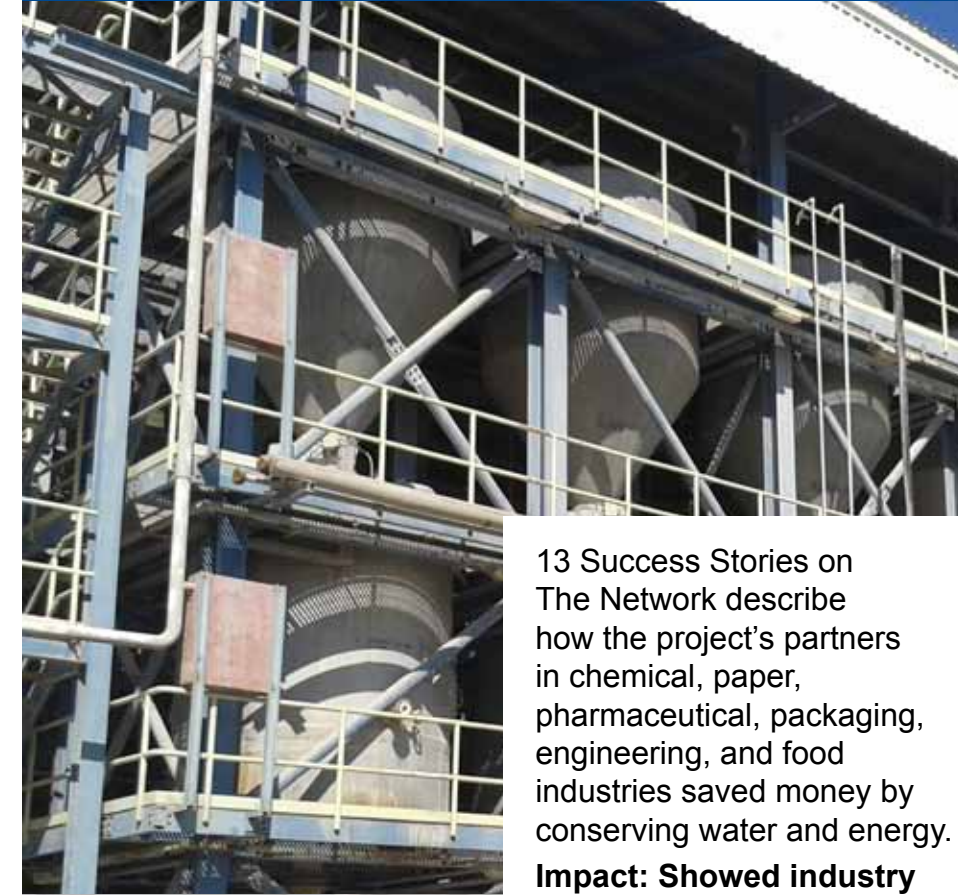
**Impact: Improved environmental protection and industrial economic growth.**

Analyzed environmental and financial benefits of P2 investments made by industrial partners and presented results to 120 industrial owners and staff at workshop.

**Impact: Demonstrated which P2 improvements yield highest results in specific sectors and thus should be replicated.**



# Water Reuse and Environmental Conservation Project



13 Success Stories on The Network describe how the project's partners in chemical, paper, pharmaceutical, packaging, engineering, and food industries saved money by conserving water and energy.

**Impact: Showed industry leaders throughout Jordan how P2 investments will improve environmental performance and increase profits.**



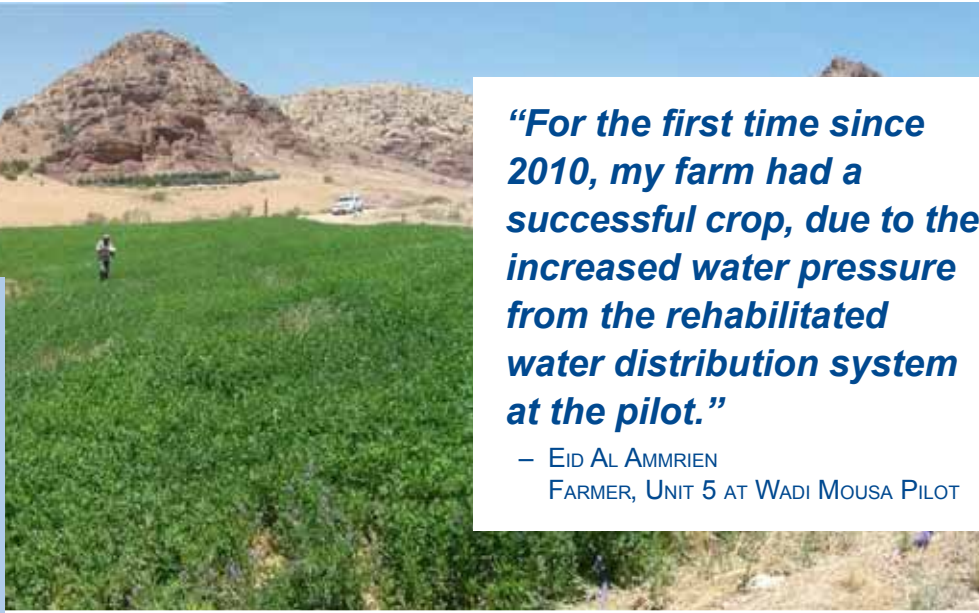
# Water Reuse to Enhance Community Livelihoods

**WRECP** re-invigorated a USAID water reuse pilot at Wadi Mousa and turned it into a major success story that is being replicated at Lajjoun and elsewhere in Jordan.

Supervised Wadi Mousa farmers and water users association staff in rehabilitating the irrigation network; recommended a new irrigation schedule; trained farmers in water reuse techniques.

**Impact:**

- Enhanced water pressure, thus increasing crop yield
- Increased forage production up to 21% more than 2011, and 48% more than 2012
- Expanded planted areas with forages up to 34%
- Rehabilitated 9 farm units and added 2 new units
- Added new female farmers to pilot project
- Increased number of alfalfa bales produced at pilot: 150 bales in 2014 (48% increase over 2012) (WUA statistics)
- Increased annual income from alfalfa, per farmer: 1,144 JD in 2014 vs 770 in 2012. (WUA statistics)



*“For the first time since 2010, my farm had a successful crop, due to the increased water pressure from the rehabilitated water distribution system at the pilot.”*

— EID AL AMMRIEN  
FARMER, UNIT 5 AT WADI MOUSA PILOT



Trained Wadi Mousa Water User Association board and members.

**Impact:**

- Knowledge-sharing with other WUAs and consequent introduction drip irrigation in Ramtha
- Increased WUA income in 2013 and 2014 (57% increase over 2012 income)
- Improved financial and technical management of the pilot as a cooperative
- Anticipated increased WUA income next year from increased machinery rental



## Water Reuse and Environmental Conservation Project

Worked with Lajjoun WUA to replicate successful elements from Wadi Mousa plot.

**Impact:**

- Trained farmers in reuse best practices
- In context of training, supervised farmers in installing solar energy unit, to run the irrigation pump and use excess energy to pay for water
- In context of training, supervised farmers in installing forage farm irrigation network with drip irrigation and automatic flushing sand filter
- Anticipated water conservation: 300,000 m<sup>3</sup>/year
- Anticipated income for 50 farmers and economic growth in governorate



Established seed production farm.

**Impact: Proved that farmers can produce good quality seeds rather than pay high prices or purchase poor (cheaper) quality.**



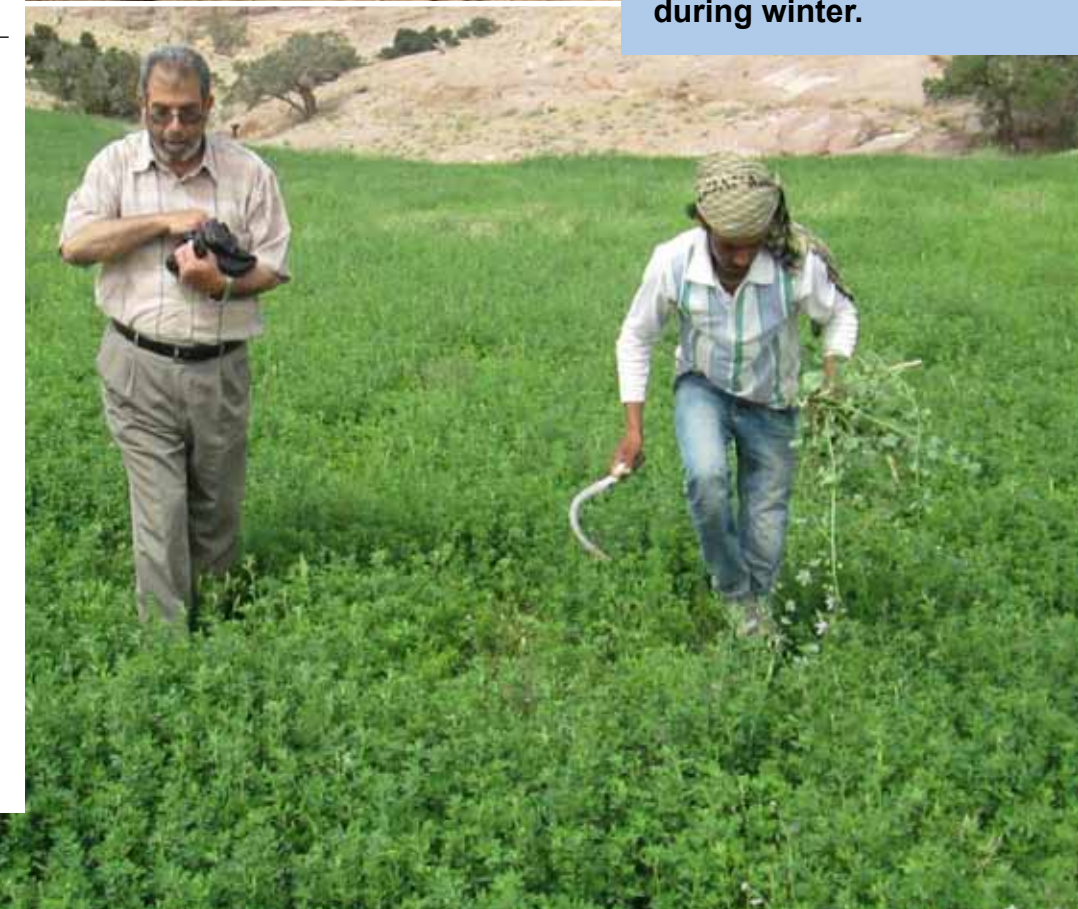
Established Wadi Mousa WUA marketing center for storage of produced fodder.

**Impact: Proper storage allowed farmers to hang onto fodder until price went up from 3 JD/bale in summer to 5 JD/bale during winter.**

Prepared water reuse plans and options for refugee camps.

**Impact:**

- Newly established WUA at Za'atari
- 50 farmers are now reusing 1000 m<sup>3</sup>/day of reclaimed water to grow forage crops next to Za'atari camp
- Za'atari WUA hired 80 Syrian refugees to work inside the farm
- Reuse is protecting wells near Za'atari from being polluted
- Preliminary water reuse options are defined for Azraq refugee camp



### Irbid

- Master plan for Ekeker rehabilitation and expansion
- Ekeker lagoon cleanup design
- JUST sampling equipment training and donation
- P2/EMS systems for 2 facilities
- Capacity-building for MoEnv Directorate Office
- 16 facilities participated in industrial survey
- Staff from 11 industrial facilities selected for eco-efficiency training

### Ajloun

- Capacity-building for MoEnv Directorate Office

### Mafraq

- Al Bayt Laboratory
  - Supported ISO certification with plans and training
  - Trained 36 staff in water and soil testing
  - Donated and calibrated testing equipment
  - Prepared materials to market lab services
- 6 industrial facilities participated in survey
- P2 /EMS systems for 1 facility
- Capacity-building for MoEnv Directorate office
- Water reuse plan and capacity-building for Al-Zaatari refugee camp

### Jarash

- Capacity-building for MoEnv Directorate Office

### Balqa

- Capacity-building for MoEnv Directorate office
- Capacity-building for MoEnv Directorate offices in Deir Alla, Mahes, and Fuheis

### Zarqa

- Russeifah Rehabilitation Plan
  - Landfill closure and cleanup
  - Tunnels, phosphate piles closure/ remediation & redevelopment design
  - Lagoon cleanup
- IWTP feasibility study
- 71 industrial facilities participated in survey
- P2 and EMS systems for 9 facilities
- Capacity-building for MoEnv Directorate office
- Staff from 29 industrial facilities selected for eco-efficiency training
- Developed Al-Azraq refugee camp water reuse plan
  - Capacity building for the camp management staff on water reuse

### Amman

- Strengthen MoEnv enforcement capacity
  - Trained 265 staff
  - Drafted revised policies and EPL
  - Action plan
  - Data management
- KACE award for environmental excellence
- Reuse knowledge center
- 296 facilities participated in industrial survey
- P2 & EMS systems for 16 facilities
- Staff from 104 industrial facilities selected for eco-efficiency training
- University of Jordan Laboratory
  - Supported ISO certification with plans and training
  - Trained 44 staff in water and soil testing
  - Donated and calibrated testing equipment
  - Prepared materials to market lab services

### King Abdulla II Industrial Estate (Sahab)

- Strategic Environmental Management Plan
- Industrial Wastewater Management Plan
- Integrated Water Resources Management Plan
- Industrial Wastewater Treatment Plant improvements

### Biosolids Management Initiative

- Beneficial reuse options for As-Samra WWTP
- Biosolids landfill design
- Land application of biosolids for agriculture and Badia restoration
- Regulatory alignment
- Kingdom-wide biosolids management strategy

### Karak

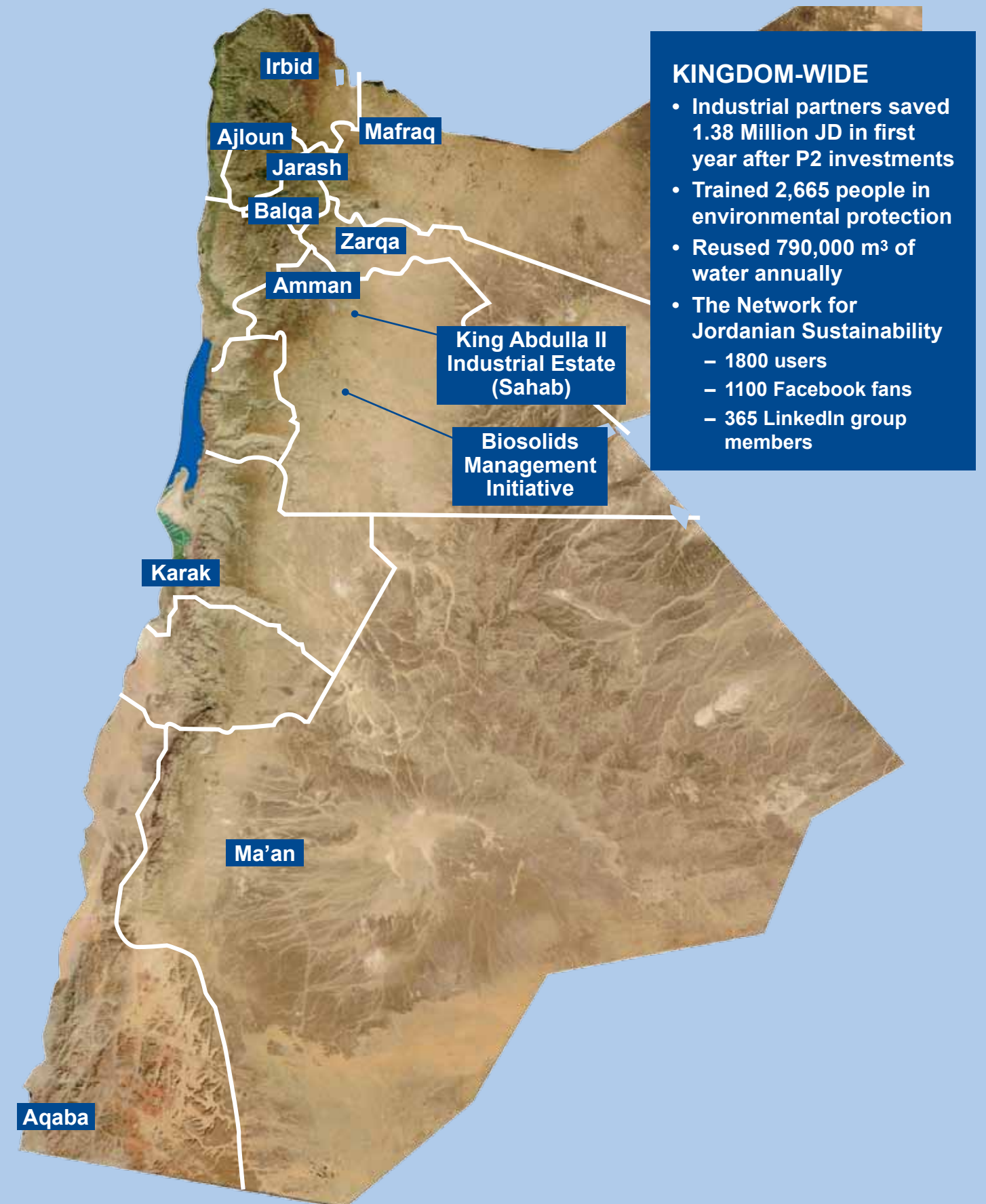
- Mutah University Laboratory
  - Supported ISO certification with plans and training
  - Trained 44 staff in water and soil testing
  - Donated and calibrated testing equipment
  - Prepared materials to market lab services
- Capacity-building for MoEnv Directorate office
- 3 industrial facilities participated in survey
- Al-Lajjoun Water Reuse Pilot Project
- Trained farmers, WUA and MoEnv
- Solar energy production unit to power water pump
- Drip irrigation network

### Ma'an

- Wadi Mousa reuse pilot support
  - Trained 28 farmers
  - Forage seed production
  - Irrigation network rehabilitation
- 2 industrial facilities participated in survey
- Ma'an reuse pilot support

### Aqaba

- Integrated water reuse master plan
- Waste tire recycling
- Design and tender of landfill expansion
- P2/EMS systems for 2 facilities
- 6 industrial facilities participated in survey
- Staff from 6 industrial facilities selected for eco-efficiency training

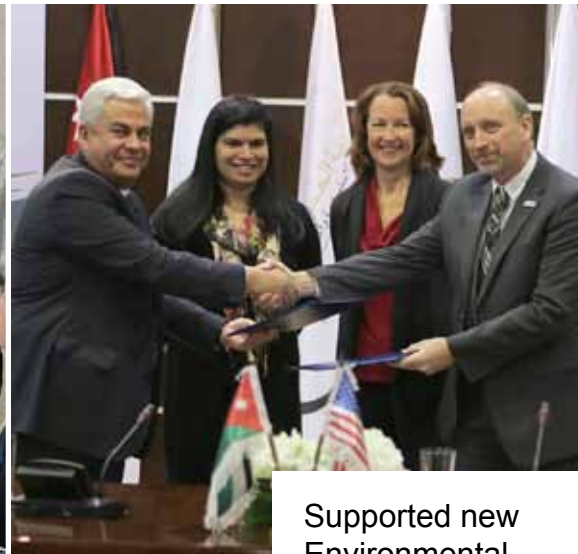


## Institutional and Regulatory Strengthening

**WRECP** strengthened the institutional and regulatory capacity of the Ministry of Environment (MoEnv) by working at all levels. WRECP helped the MoEnv reorganize to be more effective, gain management, technical and regulatory skills, manage information better internally, communicate better with and work in more effective partnerships with external stakeholders, foster environmental awareness and compliance, and revise relevant legislation.



Trained 1407 staff in institutional development, environmental policies, laws and regulations, environmental assessment and licensing, waste management, inspection and compliance.  
**Impact: Better enforcement, increased institutional transparency.**



Supported new Environmental Protection Law.  
**Impact: Eliminated gaps and overlaps in environmental legislation and regulations.**



Supported three national laboratories to qualify for accreditation in waste water testing.  
**Impact: Affordable WW testing for compliance.**

## Water Reuse and Environmental Conservation Project



Established the Network for Jordanian Industrial Sustainability (The Network) at [www.jordannetwork.net](http://www.jordannetwork.net), to serve as a portal for industry, academics, government, students, and others to share knowledge and experiences about environmental compliance. Registered 1,865 users, uploaded 1,326 resources, held 53 events, transferred to Royal Scientific Society.

**Impact: Improved environmental performance through shared database.**



Established national environmental performance award, to create incentives for and awareness of responsible environmental performance. Transferred responsibility for award to King Abdulla II Center for Excellence (KACE).

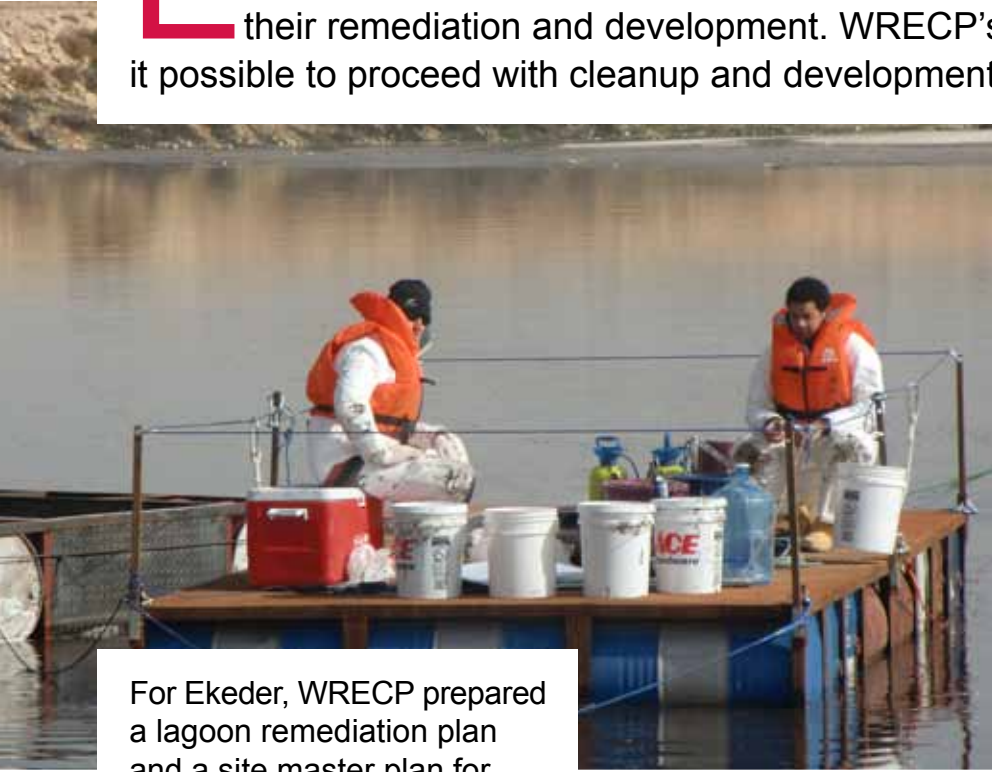
**Impact: Increased incentive for responsible industrial environmental performance.**





## Disposal Site Rehabilitation and Feasibility Studies

**E**keder, Russeifah, and Aqaba sites have posed problems for decades, but the lack of scientific data and engineering reports hindered decisions about their remediation and development. WRECP's plans and designs will make it possible to proceed with cleanup and development.



Designed cleanup plans for Russeifah landfill, lagoon, phosphate ore pile area, mining pit and abandoned tunnels.

**Impact: Clean up environmental hotspot, protect public health and the environment.**

For Ekeder, WRECP prepared a lagoon remediation plan and a site master plan for cleaning up and expanding the site; tender documents for a new Zibar lagoon; and detailed design and tender documents for expanding the municipal solid waste portion. The project engaged multiple ministers in taking responsibility for clean-up, and for expanding infrastructure to accept waste from refugee camps and host communities.

**Impact: Reduce pollution, protect public health and environment, provide economic opportunity through recycling.**



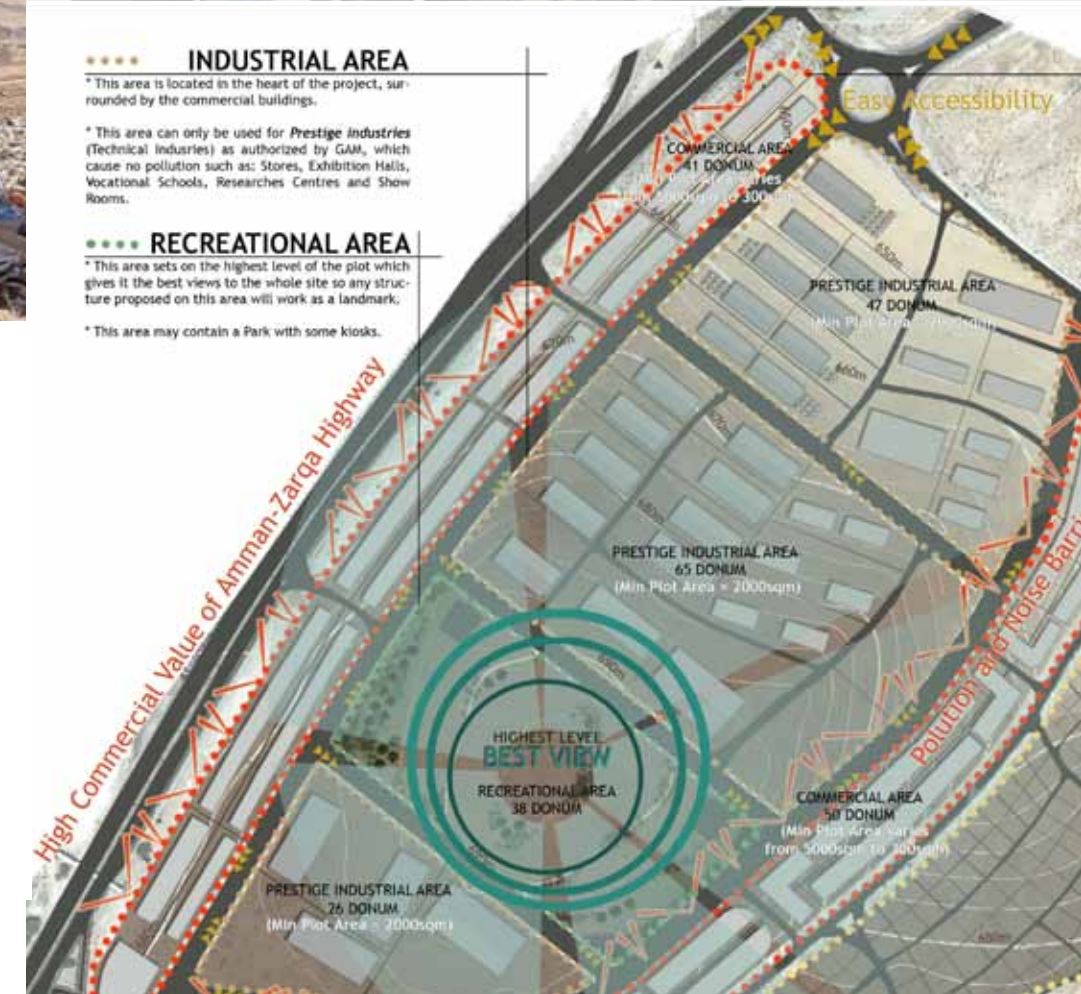
**B**ased on the technical support provided by the project, the MoEnv was able to elevate these important projects—that is, the remediation and redevelopment of these sites—to the level of the Prime Minister and was able to gain approval for proceeding at both Russeifah and Ekeder. To reduce the burden on the public sector, private sector participation has been encouraged, especially for the material recovery facilities in Aqaba and Irbid.



For Aqaba, WRECP prepared a tire recycling study; a waste management study; a feasibility report, detailed design and tender documents for the landfill; a request for proposals for a materials recovery facility to be developed by the private sector; and an operations and maintenance manual for the landfill.

**Impact: Improve environmental protection and extend landfill timeframe.**

## Water Reuse and Environmental Conservation Project



## Biosolids Management Initiative

**W**astewater facilities throughout Jordan have been constructed and/or expanded to serve the growing population and to mitigate water pollution, but solutions for the ultimate use of sludge and biosolids have not kept pace. The WRECP's Biosolids Management Initiative addressed ultimate reuse and disposal of biosolids.

Supported revisions to regulations for biosolids use in restricted agriculture; held regional workshop at which experts from Turkey, Oman, and USDA discussed successful biosolids use.

**Impact:**

- Increase fodder crop yields and thus reduce heavy reliance on subsidized fodder imports
- Restore Badia rangelands and benefit communities economically
- Reduce risk of polluting scarce groundwater resources

For As Samra, prepared design and tender documents for new landfill to dispose of biosolids.

**Impact: Safe disposal of biosolids at As Samra, with the secondary benefit of using the resulting landfill gas to generate energy.**



## Water Reuse and Environmental Conservation Project

Prepared interim strategy for sludge use and disposal.

**Impact: Provide feasible disposal options until sludge markets develop.**



Provided recommendations for treatment and use of poultry and livestock waste.

**Impact: Reduce vectors, odors, and hazards posed by untreated waste.**



# Industrial Wastewater Treatment and Water Management

**B**alancing environmental enforcement and compliance is a high priority for Jordan. Industrial facilities need affordable options for wastewater treatment and disposal, as well as tools for managing water efficiently in large estates. The WRECP designed facilities and tools to help meet these needs.

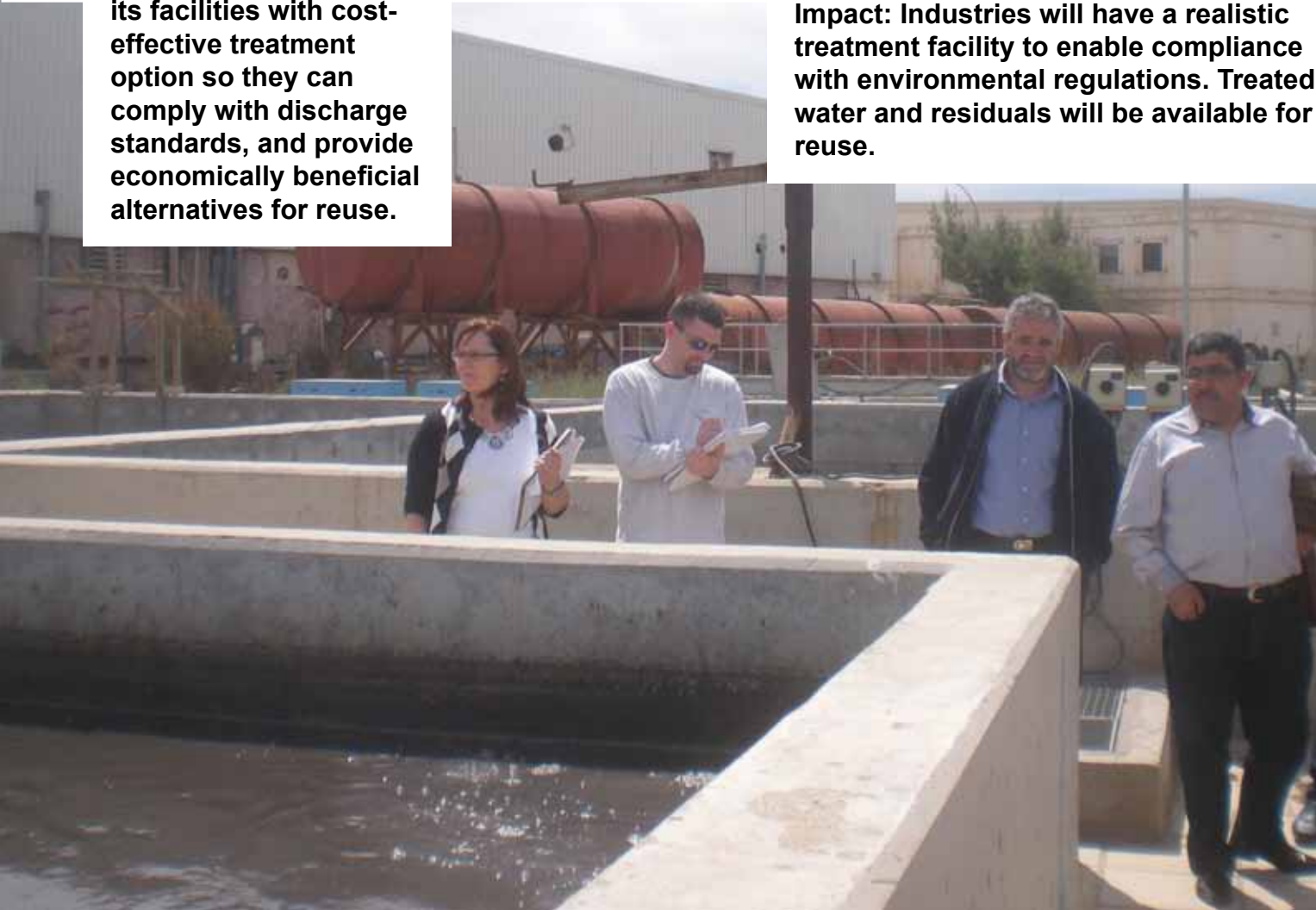


Prepared tender documents for Sahab IWTP improvements.

**Impact: Provide industrial estate and its facilities with cost-effective treatment option so they can comply with discharge standards, and provide economically beneficial alternatives for reuse.**

Designed treatment facility for discharge of treated wastewater from industrial facilities in Zarqa area.

**Impact: Industries will have a realistic treatment facility to enable compliance with environmental regulations. Treated water and residuals will be available for reuse.**



## Water Reuse and Environmental Conservation Project



Trained Aqaba Water Company's staff in the WaterGems model, so they can use IWRM to support their water reuse program.

**Impact: IWRM will be sustained.**

Prepared Strategic Environmental Management Plan (SEMP) for industrial facilities in the King Abdullah II Industrial Estate IWTP in Sahab.

**Impact: Estate manager can use SEMP to guide water-related decisions.**

Prepared Reuse Master Plan for Aqaba and Integrated Water Resources Management Plan for King Abdulla II Industrial Estate at Sahab.

**Impact: Provide a model for integrating planning for multiple water users, including wastewater treatment and beneficial reuse.**



## Measureable Success

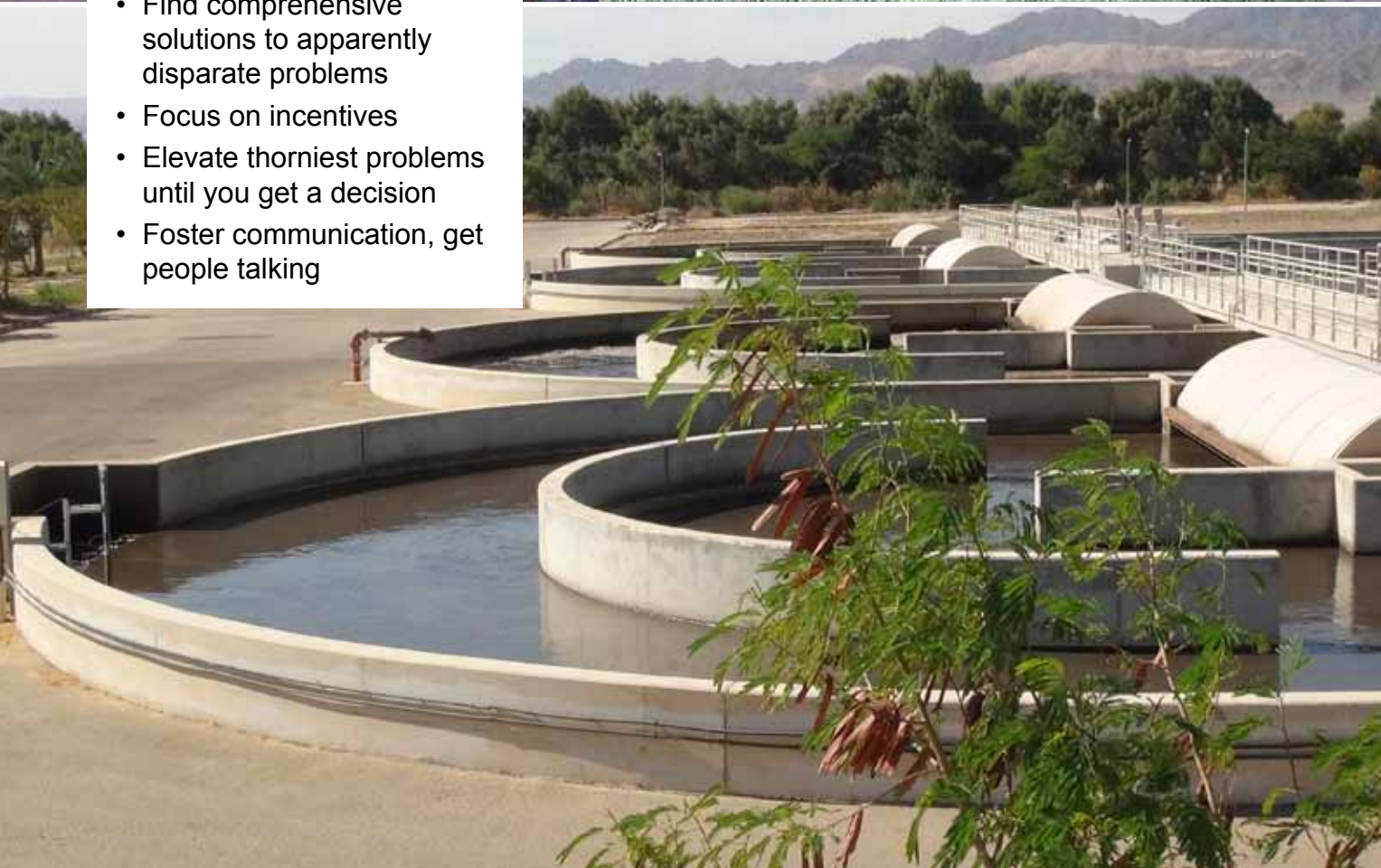


### Challenge

- Water scarcity is a complex and persistent issue
- Solutions need to cross multiple agencies and organizations

### Approach for Success

- Seek integrated solutions
- Work across ministries, with multiple stakeholders
- Find comprehensive solutions to apparently disparate problems
- Focus on incentives
- Elevate thorniest problems until you get a decision
- Foster communication, get people talking



## Water Reuse and Environmental Conservation Project

### Measureable Success

- **Adaptive capacity of the water sector is increased**
  - 30 industrial facilities adopting improved environmental management practices
  - 33 Jordanian institutions with improved MIS systems
  - 50 producers' organizations, water users' associations, trade and business associations and community-based organizations assisted
  - 2,665 people trained in environmental law, enforcement, public participation and cleaner production policies, strategies, skills, and techniques
  - 17 pollution and urban environmental policies, agreements, and regulations drafted
- **Management of water resources is more sustainable**
  - 144 hectares under improved natural resource management
  - 277 people with increased economic benefits derived from sustainable natural resource management and conservation
  - 6 water and wastewater infrastructure systems designed/constructed
  - 787,250 m<sup>3</sup> annual volume of reclaimed water used to improve natural resource management as a result of USG assistance





**USAID | JORDAN**  
FROM THE AMERICAN PEOPLE

# Water Reuse and Environmental Conservation Project—Kingdom of Jordan



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