التعاون الألماني
DEUTSCHE ZUSAMMENARBEIT

Implemented by
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The Hashemite Kingdom Of Jordan
Ministry of Industry , Trade and Supply

Ministry of Environment

Business Case: Rainwater Harvesting & Utilisation in Industrial Estates

Positioning Jordan's Industrial Estates for Green Growth through Sustainable Rainwater Utilisation

BACKGROUND

The Green Action in Enterprises (GAIN) project, implemented by GIZ in cooperation with the Jordan Industrial Estates Corporation (JIEC), supports the transition of Jordan's industrial sector towards greener and more resource-efficient practices. By promoting sustainable water, energy, and waste management, the project aims to enhance competitiveness, reduce environmental pressures, and align Jordan's industrial development with national and international sustainability targets. Within this framework, rainwater harvesting has emerged as a priority intervention area, offering both immediate resource savings and long-term environmental benefits.

The purpose of this effort is to showcase practical measures for enhancing rainwater harvesting and utilisation in Jordan's industrial estates. The focus is on identifying viable system components that can be realistically implemented and scaled, while ensuring compliance with Jordanian water management standards and contributing to Environmental, Social, and Governance (ESG) commitments. By drawing on global best practices and adapting them to local conditions, the activity demonstrates how rainwater harvesting can reduce dependency on scarce freshwater resources, provide cost savings for tenants, and strengthen the environmental credibility of industrial zones.

This business case builds on four industrial estates — Al-Salt, Al-Tafilah, Zarqa, and Madaba — as primary case studies. Each site illustrates different climatic, geographic, and operational conditions, allowing for a comparative assessment of potential rainwater harvesting solutions. While the technical feasibility and detailed cost–benefit modelling are captured in accompanying studies, this business case distils the findings into an accessible narrative targeted at decision makers, estate managers, and policy advisors, rather than technical specialists. It highlights baseline challenges, proposes practical system options, and outlines the benefits, costs, and enabling factors for implementation and replication across Jordan's wider network of industrial estates.

BUSINESS CASE RATIONALE

Jordan faces chronic water scarcity, with industrial estates depending on costly public network and trucked water that erode tenant competitiveness and increase environmental pressures. At the same time, large volumes of seasonal rainfall are left unused. Capturing and re-utilising this resource offers a practical opportunity to cut costs, strengthen water security, and reduce climate risks while advancing sustainable industrial development.

Rainwater harvesting aligns with Jordan's National Water Strategy 2023–2040, the Green Growth National Action Plan, and the Sustainable Development Goals (SDGs), while reinforcing the transition to Eco-Industrial Parks (EIPs). For JIEC and its tenants, it represents both a necessity and a business opportunity: lowering operating costs, enhancing resilience, and improving ESG performance. Drawing on four case studies — Zarqa, Al-Salt, Al-Tafilah, and Madaba — this business case demonstrates the value of rainwater harvesting and presents a replicable model for wider adoption across Jordan's industrial estates.

DESCRIPTION OF BUSINESS-AS-USUAL

CURRENT WATER SUPPLY PRACTICES

Industrial estates such as Zarqa, Al-Salt, Al-Tafilah, and Madaba continue to depend almost entirely on the public water network, with trucked water procured at high cost whenever supply gaps occur.

No systematic infrastructure exists for capturing or storing seasonal rainwater, leading to hundreds of thousands of cubic meters of runoff water being lost.

In some sites, such as Zarqa and Al-Salt, runoff contributes to localised flooding and erosion (notably in Zarqa).

Tenants face limited autonomy in securing alternative water sources, creating dependence on external supplies.

COSTS OF CURRENT MODEL

- Purchased water already represents a structural cost burden for tenants. In Zarqa and Al-Salt, consumption profiles suggest that water can account for up to 10–20% of production costs for certain sectors, such as food processing and chemicals.
- Trucked water, procured at 3–5 JOD/m³ compared to 1–1.5 JOD/m³ from the network, further magnifies the financial strain, particularly during dry months when reliance peaks.
- With electricity tariffs and network maintenance charges rising, water prices are expected to increase further, locking estates into an increasingly unsustainable cost structure.

RISKS OF CURRENT MODEL

- **Financial risks:** escalating water costs undermine industrial competitiveness, particularly for water-intensive and export-oriented tenants.
- **Operational risks:** disruptions in municipal supply or tanker availability expose estates to production downtime.
- **Environmental risks:** continued reliance on conventional resources exacerbates Jordan's national water scarcity, already among the most severe globally.
- **Reputational risks:** estates may be perceived as lagging in sustainability, undermining Jordan's positioning as a green growth economy.

UNDER BUSINESS-AS-USUAL

- Annual rainfall, if harvested, could offset 10–25% of non-potable demand in some estates — yet this resource is currently discharged unused.
- Without action, estates lose the chance to demonstrate leadership in green growth and circular water management, both of which are national policy priorities.
- Missed opportunity to align with Eco-Industrial Park (EIP) standards, UN SDG 6 (Clean Water), and Jordan's Green Growth Action Plan.
- Lack of visible sustainability initiatives may deter future investors seeking strong ESG performance.

DESCRIPTION OF BUSINESS CASE

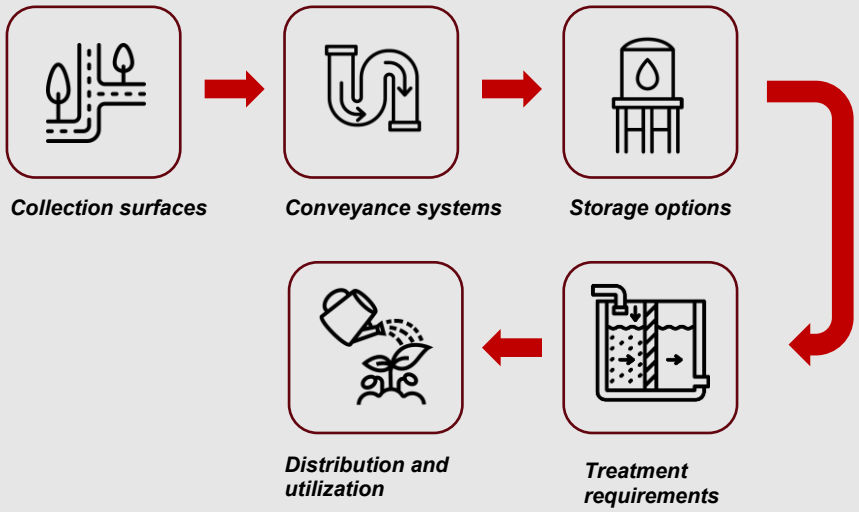
NEW WATER SUPPLY MODEL

The proposed intervention centres on the introduction of Rainwater Harvesting (RWH) systems across Zarqa, Al-Salt, Al-Tafilah, and Madaba Industrial Estates. These systems are designed to capture, store, and reuse rainwater for multiple estate functions, thereby reducing reliance on municipal supply and expensive tanker deliveries, while contributing to Jordan's green growth and Eco-Industrial Park (EIP) agenda.

Technical Opportunity

RWH in industrial estates is based on a straightforward sequence of steps: **collect, convey, store, treat, and reuse.** While simple in principle, the design must respond to estate-specific conditions such as rainfall patterns, surface areas, land availability, and tenant needs.

- **Collection surfaces:** Rainwater is captured from rooftops, paved yards, parking areas, and stormwater drains. Estates such as Al-Salt and Al-Tafilah have large warehouse roofs suitable for efficient collection, while Zarqa's extensive paved surfaces offer high runoff potential.
- **Conveyance systems:** Collected rainwater is channelled via gutters, drains, and pipes, with first-flush diversion devices installed to separate initial runoff containing debris and contaminants.
- **Storage options:** Depending on site conditions, storage can take the form of aboveground steel tanks, modular plastic tanks, or underground concrete reservoirs. In space-constrained estates such as Zarqa, decentralised tanks or retrofitted underground cisterns are more practical.
- **Treatment requirements:** For non-potable applications (irrigation, cooling, sanitation), treatment is generally limited to sedimentation and basic filtration. If water is to be used in industrial processes, additional steps such as fine filtration or disinfection (e.g. UV, chlorination) may be required.
- **Distribution and utilization:** Harvested water can be pumped into existing estate distribution networks for uses such as landscaping irrigation, toilet flushing, cooling towers, firefighting systems, and—in some cases—selected industrial processes. This reduces dependence on costly municipal or tanker supplies, while contributing to tenants' ESG credentials.



Hydrological modelling and estate drawings show that RWH could supply 10–25% of annual water demand, depending on rainfall and catchment potential. This equates to 30,000–55,000 m³ per year per estate, or approximately 2–3 months of demand. The variation reflects site differences:

- **Zarqa:** High demand but limited available roof areas; opportunity lies mainly in retrofits.
- **Al-Salt:** Moderate demand with viable roof catchments; potential for dual irrigation and sanitation use.
- **Al-Tafilah:** Estate under development; most cost-effective to integrate RWH into new infrastructure.
- **Madaba:** Strong rainfall profile; larger volumes can be harvested at relatively lower unit cost.

Captured rainwater can be applied across industrial processes, landscaping and sanitation, moving beyond irrigation-only use.

Costs and Returns

Indicative capital expenditure (CAPEX) for installing estate-scale RWH systems is estimated at JOD 350,000–600,000 per site, depending on storage capacity and treatment requirements. Operating expenditure (OPEX) remains modest at JOD 5,000–10,000 per year for maintenance and monitoring.

Financial modelling shows:

- **Payback period**: 6–9 years under current tariff and rainfall conditions, with shorter periods where tanker dependence is high.
- **Annual savings**: JOD 40,000–70,000 per estate, driven by avoided municipal/tanker water costs.
- **Lifetime benefit–cost ratio**: Greater than 1.4 across all sites, indicating strong economic viability.

CO-BENEFITS AND STRATEGIC VALUE

Beyond direct savings, RWH generates significant co-benefits:

- **Climate resilience:** Provides a predictable water buffer under variable rainfall.
- **Safety:** Storage tanks can double as firefighting reserves, meeting industrial safety audit needs.
- **Policy alignment:** Supports Jordan's National Water Strategy 2023–2040, Green Growth Action Plan, and Water Substitution and Reuse Bylaw.
- **Reputation**: Enhances JIEC's positioning as a regional leader in green industrial development.
- **Stakeholder buy-in:** Consultations confirm tenant and estate manager interest in reducing financial exposure to tanker water and improving operational reliability.

CHALLENGES

High Upfront Costs for Retrofits: For older estates such as Zarqa, the installation of storage tanks and treatment systems requires significant capital. Without dedicated financing mechanisms, estate managers and tenants may find these costs prohibitive.

Variable Rainfall and Climate Risks: Jordan's rainfall is highly seasonal and increasingly unpredictable. Dry years reduce yields, while more intense storm events can overwhelm poorly sized systems. This variability complicates design and creates uncertainty in projected returns.

Operation and Maintenance (O&M) Capacity: Although RWH systems are relatively simple, consistent upkeep is essential. Sediment removal, pump servicing, and routine inspections demand trained staff and institutionalised procedures, which are often lacking at estate level.

Tenant Engagement and Perceptions: Some tenants continue to prioritise conventional water supply, viewing RWH as secondary. Demonstrating financial savings and linking RWH to ESG credibility will be key in shifting attitudes.

Land and Space Constraints: In denser estates, particularly Zarqa, suitable land for siting large storage tanks is limited. Underground or decentralised solutions may be required, raising costs.

ENABLING FACTORS

1. **Policy and Strategy Frameworks**: Jordan's National Water Strategy 2023–2040 and the Water Substitution and Reuse Bylaw explicitly promote alternative water sources, creating a strong policy basis for RWH. In parallel, the country's Green Growth Action Plan and Climate Change Adaptation Framework encourage water efficiency and resilience measures across industries.
2. **Institutional Support:** The Jordan Industrial Estates Corporation (JIEC) has already integrated environmental management functions into estate operations. This provides a platform for embedding RWH systems into estate-level planning and monitoring, ensuring institutional ownership and continuity.
3. **Technical and Infrastructural Foundations:** Estate masterplans already include stormwater drainage networks and catchment mapping, which can be adapted to serve RWH systems. Prior feasibility studies, including the Madaba assessment, provide baseline data and tested methodologies that can be replicated elsewhere.
4. **Financing and Donor Programmes:** Several green finance and donor initiatives (e.g., EBRD GEFF, AFD SUNREF, GCF-backed projects) are already active in Jordan, offering concessional loans, grants, and technical assistance. These facilities can be leveraged directly to fund estate-level RWH investments without creating new mechanisms.

IMPLEMENTATION ROADMAP

SHORT-TERM (1 YEAR)	KPI	Timeline	Cost Incurred
Conduct detailed site surveys and confirm catchment/runoff data for 4 estates	4 site surveys completed	Y1 Q1	Yes
Finalise design and sizing of priority reservoirs and rooftop systems	4 design packages approved	Y1 Q2	Yes
Secure financing agreements with green finance facilities/donors	≥2 financing agreements signed	Y1 Q2	No
Begin construction of pilot reservoirs: Zarqa (26,000 m³), Al-Salt (25,000 m³), Al-Tafilah (27,000 m³), Madaba (25,000 m³)	4 pilot sites under construction	Y1 Q3	Yes
Train JIEC and estate staff in RWH O&M (sediment removal, pumps, filters)	20 staff trained	Y1 Q4	Yes
Conduct tenant awareness sessions on cost savings vs. tanker supply	4 sessions delivered	Y1 Q4	No

MID-TERM (2-5 YEARS)	KPI	Timeline	Cost Incurred
Commission and hand over Year-1 pilot systems in all 4 estates	Systems operational	Y2 Q1	No
Complete second reservoir in Al-Tafilah (15,000 m³, Sector 8) and expand Zarqa storage (30,000 m³ or 23,000 m³)	2 additional reservoirs completed	Y2–Y4	Yes
Connect harvested water to non-potable networks (irrigation, sanitation, cooling, firefighting)	Networks in 4 estates commissioned	Y2–Y4	Yes
Establish O&M SOPs and monitoring systems at estate level	SOP adopted; first annual report issued	Y2–Y3	No

LONG-TERM (5+ YEARS)	KPI	Timeline	Cost Incurred
Replicate RWH model in other JIEC estates	Replication projects launched	Y5–Y7	Yes

Integrate RWH with greywater/wastewater reuse to expand non-potable supply	Hybrid systems piloted	Y5–Y6	Yes
Embed RWH into JIEC estate design standards and tenant guidelines	Guidelines updated and enforced	Y5	No
Use RWH performance data (savings, resilience, ESG) to progress towards Eco-Industrial Park (EIP) alignment	EIP KPIs met and documented	Y5–Y6	No

Various Water Harvesting Systems

A) Rainwater Harvesting System from Factory and Warehouse Roofs

It is an integrated gutter system designed to collect rainwater from the roofs of factories and warehouses and direct it through dedicated channels into storage tanks, either underground or above ground.

Advantages

- Low Cost
- Available during summer when rainfall decreases
- Does not require complex infrastructure

Uses


Cleaning


Irrigation


Cooling

B) Surface Runoff Water Collection System

A system designed to collect surface runoff water by constructing small channels or pits on the edges of facilities to capture rainwater flowing from open areas and parking lots, and channel it in an organised manner.

Advantages

- Suitable for large areas and industrial zones
- Can be integrated with existing stormwater drainage systems.

Uses

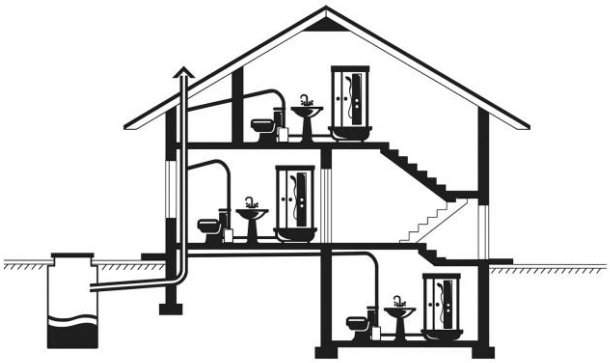
Cleaning

Irrigation

Well Recharge

C) Greywater Reuse System

It is a system for reusing greywater that collects wastewater from sinks, kitchens, and air-conditioning units, then treats it biologically or physically to allow it to be reused for non-potable purposes.



Advantages

- Reduces water consumption by 30–50%
- Can be installed inside factories or integrated within existing industrial networks

Uses

Cleaning

Irrigation

D) Condensate Water Recovery System from Cooling or Air-Conditioning Units

This system captures condensate generated by cooling units or air-conditioning systems as a result of moisture condensation on cooling coils or within central HVAC systems. The collected condensate is then directed to designated storage points and reused for suitable non-potable applications.

Advantages

- Relatively high-quality water
- Available during summer
- Very low operational cost

Uses

Cleaning

Irrigation

E) Underground Storage Tanks and Reservoirs

Large underground concrete or plastic tanks are used to store collected water, helping reduce evaporation and contamination. These systems serve as a reliable reserve water source.

Advantages

- Long service life due to durable construction materials
- Protection from contamination and temperature fluctuations

CONCLUSION

Rainwater harvesting presents a **practical, cost-effective, and scalable solution** to reduce the dependence of Jordan's industrial estates on scarce and expensive conventional water sources. Across Zarqa, Al-Salt, Al-Tafilah, and Madaba, systems designed to capture and reuse rainfall can offset up to **10–25% of annual demand**, equivalent to two to three months of supply, with **payback periods of 6–9 years**.

The intervention delivers a compelling set of **co-benefits**: direct cost savings for tenants, improved climate resilience and operational reliability, reduced stress on national water systems, and enhanced compliance with ESG standards. It also advances Jordan's commitments under the **National Water Strategy 2023–2040**, the **Green Growth Action Plan**, and the transition to **Eco-Industrial Parks (EIPs)**.

With strong enabling factors already in place — including supportive policies, existing stormwater infrastructure, and access to green finance facilities — rainwater harvesting can be implemented immediately and expanded over time. Early adoption at the four estates will create **demonstration sites** that provide tangible proof of impact and set the foundation for replication across Jordan's industrial zones.

By embracing rainwater harvesting, JIEC and its partners have the opportunity to position Jordan as a **regional leader in sustainable industrial development**, reinforcing competitiveness while delivering long-term environmental and social gains.

Many technical and practical questions emerged at the factory level, particularly around system design, approvals, and maintenance. To address this, it is recommended that JIEC develop **clear factory-level guidance** covering technical specifications, regulatory steps, and basic maintenance requirements to support smooth adoption.

The analysis also highlights the need to focus primarily on **land-owning investors**, as they have the space, design control, and long-term incentive to implement rainwater harvesting systems. In contrast, short-term tenants have limited ability to modify facilities, making large-scale adoption less feasible.

Finally, it is recommended to extend the rainwater harvesting approach to **all JIEC industrial estates**, enabling wider water savings, consistent sustainability standards, and stronger alignment with national green growth priorities.

Photos from the validation workshop with potential investors and stakeholders, held as part of the business case development

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