World Water Challenge 2025

PROGRAM BOOK

Ministry of Climate, Energy and Environment

KOREA WATER FORUM

2025

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Contents

Main Topic Environment Preservation Technology

[Solution 1] Garuda WaterGuard: An integrated Smart Ecosystem for Water Quality Restoration and Monitoring in Degraded Freshwater Bodies 06

[Solution 2] Monitoring of Water Consumption and Water Productivity in irrigated Lands of the Fergana 24

[Solution 3] Aruna Revolution: Circular Fiber Innovation for Aquatic Health and Hygiene Equity 40

Main Topic Smart Water Technology

[Solution 4] A scalable Machine-learned based Framework for cost-effective Sewer Leakage Detection 52

[Solution 5] Small Habits, Big Thirst: Smart Behavioral Water Management in Pakistan & South Africa 60

Main Topic Appropriate Technology

[Solution 6] NileSmart: Community-Centered Water Stewardship for a Resilient Egypt 70

[Solution 7] Resilient Water Pods: Solar-Powered Water Access and Household Distribution in Rural Karakalpakstan 80

Garuda WaterGuard: An integrated Smart Ecosystem for Water Quality Restoration and Monitoring in Degraded Freshwater Bodies

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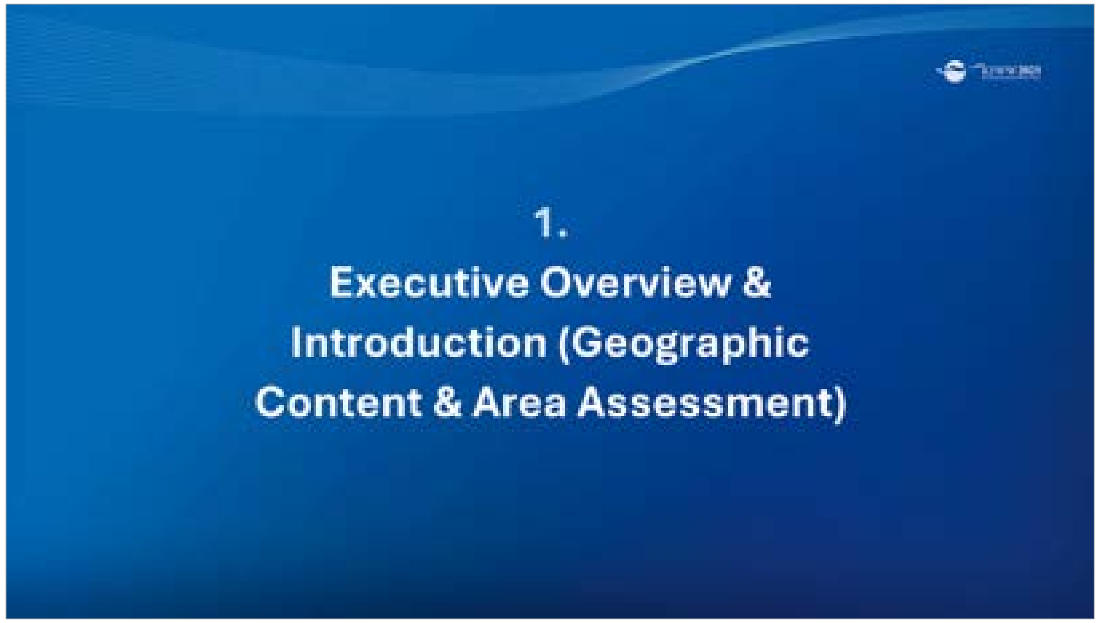
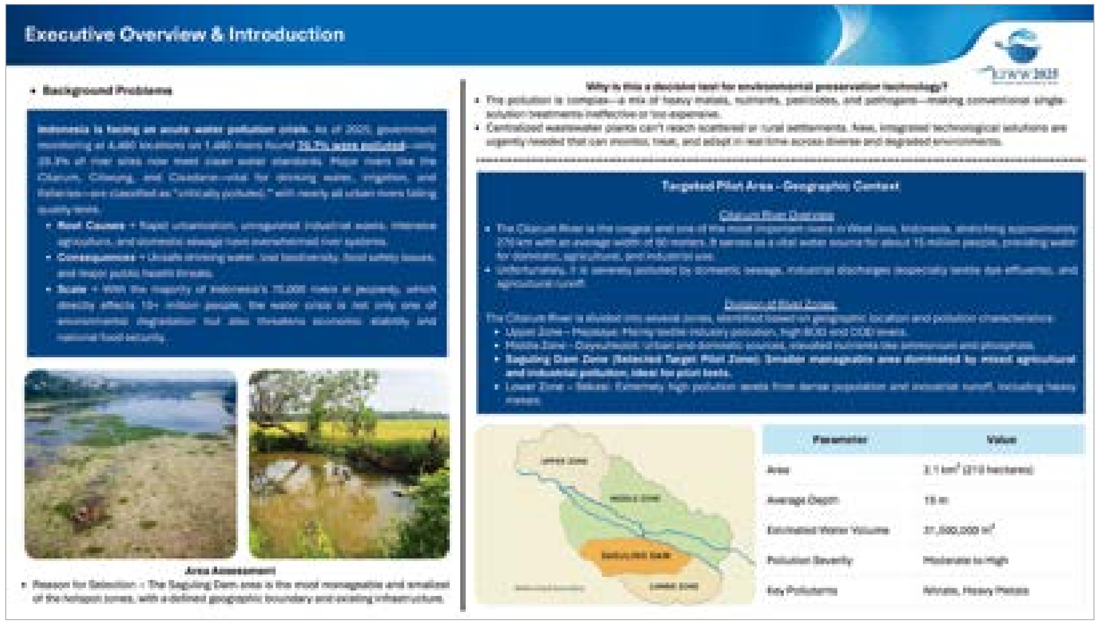
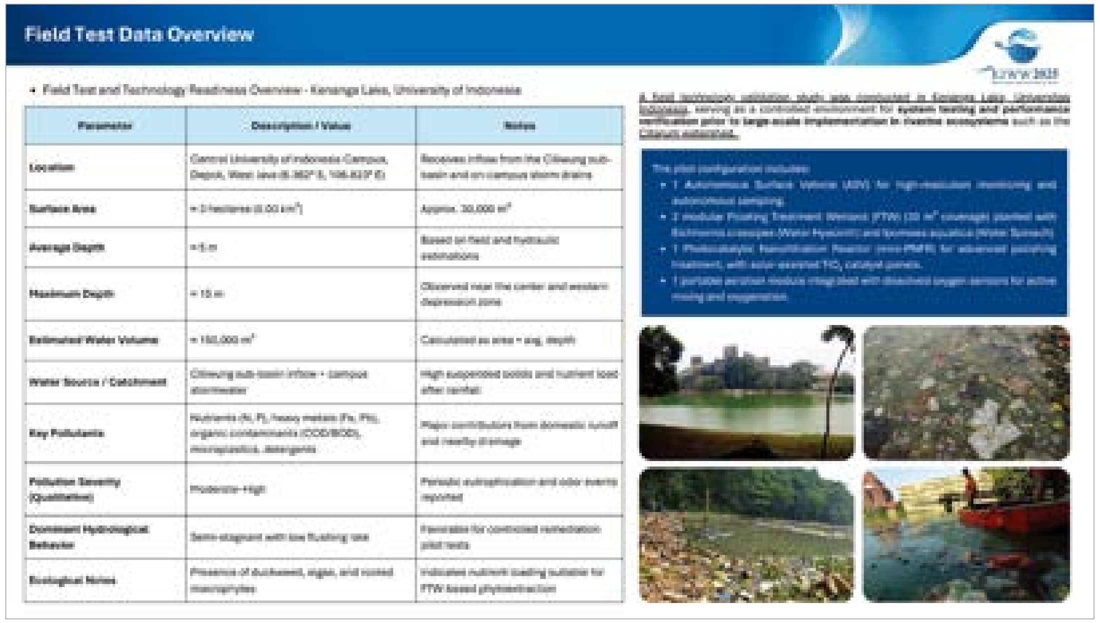
(University of Indonesia)

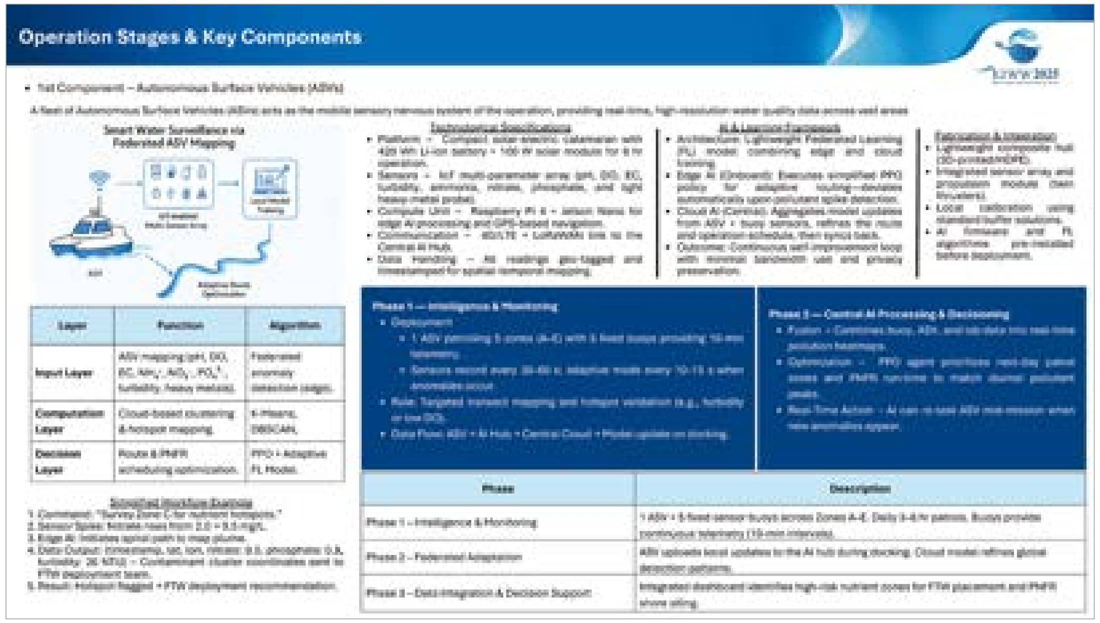

CONTENTS
05. Handling Complex, Mixed Pollution & System Integration
06. Economic Viability, Cost Calculation & Resource Planning
07. Risks, Challenges & Mitigation
08. Conclusion & Next Steps

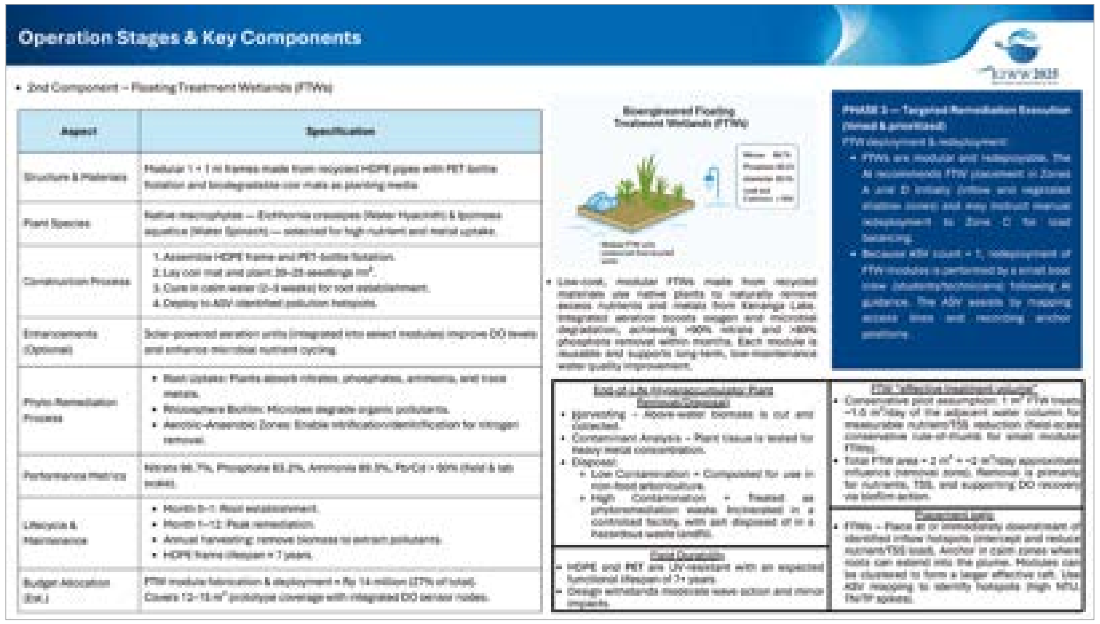

1.
Executive Overview & Introduction (Geographic Content & Area Assessment)

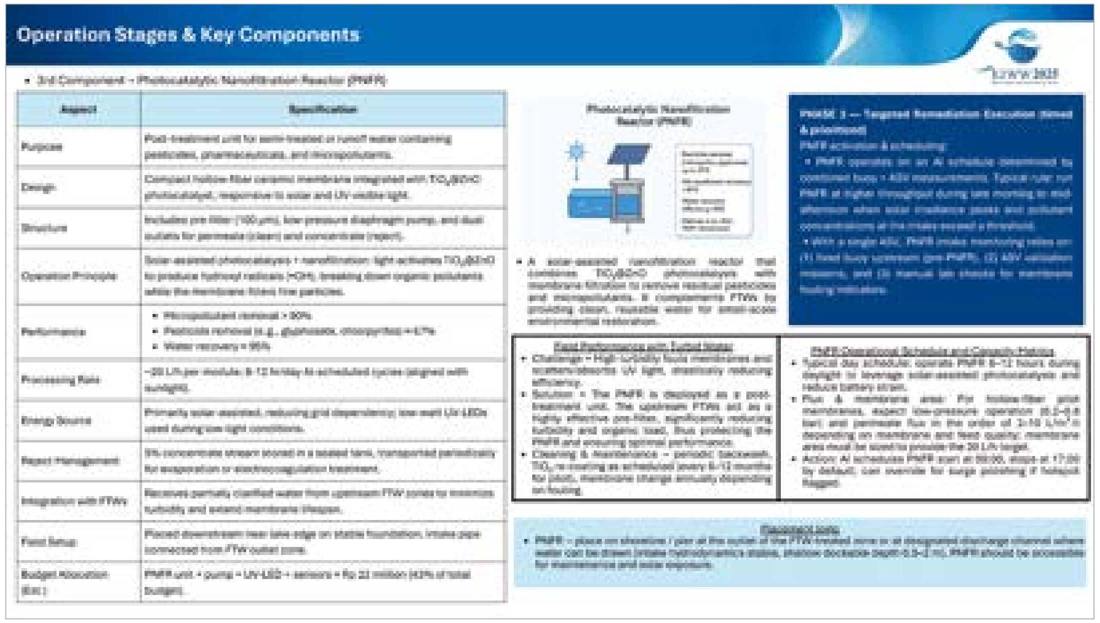

Executive Overview & Introduction
Background Problems
Area Assessment
Targeted Pilot Area - Geographic Context
Parameter
Value
Area
Average Depth
Estimated Water Volume
Pollution Severity
Key Pollutants
Moderate to High
Nitrate, Heavy Metals


Field Test Data Overview
Parameter
Description / Value
Notes
Location
Surface Area
Average Depth
Maximum Depth
Estimated Water Volume
Water Source / Catchment
Key Pollutants
Pollution Severity (Qualitative)
Dominant Hydrological Behavior
Ecological Notes


2.
Integrated Technology
(Workflow & Operational Phases)


Operation Stages & Key Components
1st Component – Autonomous Surface Vehicles (ASVs)


Operation Stages & Key Components
2nd Component – Floating Treatment Wetlands (FTWs)


Operation Stages & Key Components
3rd Component – Photocatalytic Nanofiltration Reactor (PNFR)

Operation Stages & Key Components

- 4th Components – Closed-Loop AI Optimization & Feedback

Aspect	Specification
Architecture	Hybrid edge-cloud system integrating data from sensors, FTWs, PNFRs, and a single ASV.
AI Model	Reinforcement Learning (PPO) algorithm that optimizes operations based on live water quality data.
Function	Continuously learns and updates the best placement for FTWs and operation schedule for PNFRs according to pollution dynamics and hydrological patterns.
Data Flow	ASVs collect post-treatment data (e.g., nutrient levels, turbidity, dissolved oxygen) and send it to the cloud for analysis.
Optimization Loop	Observe: ASV resamples treated zones → Analyze: AI evaluates pollution reduction → Decide: Adjust FTW/PNFR deployment and ASV patrol routes → Act: Updated commands sent automatically to field units.
Validation Phase	After each operation cycle, the ASV performs a focused resurvey mission to measure improvement (e.g., BOD, COD, metals) for feedback calibration.
Automation Level	Semi-autonomous; human input limited to supervision and maintenance.
Decision Latency	• Route & placement updates: every few hours • On-field response (ASV): within seconds.
Cost Allocation (Est.)	AI controller (edge device, sensors, software integration): Rp 9 million (18%).

PHASE 4 — Validation & Closed-Loop Feedback (single ASV workflow)

Resurveying for validation:

- After a remediation action (FTW redeployment or PNFR operation window), the ASV is scheduled for a focused validation mission to resurvey the treated area. Because only one ASV is available, the AI prioritizes validation targets by expected marginal improvement.
- Validation includes in situ sensor logging and photography; a subset of water samples are taken for lab confirmation (BOD/COD, metals) to calibrate remote sensor readings.

Feedback & policy update:

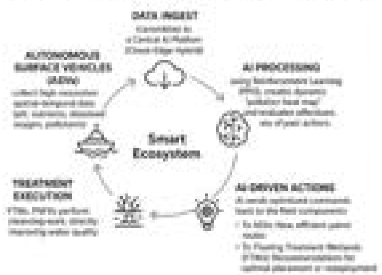
- Validation results feed the central RL trainer. Policy updates (route priorities, FTW placement heuristics, PNFR runtime rules) are transmitted to the ASV during its docked sync window.
- Over sequential cycles the RL agent learns which remediation portfolios produce measurable improvements for given inflow signatures.

Name	Parameter
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

- The AI-powered control system forms the brain of the Smart Ecosystem. It processes live data from ASVs, FTWs, and PNFRs, continuously optimizing deployment and operation for maximum water quality improvement — all within a closed, adaptive loop that learns and evolves over time.

System Overview Diagram

- System Overview Diagram: The "Smart Ecosystem" (ASVs, FTW, PNFR, AI feedback)



- Before

- After (3 Months)

3. Field Tested Outcomes

Field Tested Outcomes

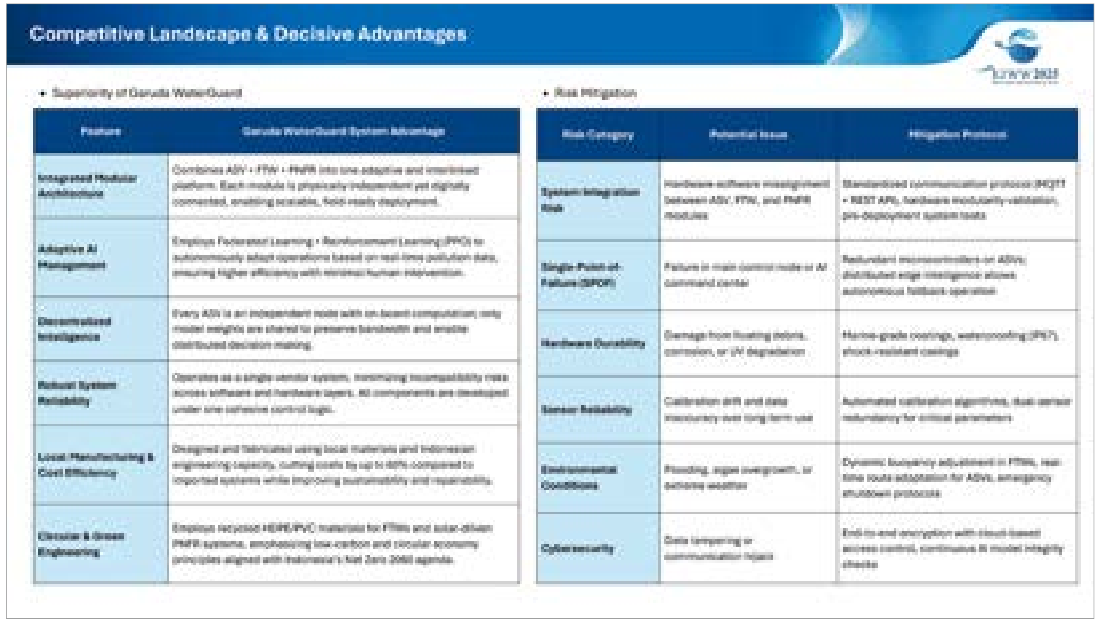
- System Effectiveness & Quantitative Results

Parameter	Pre-Treatment (Baseline)	Post-Treatment (60 Days)	Efficiency (%)	Remarks
Heavy Metals	0.05 mg/L	0.025 mg/L	50%	Restored to neutral stability
Dissolved Oxygen (DO)	2.1 mg/L	6.5 mg/L	210%	Improved through aeration
Biological Oxygen Demand (BOD_5)	35 mg/L	9 mg/L	74%	Bioremediation via FTW root biofilm
Chemical Oxygen Demand (COD)	65 mg/L	18 mg/L	72%	PNFR photocatalytic oxidation effective
Total Nitrogen (TN)	8.5 mg/L	3.1 mg/L	64%	Nutrient uptake by wetland plants
Total Phosphorus (TP)	2.3 mg/L	0.8 mg/L	65%	Phytoextraction dominant
Turbidity	85 NTU	18 NTU	79%	Reduced by filtration & bioflocculation
Total Coliform	8200 CFU/100mL	640 CFU/100mL	92%	UV sterilization + microbial competition

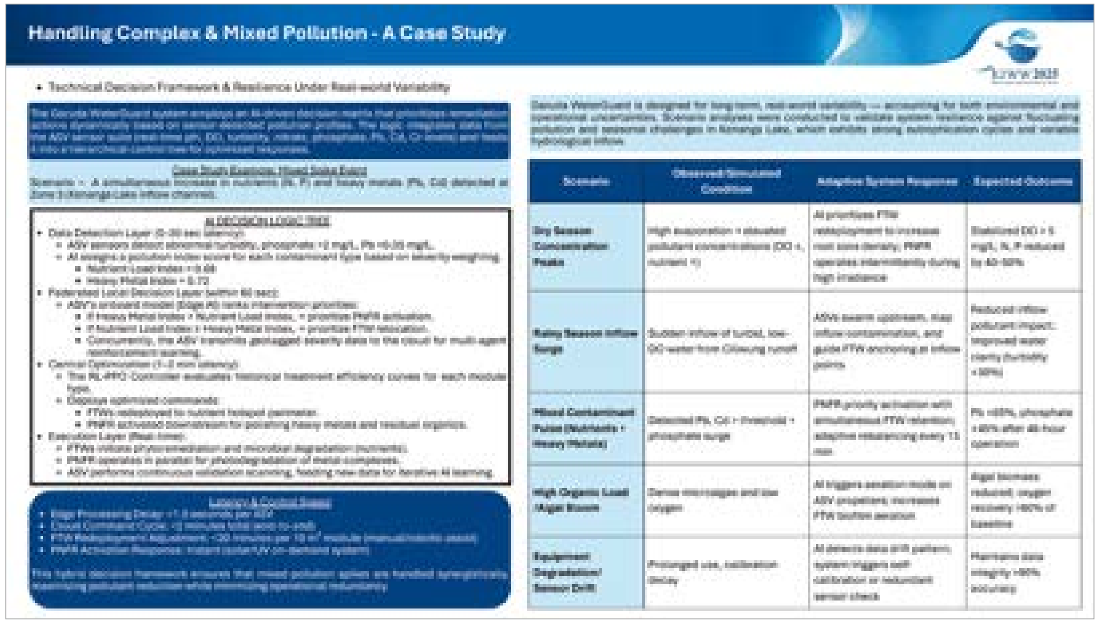
- Impact Assessment

Impact Dimension	Indicator / Parameter	Observed or Projected Result	Quantitative / Qualitative Metrics	Remarks
Environmental	Nutrient & Organic Load Reduction	70–75% pollutant reduction (COD, BOD, TN, TP)	BOD_5 ↓ from 35 → 9 mg/L; TP ↓ 65%	Substantial eutrophication mitigation
	Biodiversity Recovery	Reappearance of plankton and small fish	DO ↑ from 2.1 → 6.8 mg/L	Improved aquatic life resilience
	Carbon Footprint	Low-carbon operation via solar PNFR	~0.27 kWh/m³ energy use	50% lower energy vs. conventional aeration
	Water Quality Upgrade	Class IV → Class II (within 1 year)	SNI 7389-2009 standard alignment	Suitable for recreational and educational use
Social/Educational	Student & Research Engagement	Involvement of ~10 students across Engineering	Cross-department (Chemical, Environmental, Electrical Eng.)	Promotes interdisciplinary innovation
	Academic Demonstration & Training	On-site demo and short training sessions	Conducted periodically for coursework or research methodology classes	Coordinated with Chemical Engineering Lab
	Campus Sustainability Alignment	Contributes to internal sustainability tracking	Data shared with FT UI's sustainability reporting unit	Aligns with GreenMetric environmental performance indicators


4.
Competitive Landscape & Decisive Advantages


Competitive Landscape & Decisive Advantages
Superiority of Garuda WaterGuard
Risk Mitigation
System Integration Risk
Single-Point-of-Failure (SPOF)
Hardware Durability
Sensor Reliability
Environmental Conditions
Cybersecurity


5.
Handling Complex, Mixed Pollution & System Integration


Handling Complex & Mixed Pollution - A Case Study
Technical Decision Framework & Resilience Under Real-world Variability

System Integration, Sensor Technology & Field Robustness

- Durability Solutions

The Garuda WaterGuard system is designed to sustain long-term operations under tropical aquatic environments such as Kenanga Lake. Each subsystem incorporates field-proven durability measures:
- Biofouling Resistance – All submerged components—including sensor casings and FTW root mats—are coated with non-toxic, hydrophobic fluoropolymer layers to prevent algal or bacterial buildup. Self-cleaning sensor housings use micro-vibration pulses every 12 hours to dislodge biofilm accumulation without manual intervention.
- Anti-Corrosion Coating – Metallic elements (mounts, frames, ASV propeller housings) are anodized or made from marine-grade aluminum with epoxy sealing to resist oxidation and corrosion from nutrient-rich water.

- Calibration & Maintenance Protocols

To ensure continuous data reliability and operational accuracy:
- Automated Calibration – ASVs feature onboard reference solutions allowing in-situ calibration for DO, pH, and conductivity sensors every 48 hours.
- Scheduled Manual Check – Human maintenance is performed biweekly for cross-validation against laboratory standards and cleaning of FTW sampling points.
- Sensor Replacement Cycle:

Sensor Type	Expected Lifespan	Replacement Cycle
DO Sensor	12 months	Annually
pH/ORP Sensor	18 months	Every 1.5 years
Turbidity Sensor	24 months	Every 2 years
Heavy Metal/IC Sensor	36 months	Every 3 years

- Local Repair & Rapid Recovery Strategy

To maximize uptime and reduce dependency on imported components:
- Local Manufacturing – Most structural and electronic components are sourced from domestic suppliers, enabling quick replacement within 72 hours.
- Modular Architecture – Each subsystem (ASV, FTW, PNFR) can be decoupled for independent repair without halting the entire operation.
- Fault Detection & Recovery – The central AI continuously monitors sensor health via self-diagnostic indicators. Faults trigger contingency rerouting—ASVs in standby automatically cover failed units until maintenance is complete.

- Integrated Operational Resilience

This robust integration of mechanical, electrical, and digital safeguards ensures the Garuda WaterGuard system can maintain high fidelity and continuity in complex, mixed-pollutant aquatic environments. The combination of biofouling resistance, modular redundancy, and adaptive edge intelligence makes it a fully field-robust, self-sustaining smart ecosystem suitable for long-term deployment in lakes and riverine systems.

- Edge Computing & Battery Management

Each ASV is powered by a hybrid solar–$LiFePO_4$ battery pack providing 48 hours of continuous operation. Intelligent edge computing allows local AI inference to minimize data transmission load, enabling autonomous operation even under weak connectivity. Power allocation dynamically prioritizes propulsion, sensing, or computation depending on the mission phase, with automatic docking for solar recharge at the shoreline hub.

6. Economic Viability, Cost Calculation, and Resource Planning

Cost Calculation

- Cost Breakdown

Category	Component	Qty	Unit Cost (IDR)	Total (IDR)	Notes
A. Autonomous Surface Vehicle (ASV)	Body & Propulsion	1 unit	12,000,000	12,000,000	Local fabrication using HDPE and PVC
	Sensor Suite	1 set	6,000,000	6,000,000	Recalibrated monthly
	Microcontroller & Telemetry	1 set	2,000,000	2,000,000	Connected to cloud platform
Subtotal ASV				**20,000,000 (USD 1,206)**	
B. Floating Treatment Wetlands (FTWs)	Frame & Floats	2 modules	4,500,000	9,000,000	Local materials
	Plant Media	2 sets	750	1,500,000	Native species from UI nursery
Subtotal FTWs				**10,500,000 (USD 632)**	
C. Mini Photocatalytic Nanofiltration Reactor (PNFR)	Reactor Shell	1 unit	7,000,000	7,000,000	With 20-L capacity
	Catalyst & Membrane	1 set	3,500,000	3,500,000	Solar/UV driven
	Control & Solar Panel	1 set	2,000,000	2,000,000	IoT integrated
Subtotal PNFR				**12,500,000 (USD 752)**	
D. Labor, Logistics & Installation	Field Deployment & Setup	Lump sum	3,000,000	3,000,000	2-day setup
E. Cloud & AI System Setup	Cloud server, dashboard & initial training		5,000,000	5,000,000	PPO + data dashboard
TOTAL PILOT PHASE				**≈51,000,000 IDR (USD 3,070)**	

Economic Viability

- Full Scale-Up Scenario

Item (per hotspot zone)	Qty	Unit price (USD)	Subtotal (USD)	Notes / assumptions
ASV (field-ready, modular)	3	2	6	Small catamaran ASVs (modest sensors & propulsion) — 3 per zone for coverage
FTW modules (1 m² kits)	50	60	3	Modular recycled-HDPE/PET units; 50 m² total footprint per zone
PNFR modules (pilot-scale)	4	1,6	6,4	20 L/h ceramic + TiO_2@ZnO modules (parallel for throughput)
Edge & comm gateway	1	2	2	LoRaWAN gateway + local edge server + local dashboard
Fixed sensor buoys	4	250	1	Simple pH/DO/turbidity/EC nodes

- Unit Economics

Parameter	Smart Ecosystem	Legacy Treatment (Conventional)
Cost per m³ treated	~IDR 1,500–2,000 (USD 0.095 – 0.13)	IDR 3,000–4,500 (USD 0.2 – 0.3)
Energy Source	Solar-driven	Grid electricity
Operation Mode	Autonomous, adaptive	Manual, scheduled
Maintenance Frequency	Monthly calibration	Weekly
Data Value	Real-time environmental data	None

- Local Sourcing & Supply Chain

- FTW Components – 100% locally sourced (HDPE, coir mats from West Java suppliers).
- ASV Hardware – Electronics via UI Instrumentation Lab & local solar integrators.
- PNFR – Membrane and TiO_2@ZnO catalyst fabricated via collaboration with FT UI Chemical Engineering Lab.
- Risks
  - Supply chain delay (1–2 weeks) for imported NF membranes.
  - UV degradation of polymer floats—contingency → coating with UV-resistant paint.

Annual Operational Cost

- Annual Operational/Replacement Costs – Sensor lifespans, routine maintenance, labor

Component / Technology	Description	Estimated Lifespan	Maintenance Frequency	Annual Cost (IDR)	Notes
Autonomous Surface Vehicle (ASV)	Battery-powered robotic unit for data collection, mapping, and monitoring.	3 years (hull & frame)	Battery replaced every 2 years; calibration every 6 months.	5,000,000 (USD 301)	Includes motor and sensor cleaning, firmware updates.
Battery Module (Li-ion)	Power source for ASV and sensors.	2 years	Replace every 2 years	1,500,000 (USD 90)	Degradation after ~800 cycles.
Floating Treatment Wetlands (FTWs)	Modular floating platforms with aquatic plants and root mats.	6–7 years	Monthly inspection, partial replanting annually.	3,000,000 (USD 181)	Plant replacement (15–20% per year).
Photocatalytic Nanofiltration Reactor (PNFR)	Solar-driven reactor for advanced oxidation and nanofiltration.	3–4 years	Filter membrane replaced annually; photocatalyst refreshed every 2 years.	6,000,000 (USD 361)	TiO_2 coating and membrane maintenance cost included.
Water Quality Sensors (DO, pH, Turbidity, Conductivity, ORP)	Smart multi-parameter sensor array integrated with ASV & PNFR.	2 years	Calibration every 3 months; sensor replacement every 2 years.	4,000,000 (USD 241)	Includes calibration fluid and spare probes.
Microcontroller & Edge Computing Unit	Onboard AI edge unit for autonomous operation and data logging.	3–4 years	Firmware updates every 6 months.	2,000,000 (USD 120)	Maintenance includes data syncing and diagnostics.
Solar Panels & Power Electronics	Provides power to PNFR and FTWs auxiliary systems.	7–10 years	Cleaning every 3 months; inverter replaced every 5 years.	1,500,000 (USD 90)	Assumes tropical sunlight exposure.
Aeration System	Provides oxygenation for biological activity under FTWs.	3 years	Routine cleaning quarterly.	2,500,000 (USD 150)	Replacement of tubing and diffusers as needed.
Network & Data Transmission (IoT Gateway)	Data transfer via cellular or LoRaWAN to the dashboard.	3 years	Replace SIM and service annually.	1,000,000 (USD 60)	Includes cloud storage fee.
Labor & Field Technicians	On-site monitoring, maintenance, sample testing, and reporting.	—	Monthly (2-person team)	12,000,000 (USD 722)	Covers training, site visits, safety gear.
Miscellaneous (spare parts, logistics, calibration tools)	Safety margin for operational continuity.	—	—	2,000,000 (USD 120)	Contingency 10–15% of total cost.

Feasibility Note & Resource Planning

- Total Estimated Annual Operational Cost
  - Per zone (outdoor) ≈ USD 22,400
  - CapEx (4 zones): USD 89,600 (~IDR 1.344 billion)
  - Included: hardware (ASVs, FTWs, PNFRs), local gateways, field buoys, installation, training, 10% contingency.
  - Not included: long-term central cloud subscription beyond 12 months, large civil works (docks), advanced lab testing consumables beyond initial validation.
- Operational Highlights
  - Sensor Lifespan → Average 2 years; replacement aligned with ASV calibration cycles.
  - FTW Components → 15–20% of vegetation replanting yearly ensures nutrient uptake performance stability.
  - PNFR Reactors → Catalyst re-coating biennially sustains >85% pollutant degradation efficiency.
  - Maintenance Strategy → Preventive-based system—predictive diagnostics via AI data trends minimize downtime.
  - Local Repair Network → UI-based technical team handles first-line maintenance, minimizing external cost.
- Feasibility Note & Pilot Scale Adjustment
  - The Rp 11 million (USD 687) budget covers only a functional prototype, not a full-scale deployment.
  - Focus → validation of data integration, small-scale pollutant reduction, and community awareness.
  - Real-scale implementation would need 5–6× higher capital for durable components, larger FTWs, and multi-ASV setup.
  - Pilot data will be used to support scaling and funding proposals (e.g., GreenMetric, PT UI ESG, or research grants).
- Value To Society

Impact Dimension	Quantified Benefit	Illustration
Health Impact	30–50% reduction in bacterial load and nutrient concentration	Lower waterborne disease risks for surrounding communities
Regulatory Compliance	Supports SDGs 6 (Clean Water), 9 (Innovation), 13 (Climate Action)	Pilot serves as green-tech demonstration
Economic Multiplier	Job creation + research & manufacturing ecosystem	Estimated multiplier ×2.5 (local fabrication)

- Business Model Scenario

Model Type	Description	Value Proposition	Revenue Stream
Product Sale Model	Selling modular FTWs, ASVs, PNFRs	Affordable decentralized treatment	Unit margin 15–20%
Service-as-a-Solution	Offering "Smart Water Remediation" subscription	Monthly service + data-driven maintenance	Recurring revenue
Data Analytics Platform	Selling environmental intelligence to	Predictive water quality analytics	Data monetization model

Cost Projection

- 5 Year Operational Cost Projection (in USD)

Category	Initial (Year 0)	Year 1	Year 2	Year 3	Year 4	Year 5	Replacement Cycle	Depreciation (%)
ASV Unit (1 unit)	**1,161**	129	129	194	129	194	Every 3 yrs (battery), 5 yrs (unit)	15%
FTW System (Large Modular)	**774**	65	65	129	65	129	Every 3 yrs (bio-mat), 10 yrs (frame)	10%
Mini PNFR Module	**645**	65	65	65	65	65	Every 5 yrs (membrane & catalyst)	20%
Sensors & Electronics	**258**	65	65	129	65	65	Every 2–3 yrs	25%
Labor & Field Ops	—	387	387	387	387	387	Annual recurring	—
Data Platform & AI Maintenance	**129**	65	65	65	65	65	Annual subscription & cloud fee	—
Consumables (Nutrients, Cleaning)	—	65	65	65	65	65	Annual recurring	—
Total (Annual)	**3,03**	**841**	**841**	**1,034**	**841**	**971**	—	—
Cumulative Total	**3,03**	**3,871**	**4,712**	**5,746**	**6,587**	**7,558**	—	—

Timeline Implementation

- 12-Week Phased Deployment & Testing Schedule

Phase	Week	Key Activities	Deliverables	Risk Points & Mitigation
Phase 1 – Concept Refinement & Design (2 weeks)	Week 1–2	• Finalize 3D CAD design for ASV hull & PNFR casing • Define sensor suite & IoT architecture • Select local materials for FTW structure & plants • Validate solar system sizing	• Final design documents • Procurement list	• Risk: Delay in material confirmation • Mitigation: pre-identify local suppliers (Jakarta & Depok) and reuse lab inventory for prototyping.
Phase 2 – Procurement & Fabrication (3 weeks)	Week 3–5	• Fabricate ASV body & PNFR unit • Assemble FTW modules (2 units) • Purchase sensors, microcontrollers, batteries • Bench test power management & microcontroller logic	- Functional ASV chassis - PNFR filtration assembly - Verified power system	• Risk: Delivery delay of sensors/components • Mitigation: maintain backup analog sensors & alternative local electronics vendors (e.g., Glodok, Tokopedia).
Phase 3 – Integration & Software Deployment (2 weeks)	Week 6–7	• Integrate IoT sensors to ASV - Develop AI-based control (navigation & cleaning path) • Calibrate PNFR flow & UV intensity • Conduct closed-loop test in lab scale	- Fully assembled and connected system - Initial data stream validation	• Risk: Software delay • Mitigation: modular coding; fallback to semi-autonomous manual override mode for ASV.
Phase 4 – Field Deployment & Testing (3 weeks)	Week 8–10	• Install prototype at Pilot Field • Operate system under controlled observation • Collect baseline and operational WQI data • Adjust flow rate, FTW buoyancy, and solar charge	- Performance log (DO, COD, TDS, pH) - Visual and quantitative performance data	• Risk: Weather or turbidity issues • Mitigation: flexible daily operation window & backup test days.
Phase 5 – Evaluation, Documentation, and Handover (2 weeks)	Week 11–12	• Analyze data (before vs. after deployment) • Prepare technical report & impact summary • Conduct hands-on volunteer training (operation + maintenance) • Establish online data dashboard & remote support	- Pilot evaluation report - Simplified SOP & user manual - Trained volunteer operators	• Risk: Limited user absorption • Mitigation: visual, infographic-based training materials & 2-week shadowing by core team.

7. Risks, Challenges, and Mitigation

Risks, Challenges & Mitigation

- Technical Risks

Category	Specific Risk / Challenge	Impact	Mitigation Strategy
Technical Risks	Hardware Import Volatility – Delays or cost spikes in sensors, control boards, or nanofiltration membranes sourced internationally.	Medium-High	• Prioritize local component fabrication (HDPE frames, mats, casings). • Establish dual-sourcing agreements and maintain a small inventory buffer. • Utilize modular electronics for easy substitution.
	Reliance on Local Supply Chain Maturity – Limited domestic vendors for precision sensors or AI hardware.	Medium	• Partner with universities and local startups for co-development. • Implement component certification program to assure quality. • Gradually localize manufacturing through government-supported programs (TKDN).
	Regulatory Delays – Extended approval time for permits or environmental assessments.	Medium	• Conduct early stakeholder engagement with BBWS Citarum, KLHK, and UI administration. • Prepare template documentation for UKL-UPL and safety submissions. • Include a buffer timeline in project Gantt chart (min. + 2 months).
	Force Majeure & Physical Damage – Floods, debris impact, or vandalism.	High	• Design anchoring redundancy (dual mooring, shock-absorbing cables). • Install protective booms and debris screens near FTWs. • Implement CCTV or IoT-based surveillance integrated with ASV telemetry. • Community engagement for shared guardianship.

Risks, Challenges & Mitigation

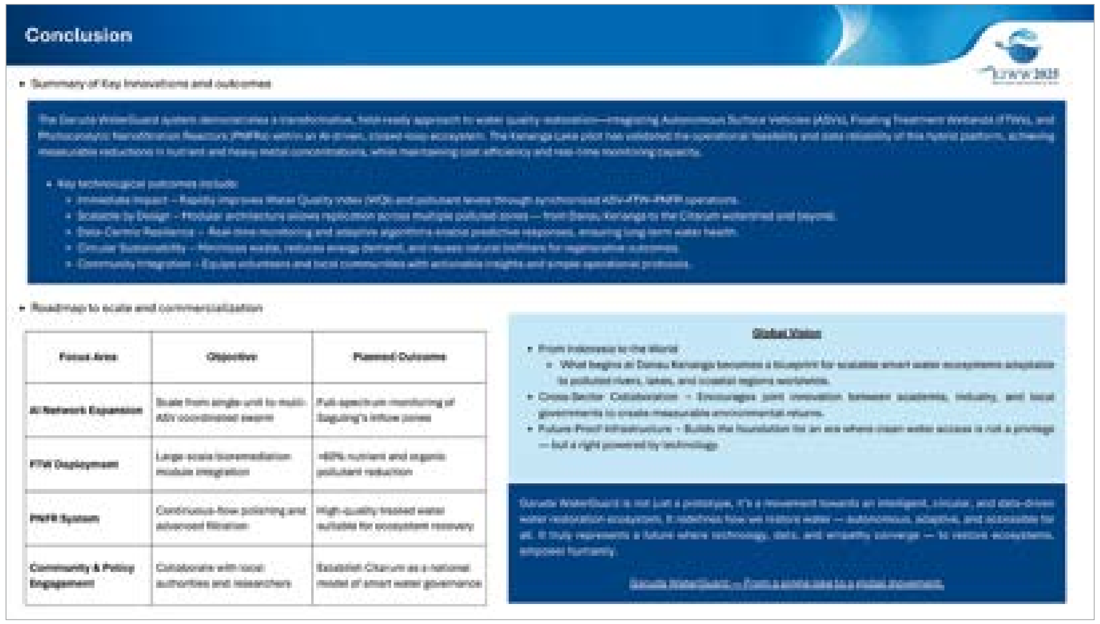
- Long - Term Maintenance

Category	Key Risks	Impact Level	Mitigation Strategy	Responsible Entity
Local Technical Expertise	Limited local expertise for high-tech system maintenance	High	Establish local training programs with certification for maintenance personnel	Project Management Unit (PMU), UI Engineering Faculty
Spare Parts Availability	Delay in importing or procuring key components (e.g., sensors, membranes, batteries)	Medium	Build local partnerships with component manufacturers; maintain a minimum stock of critical parts	Procurement & Supply Chain Division
Sensor Calibration & Degradation	Sensor drift or degradation over time reduces data accuracy	High	Implement quarterly calibration schedules; adopt modular sensor replacement design	Field Operations Team
Biofouling & System Wear	Organic buildup and sediment accumulation on FTW and PMFR modules	Medium	Regular cleaning and anti-biofouling coatings application; incorporate routine inspection logs	Field Technicians
Data System Continuity	Server or data storage failures causing monitoring interruptions	Medium	Cloud-based redundancy, automatic data synchronization	Data Management Division
Sustainability of Operations	Declining operational budget over years	Medium	Develop hybrid funding (public-private) model and offer data-as-a-service subscription	Financial & Policy Team

- Open Source Value & Competition Risk

Category	Key Risks	Impact Level	Safeguarding Strategy	Sustainability & Value Enhancement
Open Source Exposure	Excessive sharing of designs, AI algorithms, or software framework leading to imitation	High	Use modular code release (core proprietary algorithms remain closed source)	Encourage academic collaboration while retaining proprietary edge
Competition Risk	Entry of competing systems with cheaper but less reliable hardware	High	Emphasize integrated performance, local adaptability, and data accuracy as differentiators	Develop exclusive partnership programs with local governments
Intellectual Property (IP) Protection	Lack of clear patent or IP filing for unique components	Medium	Register proprietary modules (ASV control logic, PMFR design) under national IP rights	Build technology branding and identity under "Garuda WaterGuard"
Market Sustainability	Short-term competition with unsustainable cost models	Medium	Focus on lifecycle cost efficiency and long-term environmental value	Strengthen social impact and ESG-based funding eligibility
Knowledge Diffusion	Open training leads to transfer of operational know-how	Medium	License-based access for advanced operation manuals and training tools	Develop revenue from certification and licensing programs

8. Conclusion & Next Steps


Conclusion
Summary of Key Innovations and outcomes
Roadmap to scale and commercialization
Focus Area | Objective | Planned Outcome
AI Network Expansion | Scale from single unit to multi-ASV coordinated swarm | Full-spectrum monitoring of Saguling's inflow zones
FTW Deployment | Large-scale bioremediation module integration | pollutant reduction
PNFR System | Continuous-flow polishing and advanced filtration | High-quality treated water suitable for ecosystem recovery
Community & Policy Engagement | Collaborate with local authorities and researchers | Establish Citarum as a national model of smart water governance
Global Vision
From Indonesia to the World
What begins at Danau Kenanga becomes a blueprint for scalable smart water ecosystems adaptable to polluted rivers, lakes, and coastal regions worldwide.
Cross-Sector Collaboration – Encourages joint innovation between academia, industry, and local governments to create measurable environmental returns.
Future-Proof Infrastructure – Builds the foundation for an era where clean water access is not a privilege — but a right powered by technology.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Oryza Sativa Afra Iftikar I University of Indonesia

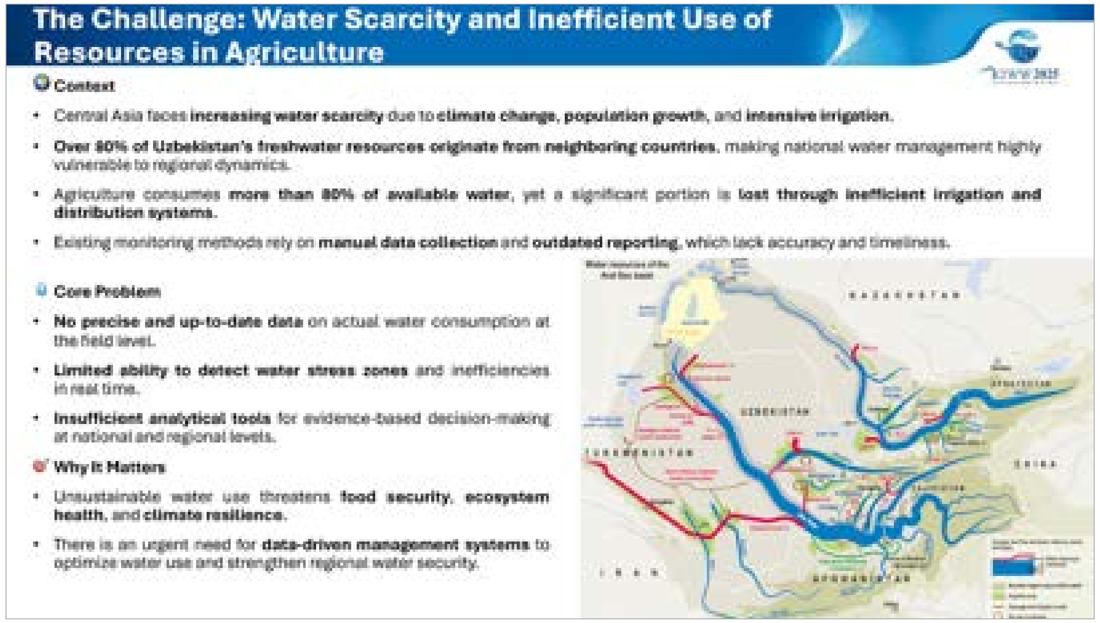
MEMO

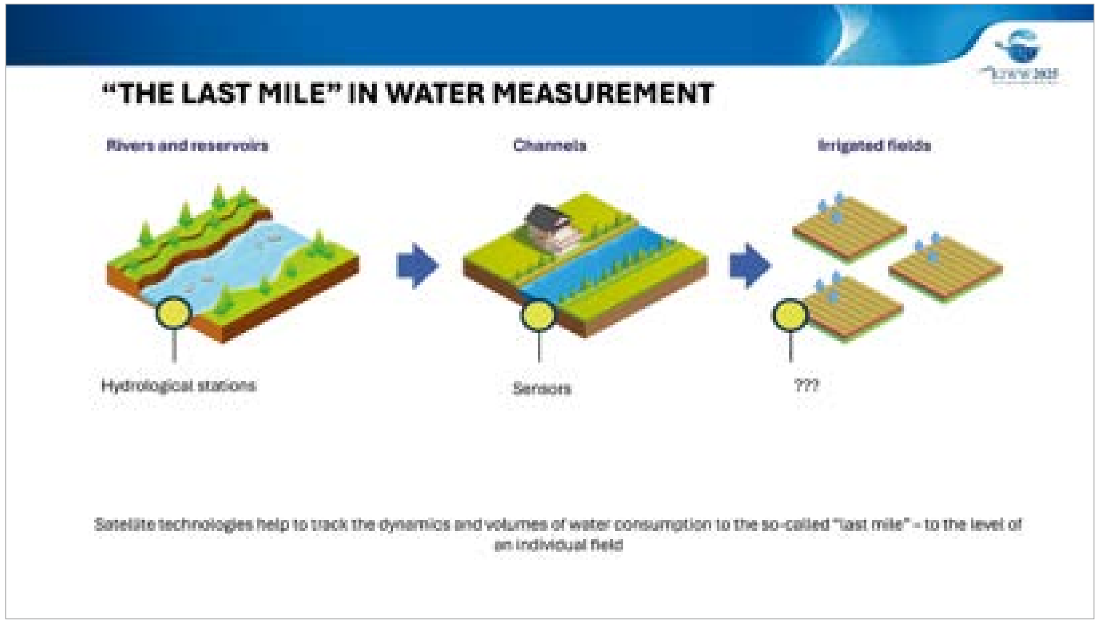
Monitoring of Water Consumption and Water Productivity in irrigated Lands of the Fergana

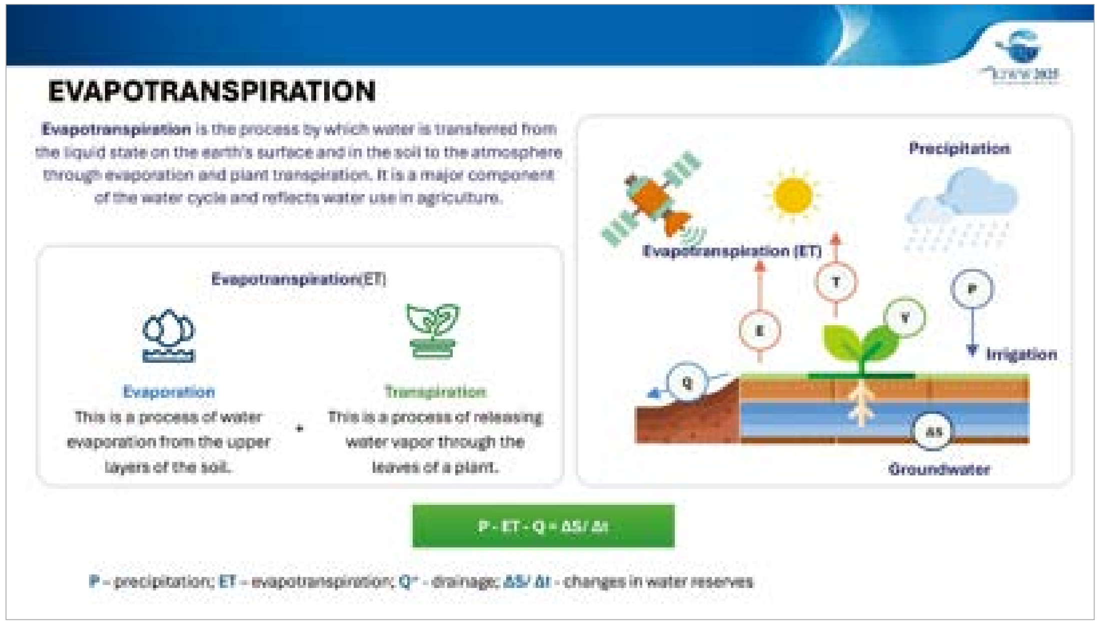
Jakhongir Iskhakov
(Uzcosmos)


1.
The Challenge

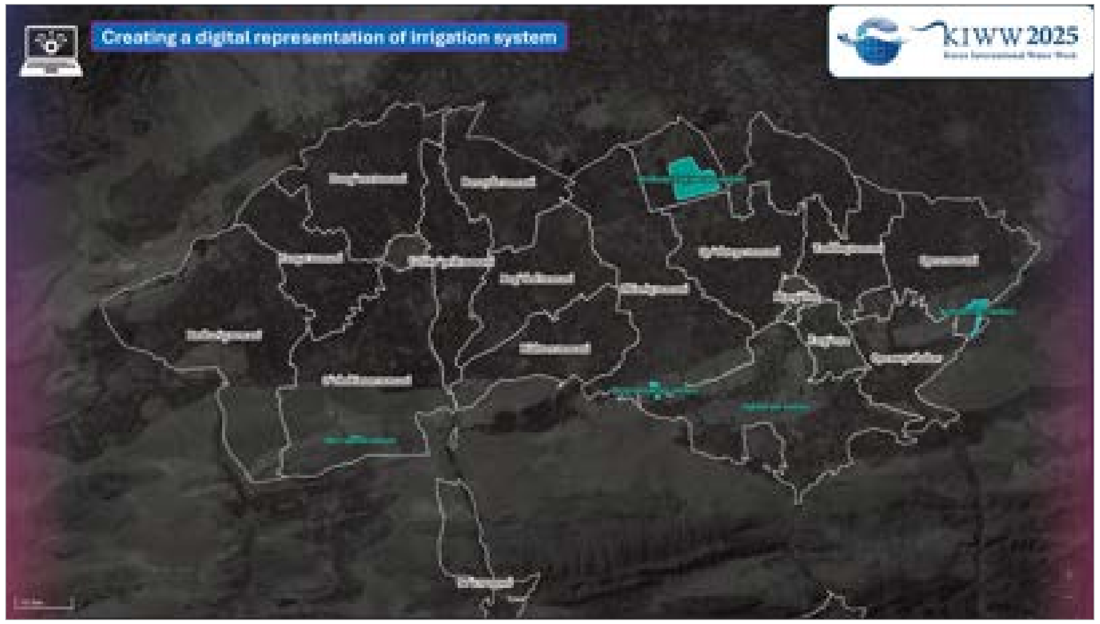

UZCOSMOS
KIWW 2025
Tracking Every Drop: Satellite-Driven Water Governance in Uzbekistan

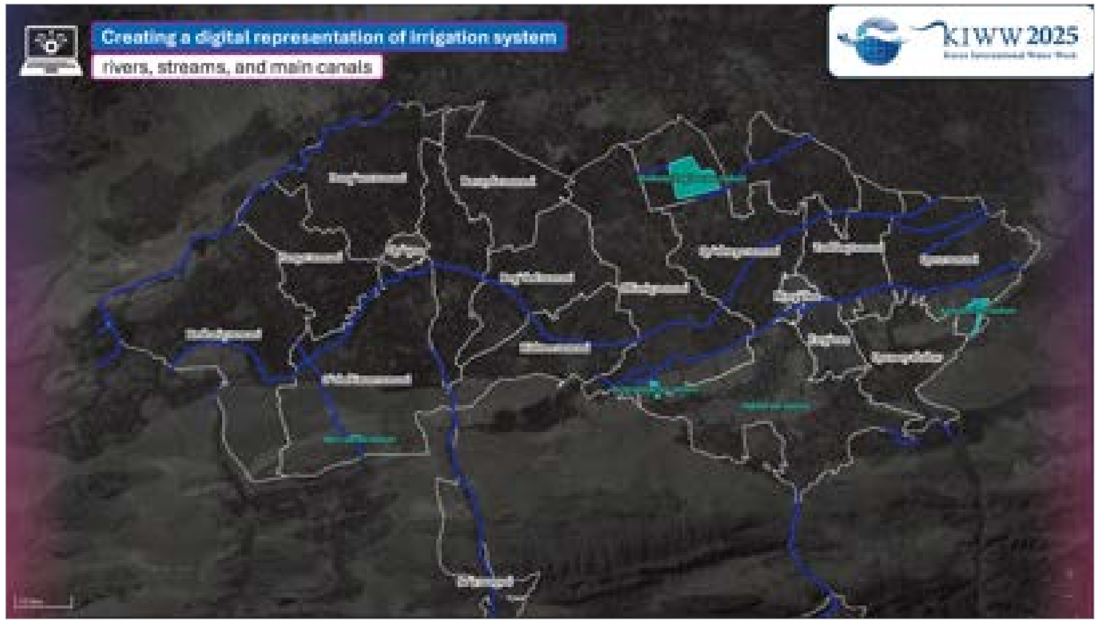

The Challenge: Water Scarcity and Inefficient Use of Resources in Agriculture
Context
• Central Asia faces increasing water scarcity due to climate change, population growth, and intensive irrigation.
• Over 80% of Uzbekistan's freshwater resources originate from neighboring countries, making national water management highly vulnerable to regional dynamics.
• Agriculture consumes more than 80% of available water, yet a significant portion is lost through inefficient irrigation and distribution systems.
• Existing monitoring methods rely on manual data collection and outdated reporting, which lack accuracy and timeliness.
Core Problem
• No precise and up-to-date data on actual water consumption at the field level.
• Limited ability to detect water stress zones and inefficiencies in real time.
• Insufficient analytical tools for evidence-based decision-making at national and regional levels.
Why It Matters
• Unsustainable water use threatens food security, ecosystem health, and climate resilience.
• There is an urgent need for data-driven management systems to optimize water use and strengthen regional water security.
KAZAKHSTAN
UZBEKISTAN
TURKMENISTAN
CHINA
IRAN
AFGHANISTAN

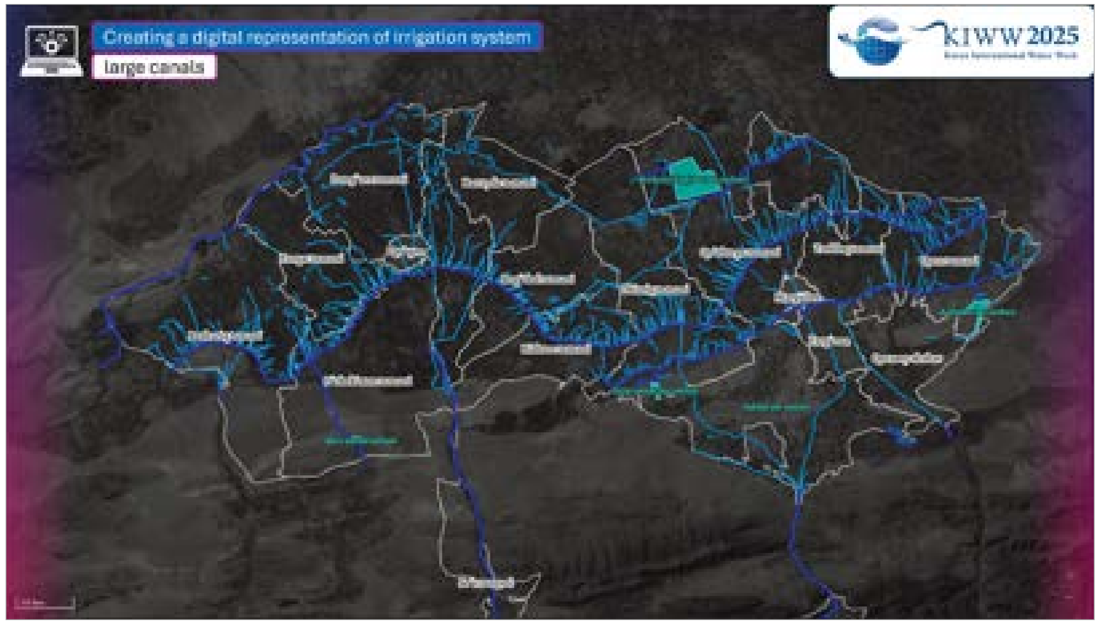

"THE LAST MILE" IN WATER MEASUREMENT
Rivers and reservoirs
Channels
Irrigated fields
Hydrological stations
Sensors
???
Satellite technologies help to track the dynamics and volumes of water consumption to the so-called "last mile" – to the level of an individual field

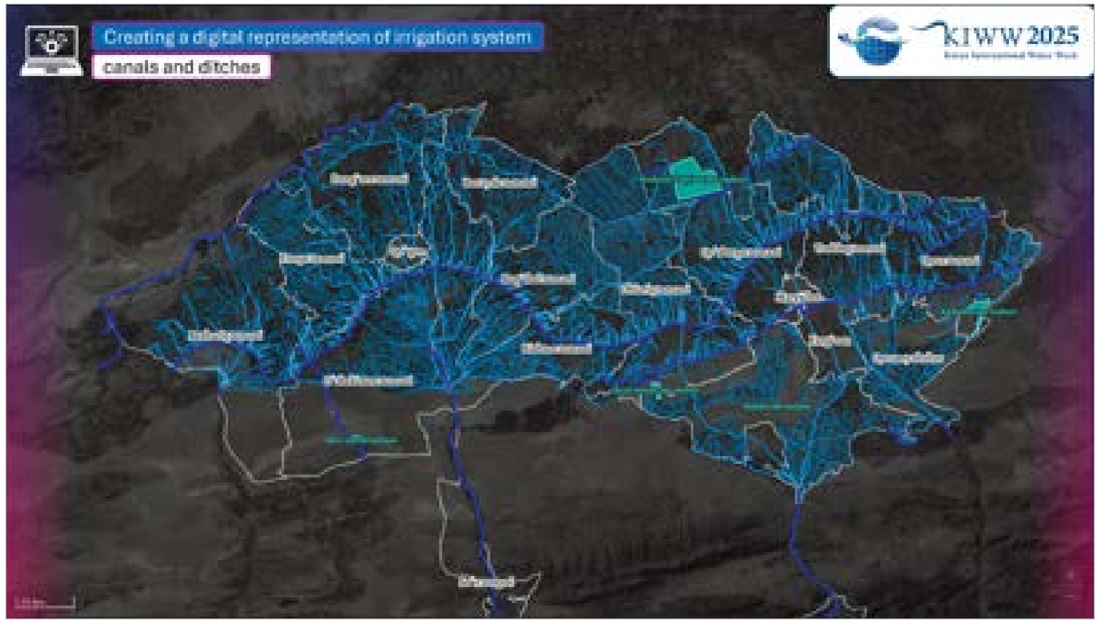

EVAPOTRANSPIRATION
Evapotranspiration is the process by which water is transferred from the liquid state on the earth's surface and in the soil to the atmosphere through evaporation and plant transpiration. It is a major component of the water cycle and reflects water use in agriculture.
Evapotranspiration(ET)
Evaporation
This is a process of water evaporation from the upper layers of the soil.
+
Transpiration
This is a process of releasing water vapor through the leaves of a plant.
Precipitation
Evapotranspiration (ET)
Irrigation
Groundwater
P - ET - Q = ΔS/ Δt
P – precipitation; ET – evapotranspiration; Q* - drainage; ΔS/ Δt - changes in water reserves

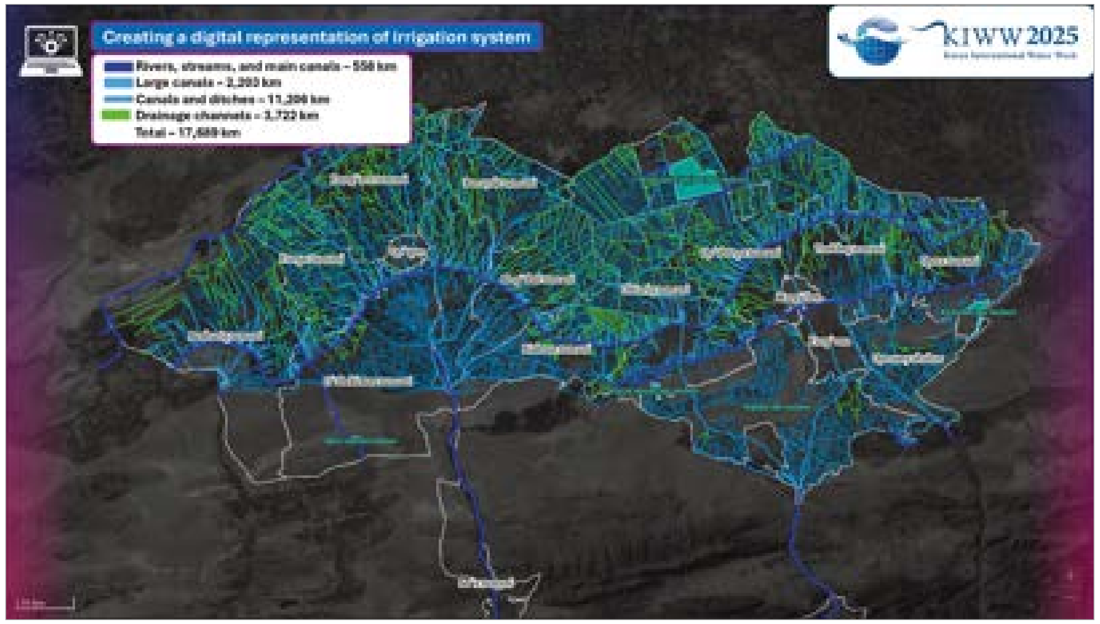

SUMMARY OF COMPLETED WORK
Samarkand
Kashkadarya
Fergana
3 regions
Fergana, Samarkand, Kashkadarya
49.5 thousand km
Digitized water bodies (rivers, streams, canals and ditches)
1.62 million hectares
Agricultural land linked to the irrigation system
52.4 thousand km² Area covere d by satellite monitoring
7 crop types
Water consumption indicators id entified

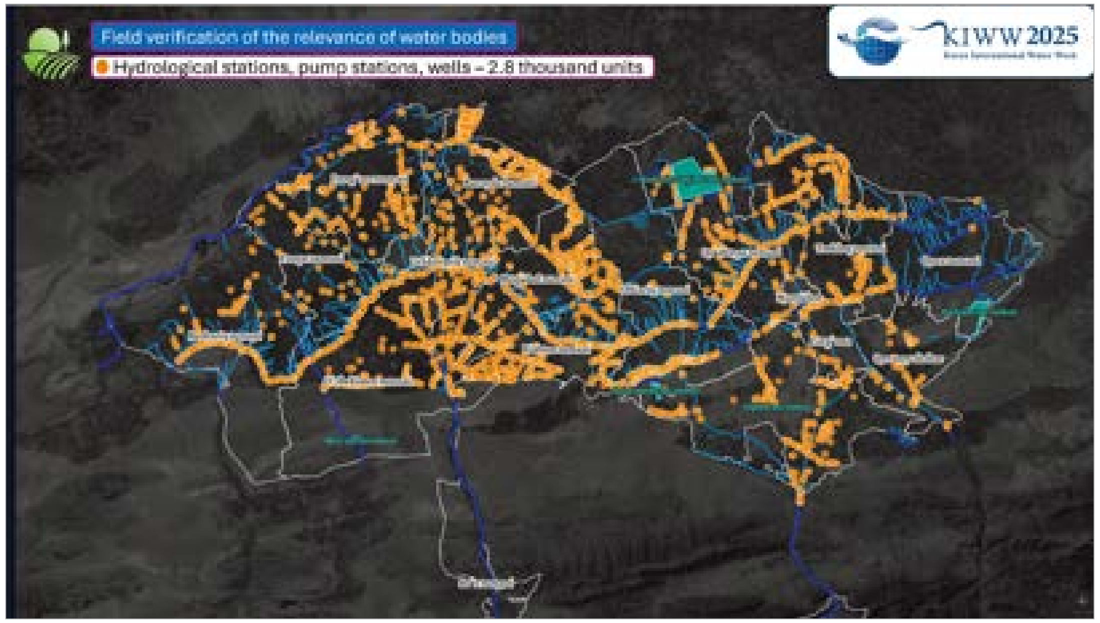

Creating a digital representation of irrigation system
KIWW 2025

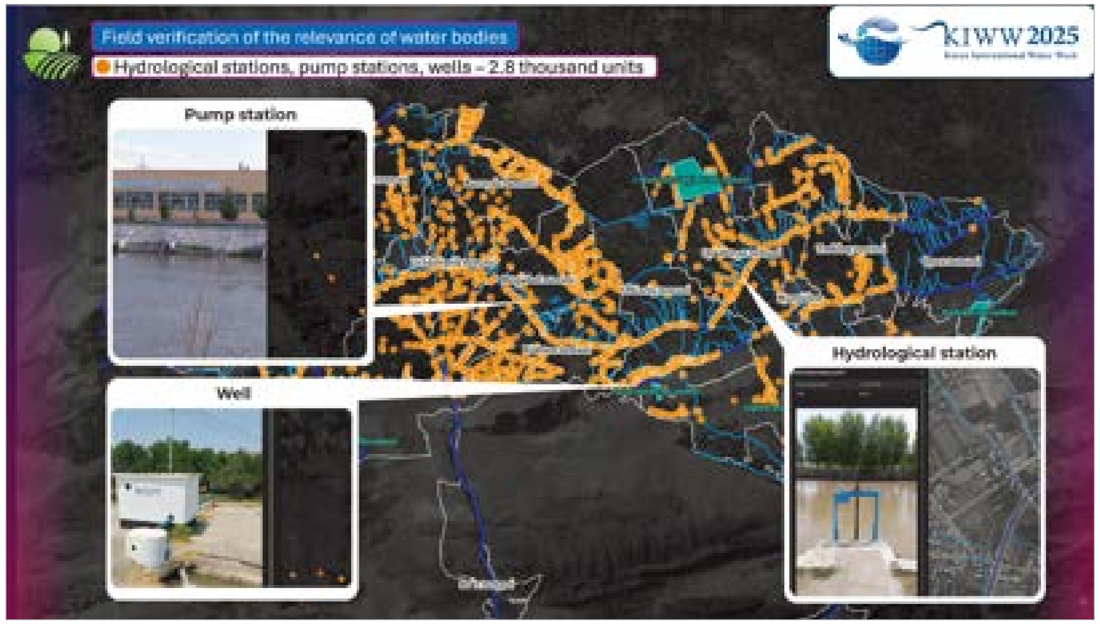

Creating a digital representation of irrigation system
rivers, streams, and main canals
KIWW 2025

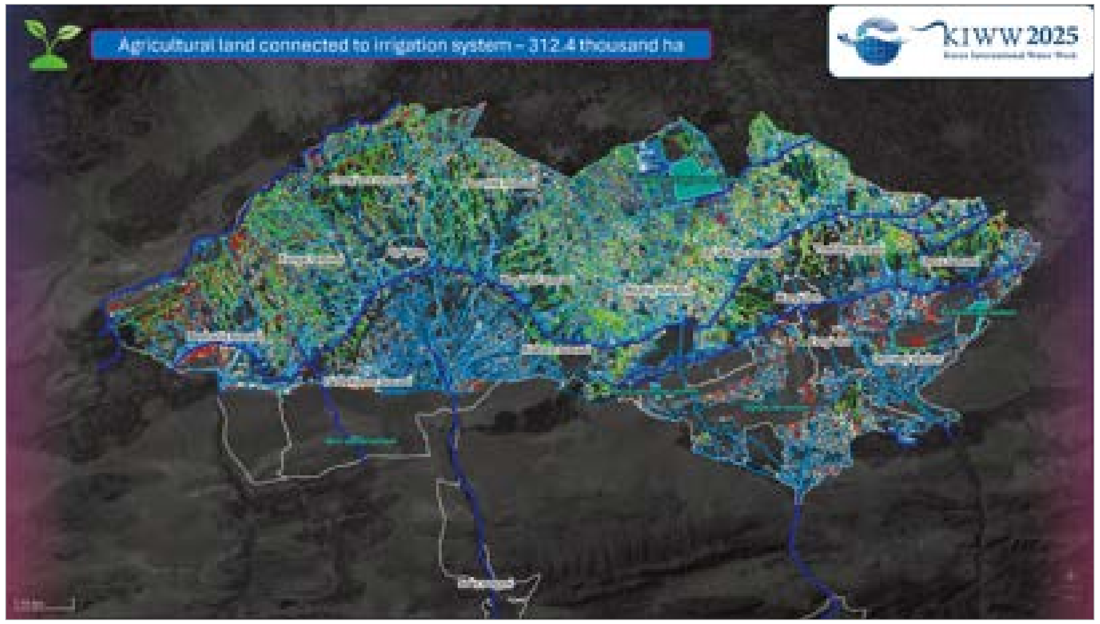

Creating a digital representation of irrigation system
large canals
KIWW 2025

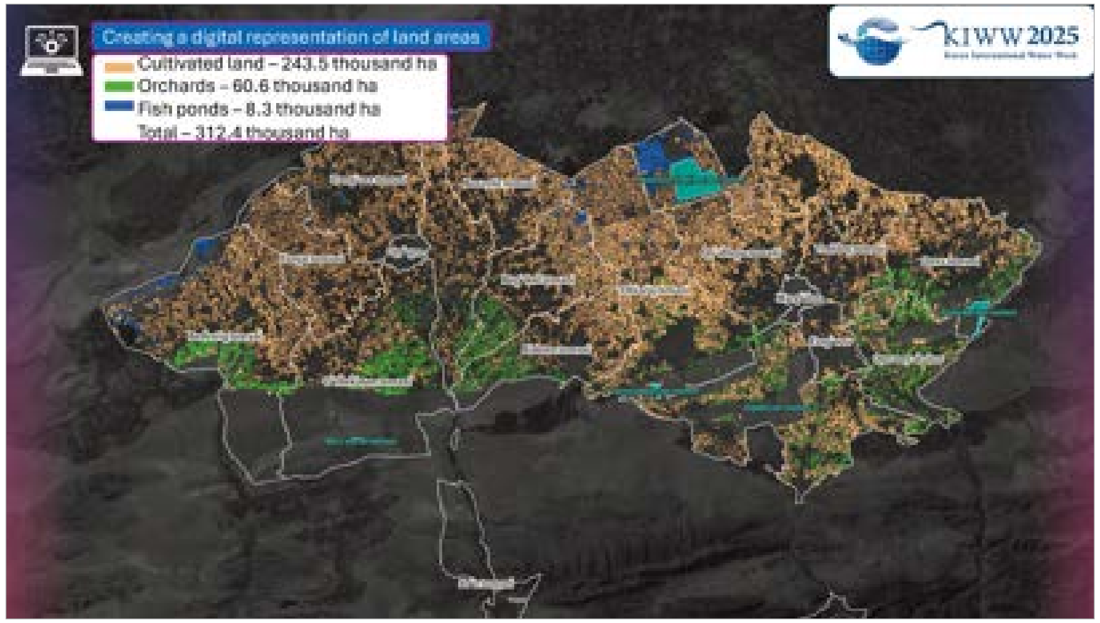

Creating a digital representation of irrigation system
canals and ditches
KIWW 2025


Creating a digital representation of irrigation system
Rivers, streams, and main canals – 558 km
Large canals – 2,203 km
Canals and ditches – 11,206 km
Drainage channels – 3,722 km
Total – 17,689 km
KIWW 2025

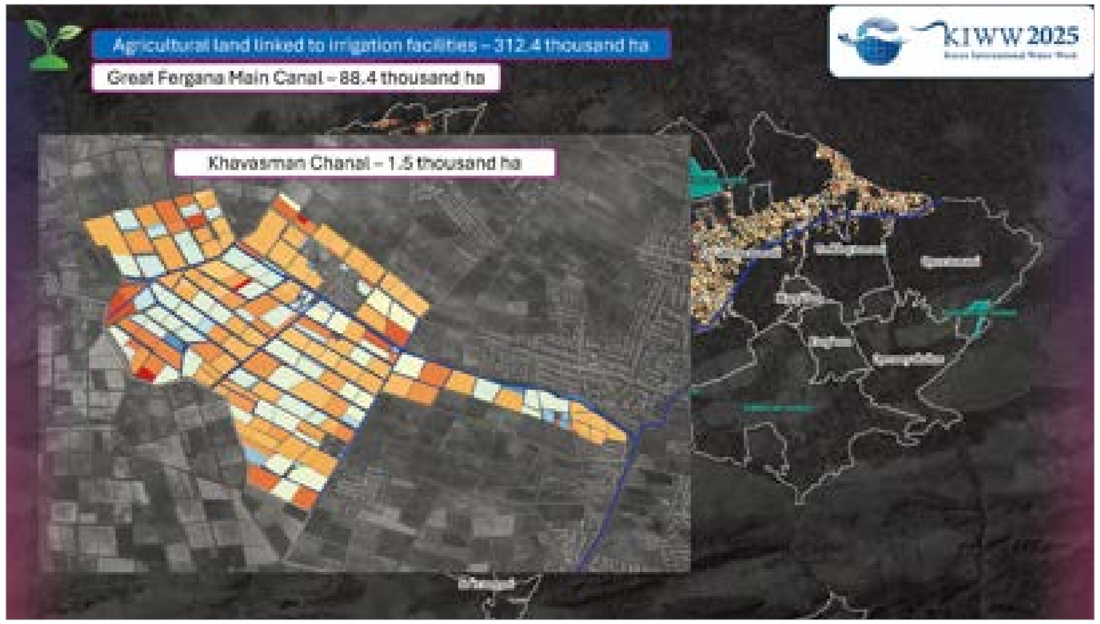

Field verification of the relevance of water bodies
Hydrological stations, pump stations, wells – 2.8 thousand units
KIWW 2025

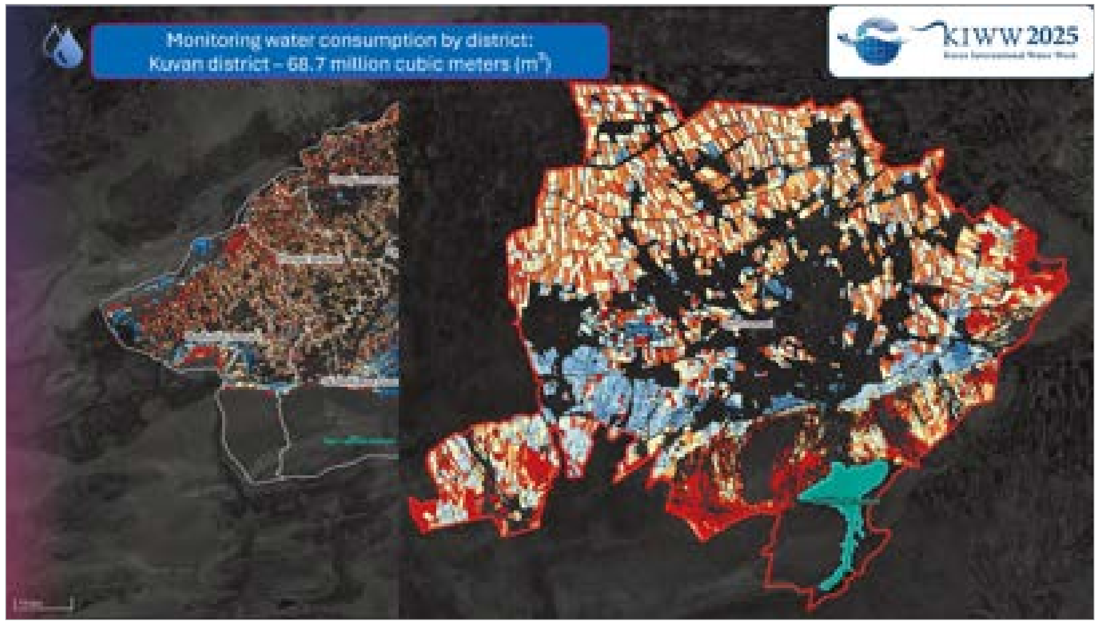

Field verification of the relevance of water bodies
Hydrological stations, pump stations, wells – 2.8 thousand units
KIWW 2025
Pump station
Well
Hydrological station

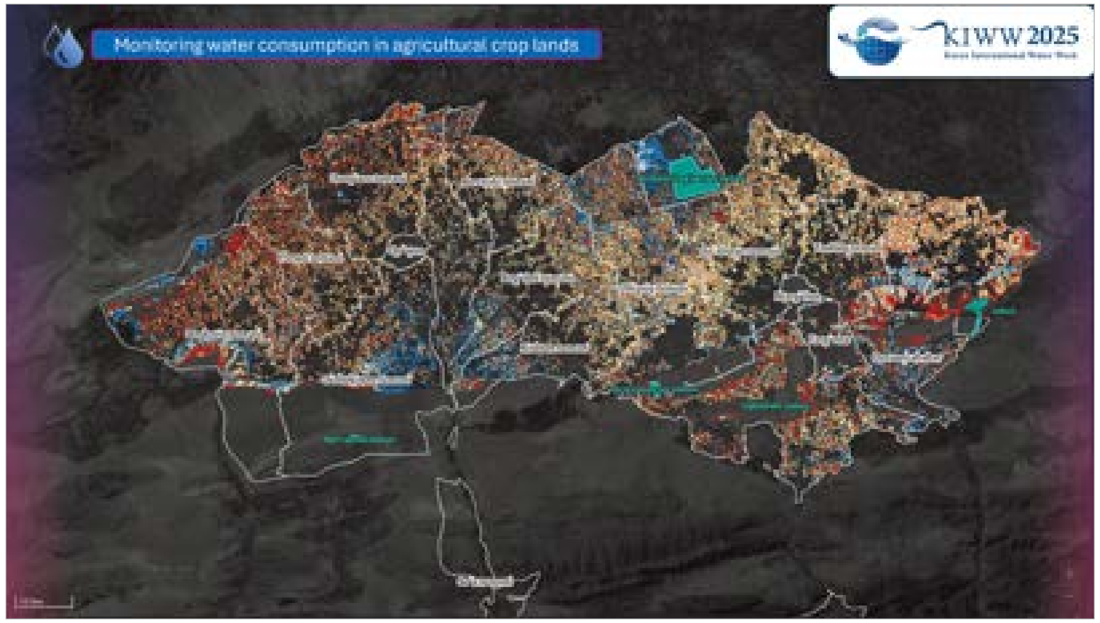

Agricultural land connected to irrigation system – 312.4 thousand ha
KIWW 2025

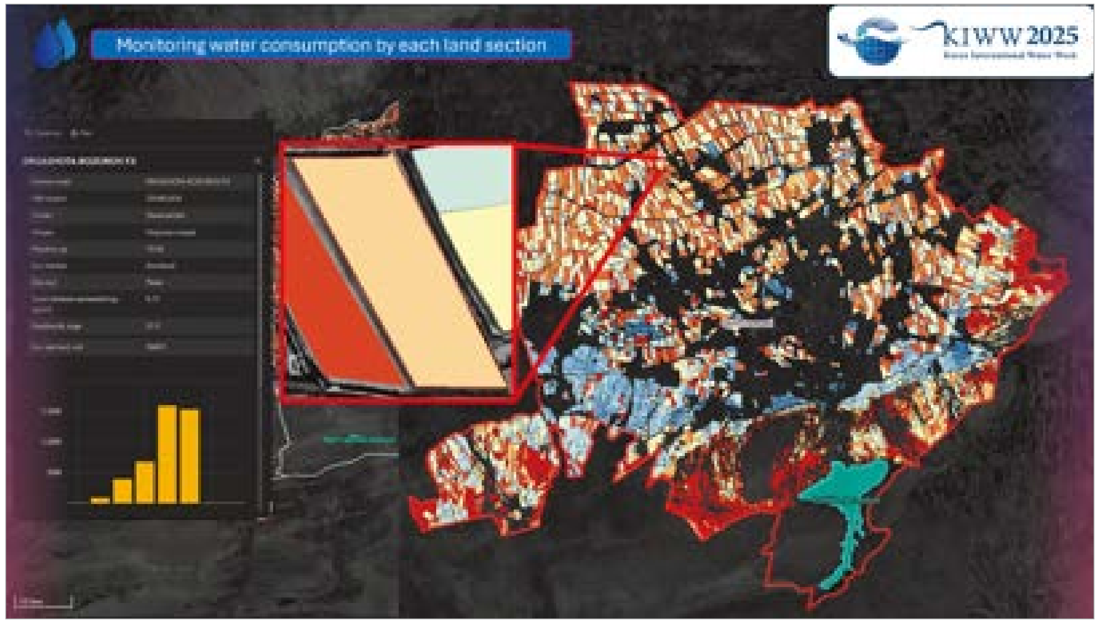

Creating a digital representation of land areas
Cultivated land – 243.5 thousand ha
Orchards – 60.6 thousand ha
Fish ponds – 8.3 thousand ha
Total – 312.4 thousand ha
KIWW 2025

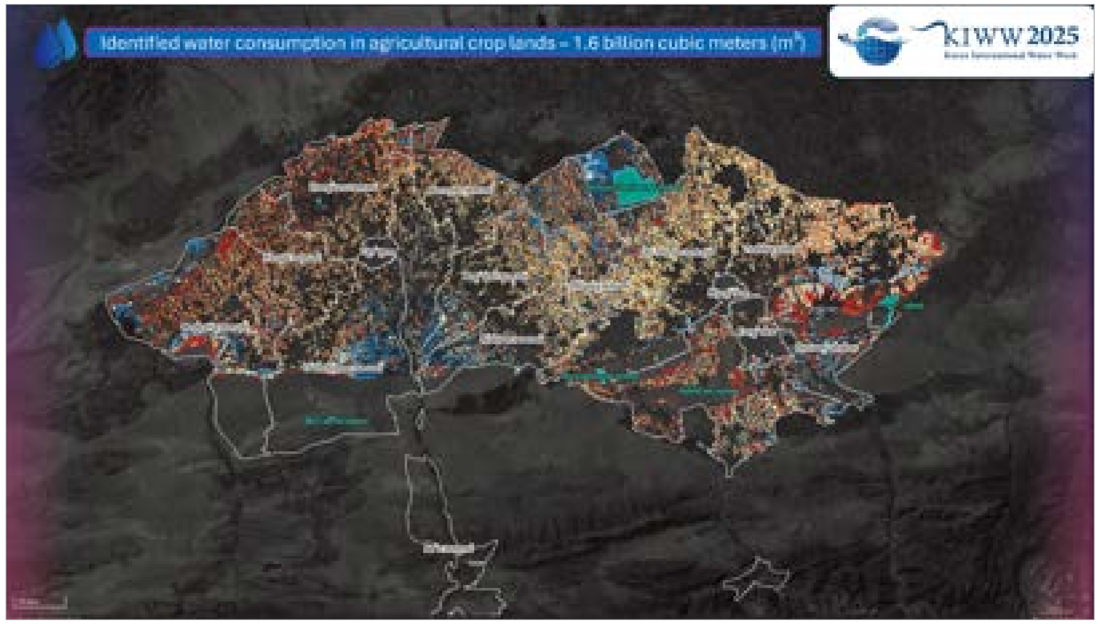

Agricultural land linked to irrigation facilities – 312.4 thousand ha
Great Fergana Main Canal – 88.4 thousand ha
KIWW 2025

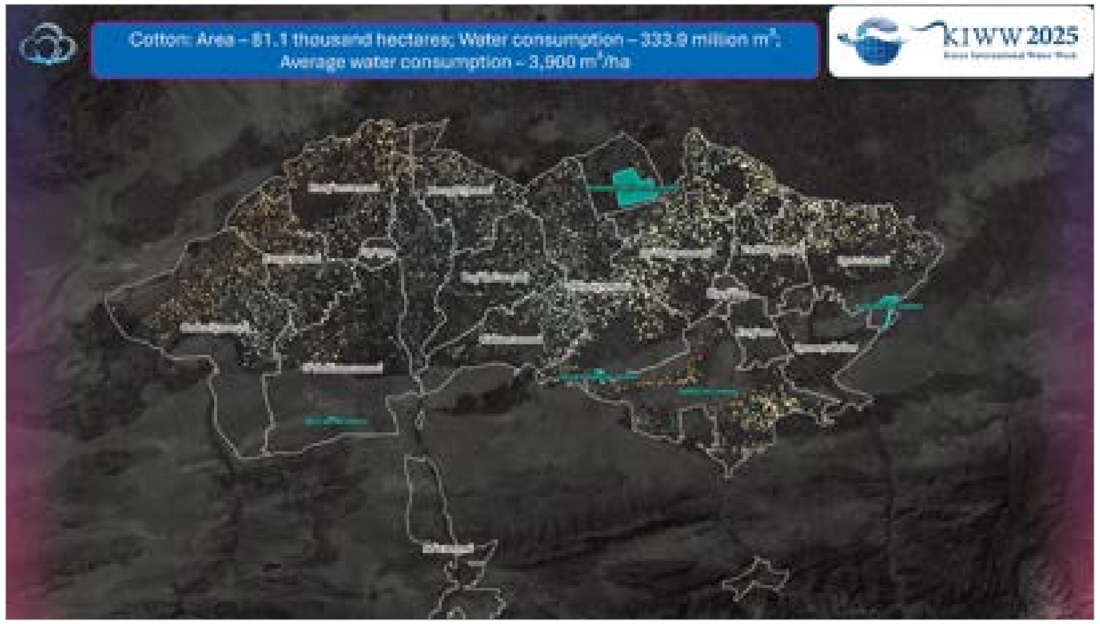

Agricultural land linked to irrigation facilities – 312.4 thousand ha
Great Fergana Main Canal – 88.4 thousand ha
Khavasman Chanal – 1.5 thousand ha
KIWW 2025

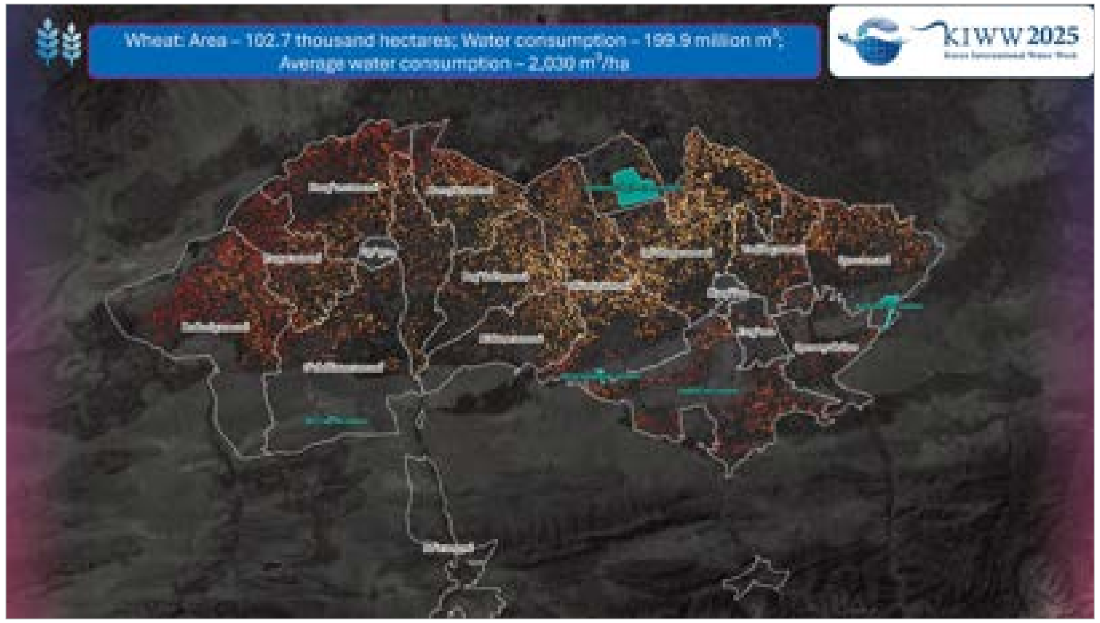

Monitoring water consumption by district:
Kuvan district – 68.7 million cubic meters (m³)
KIWW 2025

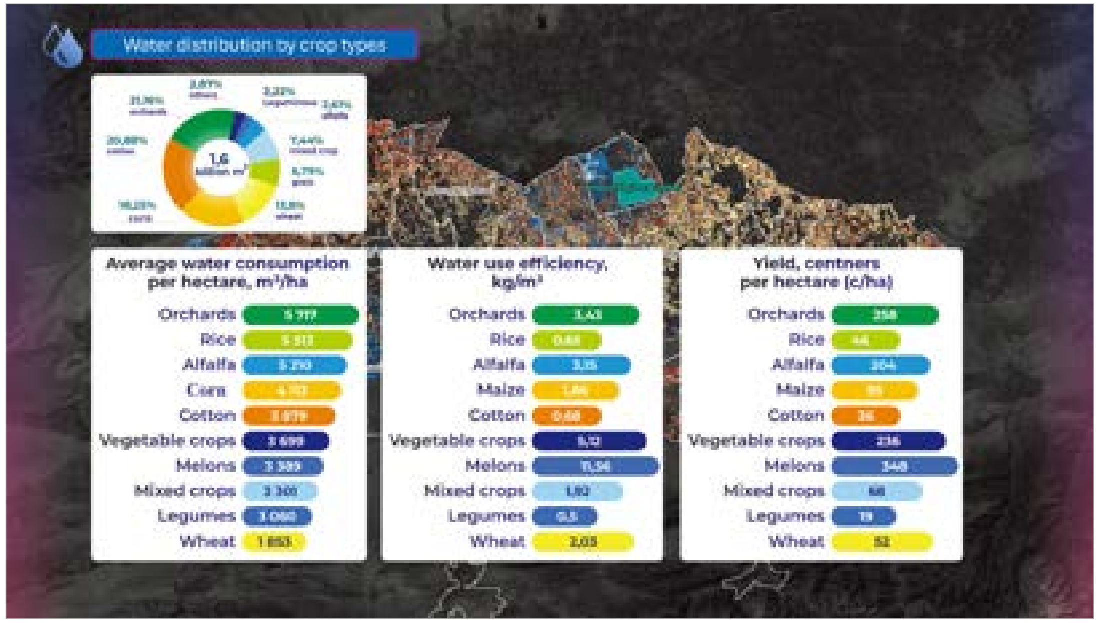

Monitoring water consumption in agricultural crop lands
KIWW 2025


Monitoring water consumption by each land section
KIWW 2025


Identified water consumption in agricultural crop lands – 1.6 billion cubic meters (m³)
KIWW 2025


Cotton: Area – 81.1 thousand hectares; Water consumption – 333.9 million m³;
Average water consumption – 3,900 m³/ha
KIWW 2025


Wheat: Area – 102.7 thousand hectares; Water consumption – 199.9 million m³;
Average water consumption – 2,030 m³/ha
KIWW 2025


Water distribution by crop types
1,6 billion m³
Average water consumption per hectare, m³/ha
Orchards
Rice
Alfalfa
Corn
Cotton
Vegetable crops
Melons
Mixed crops
Legumes
Wheat
Water use efficiency, kg/m³
Orchards
Rice
Alfalfa
Maize
Cotton
Vegetable crops
Melons
Mixed crops
Legumes
Wheat
Yield, centners per hectare (c/ha)
Orchards
Rice
Alfalfa
Maize
Cotton
Vegetable crops
Melons
Mixed crops
Legumes
Wheat


Main Goals
Reducing water consumption while maintaining the current level of crop yield.
Current Situation
Water Saving
Increasing crop yield while maintaining the current level of water consumption.
Current Situation
Increase in Yield


Korea International Water Week 2025
Session Title
Tracking Every Drop: Satellite-Driven Water Governance in Uzbekistan
Speaker I Affiliation
Jakhongir Iskhakov - Uzcosmos
j.iskhakov@spacemc.uz

MEMO

Aruna Revolution: Circular Fiber Innovation for Aquatic Health and Hygiene Equity

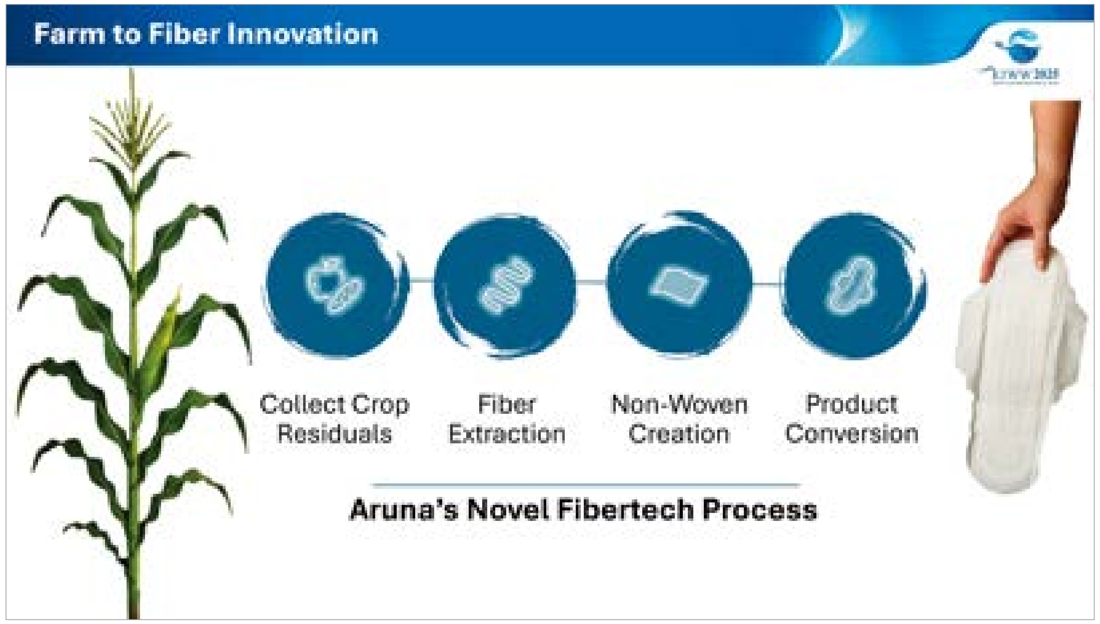
Rashmi Prakash
(Founder)


1.
The Problem


The Problem - Harmful Fibers in Healthcare Products
600 Billion+
Pollute our world yearly
500+ Years
Sitting in Rivers & Oceans
Carcinogens
Like Lead, Arsenic, PFAS


2.
THE SOLUTION


Cleaner & Safer Healthcare, Powered by Aruna Fibers
Aruna Revolution creates
Compostable & Ocean Safe,
Toxin Free &
High Performance Fibers
out of Local Agri By-Products


Farm to Fiber Innovation
Collect Crop Residuals
Fiber Extraction
Non-Woven Creation
Product Conversion
Aruna's Novel Fibertech Process


The Revolution: Circular Fibers for Disposable Hygiene
300% More Absorbent
Ocean Degradable in < 30 Days
Limitless Applications
Lower Manufacturing Cost


Feedstock Flexibility, Globally Scalable
Proprietary Process: Use any plant materials to make fibers
We can use all types of plant based feedstock - Corn, Soy, Canola, Hemp, Orange Peels, etc
Aruna's soft & clean fibers


Aruna's Pipeline: Turning Off Water Pollution at the Source
Hygiene Products
Medical Products
Cosmetics
Hydroponics
P&G
Honeywell
L'ORÉAL
GROWCER

3. THE MARKET

Unlocking a $220 Billion Global Market

Total Addressable Market

Global Disposable Hygiene Product Market

$220 Billion 2030 , 4.6% CAGR

Regulatory Tailwind

Governments globally, including **Korea and the EU,** are advancing **zero-plastic initiatives** to **protect waterways and oceans.**

Major brands (P&G, Unilever, Kimberly-Clark) pledging to **eliminate single-use plastics** by 2030

Scalable, High Impact Growth

Aligned with Korea's ocean protection and circular economy initiatives

Menstrual Pad Sales
Early revenue + brand & fiber awareness

Fiber Licensing
High Margin, recurring B2B deals

Carbon Credit Monetization
Verified emissions reductions

Why This Works:

- **"Powered by Aruna Fibers"** creates brand equity for channel partners.
- Licensing enables **scale & recurring revenue** without heavy CapEx.
- **Proven model** used by Nvidia, Goretex & Intel Inside

4. THE TEAM

Team Aruna – Engineered to Protect the Ocean & Planet

Our Team's Key Milestones

1. **Proven Market Demand**
   - **$750K ARR** in 2025
   - In **hospitals, airports, universities**
   - Interest from **9+ Verticals**
   - In discussion with KC for **Huggies**

2. **Global Footprint & Organic Growth**
   - Sold in **Canada, Singapore, UK, US, Monaco**
   - **100% organic sales & growth**

3. **Validated & Protected Technology**
   - **Third Party Verified & Certified**
   - **IP protected** in multiple markets

Team Aruna – Engineered to Protect the Ocean & Planet

John P.
30+ years
Hygiene Product Material Innovation Director
Johnson & Johnson

Vlad N.
30+ years
Hygiene Product Manufacturing Director
P&G

Richard B.
30+ years
Product & Business Development Executive
Nestlé

ySpace Markham · Creative Destruction Lab · Emera ideaHUB · MaRS · L2M Launch · m51 · League of Innovators

Economic Growth for Environmental Impact

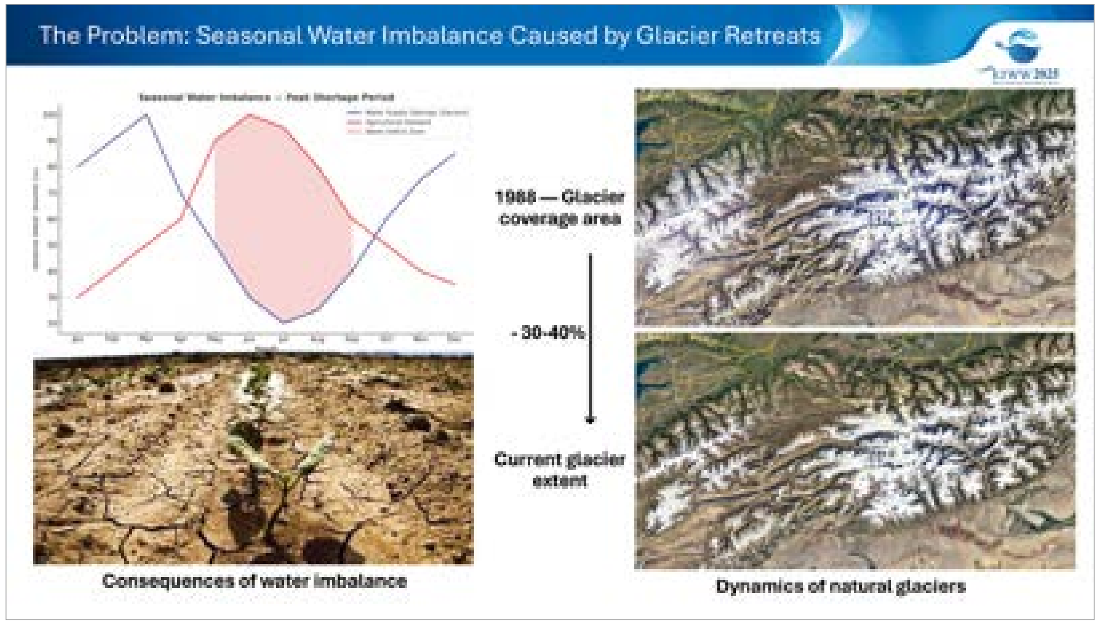
Aruna, Turning the Tide on Hygiene Waste

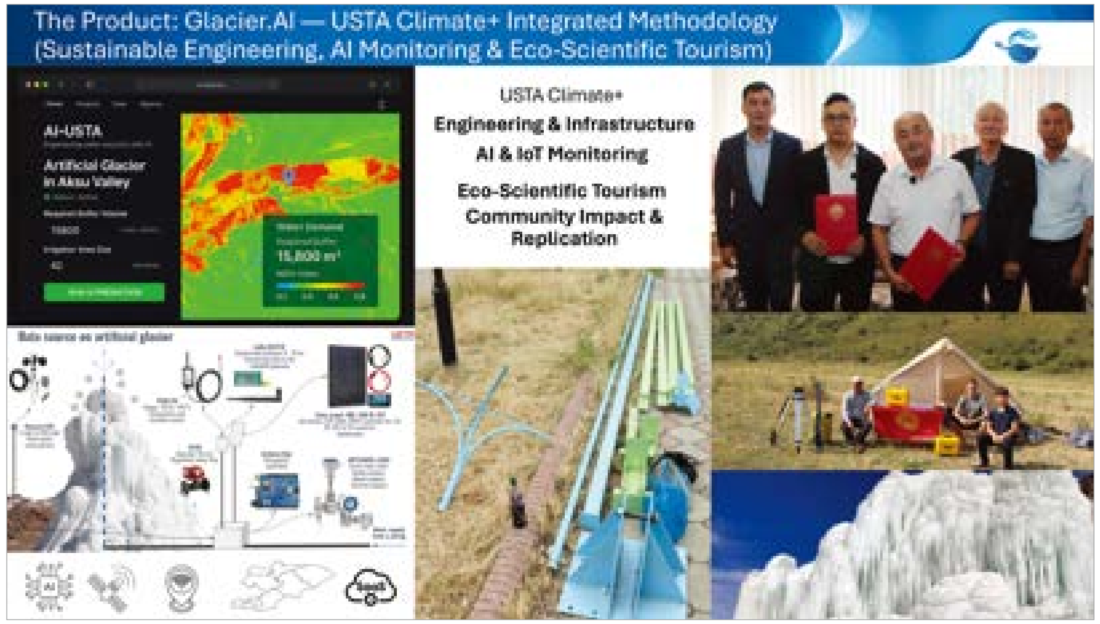
1) Environmental Impact – Keeps plastic and toxins out of oceans
2) Economic Impact – Builds local circular economies from waste
3) Social Impact – Promotes menstrual health and gender equity

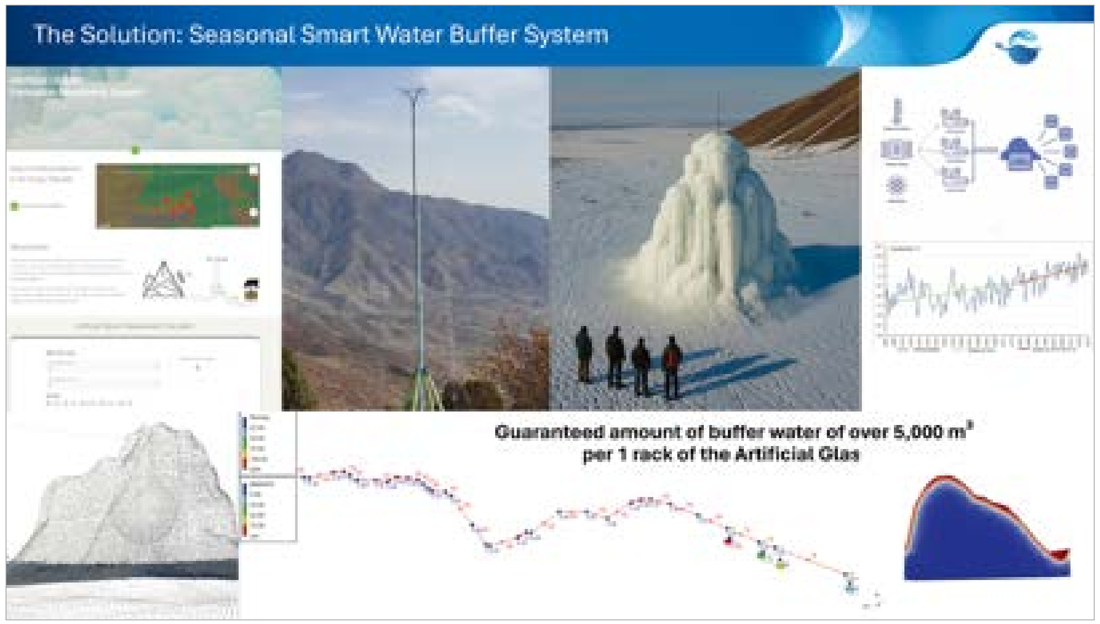
MEMO

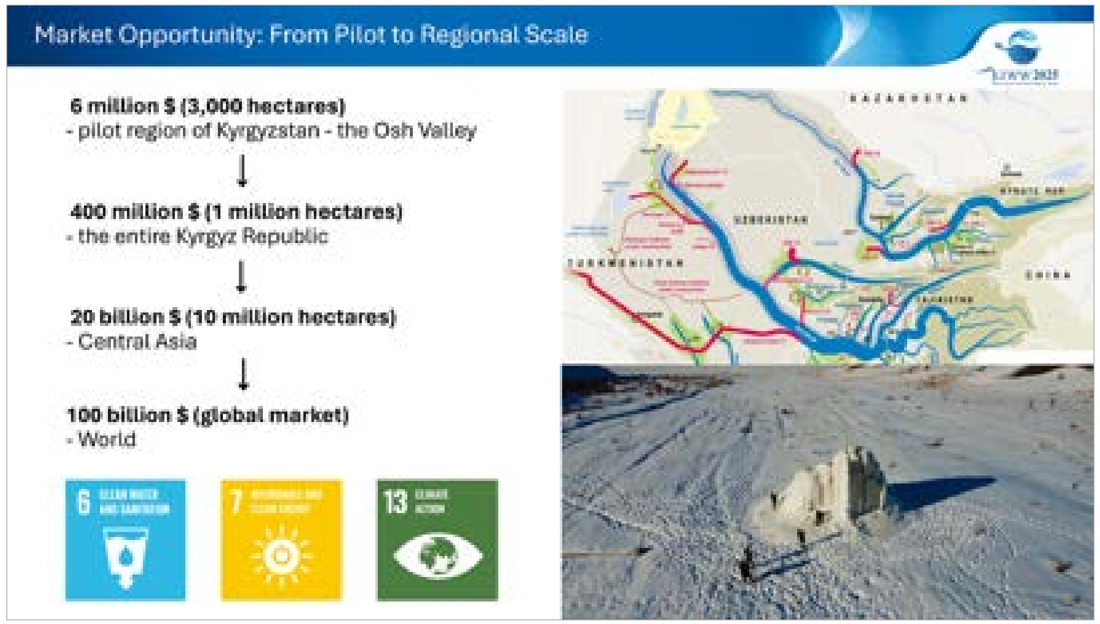
A scalable Machine-learned based Framework for cost-effective Sewer Leakage Detection

Muratbekov Erkin
(USTA INTERNATIONAL)

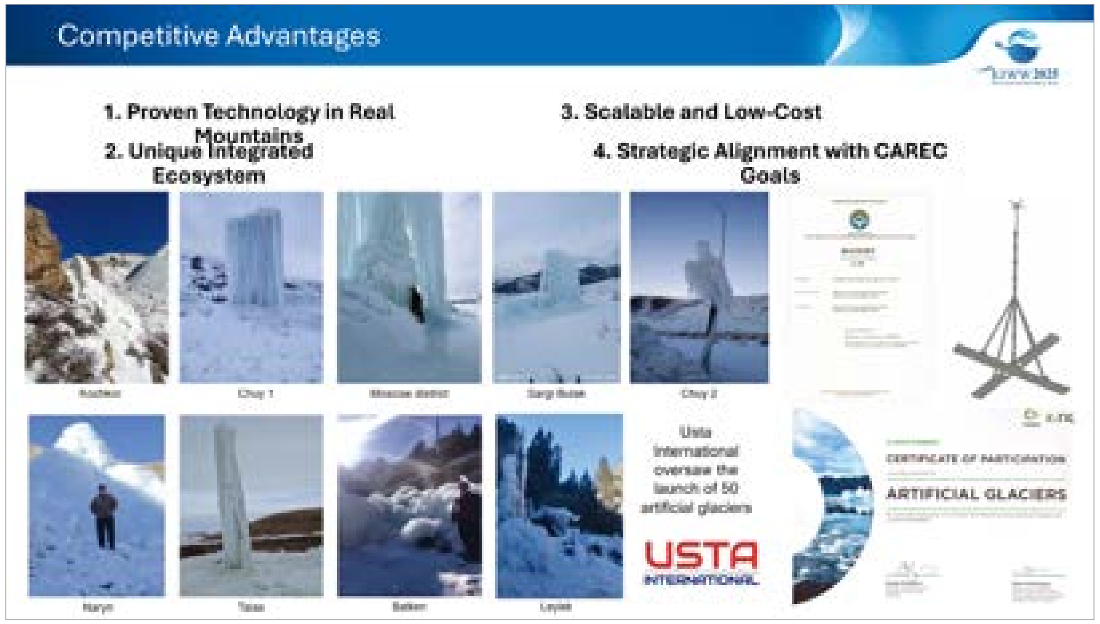

The Problem: Seasonal Water Imbalance Caused by Glacier Retreats
1988 — Glacier coverage area
- 30-40%
Current glacier extent
Consequences of water imbalance
Dynamics of natural glaciers

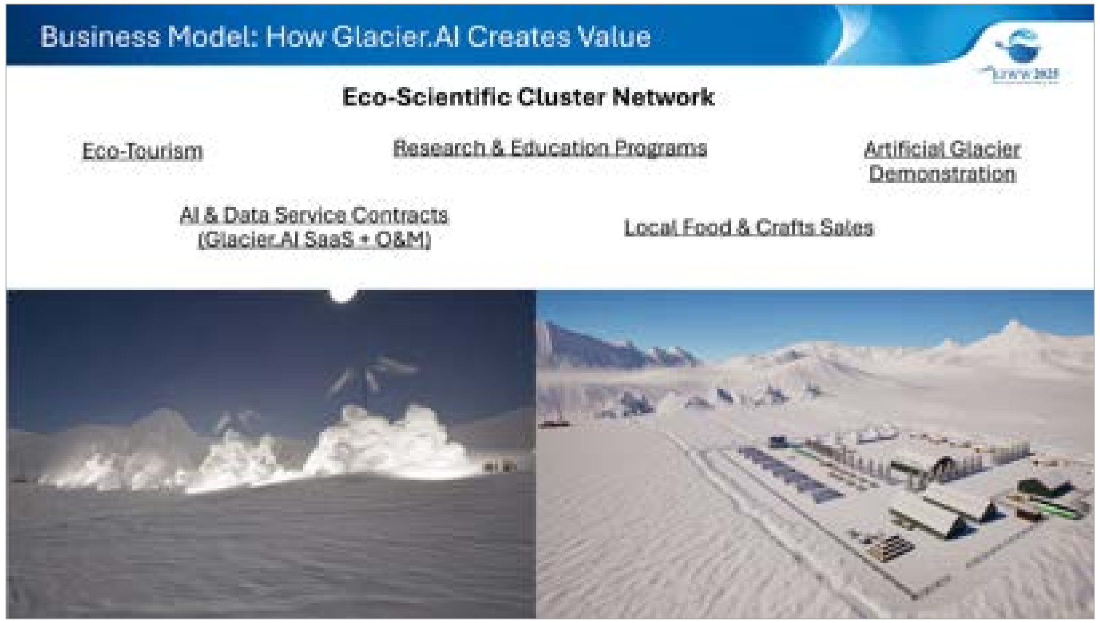

The Product: Glacier.AI — USTA Climate+ Integrated Methodology (Sustainable Engineering, AI Monitoring & Eco-Scientific Tourism)
AI-USTA
Artificial Glacier in Aksu Valley
15,800 m³
USTA Climate+
Engineering & Infrastructure
AI & IoT Monitoring
Eco-Scientific Tourism
Community Impact & Replication

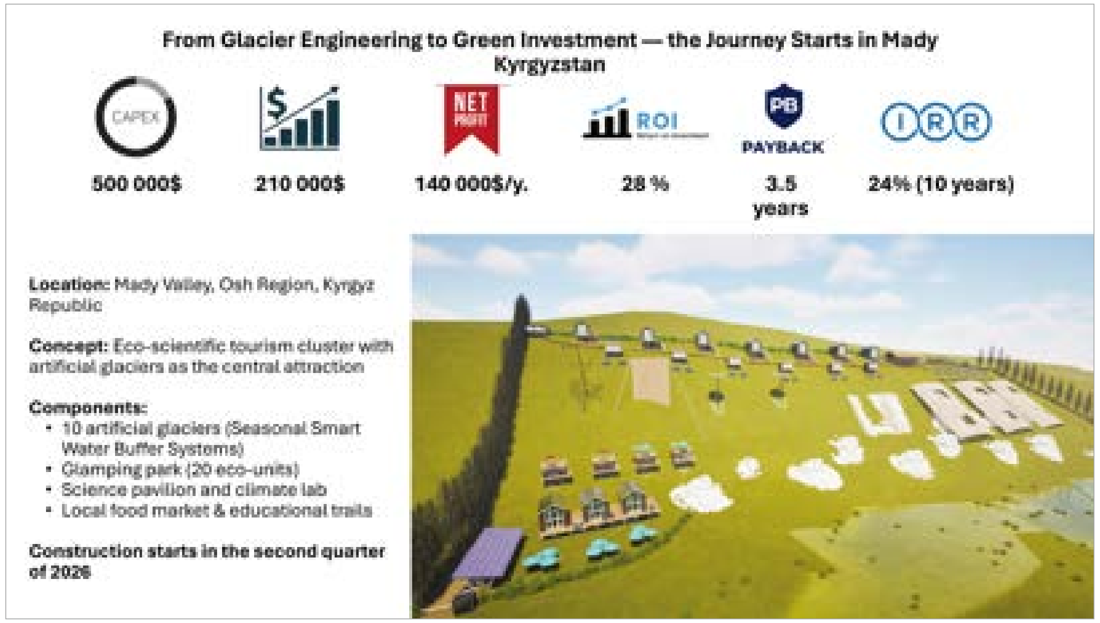

The Solution: Seasonal Smart Water Buffer System
Guaranteed amount of buffer water of over 5,000 m³ per 1 rack of the Artificial Glas


Market Opportunity: From Pilot to Regional Scale
6 million $ (3,000 hectares)
- pilot region of Kyrgyzstan - the Osh Valley
400 million $ (1 million hectares)
- the entire Kyrgyz Republic
20 billion $ (10 million hectares)
- Central Asia
100 billion $ (global market)
- World
KAZAKHSTAN
UZBEKISTAN
TURKMENISTAN
CHINA


Why Now ?
Central Asia is heating twice as fast as the global average
Kyrgyz Republic's National Adaptation Plan 2024–2030 prioritizes mountain water storage and digital monitoring
AI and IoT costs fell by >60 % in five years, making smart water systems affordable
Social demand & eco-tourism trend


Competitive Advantages
1. Proven Technology in Real Mountains
2. Unique Integrated Ecosystem
3. Scalable and Low-Cost
4. Strategic Alignment with CAREC Goals
Usta International oversaw the launch of 50 artificial glaciers
USTA INTERNATIONAL
CERTIFICATE OF PARTICIPATION
ARTIFICIAL GLACIERS


Business Model: How Glacier.AI Creates Value
Eco-Scientific Cluster Network
Eco-Tourism
Research & Education Programs
Artificial Glacier Demonstration
AI & Data Service Contracts (Glacier.AI SaaS + O&M)
Local Food & Crafts Sales

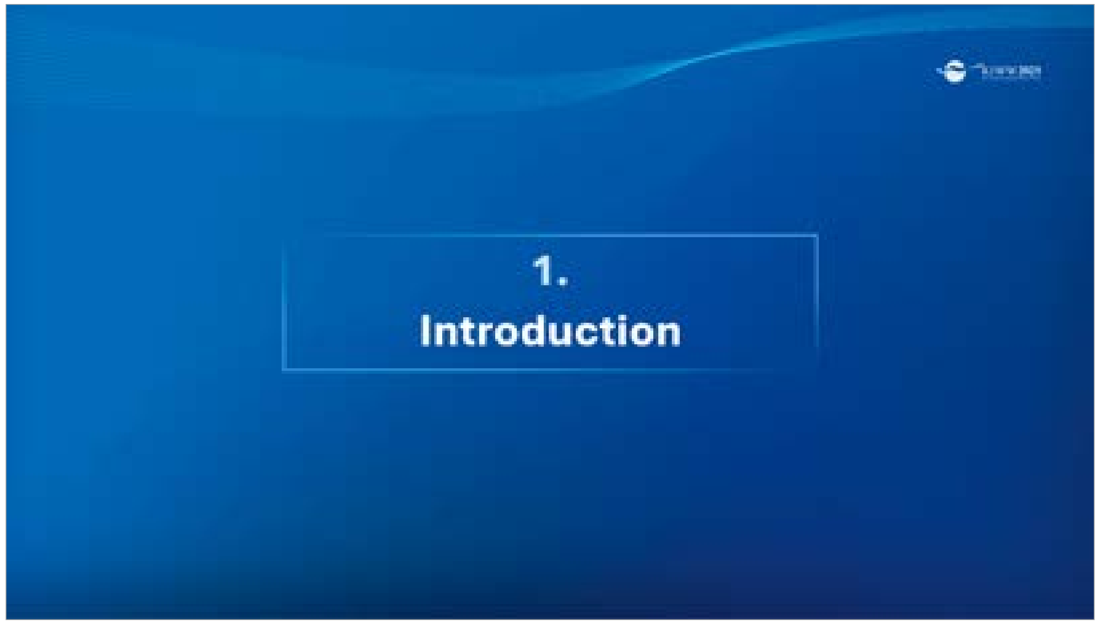

From Glacier Engineering to Green Investment — the Journey Starts in Mady Kyrgyzstan
CAPEX
500 000$
210 000$
NET PROFIT
140 000$/y.
ROI
28 %
PB
PAYBACK
3.5 years
IRR
24% (10 years)
Location: Mady Valley, Osh Region, Kyrgyz Republic
Concept: Eco-scientific tourism cluster with artificial glaciers as the central attraction
Components:
• 10 artificial glaciers (Seasonal Smart Water Buffer Systems)
• Glamping park (20 eco-units)
• Science pavilion and climate lab
• Local food market & educational trails
Construction starts in the second quarter of 2026

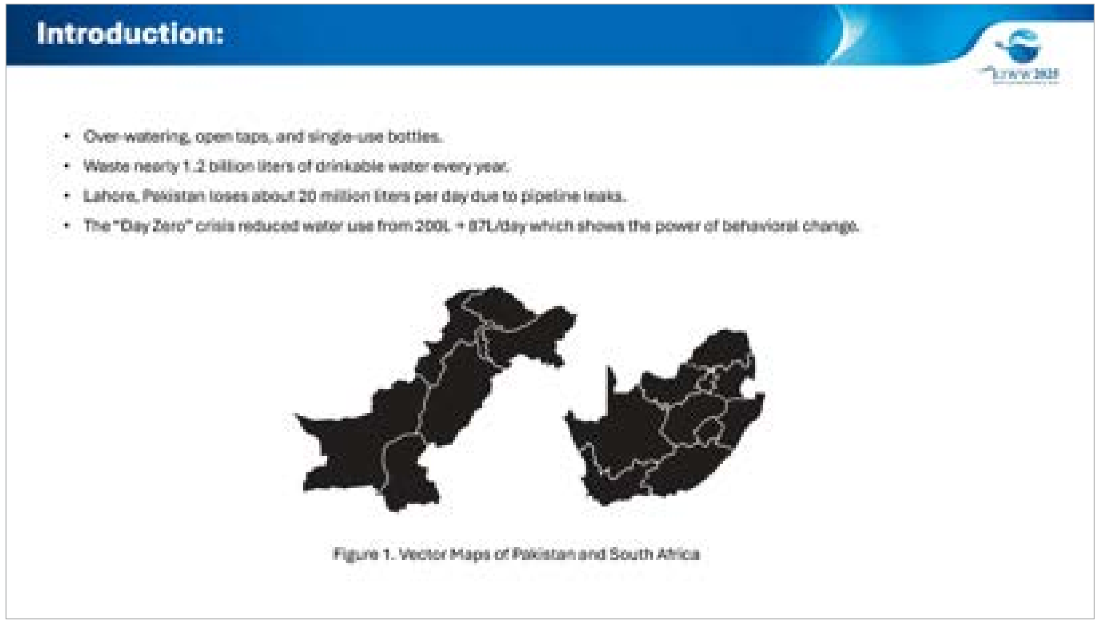

USTA
INTERNATIONAL
Kyrgyzstan may be small on the map
but it stands tall in climate
innovation
Contact for construction of artificial glacier all over the world
save us from global warming!
YouTube
@USTA_INTERNATIONAL

MEMO

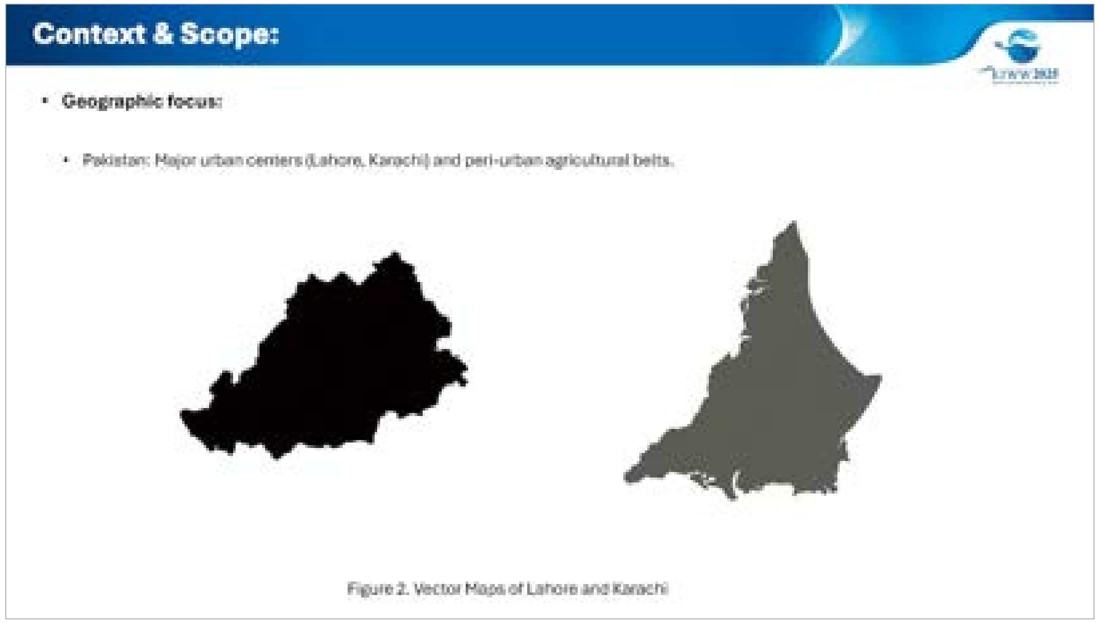
Small Habits, Big Thirst:
Smart Behavioral Water Management in Pakistan & South Africa

Hafsa Masood
(FFCG)


1.
Introduction


Introduction:
Over-watering, open taps, and single-use bottles.
Waste nearly 1.2 billion liters of drinkable water every year.
Lahore, Pakistan loses about 20 million liters per day due to pipeline leaks.
The "Day Zero" crisis reduced water use from 200L → 87L/day which shows the power of behavioral change.
Figure 1. Vector Maps of Pakistan and South Africa


2.
Context & Scope


Context & Scope:
Geographic focus:
Pakistan: Major urban centers (Lahore, Karachi) and peri-urban agricultural belts.
Figure 2. Vector Maps of Lahore and Karachi

Context & Scope:

- **Geographic focus:**
  - South Africa: Cape Town metro area and adjoining farmlands.

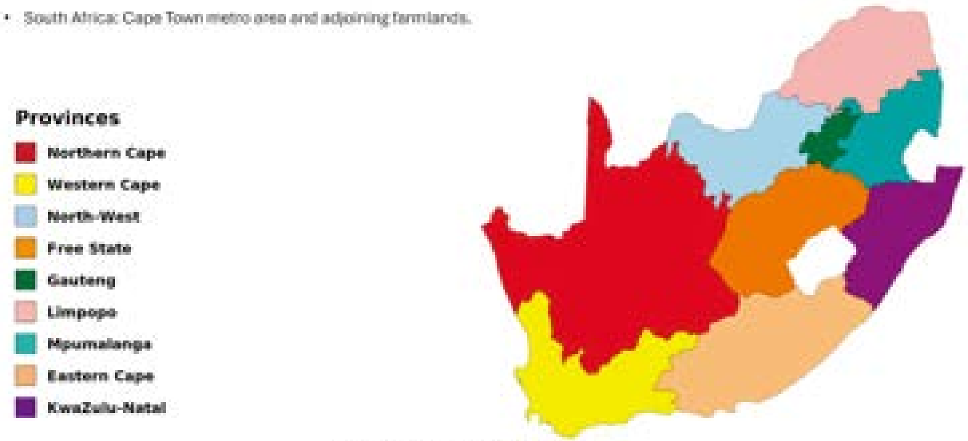
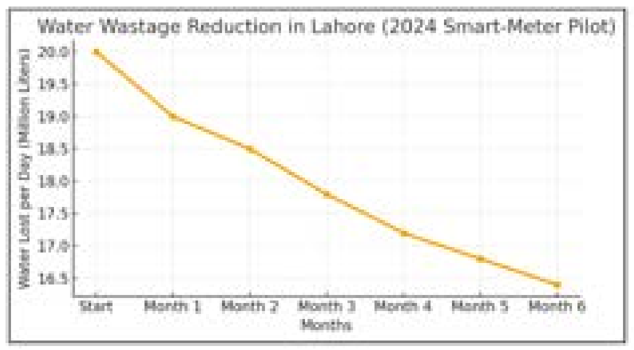


Figure 3. Vector Map of South Africa

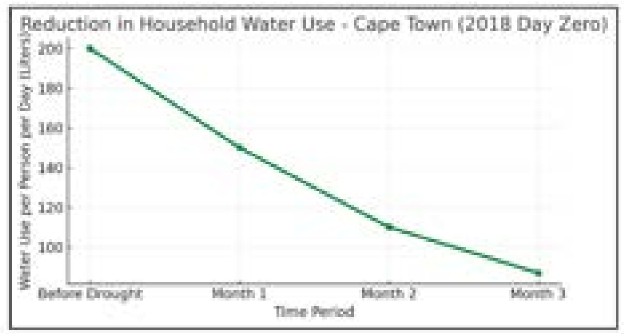
Context & Scope:

- **Local Data & Case Studies**
  - **Lahore, Pakistan**: Municipal report (2024) records 20 ML/day lost through undetected household leaks; a pilot smart-meter program cut residential waste by 18 % in six months.



Context & Scope:

- **Local Data & Case Studies**
  - **Cape Town, South Africa:** Day Zero drought (2018) reduced average household use from 200 L to 87 L/day; adoption of drip irrigation yielded a 40 % drop in garden water use within three months.



3.
Causes & Effects

Causes & Effects:

Overwatering Gardens:

Cause: Cultural preference for lush lawns; absence of soil-moisture controls.

Effect: Strains municipal treatment and distribution, increasing per m^3 tariffs by 10–15 %.

Overwatering Gardens:

Cause: People discard single-use plastic bottles instead of reusing or recycling them.

Effect: This increases water demand for making new bottles and worsens water scarcity.

Overwatering Gardens:

Cause: Low public awareness during brushing, dishwashing, etc.

Effect : Municipal losses of 15 ML/day; higher energy use for pumping and treatment

4. Methodology & Implementation Plan

Methodology & Implementation Plan:

Phase	Activities	Timeline
1. System Design & Pilot • Pilot in 100 households (Cape Town) • Pilot in 100 households (Lahore)	• Develop IoT sensor prototypes (leak, flow, soil-moisture) • Adapt sensors for the municipal network	Jul 2025 – Dec 2025
2. Community Engagement & Rollout • Deploy 500 sensors in Cape Town & Karachi • Launch refill station network (10 sites)	• Train local water utility staff & farmers (Karachi region) • Workshop with City of Cape Town	Jan 2026 – Jun 2026
3. Evaluation & Optimization • Refine algorithms & hardware • Optimize soil-moisture thresholds	• Collect usage data & user feedback • Analyze Cape Town pilot results	Jul 2026 – Dec 2026
4. Scale-up & Sustainability • Hand over to the local water boards • Establish maintenance & funding model	• Expand to 5 additional Pakistani cities • Expand to 5 additional South African metros	Jan 2027 – May 2027

Methodology & Implementation Plan:

- **Resources Required:**

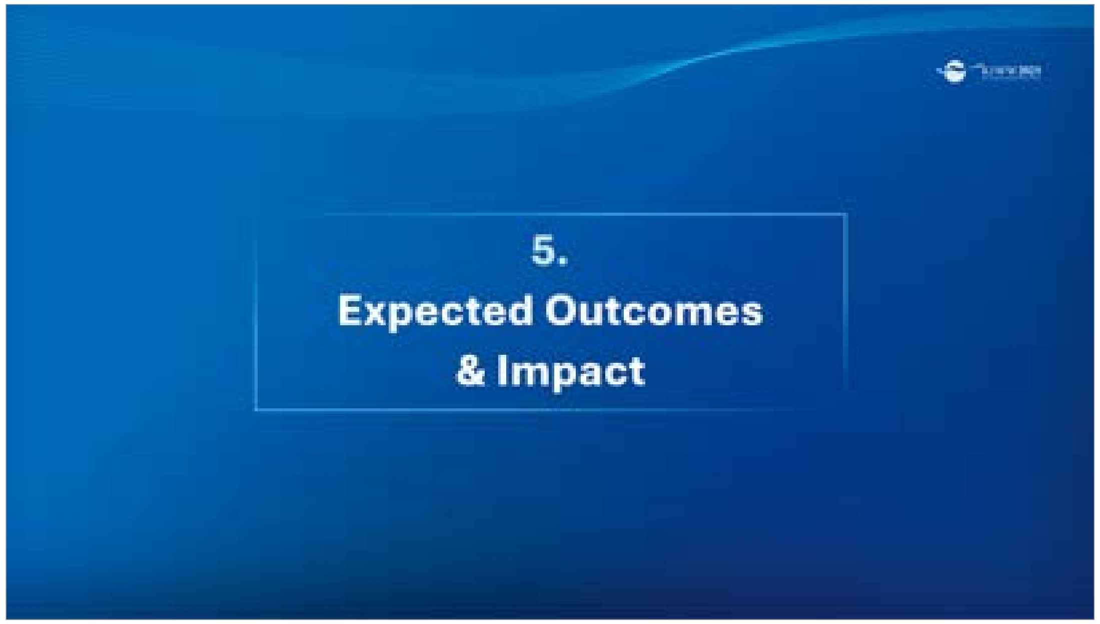
Hardware: 2,000 IoT sensors, gateway devices, mobile app maintenance

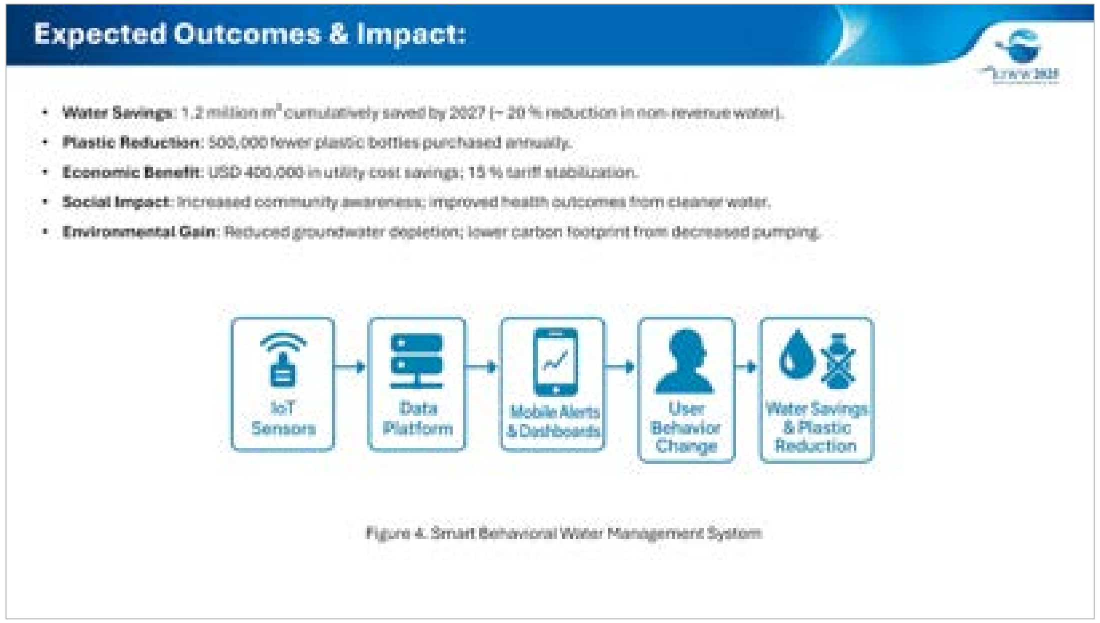
Personnel: 4 engineers, 6 community engagement officers, 2 data analysts

Budget: USD 250,000 (development, procurement, training, operations)

Partners: Local water utilities, municipal governments, NGOs

Risk	Likelihood	Mitigation
Technical failures	Medium	Redundant sensors; field-service protocol
Low user adoption	Medium	Incentives, user-training workshops, ongoing support
Funding shortfalls	Low	Phased budgeting, co-funding agreements with utilities
Data privacy concerns	Low	GDPR-style data policies, anonymized usage statistics


5.
Expected Outcomes
& Impact


Expected Outcomes & Impact:
• Water Savings: 1.2 million m³ cumulatively saved by 2027 (~ 20 % reduction in non-revenue water).
• Plastic Reduction: 500,000 fewer plastic bottles purchased annually.
• Economic Benefit: USD 400,000 in utility cost savings; 15 % tariff stabilization.
• Social Impact: Increased community awareness; improved health outcomes from cleaner water.
• Environmental Gain: Reduced groundwater depletion; lower carbon footprint from decreased pumping.
IoT Sensors
Data Platform
Mobile Alerts & Dashboards
User Behavior Change
Water Savings & Plastic Reduction
Figure 4. Smart Behavioral Water Management System


Expected Outcomes & Impact:
Long Term Vision:
• An open-source platform to help cities manage water more efficiently.
• Local water boards and authorities will lead operations and maintenance.
• Expansion planned for five additional cities in both Pakistan and South Africa.
• Communities stay actively engaged through accessible, real-time water data.
Efficiency
Engagement


Small Habits, Big Thirst: Smart Behavioral Water Management in Pakistan & South Africa
Every Drop Counts Beyond Borders
Together, we can turn small habits into lasting change.
Let's make every drop count — for people, for cities, and for our shared planet.
Hafsa Masood
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Email: hafsaablue@gmail.com
International Week of Water | Nov 2025

NileSmart: Community-Centered Water Stewardship for a Resilient Egypt

Walid Rezk
(Suez University)

1.
The Challenge

The Challenge: Navigating Egypt's Water Stress

- **Nile Dependency**
  - Egypt relies almost entirely on the Nile River for its freshwater needs, making it highly vulnerable to external factors and resource management issues.
  - **Compounding Stresses**
  - The nation faces severe water stress due to escalating climate change effects, upstream geopolitical challenges, inefficient traditional irrigation methods, and rapid population growth.
  - **Growing Deficit**
  - Despite resourcefulness, Egypt's annual water deficit currently exceeds 30 billion cubic meters, necessitating urgent, scalable solutions.

NileSmart: A Holistic Approach to Water Resilience

NileSmart is a groundbreaking initiative designed to tackle water scarcity by fusing tradition, culture, and frugal innovation into a community-led model.

Traditional Knowledge
Leveraging centuries of water management experience from Nile cultures to inform modern practices.

Behavioral Change
Using cultural tools like storytelling and arts to instill a sense of water stewardship and sustainable habits.

Low-Tech Innovation
Deploying simple, locally-sourced, and affordable technologies for immediate, impactful results in water conservation
Our core objective is to reduce waste, improve local water governance, and build climate resilience at the grassroots level
-

- Three Pillars of NileSmart Action
- 1. Smart Basin Literacy Campaigns
- Engaging communities through powerful cultural mediums—storytelling, poetry, and folk theatre—to shift mindsets toward responsible water use.
- 2. Low-Cost Harvesting & Reuse Units
- Implementing simple, maintainable systems for harvesting rainwater and treating greywater for non-potable uses in households and communal areas.
- 3. Women & Youth Water Committees
- Establishing local governance groups empowered by mobile technology for real-time reporting of leaks, misuse, and maintenance needs.

Impactful Field Applications

Applications

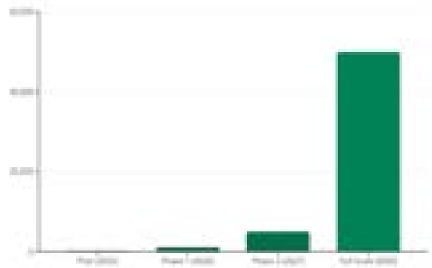
- Our pilot program demonstrated strong community ownership and sustainable practices in the Menoufia and Suez governorates.
- **Community Integration**
- Collaborations established with local schools, mosques, and agricultural unions for maximum reach and participation.
- **Resourceful Tools**
- Focus on utilizing local, readily available materials for unit construction, complemented by user-friendly mobile technology.
- **Long-Term Ownership**
- The community-led model ensures high local ownership, making the project inherently sustainable and resilient against external funding fluctuations.

Contributing to Global Sustainability

- **Environmental**
- Increases water reuse rates
- Reduces pressure on Nile ecosystems
- Promotes climate-smart agriculture
- **Social**
- Empowers marginalized women and youth.
- Fosters social Bridges water literacy gaps across generations.
- cohesion and local governance.
- **Economic**
- Creates local jobs in unit construction and maintenance.
- Reduces household expenses on water and energy.
- Prevents significant crop loss due to water stress.

Cost-Effectiveness and Scalability

- Frugal Design, Massive Reach
- **Unit Cost:** Less than $50 per household unit.
- **Materials:** Simple, locally sourced items like plastic barrels, gravel, s and, and mesh
- **Financing:** Achieved through community co-financing, supported by small microgrants and local government partnerships. The low-cost, decentralized nature allows for rapid adoption across the Nile Basin a nd similar African regions facing water stress.
- **Scalability:** The low-cost, decentralized nature allows for rapid adop tion across the Nile Basin and similar African regions facing water stre ss.



Originality and Core Innovation

- NileSmart's uniqueness lies in its cultural deep-dive and commitme nt to accessible, low-barrier technology.
- Cultural Fusion
- We blend ancient Egyptian water culture and knowledge systems with modern participatory design principles.
- Behavioral Arts
- The use of poetry, folk theatre, and communal storytelling is a novel, h igh-engagement method for driving long-term behavioral change in w ater use
- Frugal Innovation
- Prioritizing simple, affordable, and durable 'frugal innovation' over co mplex, capital-intensive technology, making it perfectly suited for rura l and underserved communities.
- Future Projection
- With successful scaling, we project the NileSmart model can save 1 b illion cubic meters of water per year by 2030.
- Quantifiable Impact from Pilot Projects
- Initial results from Menoufia and Suez demonstrate the project's p owerful potential for immediate resource conservation
- 70% Reduced Water Use
- Percentage of participating households that reduced their water c onsumption by 20–30%.
- 500+ Children Engaged
- Number of students who actively participated in water literacy an d practical application programs.
- 15+ Incidents Prevented
- Major leak and misuse incidents identified and resolved early thro ugh women's committee mobile reporting.
- Crucially, women-led maintenance efforts across the pilot sites e nsured the longevity and sustained performance of the low-cost w ater units.

Our Vision for the Future

- **NileSmart is ready to move beyond the pilot phase and become a fo undational element of regional water management.**
- **Regional Expansion:** Extend the model to other water-stressed regi ons across the broader Nile Basin.
- **Strategic Partnerships:** Collaborate with international NGOs, local civil society organizations, and universities for technical support and outreach.
- **Curriculum Integration:** Work with the Ministry of Education to for mally integrate NileSmart's literacy concepts into national water educ ation curricula
- **Global Alignment:** Directly align project outcomes with the United Nations Sustainable Development Goals (SDGs) 6 and 13.
- SDG 6
- Ensure availability and sustainable management of water and sanitation for all.
- SDG 13
- Take urgent action to combat climate change and its i mpacts.

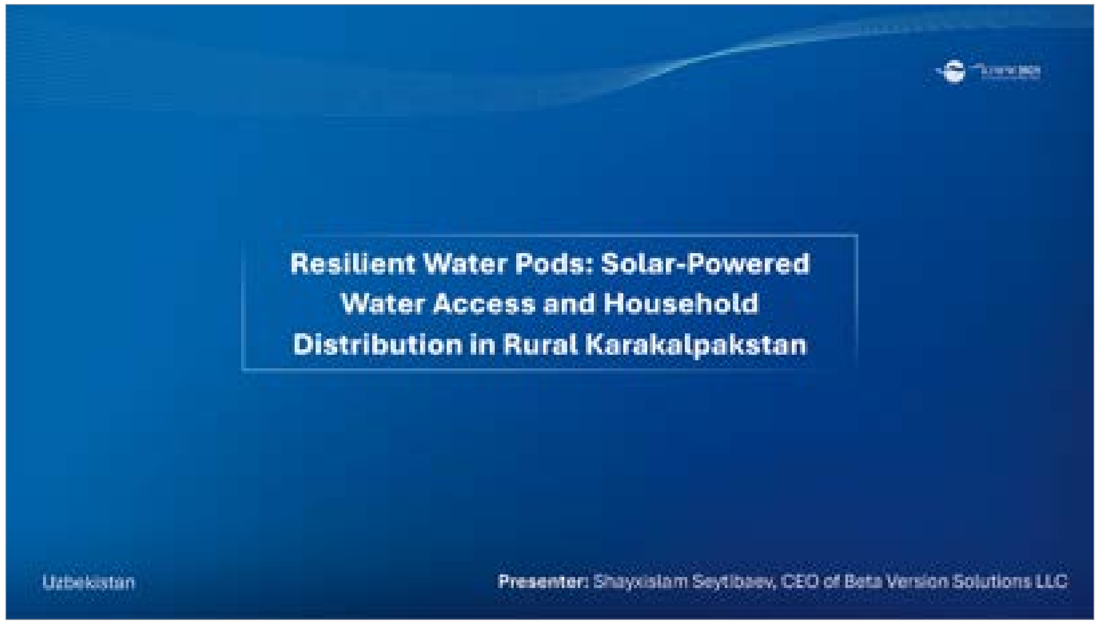

مبادرة المشروع القومي لترشيد استهلاك المياه
تحتفل باليوم العالمي للمياه ويوم الإخوة الكشفي ٢٢ مارس
بمحافظات جمهورية مصر العربية
برعاية الاتحاد العام للكشافة والمرشدات
بمحافظة القليوبية

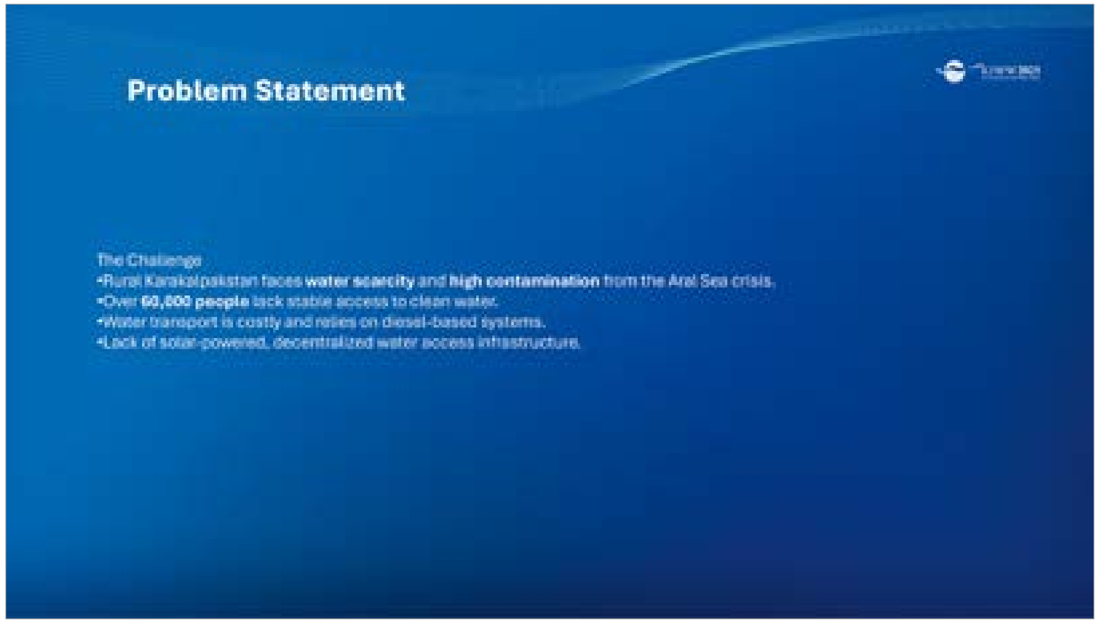

اليوم العالمى للمياه
اليوم العالمى للمياه

MEMO

Resilient Water Pods: Solar-Powered Water Access and Household Distribution in Rural Karakalpakstan

SHAYXISLAM SEYTIBAEV
(UZB, BETA VERSION SOLUTIONS LLC, ceo)





Problem Statement

- The Challenge
  - Rural Karakalpakstan faces **water scarcity** and **high contamination** from the Aral Sea crisis.
  - Over **60,000 people** lack stable access to clean water.
  - Water transport is costly and relies on diesel-based systems.
  - Lack of solar-powered, decentralized water access infrastructure.

Solution

- The Challenge
  - **Modular solar-powered water purification pods** designed for rural areas.
  - Converts **ground or canal water into potable water** using solar energy and ceramic filtration.
  - **IoT dashboard** for monitoring usage and maintenance.
  - Already **7 pilot pods installed** in Nukus District


Impact & Achievements

- **15,000 households (60,000 residents)** served in 2025.
- Reduction in **diesel consumption by 80%.**
- Increased access to **affordable clean water (70% cost per liter).**
- **Empowered 25 women** trained as community operators.
- Strong support from **local government** and **community councils.**

Scale-up Vision & Funding Need

- Goal: Expand to **100 pods** across 10 rural districts by 2027.
- Seeking **$150,000 USD** co-financing for phase 2 deployment.
- Partnerships with **UNDP, OPEC Fund, and Korean tech partners.**
- Long-term goal: integrate solar-water pods into **Uzbekistan's rural infrastructure policy.**

Why Solar Water Pods Matter

- Aligned with **SDG 6 (Clean Water)** and **SDG 7 (Clean Energy)**.
- Community-driven innovation with **proof of success**.
- Replicable model for **Central Asia's water-stressed zones.**
- Together, we can ensure every rural family in Karakalpakstan drinks clean water.

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World Water Challenge 2025

Ministry of Environment

KOREA WATER FORUM