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# HawkaMaa-EU

## Decentralized Wastewater Treatment Systems

### Lessons Learned Workshop





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# Workshop Outline

- 1 Background and History
- 2 Purpose and Objectives
- 3 Phases of implementation: challenges and lessons learned
- 4 Case Study: DEWATS for institutions by SI
- 7 Wrap up and conclusions



# Background and History

## Sanitation Management in ITS





## The Sanitation Action Plan

### Primary

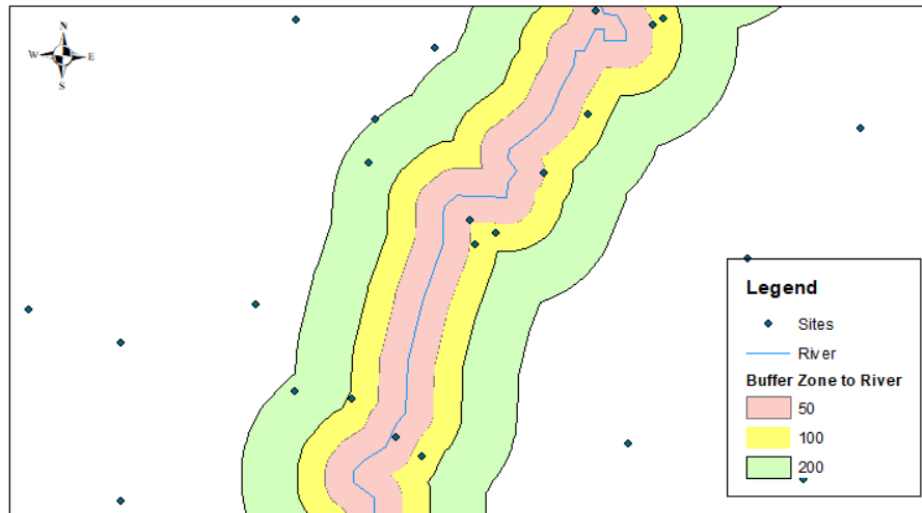
#### Pollution production

- Integrating greywater and blackwater
- Ranking the sites based on the level of pollution produced and mismanaged

### Secondary

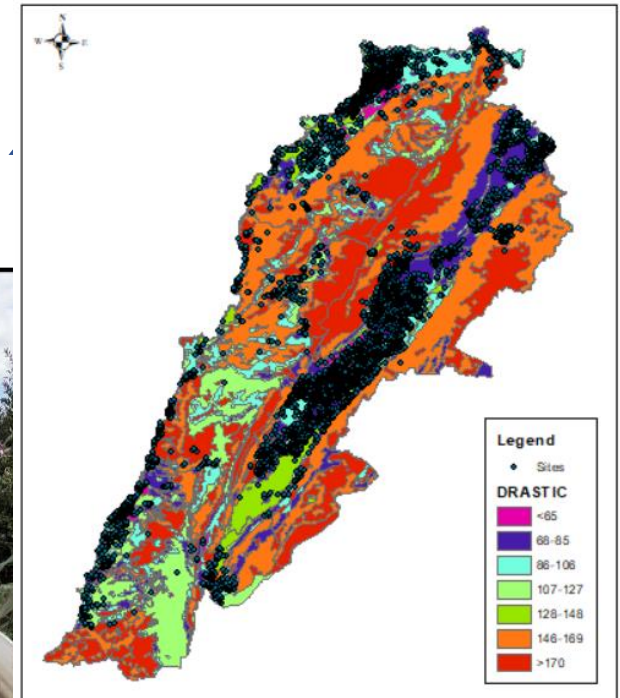
#### Distance to rivers

Done using a GIS exercise to categorize sites into buffer zones from rivers: 50m, 100m, 200m, and >200m.



### Tertiary

### Environment



# Background and History

## MoEW ban on DEWATS



The effective Sustainability of the O&M at ITSs level

The quality of effluents (COD/BOD) not respecting limits

Possible diversion of Aid in the ITSs

# Purpose and Objectives



Identifying good practices, limitations and challenges



Developing recommendations and improvement of DEWATS



Enhancing knowledge sharing and organizational learning about Decentralized Treatment systems.



Documenting lessons learned for future contextualized installation.

# DEWATS Phases of Implementation

Identification

Design

Procurement

Preliminary  
assessment

Detailed  
Technical  
Assessment

Implementation

Stakeholders'  
Analysis

Community  
Engagement

Monitoring and  
O&M



## Identification and Selection: Prioritization List

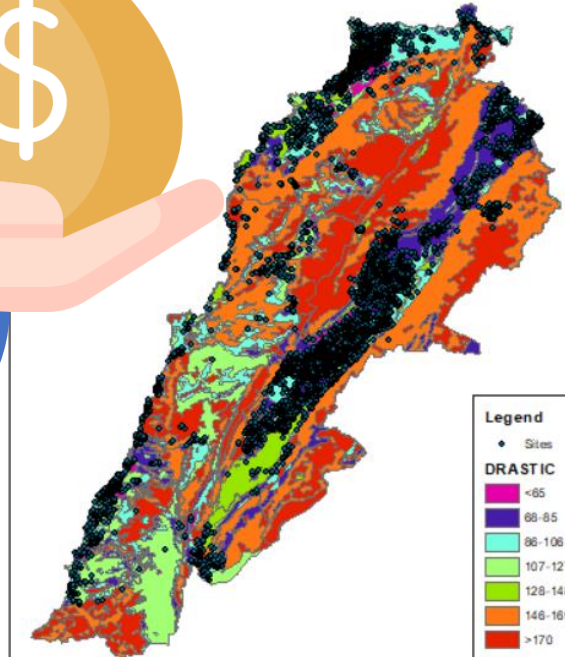
### Pollution production

- Integrating grey and blackwater
- Ranking the sites based on the level of pollution produced and mismanaged



### Proximity to rivers

GIS exercise to categorize sites into buffer zones from rivers: 50m, 100m, 200m, and >200m.





# DEWATS Phases of Implementation

## Identification and Selection: Preliminary Assessment

### Checklist

- ☐ Site accessibility
- ☐ Users
- ☐ Existing infrastructure
- ☐ Available space
- ☐ Land gradient
- ☐ Soil type
- ☐ Depth of water table
- ☐ Options for disposal



# DEWATS Phases of Implementation

## Identification and Selection: Stakeholders' Analysis





# DEWATS Phases of Implementation

## Identification and Selection

Challenges and root causes	Lessons learned and recommendations
Finding sites that satisfy all the technical requirements with acceptance from the landowners	Assess as many sites as possible and go for alternative sanitation solutions if DEWATS is not feasible
Sites with multiple landowners	Get approval from each landowner through an MoU. Otherwise, let go.



# DEWATS Phases of Implementation

## Detailed Technical Assessment

### Main parameters needed

- ☐ The wastewater flow (m<sup>3</sup>/d)
- ☐ Quality of wastewater (COD and BOD in (mg/l))
- ☐ Peak hours of most flow (h)
- ☐ Dimensions of available space (m)
- ☐ Distances from interfaces to available space (m)
- ☐ Ground levels (m)
- ☐ Average and lowest ambient temperatures (C)

### Additional information

Condition of interfaces and network

Sources of energy

Site improvement needs

Options for disposal or reuse



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# DEWATS Phases of Implementation

## Detailed Technical Assessment

Challenges and root causes	Lessons learned and recommendations
Lack of resources for geotechnical and hydraulic tests.	Collect information and history of other nearby infrastructural works to get an idea about type of soil and water table.
Population figures changing.	Try to select sites with stable communities and consider designing with a population growth factor.

# DEWATS Phases of Implementation

## Design

**Primary Treatment**  
**Anaerobic Baffled Reactor (ABR)**



**Secondary Treatment**  
- Anaerobic filter (AnF)  
- Biological Aerated Filter (BAF)



**Tertiary Treatment**  
- Slow Sand Filter (SSF)  
- Vertical Constructed Wetland (VFCW)



**Environment  
Limit Values**





# DEWATS Phases of Implementation

## Materials Used



UPVC pipes for network



Plastic tanks for manholes



Steel for treatment unit



# DEWATS Phases of Implementation

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## Documents Produced

	A	B	C	D	E
1	Daily waste water flow	time of most waste water flow	max peak flow per hour	General spread sheet	BOD5
2	acc	acc	acc	COD inflow	acc
3	m3/day	h	m3/h	mg/l	mg
4	24	6	4.00	712.5	31
5					
6					
7					
8	BOD removal rate in settler	Inflow into baffled reactor	COD/BOD ratio after settler	Factors	
9	calculated	COD	BOD		
10	%	mg/l	mg/l		
11	25%	546	282	1.94	
12	1.06				
13					
14	Total BOD rem. Rate	Total COD rem. Rate	COD out	inner masonry measurement	
15	calculated	calculated	calculated	acc. To required	
16	%	%	mg/l	width	
17	17%	17%	17%	m	
18					
19					
20	length of chambers should not exceed half depth	area of single upflow chamber	width of chamber		
21	calculated	calculated	calculated		
22	m	m	m		
23	1.5	1.5	5.71	0.81	
24					
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Alternative I inlet

Alternative II inlet

Water Level Sensor

Carbon Filter

Perforated steel plate

Kafraiy Decentralized Wastewater	
1	Arabic text
2	4" U-PVC pipe - branching
3	4" floor drain with a water trap
4	4" U-PVC pipe - in-house connection
5	Manhole (barrel)

1	Steel Tank
2	Excavation Work
3	Baro Course
4	HDPE membrane (2mm)
5	Carbon Filter
6	4" U-PVC pipe
7	Media For AnF and BAF
8	Circular 4" Diffuser Fine Air Bubbler
9	Ventilation PVC 2" In The Carbon Filter
10	Medium Sized Aggregator

1	Reinforced Concrete Slab
2	Plastic tank (5,000L)
3	Plastic tank (5,000L)
4	Wetland media
5	3" U-PVC Pipe
6	2" U-PVC Pipe
7	Gravel Infiltration gravel
8	Drainage channel rehabilitation
9	Water barrel 60L

1	Latrine superstructure - electric control room
2	Submersible pump
3	Air blower
4	PFR pipe (20mm)
5	Solar Panel

### TERMS OF REFERENCE

**Title:** Installation of Decentralized Wastewater Treatment Systems

**Area:** Joubb Jannine 020-026-043

**PD Reference:** LB-ZB-xxxx

LB-ZB-01724

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# DEWATS Phases of Implementation

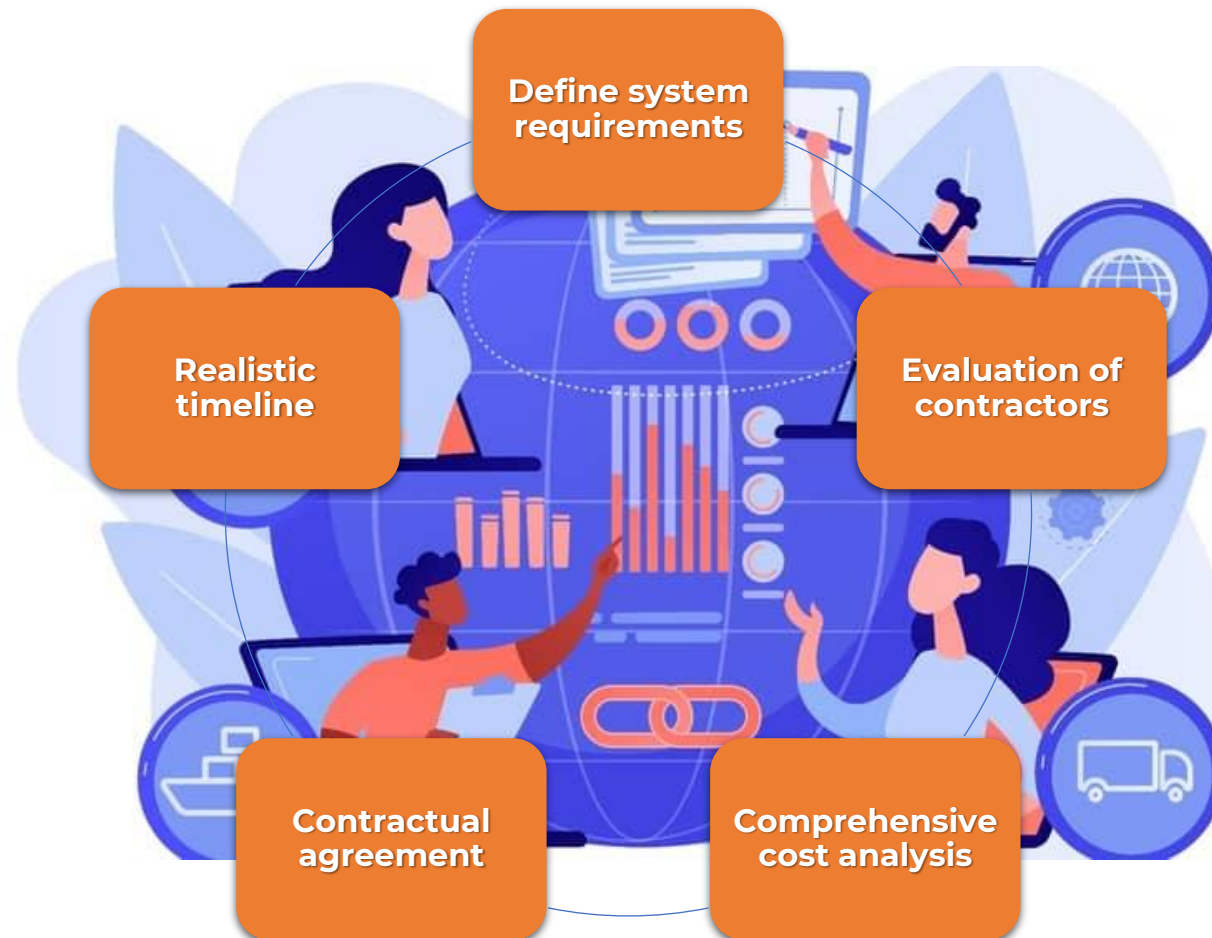
## Design

Challenges and root causes	Lessons learned and recommendations
Small space for implementation	Try different technologies and different iterations for the sizing of the system to fit the available area. You might need to include energy dependent technologies.
Lack of data	Ensure a comprehensive and detailed technical assessment of resources allow, or rely on history of infrastructural works in the area for preliminary knowledge



# DEWATS Phases of Implementation

## Procurement



# DEWATS Phases of Implementation

## Implementation





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# DEWATS Phases of Implementation

## Implementation

Challenges and root causes	Lessons learned and recommendations
Unforeseen site conditions (high water table, rocky soil)	Risk management and prompt amendments
New or unanticipated landowners	Negotiation for approval. Otherwise, let go of the project to avoid tension (no harm approach)



## Monitoring, Operation and Maintenance (O&M)

### Standard Operating Procedures Wastewater Management Monitoring and ITS May 10, 2021

These Standard Operating Procedures are elaborated to ensure function wastewater treatment systems installed in ITS in Lebanon with the **Characterization** following steps to be analyzed followed by level measurement tools.

#### I- General Safety Pre

During monitoring of wastewater treatment systems, consideration by using non-resistant footwear.

Toxic gas may be present in manholes open for at least 15 minutes.

Due to COVID-19 pandemic, the rule when dealing with wastewater treatment systems.



**Operation and Maintenance Tasks for the Upkeep of the Decentralized Wastewater Treatment System – Kamed El Laouz 007**

2022

#### Laboratory Measurements

Parameter	Monitoring Stage	Frequency/Month											
		1	2	3	4	5	6	7	8	9	10	11	12
BOD <sub>5</sub>	In						c						c
	Phases						g						g
	Out						g						g
		c	c	c	c	c	c	c	c	c	c	c	c
		g	g	g	g	g	g	g	g	g	g	g	g
		c	c	c	c	c	c	c	c	c	c	c	c
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		c	c	c	c	c	c	c	c	c	c	c	c
		g	g	g	g	g	g	g	g	g	g	g	g

The Operation and Maintenance Tasks for the Upkeep of the Decentralized Wastewater Treatment System – Kamed El Laouz 007 is part of the series of Operation and Maintenance Manuals of the Decentralized Wastewater Treatment Systems developed by Action Against Hunger under the HawkaMaa-EU Project.

Revised Edition – 2022

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## Monitoring, Operation and Maintenance (O&M)

Chemical Oxygen Demand (COD)  
(ELV limit: 125 mg/L)

Site	Main Manhole	Settler	ABR	AnF	BAF	WTL	Treatment Efficiency
Kamed El Laouz 007	2,100	350	120	110	90	40	98%
Ghazze 012-060	435	170	110	100	90	80	82%
Kafraiya 002	530	650	125	115	70	40	92%
Kafraiya 006	195	120	60	50	<20	<20	95%
Qaraaoun 006	1,450	230	60	40	<20	<20	99%





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# DEWATS Phases of Implementation

## Implementation

Challenges and root causes	Lessons learned and recommendations
Breakage or blockage of pipes or manholes.	Provision of tools and capacity building for community to do minor rehab.
Faults or vandalism of electric components.	Secure the system and have an emergency plan.
Uncompliant treatment efficiencies.	Optimization of the treatment stages or addition of a treatment stage.





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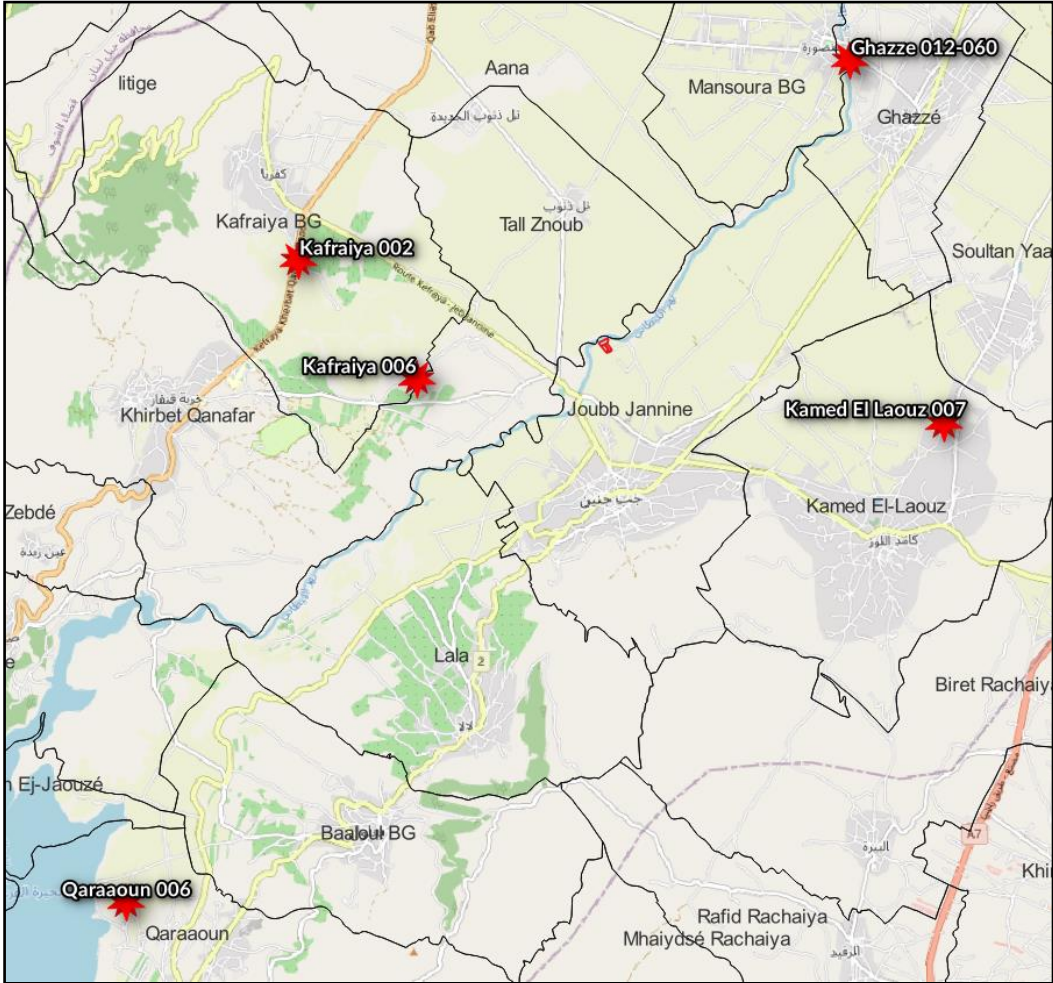
# DEWATS Phases of Implementation

## Community Engagement



## DEWATS for ITS by ACF

Batch I				
Site	Shelters	Ind.	Design	Completion
Kafraiya 006	10	70	Settler – ABR – AnF – BAF – WTL	Apr 2022
Kamed El Laouz 007	21	120	Settler – ABR – AnF – BAF – WTL	Feb 2022
Qaraaoun 006	8	70	Settler – ABR – AnF – BAF – WTL	Apr 2022
Batch II				
Site	Shelters	Ind.	Design	Completion
Ghazze 012-060	40	375	Settler – ABR – AnF – WTL	Aug 2022
Kafraiya 002	10	50	Settler – ABR – AnF – BAF – WTL	May 2022



# Case Study

## DEWATS in MINJEZ Municipality

This project considered the 1<sup>st</sup> WWTS installed at communal level out 5 installed under different fund (UNICEF, LHF, EU-MADAD)

**Target Population:** 50 individuals

**Sewer's connection pre-intervention:** Connection by network constructed by the municipality and direct to Valley with no treatment.

**Threats:** Underground water, bad smell, health, plants

**Consumption:** 150–200-liter/p/d

Place before the WWTS installments



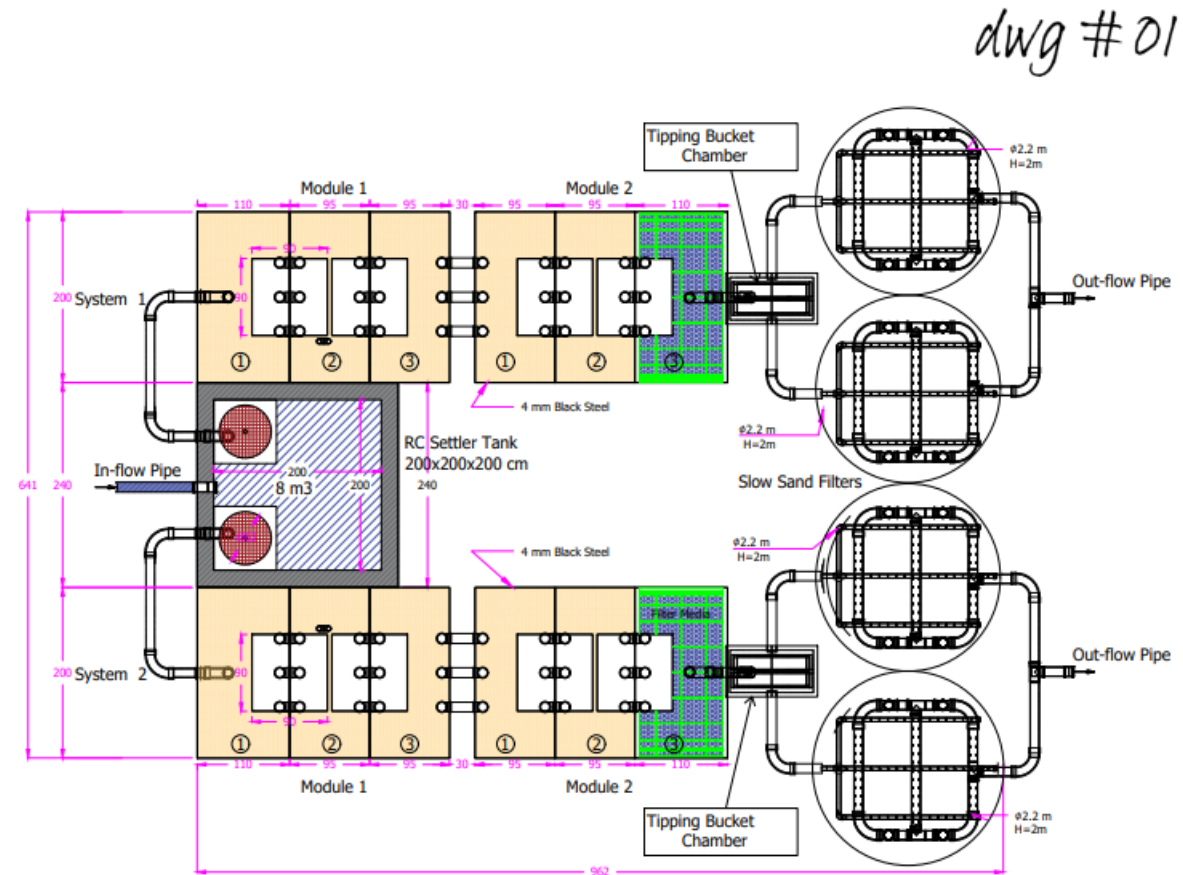


## DEWATS in MINJEZ Municipality

WWT technologies installed / above or underground | **1st Step:** Anaerobic Baffle Reactor / Underground

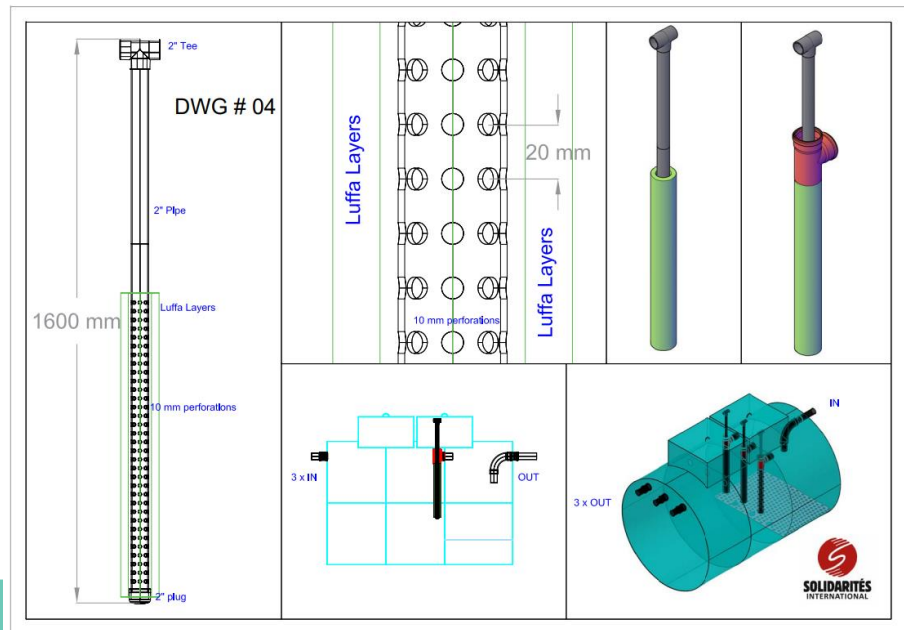
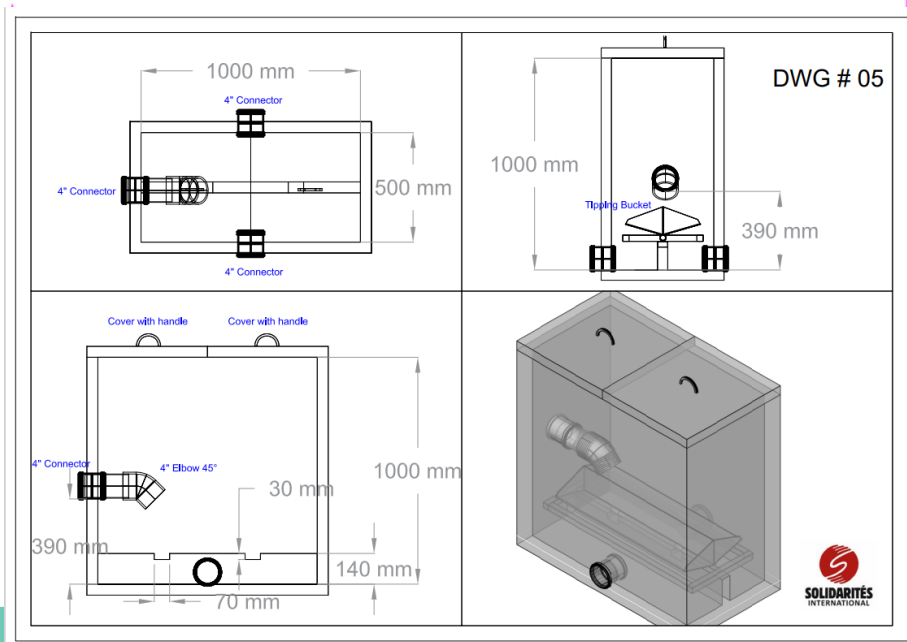
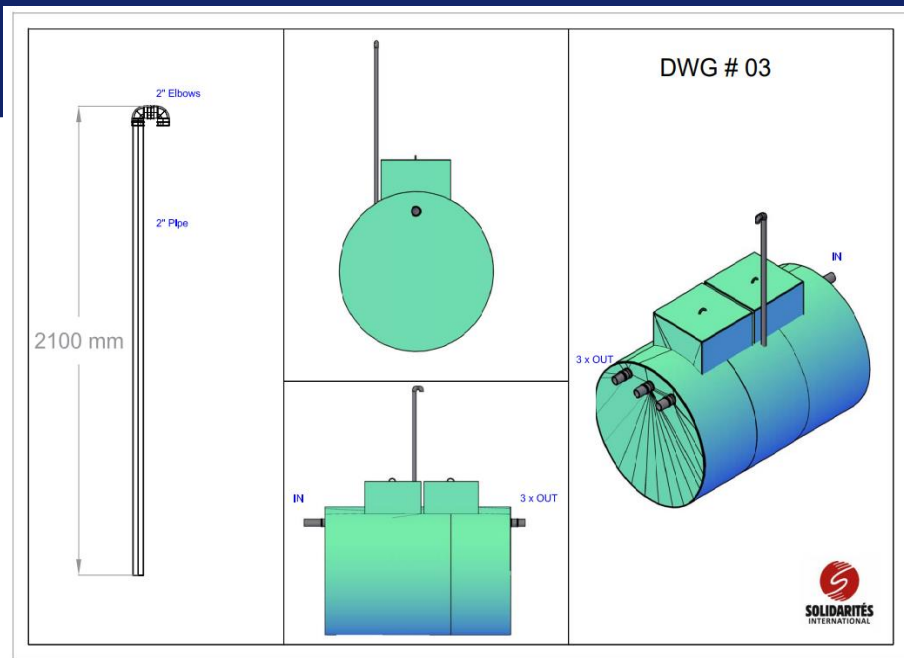
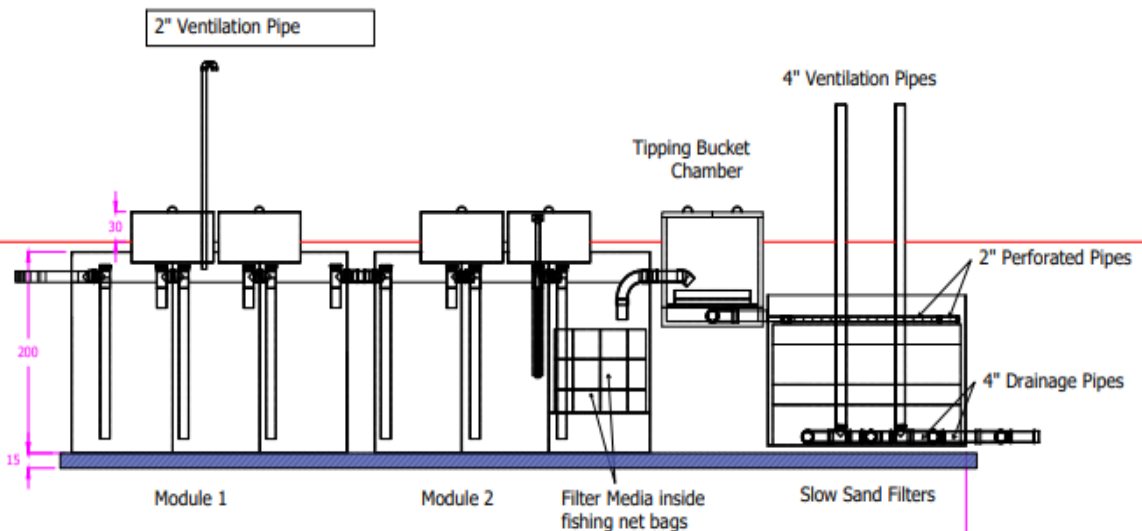
WWT technologies installed / above or underground | **2nd Step**: Anaerobic Filter / Underground

WWT technologies installed / above or underground | **3rd Step:** Sand Filter/Underground



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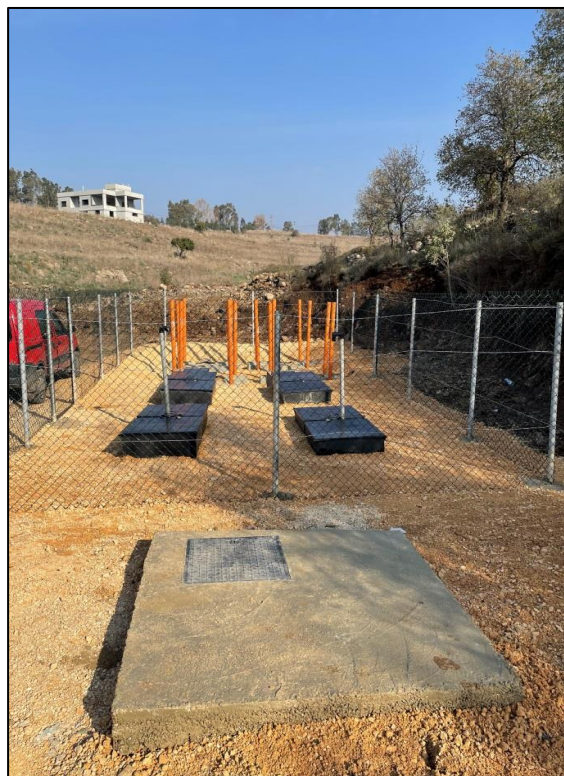


## DEWATS in MINJEZ Municipality

Prior to the intervention



Post-intervention







# Case Study

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## DEWATS in MINJEZ Municipality

### Result of testing the influent vs effluent

Governorate	site	#	Black / Grey / Black & grey	Secondary treatment	Tertiary treatment		pH	TSS	COD	Removal rate on the entire treatment chain	BOD5	Removal rate on the entire treatment chain
							5-9	60mg/l	125mg/l		25mg/l	
Akkar	Menjez -Leb		black & grey	ABR AF	SSF	in	7.3	850	300	83%	130	88%
						out	7.3	760	50		15	
Akkar	Menjez - Leb		black & grey	ABR AF	SSF	in	7.3	850	300	83%	130	92%
						out	7.2	750	50		10	

Governorate	site	#	Black / Grey / Black & grey	Secondary treatment	Tertiary treatment		[NO3]	[NO2]	TKN	TN	TP	TC	FC
										30mg/l		2000	100
Akkar	Menjez -Leb		black & grey	ABR AF	SSF	in	<0.1	<0.1	120		15	tntbc	tntbc
						out	<0.1	<0.1	30		10	tnbc	0
Akkar	Menjez - Leb		black & grey	ABR AF	SSF	in	<0.1	<0.1	120		15	tntbc	tntbc
						out	<0.1	<0.1	20		8	tnbc	150000

# Case Study

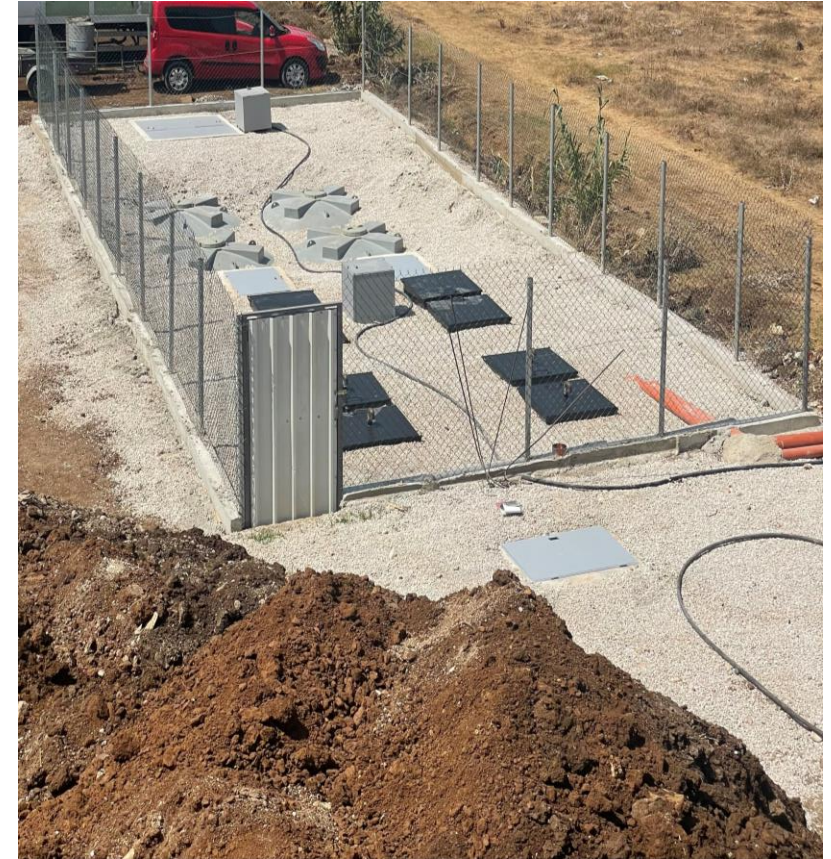
## WWTS in Salamtk PHC

WWT technologies installed /  
above or underground | 1st  
Step: **Anaerobic Baffle  
Reactor / Underground**

WWT technologies installed /  
above or underground | 2nd  
Step: **Anaerobic Filter /  
Underground**

WWT technologies installed /  
above or underground | 3rd  
Step: **Biological Aerated  
Filter / Underground**

WWT technologies installed /  
above or underground | 4th  
Step: **Sand Filter / Above  
Ground/ underground**





# Case Study

## Challenges and Lessons Learned



### Challenges:

1. Manholes installed by municipality were mixing black/grey water and rainwater.
2. A consistent flow of water
3. Difficult to persuade the owner of the system since it requires a large amount of land (20 m2) for project in PHC, vaccination center or others

### Lessons Learned for communal level projects:

1. The selection of the system and municipality should take into account the representative's willingness to manage the project and recognize its importance
2. Capacity training and inclusion of representatives in all implementation phases ensure their understanding and ability to maintain the system.
3. **For other project** Conducting focus group discussions involving beneficiaries, the owner, municipality, and representatives from the surrounding community is essential. This aims to elucidate the system's benefits and thoroughly discuss every aspect of the project before commencement.
4. **For other project** Ensuring community approval in the vicinity is crucial to prevent tensions, particularly in the case of solar system installation.
5. **For other project:** Due to the potential risk of theft, especially targeting items like solar panels, batteries, inverters, and electrical pumps, precautions should be taken, security/risk assessment should be conducted.
6. **For other project:** For the discharge of purified water, it is imperative to verify the feasibility of releasing it through outlets such as rivers, water channels, seas, etc.





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# Case Study

## Successes and Failures



Lebanon  
Humanitarian  
Fund



### Successes:

1. Remarkable success has been achieved in purifying wastewater to the designed value, meeting acceptable standards for environmentally safe discharge. While the removal rate on the entire treatment chain is 83-92% comparison of the inlet and outlet result.
2. Successful community engagement efforts by SI and municipality facilitate the implementation and monitoring
3. Demonstrating cost-effectiveness
4. System working on gravity, no need for electricity.
5. Ensuring continuous and thorough follow-up, along with regular cleaning, is essential for system maintenance and optimal performance.

### Failures:

1. Managing fluctuations in the number of users/beneficiaries is critical, as the system's capacity is designed for a specific user base. Any increase may require an additional system, while a decrease could impact the quality of the outlet water.



**ACTION  
AGAINST  
HUNGER**



**SOLIDARIT  S  
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# **Thank you for participating!**

