Sustainable Water Resource Management for Vulnerable Populations: Addressing Water Scarcity and Climate Resilience in Southern Bangladesh

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Introduction

📌 Rohingya: Forcedly Displaced Myanmar Nationals
- A Muslim ethnic minority from Myanmar, resided in Rakhine state.
- Lived for centuries but denied citizenship since 1982.
- World's largest stateless population—no legal rights, no recognition.

📌 Crisis & Forced Displacement
- August 2017: Armed attacks, mass violence, human rights violations.
- Fled Myanmar's Rakhine State, walking for days through jungles & crossing treacherous rivers.
- Nearly 1 million Rohingya now live in Cox's Bazar, Bangladesh—home to the world's largest refugee camp.

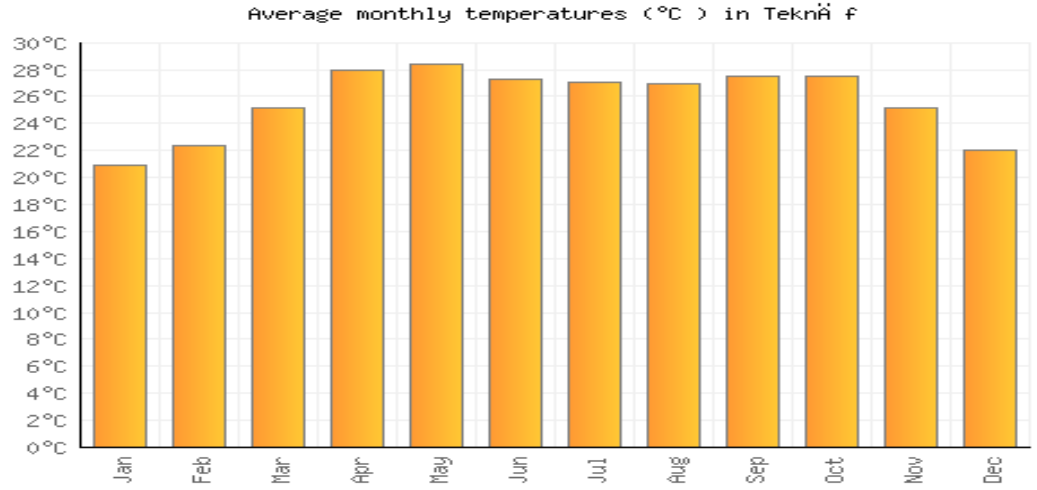
📌 A Persecuted People
"The UN calls the Rohingya "the most persecuted minority in the world.""

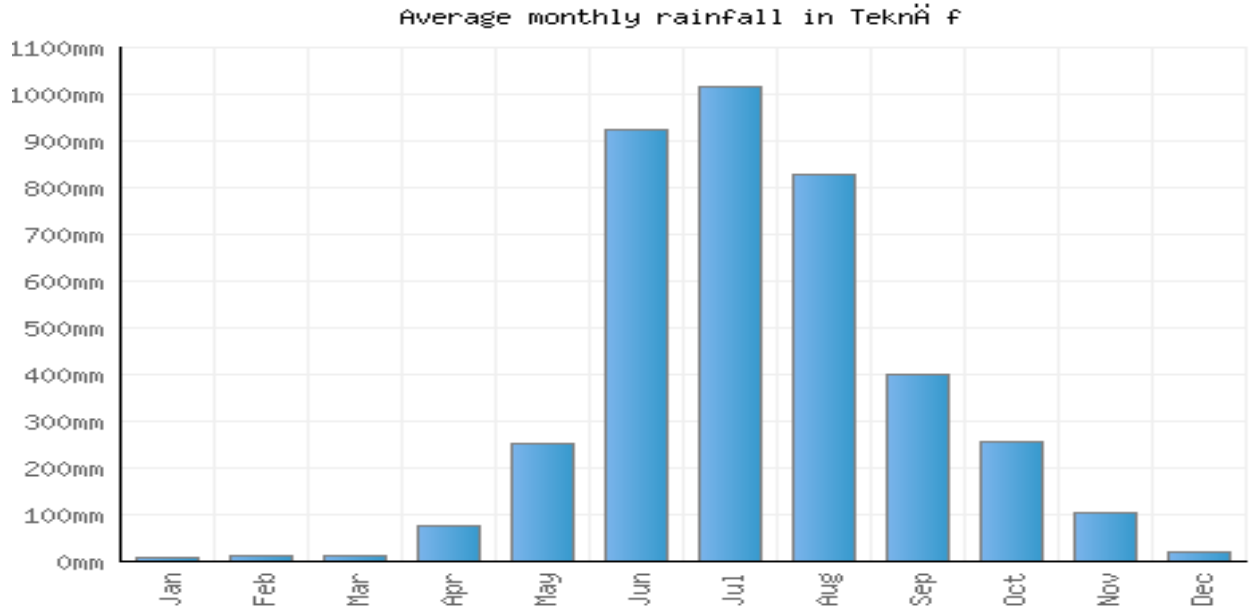
WASH related Challenges in Camps

- **Water Scarcity & Contamination**
  - Rapid population growth → water shortage.
  - Contaminated water → diseases.
  - Over-extraction → declining groundwater
- **Disease Outbreaks**
  - Cholera, AWD, Hepatitis E due to poor hygiene.
  - Overcrowding → skin infections & respiratory illnesses.
- **Poor Sanitation & Open Defecation**
  - Lack of toilets → open defecation.
  - Makeshift toilets overflow in monsoons.
  - Women & girls face safety issues.
- **Hygiene Awareness & Cultural Barriers**
  - Low hygiene awareness → unsafe practices.
  - Limited menstrual hygiene products.
  - Poor handwashing → disease spread.

Situation of Study Area

- Study Camps are situated in the southmost sub-district of Bangladesh,
- Teknaf is one of the rainiest area
- 80% of its very high annual rainfall occurred in a four months between June and September
- Surface water is difficult to manage, with limited areas for reservoirs,
- Groundwater is generally scarce in the area
- Experiences active low-high tide
- Saltwater intrusion is evident





Challenges of Water

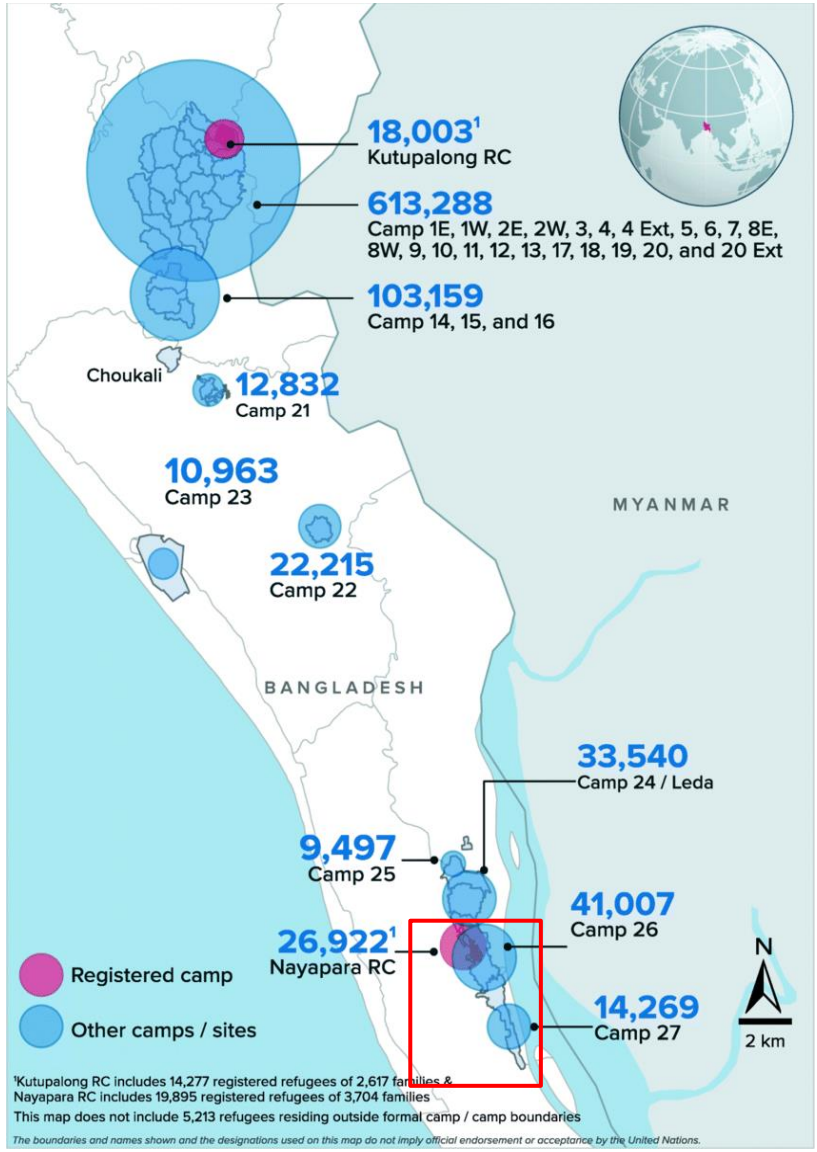
- Insufficient water sources to meet demand
- Unusually long dry seasons impacting availability
- Reservoirs have dried up, reducing storage capacity
- Lack of replenishing groundwater aquifers
- Ongoing groundwater depletion affecting long-term supply
- Saltwater intrusion contaminating groundwater
- Functionality issues of shallow tubewells
- Nearest suitable groundwater sources are 20 km away
- Lack of infrastructures
- Coordination and Management

Water Supply in 2020 (dry period)

- ❑ Dry Season: December to May
- ❑ The daily water requirement for over 85,000 individuals in three camps within the Teknaf Cluster is 1.9 million liters.
- ❑ The total available water supply was 178,416 m³, compared to an estimated demand of approximately 250,000 m³.
- ❑ Only about 72% of demand can be met as per the standard.

Steps taken

- ✓ Stakeholder consultation
- ✓ Distribution reduction
  - reduces to 15 lpcd initially from March 15
  - reduces to 10 lpcd in acute situation, beginning on May 10.
- ✓ Water trucking daily 280-300 m³ for 15 days.



Strategic Planning: Hydrological Feasibility Study

- ✓ Exploitation of potential additional water source
  - ➢ Surface water source given priority over groundwater
  - ➢ Rainfall-runoff assessment
  - ➢ Additional dam in same stream (Cascade dam)
  - ➢ Acceptable yield (>1000 m^3) has been considered
  - ➢ Located within 1000 meters of the existing water network
  - ➢ Water quality assessment
  - ➢ Risk of greywater contamination
  - ➢ Recommendations from local authorities
  - ➢ Long-term sustainability
  - ➢ Other physical constraints, including security, accessibility, and legal considerations

Strategic Planning: Integration of Water treatment plants and water storage

- ✓ All existing and proposed water storage points should be integrated into a common transmission line.
- ✓ The transmission line will be connected to all water treatment plants.
- ✓ New water intake stations will be established with sufficient pumping capacity.
- ✓ Water flow meters must be installed at each pumping station to monitor transmission losses and leakage.

Expansion of Existing Reservoir Storage

- ✓ Excavation of reservoir beds to increase the volume
- ✓ Consider lateral expansion of the reservoir wherever feasible
- ✓ Increase of the Dam’s height without impacting the upstream agricultural land

Strategic Planning: Exploitation of potential Groundwater sources

- ✓ Assessment of Potential Groundwater Aquifer (Studied by the Dhaka University Team)
- ✓ Installation of High-Yield Production Well
- ✓ Enhancement of Water Extraction Capacity of Existing Tube Well Within Sustainable Yield Limits.
- ✓ Explore the back-up tubewells (20 km far) for water trucking

Integration of groundwater networks

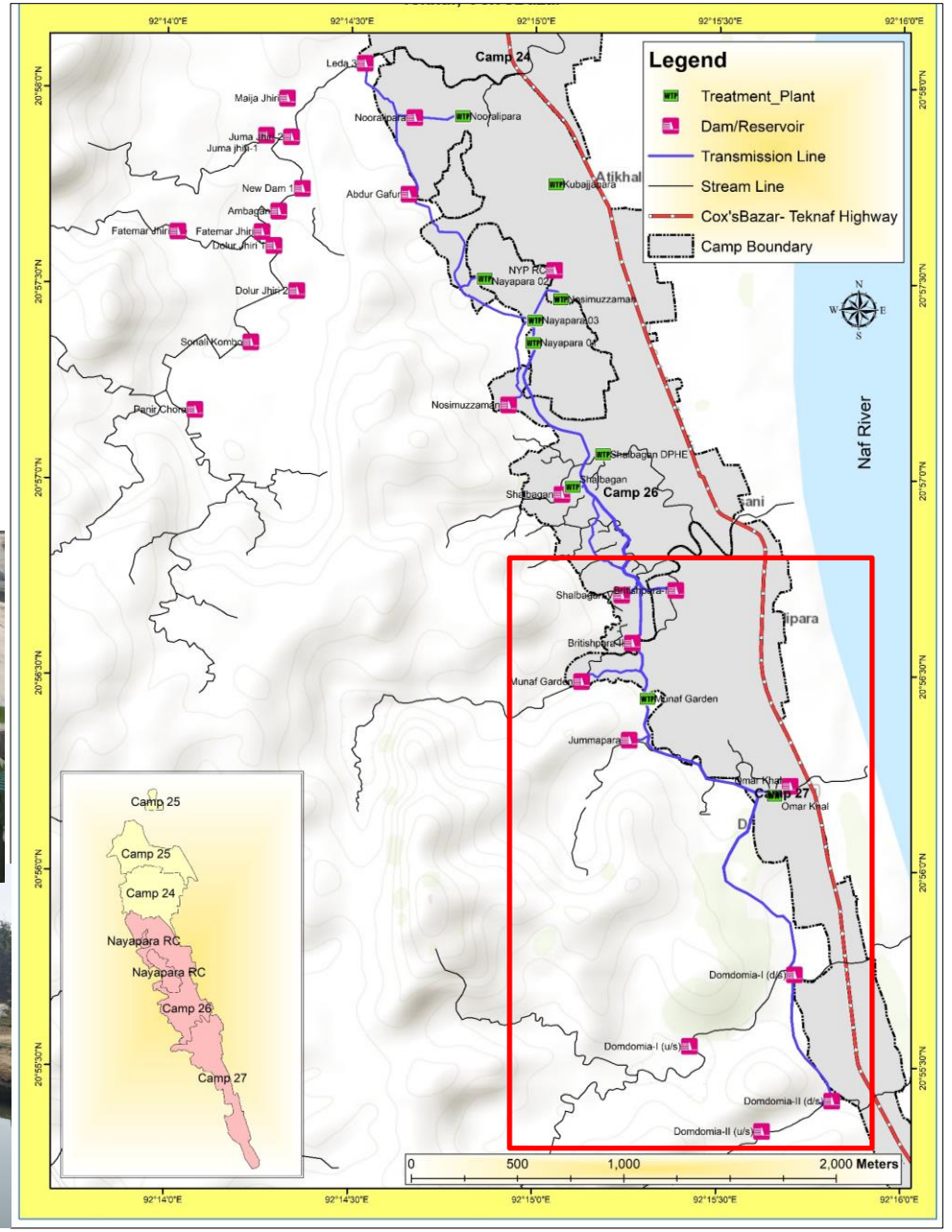
- ✓ Decommission the low-yield tubewell and minimize reliance on private sources where possible.
- ✓ Mini water distribution networks should be integrated into the system.
- ✓ Centralized treatment plant has been proposed.
- ✓ Inter-connected with the surface water treatment plant (mitigation measure).

Strategy: Monitoring and Management for Mitigation

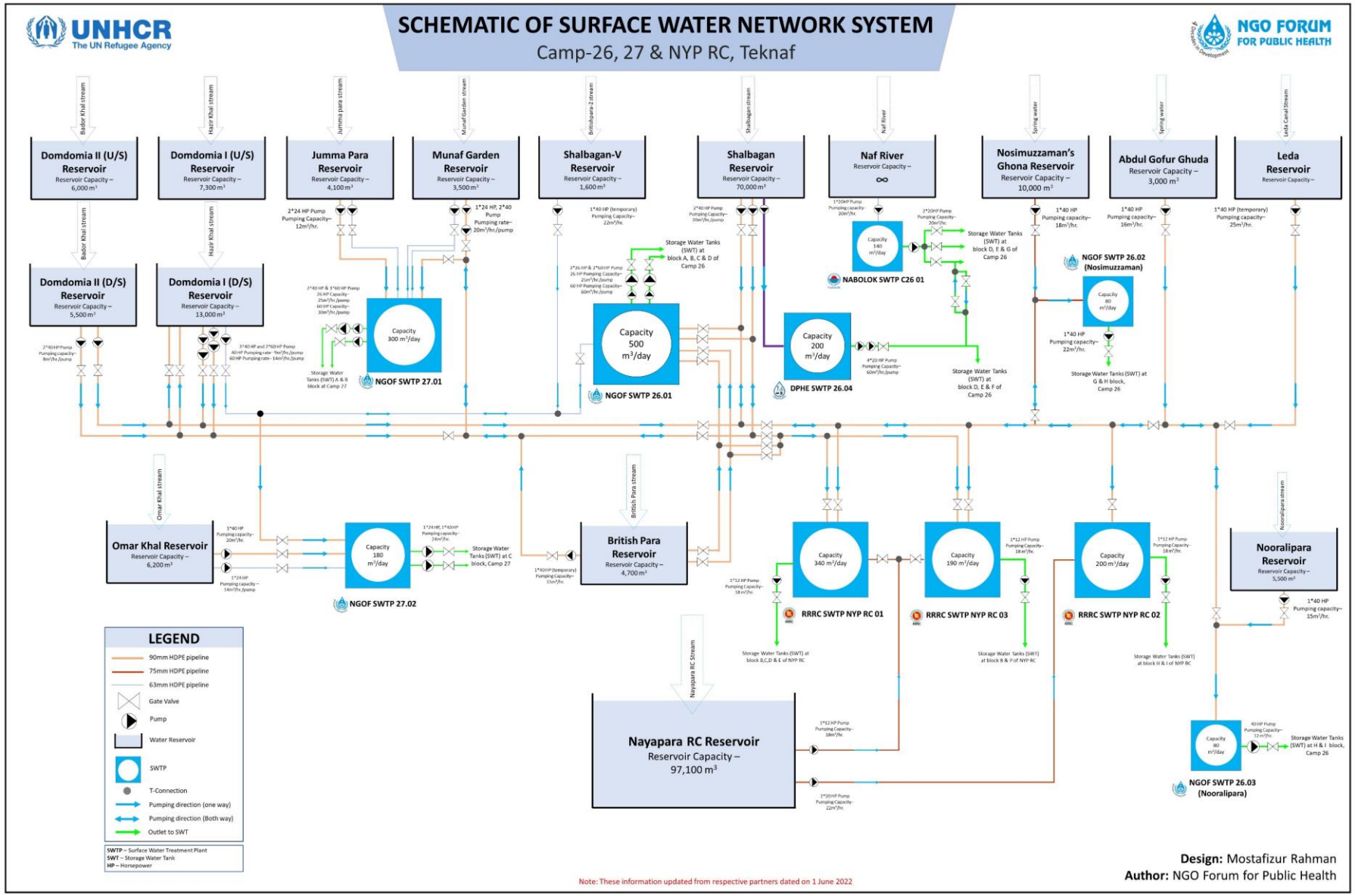
- ✓ A three-tier team has been established to monitor the situation during the dry period.
- ✓ A focal point from each water supply agency has been designated.
- ✓ Bi-weekly meetings are being conducted until a substantial amount of rainfall is received.
- ✓ An online real-time dashboard has been developed to track water extraction from each storage facility, updated daily and accessible to all agencies.
- ✓ A comprehensive schedule has been prepared for water pumping from storage and intake by the treatment plant.
- ✓ A dedicated team has been assigned for valve control, rapid repairs, and maintenance work.
- ✓ Resource planning and management strategies are in place.
- ✓ Advocacy efforts are underway for a large-scale, sustainable water supply system.

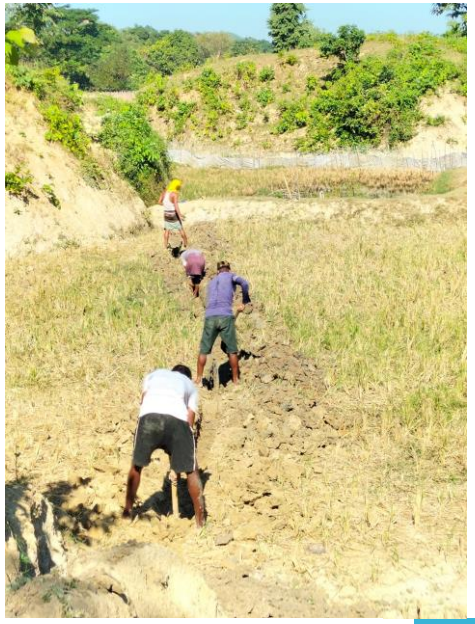
Intervention/Output

- Reconstruction of 10 dams, with the excavation of 3 reservoirs annually.
- Water storage capacity expanded to 257,500m³.
- Daily treatment plant capacity upgraded to over 2,000 m³.

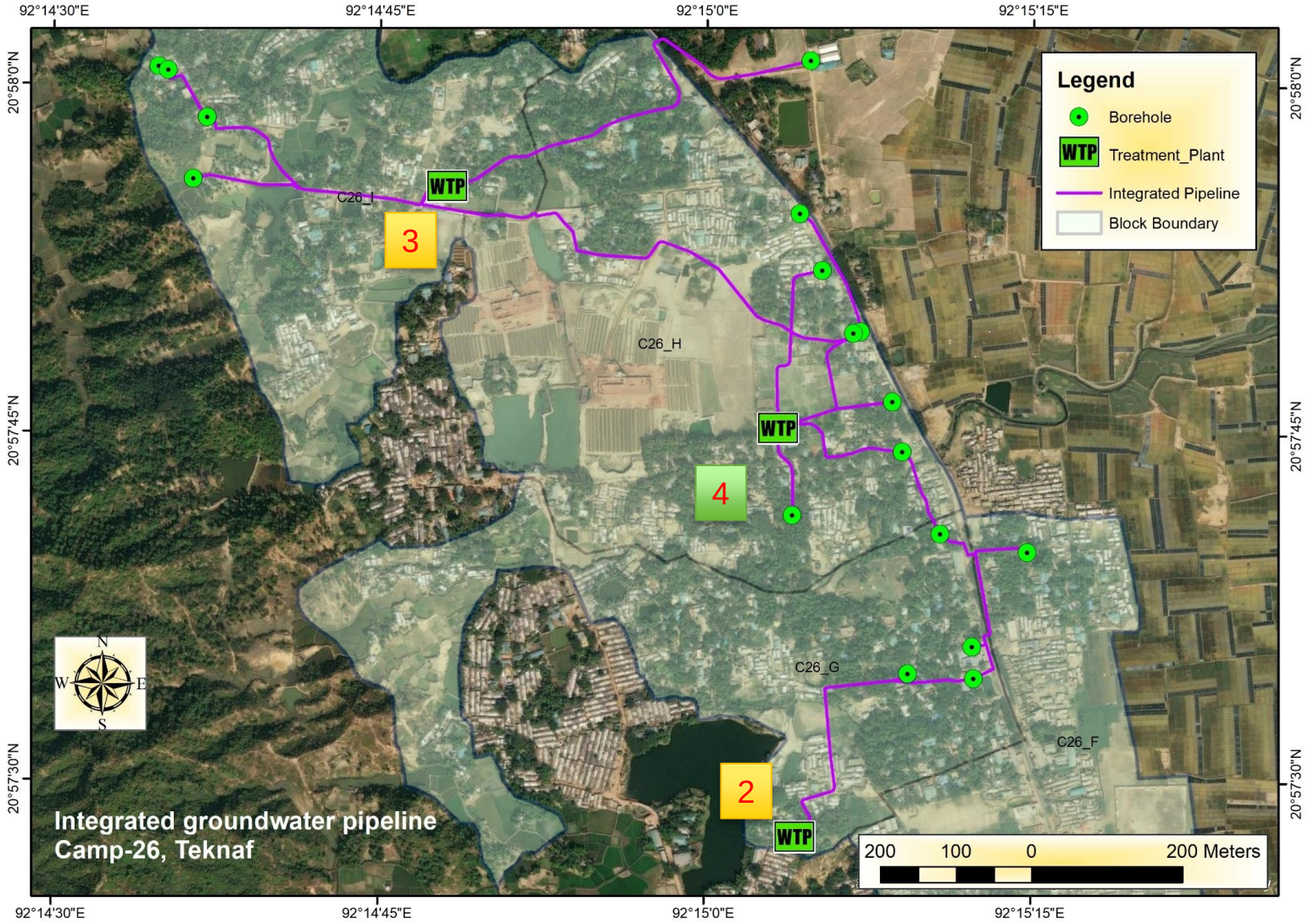


Intervention/Output



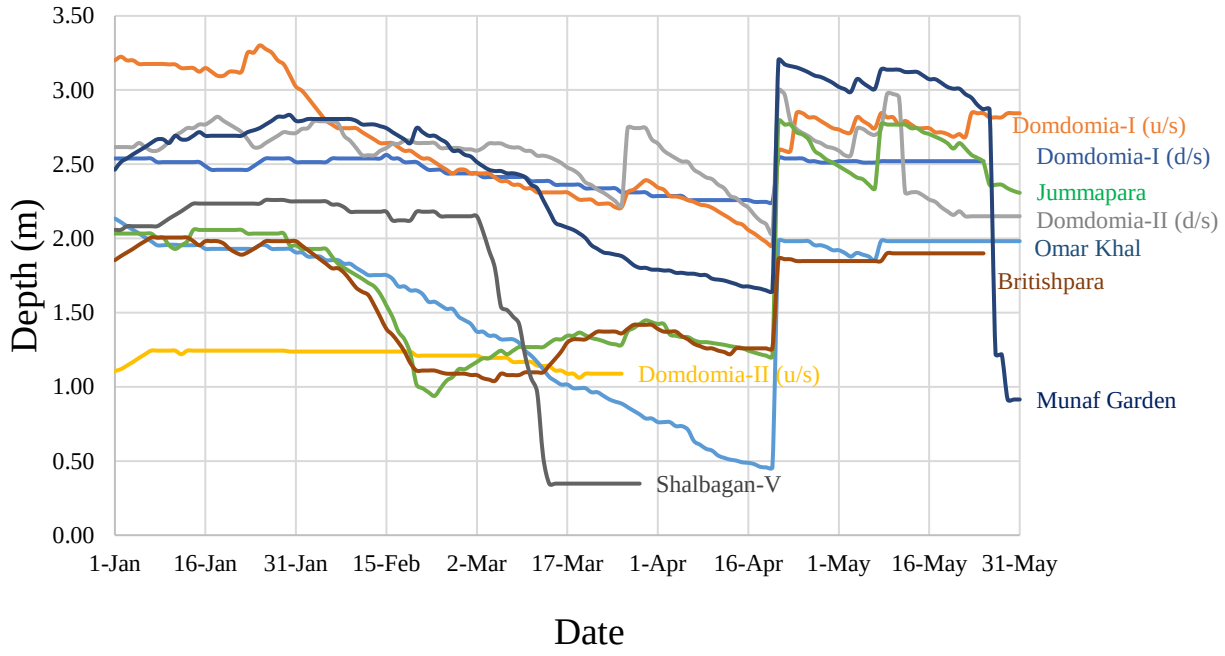


Intervention: Groundwater integration & Benefits



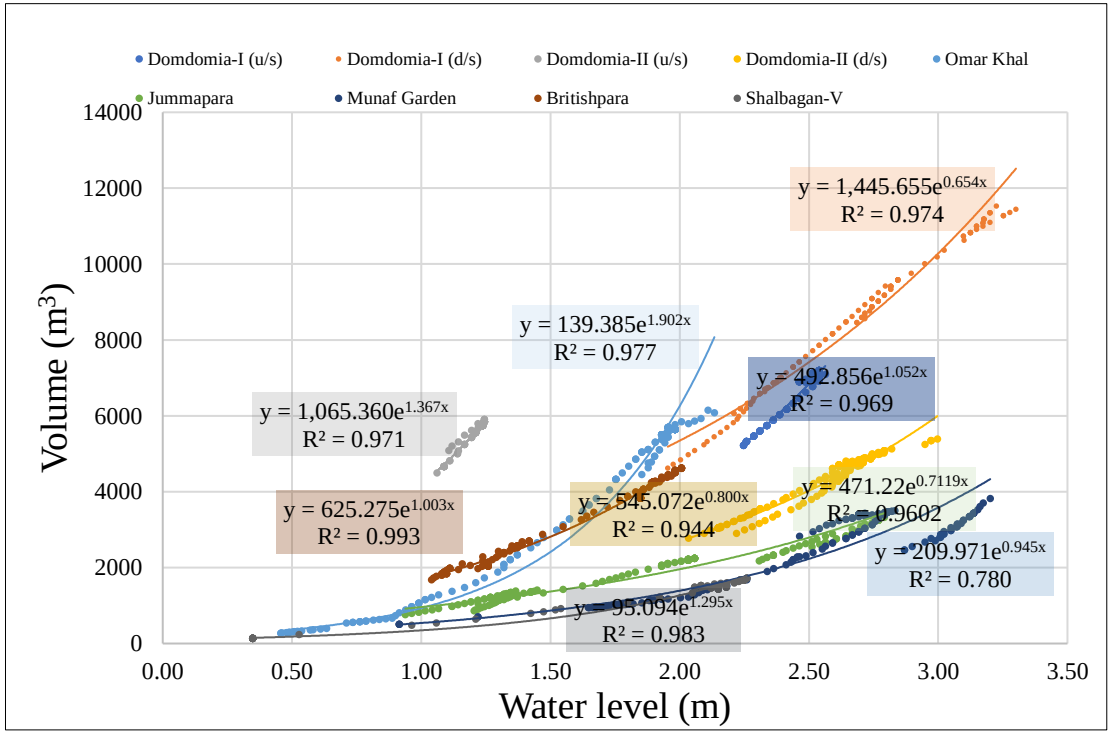
- ✓ Supports each other during emergencies, such as borehole depletion or generator/solar system failure.
- ✓ Hybrid treatment plants (TP 2 and TP 3) provide additional backup in cases of surface or groundwater shortages.

Monitoring Mechanism: Reservoir water level and Volume



Reservoirs water level

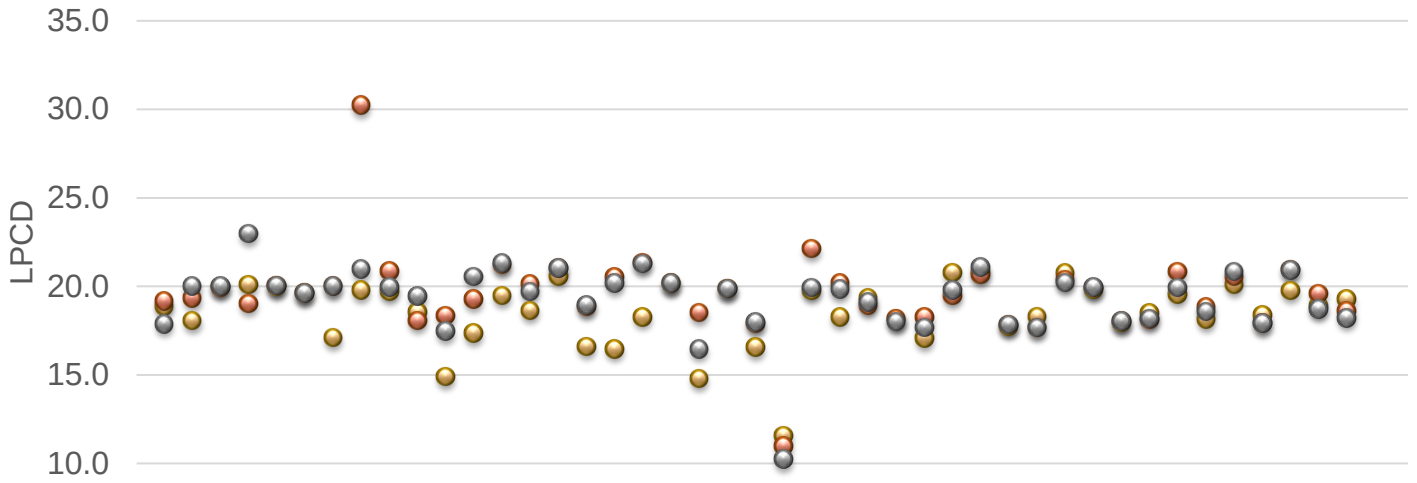
Depth and Volume relationship



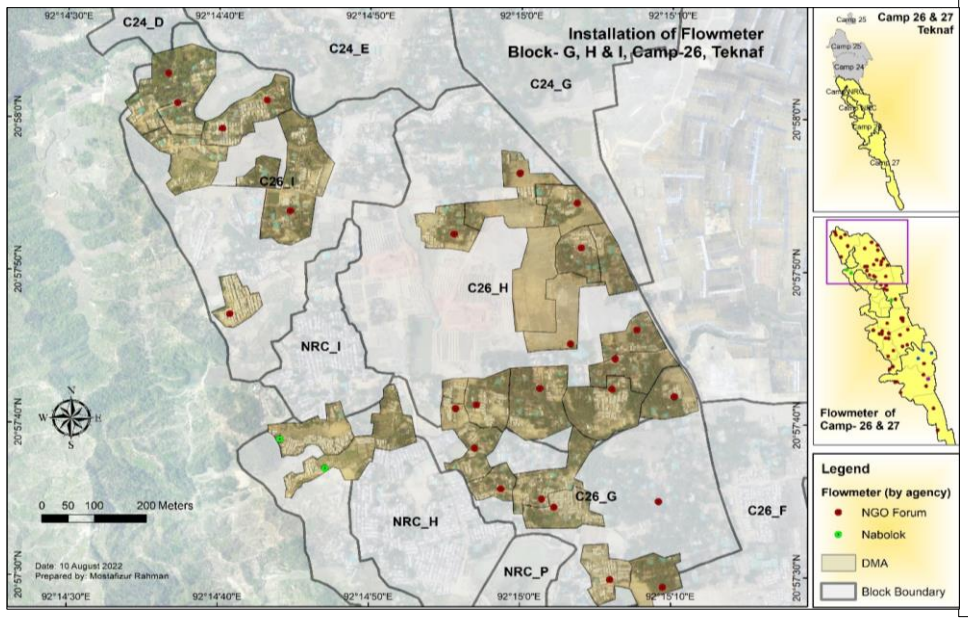
Monitoring Mechanism: Surface water intake

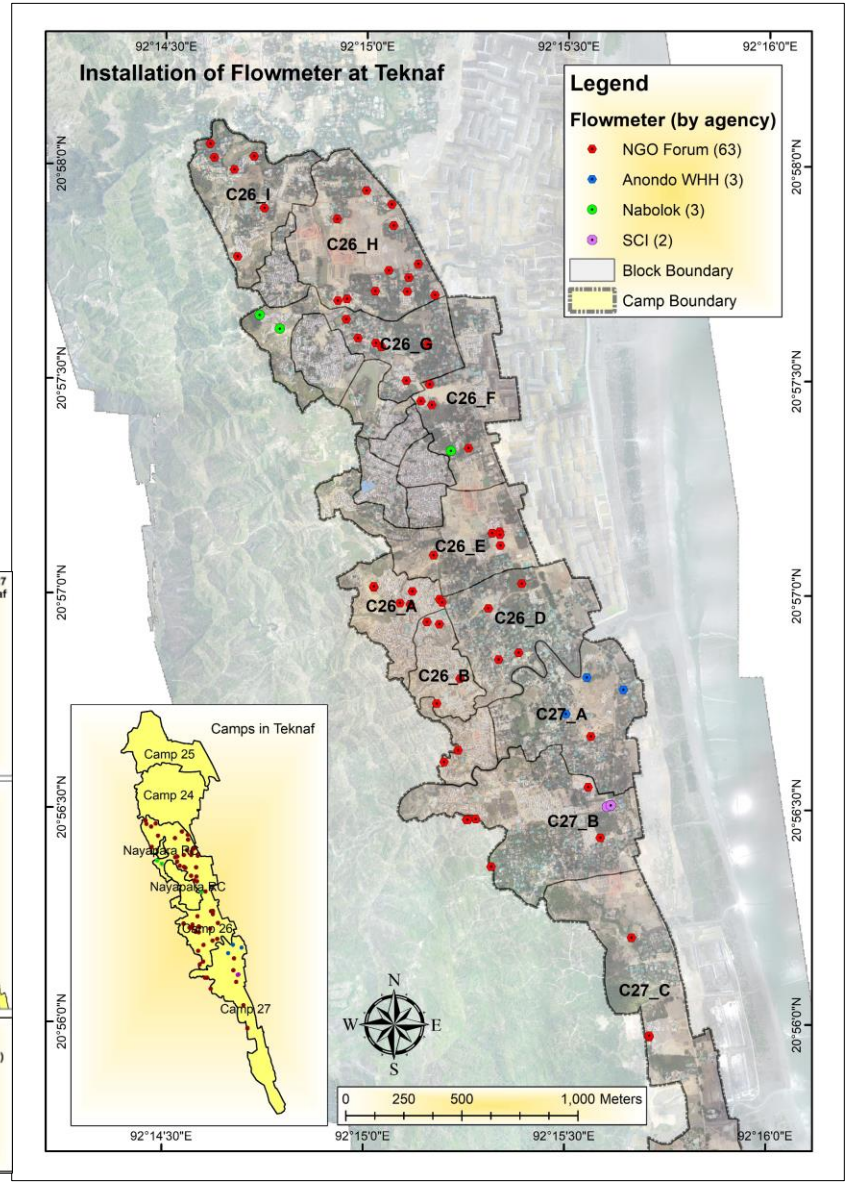
Sl.	Plant	(10l/day) (m^3)	Source	Capacity (m^3)	Remains Capacity	5/4/2021	5/5/2021	5/6/2021	5/7/2021	5/8/2021	5/9/2021	5/10/2021	5/11/2021	5/12/2021	5/13/2021	5/14/2021	5/15/2021	tribution	Discharge rate (m^3/hr.)
1	Shalbagan Plant_NGOF	280	Shalbagan	1152	62	130	120	120	120	120	120	120	120	120				01	26
			Domdomia I (u/s +d/s)	2339	69	110	110	110	110	110	110	110						Plant	22
			Munaf Garden	2772	492	60	60	60	60	60	60	60	60	60	60	60	60	01	18
			Domdomia II (u/s +d/s)	3678	3678													Plant	16
2	P Block Plant_NGOF	40	Nosimuzzaman Ghona	342	22	40	40	40	40	40	40	40	40					01	20
3	Munaf Garden Plant_SI	120	Munaf Garden	2772	492	130	130	130	130	130	130	130	130	130	130	130	130	01	12
			Domdomia II (u/s +d/s)	3678	2238													01	16.5
4	Jumma Para Plant_SI	38	Munaf Garden	2772	1212													Plant	14.5
			Jummapara	503	23	40	40	40	40	40	40	40	40	40	40	40	40	01	23
			Domdomia II (u/s +d/s)	3678	2238													01	14
5	Domdomia Plant_SI	50	Domdomia II (u/s +d/s)	3678	2238	50	50	50	50	50	50	50	50	50	50	50	50	01	18
6	Omarkhal Plant_SI	65	Domdomia II (u/s +d/s)	3678	2238	70	70	70	70	70	70	70	70	70	70	70	70	Plant	12
7	NYP RC_ SWTP#01		Domdomia I (u/s +d/s)	2339	69	125	125	125	125	125	125	125	125	125	125	125	125	01	8
																		02	10
																		02	17
																		03	13
																		Plant	20
																		01	15
																		Plant	19
																		02	18
																		03	24

Monitoring Mechanism: Water Distribution



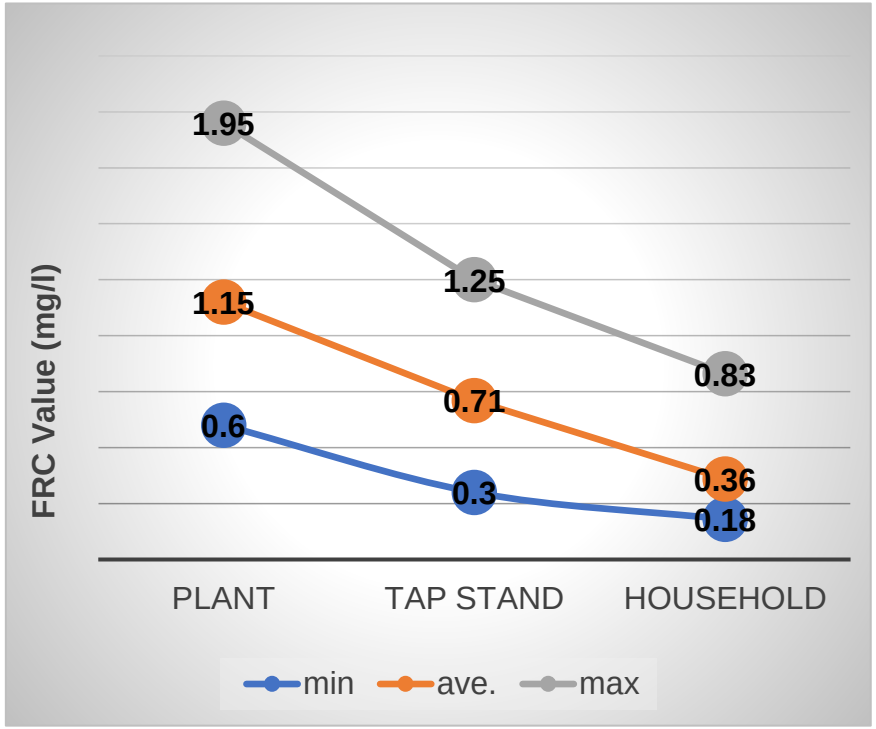
DMA flowmeter: ensures equal water distribution





Monitoring Mechanism: Water Quality

Variation of FRC value at different points



Network	No. of TS	No. of FRC Test daily					
		Chlorination tank		Tap stand		Household	
		Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
WDZ_26.01	61	2	2	3	3	3	3
WDZ_26.02	25	1	1	2	1	2	1
WDZ_26.03	39	1	1	2	2	2	2
WDZ_26.05	23	1	1	2	1	2	1
WDZ_27.01	61	2	2	3	3	3	3
WDZ_27.02	27	1	1	2	1	2	1

Outcomes:

- Each treatment plant has equal access to all water storage facilities.
- There is no risk of water shortages for any treatment plant.
- Every individual living in the area receives the same amount of water.
- A reduction in the overall number of volunteers due to integration.
- Streamlined and more efficient operation of treatment plants and distribution systems.
- Conflict reduction at water distribution points.
- Agricultural water requirements have been taken into account.
- Promotion of socio-economic development.
- Simplified monitoring and an improved decision-making mechanism.

Achievement:

Last year, the team received $2.5 million
Offering continuous water to the surrounding host communities as well

Thank You

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