Zaatari Water Network Technical Working Group

Water Network studies for Zaatari Camp

8th May 2014

ACTED JEN OXFAM unicef UNHCR The UN Refugee Agency

AGENDA

Current Zaatari Water System

- ✓ *Population change,*
- ✓ *standards,*
- ✓ *water delivery trends,*
- ✓ *existing water supply system,*
- ✓ *summary of capital costs so far,*
- ✓ *community participation/mobilisation components,*
- ✓ *history of changing situation and challenges (internal and external),*
- ✓ *example of District 6,*
- ✓ *operational costs, and*
- ✓ *lessons learnt*

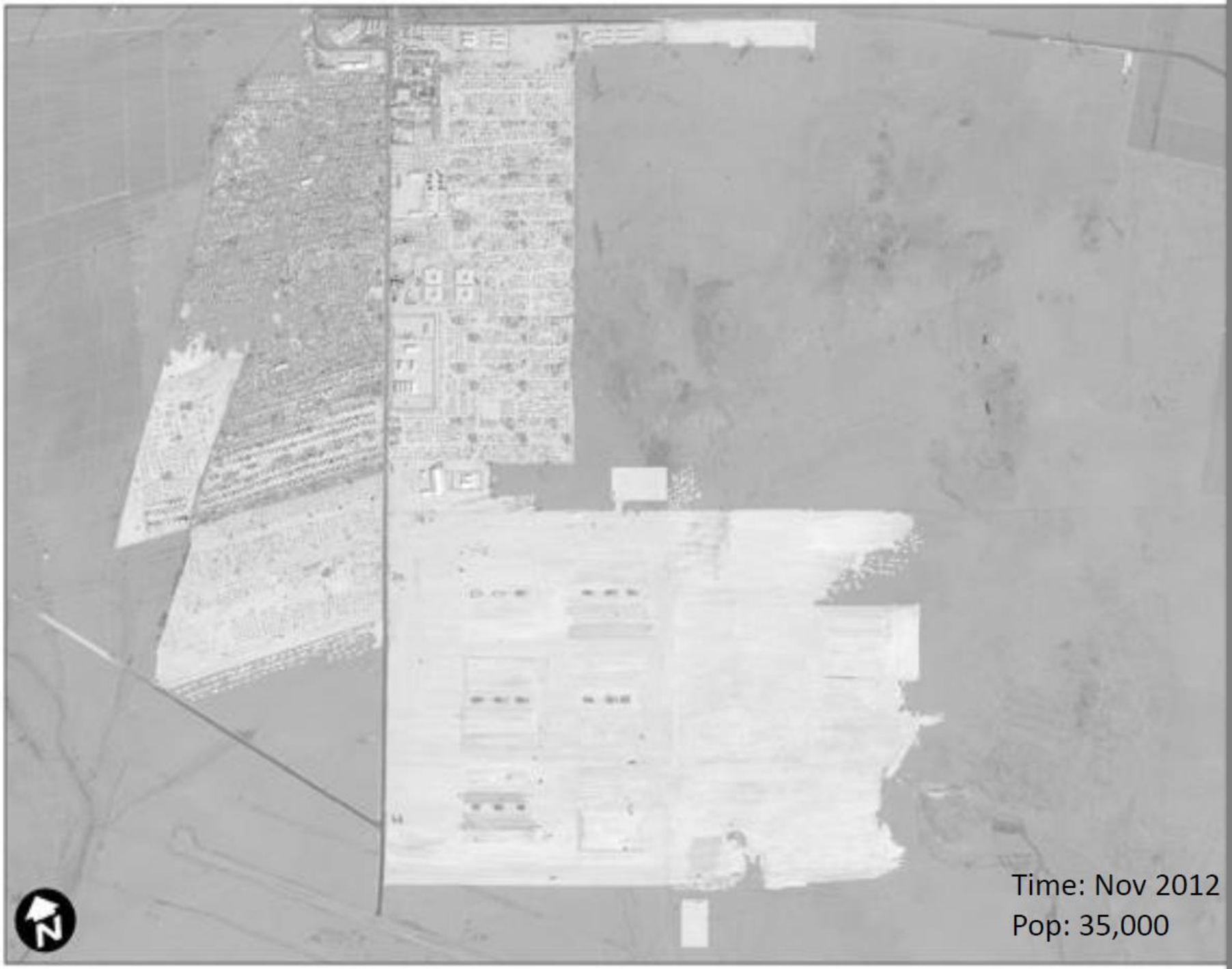
Future Zaatari Water Network

- ✓ *Drivers for need - outcomes of community consultation/FGD and indicated by current community behavior*
- ✓ *Future camp master plan*
- ✓ *History of ZWatNet (working group)*
- ✓ *New ZWatNet TOR – including external technical review*
- ✓ *Summary of other experiences referenced (need more)*
- ✓ *Description of options to be compared*
- ✓ *Comparison of options in terms of cost, SWOT, O&M/recurrent costs, timetable for implementation, example of operational scenarios*
- ✓ *Gaps in information/experience to be addressed – technical, socio-economic*
- ✓ *ZWatNet recommendations*

Time schedule

- 12:00 - 12:15 Introduction
- 12.15 - 13.45 Current Zaatari Water System
- 13.45 – 14.00 Break
- 14.00 - 15.00 Future Zaatari Water Network
- 15.00 – 15.15 Break
- 15.15 – 15.30 Recommendation
- 15.30 – 16.30 Discussion

Current Zaatari Water System



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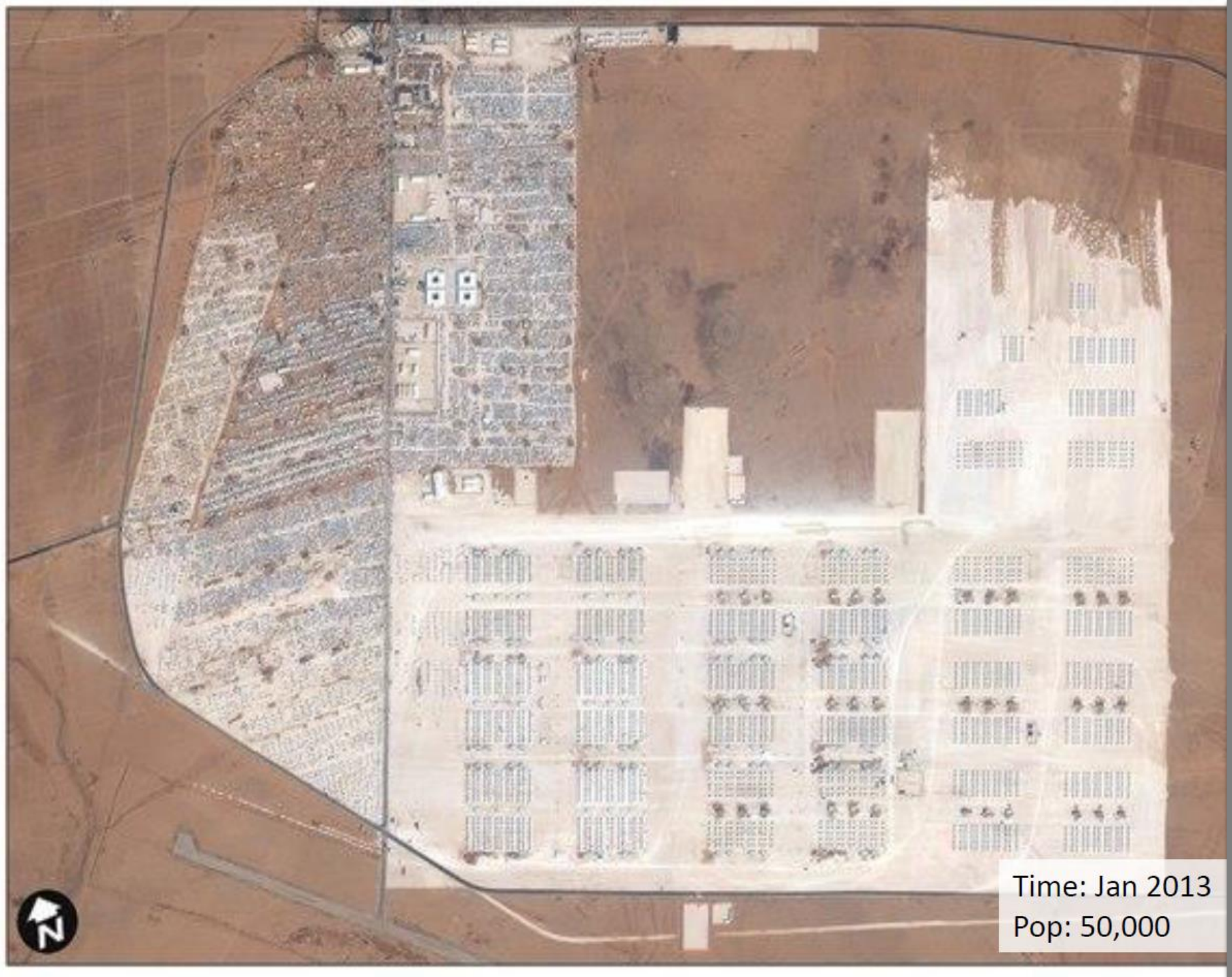

Current Zaatari Water System

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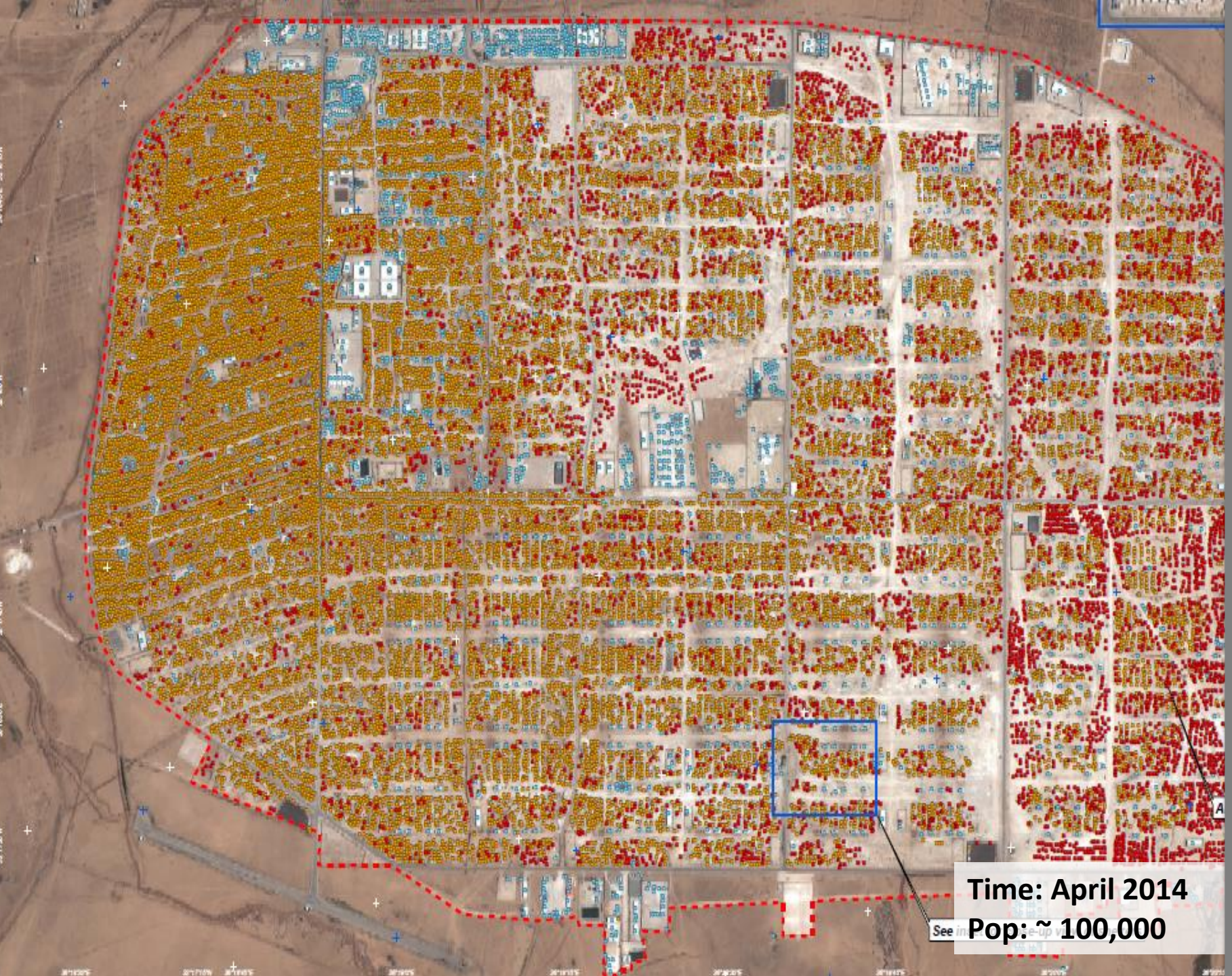


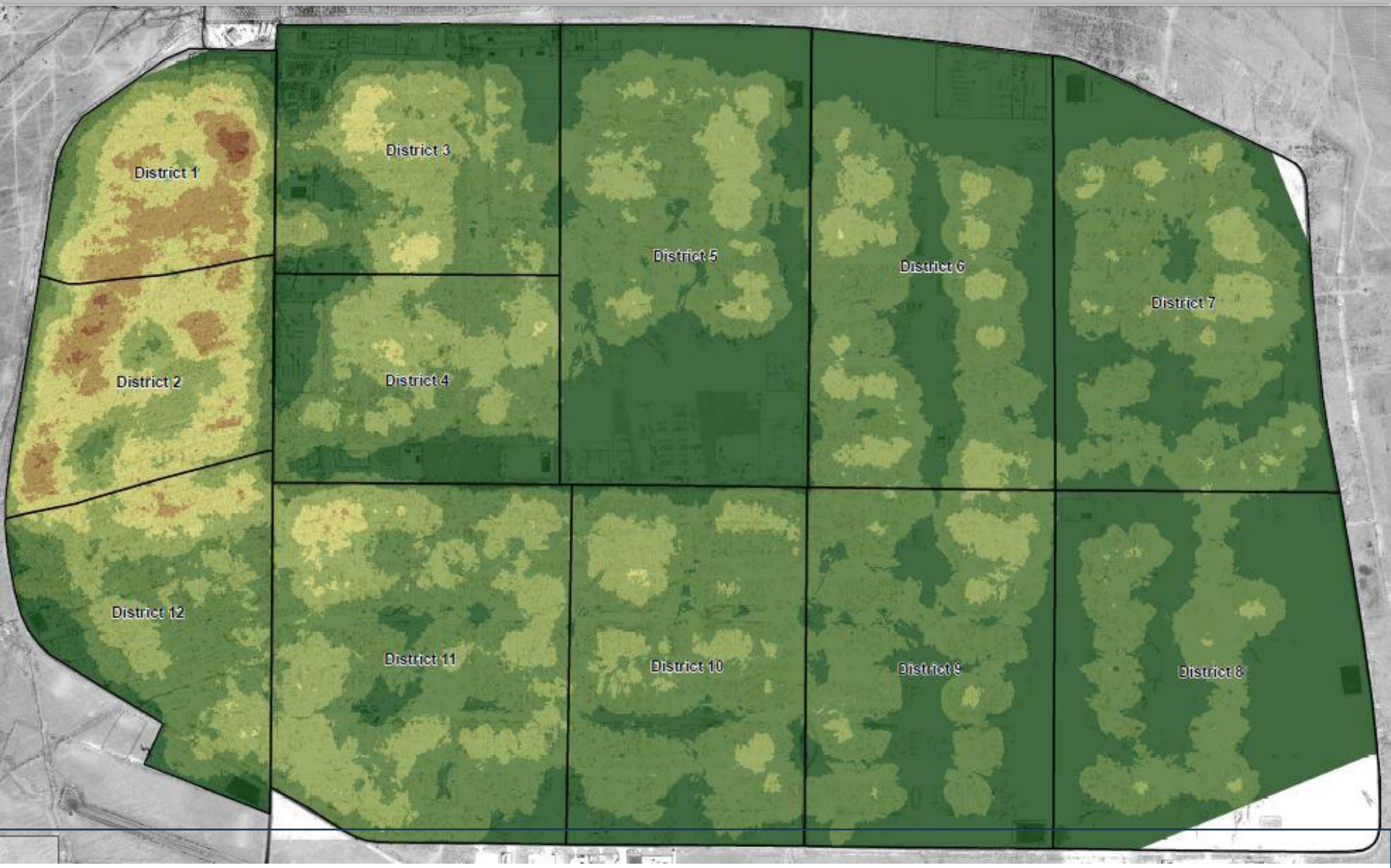
Current Zaatari Water System

Camp Demographics

Al Zaatari Camp Sweep Report: A shelter and NFIs assessment for winterization programming (REACH, UNHCR, Nov. 2013)

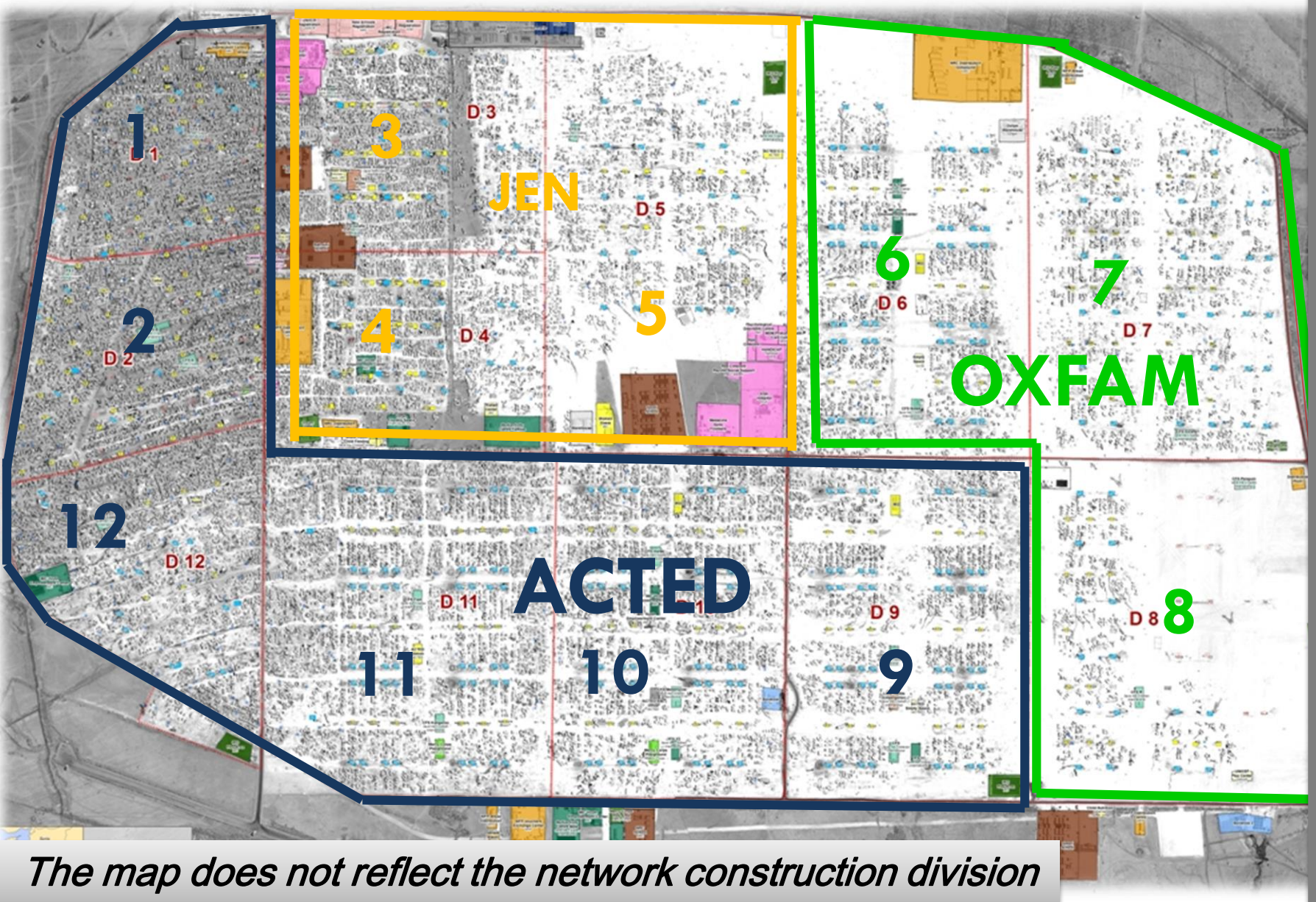
- Average family size – 4.6
- Average household size – 5.57 people
- Average families per HH – 1.21
- 7,822 tents and 15,532 caravans (portable prefabricated units)

Camp Demographics – Al Zaatari Camp Sweep Report: A shelter and NFIs assessment for winterization programming (REACH, UNHCR, Feb 2014)



Population Density – Districts 1, 2 and 12 < 30 -45 m^2 per person (UNHCR min)

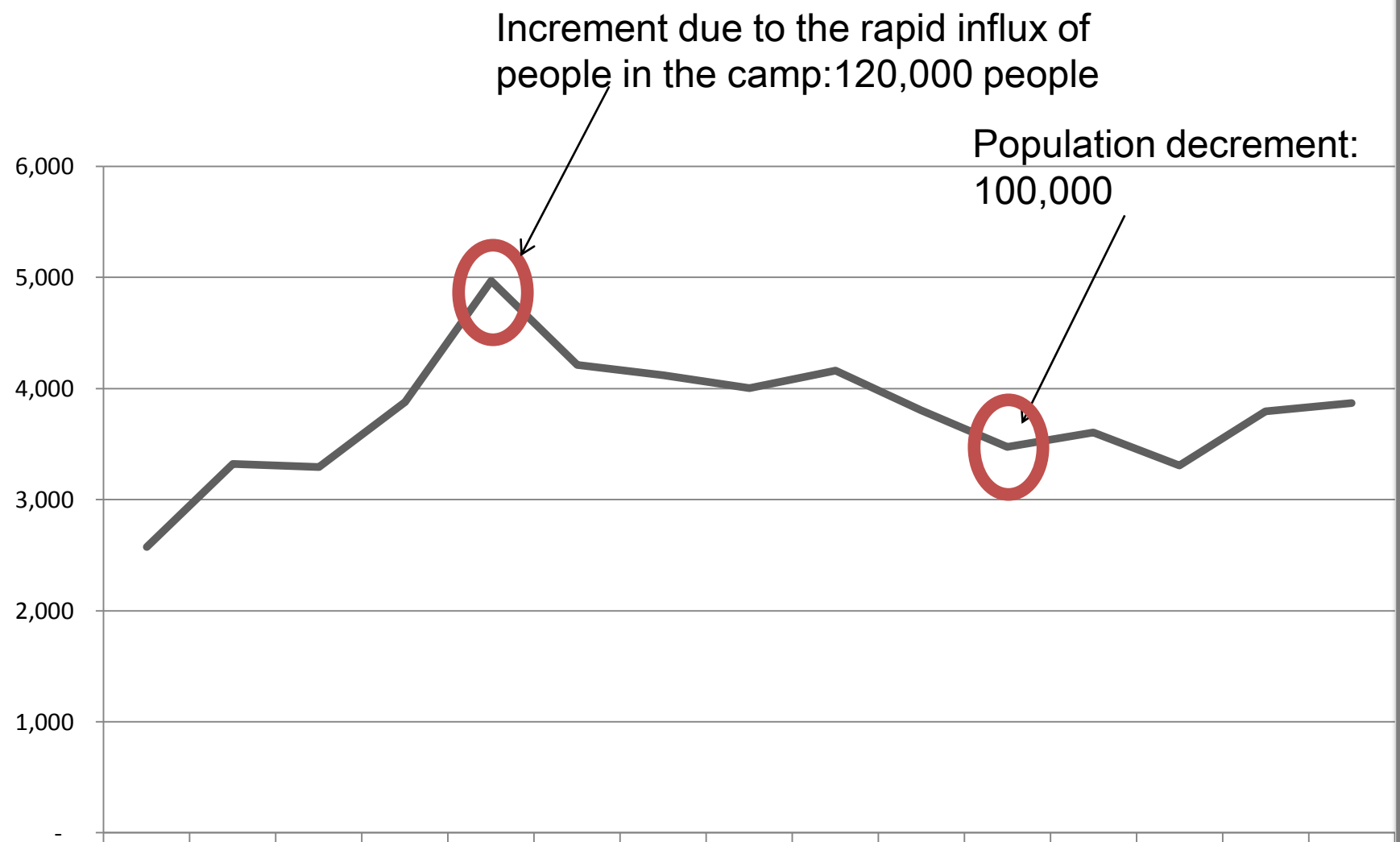
MAIN District division in the camp for community mobilization and HP activities



The map does not reflect the network construction division

Current Zaatari Water System

Daily m3 water supply Feb 2013 to Apr 2014



	13 Feb	13 Mar	13 Apr	13 May	13 Jun	13 Jul	13 Aug	13 Sep	13 Oct	13 Nov	13 Dec	14 Jan	14 Feb	14 Mar	14 Apr
daily m3	2,574	3,323	3,292	3,878	4,972	4,214	4,120	4,006	4,163	3,805	3,477	3,607	3,308	3,793	3,871

Current Zaatari Water System

Current Zaatari Water System

Current water supply system

Trucking

ACTED for the entire camp

90 trucks

270 trips per day

Challenges

Fuel increment

Tanker strikes

Safety (private tank)

Complex water quality monitoring

Water continuity (road blockages or demonstration)

High operational cost

Inequity

Sustainability is a challenge

Social cohesion with HC

Potential

Lower cost in O&M

Safety problem reduction

Reduction in current cost

potential to better meet preferences by population

Lower risk for water quality

Downside

Capital investment

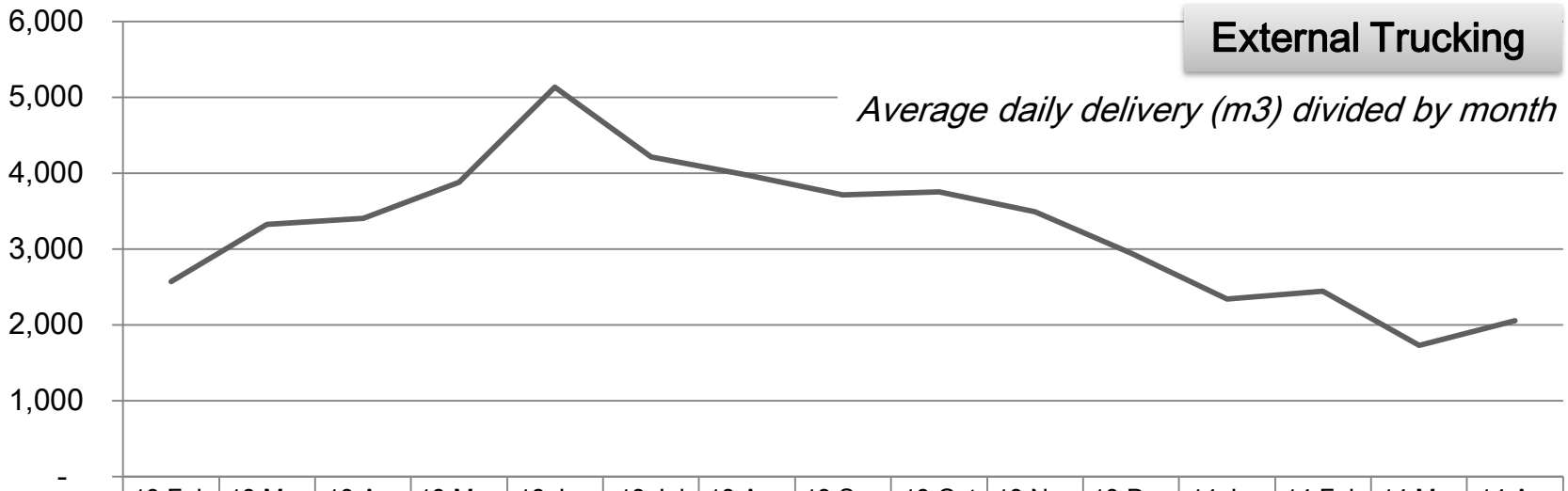
Complexity in the implementation phase

Water network

Current Zaatari Water System

External Trucking

Average daily delivery (m3) divided by month

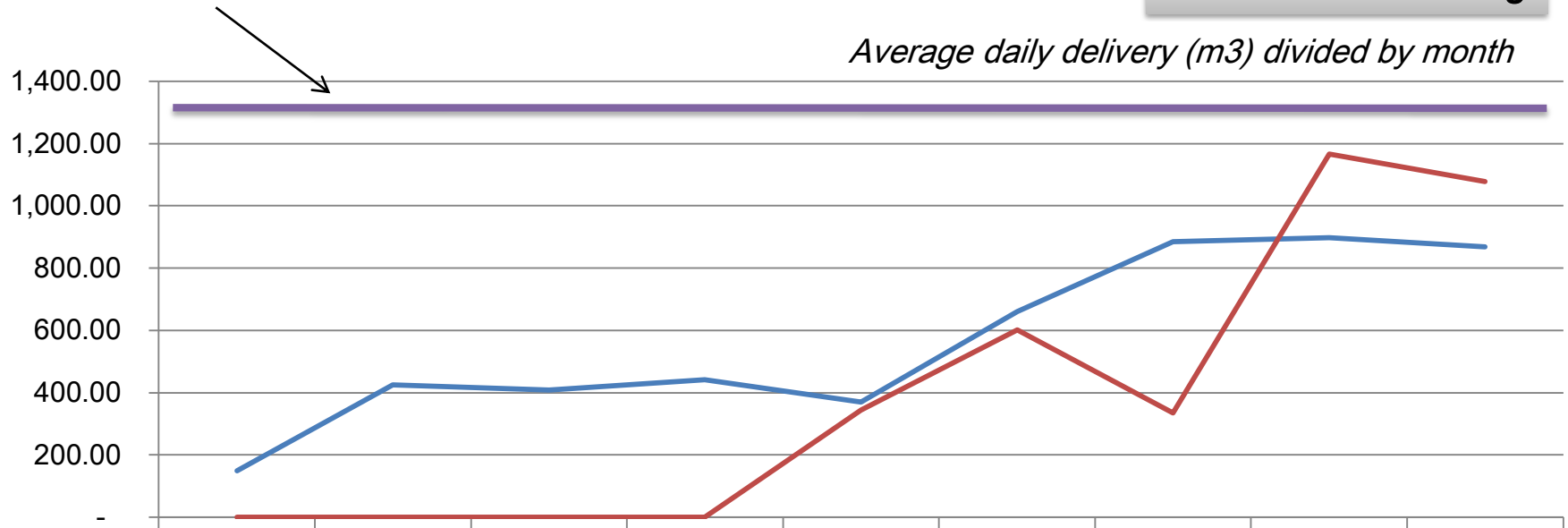


	13 Feb	13 Mar	13 Apr	13 May	13 Jun	13 Jul	13 Aug	13 Sep	13 Oct	13 Nov	13 Dec	14 Jan	14 Feb	14 Mar	14 Apr
External Trucking	2,574	3,323	3,401	3,878	5,138	4,214	3,972	3,714	3,755	3,491	2,941	2,344	2,443	1,728	2,053

Daily production expected from internal BHs: 1320 m3/day each

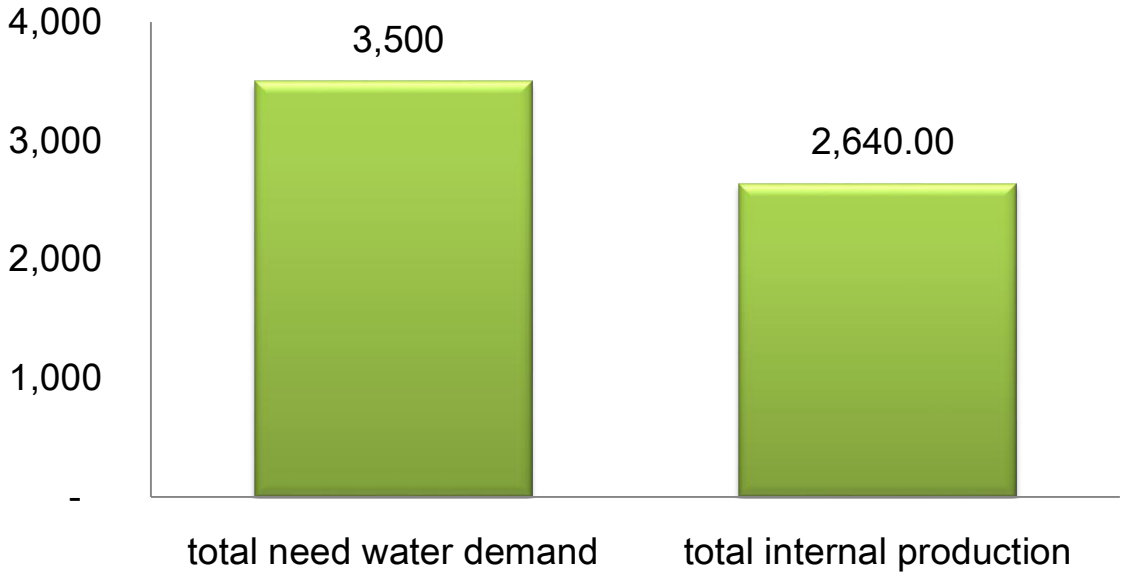
BH 1 – BH2 Trucking

Average daily delivery (m3) divided by month

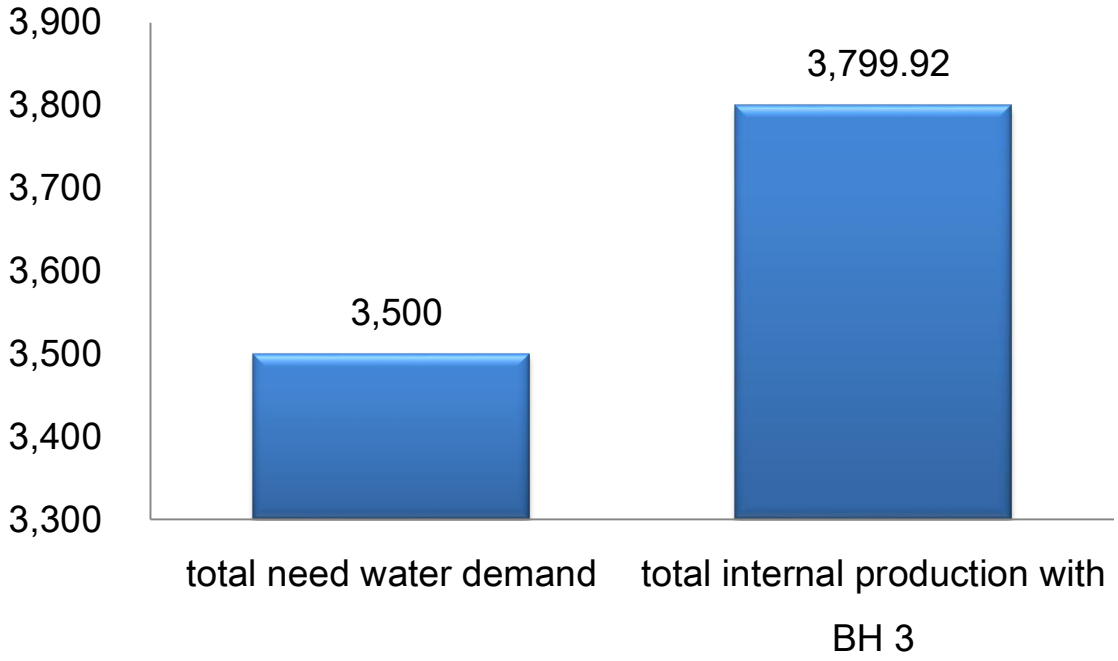


	13 Aug	13 Sep	13 Oct	13 Nov	13 Dec	14 Jan	14 Feb	14 Mar	14 Apr
BH 1	148.65	425.40	408.00	440.83	369.23	661.00	884.46	897.35	868.30
BH 2	-	-	-	-	343.53	602.10	334.18	1,166.94	1,078.47

INTERNAL BOREHOLES PRODUCTION VS CAMP DEMAND



Up to 75% of the water camp demand could be cover



100% of the water camp demand could be cover

Current Zaatari Water System

Saving: unit cost of external trucking – unit cost internal trucking x m3

Monthly indicative saving with internal boreholes - **ACTUAL**

BH 1 + BH 2 m3/month	Unit cost USD	INT USD	Ext. Truck. m3	Unit cost USD	EXT USD	TOT USD	SAVING USD
79,860.00	2.12	169,303	25,140	3.53	88,744	258,047	112,603

Monthly Indicative saving with the addition of the 3rd BH - **future situation WITHOUT network**

BH 1 + BH 2 m3/month	BH 3 m3/month	Unit cost USD	INT USD	Ex Tr.	Unit cost USD	TOT USD	SAVING USD
79,860.00	39,600.00	2.12	253,255	-	3.53	253,255	168,439

Monthly indicative saving with the addition of the 3rd BH - **future situation WITH network**

BH 1 + BH 2 + BH 3 m3/month	Unit cost USD	INT USD	Ex Tr.	Unit cost USD	TOT USD	SAVING USD
114,947.58	-	-	-	-	-	253,255

MONTHLY SAVING USD	MONTHS	YEARLY SAVING USD
253,255	12	3,039,062

Current Zaatari Water System

Monthly - Boreholes Operation Cost

Item No.	Item description	Man/Day	Sites	Private Contractor			
				Unit Price Man / Day (JOD)	Total AMT Man / Day (JOD)	Total AMT / Month (JOD)	Remarks
1	Operator	3	2	21.00	126.0	3,780	The daily rate is calculated based on daily visits per month
2	Guard	3	2	12.50	75.0	2,250	
3	Technician	1	2	31.25	31.3	250	The daily rate is calculated based on 8 visits per month
4	Engineer	1	2	25.00	25.0	150	The daily rate is calculated based on 6 visits per month
Sub-Total		8			257.25	6,430.00	
Item No.	Item description	Man/Day				Total AMT / Month (JOD)	
2	Transportation	1				1,333.00	
3	Spare parts Supplies	1				N/A	
4	Supplies (Chlorine, chlorine tester/turbidity meter)	1				500.00	
5	Reporting	1				500.00	
6	Management	1				2,348.00	
Total Monthly in JD						**11,111.00**	

Current Zaatari Water System

Main challenges encountered during the water trucking period

- ✓Major challenge for water access is equitable distribution
- ✓Lack of law enforcement in the camp
- ✓Monitoring and security
- ✓Water usage at the tap level
- ✓Increasing private water storage capacity:
- ✓Camp population figures
- ✓Poor condition of roads in specific times of the year

Assessment of Water Storage and Distribution in the Camp

- May not be enough capacity in public points alone to supply the daily needs of some districts (ACTED Water Storage Report, March 2014)
- Water tanks from public collection points have been relocated and controlled by individuals
- Current policy is the Sector does not fill private tanks. But forced to due to blocking of access to public facilities and threats to drivers
- 60 - 80% of households have private water tanks
- Will impact water supply network project as it'll impact on community expectation of supply
- Vandalised locks and most of the public facilities became private

Population	No. Tanks			Total installed capacity m/cub			Water distributed m3
	Private	Public	Total	Private	Public	Total	
100002	2723	1668	4391	2776.2	3665	6441.2	3500.07

Current Zaatari Water System

Assessment of Water Storage and Distribution in the Camp (Feb 14)

- Household hose connections running from public water points to private storage

- Current consideration of challenges and solutions:

  - To ensure public tanks are filled before private tanks - assign specific water trucks to particular Districts or parts of Districts with focal points to guide and monitor based on street by street population
  - Specific truck routes to be determined
  - Maintain water complaint log for verification
  - Better mapping of public water tanks
  - Distribute private tanks, remove public tanks and issue vouchers/coupons
  - Street leaders can influence distribution, trucks can still be hijacked
  - No information exists on private tankers entering the camp – permission, source of water, or quality
  - Colleagues have relayed community experience of health complaints associated with private water tankers

Communal water distribution point

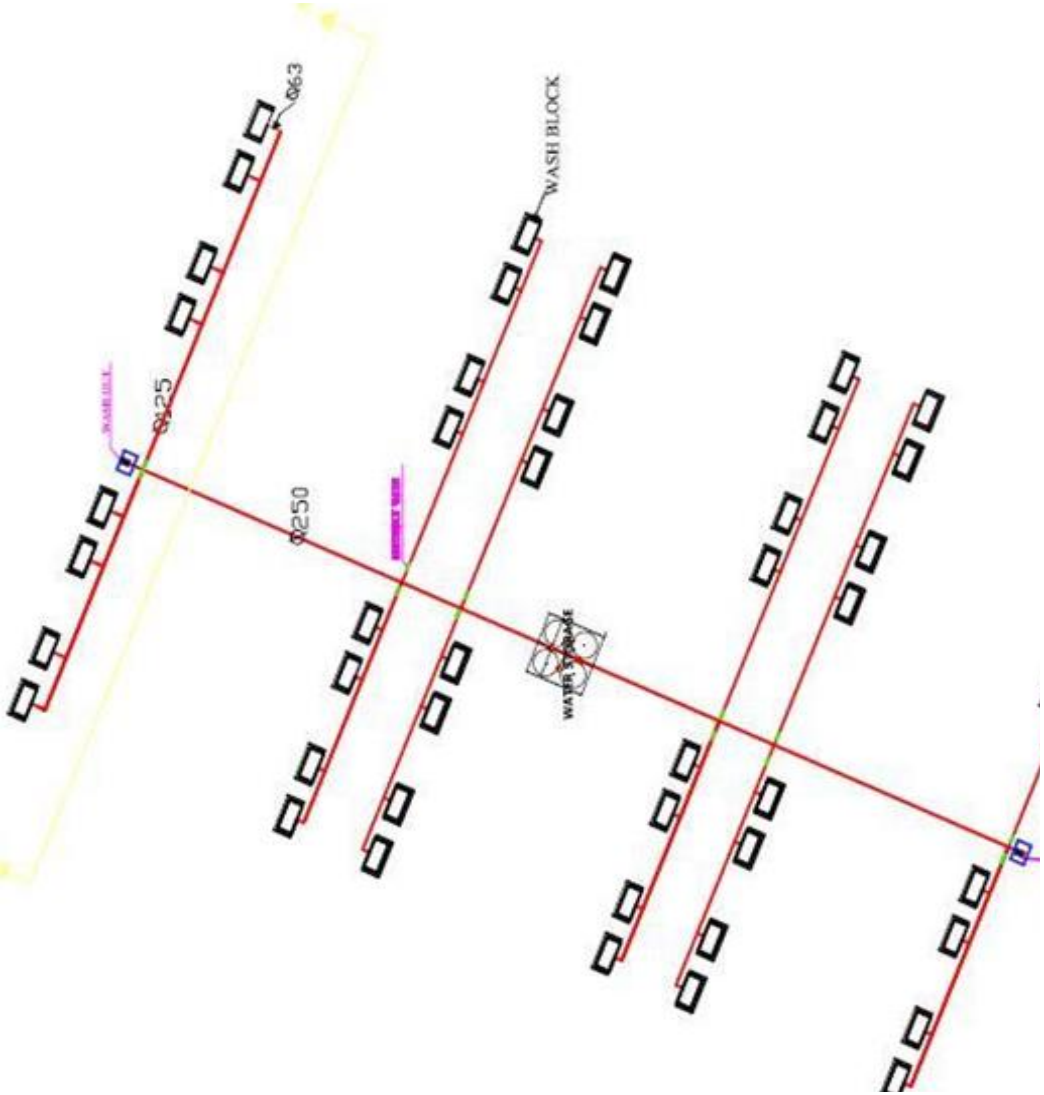
Private water connections from communal storage tanks

Current Zaatari Water System

Current Zaatari Water System

Water delivery at household (private) level from trucks meant to be for communal distribution

Existing District 6 Water Network



Delivery of water at communal WASH Blocks level only

- $ 120,000 1,5 months
- Storage 380 m³
- 1 year Operation
- Open branch network

- Equitable distribution to all 48 WASH blocks
- Improvement of quantity control
- Improvement of quality control

- Water quality monitoring: regularly for every truck in the camp – regularly at tank level and spot check at wash block level

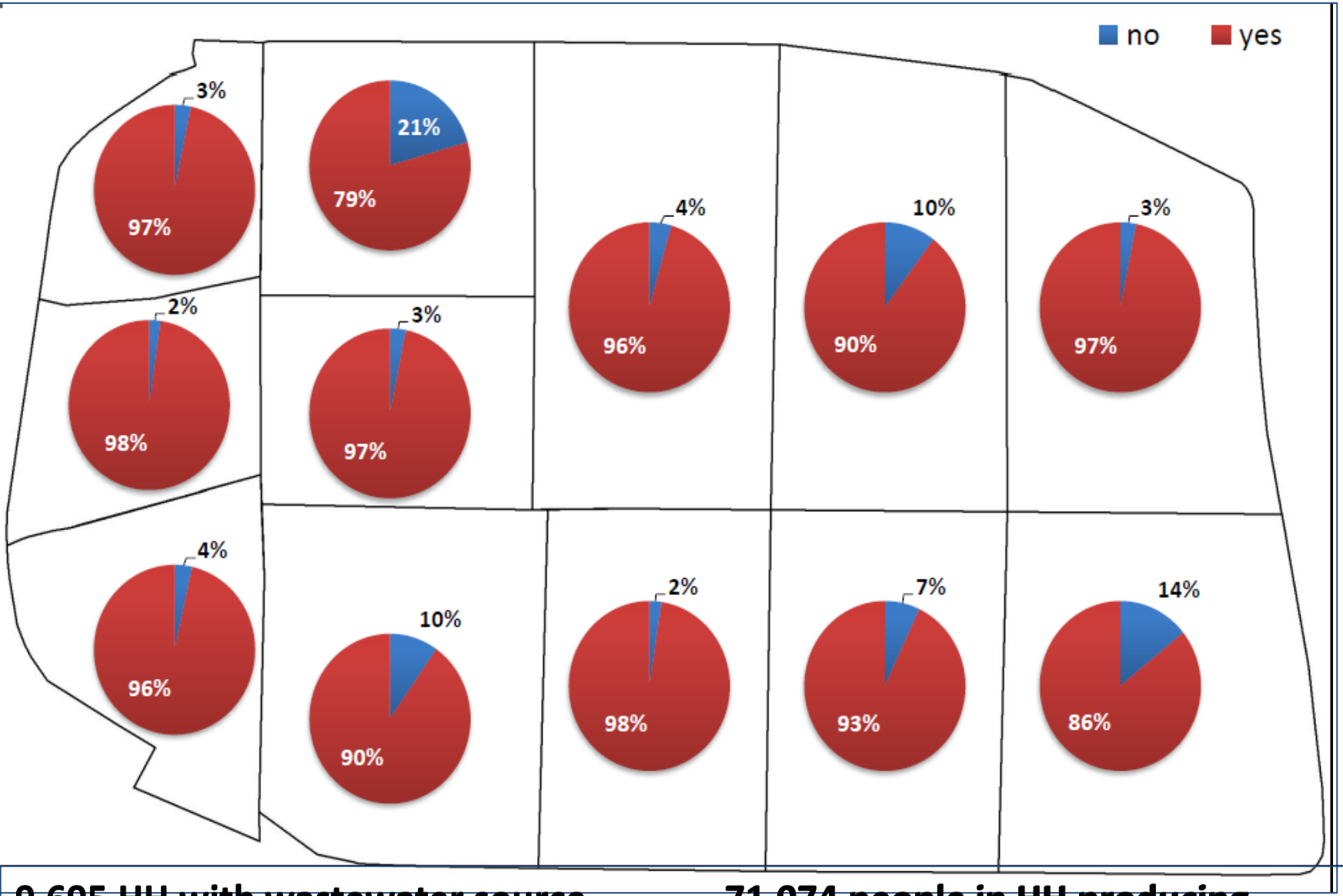
Current Zaatari Water System

Lessons Learnt from District 6

Challenges	Mitigation
Not proper Site planning Increase of new Arrivals in D6	Coordinated planning for settlement of Beneficiaries in the camp
Illegal connections (tapping in the network illegally drive to failure of the system). More than 50 , including local pump (20) → Inequity distribution / Negative pressure	Strong Community Mobilisation
Revision of the Water network	Loop System / tank elevation

Lessons Learnt from District 6

Household WASH Facilities
(REACH UNICEF, Wastewater Assessment, Dec. 2013)



9,695 HH with wastewater source

71,074 people in HH producing wastewater

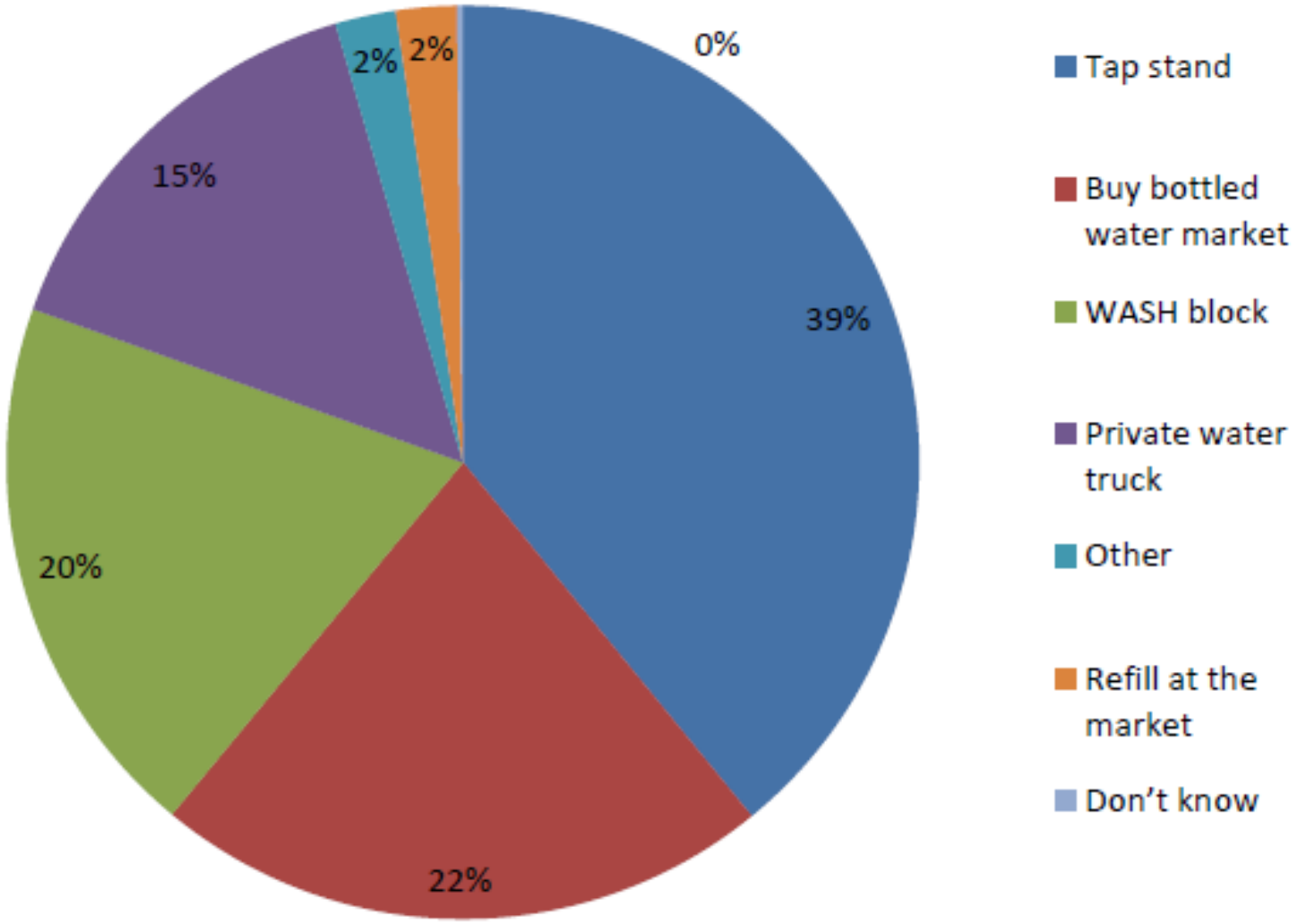
Current Zaatari Water System

Current Zaatari Water System

Household WASH Facilities (REACH UNICEF, Wastewater Assessment, Dec. 2013)

Challenges	Impact / Recommendation
The refugees generally do not like the communal WASH facilities – want to wash/bathe inside their tents. Resulting in HH water storage.	Smaller WASH units much closer to tents/caravans. Water distribution plan being developed for equity of distribution. Planning for HH WASH facility design.
The WASH facilities in Zaatari have suffered a lot from theft and vandalism.	WASH Committees established and working. Moving towards household WASH facilities design.
Establishment of household storage by refugees by stealing storage tanks at communal WASH blocks.	Zaatari water network group is struggling to prevent 'ad hoc' to existing network in District 6 or connect hoses to public tanks

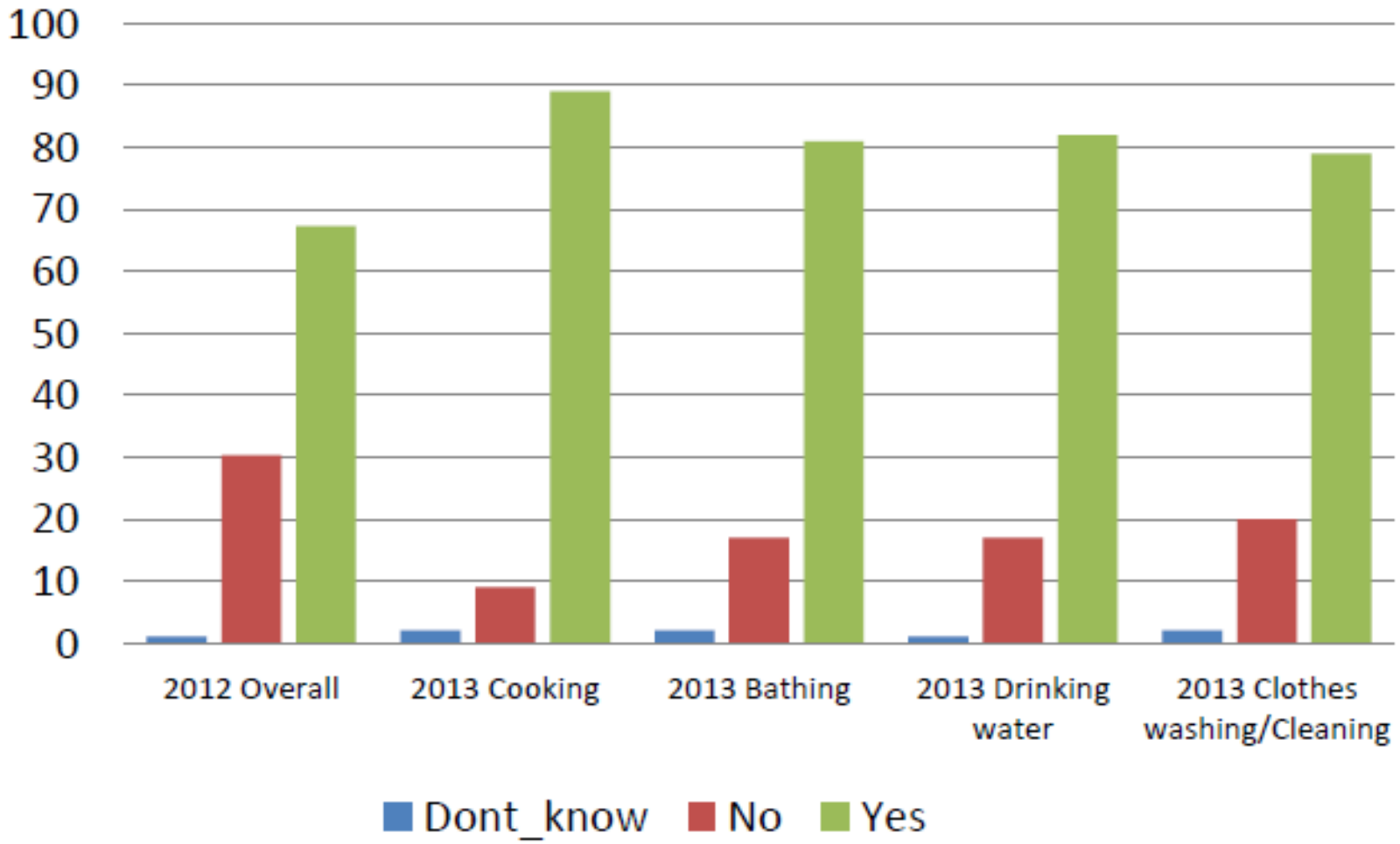
WASH Sector Knowledge, Attitudes and Practices Survey in Zaatari Camp (UNICEF, ACTED, JEN, OXFAM, Nov. 2013)



Where do people get their drinking water?

Current Zaatari Water System

WASH Sector Knowledge, Attitudes and Practices Survey in Zaatari Camp (UNICEF, ACTED, JEN, OXFAM, Nov. 2013)

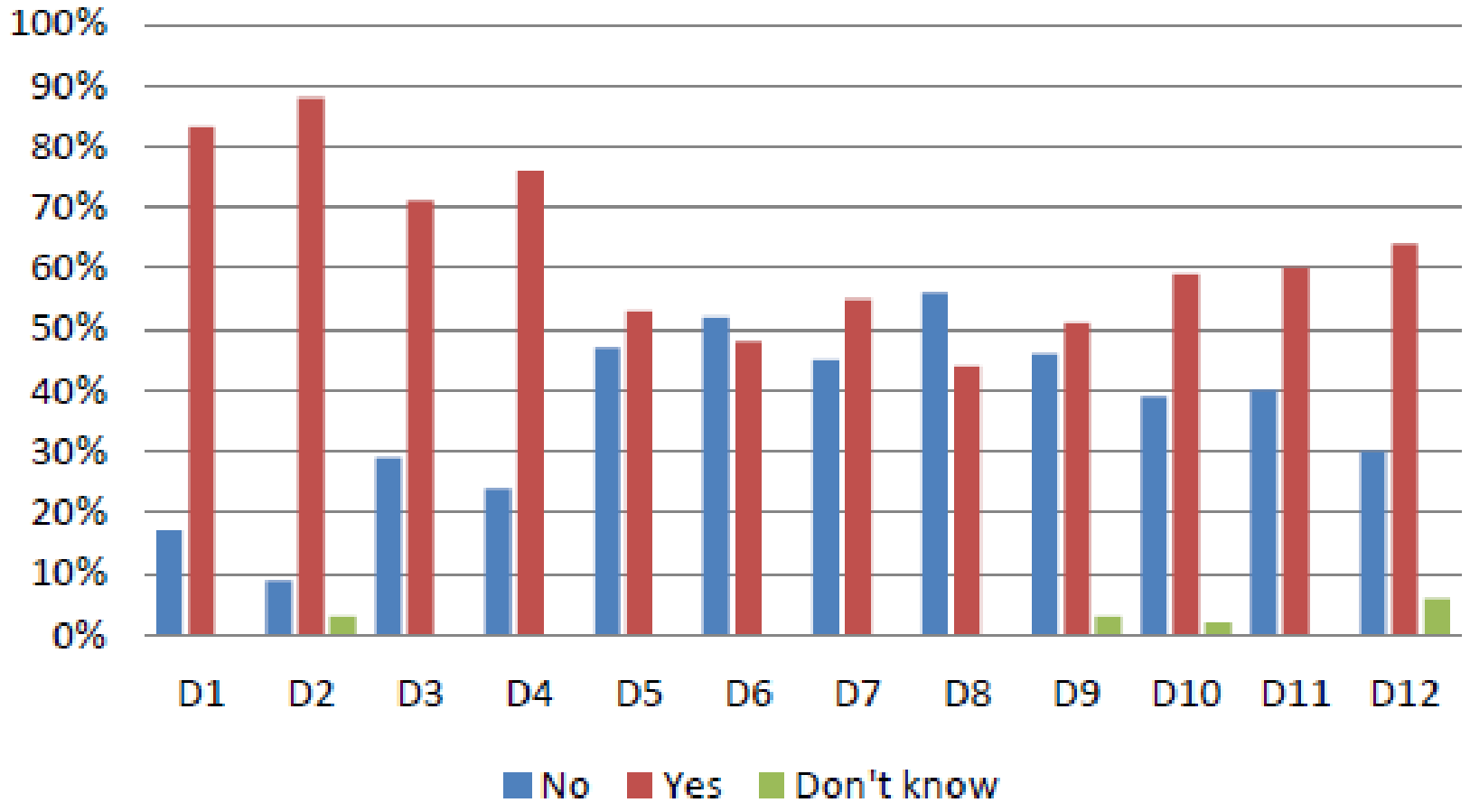


Do people have access to enough water?

WASH Sector Knowledge, Attitudes and Practices Survey in Zaatari Camp (UNICEF, ACTED, JEN, OXFAM, Nov. 2013)

- Summary of respondent responses:
  - 50% collect water in the morning
  - 84% wait less than 15 minutes daily
  - Most people use jerry cans and buckets for collection and storage
  - Household container capacity not sufficient storage for their daily water needs and private tanks are preferred storage.
  - 76% satisfaction with the water quality, those unsatisfied mainly due to taste
  - About 6% believe people got sick from drinking bad quality water
  - Water diarrhea was experienced in last two weeks by member of household in 24% of responses
  - 14% of respondents believe water quality or cold water are the causes of illness in the camp

WASH Sector Knowledge, Attitudes and Practices Survey in Zaatari Camp (UNICEF, ACTED, JEN, OXFAM, Nov. 2013)



People having shower/bathing area inside their shelter

WASH Sector Knowledge, Attitudes and Practices Survey in Zaatari Camp (UNICEF, ACTED, JEN, OXFAM, Nov. 2013)

- ✓ About 70% indicate satisfaction with frequency of bathing
- ✓ Most satisfied with using communal facilities during the day
- ✓ Those not satisfied indicate water too cold, too far to walk, not enough water, lack of privacy, broken facilities and facilities not safe
  - Most concern is safety for children especially girls aged 11 – 18 yrs.
  - Main contributing factors for private facilities
- ✓ Survey sample/respondents information:
  - 978 households or 7% across Districts and camp sampled
  - Mostly women (64%) during the day and women head of households
  - Most living in the camp for 7 months

WASH Minimum standards in Zaatari camp

Overview:

- **May 2013.** Early drafting of standards and indicators.

- **October 2013-March 2014**. Update and restructuring of the document.
    - **Why?** Provide standards and indicators for current and new WASH activities.
    - **How?** Build on lessons learned and on good practice in the camp.
    - **Who?** WASH agencies active in the camp.
    - **Endorsed by**: WASH Sector.

WASH Minimum standards in Zaatari camp

Water Quantity:

• **Standard:** Safe and equitable access to a sufficient quantity of water for drinking, cooking and personal and domestic hygiene.

• **Indicators:**
- 100% People have at least 35L/p/d of safe water available. - 80% People are aware that every individual is allotted 35L/p/d only.
- 70% of people believe they have sufficient water for their needs.

WASH Minimum standards in Zaatari camp

Water Quality:

•**Standard:** Water is odourless, colourless, no taste other than that of chlorine, and of sufficient quality to be drunk and used for cooking and personal and domestic hygiene without causing risk to health.

• **Indicators:**
- 100% of water supplied by the Sector has FRC = 1-1.8mg/l at the truck, and 0.5-1.0mg/l at the point of delivery.
- 100% of samples are free from faecal coliforms at the point of delivery and use.

The document is available at:
http://reliefweb.int/report/jordan/minimum-standards-za-atari-wash-sector

Community Mobilization

- ✓ Inter-agency KAP Survey (July/December)
- ✓ Standardized key hygiene promotion messages/activities (Child to child / painting/Drama)
- ✓ WASH committees created and trained
- ✓ WASH Facilities(307) Handover to WASH committee for effective O&M
- ✓ Referral mechanism: Global and specific (Protection / Disabled refugees)
- ✓ Consultation with community members and Street leaders in gaining community acceptance and ownership of facilities
- ✓ Survey on community perception regarding the water facilities and way forward
- ✓ Focus Group discussion for community participation in the process

Challenges

✓Initially riots/Demonstrations due to lack of information dissemination by Humanitarian actors
✓Vandalism of WASH facilities
✓Community engagement

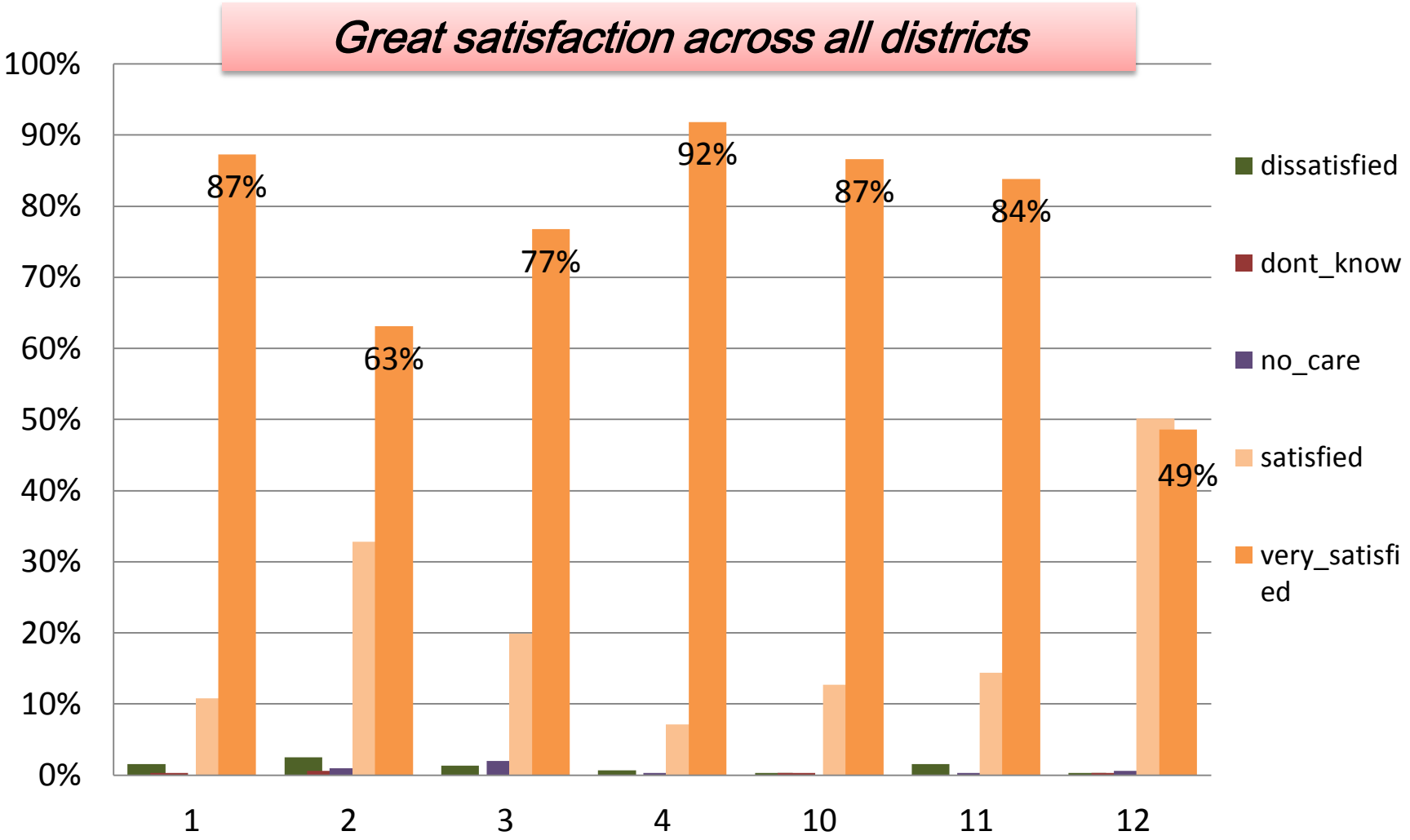
Zaatari Water Network Technical Working Group

8th May 2014

BREAK

Camp residents' opinion – November survey

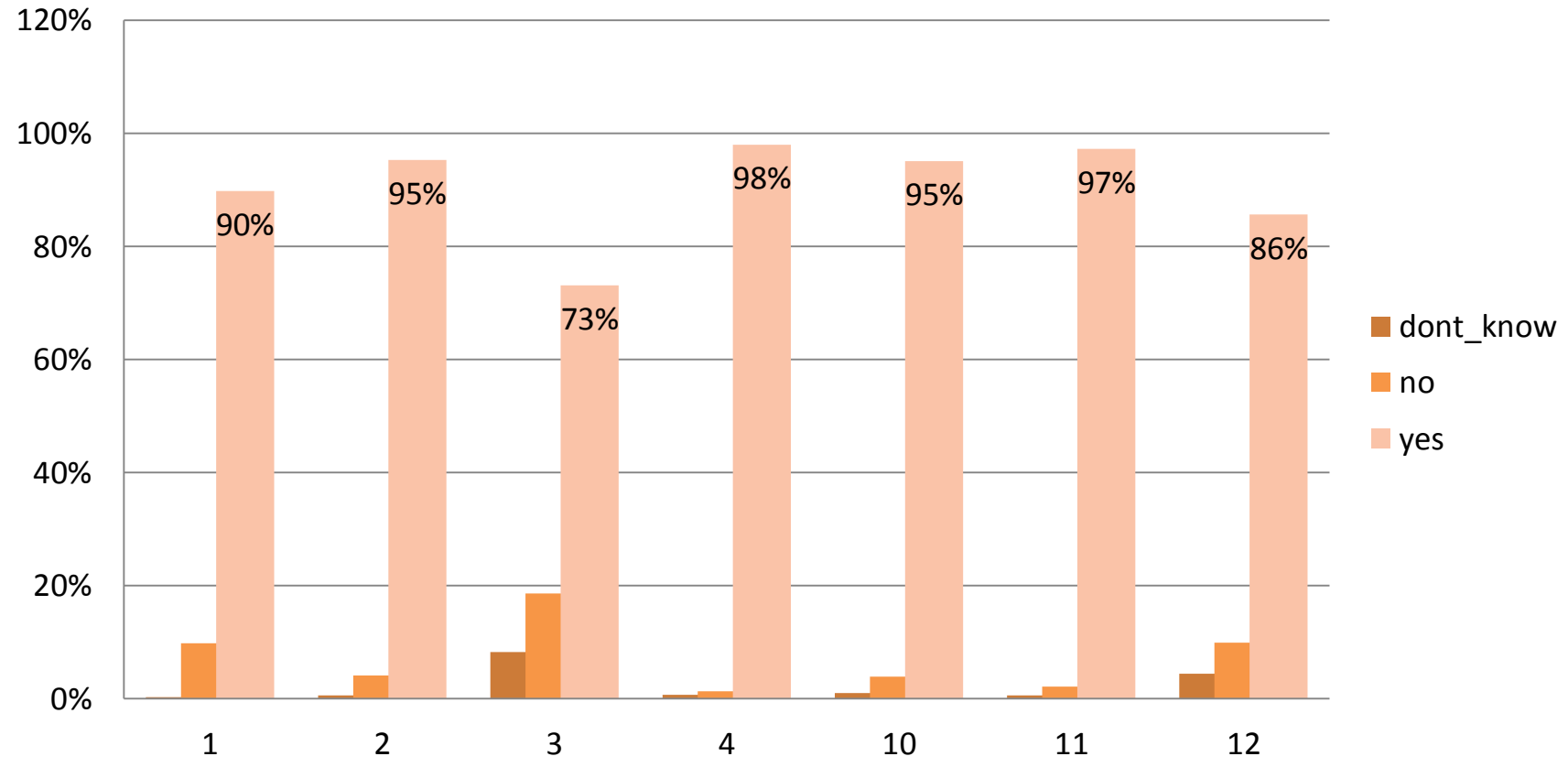
Will you be satisfy if a water network is built in this area of the camp?



Future Zaatari Water Network

Camp residents' opinion – November survey

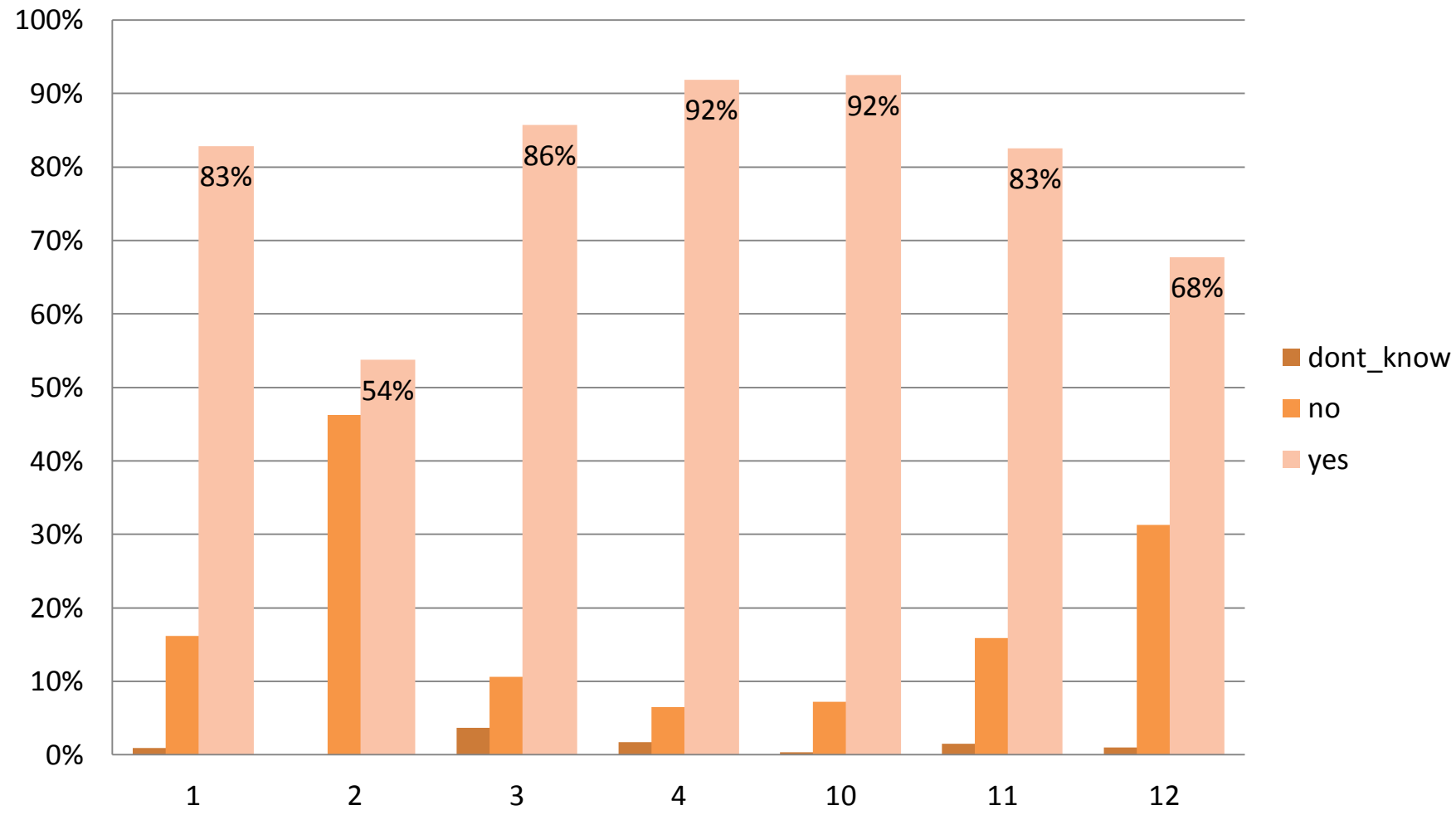
Looking at your district you have many water points. Having house connection will not be possible at this stage. The new water point will replace the old one in the same position. If people will start to connect by themselves the system will not work anymore. Will you still be satisfied to have the water pipe network?



Future Zaatari Water Network

Camp resident opinion – November survey

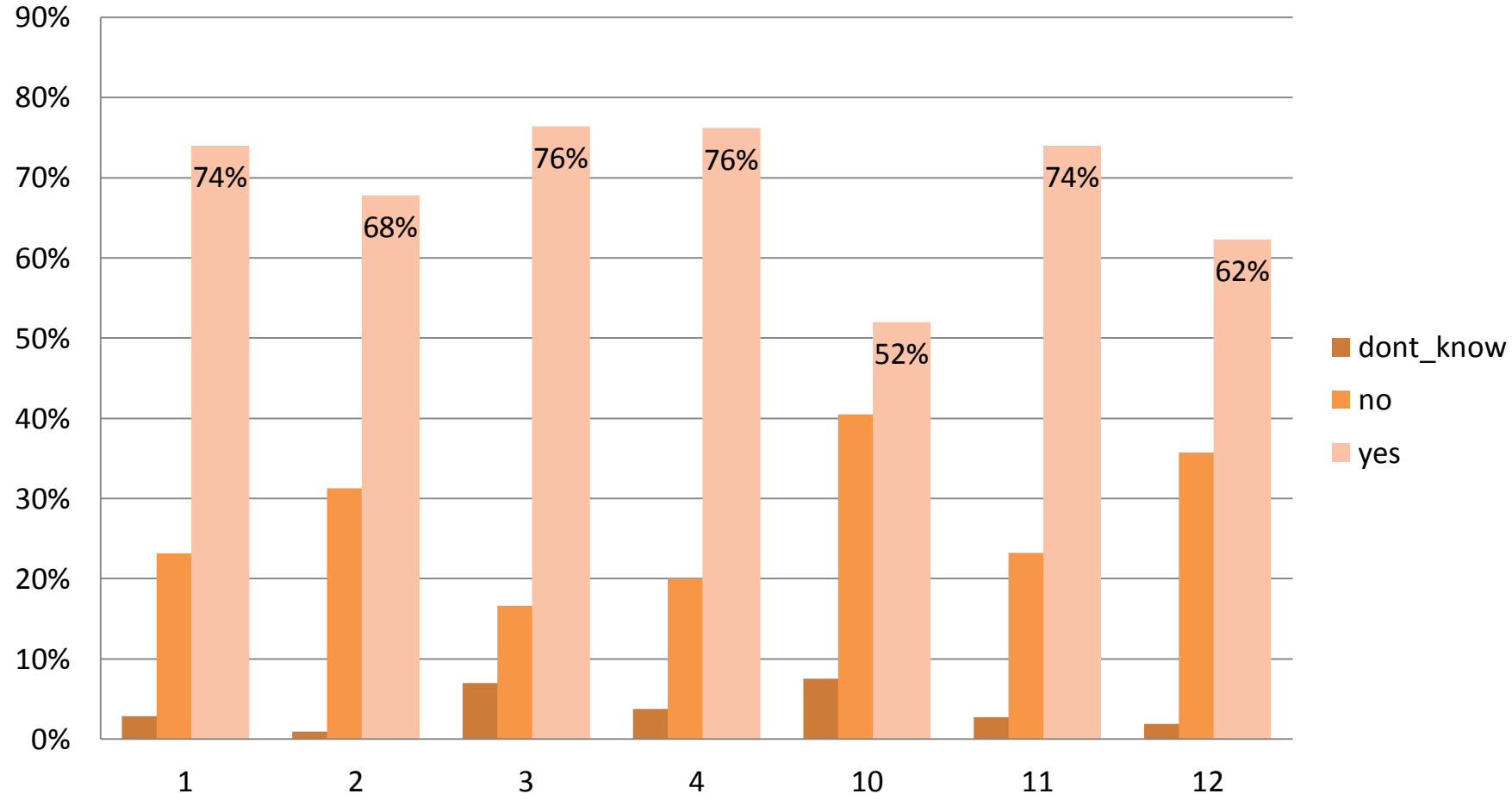
Do you think you will need to have a responsible from the street to check on the water point?



Future Zaatari Water Network

Camp resident opinion – November survey

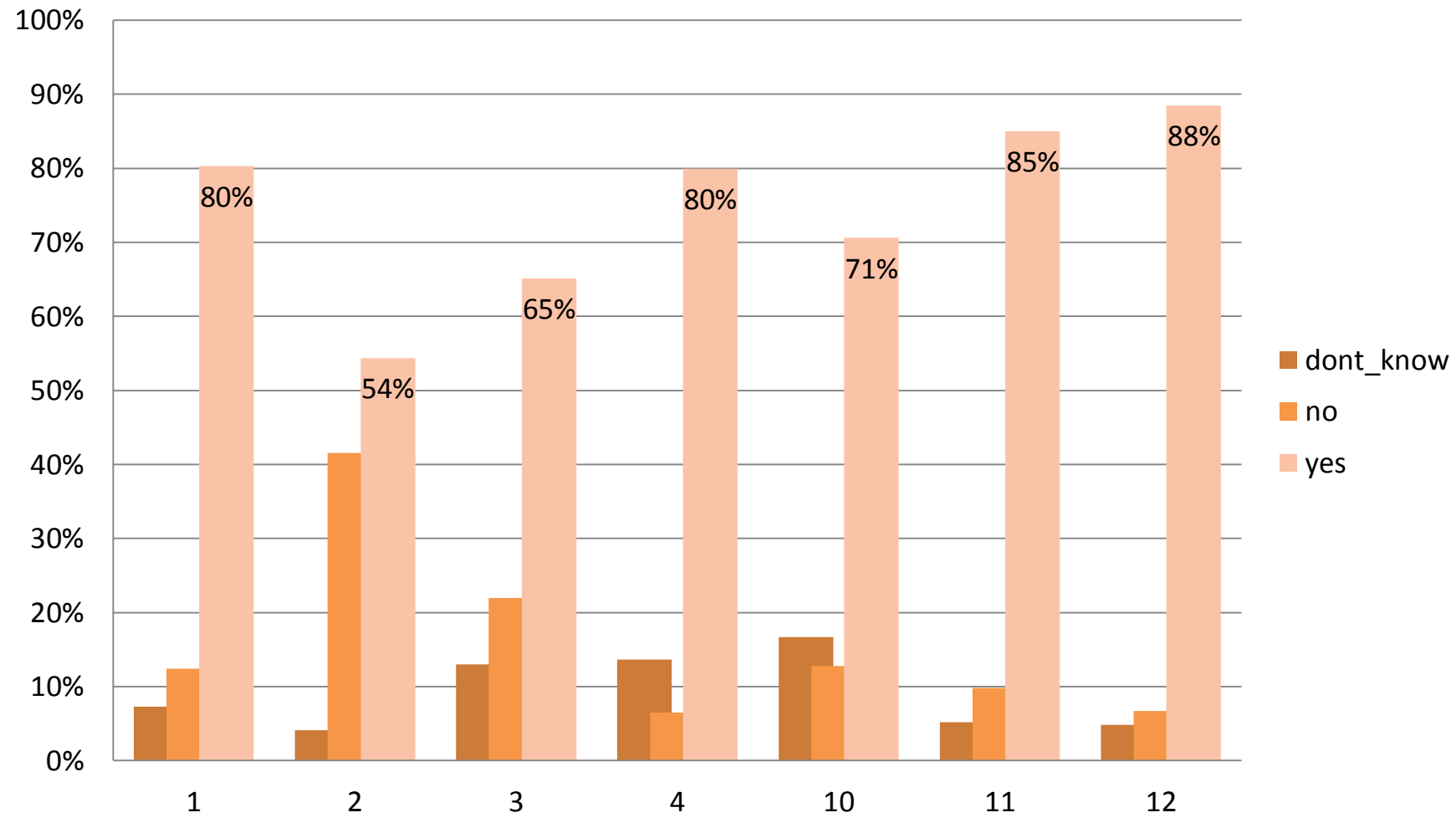
Do you think your people will vanda lise the water point and use the material for their own purpose?



Future Zaatari Water Network

Camp resident opinion – November survey

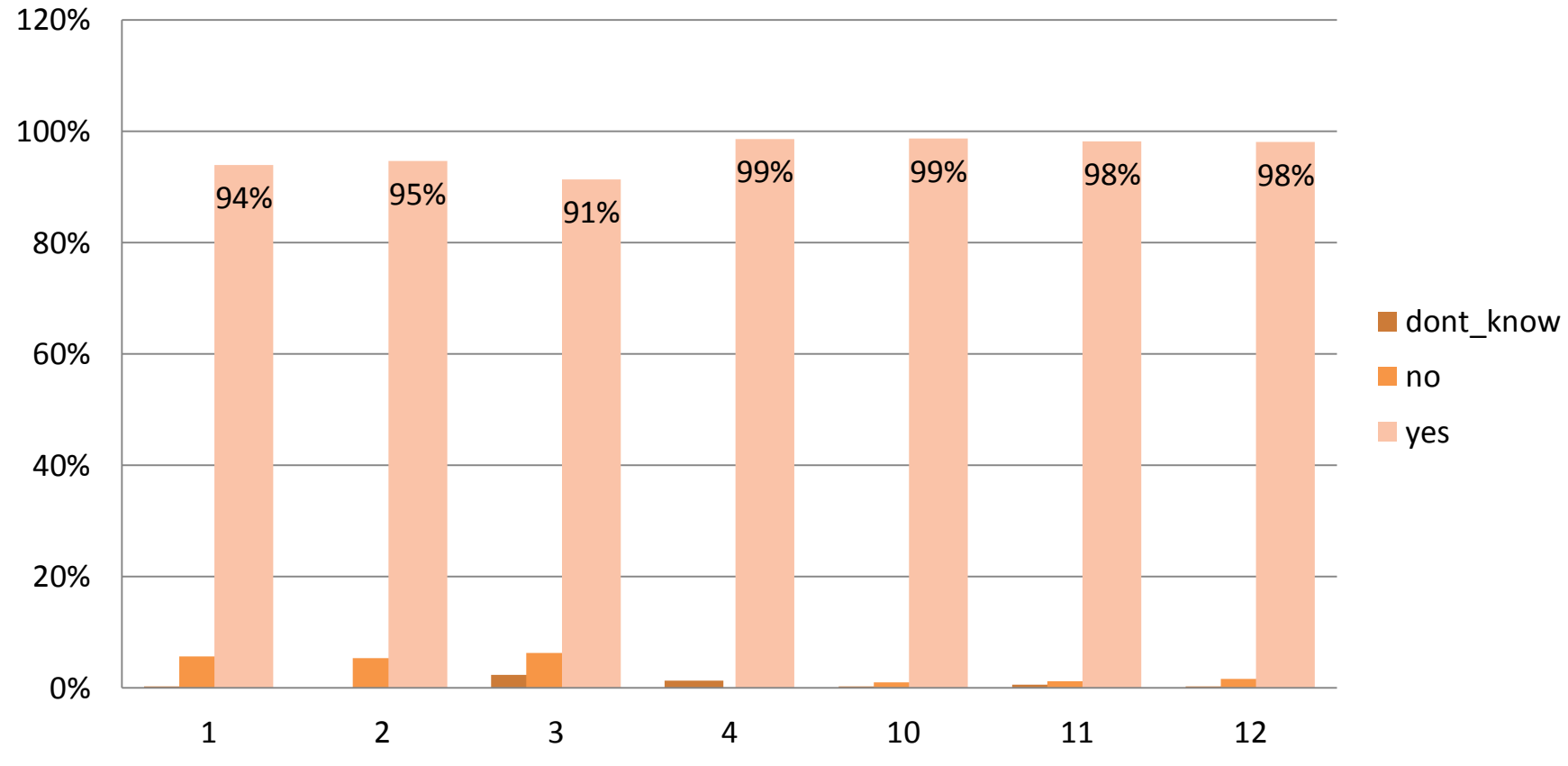
Are you going to contribute to keep the facility safe?



Future Zaatari Water Network

Camp resident opinion – November survey

Working on a Water piped network will take long time. The normal water supply in the meantime will be affected with delays and moving your normal water collection point. The construction can take 6 months; will you still be satisfied to have then the connection?



Future Zaatari Water Network

Camp resident opinion – March 2014 FGD

✓Suggestion on HH connection

Respondents say that illegal connection will happen, regardless the mitigation measures

✓Prefer to fill their private tanks by water tanks as now, instead of network

Compare to September data up to now there is an increment of private water tank of about 50%. People will not leave their private tanks and they will keep on having their own storage. Any of the option for the water network (communal, communal plus or HH) will need to take in consideration that.

✓ Suggestion: every district has its own storage reservoir

We can read this suggestion as sense of ownership. People want equitable access to water in terms of location and quantity

✓Suggest to construct main water pipe & then they will connect from it

Other clear message that the people want to have HH connection. People are willing to pay and do their own connections if not provided by the camp actors

✓Some of the FGD request the system to pump 6hr/day with two shifts 3 hrs in the morning 3 hrs in the afternoon

Understanding the rationalization of the hours for water delivery

Camp resident opinion – March 2014 FGD

In some of the FGD emerged that there is a concern that the ports might lead to tensions/fights. The concern is about the mismanagement of the rotation and so equitable access.

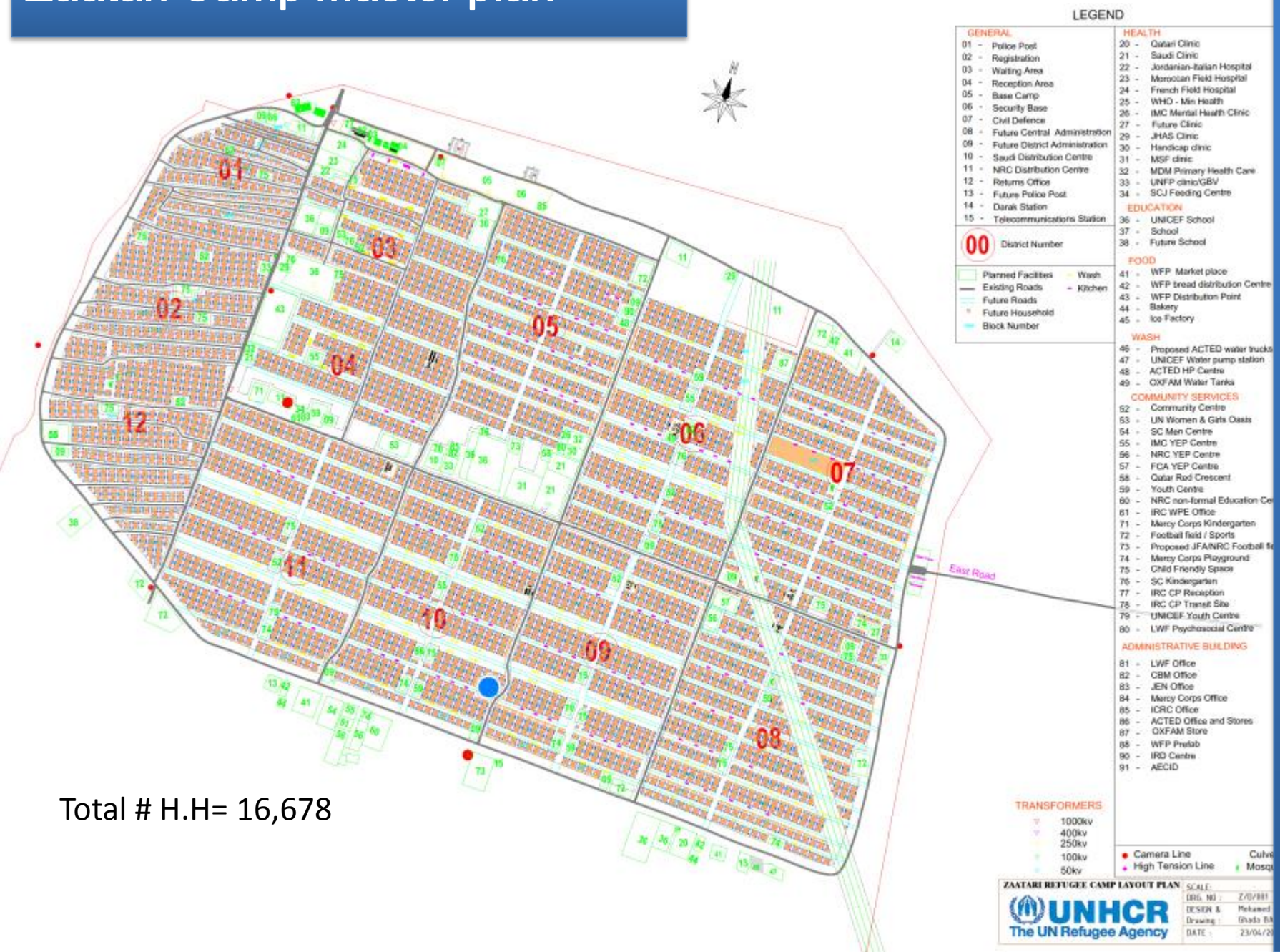
The general fear is that people will connect illegally regardless the sanction that might be applied to them.

Some respondents mentioned the possibility that people will use private pumps connected to the system

Some of the people request to have more control by the police in the camp and to start enforce regulation and sanctions.

There will be also the possibility that people will continue to buy water from private tanks (process that need regulation)

Zaatari Camp Master plan



Total # H.H= 16,678

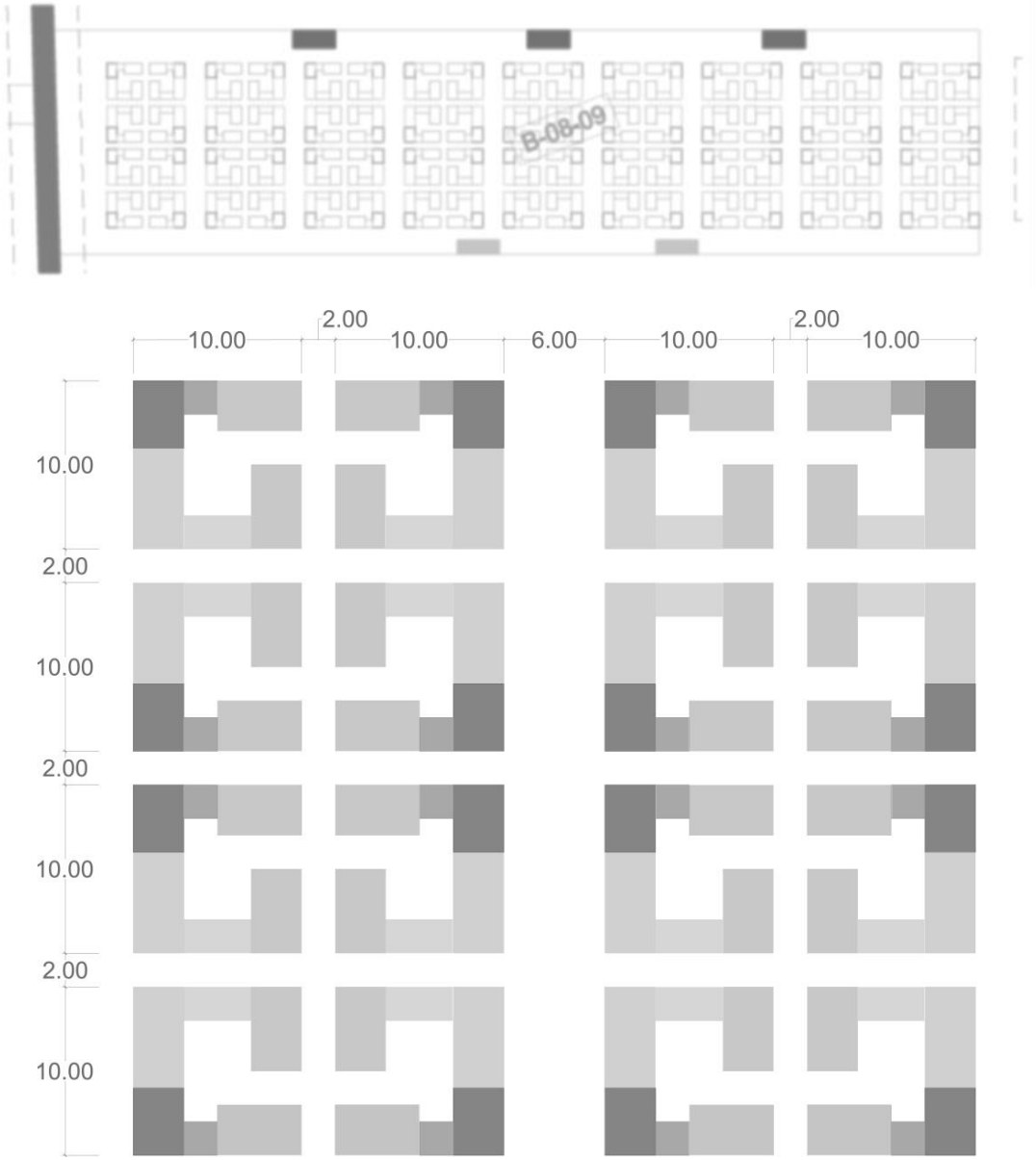
Future Zaatari Water Network

District Layout

- Every district is arranged into blocks.
- Blocks are divided by kitchen and WASH service roads.
- A 20 m vertical intermediate road is left open for access.
- Distance from household (H.H) areas to ring road is 30 m.
- Distance from H.H areas to inter district roads is 10 m.
- Distance form H.H areas to services and communal facilities is 10 m.
- Distance from H.H areas and high tension line is 15 m.
- Every H.H plot will be connected with its ration card number.

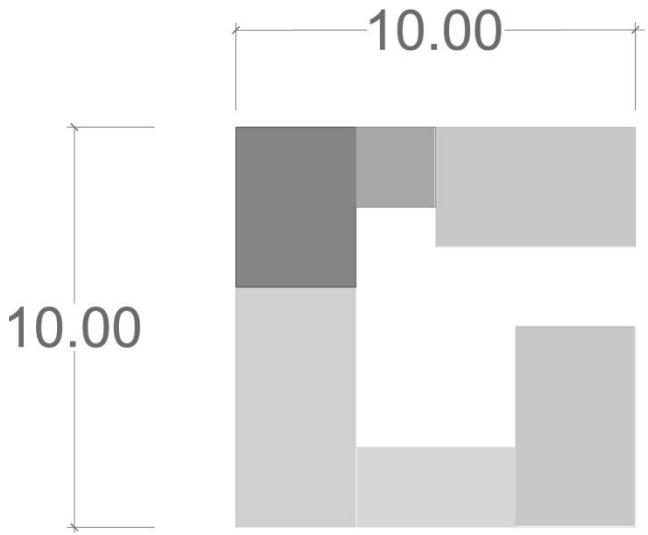
Future Zaatari Water Network

Blocks Layout



- Pathways of 6m are left between every column of households to provide access to services as well as emergency.

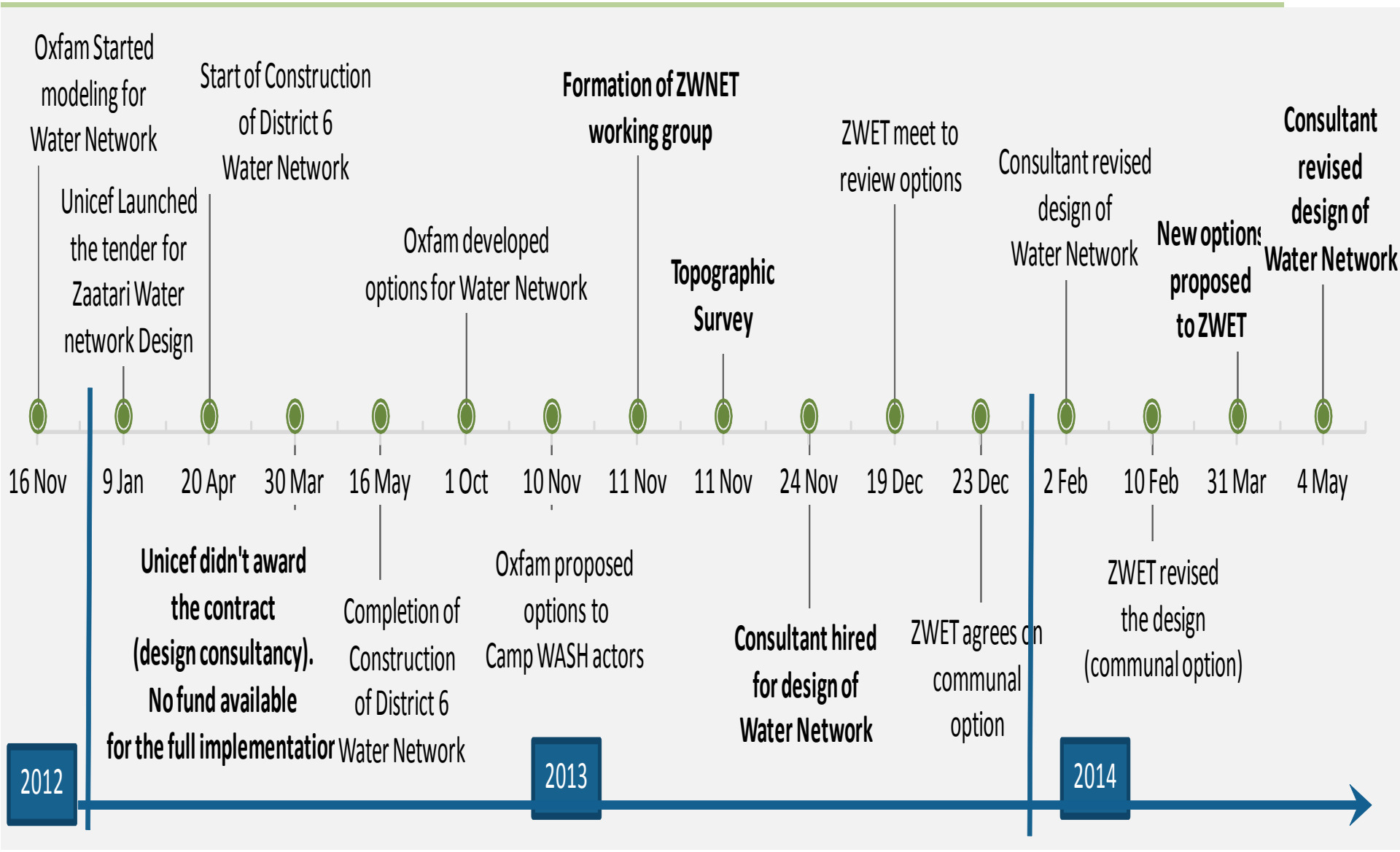
Household Plot:



- Each household will have a 10x10 plot size to fit their caravans, tents, and installations.

Future Zaatari Water Network

History for ZWNET



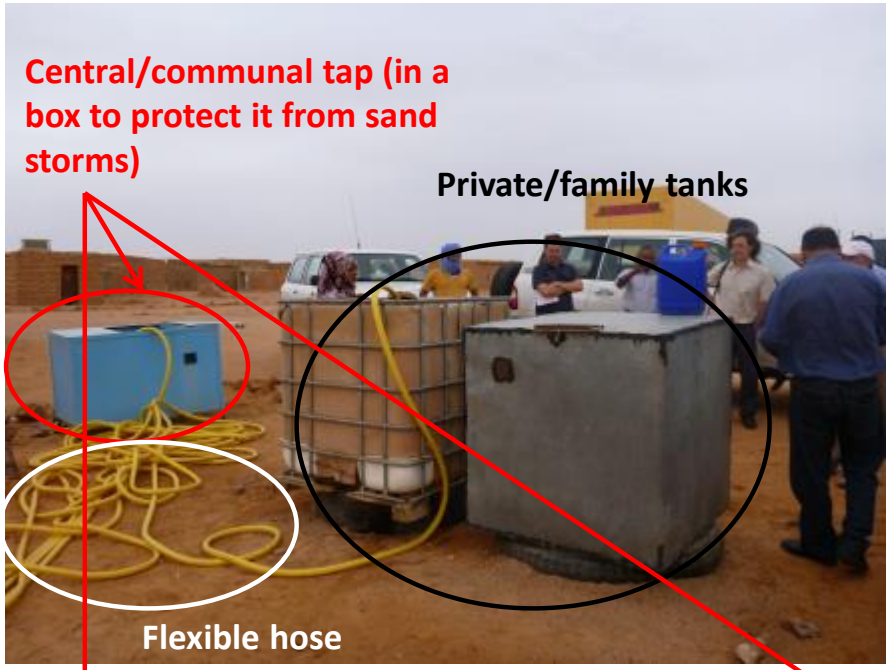
Similar experience from other countries

-The camp is located in a deserted area.
- UNHCR experience at the 27 years old camp
-No ground water source is available. Boreholes drilled to supply a central storage tanks then flow goes to Port/header units by gravity
- 20 - 25 ports scattered and each port serves 20 - 25 HH. Distance 150 meter between
- Each HH gets water through flexible hose connected to the port
- Port manager mainly female to control and monitor water distribution and rotation.

-Rationing: Water delivered ONLY during day time.

Algeria - Sahrawi refugees camp

Algeria - Sahrawi refugees camp



The right tank is being refilled (note the yellow flexible pipe)

Detail of the communal tap from inside the box

-Mix of informal and formal habitat settled 5-10 years ago
-Cholera outbreak / water scarcity crisis

Phase 1 - **Emergency WASH interventions → Water trucking.**
Temporary Drinking water storage 20 to 30 m3. Tap stands Distribution (Locally managed)

Phase 2 –**Recovery →Advocacy**
Connected the emergency water systems to the existing Water network and installed several water meters (managed by the community)

Phase3-**Phasing out** Except for hygiene promotion, breastfeeding promotion, nutrition activities
- Permanent System managed by the community.

Djibouti - Urban contest slum

Advantages

- Community-based management and decisions
- No more long walk for water collection
- Cheaper: 2 USD/m3 instead of 5 USD/m3 for Water Trucking)
- More reliable (Good quality, service 24/7)
- Contingency storage 48 hours (survival allocation 5 liters / perso

- Contextual information:
  - People allowed to work;
  - People free to move in and out of camp;
  - Part of the camp is connected to the water network and the rest is supplied with water trucking

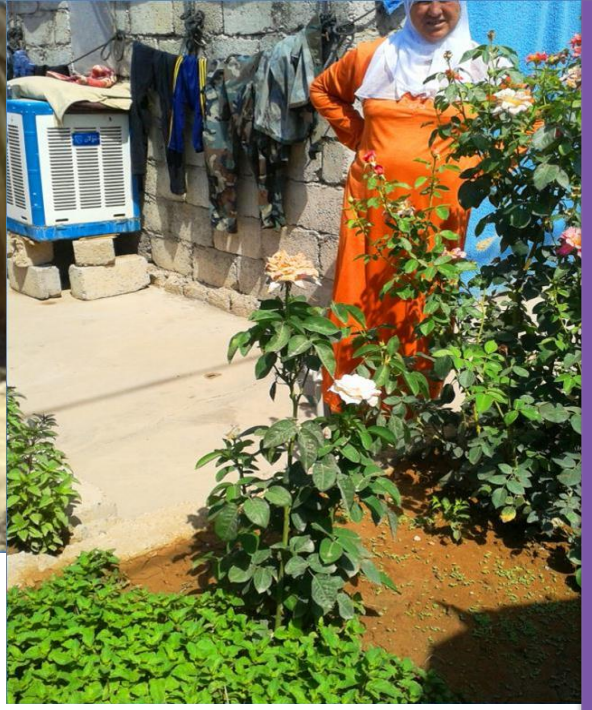
- Challenges to the water network:
  - Physical planning due to congestion;
  - No access for trucks (water, dislodging, and garbage collection);
  - Share water line with host community;
  - People movement leading to water network pressure decrease (original network overstressed);
  - Irregular connections to the mains pipelines and proliferation of domestic electrical pumps (dramatic decrease of water pressure). When there is a power cut in the camp the flow increases in the pipeline!
  - Proliferation of evaporative coolers with estimated water demand – 100 L/day

Iraq - Domiz refugees Camp

- Main challenges to the water network is refugees making ad-hoc connections with following consequences:
    - dramatic loss in pressure and quantity of water supply lower than planned;
    - access not equal in all areas;
    - Quality challenges

- Main responses to water network significantly affect O&M budgets for water supply, water quality/health monitoring and hygiene promotion/water conservation messaging:
    - Campaign against irregular connections and domestic water pumps;
    - Reparation of pipelines damaged by irregular connections;
    - Reinforcement of the pipeline (protection fittings);
    - Regular monitoring of water points, tap stands, hand washing points;
    - Detailed health indicators mapping;
    - Chlorination monitoring from source to user – regular and tracing contamination;

Iraq - Domiz refugees Camp



Ad hoc connection to network by community

Demand supply – domestic gardening

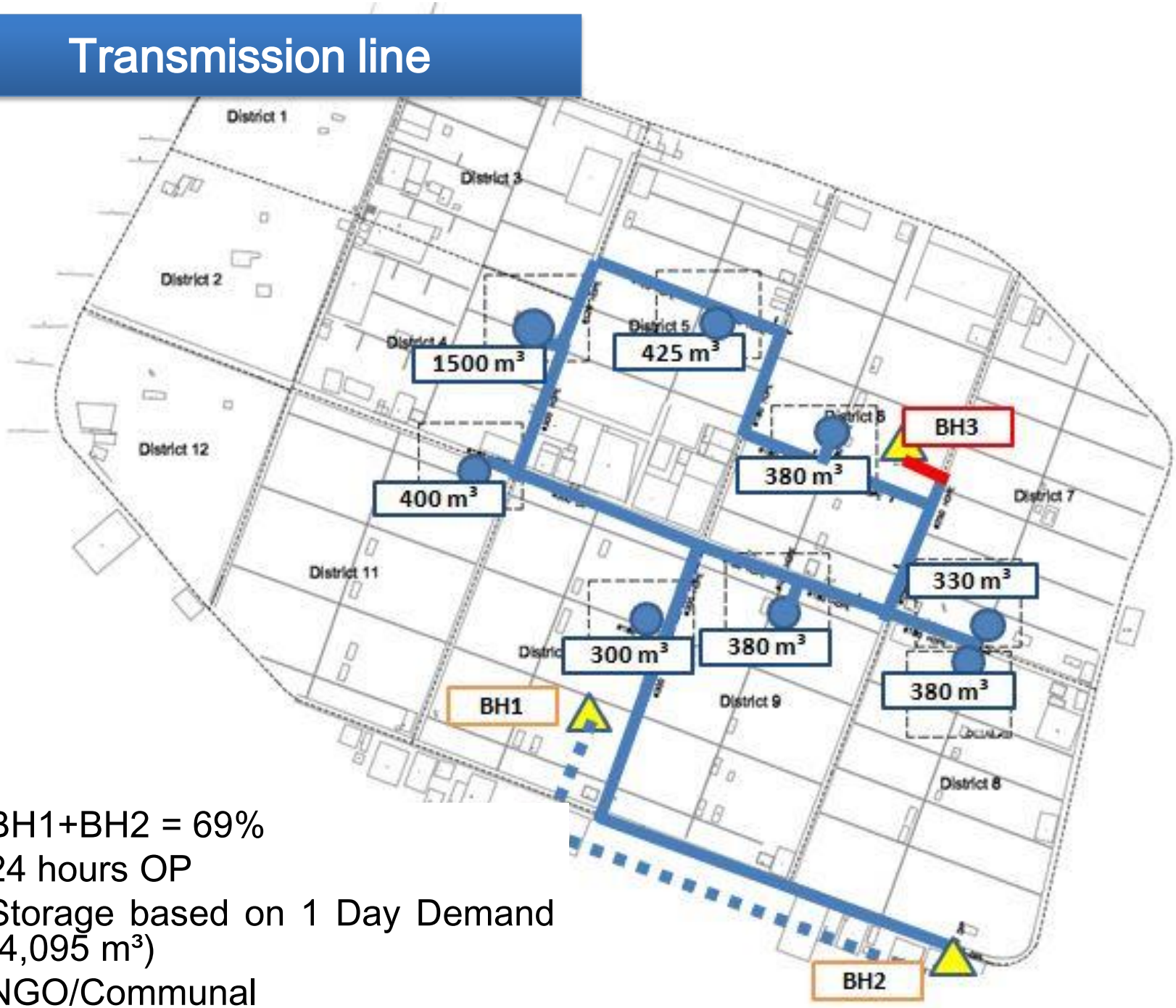
Iraq - Domiz refugees Camp

Gaps

Gaps in information/experience and challenges to be addressed:

- Strategic – Integration with camp vision;
- Technical – detailed topographic survey, integration with other infrastructure plans;
- Socio-economic aspects – experience with camp-like/slum system development; cost-recovery mechanisms

Transmission line



- BH1+BH2 = 69%
- 24 hours OP
- Storage based on 1 Day Demand (4,095 m³)
- NGO/Communal

Future Zaatari Water Network

Design parameter

3 OPTIONS: Communal
Communal Plus (Ports)
House Hold

Communal	Communal Plus	Households
1 tap every 80 people (indicative)		HH size 6 persons
Connection for NGOs and communal facilities		
/	Ports every 50m Port at least 15 mt from Female WASH centers. 4 outlets per port (~5 households per outlet)	One connection per HH (6 persons)
35l/p/d storage design based on camp minimum standards		
System design based on Seasonal peak factor of 1.43		
5% safety factor on the transmission line		
20% safety factor on the distribution line		
Peak factor 3 for distribution line	Peak factor 1.8 for distribution line	
Peak factor 1.6 for transmission line		
8 hours rationning	12 hours rationing	

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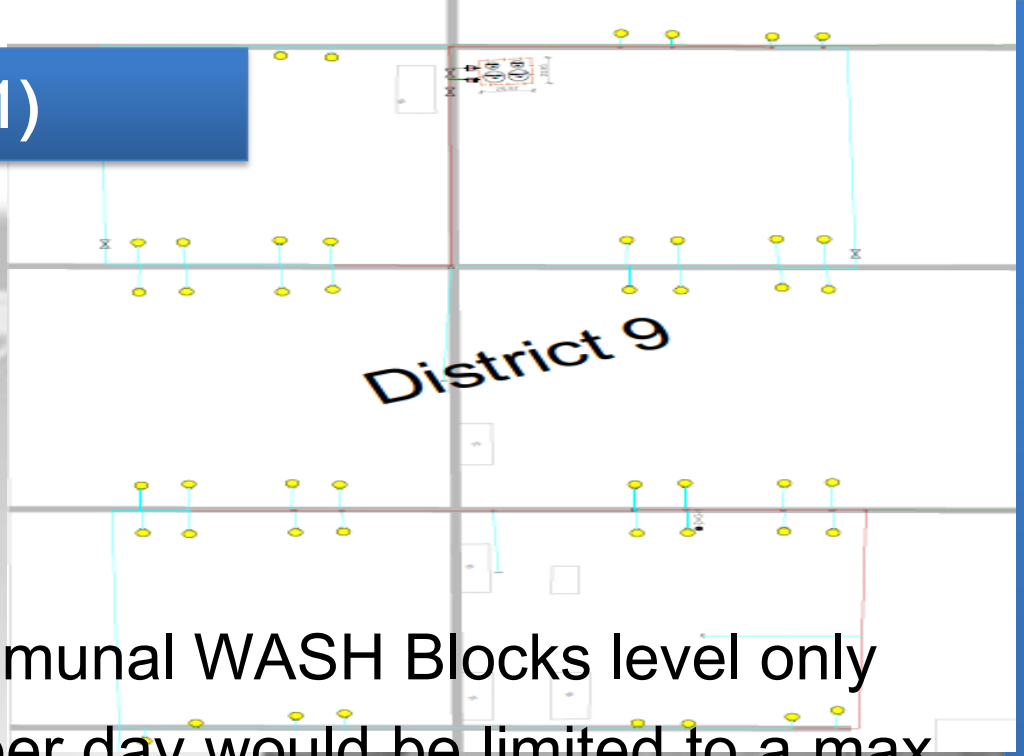
Communal (Option 1)



- Delivery of water at communal WASH Blocks level only
- The distribution period per day would be limited to a max of 8 hours

Only WASH Block Connected

Future Zaatari Water Network

Communal Plus - with Ports (Option 2)

- Delivery of water for communal WASH Blocks and additional ports level
- The distribution period per day would be limited to a max of 12 hours

689 Ports needed Full camp

WASH Block

Ports

Future Zaatari Water Network

Household (Option 3)

- Delivery of water at each household level (i.e. a service connection in front of each household) and NO connections to communal WASH blocks or ports.
- The distribution period per day would be limited to a max of 12 hours
- The minimum ground level residual pressure at all households to be 2 m at the highest point in each District

Future Zaatari Water Network

Household (Option 3)

Future Zaatari Water Network

Simplified Risk Analysis

Risk score:
Low 1
Medium 5
High 10

Technical and Social Criteria	Definition	Risk Score Communal	Risk Score Communal +	Risk Score HH
Equitability	Ability to meet the adequate amount of water needed by all groups/HHs/individuals.	10	5	1
Accessibility	Ability to maximise adequate access to water supply as per minimum standard agreed at camp level.	10	5	1
O&M	Ability to minimise technical and operational challenges in O&M from boreholes to points of use.	5	5	10
Water losses (not misuse or wastage)	Ability to minimise water losses from boreholes to points of use.	1	5	10
Water quality	Ability to prevent water contamination or re-contamination from boreholes to points of use.	1	5	5
Implementation	Ability to minimise the social challenges during implementation (social and technical)	5	5	10
	Overall Technical risk score for the 3 options	32	30	37
WEIGHTING ACROSS ALL OPTIONS - Community acceptance and engagement	Ability to meet the preferences by the population in terms of service level, not only in design phase but also in implementation and in operation phase.	3	2	1
	Risk score for the 3 options	96	60	37

Future Zaatari Water Network

Capital investment

Communal USD	Communal Plus USD	House Hold USD
5,732,579	6,115,668	16,327,308

Future Zaatari Water Network

Recurrent Costs Oxfam

Recurrent costs	Trucking	Communal	Communal +	HouseHold
Monthly Operator costs				
Main pump Operator	$ -	$ 4,639.14	$ 4,639.14	$ 4,639.14
Mainline valve Operator	$ -	$ 3,092.76	$ 3,092.76	$ 3,092.76
District pump Operator	$ -	$ -	$ 3,865.95	$ 3,865.95
District Valve Operator	$ -	$ 3,608.22	$ 3,608.22	$ 3,608.22
Port operator	$ -	$ -	$ 96,391.02	$ -
Wash block	$ -	$ 25,276.00	$ 19,454.00	$ -
Water treatment consumables	$ -	$ 2,500.00	$ 2,500.00	$ 2,500.00
Total Operator Costs	**$ -**	**$ 39,116.12**	**$ 133,551.09**	**$ 17,706.07**
Power units				
Power (main) kWh	0.00	29.95	29.95	29.95
Power (District) kWh	0.00	0.00	9.72	9.72
Elec Rate USD/kWh				
Power (main) kWh	0.00	2.78	2.78	2.78
Power (District) kWh	0.00	0.00	0.90	0.90

Future Zaatari Water Network

Recurrent Costs ACTED

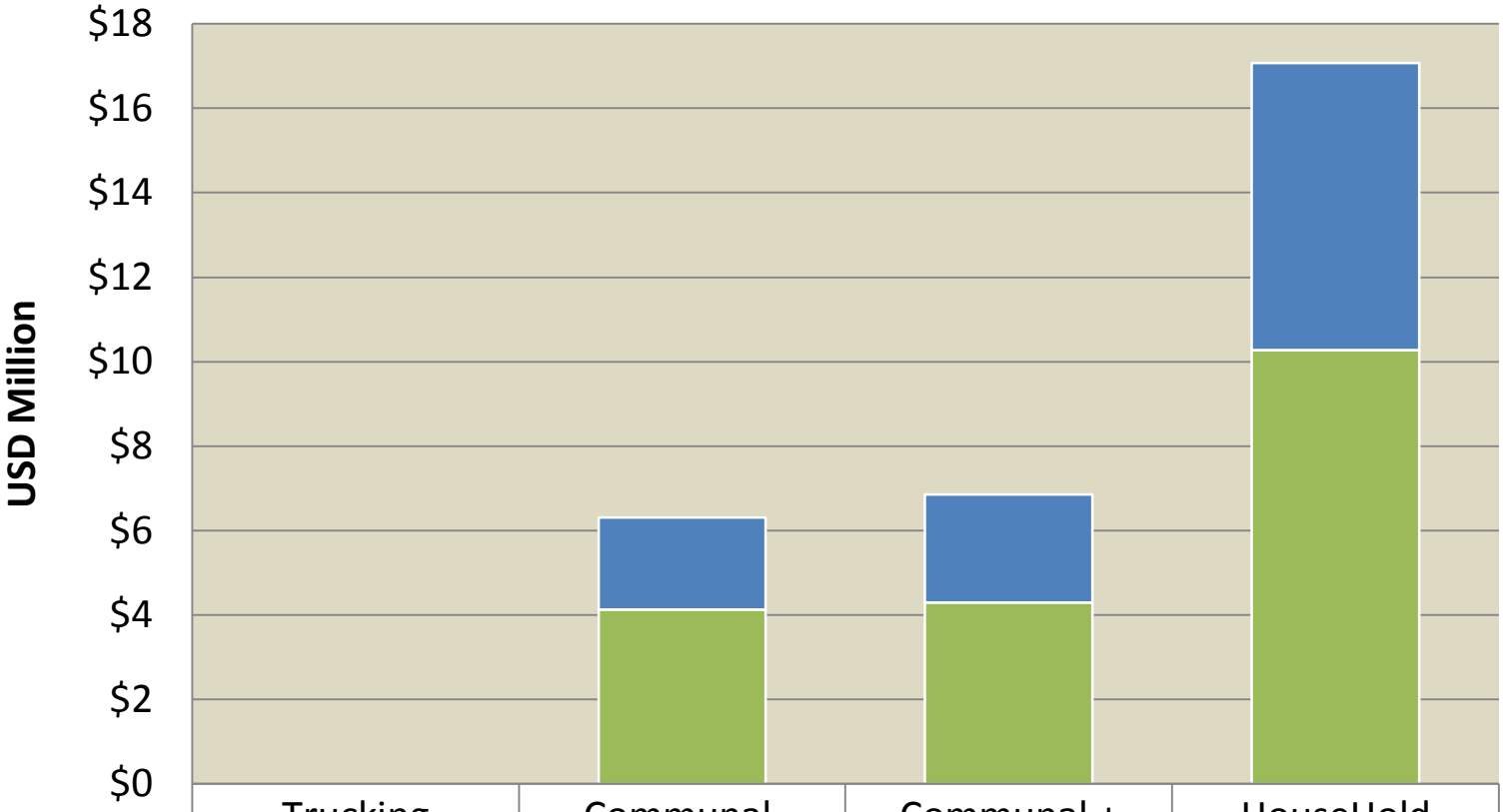
Recurrent costs	Trucking	Communal	Communal +	HouseHold
Monthly Operator costs				
D4 pump Operator	$ -	$ 1,546.38	$ 1,546.38	$ 1,546.38
Mainline valve Operator	$ -	$ -	$ -	$ -
District pump Operator	$ -	$ 1,546.38	$ 1,546.38	$ 1,546.38
District Valve Operator	$ -	$ 2,061.84	$ 8,247.36	$ 12,886.50
Port operator	$ -	$ -	$ 258,760.92	$ -
Wash block	$ -	$ 17,800.00	$ 17,900.00	$ -
Water treatment consumables	$ -	$ 2,500.00	$ 2,500.00	$ 2,500.00
Water trucking (internal)	$ 194,483.06			
Water trucking (extarnal)	$ 133,289.37			
Total Operator Costs	**$ 327,772.42**	**$ 25,454.60**	**$ 290,501.04**	**$ 18,479.26**
Power units				
Filling Pumps kWh	5.61	0.00	0.00	0.00
Power (D4) kWh	0.00	12.65	12.65	12.65
Power (D10) kWh	0.00	2.34	2.34	2.34
Power (D11) kWh	0.00	1.56	1.56	1.56
Elec Rate USD/kWh				
Filling Pumps USD kWh	0.52	0.00	0.00	0.00
Power (D4) (USD/kWh)	0.00	1.18	1.18	1.18
Power (D10) (USD/kWh)	0.00	0.22	0.22	0.22
Power (D11) (USD/kWh)	0.00	0.14	0.14	0.14

Future Zaatari Water Network

Financial Analysis

Cost Components

Total Capital Costs

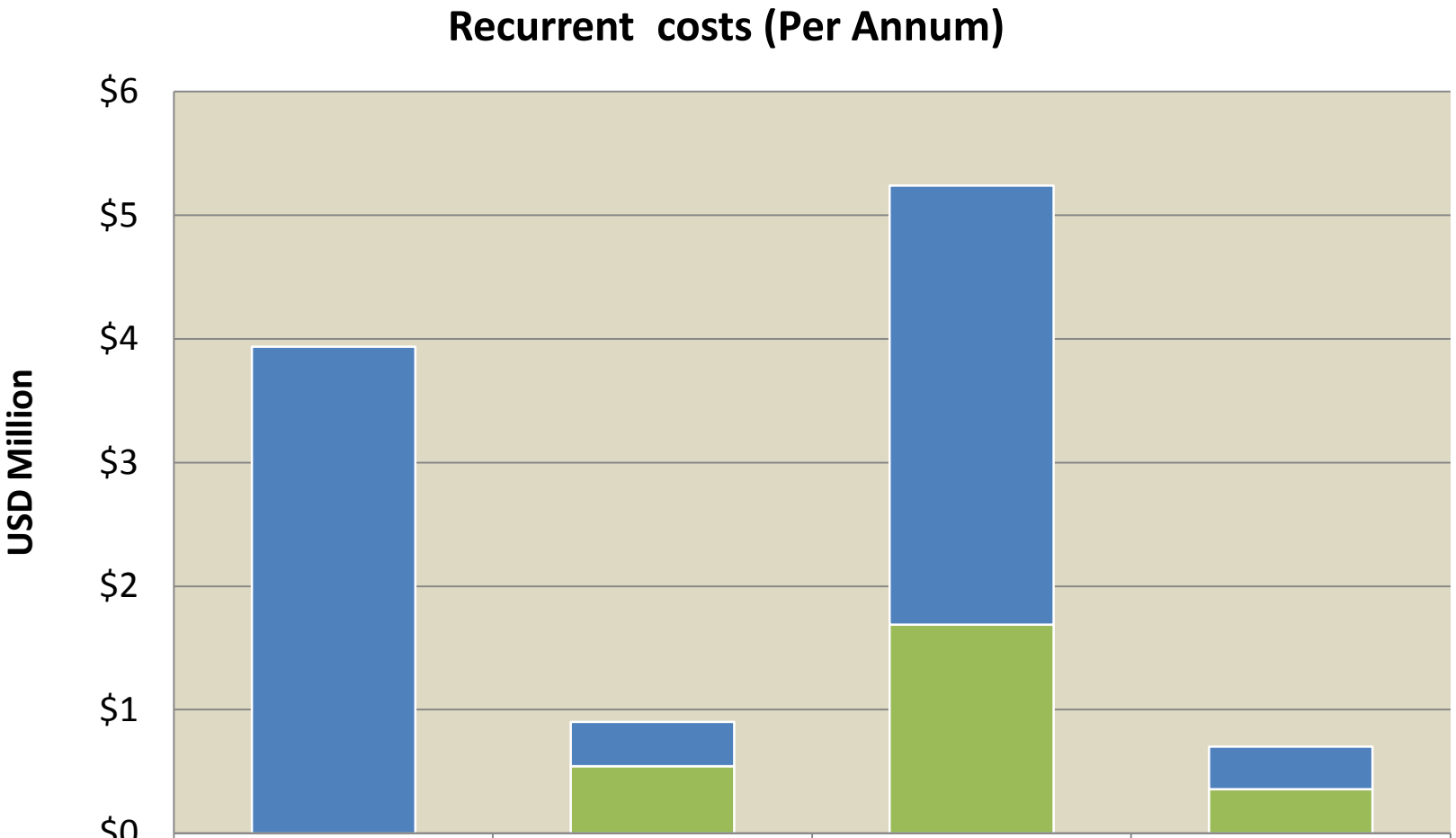


	Trucking	Communal	Communal +	HouseHold
ACTED	$-	$2,174,401.98	$2,555,791.26	$6,796,423.88
OXFAM	$-	$4,128,001.92	$4,298,405.72	$10,269,413.42

Future Zaatari Water Network

Financial Analysis

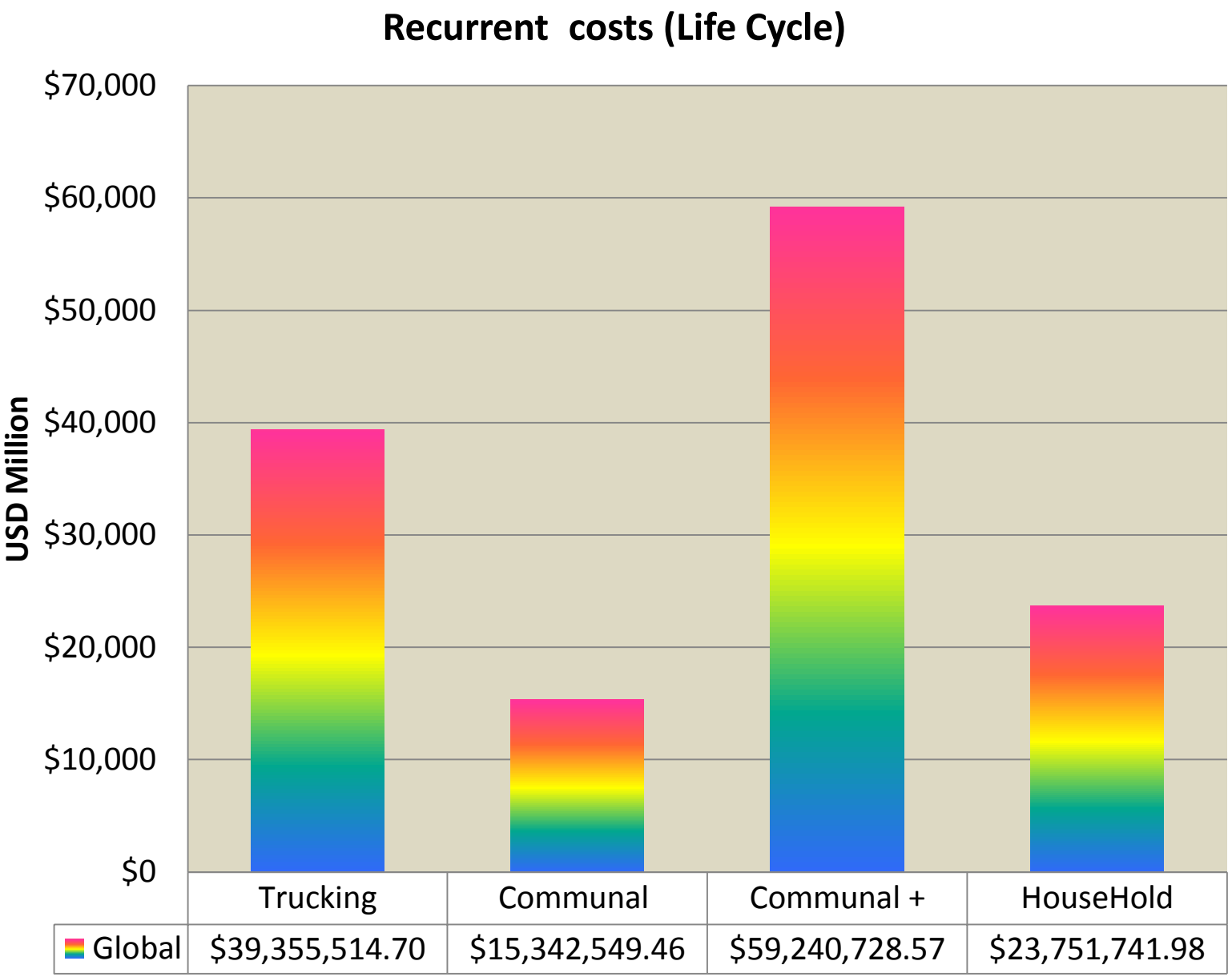
Cost Components



	Trucking	Communal	Communal +	HouseHold
ACTED	$3,935,551.47	$361,212.37	$3,550,221.89	$345,670.61
OXFAM	$-	$542,802.18	$1,688,431.27	$358,001.11

Future Zaatari Water Network

Combined Life cycle costs



Future Zaatari Water Network

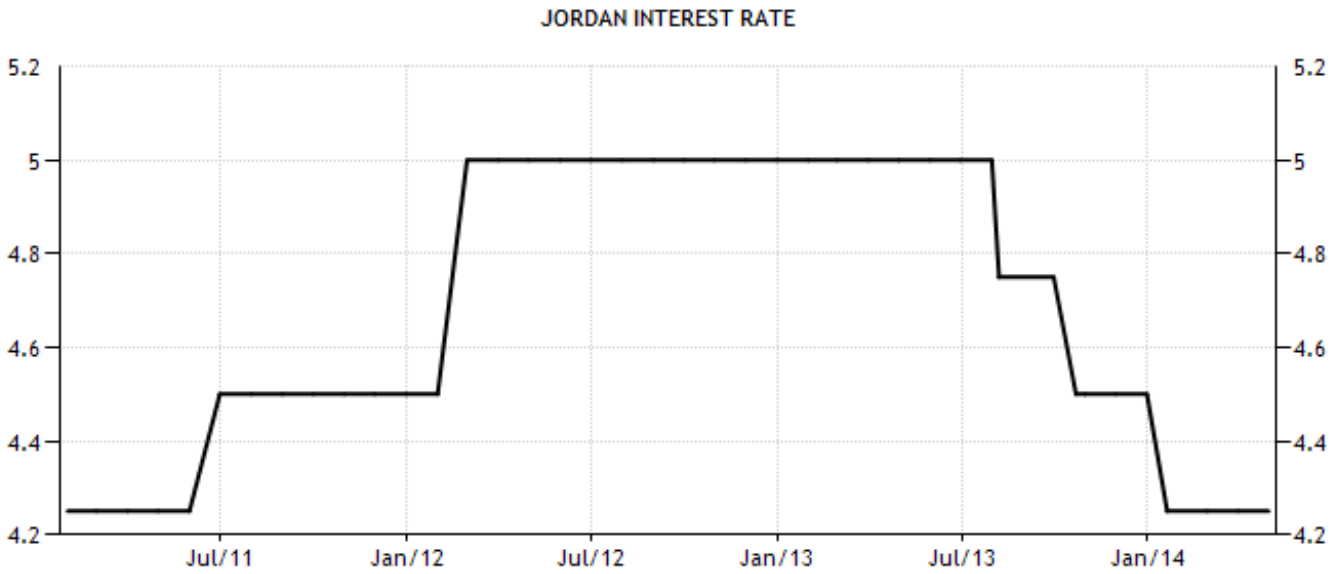
Consolidated Costs

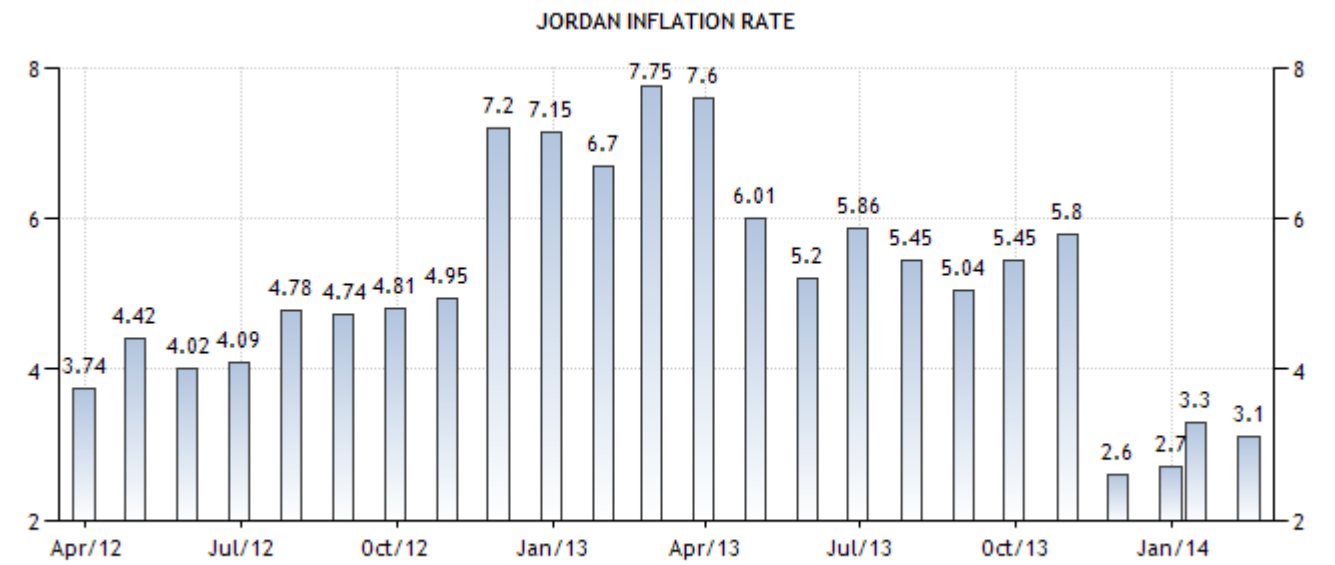
OPTION	OXFAM					
	CAPITAL COSTS			Annual Power + O&M Costs		
	CIVIL (USD)	E&M (USD)	TOTAL (USD)	Elec Cost (USD)	O&M (USD)	TOTAL (USD)
Trucking	$ -	$ -	$ -	$ -	$ -	$ -
Communal	$ 3,934,478.92	$ 193,523.00	$ 4,128,001.92	$ 24,387.80	$ 518,414.38	$ 542,802.18
Communal +	$ 3,936,177.72	$ 362,228.00	$ 4,298,405.72	$ 28,345.01	$ 1,660,086.26	$ 1,688,431.27
HouseHold	$ 9,907,185.42	$ 362,228.00	$10,269,413.42	$ 28,345.01	$ 329,656.09	$ 358,001.11

OPTION	ACTED					
	CAPITAL COSTS			Annual Power + O&M Costs		
	CIVIL (USD)	E&M (USD)	TOTAL (USD)	Elec Cost (USD)	O&M (USD)	TOTAL (USD)
Trucking	$ -	$ -	$ -	$ 2,282.39	$ 3,933,269.08	$ 3,935,551.47
Communal	$ 1,798,101.98	$ 376,300.00	$ 2,174,401.98	$ 6,736.23	$ 354,476.14	$ 361,212.37
Communal +	$ 2,179,491.26	$ 376,300.00	$ 2,555,791.26	$ 6,736.23	$ 3,543,485.66	$ 3,550,221.89
HouseHold	$ 6,420,123.88	$ 376,300.00	$ 6,796,423.88	$ 6,736.23	$ 338,934.37	$ 345,670.61

Future Zaatari Water Network

Discount and Interest rates



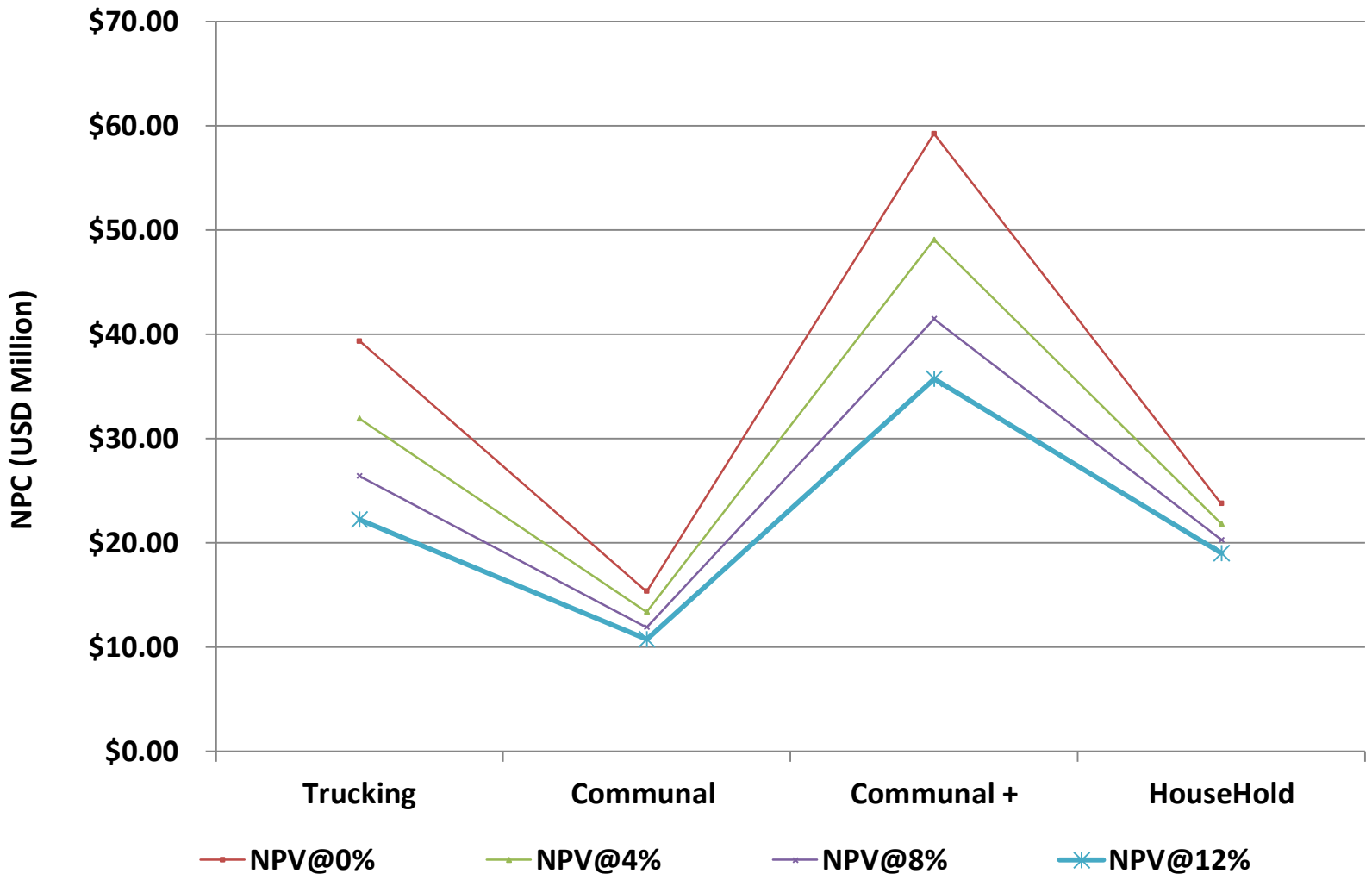


SOURCE: WWW.TRADINGECONOMICS.COM | CENTRAL BANK OF JORDAN

Future Zaatari Water Network

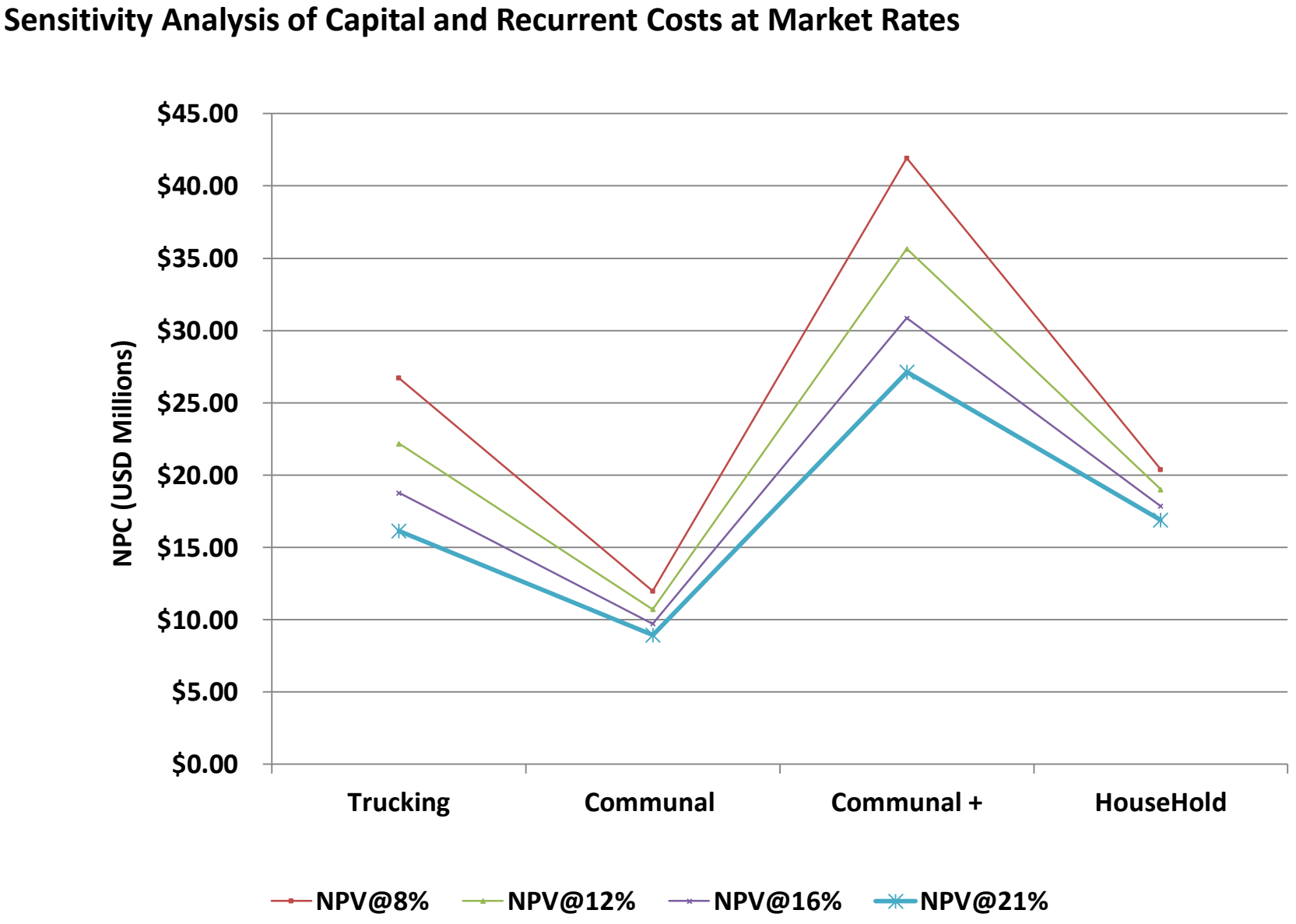
Sensitivity Analysis at Discount rates

Sensitivity analysis of Capital and recurrent Costs at Discount Rates



Future Zaatari Water Network

Sensitivity Analysis at market rates



Future Zaatari Water Network

Indicative Implementation Timeframe

	Communal	Communal +	HH
months	7	10	13
	Only WASH blocks connected	WASH blocks connected	HH connected
	NGOs communal facilities connected	Ports construction	NGOs communal facilities connected
		NGOs communal facilities connected	

1.5 month executive design
1 month tender construction
15 days mobilization - permits

Future Zaatari Water Network

Zaatari Water Network Technical Working Group

8th May 2014

BREAK

Conclusions on the Financial Analysis

From the Sensitivity analysis, the following can be deduced:

- The Communal option represents the least NPC at all rates.

- The Communal+ exerts the highest combined capital and recurrent cost of all the options. This is consistent at discount and market rates.

- The House hold option requires the highest infrastructure costs of the 3 three options. However, it also attracts modest recurrent costs thus consistently demonstrates the second least NPV at Discount and Market rates.

FINAL Recommendations

- Financial Analysis indicate that **Communal option is the cheapest options** (NPC calculation)
- **Risk Analysis strongly indicates that Communal and Communal + will require additional risks mitigation costs** (not consider) and wouldn't be adequate based on lack of community acceptance
- For the Communal + option, financial analysis indicate very high operational costs make it unfeasible (Operational costs). This option could be more feasible if the operation is handing over to the community.
- **Technical/Financial/social analysis shows that HH option is cheaper to operate in the long run** (around 5 years payback depending on the Market rate) compared against the other options considering the additional risk mitigation cost expected for communal and communal plus option

Open Discussion

- A linear phased approach can be explored to adopt the system from Communal to House hold option in line with available funds. Note that during the phasing, morphing through the communal+ stage may not be viable due to the high capital costs necessary to mitigate the identified risks and the steep running costs accruals during operation.

Zaatari Water Network Technical Working Group

The end

8th May 2014

ACTED JEN OXFAM unicef UNHCR The UN Refugee Agency