

Water efficiency and drainage in challenging environments

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1	Refugee camps	 Humanitarian innovation fund elrha		
2	Favelas	 CONFAP Conselho Nacional das Fundações Estaduais de Amparo à Pesquisa	 RESEARCH COUNCILS UK	 Newton Fund

Aims

To address issues with:

Flooding

Disease vectors

Greywater management

Sustainable drainage

Resolution 64/292, 2010 (United Nations General Assembly)

Access to clean, safe drinking water and sanitation is a human right

Does not mention “floods” or “drainage”

Why?

Human and environmental health



1. Refugee camps: Kurdistan Region of Iraq

Study site: Gawilan



Challenges:

Densely populated

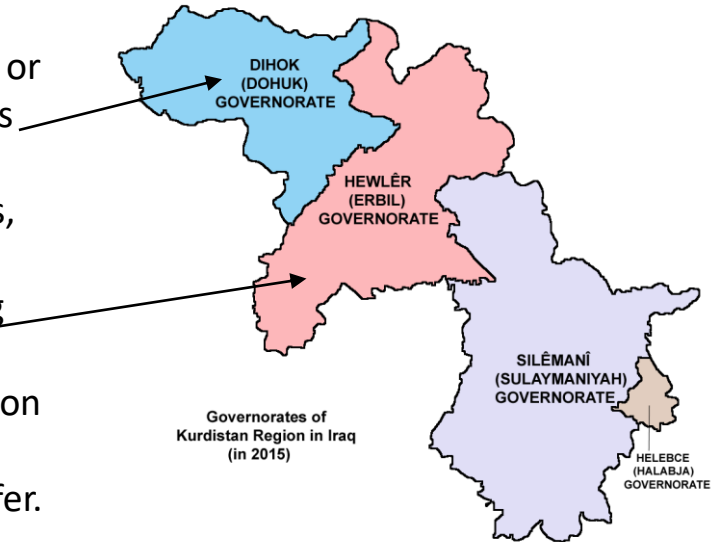
Waste is an issue

Little greywater disposal

Little drainage

However, WASH installed

- UNHCR: responsibility for infrastructure planning and implementing majority of refugee camps in KRI.
- Once established, camps managed by local government or agencies such as Board of Relief for Humanitarian Affairs (BRHA) in Dohuk.
- BRHA oversees camps future development: new arrivals, new infrastructure as the 'old' is overwhelmed.
- Erbil Joint Crisis Co-ordination responsible for managing camps in Erbil
- Management culture and priorities vary from organisation to organisation.
- Potential for sharing best practice and knowledge transfer.



Governance and policy structure



Open concrete channel for
rainwater



Open channel for
greywater and rainwater





Direct it “to another environment”





Gawilan drainage below the camp
SuDS management train design for:
Long term greywater management
Short term stormwater management

Gawilan camp, Ninewah Governate

Opened in 2013
Population ~8,000

1. Background water sampling at 3 sites
2. Household survey: water use, personal bathing, greywater management etc
3. Community design of management train





Table-1 List of Parameters

No	Name Of Parameter
1	BOD
2	Total Coliform
3	Faecal Coliform
4	E.Coli
5	Heavy Metals
	Cobalt
	Chromium
	Iron
	Manganese
	Zinc
	Lead
	Nickel
	Arsenic
	Mercury
6	Discharge m ³ /sec

Parameters measured during the water sampling campaign.

As, Co, Pb and Hg below the limits of detection
Cr, Mn, Ni, Zn and Fe below guidelines

1. Monitoring of the site pre-construction of SuDS demonstration site.

A. Monitoring of pH

B. Collection of water sample at the end of a concrete channel

	units	sample 1	sample 2	outlet	standards
Turbidity	NTU	213	468	473	<50
BOD5	ppm	353	470	59.1	50
COD	ppm	668	966	202	250
Faecal coliforms	CFU/100ml	2000	18000	2300	400

Cp x WHO Treated wastewater for RTE: 1000 cfu/100ml
Raw sewage = 10^7 cfu/100ml

Grey water and reuse at the household level	Frequency	Percentages
Detergents used		
Bath soaps	10	100.0%
Washing powders	10	100.0%
Dish washing liquids	10	100.0%
Shampoos	10	100.0%
How often are clothes washed		
Daily	1	10.0%
Twice a week	7	70.0%
Other	2	20.0%
How many litres of water is used for each wash?		
100-150 ℓ (from 10 to 15 10 ℓ buckets)	2	20.0%
> 150 ℓ (more than 15 10 ℓ buckets)	8	80.0%
How often do you / members of the family take baths?		
Once daily	4	40.0%
Less than once daily	6	60.0%
How many litres of water is used for each bathing wash?		
100-150 ℓ (from 10 to 15 10 ℓ buckets)	2	20.0%
> 150 ℓ (more than 15 10 ℓ buckets)	8	80.0%
What do you do with the dirty water (grey water) after use?		
Throw away (Specify where – street, drain other)	10	100.0%
Water plants (Specify type of plants):	4	40.0%
What extra sources of water do you have for use in your household (additional to main source of water)?		
Reuse of grey water	1	10.0%
No other source	7	70.0%
Missing	2	20.0%

2. Household survey of water use and greywater disposal

3. Designing the SuDS at Gawilan

Community engagement and SuDS workshops



Male representatives of sector C (1512 residents) closest to the SuDs site, about their role as “producers” and potential “service users”.

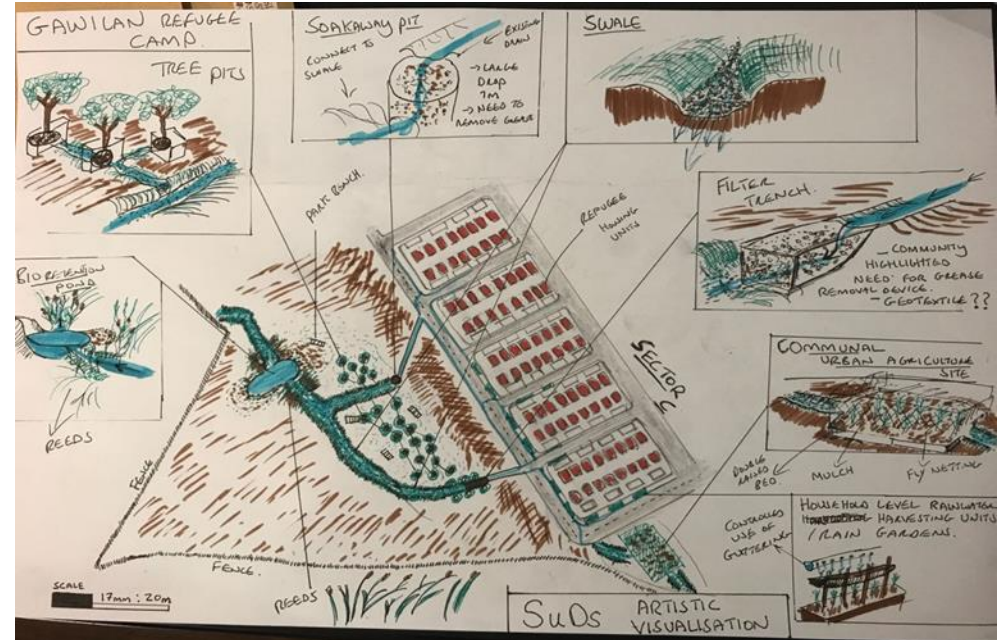


Site walk (left) through with UNHCR WASH Associate, camp management and women from the SuDs community committee

Results of the SuDS workshop: participatory design

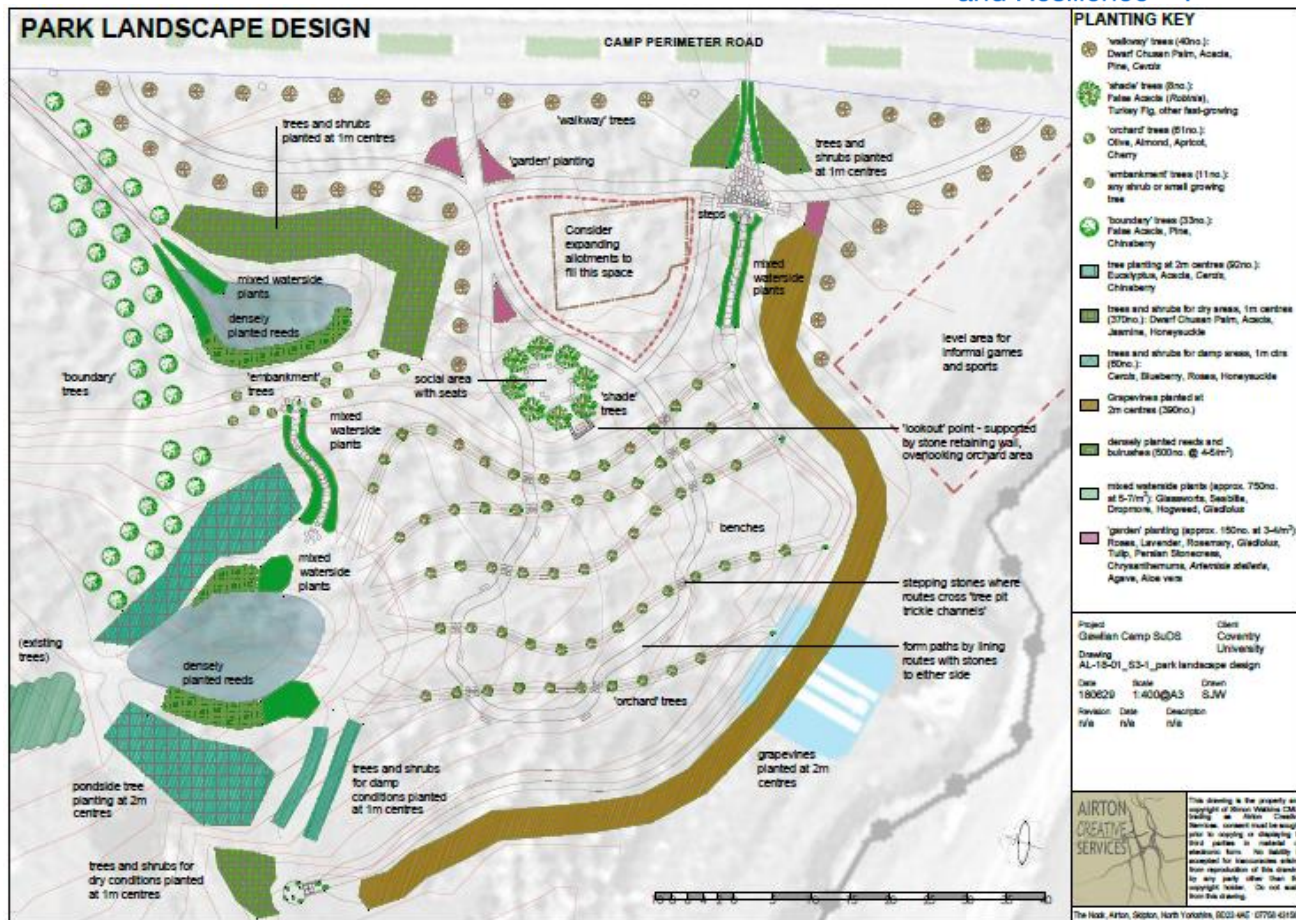


The group tackles what drainage meant to them initially.



The final design!

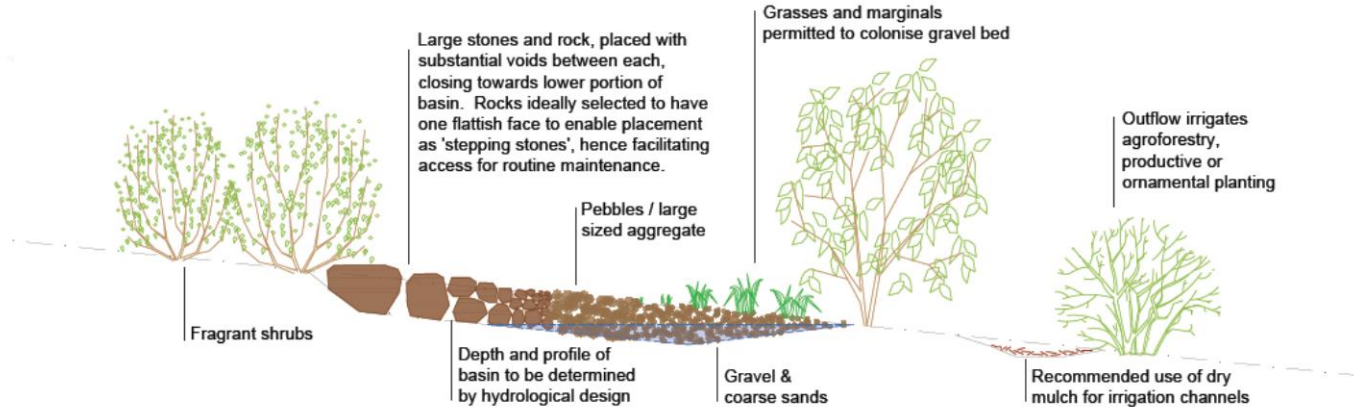






Potential swale, Domiz 1





Make use of native vegetation



Some progress:
Efficient use of greywater
Stabilisation Agriculture.
Making use of greywater and
available space, Domiz 1

Andrew Adam-Bradford

2. Favelas: Zika virus mosquito in poor areas of Brazil

Application of SuDS to reduce surface water

Microcephaly in infants. 2015-2016.



Standing wastewater



WASH

Lack of reliable potable
supplies: storage of drinking
water in open containers



Open surface
water drain
blocked with
solid waste



Favelas	Refugee camps
Temporary: self-build	Temporary: set up formally by NGO
Can become permanent Located in developing countries	
No WASH infrastructure unless installed by the community	WASH installed
Waste disposal an issue Little-no surface water/ greywater management	
Flooding and fire problems not addressed	Flooding addressed with ditches and pipes: Not fit for purpose
No overall governance/ management	Governance/ management by Governate in which the camp is located
Limited understanding of SuDS, but reactive structures at the individual shack or community scale	Limited of understanding of SuDS.
No guidelines	Guidelines for camp planning, very little addresses drainage
Population stabilised/decreasing	Population increasing
House the poorest, engage in service and tourism industries	House the displaced under crisis conditions
Disease vectors and nuisance animals can be a problem	
No planning	Drainage needs to be included at the earliest stage of planning

Recommendations

Particularly in countries unfamiliar with SuDS, the design should:

- Engage with the community
- Be simple enough to enable residents, developers and engineers to understand
- Be easy to construct, using existing materials, skills and technology
- Be robust, to allow simple maintenance, repairs or replacement to be carried out
- Have funding in place for construction and maintenance



“This garden reminds me of my childhood, my land. It also provides me with food, but it connects me to my homeland.”

