The impacts of on-site septic tank wastewater disposal in Kampala city

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Background

- increasing urbanization worldwide
- majority of growth occurring in smaller urban areas and peri-urban developments
- much of this growth is unplanned with inadequate infrastructure - in particular, water and sanitation
- health risks compounded as household and drainage water systems are invariably combined
- poorer communities often inhabit low-lying / marginal land, alongside drainage channels, which are polluted

→ decentralised approach to the planning of sanitation is required

Water & Sanitation in Kampala

- 6.4% of the population is served by public sewer
- 17.5% depending on septic tanks
- 69.8% using various forms of pit latrine

The septic tank is recognised under Ugandan legislation and therefore on-site options, are likely to remain the most appropriate decentralized sanitation solution

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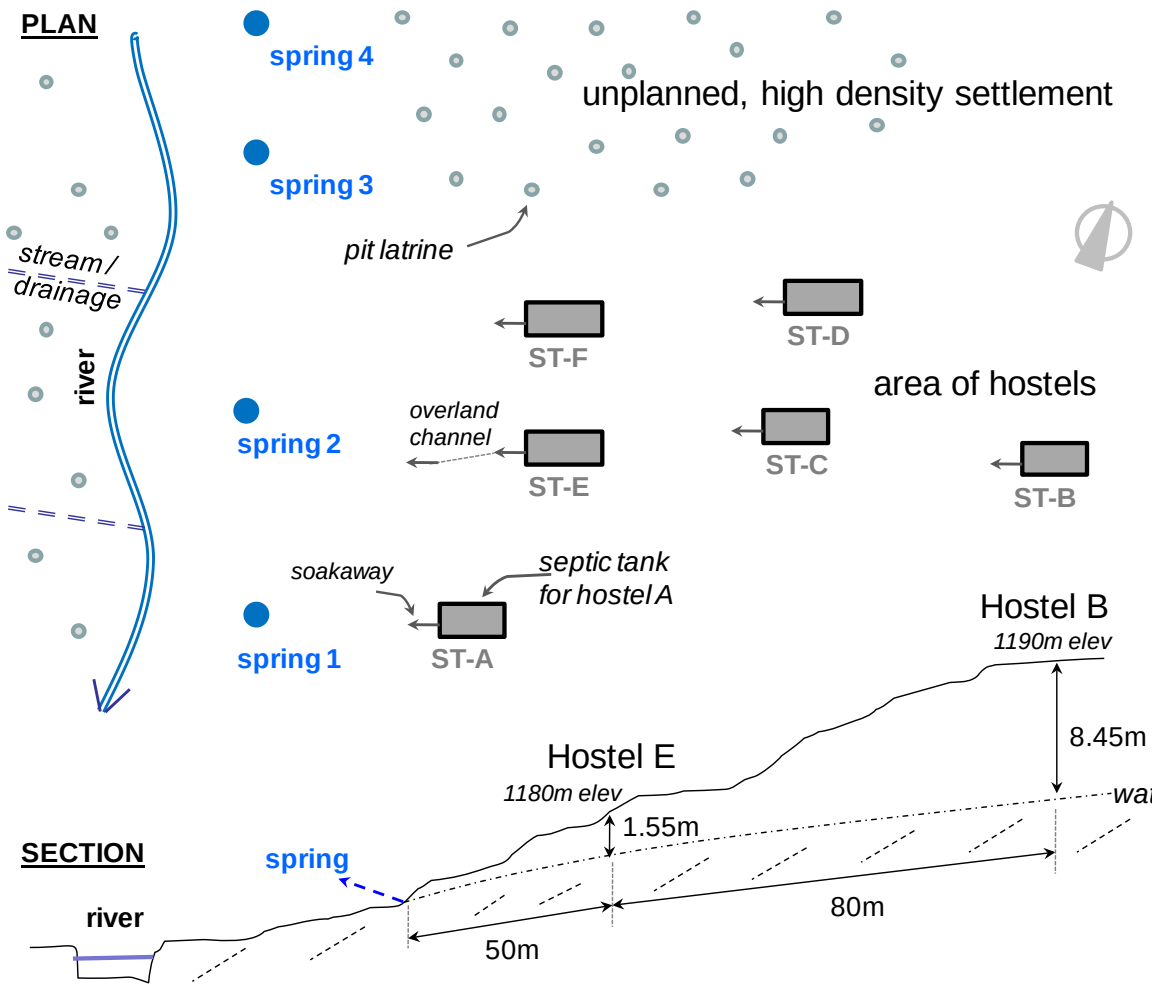
- springs are main source of water for those living in low income areas (243 protected springs, 75 unprotected springs and 38 wells)

Previous studies have shown increased microbiological contamination in shallow groundwater in Kampala during rainfall peaks

Site characteristics

Area which contained a number of septic tanks serving hostels next to and above an unplanned settlement facing the Nakulabye / Kasubi suburbs



springs

stream /
drainage channel

Field Studies

- water usage in hostels and peri-urban area

- subsoil investigations

  - unsaturated subsoil depth
  - field saturated hydraulic conductivity
  - particle size distribution

- septic tank effluent, groundwater and spring water quality

Table 1. Metered water use in hostels 2008/09 and septic tank characteristics

	Hostel A		Hostel B		Hostel C		Hostel D	
	Sem. 1	**Sem. 2**	**Sem. 1**	**Sem. 2**	**Sem. 1**	**Sem. 2**	**Sem. 1**	**Sem. 2**
Water consumed (m^3/month)	20	29	479	421	491	279	259	464
No. students	230	230	142	115	300	300	91	180
Per capita demand (L/p.d)	3	4	112	122	55	41	95	86
Septic tank volume (m^3)	64.3		19.8		56.1		84.7	
Mean hyd. retention (days)	3.0		1.8		2.0		5.0	
Distance to spring (m)	45		140		15		30	

Unprotected springs

Families had an average consumption
12 to 20 Lcd (ave = 15.9 Lcd)

Septic tank effluent, groundwater and spring water quality

Table 2. Septic tank effluent characteristics

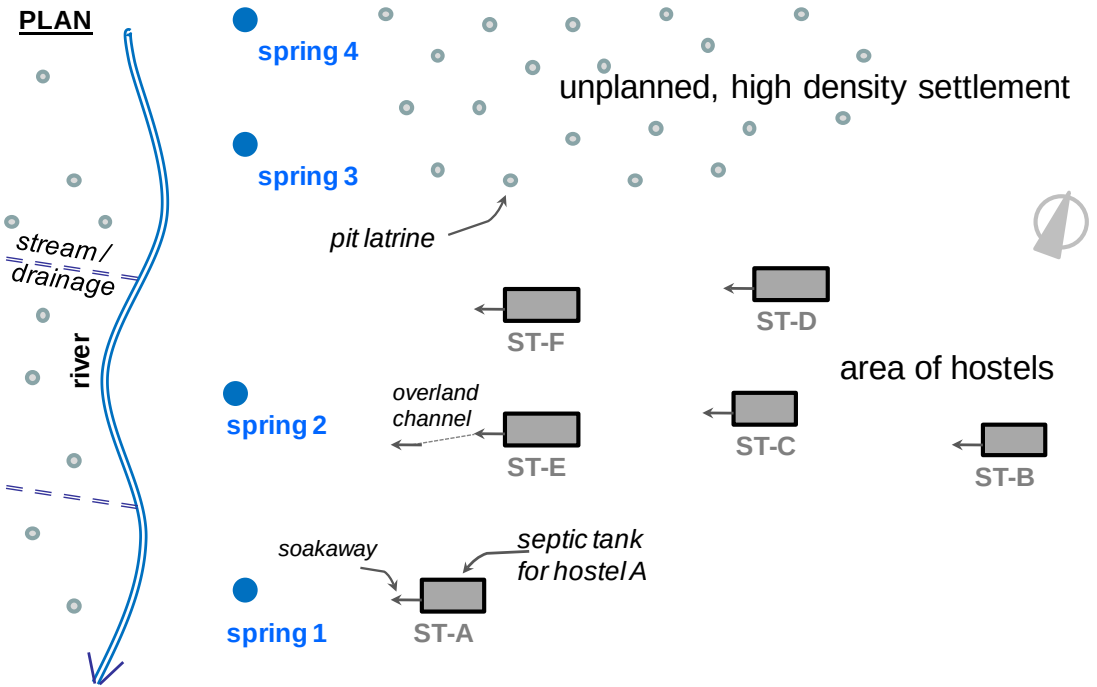
Septic tank for hostels	BOD_5 (mg/l)	COD (mg/l)	TSS (mg/l)	NH_3-N (mg/l)	Total P (mg/l)	Total coliforms /100 ml
ST-A	320	1612	226	31.5	36.2	$3.8x10^7$
ST-B	319	876	188	9.4	18.1	$4.0x10^7$
ST-C	178	486	221	11.9	52.7	$5.0x10^6$
ST-D	328	1684	220	20.8	35.8	$9.8x10^7$

Table 3. Groundwater next to hostels

Groundwater for hostels	pH	EC (µS/cm)	BOD_5 (mg/l)	COD (mg/l)	TSS (mg/l)	NH_3-N (mg/l)	Total P (mg/l)	*E.coli* /100 ml
Hostel-A (pumped)	5.5	172	2.4	5.4	22	<0.05	0.1	0
Hostel-C (pumped)	5.7	204	2.8	4.0	27	<0.05	0.1	88
Hostel-E (trial pit)	7.3	804	45.6	181	190	12.2	1.0	$4.0x10^3$
Hostel-F (trial pit)	7.3	782	21.2	127	205	11.0	0.9	$1.2x10^3$

Table 4. Spring water and stream characteristics

Spring	pH	EC (µS/cm)	BOD_5 (mg/l)	COD (mg/l)	TSS (mg/l)	NH_3-N (mg/l)	Total P (mg/l)	*E.coli* /100 ml
Spring 1	5.8	161	6.9	17.6	0	<0.05	0.1	2
Spring 2	5.8	207	4.8	11.2	0	<0.05	0.2	6
Spring 3	5.3	203	12.0	25.0	0	0.3	0.2	62
Spring 4	5.2	230	10.3	21.3	0	0.5	0.2	78
Stream	6.9	607	18.4	30	40	18	0.8	$6.0x10^5$



Conclusions

- the septic tanks do not discharge into a correctly constructed percolation area and have not been properly maintained

- however, the unsaturated sandy subsoil attenuates significant concentrations of pollutants to protect the downstream springs

- in contrast, the springs situated within unplanned development indicated higher levels of contamination

(originating close to the wells from latrines or other human activity?)

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