Greywater experiences in Erdous, China, East London (BCM) and Kimberly, South Africa

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Dong Sheng, Erdous Municipality, Inner Mongolia, China

"Home of Djingis Khan"

Open dry landscape

Winter: very cold, windy

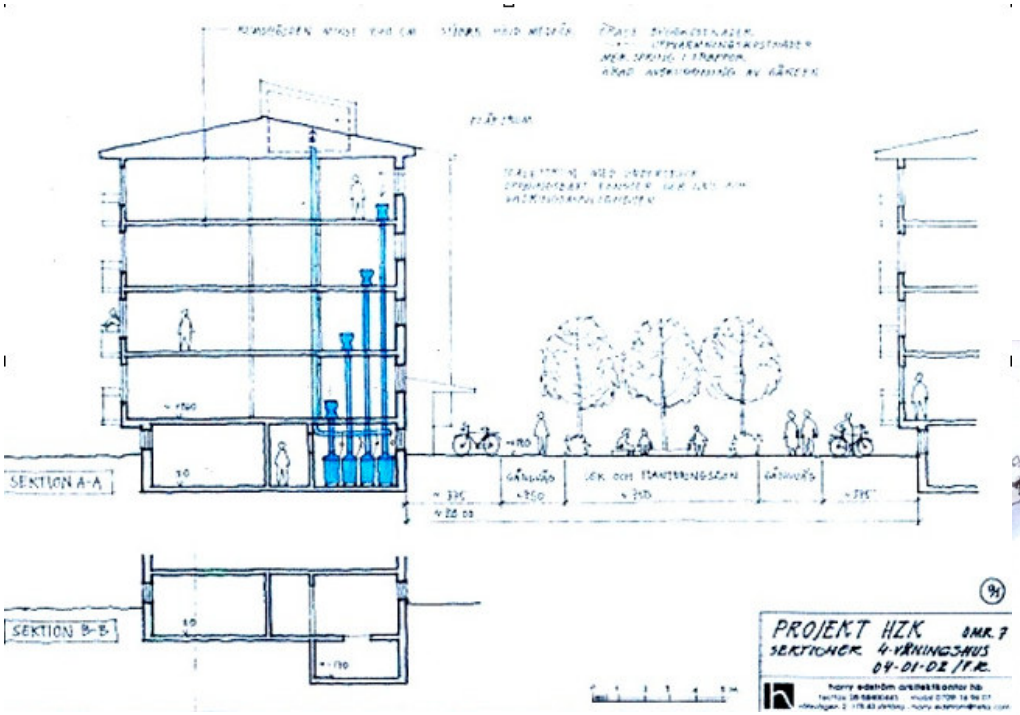
Summer: sunny and quite hot

Rapid urbanisation and development of industry

Most people are very poor and lack Sanitation

Official start of co-work -Signing Ceremony Sept 2003

Erdous Eco Town Project - the Vision



Organisations (persons) involved”

SEI team (Arno Rosemarin, Uno Winblad, Xiao Jun, Zhu Quiang, PR)

EPB, Environmental Protection Bureau, DS
DI, Design Institute, DS

DX, Daxing Building Company

TAES, Tanjing Academy of Environmental Sciences

and many more…..

The Site….

Groundwater and soils...

GRW Experts in Dialogue

Workshops, meetings, discussions…..

Main Issues discussed...

• **GRW quality ?** -very little experiences! Lot of discussions risks and impacts, requirement for treatment vs. Enduses.

•how to discharge and use treated GRW ? A lot of different opinions on measures and feasibility (irrigation, winter storing, surface discharge or groundwater reclamation)

•**GRW amounts** - user behaviour, technical and economical tools for source control, dimensioning criteria (pipes, pre-treatment, treatment and post treatment?

• **Scale level** - House level, block of houses, semi-centralised, centralised

• **Adapting** the unit design and sites to house planning, other infrastructure including the concept of Eco-station

• (Maintaining, investment and operational costs)

Principles and options discussed and assessed….

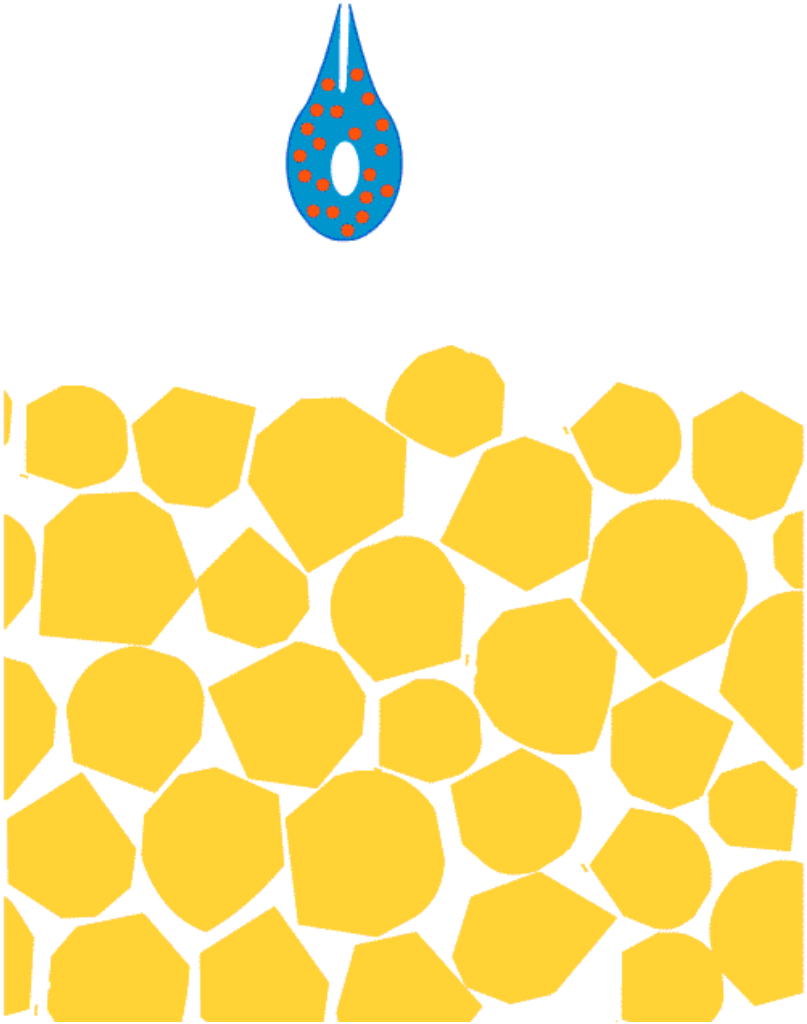
My (preconceived) ideas :

1. Precaution by **water saving**. Specific load: max 80 l/p day!

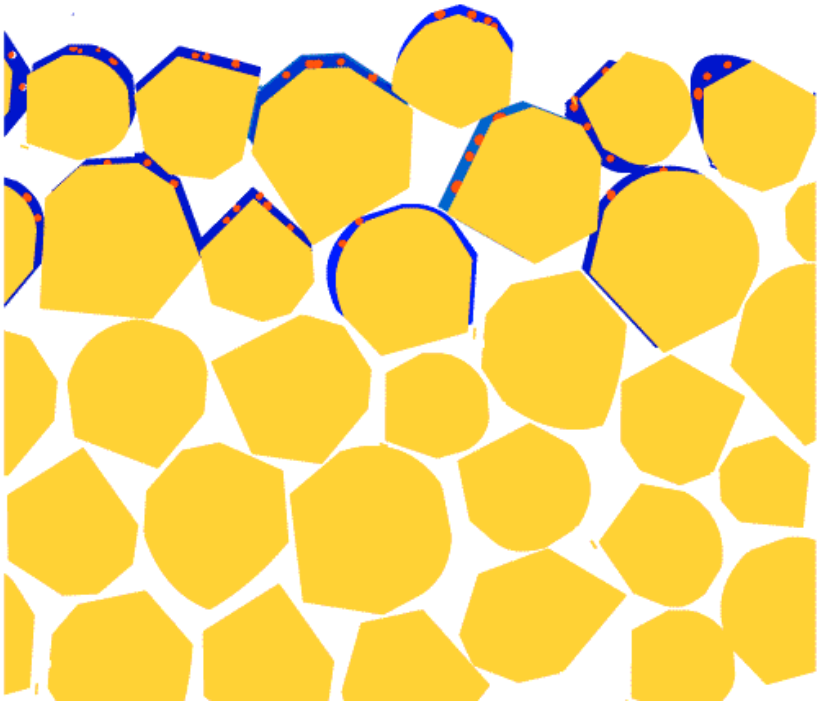
2. **Close to houses,** no extensive pipe systems. Local reuse of treated water for trees, hedges, wetlands and ponds for scenery. Reclaiming of ground water.

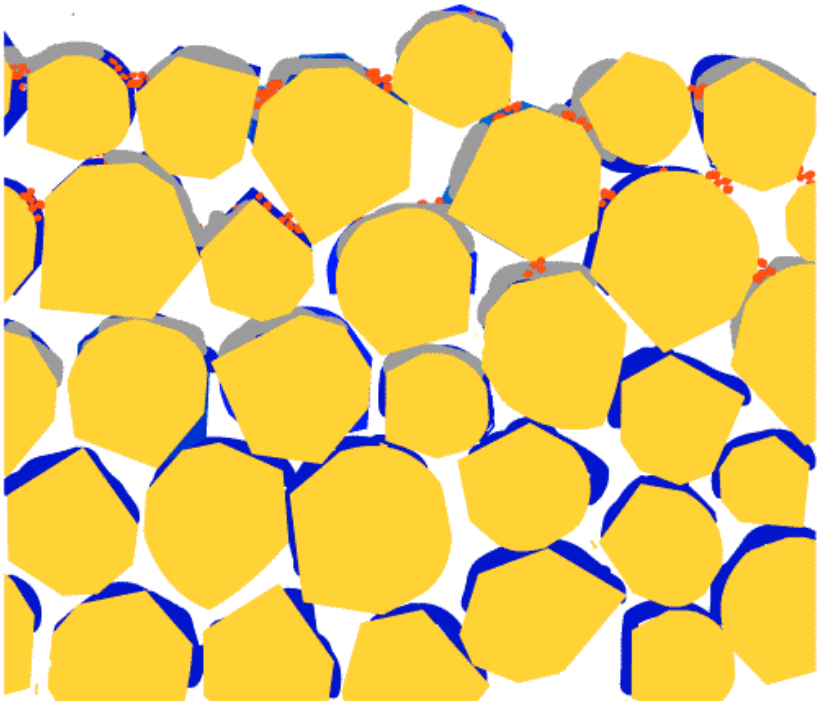
3. **Requirements on SS and BOD with precautions on pathogens.** Not on P and N

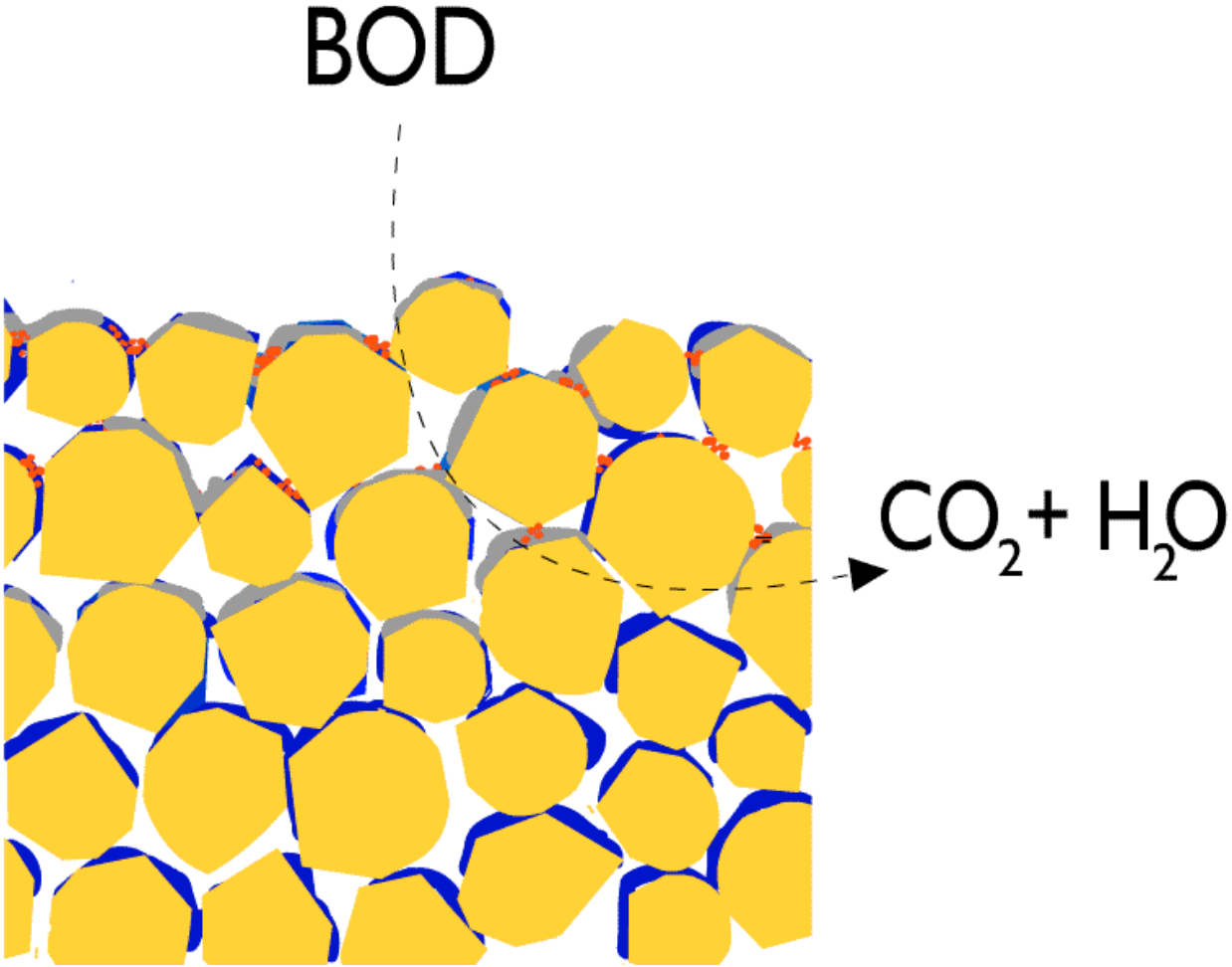
4. **Treatment should be "soil-based**" ig. pre- treatment in septic tank teratment in natural or constructed (vertical) soilfilter



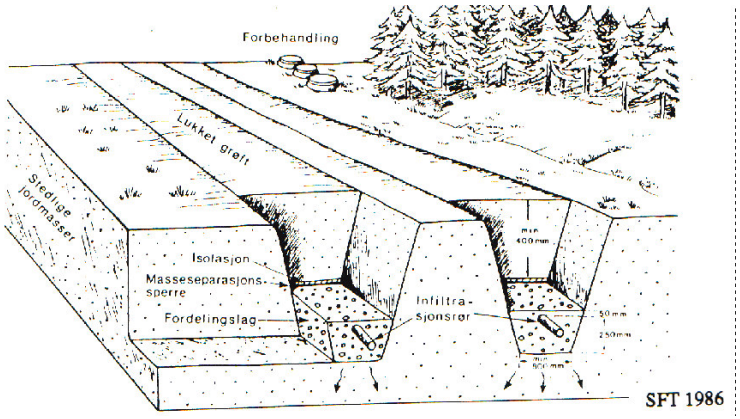
Principle for treatment of Septic Tank Effluent in vertical soil filter





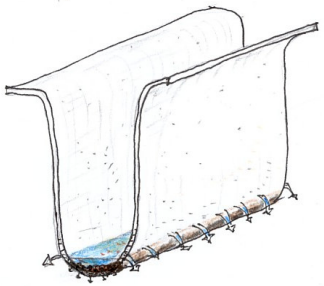


Options discussed and assessed….

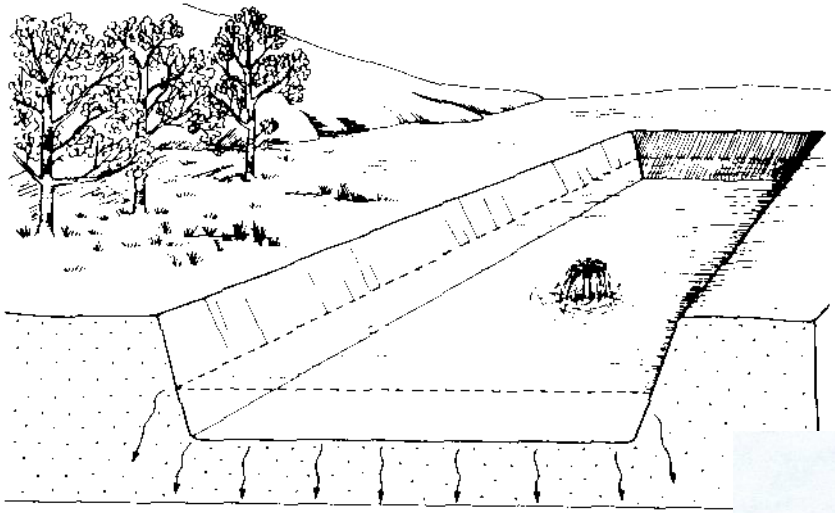


Infiltration trenches (30-50 mm/d)

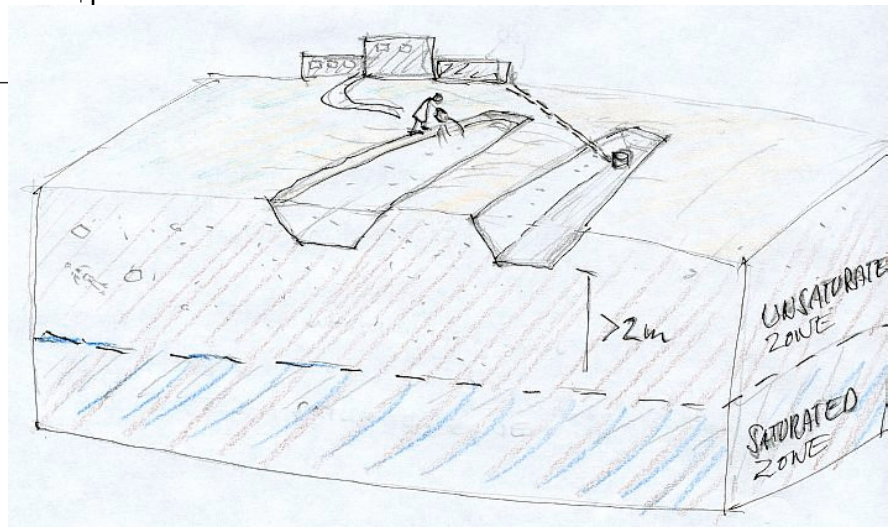
Improved infiltration in artificial media (120-200 mm)



...more options discussed and assessed....

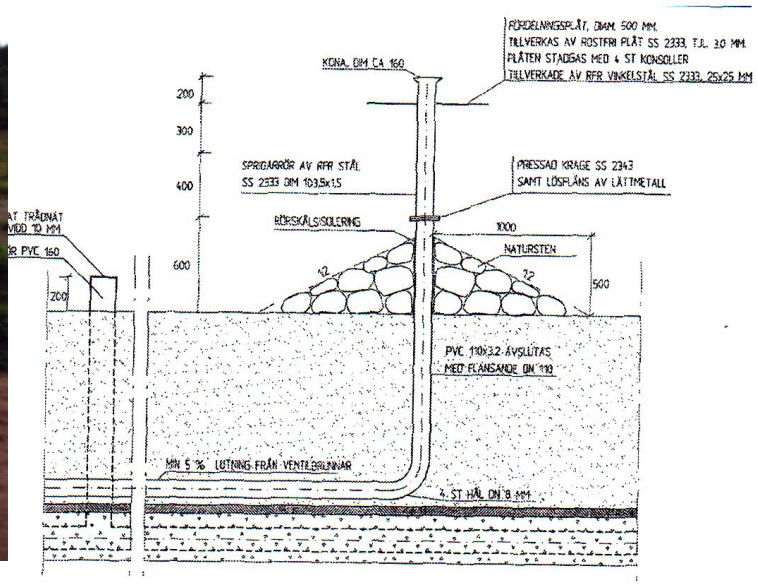


Infiltration ponds...



...more options discussed and assessed..

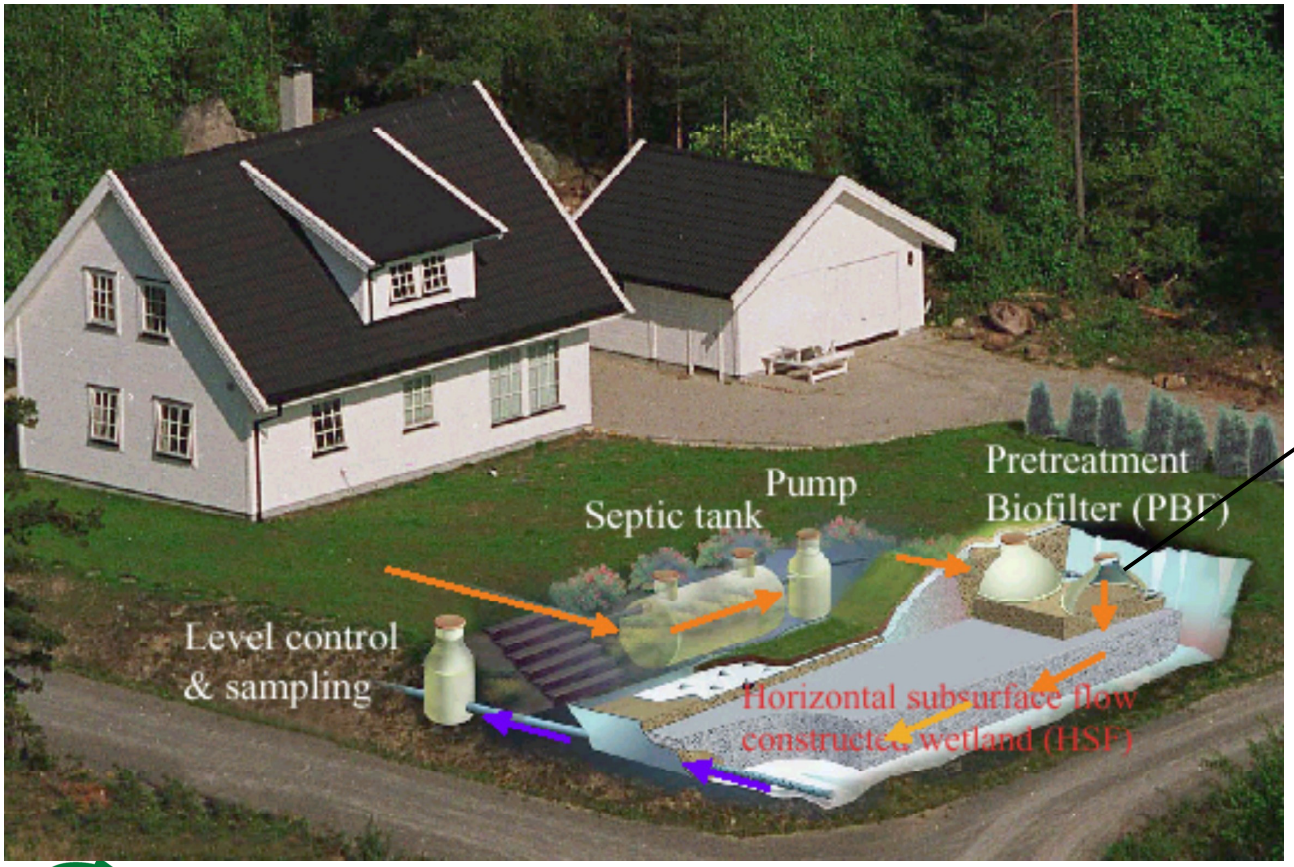
Open Sandfilter (80-120 mm



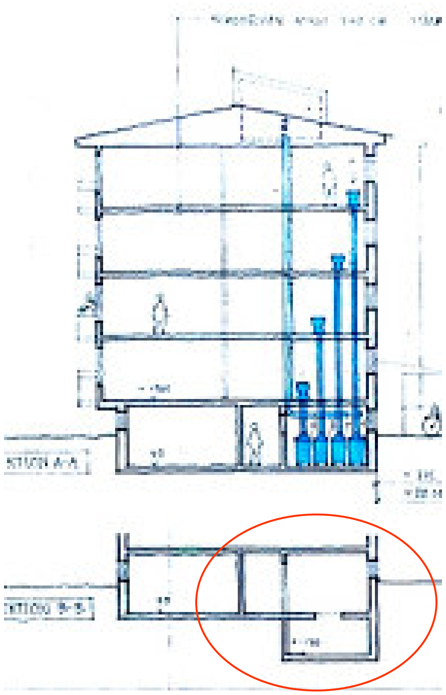
Ex. 1000 persons, 80 l/p.d = c:a 650 m2

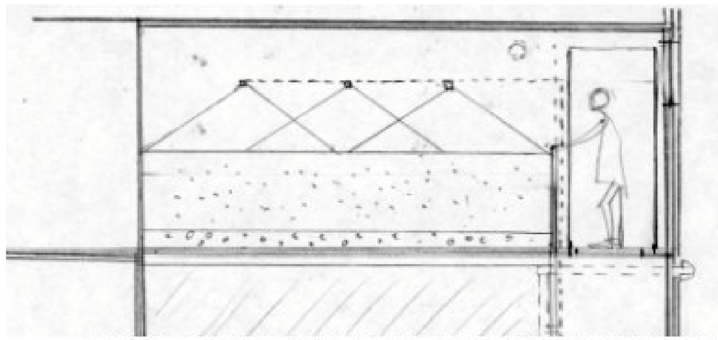
...more options ....

" the Norwegian spray technique"



Norwegian spray on house level- indoored in basement in blockhouse building (24 hh)

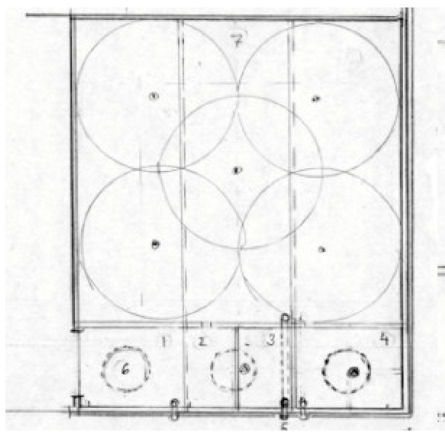


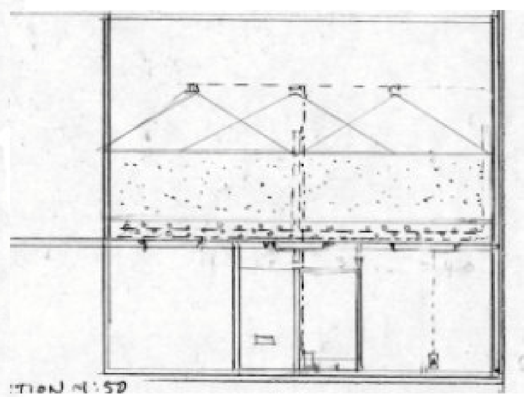


Technical description of Ecosan in HLK, Dong Sheng, China. An outline for discussion within China Project, meeting in January 2004, Peter Ridderstolpe WRS AB, Sweden

Design of Filter bed
Spraying techniques developed in Norway is used. Small plastic nozzles are used for spreading.

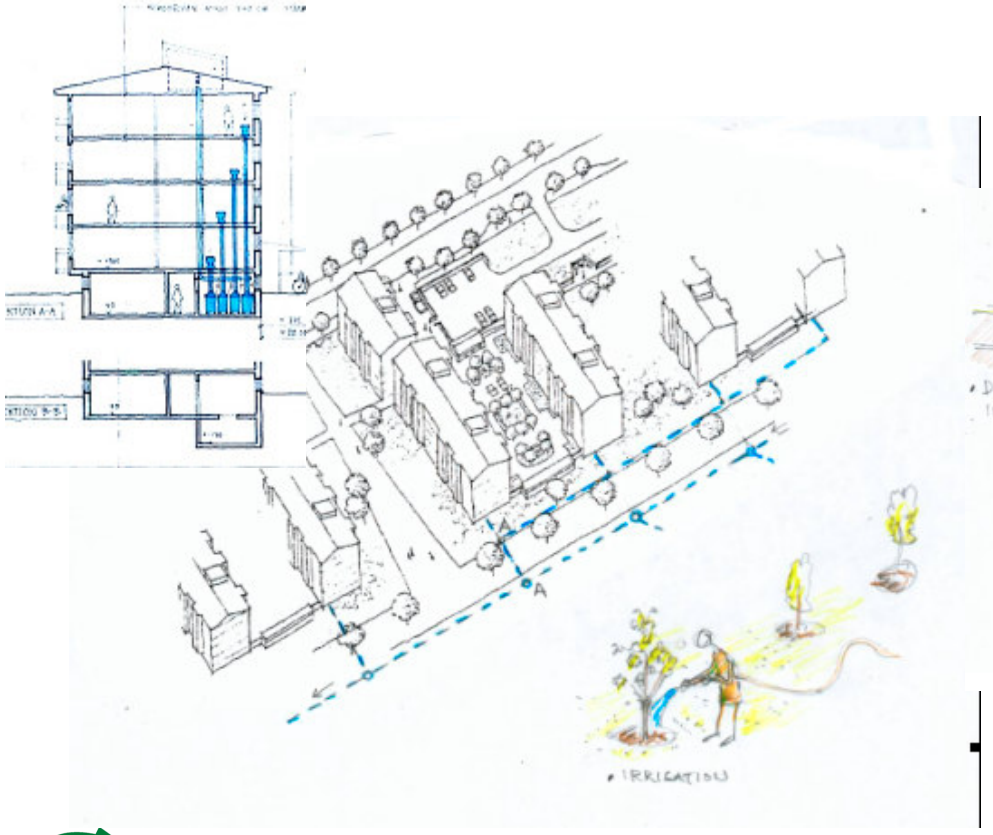
Filter layer (70 cm) is made of low density LECA (2-6 mm). Drainage layer (20 cm) is made by more coarse particles (8-24 mm).

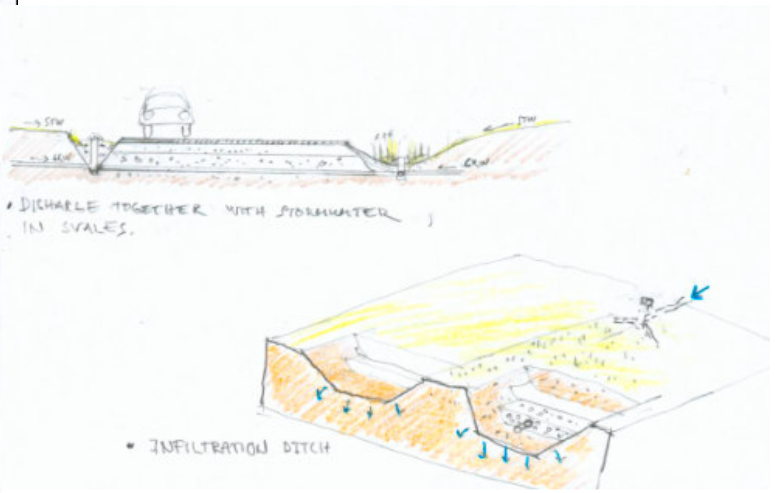




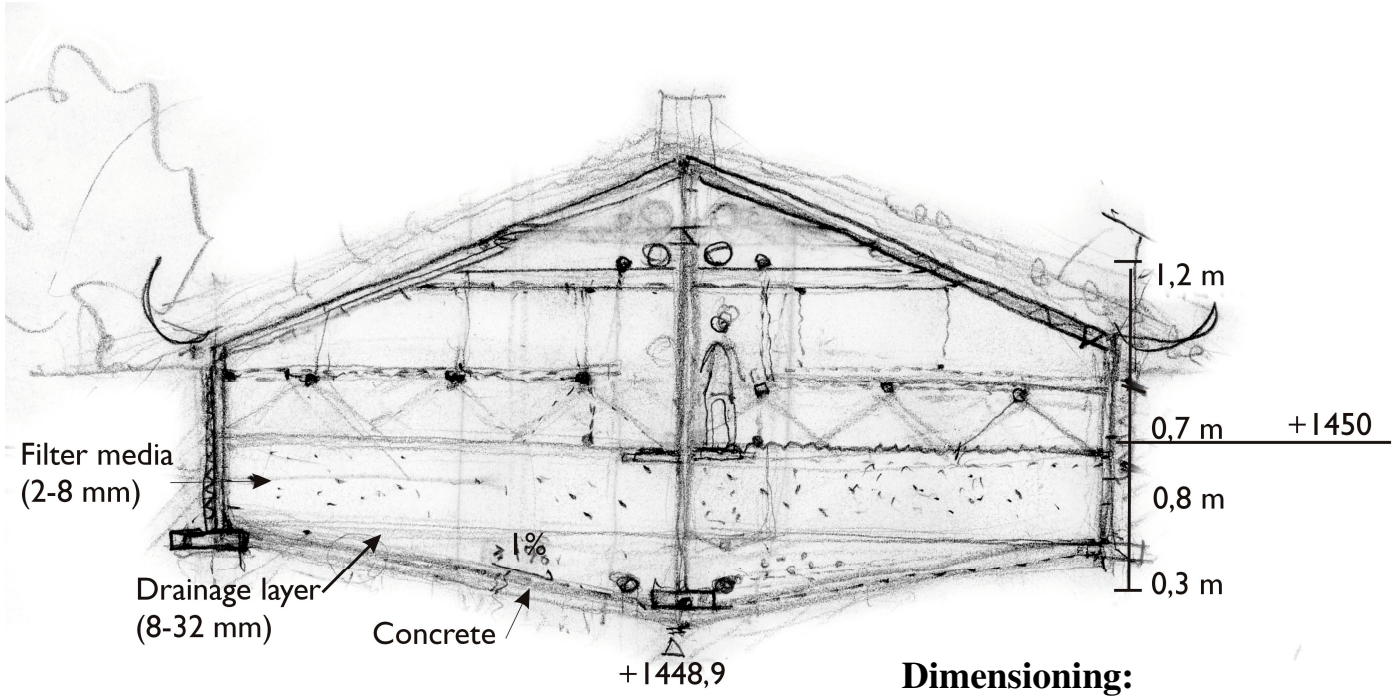
EcoSanRes

…. Summer: irrigation/discharge to surface water, winter: infiltration of treated water





Norwegian spray technique on semi-centralised level



Dimensioning:

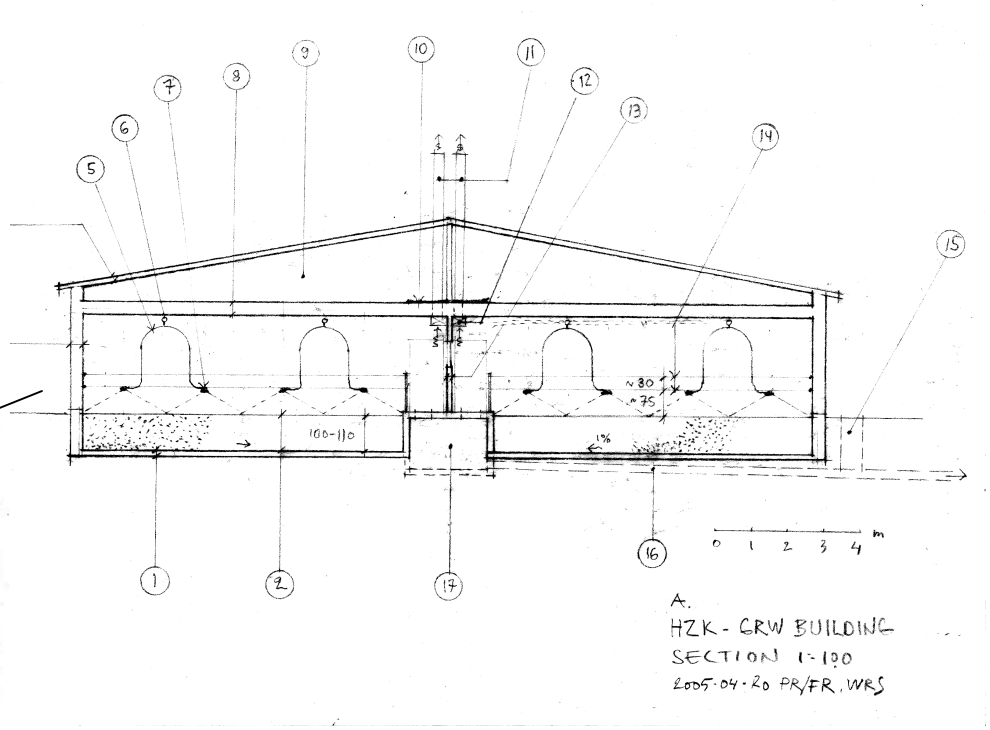
Q=80 /pers.d

Qload= 350l/m2.d

1000 person > 300 m2 (10x30m)

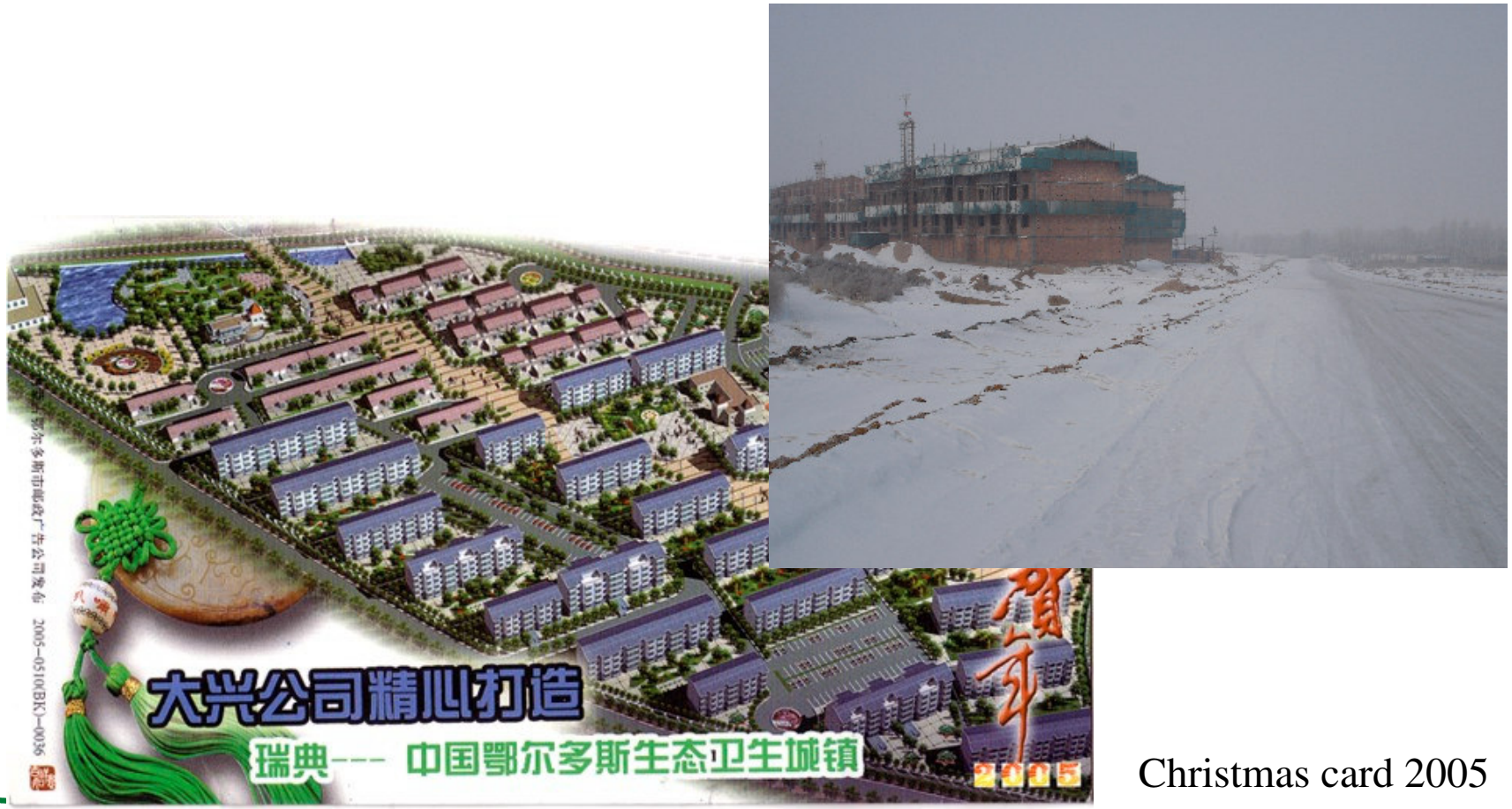
Norwegian spray on centralised level

Designed June 2005



3000 pers = > 900 m2

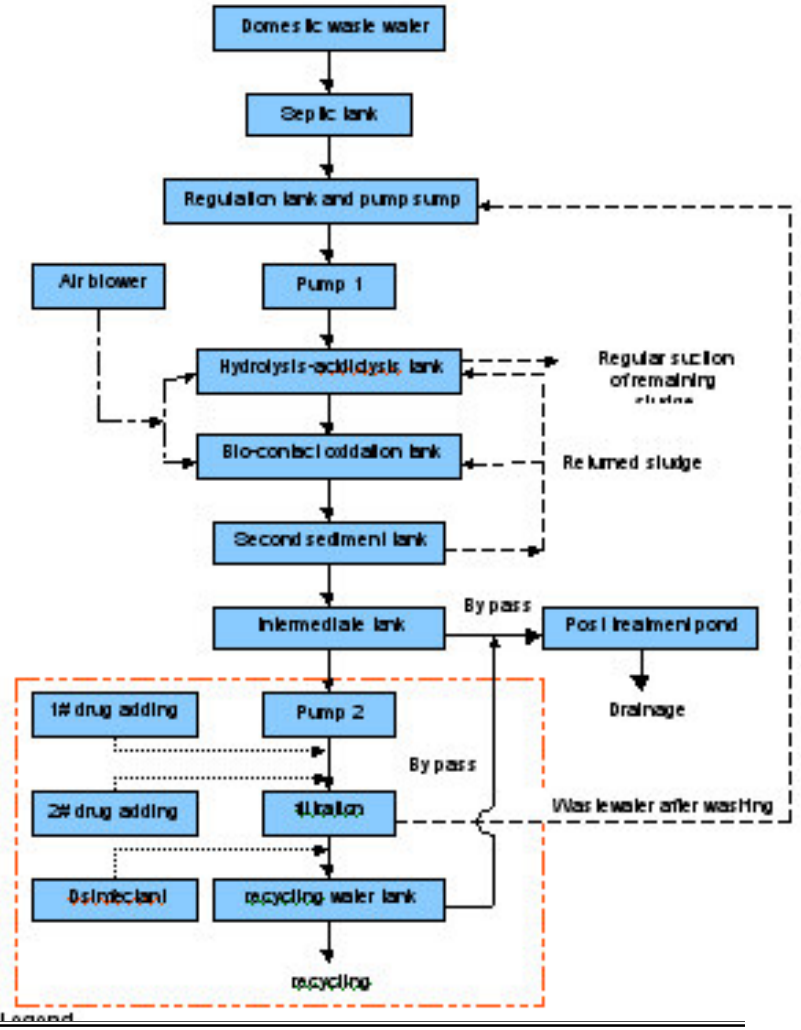
House building started 2004. First people move in Nov 2005



Christmas card 2005

Conventional treatment in activated sludge -final solution!

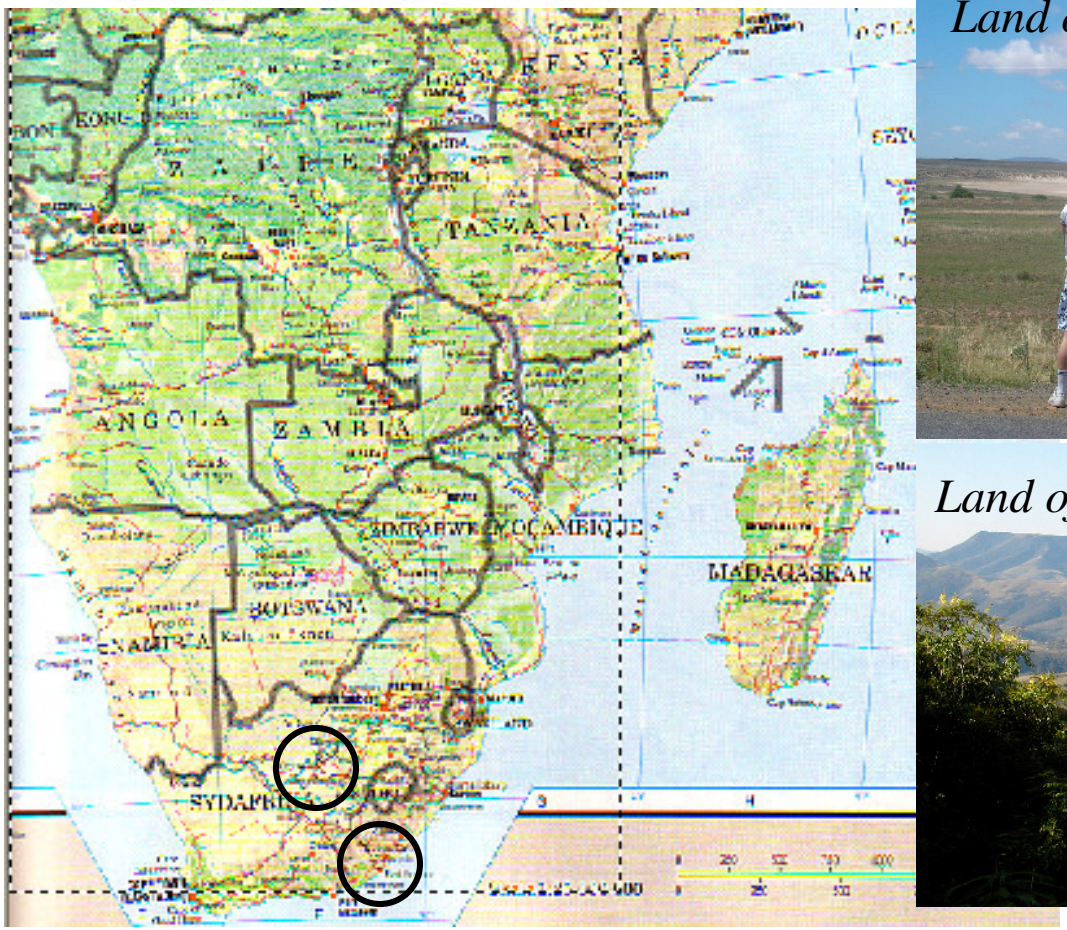
2006-02. GRW system built but not in operation. Photo Ebba af Petersens

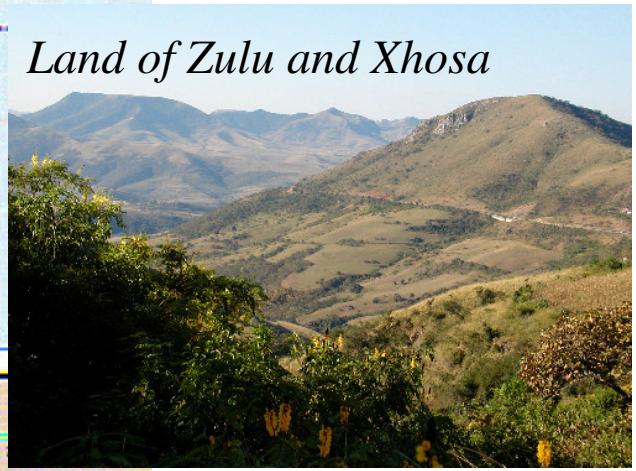


The Erdous experience so far:

- From focus on measures at point of origin (eg water saving, no use of harmful chemical etc) to focus on the end of pipe
- From onsite and natural based treatment to centralised and conventional WWTP (pumping, blowing, sludge management
- A “laboratory” is under planning where other more (sustainable solution) will be tested and demonstrated

Kimberly and East London (BCM), South Africa





A rich country with ...

.. mostly poor people.

With poor (no) sanitation

Supply with appropriate sanitation- essential in the RDP program

No water for flushing, no system for treatment

Challenge for ecosan!

Some prerequisites (in BCM)

- Total cost of sanitation: USD 400
- area available very limited (300 m2 total per hh)
- in general impermeable soils
- periods with heavy rainfall and no transpiration
- water supply can be limited to 6 m3/hh month (200 l/hh day)
- low awareness among people

Main Issues discussed...

Centralised or on site?

Controlling water use (GRW production)?

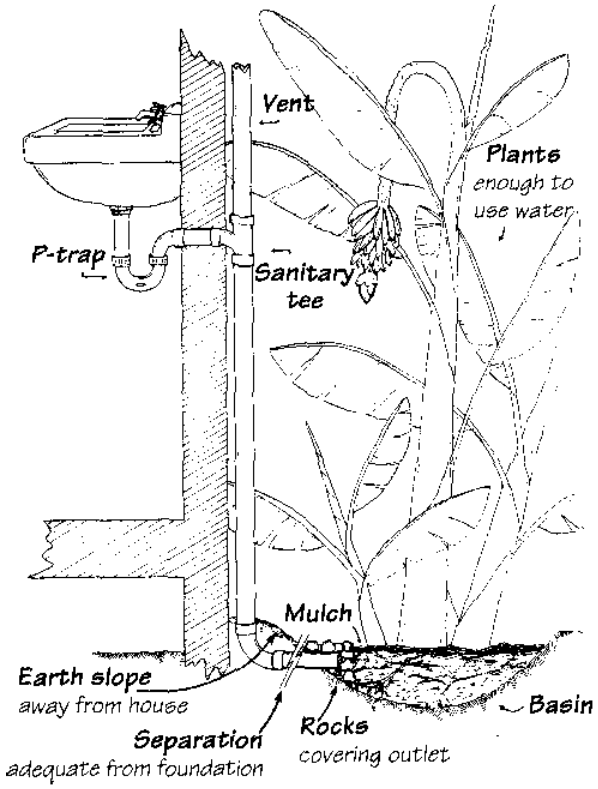
All greywater or only one or two fractions? (kitchen sink, showers…?

Need for treatment

Mulch bed principle, how design dimension and adapt?

Ecosanres core team: Peter Ridderstolpe, WRS, Håkan Jönsson, SLU and Kevin Wittington Jones, Rhodes University, SA.

Principle suggestion - direct use in mulch bed



Process principle

1. Removal of suspended solids (SS) by straining in mulch

2. Degradation of organic,s (BOD) by soil fauna (earthworms and bacteria's). Fats, oil, proteins, carbohydrates transformed to humic,s (mulch)

3. Water removal by infiltration and transpiration

Greywater learning's from Kimberly...

Succesful GRW irrigation in gardens, Hull Street, Jan 2006

.. more learning's from Kimberly...

Clogging sandfilter and pond system in Moshoeshoe (Ecovillage), May 2006

.. more learning's from Kimberly...

Clogged Pit-soakaways, Hull Street Jan 2006

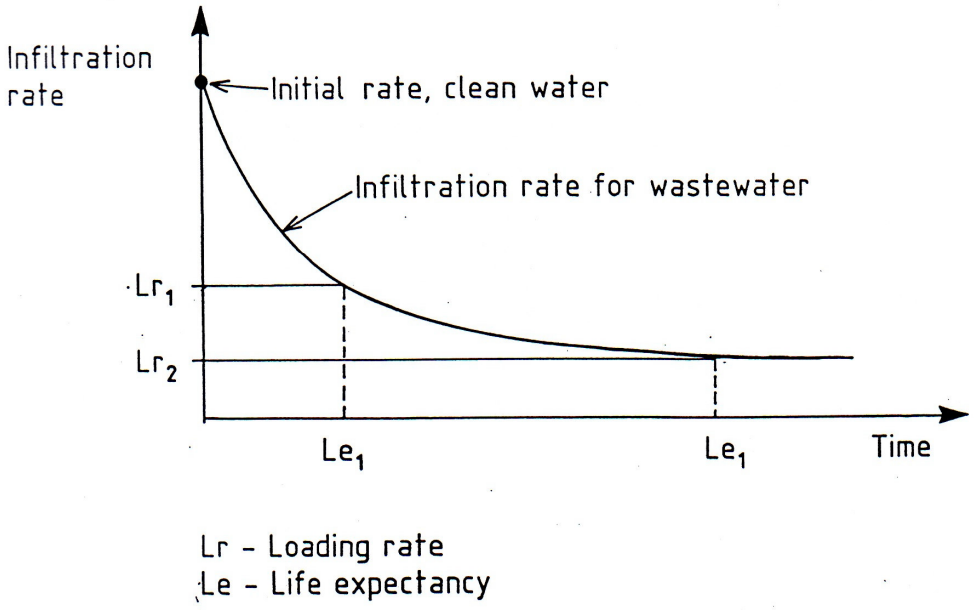
.. more learning's from Kimberly...

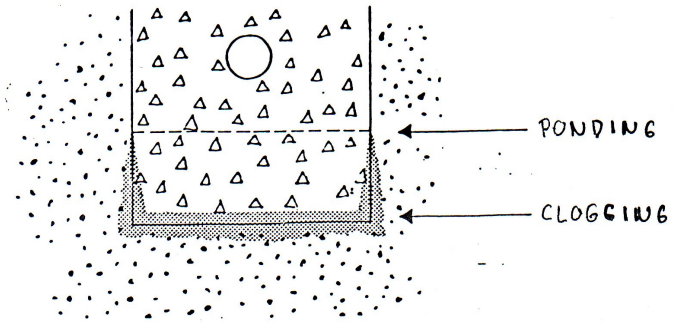
Combination grease trap and BOD removal in submerged biofilter- not a good idea. Hull Street, 2006

.. more learning's from Kimberly...

Signs of clogging in gravel trenches, Hull Street Jan 2006

Why stopping and clogging?

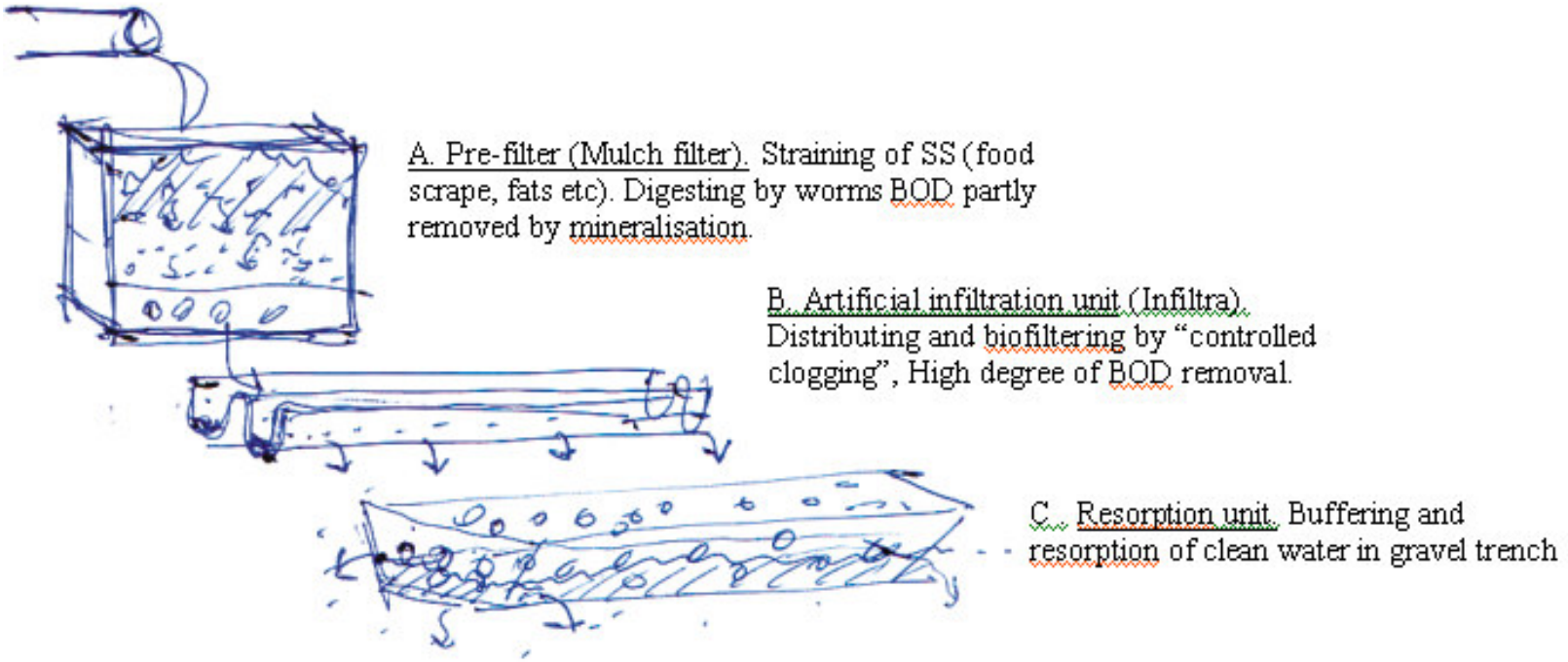




From, Jenssen, P, 1996, Fundaments in water infiltration and transport in soils

Particles and and much of BOD must be removed before resorption in fine textured soil !

The idea to be tested: “Mulch filter tower followed by improved resorption”



A. Pre-filter (Mulch filter). Straining of SS (food scrape, fats etc). Digesting by worms BOD partly removed by mineralisation.

B. Artificial infiltration unit (Infiltra). Distributing and biofiltering by “controlled clogging”, High degree of BOD removal.

C. Resorption unit. Buffering and resorption of clean water in gravel trench

Dimensioning criteria (worse case)

Q = 180 l/d (Max short periods 300 l/d)

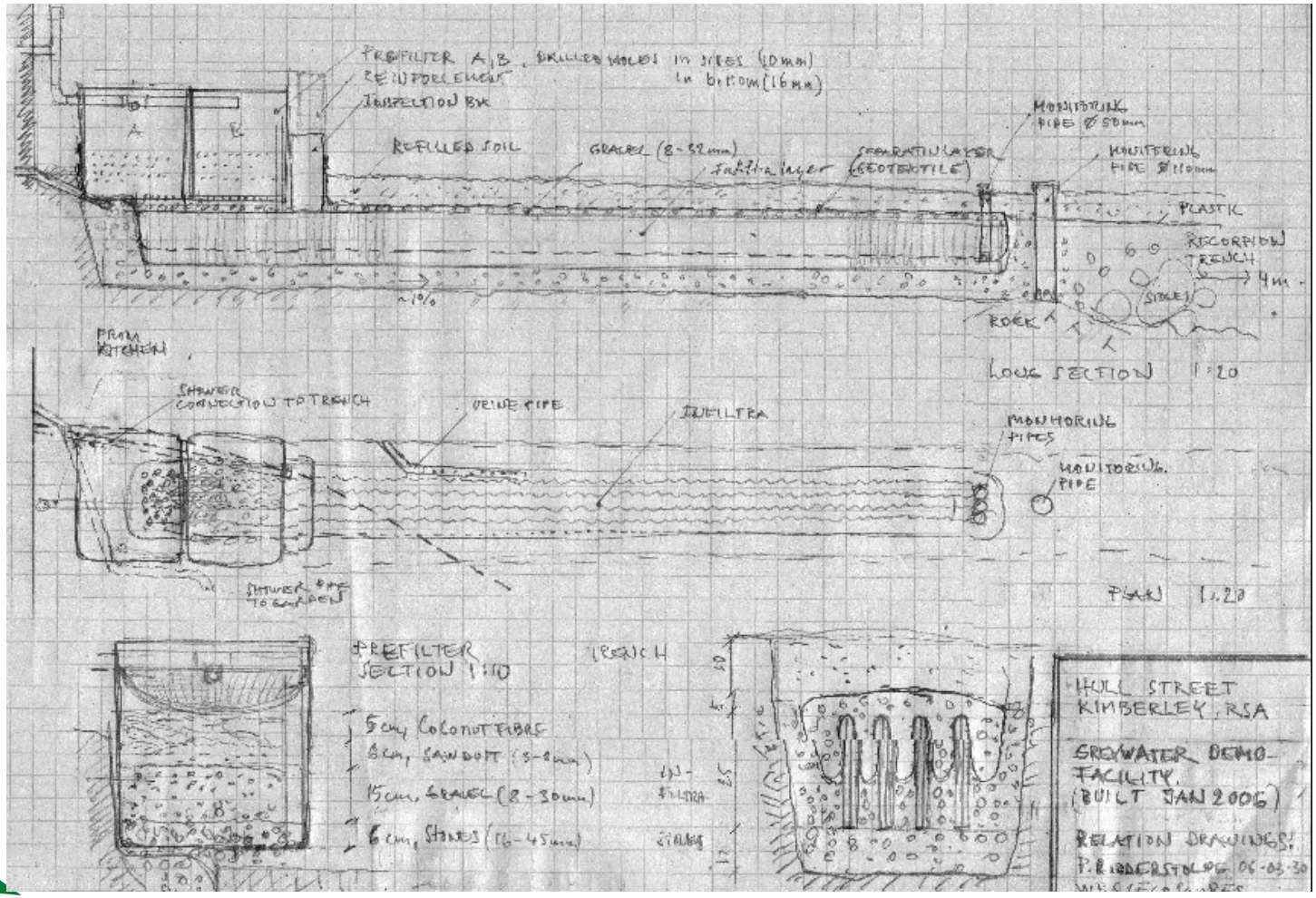
qdim = 20 l/h (10 l/min)

TS = 350 g/d

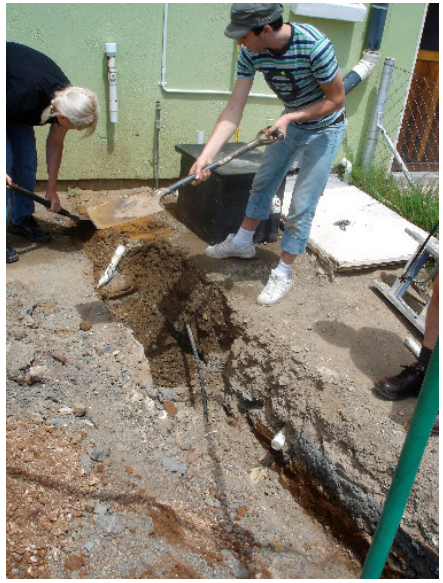
COD = 300 g/d

BOD = 70 g/d

Demo facility, relation sketch



Building demo facility, Hull Street Jan 2006

Building demo facility, continue

After five month in operation (May 2006)...

Dissecting the demo-system, continue….

Dissecting the demo-system, continue….

Dissecting the demo-system, continue….

Following up demo facility May 2005

Following up demo facility Nov 2005

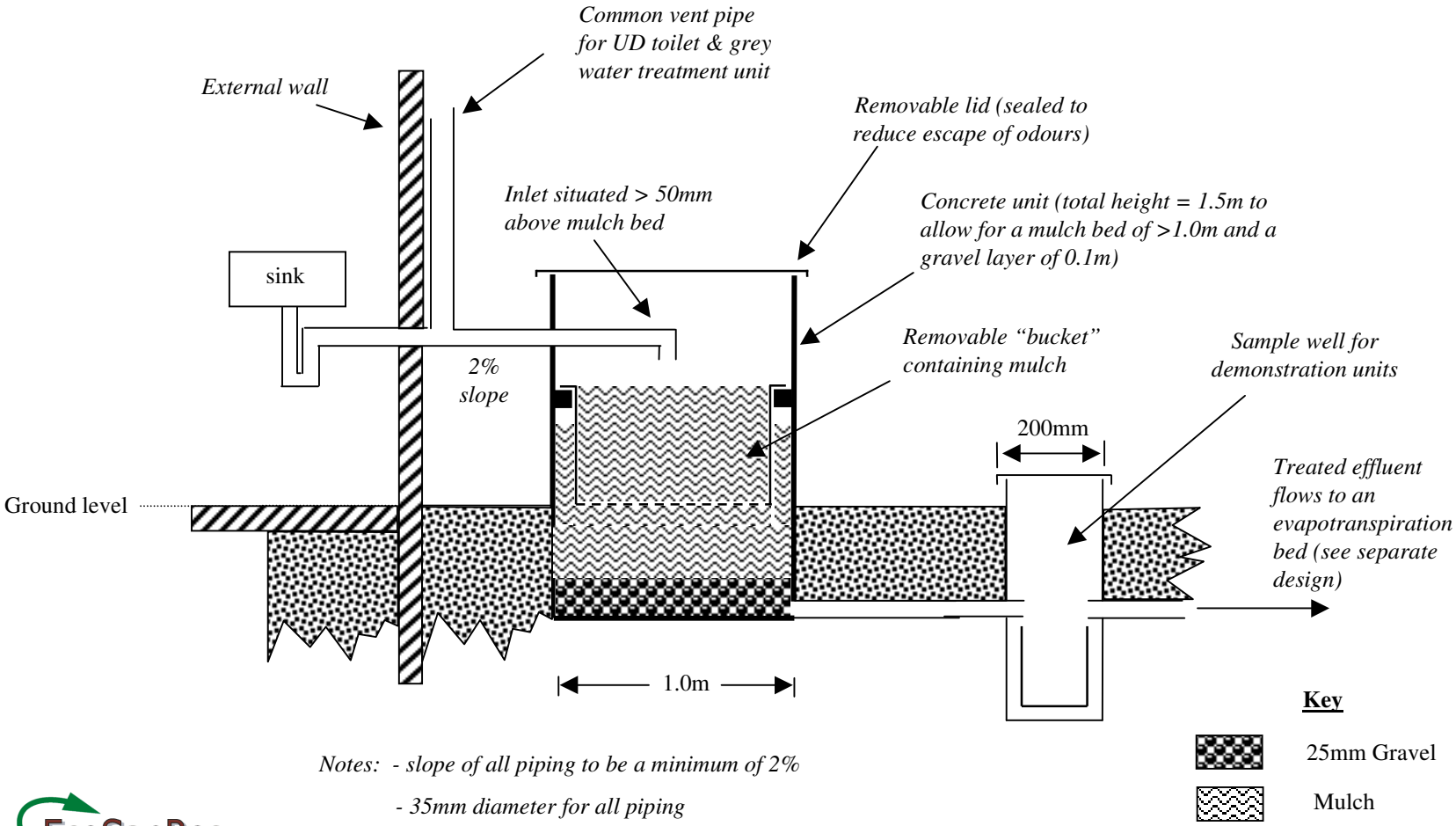
Assessing the Kimberley experience

Demo facility very promising. Indicate that mulch filter principle can be an efficient, robust and affordable method for GRW treatment and end-use in urban areas for poor peoples.

Much trials, errors and failures in previous built systems have made people very frustrated. Obvious risk for centralised system with conventional treatment

Very important that demo facility is kept and followed up!

Mulch Bio Reactor -a compact and sheltered mulch bed system



Building demo facility, BCM May 2006

Building demo facility, BCM, contiue...

Demo facility, BCM June 2006

Conclusions and Recommendations:

- Need for technique development, testing and learning's. System evaluation

Recommendations:

- Consider the whole system! Source control is essential.

- Requirement (ToR): “safe disposal and reuse” (no smell, no logging, no bacteria exposing)

- Agree on dimensioning ToR criteria. Remember that all system built on site onsite must be designed from worse scenario.

- Vertical soil filters are proven and often appropriate in cold climates. Soil macro fauna (worms) and green plants should be used in warm climates .

Always do pilots, Be careful in planning, design, installation/building! Monitor and learn! Upscale stepwise.

Read more...

- ***Introduction to Greywater Management*** and ***other reports found on Ecosanres homepage***; www: Ecosanres.se

- ***Sustainable Wastewater Treatment for a New Housing Area- How to find the right solution*** and ***other reports CCB homepage***, also translated in Russia. www. ccb.se

- **Oasis design,** Various litterature about GRW, http://www.oasisdesign.net/greywater/index.htm

- **Biolytix**; http://www.biolytix.com/index.php