Alternative hybrid UF-SAT or SAT-NF treatments to upgrade effluent quality

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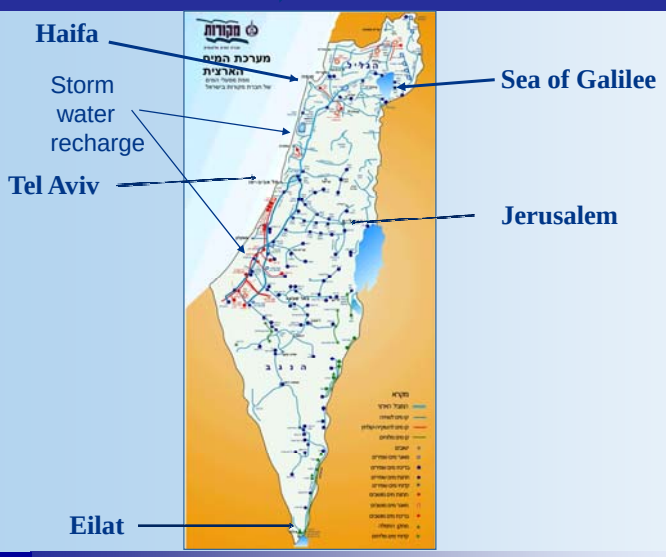
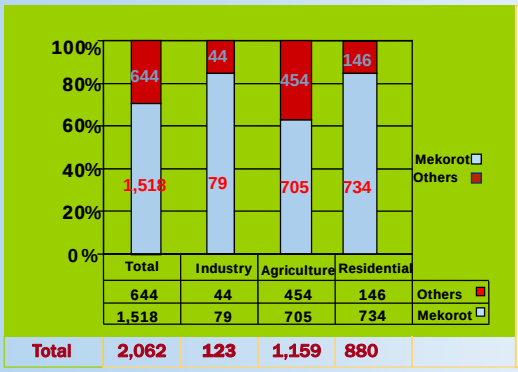
Mekorot, Israel National water Co.

Israel's National Water Supply System

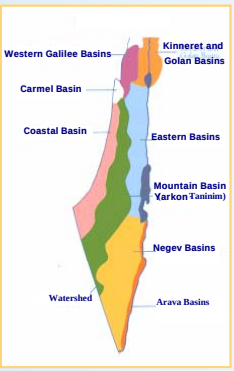


Israel's National Water Supply

Annual Water Consumption in million m³ (m.c.m.)



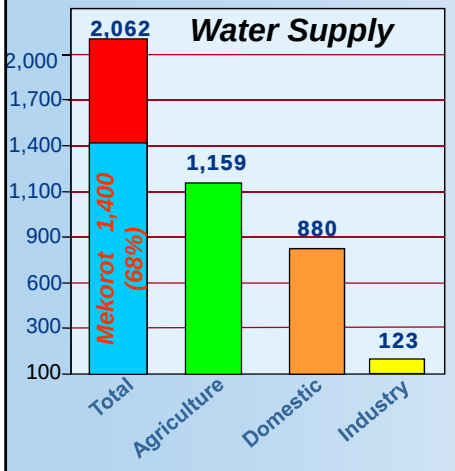
	Total	Industry	Agriculture	Residential	
	644	44	454	146	Others
	1,518	79	705	734	Mekorot
Total	2,062	123	1,159	880	

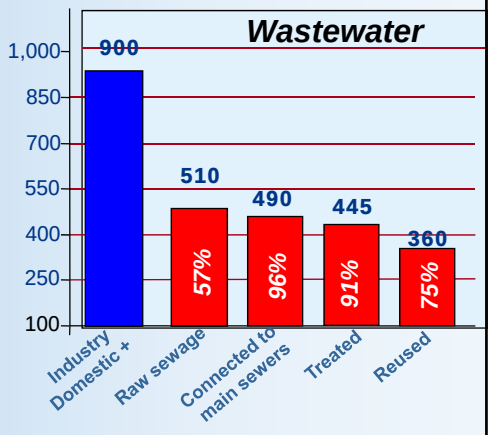


Based on 2007 figures

Water consumption and wastewater production in Israel (Mm3/Year)

(100 Mm3/Year to Jordan and Palestine)





The Main Water Problems in Israel

- Pollution and salinization of part of the coastal aquifer due to the intensive urbanization, industrial pollution and agriculture activities
- Intensive urbanization - change from extensive to intensive wastewater treatments methods
- Scarcity of natural water sources - very high effluent reuse

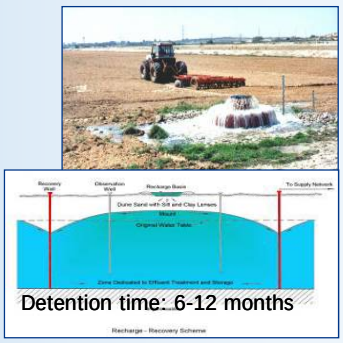
Dan Region WWTP and Reclamation project

140 Mcm3/year

Soil Aquifer Treatment

SAT basins – divided to sub-basins

View from a sub-basin at the beginning of the filling cycle and a soil treatment machine



Third Line supply area

PROBLEMS IN THE SAT SYSTEM

During the 30 years of operation:

1. Deterioration in Recharge Capacity (OM, Temp, Rain)
2. Bio-fouling of Effluent Pipelines(Before and after SAT)
3. Mn and Fe oxides due to anaerobic conditions in part of the SAT system cause clogging problems in irrigation systems
4. No more new lands are available for infiltration !!

TREATMENT ALTERNATIVES for the Mn and Fe Problem

1. shut off wells with high Mn conc' (more than 500 ppb)
2. Flushing of the main pipe at the beginning of the irrigation season
3. Mechanical cleaning of the pipe-line (pigging)
4. Automatic control of the flooding – drying cycles in SAT system to ensure aerobic conditions in the Vadose zone
5. Researches

SUGGESTED SOLUTIONS: HYBRID UF-SAT OR SAT-NF TREATMENTS

In order to improve the current extensive method (convetional SAT) and be able to infiltrate more effluents in a given infiltration area two EU Research projects were started in 2005-2006:

- The RECLAIM project: UF- short SAT
- The SWITCH project: short SAT-NF

THE RECLAIM PROJECT

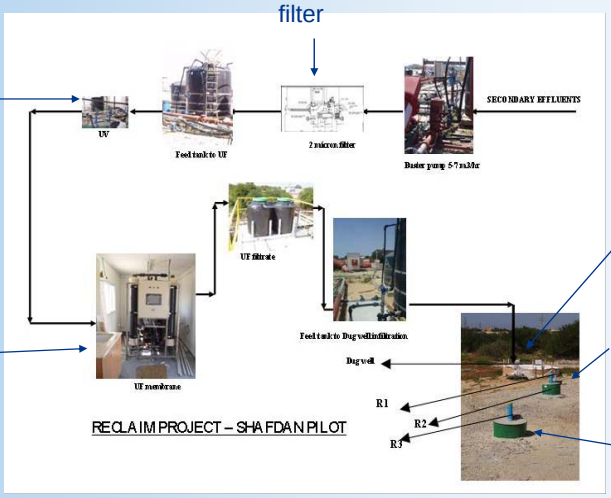
- Ultra-filtration (UF) of the secondary effluents
- Dug Well injection at short term (up to two months).
- The results from this operation were compared with the actual long - term system (up to 12 months SAT).

RECLAIM PILOT – UF + Short SAT

Fiber filter

UV-MP 100 mj

UF 0.01 u



Dug Well

OW -10 days

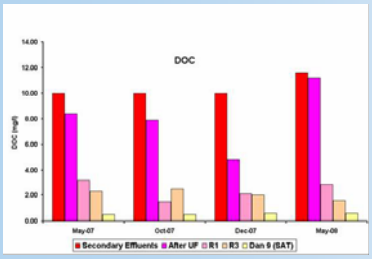
OW -35 days

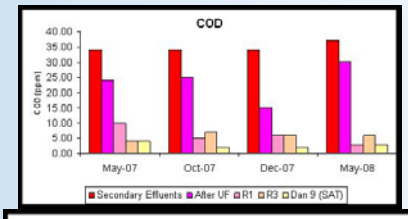
THE RECLAIM PROJECT RESULTS

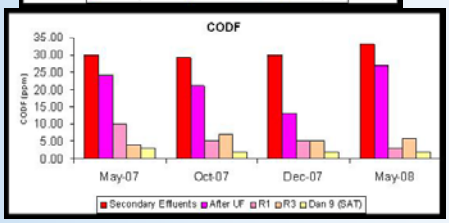
- **UF as pretreatment to SAT:**
  - **Increasing of infiltration velocity (10 m/d instead of 1 m/d in convetional SAT)**
  - **most of the polysaccharides and other clogging material were retained on the UF**
- **Short SAT (1-2 month retention time) able to remove :**
  - **all N removed**
  - **most of C (only 2-3 mg/l DOC left)**
  - **P was not removed effectively**
  - **High removal of all bacteria and viruses**
  - **In comparison to the long SAT (DOC 0.5-1 mg/l), still some micropollutants were present**

RECLAIM PROJECT RESULTS: DOC, COD, CODf

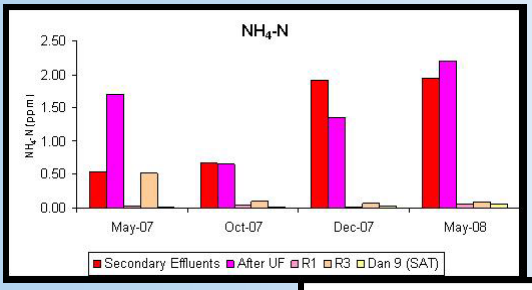
R3 : final short SAT -35 days retention time results
Dan 9:conventional SAT results)

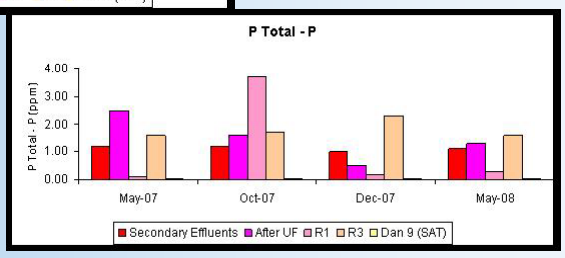




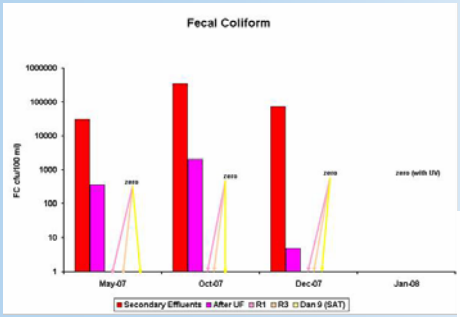


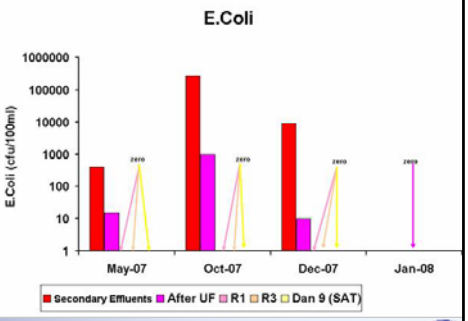
RECLAIM PROJECT RESULTS: NH4, P





RECLAIM PROJECT RESULTS
Bacterial and virus removal





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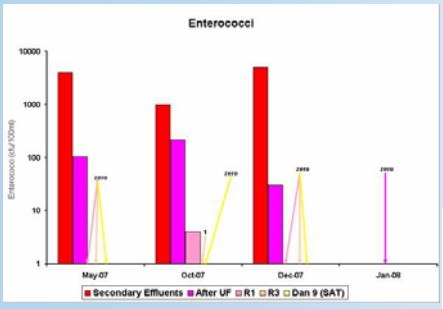

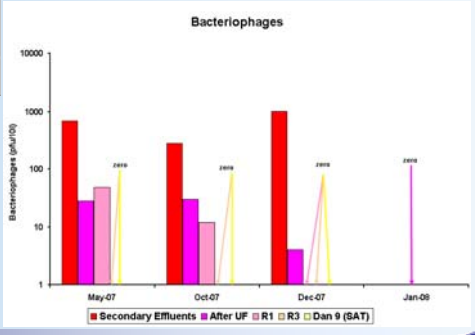

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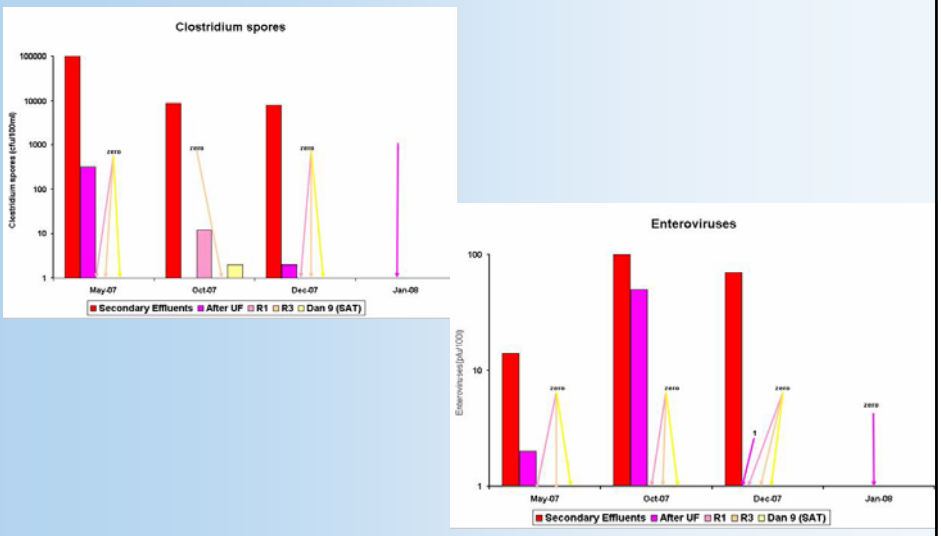
Bacterial and virus removal



RECLAIM PROJECT RESULTS:
Micropollutants

- **long range SAT : hardly biodegradable organic compounds like Trimetoprim and Carbamazepin, estrogens are removed.**
- **short SAT: partial removal**

IMPORTANCE OF SWITCH RESEARCH: TO CHECK THE PROCESS EFFICIENCY IN COMPARISON TO RECLAIM RESEARCH

- **An alternative Switch method :**

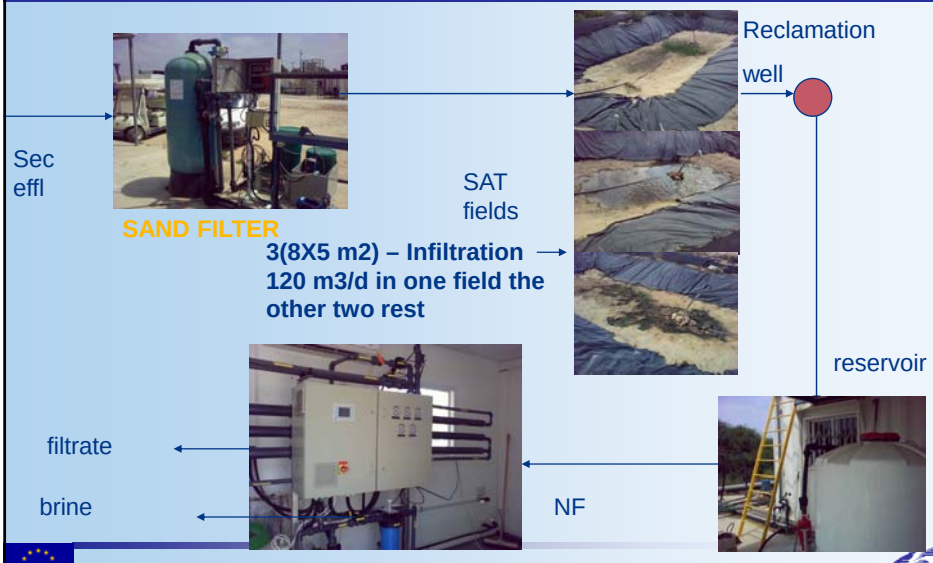
Principle of removal of the clogging material:

*** Prefiltration on a sand filter**

*** Extensive SAT to improve the infiltration velocity**

***Polishing with a nano-filter (NF) which will remove the micropollutants efficiently**

SWITCH PILOT PLANT



LOCATION OF THE SWITCH PILOT PLANT

SAND FILTER

SAT INFILTRATION PONDS AND RECLAMATON WELL

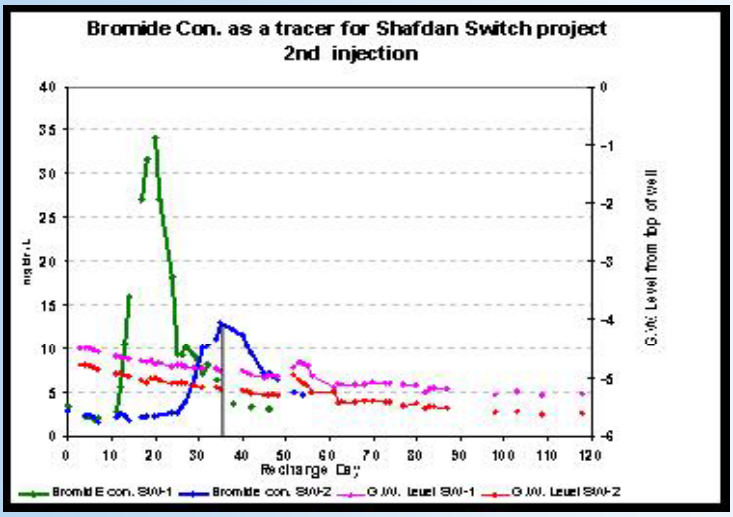
3(8X5 m^2) – Infiltration of 120 m^3/d in one field the other two rest

Reclamation well

Switch pilot – status and intermediate results

- Completion of 2 tracer tests (Bromide),
- September 2008: The first infiltration tests with sand filtered secondary effluents
- Sand filter removal:
  Turbidity: 1 NTU (from 1.5-3 NTU)
  TSS : 1 mg/l (from 2-4 mg/l).
  As a result no clogging of the fields is seen even at 3-4 m/d infiltration velocity.
- Beginning November 2008: Analyses of the first samples after SAT to check if the polysaccharides and other clogging material had been retained by the sand filter and the short SAT
- November 2008: Operation of the NF membrane

SWITCH, TRACER TEST



The SWITCH PROJECT results till now compared to the conventionl SAT and RECLAIM

The process	The method	Infiltration rate	Retention time in aquifer before pumping	Expected final effluent quality
Conventional SAT	1 day infiltration 2 days relaxation	1 m/d	6-12 months	DOC 0.5-1 mg/l, no bacteria and viruses, most micropollutants removed
UF-Short SAT	UF prefiltration and short SAT	10 m/d	1-2 month	DOC 2-3 mg/l, no bacteria and viruses, some hardly biodeg. micropollutants not removed
Short SAT-NF	Sand filter prefiltration, short SAT, NF	3-4 m/d	1-2 month	Final quality after NF expected to be like conventional SAT (not completed yet)