INNOVAMED

The re-use of treated wastewater for sustainable agriculture

Morocco: Drarga Wastewater Treatment and Reuse Project

October 8-11, 2007

Morocco's water challenge

- Morocco is projected to become a water deficit country by 2020
- Some areas of Morocco are already experiencing severe water shortages
- The Souss-Massa region in southern Morocco is under significant water stress

The Commune of Drarga

- Drarga is a rapidly expanding town in the Souss-Massa (population 10,000)
- The town of Drarga has built potable water and sewage collection systems
- Raw wastewater was released untreated in nature, creating cesspools

Project Objectives

- Treat the domestic sewage of Drarga
- Reuse the treated effluents for irrigation
- Implement a technology adapted to the Moroccan context
- Recover the operation and maintenance costs of the plant
- Demonstrate a model of institutional partnership

Project Steps

- 1997 : Feasibility study
- 1997 : Environmental impact assessment
- 1998 : Signature of a collective agreement
- 1998 : Observational study tour in the U.S.
- 1998 : Plant design
- 1999 - 2000 : Construction
- October 2000 : Inauguration

Institutional Partnership

- Collective agreement signed between project partners:
  - Moroccan Ministry of Environment
  - WRS project (USAID financing)
  - Wilaya of Agadir
  - Commune of Drarga
  - ERAC-Sud
- Technical monitoring committee

CRITERIA FOR SELECTING APPROPRIAT TECHNOLOGY

- Efficiency and performance of the technology;
- Reliability of the technology;
- Institutional manageability, financial sustainability;
- Wastewater characteristics,
- Desired effluent quality which is mainly related to the expected uses

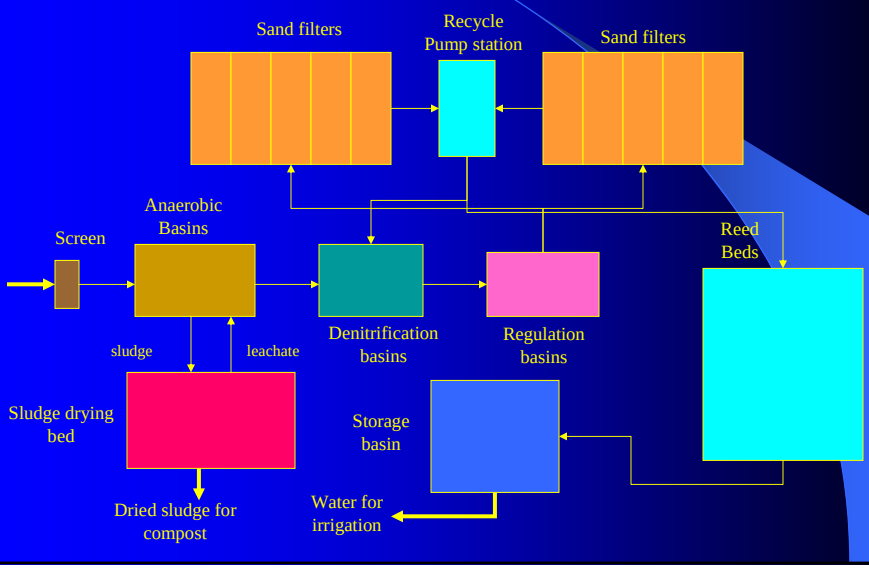
Potential cost effective alternatives

- Stabilization ponds or lagoons,
- Sand filters,
- Land treatment systems, and
- Constructed wetlands

Plant design

- Treatment capacity : 1000 m^3 / day
- Recirculating sand filtration system
  - Primary treament: anaerobic basins
  - Secondary treatment: sand filters
  - Tertiary treatment: reed beds
- Residual sludge drying beds
- Treated effluents storage basin

Drarga wastewater treatment process



View of the wastewater treatment plant

Anaerobic basin

Denitrification basin


Sand filters

Maintenance of sand filters

Re-circulation of effluents


Reed beds


Storage basin

Office and laboratory

Plant performance

Indicator	BOD_5 (mg/l)	COD (mg/l)	TSS (mg/l)	NTK (mg/l)	Fecal Coliforms (mg/l)
Entrance	625	1825	651	319	$6.3x10^6$
Standard	<30	N/A	<30	N/A	10^3
Exit	10	75	3.9	10.2	<500

Project Costs

- The project cost is $1 million
  - Studies : $150,000
  - Design : $100,000
  - Construction : $400,000
  - Equipment : $250,000
  - Transportation : $100,000
- Operating costs : $1,000 per month

Cost recovery

- Methane gas is recovered from the anaerobic basins and converted to energy
- Treated wastewater is sold to farmers for irrigation
- Reeds are harvested and sold
- Residual sludges will be dried and used with organic solid wastes from Drarga to make compost

Wastewater reuse

- Treated effluents are sold to farmers through a water users association
- Treated effluents contain fertilizer elements (potassium, phosphorous)
- The price of the treated wastewater is competitive with alternative water sources

Reuse Perimeter

- Area : 6 hectares
- Farmers : 12
- Soil texture : sandy loam (risk of nitrate infiltration)
- Irrigation system : surface, microjet and drip


Zucchini

Tomatoes

Maize

Impact of reuse

Biomass Yield				
	Yield of the 1st cut (T/ha)	Total yield (T/ha)	Average yield (T/ha)	Yield California-Davis (T/ha)
Alfalfa	2.85	28.5	14	31
Italian Ray-Gras	9.75	48.7	21	-

Fertilizer savings

	Tomato	Zucchini	Alfalfa	Italian Ray Grass	Wheat	Maize
Water Requirements (m3/ha)	8 000	5 000	12 000	10 000	4 000	4 800
Nitrogen (kg/ha)	248	155	372	310	124	149
Phosphorous (kg/ha)	352	220	528	440	176	211
Potassium (kg/ha)	408	255	612	510	204	245

Project Impact

- The town of Drarga has full sewage treatment
- There is more water available for irrigation
- Crop yields have increased and farmers are saving on fertilizer applications
- Property values in Drarga have increased
- The project has generated a lot of interest from other localities in adopting similar technologies

Conclusion

- The Drarga wastewater treatment and reuse project is demonstrating the use of non-conventional water sources in a water scarce environment
- This project and the lessons learned from it can serve as a useful model for replication of similar technologies and approaches in many areas