



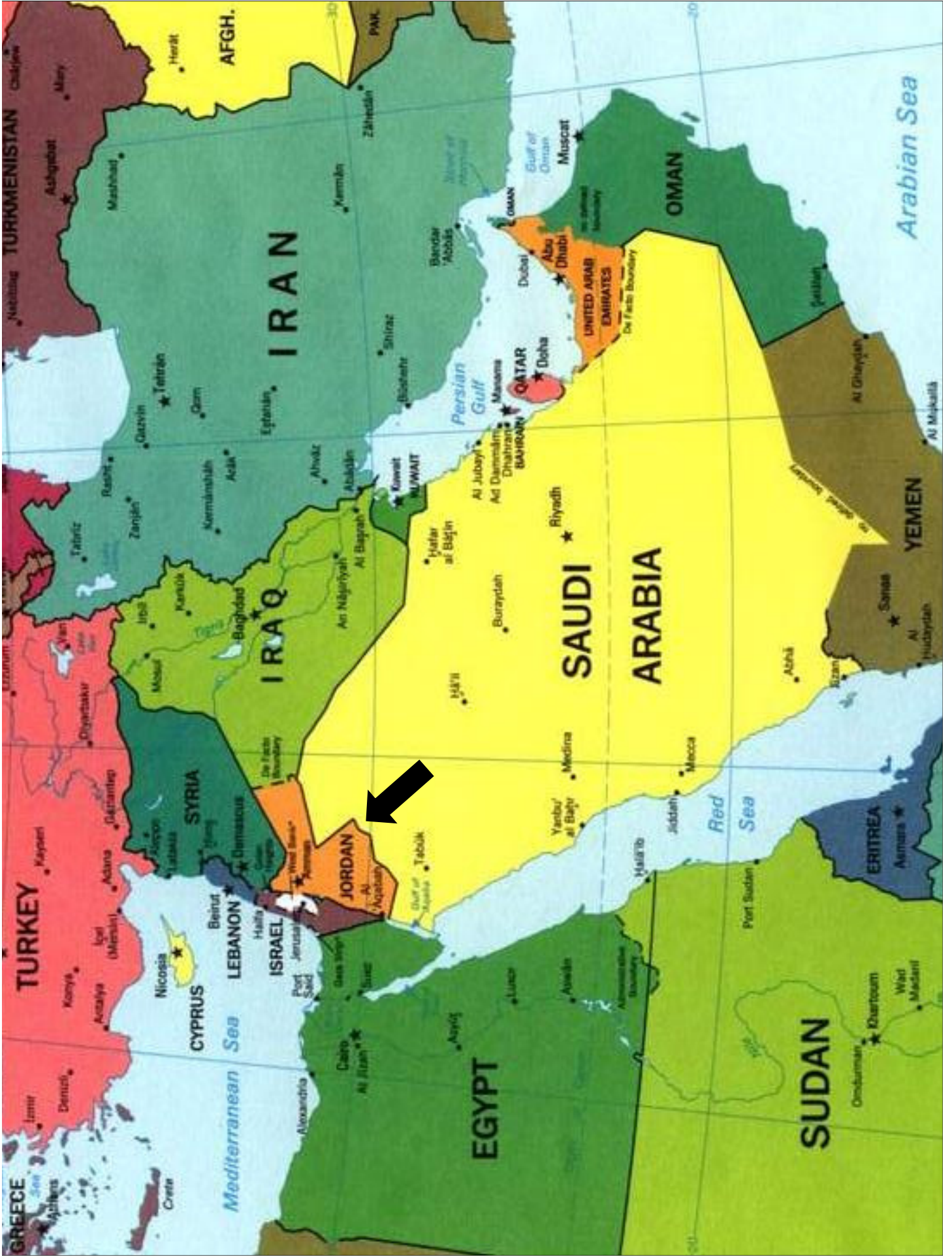
# Projektvorstellung

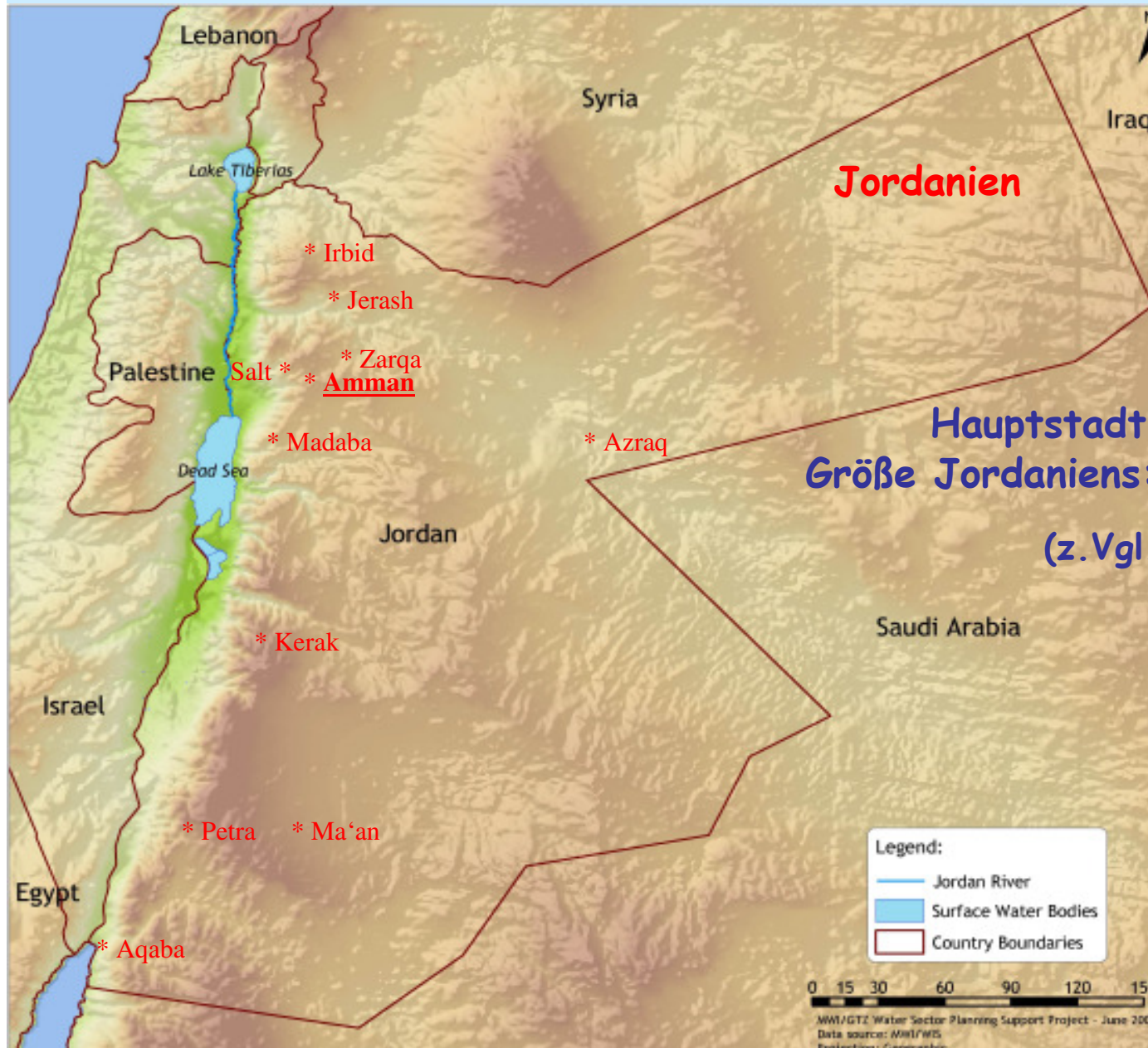
## FH Mainz, 23.02.2006

# Reclaimed Water Project

Thomas Ziegelmayer







**Hauptstadt:** Amman  
**Größe Jordaniens:** 88.946 km<sup>2</sup>  
 (z. Vgl. Deutschland:

357.030 km<sup>2</sup>)

3-Teilung:

Jordantal

Bergland

Hochplateau

(90% Wüste  
 oder Steppe)

# Klima (1)



## Westen:

- mediterranes Klima
- Temperatur: Sommer bis 40 °C, Winter z.T.
- Niederschlag 300 - 500 mm



# Klima (2)



## Osten und Süden:

- Wüstenklima
- Temperatur: 25 °C Jahresdurchschnitt
- fast kein Niederschlag



# Wasserressourcen



	D (z.Vgl.)	Israel	Palästina	Jordanien
<b>2003:</b> <b>Erneuerbare Wasserressourcen</b> [m <sup>3</sup> /EW a]	<b>1.864</b>	<b>265</b>	<b>62</b>	<b>169</b>
<b>Wasserentnahmen</b> [% der erneuerb. Wasserressourcen]	<b>31</b>	<b>108</b>	<b>100</b>	<b>151</b>
<b>Wassernutzung</b> [Haushalte:Industrie:Landwirtschaft]	<b>11:69:20</b>	<b>39:7:54</b>	<b>30:0:70</b>	<b>22:3:75</b>
<b>2025:</b> <b>Erneuerbare Wasserressourcen</b> [m <sup>3</sup> /EW a]	<b>1.878</b>	<b>215</b>	<b>30</b>	<b>123</b>
<b>Pro-Kopf-Verbrauch</b> [l /EW d]	<b>128</b>	<b>275</b>	<b>63-104</b>	<b>115</b>

## Mujib Reservoir



# Wadi Rum





# Abhilfemaßnahmen gegen Wassermangel



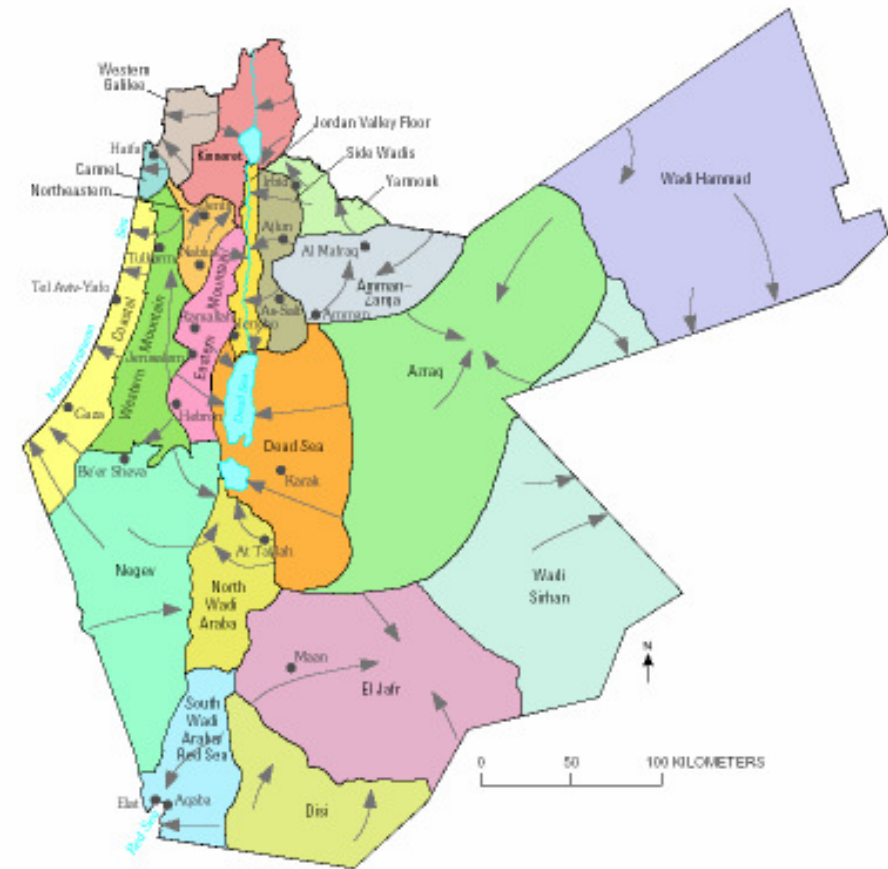
- **Wiederverwendung von Abwasser (Landwirtschaft, Industrie)**
- **Zwischenspeicherung von Regen- und Flusswasser**
- **Optimiertes Wassermanagement (Bewässerung, Wasserverluste)**
- **Entsalzungsanlagen bauen**
- **weitere Grundwasserreserven erschließen**
- **Wasserimporte**
- **künstliches Ausregnen**

*... und:*

- \* *Bevölkerungszuwachs minimieren*
- \* *kein Export virtuellen Wassers*



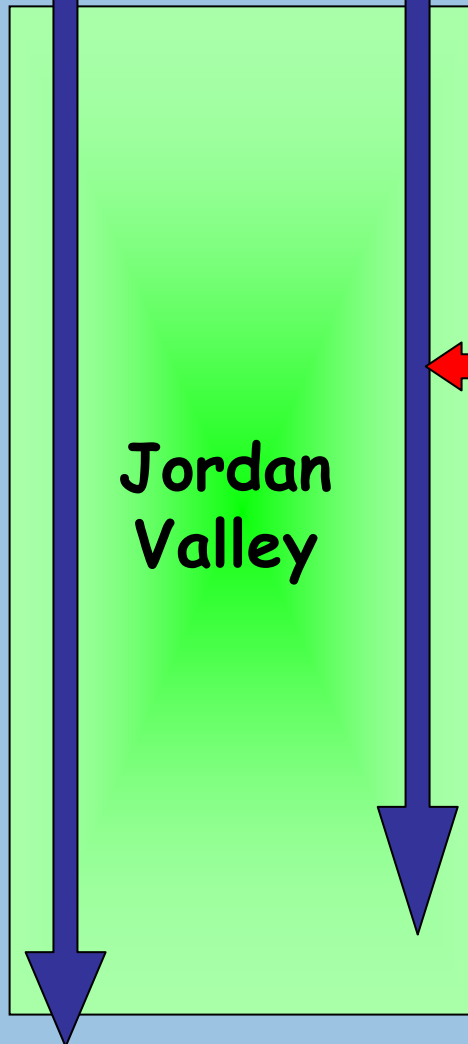
# Wasserressourcen Jordaniens



Jordan River



King-Abdullah-Canal



WWTP Kufrinja  
(Wadi Kufrinja)

WWTPs Khirbet As-Samrah,  
Baq'a, Jerash and Abu Nuseir  
(Wadi Zarqa)

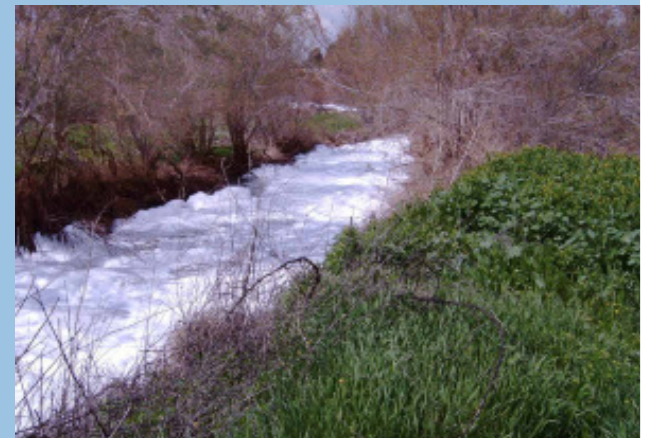
WWTPs As-Salt and  
Fuheis-Mahes  
(Wadi Shueib)

WWTP Wadi Essir  
(Wadi Kafrein)



Jordan Valley

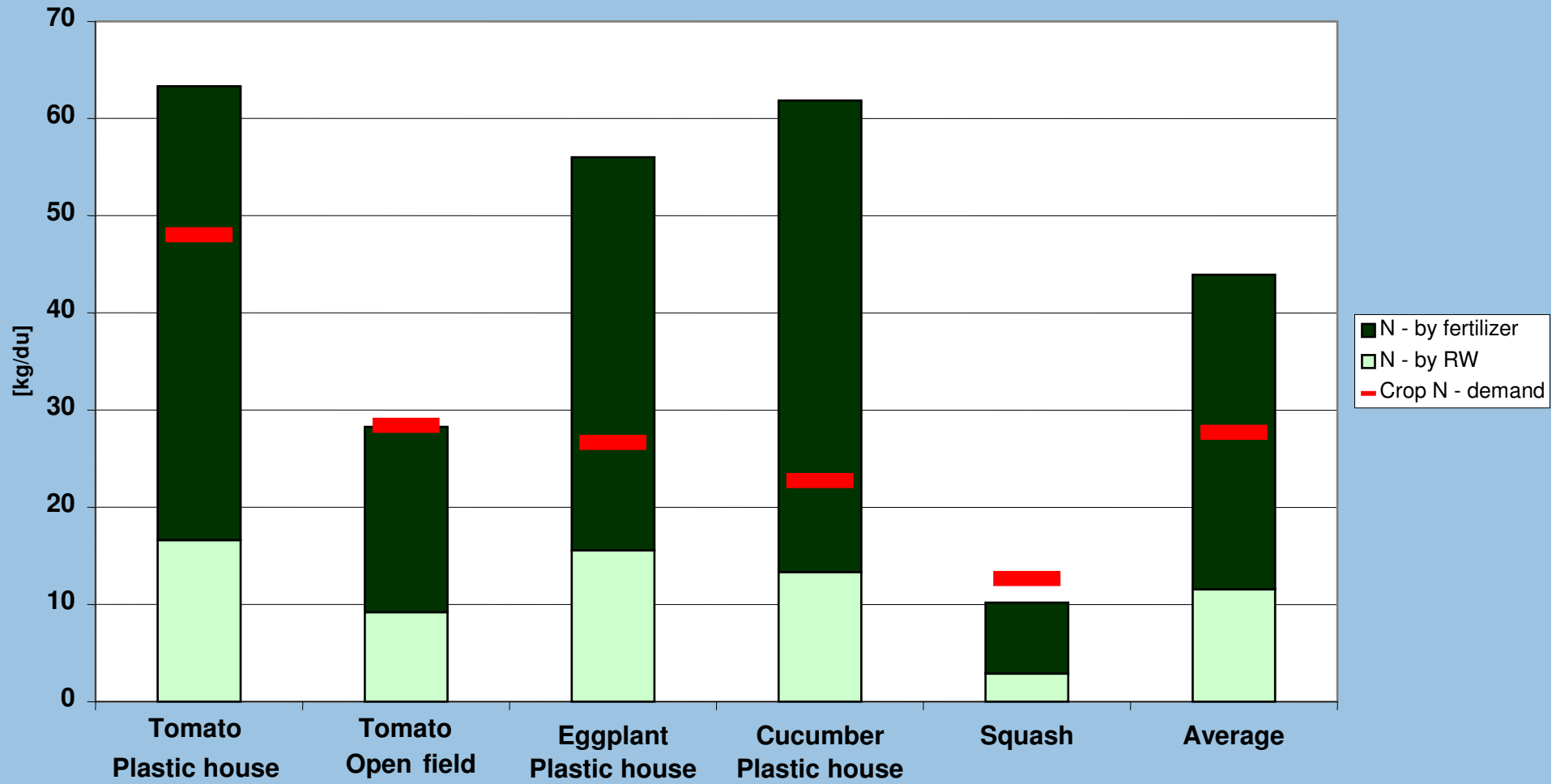
# WWTP Khirbet As-Samra



# N - supply for vegetables



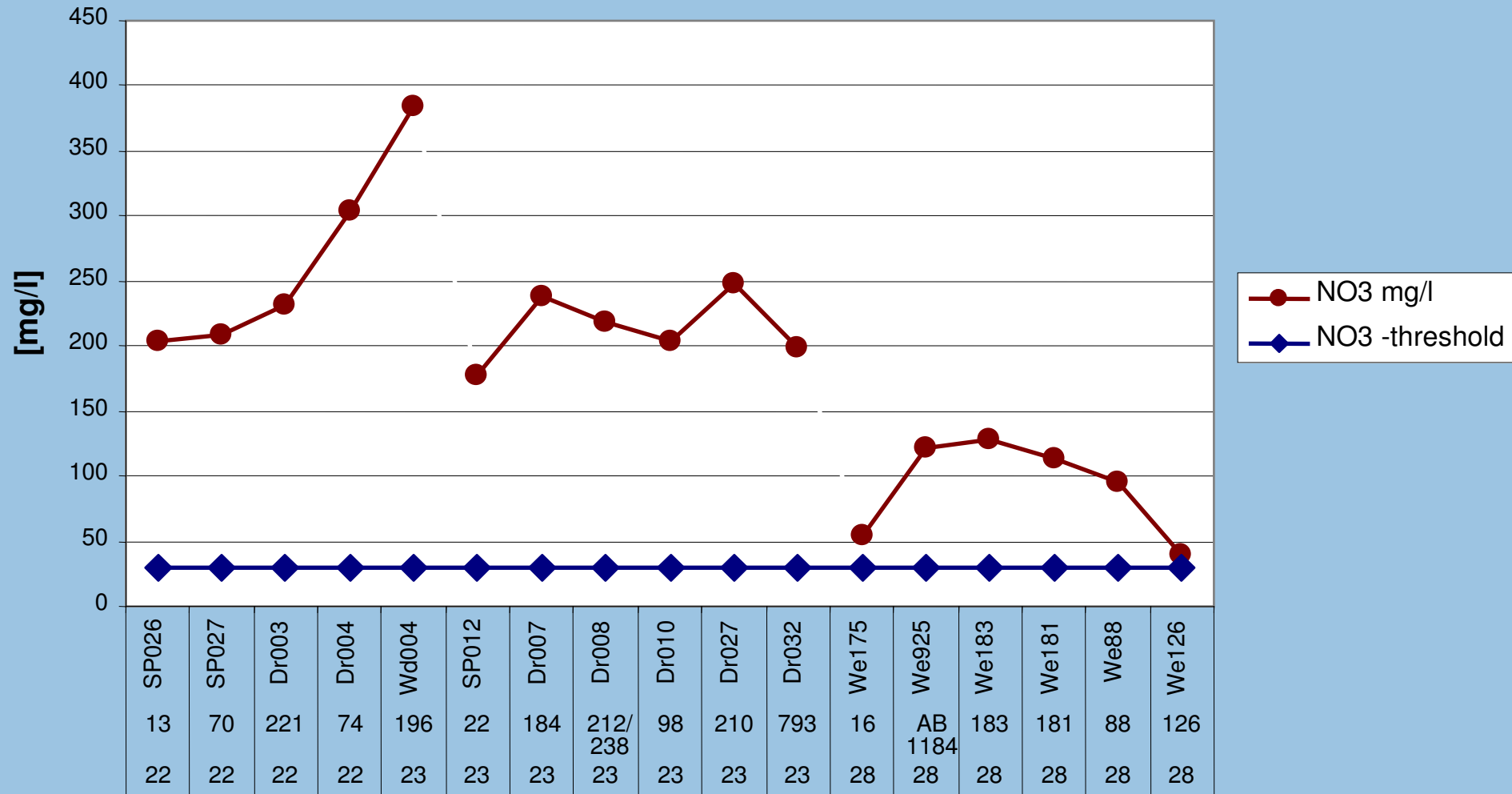
## by Reclaimed Water and fertilizers (RWP 2004)



# NO<sub>3</sub> in groundwater



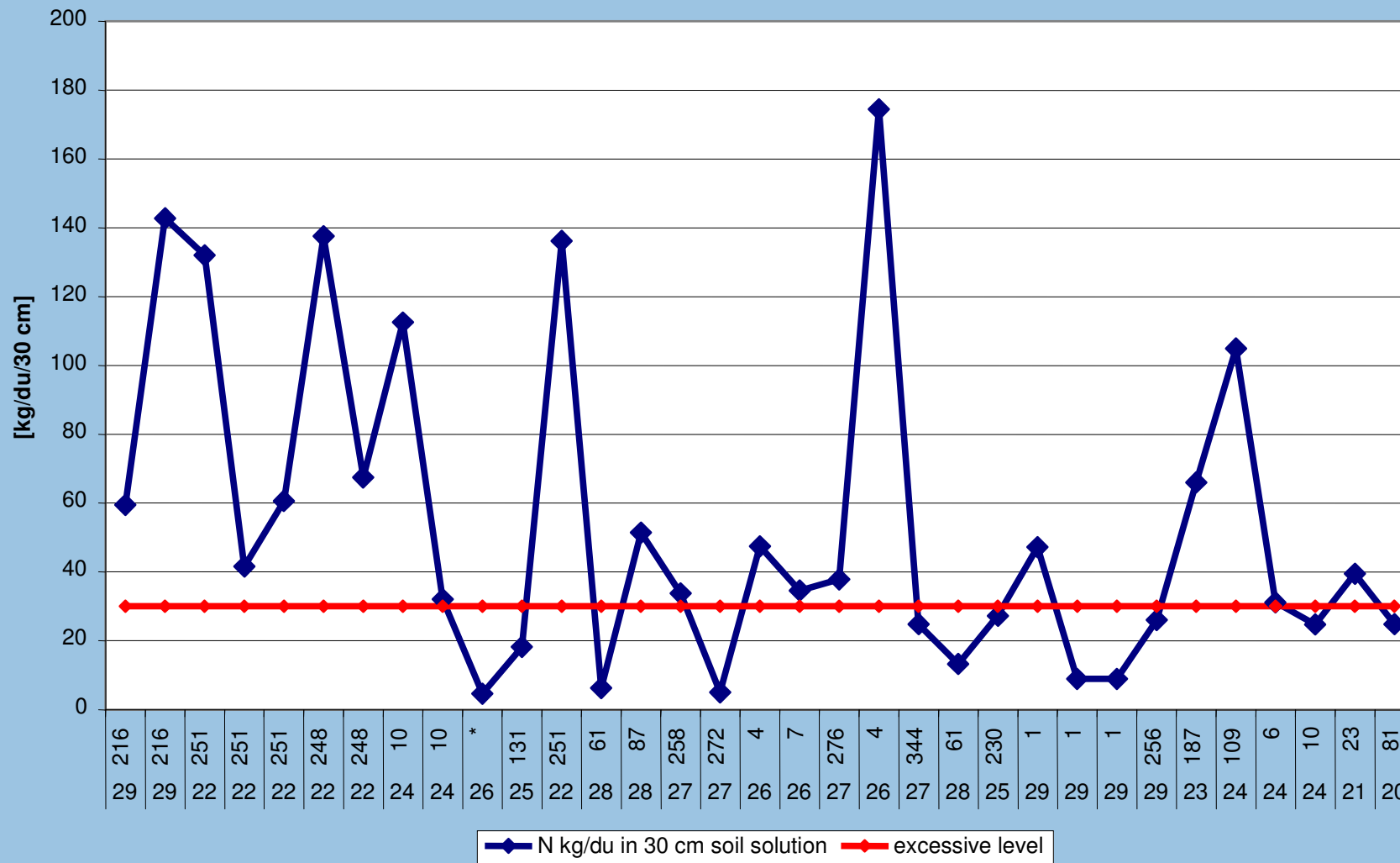
(RWP 2004)



# NO<sub>3</sub>-N in 30 cm surface layer



(RWP 2004)





# Jordanian-German Technical Cooperation



Jordan Valley Authority (JVA) – German Technical Cooperation (GTZ)

## **Reclaimed Water Project**





# “Reclaimed water”



## Definition:

**Treated municipal wastewater  
mixed or unmixed with other water sources  
to be used for irrigation**



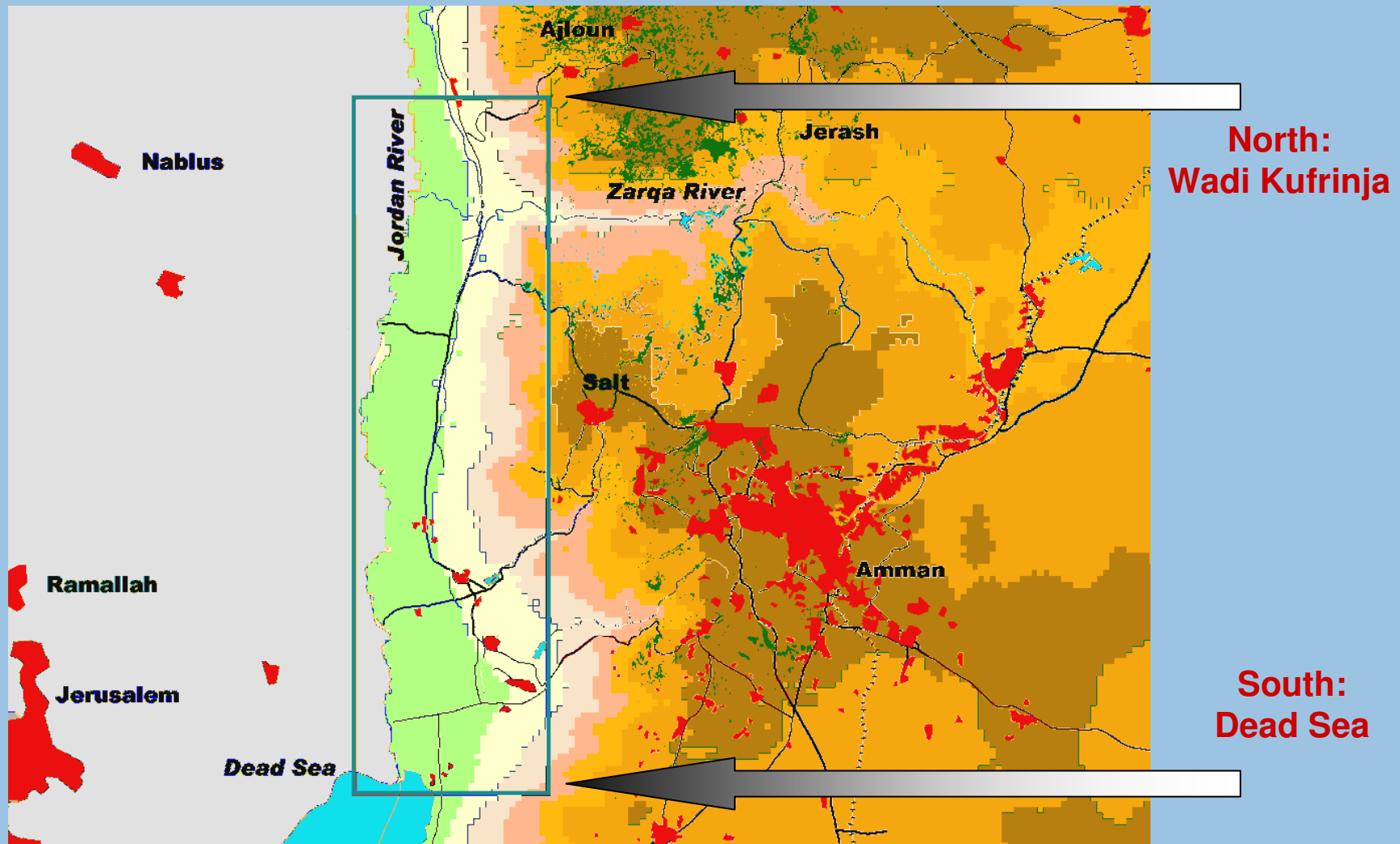
# Reclaimed Water Project purpose



**Farmers in the Jordan Valley  
use reclaimed water for irrigation  
- in accordance with  
environmental and public health regulations**



# RWP – Area (1)

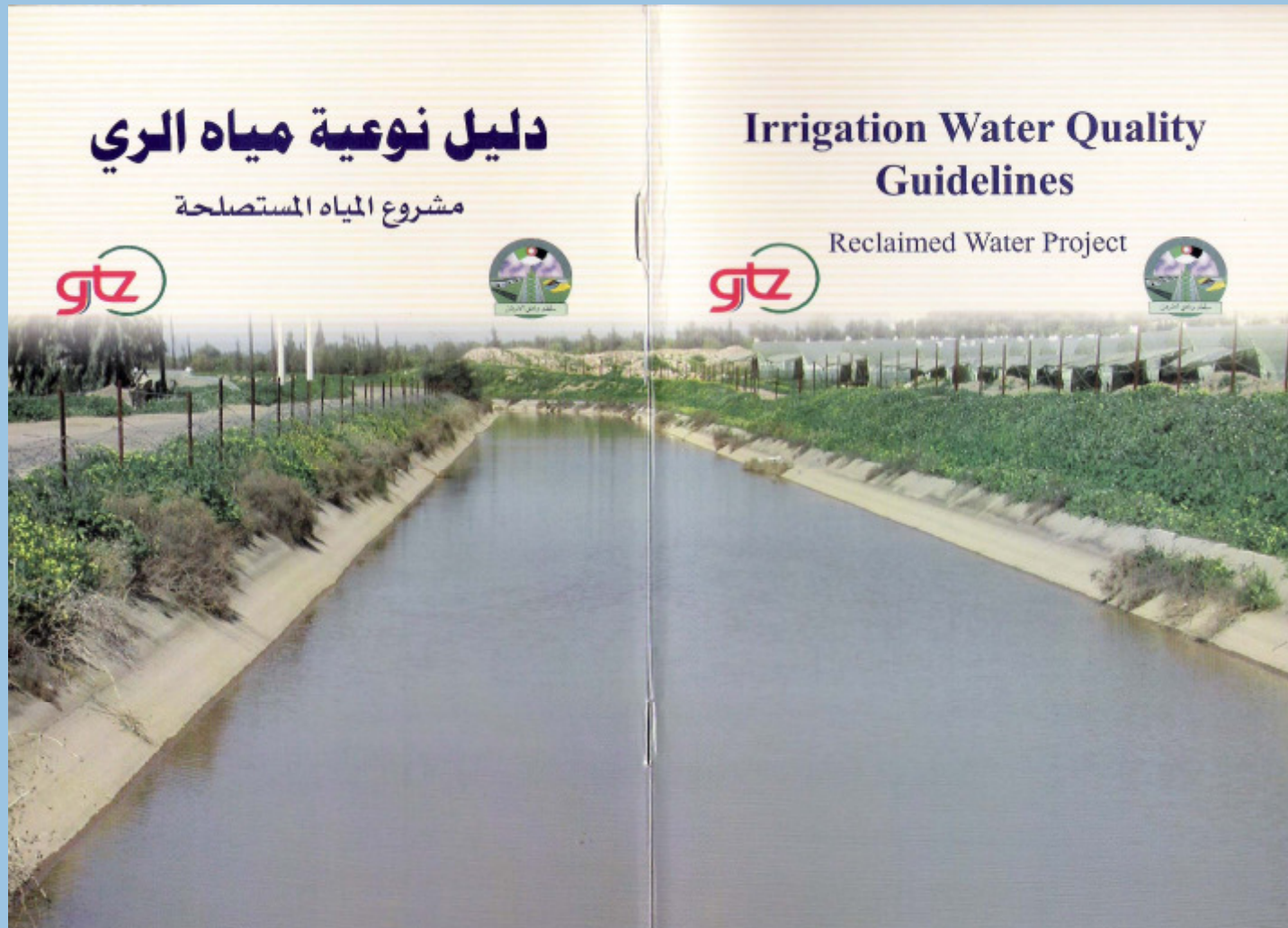


# RWP components



Status surveys	Concepts, Project Outputs	Use of Project Outputs		Responsibility
<b>Baseline Report (2003)</b>  with pre-reports:  Docu I: RWP-Milestones  Docu II: Origin of irrigation water  Docu III: Legal aspects  Docu IV: Existing monitoring  Docu V: Capacity building  Docu VI: Farmers' perceptions  Docu VII: Bacteriological load	<b>Guidelines on farming practices (2005)</b>  Farmers' guidelines for diluted reclaimed water irrigation	Information, dissemination (2004-2006)	...with progress reports	Advisory Services JVA, RWP
	<b>Concepts on soil and groundwater (2004)</b>  Soil- / Groundwater monitoring system	RWP internal soil and groundwater monitoring (2004-2005)	...with progress reports	RWP
	<b>Concepts on irrigation water quality (2004)</b>  Information system/Guidelines with pre-report: INFO: Review of regulations	Implementation: „Irrigation water quality information system“ (2004-2005)	...with progress reports	JVA, WAJ, MoWI
	<b>Concepts on fresh fruit and vegetables (2004)</b>  Guidelines/State monitoring/ Quality assurance system with pre-reports: INFO: Bacteriological load INFO: Recommendations INFO: Review of Europ. Standards	Implementation: „State monitoring system for fresh fruit and vegetables“ (2004-2005)	Implementation: „Steps to a crop quality assurance system“ (2005-2006)  ...with progress reports	MoH/JFDA MoA JEPAFV

# Irrigation water quality guidelines (1)



# Irrigation water quality guidelines (2)



Parameter	Limit value	Unit
pH	6 - 9	---
EC	< 1.7 - > 3.0	dS/m
BOD <sub>5</sub>	60	mg/l
COD	120	mg/l
Ca	< 400	mg/l
Mg	< 150	mg/l
SAR	6 - 9	mg/l
K	< 80	mg/l
HCO <sub>3</sub>	< 520	mg/l

Parameter	Limit value	Unit
NO <sub>3</sub>	300	mg/l
SO <sub>4</sub>	960	mg/l
B	0.5 - 15	mg/l
Fe	5	mg/l
Mn	5	mg/l
Zn	5	mg/l
Cu	5	mg/l
E.Coli	1,000	MPN/100 ml
Int. Helminths Eggs	1	Egg/l

# Irrigation water quality information system



## After approval of Secretary Generals of JVA and WAJ:

- Access to existing real-time measurement / database for JVA and WAJ
- Modification of sampling frequency and parameters to be analyzed
- Fixing of criteria for evaluation
- Implementation of a modified information flow
- Annual report, information for farmers as water users

# Safety control guidelines for fresh fruit and vegetables



Parameter	Microbiological quality			
	satisfactory	acceptable	un-satisfactory	Un-acceptable
Escherichia coli (total)	< 20	20 - < 100	$\geq 100$	not applicable
Salmonella spp.	not detected in 25 g	---	---	detected in 25 g

Product	Maximum level (mg NO <sub>3</sub> /kg)
1.1 Fresh spinach (Spinacia oleracea)	2,500
1.2 Fresh lettuce (Lactuca sativa L.) (protected and open-grown lettuce) excluding lettuce listed in point 1.3	2,500
1.3 "Iceberg" type lettuces	2,000

<b>Beans, Cucumber, Dates, Eggplant, Olives, Onion, Oranges, Pepper, Red Beet, Spinach, Squash / Zucchini, Strawberry, Sweet Corn, Tomato, Watermelon</b>	
Pb (mg/kg)	0.10
Cd (mg/kg)	0.05
<b>Asparagus, Carrots, Potato, Radish</b>	
Pb (mg/kg)	0.10
Cd (mg/kg)	0.10
<b>Cabbage (red, white), Cauliflower</b>	
Pb (mg/kg)	0.30
Cd (mg/kg)	0.05
<b>Grapes</b>	
Pb (mg/kg)	0.20
Cd (mg/kg)	0.05
<b>Herbs (Parsley, Rockett, Mint, Coriander...)</b>	
Pb (mg/kg)	0.30
Cd (mg/kg)	0.20
<b>Wheat</b>	
Pb (mg/kg)	0.20
Cd (mg/kg)	0.20

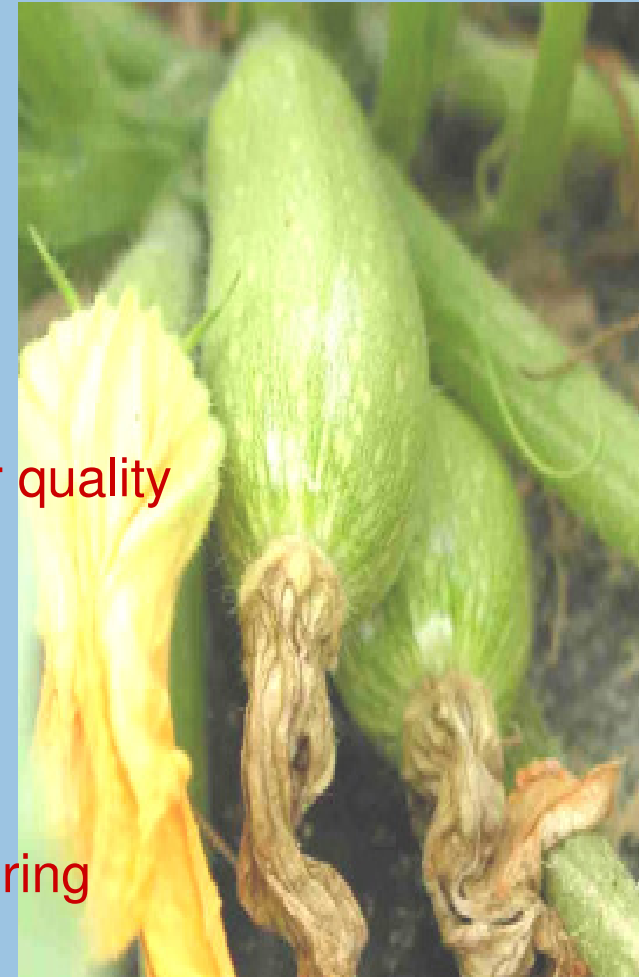


# State crop monitoring system (1)



## After approval of Secretary Generals of MoH, MoA, JFDA:

- Getting started with monitoring – focus is on crops irrigated with marginal water quality
- Training for sampling and laboratory staff of MoH (HDs), JFDA, MoA
- Expert to help and train laboratory staff of JFDA on the job
- Improvement measures of MoA - state monitoring
- Data transfer among authorities / publication



# State crop monitoring system (2)



## Reclaimed Water Project /GTZ – Royal Scientific Society:



**Training Course**

**04.-10.10.2004**

## Reclaimed Water Project (Jordanien) der JVA/GTZ

- \* **Erarbeitung von Richtlinien über**
  - **die Qualität von Bewässerungswasser**
  - **die Qualität von mit verdünntem Abwasser bewässertes Obst und Gemüse**
  - **„Gute Landwirtschaftliche Praxis“**
  
- \* **Erarbeitung und Implementierung von „vernünftigen“ staatlichen Monitoringsystemen bzgl. Bewässerungswasser sowie Obst und Gemüse**
  
- \* **Farmer wenden „Gute Landwirtschaftliche Praxis“ an**



**Thanks for listening.**

