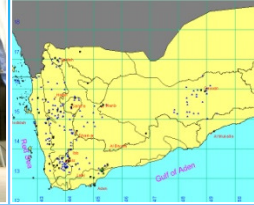


S1



الجمهورية اليمنية · وزارة المياه والبيئة
Republic of Yemen · Ministry of Water and Environment



MINISTRY OF WATER AND ENVIRONMENT NATIONAL WATER RESOURCES AUTHORITY (NWRA)

GROUNDWATER MANAGEMENT AND AGRICULTURAL DEVELOPMENT IN YEMEN

NWRA-YEMEN
2009



Slide 1

S1

SALEM, 25/10/2007

YEMEN: Basic Information

● Area: 527,970 km²

● Cultivated area: 1,200,000 ha

● Population: 22.38 million

● **Rural**

75%

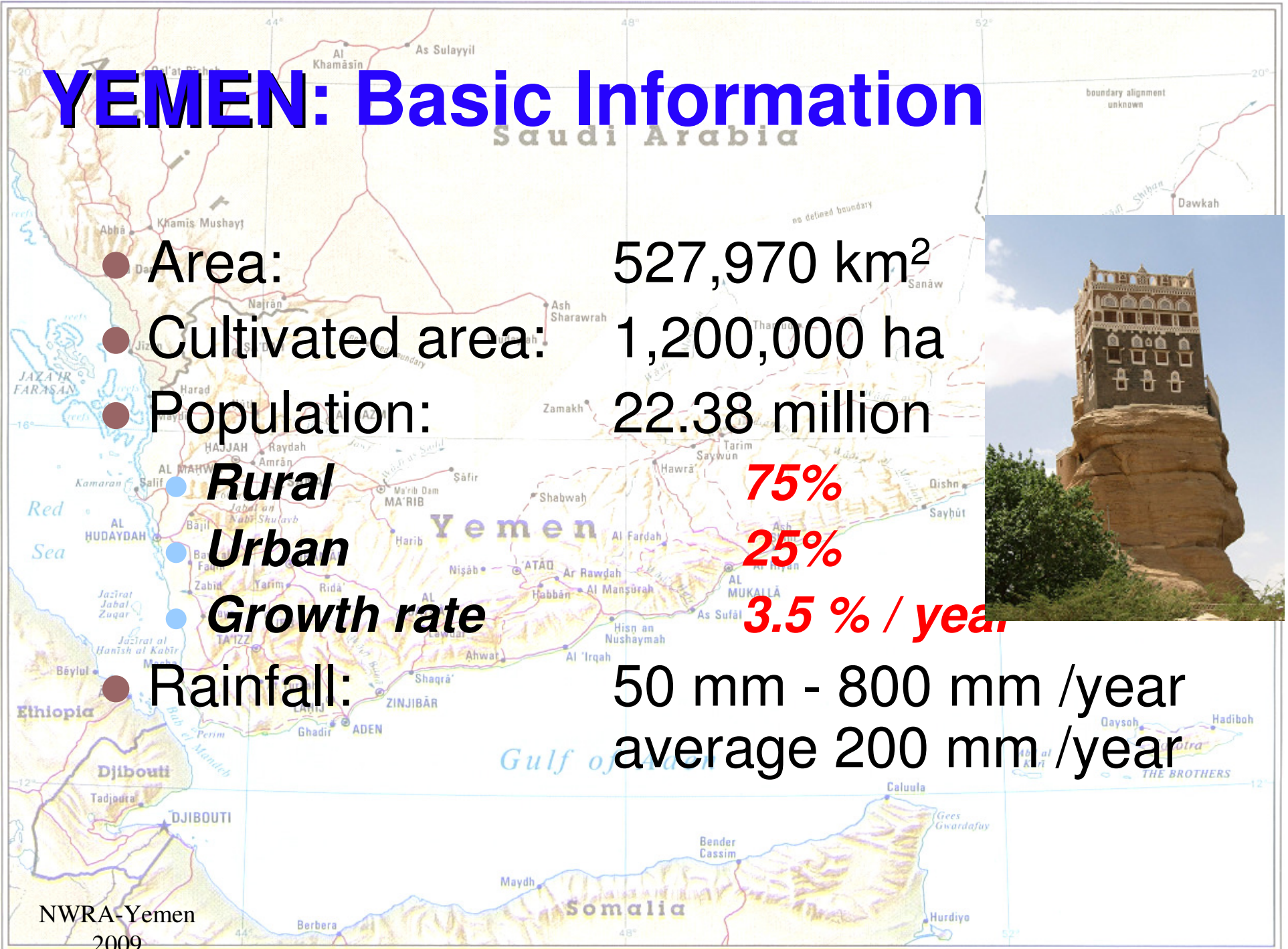
● **Urban**

25%

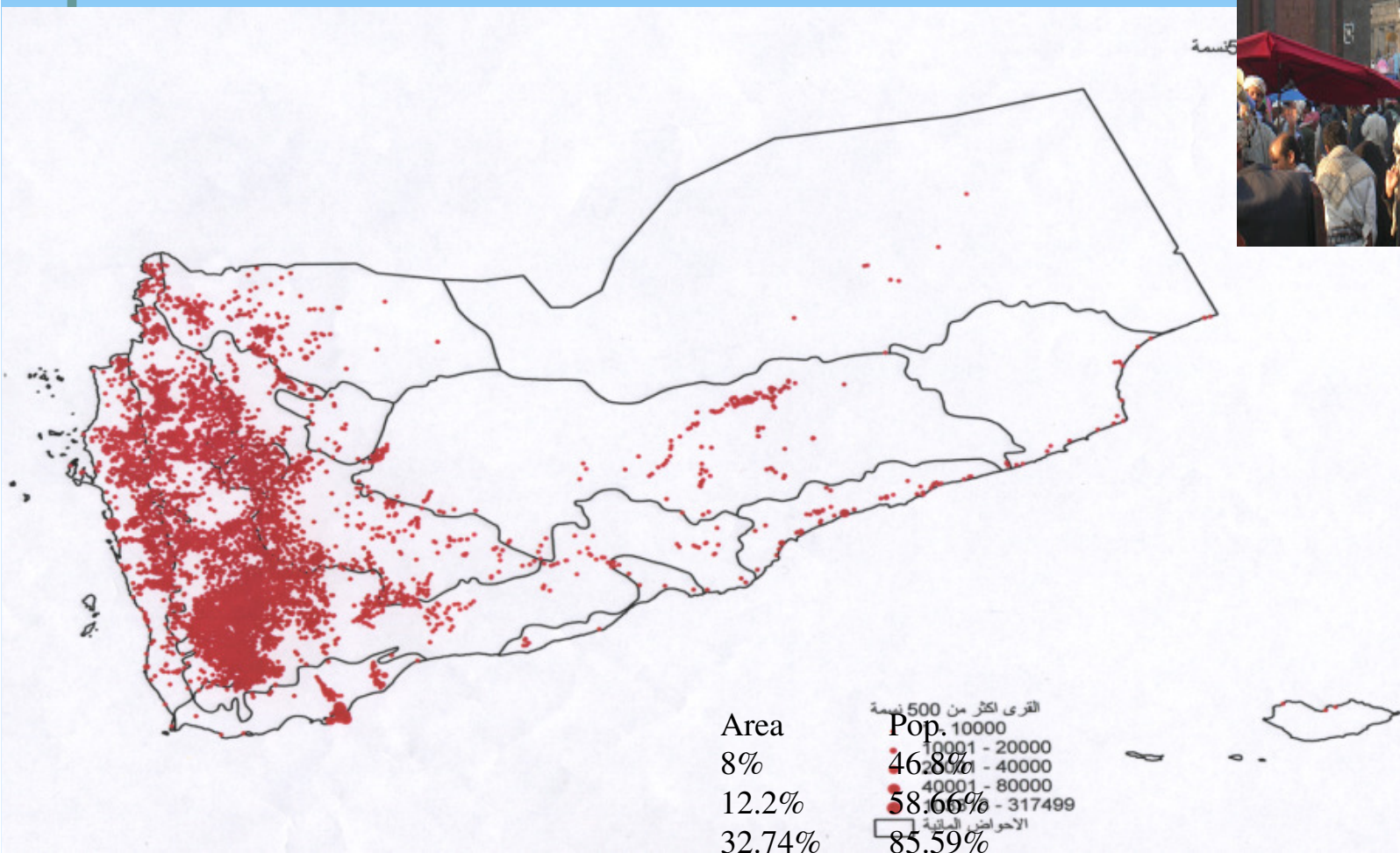
● **Growth rate**

3.5 % / year

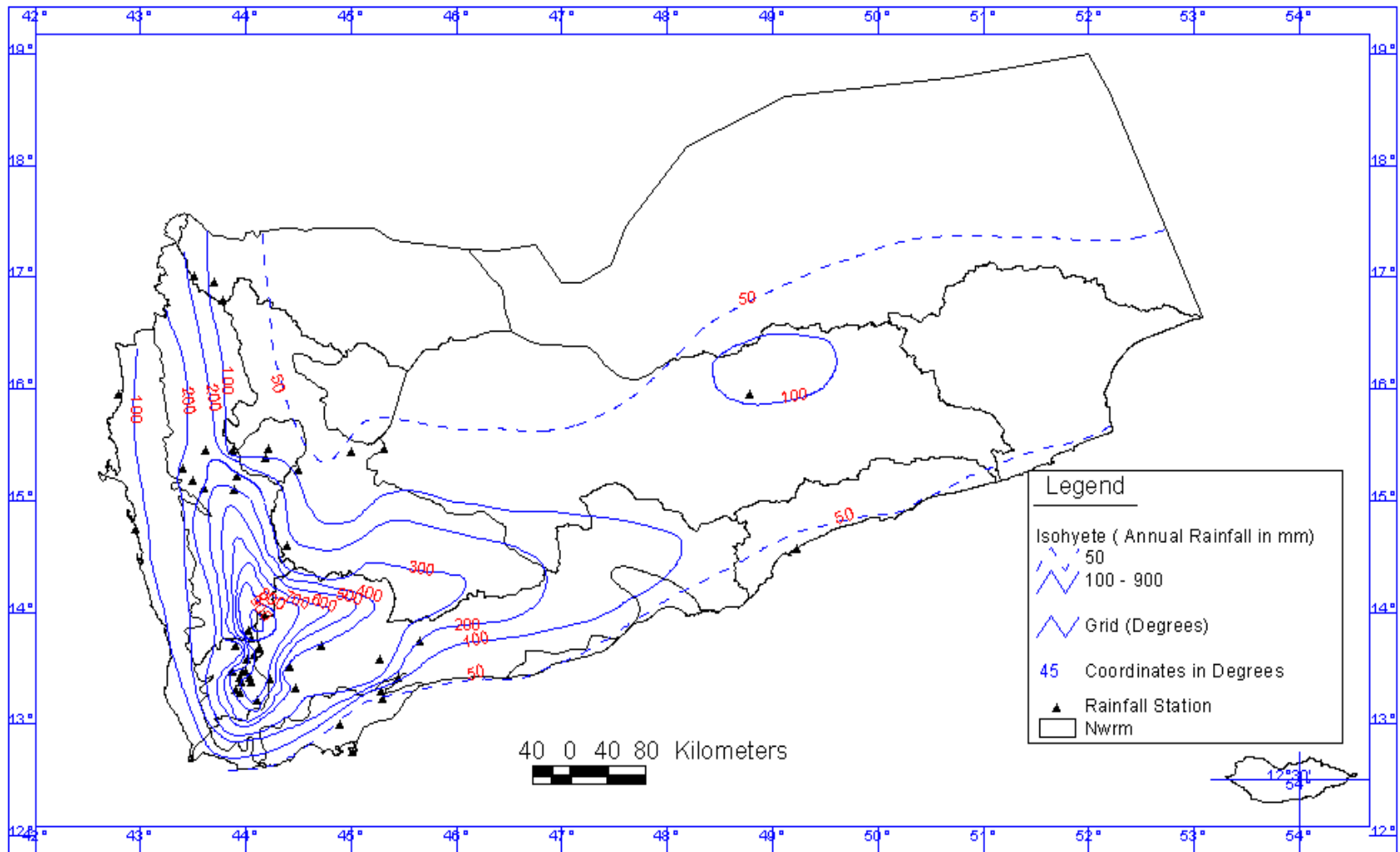
● Rainfall: 50 mm - 800 mm /year
average 200 mm /year



Concentration of population in Yemen



Republic of Yemen
National Water Resources Authority
Yemen Isohytes-MAP (mean 1999-2000)



FACTS AND FIGURES ABOUT WATER RESOURCES

⌚ Groundwater depletion has become a critical issue since 1980s

⌚ Water scarcity is more critical in the western part of the country, where more than 90% of the population live.

⌚ Annual Per capita water availability in Yemen 135 m³ while in the MENA region is 1250 m³ and 7500 m³ in the world

⌚ Total water use is estimated in 2000 at 3565 MCM while annual renewable resources were 2500 MCM

⌚ Annual water deficit is about 1065 MCM

⌚ Irrigated area has expanded from 37,000 ha to more than 500,000 ha between 1970 to 2005, mostly depending on groundwater

MAIN CHALLENGES

Groundwater mining

- Water levels are dropping in most of the basins, and majority of dug wells have gone dry
- Groundwater quality continues to deteriorate, and seawater intrusion is taking place in most of the coastal aquifers
- Water is becoming more expensive
- Increasing stakeholders conflicts
- More environmental concerns

Major cities are running out of water

- Some regions are receiving water once in every 40 days
- Private market is expanding but expensive
- Urban and industrial development is threatened
- Conflicts between rural and urban segments of the society are becoming intense

Large No. of the population do not have access to safe water

- In general **60%** households are connected to public water supply network
- In rural areas where majority of population live, only **49%** have the access to safe water
- Shallow aquifers are polluted causing poor health conditions

CAUSES OF PROBLEMS

New Technological factors

- Introduction of new technologies empower us to extract water supplies faster than the rate of replenishment
- drilling technology and pumps
- Inefficient use - particularly in agricultural sector -
 - Random drilling of wells
 - There are about 381 drilling companies, with about 656 drilling Rigs

Social factors

- Population growth
- Absence of effective awareness
- Absence of implementing GW use right
- Process of privatisation in the southern part

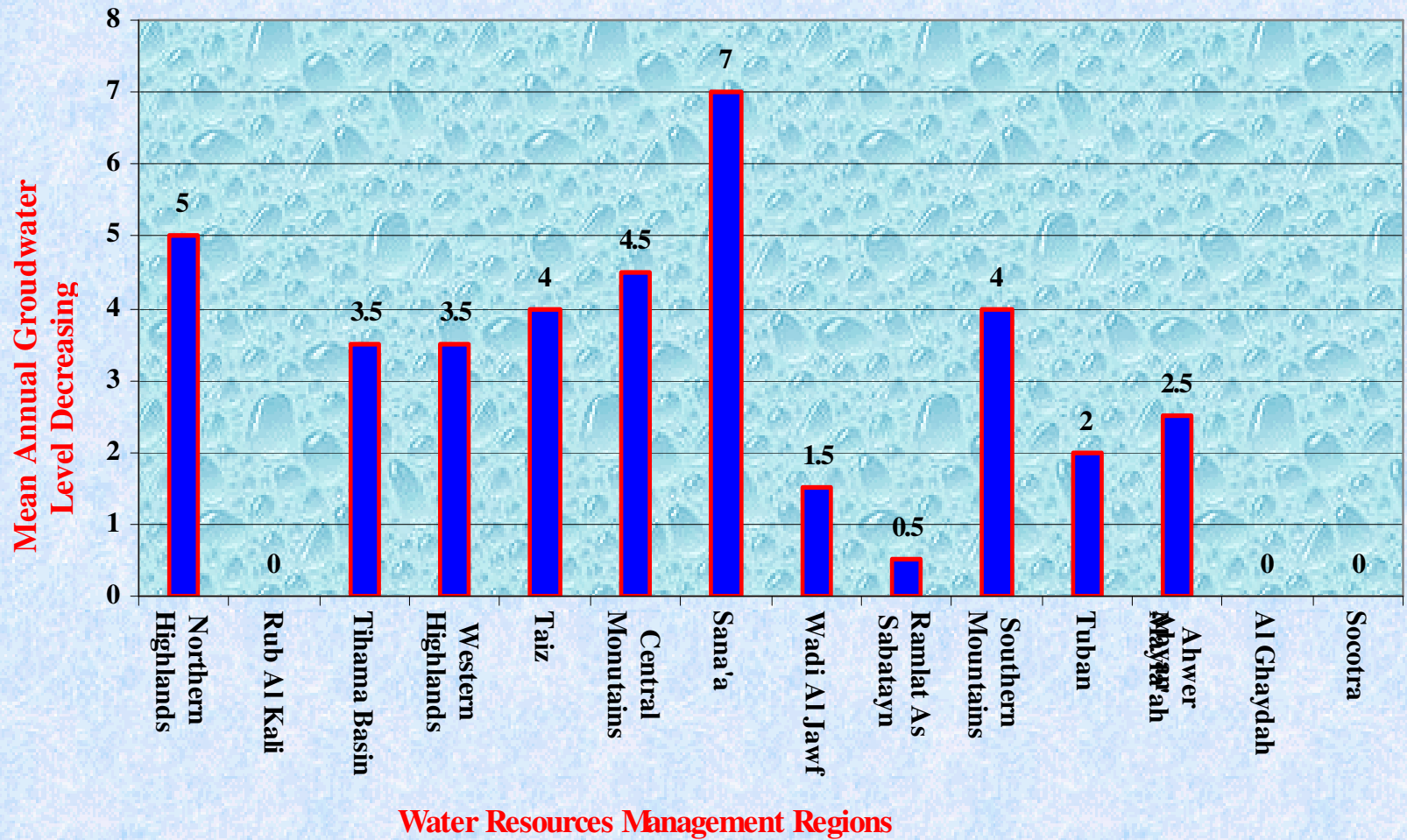
Economic and financial factors

- Subsidy on diesel fuel and lending interest rates
- No pricing policy – water is free for agriculture
- Cropping patterns are guided by market signs
- Low water tariffs

Institutional & legal factors

- Difficulties in enforcement of water law and water by-law
- Slow and difficult implementation the legislation & regulations

Mean Annual Groudwater Depletion in the Yemen Water Resources Management Regions



MAJOR WATER SECTOR CHALLENGES

Providing safe and sufficient water to larger segments of the society

Maximizing social and economic benefits from available resources through proper IWRM

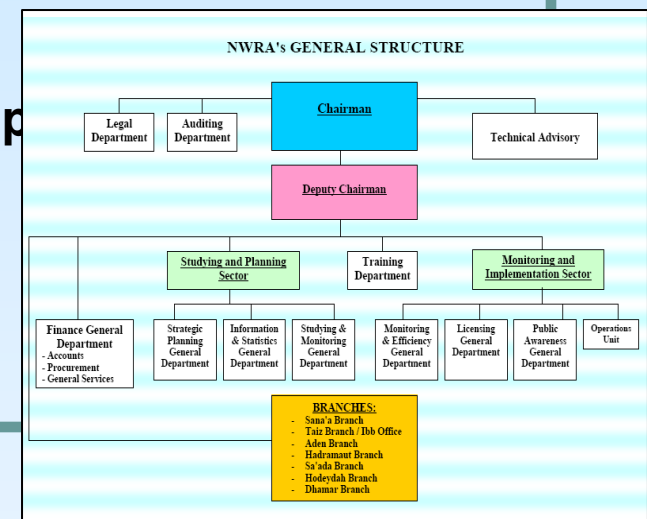
Enforcement of water law and other water regulations

Yemen's reaction to IWRM challenges

1. Institutional Development & capacity building
2. Water policies and legislation
3. Water Resources Studies & Management Plans
4. Water Resources Monitoring Network
5. National Water Information Center
6. Public Awareness
7. Human Resources Development Plan
8. Coordination
9. Enforcement of the Water Law

1. Institutional Development and capacity building

- Concentration and consolidation of water resources management functions under NWRA
- Creation of Ministry of Water and Environment and integration of all water institutions under its umbrella
- Approval of amended Water Law
- Preparation of by-law of Water Law
- Decentralization
 - ◆ **Creation of local authorities**
 - ◆ **Decentralization of urban & rural water supply**
 - ◆ **Establishment of NWRA branches**



2. Water policies and legislations

- **Water Law (2002)**

- **National Water Policy**

- **National Water Strategy**

- **National Water Sector Strategy Investment Plan**

- **Irrigation & watershed management policies**

- **Water quality standards**

- **Regulating and control on drilling rigs movement and water wells**

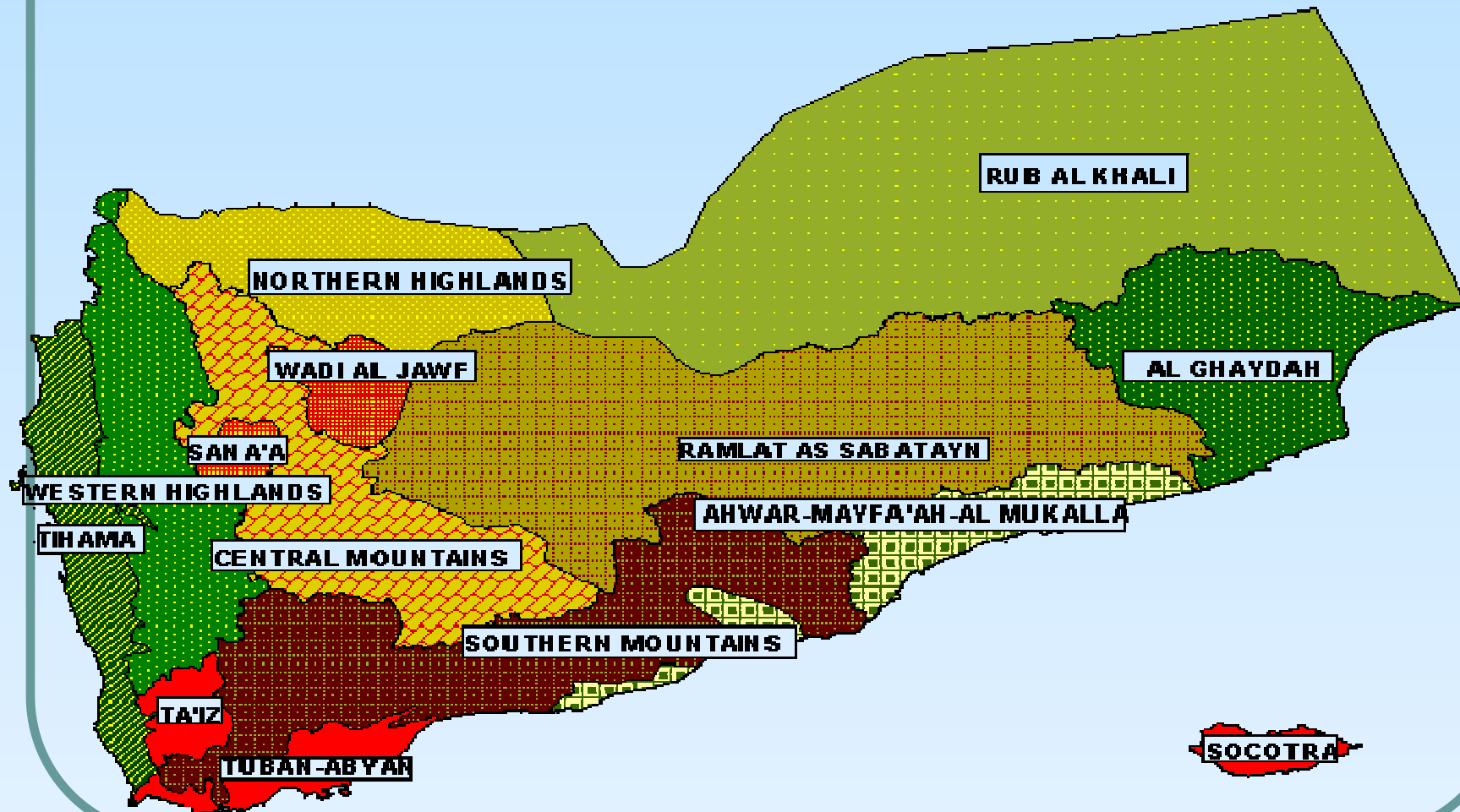


3. Water resources studies and management plans

- Division of country into Water Management Regions & Identification of critical regions
- Water resources assessments/studies:
 - Well inventory in critical basins (> 60,000 wells)
 - Hydro-geological investigations
 - Socio-economic, agricultural & water use surveys
 - Groundwater economic
- Preparation and implementation of regional WRM action plans for priority regions
- Creation of Water Basin Committees and Water Users Associations

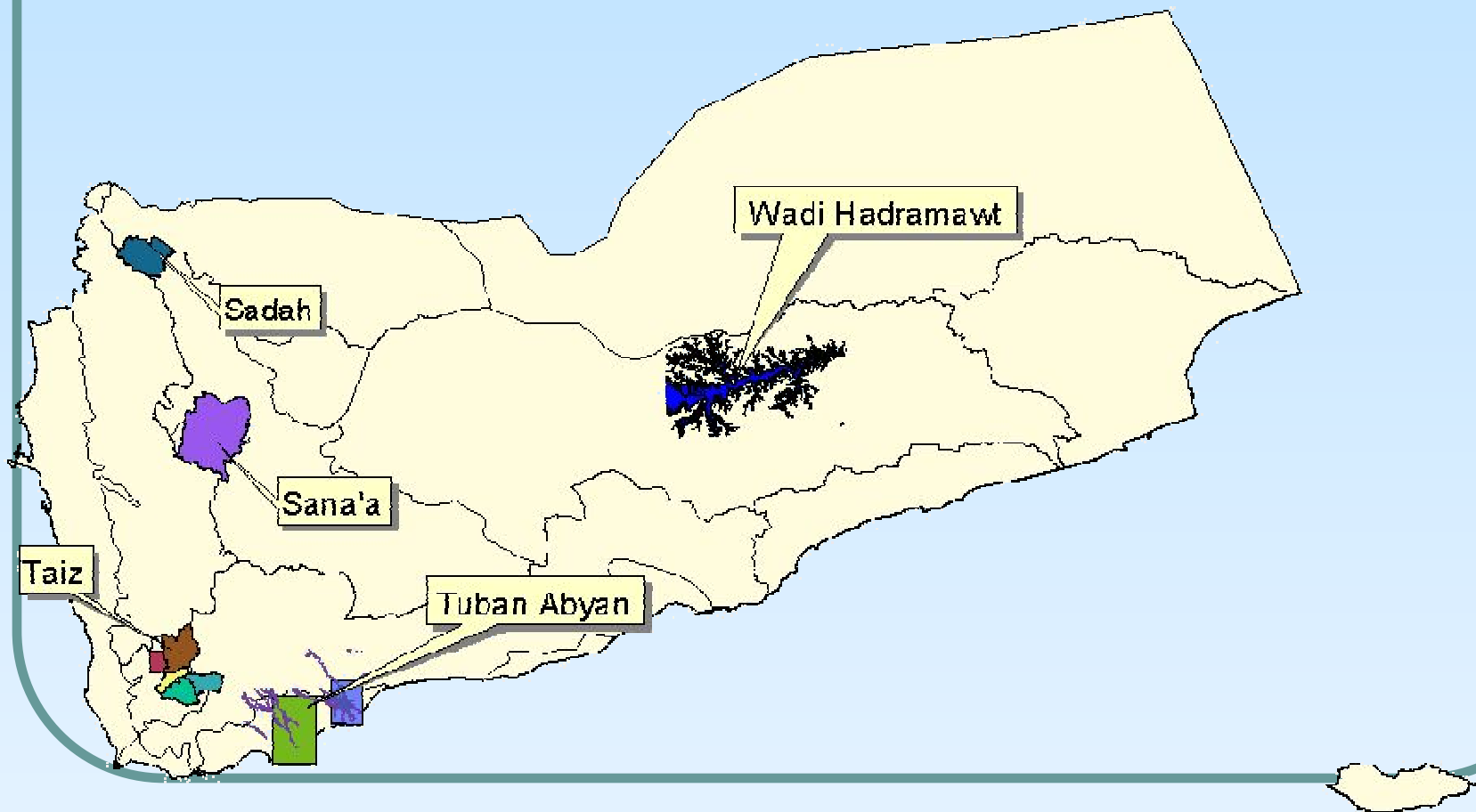


Water Management Regions



Priority Areas

Priorities Areas



WATER BALANCE

Water Balance (2005) in Yemen and in Sana'a governorate, Taiz and Hadramout governorate (MCM)

	Domestic abstraction	Irrigation abstraction a)	Industry abstraction	Total abstraction	Total Recharge	Water Balance
Yemen	265	3,235	65	3,565	2,500	-1,065
Sana'a	55.4	209.2	4.8	269.7	50.7	-219
Ta'iz	18.5	39.3	4.2	62	20	-42
Hadramout	40	360	0	400	150	-250

a) Sana'a Actual evapotranspiration is 83.7MCM/year, but calculated abstractions 209.2MCM assuming an irrigation efficiency of 40%.

Source: JICA (2007).

4. Water Resources Monitoring Network

- **National Water Resources Monitoring network**

- **Installation of monitoring stations**

- NWRA has > 850 stations
- Others have about 400 stations

- **Data collection**

- Routine monitoring
(ground & surface-water, quality, climate etc..)



Major Drivers Policies and Programs

- NWRA, basin committees, local Authorities and other partners have the institutional capacity to develop and coordinate IWRM.
- Communities are empowered and enable to manage their water resources at the local level.
- Urban and rural, have increased affordable access to safe and regulated water supply and sanitation.
- Farmers are able to sustain their incomes whilst using less water in GW and through harvesting/ diverting more a spate water.
- Groundwater abstractions from critical basins have been stabilized or reduced.

New Features in Sana'a Basin and some projects

- Encouraging community-based water management through WUAs and informal WUGs
- Tripartite agreements between beneficiary, project and local entity (local council, WUAs, agri. cooperatives)
- Controlling horizontal irrigation expansion through the tripartite agreements and peer pressure □ Intensive monitoring and evaluation (flow meters, pressure transducer at randomly selected wells)
- Establishment of Irrigation Advisory Service for better O&M and agronomics and demonstration farms
- Massive public awareness campaign on the benefits of common aquifer resources and efficient water use

Development of cropping pattern (x 1,000 ha) between 1990 and 2005

	Yemen 1990	Yemen 1995	Yemen 2000	Yemen 2005	Sana'a 2005	Taiz 2005	Hadhra 2005
Sorghum and Millet	643	540	463	530	27.1	38.0	(0)12.0
Maize	52	43	32	39	5.0	5.0	0.1
Wheat	98	102	87	86	20.0	0.2	(2.2)4.0
Barley	52	50	37	35	13.0	0.1	0.0
<i>Total Cereals</i>	<i>845</i>	<i>733</i>	<i>619</i>	<i>689</i>	<i>65.1</i>	<i>43.3</i>	<i>16.1</i>
Tomatoes	11	13	17	15	2.0	0.4	0.3
Potatoes	14	14	17	17	1.4	0.2	0.2
Other vegetables	27	27	31	42	3.3	8.7	2.9
<i>Total Vegetables</i>	<i>52</i>	<i>54</i>	<i>65</i>	<i>74</i>	<i>6.7</i>	<i>9.3</i>	<i>3.3</i>
Sesame	19	23	32	19	0.0	0.2	0.7
Cotton	10	13	27	18	0.0	0.0	0.0
Tobacco	4	4	5	8	0.0	0.0	0.4
Coffee	25	27	33	29	9.0	0.0	0.0
<i>Total Cash crops</i>	<i>58</i>	<i>67</i>	<i>97</i>	<i>73</i>	<i>9.0</i>	<i>0.2</i>	<i>1.1</i>
Grapes	17	21	23	12	10.0	0.1	0.0
Palm Trees	15	19	23	14	0.0	1.0	5.0
Other fruits	24	35	46	57	6.8	1.4	1.6
<i>Total Fruits</i>	<i>56</i>	<i>75</i>	<i>92</i>	<i>83</i>	<i>16.8</i>	<i>2.5</i>	<i>6.6</i>
Alfalfa	17	21	26	21	2.0	0.0	3.0
Sorghum fodder	44	63	90	102	3.3	6.6	6.4
<i>Total Fodder</i>	<i>61</i>	<i>84</i>	<i>116</i>	<i>123</i>	<i>5.3</i>	<i>6.6</i>	<i>9.4</i>
<i>Total Pulses</i>	<i>49</i>	<i>54</i>	<i>52</i>	<i>39</i>	<i>7.2</i>	<i>0.6</i>	<i>0.0</i>
<i>Qat</i>	<i>80</i>	<i>90</i>	<i>103</i>	<i>124</i>	<i>23.0</i>	<i>10.0</i>	<i>0.0</i>
<i>Total area</i>	<i>1,201</i>	<i>1,157</i>	<i>1,144</i>	<i>1,204</i>	<i>133</i>	<i>73</i>	<i>37</i>

Agricultural products-Yemen

Sorghum, potatoes, tomatoes, wheat, grapes, watermelons, bananas, onions, qat, coffee, cotton and fruits like

Mango, Citrus and Vegetable

With only 3% of its land area arable, Yemen's potential for agricultural self-sufficiency is very remote.



QAT & FRUIT CROPS



PEACH WITH DRIP



QAT



GRAPES WITH DRIP



BIG FARM

Development of cultivated areas (x 1,000 ha) in Yemen according to the source of irrigation between 1975 and 2005

Year	Rainfed	Well	Spring	Spate	Cropped area
1975	1,285	37	73	120	1,515
1990	685	310	25	101	1,121
1995	579	368	20	100	1,067
2000	515	457	46	126	1,144
2005	609	393	34	137	1,202

Major issues in Agricultural Water Management

- Sustainability through Water Resources Protection.
- Increasing farmers income through increasing the efficiency of water use in irrigation
- Establishing institutions for efficient agricultural water use.
- Reducing the area under Qat
- Establish a system of groundwater rights based on the outputs of the pilot projects to be implemented in cooperation with stakeholders and local councils



6. Public Awareness

◆ Developed a National Public Awareness Strategy

- ◆ Printing and distribution of public awareness materials
- ◆ Introduced water awareness in school curriculum
- ◆ Campaign about system of permits and licensing
- ◆ TV Flashes and Round Table Discussions on TV
- ◆ Radio messages & Mosque lectures
- ◆ Bill Boards at city entrances
- ◆ Quarterly magazines (HQ and branches) and weekly newspaper pages
- ◆ Design and distribution of calendars
- ◆ World Water Day celebrations
- ◆ Established school water groups
- ◆ Pilot projects on water conservation



7. WATER USER ASSOCIATIONS

- **No. of WUAs 145**
- **No. of WUG 1278**
- **Irrigation after installation of**
- **pressurized (Drip, bubbler, sprinkler systems) –**
Savings
- Net Water Savings in Water : 4275 m³ (45% Saving)
- Savings in Cost of Diesel : YR21450 (45% Saving)
- Saving in Pumping Time 165 hours/ha(55% Saving)
- (Under Groundwater and Soil Conservation Project)



8. Coordination

- ◆ MAI
 - Awareness Programmes
 - Establishing of water basin com.WUAs
 - Exchange of information
- NWSA
 - controlling Random drilling
- ◆ GAREWS
 - Enforce the Mechanism of licensing
- ◆ IWRM group
 - Enforcement of the water law
- ◆ Local Authorities
- ◆ EPA
- ◆ NGOs
- ◆ WEC



9. Enforcement of the Water Law

Actions taken to control groundwater exploitation and random drilling

- Prepare implementation mechanism outlined the roles and responsibilities of various stakeholder towards controlling the random drilling and Rigs Movements.
- Detailed inventory of all Drilling Companies (DC) and individual contractors are stored the data base.
- Coordinate with all government institutions not to contract with unlicensed Drilling Companies,
- Monitoring the movement of drilling Rigs through satellite (Fleet tracking unit)
- Develop and implement a proper system for licensing of DC's and permits for drilling wells.

Photo: fleet-tracking system

Summary of Key Messages:

- IWRM as its key approach in Water Resources Management. Better coordination and monitoring is ultimate in implementation of Basin Plans.
- to identify the needed outputs and indicators and ultimately to conserve Groundwater, increase in irrigation efficiency and better agricultural out put.
- Evolve some acceptable mechanism to solve the problem of Qat.

Summary of Key Messages

- Expand a national network of monitoring stations and link it is with the National Water Resources Information Center at NWRA.
- Training and Capacity Building. Institutional Building.
- Implement NWSSIP Program, which would be on the Water sector reform agenda to help to achieve the MDGs and to help solve the water sector problems, which will help poverty alleviation



Thank you for your attention

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**MUD
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