Presentation from

2016 World Water Week in Stockholm

www.worldwaterweek.org

Hashemite Kingdom of Jordan
Ministry of Water and Irrigation (MWI)
Amman, Jordan

Federal Institute for Geosciences
and Natural Resources (BGR),
Hannover, Germany

German-Jordanian Technical Cooperation Project
Improved Groundwater Resources Management (I-GWRM)

World Water Week 2016 – MENA Focus Day

BGR Activities in Jordan – Response to the Syrian Refugee Crisis

30 August 2016

Dr. Armin Margane, BGR

BGR Cooperation in the Field of Groundwater in Jordan

Technical Cooperation since 1959, in groundwater since 1968

Focus of Work (Capacity Building)

until 1986: mainly Groundwater Resources Exploration
since mid 1980s: GW-Management & Tools (Potential Maps, GW-Modeling)
since mid 1990s: GW-Protection (Vulnerability Maps, GW Protection Zones)
since 2002: legal framework conditions & awareness (SW/GW Protection Zones, Landuse Planning)
since 2015: back to Groundwasser Resources Management

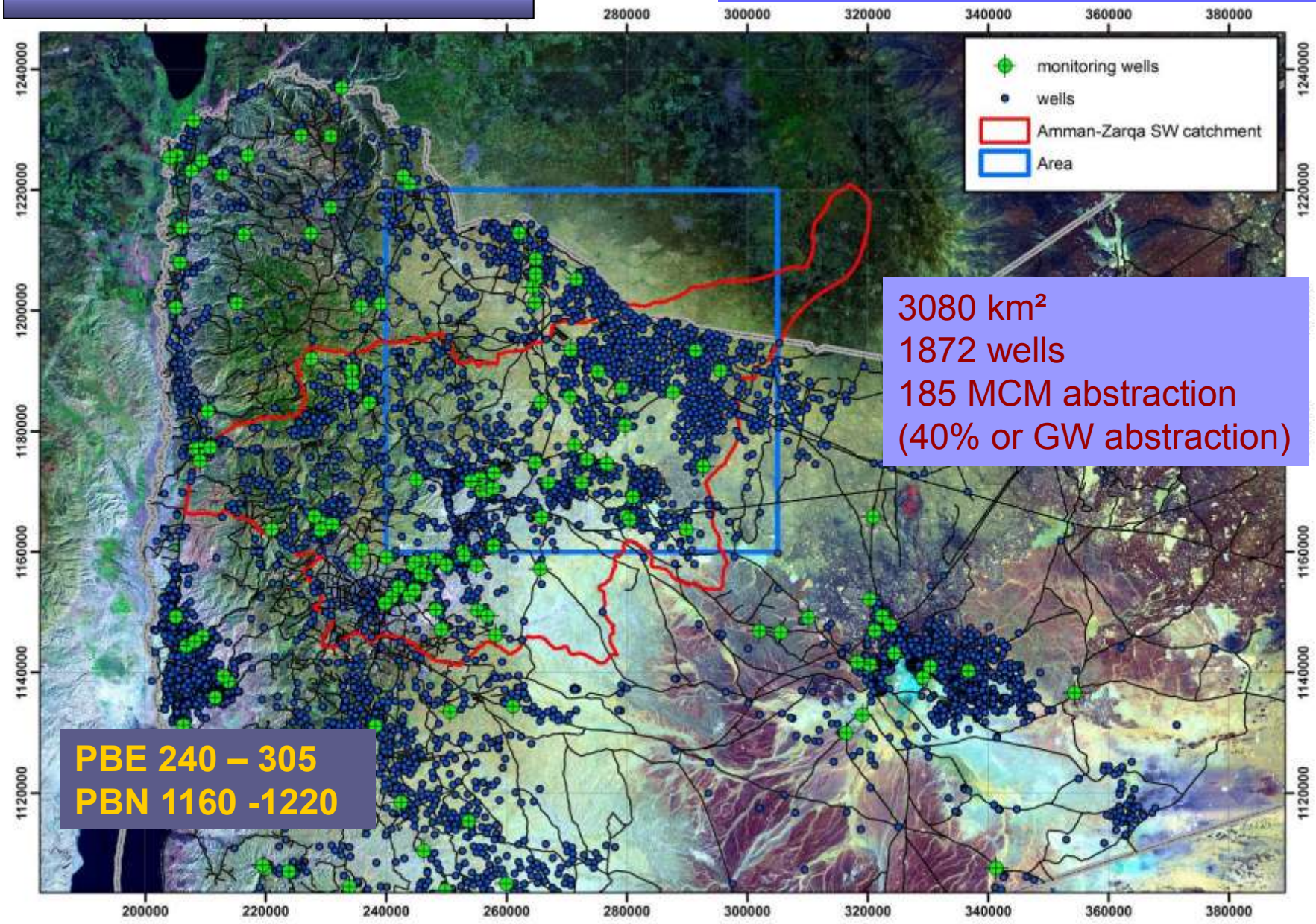
The situation has become considerably worse over the past 10 years

- **Groundwater has become much more scarce (60 m^3/ca/yr of renewable resources) due to increase in population/refugees**
- **High costs of operation**

► **Goal: more efficient use of scarce GW resources (wellfield management)**

GW Contour Update 2014

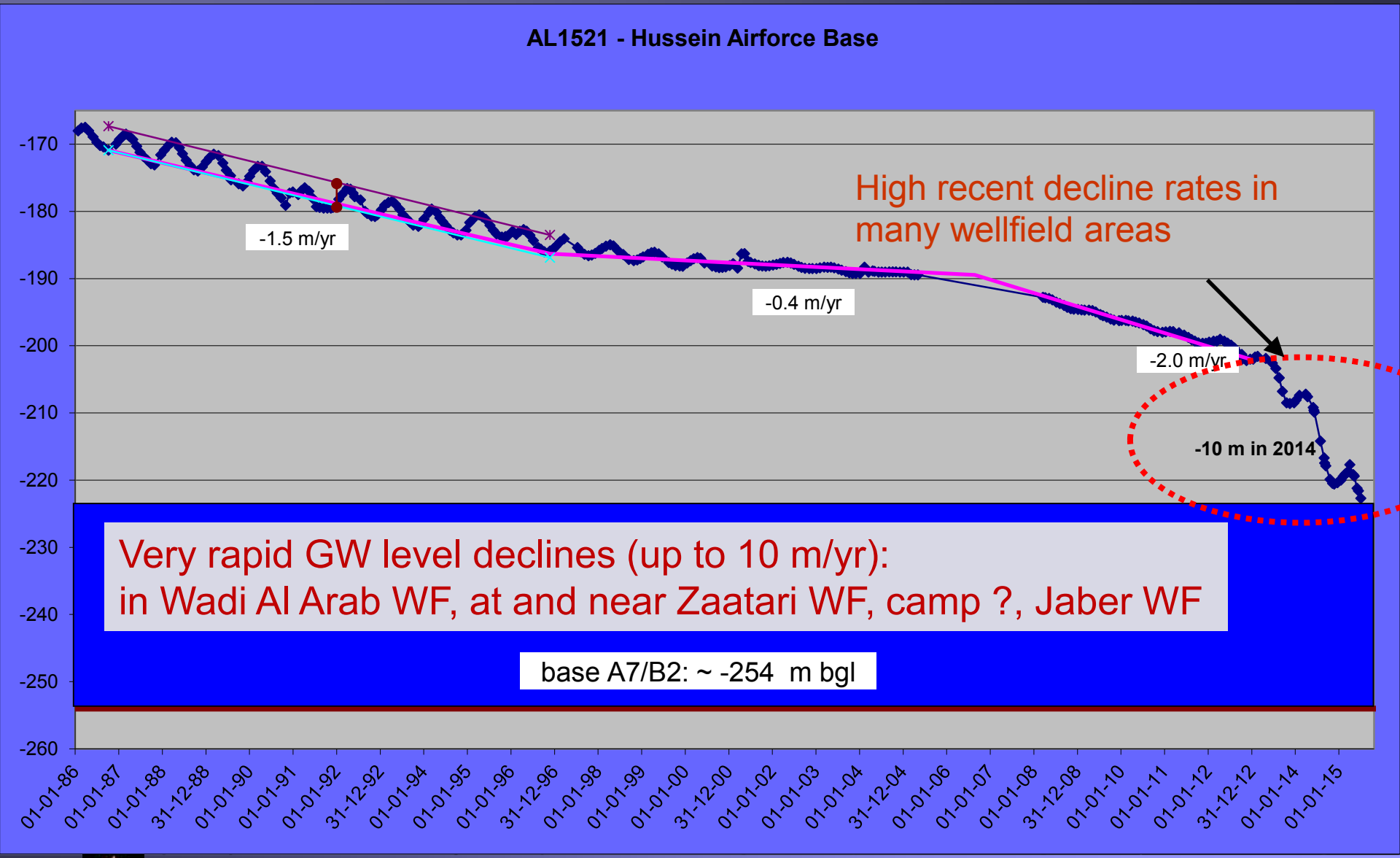
Last comprehensive GW resources assessment by BGR in 1995



3080 km²
1872 wells
185 MCM abstraction
(40% or GW abstraction)

PBE 240 – 305
PBN 1160 -1220

Monitoring


AL1521 - Hussein Airforce Base
-170
-180
-190
-200
-210
-220
-230
-240
-250
-260
-1.5 m/yr
-0.4 m/yr
-2.0 m/yr
High recent decline rates in many wellfield areas
-10 m in 2014
Very rapid GW level declines (up to 10 m/yr):
in Wadi Al Arab WF, at and near Zaatari WF, camp ?, Jaber WF
base A7/B2: ~ -254 m bgl
01-01-86
01-01-87
01-01-88
31-12-88
01-01-90
01-01-91
01-01-92
31-12-92
01-01-94
01-01-95
01-01-96
31-12-96
01-01-98
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01-01-02
01-01-03
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31-12-04
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01-01-07
01-01-08
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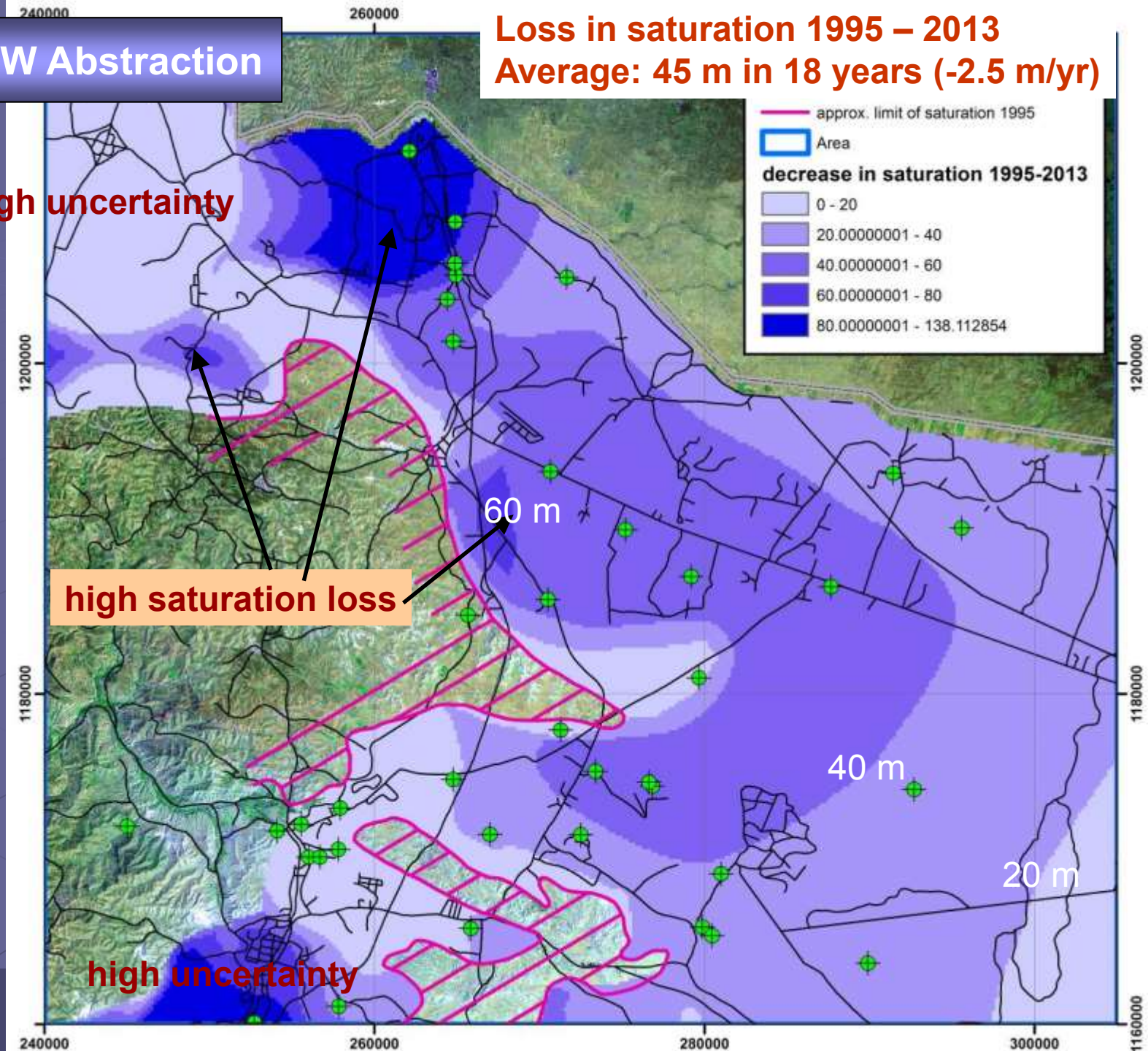
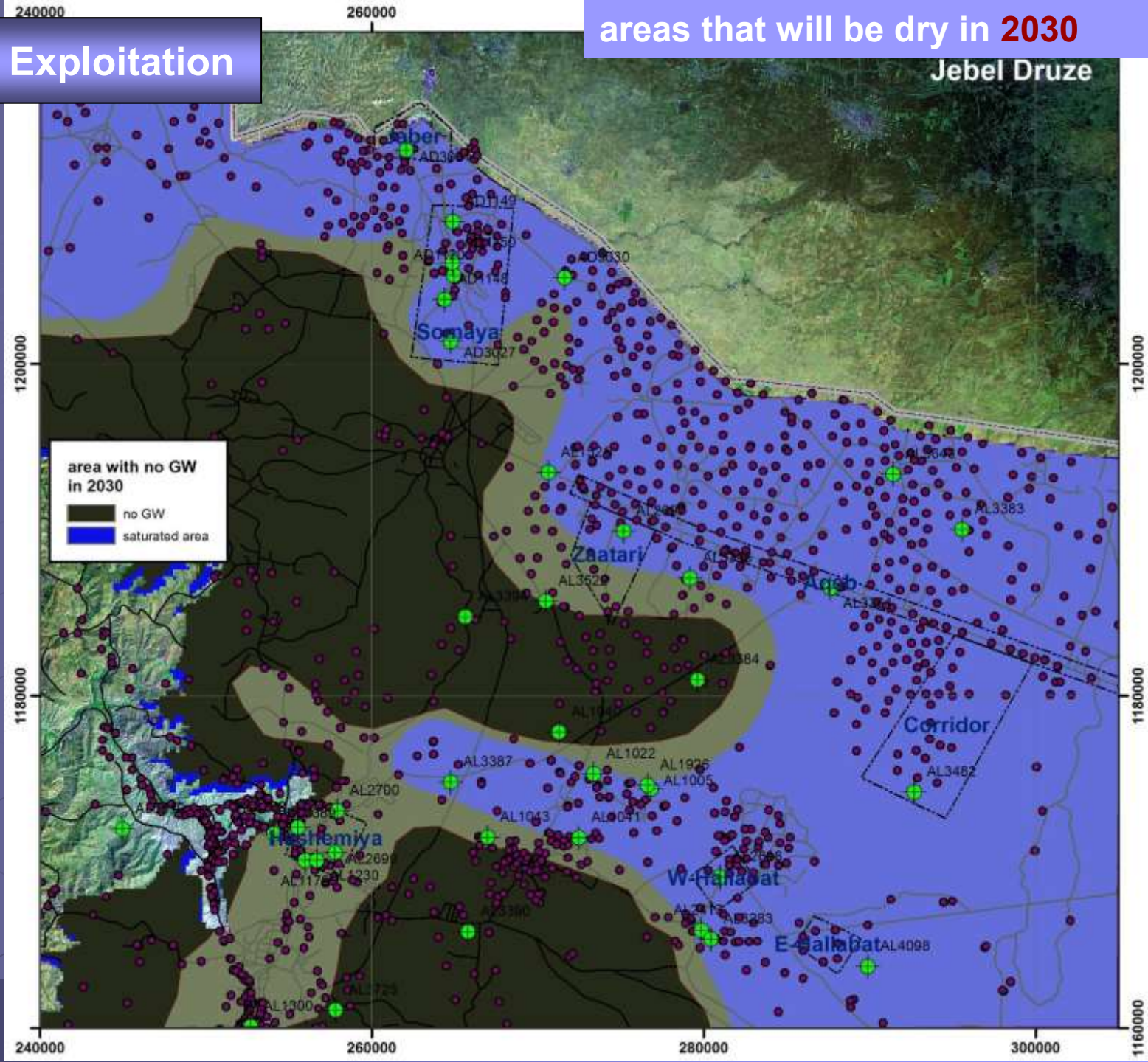
01-01-14
01-01-15

Effect of GW Abstraction



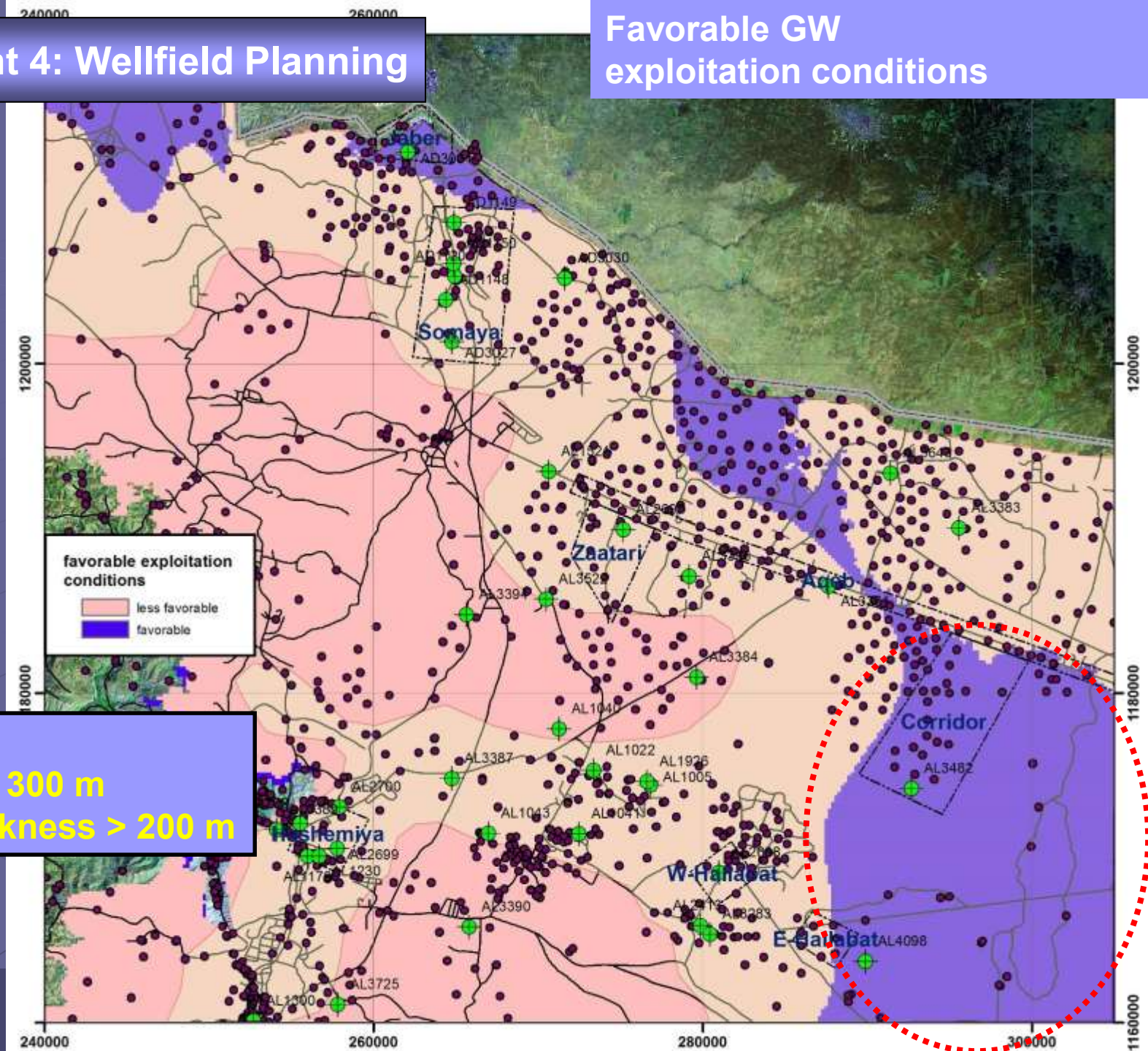
Future GW Exploitation

areas that will be dry in 2030



Component 4: Wellfield Planning

Favorable GW exploitation conditions



Favorable:
Pumping lift < 300 m
Saturated thickness > 200 m

Component 1: Wellfield Management

Problem

Maintenance was neglected over decades (Water Authority, Utilities)
Resource management did not get the attention it requires (data collection and analysis) (MWI)

- ► **Water level data** > were not collected on a regular basis
- ▼ **GW contour maps** (pumping lift, adjustment of pump specifications)
- ► **Geological data** > no geological logs for wells drilled after 1990
- ▼ **structure contour maps** (deepening of existing, siting of new wells)
- ► **Hydrogeological data** > no pumping tests, no well rehabilitation
- ▼ **optimal yield of a wellfield**
- ► **GW abstraction data** > damaged/uncalibrated flow meters/illegal wells
- ▼ **sustainable management of resources**
- ► **Update of all hydrogeological base data** (component 1 I-GWRM project)

Reasons

- ► lack of communication between resource managers and operators
- ► lack of coordination (new wells, rehabilitation, drilling design)
- ► fragmentation of tasks (the other department should do it)
- ► lack of awareness (who needs what & why)

Wellfield Management Plans

Re-establish cooperation between resource managers and operators:

Every wellfield should be managed by a wellfield manager who has all information about the current situation of the resources and his wells and initiates :

- Drilling of new wells/replacing old wells, deepening of wells
- Rehabilitation of wells
- Pumping tests
- Water quality testing (wells, reservoirs, PS) (monitoring plan)
- Monitoring of water levels and GW abstraction (installing/repairing/calibrating flow meters), repair of leakage losses
- Exchange of pumps, modification of pump specifications
- Protection measures (fences, gates, guards)
- Awareness measures with local population

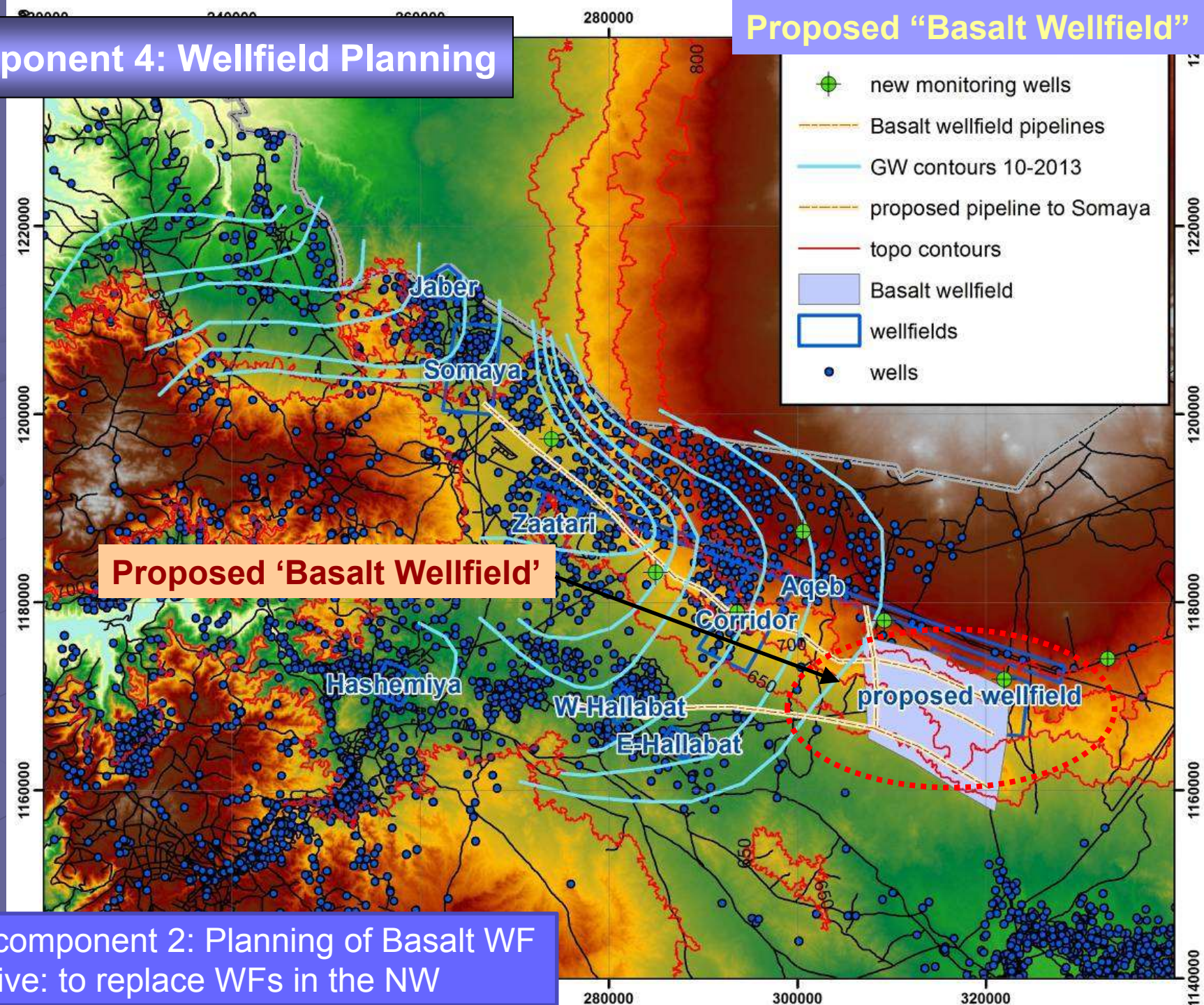
► A better management saves costs and improves the yield and efficiency of wellfields > improved reliability of water supply

Expected results

Proposed measures will:

- Increase the efficiency of wellfields in terms of output [location]
- Reduce the use (and cost) of energy use [adjust pumps]
- Reduce the costs to build, operate and maintain wells [borehole design]
- Lead to a sustainable management (optimal abstraction rates) [hydrogeological analysis]
- Ensure the supply of safe water [water quality, protection zones]
- Development of capacity for all involved personnel (MWI, WAJ, Utilities)

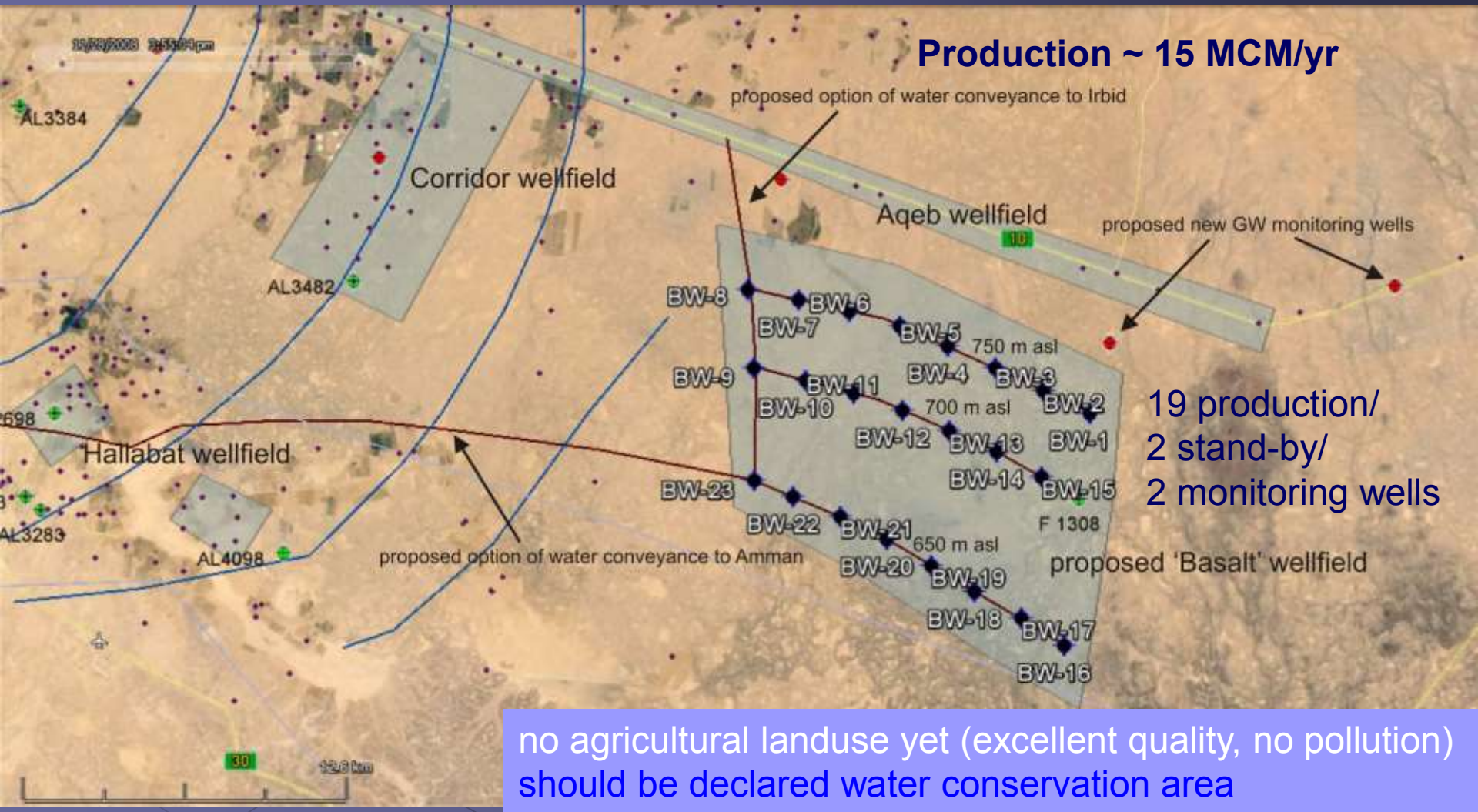
Component 4: Wellfield Planning



Project component 2: Planning of Basalt WF
> objective: to replace WFs in the NW

Component 4: Wellfield Planning

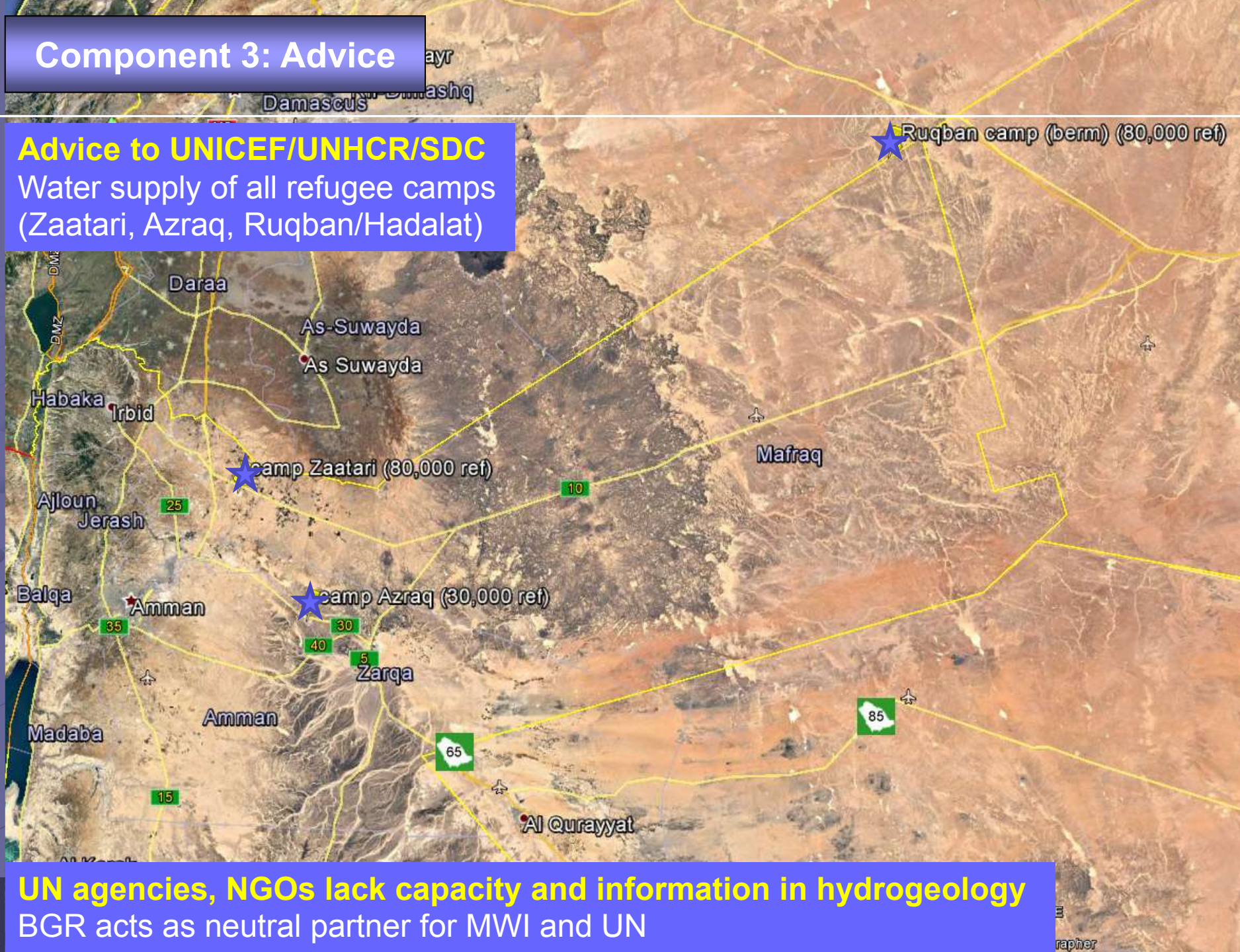
Proposed "Basalt Wellfield"



no agricultural landuse yet (excellent quality, no pollution)
should be declared water conservation area

Component 3: Advice

Advice to UNICEF/UNHCR/SDC
Water supply of all refugee camps (Zaatari, Azraq, Ruqban/Hadalat)



UN agencies, NGOs lack capacity and information in hydrogeology
BGR acts as neutral partner for MWI and UN

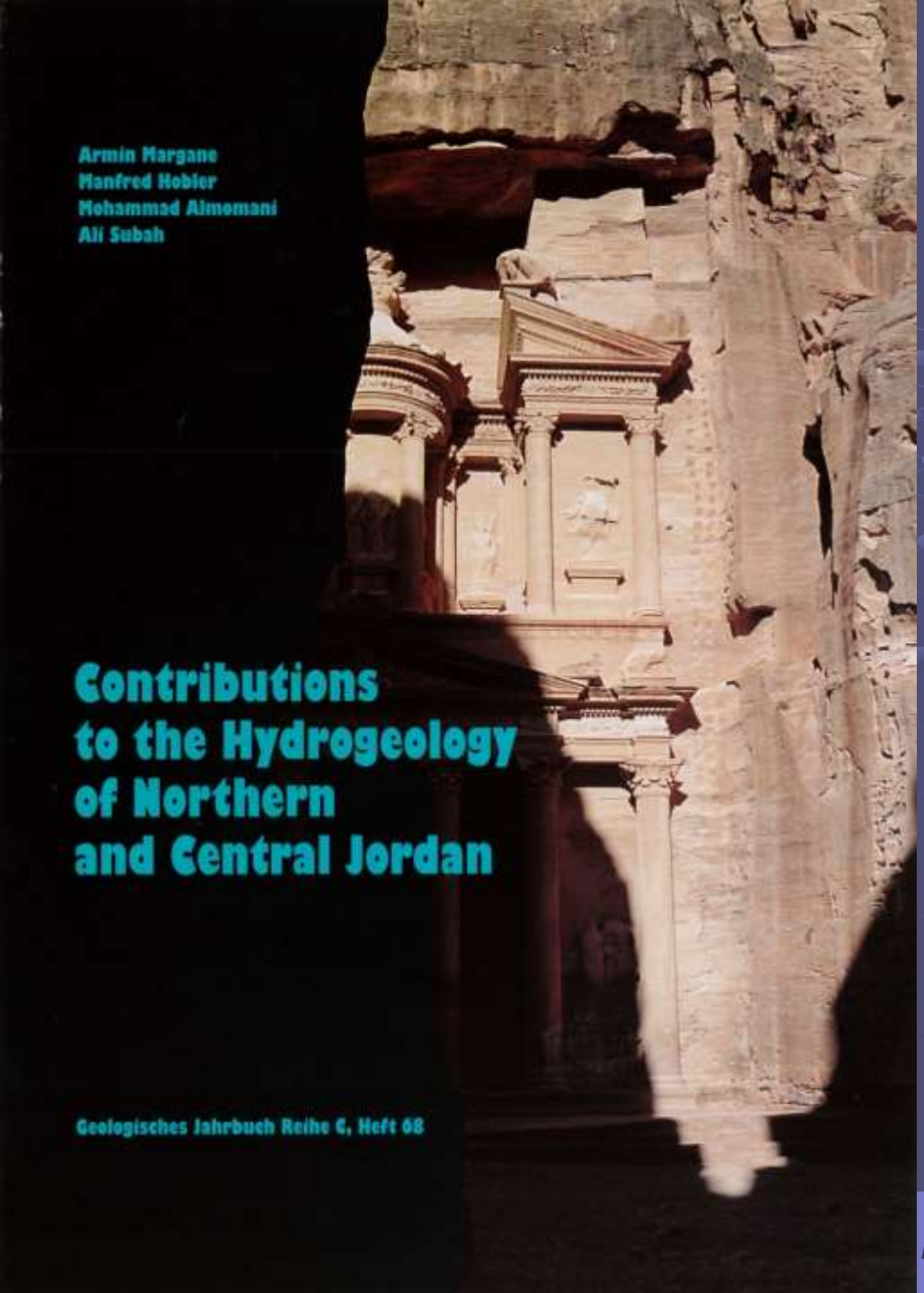
Imminent water supply problems in all camps

Zaatari Camp, Facts:
80,000 refugees on 5 km²
35 l/ca/d – 3,600 m³/d
3 boreholes in camp
A7/B2 aquifer dry / water from A4 aquifer (thickness ~50 m)
yield decreased to half
rapid water level decline
Survey of impact on groundwater
Aqib wellfield nearby (Irbid)
Potential new source: Basalt wellfield (planned)

Azraq Camp, Facts:
~30,000 refugees
35 l/ca/d – ~1000 m³/d
1 boreholes on site + 1 failed (Mo contamination)
> + 2-3 planned
Well organized infrastructure
AWSA wellfield nearby (Amman)

Ruqban Camp, Facts:
~80,000 refugees
<15 l/ca/d – 450 m³/d
0 boreholes on site
> Trucking from Ruwaished
27 USD/m³ (> 100 km)
No GW recharge > upper two aquifers probably almost dry
High salinity anticipated > mobile RO unit
Security and access are problematic

Coordination between Local Government and Aid Agencies is essential and should be improved in order to agree on the required infrastructure and water sources for refugees and host communities



Thank you for your kind attention

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