Vulnerable Water Resources in Jordan

Aim of the Study

- A request by the National Implementation Committee for Effective Integrated wastewater Management –NICE to review and update the previously developed list of Hot Spots
- Hot Spots are defined as areas where groundwater resources, through leakage of domestic wastewater from cesspools, septic tanks, or sewage networks or through inappropriate handling of wastewater, have been contaminated or are expected to be contaminated

Protection Zones

- Groundwater is an invaluable resource in Jordan, It contributes to about 70% of the domestic water supply and is the major source of drinking water in the country.
- In 2011, the MWI, in collaboration with the German Federal Institute for Geosciences and Natural Resources (BGR), implemented Groundwater Protection Zones in Jordan, in which the watershed of each groundwater well was divided into three zones, delineated using GIS maps.
- Groundwater Protection Zones(for springs , wells and dams) indicate areas where groundwater is at risk from potentially polluting activities and accidental releases of pollutants.

Protection Zones

Zone 1, no industrial or human activities are permitted

Zone 2, domestic and agricultural activities are allowed, but with strict limitations and frequent monitoring.

Zone 3 covers the rest of the groundwater catchment area and it is assumed that human activities herein are less likely to contaminate the groundwater within the watershed.

Protection Zones

- the Groundwater Protection **Zone 1** of a spring has to extend at least 50 m upstream of the spring and at least 25 m for the well.
- 10 m downstream(well/spring)and 15 m to each side(well/spring).
- The perimeter should be completely fenced and locked, allowing only authorized personnel to access the area.
- There must be signs indicating restrictions and the significance of Zone 1

منطقة الحماية الأولى لمصادر المياه

أنت الآن في منطقة الحماية الأولى ( )

لحماية مصادر المياه من التلوث يجب:

عدم
تجاوز هذا السياج

عدم
الرعي وسقاية الحيوانات

عدم
إلقاء النفايات

الرجاء التبليغ عن أي من التجاوزات أعلاه أو أي أعمال قد تؤدي الى تلويث المياه والبيئة على رقم الخط الساخن للشرطة البيئية:

USAID
من الشعب الأمريكي

BGR

المعهد الألماني لعلوم الأرض

Protection Zones

Protection Zone 2
starts at the outer boundary of Zone 1 and ends at the line from which groundwater will, theoretically, take 50-days to reach the well. The 50-day line assumes that most pathogenic bacteria die within a period of 40 – 60 days while moving towards the groundwater.

Protection Zone 3
comprises all the remaining groundwater recharge area for the well or spring.

منطقة الحماية الثانية لمصادر المياه

أنت الآن في منطقة الحماية الثانية ( )

لحماية مصادر المياه من التلوث يجب:

عدم استخدام
المبيدات والأسمدة الكيماوية

عدم طرح
المشتقات البترولية والزيوت

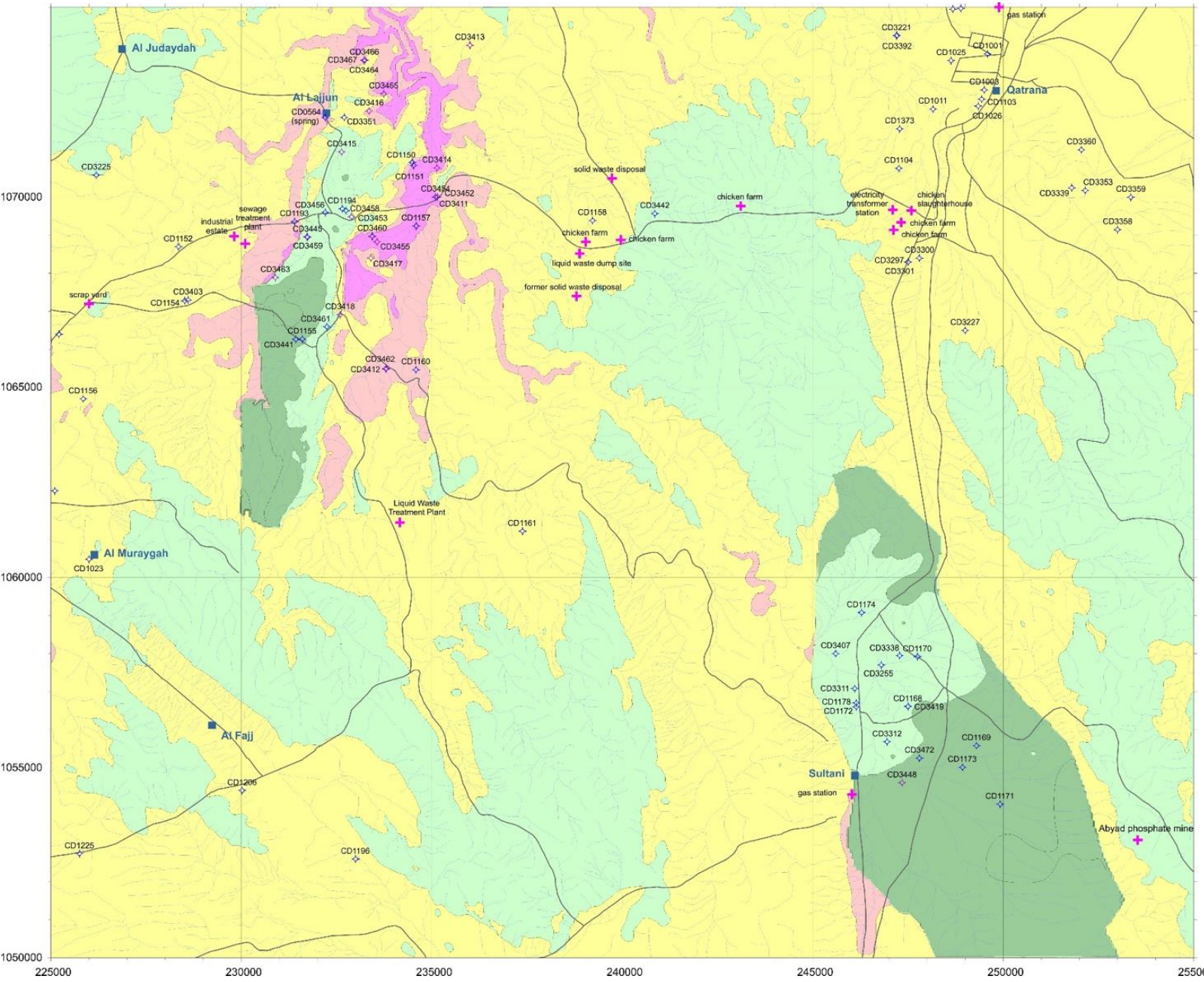
تفريغ
الحفر الامتصاصية بانتظام
والتخلص من الحمولة في
( )

عدم إلقاء النفايات الصلبة،
والتخلص منها في
( )

الرجاء التبليغ عن أي من التجاوزات أعلاه أو أي أعمال قد تؤدي الى تلويث المياه والبيئة على رقم الخط الساخن للشرطة البيئية:

Groundwater Vulnerability Maps

- Mapping the vulnerability of groundwater aquifers through spatial hydrogeological assessments can help the way for an enhanced understanding of the sensitivity of natural systems to anthropogenic activities.
- These maps are an important decision support tool that should be considered for land management planning.
- Groundwater Vulnerability Maps were produced using the COP-Method



Ministry of Water and Irrigation (MWI) Jordan

Federal Institute for Geosciences and Natural Resources (BGR) Germany

Jordanian-German Technical Cooperation Project Groundwater Resources Management

Groundwater Vulnerability Map of the Karak - Al Lajjun Area

Prepared by: Dr. A. Margane, A. Subah, N. Khalifa, T. Almomani, S. Ouran, Z. Hajali, A. Jaber, M. Atrash, H. Hijazi & R. Tarawneh

Scale 1 : 50,000

October 2005

Legend

- CD1152 — groundwater well tapping A7/B2 aquifer, ID number
- CD3418 — groundwater well tapping Ram Group aquifer, ID number
- Qatrana — settlement
- road
- wadi
- potential groundwater hazard

Map prepared using SURFER with 50 m grid spacing

Vulnerability Class

- very low
- low
- moderate
- high
- very high

Groundwater Vulnerability Maps

- These maps are an important decision support tool that should be considered for land management planning.
- Groundwater Protection Zones along with Groundwater Vulnerability Maps are becoming essential in Jordan particularly in areas that are not served with a sewage network.

Groundwater Vulnerability Maps

1st parameter C–Factor(Concentration of Flow): Surface features (e.g. karst, slope, vegetation - Concentration of Flow). The C-Factor represents the infiltration conditions of surface water into the aquifers. In karst environments, water infiltrates rapidly, bypassing the protective cover.

Groundwater Vulnerability Maps

2nd Parameter :

O–Factor (Overlying Layer): Texture and thickness of the soil cover; thickness and lithology of the geological layers above the groundwater table (Overlying Layer).

The O-Factor is a combination of the vertical distance that contaminated water has to traverse to reach the groundwater table and the retention potential of the soil and rocks.

Groundwater Vulnerability Maps

3rd Parameter :

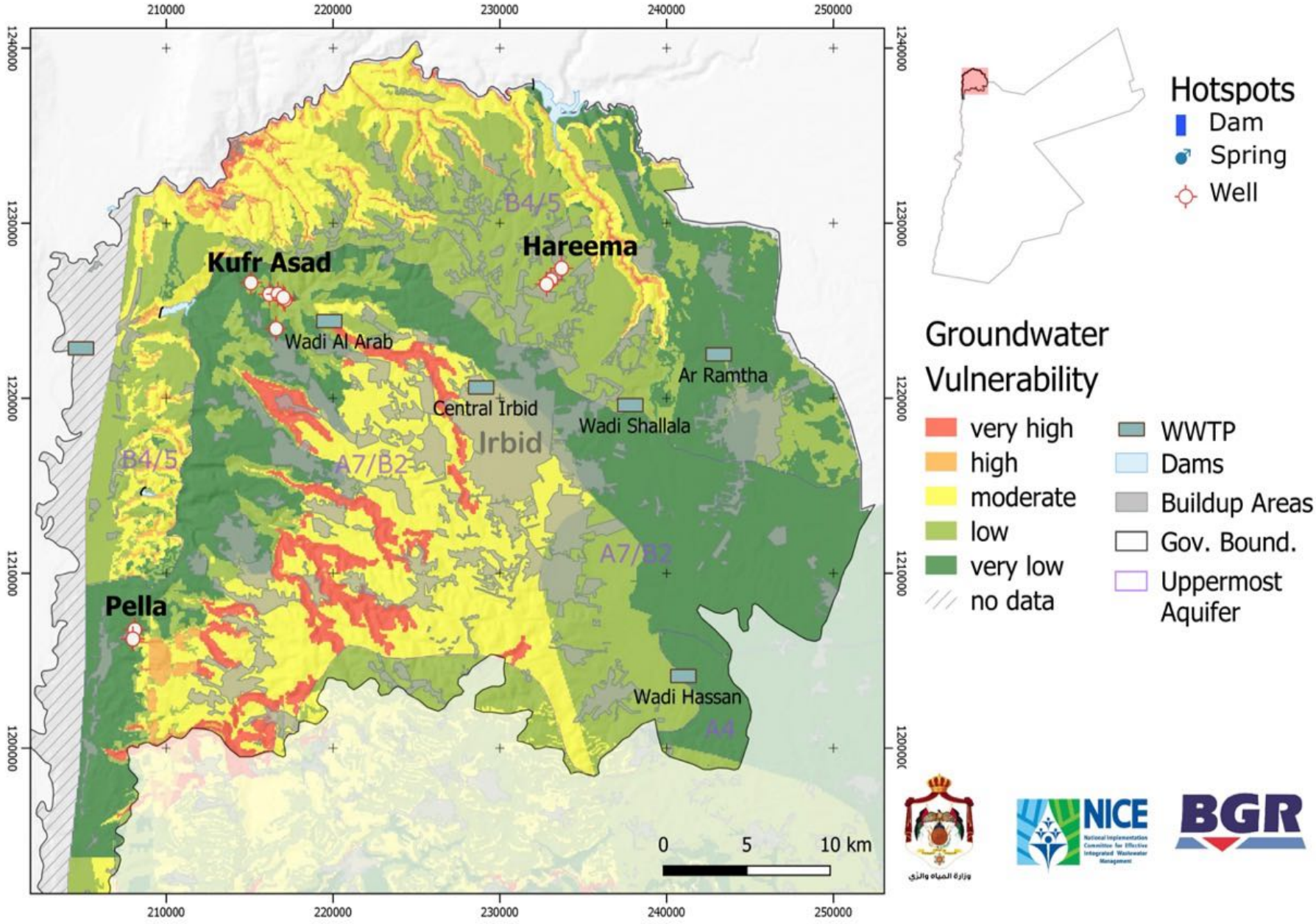
P –Factor (Precipitation): Quantity of rainfall as well as rainfall intensity (Precipitation).

Prioritization of Hot Spots

Hot Spots are defined as areas where groundwater resources, through leakage of domestic wastewater from cesspools, septic tanks, or sewage networks or through inappropriate handling of wastewater, have been contaminated or are expected to be contaminated.

Prioritization of Hot Spots

- people served
- level of pollution
- frequency of pollution
- availability of treatment of the water resource.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1210000
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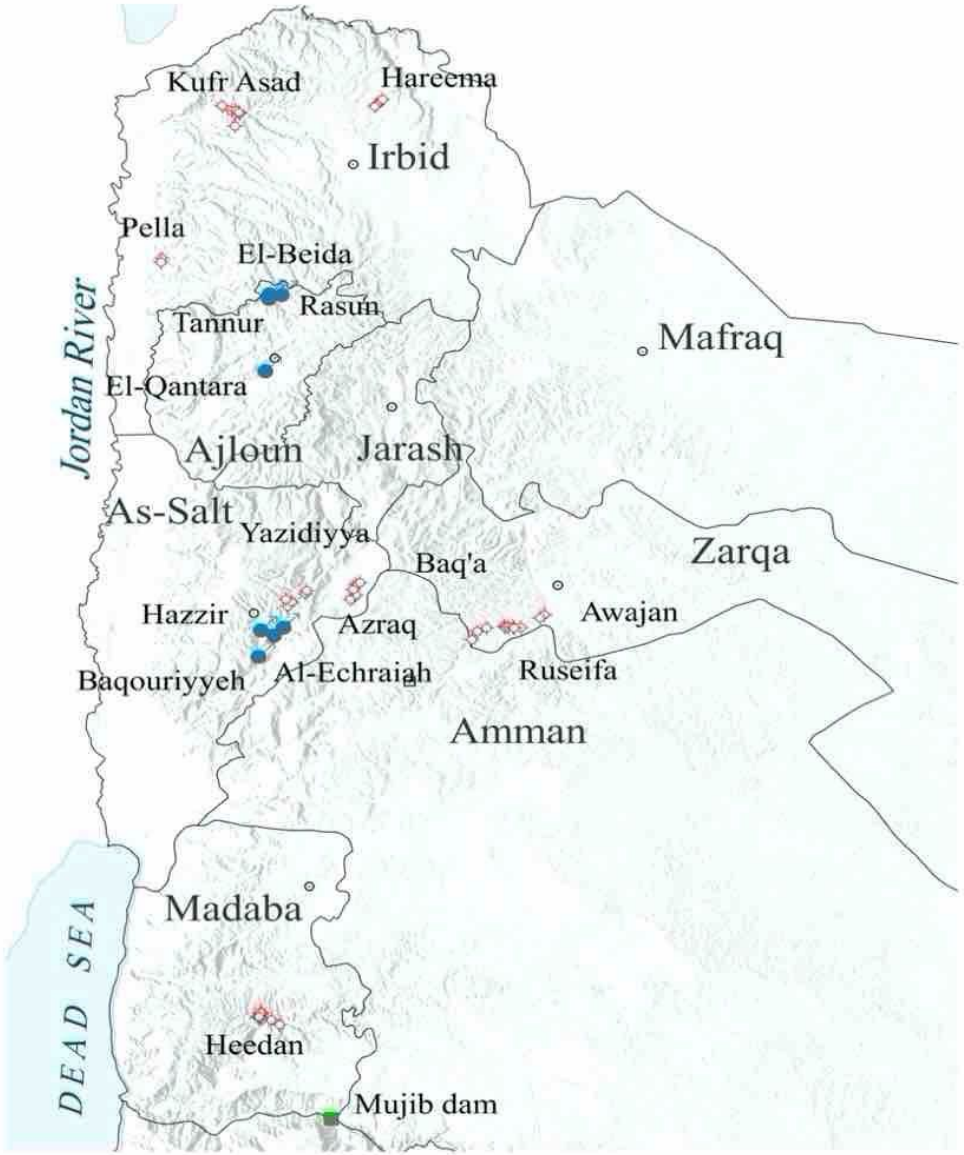
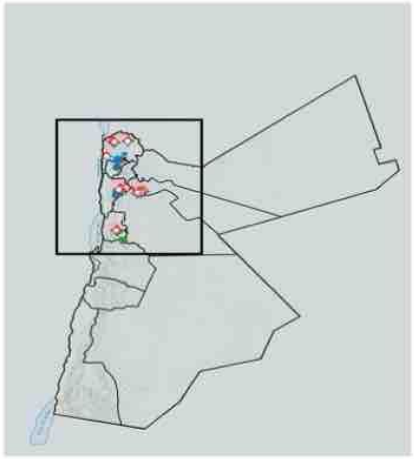
Kufr Asad
Hareema
Wadi Al Arab
Central Irbid
Irbid
Wadi Shallala
Ar Ramtha
Pella
Wadi Hassan
B4/5
A7/B2
A4
0
5
10 km
Hotspots
Dam
Spring
Well
Groundwater Vulnerability
very high
high
moderate
low
very low
no data
WWTP
Dams
Buildup Areas
Gov. Bound.
Uppermost Aquifer
NICE
BGR





N

0 50 100 km

Governorate
Dam
Spring
Well/Wellfields
Lake
City/Town

وزارة المياه والري

NICE

Done By GIS Department /MWI

Prioritization of Hot Spots

- The identified Hot Spots, in combination with the Groundwater Protection Zones and Groundwater Vulnerability Maps, can be seen as an important decision support tool for stakeholders and decision makers when deciding where wastewater treatment plants will have the biggest impact for groundwater protection.
- In addition to improving public health and reducing environmental pollution, wastewater management is most beneficial where it supports the protection of groundwater and, in particular, where it facilitates the implementation of groundwater protection

Prioritization of Hot Spots

- Kufr Asad wellfield Located in the west of the Irbid Governorate.
- Approximately 281 m3/h of water is extracted providing water for the network including Kufr Asad, Sidour, AlKharaj, Malakah, Mansoura, Hatem, Abder, Umm Qais – all located in the district of Bani Kinanah – and Qumim. Treatment at the wellfield: Chlorination.
- Contamination from the Wadi Arab WWTP as a result of bypass or overflow due to overloading.

Recommendations

- A careful assessment of risks and benefits of wastewater treatment in Groundwater Protection Zones.
- When reusing treated wastewater, e.g. in agriculture, the Jordanian Standard for Reuse (JS 893, 2006), is to be complied with.
- It is permissible to use treated wastewater for the purposes of artificial recharge, provided that the water in the aquifer is used for irrigation purposes only.

Recommendations

- Due the prevalent karstic geology and ensuing high vulnerability to pollution, the establishment of wastewater treatment systems is confined to Protection Zone 3.
- Treated effluents should not be discharged into wadis leading to Protection Zone 2 (JS 893, 2006) or areas of high groundwater vulnerability.
- The open discharge of treated wastewater to the valleys adjacent to Protection Zones 1 and 2 is prohibited by Article 30 A/3 of the Water Authority Law No. 18 of 1988 and amendments thereof.

Thank you