



# Delineation of Wellhead Protection Zone for Groundwater Wells in Tulkarem District

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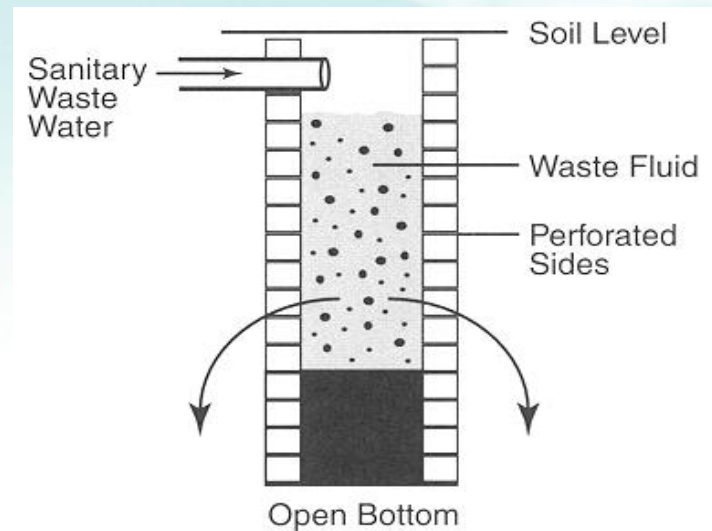
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# Introduction

- ❖ Groundwater is considered the main fresh water resource in the West Bank and definitely the only reliable source for water supply for Palestinians.
- ❖ Protecting groundwater from pollution is a priority and a major concern as well.
- ❖ Wellhead Protection zones is an effective management plan to minimize the risk of groundwater contamination.
- ❖ Wellhead protection involves integrated water resource planning and preventative actions intended to solve an on-going problem or to avoid the occurrence of a potential problem from contaminants.

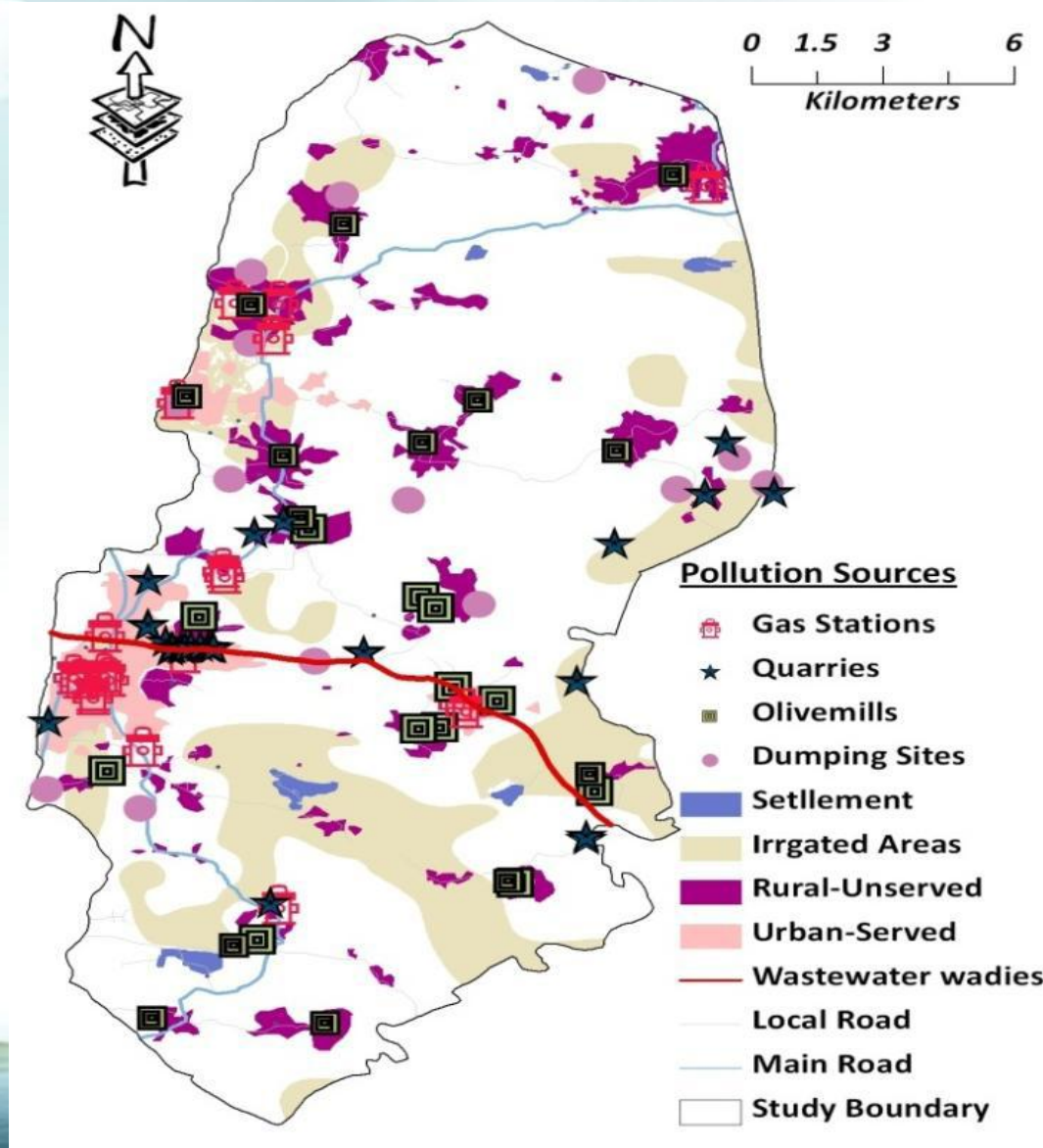
❖ Pollutants originating from **landfills**, **cesspits**, **overuse of fertilizers** and **pesticides** can pollute groundwater.

❖ Cesspits are considered as **concentrated point sources** of pollution yet widespread.



❖ The majority of cesspits that are in use in the West Bank are **not coated or lined** and thus wastewater will leach down and percolate and may negatively affect the quality of groundwater.

# The distribution of pollution sources in the study area (Tulkarm district and part of Jenin District).



# Motivations

- Groundwater is the most important water resource in the West Bank, and thus understanding the issues affecting its quality and protecting it from pollution is important and needful.
- Identification of areas with heavy contamination loadings from pollution sources is important for land use planners and environmental regulators.
- The groundwater wells are highly vulnerable to pollution from cesspits, dumping sites, wastewater discharged without any type of treatment, industrial and agricultural activities.

# Objectives

- To delineate the wellhead protection zone for groundwater wells in Tulkarem district.
- Identify the potential sources of contamination within each zone.
- Strategies and preventive guidelines that must be formulated for the decision makers and planners in order to protect the groundwater from pollution.

## Wellhead Protection Zone

Wellhead protection zone is the area surrounding the groundwater well, through which contaminants are reasonably likely to move toward and reach groundwater well. It is good way to protect groundwater from pollution and improve its quality.

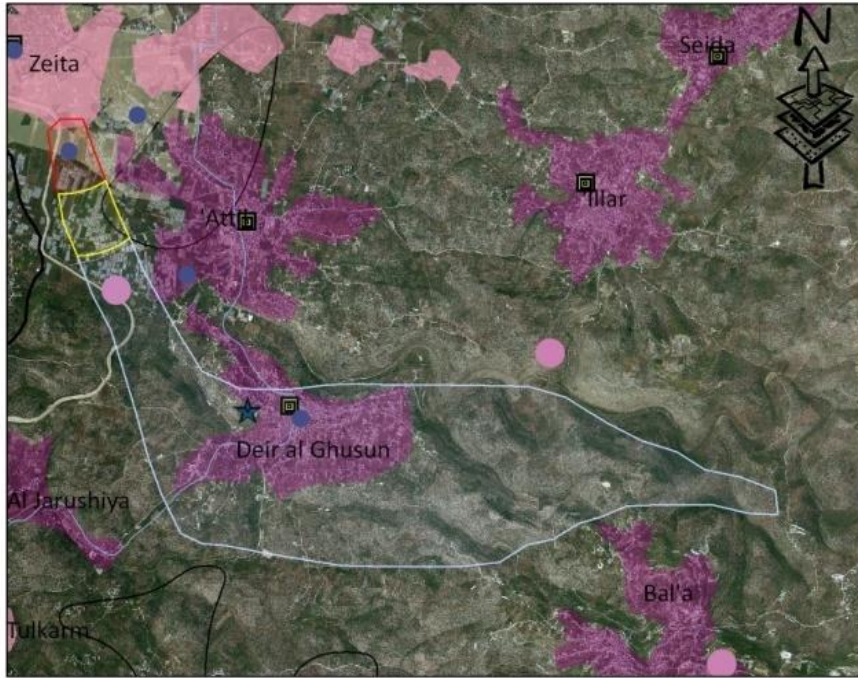
Three zones were delineated that make up a wellhead protection area are based on how long it would take a contaminant to travel through the aquifer and reach the well.

## Delineation of Protection Zones for Groundwater Wells in Tulkarm District

The wellhead protection zone was delineated for selected groundwater wells in the study area using **MODPATH backward tracking model**. The data was processed and analyzed by GIS tools for better visualization.

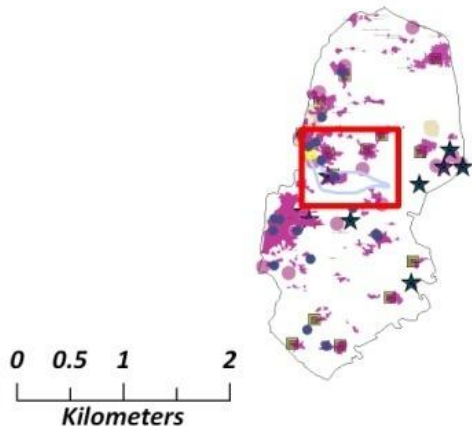
# Protection zones for Anabta Municipality and Attil Cooperative Society wells.

## Wellhead Protection Zone for Attil Cooperative Society

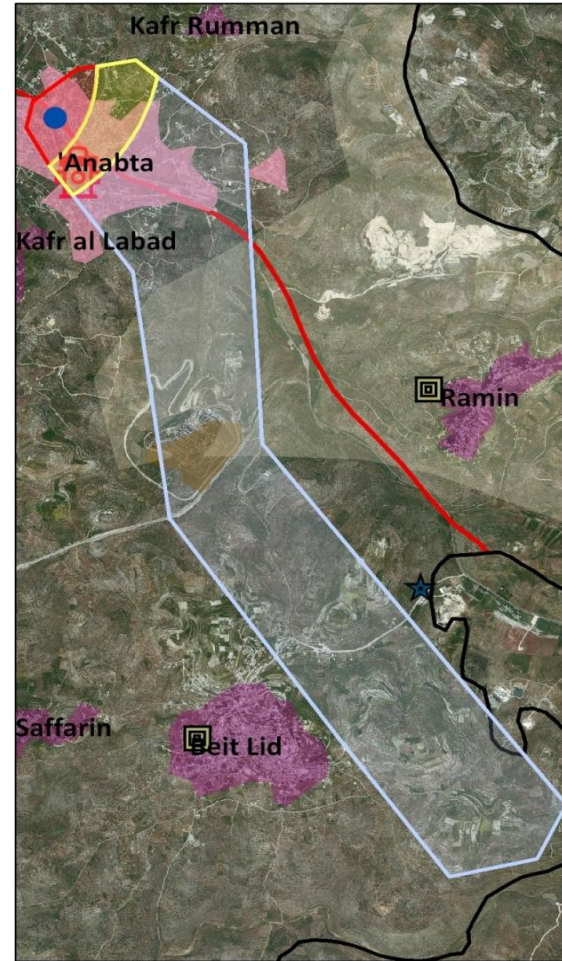


### Legend

- ★ Quarries
- Olivemills
- Dumping Sites
- Rural-Unserved
- Urban-Served
- Irrigated area
- ▭ 2-years time of travel
- ▭ 5-years time of travel
- ▭ 70-years time of travel

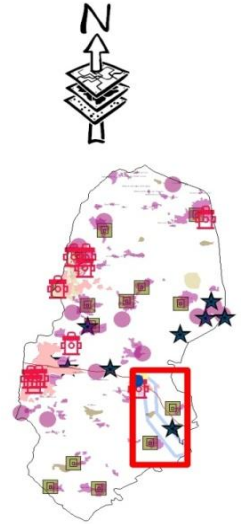
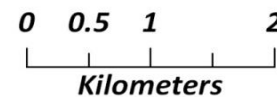


## Wellhead Protection Zone for Anabta Municipality 2



### Legend

- 16-10/002
- ▭ 2-year time of travel
- ▭ 5-year time of travel
- ▭ 200-year time of travel
- Wastewater wadies
- ★ Quarries
- Olivemills
- Gas Stations
- Settlement
- Irrigated area
- Urban-Served
- Rural-Unserved





# Groundwater Protection Strategies for Selected Groundwater Wells in the Study Area

There are many **actions** within each zone that should be considered to protect groundwater wells in the study area as summarized in the following strategic points:

1. The majority of groundwater wells in the study area are located in or near un-served communities, so the construction of a wastewater sewage network and treatment plant is imperative.
2. Public education and workshops in coordination with all stakeholders to become more willing to change their behavior when they realize their activities could adversely affect the sources of drinking water.
3. Minimizing the number of pollution sources generated from the random solid waste disposal by establishing main isolated dumping site and outside the wellhead protection area.

4. Fertilizer and pesticide applications must be controlled in irrigated areas and restricted or limited in the critical zones around wells. In addition, public education and workshops on safe pesticide and fertilizer use must be implemented by the Ministry of Agriculture.

5. Reducing the risk resulting from the wastewater generated from the industrial sector such as quarries and olive mills. This can be achieved by forcing the industrial sector to treat their wastewater before disposing it.

Field visits were carried out to the village councils and municipalities in Tulkarem District and the locations of the groundwater wells. Through the visit, the Municipality of Anabta and Attil assured that the Anabta Municipality 1 (16-19/001) and Muhammad Nemer Barakat (15-19/041) wells are closed because the contaminant concentration for these wells is above the MCL. So without a management plan the quality of water in the aquifer will eventually become degraded.

# Discussion

- All public authorities such as Palestinian Water Authority, Ministry of Health, Ministry of Agriculture, Ministry of industry, Ministry of environmental and Municipalities to meet their responsibility and take immediate actions to prevent and control groundwater contamination. This is achieved through a good management plan and developing land use regulation and monitoring program.
- The public participation is extremely an important part in developing management plans of wellhead protection. This is achieved through public information via advertisements and brochures and through public consultations which encourage the stakeholders to be more active and powerful as members of the decision making.

- The first protection zone must be totally a fence and the land use activities should be prevented. In the second and third zones all development activities such as agricultural, industrial and social activities were implemented under the condition that they comply with the laws, which applied in environmentally sound practices.
- To further enhance comprehensive groundwater protection and management, selection of new location for domestic wells should be preceded by delineation of well head protection zone, identification and consultation of development plans to identify the impact of future land use and any need for land use controls within zones to protect well from contamination.
- Set up management policies and regulations of land use activities for wellhead protection zones especially the critical zones around the groundwater sources. Developing preventive guidelines and operational controls necessary to ensure better management for groundwater resources which can be part of the Palestinian Water Authorities regulations.

