Pro-Aquifer
Protecting Trans-boundary Groundwater Sources from Pollution:
Guidelines for Israeli Municipalities
And Umm el Fahem Case Study
September 2008
Pro-Aquifer
Protecting Trans-boundary Groundwater Sources from Pollution:

Guidelines for Israeli Municipalities
And Umm el Fahem Case Study

September 2008

Primary Authors: Ladeene Freimuth, Amnon Saltman, Gidon Bromberg, FoEME
Dr. Amjad Aliewi, Khaled Rajab, Najwan Imseih, HWE

The authors would like to thank the Pro-Aquifer Steering Committee and Working Committees for their guidance and support throughout this project, as well as the European Commission LIFE Third Countries Programme and Green Cross France for their support.

EcoPeace/Friends of the Earth Middle East (FoEME) is a unique organization that brings together Israeli, Palestinian and Jordanian environmentalists to advance both sustainable regional development and the creation of necessary conditions for lasting peace in the region. FoEME has offices in Tel Aviv, Bethlehem, and Amman. It is a member of Friends of the Earth International, the largest grassroots environmental organization in the world. For more information, please visit: www.foeme.org.

House of Water and Environment (HWE) is a Palestinian not-for-profit organization that aims to promote practical research into the current and future state of water resources and the environment. HWE serves as a regional base for networking and partnering around the common theme of water resources and environment sustainability and aims to implement a wide range of activities including research, community water development projects, information dissemination, and training. For more information, please visit: www.hwe.org.ps.

Disclaimer
This report is an output from the Pro-Aquifer project. The findings, interpretations and conclusions expressed are those of the authors (the team) and should not be attributed to any official parties nor to our donors. The project does not guarantee the accuracy of the data of other researchers included in this publication. Boundaries, colors, denominations and other information shown in maps, figures, tables and the text do not imply any judgment on legal status of territory or the endorsement of boundaries.

© All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, mechanical, photocopying, recording, or otherwise, without prior written permission from HWE or EcoPeace/Friends of the Earth Middle East.
## TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executive Summary</td>
<td>3</td>
</tr>
<tr>
<td>Introduction</td>
<td>5</td>
</tr>
<tr>
<td>Part I: Israeli Municipal Guidelines</td>
<td></td>
</tr>
<tr>
<td>Israeli Guidelines for Municipalities: Applying the Pro-Aquifer Methodology</td>
<td>9</td>
</tr>
<tr>
<td>Part II: Umm el Fahem Case Study</td>
<td></td>
</tr>
<tr>
<td>1. Background on Umm El Fahem</td>
<td>13</td>
</tr>
<tr>
<td>1.1 Demography, Geography, and Hydrology</td>
<td>13</td>
</tr>
<tr>
<td>1.2 Economy</td>
<td>14</td>
</tr>
<tr>
<td>2. Findings on Umm el Fahem's Current Hazards and Potential Threats to the Mountain Aquifer</td>
<td>16</td>
</tr>
<tr>
<td>2.1 Pollution Sources and Infrastructure Problems</td>
<td>16</td>
</tr>
<tr>
<td>2.1.1 Hazardous/Industrial Waste</td>
<td>16</td>
</tr>
<tr>
<td>2.1.2 Municipal Solid Waste</td>
<td>17</td>
</tr>
<tr>
<td>2.1.3 Sewage/Wastewater</td>
<td>19</td>
</tr>
<tr>
<td>2.2 Governance Issues</td>
<td>20</td>
</tr>
<tr>
<td>2.2.1 National Institutional Structure</td>
<td>20</td>
</tr>
<tr>
<td>2.2.2 Municipal Institutional Structure</td>
<td>20</td>
</tr>
<tr>
<td>2.2.3 Standards, Regulations, and Laws</td>
<td>21</td>
</tr>
<tr>
<td>2.2.4 Lack of Enforcement</td>
<td>22</td>
</tr>
<tr>
<td>2.2.5 Lack of Financing</td>
<td>22</td>
</tr>
<tr>
<td>2.3 Lack of Public Education and Awareness</td>
<td>23</td>
</tr>
<tr>
<td>3. Recommendations to Alleviate Contamination of the Mountain Aquifer</td>
<td>24</td>
</tr>
<tr>
<td>3.1 Pollution Sources and Infrastructure</td>
<td>25</td>
</tr>
<tr>
<td>3.1.1 Hazardous/Industrial Waste</td>
<td>25</td>
</tr>
<tr>
<td>3.1.2 Municipal Solid Waste</td>
<td>25</td>
</tr>
<tr>
<td>3.1.3 Agricultural Pollution</td>
<td>26</td>
</tr>
<tr>
<td>3.1.4 Sewage/Wastewater</td>
<td>26</td>
</tr>
<tr>
<td>3.2 Governance</td>
<td>27</td>
</tr>
<tr>
<td>3.2.1 Institutional Capacity</td>
<td>27</td>
</tr>
<tr>
<td>3.2.2 Enforcement</td>
<td>28</td>
</tr>
<tr>
<td>3.2.3 Financing</td>
<td>29</td>
</tr>
<tr>
<td>3.3 Public Awareness</td>
<td>29</td>
</tr>
<tr>
<td>3.4 Conclusion</td>
<td>30</td>
</tr>
<tr>
<td>Appendices</td>
<td>31</td>
</tr>
</tbody>
</table>
EXECUTIVE SUMMARY

The Mountain Aquifer underlies part of Israel and most of the West Bank. Pollution hazards – such as waste and sewage – threaten the Aquifer. These physical threats are compounded by governance problems that exacerbate the likelihood of contamination of the Aquifer. Yet the Mountain Aquifer is a critical trans-boundary groundwater resource, because it serves as a main source of drinking water for Israelis and is the only source of drinking water for Palestinians in the West Bank. The Aquifer will become more vital with population growth and projected climate impacts on regional water resources. Thus, if it were to become contaminated, the overall water situation in the region would deteriorate and could exacerbate the already-existing political conflict.

This paper contains research findings and policy recommendations to help Israeli municipalities in the recharge area alleviate pollution of the Aquifer. This paper is one component of a two-year, joint Palestinian-Israeli project, designed to prevent contamination of the Mountain Aquifer. It is referred to as the “Pro-Aquifer” project, and has been conducted by EcoPeace/Friends of the Earth Middle East (FoEME) and the Palestinian House of Water and Environment (HWE). The "Pro-Aquifer" project also aims to foster cross-border cooperation in its efforts to protect the Aquifer, because this is a shared resource.

The “Pro-Aquifer” project has focused on the municipal level, because municipalities play a pivotal role in environmental management and in infrastructure planning. The project selected Umm el Fahem as an Israeli Arab case study municipality, which sits in the recharge area of the Mountain Aquifer, based on an extensive selection process, including the nature and severity of hazards that could threaten the Aquifer, governance issues, its hydrological sensitivity, and its willingness to participate in this effort, among other factors. Pro-Aquifer also focused on the Palestinian West Bank municipality of Tulkarm, as a case study, because it, too, sits in the Aquifer recharge area and possesses significant hazards and institutional issues and, again, because of the cross-border nature of this issue. A joint Israeli-Palestinian Steering Committee provided input into all aspects of this project.

The project consisted of: 1) having undertaken scientific and institutional research in the case study municipalities; 2) having implemented joint and parallel Israeli-Palestinian training courses and study tours; and 3) having developed detailed policy recommendations for the two case study municipalities, and “generic” guidelines for Israeli and Palestinian municipalities in the recharge area, hereinafter also referred to as recommendations.

This paper presents the “generic” recommendations for Israeli municipalities in the recharge area, which are drawn from the Umm el Fahem case study. The Palestinian generic recommendations and Tulkarm case study are provided in a separate document.

Overview of Key Recommendations for Israeli Municipalities in the Aquifer Recharge Area

This “Pro-Aquifer” methodology is designed to provide a systematic approach to help empower municipal staff and better equip them to begin to alleviate contamination threats to the Mountain Aquifer. For those municipalities with systems in place for protecting groundwater resources, these recommendations will be useful as a “checklist” to make sure that all issues are covered. For municipalities, such as Umm el Fahem, that are overwhelmed by the extent of the pollution problems they face, these recommendations will provide a methodology to help them begin solving these issues.
This approach consists of seven steps, which are described in greater detail in Chapter 2 of this document. The first two steps form the basis of the Pro-Aquifer “toolkit.” The subsequent five steps consist of additional “generic” recommendations to help municipalities prevent groundwater pollution.

- **Step 1:** Conduct scientific and institutional research; and, use Geographic Information Systems (GIS) to prioritize threats to the Aquifer.
- **Step 2:** Provide training courses on relevant topics (e.g., sewage treatment management techniques) for municipal staff.
- **Step 3:** Develop a strategic plan to prevent groundwater pollution.
- **Step 4:** Enhance infrastructure.
- **Step 5:** Conduct inspections, monitoring, and enforcement.
- **Step 6:** Secure sustainable financing.
- **Step 7:** Improve education and awareness.

Moreover, municipalities that conduct their own research will be able to develop additional or modified recommendations specific to their unique circumstances and needs. It seems reasonable to believe that these tools also could be replicated and applied in other areas where there is a need to protect trans-boundary groundwater resources.
INTRODUCTION

This paper contains research findings and policy recommendations for Israeli municipalities, which sit in the recharge area of the Mountain Aquifer, to help them address actual and potential pollution threats to the Mountain Aquifer. This paper is based on the joint Israeli-Palestinian "Pro-Aquifer" project, which has been conducted by EcoPeace/Friends of the Earth Middle East (FoEME) and the Palestinian House of Water and Environment (HWE). Pro-Aquifer has consisted of: research, training, and policy recommendations that have been developed and implemented for the Israeli case study municipality of Umm el Fahem and the Palestinian case study municipality of Tulkarm. This paper extrapolates the findings from the case study and applies the recommendations and "Pro-Aquifer toolkit" to Israeli municipalities, more broadly – to protect the Mountain Aquifer, one of the area's critical trans-boundary groundwater resources, from pollution. The Mountain Aquifer underlies a majority of the West Bank and part of Israel and is a critical trans-boundary groundwater resource, because it is the main drinking water source for Israelis and the only source of drinking water for Palestinians in the West Bank. A separate paper contains “generic” recommendations for Palestinian municipalities and the Tulkarm case study, upon which the broader Palestinian recommendations are based.

This project has aimed to protect the vital Mountain Aquifer and to foster cross-border cooperation in doing so to mitigate the potential for conflict. It has achieved this goal by working to improve practices – at the municipal level – to alleviate groundwater pollution, because municipalities play a pivotal role in protecting the local environment and in infrastructure planning and operations.

**Project and Research Methodology**

Based on the above-stated premise, the project methodology was designed from the outset with and for municipal needs in mind. Umm el Fahem was selected for this project based on an extensive process, including its willingness to participate in this effort. FoEME – in cooperation with Umm el Fahem’s municipal staff – conducted two types of research: scientific and institutional. Both the generic policy recommendations and the detailed recommendations for Umm el Fahem have been developed based on this research and are contained in this document. This process is outlined in greater detail in the following chart.

![From Research to Policy Guidelines](image)

The scientific research consisted of collecting field data on existing and potential hazards to groundwater within the municipality, including the state of its physical infrastructure. Originally, sewage was identified as a major hazard. During the course of this research, solid waste was also identified as a major problem, especially that of illegal dumping.

These threats were then mapped using Geographic Information Systems (GIS), because it is a valuable tool to help municipalities gain a real understanding of the most pressing threats to groundwater. Free, easy-to-use, Quantum GIS Software was used in this instance. The GIS provides an overview of a municipality’s environmental situation and helps municipal staff prioritize environmental hazards by combining the actual hazards with vulnerability assessments to create a risk analysis. The results of the scientific research for Umm el Fahem and Tulkarm have been published by HWE and FoEME in a separate Scientific Paper, which is referenced throughout this document.¹

The research effort also included an analysis of Umm el Fahem's institutional structure and governance issues. FoEME studied the roles of municipal staff, and their perception of their roles, that help explain the reasons for the current environmental situation in the municipality that could, ultimately, lead to contamination of the Aquifer. FoEME found a lack of political will and political

leadership at the pinnacle of the municipal structure and a lack of awareness of environmental hazards amongst staff. As a result, environmental protection responsibilities often "fall through the cracks." Lack of enforcement is also a problem, due to a lack of administrative and financial resources, the complex "clan" structure within the municipality, and other factors. In addition, the municipality has problems collecting municipal taxes. This issue leads to inadequate revenues for the municipality as a whole, including for environmental protection and management needs. For these reasons, and because environment has not been a priority for municipal staff, environmental hazards often go unaddressed.

This paper presents policy recommendations, based on these results. The recommendations aim to empower municipal staff to change the situation with respect to the way in which they manage and protect resources. They also seek to incorporate a holistic approach for improving groundwater resource management, applying the concept and principles of integrated water resources management (IWRM). The core principles of IWRM are as follows:

- Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment.
- Water development and management should be based on a participatory approach, involving users, planners and policymakers at all levels.
- Women play a central part in the provision, management and safeguarding of water.
- Water has an economic value in all its competing uses and should be recognized as an economic good.

Because women play such a vital role in water resource management and because community involvement is so critical to facilitating change, FoEME has been working with the Women's Center in Umm el Fahem to educate them on the local environmental situation and to empower them to begin to rectify the conditions they face. This includes empowering and enabling them to apply pressure to their political leaders – from the grassroots level.

**Improved Capacity and Cross-border Cooperation**

HWE and FoEME also conducted several parallel and joint training courses as part of this “Pro-Aquifer” project, both to enhance municipal capacity and to foster cross-border cooperation. Courses on sewage treatment technologies and management techniques, and on GIS were held in parallel with Palestinian municipal staff, and a course on these policy recommendations and two joint study tours of wastewater treatment facilities were conducted jointly. These courses and tours helped achieve cooperation by: 1) helping to develop a common knowledge base and set of tools to help these practitioners work toward better protecting the Mountain Aquifer; and 2) establishing a cross-border network of water and wastewater experts that staff on both sides of the border can access to better address water and sewage treatment needs.
PART I: ISRAELI MUNICIPAL GUIDELINES
PART I: ISRAELI GUIDELINES FOR MUNICIPALITIES: APPLYING THE PRO-AQUIFER METHODOLOGY

Following are seven steps that comprise the Pro-Aquifer methodology. The first two steps form the basis of the Pro-Aquifer “toolkit.” The subsequent five steps consist of additional “generic” recommendations to help municipalities in groundwater resource management. These tools are designed to empower municipal staff in the Mountain Aquifer recharge area to better understand and fulfill their roles to ultimately protect the Aquifer to a greater extent.

Step 1: Conduct two levels of research: scientific and institutional/legal (national and local); use GIS as a tool to map and prioritize risks to ground water.

For scientific research:

- Conduct site visits to a given municipality and collect data to understand the types of pollutants contained within a given municipality and the threats they pose to the Mountain Aquifer (threat and hydrological sensitivity).
- Gather data on the topography, soils, and hydrological sensitivity of the area.
- Learn the structure, operations, and maintenance of the physical water supply, wastewater treatment, and solid waste collection and disposal infrastructure, as well as future development/expansion plans.

Use the GIS process to identify and address greatest threats to the ground water:

- Acquire the necessary GIS software package. Quantum GIS is one such package that is available free-of-charge on the Internet.
- Once the skills to use GIS have been acquired, incorporate these scientific data into the GIS system and begin to use the GIS map as a tool by combining the hazards with a vulnerability assessment to create an overall risk analysis.
- Understand the overall environmental situation and specific hazards and use the risk analysis findings to prioritize the order for addressing the threats identified. The map below illustrates several hazards in Umm el Fahem that pose the greatest threats to the Aquifer, based on the type of hazard, location, and hydrological sensitivity.
  - Assign the highest-risk hazards to the appropriate departments to remediate them.
  - Potential hazards should be particularly avoided and prevented in areas that are the most vulnerable.
- Educate and involve additional municipal staff on using GIS to help identify the highest priority threats to ground water, remediating them, and preventing them in the future.

Source: Pro-Aquifer Scientific Paper, p. 81.
For governance research:

- Conduct research on the national and local institutional structures to understand the theoretical and actual responsibilities for environmental protection and infrastructure planning, operations, and maintenance.
- Research the applicable national and municipal laws, standards, and regulations.
- Research the ways in which environmental institutions, hazardous and solid waste remediation, and related environmental protection and infrastructure are financed.
- Enhance this research by:
  - Interviewing local municipal officials responsible for preventing local hazards and pollution, including those responsible for waste disposal and wastewater treatment infrastructure planning, operations, and maintenance.
  - Gaining an understanding of the municipal staff’s capacity to protect the local environment, and to inspect and enforce environmental requirements.
  - Enhancing staff awareness of environmental issues and groundwater threats. (See also training recommendations below.)

Step 2: Conduct training courses for municipal staff.

Conduct training on sewage treatment management techniques, sewage treatment technologies, and GIS, and/or on other topics identified by a particular municipality to meet local needs to better protect the Aquifer. This will establish a trained network of practitioners to prevent further threats to groundwater contamination. For trans-boundary resources, training municipal staff on both sides of the border develops a common base of knowledge and a network to facilitate cross-border solutions, and thus, is highly recommended, along with the following measures.

- Incorporate IWRM and sustainable development principles into training courses to instill municipal staff with a holistic approach to groundwater resource management.
- Incorporate lessons learned and best practices from other municipalities, the region, and abroad.

Additional Recommendations:

Step 3: Develop a strategic plan to prevent groundwater pollution.

Take into account protection of the Mountain Aquifer, and include infrastructure and land use needs, based on a holistic approach to water resources management, such as Integrated Water Resources Management (IWRM).

- Incorporate staffing, financial, and educational needs.
- Reconcile with national water and environmental protection controls, plans, the municipality’s Master Plan and other relevant plans, laws, and requirements.
- Update this plan in the medium to long term.
- Account for anticipated population growth.

Step 4: Enhance infrastructure.

- Maintain, upgrade and enhance infrastructure to prevent risk of accidents and contamination.
  - Plan to build appropriate-scale infrastructure that will enable ongoing operations and maintenance.
- Develop local and regional plans for wastewater treatment, water supply, and waste disposal.
  - Incorporate population growth projections.
For homes and/or neighborhoods not yet connected to the sewage treatment system, consider "low tech" solutions, such as reconstructed wetlands, and expedite connection to the main system for the medium-to-long term.

Incorporate sustainable solutions, including, for example, compost toilets or domestic rainwater harvesting systems/greywater recycling systems (to the extent possible to provide water for flushing toilets), especially for municipal facilities.

- Coordinate these plans with the strategic groundwater pollution prevention plan, as appropriate.

**Step 5: Conduct inspections, monitoring, and enforcement.**

- Enhance human and financial resources so the municipality can conduct on-site inspections and enforcement on a regular basis.
- Assign responsibility for inspections and enforcement to the appropriate department, according to the relevant laws and regulations.
- Facilitate and improve coordination between municipal departments.
- Inspect and monitor most frequently those areas identified by the GIS as posing the greatest threats to ground water.
- Conduct enforcement in these areas to a greater extent.
- Create an enforcement team – integrate with all relevant departments. Share enforcement responsibilities on a national and local basis.

**Step 6: Secure sustainable financing.**

- Re-direct the portion of municipal taxes collected for water supply and sewage into funding local water supply and sewage infrastructure in a "closed water system."
- Enforce collection of all municipal taxes (e.g., through a private contractor) to provide the financial resources to implement these guidelines.

**Step 7: Improve education and awareness.**

- Enhance community education, awareness and participation with respect to local ground water issues, best practices, and lessons learned. This will empower local citizens to become involved in protecting the local environment and will lead the community to pressure the municipal staff. In turn, the municipal staff will be more likely to address the environmental problems in their community.
- Develop an environmental education curriculum for the schools.
  - Ensure ongoing education and awareness in the schools, especially in kindergarten and the early grades, public education centers, and through public forums on local environmental issues that can affect the Aquifer. In this manner, the next generation will have a better understanding of the environmental and economic situations and can address these together in a sustainable manner.
- Develop a public awareness/media campaign on threats to ground water pollution and ways to prevent this contamination.
- Involve the community, especially women and students, and teach them to use GIS to understand the local environmental situation and to help address the highest risk problems, to the extent this is feasible.
  - Hold public meetings to inform the public about local environmental issues and projects.
PART II: UMM EL FAHEM CASE STUDY
Part II: Umm el Fahem Case Study

1. BACKGROUND ON UMM EL FAHEM

1.1 Demography, Geography and Hydrology

Umm el Fahem (meaning Mother of the Charcoals in Arabic) is an Israeli Arab municipality (Arab Palestinian citizens of Israel) located on the northwest rim of the Eiron Valley (Wadi Ara) adjacent to the Green Line. It is located on the recharge area of Western and Northeastern basins of the Mountain Aquifer, which constitute part of the recharge plain of the Aquifer, as illustrated in the following map.

![Map of Major Existing and Planned Solid Waste Disposal Sites in the Mountain Aquifer Area](image)


Umm el Fahem was granted status as a local council in 1960 and became an official municipality in the mid-1980s. Its area covers approximately 5,625 acres. It has 41,000 Muslim inhabitants, with a population growth rate of 2.7 percent per year. Umm el Fahem ranks very low in terms of socioeconomic indicators: specifically, it ranked second-lowest out of ten on a scale in terms of unemployment, income, and other factors, according to the Israeli Central Bureau of Statistics. The population consists of four “clans”/extended families of approximately 10,000 people each. This means that the municipality is built on complex relationships, which affects the way in which all issues within the municipality are handled, including the way in which bylaws and regulations are implemented and enforced, as further highlighted below. For example, people tend to vote in municipal elections, according to family ties and not on the basis of a clear political platform. In addition, family ties restrict enforcement actions, because decision makers lack the will to act against their extended family members or another family, because that could lead to conflicts between these extended families.
Umm el Fahem is located on hilltops and has very steep slopes. The city's elevation ranges between 220 and 510 meters above sea level. This is relevant for the physical infrastructure and relationship to groundwater sensitivity. Its land surfaces have several major faults and joints, and karstic features. These structures increase the recharge rates and hence the infiltration rates of pollution to groundwater. The soil is volcanic in origin, and therefore is very porous and full of cracks, which is another reason why substances can percolate easily through the soil. Thus, its overall groundwater sensitivity is relatively high. Below is a hydrological sensitivity map of Umm el Fahem. More about the topography and hydrology are described in the HWE/FoEME Scientific Paper that describes the research for this project in greater detail (link provided below).

Springs and Nature Reserves: Umm el Fahem does not have any nature reserves within its boundaries, but there are 17 natural springs, and two wells, the latter of which are owned by Mekorot, the Israeli National Water Company.

1.2 Economy

Umm el Fahem's industrial economy consists of approximately 500 small businesses, including: gas stations, olive mills, one slaughterhouse, and garages. Many environmental requirements are enforced locally through business licenses under the national Business Licensing Law, over which the Sanitation Department's Business License Unit has jurisdiction in Umm el Fahem. Only 20 percent of the local businesses have licenses, while the rest remain unlicensed. This is due largely to the fact that most businesses in Umm el Fahem are scattered throughout residential neighborhoods, rather than

---

2 Rabah, Mohamad. (Head of the Northern Triangle Environmental Quality Unit). Personal interview. May 2008.
3 This hydrological sensitivity (i.e., vulnerability) map was obtained from the Israeli Water Authority. The purple lines represent the municipal boundaries. The map shows the ability of wastewater – as a base measure against which to measure groundwater sensitivity – to seep through soil to ground water (and thereby pose a potential risk to contaminate the ground water, i.e., ground water vulnerability) – meaning, the map essentially also shows the geologic conductivity of soils (i.e., how porous the soils are, what kind of soils, etc.). Horizontal lines (in between the 2 black lines on the middle-left of the map) indicate areas of high sensitivity in terms of wastewater being able to seep into the ground water. Vertical lines indicate medium sensitivity; and diagonal lines indicate low sensitivity. Umm el Fahem sits primarily under the vertical lines.
5 Rabah, Mohamad., Umm el Fahem Municipality, E-mail correspondence. July 2008 [Rabah, July 2008].
The municipality has an extensive list of additional environmental protection and water quality bylaws with which businesses must comply; other national environmental protection laws apply, as well.

**Agriculture:** Although historically there is a strong connection between land cultivation and the Arab way of life, Umm el Fahem has grown into a city and has shifted from agriculture to commerce. Umm el Fahem has approximately 50 livestock sheds.

---

\[\text{\textsuperscript{6} Ibid.}\]
2. FINDINGS ON UMM EL FAHEM'S CURRENT HAZARDS AND POTENTIAL THREATS TO THE MOUNTAIN AQUIFER

The research conducted for this project identified the following as Umm el Fahem's most significant problems that pose a threat to ground water:

1) Inadequate infrastructure and improper disposal of various types of waste and inadequate/improperly maintained sewage/wastewater infrastructure;

2) Institutional problems, including lack of leadership and political will, lack of enforcement and financing issues; and

3) Lack of public education and awareness.

2.1 Pollution Sources and Infrastructure Problems

These findings on Umm el Fahem's pollution sources and infrastructure problems are based on the scientific research conducted for this project, which included risk analyses of the threats these hazards pose to the Aquifer. These results are described in greater detail in the Pro-Aquifer Scientific Paper that has been published separately as part of this project.\(^7\)

In Umm el Fahem, sewage was anticipated to be a problem. Through the course of this research, waste (including municipal solid waste, industrial and hazardous waste, and construction waste) was also found to be one of the major problems threatening ground water. Issues include: improper disposal, inadequate infrastructure, insufficient disposal containers, inadequate collection, poorly-maintained facilities, and a lack of awareness by citizens to properly use the facilities that do exist. The Scientific paper highlights the fact that Umm el Fahem is located in a highly vulnerable area, due to the nature of the region, and thus this area is particularly vulnerable to pollution from the highly toxic leachate produced from solid waste. Sewage and inadequate wastewater treatment infrastructure are also major problems, including lack of pre-treatment.

2.1.1 Hazardous/Industrial Waste

In Umm el Fahem, there are approximately 500 businesses, including gas stations, garages, and other light industry; their owners generally lack awareness regarding the threats posed by hazardous waste. One industrial zone within the city was permitted, but was halted and businesses have never been located there. Two regional industrial zones have been in the planning stages for several years, but also have not moved forward thus far.\(^8\) Overall, lack of pre-treatment is a major problem, because it causes deterioration of the treatment system as a whole, which can contribute to groundwater contamination.

Businesses are supposed to be regulated through business licenses. However, only approximately 20 percent of the 500 businesses in Umm el Fahem have business licenses.\(^9\) This is due, in large part, to the lack of an industrial zone and the consequent difficulty of locating, monitoring, and licensing businesses. Approximately 200 of these businesses are subject to additional national environmental requirements, as well. Yet the municipality has no regular inspection program and generally does not conduct enforcement locally, either, due to a lack of human and financial resources, among other reasons (described in further detail in the Enforcement sections of this paper).

In addition, hazardous waste often is disposed illegally. For example, some above-ground gas tanks operate privately and illegally as "gas stations," without any platform or other means of protection to prevent leakage to soil and ground water. Many times the tanks are moved from place to place and are hard to find.

---


\(^8\) Mahamid, June 2008; and Rabah, Mohamad. Personal interview. June 2008.

\(^9\) Rabah, July 2008.
For those businesses that have licenses, there is still little or no inspection, monitoring, or enforcement. Thus, businesses can be violating the environmental requirements of their business licenses and improperly or illegally disposing of hazardous wastes that can threaten the ground water to varying degrees, depending on the type of waste and hydrological sensitivity of the location of the business.

As another example, runoff from garages causes soil contamination, as well as surface and groundwater pollution. Oil and gas spilled onto paved areas are easily washed away by water, either from hoses or rainfall and carried into surrounding land and wadis. There is no on-site treatment of this contaminated water, which may contain copper and brass from engine degreasers, as well as grease, oil, and even engine and brake residues. Many garages also are in highly hydrologically-sensitive areas. Appendix III describes the way in which the municipality should track and manage a potential industrial hazard from an industrial facility to adequately protect ground water.

2.1.2 Municipal Solid Waste

Several different types of municipal solid waste problems in Umm el Fahem pose a threat to ground water. The biggest solid waste problems are: inadequate infrastructure for collection and disposal; lack of awareness, which prevents waste from being properly disposed in disposal sites; and, improper mixture of wastes that are disposed (e.g., hazardous and solid).

Umm el Fahem has two designated disposal sites: 1) for construction debris, and 2) a transfer station for household waste, from which the waste then goes to a landfill. The transfer station operates according to a specific section of the national Business Licensing Law. Both of these sites are owned by the municipality and are run by private contractors. The city also has eight major illegal dump sites.\(^{10}\)

**Household Waste:** The transfer station is built on concrete and has a drainage system, though different types of waste often are mixed in and then transferred to the landfill (which could threaten ground water). Thus, it does not always operate according to its license requirements. In addition, if the drainage system were to fail, then this station also could pose a severe threat to ground water, because the waste is so concentrated and of different types. There is only occasional monitoring of the station; as is the case with other municipal facilities and infrastructure.

\(^{10}\) *Ibid.*
In addition, Umm el Fahem lacks adequate municipal cleaning equipment, so it has hired a private contractor to clean the streets. Unfortunately, this contractor does not perform up to established standards, yet at the same time is politically difficult to replace. Not enough waste collection containers exist, either. All of this means that waste remains scattered across the municipality in places that can eventually threaten the ground water (see also Illegal Dump Sites below).

**Illegal Dump Sites:** Eight primary illegal dump sites exist that consist of many different types of waste that can range from slaughtered animal remnants to construction debris (despite the legal dump site that exists for the latter, described below). These sites cover large land areas and pose a hazard to ground water, because of the city's geographic proximity to the Aquifer. The leachate can seep into the ground and then to groundwater sources. Waste illegally disposed on concrete -- whether at these sites or not -- has the potential via runoff and/or movement of the waste via a vehicle or person eventually to pose a threat to the ground water. Lack of awareness and inadequate infrastructure (including insufficient collection containers) are among the primary reasons for illegal waste disposal in Umm el Fahem, as well as inadequate enforcement to ensure proper disposal.

**Construction Debris Dump Site:** The construction debris site has no infrastructure to separate the waste from the ground, so the waste can still seep into the groundwater, thereby posing a significant threat to this resource. In addition, the quality of waste at this site is not managed or regularly monitored, so other toxic or hazardous materials that can endanger the ground water often are found in the Construction Debris Dump Site. Moreover, construction waste often does not make it to this facility at all. It is instead disposed illegally around the city, which threatens ground water even more severely than if it were in the designated site, because of the municipality's topography and proximity to ground water.

**Restored sites:** Some of the illegal sites that existed for years were eventually "addressed" and restored (i.e., covered) by the municipality. One example is a playground that was constructed on an illegal dump site. However, these sites are problematic because, at such sites, the treatment has been mainly cosmetic by having covered over an old waste site. So, the waste itself generally has not been treated properly. Therefore, hazardous substances from the waste still have the potential to seep into the soil and eventually into the ground water. It is unlikely that any sites in Umm el Fahem have been restored in a manner that does not threaten ground water.
2.1.3 Sewage Treatment

Eighty-five to ninety percent of Umm el Fahem’s neighborhoods are connected to the main sewage system, from which the waste then goes to a regional site.\(^1^{11}\) Most of Umm el Fahem's sewage system operates by gravity. There are a number of pumping stations.

While most of the municipality is connected to a sewage treatment system, sewage/wastewater still poses a major threat to groundwater contamination, for several reasons. For example, the existing system is poorly maintained and the pumping stations are aging. At least one of Umm el Fahem's pumping stations was originally designed for other purposes, so it does not operate very effectively.

Thus, raw sewage leaks from time to time, which constitutes threats both to ground water and to human health. If a leak occurs at a certain location on a regular basis, it would constitute a “hot spot” that poses a particular threat to ground water. The risk essentially depends more on municipal response time to notifications of a leak, and the ability of the municipality to locate and address such problems. In the past year, the Ministry of Environment contacted the municipality, because the municipality was not adequately addressing such hazards. Consequently, the municipality hired a private contractor, which has dramatically shortened the response time to remedy such leaks, thereby reducing the risk to groundwater contamination.

**Illegal connections:** In several places around the city, people have connected themselves illegally to the sewage system. Such connections are problematic, because they typically result in too much pressure being placed on the treatment system. The stress may trigger failures in the main line, resulting in leaks that are hazardous to the ground water.

**Septic Tanks:** Approximately four neighborhoods, or ten-to-fifteen percent of Umm el Fahem’s population, are not yet connected to the main sewage system.\(^1^{12}\) These neighborhoods rely on septic tanks. Septic tanks constitute a major hazard to ground water, because they often are poorly maintained and leak easily. According to the municipality, this situation is due to change in the near future, because it has approved a plan to connect these neighborhoods to the main system with a new sewage line. However, each household will have to pay to be connected, therefore, many households might opt out of this solution and thus would continue to have inadequately treated sewage, which threatens the ground water.

**Gutters/Sewage System:** During the winter, the slopes of the roads cause rainwater to run off and hit the houses that sit below the road in heavy bursts. In addition, rainwater comes pouring onto the road(s) from the roofs of houses that sit above the road(s). As such, the houses below the road are at risk of flooding. The municipality addressed this problem by connecting the gutters of the roofs to the sewage system. However, this situation has created another significant set of problems, including, for example, too much pressure on the sewage system. This causes the sewage system to back up and break down from time to time during the rainy season. Consequently, sewage can back up onto the land, which creates an environmental and health hazard, including to the ground water.

**Drainage system:** Umm el Fahem has a drainage system that runs parallel to its sewage system. The diameter of a number of the drainage pipes is insufficient, so the system frequently backs up and overflows. This poses an extreme hazard to ground water, because the water picks up oil and other debris from the streets that can be hazardous and/or toxic, or otherwise pose a threat. The system also gets clogged with debris, because it is not regularly maintained, which also causes the system to back up and overflow. The municipality is working on replacing much of the drainage system.

\(^1\) Mahamid, Hussein. *(Head of the Umm el Fahem Water and Sewage Branch).* Telephone interview. June 2008.

\(^1\) Mahamid, June 2008

\(^1\) Mahamid, Hussein. *(Head of the Umm el Fahem Water and Sewage Branch).* Telephone interview. June 2008.
2.2 Governance Issues

2.2.1 National Institutional Structure

Since 2007, water management in the State of Israel has fallen under the auspices of the Governmental Authority for Water and Sewage (Water Authority). Previously, responsibility for protection and allocation of water resources at the national level was held by various ministries, including Agriculture, Finance, National Infrastructure, Health, Interior, and Environmental Protection. However, in 2005, a governmental committee concluded that these responsibilities were too diffuse and therefore condensed them into this single Authority, which now has jurisdiction over water quality, allocation, pricing, establishing standards for handling wastewater, and for sanitation.¹³

The Ministry of Environmental Protection issues water quality regulations, in conjunction with the Water Authority. At the national level, the Environment Ministry is responsible for implementing and enforcing environmental regulations. The Ministry of Interior is responsible for implementing the Business Licensing Law. This Ministry delegates oversight of environmental-related provisions of the Business Licensing Law to the Environment Ministry.

The Ministry of Environmental Protection maintains a "Green Police" force that is responsible for most environmental inspections and enforcement. The Environment Ministry, however, has only one officer responsible for approximately 20 municipalities, including Umm el Fahem, so enforcement is quite weak. Umm el Fahem depends on the Environment Ministry for conducting enforcement, because the municipality lacks the capacity to do so on its own. The complex nature of personal relationships, based on its "clan" structure and system, as described in the Demography Section above, also makes local enforcement politically difficult. These factors further contribute to the above-referenced pollution problems that threaten the groundwater resources.¹⁴

Umm el Fahem is cooperating with the Ministry of Agriculture on a plan to use treated water and compost for a biogas plant. In addition, the Environmental Unit is cooperating with the local Health Department and is receiving support from the national Environment Ministry to develop a Master Plan to address construction waste. They have received 200,000 NIS for this, which includes 10,000 NIS for environmental education.

2.2.2 Municipal Institutional Structure

In Umm el Fahem, institutional problems range from inadequate capacity to lack of leadership and lack of political will to change the "situation on the ground." The rather uncommon, complex nature of personal relationships in the municipality also must be taken into account. Local authorities are responsible for resource protection, infrastructure planning and development, and sewage treatment. However, environmental responsibilities often "fall through the cracks," because they often are not assigned to specific departments or units, and departments do not always communicate effectively to prevent and address environmental problems. For example, a sewage leak falls under the jurisdiction of the Municipal Water and Sewage Branch, but the problem often is not treated comprehensively. That is, other health and environmental aspects are not adequately taken into account. Umm el Fahem also lacks adequate support from the National government for planning, financing infrastructure, and other environmental endeavors (including enforcement).¹⁵

Moreover, every municipality is required by law to have an Environmental Committee, but not every municipality has such a committee. Umm el Fahem's Environment Committee is defunct, which also is a problem in terms of ensuring overall environmental protection and coordination on such issues.

¹³ Israel Water and Sewage Authority Internet Site, www.water.gov.il (Hebrew site).
Umm el Fahem’s institutional structure is similar to that of a typical Israeli municipality (see Appendix II). Umm el Fahem has a Mayor and Deputy Mayor. There is a Strategic Planning Unit. There are ten committees, some of which include a Planning Committee; an Environment Committee; a Health Committee; a Welfare Committee; and an Education Committee. These Committees communicate with three major branches: Accounting/Budget; Planning and Engineering; and Education, Health and Welfare.\textsuperscript{16} A Water and Sewage Department is located in the Planning and Engineering Branch. This Department operates and maintains the water and sewage systems, and oversees contractors.

Sanitation Department and Business Licensing Unit: The municipality has a Sanitation Department, within the Education, Health, and Welfare Branch that employs five people. A Business Licensing Unit falls under the jurisdiction of the Sanitation Department and implements the Business Licensing Law locally, through business licenses. This Unit is critical, because, in Israel, these licenses contain many key environmental requirements. This Unit also has enforcement authority, in theory. However, in reality, waste management primarily is left to the Ministry of Environment, and, to a lesser extent, to the local Northern Triangle Environmental Unit.

The local Business License Unit should play a critical role in Umm el Fahem in terms of groundwater protection, because many environmental requirements are incorporated into business licenses. However, because it is folded into the Sanitation Department, it does not have sufficient autonomy, adequately trained staff to conduct monitoring and enforcement, or financial resources. The fact that this Unit is not actively working to identify and work with businesses to provide licenses and bring them into environmental compliance is problematic and poses a major threat to groundwater protection. So, the following chapter contains a series of recommendations to help the Unit address these circumstances and, ultimately, to better protect the groundwater resources in Umm el Fahem.

Northern Triangle Environmental Quality Unit: The Northern Triangle Environmental Quality Unit (NTEQU), established in 1994, covers six Arab local authorities and more than 115,000 inhabitants.\textsuperscript{17} It is located in Umm El Fahem and is responsible for environment and sustainable development in the municipality including planning; municipal household waste collection; and helping to oversee and inspect business licenses.\textsuperscript{18}

In addition, the Unit’s salaries are paid partially from the Ministry of Environment’s budget and partially from the municipality’s budget. This can cause an inherent conflict of interest, at times. The Unit consists of the following four staff: the Manager; an Environmental Planning Advisor that also helps with the Strategic Planning for the Planning Department (i.e., this Advisor serves as the liaison between the Environmental Unit and the Planning Department); an Educational Advisor, who is physically located in the Education Department; and a Secretary, who is located in the Mayor’s office.\textsuperscript{19} This Unit also lacks adequate staff and financial resources.

2.2.3 Standards, Regulations, and Laws – National and Local

Israel has an extensive body of national laws, standards and regulations that govern environmental management and resource protection and public health; a number of the relevant laws and regulations are highlighted in Appendix I. For industry, most environmental requirements are implemented locally through business licenses under the national Business Licensing Law, as noted above. Umm el Fahem also has an extensive list of environmental protection and water quality bylaws.

In addition, Umm el Fahem has a Master Plan that covers land use (26,000 dunums). All planning and construction are supposed to be designed and implemented according to this Plan. So, the municipality addresses infrastructure construction in a comprehensive manner, e.g., for sewage, housing, water supply, and so on. However, public infrastructure construction really only began in the 1990s, so construction is not yet complete. Funding is a major reason for these construction...

\textsuperscript{16} Umm el Fahem municipal chart provided by Mohamad Rabah.
\textsuperscript{17} Rabah, July 2008.
\textsuperscript{18} Ibid.
\textsuperscript{19} Rabah, July 2008; and Rabah, April 2008.
delays (see Financing Section below). This Master Plan also contains more detailed plans for the Municipality's 40 neighborhoods, which, in turn, include conditions for building construction.

In the last year, a District Master Plan was issued (for the Haifa District, which includes Umm el Fahem). This District Plan conflicts with Umm el Fahem's Master Plan, in that the District Plan requires more open space to prevent development in the Western area of Umm el Fahem, while the municipality's Master Plan supports development in that area. So, 2,000 residents have signed a petition opposing the District Plan. This could lead to additional problems in the future.

### 2.2.4 Lack of Enforcement

The complex nature of the personal relationships within Umm el Fahem, due to its "clan" structure, makes local enforcement very difficult and thus requires assistance from the national Environment Ministry. In addition, as noted above, not enough staff and financial resources exist for proper monitoring and enforcement. The municipality has a Business Licensing Unit within the Sanitation Department, but neither this Unit nor the Sanitation Department conduct site inspections or any significant enforcement procedures.

The Environment Unit has no enforcement powers. So, environmental enforcement primarily is conducted by the national Environment Ministry's "Green Police." However, the national Environment Ministry only has one "Green Police" officer responsible for approximately 20 municipalities, including Umm el Fahem, so enforcement remains quite weak. This is another reason why hazardous pollutants in Umm el Fahem remain unaddressed and threaten to contaminate the ground water.

### 2.2.5 Lack of Financing

In general, environment comprises only a small portion of Umm el Fahem's overall budget. The municipality has two financing problems: first, it does not have a "closed loop" system for the water and sewage system, meaning that municipal taxes collected for these purposes are not re-directed back exclusively for funding these programs and infrastructure. The second problem is that the municipality has a problem collecting taxes. According to an accounting survey conducted in 2006 for the Ministry of Interior, only 15 percent of municipal taxes ("arnona") were being collected, though municipal officials indicate this figure was closer to 40 percent. Either way, it has amounted to less than 50 percent. This problem is due to relatively poor socio-economic conditions, as noted in the Background Section above, and the complex nature of personal and "clan" relationships within the municipality.

The municipality receives most of its environment-related funding from the Environment Ministry. It does not have adequate financial resources to maintain existing infrastructure, or to complete planned infrastructure construction, as defined in its Master Plan. The Municipality also does not have adequate funding to employ adequately trained staff to operate and maintain the infrastructure, or to inspect and enforce facilities to ensure compliance with environmental requirements. This is an ongoing, significant problem.

---

20 Rabah, Mohamad. Personal interviews and e-mail correspondence. 2007-2008.
21 Israeli Environment Ministry Inspection and Enforcement Bodies website.
22 Ministry of Interior website (Hebrew) of municipal budgets, 2006.
23 This difference is due to the fact that the accountant incorporates outstanding debts into his calculations for taxes that are not collected, so his figure is lower.
24 Rabah, July 2008.
2.3 Lack of Public Education and Awareness

Generally speaking, education in Israeli Arab communities suffers compared to Israeli Jewish communities, because the Government invests less in the Israeli Arab sector. This is reflected, for example, in recent reports, which indicate that "the Arab school system in Israel has been under-funded for many years at all levels of the system. This factor is heavily implicated in the underachievement of Arab schoolchildren. The Shoshani Commission, appointed at the end of 2001, was established in the context of allegations of unequal budgets and dissatisfaction with educational outcomes." The report also emphasizes that "the State must initiate, develop and implement programs to eliminate the disparities [between Arab and Jewish citizens-ed.], notably in funding for all aspects of EDUCATION, housing, industrial development, employment and services.... While improvements have occurred more recently, disparities still exist. Along these lines, environmental education and awareness are low in Israeli Arab municipalities. Lack of education and awareness of environmental problems, ways in which to protect one's environment, and potential pollution sources, mean people do not understand how to improve their environmental conditions. This lack of awareness also means that waste is improperly treated and disposed, without knowledge of the threats such waste can pose to ground water (whether visible or not). Thus, our recommendations focus significantly on improving public education and awareness.

3. **Recommendations to Alleviate Contamination of the Mountain Aquifer**

Despite the severity of its problems, Umm el Fahem could alleviate threats to groundwater pollution (i.e., of the Mountain Aquifer), if it were to adopt a systematic approach using as tools this innovative "Pro-Aquifer" package – as it has begun to do -- that includes: 1) research and use of GIS; 2) training courses for municipal staff; and 3) these policy recommendations. The key recommendations in this policy paper focus on addressing municipal responsibility to alleviate ground water pollution in the short (1-2 years), medium (3-5 years) and long term (5+ years), based on the types of threats identified. The short-term recommendations are meant to address the most pressing problems. Appendix III provides an example of the way in which the municipality should track and properly manage an industrial facility and its hazardous waste.

Following implementation of the short-term solutions, and/or simultaneously, it is important to begin to address the governance/institutional issues, as well as those to improve public education and awareness. These latter types of recommendations also might be easier to address, because of the financing issues the municipality faces and the fact that such recommendations will be generally less expensive to implement than the infrastructure recommendations, particularly those infrastructure items identified for the medium and long term.

**Overview of Key Recommendations for Umm el Fahem**

The main recommendations consist of:

- Improving coordination and communication among municipal departments to properly assign and address hazards.
  - Using GIS to share information among different departments and provide a common base of information for dialogue.
  - Activating (re-activating) the municipal Environmental Committee and improving the way it functions (i.e., its efficacy).
- Increasing the municipality's institutional capacity to conduct inspections and monitoring of infrastructure and of businesses, and its capacity to enforce against environmental violations;
- Securing sustainable local financing, for example, by directing municipal taxes for water and sanitation back into operating, maintaining, and upgrading, where necessary, these systems;
- Working with businesses to help them pre-treat their wastes, as well as to obtain business licenses, comply with environmental requirements, and, ultimately, to move to an established, functioning industrial zone.
- Developing a strategic environmental/groundwater management plan that incorporates a holistic approach, based on the concept and principles of Integrated Water Resources Management (IWRM), including, for example, land use needs;
- Enhancing infrastructure, taking population growth into account, to improve solid waste collection and disposal/prevent illegal dumping, and to enhance sewage treatment;
- Expanding public education and awareness on local environmental conditions and on ways in which to protect the local and trans-boundary ground water, especially by working with youth, women, and NGOs.

With the end of this two-year project approaching, Umm el Fahem municipal staff have asked FoEME to continue the partnership by beginning to help implement some of these key recommendations.

These recommendations are described in greater detail below.
3.1 Pollution Sources and Infrastructure

3.1.1 Hazardous/Industrial Waste

Short Term Recommendations:
- Identify and clean up existing facility hazards, beginning with those that are in areas posing the greatest threat to groundwater, according to the GIS risk analysis produced as part of this research effort, and included in the Scientific Paper.
- Work with businesses to educate them on the risks their waste(s) pose to ground water, and encourage them to pre-treat and properly dispose their waste. (See Education Section below for more details.)
- Follow the recommendations provided below (in the Institutional Section) for cooperating with business owners, so they acquire business licenses and then comply with these requirements.
- Work with/pressure the national government to approve the zoning plan for the municipal industrial zone.

Medium Term:
- Continue to work with businesses to encourage pre-treatment of hazardous waste and ensure proper disposal.
- Work with businesses to help them locate (relocate) in the municipal industrial zone (this zone is already permitted) and move forward with the two planned regional industrial zones.
- Educate and provide incentives for new businesses to locate in the industrial zone.
- Within an industrial zone, remediate contaminated, unused sites for industrial development before using open spaces.

Long Term:
- Continue to work with businesses enhance pre-treatment and proper disposal, as well as to obtain licenses.
- Inspect and monitor facilities.
- Enforce violations.
- Force businesses to move to an industrial zone.

3.1.2 Municipal Solid Waste

Short Term:
- Use GIS to identify improper and illegal waste sites that pose the greatest risk(s) to ground water. Clean up illegal waste dumps and improperly disposed waste that pose the greatest threats in an environmentally sound manner to prevent ground water contamination (i.e., do not just cover over hazardous waste).
- Work with landowners and local citizens, to the extent possible, and, where appropriate, develop a plan and timeframe for conducting these cleanup activities.
- Once a site is cleaned up, put signage up, and enhance public awareness to prevent the site from becoming contaminated again in the future.
- Use experienced private contractors to ensure proper municipal collection of domestic waste.
- Develop a municipal recycling program – and develop a media campaign around it.
- Work with neighborhoods to develop household and neighborhood compost programs.
- See education section below on enhancing community awareness to prevent future improper disposal of solid waste.

Medium Term:
- Remediate more sites, continuing with those that pose the next greatest threats to ground water, according to the GIS maps and the field visits conducted during the course of this "Pro-Aquifer" project.
- Monitor the municipality's transfer station and construction debris dump site to prevent improper mixing of hazardous and solid wastes.
- Develop a new local and/or regional environmentally-sound solid waste landfill site.
• Improve the infrastructure of the construction debris site, so there is protection between the site and the soil (e.g., impermeable layer).
• Develop more ecological "open spaces" (e.g., around springs), so citizens can see the value of protecting environmental resources and preventing improper waste disposal.
• Continue to work with the community to enhance awareness to prevent illegal dumping.

Long Term:
• Conduct ongoing monitoring to prevent illegal dumping.
• Conduct ongoing awareness campaigns.
• Enhance cleanup and closure of illegal dump sites.
• Ensure adequate legal sites exist for proper disposal and monitor these sites to prevent improper mixture of different waste types (e.g., hazardous, medical and solid waste).
• Provide adequate disposal sites for hazardous and other types of waste.

3.1.3 Agricultural Pollution

Short Term:
• Educate farmers to ensure agricultural fertilizers, manure, and organic and chemical products, and so on, are properly managed and contained to prevent non-point source contamination, especially in areas that are the most hydrologically-sensitive and at risk of threatening the Aquifer.

Medium/Long Term:
• Continue to work with farmers so they manage and contain organic and chemical products in a way that prevents non-point source contamination in high risk and other areas.
• Conduct ongoing education and waste management activities for the agricultural sector.
• Inspect and monitor farms and agricultural areas regularly.

3.1.4 Sewage Treatment

Short Term Recommendations:
• Regularly inspect and monitor the existing system for leakages, and repair those in areas that pose the greatest threat to ground water as quickly as possible.
• Maintain, upgrade and enhance infrastructure to prevent risk of accidents and contamination.
• For isolated neighborhoods not yet connected to the sewage treatment system, consider "low tech" solutions, such as constructed wetlands.
• To fix the inadequate sewage, drainage and gutter systems, conduct a comprehensive analysis of potential solutions, which could include, for example, expanding the sewage system; alternatively, it could include separating the sewage and gutter systems (ensuring adequate means for treating rainwater runoff).
• Incorporate consideration of sustainable solutions, including, for example, compost toilets or domestic rainwater harvesting systems/greywater recycling systems (to the extent possible to provide water for flushing toilets), especially for municipal facilities.
• To prevent illegal connections to the sewage system (which puts additional pressures on the system that could lead to ruptures), provide subsidies to households in the near term so they will use a contractor for septic tank sewage collection.

Medium Term:
• Conduct ongoing monitoring and maintenance to prevent leakages, and quickly repair those leakages that do occur.
• Use the GIS to identify the areas of highest vulnerability, and plan to build top quality infrastructure in these areas.
• Upgrade sewage and drainage pipelines, as needed.
• Expedite completion of the sewage treatment system and lines to connect to the main system those neighborhoods that remain unconnected thus far.
Long Term:
- Continue to enhance and upgrade the infrastructure.
- Conduct ongoing monitoring and maintenance.
- Connect any remaining unconnected households to the system and/or provide alternate treatment solutions.

3.2 Governance

3.2.1 Institutional Capacity

Short Term Recommendations:
- Develop a strategic plan to prevent groundwater pollution in the short-to-medium term: take into account protection of the Mountain Aquifer, and include infrastructure and land use needs, as well as staffing, enforcement, financial, and educational needs.
  - Reconcile with national water and environmental protection controls, plans.
  - Update this plan in the medium to long term;
  - Incorporate IWRM principles into the plan and into municipal management and responsibilities.
  - Account for anticipated population growth.
- Improve coordination and communication among municipal departments to assign hazards to the appropriate departments and address them.
  - Use GIS to share information among different departments and to provide a common base of information for dialogue.
  - Activate (reactivate) the municipal Environmental Committee; improve the way it functions (efficacy). The Committee can help assign responsibility to various departments and units for addressing the priority hazards. Regular meetings are needed to determine whether environmental protection, monitoring and enforcement are functioning properly.
- Hire and train municipal staff, particularly for the Business Licensing Unit, to strengthen local capacity.
- Educate and involve municipal staff on identifying and being aware of the environmental hazards, especially the highest priority risks as well as on applicable environmental laws (addressed in greater detail in the Education Section below).
- Encourage staff to attend environmental education conferences and meetings to incorporate lessons learned and best practices from other municipalities within Israel, the region, and abroad.
- To address the lack of inspections and monitoring, implement a system for conducting ongoing site visits and for monitoring the municipal areas, focusing first on the most hydrologically-sensitive areas and suspected high-risk hazards, to identify the potential greatest threats to the ground water.
- Work with business owners and municipal departments to identify and remediate current hazards, and to prevent potential threats from becoming actual ones.
- Partner with the national government to achieve more national administrative and financial support (for planning, etc.).

Medium Term:
- Elevate the status of the Business Licensing Unit to that of a Department.
- Continue to enhance the capacity of the municipal staff, including ongoing incorporation of IWRM principles.
- Continue to enhance coordination across departments.
- Expand the number of staff and departments using GIS as a tool to detect and prevent groundwater threats.
- Implement the strategic plan.

Long Term:
- Continue to implement the strategic plan. Revise it every 3 to 5 years.
3.2.1.1 Recommendations for the Business License Unit/Sanitation Department:

Taking into account that Umm el Fahem now has GIS as a tool, the Business License Unit should:

- Inventory the businesses. (Use trained staff, students, and other residents to help accomplish this item.)
- Enter the businesses into the GIS map, if this has not already been accomplished.
- Determine which businesses have licenses.
- **Address the most significant hazards first, regardless of whether a business is licensed or unlicensed.**

For licensed businesses:

- Monitor them.
- Cooperate with all business owners to facilitate and encourage compliance with business license requirements.
- For ground water violations, especially those that threaten the ground water, help bring these businesses into compliance to reduce or eliminate the groundwater threat – address them in order of the threat they pose to the groundwater (according to the scientific research and GIS tools) – establish a plan and timeframe for doing so.
- For ongoing violations after the period to come into compliance ends, take enforcement actions (e.g., issue fines).

For unlicensed businesses:

- For those that are causing ground water violations, especially those that are in a high-risk, hydrologically sensitive area according to the scientific/GIS risk analysis and threaten the ground water, help address the threat – in order of risk they pose. Provide a plan and timeframe to remediate the threat.
- Simultaneously, work with all non-licensed businesses to help them acquire business licenses.
  - Educate business owners to understand the value and importance of preventing harm to the ground water (especially the economic importance of doing so) and of acquiring business licenses.
    - Conduct seminars and conferences for particular industrial sectors.
    - Explain this is a one-time expenditure.
  - Provide incentives or otherwise defray the cost of meeting the requirements to comply with licenses.
  - Do not enter into contractual relationships with unlicensed businesses, as a further incentive for these businesses to obtain licenses.

3.2.2 Enforcement

Short Term Recommendations:

- Hire/train more staff.
- Conduct more field visits/ongoing monitoring to prevent further threats/contamination and facilitate environmental compliance.
- Conduct enforcement actions, to the extent the polluter is known and this is feasible: bring in the national Green Police to conduct more enforcement; outside enforcement will be more effective in Umm el Fahem, due to the complex nature of relationships in the municipality.

Medium Term:

- Hire and train more local enforcement staff; conduct more local enforcement.
- Create an enforcement team – integrate with all relevant departments.
- Once the municipality acquires more enforcement powers, share enforcement responsibilities, i.e., with the "Green Police," on a national and local basis.
- Establish a reporting system whereby citizens can report potential and actual environmental hazards to the municipality (anonymously and/or without feeling threatened).
Long Term:
- Incorporate into municipal annual plans targets for undertaking a greater number of municipal enforcement actions.
- Continue to develop a multi-disciplinary municipal enforcement team (i.e., from different departments).

3.2.3 Financing

Short Term:
- Use taxes collected for municipal services (e.g., water and wastewater) to fund the operation, maintenance, and construction of water-related infrastructure.
- Seek more national support for local and regional ground water protection solutions, including infrastructure construction.
- Use such local financing and seek more national financing for staff to conduct local monitoring and enforcement, with the caveats described here.

Medium Term:
- Continue to collect taxes and increase the portion of the population from which municipal taxes are collected.
- Impose fines for illegal waste disposal and direct these revenues back into infrastructure maintenance and upgrades.

Long Term:
- Continue to ensure and enhance collection of municipal fees using a "closed water system."
- Seek more national funding and administrative support for groundwater and environmental protection, and for infrastructure upgrades.

3.3 Public Awareness

Short Term:
- Work with existing community based organizations, local NGOs, women’s groups, and youth organizations to encourage programming and activities concerning local ground water and environmental issues, best practices, and lessons learned.
- Work with school principals and relevant Departments of the Ministries of Education and Environment to implement an environmental education curriculum for the schools, beginning with kindergarten and continuing through high school.
- Involve the religious leaders in educating the community on the importance of environmental protection – and the related health risks.
- Develop a public awareness/media campaign on threats to ground water pollution and ways to prevent this contamination.
- Share GIS data collection and findings – by creating a community GIS; have this effort led by a local NGO.
  - Involve the public in the prioritization process based on GIS findings and in identifying and implementing solutions.
  - Provide more information to the public on local actual and potential groundwater hazards through placing the community GIS on the municipal website, use of media, classrooms, and public forums.

Medium Term:
- Address the remaining lack of scientific knowledge and cooperation by:
  - Enhancing cooperation with national bodies that have access to existing scientific data, e.g., the Hydrological Service, and acquire more knowledge.
  - Inviting outside researchers/universities to the municipality to conduct research.
  - Sharing knowledge across political boundaries.
  - Enhancing transparency of information sharing.
• Ensure ongoing education and awareness in the schools, especially in kindergarten and the early grades, public education centers, and through public forums on local environmental issues that can affect the Aquifer; incorporate sustainable development concepts.

**Long Term:**
• Continue to enhance community involvement, awareness, and empowerment on these environmental and groundwater resource protection issues.
• Continue to increase environmental education for the youth, women, NGOs, and others.
• Continue to foster local and cross-border data collection, scientific modeling, and information sharing.

3.4 **Conclusion**

The task Umm el Fahem faces in addressing these environmental challenges is significant. Environmental protection has not been a priority for the municipal staff, and they appear to be overwhelmed by the scope and magnitude of these challenges. However, these conditions also present an opportunity to create change. Moreover, these conditions also present an opportunity for cooperation – both within various departments of the municipality, as well as across political boundaries – to begin working toward achieving common solutions to the common need of protecting the trans-boundary Mountain Aquifer.

This two-year “Pro-Aquifer” project has enabled FoEME and municipal staff in Umm el Fahem to better understand their circumstances that have led to the current environmental conditions and to develop a systematic approach to rectify these circumstances and to work within and across political boundaries to do so.

In particular, the tools and process that have been developed as part of this Project are designed to empower municipal staff and better equip them to manage and protect the local environment and threats to trans-boundary ground water – and to take greater responsibility for doing so. As a sign of such growing environmental awareness, Umm el Fahem has asked FoEME to work with its staff to begin implementing some of the recommendations developed as part of this process. For example, one of the recommendations made herein is that the municipality should re-establish its Environment Committee to facilitate coordination of environmental responsibilities. As a first step, the municipality is working to make this happen.

Community involvement is another key recommendation and component of this project, because civil society involvement often is instrumental to creating change – by creating pressure on political leaders from the “bottom up.” To initiate this component, FoEME and municipal staff also have been working with the Umm el Fahem Women’s Center to educate a group of local women about local environmental issues, GIS at the community level, and sustainable development, so they will be more aware of their local conditions and needs, and will be empowered to facilitate change in political interest and will.

In addition, elections also create opportunities for elected officials to demonstrate leadership and political will – from the “top down” – to change the current situation and to better protect the local environment, including the trans-boundary groundwater resources of the Mountain Aquifer. By beginning to implement these recommendations, and disseminating these results, Umm el Fahem can lead by example and become a model for other municipalities in the Mountain Aquifer recharge area.
Appendix I: Primary National Laws Applicable to Environmental Resource Management

As stated by the Ministry of Environmental Protection: “Israel's environmental legislation is wide ranging. It covers the entire expanse of environmental issues, uses all forms of legislative instruments - laws, regulations, administrative orders and bylaws - and is linked to international environmental law.”

Following are the key relevant laws pertaining to environmental protection and, especially to water quality and quantity:

A. Water Law, 1959

This law creates an institutional framework for control and protection of Israel's water resources, including pollution prevention. It establishes water as public property, and charges the Ministers of Agriculture and National Infrastructure as well as the Water Commissioner with responsibility for water resources. It also directly illegalizes water pollution, and puts pollution prevention under the auspices of the Minister of the Environment. The law establishes personal liability for pollution and includes measures to enforce pollution prevention, such as financial and legal penalties against polluters.

B. Local Authorities (Sewerage) Law, 1962

This law governs maintenance of sewage systems and requires local authorities to do the same, and imposes sewage system charges. "New sewage systems must be approved by regional planning commissions and by health and environmental authorities."

C. Business Licensing Law, 1968

The Ministry of Interior administers this critical law, which contains many environmental requirements. Businesses that could adversely affect the environment and/or water quality are required to have such a license and must adhere to certain water quality protection requirements, including those pertaining to agricultural pollution (pesticides and fertilizers), hazardous waste, and industrial effluent.


Pursuant to the Business Licensing Law and the Public Health Ordinance, this regulation requires industrial plants to properly dispose of hazardous wastes in their own plants as soon as possible after production, and to transfer this waste to a regional/central treatment site no later than six months after production.

2. Hazardous Industrial Plants Regulation, 1993

This regulation requires owners of industrial plants that produce, store, sell, and/or process hazardous substances to take all necessary steps to handle and treat hazardous substances and prevent accidents, given best technologies currently available.  

D. Building and Planning Law, 1965

New construction requires a construction (building) permit. All building and land-use planning must take into consideration potential environmental impacts. Planning bodies at the national, regional, and local level are responsible for considering these impacts. A 2003 amendment aims to include environmental impact assessment as early as possible in the planning and decision-making processes, as well as to incorporate sustainable development principles in water and other areas.

E. Hazardous Substances Law, 1993

This law authorizes the Ministry of Environmental Protection to regulate and manage hazardous substances from "cradle to grave," or throughout the entire process of production, distribution, storage, and so on. Under this law, special licensing and permitting requirements exist for any premise selling hazardous substances or dealing in toxics. These permits are classified based on the level of hazard and potential risk, are only granted when an applicant is sufficiently familiar with the risks and safety procedures for the poison that he or she is handling. The applicant is also required to maintain a record of all sales and purchases of hazardous materials.

F. Maintenance of Cleanliness Law, 1984

This law prohibits unauthorized disposal of waste, construction debris, and vehicle scrap in the public domain and requires local authorities to build the proper facilities to dispose of these materials. The Ministry of Environmental Protection may issue Cleanup Orders to private, corporate, or municipal offenders. In 2007 the Knesset unanimously passed a Landfill Levy amendment, which requires landfill operators to pay a levy for each ton of waste in their landfill. The amount of the levy varies according to the type of waste, including classifications for sludge, and levies for all types of waste will be gradually increased until 2012. The amendment is an attempt to internalize the costs of waste treatment and disposal, including real costs like water pollution, and to increase recycling and recovery as alternative methods of waste disposal.
G. Drainage and Flood Control Law, 1957

This law governs the concentration, storage, and/or removal of surface or other water that could potentially harm agriculture, public health, or development and infrastructure, as well as protection against flooding.  

H. Abatement of Nuisances (Used Oil) Law, 1993

Under this law, the burning or improper disposal of used motor oil is not allowed. Buyers, sellers, and consumers must collect used oil in special containers and transfer it either to the Ramat Hovav (central) hazardous waste treatment site or to a recycling facility.

I. Effluent Treatment Standards ("Inbar Committee")

In December 2007, the Water Council of the Israeli Water Authority approved the recommendations of an Interministerial Committee (known as the "Inbar Committee") for upgraded effluent standards for existing and new wastewater treatment plants. The actual numbers for the standard have not yet been determined; the standards would apply beginning in 2010.

ENFORCEMENT

Israel’s environmental legislation is enforced through administrative, civil and criminal procedures, and at the national and/or local levels. Individuals also can bring actions, which is significant, because they can take actions against local governments for failure to adequately treat wastewater or operate such facilities.

Administrative enforcement relates to planning and building, business licensing, and hazardous waste and resource management. Where administrative and deterrent enforcement policies do not ensure compliance, there are legal channels to penalize those who violate environmental laws. According to the Israel Ministry of Environmental Protection, the primary avenue for administrative enforcement is through permits or business licenses. The administrative authority under the Business Licensing Law is such that a business can be closed if it is violating its business license or operating without one. Of note, however, is that the Water Commissioner has authority to issue administrative orders for water pollution violations, although general authority for water pollution control does belong to the Environment Ministry.

Criminal enforcement is a significant deterrent since it personally affects those who are prosecuted (i.e., through fines) and carries a social stigma. Therefore, legal proceedings initiated by the Environment Ministry against a company or local authority are generally accompanied by personal measures against high-ranking officials (mayors, managers or partners) having direct, or even indirect, responsibility for a facility.

Pollution prevention and cleanup depend on who created the violation. In most cases, when the origin of the polluter is not known and the pollution is on public land, the law enables the Ministry of

44 Ibid.
Environmental Protection to require the municipality to clean it up. If a violation occurs on private land, the Environment Ministry can impose a similar requirement on the landowner.

**FINANCING**

The Ministry of Environmental Protection operates a special trust called the "Trust for Cleanliness Protection” to protect the environment, prevent improper waste disposal, treat wastewater, implement recycling, treat and prevent hazardous wastes, and more. The trust supports municipalities through grants, for which municipalities can apply. Umm el Fahem has not received funds from this trust for many years.
Appendix II: Institutional Structure for a Typical Israeli Mid-size Municipality (30-100,000 people)\textsuperscript{46}

Appendix III: Steps a Municipality Should Follow to Properly Manage an Industrial Facility and Its Hazardous Waste (using a garage in Umm el Fahem as an example)

The red dot on the map below identifies the location of a garage in Umm el Fahem. The map also contains a box detailing specific environmental hazards for this facility (0 – this hazard does not exist or 1 – this hazard does exist for this facility). The garage is located in an area of medium hydrological sensitivity to ground water. However, based on its type of operations and the hazards it creates, the GIS analysis concludes that this facility actually poses a high risk to ground water.

The following steps illustrate the ways in which a municipality can act to alleviate this pollution source.

The Northern Triangle Environmental Quality Unit (NTEQU) obtains this information.

1. It determines which local Departments have responsibility for this business and/or these hazards.

In this case:
   a. The NTEQU;
   b. The Business Licensing Unit; and
   c. The Sanitation Department

   have jurisdiction, or responsibility, over this garage.

2. NTEQU's responsibilities:

   NTEQU's responsibilities include:
   • Gathering information on the facility;
   • Determining whether it has a business license;
   • Inspecting it for compliance with environmental regulations to ensure protection of the local soil and groundwater resources.
3. Business License Unit's responsibilities:

3A) If the garage, has a business license:

The Business Licensing Unit should check to see if the garage is complying with the business license requirements. If it is in compliance, then it becomes the Sanitation Department's Responsibility (see #4 below).

If it is not in compliance with its license, the Business Licensing Unit should work with the garage owner to help him understand what needs to be accomplished to come into compliance, including helping him understand the requirements, the procedures needed to meet those requirements, and assistance in completing those procedures. The Business License Unit and the garage owner should jointly determine a period of time within which the garage will come into compliance with its business license requirements.

If at the end of that period, the garage does not come into compliance with its license requirements or is not close to doing so, the Business Licensing Unit (likely bringing in the national Environment Ministry's "Green Police") should take enforcement actions against the garage. This can include stages of enforcement, as well, ranging from a "warning" to a fine or more severe action or penalty to shutting down the garage, if repeated violations occur.

3B) If the garage does not have a business license:

The Business Licensing Unit should work with the garage owner to educate him and help him understand the importance of obtaining a business license, and the fact that a license is required by law. The Unit should then work with the owner, as noted above, to help the owner determine what needs to be accomplished to come into compliance, including helping him understand the requirements, the procedures needed to meet those requirements, and assistance in completing those procedures. The Business License Unit and the garage owner should jointly determine a period of time within which the garage will obtain a business license. If the garage does not obtain a license after a certain period of time, it should be closed down and cleaned up.

4) The Sanitation Department's responsibilities:

The Sanitation Department should conduct periodic inspections of the garage to ensure that the various hazards (e.g., oils, greases) are not leaking, running off the pavement, or in any way threatening the soil or ground water and, in turn, human health and the environment.

If the Department finds that the garage is in compliance, it can continue with its routine inspections. If the Department finds that the garage is not in compliance with the various health and environmental laws and regulations, then it should work with the NTEQU, the Business Licensing Unit, and the "Green Police" to determine what happens next, based on the responsibilities and steps outlined here.