ENVIRONMENTAL HEALTH PROJECT

Save the Children

USAID Village Water and Sanitation Program

West Bank

Environmental Health Assessment – Phase II

by

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June 2003

Environmental Health Project
Contract HRN-I-00-99-00011-00
is sponsored by the
Office of Health, Infectious Diseases and Nutrition
Bureau for Global Health
U.S. Agency for International Development
Washington, DC 20523

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Abbreviations

CFU	Colony Forming Units
EHP	Environmental Health Project
EPSEM	Equal Probability Selection Method
FC	Fecal Coliforms
HH	Household
IFPRI	International Food Policy Research Institute
KHI	Key Household Informant Questionnaire
MIF	Merthiolate-Iodine-Formol solution
MOH	Ministry of Health
Nablus	Nablus Governorate
NIS	New Israeli Shekels
NTU	Nephelometric Turbidity Unit
PCBS	Palestinian Central Bureau of Statistics
PWA	Palestinian Water Authority
SCF	Save the Children Federation
Survey 1	Phase I Environmental Health Assessment or baseline
Survey 2	Phase II Environmental Health Assessment or follow-up
SPSS	Statistical Package for the Social Sciences
TC	Total Coliforms
USAID	United States Agency for International Development
VWS	Village Water and Sanitation Program

West Hebron	Western part of the Hebron Governorate
WHO	World Health Organization

Acknowledgements

The follow-up environmental health assessment was made possible through the cooperative work of the Environmental Health Project and Save the Children Federation by means of generous funding from the United States Agency for International Development (USAID).

Save the Children Federation, as the implementing agency for the follow-up environmental health assessment, would like to extend its gratitude to all the organizations and individuals whose great commitment and dedicated work helped in accomplishing the research in exceptional conditions.

Special recognition is given to the following individuals and organizations:

1. Louis O' Brien, EHP Chief of Party, and Shakoor Bitar, Deputy Chief of Party, for their continuous support and help in all stages of the research planning and implementation.

2. Municipal and village council heads and members, who provided all needed facilitation and support in conducting the field work in record time even in extremely difficult conditions.

4. Professionals from the Palestine Polytechnic University and Bethlehem University for their high dedication and the professional and personal quality demonstrated throughout the implementation of the research.

5. The Union of Palestinian Medical Relief Committees and the Union of Health Work Committees for demonstrated professionalism and dedication in providing laboratory testing.

In recognition of all the efforts that have been devoted to the completion of this environmental assessment, Save the Children Federation hopes that the results of this assessment will help in the developing of interventions that will lead to a better environment and improved health and quality of life for Palestinian children and families.

Finally, special thanks and recognition go to those without whom the assessment could not have been accomplished. A list of the names of all who directly contributed to the survey can be found in Appendix A.

Executive Summary

Highlights: Provision of reliable, treated piped water is probably the single most important intervention for improving health and quality of life in the West Bank within a water supply and sanitation program context.

Introduction and Background

This survey is the second in a series of environmental health assessments in the Environmental Health Project implemented by Camp, Dresser & McKee, Inc., under the auspices of the USAID Village Water and Sanitation Program in the West Bank. The objective of the project is to improve the delivery of safe and sustainable water and sanitation services to 170,000 people (2003 population estimates) in 50 villages in Nablus governorate (referred to as "Nablus" in the remainder of the document) in the north and West Hebron in the south (western part of the Hebron governorate).

Key findings from baseline data collected during January 2002 (winter and rainy season) showed the following:

- Piped water was of a much better quality (with 80% having zero fecal coliforms) than tanker water (only 38% zero fecal coliforms). Other water sources did not constitute a significant supply for households.

- Domestic water supplies are limited in quantity and quality in over 50% of households.

- There is a need for improvements in the appropriate areas for and techniques of handwashing.

- The prevalence of amebiasis and giardiasis in children 12 to 47 months of age were about 15% and 10%, respectively; no ascaris was found.

- The two-week prevalence of diarrhea in children under five years was 12%.

- Children with diarrhea received appropriate home care in only one-fifth of the cases.

- Widespread poverty exists, and it has increased since the beginning of the second Intifada.

The phase II environmental health assessment reported here is a follow-up survey to the phase I assessment and was performed in October 2002 (summer and dry season). The purpose of the second environmental health assessment was to answer two research questions:

1. Are there seasonal variations of key health indicators, such as the prevalence of diarrhea and intestinal parasites between winter and summer conditions?

2. What is the impact of the continuing deterioration of the social, economic, and political situation in the West Bank in general and in project communities in particular?

With regard to seasonal effects, the authors expect to observe changes in water quantity and quality because of a greater reliance on tanker water during summer months. Although little prior research exists regarding the West Bank, according to findings by Ali-Shtayeh et al. (1989), the prevalence of diarrhea and intestinal parasites in children under five may be higher during the dry season. With regard to the impact of the deteriorating political situation, the authors expect a decrease in socioeconomic conditions, access to adequate quantities and quality of water, and access to health care services. These may also contribute to worsening health conditions, as measured by an increase in the prevalence of intestinal parasites and diarrhea in children. For example, the prevalence of diarrhea was 17% in October 2002 and 13.5% in summer 1996 (Palestinian Central Bureau of Statistics, 2001), which could be due to worsening socioeconomic conditions. However, it will be difficult to differentiate seasonal effects and the impact of the political situation in all instances because study populations and survey methods used are not the same.

Study Methods

The environmental health assessments, of which this is the second, have been designed to provide "panel" data. This means that the goal was to reexamine the same 596 households that had been randomly selected for the first survey.

Interviews were conducted with key household informants and caretakers of children under five years of age. Stool samples were collected for one child aged 12 to 47 months (when present) per household, and water samples from internal sources were collected from every third household, 178 in total.

The data collection instruments for the key informant and diarrhea interviews were shortened versions of those used in the first round. Hygiene behaviors were not assessed a second time, because no interventions took place that could have affected behaviors, and therefore no changes were expected. Because of major mobility restrictions and the high unpredictability of work conditions, highly decentralized management and high levels of logistic and communication support in the field were essential. Thus both training and fieldwork followed separate systems in the north and the south. Special emphasis on communication skills during the training resulted in the communities' acceptance and a high response rate of the selected households.

As in the first survey, strict attention was paid to quality control in all phases from data collection in the field to data entry into the computer.

Summary of Findings

The two environmental health assessments (phase I baseline survey in January 2002, and phase II follow-up survey nine months later in October 2002) have documented that piped water is an essential commodity. Although the quality and quantity of piped water can still be improved, it is much safer, as measured by the presence of fecal coliform bacteria, than other water sources, especially tanker water, and it is much more available in sufficient quantities. Several key indicators have worsened between the first and second assessments, as explained in the following paragraphs:

- **Access to and quality of water:** Household access to adequate supplies of water has decreased, and water quality has deteriorated. While the quality of piped water has worsened, households depending on tanker water have experienced the greater impact. Tanker water is much more likely to be contaminated with bacteria than piped water. At the same time, the cost of tanker water during dry summer months has risen, and since poverty levels have remained very high, water appears to be less affordable for many households, as evidenced by a 23% reduction in consumption. Moreover, the poorest communities in rural areas are probably the worst affected, as they rely almost exclusively on tanker water. Households in Nablus use mostly tanker water, and at an average consumption of 35 liters per capita per day, use considerably less water than the 40 to 50 liters per capita per day considered to be a minimum for domestic needs (IFPRI 2002). This situation clearly underlines the need for a better water supply infrastructure. Key indicators of access to and quality of water changed as follows:

  – Sufficient water supply was noted in only 39% of the households compared with 48% at baseline.

  – Use of tanker water during the 12 months prior to the survey decreased to 60% compared with 70% at baseline, while costs increased 84% comparing winter 2000/01 with winter 2001/02 and 55% comparing summer 2001 with summer 2002.

  – The bacteriological quality of water at point-of-use decreased by almost 10% (zero fecal coliforms), but more markedly for piped water, which dropped from 80% of the samples tested at baseline to 59% at follow-up; for households relying on tanker water, the quality remained poor with 35% having zero fecal coliforms compared with 38% at baseline.

- **Health outcomes:** Gastrointestinal infection in children under five has increased substantially between the first and second environmental health assessments, as evident from a 42% increase in diarrhea and a 40-60% rise in the prevalence of ameba and giardia. Roundworms (ascaris) appeared in substantial numbers in

Nablus. Although seasonal changes were expected, the fact that cases of diarrhea and intestinal parasites all increased may point to the deteriorating socioeconomic situation as a cause. This is even more plausible considering that access to health services decreased as fewer children with diarrhea sought medical care or received treatment against intestinal worms while the disease burden rose. As to be expected in the absence of intensive hygiene promotion, beliefs about water safety and household practices related to water treatment did not change. The following health outcomes were noted:

– An increased risk of gastrointestinal diseases in children under five years:

  - In the second survey, a two-week prevalence of diarrhea was 17% compared with 12% at baseline

  - The prevalence of intestinal parasites was 21% versus 15% at baseline for amebiasis, 16% versus 10% at baseline for giardiasis (entire survey area), and 16% versus 0% at baseline for ascariasis (in Nablus only).

– Diminished access to modern health care:

  - Only 72% of children with diarrhea consulted medical personnel compared with 86% at baseline

  - Complementary evidence showed that significantly more children were treated by a pharmacist or neighbor, up to 17% from 4% at baseline

  - Only 13% of children under five received worm medicine during the six months prior to the second survey compared with 22% at baseline.

– Continuing inappropriate health beliefs and practices related to the safety of drinking water and home care of children with diarrhea:

  - Of the respondents interviewed, 83% (85% at baseline) believe water is safe, although only 45% (53% at baseline) of the household water tested had zero fecal coliforms

  - Water treatment at the household level is insufficient with 17% of water being treated (27% at baseline), and seems ineffective in general with zero residual chlorine detected in all samples taken during both assessments

  - Only 22% (19% at baseline) of children with diarrhea received appropriate home care.

- **Socioeconomic status:** Several indicators show that poverty remained very high or increased in the West Bank. Based on survey findings, the monthly cost of electricity and water may be as high as 40% of total household income. Fewer household members are fully employed; the ability or willingness of households to pay bills for piped water and electricity dropped; and more households sold

property or borrowed money to meet basic needs according to comparisons of results from baseline and follow-up environmental health assessments. The socioeconomic status worsened, as evidenced by the following:

Findings for key indicators were as follows:

- Fewer household members are fully employed at follow-up than were at baseline, with the range of members employed dropping from 0-6 to 0-3.

- Median household income the month prior to the survey remained at the hardship level of about $104[1] (500 NIS) per month ($180 per capita annually); and three in four households continue to live below the poverty level of $332 (1,600 NIS) per month ($564 per capita annually).

- The ability or willingness of households with piped water to pay their water bill dropped from 31% at baseline to 24%, and on-time payment of the electricity bill dropped from 51% at baseline to 41%.

- More households sold property (21% versus 17% at baseline) or borrowed money (60% versus 56% at baseline) to meet basic needs.

Decreases in access to and quality of water may be due in part to seasonal effects. Dry summer months could explain why water is not as sufficient as in the rainy season, but increased poverty may make water also less affordable. Greater scarcity of water during the dry season would explain higher prices and may partly explain lower quality. In addition, the destruction of water and sanitation infrastructure elsewhere in the West Bank during Israeli incursions may have increased the demand for tanker water. The worsening of health outcomes is probably attributable to a combination of seasonal effects, including lower water quality, and the deteriorating political situation with its increase in poverty. Although seasonal variations in employment status are likely, the worsening status across several socioeconomic indicators would not be the result of changing seasons alone and is probably due to the political situation.

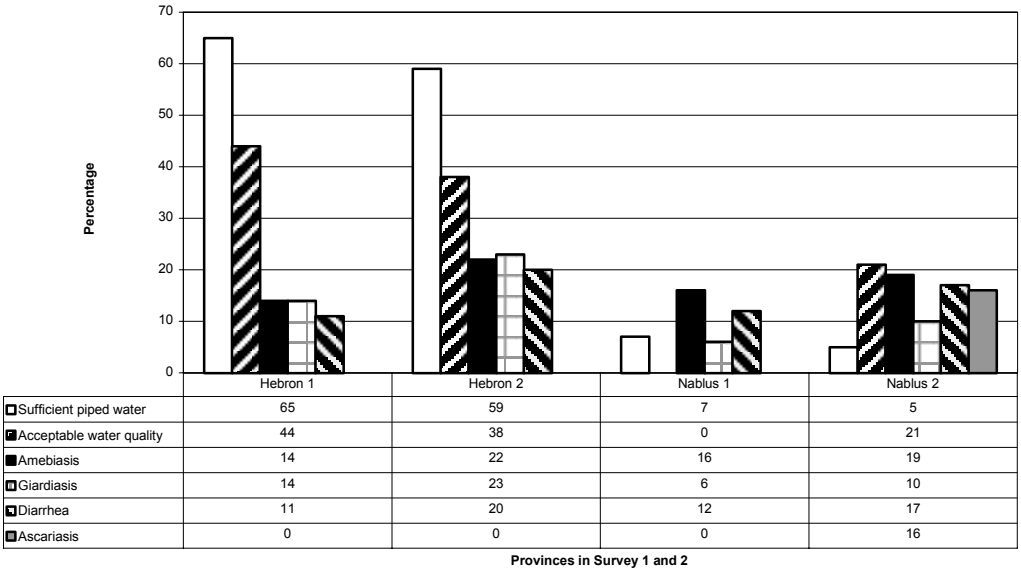
While changes in these key water, health, and socioeconomic indicators were observed in Nablus and West Hebron, some significant differences between these two governorates remain. Comparisons of the values found in the Nablus and West Hebron at the times of the first and second surveys are shown in Figure 1 and are summarized below.

- Households with access to piped water are found almost exclusively in West Hebron, but their number decreased over time.

- Acceptable quality drinking water is consistently better in West Hebron than in Nablus; however, it has decreased in West Hebron and increased in Nablus.

1 All amounts converted from New Israeli Shekels (NIS) as per 10/15/2002: 1 US$ = 4.82 NIS

- Amebiasis levels are the same in both governorates and have increased.
- Giardiasis levels are consistently almost twice as high in West Hebron than in Nablus and have increased in both governorates.
- Diarrhea levels are the same in both governorates and have increased.
- Ascaris has appeared in Nablus and remains absent in West Hebron.



	Hebron 1	Hebron 2	Nablus 1	Nablus 2
Sufficient piped water	65	59	7	5
Acceptable water quality	44	38	0	21
Amebiasis	14	22	16	19
Giardiasis	14	23	6	10
Diarrhea	11	20	12	17
Ascariasis	0	0	0	16

Provinces in Survey 1 and 2

Figure 1. Water and Gastrointestinal Indicators in Surveys 1 and 2

The findings in the environmental health assessments during phases I and II are similar to findings from the Sentinel Surveillance Study (2002-2003). For example, findings from household surveys in the West Bank and Gaza between May and July 2002 (biweekly report 1) showed that 27% of households reported at least one household member had experienced watery stools in the two weeks prior to the interview and 55% of the diarrhea episodes were experienced in children under five. Households in the West Bank reported substantially lower rates than Gaza, less than 10% versus more than 30% (biweekly report 3). According to data collected between May and October 2002 (biweekly report 5), in 36% of the households at least one family member was not able to access needed emergency care, a finding consistent with diminished access to modern health care observed in the environmental health assessments. Another result presented in biweekly report 5 was similar to the assessments: households in the West Bank that sold property (48%) or borrowed money (15%) were comparable to the figures reported here. The same biweekly report also showed significant interruptions of water supply of 34% during the two weeks preceding the survey. While the sentinel surveillance surveys did not ask the same question as the environmental health assessments, this finding is consistent with

the assessments' finding in that only a minority of households has access to sufficient water.

Diarrhea in children under five in Palestine was 6.7% in spring 2001, according to the Palestinian Central Bureau of Statistics (2001), and 13.5% in summer 1996; the data for the latter were gathered during a season comparable to the second environmental health assessment. Although prevalence of diarrhea was higher in October 2002 (17%) and could be due to worsening socioeconomic conditions, the rates do not deviate considerably and could be explained by differences in study population and methodology.

The findings of high prevalence for diarrhea and intestinal parasites are consistent with the high level of acute and chronic malnutrition of 4.3% and 7.9%, respectively, in the West Bank, according to another USAID-funded study, Nutritional Assessment of the West Bank and Gaza Strip (Abdeen et al. September 2002). Infections from intestinal parasites are also linked to anemia, which was present in moderate and severe form in 21% of children aged 6 to 59 months. In addition, this study documented deficiencies of several micronutrients (vitamin A, iron, folate, and zinc), which play an important role in a child's resistance to infectious diseases such as diarrhea. Zinc in particular has been shown to reduce the duration and severity of diarrhea. The proportion of children under five that received a less than 80% intake of daily recommended allowances of zinc reached almost 90%.

Recommendations

This report presents changes in key water, health, and socioeconomic indicators that will be useful for planning and designing programmatic options in the Village Water and Sanitation Program. To feed these data into the program management cycle, it will be important to widely disseminate the results to all concerned, from the project managers and decision makers in development and humanitarian agencies to the people in the project communities.

- Survey findings reveal the need for immediate interventions in several areas to avoid further deterioration of environmental health conditions, health care, and ultimately the health of the target populations:
  - Appropriate programmatic options to improve water quality
    - Provision of reliable, treated piped water—probably the single most important intervention for improving health and quality of life in the West Bank within a water supply and sanitation program context
    - Purification of tanker water
    - Development of appropriate sanitation systems (based on the finding from phase I of the environmental health assessment that 10% of the households reported problems with their septic system)

  - Appropriate water quality monitoring systems and procedures
    - Enhancement of the role of the Palestinian Water Authority (PWA) in monitoring water sources
    - Improvement of district-level capacity for water quality monitoring through multisectoral cooperation
  - Appropriate health and hygiene education programs to maximize the impact of system improvements
    - Promotion of simple and effective water treatment in households as an emergency measure until safe piped water becomes widely available
    - Promotion of appropriate home care for children with diarrhea
    - Training of health service providers in the appropriate management of diarrhea
    - Enhancement of community-wide responsibility and action for a healthier environment.

- Certain findings require further investigation because either they are inconclusive or the scope of the environmental health assessments is not suited to investigate the underlying causes of certain findings. To make specific recommendations and take appropriate programmatic action, additional information is needed that could be obtained through the following means:
  - Investigate causes of low overall water quality by tracing tanker and piped water to its sources and by identifying the potential origin of fecal coliforms and contaminants such as nitrate to determine whether an increase could be seasonal and preventable
  - Investigate causes for deteriorated quality of piped water in the south
  - Investigate the use of lead pipes in homes, lead concentration in water, and potential effects of water pH and alkalinity
  - Determine households' ability and willingness to pay water and electricity bills by comparing communal supply systems to private providers
  - Conduct a study to determine the source of infection with ameba and giardia and the incidence of dysentery
  - Investigate reasons of a higher prevalence of giardia in the south where water quality has been consistently better than in the north

- Identify reasons for the occurrence of ascaris in the Nablus but not in West Hebron

- Study the correlation between household water quality, especially the presence of fecal coliforms, and the incidence of intestinal parasites, diarrhea, and dysentery

- Investigate decreasing access to formal and nonformal health care for acute gastrointestinal infections and the potential impact on child morbidity and mortality.

1. Introduction

1.1. Background

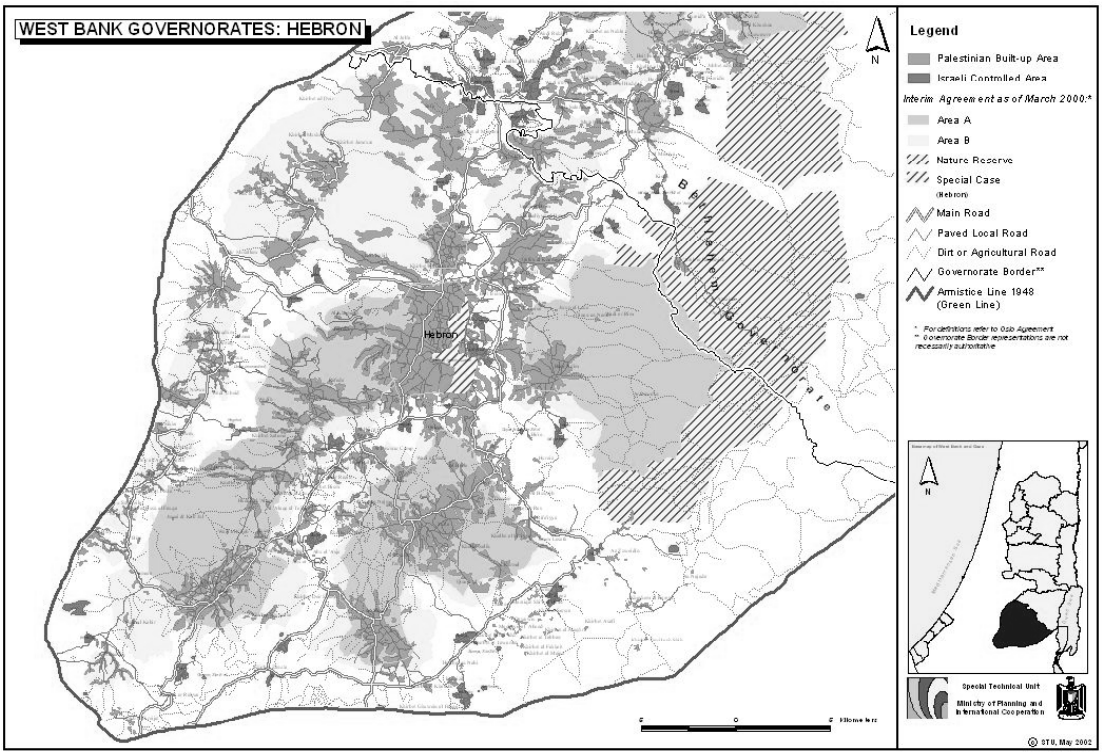
Save the Children Federation (SCF), in cooperation with the Environmental Health Project (EHP), implemented by Camp, Dresser & McKee, Inc., conducted this survey to enhance an understanding of the water supply, socioeconomic, and cultural contexts in which USAID will implement the Village Water and Sanitation Program (VWS). The VWS is a comprehensive environmental health program that has the objectives of ensuring adequate and sustainable access to water and sanitation systems to an estimated population of 170,000 (2003 population estimates) in 50 marginalized, rural communities in the north (Nablus governorate) and the south (Hebron governorate) of the West Bank. Maps 1 and 2 show Palestinian built-up and Israeli controlled areas in these two governorates. Updated population estimates, brief descriptions of the villages and maps of the two governorates showing towns and villages are presented in Appendices B and C, respectively.

The program plans to address critical water and sanitation problems with the goal of improving health and thus the quality of life in the target communities. Within the planning phase, EHP has conducted a series of qualitative and quantitative research activities aimed at providing data on water and environmental sanitation systems, capacity-building needs of local governments, and individual and community practices related to environmental and human health.

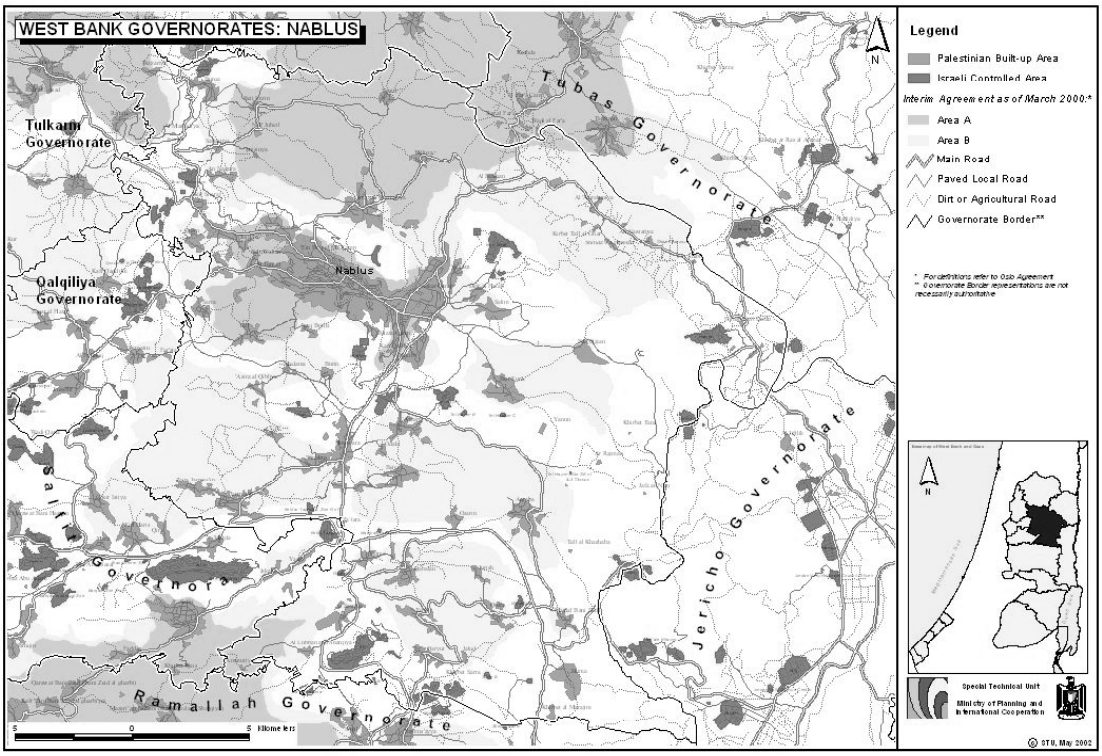
The baseline quantitative environmental assessment was conducted in January 2002. The follow-up environmental assessment conducted in October 2002 was planned to capture the seasonal variation in water supplies and quality between winter and summer months and also to examine changes in key indicators occurring as a result of the deteriorating political and socioeconomic conditions within project communities in the West Bank due to the Intifada.

The Intifada, or Palestinian uprising, began in September 2000 after Ariel Sharon, then leader of the Israeli opposition, made a controversial visit to the Temple Mount, a site sacred to both Jews and Muslims. During the Intifada, armed conflict and violence against civilians on both sides escalated and the socioeconomic conditions in the West Bank worsened. According to BBC News, since September 2000 through the end of 2002, at least 1,600 Palestinians and more than 600 Israelis have been killed. For most of 2002 and 2003, Palestinian cities were regularly raided, they remained cut off from each other, and they were surrounded by Israeli troops and under curfew for long periods of time. According to figures from the World Bank (March 5, 2003), 27 months after the outbreak of the Intifada, 60% of the population of the West Bank and Gaza live under a poverty line of $2 per day. The number of

people living in poverty has tripled from 637,000 in September 2000 to nearly 2 million.



Map 1: Hebron Governorate with Palestinian built-up and Israeli controlled areas



Map 2: Nablus Governorate with Palestinian built-up and Israeli controlled areas

Maps from the United Nations Humanitarian Information Centre for the occupied Palestinian territory (2002)

2. Survey Objectives and Conceptual Framework

2.1. Objectives

The specific objectives of this follow-up survey include the following:

- Explore the seasonal variation in access to water in project communities
- Identify the socioeconomic conditions in target communities and the ability of project communities to contribute to the development of water supply systems
- Assess the changes occurring as a result of both the seasonal effects and deteriorated socioeconomic conditions vis-à-vis access to water quantity and quality adequacies
- Assess the health impact of all of the above on child health as measured by intestinal parasite and diarrhea prevalence
- Develop recommendations about priority community interventions needed to address the urgent needs of target communities regarding access to safe water and health and hygiene education programs.

2.2. Conceptual Framework

This survey was guided by the hypothesis that seasonality (changing from the wet winter to the dry summer season) would influence health and water-related (adequate quantities and quality) indicators, but that findings would be compounded by the deteriorated situation in project communities and the resulting decrease in socioeconomic standards. To the extent possible, findings will be attributed either to the effects of seasonality or to the sociopolitical situation. However, this can be done only to a limited extent, because both effects may impact key indicators in the same direction.

For example, based on prior research by Ali-Shtayeh et al. (1989), the prevalence of diarrhea and intestinal parasites in children under five may be higher during the dry season. With regard to the impact of the deteriorating political situation, the authors expect a decrease in socioeconomic conditions, access to adequate quantities and

quality of water, and access to health care services. These may also contribute to worsening health conditions, as measured by an increase in the prevalence of intestinal parasites and diarrhea in children. It will be difficult to separate seasonal effects from the impact of the political situation in all instances because comparable data do not exist prior to the Intifada that would allow such an independent assessment of these two criteria.

3. Study Methods and Preparations

3.1. Study Type

This survey was the second in a series of environmental health assessments for the 50 villages to be served by the USAID-financed VWS project. The studies were designed to provide panel data; in other words, the families interviewed in January 2002 were reinterviewed nine months later in October 2002.

The major advantage of this design over separate independent random samples is that the situation for specific households can be measured between two time periods, thus improving the possibility of better understanding the dynamics and possible determinants of detected changes.

3.2. Reference Population and Sample Selection

In phase I of the environmental health assessment (Survey 1), the reference population was determined by conducting mini-censuses and upgrading available maps in each community to identify all of the households.

The original sample was stratified by two governorates: communities in West Hebron and Nablus governorates. An eligible household was one that had at least one child aged 12 to 47 months. If they were still in this age group nine months later, these same children were selected for stool samples in the second round; if they had surpassed this age group, they were replaced by younger children.

3.3. Sample Size

The sample size of 300 households per governorate was calculated in Survey 1 using the formula necessary to determine the significance of changes between two time periods in panel data (see Appendix D).

In phase II of the environmental health assessment (Survey 2), the planned size was as follows:

- All 596 households participating in Survey 1
- One stool sample from all households having a child in the 12- to 47-months-old age group
- A water sample from 200 households.

3.4. Data Collection Instruments

The data collection instruments used in Survey 2 included the following:

a. Questionnaires

   i. Key household informant

      1. Household census, electricity, water supply, beliefs and practices related to drinking water, household economy, garbage disposal

   ii. Questionnaire for all children under five years

      1. Diarrhea in the last two weeks for ages 0 to 59 months

      2. Feeding practices for infants under 12 months

b. Sample collection forms

   i. Stool samples

   ii. Water samples.

The questionnaires were condensed versions of those used in Survey 1. Numbers for each household were identical in both surveys to facilitate the merging of the data files necessary for the change analyses.

Stool Samples/Examination

As in the first survey, microscopic examination focused on intestinal parasites transmitted by fecal-oral contamination due to water pollution, poor environmental sanitation, and inappropriate health beliefs and practices. The first survey had found widespread pathogenic protozoa (amoebae and giardia), but only rare intestinal worms (ascaris, pinworm, and dwarf tapeworm).

The same solution as in Survey 1 was used for fixation and staining (Merthiolate, Iodine, Formalin – PARA-FIXTM). Because of the extreme difficulty of transporting samples between the north and the south, two organizations with well-equipped laboratories were contracted to do the analyses:

- North: Union of Health Work Committees[2]
- South: Union of Palestinian Medical Relief Committees (This organization had done quality work for all of the analyses in Survey 1).

Quality control for stool samples consisted of random rechecking of 10% of samples.

Water Samples/Testing

Transportation problems again required that the samples be split into two and sent to the two universities involved.

- Palestine Polytechnic University
  - Field collection of all samples
  - Testing for physical parameters (odor, color) and bacteriology for all samples
- Bethlehem University
  - Testing for chemical parameters for all samples

  The analyses followed the standard World Health Organization (WHO) guidelines as follows:
  - Visual inspection for color and odor
  - Testing for turbidity, chlorine, pH, and nitrates
  - After incubation, reporting of total and thermotolerant (fecal) coliforms in number of Colony Forming Units (CFU).

  Quality control for water samples consisted of random rechecking of 10% of samples.

3.5. Training

Selection of Interviewers

In the second assessment, interviewers were selected from a pool of individuals that had participated in Survey 1 and

[2] Although the use of a laboratory not involved in Survey 1 could theoretically influence the outcome of the stool exams, this is unlikely, because a subsample of specimens was reanalyzed for quality assurance.

– had demonstrated a high level of accuracy in collecting data,

– were committed to work in difficult conditions and were flexible to move within survey communities, and

– had demonstrated a good understanding of survey objectives and tools.

Training Locations and Agenda

Training was conducted sequentially in the north and the south in October 2002, followed immediately by data collection.

– Field supervisors—one day

  - Objectives

  - Staffing

  - Management of the fieldwork

  - Training of data collectors (interviewers and stool and water sample collectors)

– Data collectors

  - Feedback on the results of the first survey

  - Reflections on the cultural and social constraints associated with repeating the survey in the same households

  - Finalization of the management scheme for fieldwork and agreement on plans for operations, communication, and logistics

  - Training of data collectors on administration of questionnaires and sample collection.

4. Survey Implementation

4.1. Overall Organization

Given the extremely difficult travel conditions and the desire to take precautions to minimize the dangers to which the survey personnel might be exposed, the authors organized the data collection as follows:

- Independent fieldwork systems were built for the north and south.
- Within each region, target communities were divided into three clusters with fairly easy movement within each cluster.
- Wide decision-making freedom concerning logistics was given to field supervisors to ensure safety and aid efficient implementation of fieldwork.
- Field workers were encouraged to use their personal mobile phones and were reimbursed for the expense.
- Water and stool sample collection procedures were built as separate components from the questionnaires, with separate logistical and administrative procedures.
- Close coordination with village and municipality councils was provided prior to and during the period of fieldwork to ensure support and cooperation.
- Data collectors were provided with toys and games to be given to children to "break the ice" with households. This was done in case people who had not seen any tangible results from the first survey had developed negative attitudes towards a repeated assessment.

4.2. Supervision and Coordination

To ensure effective management of the survey, SCF built the following supervisory structure for the work:

- The SCF health specialist was responsible for the overall implementation of the survey, including coordination both within SCF and with other collaborating agencies.

- Two SCF regional coordinators, one in the north and one in the south, fulfilled the following tasks:
  - Coordinated with village councils, municipalities, and relevant personnel key activities such as training, data collection, and water sample collection
  - Ensured field supervisors and surveyors received administrative and logistic support
  - Provided in-field supervision and ensured consistency and coordination among different survey elements (questionnaire, stool testing, and water quality assessment). This was done through regular field visits
  - Provided second-level quality checks on filled questionnaires and documented this in appropriate place on the questionnaire
  - Delivered completed questionnaires and results of laboratory tests to the project manager according to agreed-upon mechanism
  - Reported to the project manager on progress in the fieldwork
  - Issued and approved payments to field staff as per SCF financial protocols.
- Field supervisors: Three in each region (one per administrative cluster) ensured field support and follow-up of project activities. Generally they performed the following:
  - Participated in the selection and recruitment of field surveyors
  - Participated in the development of the survey management systems together with the regional coordinators and project manager
  - Provided field coordination for project activities such as data collection and training
  - Supervised and supported field surveyors
  - Provided field quality checks on filled questionnaires and coordinated the provision of other elements of the survey
  - Delivered filled and checked questionnaires and results of laboratory examinations to the regional coordinator
  - Reported daily progress to the regional coordinator and solved problems arising during the data collection
  - Submitted financial reports and payment requests to regional coordinators and approved payment requests from field surveyors

- Field surveyors: Throughout the project, they performed the following tasks:
  - Attended initial training
  - Provided data collection using the questionnaires
  - Provided instructions about stool testing to child caretakers
  - Collected stool samples and delivered them to the agreed-upon point
  - Provided quality checks on filled questionnaires and made necessary corrections to ensure the quality of data
  - Reported on a daily basis to field supervisors on the progress of data collection and related issues.

4.3. Logistics and Communication

Transportation: To implement the fieldwork, researchers used ten vehicles. These vehicles ensured staff mobility and enabled on-time accomplishment of different tasks. One "yellow-plated" vehicle was also used to transport staff and samples smoothly through checkpoints and, when needed, through Jerusalem.

Communication: A network of mobile phones was used to ensure safety and the ability of field workers to communicate with each other and with supervisors and SCF staff. Field workers and supervisors were reimbursed for use of their own mobile phones for work purposes, and hence the network has proven to be efficient.

4.4. Problems and Solutions

Researchers encountered three types of problems. The first category was the most common, and thus the problems were solved by means of the flexible, decentralized mechanisms put in place.

- **Category One**: Anticipated and occurred
  - Mobility restrictions
    - Required dual systems for training, implementation, and laboratory analyses
- **Category Two**: Anticipated and did not occur
  - Survey fatigue

- People refusing to participate a second time. This did not occur, and, in general, communities and households were eager to cooperate as evident from low refusal rates during both assessments.

– People leaving the area: A large number of families leaving the survey area would have been detrimental to the panel design. Very few families had left for job-seeking purposes.

- **Category Three**: Unanticipated

– Stool sample collection: As a result of a two-week delay in receiving the stool kits (due to a strike at Ben Gurion Airport), the stool sample collection took place after the interviews rather than simultaneously. This required the redesign of the collection system and provision of logistical support for field workers.

– Olive-picking season: During the time of the survey, people were outside of their homes for the olive season. To avoid the absences caused by this, field workers coordinated with the village councils to inform target households on the day prior to the date of data collection that their presence at home would be required. In some cases, data collectors visited the people in the field and filled out the questionnaire in the olive groves.

– In Talfit, the head of the village council was murdered a few days before the survey started. To avoid insensitivity in going into the village with the assessment, intensive communication with the village people and other village council members prior to the survey was conducted, and this enabled the smooth performance of the fieldwork.

– In Aqraba, one person was killed, and similar arrangements were made as in Talfit.

– Yanun inhabitants were forced out of their village one day after the questionnaire was filled out, and therefore the stool sample was not collected to avoid any danger resulting from field workers visiting this site again.

– One child eligible for a stool sample died due to a chronic disease.

– Working beyond calendar dates of the summer season: Actual data collection concerning stool samples and water samples took place beyond the calendar time of the summer season in the West Bank. This did not, however, affect the quality of data obtained because of extremely dry conditions that year and the above average temperatures comparable to those prevailing in the summer season. This issue was of special consideration for the water quality testing. Given that water sample collection was completed in all target households prior to the beginning of the rainfall, samples obtained represent those usually collected in the summer season.

4.5. Methods of Implementation

The name of the head of the household, the address, and the identification number used in the first survey were written on the questionnaires and on stickers that were to be used for stool and water sample collection. This ensured correct matching of the data of Survey 2 to Survey 1 and of the samples to the appropriate household.

Thus, the number of the questionnaires located on both the sticker and the questionnaire formed the first matching point for surveyors.

After the interviews, the field surveyors provided information to the household key informant and child caretakers about the procedures to be followed for water sampling and the collection of stool specimens, including the provision of Merthiolate-Iodine-Formol solution (MIF) stool kits and instructions for their use.

Field surveyors collected stool samples from eligible households on a daily basis and transferred them to the agreed-upon point. Field supervisors then delivered the samples to the laboratory with SCF and ambulance assistance.

The Palestine Polytechnic University teams implemented water sample collection. To ensure obtaining a collection in the shortest possible time, one team in each cluster had a vehicle with a driver from the respective cluster who was highly knowledgeable about routes of communication. This mechanism helped in accomplishing the water collection in one day in each region. As many as 170 households were visited and 170 water samples were collected from the internal source of water (the one nearest to the user).

Labeled water samples were then transported via portable iceboxes to the Polytechnic and Bethlehem laboratories via a yellow-plated vehicle (an Israeli-plated vehicle that can easily move through checkpoints). This ensured delivering water samples to respective laboratories without delay.

4.6. Critical Implementation Dates

Since planning for the survey implementation started long before formal approval and signing of the contract, it was possible to get the program started quickly once the formal contract was in place.

- Final approval and signing contract: September 23, 2002
- Training of field supervisors:
  - North: October 7–8
  - South: October 13–14

- Household interviews:
  - North: October 8–14
  - South: October 15–24
- Stool sample collection: November 1–20
- Water sample collection:
  - South: October 30
  - North: November 4
- Data entry and cleaning: November 15–December 20.

4.7. Data Computerization and Verification

A private consulting firm—Arab Hasub Center in Nablus—entered the data.

- Data entry modules were written using Epi Info 6
  - A menu-driven program was written with EPIGLUE with extensive error checking in the CHECK files.
- Data were entered into five separate files: household census, Key Household Informant Questionnaire (KHI) and diarrhea questionnaires, and stool and water laboratory results
- Unique household identification codes ensured that the separate files could be properly merged to each other and to the data from the first survey
- Quality control was conducted by systematic checking for outliers, coding errors, and impossible results
- Statistical Package for the Social Sciences (SPSS) was used for data analysis.

5. Characteristics of Households and Respondents

5.1. Sample Sizes

Table 5.1 shows that despite travel difficulties and other problems encountered during the survey implementation, it was possible to collect data for all survey elements and in all survey locations. The completion rate of household interviews was very high with over 95% overall. The rate was 5% higher in the south than in the north, due to people traveling from the region, inappropriate coding of questionnaires in the first survey, and the absence of backup records. If an interview of a household could not be completed, follow-up was not possible, but any resulting bias would be insignificant due to the small number of households missed.

Table 5.1. Survey Plans Compared with Results in Surveys 1 and 2

Results	Nablus	West Hebron	Total	%
Household interviews				
Survey 1 (Goal = 600)	*300*	*300*	*600*	
Completed interviews	*300*	*296*	*596*	*99.3*
Survey 2 (Goal = 596)	300	296	596	
Completed interviews	278	293	571	95.8
Stool samples collected				
Survey 1 (Goal = 600)	*280*	*240*	*520*	*86.7*
Survey 2				
Eligible HH (Child 12-47 months)	283	263	546	
Samples collected	243	236	479	87.7
Water samples				
Survey 1 (Goal = 200)	*100*	*100*	*200*	
Collected	*77*	*93*	*170*	*85.0*
Survey 2 (Goal = 200)	100	100	200	
Collected	84	93	177	88.5

Stool samples were requested from the same child participating in the first survey. In cases where the child was now older than the target age group, another sibling in the

range of 12- to 47-months old was randomly selected. If there was no substitute, no sample was collected from that household. In five cases in Nablus and three cases in West Hebron, data collection teams had to return to the households four times.

The number of collected water samples in the north was higher in Survey 2 than it had been in Survey 1, because SCF wrote special letters and coordinated the work of water collection teams during Survey 2. This allowed the team to reach the communities of Beit Dajan and Beit Furik, which were inaccessible and had been excluded from water sample collection during Survey 1.

5.2. Household Demographics

The median household size in Survey 2 was seven, a result identical to the median found in Survey 1 and close to the 6.9 reported from the Palestinian Census of 1977. This result shows stability of family size in the surveyed communities and serves as a quality check on the quality of the data.

Table 5.2 shows the details of the percentage distribution of households by size from Survey 2.

Table 5.2. Percentage Distribution of Households by Size in Survey 2

No. of members	Nablus	West Hebron	Total
1	0.7	0.3	0.5
2	0.0	0.0	0.0
3	2.2	2.1	2.1
4	13.3	13.4	13.3
5	15.4	11.3	13.3
6	11.8	17.5	14.7
7	12.9	11.6	12.3
8	15.1	14.0	14.5
9	10.8	10.3	10.5
10+	18.0	19.4	18.8
Total %	100.0	100.0	100
Median	7.0	7.0	7.0

The age distribution of children 12- to 47-months old from Survey 2, as seen in Table 5.3, shows a significant shift from that found in Survey 1. This is because the preferred child for the stool sample in Survey 2 was one who had participated in Survey 1; this selection process raised the age of participants, thus explaining the higher percentages of older children.

Table 5.3. Age Distribution of Children 12 to 47 Months by Sex for Whom a Stool Sample Was Taken in Survey 2

Age Group	Male		Female		Total		M/F
Years	n	%	n	%	n	%	Ratio
1	30	11.6	20	10.2	50	11.0	1.5
2	112	43.2	86	43.9	198	43.5	1.3
3	117	45.2	90	45.9	207	45.5	1.3
Total	259	100.0	196	100.0	455	100.0	1.3
Median (m)		34		34		34	

6. Household Environment

Highlights: Based on survey findings, the monthly cost of electricity and water may be as high as 40% of total household income. Comparing the results from baseline and follow-up environmental health assessments, fewer household members are fully employed; the ability or willingness of households to pay bills for piped water and electricity dropped; and more households sold property or borrowed money to meet basic needs. In Nablus and West Hebron, three-quarters of families live under the poverty line of $332/month, and one-half are under the hardship line of $104/month. (Poverty levels adapted from Bocco, 2002)

6.1. Housing Characteristics

Since no major changes were expected, housing characteristics such as construction type and household possessions were measured only during the first environmental health assessment. Only questions related to the supply of electricity and ability or willingness to pay electric bills were retained during the second assessment.

Electricity is available in almost all households in both governorates, as shown in Table 6.1a. The median monthly cost of $21 is unchanged from Survey 1. On-time payment of the electricity bill, however, shows a significant decrease from Survey 1 (51% down to 41%), and there is significant variation between north and south (58% in Nablus versus 24% in West Hebron).

Given that the median household income the month before Survey 2 is higher in the south than in the north, this finding may seem counter intuitive. It is possible that payment of the electricity bills is not considered to be a priority, especially given that municipalities in the south reported that they are not willing to take any measures to force the on-time payments.

Table 6.1a. Percentage of Households with Electricity in Surveys 1 and 2 (n = 571)

Characteristic	Nablus	West Hebron	Total
Electricity available	98.9	99.3	99.1
Median cost per month (Shekels)	$20.75	$20.75	$20.75
Up to date on paying bill			
Survey 1	*69.7*	*32.3*	*51.2*
Survey 2	58.4	23.5	40.5
Months since paying last bill (Median)	4	7	6
On-time payment of bill before Intifada	91.2	80.6	86.0

Statistical tests:[3]

1. Up-to-date payment comparing Survey 1 with Survey 2: Z = 3.9 > 2.8 (Thus significant at the .95 level)

2. Up-to-date payment comparing governorates in Survey 2: $\chi^2 = 71.0$, P = 0.0 ($P \leq 0.05$ is significant at the .95 level)

As claimed in Chapter 3 (Study Methods and Preparations), panel data might help researchers to better understand the dynamics of intra-household changes between the two periods. To identify these differences, a statistical modeling tool known as Markov chains[4] was used in the assessment. Researchers have used this tool for the past 50 years.

Using the discrete variable "up to date in paying electric bill," as shown in Table 6.1b, four scenarios explain the status of households related to this question and possible changes in status between Surveys 1 and 2:

- Household (HH) up to date in Survey 1; remained up to date in Survey 2
- HH up to date in Survey 1; changed to not up to date in Survey 2
- HH not up to date in Survey 1; changed to up to date in Survey 2
- HH not up to date in Survey 1; remained not up to date in Survey 2.

3 The formula for significance testing of differences of proportions in two periods for panel data is presented in Appendix D. The interpretation of Z > 2.8 is that the difference is statistically significant with a 95% degree of confidence that the difference did not occur by chance and an 80% degree of confidence (power) of detecting a real change that has actually occurred.

4 A description of the Markov method and details of the calculations are presented in Appendix E.

Table 6.1b. Percentage of Households Up to Date in Paying Electric Bill in Surveys 1 and 2 (n = 545)

Survey 1	Survey 2	Percentage	n
Up to date	Up to date	51.6	143
Up to date	Not up to date	48.4	134
Not up to date	Up to date	29.1	78
Not up to date	Not up to date	70.9	190

For the changed households—categories 2 and 3—the trend has been that the situation has deteriorated for more households than it has improved, by the ratio of 1.7.

6.2. Household Economics

Table 6.2 shows that the general deterioration of household economic status is more severe in the north in Survey 2. The median number of household members working full time in the north changed from 1 to 0, with a range reduced from 0-6 to 0-3. This may be explained by the reduction in access to employment opportunities. People from the south reported better opportunities for part-time work than in the north. Those with relatively good mobility and living closer to Israel were able to earn some income through jobs in small-scale agricultural enterprises and sometimes by illegal entrance to nearby Israeli towns. The jobs they found, however, were only part time.

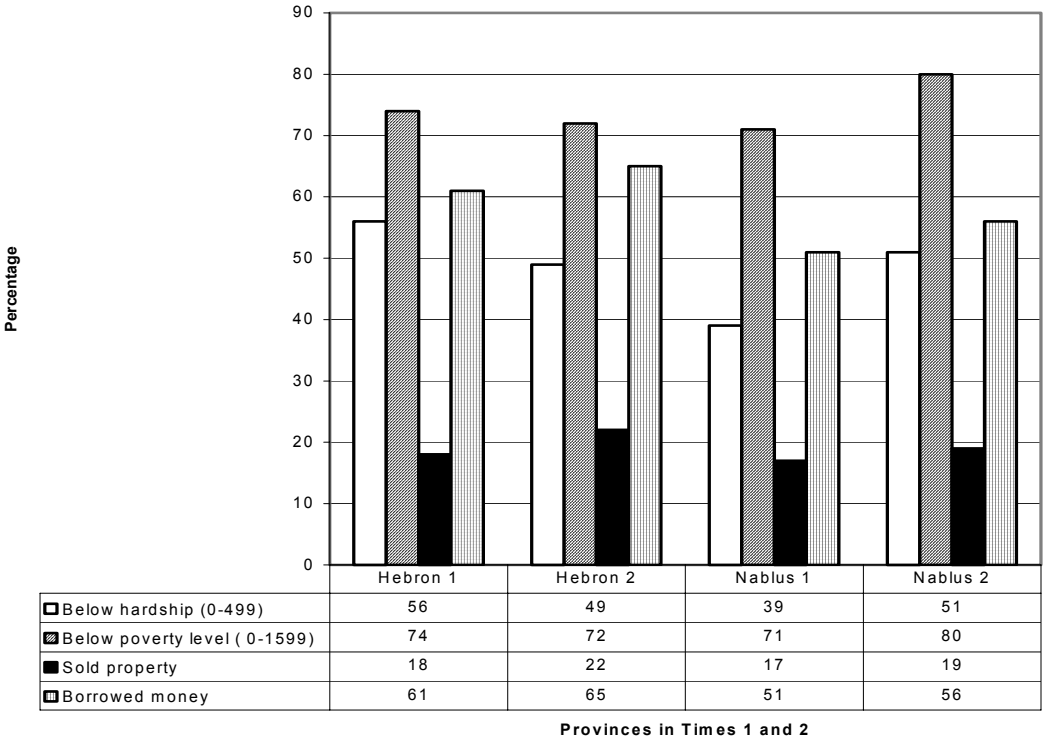
Table 6.2. Household Economics in Survey 2 (n = 570)

Characteristic	Nablus	West Hebron	Total
Number of household members working			
Full-time (≤ 30 hours/week) Median			
At time of survey (Range = 0-3)	0	0	0
Before Intifada (Range = 0-7)	1	1	1
Part-time (< 30 hours/week) Median			
At time of survey (Range = 0-3)	0	1	0
Median monthly household income last month	$83	$104	$104
Median monthly per capita income last month	$12	$15	$15
Projected annual per capita income	$144	$180	$180
Sold property for HH support since Intifada (%)	19.5	22.0	20.8
Borrowed money for HH costs since Intifada (%)	54.7	64.7	59.8

Figure 2 shows a comparison of economic indicators occurring between Survey 1 and Survey 2. In both regions, three-fourths of families are under the poverty line (income of $332/month) and one-half are under the hardship line (income of $104/month), with considerable increases occurring in the north and slight decreases in the south (poverty levels adapted from Bocco, 2002).

Both governorates experienced an increase in the percentage of households where property was sold and/or money was borrowed for basic household support.

Figure 2. Household Income Levels and Sources in Surveys 1 and 2 (Income Reported in New Israeli Shekels)



	Hebron 1	Hebron 2	Nablus 1	Nablus 2
Below hardship (0-499)	56	49	39	51
Below poverty level (0-1599)	74	72	71	80
Sold property	18	22	17	19
Borrowed money	61	65	51	56

Overall, about four-fifths of households were found to be below the poverty line and one-half below the hardship line in Survey 1 and Survey 2. Tables 6.3a and 6.3b show the Markov analysis of the data. For both categories of poverty, the trends of change were about the same (poverty line change ratio = 1.05 [67/64], hardship line change ratio = 1.1 [111/101]). This indicates continuing high levels of poverty.

Table 6.3a. Percentage of Households above and below the Poverty Line in Surveys 1 and 2 (n=433) (Household Income Last Month < $332)

Survey 1	Survey 2	Percentage	n
Above	Above	21.2	18
Above	Below	78.8	67
Below	Above	18.4	64
Below	Below	81.6	284

Table 6.3b. Percentage of Households above and below the Hardship Line in Surveys 1 and 2 (n=433) (Household Income Last Month < $104)

Survey 1	Survey 2	Percentage	n
Above	Above	50.7	114
Above	Below	49.3	111
Below	Above	48.6	101
Below	Below	51.4	107

While seasonal variations in employment status are likely, the worsening situation across several socioeconomic indicators would not be expected simply as a result of changing seasons and is probably due to the political and security situation.

6.3. Household Water Supply

Highlights: As monthly costs for tanker water for households in Nablus nearly doubled between comparable seasons, water consumption decreased by 23 percent. Increased costs and lower water quantities seem to affect mostly the poorest communities in rural areas, because they depend almost exclusively on tanker water. The percentage of households that judged water quantity sufficient stayed about the same or may have decreased slightly in West Hebron, which may indicate that despite poor services, areas served primarily by piped water systems are not as severely affected by the deteriorating sociopolitical situation as are areas that depend on tanker water. These findings clearly suggest the need for a better water infrastructure.

Table 6.4 shows that access to sufficient quantity of water between Survey 1 and Survey 2 markedly deteriorated.[5] While 30% of households in the north and 66% in the south reported access to sufficient quantities of water in Survey 1, these numbers changed to 14% and 62%, respectively, in Survey 2. The change for Nablus in the north, which relies mainly on tanker water, was statistically significant at the .95 level, but not for West Hebron in the south, which relies mainly on piped water. This may indicate that despite poor services, areas served primarily by piped water systems have experienced only minor decreases in water quantities. The overall change was a statistically significant decrease of 9% at the .95 level (48% to 39%—$Z = 5.4 > 2.8$).

Household connections to piped water and possession of roof tanks did not change from the first survey. However, a significant decrease in the prevalence of tanker water use was detected in West Hebron at the .95 level ($Z=5.4>2.8$). No data are available to determine whether this effect was seasonal or resulted from a combination of factors: seasonality and social, economic, and political effects. The

5 Sufficiency is based on the subjective response of the interviewee to the question: "In general, is the quantity of water that is available to your household sufficient for your daily needs?" There are no data available to quantify the volume of water per capita that this represents.

use of tanker water may have decreased due to higher seasonal costs combined with a decreased ability or willingness to pay due to rising unemployment.

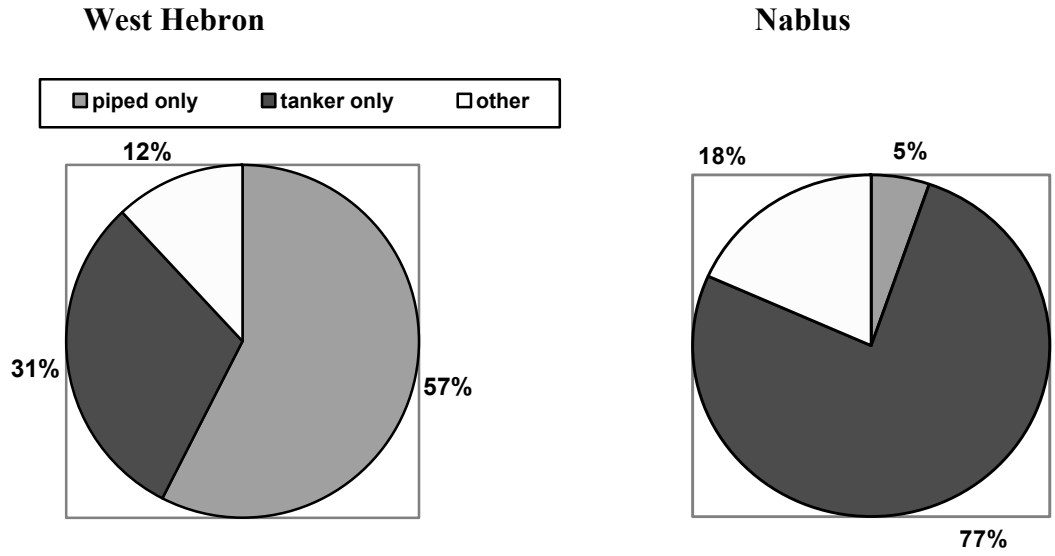
It is important to note that the survey preceded delivery of subsidized water by USAID and the Red Cross in the project villages.

Table 6.4. Percentage Distribution of Households by Water Supply in Surveys 1 and 2 (N = 571)

Characteristic	Nablus	West Hebron	Total
Quantity available usually sufficient			
Survey 1			
Yes	*29.7*	*66.2*	*47.7*
Insufficient at times	*28.7*	*17.1*	*22.9*
Covers only basic needs	*5.7*	*1.0*	*3.4*
Totally insufficient	*35.7*	*12.6*	*24.3*
Survey 2			
Yes	14.0	62.1	38.7
Insufficient at times	31.3	16.0	23.5
Covers only basic needs	2.9	3.4	3.2
Totally insufficient	51.1	18.4	34.3
Piped water			
Survey 1	*9.0*	*90.5*	*49.3*
Survey 2	8.0	90.4	50.6
Piped water of usually sufficient quantity			
Survey 1	*7.0*	*64.5*	*35.4*
Survey 2	6.3	64.6	36.3
Roof tank			
Survey 1	*92.3*	*93.9*	*93.1*
Survey 2	91.0	93.3	92.5
Tanker water			
Survey 1	*90.3*	*49.7*	*70.2*
Survey 2	86.3	34.6	59.8
Other sources (wells, springs)			
Survey 1	*13.0*	*9.9*	*11.5*
Survey 2	12.9	11.6	12.3

Figure 3 shows the dramatic differences in distribution of water sources in the north and the south. While over half of households in West Hebron are supplied by piped water only, nearly eight of ten households in the north depend on tanker water exclusively.

Figure 3. Household Water Sources by Governorate in Survey 2



In support of an earlier statement that there could have been a decrease in the on-time payment of electric bills, Table 6.5a shows that people in both the north and south were less up-to-date on paying their water bills in Survey 2 (31% to 24%). Although this decrease is below statistical significance at the .95 level ($Z = 2.3 < 2.8$—which is close to significance at the .95 level), it signals the deterioration of household economies and the prioritization of household expenditures on water. The slight raise in income noted in West Hebron did not positively impact the on-time payment of water bills. As for electricity, the poorer north seems to be more up to date in paying bills than the south. However, residents in Nablus rely mainly on tanker water, which is mostly provided though private vendors. They may have a greater incentive to pay their bills to ensure future supplies. A large proportion of residents in West Hebron receive water through municipal supply systems, which do not strictly enforce payment by turning taps off. Identifying people's reason for paying or not paying for water and electricity may warrant further investigation.

Table 6.5a. Percentage of Households Using Piped Water in Surveys 1 and 2 (n=567)

Characteristic	Nablus	West Hebron	Total
Survey 1			
Households with piped water connection	*9.0*	*90.5*	*49.3*
All water from piped source	*65.4*	*63.2*	*63.4*
Up to date on paying bill	*48.0*	*29.4*	*31.0*
If no, months since paying last bill (Med.)	*6*	*4*	*4*
Survey 2			
Households with piped water connection	8.0	90.4	50.6
All water from piped source	72.7	64.5	65.2
Up to date on paying bill	52.4	21.3	23.6
If No, months since paying last bill (Med.)	11	10	10

The deterioration/improvement ratio from Markov analysis (47/27 = 1.7), as seen in Table 6.5b, shows that the odds of becoming less up to date on paying water bills were greater than the odds of becoming more up to date.

Table 6.5b. Percentage of Households Up to Date Paying Piped Water Bill in Surveys 1 and 2 (n = 246)

Survey 1	Survey 2	Percentage	n
Up to date	Up to date	39.0	30
Up to date	Not Up to date	61.0	47
Not up to date	Up to date	16.0	27
Not up to date	Not up to date	84.0	142

Tables 6.6a and 6.6b show that in Nablus household consumption of water delivered by tanker decreased between comparable seasons in both time periods, accompanied by consistently rising monthly costs ($8 to $15 between the two winters and $21 to $31 between the two summers). This evidence strongly suggests that cost is limiting the ability of rural Nablus residents to procure water. Households in mostly unserved rural communities, which are also the poorest, depend almost exclusively on tanker water, except during wet winter months. In addition to tanker and rainwater, few households consumed piped water in Nablus.

The situation was different in West Hebron, where dependence on tanker water increased more than 50% from 3.2 m^3/month the winter of November 2001 to 5.0 m^3/month the winter of 2002. The greater tanker water use in West Hebron than in Nablus during the winter season might be the result of fewer households having systems for rainwater collection and cisterns (60%) and therefore being less able to collect rainwater compared to the north, whereabout 85% of households own a collection cistern. Over 90% of households in Nablus and West Hebron have roof tanks, which can be filled directly with tanker or piped water.

The median cost per month in West Hebron during the winter tripled from $14 to $41, implying that the unit costs more than doubled. Because tanker water must be paid in cash, water costs greatly increased the economic burden on families.

Possible reasons why costs for water increased include more difficult access and longer distances to fill tankers, more households defaulting on paying bills, and poor rains in the winter of 2002.

As was the case in Survey 1, seasonal variation (higher volume in the summer than in the winter) in the use of tanker water was found in Survey 2. This is consistent with the fact that rainwater is an important source during the winter season, but not during the dry summer.

Table 6.6a. Households Using Tanker Water in Survey 1 (n=594)

Characteristic	Nablus	West Hebron	Total
Household used tanker water in last year (%)	90.3	49.7	70.2
Winter (November 2000 - April 2001)			
Median cubic meters per month	3.3	3.2	3.3
Median liters per HH per day	110.0	104.0	110
Median liters per capita per day *	16.0	15.0	16
Median cost per cubic meter (in US dollar)			
10 cubic meter load	$2.14	$2.49	$2.18
3 cubic meter load	$3.11	$3.47	$3.47
Median cost per month	$8.30	$13.90	$10.37
Summer (May - October 2001)			
Median cubic meters per month	8.3	5.0	6.7
Median liters per HH per day	274.0	164.0	271.0
Median liters per capita per day *	39.0	23.0	34.0
Median cost per cubic meter (in US dollar)			
10 cubic meter load	$2.49	$3.73	$2.49
3 cubic meter load	$3.47	$3.47	$3.47
Median cost per month	$20.75	$25.42	22.41
Cost ratio (winter 2000-2001/summer 2001)	2.5	1.8	2.2

* Estimated median HH size = 7

Table 6.6b. Households Using Tanker Water in Survey 2 (n=569)

Characteristic	Nablus	West Hebron	Total
Household used tanker water in last year (%)	86.3	34.6	59.8
Winter (November 2001 – April 2002)			
Median cubic meters per month	2.5	5.0	3.3
Median liters per HH per day	82.1	164.3	109.5
Median liters per capita per day *	11.7	23.5	15.6
Median cost per cubic meter (in US dollar)			
10 cubic meter load	$2.28	$4.15	$3.11
3 cubic meter load	$4.15	$4.15	$4.15
Median cost per month	$14.52	$41.49	$19.09
Summer (May – October 2002)			
Median cubic meters per month	6.7	5.8	6.7
Median liters per HH per day	219.0	192.0	219.0
Median liters per capita per day *	31.0	27.0	31.0
Median cost per cubic meter (in US dollar)			
10 cubic meter load	$2.70	$4.15	$2.91
3 cubic meter load	$2.70	$3.53	$2.70
Median cost per month	$31.12	$46.06	$34.65
Cost ratio (winter 2001-2002/summer 2002)	2.1	1.1	1.8

* Estimated median HH size = 7

Table 6.7 shows that most households (83%) believe that their water is safe for drinking—a finding almost identical to that in Survey 1. Those who believe that the water is not safe report dirtiness, color, and bad taste as the most frequent problems.

Table 6.7. Percentage Distribution of Drinking Water Beliefs and Practices in Survey 2 (n=571)

Characteristic	Nablus	West Hebron	Total	Total (Survey 1)
Belief that water supply is safe for drinking	82.4	83.3	82.8	84.5
If no, why isn't water considered safe				
Not clear	37.2	14.6	25.3	27.0
Bad taste	39.5	43.8	41.8	25.8
Dirty	55.8	20.8	37.4	20.2
Unspecified reasons	7.0	4.2	5.5	19.1
Color	41.9	27.1	34.1	18.2
Contains bacteria	14.0	12.5	13.2	11.2
Chemical pollutants	9.3	6.3	7.7	9.0
Contact with animals	7.0	0.0	3.3	4.5
Salty taste	7.0	4.2	5.5	2.2
Drinking water is treated in the household	17.7	15.8	16.7	26.5
If yes, types of water treatment				
Boil	56.3	55.6	55.9	44.6
Filter	27.1	17.8	22.6	11.5
Chlorination	16.7	26.7	21.5	20.4
Where added				
Cistern	100.0	54.5	73.7	78.1
Tank	0.0	36.4	21.1	18.8
Treatment at least once a month	50.0	25.0	35.0	15.6
Added during rainy season	25.0	27.3	26.3	31.3

Household treatment of drinking water was found to be significantly lower in Survey 2 than Survey 1 (27% to 17%—$Z = 4.5 > 2.8$). Those who did treat their water used boiling, filtration, and chlorination methods with frequencies similar to those in Survey 1.

Despite the fact that laboratory analyses found 23% of water samples from the north to have an odor, respondents did not report this defect. Likewise very few respondents were concerned about bacterial contamination, although over 50% of the samples were contaminated with fecal coliform bacteria. Considering that the majority of residents believe that the quantity of available water is insufficient, it is perhaps to be expected that standards for water quality are rather low.

Exploring possible correlations between beliefs and practices, the survey found that those who use water from sources other than pipes, tanker trucks, or rainwater are less likely to consider it safe (75.4% versus 85.0%—$X2 = 4.2$, $P = 0.04$). However, this belief did not translate into an increased prevalence of treatment of drinking water. Water clarity (lack of turbidity) determined in the laboratory was also associated with the belief that water is safe (91.0% versus 72.5%—$X2 = 8.8$, $P = 0.003$). Even when

households report treating the water, undetectable levels of residual chlorine in all samples tested may indicate that treatment is not effective (see laboratory results of water tests in Chapter 9).

Beliefs and treatment practices were not expected to change between the two environmental health assessments or to show any seasonal variations. The beliefs about the quality of drinking water and the practice of home purification using simple and cost-effective techniques such as chlorination could form an area for a social marketing program that would improve the health of the target population. Household water treatment could constitute an emergency measure until safe piped water becomes widely available.

7. Household Sanitation

7.1. Garbage Disposal

Although there was no significant change in garbage disposal practices between the two surveys, there was a slight decrease (82% to 76%) in the use of municipal services in the north, as expressed by the percentage of households reporting a garbage collector taking away trash. In addition, the north experienced an increase (0.7% to 3.2%) in the number of people who reported throwing garbage in distant places. Table 7.1 reflects these changes. None of the changes was statistically significant.

Table 7.1. Percentage Distribution of Household Garbage Disposal in Surveys 1 and 2 (n=570)

Characteristic	Nablus	West Hebron	Total
Survey 1			
Type of garbage disposal			
Garbage collector takes	*81.8*	*18.4*	*50.3*
Municipal box	*15.8*	*67.3*	*41.5*
Burn	*1.3*	*7.8*	*4.6*
Throw in distant place	*0.7*	*5.4*	*3.0*
Survey 2			
Type of garbage disposal			
Garbage collector takes	75.9	17.5	46.0
Municipal box	19.4	68.2	44.4
Burn	1.4	8.2	4.9
Throw in distant place	3.2	6.2	4.7

8. Intestinal Parasites and Diarrhea

Highlights: The second survey has shown marked increases in the prevalence of diarrhea and intestinal parasites such as ameba, giardia, and roundworm. The two-week diarrhea prevalence increased from 12% to 17%. A prevalence of 17% is higher than previously reported by other research findings for a comparable period. More remarkably, on the day of the survey the number of cases of diarrhea among children who had diarrhea during the past two weeks had increased from 19% to 28% between surveys. Giardia prevalence in both assessments have been consistently higher in West Hebron than in Nablus, while roundworm showed up in significant numbers in Nablus only. Although seasonal changes were expected, the deteriorating socioeconomic situation also may have contributed to the increased rates of diarrhea and intestinal parasites. Two aggravating factors were found: both areas significantly decreased their access to medical personnel, and Nablus experienced a significant drop in the use of worm medicine—a factor that remained essentially unchanged in West Hebron. The management of diarrhea by caretakers and medical personnel remained inadequate.

According to medical practitioners, intestinal parasites represent a major public health problem among children in the Palestinian community. The diagnostic of intestinal parasites focused on *Entamoeba histolytica* (amebic dysentery), *Giardia lamblia* (flagellates), and *Ascaris lumbricoides* (roundworm). Parasitic infections are aggravated by poverty, inadequate quantities of water for hygiene, and bad water supplied to households via pipes, tanker trucks, or other means. These parasites depend on unsanitary conditions and other environmental factors, such as soil humidity in the case of roundworms.

8.1. Intestinal Parasites

Table 8.1 summarizes the results of microscopic examination of stool samples from children 12- to 47-months old. In the first survey, the prevalence found was 15% for ameba, 11% for giardia, and very rare occurrences of ascaris and pinworm.

The second survey showed marked increases in the occurrence of the parasites. Giardia increased to 16% ($Z = 3.0 > 2.8$—which is significant at the .95 level) and ameba to 21% ($Z = 2.5 < 2.8$—which is close to significant at the .95 level) . Giardia prevalence in Survey 1 and Survey 2 have been consistently higher in West Hebron

than in Nablus (χ^2 = 8,4, P = .004 for Survey 1 and χ^2 = 13, P = 0 for Survey 2—both significant at the .95 level).

A surprise was the 16% prevalence of ascaris in the north versus 0% in the south. Whether this finding suggests seasonal variations or a major deterioration in environmental health conditions in the north requires further investigation into the specific locations and causes. The change of laboratories that did the stool analysis is unlikely to be a factor because of the quality control measure implemented, which consisted of a reanalysis of a subsample of stool specimens.

The findings related to intestinal parasites are consistent with the expectation of a higher prevalence during the dry summer months, but, unfortunately, they may also be driven by the deteriorating social, economic, and political situation.

The decrease in the use of worm medicine in the past six months from 22% to 13% may reflect the more restricted access to health services in parts of the West Bank. In looking at the regions separately, the use of worm medicine decreased significantly in Nablus, from 27% to 10%, and remained essentially unchanged in West Hebron. This might partially explain the increase of ascaris occurrence in the north. However, the continuing absence of worm ova or parasites in the south in Survey 2 is surprising, since patterns in environmental health conditions and access to health care and medications are similar to those in the north.

Table 8.1. Percentage Distribution of Intestinal Parasites in Children 12 to 47 Months in Surveys 1 and 2 (n=447)

Results	Nablus	West Hebron	Total
Protozoa			
Amebiasis (*Entamoeba histolytica*)			
Survey 1	*16.0*	*14.0*	*14.8*
Survey 2	20.1	21.6	20.8
12 - 23 months	13.0	26.9	20.4
24 - 35 months	18.3	20.8	19.6
36 - 47 months	21.6	21.0	21.4
Giardiasis (*Giardia lamblia*)			
Survey 1	*5.9*	*14.0*	*10.4*
Survey 2	10.0	22.5	16.1
12 - 23 months	8.7	15.4	12.2
24 - 35 months	10.8	23.8	17.5
36 - 47 months	9.9	23.3	15.9
Amebiasis and Giardiasis			
Survey 1	*0.0*	*3.2*	*1.7*
Survey 2	2.2	4.6	3.4
Roundworms			
Ascaris (*Ascaris lumbricoides*)			
Survey 1	*0.4*	*0.0*	*0.2*
Survey 2	15.7	0.0	8.1
Hookworm (*Ancyclostoma duodenale*)	0.0	0.0	0.0
Pinworm (*Enterobius vermicularis*)	0.0	2.3	1.1
Worm medicine in past six months			
Survey 1	*27.1*	*16.7*	*21.6*
Survey 2	9.9	15.2	12.6

8.2. Diarrhea

Table 8.2 indicates that the two-week diarrhea prevalence increased from 12% to 17% from the time of Survey 1 to Survey 2 ($Z = 2.4 < 2.8$—which is close to significance at the .95 level). To detect an increase of this size at the .95 level of statistical significance would require a larger sample. However, the direction of change is consistent with other health outcomes and related indicators, which would in part confirm the hypothesis that diarrhea prevalence is higher during the dry summer months. Unfortunately, it is also consistent with the overall picture of deteriorating environmental health and health status in the surveyed communities due to sociopolitical conditions. Although seasonal changes were expected, the fact that diarrhea and intestinal parasites all increased may point to the deteriorating

socioeconomic situation as a probable cause. Children ages 12 to 23 months had the highest prevalence, as was the case in the first survey.

Table 8.2. Two-Week Prevalence of Diarrhea in Children < 5 Years in Surveys 1 and 2 (n=950)

Results	Nablus	West Hebron	Total
Age (Months)			
0-11	20.7	17.9	19.1
12-23	25.4	23.5	24.4
24-35	16.7	23.3	20.0
36-47	12.9	15.1	13.9
48-59	6.2	12.0	9.7
0-59 *			
Survey 1	*12.2*	*11.1*	*11.6*
Survey 2	15.8	18.2	17.1

* Key Indicator: two-week diarrhea prevalence in children under 5 years of age

Table 8.3 shows a remarkable overall increase in the percentage of children aged 0 to 59 months who had diarrhea on the day of the visit during Survey 2 (28%) compared with those visited during Survey 1 (19%); in both surveys, these were children who had diarrhea in the last two weeks.

Using the denominator of all the children included in the second environmental health assessment (950), the point prevalence is 4.7%. This point prevalence provides a crosscheck of the accuracy of caretaker recall by calculating the theoretical two-week prevalence and comparing the result with the actual survey finding of 17.1%. The expected two-week diarrhea prevalence is 17.8%, which is very close to the prevalence actually measured, and increases the confidence in the reliability of the data collected.[6]

6 Point Prevalence $P_1 = 0.047$ (45/950) and reported mean duration of diarrhea D = 4.66 days. $P_T = I_1 (T + D - 1)$: I_1 = daily incidence = probability of new cases/day = 0.047/4.66 = 0.0101, T = time period in days. $P_{14} = I_1 (14 + 4.66 - 1) = 0.01 (17.66) = 0.178$.

Table 8.3 Percentage Distribution of Characteristics of Diarrhea in Children 0 to 59 Months of Age in Surveys 1 and 2 (n=162)

Results	Nablus (Survey 2)	West Hebron (Survey 2)	Total (Survey 2)	*Total (Survey 1)*
Duration in Days (Median)	3.0	3.0	3.0	*4.0*
Diarrhea the day of the visit	27.8	28.1	28.0	*19.4*
Blood in the stool	10.0	13.3	11.8	*7.1*
Mucus in the stool	47.1	41.9	44.2	*43.8*
Liquids given to child				
Less than usual	4.2	8.9	6.8	*10.1*
Same as usual	52.8	55.6	54.3	*36.4*
More than usual	43.1	35.6	38.9	*53.5*
Food given to child				
Less than usual	29.2	33.3	31.5	*54.5*
Same as usual	62.5	65.6	64.2	*36.4*
More than usual	8.3	1.1	4.3	*9.1*
Appropriate home care *	20.8	23.3	22.2	*19.2*
Child received diarrhea treatment	54.2	53.3	53.7	*56.3*

Key Indicator: Appropriate home care = More liquids than usual and food at least the same as usual

Another finding is that bloody diarrhea almost doubled from 7% to 12% over the same period. This may indicate that more children had dysentery—the more severe form of diarrhea—and not just acute watery diarrhea. Again, this finding is consistent with the higher prevalence of intestinal parasites during the second survey. Mucus in the stools was 44% in both surveys. Taken together, the findings that diarrhea is frequent and has increased since the first environmental health assessment indicate a serious public health problem.

These concerns are heightened further by the observation that home care for children with diarrhea did not show significant improvement. Considering the worsening socioeconomic conditions in the region, it has become critical for future programmatic interventions to address this shortcoming by focusing on home care, especially in cases where access to the formal health care system is markedly limited.

Survey 1 found that almost 80% of children with diarrhea received treatment from a doctor. Table 8.4 shows that in Survey 2 the probability of such treatment dropped significantly to 62%. This is an indicator of the problem of access to health care, confirmed by the complementary evidence that a pharmacist or neighbor treated significantly more children in Survey 2 than in Survey 1 (17% compared with 4%, respectively).

Table 8.4. Percentage Distribution of Sources of Treatment for Diarrhea in Surveys 1 and 2 (n=87)

Results	Nablus	West Hebron	Total
Survey 1			
Doctor	*80.0*	*72.2*	*77.6*
Medication prescribed by doctor	*83.3*	*47.1*	*68.8*
Other health professional	*10.0*	*5.9*	*8.3*
Pharmacist or neighbor	*3.3*	*5.9*	*4.2*
Medicine already in house	*27.6*	*44.4*	*33.3*
Survey 2			
Doctor	66.7	58.3	62.1
Medication prescribed by doctor	64.1	35.4	48.3
Other health professional	17.9	4.2	10.3
Pharmacist or neighbor	23.1	12.5	17.2
Medicine already in house	15.4	39.6	28.7

Table 8.5 shows that the percentage of children in the north who had been breastfed dropped from 98% to 82%, and this was accompanied by a drop in median duration in months for infants breastfed from 7 to 3 months. However, these practices increased in the south, where breastfeeding rose from 86% to 98% and the median duration increased from four to six months. Other findings are equally inconclusive, which is mainly due to including only a small number of children under the age of one in the survey. The sentinel surveillance surveys have larger samples that are better suited to measure breastfeeding indicators.

Table 8.5. Percentage Distribution of Infant Feeding (0 to 11 months) in Surveys 1 and 2 (n=137)

Results	Nablus	West Hebron	Total
Survey 1			
Child ever breastfed			
Yes	*98.2*	*86.2*	*92.0*
Exclusive breastfeeding	*86.3*	*86.0*	*86.1*
Duration in months (median)	*7.0*	*4.0*	*6.0*
Child drinks liquids from bottle	*29.6*	*53.6*	*41.8*
Child drinks water	*59.3*	*64.9*	*62.2*
Survey 2			
Child ever breastfed			
Yes	82.1	98.4	90.7
Exclusive breastfeeding	89.1	54.1	69.2
Duration in months (median)	3.0	6.0	4.0
Child drinks liquids from bottle	32.1	41.9	37.3
Child drinks water	69.6	72.6	71.2

It was also discovered in Survey 2 that there was a decrease in reported jaundice (from 12% to 7%), but this is not significant.

9. Water Quality—Laboratory Results for Water Samples

Highlights: Over half the households in the West Bank may be drinking fecally contaminated water. The bacteriological quality of household water samples decreased by almost 10% (zero fecal coliforms), but more markedly for piped water, which dropped from 80% of the samples tested during Survey 1 to 59% during Survey 2. Despite this drop in the quality of piped water, tanker water is significantly worse with only 35% of water samples fecal coliform free, which is another indication of the positive impact of a better water supply infrastructure in an emergency situation. As in the first assessment, the situation is worse in Nablus, where two-thirds of households are exposed to contaminated water compared with almost half of households in West Hebron.

In addition to bacteriological quality, the chemical quality of water samples worsened as well. The median nitrate concentration, although still below the critical threshold of 50 mg/liter, has increased substantially from 2.5 during Survey 1 to 27 mg/liter during Survey 2, and is essentially the same in piped and tanker water.

As Table 9.1 indicates, significant differences in the physical characteristics of household water were reported in the north.

Table 9.1. Physical and Chemical Characteristics of Household Water Internal Samples * in Surveys 1 and 2 (n=170)

Results	Nablus	West Hebron	Total
Colorless (%)			
Survey 1	*94.7*	*96.7*	*95.9*
Survey 2	98.8	97.7	98.2
Odorless (%)			
Survey 1	*17.1*	*100.0*	*62.1*
Survey 2	76.8	97.7	87.6
Turbidity (Median NTU)			
Survey 1	*1.6*	*0.7*	*1.1*
Survey 2	0.5	0.7	0.5
Turbidity (NTU < 1)			
Survey 1	*25.0*	*65.2*	*46.7*
Survey 2	80.6	69.6	74.2
pH (Median)			
Survey 1	*7.7*	*7.8*	*7.7*
Survey 2	8.0	8.0	8.0
pH < 8 (%)			
Survey 1	*77.3*	*81.3*	*79.6*
Survey 2	53.5	53.3	53.8
Residual Chlorine - mg/liter (Median)			
Survey 1 Range (0 – 0.75)	*0*	*0*	*0*
Survey 2 Range (0 – 1.42)	0	0	0
Survey 1			
*Nitrates (Range - mg / liter) **	*0.1-50.0*	*0.9-26.0*	*0.1-50.0*
Nitrates (Median - mg / liter)	*1.4*	*2.9*	*2.5*
Nitrates (<= 50 mg / liter) (%)	*100.0*	*100.0*	*100.0*
Survey 2			
Nitrates (Range - mg / liter) **	12.0-37.0	9.0-38.0	9.0-38.0
Nitrates (Median - mg / liter)	30.5	26.6	29.3
Nitrates (<= 50 mg / liter) (%)	100.0	100.0	100.0

* Internal Source: Water just before drinking (faucet, jar, or bottle)
** The WHO guideline for the nitrate ion is ≤ 50 mg/liter, to prevent methemoglobenemia in infants. Its sources may include the natural nitrogen cycle, runoff from inorganic fertilizer, and human and animal wastes.

The probabilities of water having no odor increased from 17% to 77% and low turbidity (NTU < 1) increased from 25% to 81%, which may well be a seasonal effect

due to lower water levels during the dry season and perhaps different water sources than in the rainy season. The proportion of households with water pH < 8 decreased from 80% to 54%. Greater pH is often correlated with hardness, and salinity in water with high bicarbonate concentrations. Water pH and hardness (and turbidity) influence the effectiveness of water chlorination. Increases in these variables are expected in summer, when there is less dilution by rainwater.

The median nitrate concentration, although still below the critical threshold of 50 mg/liter, has increased substantially from 2.5 at baseline to 27 at follow-up. Survey 2 data show that the current levels of nitrates are essentially the same in piped and tanker water. Increased nitrate concentrations may be a sign of seasonal variations, reflecting lower water levels in summer and dilution in winter and changes in the intensity of agricultural activities. The presence of nitrates may indicate water contaminated with human or animal feces, which is consistent with higher counts of fecal coliforms in the second environmental health assessment. High concentrations of nitrates can have serious health consequences, especially methemoglobinemia or "blue baby syndrome" in infants and possibly various forms of cancer (bladder, stomach, esophageal). However, the magnitude of risk for the latter is not yet clear. Further investigation of this finding is recommended by tracing tanker and piped water to its sources and by identifying the potential origin of nitrate contamination and whether such an increase could be seasonal and preventable.

Residual chlorine continues to be 0%, showing that any chlorination by households, which was reported to be 20%, or by tanker water vendors or municipal suppliers may be ineffective.

Bacteriological Characteristics

Table 9.2 shows that over half the households may be drinking fecally contaminated water. Bacterial contamination of household water has worsened between surveys. The probability of fecal coliforms has increased (48% to 56%), although that of total coliforms has decreased from 73% to 65%; however, these changes were not significantly different statistically. These opposite trends are likely to be an indication of variability inherent to sampling and laboratory tests. However, higher fecal coliform counts are consistent with the observed increase in diarrhea prevalence and merit further investigation.

The two surveys were not designed to determine the causes for the fecal contamination of water. Probable causes include agricultural activities as well as inadequate septic systems. Almost one in ten households reported problems with sanitation facilities during Survey 1.

The same reasons may also explain why contamination of water with fecal coliforms increased in Nablus from 57% to 67% (not significant at the .95 level due to the small number of cases—58), while at the same time physical parameters of odor and turbidity were improving.

In addition to the changes observed between the two environmental health assessments, the fact that over half the households may be drinking fecally contaminated water is alarming. As in Survey 1, the situation is worse in Nablus, where two-thirds of households are exposed to contaminated water compared to almost half of households in West Hebron.

These results combined with the increased infestation with intestinal parasites reflect a serious public health problem in the survey communities and create an urgent need for programmatic intervention. Given the limited possibilities to control and improve water sources, a necessary and urgent intervention to avoid the health impacts of fecally contaminated water would be water treatment at the household level combined with health education.

Table 9.2. Percentage Bacteriological Characteristics of Household Water in Surveys 1 and 2 (n=170)

Results	Nablus	West Hebron	Total
Thermotolerant Coliforms (CFU / 100 ml)			
Survey 1			
No risk (0)	*43.4*	*59.8*	*52.1*
Low risk (1-10)	*22.4*	*21.7*	*21.9*
Intermediate risk (11-100)	*25.0*	*10.9*	*17.8*
High risk (101 – 998)	*7.9*	*5.4*	*6.5*
Very high risk (Too many to count)	*1.3*	*2.2*	*1.8*
Survey 2			
No risk (0)	33.0	53.4	43.5
Low risk (1-10)	3.7	2.3	2.9
Intermediate risk (11-100)	36.6	22.7	29.4
High risk (101 – 998)	26.8	21.6	24.1
Very high risk (Too many to count)	0.0	0.0	0.0
Total Coliforms (CFU / 100 ml)			
Survey 1			
No risk (0)	*5.3*	*44.6*	*26.6*
Low risk (1-10)	*18.4*	*14.1*	*16.0*
Intermediate risk (11-100)	*32.9*	*15.2*	*23.7*
High risk (101 – 998)	*27.6*	*14.1*	*20.1*
Very high risk (Too many to count)	*15.8*	*12.0*	*13.6*
Survey 2			
No risk (0)	19.5	50.0	35.3
Low risk (1-10)	0.0	3.4	1.8
Intermediate risk (11-100)	36.6	31.8	34.1
High risk (101 – 998)	43.9	14.8	28.8
Very high risk (Too many to count)	0.0	0.0	0.0

Drinking Water of Acceptable Quality

As Table 9.3 indicates, the number of households with access to quality water that follows WHO standards may have increased slightly from 24% to 30%. Nablus experienced a greater increase from 0% to 21%, while West Hebron decreased slightly from 44% to 38%. However, the apparent improvements are only related to the physical characteristics of water quality. It masks an increase in pH and nitrates, and, as mentioned already, the bacteriological quality worsened. As shown in Table 9.4, the public's perception seems to be based on the physical appearance of water, rather than the risk of bacteriological contamination. This discrepancy between actual risk and perceived risk from unsafe water should be taken into consideration for public health programming at the community level.

Table 9.3. Percentage of Households with Access to Water of Acceptable Quality at Point-of-Use in Surveys 1 and 2 (N=170)

Results	Nablus	West Hebron	Total
Survey 1			
Esthetic Quality			
Colorless	*94.7*	*96.7*	*95.8*
Colorless+odorless	*17.3*	*96.7*	*60.8*
Colorless+odorless+clear	*6.7*	*64.8*	*38.6*
Bacteriological quality (no FC/100 ml)	*44.0*	*60.4*	*53.0*
Chemical quality (nitrates <= 50 mg/l)	*100.0*	*100.0*	*100.0*
Esthetic+Bact.+Chemical quality	*0.0*	*44.2*	*23.9*
Survey 2			
Esthetic Quality			
Colorless	98.8	97.7	98.2
Colorless+odorless	76.8	95.5	86.5
Colorless+odorless+clear	54.4	66.3	61.1
Bacteriological quality (no FC/100 ml)	32.9	53.4	43.5
Chemical quality (nitrates <= 50 mg/l)	100.0	100.0	100.0
Esthetic+Bact.+Chemical quality	20.8	37.8	29.9

Table 9.4 indicates that the quality of water varied significantly by time and source. While good quality piped water decreased from 56% to 42%, the quality of tanker water has increased from 0% to 25%, but this is only due to improvement of the physical characteristics of water. The bacteriological quality of households water samples decreased by almost 10% (zero fecal coliforms), but more markedly for piped water, which dropped from 80% of the samples tested at baseline to 59% at follow-up (point of use only for both assessments). For households relying on tanker water, the quality remained poor with 35% of water samples having zero fecal coliforms compared with 38% at baseline.

Comparing households that have only piped water with those having only tanker water in Survey 2, the inadequate water quality of tanker water was found to be significantly worse at the .95 level than in piped water (75% versus 58%—$\chi^2 = 4$, P = 0.045).

Table 9.4. Comparison of HH Water Quality by Source Only Piped Water (n=54) or Only Tanker Water at Point-of-Use in Surveys 1 and 2 (n=82)

Results	PW	TANKER
Survey 1		
Esthetic Quality		
Colorless	*96.6*	*93.1*
Colorless+odorless	*88.1*	*27.6*
Colorless+odorless+clear	*69.5*	*8.6*
Bacteriological quality (no CFU/100 ml)		
Thermotolerant – fecal coliforms	*79.7*	*37.9*
Total coliforms	*57.6*	*6.9*
Chemical quality (nitrates <= 50 mg/l)	*100.0*	*100.0*
Esthetic+Bact(FC)+Chemical quality	*55.5*	*0.0*
Survey 2		
Esthetic Quality		
Colorless	96.3	100.0
Colorless+odorless	94.4	79.3
Colorless+odorless+clear	64.7	62.2
Bacteriological quality (no CFU/100 ml)		
Thermotolerant – fecal coliforms	59.3	35.4
Total coliforms	59.3	23.2
Chemical quality (nitrates <= 50 mg/l)	100.0	100.0
Esthetic+Bact(FC)+Chemical quality	41.5	25.0

Table 9.5 relates beliefs about water quality from households that had either piped water or tanker water, whether or not water samples were taken from those households. As observed in Survey 1, more than eight out of 10 households believe that their water is safe regardless of the source, and those who think it is bad are more concerned about taste than bacteria. Surprisingly, of those who think the water is bad, twice as many households with piped water believe it contains bacteria.

Table 9.5. Beliefs Concerning Water Quality for Households with only Piped or Tanker Water in Survey 2 (n=476)

Results	PW	TANKER
Number of households	183	293
Nablus	15	201
West Hebron	168	92
Respondent believes water is safe (%)	86.0	83.4
If no		
Claims water tastes bad (%)	38.5	42.9
Believes it contains bacteria (%)	15.4	8.2

10. Conclusions

The two environmental health assessments (phase I baseline survey in January 2002 and phase II follow-up survey in October 2002) have documented that piped water is an essential commodity. Although the quality and quantity of piped water can and should be improved, it is much safer than other water sources, especially tanker water, as measured by the presence of fecal coliform bacteria. Piped water is also much more available in sufficient quantities. However, several key indicators have worsened between Survey 1 and Survey 2, as explained in the following paragraphs:

- **Access to and quality of water:** Household access to adequate supplies of water has decreased, and water quality has deteriorated. While the quality of piped water has worsened, households depending on tanker water have experienced the greater impact. Tanker water is far more likely to be contaminated with bacteria than piped water. At the same time, the cost of tanker water during dry summer months has risen, and since poverty levels have remained very high, water appears to be less affordable for many households, as evidenced by a 23% reduction in consumption. Moreover, the poorest communities in rural areas are probably the worst affected, as they rely almost exclusively on tanker water. Households in Nablus use mostly tanker water, and at an average consumption of 35 liters per capita per day, use considerably less water than the 40 to 50 liters per capita per day considered to be a minimum for domestic needs (Chattergee et al. in Vision 21, and IFPRI 2002). This situation clearly underlines the need for a better water supply infrastructure.

- **Health outcomes:** Gastrointestinal infection in children under five years has increased substantially between the first and second environmental health assessments, as evident from a 42% increase in diarrhea and a 40%-60% rise in the prevalence of ameba and giardia. Roundworms (ascaris) appeared in substantial numbers in Nablus. Although seasonal changes were expected, the deteriorating socioeconomic situation also may have contributed to increased rates of diarrhea and intestinal parasites. This is even more plausible considering that access to health care services decreased as fewer children with diarrhea sought medical care or received treatment against intestinal worms while the disease burden rose. As to be expected in the absence of intensive hygiene promotion, beliefs about water safety and household practices related to water treatment did not change between the two assessments.

- **Socioeconomic status:** Several indicators show that poverty remained very high or even increased in the West Bank. Based on survey findings, the monthly cost of electricity and water may be as high as 40% of total household income. Fewer

household members are fully employed; the ability or willingness of households to pay bills for piped water and electricity dropped; and more households sold property or borrowed money to meet basic needs according to comparisons of results from the baseline and follow-up environmental health assessments.

Decreases in access to and in the quality of water may be due in part to seasonal effects. Dry summer months could explain why water is less sufficient than in the rainy season, but increased poverty also may make water less affordable. Greater scarcity of water during the dry season would explain higher prices and may partly explain lower quality. The worsening of health outcomes is probably attributable to a combination of seasonal effects, including lower water quality, and the deteriorating security and political situation with its increase in poverty. Although seasonal variations in employment status are likely, the worsening status across several socioeconomic indicators would not be the result of changing seasons alone and is probably due to the political situation.

While changes in these key water, health, and socioeconomic indicators were observed in Nablus and West Hebron, some significant differences between these two governorates remain. Comparisons of the values found in the Nablus and West Hebron at the times of the first and second surveys are shown in Figure 1 and summarized below.

- Households with access to piped water are found almost exclusively in West Hebron, but this amount has decreased over time.

- Drinking water of acceptable quality is consistently more abundant in West Hebron than in Nablus; however, it has decreased in West Hebron and increased in Nablus.

- Amebiasis levels are the same in both governorates and have increased.

- Giardiasis levels are consistently almost twice as high in West Hebron than in Nablus and have increased in both regions.

- Diarrhea levels are the same in both governorates and have increased.

- Ascaris has appeared in Nablus and remains absent in West Hebron.

The findings in the environmental health assessments during Survey 1 and Survey 2 are similar to findings from the Sentinel Surveillance Study (2002-2003). For example, findings from household surveys in the West Bank and Gaza between May and July 2002 (biweekly report 1) showed that 27% of households reported at least one household member had experienced watery stools in the two weeks prior to the interview and 55% of the diarrhea episodes were experienced in children under five. Households in the West Bank reported substantially lower rates than Gaza, less than 10% versus more than 30% (biweekly report 3). According to data collected between

May and October 2002 (biweekly report 5), in 36% of the households at least one family member was not able to access needed emergency care, a finding consistent with diminished access to modern health care observed in the environmental health assessments. Another result presented in biweekly report 5 was similar to the assessments: households in the West Bank that sold property (48%) or borrowed money (15%) were comparable to the figures reported here. The same biweekly report also showed significant interruptions of water supply of 34% during the two weeks preceding the survey. While the sentinel surveillance surveys do not ask the same question as the environmental health assessments, this finding is consistent with the assessments' finding that only a minority of households has access to sufficient water.

According to the Palestinian Central Bureau of Statistics (2001), diarrhea in children under five in Palestine was 6.7% in spring 2001 and 13.5% in summer 1996; the data for the latter were gathered during a season comparable to the second environmental health assessment. While prevalence of diarrhea was higher in October 2002 (17%), the rates do not deviate significantly and could be explained by differences in study population and methodology. However, a higher rate is also consistent with a deteriorating sociopolitical situation.

The findings of high prevalence for diarrhea and intestinal parasites are consistent with the high level of acute and chronic malnutrition of 4.3% and 7.9%, respectively, in the West Bank, according to another USAID-funded study, Nutritional Assessment of the West Bank and Gaza Strip (Abdeen et al., 2002.) Infections from intestinal parasites are also linked to anemia, which was present in moderate and severe form in 21% of children aged 6 to 59 months. In addition, this study documented deficiencies of several micronutrients (vitamin A, iron, folate, and zinc), which play an important role in a child's resistance to infectious diseases such as diarrhea. Zinc in particular has been shown to reduce the duration and severity of diarrhea. The proportion of children under five that received a less than 80% intake of daily recommended allowances of zinc reached almost 90%.

To illustrate the magnitude of the crisis that exists in the West Bank, the number of people and households affected by significantly reduced access to safe water, which increases the burden of disease and poverty, will be calculated. The following information is needed to estimate these numbers: probabilities related to water, health, and poverty and population in the project area and size of specific age groups.

A typical family in the project villages faces the following probabilities:

- At the current level of monthly household income (median = $104), the annual per capita expected income is $182—about 50 cents a day. If the mean of $166 is used, the result rises to 80 cents a day. This may mean that the monthly cost of electricity and water may be as high as 40% of household income.

- In six out of ten households, the quantity of water available is insufficient, as reported by the households. For households relying mostly on tanker water during

dry summer months, a more quantitative comparison is possible. A minimum of 40 to 50 liters per capita per day is considered to be a minimum for domestic needs (Chattergee et al., IFPRI 2002). Households in Nablus, where mostly tanker water is used, consume considerably less than this with an average of 35 liters per capita per day.

- There is a greater than 50% chance that the household's drinking water is contaminated with fecal coliforms. The chance of the overall quality of water being good is less than one-third.

- Households in Nablus and West Hebron have on average almost two children under the age of five, which means that one of these children will have acute watery diarrhea in a six-week period lasting approximately three days. During this time, a family member will have to care for the sick child, and related expenses will be incurred.

- A child 12- to 47-months old has a 20% chance of getting intestinal protozoa (amebiasis or giardiasis).

By including results of the above-mentioned nutritional assessment, the following probabilities can be added:

- A child 6- to 59-months old has a 7% chance of having chronic malnutrition, a 4% chance of acute malnutrition (the moderate and severe forms), and a 20% chance of moderate or severe anemia (Hemoglobin < 10 gm/dl). Malnutrition and diarrhea are closely associated and lead to a lower than recommended intake of essential micronutrients that strengthen children's resistance to diarrhea and reduce the severity. It is important to note that more than 85% of children in the West Bank have a lower than recommended daily intake of zinc (see Table 10.1).

The second piece of information needed is the population and size of specific age groups. The population of the project communities is known to be about 170,000 (2003 population estimate). By applying population proportions based on census data from the Palestinian Central Bureau of Statistics, it is estimated that there are 20,000 households with 25,200 children under five years of age, 22,680 children between 6- to 59-months old, and 15,100 children between 12- to 47-months old. Using these population numbers together with the probabilities listed above, the lack of good water and the burden of illness can be translated into the numbers affected. These numbers make it easier to comprehend the magnitude of the environmental and public health crisis in the West Bank. The tragedy is compounded because two-thirds of the cases of diarrhea and most of the infections with intestinal parasites can be easily prevented (EHP, 2003).

Table 10.1. Estimated Number of Cases Affected for Selected Indicators in Project Communities

Indicator	%	Total Number
Households with self-described insufficient water	61	12,260
Households with fecally contaminated water	57	11,300
Households with bad water quality (WHO standards)	70	14,020
Total number of diarrheal episodes per year in children under five years		*(255*365)*= 93,075
Number of sick days per year due to diarrhea requiring care by a family member		*(93,075*3)*= 279,225
Number of children 12-47 months with intestinal protozoa	20	3,020
Number of children 6-59 months with chronic malnutrition	7	1,588
Number of children 6-59 months with acute malnutrition	4	907
Number of children 6-59 months with moderate or severe anemia	20	4,536
Number of children 6-59 months with lower than recommended daily intake of zinc	85	19,278

11. Recommendations

This report presents changes in key water, health, and socioeconomic indicators that will be useful in planning and designing programmatic options in the VWS project. To feed these data into the program management cycle, it will be important to widely disseminate the results to all concerned, including the project managers, decision makers in development and humanitarian agencies, and the people living in the project communities.

- Survey findings reveal the need for immediate interventions in several areas to avoid further deterioration of environmental health conditions, health care, and ultimately the health of the target populations:
  - Appropriate programmatic options to improve water quality and quantity
    - Provision of reliable, treated piped water is probably the single most important intervention for improving health and quality of life in the West Bank water supply and sanitation program
    - Purification of tanker water
    - Development of appropriate sanitation systems
  - Appropriate water quality monitoring systems and procedures
    - Enhancement of the PWA role in monitoring water sources
    - Improvement of district-level capacity for water quality monitoring through multisectoral cooperation
  - Appropriate health and hygiene education programs to maximize the impact of system improvements
    - Promotion of simple and effective water treatment in households as an emergency measure until safe piped water becomes widely available
    - Promotion of appropriate home care for children with diarrhea
    - Training of health service providers in the appropriate management of diarrhea
    - Enhancement of community-wide responsibility and action for healthier environment

- Certain findings require further investigation because either they are inconclusive or the scope of the environmental health assessments is not suited to investigate the underlying causes. To make specific recommendations and take appropriate programmatic action, additional information is needed that could be obtained through the following means:

  - Investigate causes of low overall water quality by tracing tanker and piped water to its sources and by identifying the potential origin of fecal coliforms and nitrate contamination and whether such an increase could be seasonal and preventable

  - Investigate causes for deteriorated quality of piped water in the south

  - Investigate the use of lead pipes in homes, lead concentration in water, and potential effects of water pH and alkalinity

  - Determine households' ability and willingness to pay water and electricity bills by comparing communal supply systems to private providers

  - Conduct a study to determine the source of infection with ameba and giardia and the incidence of dysentery

  - Investigate reasons for a higher prevalence of giardia in the south where water quality has been consistently better than in the north

  - Identify reasons for the occurrence of ascaris in Nablus but not in West Hebron

  - Study the correlation between household water quality, especially the presence of fecal coliforms, and the incidence of intestinal parasites, diarrhea, and dysentery using existing data from Surveys 1 and 2

  - Investigate the decreasing access to formal and nonformal health care for acute gastrointestinal infections and its potential impact on child morbidity and mortality.

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Appendix A—List of Those Who Participated Directly

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Maha Zyada	**Buthaina Najjar**	

South:

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Zenat Qaqur	**Suhaer Rjoub**	**Kahoula Rjoub**
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Fahd Abu Saymeh	**Hatem Tabouni**	**Ahmed Sa`adeh**
Abdullah Isawi	**Hana Sa`ad Eddin**	

Data Entry Team (Arab Hasub Center – Nablus)

Dr. Ali Hamad	**Shadi Hamad**	**Nadia Hamad**

Appendix B—List of Surveyed Villages

List of Surveyed Villages

Zone	*Cluster No*		*Village*	*Piped Water Networks*	*Pop. in 2001 **	*Pop. in 2003 **
West Hebron	Idhna	1	Al Bira	Exist	268	292
	Idhna	2	Al Burj	Exist	2,091	2,281
	Idhna	3	Al Kum	Exist	1,130	1,233
	Idhna	4	Al Majd	Exist	1,544	1,685
	Idhna	5	Al Muwarraq	Exist	496	541
	Idhna	6	Al Simiya	Exist	1,438	1,589
	Idhna	7	Beit ar Rush al Fauqa	Exist	830	905
	Idhna	8	Beit ar Rush at Tahta	Exist	421	459
	Idhna	9	Beit 'Awwa	Exist	7,081	7,727
	Idhna	10	Beit Maqdum	Exist	606	661
	Idhna	11	Beit Mirsim and Abu Suhweila	Do not exist	284	310
	Idhna	12	Deir al 'Asal al Fouga	Do not exist **	1,569	1,713
	Idhna	13	Deir al 'Asal at Tahta	Exist	518	565
	Idhna	14	Deir Samit	Exist	4,860	5,304
	Idhna	15	Idhna	Exist	15,973	17,431
	Idhna	16	Iskeik	Exist	143	157
	Idhna	17	Khirbet Salama	Do not exist	286	312
	Idhna	18	Sikka	Exist	684	746
	Idhna	19	Tawas	Exist	126	137
West Hebron	Kharas	20	Al Jaba'	Exist	769	839
	Kharas	21	Beit Ula	Exist	8,039	8,773
	Kharas	22	Beit Ummar	Exist	10,742	11,722
	Kharas	23	Jala	Do not exist	215	235
	Kharas	24	Kharas	Exist	6,043	6,595
	Kharas	25	Nuba	Exist	3,799	4,145
	Kharas	26	Safa	Exist	938	1,024
	Kharas	27	Surif	Exist	11,404	12,445
	Kharas	28	Tarrqumia	Exist	12,465	13,603
	Total/West Hebron				***94,762***	***103,429***
South Nablus	Burin	29	Asira Al Qibliya	Do not exist	2,015	2,199
	Burin	30	Burin	Do not exist	2,897	3,162
	Burin	31	Einabus	Do not exist ***	1,957	2,135
	Burin	32	Iraq Burin	Do not exist	679	729
	Burin	33	Madama	Do not exist	1,462	1,595
	Burin	34	Rujeib	Exist	3,452	3,767
	Burin	35	Sarra	Do not exist	2,549	2,782
	Burin	36	Tell	Do not exist	4,179	4,560
	Burin	37	Urif	Do not exist	2,503	2,731
South Nablus	Aqraba	38	Aqraba	Do not exist	6,991	7,629
	Aqraba	39	Awarta	Do not exist	5,123	5,590
	Aqraba	40	Duma	Do not exist	1,957	2,135
	Aqraba	41	Jalud	Do not exist	399	436
	Aqraba	42	Jurish	Do not exist	1,219	1,330
	Aqraba	43	Majdal Bani Fadel	Do not exist	1,926	2,101
	Aqraba	44	Osarin	Do not exist	1,437	1,568
	Aqraba	45	Qaryut	Do not exist	2,177	2,375

Aqraba	46	Qusra	Do not exist	3,916	4,273
Aqraba	47	Talfit	Do not exist	2,637	2,877
Aqraba	48	Yanun	Do not exist	133	146
Aqraba	49	Beit Dajan	Do not exist	3,101	3,395
Aqraba	50	Beit Fuik	Do not exist	8,987	9,841
	Total/South Nablus			***61,696***	***67,356***
	GRAND TOTAL			***156,458***	***170,785***

*** Population estimates are based on the PCBS 1997. The annual growth rate is assumed to be 4.5%**
**** Although 100% (4) of households reported piped water, no network exists.**
This is the only village where survey data do not match information about water supply networks.

***** There is a network but it is not functional**

Appendix C—Brief Description of Towns and Villages in the Hebron and Nablus Governorates

West Hebron Communities:

Idhna Cluster

- **Al-Bira:** Very close to Al-Burj but with less population. About 65% of the population used to be workers inside Israel. They also rely on small agricultural activities—mainly growing grapes as well as livestock—as a source of income.

- **Al-Burj:** A small town in the south of the project area. No major industries were reported. In this village, about 80% of the population used to be workers inside Israel. Main roads in the town are paved, while most of the smaller ones are dirt.

- **Al-Kum, Al-Muwarraq and Beit Maqdum:** The three villages are very close and connected to each other. They have one village council. Most of the activities reported in the three villages were agricultural. More than 50% of the population used to be workers inside Israel. The main streets are paved, while most of the roads are dirt. Health care is very limited with only one public clinic and a few private ones that are responsible for primary health care.

- **Al-Majd, Sikka, and Tawas:** The three communities are very close to each other. About 70% of the population used to be workers inside Israel, while the remaining 30% depends on agricultural activities as their source of income.

- **Deir Samet and Al-Simya:** Deir Samet is one of the biggest villages in the southern part of the project area. In this village, 60% of the population used to be workers inside Israel. Small light industries as well as industrial jobs were reported in this village. Al-Simya is considered as the center of the surrounding communities that include Al-Kum, Al Muwarraq, and Beit Maqdum in addition to Al-Simya.

- **Beit ar Rush al Fauqa and Beit ar Rush at Tahta:** Two small communities that are similar to Al-Birah. About 20% of the population works in agriculture while about 60% used to be workers inside Israel. No industries or trades were reported in these villages.

- **Beit Awwa:** It is considered a big town. The town has a municipality that provides municipal services for the people. About 20% of the population works in the used furniture trade, while 50% are workers in Israel. The remaining 30% depends on agricultural activities as their source of income.

- **Bit Mirsim and Abu Suhweila:** Very small communities adjacent to Israel. Living standards are very low and the people of these villages depend totally on livestock and working inside Israel as the main source of income. Agricultural activities are minimal.

- **Deir al Asal al Fouqa and Deir al Asal at Tahta:** Two small communities that are similar to Al-Bira. About 20% of the population of the two villages works in agriculture while about 60% used to be workers inside Israel. No industries or trades were reported in these villages.

- **Idhna:** The largest town among all West Hebron communities. The semi-urban lifestyle is different from that in the other small villages. Light industries as well as small business and trades were reported in this town. More than 70% of the roads are paved. The health institutions are considered insufficient: one public clinic and some private clinics are the main source of primary health care and there are no hospitals.

- **Iskeik:** It is a very small Khirba (hamlet). Most of the population used to depend on working inside Israel. Its roads are not paved. The inhabitants depend on surrounding localities to get the basic needs.

- **Khirbet Salama**: It is similar to Al-Bira in all aspects.

Kharas Cluster

- **Al Jaba':** This village is located at the southern part of the project area, very close to the Bethlehem District. Most inhabitants used to be workers inside Israel and they also depend on agriculture—particularly olive trees—for their living. No light industries or handicrafts are recorded in this village.

- **Beit Ula:** It is the largest town among all West Hebron communities. The lifestyle at Beit Ula is different from that in the other small villages but similar to that at Kharas and Tarqumia. Light industries as well as small business and trades were reported in this town. About 60% of the roads in the town are paved. The health care situation is inadequate. One public clinic as well as some private clinics and pharmacies are the main sources of primary health care with no hospitals available.

- **Kharas:** One of the big towns among West Hebron communities. The lifestyle at Kharas is the same as at Surif. Light industries as well as small business and trades were reported in this town. More than 70% of the roads are paved. As in

other towns in West Hebron, the health care situation is inadequate, with a few clinics and no hospital.

- **Nuba:** One of the biggest villages in the southern part of the project area. As much as 60% of the population of the village used to be workers inside Israel. Small light industries as well as industrial jobs were reported.

- **Surif:** Also one of the largest towns among all West Hebron communities. The semi-urban lifestyle in Surif is the same as in Idhna and Tarqumia. Light industries as well as small business and trades were reported in this town. More than 65% of the roads are paved. The health care situation is inadequate, with no hospital in the area.

- **Tarqumia:** One of the largest towns among West Hebron communities with a semi-urban lifestyle. Light industries as well as small business and trades were reported in this town. More than 80% of the roads are paved. Again, the health care situation is inadequate, with no hospital in the area.

South Nablus Communities

Burin Cluster

- **Asira al-Qibliya and Madama**: Very close to each other, about 10 km. from Nablus and 5 km. from Burin. Agricultural activities include mainly olive trees and rain-fed crops. Electricity networks are available at both villages, but there are no water or sewage networks. There are no industrial activities, with the exception of some carpentry works and blacksmiths. In the two villages, about 70% of the population used to be workers inside Israel. The main road to the villages is paved while internal roads are dirt and narrow. For health care, residents depend on one public clinic, a few private clinics, and no pharmacies.

- **Burin**: Located 5 km. south of Nablus. The economic activities of the village are predominantly related to skilled and nonskilled labor, and about 25% of the population works in agriculture, particularly olive trees. In this village, about 60% of the population used to be workers inside Israel. The main road to the village and internal roads are paved but narrow. No industrial or trade activities were reported in this village. Because of its proximity to Nablus, the inhabitants depend totally on the city. An electricity network is available, but no water or sewage networks. For health care, residents depend on one public clinic, a few private clinics, and no pharmacy.

- **Einabus**: A very small village near Huwarra that depends totally on Huwarra for all its economic and industrial activities. It is connected to the Huwarra electricity network. No industrial or trade activities were reported. About 60% of the population used to be workers inside Israel, and about 30% of the population depends on agricultural activities as the source of income.

- **Rujeeb**: 4 km. south of Nablus. About 30% of the active population works in agriculture, particularly olive trees and rain-fed cereals. Before the Intifada, the majority of the labor force worked inside Nablus city and in Israel. There is one government clinic.

- **Urif**: A small village with a poor economic situation compared to the others. Its location away from the main road of Nablus-Jerusalem has a direct effect on its economic activities, which are mainly agricultural, with olive and almond trees. It also has quarries for building stones that increase the opportunities for job creation. About 60% of the population used to be workers inside Israel. The main road to the village is paved and internal roads are paved but narrow. The health care situation is bad, with the village depending on the clinics in the nearby villages, mainly those in Huwarra.

- **Tell, Sarra and Iraq Burin**: Very close to Nablus city and linked totally with Nablus in their economic and trade situations. Only agricultural activities, including livestock and poultry, were reported in the three villages. The main crops are fig and olive trees as well as rain-fed crops that are usually sent to Nablus on a daily basis. Tell and Sarra have electricity grids while Iraq Burin has an internal generator that works for some hours during the day and night. In the three villages, about 50-60% of the population used to be workers inside Israel, and between 30-40% used to work in Nablus city, returning to their villages on a daily basis.

Agraba Cluster

- **Aqraba:** The biggest community in the cluster, 17 km. to the southeast of Nablus**,** it is considered to be the center for the surrounding villages. About 50% of the active population works in agriculture, particularly in livestock and diary products: cheese and yogurt. Some small businesses and trade activities are reported. Before the Intifada, the majority of this labor force worked inside Israel.

- **Awarta:** Located 8 km. south of Nablus. About 30% of the active population works in agriculture – mainly olive and almond trees. The people of this village are highly educated and work in both public and private sectors. Before the Intifada, the majority of this labor force worked inside Israel. There is one health clinic.

- **Duma:** Located 27 km. south of Nablus. About 30% of the active population works in agriculture, particularly olive trees, rain-fed cereals, and livestock. Before the Intifada, the majority of this labor force worked inside Israel. There is one medical center that needs to be equipped and one part-time clinic for the Al-Zakat Charity.

- **Jalud:** Located 24 km. south of Nablus. About 30% of the active population works in agriculture, particularly olive trees. Before the Intifada, the majority of this labor force worked in Israel.

- **Jurish:** Located 21 km. south of Nablus. About 30% of the active population works in agriculture, particularly olive trees. Before the Intifada, the majority of this labor force worked in Israel.

- **Majdal Bani Fadel:** Located 25 km. south of Nablus. About 30% of the active population works in agriculture, particularly olive trees, rain-fed cereals, and livestock. Before the Intifada, the majority of this labor force worked in Israel.

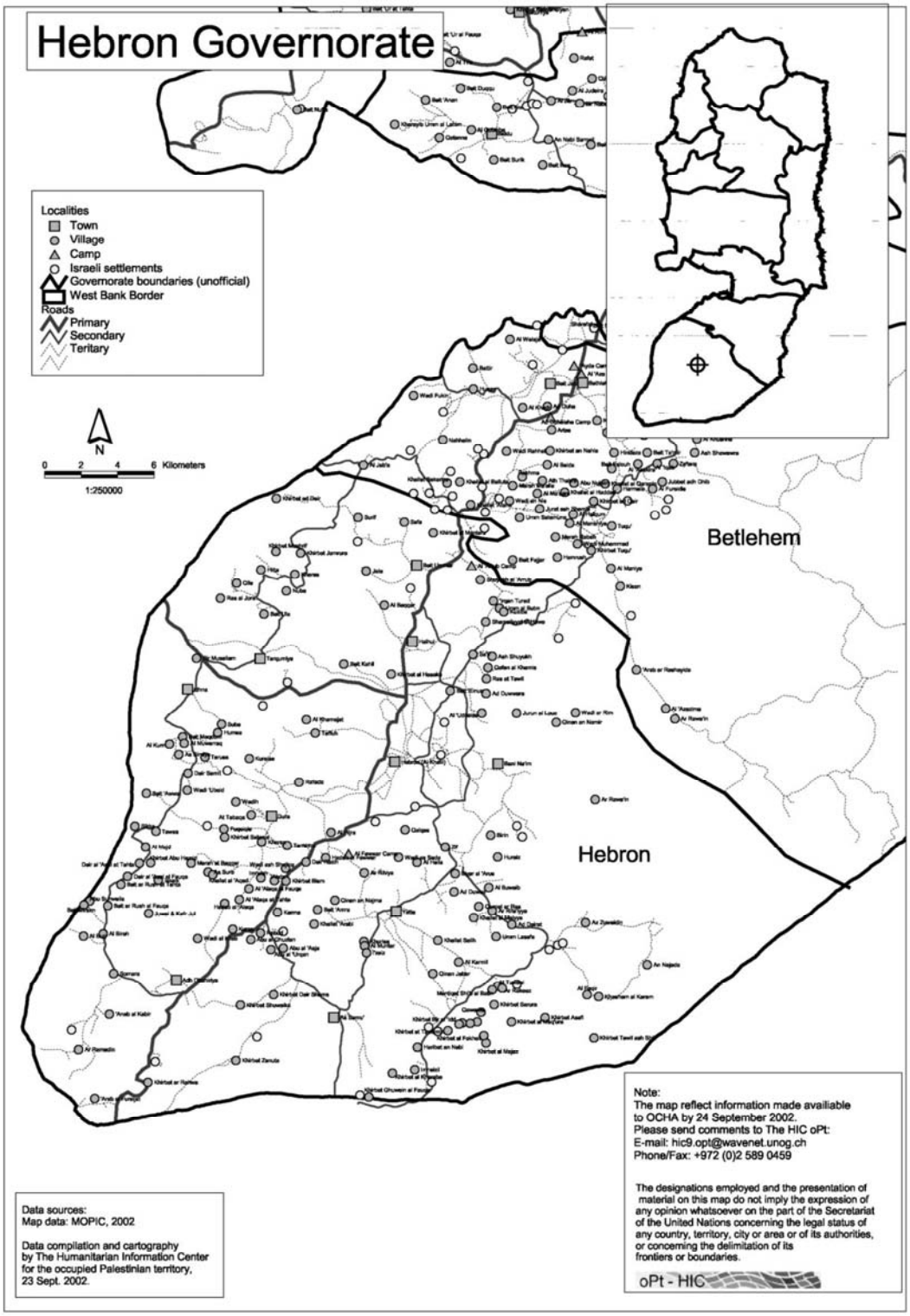
- **Usarin:** Located 22 km. southeast of Nablus. About 30% of the active population works in agriculture, particularly olive and almond trees. Many people of this village are highly educated and work in both public and private sectors. Before the Intifada, the majority of this labor force worked in Israel.

- **Qaryut:** Located 26 km. south of Nablus. About 30% of the active population works in agriculture, particularly olive trees. Before the Intifada, the majority of this labor force worked in Israel.

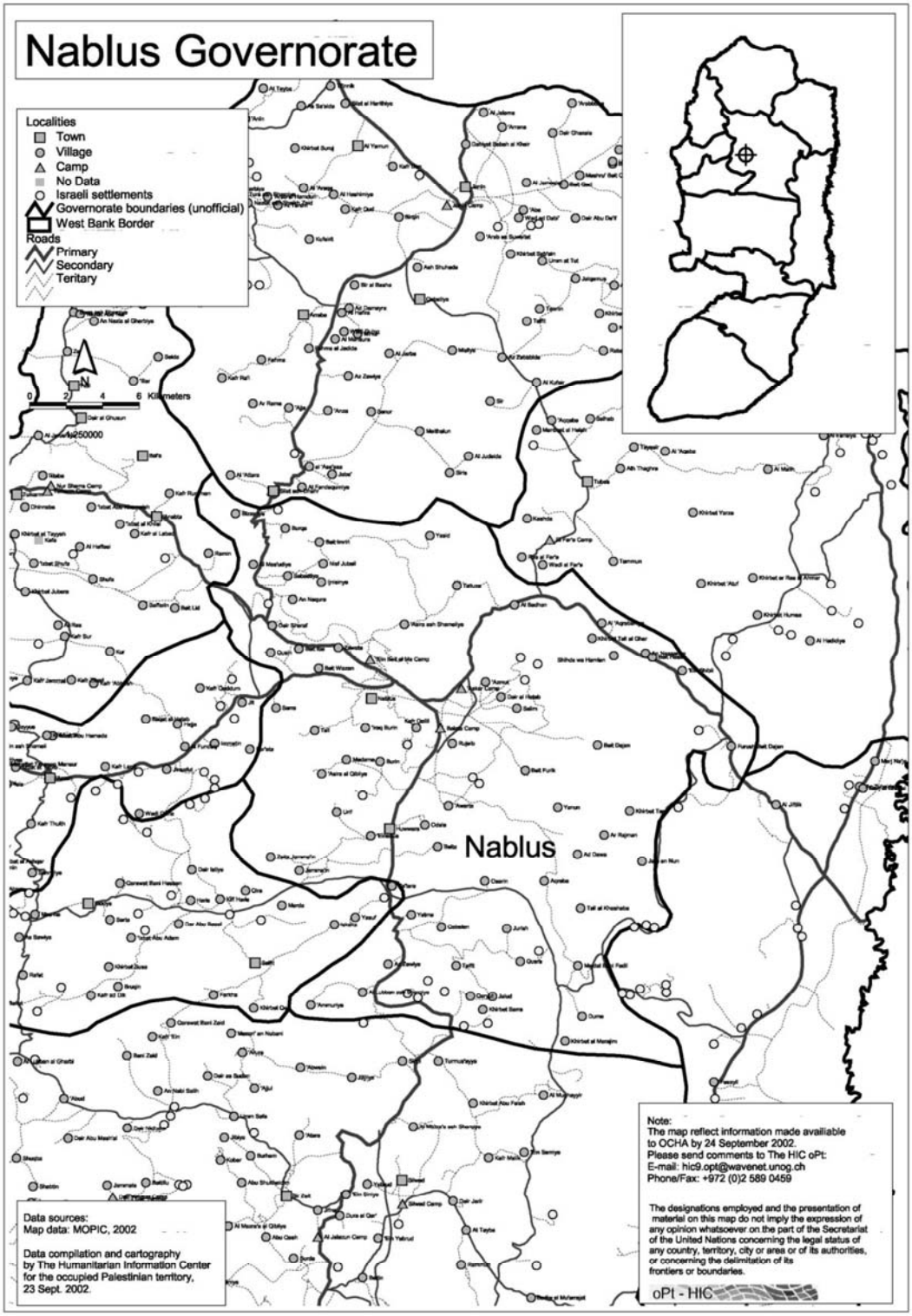
- **Qusra:** Located 24 km. southeast of Nablus. About 30% of the active population works in agriculture, particularly olive and almond trees. Qusra is considered the center for the surrounding villages of Jurish, Talfit, Jalud, and Qaryut. Light industrial activities and trade are practiced. Before the Intifada, the majority of this labor force worked in Israel.

- **Talfit:** Located 24 km. south of Nablus. About 30% of the active population works in agriculture, particularly olive trees. Before the Intifada, the majority of this labor force worked in Israel.

- **Yanun:** Located 3 km north of Aqraba, 15 km. to the southeast of Nablus. About 25% of the active population works in agriculture.



Map 3: from the United Nations Humanitarian Information Centre for the occupied Palestinian territory (2002)



Map 4: from the United Nations Humanitarian Information Centre for the occupied Palestinian territory (2002)

Appendix D—Sample Size and Significance Calculations

Sample Size

The household sample size formula used for the difference between proportions between Survey 1 and Survey 2 was the following:

$n = D(((Z_{1-\alpha/2}+Z_{1-\beta})^2(P_1Q_1 + P_2Q_2))/(P_2 - P_1)^2)(1-PR_{12})$ where:
D = design effect = 1 for a simple random sample (EPSEM).
$Z_{1-\alpha/2} = Z_{0.95}$ = 1.96 (2 - tailed) Alpha error (α) = Probability of rejecting H_0 when H_0 is true
$Z_{1-\beta} = Z_{0.8}$ = 0.84 (1 - tailed) Beta error (β) = Probability of not rejecting H_0 when H_A is true
Power (1-β) = Probability of rejecting H_0 when H_A is true
$Z_{1-\alpha/2} + Z_{1-\beta} = 2.8$

P_1 = Proportion at time 1
$Q_1 = 1 – P_1$
P_2 = Proportion at time 2
$Q_2 = 1 – P_2$

P = the proportion of overlap of households from surveys 1 to 2, ranging from 0-1. If P=0 then the term $(1-PR_{12})$ drops out and we are left with the standard formula for two independent populations.

Since D=2 and P=1 in our surveys, the above formula simplifies to:

$n = (((Z_{1-\alpha/2}+Z_{1-\beta})^2(P_1Q_1 + P_2Q_2))/(P_2 - P_1)^2)(1-R_{12})$

R = the correlation between the observations. The higher it is, the smaller the needed sample size. If it is zero, the term $(1-R_{12})$ drops out. The R used for comparing nominal with nominal data is the PHI or Cramer's V correlation coefficients

Assuming a small effect size (percentage difference of 10% -- e.g. from 40-50%) and a simple random sample, the formula for independent populations gives a sample size of n=384. If P = 0.8 and R_{12} = .5, then n would be adjusted to 230.

Statistical Significance

To test for significance in the differences in proportions between surveys 1 and 2, we can arrange the above formula to solve for Z.

$$Z = | P1\text{-}P2 | / (\sqrt{}((P_1Q_1 + P_2Q_2) / n)\sqrt{}(1 – R))$$

If the resulting number is less than 2.8, the difference is not statistically significant at the 0.95 level. We remind the reader that these mathematical manipulations only deal with statistical errors resulting from the random selection, not nonstatistical errors, which in some cases may be of a much greater concern.

Appendix E—Markov Chains

A Markov chain describes a change in the status of a variable over a period of time. Its simplest form – a first-order Markov chain – notes that the probability of the unit of analysis being in a particular status in time t+1 is a function of its status in the previous time t.

Using the discrete variable "up to date on paying electricity bill," we can see that four categories of households produced the proportion of 0.405 in Survey 2. They are as follows:

1. HH up to date in Survey 1, which remained up to date in Survey 2

2. HH up to date in Survey 1, which changed to not up to date in Survey 2

3. HH not up to date in Survey 1, which changed to up to date in Survey 2

4. HH not up to date in Survey 1, which remained not up to date in Survey 2

The result in time t+1 is calculated by multiplying the proportions of households in each status at time t by a matrix of transition probabilities (R) to find the proportions in each status at time t+1. Thus we see:

Up to date in Survey 1					Up to date in Survey 2	
	Yes	No		R	Yes	No
			⌜			
			| .516	.484 |	
0.512	0.488	| .291	.709 |	= 0.406	0.594	
		⌞		⌟		

The transition probabilities and number of households in each category can be read from the following table that SPSS produced from CROSSTABS of the variable in Survey 1 by the variable in Survey 2.

Most households did not change their status, with about one-half of those up to date at time t (143/277) remaining so at t+1. Seven of 10 not up to date at t (190/268) remained not up to date at t+1. Categories 2 and 3 represent households where a change in status occurred for this indicator. Almost half (134/277) of households lost their up-to-date status while almost one-third (78/268) not up to date at time t were so by the time of t+1. Thus for the changed households, the trend has been that the

situation has deteriorated for more households than for which it has improved, by the ratio of 1.7 (134/78)

F_15 = up to date variable at Survey 1 and F15 = up to date variable at Survey 2

Households with missing data in Survey 1 or Survey 2 were not included in the table

Appendix F—Key Household Informant

Village Water and Sanitation Project

Section I: Key Household Informant

The Palestinian Water Authority and USAID are now designing a project for household water supply and sanitation for a group of villages in West Hebron and Nablus pGovernorates. As part of the planning process, the Environmental Health Project and Save the Children have conducted a survey of households in villages, which are being considered for participation in the project. The purpose of the survey was to help ensure that the project meets the needs of the people of these villages for more and cleaner water, better sanitation and hygiene, and improved health.

The first survey was conducted in January 2002. The current survey aims at exploring changes in key variables related to household water and sanitation, household economy, and child health between January and September.

The questions asked of participating households included the following information:

- Information about the household and the people living there
- The current situation of water supply and sanitation
- A stool sample from young children to look for worms and other parasites
- Water samples to be tested for possible contamination that may cause disease

Households that will participate in this survey are those that participated in the first one. The information collected in this survey will be analyzed by computer for the project areas as a whole. Names and addresses of participants will not be included in the analysis or report, nor will information about your household be shared with anyone else. Participation is totally voluntary; if for any reason you do not wish to participate, this is your choice, and if you object to answering any specific question or questions in the questionnaire, this is also your choice. We hope that you will agree to participate. We are planning to return to participating households once as the project develops, so that we can track the achievements of the project.

The whole interview will take approximately 30 minutes and involve several members of your household. Would you be willing to participate? We would really appreciate your help. Do you agree to participate?

x

Interviewer, if the household refuses to participate, or if the survey cannot be done at the present time for other reasons, please record that refusal and report to your field supervisor by the end of the day.

A - LOCATION

A1: GOgovernorate : 1 – West Hebron 2 – Nablus ----------

A2: SETTLEMENT ----------

A3: QUESTIONNAIRE NUMBER ----------

A4: NAME OF HEAD OF HOUSEHOLD _____

A5: HOUSEHOLD ADDRESS _____

A6: Questionnaire Number in the first survey_____

B- HOUSEHOLD CHARACTERISTICS and ELIGIBILITY

B5: Children 0-59 months living here: YES NO ☐ ☐

B6: Caretakers of children 0-59 months living here: YES NO ☐ ☐

NUMBER OF VISITS TO HOUSEHOLD

	1	2	FINAL VISIT	* RESULT OF EACH VISIT
Date: DDMM	☐☐☐**02**	☐☐☐**02**	☐☐☐**02**	**1** - Completed **2** - Refused **3** - Partially completed, return visit not agreed to **4** – Partially completed, return agreed to **5** - People absent for extended period **5** - No eligible person present **6** - Dwelling empty **8** - Other _____
Interviewer ID	☐☐	☐☐	☐☐	
Result*	☐	☐	☐	
Next visit scheduled for Date: DDMM Time: HHMM	___ ___ / ___ ___ ___ ___ / ___ ___	___ ___ / ___ ___ ___ ___ / ___ ___		

C- SURVEY COMPONENTS COMPLETED FOR THIS HOUSEHOLD

C7 Household head interview completed:
YES ☐ NO ☐

C8 Caretaker interview completed:
YES ☐ NO ☐

C10 Stool sample agreed to for child 12-47 months?
YES ☐ NO ☐
NO CHILD ☐

C11 Water sample to be requested?
YES ☐ NO ☐

C12 Water samples agreed to?
YES ☐ NO ☐

FIELD VERIFICATION | **OFFICE VERIFICATION**

Interviewer Sect I	INTERVIEWER SECT II	Supervisor	Study Supervisor	Data Entry Specialist
__ __ **02**	__ __ **02**	__ __ **02**	__ __ **02**	__ __ **02**
PERSON'S ID __ __	PERSON'S ID __ __	PERSON'S ID __ __	**Person's ID** __ __	**Person's ID** __ __

E - Education, Employment and Occupational Status of Respondent			
The respondent may be the head of the household or another person who is familiar with household water supply, sanitation and electricity, along with household income and, expenditures.			
4	**Are you working full-time (30 hours or more per week) now?**	1 – yes ---------- ► 2 – no	8
5	**Are you working part-time or intermittently now?**	1 – yes 2 – no	
F - Electricity			
8	Now I would like to ask you some questions about your household electricity.		
1.	**Does your dwelling have electricity?**	1 – yes 2 – no ----------►	01 8
14	**About how much do you spend on electricity per month?** *May answer in Jordanian Dinars or in shekels (NIS).*	___ ___ ___ **JD** or **NIS** (*circle one*) 888 – Don t know 999 – Not answered	
15	**Are you up to date on paying your electricity bill?**	1 – yes ----------► 2 – no 8 – don't know ----------► 9 – not answered ----------►	18 18 18
16	**How many months ago did you last pay your electricity bill?**	___ ___ 88 – don t know 99 – not answered	
G - Water Supply			
18	**Now I would like to ask you some questions about your household water supply**.		
	In general, is the quantity of water that is available to your household sufficient for your daily needs? *If interviewee says "no," read out the answers and ask him/her to choose the most appropriate one.*	1 – yes 2 – insufficient at times 3 – covers only basic needs 4 – totally insufficient 5 – other _____ 8 – don't know	

PIPED WATER			
19	**Do you have a piped water connection?**	1 – yes 2 – no----------►	03 9
21	**Do you get all of your household water from the piped network?**	1 – yes 2 – no	
29	**Are you up to date on paying your water bill?**	1 – yes----------► 2 – no 8 – don't know ---------- ► 9 – not answered ---------- ►	39 39 39
30	**How many months ago did you last pay your water bill?**	___ ___ 88 – don t know 99 – not answered	
CISTERN			
ROOF TANKS			
39	**Do you have one or more roof tanks?**	1 – yes 2 – no ---------- ►	04 3
40	**How many roof tanks do you have?**	____ ____	
41	**How many m3 of water can these tanks store in total?**	___ ___ 88 – don t know	
42-a	**Do you own a pump for lifting water to the roof tanks?**	1 – yes 2 – no 8 – don t know	
42-b	**How many roof tanks have been damaged in your household through the incursion?**	- Non ---------- ► - Number of damaged roof tanks: ___ ____	43
42-c	**How many of the damaged roof tanks have you repaired?**	Number of repaired roof tanks: ____ ____	
TANKER WATER			
43	**Have you used tanker water during the past 12 months?**	1 – yes 2 – no ----------► 8 – don't know ----------►	46 46

44	**In what currency do you pay for water?**	1 - Dinars 2 - Shekels	

45. NOW I WOULD LIKE TO TRY TO DEVELOP AN ESTIMATE OF THE TOTAL AMOUNT OF TANKER WATER YOU BUY OVER THE YEAR, AND HOW MUCH IT COSTS YOUR HOUSEHOLD.							
CONSUMPTION OF TANKER WATER DURING LAST WINTER AND LAST SUMMER							
Season	TANKER CAPACITY						
	10 m^3		**3 m^3**		**Other m^3**		
	# loads	**cost/load (Includes pumping)**	**# /loads**	**cost/ load (Includes pumping)**	**# of cubic meters**	**# loads**	**cost/load (Includes pumping)**
Winter Nov 2001 – Apr 2002							
Summer May 2002– Aug 2002							

THERE MAY BE A NEED FOR RECALCULATION THE TANKER WATER CONSUMPTION PER MONTH TO ENABLE COMPARISONS WITH THE PREVIOUS FIGURES!!!!!!!

46.	**Does your household use any water sources other than piped water, rainwater or tanker truck?**	1 – yes 2 – no ----------► 8 – don't know----------►	 69 69
WATER FROM WELLS, SPRINGS, STANDPIPES AND SURFACE SOURCES			
47.	**Which other water sources do you use?** *Multiple responses accepted* *Read out all responses* *"Protected" means that the well has an enclosure with lid or a spring has a spring box and outflow. .	1 – protected* Roman well 2 – unprotected Roman well 3 – protected* spring 4 – unprotected spring 5 – borehole or tube well 6 – public standpipe 7 – surface water (river, stream, lake, dam) 8 – other **If only one source is cited then ----------►**	 49
48.	**Which of these sources do you use most often?** *Enter one response only.*	1 – protected* Roman well 2 – unprotected Roman well 3 – protected* spring 4 – unprotected spring 5 – borehole or tube well 6 – public standpipe 7 – surface water (river, stream, lake, dam) 8 – other _____	
49.	**Who generally collects the water from this source?** *Multiple responses accepted* *Read out all responses*	1 – adult male of household (age 15 and up) 2 – adult female of household (age 15 and up) 3 – children of household 4 – anyone of household who is free 5 – other _____	
50.	**How is the water brought to the house?**	1 – already on premises 2 – carried by hand 3 – carried by animal 4 – by wagon 5 – other _____	
51.	**In what type of container is the water carried?**	1 – gallon (plastic or metal) 2 – bucket 3 – drum/barrel 4 – jerry can 5 – other _____	

52.	**What is the approximate volume in liters of:** (*D/K - don't know*) *If these are containers of standard size and consistently used by all households, this does not have to be asked during the survey, but can be calculated at time of date entry.*	1 – gallon---------- _____ ltr 2 – bucket ---------- _____ ltr 3 – drum/barrel ---------- _____ ltr 4 – jerry can---------- _____ ltr 5 – other _____ _____ ltr	
53.	**How many of these containers are carried at a time?**	___ ___	
54.	**How many loads do you fetch per week?**	___ ___	
55.	**Do you use this water source all year around?**	1 – yes ---------- ► 2 – no	57
56.	**How many months of the year do you use this source?**	___ ___	
57.	**How far is the water source from your house?** *One response only.* *If response does not fit these categories, read out all responses.*	1 – already on premises 2 – across the street or neighbor 3 – 200 meters or less 4 – one kilometer or less 5 – over 1 kilometer 8 – don't know	
58.	**How long does it take to get from your house to the water source?** *One response only.* *Read out all responses.*	1 – on premises 2 – 1 minute or less 3 – over 1 minute, not more than 5 min. 4 – over 5 min., not more than 20 min. 5 – over 20 minutes 8 – don't know	
59.	**Do you <u>usually</u> have to wait in line before you can fill your containers?**	1 – yes 2 – no ----------►	61
60.	**Approximately how long do you <u>usually</u> have to wait?** *One response only.* *Read out all responses.*	1 – 5 minutes or less 2 – 20 minutes or less 3 – one hour or less 4 – if over one hour, specify: _____ hrs 8 – don't know	
61.	**How long does it <u>usually</u> take to fill a load of water from the source?** *One response only.* *Read out all responses.*	1 – 5 minutes or less 2 – 20 minutes or less 3 – one hour or less 4 – if over one hour, specify: _____ hrs 8 – don't know	
69	**Now I would like to ask a few questions about your drinking water.**		

	Do you feel that your water supply is safe for drinking?	1 – yes ----------► 2 – no 8 – don't know ----------►	071 71
70	**Why do you feel that the water is not safe for drinking?** *Do not read out responses, but when respondent answers, ask if there is anything else, until respondent has nothing else to say. Multiple responses accepted.*	1 – contains dirt 2 – contains chemical pollutant 3 – contains bacteria 4 – tastes salty 5 – tastes bad 6 – not clear, sediments 7 – is colored 8 – animals come in contact 9 – other _____ 10 – don't know	
71	**Do you do anything to treat your water so it will be safe for drinking?**	1 – yes 2 – no ----------►	 94
72	**What do you do to treat your drinking water?** *One answer only.* *If respondent gives more than one means of treating drinking water, ask which is the main way used.*	1 – boil it ----------► 2 – filter ----------► 3 – add chlorine (tablets, powder or liquid) 4 – other _____ _____ ----------►	94 94 94
73	**Where do you add chlorine?**	1 – cistern 2 – tank 3 – storage container 4 – other _____	
74	**How often do you add chlorine?**	1 – when cistern is filled 2 – every week 3 – every month 4 – longer period_____ 5 – other _____	
75	**Do you add chlorine during the rainy season?**	1 – yes 2 – no	

I - Household Economy			
94	**How many people in this household are employed full-time (30 hours/week or more)**	___ ___ 88 – don't know 99 – not answered	
95	**How many people were employed full-time (30 hours/week or more) before the current *Intifada*?**	___ ___ 88 – don't know 99 – not answered	
96	**How many people are now working part time or intermittently?**	___ ___ 88 – don't know 99 – not answered	
99	**What was this household s income last month?** *May answer in Dinars or Shekels*.	___ ___ ___ ___ **JD** or **NIS** (*circle one*) 8888 – don t know 9999 – not answered	
100	**Have you sold any property belonging to the household (or personal property) since the beginning of the current Intifada in order to help support the household?**	1 – yes 2 – no 8 – don't know 9 – not answered	
101	**Have you borrowed money since the beginning of the current in order to help support the household?**	1 – yes 2 – no 8 – don't know 9 – not answered	

133	***K – Garbage Disposal***		
	How do you dispose of your garbage? *One answer only.* *Do not read out answers.*	1 – garbage collector takes 2 – municipal box 3 – burn 4 – throw in a distant place 8 – other _____ 9 – don't know	
	L - Sanitation and Hand washing Observations		

	M - WATER SAMPLES		
164	*Is this household included in the water sample group? yes no----------►*		end
165	**We would like to test the water in your house for quality. If you agree to that, we will send someone to collect specimens of your water, and we will inform you of the results of the test. It may take several weeks for these results to arrive. Are you willing to have your water tested?**	1 – yes 2 – no ---------- ►	end
166	Fill out water sample form before leaving house		

End: Thank you very much for participating in this survey!

Appendix G—Interview of Caretaker of Child Age 0-59 Months

Village Water and Sanitation Project

Section II: Interview of Caretaker of Child Age 0-59 Months

Using your copy of the household form, enter the codes and names of the people randomly chosen to participate in the study.

Primary caretaker of children 0-59 months old		Child 12-47 months old taken care of by person in column A	
A		B	
Code	Name	Code	Name

A **Primary Caretaker of children 0-59 months old**: This is the person with the primary responsibility for at least one child 0-59 months old. If there are more than one, then one has been randomly chosen and checked in Column D9 in the Household Person List in the Head of Household Questionnaire. Repeat the line number (D1) and Name (D2) here.

B **Child 12-47 months old**: This is a child for whom the primary caretaker is the person chosen above. If there are more than one, then one has been randomly chosen and checked in Column D11 in the Household Person List in the Head of Household Questionnaire. Repeat the line number (D1) and Name (D2) here. This is the child, for whom a stool test will be requested. If there is no child in this age, record that and complete the rest of the questionnaire

If any one of these persons is unavailable, then a return appointment can be made -- marking the cover page of Section I with the date and time for return -- otherwise another eligible person can be randomly chosen.

I would like to ask you some questions about your child(ren),

2. K - CHILD FORM FOR ALL CHILDREN 0 – 59 MONTHS

Use a second page if necessary – Enter data on child whose stool sample is to be taken under "Child 1", if there is no child in this age, then leave column one empty and fill the table starting from column 2

Questions [note that Child 1 is the child whose caretaker was interviewed, and for whom a stool sample was requested]	Children															
	Child 1		**2**		**3**		**4**		**5**		**6**		**7**		**8**	
1 Name of child																
2 ID# of child																
3 Age of child in months (2 digits)																
4 ID # of caretaker (2 digits)																
5 First name of caretaker																
6 Caretaker available for interview?	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**
Questions for Children 0-59 months whose Caretakers are Present and can be Interviewed																
8 Has this child taken worm medicine during the past 6 months?	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**
9 Has this child had diarrhea during the last 2 weeks? (diarrhea = 3 or more liquid stools in a 24 hour period)	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**
QUESTIONS FOR CHILDREN 0-59 MONTHS WHO HAVE HAD DIARRHEA IN THE PAST TWO WEEKS (Q9 =YES)																
10 For how many days did this diarrhea last? (2 digits)	— —		— —		— —		— —		— —		— —		— —		— —	
13 11 Does the child still have diarrhea today? (1=yes, 2=no, 3=don't know)	**1 2 3**		**1 2 3**		**1 2 3**		**1 2 3**		**1 2 3**		**1 2 3**		**1 2 3**		**1 2 3**	
12 Was there blood in the child's stool? (1=yes, 2=no, 3=don't know)	**1 2 3**		**1 2 3**		**1 2 3**		**1 2 3**		**1 2 3**		**1 2 3**		**1 2 3**		**1 2 3**	
13 Was there mucus in the child's stools? (1=yes, 2=no, 3=don't know)	**1 2 3**		**1 2 3**		**1 2 3**		**1 2 3**		**1 2 3**		**1 2 3**		**1 2 3**		**1 2 3**	
14 How much liquid did you give the child while he had diarrhea? (1=same as usual, 2=less, 3=more)	**1 2 3**		**1 2 3**		**1 2 3**		**1 2 3**		**1 2 3**		**1 2 3**		**1 2 3**		**1 2 3**	
15 How much food did you give the child while he had diarrhea (1=same as usual, 2=less, 3=more)	**1 2 3**		**1 2 3**		**1 2 3**		**1 2 3**		**1 2 3**		**1 2 3**		**1 2 3**		**1 2 3**	
16 Did the child receive any treatment for diarrhea in the last two weeks? (1=yes, 2=no, 3=don't know)	**1 2 3**		**1 2 3**		**1 2 3**		**1 2 3**		**1 2 3**		**1 2 3**		**1 2 3**		**1 2 3**	

Questions for Children 0-59 months who had Diarrhea in the past 2 weeks who were Treated (Q9 = YES and Q16 = YES)																
What treatment did the child receive? [***Interviewer: Do not read out answers, but each time the mother gives an answer, ask if there is anything else until she says no.***]																
17 Saw doctor	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**
18 Saw other health professional	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**
19 Took medication prescribed by doctor	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**
20 Took medicine on recommendation of pharmacist or neighbor	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**
21 Took medicine already present in house	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**
QUESTIONS FOR CHILDREN AGE 11 MONTHS AND YOUNGER ONLY																
22 Was this child ever breastfed?	Y	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**
23 Was s/he exclusively breastfed (i.e. took no food or liquids other than breastmilk) [*if no, go to Q 25*]	Y	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**
24 Until what age in months was s/he exclusively breastfed [two digits]	__ __		__ __		__ __		__ __		__ __		__ __		__ __		__ __	
25 Does this child receive any liquids by bottle?	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**
26 Does this child drink any water, whether alone or mixed with formula or other fluids?	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**

297 Ask this question only of Child 1, the child whose caretaker has just been interviewed

May we take a stool sample for this child and analyze it for intestinal parasites? If you agree, we will give you a copy of the results when they are ready.	Y	N	THANK YOU VERY MUCH FOR YOUR HELP WITH THIS SURVEY!
If No, then the interview is over If Yes, Fill out the stool collection form and leave the collection cup with the caretaker before leaving house: **Be careful to correctly write the identification variables (governorate, settlement, household and interviewer).**			

Thank you very much for participating in this survey!

Interviewer: Immediately upon leaving house, compare notes with the interviewer for the Head of Household questionnaire.			
299	Is there garbage in front of this house?	1 – yes 2 - no	End