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WASTEWATER TREATMENT FACILITIES FOR SMALL COMMUNITIES IN JORDAN

TASK 3
FINAL ENVIRONMENTAL ASSESSMENT
NORTH SHOUNEH

سلطة المياه
WATER AUTHORITY

November 2005

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NORTH SHOUNEH

Prime Contract EPP-I-00-03-00013-00
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DISCLAIMER

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Executive Summary

The Water Authority of Jordan with the support of USAID plans to implement a low-maintenance wastewater treatment and reuse (WWT&R) project in North Shouneh using proven, appropriate technology. This WWT&R project is part of the wider USAID-funded activity, Wastewater Treatment Facilities for Small Communities in Jordan (the "Small Communities Project"). This report presents the Environmental Assessment for the project in North Shouneh. A separate Final Feasibility Study Report has also been submitted.

EA methodology

The project team conducted a scoping session on February 23rd, 2005 at the Offices of the Northern Jordan Valley Administrative Governor (Mutasarrifiya) in North Shouneh and submitted a scoping statement immediately thereafter. This draft EA report was researched and prepared on the basis of the MoE and USAID approved scoping statement by a multidisciplinary team of seven specialists with proven EA experience in Jordan under the supervision of the Chief of Party. The team visited the sites on several occasions, collected and interpreted data from several official sources and consulted numerous stakeholders to identify all significant environmental concerns and mitigation measures.

Major project stakeholders consulted regularly since the inception of the project include the JVA, WAJ, the MWI, the Municipality of Muath Bin Jabal (MBJ), several local community leaders, the MoI (Mutassarif) and septage tanker operators. Additional consultations have also taken place with several other stakeholders including the MoE, MoH, the Military, the MoA, DoA, other municipalities, environmental organizations, research institutes and several members of the general public.

Description of the proposed project

The proposed service area

The proposed WWTP will serve communities that lack sewage collection networks and depend on septage tanker trucks for the collection and disposal of their wastewater. Initially, the proposed WWTP will serve a large geographical service area. It will receive septage from communities under the jurisdiction of Northern Jordan Valley Sub-Directorate (e.g. municipalities of Mu'ath Bin Jabal, Tabqit Fahel, Sharhabeel Bin Hasna) as well as some of the septage from communities in the eastern uplands within Taybeh and Kura municipalities. The service area will gradually shrink thereafter as population increases and will need to be further restricted during the summer when septage quantities are at their highest.

As such, the WWTP will serve up to 80,000 people. The plant is expected to begin operations in 2008 and is designed for a 20-year time horizon (i.e., until 2028) with an influent capacity of 1,200 m3/day of septage.

The proposed WWTP site

The proposed WWTP site is located about 5 km southwest of North Shouneh town center, 230 meters below sea level, in the narrow strip of land available in northern parts of the Northern Jordan Valley (NJV) within the Irbid Governorate. The site boundary is 50 meters from the international border with Israel and is therefore associated with a heavy military presence and lies within areas explicitly referred to in the Jordan-Israel Peace Treaty.

The property (slightly over 300 Dn) was selected in consultation with a wide range of stakeholders as one of the only government-owned properties in the area that satisfied several environmental and economic criteria and is large enough to host a WWT&R project for the targeted service area.

The proposed WWTP technology

Following a rigorous comparison of several treatment alternatives, the detailed design of the WWTP in North Shouneh will be based on: screening and grit removal; anaerobic basins; denitrification reactors; recirculating sand filters; constructed wetlands; sludge drying beds; and a storage lagoon/polishing pond. These consecutive treatment steps are required to treat the influents (1,850 mg/l BOD, 7,353 mg/l COD, 6424 mg/l TSS and 322 mg/l TKN) to the required effluent standards.

Effluent reuse

The water reuse activity will maximize on-site reuse revenues within given land constraints (about 140 Dn available for cultivation) to help recover O&M costs and to serve as a reuse demonstration. Any reclaimed water not used on the site will be used for irrigation on nearby agricultural land. Accordingly, the WWTP will be designed to meet Class B - "Fruit Trees, Sides of Roads outside city limits and landscape" standards (JS 893/2002, refer to appendix B).

Potential impacts, mitigation measures and environmental management

The overall net impact of the project on the environment in the area will be positive. Potential adverse impacts, mostly limited to the area immediately surrounding the WWTP, have nonetheless been comprehensively identified and assessed. Specific mitigation measures are proposed that ensure potential impacts are minimized.

Positive impacts

The project will result in several positive impacts on the local environment and communities. Most significant of these are that it will: reduce the costs borne by households to empty cesspits (currently between JD20 and JD45 per trip) by providing a nearby, long-term WWTP solution that will receive and treat septage in an environmentally friendly manner. It will improve public health/sanitation and protect soil and water resources in the region by minimizing current cesspit overflows and controlling current tanker disposal practices. The project planning process included measures to enhance these and other potential positive impacts. The design will provide further enhancement of positive impacts as will the environmental management plan using the long-term operations.

During construction

As with all infrastructure projects, the potentially significant adverse impacts during construction include noise and air quality deterioration from earthworks and transportation, impacts from the disposal of excavated materials and construction waste as well as health and safety hazards. The site also borders a restricted area with landmines. The mitigation measures proposed include strict coordination with the military, carefully designing and planning earth works and a construction transport management plan, implementing various measures to minimize dust generation and noise, ensuring appropriate separation, handling and disposal of wastes, health screening of labor for infectious diseases as well as requiring various other health and safety measures to be implemented.

There is also the risk of potentially disturbing archaeological sites, however this risk is low and the project team will coordinate with the DoA as required prior to and during construction. The construction site itself is also at risk from erosion, however an evaluation of the site and the design and implementation of necessary erosion/runoff control will minimize this risk if construction is to carry through to the winter. With such mitigation measures, discussed and specified in detail in this report, all residual adverse impacts will be minimized.

During operation

Potential adverse impacts during operation are similar to typical wastewater treatment plants and include odor emissions, pollution from sludge disposal, improper effluent reuse, contamination from accidental spills, overflows and seepages, an increase in pests and occurrence of parasitic diseases as well as health and safety hazards. The potential cumulative impact of TWW reuse on water resources in the immediate area is insignificant in comparison with those from other stressors.

Mitigation measures proposed include a major focus on odor minimization and control in the WWTP design, conservative design with high operational flexibility to ensure being able to continuously meet effluent and sludge standards, including several hydraulic safeguards as appropriate, disease vector and pest control management as well as requiring various other standard health and safety procedures. Planned groundwater monitoring and early warning systems will help protect the water resources in the immediate area. These systems and other mitigation measures will also assure rapid remediation of any unanticipated adverse effects.

Risks to the WWTP structures and its appropriate operation

The project area is within one of the most active earthquake zones in Jordan and will therefore be designed and built with strict adherence to the relevant Jordanian building codes (Zone A). The military may also temporarily restrict access to the site for security reasons. Therefore, the project will include provision for building a dedicated off-site receiving facility if needed in the future. Several other risks that may hinder normal operations include receiving non-residential septage, volumetric flow imbalances and sub-optimal operating capacity, flooding and power failures. The project design and operating procedures will include emergency response procedures and specific contingency plans for each of these risks to ensure adequate protection of the environment.

Environmental management and monitoring

This report presents a meticulous environmental management and monitoring plan (EMMP) to ensure environmentally sound project implementation, monitoring and follow-up with responsibilities and timings assigned for each particular mitigation measure. This EMMP must be continuously revisited by the project team, contractor, Municipality and other concerned stakeholders to ensure it is being implemented, remains up to date and is adjusted where and when necessary to keep potential adverse impacts at a minimum.

Table of Contents

Executive Summary i
List of Tables vii
List of Figures viii
Acronyms and Abbreviations ix

1. INTRODUCTION 1
1.1. Background to the Small Communities Project 1
1.2. Purpose of the EA 2
1.3. Methodology 2
1.4. Report Organization 3

2. ANALYSIS OF ALTERNATIVES AND DESCRIPTION OF THE PROPOSED PROJECT 4
2.1. Overview of the potential service area and need for the project 4
2.1.a. The no action alternative 5
2.2. Design capacity, service area and phasing 5
2.2.a. Proposed design capacity and service area 6
2.2.b. Phasing, Expansion & Decommissioning 6
2.3. Alternative WWTP sites 7
2.3.a. Comparative analysis of site alternatives 9
2.3.b. The preferred and selected site 10
2.4. WWTP technology 13
2.4.a. Screening of WWTP technology alternatives 13
2.4.b. Analysis of WWTP alternatives 14
2.4.c. The design criteria and preferred WWTP treatment trains 17
2.4.d. Built-in mitigation measures 20
2.5. Treated water reuse strategy 21
2.6. Summary of construction & operational activities 22

3. LEGAL AND INSTITUTIONAL FRAMEWORK 24
3.1. Relevant laws & regulations 24
3.1.a. Environmental Protection and EIAs 24
3.1.b. Other Environmental Policies & Controls 24
3.1.c. International Treaties 26
3.2. Relevant standards 27
3.3. Institutions 27
3.3.a. Monitoring and Surveillance 27

3.3.b. Wastewater treatment and reuse 28
3.3.c. Special considerations in Jordan Valley 29

4. DESCRIPTION OF THE EXISTING ENVIRONMENT (AFFECTED AREAS) 30

4.1. The Study Area 30
4.2. Human Environment 30
4.2.a. Demographics 30
4.2.b. Septage generation, collection and disposal 31
4.2.c. Economy and living standards 32
4.2.d. Agriculture 33
4.2.e. Land-use, community infrastructure & services 33
4.2.f. Archeology 34
4.3. Physical Environment 34
4.3.a. Climate 34
4.3.b. Topography and Soils 36
4.3.c. Water resources and hydrogeology 36
4.3.d. Seismicity 43
4.4. Biological Environment 43
4.4.a. Habitats and ecosystems 44
4.4.b. Flora 44
4.4.c. Fauna 44
4.4.d. Disease vectors 45

5. ASSESSMENT OF IMPACTS AND PROPOSED MITIGATION MEASURES 47

5.1. Positive impacts and their enhancement 47
5.1.a. Reduced tanker charges relative to the no-action alternative 47
5.1.b. Improved public health, sanitation and pollution prevention in the wider area 47
5.1.c. Employment opportunities 48
5.1.d. Change in land values 48
5.1.e. Demonstration of water reuse and improved public perception 48
5.1.f. Prospect for sewage system in the future 48
5.2. Potential adverse impacts during construction and their mitigation 48
5.2.a. Air quality and noise pollution 48
5.2.b. Disposal of construction wastes and handling of hazardous materials 49
5.2.c. Health & safety (H&S) 50
5.2.d. Change in local hydrology, soil erosion, structural and earthquake risks 50
5.2.e. Archeological disturbance 51
5.2.f. Ecological disturbance 51
5.3. Potential adverse impacts from WWTP&R operations and their mitigation 52
5.3.a. Soil and water resource contamination in general 52
5.3.b. Contamination from accidental spills, overflows and seepages 52
5.3.c. Contamination from reuse of TWW in irrigation 53
5.3.d. Contamination from sludge reuse and disposal 53
5.3.e. Odors 54

5.3.f. Changes to local ecology 54
5.3.g. Inequality of socio-economic impacts 55
5.3.h. Health & safety 55
5.3.i. Diseases vectors 56

5.4. Risks to the WWTP structures, its operation and their mitigation 57
5.4.a. Earthquakes 57
5.4.b. Non-residential septage and/or sudden deteriorations in effluent quality 57
5.4.c. Volumetric flow imbalance and sub-optimal operating capacity 58
5.4.d. Flooding and erosion 58
5.4.e. Total power failure 59
5.4.f. Restricted access to the WWTP 59

6. ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN 60

6.1. Monitoring requirements 60
6.1.a. Effluent and sludge quality 60
6.1.b. Groundwater level and quality 61
6.1.c. Health and Safety 61
6.2. Emergency response and contingency plans 61
6.3. Construction transport / waste disposal plans 62
6.4. Environmental management and monitoring plan summary table 63

7. CONCLUSIONS 68

7.1. Positive impacts 68
7.2. Potential adverse impacts and their mitigation 68
7.2.a. During construction 68
7.2.b. During operation 69
7.2.c. Risks to the WWTP structures and its appropriate operation 69
7.3. Environmental management and monitoring plan 70

List of Tables

Table 1 Key Advantages & Disadvantages of Site Location Alternatives in N. Shouneh 9
Table 2 Advantages and disadvantages of various treatment systems 13
Table 3 Summary comparisons of key technical and economic data for all alternatives 16
Table 4 Design septage influent quality 17
Table 5 Climate and water temperature (°C) design assumptions 17
Table 6 Tentative effluent discharge standards 18
Table 7 Tentative specifications of the preferred WWTP technology option 19
Table 8 Tentative on-site cultivated area and use of TWW 22
Table 9 List of other relevant National Laws and Regulations 25
Table 10 Treaties, Conventions and International Agreements Related to Environment and Resources 26
Table 11 Service area households, populations and population projections (2004 – 2030) 31
Table 12 Septage estimates and projections (2004 – 2030) 31
Table 13 Climatic profile of North Shouneh region 35
Table 14 Lithological Succession in Northern Jordan including NJV 39
Table 15 Data on wells 42
Table 16 Data on springs 42
Table 17 Effluent Quality Monitoring 60
Table 18 Preliminary emergency response procedures 62
Table 19 EMMP Summary Table 64
Table 20 Population and household data by community C-1
Table 21 Prevailing Monthly Wind Direction (Degree) C-2
Table 22 Mean Monthly Wind Speed "Knot" C-2
Table 23 Plant Species Recorded/Observed in Study Area E-1
Table 24 Mammal Species Recorded/Observed in Study Area E-2
Table 25 Land Amphibians Species Recorded in the Study Area (Reptiles) E-2
Table 26 Potential Bird Species in Project Area E-2

List of Figures

Figure 1 The NJV: its main towns and location within Jordan 4
Figure 2 Map of the five potential site area locations 8
Figure 3 The Selected WWTP Site 12
Figure 4 Simplified process flow diagram for Alternatives 1 & 2 15
Figure 5 Simplified process flow diagram for Alternatives 3 & 4 15
Figure 6 Simplified tentative water mass balance 20
Figure 7 Potential archeological sites within a 1km radius of the proposed site 35
Figure 8 Topography of the site and surrounding area 37
Figure 9 Soil Map of the localized study area 37
Figure 10 Simplified Geologic Map of Project Area (incl. Aquifers) 38
Figure 11 Groundwater Flow in NJV: Equipotential Lines of the Intermediate (B2/A7) Aquifer System 40
Figure 12 Distribution of groundwater wells in North Shouneh Area 41
Figure 13 Preliminary WWTP layout A-1
Figure 14 Preliminary process flow diagram A-2
Figure 15 Preliminary hydraulic profile A-3

Acronyms and Abbreviations

AIPS	Advanced Integrated Pond Systems
AL	Aerated Lagoons
AS	Activated Sludge
asl	Above Sea Level
BAF	Biological Aerated Filters
CW	Constructed Wetlands
Dn	Dunums (1 Dn = 0.1 Hectares = 1,000 m^2)
EA	Environmental Assessment
EPIQ II	Environmental Policy and Institutional Strengthening Indefinite Quantity Contract II
FS	Feasibility Study
JD	Jordanian Dinar (1 JD = 1.41 USD)
KAC	King Abdullah Canal
MBJ	Mu'ath Bin Jabal (Municipality)
MBR	Membrane Bioreactor Systems
MWI	Ministry of Water and Irrigation
NGO	Non Governmental Organization
NJV	Northern Jordan Valley
OD	Oxidation Ditch Systems
O&M	Operation and Maintenance
RSF	Recirculating Sand Filters
TF	Trickling Filters
TWW	Treated Wastewater
UASB	Up-flow Anaerobic Sludge Blanket
USAID	United States Agency for International Development
WAJ	Water Authority of Jordan
WSP	Waste Stabilization Ponds
WWT	Wastewater Treatment
WWTP	Wastewater Treatment Plant
WWT&R	Wastewater Treatment and Reuse

1. INTRODUCTION

In support of the people and Government of Jordan, USAID plans to finance the implementation of a low-cost low-maintenance wastewater treatment and reuse (WWT&R) project in North Shouneh. This is a four-year project implemented for the Water Authority of Jordan by IRG and ECODIT under the USAID Environmental Policy and Institutional Strengthening Indefinite Quantity Contract II (EPIQ II). In accordance with USAID (22 CFR 216) environmental review requirements, an initial environmental examination (IEE) prepared by USAID Jordan in August 2004 requires a full environmental assessment (EA) to be carried out for the proposed project. This report presents the EA, which is a detailed study of the reasonably foreseeable significant effects, both beneficial and adverse, of a proposed action on the environment.

1.1. Background to the Small Communities Project

The WWT&R project in North Shouneh is part of the wider activity, Wastewater Treatment Facilities for Small Communities in Jordan (the "Small Communities Project"). The Small Communities Project will design, supervise and construct proven low-cost/low-maintenance, septage-based wastewater treatment plants (WWTP) to serve Shobak and North Shouneh (both communities lack sewage collection networks).

The Jordanian Wastewater Management Policy states that central treatment plants shall be built to serve semi-urban and rural communities and collection of wastewater shall be made initially through trucking until such a time when collection systems (such as an underground piping network) are justified. Trucking wastewater to the central treatment plants eliminates the need for expensive collection infrastructure and provides flexibility in selecting sites. It also facilitates a "community cluster approach," serving several neighboring rural communities.

The Small Communities Project will also develop local capacity to operate and maintain the facilities in a sustainable manner after the project ends, turn over the operation and maintenance of these facilities to local bodies (Municipality, Village Councils, Private Sector, etc.), and create the framework to secure reuse of the treated wastewater (TWW). This will serve as a model for other areas in Jordan. The Project began in the summer of 2004, will span four years and covers a scope of work comprised of the following detailed tasks:

Task 1: Conduct preliminary planning activities (& select communities to work in);

Task 2: Prepare a feasibility study;

Task 3: Conduct a Scoping Session and prepare an EIA;

Task 4: Establish "institutional partnerships" and cost recovery mechanisms;

Task 5: Prepare detailed engineering design/drawings and bid documents;

Task 6: Select contractors and supervise construction;

Task 7: Monitor plant operations and the quality of treated effluents;

Task 8: Implement the wastewater reuse components;

Task 9: Provide capacity building and training related to the projects;

Task 10: Assist the Government of Jordan in the formulation of policies, guidelines, and standards related to WWT&R; and

Task 11: Prepare final report including lessons learned.

1.2. Purpose of the EA

Consistent with USAID environmental regulations 22 CFR Part 216 and Jordanian draft EA guidelines, the objectives of this EIA are to:

1) Assess and analyze the significant environmental issues related to the project;
2) Describe and compare project alternatives;
3) Identify and describe the positive and potential adverse impacts of the project on the environment; and
4) Propose measures to mitigate the potential adverse impacts and formulate a monitoring program with clear distribution of responsibilities. The EA is also a planning tool to minimize negative environmental impacts by enhancing the project design.

According to the IEE prepared by USAID Jordan in August 2004, all of the above project tasks with the exception of Task 6 and Task 8 qualify for "Categorical Exclusions" per 22 CFR 216.2(c)(2)(iii), (xiv), (xv) and/or (i). Task 6 is given a "Positive Determination" requiring the design, feasibility, and construction management contractor to prepare a combined scoping session and full EA per 22 CFR 216.2(d)(xi) as "classes of actions normally having a significant effect on the environment". Task 8 qualified for a "Negative Determination" as it is not expected to have a negative impact on the environment, as proposed mitigation measures will eliminate/minimize negative impacts. Nonetheless, reuse design and operational considerations are addressed in this EA.

1.3. Methodology

Guided by the IEE determination, the project team drafted a scoping brief based on the identified project alternatives and general understanding of the local situation. This brief provided the background for a public Scoping Session conducted on February 23rd, 2005 at the Offices of the Northern Jordan Valley Administrative Governor (Mutasarrifiya) in North Shouneh. Following the scoping session in North Shouneh, the team prepared and submitted to USAID a scoping statement.

The Scoping Statement anticipated potentially significant issues, issues that are potentially not significant, and proposed how and by whom the EA study will be conducted. This scoping statement was also used to set forth a clear understandings between USAID and the Water Authority of Jordan / Ministry of Environment with respect to these issues for this project in North Shouneh and forms the basis for this EA report. USAID submitted the scoping documents to MOE on March 15 and MOE replied with agreement in principle on May 2nd 2005. A final Scoping Statement was submitted to USAID in early June.

The EA team visited the preferred candidate sites in North Shouneh and collected baseline data including population and economic activities, septage generation and collection (part of feasibility study), important recreational, cultural and historic areas, topography, hydrogeology, climate, biodiversity (fauna, flora, avifauna) and ecosystem as relevant to the defined study area and potential impacts identified in the Scoping Statement.

The project activities, their impacts and specific mitigation measures are summarized in tabular format along with the necessary monitoring requirements, indicating the roles and responsibilities for implementing the mitigation measures/monitoring etc. This environmental management and monitoring plan (EMMP) is intended to be practical and will need to be periodically reviewed and updated during the lifetime of the project. As such, it will serve as the cornerstone for ensuring the implementation of the EA recommendations and any adjustments where and when deemed necessary in the future.

1.4. Report Organization

This report is organized into seven chapters:

1. Introduction
2. Analysis of alternatives and description of the proposed project
3. Legal and institutional framework
4. Description of the existing environment (affected areas)
5. Assessment of impacts and proposed mitigation measures
6. Environmental management and monitoring plan
7. Conclusions

There are six appendices to the main report:

Appendix A	Preliminary WWTP Layout, Process Flow and Hydraulic Profile
Appendix B	Water Reuse and Sludge Standards
Appendix C	Population and Monthly Wind Data
Appendix D	Jordan Archaeological Data Information System (JADIS)
Appendix E	List of Observed and Known Species
Appendix F	References
Appendix G	The EA Team
Appendix H	Stakeholder consultations and approvals

2. ANALYSIS OF ALTERNATIVES AND DESCRIPTION OF THE PROPOSED PROJECT

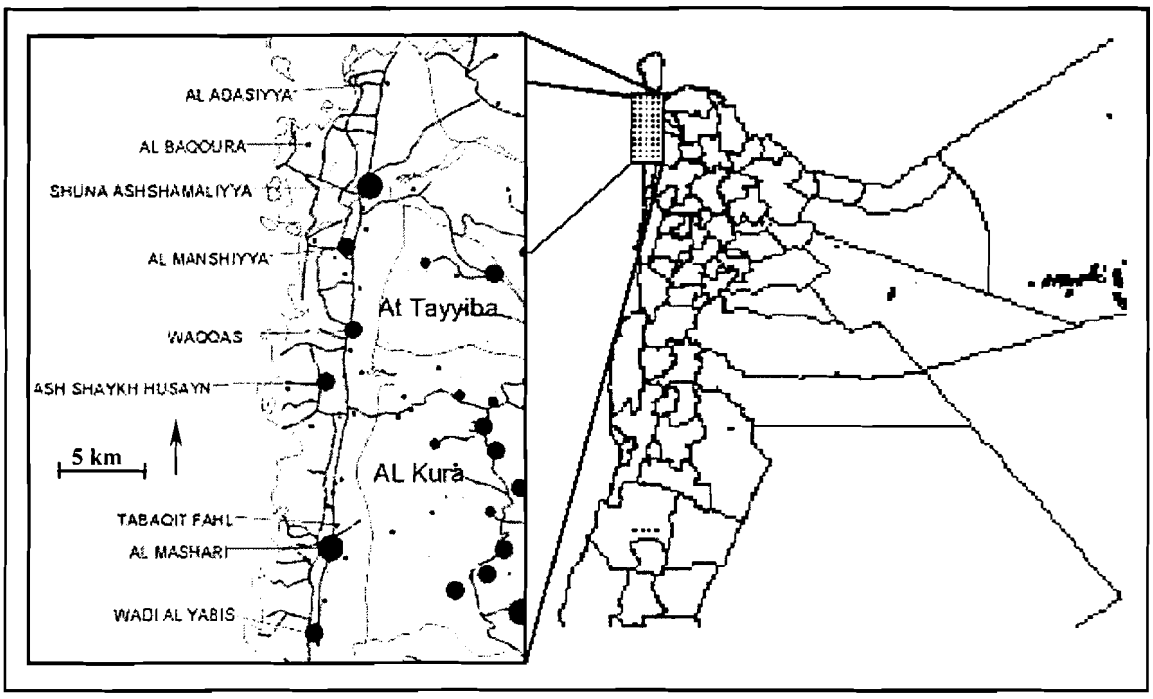
This chapter provides an overview of the project area and its current situation with respect to septage generation, collection and disposal. It discusses the need for the project, the project alternatives considered and provides the rationale for the preferred action: including the preferred location for the wastewater treatment plant, technology to be used, the service area and the proposed water reuse activities. It also summarizes the project activities during construction, operation and maintenance.

2.1. Overview of the potential service area and need for the project

North Shouneh ('Shouneh Shamaliya'), with a population of approximately 15,000 people, is one of the largest towns in NJV. It is part of the Municipality of Mu'ath Bin Jabal, the northern most municipality of the Jordan Valley with a total registered population of over 30,000 people. Other municipalities in the NJV also include the Municipality of Tabqit Fahel, just south of Mu'ath Bin Jabal, and the Municipality of Sharhabeel Bin Hasna which is the furthest south. Tabqit Fahel has over 27,000 registered people and includes towns such Mashari and Sheikh Hussien. Sharhabeel Bin Hasna has over 28,000 people and includes towns such as Wadi Al Yabis, Abu Sido and Kraymah, the southernmost town in the NJV.

Population density is relatively high in some of the larger town-centers such as North Shouneh, but is less so in other smaller residential areas. Residential space is quite limited in the NJV since the valley falls within a narrow strip of highly agricultural lands surrounded by steep hills to the east and the Jordan River to the West. The area borders Syria to the North and the Occupied Territories / Israel to the West. In the hills to the east, the NJV is bordered by the Municipalities of Taybeh and Kura that are home to over 100,000 people. The NJV area and some of the main towns in it are presented in Figure 1 below.

Figure 1
The NJV: its main towns and location within Jordan



Within the NJV, around seven septic tankers currently operate full-time, disposing of 400 to 500 m3 of septage per day and as high as 700 to 800 m3/day in the summer (see Section 4.2.b). On average, households in the NJV normally used to pay anywhere between 5 and 20 JD per tanker trip for this service

for disposal within the NJV. The exact amount would depend on the distance tankers would have to travel before unregulated discharge to the open environment.

Until very recently (December 2004) tanker drivers disposed of septage in the lower reaches of a nearby Wadi that empties into the Jordan River. They are currently banned from disposing in the area due to environmental and health concerns and are now required to discharge at WWTP's much further away. As a result, tankers are now charging between 20 and 45 JD's per trip unless they discharge illegally. Many households have to pump their cesspits quite regularly (once every 2 to 3 months, some once every 3 to 4 weeks).

Mostly dependent on farm work, the financial strain on most households from this septage situation is tremendous. With the recent increase in tanker costs, many households could no longer afford to pump their cesspits, and have left them to overflow into the streets. When tankers discharge illegally, they often get caught, fined and thrown in jail for a few nights and are unable to provide their services temporarily – making it even more difficult for households to get their cesspit emptied. This situation is most severe in the Municipality of Mu'ath Bin Jabal, and particularly in the town of North Shouneh.

2.1.a. The no action alternative

If nothing is done about the situation described above, tanker drivers would continue to collect septage from households in the area and charge between JD20 and JD45 per trip. Considering only the town of North Shouneh in the NJV, at average current private tanker transport rates, the septage transport savings associated with the selected site (see Section 2.3) are expected to be anywhere from 8,000 to 15,000 JD per month when compared with the no-action alternative of continuing to require tankers to discharge at the Tell Al Mantah WWTP. In 2028, these savings are expected to approximately double.

Many households cannot afford to pay for the service – they either empty their cesspits less regularly or stop emptying their cesspits altogether. In both cases, cesspits will overflow, contaminate streets and generally create unsanitary conditions in and around residential areas. Otherwise, tankers will revert to discharging into the open environment with similar consequences.

The quantities requiring disposal are increasing over time and without this project, would increasingly cause significant pollution of soils, important water resources in the area as well as a further risk to the already fragile public health situation and a further unbearable drain on meager family incomes.

2.2. Design capacity, service area and phasing

Varying the WWTP service area and design capacity to cover a larger, regional area is not a viable alternative. A regional WWTP in the area would present significant risks associated with plant size (without needing to resort to high-cost and high-tech/maintenance), site location, etc. Furthermore, implementing a single WWTP for such a large area (e.g. to include more than one or all of the municipalities in the region) would not be economic in the long run as the average distances that tankers would need to travel would remain high (and will not cease to place a burden on households).
In light of the relatively large populations in the region, and the most pressing need for such a WWTP to serve North Shouneh in particular, the service area, and accordingly the design capacity of the WWTP, should target the Municipality of Mu'ath Bin Jabal in the long-run. The WWTP will be designed to receive septage from this service area for the next 20 years (20-year time horizon) as an acceptable, long-term WWTP target. After that, additional expansion/upgrade or another WWTP could be implemented to meet the additional septage being generated by further increases in population.

However, until Mu'ath Bin Jabal begins to produce septage quantities at the WWTP's future flow design capacity as discussed below, the WWTP would be able to accept septage from other communities in the NJV (e.g. the municipalities of Tabqit Fahel, Sharhabeel Bin Hasna) as well perhaps some septage from Kura and Taybeh in the higher elevations.

2.2.a. Proposed design capacity and service area

The design influent capacity for the WWTP is 438,000 m3/year, which corresponds to a maximum daily septage influent of 1,200 m3/day during the peak summer months. The Mu'ath Bin Jabal Municipality (the target service area) is projected to generate this quantity of septage during the summer by the year 2028 (see MBJ "high" septage estimate for 2028 in Table 12) when its population is expected to reach/exceed 45,000 inhabitants (see Table 11). At that time, Mu'ath Bin Jabal (MBJ) is expected to produce significantly less than this amount during the winter (see MBJ "low" septage estimate for 2028 in Table 12), implying that the WWTP can accept septage from a wider service area during the winter months.

Alternatively, if MBJ begins to exceed 1,200 m3/day as a peak summer value sooner than expected, then summer discharges can be limited/discouraged and winter discharges encouraged through pricing and/or other regulatory mechanisms. Such an adjustment in the seasonal distribution of discharges (i.e., when people empty their cesspits) could be used to increase the length of time that the WWTP could potentially continue to serve MBJ without expansion or upgrade.

The proposed WWTP can accept septage from the widest possible service area during the first 5 years of operation – including all septage (summer and winter) from communities under the jurisdiction of Northern Jordan Valley (NJV) Sub-Directorate (e.g., Tabqit Fahel, Sharhabeel Bin Hasna in addition to MBJ municipalities) as well as some of the septage from communities in the eastern uplands within Taybeh and Kura municipalities. Starting around year 5 and by no later than year 10, the WWTP would only be able to serve the summer quantities from the NJV communities (see NJV "high" septage estimate for 2015 and 2020 in Table 12). After this time, summer septage from Sharhabeel Bin Hasna (furthest away in the NJV) would also need to be barred from entering the plant, followed by limitations on septage from Tabqit Fahel. In the winter, as mentioned above, these two municipalities (and possibly more) should still be able to use the WWTP.

Service area restrictions over time will need to be determined as and when needed by the operator of the WWTP, WAJ and through the institutional arrangements vital for the project's success. Nonetheless, throughout its entire lifetime the plant should continuously serve between 45,000 people (summer) to 80,000 people (winter) or more as can be seen in Table 11 in conjunction with Table 12 and in light of the explanations provided above. The exact number of people will fluctuate from summer to winter and vary with the service area.

2.2.b. Phasing, Expansion & Decommissioning

Significant expansions of the WWTP are not envisioned and would be difficult given land constraints. Upgrades however will be possible. Maintaining this WWTP as a regional plant would not be economical in light of the region's geography (a long, narrow strip bound by mountains to the east) and the relatively long distances between the main population centers. Transportation costs associated with a long-term regional WWTP would therefore be prohibitive, especially for those communities furthest away. The different municipalities and main population centers they house are also large enough to ensure enough septage to capitalize on economies of scale for building separate WWTPs in the future. Separate WWTPs should be more economical as a result. Therefore, no phasing (i.e., capacity expansions) is anticipated at this stage for the North Shouneh WWTP due to limited land availability. The detailed design will provide built-in flexibility to upgrade the WWTP to incorporate low-cost aeration technologies in the distant future.

The ability to convey sewered wastewater to the site by gravity was taken into consideration during site selection and the WWTP will be designed to minimize any modifications needed to be able to accept sewered wastewater if needed in the future. Though these efforts have and will be included, conveying and treating sewered wastewater are not the main purpose of this project's design.

Decommissioning is not considered here as the WWTP is expected to either continue to serve a portion of the population within the design capacity, in which case a separate treatment plant will need to be

provided or it will be upgraded, as are most WWTP's in the country, in order to be able to serve a larger population for a longer period of time.

2.3. Alternative WWTP sites

The Municipality in cooperation with the JVA and Land Registration department in North Shouneh originally proposed 8 potential sites for the WWTP. They and the project team quickly eliminated 6 of these sites for various reasons not discussed here. The project team then proposed an additional 3 site areas for consideration. The resulting 5 potential site alternatives for the North Shouneh WWTP were presented at the scoping session and are discussed and evaluated here. One of these sites is on government-owned land, the other four are on privately owned lands and would require acquisition by WAJ. The five potential WWTP locations are:

Site 1. Approximately 5 km south west of North Shouneh, adjacent to the Jordan River, just north (parallel) of Wadi Al Arab;

Site 2. Approximately 3 - 5 km south west of North Shouneh, in the same vicinity of Site 1 but not as close to the Jordan River;

Site 3. Approximately 3 - 5 km west (slightly north) of North Shouneh, along the main road from North Shouneh to the Jordan River near Al Baqoura Al Musta'adeh;

Site 4. East of the KAC, just north of Waqqas; and

Site 5. East of the KAC, just north of Fiddeen and west of Al A'aramsheh

The advantages and disadvantages provided in Table 1 and the subsequent rationale and recommendations for the preferred alternatives provided in the sections that follow, are based on the project team's assessment of these sites and built on stakeholder opinions solicited during discussions on the project alternatives at the Scoping Session and site visits with an inter-ministerial site selection committee. A map of these 6 sites is available in Figure 2.

None of these sites were initially recommended by the Inter-ministerial Committee during 2003/2004 because evolving stakeholder and project team opinion was that the recommended site did not ideally respond to local project and community needs.

The recommended site (which was near Tabqit Fahel) was commendable from most points of view. Further analysis, however, revealed that its location (20 km from the main target community) would impose unsustainably high septage transportation costs on most households in the service area. Several tankers would also end up driving down the main JV road and would pose a high traffic accident risk. Additionally, topographical constraints on the site, bounded by mountains and wadis, made it too small to accommodate the size requirements for a low cost, low maintenance WWTP serving North Shouneh. This site however should not be eliminated for consideration if a potential, separate WWTP serving Tabqit Fahel is required in the future.

Figure 2
Map of the five potential site area locations

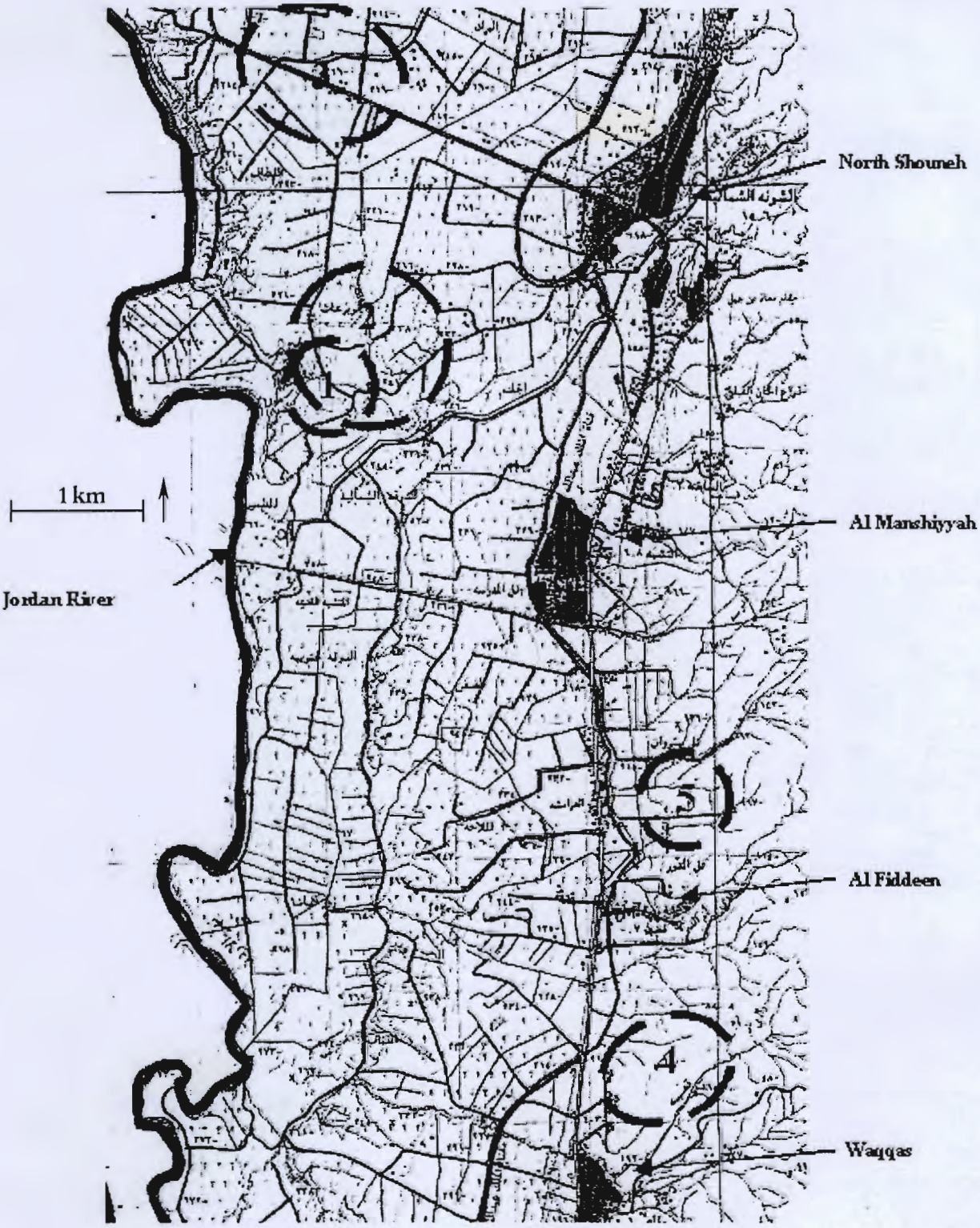


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Table 1
Key Advantages & Disadvantages of Site Location Alternatives in N. Shouneh

Site	Advantages	Disadvantages
Site 1.	• Government owned property • Potential future sewerage for North Shouneh • Main access roads to site are low in traffic; separate access for northern towns, N. Shouneh and southern towns is possible (avoiding the need to funnel tankers through residential areas or along high traffic routes) • Other government owned (border) properties nearby • Lowest hydrologic risk • Promising reuse opportunities	• Will require significant land preparations in light of topography and geo-technical properties • Very close to military border zones • May require additional acquisition of adjacent lands • Access may damage existing agricultural roads • Upwind of North Shouneh
Site 2.	• Similar to Site 1 advantages, but privately owned property (not government) • Requires less land preparations than Site 1	• Private owned properties • Access may damage existing agricultural roads • Upwind of North Shouneh
Site 3.	• Potential future sewerage for North Shouneh	• Private owned properties • May be too close to a main road • Less accessible for towns south of Shouneh (e.g., Mashari, Waqqas) than Sites 1 & 2: may require many tankers to travel via N. Shouneh proper
Site 4.	• Inducing farmers in the vicinity to switch to TWW for reuse may prove relatively easier • Relatively close to towns south of North Shouneh	• Private owned properties • Relatively far from North Shouneh (costly transportation) • Potential flooding risks from adjacent wadi • A few houses on hilltops surrounding the site • Too close to Waqqas • Relatively high archeological risk area • Main access route is along major road
Site 5.	• Inducing farmers in the vicinity to switch to TWW for reuse may prove relatively easier (although irrigation supplies do exist) • A reasonable distance from most towns, with the exception of those north of N. Shouneh (too far)	• Private owned properties • Too close to residential areas (Fiddeen) • Upstream of the King Abdullah Canal • Relatively high archeological risk area • Main access route is along major road

2.3.a. Comparative analysis of site alternatives

Site No. 1

Local stakeholders prefer this site to all other sites. The inter-ministerial site selection committee also granted its approval for this site on condition of including appropriate environmental mitigation measures pertaining specifically to potential odors and water resource protection. It presents the lowest risk of odors, mosquitoes and other pests from adversely affecting residents, as it is the furthest site from main residential areas. The water quality in the area is already deteriorated from agricultural return flows and run-off as well as other sources of pollution: farmers in the area do not use Wadi Al Arab water nor Jordan River water due to its negative effects on crops and trees. This area is also generally furthest downstream (surface and groundwater) as it is to the east and south, without being too far from major residential areas. As a result, it presents a relatively low hydrological risk. As this area is at the tail-end of irrigation canals as well, farmers in these parts tend to receive less supplies, especially in the summer. This fact, along with the poor quality of natural supplies in the area provide for a good opportunity to develop and benefit from TWW reuse.

It also presents the least cost in terms of land, while offering a high opportunity for future sewerage (potential future sewerage being a very important aspect from the stakeholders point of view). Even if additional acquisition is required to supplement this property, and although there are higher value lands in the area than in Site No. 4 or No. 5, this does not financially outweigh the fact that slightly over 200 Dn is available as government owned property. This site also presents the best access route options: allowing access from North Shouneh directly, while towns from the north and south of N. Shouneh can avoid N. Shouneh proper. This reduced traffic risk however means transport along more minor agricultural roads, which will need upgrading, and there may be a higher risk of illegal dumping along the way. The area around Site 1 is also relatively little developed agriculturally (when compared to Site 2 and 3) and would not exclude any potential future residential expansion (as with Site 4 and 5). Being near the Jordan River and border does however present some potential trans-boundary considerations.

Site No. 2 & No. 3

Site No. 2 and Site No. 3 present similar advantages to Site No. 1, with some exceptions. These exceptions include: they are surrounded by well developed agricultural lands, making property values slightly higher (for acquisition); and full acquisition is needed. Site No. 2 may potentially be too close to residential areas and Site 3 may be too close to a main road (potential future touristic implications). The main advantages these sites pose over Site 1 are the expected minimal land preparation needs and the fact that they are closer to residential areas (potentially offering slightly reduced transportation costs). The project team views site No. 2 and 3 as back-ups to Site No. 1, if it should fail to meet technical requirements or any relevant government approvals.

Site No. 4 & 5

As a result of the above preliminary assessment and compelling objections from stakeholders, the Project Team recommends excluding Sites No. 4 and 5 from further consideration. Site No. 4 is potentially prone to annual flooding, is far from North Shouneh (implying excessive transport costs), would not be able to receive raw sewage transported by gravity from a major residential area (via a future sewer line), and most importantly, is surrounded by a few dwellings and is very close to Waqqas. Site No. 5 is within 1 km upwind of Fiddeen and is potentially too close to the KAC and may present an unacceptable risk to the head waters of this valuable water carrier as a result.

The potential for gravity conveyed-sewerage from a main town to Site No. 4 is very unlikely; and questionable with Site No. 5. Both these sites may present land area limitations and may be considered as encroaching on potentially valuable future residential areas. Furthermore, due to potential land constraints, reuse on site would not be likely, and their vicinity to residential areas, main roads and the KAC mean that the nearest downstream reuse area would need to be around 500 m away and in areas already covered by an irrigation network. The main tanker vehicle access to both these sites would be along the main JV highway, increasing the associated risk of accidents. Furthermore, being upstream (of general surface water and groundwater flows), these sites may pose a higher risk to water resources (some of which may be used, e.g. wells or streams).

2.3.b. The preferred and selected site

The preferred North Shouneh site is Site No.1 as it presents the following advantages over the other candidate sites:

- It is on government owned property;
- It is as close as possible to the main septage generating residential areas, minimizing septage transportation costs, but remains sufficiently distant from any residential areas to avoid risk of odors and mosquitoes;
- Separate tanker access can be provided for N. Shouneh, towns north of it and towns south of it, avoiding the need to channel tankers through residential areas or along routes with high traffic volumes;
- It is downstream of North Shouneh and is therefore amenable to a future gravity-flow sewerage network serving this major population center of the Northern Jordan Valley;

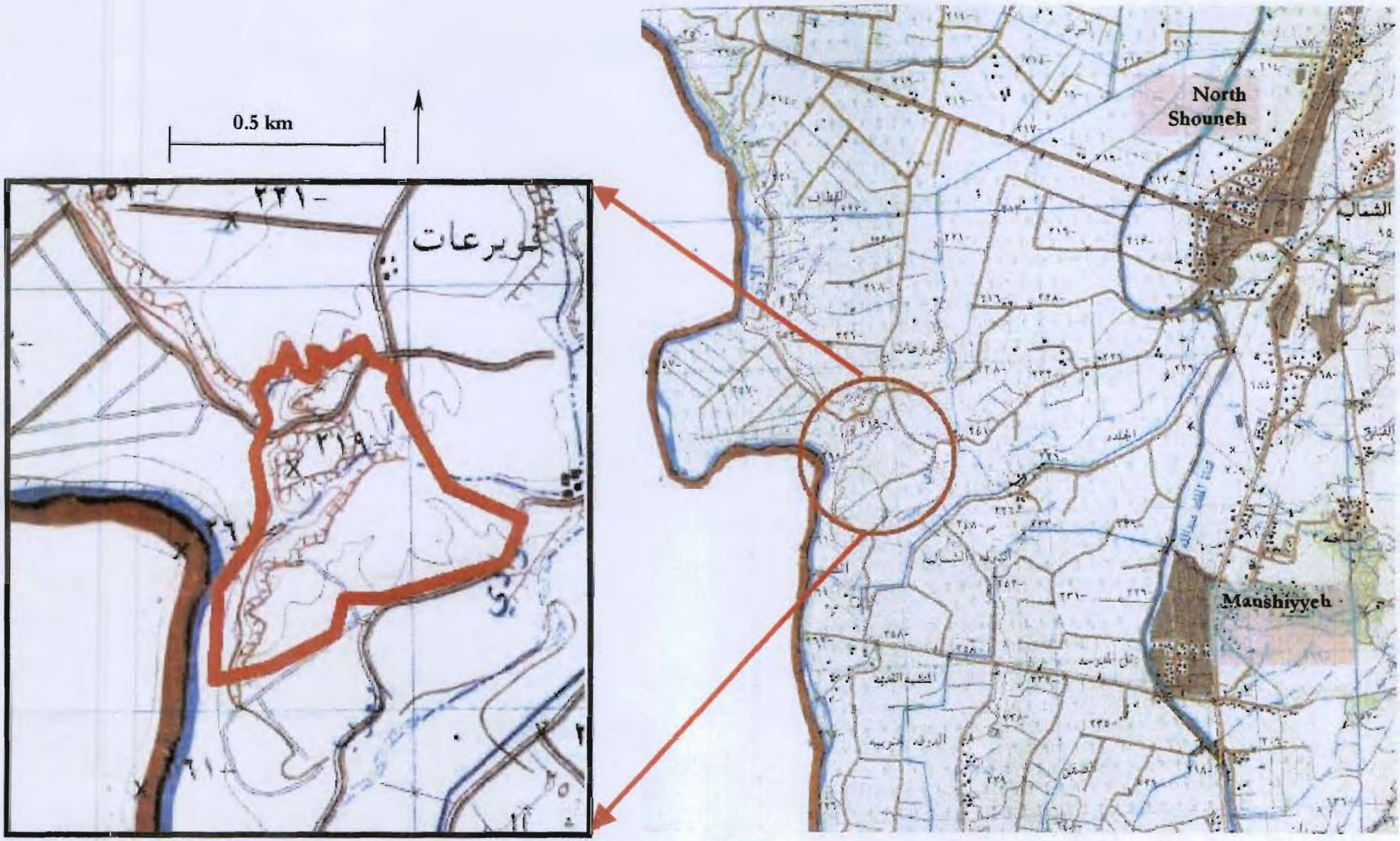
- Being generally as far as practical to the south and west, it presents a relatively low-risk to useable water resources since it is downstream of the KAC and irrigation networks, wadis and any potential springs or future wells in the area – surface and groundwater resources in the area are also already polluted (e.g. high salinity in the Jordan River and streams/groundwater polluted from agricultural run-off and return flows); and
- There are better reuse opportunities since, in this area, surface water quality is poor (farmers do not use it) and farms are at the tail-end of irrigation distribution networks (therefore they receive relatively lower quantities of irrigation supplies).

The selected property is located in D.A. 5 and is slightly over 300 Dn. Approximately 180 Dn of it are on an upper level, while the remaining area is made up of steep ravines/wadis and a few low-lying riverbank areas. About 60 Dn of it are a restricted security zone and cannot be used. It is a government-owned property divided up into 3 plots. The location of this property in relation to North Shouneh town and the roads surrounding it are shown in Figure 3 that follows.

The Project Team and the Municipality of Mu'ath Bin Jabal selected this particular property in consultation with a wide range of stakeholders since it is one of the only government-owned[1] properties in the area that satisfied several environmental and economic criteria and is large enough to host the proposed WWT&R project for the targeted service area.

[1] A private property of similar size would cost at least half a million JDs

Figure 3
The Selected WWTP Site



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2.4. WWTP technology

2.4.a. Screening of WWTP technology alternatives

The Project Team has examined several possible WWT technologies: stabilization ponds, Recirculating Sand Filters, activated sludge, Up-flow Anaerobic Sludge Blanket (UASB), Advanced Integrated Pond Systems (AIPS), etc. Waste stabilization ponds (WSP), aerated lagoons (AL), constructed wetlands (CW), and recirculating sand filters (RSF) are often referred to as low-rate systems, which use biological treatment processes and require little or no mechanical equipment. Often a combination of several low-rate technologies is required to meet stringent effluent standards. When properly designed and operated, low-rate systems can produce a final effluent comparable to high-rate systems, which use mechanical equipment. High-rate treatment systems are typically used to treat wastewater generated from larger communities, because of the large land requirements of a low-rate system. Listed below are some of the most commonly used high-rate systems serving larger communities:

- Trickling Filters (TF)
- Activated Sludge Plants (AS) (high rate and extended aeration type)
- Oxidation Ditch Systems (OD)
- Biological Aerated Filters (BAF) and most recently
- Membrane Bioreactor Systems (MBR or "Activated sludge without clarifier")

Table 2 compares the advantages and disadvantages of some of the low- and high-rate systems listed above. The low rate processes are usually more cost-effective in developing countries and rural communities, where land is available at a reasonable cost and finances are limited.

Table 2
Advantages and disadvantages of various treatment systems

Criteria	Low-rate systems					High-rate	
	WSP	CW	RSF	AIPS	AL	TF	AS
			Technical				
BOD removal	G	F	F	G	G	G	G
FC removal	G	F	F	F	F	P	P
TSS removal	F	F	G	F	F	F	G
N removal	G	F	G	G	G	G	G
HE removal	G	P	P	F	F	P	P
V removal	G	P	P	F	G	P	P
Applicability to Septage	G	P	F	P	G	F	F
			Economic				
Simple (O&M)	G	F	G	G	G	F	P
Foot print	P	P	F	P	F	G	G
Energy needs	G	G	G	G	F	P	P
Constructability	G	F	G	G	G	F	P

G = Good F = Fair P = Poor

After a careful evaluation, the Project Team eliminated several of these alternative treatment technologies because the proposed WWTP must:

- Use proven, appropriate, lower technology with relatively low O&M costs; and
- Treat septage collected by tankers from cesspits, which:
  - Varies in quality from tanker to tanker;
  - Varies in quantity being received at the plant from day to day and even week to week; and
  - Carries higher pollutant loads (namely BOD, COD and suspended solids) than raw sewage (i.e., sewage collected and transported via a sewer network).

For example, AIPS would not operate optimally under the conditions mentioned above, as they would require significantly higher maintenance, given the concentration of suspended solids in septage. Similarly, UASB is sensitive to variations in quality and quantity and requires advanced technical capability on the part of plant operators. High-rate treatment systems would not be considered appropriate for small communities because they often require highly skilled labor and higher costs to operate and maintain electro-mechanical equipment. It is difficult to attract people with those skills to rural areas. Technical capacity and experience required for efficient operation is again relatively high. Mechanical equipment has a shorter useful life, requires significantly more energy, is prone to breakdown, and is more expensive to repair. Some of the systems considered also require chemicals, all adding to the costs and making the technical and financial sustainability of any of these options questionable as a result.

An appropriate way to address the objectives of treating septage generated from such communities at reasonable costs and with less sophisticated maintenance requirements is to use technology that includes WSP-type units. The effluent can then pass through sand filters and reed beds (man-made constructed wetlands) to further reduce solids, organics, pathogens, and nitrates (through a recirculation step) to required levels. This treatment process requires no chemicals and no complex mechanical equipment.

Imhoff tanks were also considered as an upstream pre-treatment unit in the treatment facility to allow for easier removal of solids, thereby decreasing the solids loading in downstream processes. In spite of the benefits of such a pre-treatment step, it has relatively high sludge handling requirements, necessitates a sludge thickening system, might experience sludge transfer difficulties, needs higher maintenance, and would require additional complementary treatment units to ensure overall process stability and treatment efficiency.

2.4.b. Analysis of WWTP alternatives

Following the above screening, four conceptual alternative treatment trains/processes were conceptually designed and assessed. Three parallel treatment trains were used for all alternatives to offer higher operational flexibility and easier maintenance. A larger number of treatment trains can be operated in parallel or in series. All of the alternatives were designed with the ability to meet Class B effluent standards (JS 893/2002) with the following variation insofar as nitrates are concerned.

Alternatives 1 & 2 use the same design concept with the exception that Alternative 2 will meet the current standard of 10 mg/l of nitrate-nitrogen (N) -- which is equivalent to 45 mg/l nitrate in the form of nitrate (NO_3^-) -- whereas Alternative 1 will meet a less stringent standard of 45 mg/l of nitrate-nitrogen. The same applies to Alternatives 3 & 4, with Alternative 4 being designed to meet the current, more stringent nitrate standard. Through this project, we have initiated discussions with the Government of Jordan to review the nitrates in these standards and as a result, the relevant authorities are currently reviewing JS 893/2002.

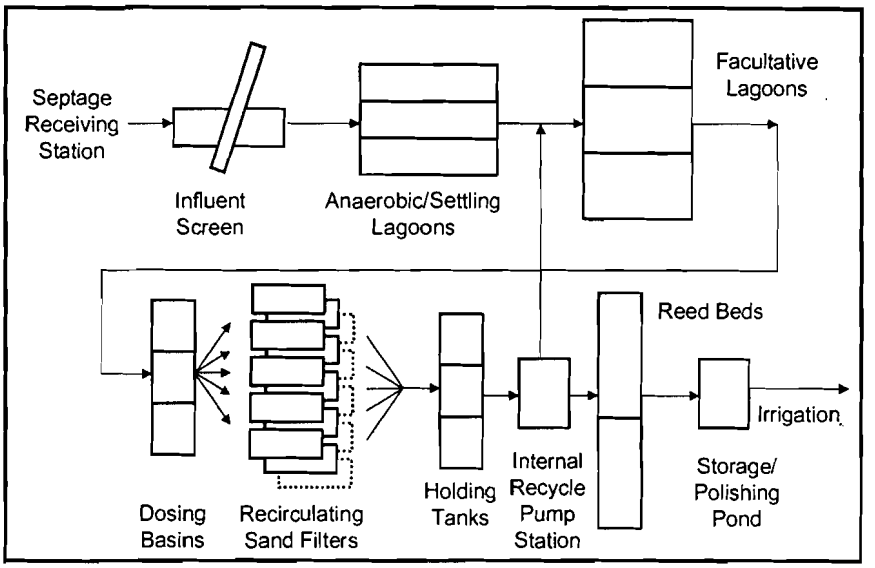
Alternatives 1 and 2

Both alternatives 1 and 2 are based on earthen (WSP) lagoons, recirculating sand filters, and constructed wetlands and include the following units (according to conceptual design):

- Septage receiving station;
- Three anaerobic/settling basins;
- Three facultative lagoons;
- Three dosing basins;
- Ten to fifteen recirculating sand filters (RSF);
- Three flow holding tanks;
- Two constructed wetlands;
- One duplex internal recycle pump station;
- One storage/polishing pond; and
- Ten sludge drying beds.

A simplified process flow diagram is presented in Figure 4 below.

Figure 4
Simplified process flow diagram for Alternatives 1 & 2

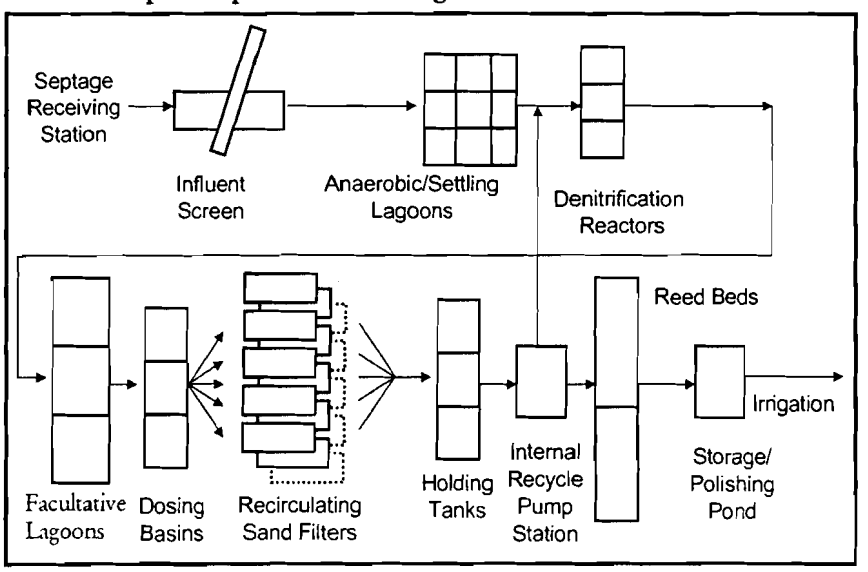


The anaerobic lagoons are sized to provide enough volume for sludge to accumulate in them over one year and to keep organic volumetric loadings limited in order to reduce odor generation potential. These large anaerobic lagoons allow for more consistent organic degradation. They would need to be covered to minimize evaporation losses and odors. Alternatives 1 and 2 are identical with the exception that Alternative No. 2 has more recirculating sand filters, larger dosing basins and flow holding basins, a higher internal recycle ratio, and slightly larger constructed wetlands in order to meet the more stringent nitrate standard.

Alternatives 3 and 4

Under Alternatives 3 and 4, the large earth-based anaerobic lagoons of Alternatives 1 and 2 were replaced with a series of cascading concrete anaerobic lagoons operated in series and separate denitrification reactors were introduced. This significantly reduces the surface area of the facultative lagoons. A simplified process flow diagram is presented in Figure 5.

Figure 5
Simplified process flow diagram for Alternatives 3 & 4



Under these alternatives, concrete structures facilitate more frequent sludge removal (e.g., through hydrostatic draining) at lower costs than pumping or dredging. Separate denitrification reactors are also introduced. Multiple basins operated in series enable a higher degree of treatment under shorter retention times. In addition, the smaller individual tanks can be isolated for cleaning, repairs or sludge removal without any significant impact on the overall performance of the system. Overall, the treatment plant would cost slightly less to build (see Table 3), would take up significantly less land (significant reduction in plant footprint), would cost less in lagoon covering, would cause less evaporation losses (and thus lower salinity in the treated effluent). Treatment plants designed according to Alternatives 3 and 4, however, would have slightly higher overall O&M costs compared to those built according to Alternatives 1 and 2, respectively.

Alternatives 3 and 4 are identical with the exception that Alternative No. 4 has more recirculating sand filters, larger dosing basins and flow holding basins and a higher internal recycle ratio than Alternative No. 3 in order to meet the more stringent nitrate standard.

Comparison of alternatives

Relative to Alternatives 1 and 2, Alternatives 3 and 4 have markedly reduced land/footprint requirements. The smaller treatment units in Alternatives 3 and 4 also provide for better and easier maintenance, added operational flexibility and more options for smaller, fractional upgrading. The main disadvantages of Alternative 3 and 4 pertain to the slightly higher operational complexity and associated O&M costs. Table 3 presents a comparison of some of the key technical and economic data for all of the alternatives.

Under Alternatives 1 and 2, sludge will need to be removed on an annual basis either through the use of a floating sludge pump or out-sourcing contract. Under Alternatives 3 and 4, sludge can be removed as frequently as needed, ideally using hydrostatic pressure. This is significantly less costly and greatly improves the reliability of the treatment process, enhancing the financial sustainability of the WWTP, considering the large quantities of sludge to be expected. Sludge removal costs are often the second highest O&M cost item in WWTP in Jordan (M&E, 1999).

Table 3
Summary comparisons of key technical and economic data for all alternatives

Parameter	Alt 1	Alt 2	Alt 3	Alt 4
Influent = 438,000 m3/yr	Effluent = 310,000 to 300,000		Effluent = 380,000 to 390,000	
Evaporation losses:	30%		12 to 13%	
Influent Salinity ~1,300 mg/l	*Effluent ~1,900 mg/l*		*Effluent ~1500 mg/l*	
Footprint*	140 Dn	190 Dn	70 Dn	80 Dn
*Area remaining for reuse***	*80 Dn*	*30 Dn*	*150 Dn*	*140 Dn*
Capital Costs****	2.9 – 3.6 M JD	3.1 – 3.8 M JD	2.6 – 3.3 M JD	2.8 – 3.5 M JD
Annual O&M Costs*****	24,000 – 28,000 JD	29,000 – 33,000 JD	27,000 – 30,000 JD	31,000 – 35,000 JD
Cost of Covers******	210,000 - 630,000 JD		90,000 - 250,000 JD	

1 USD = 0.708 JD

* Excluding Setback – treatment plant only (i.e., reuse areas not included)

** Assumes 220 Dn's of useable site

*** This includes the cost of covers (at 20 JD/m2) and a 20% contingency - ranges estimated with a +/- 10% margin for error and are rounded up / down to the nearest hundred thousand for the high / low range estimates respectively.

**** At full capacity, excludes capital replacement and depreciation. Ranges estimated with a +/- 5% margin of error and are rounded up / down to the nearest thousand for the high / low range estimates respectively. These estimates assume a part-time engineer / supervisor and laboratory cost-sharing support from WAJ.

***** Depending on the cover material selected and cost of other required fittings (range from 10 to 30 JD/m2 assumed).

While evaporation losses are also significantly lower under Alternatives 3 and 4 due to the reduced size of the facultative lagoons, they do not significantly reduce the salinity of the effluent in light of the relatively large flow of incoming septage (1,200 m3 per day). Because Alternatives 3 and 4 would require smaller footprints than Alternatives 1 and 2, respectively, more land would be available for reuse, which greatly improves cost recovery prospects. This is very important in light of the relatively limited land availability. For example, the reuse area available under Alternative 1 is half of what would be available under Alternative 3. Under Alternative 2, on-site reuse would be very limited since the WWTP would occupy most of the land available. Therefore, creating adequate setbacks would be difficult. In addition, Alternatives 3 and 4 pose a lower risk of potential odor generation due to smaller lagoons.

Although building the front-end (upstream) units out of concrete will be more expensive, the advantages are expected to outweigh the potential net savings of using earthen lagoons. The significantly larger footprint with Alternatives 1 and 2 are reflected in the capital costs, making them more expensive (with their earthen structures) than Alternatives 3 and 4. The ability to remove sludge cheaply and more frequently means that the lagoons can be designed to be significantly smaller in size, as less volume would need to be allocated to accommodate sludge build-up inside the lagoons. Hydrostatic sludge removal is also not possible with HDPE lined lagoons. Concrete structures also provide more flexibility in plant layout and hydraulic profile design. They could be easier to upgrade if necessary to accommodate increasing inflows over time. These advantages are very important in light of the land constraints and extremely uneven topography of the site. In light of the overall reduction in WWTP size and added flexibility in construction, the net cost savings of using earthen lagoons are likely to be negligible.

Designing to meet the current, more stringent nitrate standards (i.e., adopting Alternative 2 instead of Alternative 1, or adopting Alternative 4 instead of Alternative 3) would result in slightly higher capital costs, higher O&M costs, mainly due to higher recirculation requirements and more "wear and tear", and slightly increased effluent salinity. Because the treated effluent would contain less nitrate, supplemental nitrogen fertilization would be needed for most crops.

Therefore, it would be preferable to adopt the less strict effluent standards under Class B given the ability to reuse all TWW on relatively few farms in the vicinity in addition to the remaining land on-site. However, the project will design the WWTP according to Alternative 4 with the ability to operate the WWTP to meet a lower Class B reuse nitrate standard, at lower operating costs, if approved in the future.

2.4.c. The design criteria and preferred WWTP treatment trains

Based on sampling and analysis of septage from cesspits throughout MBJ, in addition to a review of all other available data on septage from other parts of the country, the influent design criteria presented in Table 4 have been adopted. Table 5 provides the design assumption temperature data that will be used.

Table 4
Design septage influent quality

Parameter	Units	Value
Design Flow Rate	m^3/day	1,200
BOD	mg/L	1,850
COD	mg/L	7,353
TSS	mg/L	6,424
TKN	mg/L	3,22

Table 5
Climate and water temperature (°C) design assumptions

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Mean Air Temperature	13.3	14.1	16.5	20.6	24.8	28.0	29.9	30.3	28.8	25.2	19.8	14.9
Water Temperature	16.3	17.1	19.5	20.6	21.8	25.0	26.9	27.3	25.8	25.2	22.8	17.9

Effluent standards

Class B Effluent Reuse Standards (JS 893/2002) have been adopted for the design (see Table 6 for the key parameters). With respect to the reuse standards, this WWTP is considered a biological treatment plant with a polishing pond. The Project Team will design to the more stringent interpretation of the nitrate standard based on Alternative 4, but will ensure that the WWTP can be operated to meet a lower standard if that is approved in the future.

Table 6
Tentative effluent discharge standards

Parameter	Units	Water reuse Class B
Biochemical Oxygen Demand	mg/L	200
Chemical Oxygen Demand	mg/L	500
Dissolved oxygen	mg/L	-
Total Suspended Solids	mg/L	150
PH	mg/L	6-9
Turbidity	NTU	-
Nitrate*	mg/L	45
Total Nitrogen	mg/l	70
Escherichia Coli	# /100 ml	1,000
Intestinal Helminthes Eggs	Egg/l	<or =1

* Interpreted "45 mg/l Nitrate" from JS 893/2002 as 45 mg/l of nitrate as measured by the ion nitrate (or, 10 mg/l nitrate-nitrogen) for Class B reuse

The treatment trains and units

The preferred WWTP technology alternative is based on Alternative No. 4 consisting of the following specific units and treatment trains *(as per the conceptual design – the final detailed design may be different)*:

- Septage receiving station;
- Three parallel trains of three concrete anaerobic/settling basins operated in series;
- Three denitrification reactors;
- Three facultative lagoons;
- Dosing basins;
- Fifteen recirculating sand filters (RSF);
- Flow holding basins;
- Two constructed wetlands;
- One duplex internal recycle pump station;
- Ten sludge drying; and
- One storage/polishing pond.

Summary specifications of the proposed treatment trains and units under the preferred WWTP technology alternative (Alternative 4) are provided in Table 7 overleaf. Figure 13, Figure 14 and Figure 15 in Appendix B show the preliminary layout, process flow diagrams and hydraulic profile. Similar figures for the other alternatives (described in Section 2.4.b) were presented in the Conceptual Design Report submitted in April 2005. The exact configuration, number, dimensions and build of the units (and any associated mitigation measures, such as lagoon covers) will be finalized during the detailed design. Setback distances will be maximized within the confines/limits of the available useable land.

Gravity flow of septage will be maximized throughout the WWTP. The recycle pump station will need to be operated on an intermittent basis during the day. Therefore the daily power consumption of the WWTP is expected to be low. Emergency/standby power generators will be evaluated in the detailed design.

Table 7
Tentative specifications of the preferred WWTP technology option

Footprint (ha)	**8**
Daily design flow rate, m^3	1,200
Anaerobic lagoons	**9 (concrete)**
Volume of lagoons, m^3	3 x 6,000 3 x 2,880 3 x 1,300
Total volume, m^3	30,300
Total surface area, m^2	~8,000
Denitrification lagoons	**3**
Total volume, m^3	2,475
Facultative lagoons	**3**
Total volume, m^3	12,000
Total surface area, m^2	7,500
RSF (recirculating sand filters)	**15**
Total surface area, m^2	24,750
Recirculating Pump Station	**2 + 1 (standby) pumps**
Recycle flow rate	1:1 to 5:1
Reed beds / Constructed Wetlands	**2**
Total surface area, m^2	14,000
Irrigation Storage / Polishing Pond	**1**
Total volume, m^3	8,500

Final design elements may be different and will be provided as part of the detailed design

The exact dimensions, number, configuration, construction, materials and other fine-tuning factors will be investigated as part of the detailed design. For example, the concrete basins/lagoons could be combined and built as circular structures with internal dividers. These lagoons may be partially above ground. The potential use of zeolite as drainage material in the constructed wetlands and sand filters, as a means of potentially improving their efficiency, will also be investigated.

The detailed design also will provide for built-in flexibility to allow an eventual upgrade of the plant to incorporate simple, low-tech/low O&M cost aeration technologies in the future. To the extent practicable without compromising the effectiveness of the proposed design in the short to mid term, the detailed design also will incorporate features and options to facilitate the conversion of the plant from treatment of septage to treatment of raw sewage in the distant future when appropriate.

Wastewater, salts & sludge balance

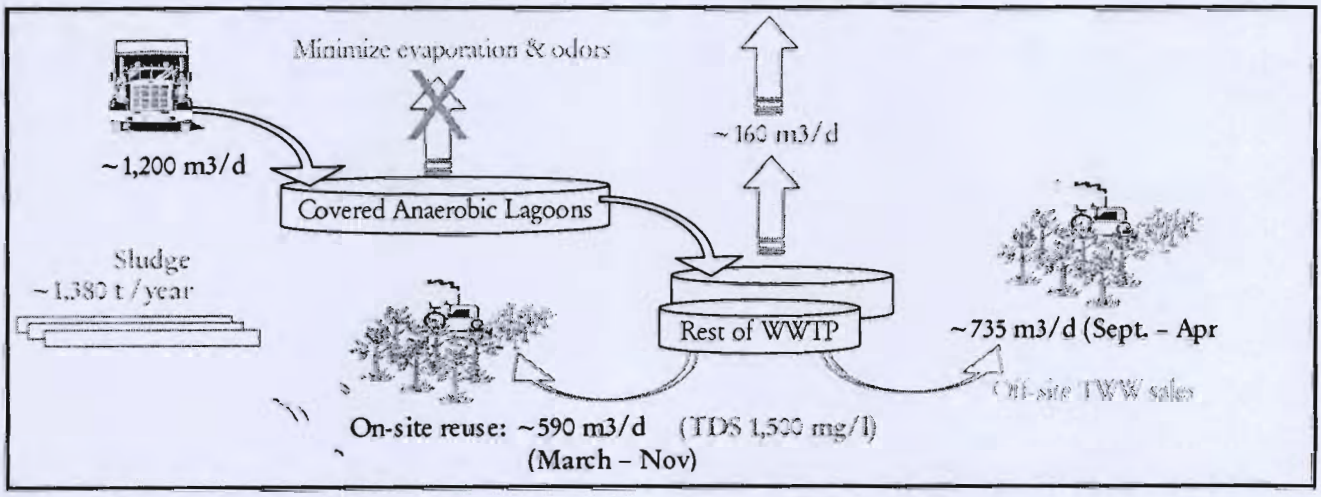
Figure 6 provides a simplified depiction of the inputs and outputs of the WWTP. Most of the TWW produced by the WWTP will be consumed on-site during the summer months. Therefore, sale of TWW to offsite farmers will occur mainly during the winter months (September through April). Sale of TWW to offsite farmers would require that these farmers have their own storage facilities to store the TWW supplied to them for use during the summer, which is when they need it most. A cursory review of the site found that such storage facilities already exist on nearby farms.

With an influent TDS concentration of 1,300 mg/l, the effluent TDS concentration is expected to be 1,500 mg/l. Net evaporation from the storage reservoir will be negligible. During the summer, when evaporation rates are high, the WWTP is expected to operate at optimal through-flow quantities as a result of relatively high summer influent quantities (e.g., treatment trains will run at their full flow rate design capacities). Therefore, the maximum salinity of the TWW used for irrigation is not expected to exceed 1,500 mg/l TDS. In reality, part of the TDS entering the plant is organic material that will be

degraded in the treatment process. Therefore, the salinity of the treated effluent is likely to be lower than 1,500 mg/l.

Up to 34,500 m3 of wet sludge (96% water content, 1,300,000 kg dry sludge) will need to be removed and sent to the drying beds. The optimal frequency of sludge removal (e.g., quarterly, bi-annually, etc.) will be assessed in more detail during the detailed design and described in the Operating Manual for the plant. Treatment of sludge, testing and reuse and/or disposal will adhere strictly to Jordanian Standards JS 1145/1996.

Figure 6
Simplified tentative water mass balance



2.4.d. Built-in mitigation measures

The septage receiving station will be designed and equipped with the necessary fittings to accept influents from a "remote discharge" facility. Designing or building a remote discharge facility (e.g., 200 - 500 m away from the WWTP site) are not proposed as part of this project; however, this Environmental Assessment has suggested such an off-site facility as an emergency discharge point (mitigation measure) in the event that unforeseen military restrictions to the site are imposed. During such periods, tankers will still be able to discharge to the WWTP without needing to enter temporarily restricted areas.

The septage receiving facilities will have a specially designed drainage system and a designated tanker cleaning area.

BOD loadings in the anaerobic lagoons will be limited (e.g., less than 300 g/m3). The volumetric BOD loading (mass of BOD per anaerobic volume per day) is the basis for anaerobic lagoon/basin designs. In other words, the influent BOD loading in kg/day is used to obtain the required volume of the anaerobic reactors. International literature on WWTP designs recommend specific values based on design temperatures and that the BOD loading should be limited to 300 mg/m3 in order to minimize odor potential and for more consistent organic degradation.

In addition, during the detailed design, the Project Team will discuss with WAJ the merits of covering the anaerobic lagoons to minimize odors, if any. The detailed design also will propose odor control, if required, at the receiving facility and other locations (e.g., sludge drying beds). Methane recovery and use as a power supply (e.g., to produce electricity for limited purposes in the plant) will also be examined during the detailed design phase and included if feasible. Concrete winter storage and anaerobic basins are proposed as they minimize surface area (and hence the potential for odor generation), are easier to cover, if needed, and require less maintenance than earth lining, and can be built partially above ground (adding flexibility to layout and hydraulic profile design).

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Most important, since the WWTP is expected to generate significant quantities of sludge per year, the concrete basins would allow for frequent sludge removal within a sloped base, ideally through hydrostatic head. This would reduce significantly (1) the size of the units, as they would not need to include significant sludge storage volumes, and (2) sludge removal costs. Improved sludge removal would offer greater assurances that the WWTP will continue to operate efficiently, as it will be less likely to become overloaded with sludge (sludge build-up reduces the "effective" liquid treatment volumes and requires an increase residence times). The feasibility of hydrostatic sludge removal and use of concrete structures will be examined further during the detailed design. The majority of sludge will be removed from the anaerobic/settling lagoons; however, eventually, sludge removal will be required from all lagoons and from the surface of the RSFs (removal of top layer of sand and replacement with a new layer of sand). Sufficient space for sludge treatment and storage will be provided.

Bypass and overflow piping and fittings will be installed on all units as appropriate to enable bypass or potential overflows to reach downstream units. In addition, all lagoons/reservoirs will have a one-meter freeboard. To further reduce the risk of overflow downstream, the detailed design will provide for pumping treated effluent from the emergency storage reservoir back to the head works. All units will be either lined with geo-membrane (HDPE liner), or a 30 cm thick layer of clay with riprap to protect from erosion, or will be built with corrosion-resistant reinforced concrete to reduce the risk of seepage or leakage from any of the treatment units. Dikes and drainage systems, possibly included as part of the on-site road system, will be included as an internal runoff drainage system to protect the units from flooding and to contain any potential spills/overflows as required.

Multiple lagoons and basins operated in series provide more efficient and reliable treatment. Multiple treatment trains provide for added operational flexibility (e.g., can be run in parallel or in series) and improved maintenance ability (e.g., by shutting down one train for maintenance). Smaller multiple units also reduce evaporation losses allow for easier maintenance as well as fractional upgrades as required.

In addition to being optimized to provide flexibility in cropping pattern development, the effluent storage reservoir will be sufficiently sized such that it provides at least one week's worth of storage to facilitate delivery to farms nearby. Such hydraulic retention times in the effluent storage ponds also provide for additional effluent "polishing" effects. An area will also be designated for a future disinfection unit if required.

2.5. Treated water reuse strategy

The reuse strategy alternatives pertain mainly to the recipients of the TWW. Consequently, the types of crops that can be grown will depend on this. The three options for reuse alternatives being considered were to:

- **Deliver the TWW to farmers in the vicinity of the WWTP** as required (but not install on-farm irrigation networks) and assist them in getting started and in applying safe reuse practice;
- **Make the TWW available to users not in the vicinity of the WWTP.** This would require tankers to collect the TWW and deliver it to reuse locations; and/or to
- **Directly reuse the TWW on-site** to grow fodder or other, potentially more-valuable crops, as a supplemental part of the WWTP and related operations.

There was an overall preference expressed by stakeholders at the scoping session for reuse alternatives to remain flexible, while emphasizing preference for on-site reuse as that presents an opportunity to generate more income for the WWTP or organization involved (e.g. municipality) and it mitigates the risk of unsafe reuse practices off-site. The second priority is to provide TWW to farmers in the vicinity of the WWTP. The project team has confirmed this prioritization and recommends maximizing revenues from commercially viable reuse-demonstration within the site in order to ensure financial sustainability.

The preferred reuse strategy is therefore to maximize on-site reuse revenues within given land constraints to help recover O&M costs while also serving as a reuse demonstration site. The project will also

encourage sale of excess TWW to farms in the vicinity (or those further away via tankers), many of which already have private storage reservoirs in place.

For the purposes of the EIA and feasibility study, one crop (Rye grass with a gross irrigation requirement estimated at 1,100 m3/year) is proposed. The cropping pattern will be further assessed, developed and refined prior to completing construction of the WWTP. Cropping patterns will be restricted by land, availability of effluent storage and peak summer TWW effluent availability and therefore are not expected to vary significantly from that shown in Table 8.

Table 8
Tentative on-site cultivated area and use of TWW

Item	*Alternative 4*
Operating capacity (influent m3/year)	219,000 to 438,000
TWW Effluents (m3/year)	194,125 to 388,250
Dn's planted on-site	80 to 140
TWW Available for Sale (m3/year)	97,150 to 223,056

A detailed irrigation system and irrigation scheduling / management regime will also be developed to maximize plant water uptake, irrigation efficiency and minimize percolation of any nitrates. Most, if not all of the nitrates applied will be exported from the soils by the plants.

2.6. Summary of construction & operational activities

Starting in spring of 2006, the project team will supervise construction of the WWTP along with associated facilities and infrastructure (e.g., administration and labor residence buildings, necessary utility and road infrastructure). Prior to award of the construction contract land preparation / leveling activities would have been completed by the Municipality under the supervision of the Project Team. Construction of the WWTP should be complete by the end of 2007. In addition, the project also will provide the irrigation delivery infrastructure required for reuse of the WTTP effluents.

The main facilities and infrastructure to be constructed include:

- The WWTP & associated facilities
- Temporary housing and facilities for construction labor; and
- Irrigation system infrastructure

The main construction activities are:

- Land preparation (excavation, filling, compacting, and soil stabilization);
- Quarrying for construction materials ex-situ (sand and gravel);
- Transportation of construction materials (sand, cement, pipes, steel, etc.);
- Transportation of construction workers and supervisors; and
- Transportation and operation of construction equipment (bulldozers, loaders, compressors, etc.); and
- Scaffolding, mixing and pouring of reinforced concrete, posing of synthetic liners and piping, etc.

Following commissioning of the WWT&R systems, the main operational activities will include:

- Hauling of septage from the sources (e.g., residential cesspits) to the WWTP in tanker trucks – converging on the WWTP from various directions along different secondary roads;
- Discharge of the septage from the tankers into the receiving station within the WWTP;

- Use of water and electricity at the WWTP to run pumps, wash equipment, etc.;
- Operation of the WWTP (e.g., opening valves, raking sand filters, sludge drying and treatment, visual inspections and routine WW quality sampling and analysis, both in-situ and at an outside lab, etc.);
- Regular and infrequent maintenance of the WWTP and associated facilities (cleaning, removing sludge, replacing piping, replacing sand/gravel filter materials, etc.);
- Sludge drying, composting, land application and off-site disposal;
- Transport of replacement materials (piping, sand/gravel, etc.) and labor;
- Movement of on-site vehicles (e.g., for sludge dredging/removal, compost turning, etc.); and
- Reuse of TWW in irrigation (on-farm activities)

Decommissioning is not considered since with appropriate maintenance the WWTP is expected to either continue to serve a smaller portion of the population within the design capacity or it will be upgraded to be able to serve a larger population for a longer period of time (see Section 2.2.a.).

3. LEGAL AND INSTITUTIONAL FRAMEWORK

This EIA conforms to both USAID regulation 22 CFR 216 CFR 216 and the Government of Jordan regulations / draft EIA guidelines. USAID environmental regulations are in accordance with sections 118(b) and 621 of the US Foreign Assistance Act of 1961 and can be found under "22 CFR 216 Agency Environmental Procedures" on the USAID website. The relevant Jordanian laws, regulations and institutions pertaining to EIA requirements and implementation of this project are discussed and cited below.

3.1. Relevant laws & regulations

3.1.a. Environmental Protection and EIAs

Article (13) -A of the Temporary Environmental Protection Law number 1 for 2003 which became effective on January 13th, 2003, states that "Every institution, company, plant or any party that, after the enforcement of the provisions of this law, exercises an activity which has a negative impact on the environment, shall be obliged to prepare a study of the environmental impact assessment for its projects, and refer same to the Ministry in order to make the necessary resolution in this effect".

In accordance with Article (23) of the Environmental Law, the Cabinet of Ministers issued on March 15th, 2005 Regulation number (37) for 2005 – Regulation on Environmental Impact Assessment. The Regulation provides direction for conducting environmental impact assessments for all types of projects including the main issues to be covered by an EIA, reporting procedures, and the approval process. Regulation (37) had been used over the previous 18 months, in its draft form, as a guideline in preparing EIA's in Jordan.

The following other regulations have also been issued pursuant to the Environment Protection Law:

- Nature Protection.
- Environment Protection from Pollution in Emergency Cases.
- Water Protection.
- Air Protection.
- Marine Environment & Coastal Protection.
- Natural Reserves & Parks.
- Management, Transport and Handling of Harmful & Hazardous Substances.
- Management of Solid Waste.
- Soil Protection.
- Charges & Wages.

3.1.b. Other Environmental Policies & Controls

Other government laws and regulations are also applicable to the EIA for this project and numerous governmental agencies with responsibility for various aspects of environmental management. These cover issues such as noise, dust from quarrying activities, monitoring and penalties for inappropriate solid waste disposal, safety, labor laws, odors etc. Those of most relevance to issues related to this project are briefly mentioned below. A more comprehensive list of these other laws and regulations is presented in Table 9.

Water & wastewater

Water Authority Law (18/88) – Water (Annex 4) – is described as the most far-reaching statute pertaining to water pollution. Article 3 of this law created Water Authority of Jordan (WAJ), and article 5 provides full responsibility to Ministry of Water and Irrigation (MWI) for all water and sewage systems and for establishing a water policy. Article 6 charges WAJ with its responsibilities.

The Public Health Act (1971) also serves as the basis for the regulation of wastewater discharges and water quality in Jordan. Pursuant to the Public Health Act, standards for the discharge of wastewater have been established. These are discussed in Section 3.2. Article 4 of the Control of Spoiled Sites Regulations (1978) reiterates some of the above Public Health Act provisions and further establishes the right of the president of the municipality, based on the health inspector's recommendation, to take such actions as may be deemed appropriate against the violator. The Town and Country Regulations Act (1966) allows Local or Regional Councils to take action against the operator of any wastewater system that is found to be a nuisance and order that the nuisance be corrected within a specified period of time.

Air quality, noise & waste management

Air quality is regulated under the Public Health Act (1971), The Control of Spoiled Sites Regulations (1978) and The Traffic and Transportation Law (1984). Noise is regulated under the Town and Country Planning Act (1966), the Control of Spoiled Sites Regulations (1978), the Local Authorities Act (1955), the Monitoring and Organization of Public Markets Regulations (1961), the Traffic and Transportation Act (1984), the Public Health Act (1971), and the Environment Law. Solid waste management is regulated under several statutes, including the Public Health Law, Control of Spoiled Sites Regulations, the Town and Country Planning Act, and the Environment Law.

Terrestrial ecology & antiquities

Terrestrial ecological resources are afforded protection under the Agriculture Law (1973) and the Hunting and Protection of Wild Animals and Birds regulations No 113 (1973). Agriculture Laws No. 20 and No. 113 (1973) contain chapters on plant and forestry protection, registration of crops and pesticides, orchard and nursery regulations, fertilizer use, soil conservation, and range-land administration. Under Article 9 of the Law of Antiquities, it is unlawful to destroy, disfigure, or cause any harm to antiquities, including causing changes in features, disconnecting any part thereof, altering it, sticking advertisements or attaching any plates to them.

Labor & safety

The construction and operation of the wastewater treatment plants will be affected by Labor Law No. 8 for 1996 including all of its subsequent amendments. Article (12) of Chapter 3 of the Labor Law pertains to nationalities and work permits. Articles under Chapters 4 and 7 relate to contracts and wages. Articles under Chapter 8 specify, among other things, working hours, leave and juvenile employment. Articles under Chapter 9 (titled "*Safety and Occupational Health*") cover the obligations of the employer to provide a safe working environment for his workers, increased risks on the job and for the public, precautions and measures to be followed in the workplace, and protective and therapeutic medical care. Articles under Chapter 10 (titled "*Work Injuries and Occupational Diseases*") provide for issues related to work injuries and occupational diseases for those employees who are not covered under the provisions of the Social Security Law of Jordan.

The Jordan National Building Codes also establish design principles and minimum requirements needed to ensure public safety of structures, provide sound and efficient electro-mechanical services and to safeguard against earthquake risks.

Table 9
List of other relevant National Laws and Regulations

National Laws and Regulations	Effective as of:
Water Authority Temporary Law No. 62	2001
Jordan Valley Development Law as amended by Law No. 30	2001
Jordan Specification Standard No. 893 (Annex 11)	1994
Water Authority Instruction No. 4	1989
Antiquities Law No 31 (Annex 3)	1988
Water Authority Law No. 18 (Annex 4)	1988
Development of Jordan Valley Act No. 19	1988
Jordan National Building Codes	various

National Laws and Regulations	Effective as of:
Rural Development Regulations No. 40	1986
Public Property Administration Law No. 17	1984
Traffic and Transportation Act No. 14	1984
Jordan Specification Standard No. 202 (Annex 5)	1982
Control of Spoiled Sites Regulations No. 1	1978
Public Property Commission and Renting Regulations No. 53	1977
Law of Antiquities, (Provisional) No. 12	1976
Agricultural Law, No. 20	1973
Agricultural Law No. 30	1973
Agricultural Law, No. 113	1973
Public Health Act No. 21	1971
Natural Resources Regulations No 12	1968
Mining Regulations No. 131	1966
Town and Country Planning Act No. 79	1966
Civil Defense Law No. 12	1959
Local Authorities Act No. 29 (Municipalities Law)	1955

3.1.c. International Treaties

There are numerous regional agreements that Jordan has reached with other entities, which are of some relevance to the EIA and this project. These include those listed in Table 10. Most notable and of relevance to the North Shouneh project are the agreements reached with Isreal (see Section 3.3.c).

Table 10
Treaties, Conventions and International Agreements Related to Environment and Resources

Treaties, Conventions and International Agreements	Year (in force)	Description
Convention on Wetlands of International Importance Especially as Waterfall Habitat (Ramsar Convention)	1971	- Protects all characteristic flora and fauna, with emphasis on protection of the waterfall habitats.
The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	1979	- Regulates export and import of listed endangered species of fauna and flora - Additionally allows Parties to give protection to selected species of flora and fauna within their jurisdiction
Vienna Convention for the Protection of the Ozone Layer (The Ozone Convention)	1985	- Regulates domestic production and consumption of green house gases.
Convention for the Control of Transboundary Movements of Hazardous Wastes and their Disposal (Basel Convention)	1989	- Accompanies declaration that Jordan will not import or transship foreign hazardous wastes
The United Nations Convention on Biological Diversity (Bonn)	1993	- Calls for identification and monitoring of biodiversity components - Calls for establishment of protected areas and emergency response plans
Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa	1994	- Combat desertification - Mitigate effects of drought.
The United Nations Framework Convention on Climate Change	1994	- Calls for stabilization of greenhouse gases, and requires Parties to prepare greenhouse gas inventories

Treaties, Conventions and International Agreements	Year (in force)	Description
Peace Treaty Between the State of Israel and the Hashemite Kingdom of Jordan, and Arrangement between the Government of the Hashemite Kingdom of Jordan and the Government of the State of Israel on Cooperation in Environmental Protection and Nature Conservation	1994 1995	- Proposes cooperation in environmental planning, legislation, enforcement, monitoring, and emergency response with a focus on impacts from industry, power generation, hazardous materials, solid waste, ports and tourism

3.2. Relevant standards

At present, there are two approved sets of water and wastewater treatment standards that are of relevant to this project:

- The Jordanian Standard for Reclaimed Domestic Water - No. 893/2002
- The Jordanian Standard for Sludge – Uses of Sludge in Agriculture - No. 1145/1996

Wastewater treatment and reuse

JS298/2002 on "Reclaimed Domestic Water" has two primary components: i) reclaimed water discharged to streams, wadis or water bodies and ii) reclaimed water for reuse. Reclaimed water for reuse standards in turn have three subsets (denoted A, B and C):

a) cooked vegetables, parks, playgrounds and roadside greenery inside city limits
b) fruit trees, roadside greenery outside city limits and landscape
c) field crops, industrial crops and forest trees

The full standards are presented in Appendix B.

Sludge

JS1145/1996 on "Uses of Sludge in Agriculture" describes sludge treatment methods and presents sludge quality standards for reuse in agriculture (see full standards in Appendix B).

Other Standards

There are also several other Jordanian regulation, guidelines and standards pertinent to the EA

- JS 286: 2001 – Drinking water standards
- JS 431: 1985 - Storage precautionary requirements for storage of hazardous material
- JS 1140: 1996 – Ambient air quality (aimed at industries)
- JS1052, 1053 and 1054: 1998 and JS 703: 1990 - Motor vehicle emissions
- JS 1059: 1998 - Motor vehicles noise levels
- JS 1401 and 1404: 1998 - Environment management systems
- JS 1411 and 1412: 1998 - Guidelines for environment auditing
- JS 525: 1997 - Heat levels allowed to be exposed to in the work environment
- JS 524: 1987 - Lighting levels in work environment

3.3. Institutions

3.3.a. Monitoring and Surveillance

There is some overlap of roles and responsibilities among institutions, especially in the area of monitoring and surveillance. The MOE Law, WAJ Law, and MOH Law all assign their respective institutions with responsibility for water and wastewater quality monitoring. MOE is concerned with environmental

protection to ensure public health and long-term environmental sustainability. WAJ is most concerned with protecting water resources, also for public health. Public health concerns are a primary concern of the MOH, and its focus is mainly on testing of microbiological parameters. The MOH and WAJ communicate and coordinate closely on monitoring and surveillance plans, results and responses to those results. The MOH can take appropriate action in relation to wastewater treatment plant operated by WAJ or any of its agents (i.e., LEMA or AWC) if needed. It can also close down any private plants it deems are a danger to public health.

In practice, WAJ monitors wastewater treatment plants connected to the sewer system. For those who recycle their own wastewater, monitoring levels depend on perceived risk. If on-site WWTPs have no connection to the sewer system, the Ministry of Environment takes monitoring responsibility, although WAJ laboratory personnel reported that they do most of the actual testing for the MOE.

Monitoring and Surveillance Concerns of Various Institutions

(Adapted from Ziegelmayer and Jaber, 2003)

Effluent quality monitoring:
- MWI – has central database of all water/wastewater quality monitoring
- WAJ Laboratories
- LEMA, AWC, NGWA
- WWTP operators do regular testing of basic parameters
- MOH (public and private WWTP)
- MOE

Irrigation water monitoring:
- Irrigation water – JVA
- Suitability of TWW for certain crops – MOA
- Environmental control – MOE

Groundwater monitoring
- Regular monitoring - WAJ
- Safe potable water sources - MOH
- Environmental protection – MOE

Soil monitoring:
- Protection of soil - JVA
- Field lab analysis related to agricultural production – MOA
- Environmental protection – MOE

Crop monitoring:
- Protection from disease caused by wastewater – MOH
- Protection of human and animal health – MOA
- Crop quality for export - MOTI

3.3.b. Wastewater treatment and reuse

Several institutions are likely to be involved in certain stages of the Small Communities Project (planning, O&M) and are discussed further in the feasibility study. It is important however to note the main institutions that must be involved throughout the life of the project. These are:

- Water Authority of Jordan
- Jordan Valley Authority
- Municipality of North Shouneh
- Local Community based organizations
- Ministry of Interior (Mutassarif)
- Private Sector Service Providers (e.g. Septage Tanker Operators)

3.3.c. Special considerations in Jordan Valley

There are three key considerations of special relevance to projects in the Jordan Valley. These pertain to the Jordan Valley Authority, the Military and the Jordanian-Israeli agreements.

The Jordan Valley Authority

The Jordan Valley Authority is responsible for socio-economic development of the Jordan Rift Valley, including water resources development and irrigation management. In the past, the JVA was responsible for all aspects of development. Parliament amended the JVA Law in 2001 with the intention of moving some of those responsibilities to line ministries. The Jordan Valley Authority administers government land in Jordan Valley and must give permission for all construction within its jurisdiction. It is also responsible for coordination with Israel on matters relating to environmental protection.

Because the Jordan Valley Authority (JVA) has critical responsibilities for development within the Jordan Valley, the project team will work closely with WAJ to consult with and inform the JVA throughout the development, implementation, and early operation of the North Shouneh facilities. To institutionalize this process the team will develop reporting procedures to ensure that JVA has all necessary information to demonstrate that the facility is meeting all environmental protection requirements of the peace treaty with Israel. Key points related to this treaty are discussed below.

Military

Due to the location of the WWTP in a border zone, specific approval from the relevant military authorities is required in respect of the selected site and for granting access for planning team personnel, the construction contractor and supervisors, and later on, for septage tankers and WWTP operating and maintenance personnel.

Agreements with Israel

The main environmental objectives of the Jordanian peace treaty signed with Israel in 1994 of relevance to this project relate to co-operation in matters relating to the environment, including conservation of nature and prevention of pollution, with explicit reference to the prevention of contamination of water resources. This project is considered a significant step in that direction due to the positive impact on the environment (see Sections 2.1.a and 5.1.b.)

4. DESCRIPTION OF THE EXISTING ENVIRONMENT (AFFECTED AREAS)

This chapter defines the geographical areas potentially affected by the proposed project (the study area) and describes the environmental and social receptors in relation to the potential impacts assessed and mitigated in Chapter 5. It also details the relevant service area populations, the septage they generate and existing impacts on the environment.

4.1. The Study Area

The study area can be divided into two potentially affected areas:

1. The "wider area" extends as far as the service area and is generally associated with positive and indirect impacts (e.g. improved sanitary conditions around households, less illegal discharges of tankers into wadis, etc.).
2. The more-immediate affected area ("localized area") generally concerns the more-direct impacts of the project that tend to be more localized around the proposed WWTP site shown in Figure 3 (e.g. potential impacts associated with odors, health and safety, dust, water pollution, etc.).

The *wider zone* covers an area from Adasiyyah to the north, may extend a few kilometers into the hills to the east, as far south as Wadi Al Yabis and is bound by the Jordan River to the west - an international border (see Figure 1 and refer to Sections 2.2.a, 4.2.a and 4.2.b). As explained in Section 2.2.a, this wider (service area) will reduce in size over time until it stabilizes to a smaller area around MBJ and is likely to vary from season to season.

The *localized area* extents are defined by each impact. For example, with respect to water resource impacts the spatial extents are dictated by watersheds, surface and groundwater flow directions and hydrogeology. Odor and dust affected areas depend on wind speeds and directions. Generally, this *localized area* ranges from the immediate vicinity of the proposed WWTP site and stretches a few km upstream (north and east) of the proposed site and 5 km downstream to the south & west (potentially as far as 10 to 20 km south of the site when considering issues related to groundwater and the Jordan River).

Figure 1 best represents the extents of the *wider area*, while the *localized area* varies in size from the two areas shown in Figure 3 and potentially extends as far as the area shown in Figure 2.

4.2. Human Environment

This section describes aspects of the human environment that are of relevance to the potential impacts and associated affected areas of the proposed project. It focuses on populations served, the septage they generate and how it is disposed of, as well as provides information on the economy, land-use, community infrastructure and archaeology/sites of important cultural heritage.

4.2.a. Demographics

Table 11 provides the number of the potentially serviced households and populations of the three NJV municipalities according to the Oct. 2004 general census. See also Section 2.1 for a description of the potential service area. It also shows population projections based on the same population growth rates used by the MWI in its National Water Master Plan databases for these areas. Annual population growth rates start at 2.25% and are projected to taper down to 1.45% per annum by the year 2030. The average household size is around 5 to 6 persons.

In relation to the table above, it must be noted that the MBJ includes two towns (from two adjacent municipalities) that are very close to MBJ and are therefore considered part of its long-term targeted

service area. The data for Sharhabeel Bin Hasna Municipality only includes towns that are north of the mid-point distance between the proposed WWTP and the Tell Al Mantah WWTP – towns south of this point would use Tell Al Mantah (near Dier Allah). These data are therefore not necessarily comparable with population data reported on the basis of administrative boundaries.

Table 11
Service area households, populations and population projections (2004 – 2030)

Municipality	No. of HH	2004 Population	2008*	2010	2015	2020	2025	2028*	2030
MBJ	5,381	30,344	32,419	33,802	37,344	40,886	44,330	46,267	47,558
T. Fahl	4,646	27,376	29,248	30,496	33,691	36,887	39,994	41,742	42,907
Sharhabeel	1,261	7,132	7,620	7,945	8,777	9,610	10,419	10,874	11,178
Total	**11,288**	**64,852**	**69,287**	**72,243**	**79,812**	**87,383**	**94,743**	**98,883**	**101,643**

* The WWTP is planned to begin operation in 2008 and has a 20-year life (2028).

When towns from Kura and Taybeh municipalities that are likely to use this WWTP (i.e., those where it is easier for a tanker to travel downhill to the proposed WWTP as opposed to traveling to Akayder WWTP east of Irbid) are included in the potential service area, the total population served nearly doubles, if not more. Less emphasis was placed on obtaining accurate estimates in relation to the towns further away from the long-term targeted service area of MBJ. A fully detailed list of populations according to each town and municipality considered is available in Appendix C.

4.2.b. Septage generation, collection and disposal

Within the NJV, five private septic tankers currently operate full-time, disposing of 400 to 500 m3 of septage per day during the winter and as high as 700 to 800 m3/day in the summer. There are also a few other tankers that occasionally work in the area from Kura and Taybeh municipalities as well as tankers owned and operated by two hospitals and the civil defense.

Septage estimates and projections

The current and projected estimated ranges of septage generated and disposed of from MBJ, and in total from all municipalities in the NJV that are likely to use the proposed WWTP are provided in Table 12. Septage from the NJV communities considered (see Section 4.2.a), increases from an annual average approximating 600 m3/day to 1,200 m3/day throughout the year 2030: MBJ makes up approximately 75% of the NJV total. These correspond to each household pumping out 10 m3 (the average size of a tanker), around 2 to 2.5 times every year. In MBJ and North Shouneh in particular, it is closer to 4 times per year on average. During the summer, when septage discharges are significantly higher than during the winter, NJV communities' septage discharges may reach as high as 800 m3/day and are likely to increase to over 1,700 m3/day around 2030.

The initial estimates and summer/winter distributions are based on the experience and research of the project team using inputs from repeated interviews with several tanker drivers, supported by information obtained from municipalities as well as random interviews with residents in different areas. The assumptions behind the projections are explained after below.

Table 12
Septage estimates and projections (2004 – 2030)

Area	*Estimate*	2005	2008*	2010	2015	2020	2025	2028*	2030
NJV	*Low***	410	452	482	543	607	664	693	713
	*High****	770	874	948	1121	1313	1509	1622	1700
MBJ	*Low***	313	346	368	415	464	508	530	545
	*High****	589	669	725	857	1004	1154	1240	1300

* The WWTP is planned to begin operation in 2008 and has a 20-year life (2028).

** The lower ranges provided are based on:
a) Lower-end initial estimates;
b) Winter discharges (usually ranging from 30 – 60 % of the peak summer values); and
c) Are projected on a septage per capita basis along with population projections (see Table 11), increasing annually at the same rate of increase used by the MWI National Water Master Plan in their per capita water supply assumptions.

*** The higher ranges provided in Table 12 are based on:
d) Higher-end initial estimates;
e) Summer discharges (when discharges peak); and
f) Are projected in a similar manner, but with an added 5% on top of the rate used in the lower range projections described previously.

With the higher range projections, 5% was added to the rate of increase in per capita water supply to account for cesspit improvements, increasing age of cesspits, better enforcement and regulation of emptying out cesspits over time - all of which result in households having to empty their cesspits more frequently - and to account for other potentially unforeseen factors. Increases in per capita water supply being the basic factor related to increases in water consumption and hence septage generation.

Costs & consequences

On average, households in the NJV normally paid between 5 and 20 JD for this service (each tanker trip) when disposal is within the NJV, depending on the distance tankers must travel. For this amount, tanker drivers would normally travel the shortest possible distance and discharge wherever they can, sometimes illegally. They have sometimes been granted un-official approval by the local authorities to dump in designated areas, usually into lower reaches of canals or wadis that discharge to the Jordan River. Environmental pollution (of soils, water and farms) and public health risks result from such discharges, especially the "illegal" ones.

Until very recently (December 2004), tanker drivers disposed of septage in the lower reaches of Wadi Al Arab, just before its confluence with the Jordan River. They are currently banned from disposing there due to environmental and health concerns expressed by the military in the vicinity and are now required to either discharge into Tell Al Mantah WWTP, much further to the south in Dier Allah, or at the Akayder WWTP east of Irbid. Tankers refuse to go up to Akayder unless paid 40 to 50 JD's per trip, and even then they still prefer not to go there due to the strain that the long climb and drive place on their vehicles. Tankers are therefore charging around 20 JDs per trip from the southernmost towns and up to 45 JD's from towns in the north like North Shouneh and Adasiyyah to deliver at Tell Al Mantah. Unnoticed illegal discharges have probably increased as a result.

Most households have small cesspits relative to their family size, especially in the higher density areas like North Shouneh. Others that live in government-built housing complexes often share one cesspit between multiple households (up to 11 households sharing a 60 m3 communal cesspit). As a result, many households have to pump their cesspits quite regularly (once every 2 to 3 months, some once every 3 to 4 weeks). Other, more fortunate households need only pump once or twice a year, few others even less frequently. Mostly dependent on farm work, the financial strain on most households from this septage situation is tremendous. With the recent increase in tanker costs, many households could no longer afford to pump their cesspits, and have left them to overflow into the street where children often play. There are even reports of septage overflowing into neighbors' houses. This situation is most severe in the Municipality of MBJ, and particularly in the town of North Shouneh.

4.2.c. Economy and living standards

Most households in the service area are dependant in one way or another on agricultural. Government and military services comes second as a source of employment after on-farm work, followed to a lesser extent by different private sector commercial activities, mostly related to services to the agricultural sector. There are also a large number of immigrant workers (mostly on farms, and occasionally in

construction). Women do not generally participate in generating family income, as most are tending children at home. Some however do take part in farming work or actively participate in education, health care, paid agricultural employment, and other sectors.

According to the latest 2004 DOS figures, average family income is around 4,800 JD per annum with 23 % of the population living in poverty. On average, this corresponds to two income earners per household on average salaries of 200 JD/month. A 2004 report published by the Municipality of MBJ suggests that average family income is closer to 150 JD/month, less than half of that reported by DOS. Regardless of which figures are correct, this area can still be considered one of the relatively better off areas in terms of agricultural related income generating opportunities in the country, but not much better in terms of overall family income. Family expenses drain all income and sometimes drive families into debt. DOS reports indicate that expenditures slightly exceed 100% of reported income.

Expenditure and losses of income as a result of health problems is expected to be relatively high. The area has one of the highest rates of certain diseases (e.g. diarrhea), and highest frequencies of certain disease outbreaks in the country (e.g. hepatitis). Local health officials attribute this health situation to the poor sanitary conditions within which households live and contaminated farm produce. This is in part due to the septage situation described in Section 4.2.b, children being exposed to such conditions, combined with poor health and hygiene awareness. Most potable water storage tanks are on ground level and liable to contamination: even when aware, many families may not be able to afford raising their tanks (due to piping and pumping costs). There are no epidemiological studies however to confirm nor refute the above conclusions. Most families live in poor to moderate houses built out of blocks or concrete. There are also over 300 government-built housing units in MBJ alone.

4.2.d. Agriculture

The wider area provides the majority of the country's citrus production and a significant amount of other, nationally important crops. The moderate temperatures in the JV also favor production of winter vegetables. Availability of water resources is however a limiting factor for agricultural production. Vegetables and field crops including fodder, tend to be grown on smaller farm plots, usually owned or rented by poorer, local families. Orchards, especially the larger ones, tend to be owned by richer people from outside the area. Drip irrigation is mostly used, however surface / furrow irrigation is also common. Levels of farmer technical know-how are some of the highest in the country.

The proposed site is situated in the southwestern corner of development area (DA5), just to the north of DA6. There are several citrus orchards, with some fruit trees and planting of field crops in the vicinity. Being at the tail end of irrigation distribution canals (fed from the KAC), most farmers in the vicinity of the proposed WWTP site do not get the quantities of water they need during the summer for optimal production. Farms that can afford it have storage reservoirs to help alleviate this problem.

4.2.e. Land-use, community infrastructure & services

Some of the land use and infrastructure described below, including roads, canals, built-up areas (residential) and farms can be seen in Figure 2 and Figure 3. There are two hospitals and a few clinics in the NJV, all run by the MoH and/or UNRWA. Schools go up to the secondary level (high school) and are all either publicly run or through UNRWA. All households have access to running water and most have electricity. Nearly all government agencies have local offices in the area; most are in MBJ as the administrative center of the NJV. There are police and emergency response (civil defense) stations, as well as military facilities and offices in various locations. NGO activity is relatively limited.

Each of the larger towns has a market, usually directly on the main road that runs from the north of the NJV towards the Dead Sea over 100 km to the south. Residential areas are almost always located along side this road that is used by most traffic, industrial, agricultural as well as residential. With high speeds, this often makes for a high-risk of traffic related incidents. North Shouneh has one of the busiest and most cramped markets and is often experiencing traffic jams during the day. The area is only accessible from the eastern highlands through a main road which runs from Irbid down to North Shouneh and a

few other, smaller roads that come down from Taybeh / Kura, further to the south. Lands to the east of the main JV road are limited due to the adjacent steep slopes that run up to the highlands and are usually not connected to the irrigation infrastructure found widespread in the areas west of this road.

Generally, the larger residential (and market) areas are quite densely populated. Agricultural lands take up most of the space in the JV, especially areas to the west of the KAC. The KAC runs along side the main JV road mentioned previously, crossing it occasionally. The KAC is one of the main potable water supply sources for greater Amman. It also provides irrigation water for most of the JV south of the study area after satisfying NJV and Amman allocations.

In the area immediately around the site, there are very few residents. It is mostly agricultural land with a few military checkpoints, watchtowers and nearby military barracks. The residential area of North Shouneh emerges approximately 2 km northeast of the proposed site and the city center is about 3 km away. Most residents live north east of the town center. Manshiyyeh is about 2 km south east of the proposed site. Three agricultural roads lead to the proposed site. These roads are in poor shape, narrow in most places and frequently used by farmer related traffic. The road coming to the site from the south crosses Wadi Arab with a culvert that is in poor condition. The road coming from the north crosses one of the main secondary KAC canals (a branch of KAC), while the road approaching the site from the east crosses the main KAC canal and is fenced off to protect the canal. Both these crossings are in good shape.

4.2.f. Archeology

This wider area is in a sub-tropical climate and quite different from the rest of the country. In this area, there are springs and the possibilities of growing different crops on the plateau. Ancient trade routes made use of the valley as a north-south corridor and of the wadis leading up to the plateau to reach the highlands and the historically important 'King's Highway'. The proposed site is also adjacent to the historically important Jordan River. There are a number of important sites down in the valley and on the lower foothills, however none of these are in the vicinity of the proposed site with the exception of a relatively recent fort which is currently being used as military barracks, over 500 m south of the proposed site. Nonetheless, within such modern agricultural areas there are scatters of pottery and flint and the possibility of buried cultural deposits.

DLS Property maps indicate a burial ground in the center of the proposed site, but no visible evidence of such a site was observed during the field visits. This cemetery is identified as Plot No. 504 of D.A. No. 5, occupying approximately 3.5 Dn in size on the DLS maps.

A search for archaeological sites within a 1 km radius of the proposed WWTP site performed with the Jordan Archaeological Data Information System (JADIS) confirmed the above findings, with the exception of the (DLS) cemetery, as shown in Figure 7 overleaf. The full JADIS search results are available in Appendix D.

4.3. Physical Environment

4.3.a. Climate

There are two climatic stations near North Shouneh: Baqura (-170 masl) is located approximately 10km north of our site and Wadi El-Rayyan (-200 masl) approximately 20km south. While climatic conditions are comparable, Wadi El-Rayyan is moderately warmer and drier than Baqura (see Table 10). The mean number of days with maximum temperature greater than 30°C is about 190 days (186 days in Baqura and 192 days in Wadi El-Rayyan). Total annual rainfall ranges from 308 mm in Wadi El-Rayyan to 397 mm in Baqura. Mean annual humidity in Baqura is about 65% but can reach almost 85% in August during the night and 90% in January (Wadi El-Rayyan only)

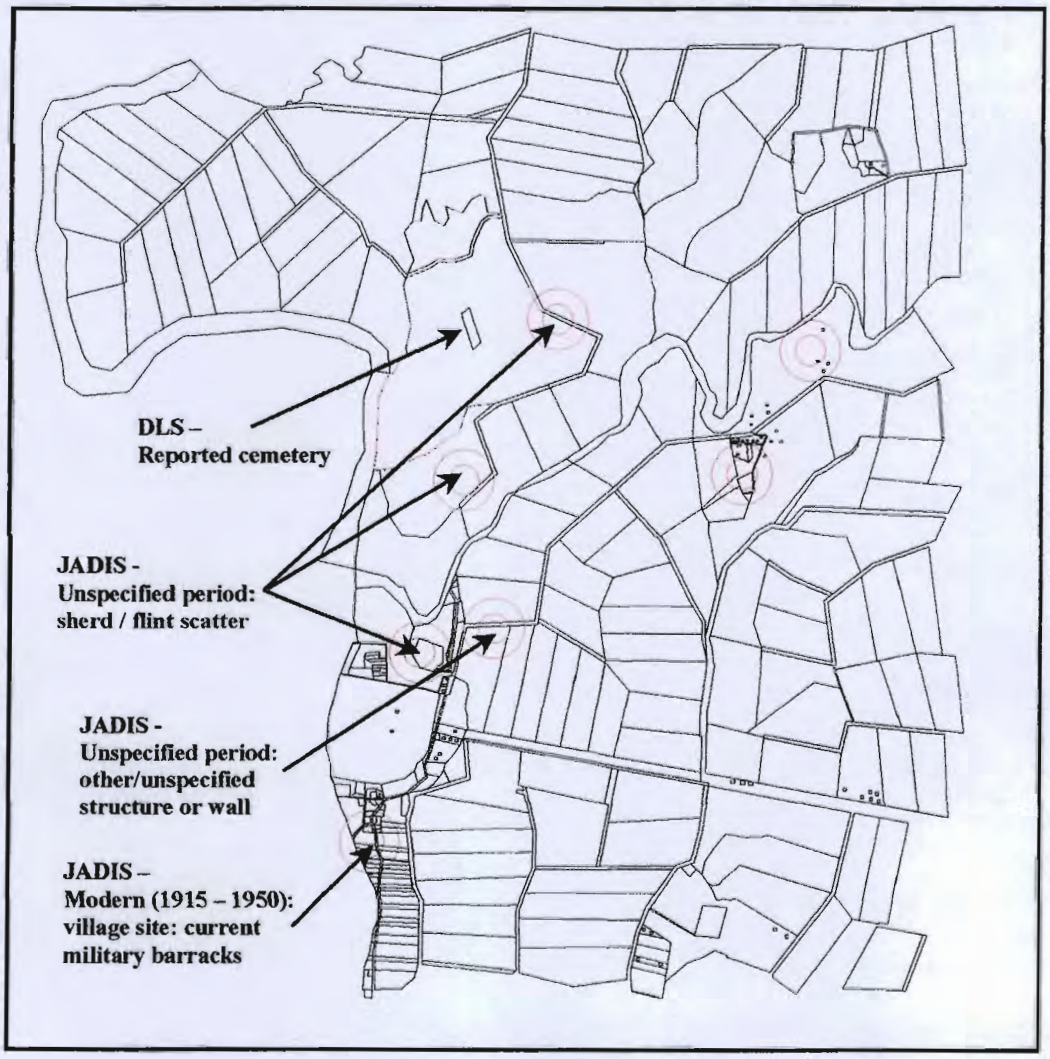
Prevailing wind direction at Baqura from April to October is westerly to southwesterly (251° in April, 268° in June and 209° in October). Wind direction from November to March is easterly to southerly (098° in November to 134° in March). In summer however, calm wind conditions and low wind speeds prevail. Wind direction from Wadi El-Rayyan was not taken into account because the site is closer to the Baqura station. Long-term monthly wind data is available in Appendix C.

Table 13
Climatic profile of North Shouneh region

Parameter	*Baqura**	*Wadi El-Rayyan**
Absolute max Air Temperature (°C)	47	47.5
Absolute min Air Temperature (°C)	-1.6	-2.6
Mean air temperature (°C)	22.2	22.2
Mean Maximum Air Temperature (°C)	28.9	29.6
Mean Minimum Air Temperature (°C)	15.7	14.9
Annual Mean Relative Humidity (%)	65.3	66.1
Total Rainfall (mm)	396.7	307.9

Notes: Climatic data in Baqura are from 1967 to 1999 and Wadi El-Rayyan from 1961 to 1999, except relative humidity data (1977-1999).

Figure 7
Potential archeological sites within a 1km radius of the proposed site



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4.3.b. Topography and Soils

The NJV is part of a deep graben to the north of the Dead Sea. Bounded on the west by the Jordan River and on the east by the escarpment of the Jordan Plateau. The site is located between 220 and 250 meters below sea level. The localized area's topography has a general south/west trend towards the adjacent Jordan River. Wadi Al-Arab is found to the southwest of the proposed site and there are several smaller wadis in the area. The proposed site is a sub-catchment delineated by watersheds running along its northern and northwestern boundaries. The proposed WWTP site is undulating and dissected by a few wadis that have easily cut through the loose soils. Figure 8 overleaf shows the contour lines and rivers/wadis in the area surrounding the site as well as a 5 m surface contour interval map of the site itself.

A soil map is available in Figure 9 overleaf. The Zor soil unit is characterized by channels, levees and cut off meanders in the flood plain of Jordan River. It is also found as alluvial fans along the rivers margins resulting from the erosion of Lisan (marl) deposits. In this area, the Zor tends to be of ustic moisture regime. These are generally deep soils (>80cm) with textures ranging from fine sandy clay loam, clay loam, to clay. They have moderately high organic matter contents on the surface and tend to be relatively non-saline. The relief[2] can be 5 m or more.

The Katar soils feature flat planes with highly dissected badlands (area of severe erosion) on lacustrine deposited Lisan formations. It can also feature nearly flat Lisan plains with deeply dissected margins and alluvial fans that separate the badlands from the Zor soils. Katar is generally associated with aridic/ustic moisture regimes in this area. The classification of these soils varies from clay, to clay loam, to silty clay loam. They have moderately high organic matter contents on the surface and tend to be moderately to very saline. The relative relief ranges from 10 - 25 m.

4.3.c. Water resources and hydrogeology

Surface waters

The proposed site is delineated to the west by the Jordan River and to the south by Wadi Al Arab. These two watercourses fall within the localized study area as can be seen in Figure 9 overleaf, which also shows the main branches of the King Abdullah Canal. Figure 10 shows more of the surface waters in the wider project area.

Though relatively significant flows are observed in the Jordan River in the area, no data has been available on its flows since 1967 (KfW, 2004 Report). Data on flows for Wadi Al Arab are available, however not for the lower reaches in the localized study area. By the time Wadi Al Arab reaches the JV floor, most of its freshwater has been stored (in Wadi Al Arab Dam) and/or is diverted for irrigation purposes.

After its diversion, Wadi Al Arab receives piped discharges from WWTP's serving greater Irbid. The total TWW effluent discharges from the three Irbid WWTP's are currently estimated at slightly over 11 MCM/year (including Wadi Shallala WWTP) and are projected to almost double by 2020 (KfW, 2004 Report). Until these TWW flows are diverted for reuse, it can be assumed that the majority of the flows in Wadi Al Arab in the vicinity of the proposed site are composed of TWW, discharged from upstream WWTP, followed by agricultural return flows and limited surface water run-off from localized catchments draining a mostly agricultural area.

The irrigation networks in the area supply most, if not all of the water used in irrigation on farms surrounding the proposed WWTP. However, this area is located near the tail end of the irrigation distribution system for DA 5 and 6 supplied by the KAC, where quantities are the lowest and are often completely utilized for agriculture.

[2] Relief refers to the differences in elevations of landscape features

Figure 8
Topography of the site and surrounding area

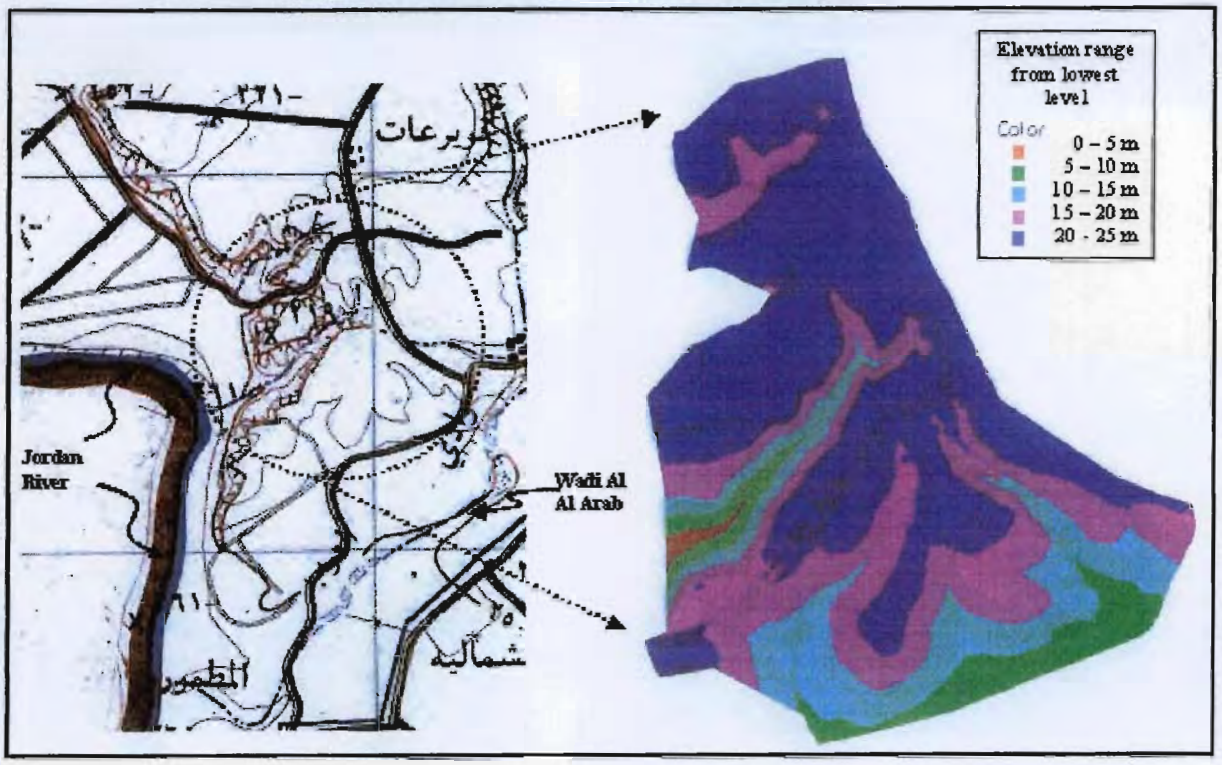
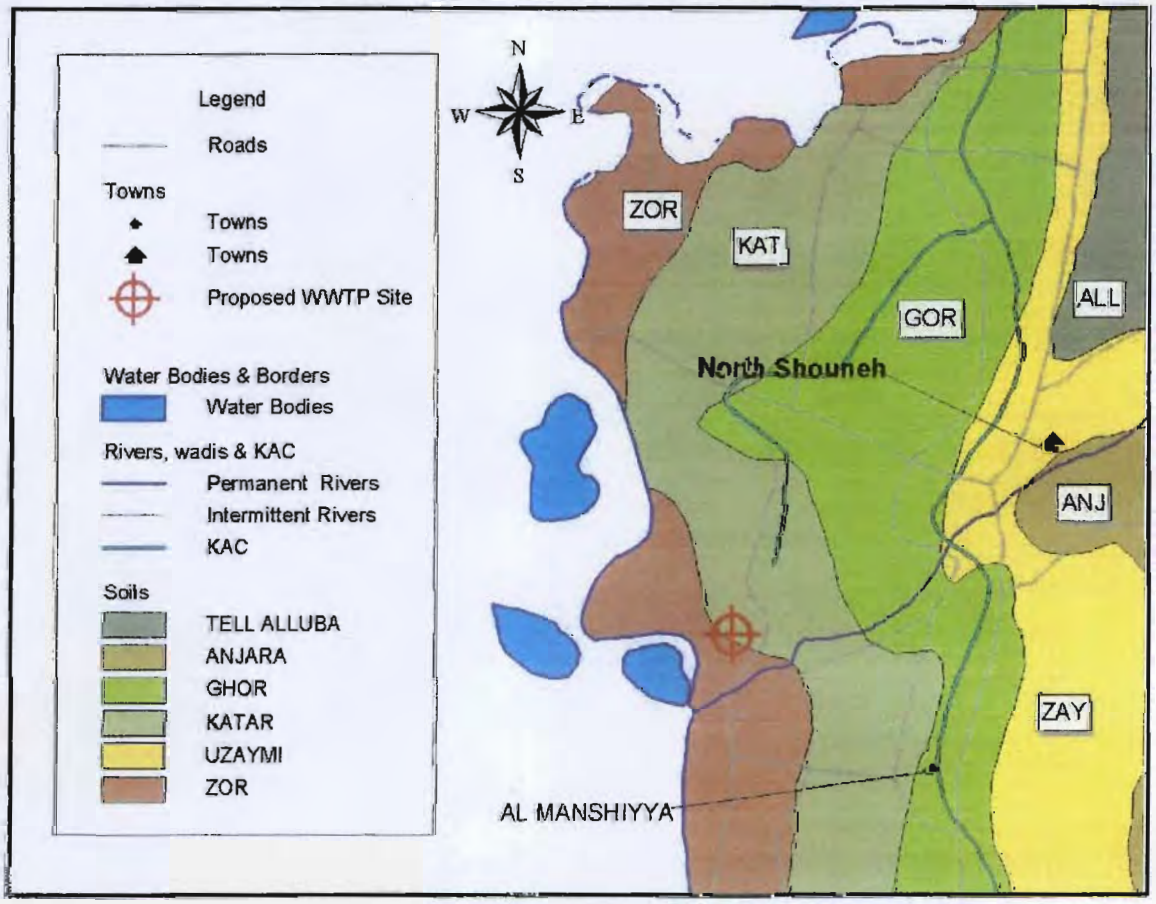


Figure 9
Soil Map of the localized study area

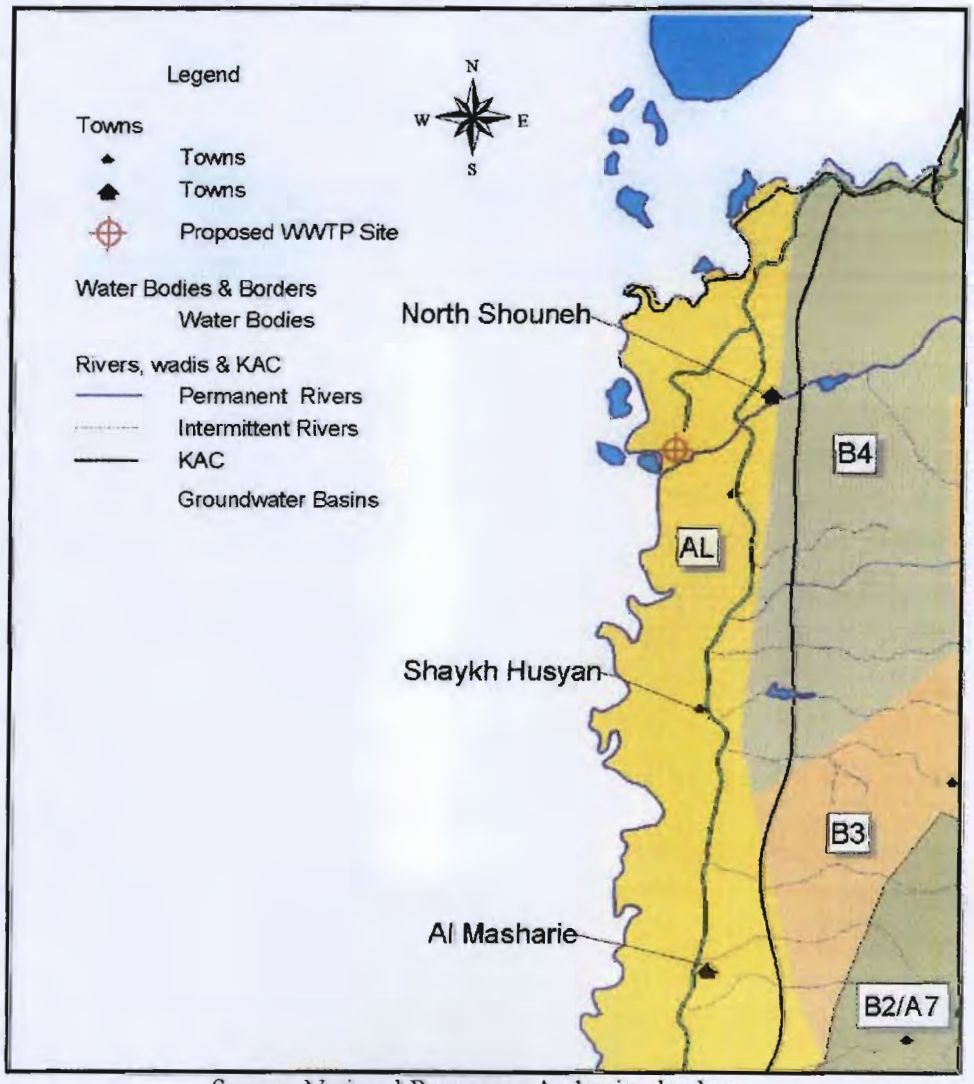


Geology

The localized study area is located within the Jordan Valley alluvial (AL) formation. The alluvial aquifer is delineated by the Jordan River to the west, the eastern escarpment of the rift valley to the east, and extends from the lower reaches of the Yarmouk River in the north to the northern shore of the Dead Sea in the south. It has an average width of 8 km and consists of intercalated layers of clastic and carbonate sedimentary rocks in addition to conglomerates and evaporates. The proposed site lies in the western boundary of this system and is in the discharge zone of the Jordan River.

The eastern part of the wider study area presents the contact zone of the alluvium formations with older rocks of mainly Upper Cretaceous age: dominated by the B3, B2/A7 and B4 - B5 formations of the Balqa and Ajloun series. A simplified surface hydro-geological map for the wider study area is presented in Figure 10.

Figure 10
Simplified Geologic Map of Project Area (incl. Aquifers)



Source: National Resources Authority database.

Lithological succession

The thickness of the alluvial formations in the Jordan valley varies from 271 m to 335m. The lower boundary of the system consists of different bedrock types of the Kumub, Zarqa, Ajloun, and different Balqa Formations. An overview of the lithological succession in the northern parts of Jordan and the NJV is presented in Table 14 overleaf.

The predominantly marly Muwaqqar Formation (B3) separates the B2/A7 from the overlying B4/B5 aquifer. The Rijam forms a shallow aquifer in the area northwest of Irbid. The aquifer materials consist of chalk, chert and limestone which are jointed and fractured with solution channels and cavities in the carbonates portions. The aquifer is highly anisotropic and heterogeneous.

The B2/A7 (the Amman Silicified Limestone - B2 and the Wadi Sir Limestone Formation - A7) are considered as one hydro-geological unit. It is composed of massive limestone, dolomitic limestone and dolomite with intercalated beds of sandy limestone, chalk, marl, gypsum; and chert. It has a wide and continuous extent, and outcrops over a large area in the highlands east of the Jordan Rift, on the western edge of the plateau. It is characterized by relatively high permeability and receives continuous recharge from the different surface water resources. In general, the underlying A1/A6 unit forms the base of the B2/ A7 aquifer. However, in the Yarmouk area, hydraulic connections with deeper aquifer systems are likely due to the facies changes in the A1/A6 unit.

The A1/A6 aquitards/aquifers of the Upper Cretaceous system consist mainly of limestone, marly and dolomitic limestone, dolomite and marl. It is in direct hydraulic contact with the overlying B2/A7 aquifer and the underlying Kurnub aquifer in region. The thickness of the A1/6 units in northern and central JV varies between 400 to 650 m. Many springs emanate from the A1/A6 aquifer system and were historically important for water supply, especially as local sources for north-western highlands. The A1/A6 is to a large extent exploited by wells throughout northern and central JV.

Table 14
Lithological Succession in Northern Jordan including NJV

Era	*Period*		*Epoch*	*Series*	*Formation*	*Symbol*	*Lithology*
CENOZOIC	Quaternary		Holocene Pleistocene	**Alluvium**	Fuviatile Lacst (Lisan) & Eolian	RC	Soil, sand, gravel
					Jordan Vally Formation	JV	
	Tertiary	Paleogene	Eocene	**Balqa**	W.Shallah	B5	Limestone, chalk, marl
			Paleocene		Rijam	B4	Chert, limestone, chalk, marl
					Muwaqar	B3	Marly limestone
					Amman	B2	Chert, limestone, phosphate
		Upper	Meastrichtian Campanian Santonian		W.Ghudran	B1	Chalk, marl, marly limestone
MESOZOIC	Cretaceous		Taronian	**Ajloun**	Wadi Sir	A7	Limestone, dolomite, chert
			Cenomanian		Shuieb	A5, 6	Limestone, marly limestone
					Hummar	A4	Dolomite, dolomitic limestone
					Fuheis	A3	Marl, marly limestone
					Naur	A1, 2	Limestone, dolomitic limestone

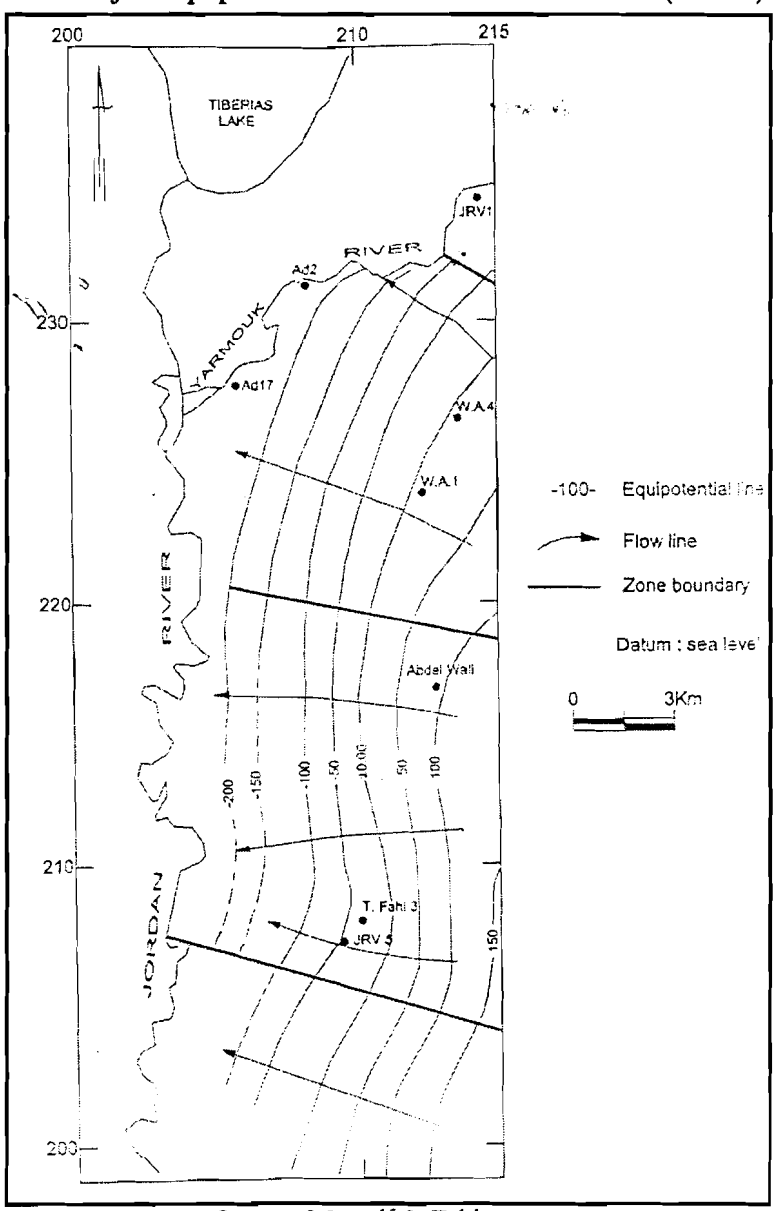
Source: The study on Water Resources Management in the Hashemite Kingdom of Jordan, final Report, JICA, 2001

Groundwater flow directions

Groundwater flow in the NJV is predominantly east to west as can be seen in the equipotential lines of the intermediate (B2/A7) aquifer system depicted in Figure 11. The shallower aquifers show similar flow directions as that of the intermediate systems. In principle therefore, any spill or leakage at the proposed WWTP would travel west and into the Jordan River.

However, the carbonate rock sequence in the central and northern parts of Jordan are characterized by karstic formations. These are characterized by deep gullies, caves, sinkholes, and underground drainage and are all the result of carbonation-solution. Such formations can result in conduit-flows[3] that may travel to deeper aquifers or to areas further to the south of the proposed WWTP. This same karst phenomena gives rise to numerous springs that emerge in the wider study area from weak zones of the carbonate rocks.

Figure 11
Groundwater Flow in NJV: Equipotential Lines of the Intermediate (B2/A7) Aquifer System



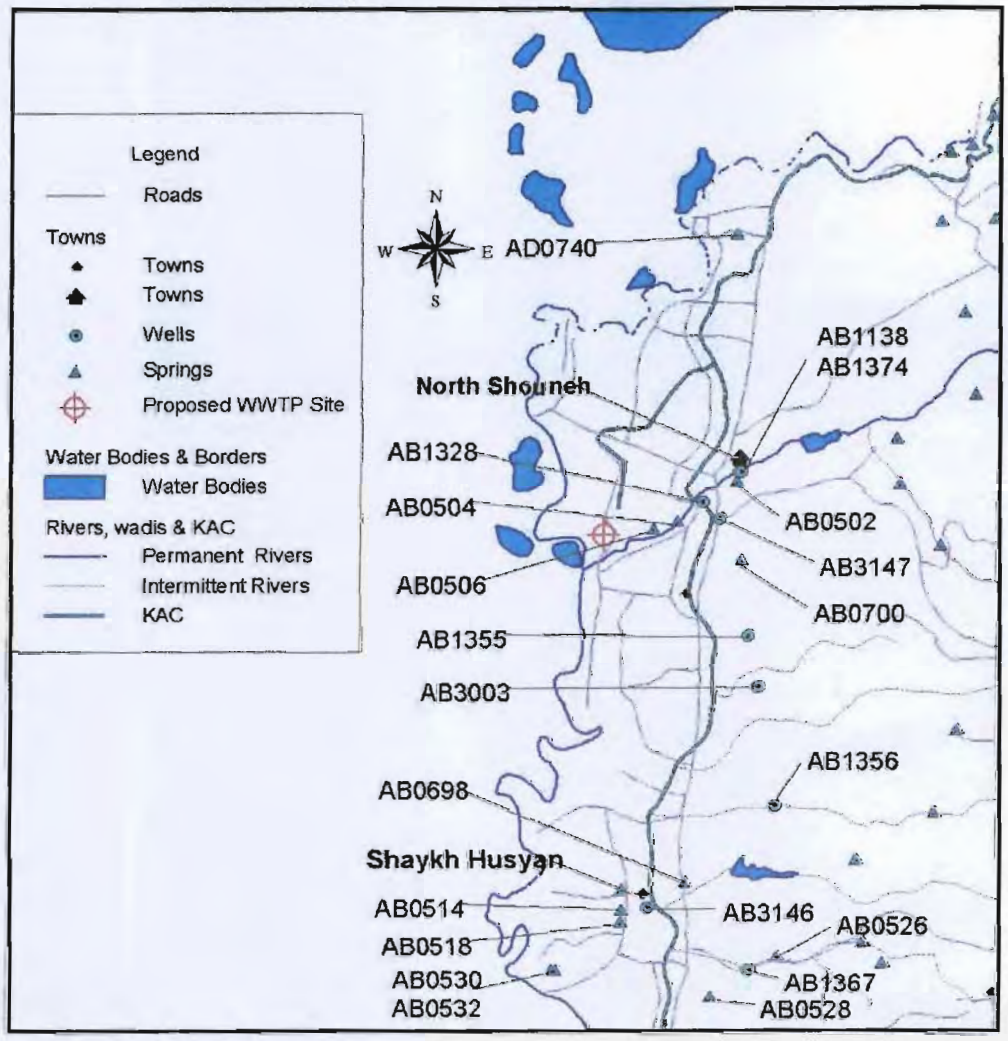
Source: Metcalf & Eddy, 1999

[3] water moving primarily as turbulent flow through well-developed conduit systems as opposed to diffuse-flow where water moves as laminar flow through small openings

Wells and springs

Figure 12 below shows the locations and names of wells and springs in the study area and in relation to the proposed WWTP. There are no groundwater wells nor springs located downstream of the proposed site within the localized study area. Within the wider study area, there are a few springs and wells that are located between 8 and 10 km south of the proposed site, which are potentially downstream of the WWTP as a result of the karstic phenomenon described in the previous section. In general however, most wells and springs within the wider project area are upstream of the proposed site and are more likely to benefit from the proposed project.

Figure 12
Distribution of groundwater wells in North Shouneh Area



There are 31 groundwater wells within a 20 km radius of the proposed WWTP. 20 of these are located to the north and east of the proposed site, while 11 are located to the south of the site. These wells are either private or government owned but only six are monitored (see Table 15 overleaf). Available records show that the average depth of the water table approximates level is 20m but can be as shallow as 1m bgl (see AB3146).

There are also at least 23 springs within a 20 km radium of the proposed WWTP. These arise from the B2/A7, B4 and the alluvial aquifers;[4] seven are located to the north and east of the proposed site while the remaining 16 are located to the south of the proposed site. Spring discharges ranges from about 13,000 to 227,000 m3/year (see Table 16 overleaf).

[4] Contribution to the Hydrogeology of Northern and Central Jordan, BGR,2002

Table 15
Data on wells

Well No.	*Usage*	*Aquifer*	*Depth to WL (m)*	*Measurement Date*
AB1164	Monitoring	Basalt	17.51	22-4-2002
AB1168	Monitoring	Basalt	15.72	22-4-2002
AB3147	Monitoring	Alluvium	17.61	18-3-2002
AB3144	Monitoring	Alluvium	17.34	17-3-2002
AB3145	Monitoring	Alluvium	17.0	15-9-2004
AB3146	Monitoring	Alluvium	1.00	13-4-2004

Table 16
Data on springs

ID	*Q(m3/Year)*	*Record Period*	*TDS (mg/l)*	*NO_3 (mg/l)*	*Sampling Date*
AB0502	141,717	2003-2004	719	12.32	20-12-2001
AB0504	29,346	2002-2003	-	-	-
AB0506	217,248	2003-2004	2176	49.34	24-12-2001
AB0512	41,698	2003-2004	717	32.74	11-12-2001
AB0514	13,666	2002-2003	-	-	-
AB0518	227,760	2003-2004	-	-	-
AB526	-	-	578	11.17	9-3-2004
AB528	-	-	1945	8.35	27-12-1999
AB532	-	-	1260	54.96	9-3-2004
AB0536	92,549	2003-2004	-	-	-
AB0538	34,164	2002-2003	-	-	-
AB0540	10,512	2001-2002	-	-	-
AB0546	164,688	2002-2003	-	-	-
AB0548	78,840	2002-2003	-	-	-
AB0552	61,846	2002-2003	-	-	-
AB0698	217,248	2002-2003	-	-	-
AB0700	77,088	2003-2004	790	7.5	20-12-2001

Notes: Table only shows springs for which discharge rates are known
Source: MWI database

Water quality

Salinity of the irrigation water supplied by the KAC in the NJV ranges from 1.1 to 1.2 dS/m (KfW, 2004 Workshop). Information on the quality of Wadi Al Arab and the Jordan river is not available, but salinity and nitrate levels are expected to be high in these surface water courses, especially in their relatively lower reaches, as a result of three main factors affecting these catchments (in Jordan, Syria and Israel):

- Return flows and surface runoff from agricultural areas
- Non-point source pollution (also organic and bacteriological) from the release of untreated (e.g. cesspits) or insufficiently treated wastewaters (from open discharges or WWTPs); and from
- Natural elevated salinity levels originating from some saline springs (more in the southern reaches of the JV).

Limited well-water quality data within the study area shows that the water salinity is less than 1000 mg/l, while the NO3 concentration in general is less than 25 mg/l[5]. The main sources of groundwater supply in the JV are the B2/A7, B4, Kurnub and Zarqa aquifers, all of which underlie the more limited water-potential alluvium system. At its fringes, the alluvial system becomes more saline but tends to have water

[5] Ministry of Water and Irrigation, Data base Department, 2005

of good quality where freshwater recharge is high, especially near the eastern foothills. Generally however, within the NJV the shallow aquifer shows higher salinities, ranging from 1,000 to over 9,000 mg/l, than the intermediate B2/A7 aquifer ranging from 400 to 1,500 mg/l (M&E, 1999).

Water quality from seven springs (see Table 16) show that water salinity ranges from 717 mg/l (AB512) to 2176 mg/l (AB506) and nitrate-NO_3 concentration ranges from 7.5 (AB700) to almost 55 /mg/l (AB532).[6] Because salinity and nitrate levels in water bodies can change rapidly, the values reported here are only indicative and cannot serve as baseline.

4.3.d. Seismicity

The study area is bound by a segment of the major East African Rift structure with proven horizontal movement. Slope stability and tectonic structures resulted in landslides in deep valleys. Structural features are related to the Jordan Rift Valley that is a part of the East African Rift Zone. Northwest and northeast lineaments, E-NE faults and NW folds dominate this part of the country. The Rift Valley Floor constitutes the western margin and a fault scrap that marks the eastern boundary of the rift. The two geomorphic sub-provinces in the area are the Zor area (Jordan River meanders) and the table-land (bounded to the east by the Jordan Valley faults). The Rift Valley Escarpment to the east is characterized by rugged highlands with E-W trending, deeply incised structurally controlled wadis. The narrow, western N-S trending zone adjacent to the rift is dominated by NNW to N-S faults, flexures and some folds. However, the southern parts are intensely faulted and gently folded.

The main plate boundary along which the Arabian plate moves with respect to the Palestinian Subplate (Sinai Plate) extends from the Gulf of Aqaba northward along Wadi Araba, Dead Sea, Tiberias, Central Lebanon, and terminates in South Turkey. The regional plate tectonic movement is characterized by the regional active Jordan Valley fault. This fault could be traced on the recent sediments showing the active movement of the Rift. The rate of plate movement from geologic and magnetic data averages 4 mm/year along the rift boundary and the rate of movement calculated from seismic data averages 1-5mm/year.

Earthquake risks

The Jordan Rift Valley is generally considered as the most active seismological zone of Jordan. The activity along the Dead Sea-Jordan Valley has been decreasing since 1990 and zero activity was recorded in 1997, an indication of stress accumulation along the northern part of the Rift Valley. The calm areas are considered potential future earthquake areas of the Rift. Within this area, a return period of 120 years is expected for magnitude 6 earthquakes and a return period of 2 years is expected for magnitude 4 earthquakes on the Richter Scale.

According to the Jordan National Building Code for Loads and Forces, the proposed site lies within Region A on Jordan's map of seismic zones (Grade 3/4 according to the recent international code). This region can have earthquakes with an intensity of more than 8 on Mercalli Scale (6.5 Richter Scale). There is an expected probability of 95% that an earthquake of magnitude 5 would occur within 50 years and a probability of 34% that an earthquake of magnitude 6 would occur in the same time frame in the area of the proposed site lies.

4.4. Biological Environment

Jordan is a signatory to several milestone conventions including Ramsar Convention, Convention on International Illegal Trade with Endangered Species (CITES); Convention for the Conservation of Migratory Species (CMS), Bonn Convention and the Convention on Biological Diversity (CBD).

[6] Ministry of Water and Irrigation, Data base Department, 2005

4.4.a. Habitats and ecosystems

The study area is part of a vast basin that belongs to the Sudanian region of Jordan's bio-geography. The typically warm climate in North Shouneh also extends to Deir Allah, Baqura and Wadi el Yabis. The area is a part of the Greater Rift Valley and overlooks the Jordan River. This region represents a rich blend of geologic formations, diverse plant and animal species, and ancient human history. It supports a wide variety of habitat types such as riparian, marsh, grassland, scrub and arid desert. A wide variety of habitats can be found along the Valley, due to its complex geology and great altitudinal range, ranging from Mediterranean, to non forest Mediterranean along the margins which are considered transitional zones, to Irano-Turanean to Afro tropical habitats.

The Jordan River and its tributaries flowing east-west on its east bank are considered biologically important. In dry and arid areas, wetlands become important ecosystems for the survival of species thus creating the chance for diversity of species and habitats. The Jordan River is also an important wetland area in the Middle East because it maintains many globally valuable species such as the Brown Fish Owl, the Common Otter, Arabian Leopard, Rock Hyrax, Freshwater Turtle, several endemic fresh water fish, fresh water snake and many other endangered species.

The following sections describe succinctly the biological diversity in and around the project site. The bulk of the information is based on literature review, some of which was observed and confirmed during our site visits.

4.4.b. Flora

According to the literature (Al-Eisawi, 1985, Long, 1957), the vegetation formation in the study area is the *Ziziphus spina christae – Balanites aegyptiaca* formation. These two tree elements are considered threatened in Jordan but were not found within the project site. Other occurring trees in the region include the cultivated Wattle, *Acacia cyanophyla*, the Caster Tree, *Ricinus communis* and the Syrian Ash *Fraxinus syriacus*.

Based on our field survey, the proposed site is dominated by weedy vegetation the result of high disturbance (mainly cultivation). Common species include: the Syrian thistle, *Notobasis syriaca*, the Holy Thistle, *Sylibum marianum*, the Centaury, *Centaurea hyalolpis*, the Mesquite, *Prosopis fracta*, the Small Nettle, *Urtica polulifera*, and the Crown Daisy, *Chrysanthemum coronarium*. Other rarer species include: *Gladiolus italicus*, *Chenopdium album*, *Silene rubella*, *Eruca sativa*, *Sinapis alba*, *Diplotaxix erucoides*, *anagalis arvensis*, *Malva nicaeensis*, *Convolulus arvensis*, and *Orobanche cernua*. *Phragmites australis* were observed in Wadi Al Arab that is adjacent to the proposed site. Two locally rare species also observed in the area include: the Shell lower *Moluccella laevis* and the *Hypecom Hypecoum procumbens*. The full list of recorded species is presented in Appendix E.

4.4.c. Fauna

At least 30 species of mammals have been recorded from several localities along the Valley. The most noticeable and worthy studies are those of Kock et al. (1993) and Abu Baker et al. (2002), where the status of the Jungle Cat, *Felis chaus*, in Jordan was discussed,. Also, the status of the Rock Hyrax, *Procavia capensis*, in a small colony north of the study site was investigated. Both species have conservation status. The most important mammal and reptile species are described next and listed in Appendix E.

Mammals

Due to the extensive man-made changes within the study area and its surrounding (extensive farming and continuous application of insecticides and fertilizers), only rodent communities of feral and commensal rodents (*Rattus rattus*, *Mus musdus* and *Gerbillus dasyurus*) were recorded. Large mammals, such as the Jungle Cat have been recorded in Al-Baqura area north of the project site. This cat presumably roams near/around the project site as it is known to have a wide home range (at least 10 km per day). Other carnivores known to occur in the study area include the Egyptian Mongoose, *Herpestes ichneumon* and the Asiatic Jackal, *Canis aureus*, in relatively large numbers. Also, the northern Jordan Valley is known to harbor large populations of the Wild Boar, *Sus scrofa* which causes extensive damage to citrus groves and

seeks refuge close to thick vegetation near the Jordan River. We also observed signs of insectivorous bats that frequent the neighboring water bodies.

Reptiles

Only two species of lizards, the Brilled Skink, *Mabuya vittata*, and the Starred Agama, *Laudakia stellio*, were observed in the study area during site visits. Other lizard species may include the Levant Fan-footed Gecko, *Ptypdactylus puiseuxi*, the European Chameleon, *Chamaeleo chamaemeon*, the Snaked-eyed Lizard, *Ophisops elegans*, the Ocellated Skink, *Chalcides ocelatus* and *Lacerta laevis*. Several snake species are also highly probable including the Large Whip Snake, *Coluber jugularis*, Montpellier Snake, *Malpolon monspessularius* and the Dice Snake, *Natrix tessellate*. The venomous Palestine Viper, *Vipera palaestina* is known to inhabit the northern Jordan Valley including the locality of Al-Hima. It is usually found near trees and dense vegetation (rather than shrubs or scrublands). It may therefore occur in the citrus plantations near the study site.

Scorpions and spiders

At least three species of scorpions are potentially found within or close to the project site; the Death Stalker, *Leiurus quinquestriatus*, the Black Scorpion, *Androctonus crassicauda*, and the Bicolor scorpion, *Androctonus bicolor*. All these species are venomous and could lead to fatalities. The Brown Recluse Spider, *Loxosceles rufescens*, is common in the Jordan Valley. An outbreak of this spider species was recoded in Wadi Araba citrus farms in 1995 (Borkan et al., 1995).

Birds

Based on a national survey in 2000, Jordan identified 27 sites, considered Important Bird Areas (IBA), seven of which are located in the Jordan Valley. These sites are critical for sustaining bird populations within the region. They cover an estimated 7000 km² and represent a diversity of habitats, ecosystems and biogeographic zones. The project area in North Shouneh lies within the IBA boundaries of NJV, a significant passageway for migratory birds that supports global avifauna. Birds potentially found in the project area are listed in Appendix E.

The Jordan Valley harbors important ecological features for bird populations including Tamarisk thickets and reed beds along the river as well as scattered poplar and eucalyptus trees attracting several species of Herons and Egrets. Other birds at the project site include the breeding Marbeled Teal, Black Francolin, Pied Kingfisher and Clamorous Reed Warbler. The Cattle Egret, Masked Shrike and Indian Silverbill (introduced) are likely present in neighboring farms. The Pygmy Cormorant and Egyptian Vulture are non-breeding residents, while Cornkrake, Bittern, White and Black Storks, Honey Buzzard, Levant Sparrow hawk, Great Snipe and the Syrian Serin have been recorded as migrants or winter visitors.

In addition to resident species, the valley is host to a continuous flux of migrating birds, dozens of which are listed as "globally threatened" by the International Union for Conservation of Nature (IUCN). For example, globally threatened water fowls in the region include the Black and White Stork, Dalmatian and Common Pelican, Kingfisher, Herons, Shovlers, Sandpipers, Shanks, Francolin.

Reed thickets along the river are home to breeding warblers like the Great Reed Warbler. The shrubbery vegetation on the steppic plains is breeding ground for the Graceful Prinia. It also attracts a variety of migratory passerines. The area supports the Black Francolin, a species of regional conservation concern that is becoming rare in Jordan due to illegal hunting.

4.4.d. Disease vectors

Malaria

Until the early 1970's, the Jordan Valley was considered an endemic focus for malaria. Several species of vector mosquitoes (*Anopheles sacharovi*, *A. sergenti*, *A. superpictus* and *A. claviger*) have been reported to breed along the Jordan Valley (Farid, 1954; Amr et al., 1997). Despite a malaria eradication programme in the late 1950's after which the country was declared malaria free in 1970 (De Zulueta & Mur, 1972), a malaria

outbreak occurred in 1990 in the southern reaches of the Dead Sea area resulting in 33 *Plasmodium vivax* cases among the local population (Amr et al., 1997).

Schistosomiasis

More than 45 sites along the Jordan Valley and the Yarmouk River harbor the snail intermediate, *Bulinus truncates* (Arbaji et al., 1998). This snail species is responsible for the transmission of urinary schistosomiasis. With the influx of workers originating from endemic countries with *Schistosoma haematobium*, the disease became established among the local population in the Jordan Valley and Tafila area (Saliba et al., 1986; Arbaji et al., 1998). The study site is near water bodies that are infested or have the potential to become infested with the snail intermediate host. The majority of laborers working in agriculture are Egyptian and many may be infected with *Schistosoma haematobium*.

Leichmaniasis

The Jordan Valley is a hyper endemic focus of *Cutaneous leishmaniasis* and several outbreaks have been reported over the past 30 years. Infected persons have been identified in North Shounah and Um Qis (Al-Hima) (Nimri et al., 2002). The major species implicated in the transmission of this disease is the sand fly (*Phlebotomus papatasi*). It is widely recognized that both forms of Cutaneous leichmaniasis -- *L. tropica* (Anthroponotic form) and *L. major* (zoonotic form) are present in the northern Jordan Valley.

5. ASSESSMENT OF IMPACTS AND PROPOSED MITIGATION MEASURES

This chapter shows that overall net impact of the project on the environment in the area will be positive. Potential adverse impacts, mostly limited to the area immediately surrounding the WWTP, have nonetheless been comprehensively identified and assessed. Specific, practical mitigation measures are proposed and discussed under each impact heading, designed to ensure positive impacts are enhanced and potential adverse impacts are minimized. These mitigation measures are incorporated in the Environmental Management and Monitoring Plan detailed in Chapter 6.

5.1. Positive impacts and their enhancement

The project will generate a number of positive impacts. It will provide a controlled sink for the collection and treatment of septage in the area and thereby replace the current hazardous practices and associated environmental and health impacts. The most significant positive impacts are described below and generally pertain to the wider study area as indirect, but very likely impacts.

5.1.a. Reduced tanker charges relative to the no-action alternative

The proposed site provides the least cost for septage transportation for residents in the proposed service areas. Considering only the town of North Shouneh in the NJV, at average current private tanker transport rates, the septage transport savings associated with the selected site are expected to be anywhere from 8,000 to 15,000 JD per month when compared with the no-action alternative of continuing to require tankers to discharge at the Tell Al Mantah WWTP. In 2028, these savings are expected to approximately double.

Overall, the proposed site location will optimize travel distances and help keep tanker transport charges to reasonable levels. Minimizing transport costs also helps ensure that cesspits are not allowed to overflow as frequently and that tankers do not discharge illegally. Although a new tanker fee may be required for discharging into the WWTP, this increase will be less than what tanker drivers would charge customers if they had to discharge septage in Akayder or Tell Al-Mantah. Although the proposed project is limited to the treatment plant per se, it will also indirectly enhance and streamline the work of tanker drivers.

Maximizing revenues from on-site reuse will help minimize tanker fees charged by the WWTP.

5.1.b. Improved public health, sanitation and pollution prevention in the wider area

As a result of the project, the incidence of overflowing cesspits will significantly decline. Cesspits may still overflow, however the project will improve sanitation and maintain a cleaner environment throughout the wider project area decreasing the incidence of disease outbreaks. The on-site tanker cleaning facility should eliminate the environmentally damaging practice of cleaning septic tankers in various locations throughout the service area.

The plant will confine the collected septage in one location and thereby eliminate the current practice of open dumping in wadis and on open land. As a result, contamination of surface waters, ground water and open lands, including agricultural lands, will significantly diminish. As expressed by one participant at the scoping session, the project will "protect local communities by averting an environmental disaster in the future." It is important to note that the project however will not directly resolve the problem of leaking cesspits and the resulting contamination.
While the WWTP and reduced transport costs will encourage this improvement (as people will be less likely to let their cesspits overflow and tankers will be less likely to discharge illegally as mentioned above), however additional enforcement and awareness raising of appropriate cesspit pumping and prevention of illegal tanker discharges will be required to enhance this positive impact.

5.1.c. Employment opportunities

Construction will generate additional employment for local people (e.g. as guards and labor). The WWTP will employ 8-9 people, some on shifts (e.g. guards). Additional long-term workers will also be required to operate and manage the reuse site. The proposed technology requires more workers but less equipment than mechanical plants. The WWTP&R operator(s) will hire local workers when possible. During the detailed design of the reuse activities, preference will also be given to labor intensive farming technology in so far as it does not negatively affect feasibility. The construction contractor will also hire local workers to the extent possible.

5.1.d. Change in land values

The effect on the value of lands surrounding the WWTP cannot be predicted. Over the life f the project, an increased supply of reuse water for irrigation will likely have a positive impact on surrounding land values. These lands would become more appealing to farmers as they would be able to buy TWW, with nutrient value, when fresh water supplies are becoming more scarce. Sale of reclaimed water, not used on site, will enhance the value of adjacent land or mitigate and negative impact on values caused by negative perceptions regard proximity to WWTP. The WWTP grounds will also be planted with visually appealing trees and ornamental vegetation.

5.1.e. Demonstration of water reuse and improved public perception

The water reuse activity will provide a unique and real opportunity to demonstrate the benefits and limitations of water reuse to farmers. Reuse will highlight important environmental, technical and health and safety issues. A successful and participatory reuse activity can also serve as a platform for improving communication between various community stakeholders and facilitate replication in other areas of the Kingdom. The success of the activity however will hinge on how well the public will be informed of the risks and benefits of water reuse. Therefore, providing safe reuse training for farmers and broader awareness campaign in relation to reuse, coupled with effective monitoring and enforcement of Jordanian reuse standards and safe reuse practices should help maximize this project benefit.

5.1.f. Prospect for sewage system in the future

One of the criteria for site selection included the ability to connect the proposed WWTP with a sewer system to residential areas. This involved giving preference to sites that were downstream (for gravity flow sewers - less costly to construct and operate) and not too far from the larger, higher density residential areas that would benefit from sewer systems. In principle therefore the proposed WWTP site could in the future receive wastewater by sewers built and operated with minimal costs. The environmental and socio-economic impacts of such a future sewer system are not part of the scope of this project and EA.

5.2. Potential adverse impacts during construction and their mitigation

A number of potential impacts are noticeable during construction including air quality deterioration, noise, and the disposal of wastes, health and safety risks as well as risks to archeological sites. Earthquake and landmine risks are also two very important factors to consider during construction.

5.2.a. Air quality and noise pollution

Several activities may impact air quality. Excavation and land leveling can generate significant dust especially since the soils are loose alluvial deposits. These activities may affect the orchards east and northeast of the site. Winds however tend to be calm during the summer when construction is planned and therefore such impacts should be infrequent and of short duration and/or limited in spatial scope. Air quality will also deteriorate for brief periods as a result of transporting some of the excavated material

off-site as trucks going to/from the site will create dust and release particulate matter with exhaust fumes. This may also impact orchards and residences along the sides of access routes.

The activities mentioned above will also generate noise. The on-site activities are not expected to affect any residential areas since the nearest ones are at least 2 km away. Local military personnel, farmers and a few residents near the site may consider the dust and noise to be a minor nuisance.

Mitigation measures

For dust control, avoiding excavation during times of high-wind conditions and maintaining vegetation cover within the construction site, and along the sides of roads to trap dust will help minimize impacts from dust. The detailed design will also seek to minimize excavations and off-site materials transport. Occasional spraying of water (from Wadi Al Arab) on internal dirt tracks and any loose piles of earth will help control dust. Trucks hauling excavated materials will be covered. Loud construction activities and off-site transportation will be prohibited in the very early morning and late in the evening.

In the event that significant volumes of excavated materials must be hauled off-site, a carefully thought out transportation and disposal plan will be developed that minimizes travel distances and trucking frequency to disposal sites. Routes will minimize the number of orchards that trucks pass by to minimize potential impacts from dusts and exhaust fumes. If transportation is required at night in order to avoid traffic congestion, then nighttime routes will avoid residential areas to minimize nuisance from noise.

5.2.b. Disposal of construction wastes and handling of hazardous materials

Construction will require a lot of materials including cement and/or ready-mix concrete, steel, geo-membranes, pumps, sand and gravel, etc. While most of the materials will be used on site, construction waste (e.g., defective materials, packaging waste) will require proper handling on-site and appropriate disposal off-site. Some of the materials used may be hazardous such as fuels and solvents. Construction workers will also require on-site sanitation facilities.

Construction traffic, especially if a significant volume of excavated materials' transport is required, may pose a heavy load of trucks on local agricultural roads (many of which are already in poor condition) and result in further deterioration of some roads.

Mitigation measures

When fuels or solvents are required in construction areas, they will be transported in small quantities as hazardous materials. Hazardous materials will be stored safely in designated locations preferably away from sleeping and resting quarters for workers. The storage area will be well-ventilated and have an impervious floor (e.g., concrete slab) with a sump or retaining walls sufficient to contain spills. Materials and equipment will be provided to clean up and properly dispose of spills. Vehicle fuelling and maintenance areas will have impervious floors and materials for spill cleanup.

Any hazardous wastes, or wastes potentially contaminated with hazardous materials must not be stored and/or disposed of with non-hazardous materials. Non-hazardous materials may be disposed of in local dumpsites in consultation with the Municipality. Hazardous wastes must be disposed of at Akayder solid waste dumpsite.

Sanitary facilities must have appropriately designed cesspits, to be pumped regularly and disposed of at Tell Al Mantah WWTP.

Construction transport plans (e.g. for excavated materials) should take into account access routes and road quality. In the event that roads are expected to deteriorate significantly, then provision must be made to rehabilitate the damaged road sections after construction. Certain access roads may also need partial improvement prior to construction for adequate flow of construction traffic or to increase their safe loads – these will be inspected prior to commencing construction and remedied as appropriate.

5.2.c. Health & safety (H&S)

WWTP construction will entail all the usual occupational risks associated with construction operations. Excavation and trenching operations will expose the workers to the risk of injury from falling debris. Collapse or parts falling from loose scaffolding could injure construction workers. Exposed electric cables or fittings may cause electric shock. Other potential hazards will be associated with the use of heavy construction machinery on the construction sites. Working in North Shouneh during the summer can also impose harsh working conditions with respect to heat and temperatures. The proposed site is also in a restricted military area. Areas with land mines will be securely blocked off.

Additionally, workers are potentially exposed to parasitic diseases including malaria, schistosomiasis and leichmaniasis as well as venomous animals. The risk of exposure is dependent on several factors including hygiene, pest control measures and worker health prior to commencing work. See Section 5.3.i for additional details on these particular potential impacts and proposed mitigation measures.

Some members of the public may also gain access to the site. Otherwise the only potentially significant risk to the public pertains to off-site transport. Although construction impacts on health and safety may be significant, most tend to be of short duration and can be mitigated through appropriate construction H&S practices.

Mitigation measures

Off-site *transport / disposal plans will carefully consider public safety / traffic accident risks and be* approved by the local traffic department, ministry of health and municipality.
The construction site will be closed off to public access and any heavily used transport routes should be fitted with appropriate "construction activity" warning signs. Areas with land mine locations will be identified in consultation with the military and clear signs to stay out and/or fencing will be provided.

Required occupational health and safety standards will be implemented during all construction activities in accordance with the "Code of Safety for Construction Works." The code defines working conditions such as lighting, heat, ventilation, noise and emissions. It also presents personal protection measures for face, arms, legs, hearing and vision. At minimum, the construction contractor will be required to provide on-site workers with protective equipment including gloves, noise attenuators, dust masks, steel-tipped shoes and hard hats, in addition to sanitary facilities and clean water.

Informing construction teams of possible hazards and training them about suitable precautions will significantly reduce the occupational risks during the construction phase. The contractors therefore will be required to develop H&S awareness plans for their workers and monitor their implementation. These plans should not be confined to the inception of on-site activities, but rather extend over the entire construction period.

The contractor will also be required to use clear and visible warning signs inside the construction site to warn the workers, and potentially any members of the public of potential hazards and alert them to the need for extra caution at areas of particular risk (e.g. trenches and excavated areas, heavy equipment paths, falling debris). The contractors may have to provide protective railings or barriers, where needed, in order to prevent the workers from falling into trenches and excavated areas.

5.2.d. Change in local hydrology, soil erosion, structural and earthquake risks

Excavation and land leveling will permanently alter the topography of the site. This is not expected to cause significant changes to the downstream hydrology, as the catchments are relatively small and localized within the site. Flooding from upstream areas is also unlikely. However, earthworks inside the site may make certain areas more vulnerable to rainfall events, soil erosion and water logging. These are potentially significant if construction is happening during the winter. Flooding from nearby rivers and wadis is not expected to be a problem as the site is 5 meters higher in elevation at its lowest points, with most of the site being at least 10 meters higher in elevation.

The project site lies within Region A on Jordan's map of seismic zones where there is a relatively high earthquake risk as discussed in Section 4.3.d and 5.4.a. However, the probability of experiencing an earthquake during the construction phase is low.

Mitigation measures

If construction activities are occurring during the winter/rainy season, hydrological alterations from land leveling and excavations will be carefully considered and proper soil erosion and flood control measures will be taken and/or temporary drainage channels will be built to avoid washing away of stored materials, damage to excavations and water-logging.

WWTP design and construction will adhere strictly to the requirements stipulated in the National Building Code for Loads and Forces (for Region A)

5.2.e. Archeological disturbance

A moderate risk of disturbing any archaeological sites may exist in light of the site's vicinity to the Jordan River and the reported presence of a burial ground in the center of the site. Most known sites are situated near or on the lower slopes of the foothills and this is also where new sites are most likely to be.

The proposed site has also been heavily eroded and is relatively disturbed. However, there is a possibility of encountering some buried sites and graves during the excavations. Based on the JADIS database, only 2 potential sites are at risk, these are scattered chards/flint, and according to JADIS, have already been at threat from cultivation. Other sites are too far from the construction site and potential construction vehicle access routes (see Figure 7).

According to the DLS maps, the cemetery straddles one of the deep wadis transecting the site and the deep cut military track (used for hidden movement): if the mapping coordinates are correct, then it is very likely that this site has already been destroyed. Furthermore, the importance of this site appears to be low as a result of limited knowledge about its existence (among DoA staff, local residents, shepherds and farmers on-site. Also, there are no related records on JADIS).

Mitigation measures

Local representatives of the DOA will be asked to carry out a rapid survey of the site and determine the risk of encountering any potentially undiscovered sites. They will also be asked to investigate the cemetery identified on DLS property maps. The DOA, in consultation with local authorities, municipality and the project team, will then determine the best course of action in light of the findings. This may include random spot-checks by the DOA during excavations. If any sites of potential importance are discovered, then the DOA can proceed to document it as appropriate and advise of needed action.

5.2.f. Ecological disturbance

Excavation can remove a lot of the existing plant cover (mostly planted fodder) and disturb the micro-habitat of some species including the Shell flower, *Molluccella laevis* and the parasitic Drooping Broomrape, *Orobanche cernua*.

If construction overlaps with winter, then it could potentially impact wintering wildfowl due to trapping by workers (being in a restricted area, hunting with firearms is strictly prohibited).

It is important to note however, that the project site is located within an ecosystem that is already heavily impacted by severe man-made interventions as evidenced by the deterioration and depletion of existing faunal and floral elements. Occurring species are also mostly general species, of little biological importance.

Mitigation measures

Construction activities are not expected to generate any significant impact on either flora or fauna and therefore no mitigation measures are proposed except for prohibiting construction workers from trapping any birds.

5.3. Potential adverse impacts from WWTP&R operations and their mitigation

5.3.a. Soil and water resource contamination in general

Although the project is expected to have an overall positive impact on soil and water resources in the wider project area as explained in Section 2.1.a and 5.1.b, the presence of a WWTP and reuse activities present new hazards to these resources in the immediate vicinity of the proposed site (localized area). Some of these potential adverse impacts may extend further than others. The main impacts to soil and water resources may occur from:

1) Accidental spills, overflows and seepages;
2) Soil contamination and percolation of treated effluent from irrigation with TWW; and
3) Sludge reuse and/or disposal

In light of the existing downstream situation, shallow aquifers and surface waters (see Section 4.3.c), the cumulative effects of any such impacts from this WWTP are generally considered low relative to the other stressors in the region. Nonetheless, comprehensive and extensive mitigation measures are put in place. Section 5.4 discusses relevant impacts and mitigation measures related to emergencies and unplanned events that will also minimize the risk of such impacts. Management and monitoring requirements in relation to these potential impacts are also extensively discussed in Chapter 6

These impacts and proposed mitigation measures are discussed separately in the sections that follow under their respective headings.

5.3.b. Contamination from accidental spills, overflows and seepages

Accidental spills or overflows on-site could potentially contaminate soils within the site, make their way to surface waters downstream (Jordan River or Wadi Al Arab) or percolate through to contaminate groundwater. Such events are expected to be rare and of short duration.

Seepage from the WWTP itself could pollute groundwater; however, in light of prevailing groundwater flows, the chance of any seepage reaching deeper aquifers or springs much further away is relatively low as explained in Section 4.3.c. Seepages, if they occur, would result most likely from cracks in concrete or tears in liners, and would therefore be relatively small in flow volumes and short-lived with appropriate and regular monitoring and maintenance. Any such seepages are more likely to seep through to the base-flows of the adjacent Jordan River or Wadi Al Arab.

Nonetheless, the likelihood of such impacts occurring is expected to be low in light of the comprehensive and extensive mitigation measures put in place.

Mitigation measures

The built-in mitigation measures described in Section 2.4.d will further minimize the risk of accidental spills or overflow events happening and ensure that if such an event occurs, they can be adequately contained. These built-in mitigation measures include on-site drainage, overflow precautions and protection from surface run-off.

All basins will also be appropriately lined to minimize the risk of seepages as discussed in Section 2.4.d and monitoring wells and monitoring program will be put in place. The exact number and location of these groundwater monitoring wells will be agreed upon with WAJ during and after the detailed design. Appropriate baseline data, not available to date, will need to be gathered as soon as possible by the

relevant authorities prior to operating the WWTP to enable more accurate monitoring of the WWTP's impacts. Seepage/leakage detection piezometers will also be put in place around main units as necessary.

Liners and concrete will be inspected on a regular basis and routine tests on units will also be performed (e.g. isolated and left for a few days to see if levels decrease). See also Section 5.4 for additional mitigation measures relating to emergencies and unplanned events and the associated contingency plans developed in Section 6.2.

5.3.c. Contamination from reuse of TWW in irrigation

Water reuse with elevated nitrate levels may lead to soil and groundwater contamination. TWW quantities being applied (see Table 8) would average around 4m3/Dn/day (reaching as high as 7m3/Dn/day), and with drip irrigation achieving 80 - 90% efficiency, no more than 1.4 m3 of TWW could be expected to percolate beyond the root-zone for every Dn in any single day. Applications will also be during the summer when crops need it, and therefore leaching aggravated by rain fall is not expected. Fodder crops also have the ability to uptake more than their requirements for nitrates, and at drinking water standards of 10 mg/l NO3 for the TWW effluents, most crops will easily take up all the nitrates.

Elevated levels of heavy metals and salinity can also accumulate and contaminate agricultural soils over the long-term, eventually affecting crop quality and yields when thresholds have been reached. The mobility of heavy metals from the soil to the plants depends on many factors including the crop, soil type, soil chemistry and crop water requirements. Salinity build-up and nitrate uptake by plants can be managed with irrigation techniques. Levels of heavy metal in the TWW are not expected to cause any problems, even over the long term as industries in the area are limited and will nonetheless not be allowed to discharge at the WWTP.

Therefore, the impacts associated with irrigation of TWW are expected to be insignificant, especially with the mitigation measures proposed and in light of the fertilization and extensive irrigated agricultural activity associated with the area.

Mitigation measuresWater reuse activity will begin only after the WWTP has been demonstrated to perform satisfactorily and preliminary test results show compliance with JS893/2002. Appropriate irrigation (and Nitrogen management) management systems and scheduling will be put in place, along with soil and TWW quality monitoring. The irrigation network design will provide for appropriate emitter and laterals spacing to this end as well. These measures will minimize the risks of over irrigation and can further reduce the already low risk of nitrogen percolation in addition to increase water use efficiency. Optimal irrigation scheduling can result in zero percolation if designed and implemented properly. Irrigation management will be adjusted for different levels of Nitrate and other forms of N. Monitoring soil salinity levels will also help adjust leaching mitigations.

See also section 5.4 for additional mitigation measures relating to emergencies and unplanned events and the associated contingency plans developed in Section 6.2.

5.3.d. Contamination from sludge reuse and disposal

At full capacity, the plant will generate an estimated 1,380 tonnes of sludge per year. The sludge will be removed from the anaerobic lagoons up to four times per year (i.e., 345 tonnes each time) - to be determined during the detailed design and ultimately once in operation. Unless properly treated and disposed of, the sludge could pose environmental and health and safety concerns. Sludge is primarily a source of biological contamination, unless effluent entering the plant also contains industrial discharges in which case the sludge could also contain heavy metals. In N. Shouneh, however, septage sampling and analysis results have indicated insignificant levels of heavy metals and the likelihood of receiving any significant loads of heavy metals from industrial discharges is very low and disposal will be well within JS 1145/1996 limitations.

Mitigation measures

Taking into consideration that sludge will mostly be stable (as it is coming from cesspits and would have spent at least one month at the bottom of lagoons) and is then sent to drying beds, the sludge produced can be considered treated to the first level according to JS 1145/1996 and can be sent to the Badia as a soil conditioner. In addition, slightly over 1 Dn of land will be allocated for sludge storage, that easily allows for composting (involving staking, turning, wetting under specific temperature requirements) to take it to level two treatment for use as soil conditioner within the area. Sludge samples will be taken on a regular basis and appropriate means of disposal and/or composting with localized including on-site use as a soil conditioner, will be developed in strict adherence to JS 1145/1996 and carried out only after the approval of the relevant authorities.

5.3.e. Odors

The plant will generate methane (odorless) and hydrogen sulfide (foul odor), especially near/around open lagoons. The front-end (upstream) units (anaerobic lagoons and denitrification reactors) can potentially generate the most odors. The receiving station and inlet works can also generate odors, however the volumes and flows involved at these facilities are low enough so as to not create large amounts of odors gases. Sudden surges in odors have also been experienced in WWTPs without other abnormalities in treatment operations.

As discussed in Section 4.3.a, winds are predominantly westerly to southwesterly and calm during the summer when septage quantities and microbial activity (which generates additional odor) are at their highest. During the winter, winds become easterly to southerly and increase slightly in speed, but remain relatively calm. With the nearest residential communities being at least 2 km away, any such impacts are only expected to affect local farmers, very few residents in the area and military personnel. A WWTP with very similar technology being operated for the last six years in Morocco has almost never had odors reported beyond the site boundaries. The nearby military barracks is located approximately 1 km south of the proposed site (see Figure 7): it is therefore rarely downwind and far enough to avoid any odors affecting personnel residing there.

Nonetheless, in light of the potential nuisance such impacts can cause, several mitigation measures are proposed to ensure minimal odors going outside the WWTP site.

Mitigation measures

Various mitigation measures will be incorporated into the detailed design in order to ensure minimal odor emissions from the WWTP. These include conservatively designing the WWTP process with odor minimization and/or control as a top priority, providing operational flexibility to ensure appropriate WWTP operation, may include covering and collecting gases from various treatment units and any other additional measures that may be needed which will be further investigated during the detailed design. These built in mitigation measures are elaborated on in Section 2.4.d. See also Sections 5.4.b and 5.4.c for other mitigation measures used to ensure the WWTP will operate well under non-normal conditions. Plant operators will also be provided with protective masks in the event that sudden odor surges within the WWTP occur and/or for duties that involve getting very close or inside units for maintenance purpose.

5.3.f. Changes to local ecology

Plant operation is not expected to impact flora or fauna. Operations (e.g. presence of water and reed beds) will potentially lead to a population increase of several nuisance species such as the black rat and the house mouse. Cultivated areas on site could also increase scorpion population densities and may also attract wild boars. These are addressed under health and safety in Section 5.3.h. Disease vectors are addressed separately under Section 5.3.i.

Plant operation and maintenance will not adversely impact the ornithological value of the site. On the contrary, important birds congregate near open water bodies including the globally threatened Pygmy

Cormorant. Nonetheless, workers on-site may potentially capture resident species such as the Gold and Green Finches and the introduced Indian Silver-bills.

Mitigation measures

Operation activities are not expected to generate any significant ecological impacts on either flora or fauna and therefore no mitigation measures are proposed except for the recommended use of anti-coagulants to control black rats and house mice. Workers will also be prohibited from trapping birds.

5.3.g. Inequality of socio-economic impacts

Neighboring farmers may oppose the proximity of a WWTP. Their image may also suffer, due to public perceptions, of being next to a WWTP or because of using TWW. Potential changes in the value of land are discussed under Section 5.1.e.

As a result of site location choices, with one of the main objectives being to reduce the aggregate costs of septage transport for residents, there will be some households that may have to pay more for septage transport (tanker charges) than others. These are the households that are furthest from the proposed WWTP sites. Tanker charges will however be kept to the minimum in general as discussed in Section 5.1.a.

Mitigation measures

Giving priority to farmers nearest to the WWTP for purchase of TWW and supporting them to carry out safe reuse will help alleviate these concerns. See also the enhancements proposed under Section 5.1.e. Public awareness programs will mitigate concerns of farmers and the general public regarding the use of TWW.

Since site location minimizes overall costs, by being located nearer to the largest numbers of households that pump their cesspits most frequently, then a geographical cross subsidy in tanker charges should be feasible. A small additional charge on the nearest households that generally pump a lot of septage, should translate into a larger subsidy for distant households that generally pump less.

The need for cross subsidies and means of implementing them will be investigated further through the participatory work under Task 4's Institutional and Cost Recovery report and Institutional Agreements. See also Section 5.1.a.

5.3.h. Health & safety

Both skilled and unskilled workers who carry out daily plant operations are potentially exposed to risks associated with WWTP operation. Plant operators could fall into open basins (e.g. WW receiving station, concrete settling basins, denitrification reactors, facultative lagoons, dosing basins). Working with WW and sludge may carry health risks to plant operators through accidental contact and spills/releases.

Additionally, exposure to reuse effluent could generate some health risk to workers and farmers. This risk would increase if effluent quality does not meet relevant reuse standards and/or reuse practices are unsafe. For example, disease could be transmitted if farmers reuse TWW to produce raw vegetable crops. Likewise, if they use sprinklers, TWW could potentially contaminate crops.

The potential congregation of dangerous animals including snakes, scorpions and spiders would also pose a serious health hazard to workers and plant operators. Changes in rodent, scorpion and wild boar populations as discussed in Section 5.3.f can also cause injury.

Tanker traffic is also expected to reach to over 100 trucks per day once operating at full capacity. This could present traffic accident risks along tanker routes to the general public, especially if tanker traffic concentrates along one road that passes through a residential area. Movement of vehicles within the site

and to the site may also generate dust. The public could also gain access to the WWTP and be at risk from the same H&S issues as WWTP&R workers,

Mitigation measures

Although the impacts on occupational H&S during plant operation are not significant, safe practices and standard operating procedures should be followed. Skilled plant operators will receive training in the safe and efficient operation of the wastewater treatment plant. Unskilled workers will also be instructed to follow basic safety practices for plant operation and water reuse.

All water bodies inside the treatment plant (e.g. WW receiving station, concrete settling basins, denitrification reactors, facultative lagoons, dosing basins) will be equipped with protective railings to prevent accidents. Signs will be posted at locations that pose specific risk of falling or other injury to plant operators (e.g., chemical storage facility, pumps, power transformer). These signs will be designed to be clear and visible at night.

Plant operators should be warned in advance of any maintenance work to be conducted on any facility/location within the plant. Warning signs should be posted where planned maintenance has a potential to cause injury. It is preferable that these signs also classify the type of risk posed by such works. Plant operators should wear protective clothing at all times.

Potential health impacts associated with reuse can be mitigated if the water reuse activity is properly implemented according to Jordanian regulations on safe reuse and in accordance with JS893/2002. Mitigation measures discussed under Sections 5.1.e, 5.3.b, 5.3.c, 5.3.d and 5.4 should also be adhered to.

Regular medical check ups for plant operators are recommended to monitor any health impacts that may be generated from working in the WWTP or from exposure to reuse effluents and potential parasitic diseases (see also Section 5.3.i). A fence around reuse sites can also prevent access of wild boars.

The entire site will be fenced off to prevent public access. One of the reasons behind selecting the proposed site is its ability to provide tanker access from different directions, minimizing the need for all tankers to pass through any single residential area. Tankers from towns to the north and to the south of North Shouneh can potentially access the WWTP from separate roads, one approaching the WWTP from the south and one from the north respectively, that avoid North Shouneh. The access routes need to be designated by the Municipality and committed to appropriate use by the tanker drivers. Speed restrictions must also be clearly agreed to, posted and monitored. All internal routes will be graded and maintained including roadside drainage ditches. Paving and maintaining external access routes will also be encouraged.

5.3.i. Diseases vectors

The plant could provide a favorable environment for the occurrence of three serious parasitic diseases and their disease vectors:

1. ***Malaria***: Open lagoons could provide a breeding environment for vector mosquitoes;
2. ***Schistosomiasis***: also known as "bilharzias" a disease caused by parasitic worms. Infection causes illness in humans including rash and fever during early stages of infection and seizures, paralysis and spinal cord inflammation during later stages. It occurs when skin comes in contact with contaminated fresh water in which certain types of snails live. The snail intermediate *Bulinus truncates* could infest any stagnant water bodies in the WWTP. Water fowls will typically carry the snails long distances between water bodies; and
3. ***Leichmaniasis***: a parasitic disease spread by the bite of sand flies which could start to breed near open lagoons. At least 23 sand fly species are potential leichmania vectors. Because they hide in humid soils, they could easily infest the project site, especially when water reuse will significantly increase soil moisture. Cutaneous leichmaniasis (common) causes skin soars and visceral

leichmaniasis (less common) affects some of the internal organs (e.g., liver, spleen, and bone marrow).

The threat of malaria and leichmania is seasonal and a function of mosquito vector populations as well as the presence of infected persons. However, the threat of schistosomiasis is year-round because snails infest water bodies in large numbers. Furthermore, should any worker be infected with schistosomiasis, it is likely that he would immediately transmit the disease to fellow workers due to direct and continuous contact with water all year round. The probability that foreign workers from schistosomiasis endemic countries are infected is also significant.[7]

It should be noted that malaria, schistosomiasis and leichmania are not a direct project impact. They are already found in the northern Jordan Valley, and therefore anywhere in the vicinity of the project site. The plant will simply extend the disease range by potentially providing additional breeding grounds for vectors and hosts.

Mitigation measures

Mitigation measures for monitoring and controlling the above mentioned parasitic diseases are discussed in detail under Section 6.1.c. Local workers will be employed to the maximum extent possible and medical examinations will mitigate disease risks.

5.4. Risks to the WWTP structures, its operation and their mitigation

This section deals with various risks that may jeopardize the WWTP structurally and the ability to properly operate it. These cover emergencies and unplanned events and include sudden changes in influent/effluent quality and quantities, earthquakes, floods and power failures that could arise during the construction or operational phases of the WWTP. Several of the potential impacts discussed here will be covered in emergency and contingency plans discussed in Section 6.2.

5.4.a. Earthquakes

The site sits in a tectonically very active area as discussed in Section 4.3.d. There is an expected probability of 95% that an earthquake of magnitude 5 would occur within 50 years and a probability of 34% that an earthquake of magnitude 6 would occur in the same time frame. The probability of experiencing an earthquake during the lifetime of the WWT plant is therefore relatively high. Such earthquakes may cause partial or total damage to the WWTP facilities (e.g. buildings, holding basins, lagoon walls, pipes, etc.).

Mitigation measures

WWTP design and construction will be conducted in strict adherence to the requirements stipulated in National Building Code for Loads and Forces (for Region A).

Although designing the various facilities in conformity with the National Building Code for Loads and Forces (for Region A) will reduce potential damage, it is necessary to consider additional mitigation measures in case structural failures occur despite such precautions. These include developing an emergency response plan (see Section 6.2) including, diversion of raw or partially treated wastewater to basins that are not damaged. Other measures include building dykes around the basins and the provision of stand-by controls to enable isolating WW in intact units, redirect flows to intact basins and/or to a nearby on-farm irrigation storage reservoir.

5.4.b. Non-residential septage and/or sudden deteriorations in effluent quality

The TP is designed to treat septage from household cesspits. It is not designed to treat septage or wastewater from non-domestic sources such as industries, olive presses, slaughterhouses, mechanic shops

[7] Schistosomiasis endemic countries include Pakistan, Egypt and Sudan

or hospitals. The probability that septage from a non-residential source arrives at the TP is low in North Shouneh due to the relative lack of such customers in relation to residential customers.

Sudden and serious deterioration in effluent quality can occur in wastewater treatment plants even when nothing unusual is observed with the treatment process.

Mitigation measures

Tanker discharge controls will be implemented and enforced, with involvement of the local communities, to assure that no banned influents are discharged into the WWTP. Targeted awareness raising for non-residential septage generators should also be carried out to inform them of what types of septage cannot be discharged at this WWTP, how to separate blood, chemicals, fats and grease from normal, domestic-type WW (e.g. at slaughter houses, restaurants, mechanic shops, hospital and even some industries) and other best practices.

A plan will be developed to manage effluents when there are sudden and severe deteriorations in effluent quality. The proposed WWTP has about eight days worth of effluent storage capacity and the ability to recirculate back to various front-end (upstream) units. An emergency response plan will be developed(see Section 6.2) including guidelines for suspending tanker discharges temporarily until appropriate remedial operating action is taken, in extreme emergency situations.

5.4.c. Volumetric flow imbalance and sub-optimal operating capacity

Maintaining the proper volumetric flow of sewage at the different treatment stages is critical for the proper operation of the WWT plant. Situations could arise whereby the WWTP receives sub-optimal levels of septage, resulting in inefficiency and excessive evaporation (increased salinity of effluents). Conversely, situations could arise whereby the treatment plant receives more septage than it can handle causing overloads. These could result due to the unpredictable nature of septage pumping and disposal, due to inappropriately set tanker fees, pressure to accept discharges of septage from additional communities or for some other unforeseen event. The duration of such imbalances is unpredictable.

Within the WWTP, a sudden interruption in flows caused by clogged pipes or pump failures may also have serious consequences on plant operation and treatment efficiency. Such stoppage may render the WWT plant unable to receive and process WW or unable to provide treated effluent. Such impacts are expected to be short in duration and easily reversible.

Mitigation measures

The WWTP design incorporates multiple units and treatment trains offering operational flexibility as explained in Section 2.4.d, therefore, the WWTP operators should be able to respond to the shorter-term imbalances in influents. Such alternate operating procedures will be included in the emergency response plan (see Section 6.2) to be developed as part of the operating manual. If such imbalances are expected to be longer-term, then regulatory actions must be taken such as restricting tanker licensing, access to the WWTP and /or fee adjustments. These and other means of regulating tankers (e.g. through ticketing systems) are being investigated under Task 4 of the project and will be agreed upon and put in place prior to WWTP operation. Public awareness campaigns to help regulate pumping (provide more balanced discharges) can also help mitigate such risks.

Routine maintenance and immediate access to spare parts in case of a localized failure, including pumps, will reduce the probability of a volumetric flow imbalance as a result of internal problems. In case of a severe interruption in the flow, incoming septage will be accommodated in a separate basin for a reasonable duration while the cause of the problem is being remedied.

5.4.d. Flooding and erosion

Flooding or flash floods may occur at the site due to sudden and intense rainfall; for example, in Baqura, 160 mm of rainfall in 24hrs have been recorded. Such floods could develop inside the WWT plant or

travel through the WWT plant and may cause soil erosion and/or damage to some of the WWTP structures. This potential impact is also discussed in Section 5.2.d in relation to the construction phase.

Mitigation measures

The proposed site will be adequately designed and engineered to divert sudden surface flows resulting from flash floods without causing damage to the plant facilities. Roadside drainage ditches will be maintained. Slopes will be stabilized with plants and any non-structural fill will be compacted to prevent erosion. An emergency response plan (see Section 6.2) will be developed as part of the operating manual allowing the surface flows to be directed to a natural holding pond constructed for this purpose.

5.4.e. Total power failure

Although rare, total power failure is not unknown in Jordan. Over the past 5 years a few such failures took place, sometimes lasting for hours and without apparent cause.

Mitigation measures

The WWT plant will be equipped with the necessary power generation means to sustain its basic operations for a reasonable time (e.g. 12 hrs) before power from the national grid is restored. The necessary emergency power generation required will be determined during the detailed design and will be dependant on plant layout, pumping requirements and hydraulic profiles. With or without power, the plant will be energy efficient. Examples of energy efficiency for the WWT plants may include high-efficiency motors and lighting, and passive heating and cooling in building designs. An emergency response plan (see Section 6.2) will be developed as part of the operating manual.

5.4.f. Restricted access to the WWTP

Because the proposed WWT plant is located close to an international border, there may develop a situation whereby the access to the project site may become restricted for security considerations. This may occur during the construction or the operation of the WWTP. In case access is restricted during operation (for a limited period), tanker trucks should be able to discharge their load at a designated alternative location.

Mitigation measures

The treatment plant design will provide for a dedicated off-site receiving facility to be installed in the future. The design of this facility will be prepared such that it may be built quickly if needed. Additionally, it is recommended to designate a liaison officer to coordinate and stay in close contact with the military command of the area and to develop an appropriate emergency response plan (see Section 6.2). This would be needed for both the construction and operational phases of the project in order to help avoid any problems arising from preventing access to the site.

6. ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

The environmental management and monitoring plan provides the tools for ensuring adequate implementation of the proposed mitigation measures so that all potential impacts are minimized. It also spells out special monitoring requirements in detail and assigns responsibilities for implementation and monitoring.

The EMMP Summary table at the end of this section (Table 19) summarizes all of the relevant mitigation measures presented in previous sections according to impacts, proposes an allocation of responsibility for their implementation and specifies the timing required for implementation and/or the frequency required for monitoring. This summary table must be continuously revisited by the project team, contractor, Municipality and other concerned stakeholders to ensure it remains up to date and is adjusted where and when necessary.

The most important aspects of environmental monitoring requirements are discussed in the next section. The emergency response and contingency plans that need to be developed at various stages of the project are discussed in 6.2 and the construction transport plan is discussed in Section 6.3.

6.1. Monitoring requirements

Monitoring is critical to ensure sound operation and maintenance of the proposed treatment plant in North Shouneh. The most important monitoring parameters include effluent and sludge quality and quantity and occupational health and safety, as described next.

6.1.a. Effluent and sludge quality

Effluent quantity and quality need to be monitored to optimize plant operation. Effluent monitoring requirements for this type of WWTP (natural) are outlined in JS893/2002 and are summarized in Table 17.

Table 17
Effluent Quality Monitoring

Sampling Frequency		Evaluation period
Operating party	Monitoring party	
• Routine Tests: 4 samples / month (composite) • Physical & Chemical Properties: 3 samples /day (grab) • Intestinal Helminthes Eggs: 2 samples/month (composite) • Escherichia coli: 4 samples/month (grab)	• Routine Tests: 1 samples / month • Physical & Chemical Properties: 1 samples /month • Intestinal Helminthes Eggs: 1 samples/month • Escherichia coli: 1 samples/month	6 months*

Routine Tests: T-N, NH4, TSS, COD, BOD5, NO3
Physical & Chemical Properties: pH, DO, RCL2, Turbidity, Temperature
* Winter and Summer (Summer: Start of May – Oct, Winter: Start of Nov – Apr)

Effluent quality monitoring is the responsibility of several agencies depending on the test parameters being monitored. Typically, WAJ would monitor physical parameters including BOD, COD TSS and salinity; the ministry of health would monitor for *E. coli* and intestinal helminthes eggs; and the ministry of environment would monitor for heavy metals and minerals including nitrates. The plant operator (municipality) should also conduct routine monitoring of basic parameters including BOD, TSS and TDS.

6.1.b. Groundwater level and quality

Depth to water table need to be monitored to assess aquifer vulnerability from reuse and in case of spillage. Groundwater monitoring wells will be installed downstream of the project site and groundwater samples should be collected monthly and tested for fecal coliform and nitrates. The precise frequency and parameters to be sampled will need to be determined by WAJ and the MoE, the monitoring authorities.

6.1.c. Health and Safety

Occupational health and safety during construction and operation is critical to project success and sustainability. The project team (chief supervising engineer and his team of resident site supervisors) will supervise the construction contractor to monitor his adherence to the safety precautions agreed upon and to document and address any violations (e.g. failure to provide and make sure that workers use adequate personal protection on site during working hours). Workers must also undergo a basic health exam before joining the site crew to make sure they are not infected with malaria, leichmania or schistosomiasis.

Monitoring for schistosomiasis

The project will train workers on how to identify the snail intermediate host of schistosomiasis to be able to implement a simple biannual snail surveillance program. In case the snail is detected, the workers would be required to immediately notify the municipality who should then report to MOA. Typically, MOA would intervene promptly, assess the extent of infestation, apply control measures and extend future monitoring and control programs to include the project site, at no expense to the affected community. Detecting just one snail warrants immediate intervention as it would signal a much more extensive infestation (surveillance detects only one percent of actual specimens). Furthermore, snails are hermaphrodites and therefore will quickly reproduce.

Monitoring for malaria

Vectors will be monitored by conducting initial mosquito land count (MLC) prior to plant construction and bimonthly thereafter. MLC is a simple diagnostic tool to monitor mosquito populations and determine critical periods for control measures. MLC requires two persons; one person stands still and the second counts the number of mosquitoes that land on him during one minute. The threshold mosquito count for regions like NJV is 10 mosquitoes per minute. Beyond that, the municipality needs to consider fumigation to reduce populations. MLC can also be used to monitor nuisance-causing species such as *Culex pipiens*.

Monitoring for leichmania

It is difficult to monitor leichmania because several types of sand flies are leichmania vectors, but risks are not considered significant. Therefore, no mitigation measures are proposed.

6.2. Emergency response and contingency plans

In case of an emergency, plant workers will be instructed to immediately report to the municipality. Table 18 provides an indicative and preliminary emergency response checklist. Specific plans and procedures must be further developed as part of the WWTP operating manual and refined and revisited regularly by the WWTP operator in consultation with the relevant authorities (e.g. MoH, Military, WAJ, civil defense, police, etc.). These plans will include simple, clear instructions and procedures, contact telephone numbers and be placed in easily accessible and clearly visible locations around the WWTP as appropriate. All WWTP personnel and reuse workers will be trained in the implementation of each plan.

Table 18
Preliminary emergency response procedures

Type of Emergency	Response Plan
Spill accident	• Activate spill prevention plan including containment and clean-up
Snake/scorpion/spider bite	• Retrieve first-aid kit and administer the treatment; call for help
Leichmaniasis, Schistosomiasis or Malaria reported	• Request a medial exam for all the workers • Contact relevant authorities
Volumetric flow imbalance and sub-optimal operating capacity	• Implement alternate operating procedures. • If are expected to be longer-term, take appropriate regulatory actions must be taken such as restricting tanker licensing, access to the WWTP and or fee adjustments. • In case of a severe interruption in the flow, incoming septage should be accommodated in a separate basin for a reasonable duration while the cause of the problem is being remedied. • Contact WAJ
Flash flood	• Bar site access to tanker trucks; monitor all installation and water bodies; conduct a complete site inspection when the flood subsides. • Direct to holding pond.
Site access restriction	• Direct tanker trucks to off-site septage storage facility • Contact military command in North Shouneh
Earthquake	• Stop all mechanical equipment; inspect all installations immediately after earthquake and report structural failure, if any; anticipate follow-up tremors • identify intact basin(s) within the WWTP where raw sewage or treated effluent may be diverted • Activate stand-by controls to for isolating WW in intact units, redirect flows to intact basins and/or to a nearby on-farm irrigation storage reservoir. • Prepare a damage control report.
Sudden deterioration of effluent quality	• Intensify sampling and analysis protocol; recirculate treated effluent; suspend water reuse activity if deterioration is severe until effluent quality is restored
Total power failure	• Activate back-up system; investigate source of power failure

6.3. Construction transport / waste disposal plans

The construction transport and waste disposal plans are very important to ensure timely completion of construction activities, minimize public health and safety risks as well as to ensure various other environmental mitigation measures are easily included during the construction process.

The construction transport plan will be specified in the bid documents. These plans will then need to be reviewed and possibly modified by relevant local authorities including representatives from the MoH, municipality, JVA, MoPW&H, the police department, the project team and other local community representatives prior to construction. The plans need to spell out along what routes and when heavy machinery or regular construction traffic can be moved and where disposal sites are taking into account the following considerations at a minimum:

- Public health and safety;
- Road quality before and after construction;

- Generation of dust and exhaust emissions (affecting residents and orchards);
- Traffic congestion;
- Noise; and
- Appropriate waste disposal sites.

6.4. Environmental management and monitoring plan summary table

The comprehensive and fully detailed EMMP table overleaf details specific mitigation measures for each impact, proposes assigned responsibilities for implementation and monitoring as well timing required for implementation. The project team will incorporate these various mitigation measures and responsibilities into one or more of the following binding project documents:

- The detailed design;
- The construction contract bid documents;
- The WWTP operating procedures; and/or
- The various cooperative institutional agreements being drafted as part of the work under Task 4 of this project;

The various key stakeholders will be actively involved in the review and finalization of relevant documents listed above during Task 4 and Task 5 of the project, agreeing to the most appropriate allocation of responsibilities and details entailed therein.

Table 19
EMMP Summary Table

Potential impact		Mitigation Measures	Responsibility	By when / frequency
1.	**Positive Impacts**			
1.a.	Reduced tanker transport charges	• Select WWTP site closest to the largest septage generating residential area	• Project team and municipality	• Completed
		• Maximizing revenues from on-site reuse to help keep tanker fees as low as possible.	• Project team • WWTP&R operator(s)	• Incorporated, to be further develop during Task 4 • Annually
1.b.	Improved public health, sanitation and pollution prevention of the wider area	• Enforcement and awareness raising of appropriate cesspit pumping	• Municipality, MoH and/or other local civil society	• During construction (awareness) • Continuously during operations (awareness & enforcement)
		• Prevention of illegal tanker discharges • See also mitigations under 1.	• Municipality, local civil society, residents, police, etc.	• Continuously during operations
		• Provide a septic tanker cleaning station on site	• Project team and WWTP operator	• Detailed design
1.c.	Employment opportunities	• Give preference for labor intensive WWTP technology and reuse activities • Give preference for local workers during construction and operation	• Project team and WWTP&R operator • Construction contractor	• Incorporated, to be further develop during bid document preparation and in institutional agreements
1.d.	Change in land values	• Ensure planting visually appealing landscape vegetation, ornamentals in and around the WWTP • Encourage sale of TWW to nearby farmers	• Project team and WWTP&R operator	• During detailed design and institutional agreements • Followed up annually by WWTP operator
1.e.	Demonstration of water reuse and improved public perception	• Provide safe reuse training for farmers • Broader awareness campaign in relation to reuse	• Project team, MoA, NCARTT, Municipality and/or other local civil society	• Prior to sale to TWW • Continuously during operations
		• Effective monitoring and enforcement of Jordanian reuse standards and safe reuse practices	• MoE, MoH, WWTP operator and WAJ	• Continuously during operations
1.f.	Prospect for sewage system in the future	• Select WWTP site that is downstream and not too far from larger, higher density residential areas	• Project team and municipality	• Completed
2.	**Potential adverse impacts during Construction**			
2.a.	Air quality and noise pollution	• Avoid excavation during high-wind conditions • Maintain/enhance low-lying vegetation inside project site and along dirt roads to trap dust • Spraying water on internal dirt tracks and any loose piles	• Construction contractor	• As and when needed during construction
		• Minimize excavations and maximize on-site fill	• Project team during detailed design	• During detailed design
		• Develop a transportation and disposal plan • Ensure all trucks are covered	• Project team, construction contractor and municipality	• Prior to construction (included as part of the bid documents)
		• Loud construction activities and off-site transportation should not be allowed to start in the very early morning nor to persist into the late night.	• Construction contractor, monitored by the Military and Municipality	• Daily, during construction
2.b.	Disposal of construction wastes and handling of hazardous materials (and impact of construction transport on road quality)	• Avoid cross-contamination o non-hazardous wastes with hazardous wastes • Store non-hazardous construction wastes separately from excavated materials • Dispose non-hazardous construction waste safely and in a designated and approved area • Ensure proper storage of hazardous materials • Materials and equipment should be provided to clean up and properly dispose of any spills of hazardous materials • Vehicle maintenance areas should have impervious floors and materials for spill cleanup • Transport hazardous materials in small quantities • Use approved dump-sites for each type of waste • Provide appropriate on-site sanitary facilities • Construction transport plans (e.g. for excavated materials) should take into account access routes and road quality.	• Construction contractor • Waste specific dump-sites to be approved by the Municipality and ministry of environment	• During construction, monitored on a monthly basis by the municipality and ministry of environment

Potential impact		Mitigation Measures	Responsibility	By when / frequency
		• Inspect access routs prior to construction, improve as needed • Rehabilitate the damaged road sections after construction.	• Municipality in consultation with the construction contractor (based on the transport plan)	• Prior to and after construction as needed
2.c.	Health & safety risks	• Off-site transport / disposal plans developed should carefully consider public safety / traffic accident risks • Any heavily used transport routes should be fitted with appropriate "construction activity" warning signs • Inform nearby farmers, military personnel and residents of potential risks to them and inform them about the construction/transportation schedules	• Construction contractor, approved by the local traffic department, ministry of health and municipality – the municipality should share the plans/relevant H&S information with relevant members of the public and advise them to be careful	• Prior to construction – specified in the bid documents by the project team
		• Occupational health and safety standards should be followed during all construction activities in accordance with the "Code of Safety for Construction Works • Provide on-site workers with gloves, noise attenuators, dust masks, steel-tipped shoes and hard hats, in addition to sanitary facilities and clean water • Use of clear and visible warning signs inside the construction site and protective railings where needed • Avoid working during peak heat hours in summer; enforce applicable regulation on temperature related working-hours • Provide sufficient, clean water for drinking purposes • Provide on-site capability to treat affected individuals (first-aid, anti-venom, medical kits)	• Contractor, in cooperation with / under the monitoring of the MoH	• During construction
		• Work with the military to ascertain the absence of mines on site and the surrounding area prior to excavation works	• Construction contractor in cooperation with the relevant local military command	• Prior to construction
		• Provide on-site capability to treat affected individuals (first-aid, anti-venom, medical kits) • Investigate nearest hospital/clinic for treatment of snake and scorpion bites • Inspect worker health prior to commencement of work • Provide H&S awareness and contingency plans for workers	• Construction contractor in cooperation with the MoH	• Prior to construction
2.d.	Change in local hydrology, soil erosion, structural and earthquake risks	• Adhere strictly to the requirements stipulated in National Building Code for Loads and Forces (for Region A) in WWTP design and construction • Ensure proper soil erosion and flood control measures are taken and/or temporary drainage channels are built and that top soils storage locations are away from potential surface runoff areas for future reuse on-site	• Project design team and construction contractor	• During detailed design and prior to construction
2.e.	Archeological disturbance	• Carry out a rapid survey of the site and determine the risk of encountering any potentially undiscovered sites and determine any follow-up (e.g. training of workers, random spot-checks during excavations) • Investigate the cemetery indicated on DLS property maps	• DoA in cooperation with the project team and construction contractor	• At least 3 months prior to construction
2.f.	Ecological disturbance	• Prohibit construction workers from trapping birds	• Construction contractor	• During construction
3.	**Potential adverse impacts during WWT&R operation**			
3.a.	Soil and water resource contamination in general	• See 3.b, 3.c, 3.d, 3.e and 4		
3.b.	Contamination from accidental spills, overflows and seepages	• Incorporate various built-in design mitigations	• Project team	• During detailed design
		• Install groundwater monitoring wells • Install seepage/leakage detection piezometers	• Project team and contractor, in cooperation with WAJ	• As early as possible (for wells) • Piezometers after construction/prior to operation
		• Collect adequate groundwater quality baseline data	• WAJ & MoE in cooperation with Project Team	• As early as possible
		• Carry out regular inspections and routine tests • See also 4.b, 4.c, 4.d and 4.e	• WWTP operator	• Regularly during operations, frequency TBD during development of O&M manual by project team

Potential impact		Mitigation Measures	Responsibility	By when / frequency
3.c.	Contamination from reuse of TWW in irrigation	• Begin the water reuse activity only after the WWTP has been deemed to perform satisfactorily and preliminary test results show compliance with JS893/2002. • Design and put in place appropriate irrigation (and Nitrogen management) management systems and scheduling along with soil and TWW quality monitoring.	• Project team	• During detailed design • Revisited and refined if needed after initial operation
		• Adjust irrigation scheduling, management as needed based on soil and TWW monitoring results and with changes in cropping patterns • Monitoring soil salinity levels to determine leaching requirements. • See also 4.b, 4.c, 4.d and 4.e	• WWTP operator, reuse contractor(s) in cooperation with MoA/NCARTT	• Annually
3.d.	Contamination from sludge reuse and disposal	• Treat sludge to first or second level in accordance with JS 1145/1996: (1) 1st level: dry wet sludge on sludge drying beds followed by storage in piles (2) 2nd level: treat sludge by composting (temperature of at least 55°C for 15 days) • Carry out sampling and analysis in accordance with 1145/1996 • Plan and obtain approval for reuse • In case of sludge disposal, identify nearest suitable disposal site/landfill • See also 4.b	• Project team and WWTP operator, monitoring by relevant authorities	• Develop treatment / reuse/disposal plan during initial year of operation • Continuously as required thereafter
3.e.	Odors	• Incorporate various built-in design mitigations • Plant windbreaks around site perimeter (about 2km) to minimize wind/odors • Install covers on anaerobic basins and denitrification reactors (as part of plant design)	• Project team	• During detailed design, ensure implementation after construction
		• Ensure sound plant operation overall • Provide protective masks for worker in the event of sudden odor surges	• WWTP operator, monitored by WAJ	• During operation
3.f.	Inequality of socio-economic impacts	• Give priority to farmers nearest to the WWTP for purchase of TWW and supporting them to carry out safe reuse • See also 1.d. and 1.e.	• Project team and WWTP&R operator	• During institutional agreements • Followed up annually by WWTP operator
		• Investigate the need for cross subsidies and means of implementing them	• Project team and relevant stakeholders, including tanker drivers	• During Task 4
		• Tanker charges should be openly discussed and revisited on a regular basis to ensure fair tanker charging systems	• WWTP operator, Municipality/village councils and tanker drivers	• Annually
3.g.	Health & safety	• Follow safe practices and standard operating procedures, including basic providing and requiring protective clothing • Provide basic safety training to all workers and managers • Fence off the entire site, provide protective railings and appropriate signs were needed • Properly implement the water reuse activity according to Jordanian regulations on safe reuse and in accordance with JS893/2002 • Provide regular medical check ups for all employees • Use anti-coagulants to control black rats and house mice • Provide on-site capability to treat affected individuals (first-aid, anti-venom, medical kits) • Investigate nearest hospital/clinic for treatment of snake and scorpion bites • See also 1.e, 3.b, 3.c, 3.d and 4.	• Project team and WWTP operator	• During operation
		• Ensure advance warning of all workers of upcoming maintenance works and ensure proper maintenance signage is put up	• WWTP operator	• Prior to maintenance activities
		• Provide tanker access from different directions, minimizing the need for all tankers to pass through any single residential area • Grade all internal roads and provide drainage ditches. Paving and maintaining external access routes will also be encouraged • Routes need to be designated and committed to appropriate use by the tanker drivers. • Impose Speed restrictions	• Project team, municipality, tanker drivers and traffic police	• Prior to completion of construction • Monitoring throughout operations

Potential impact		Mitigation Measures	Responsibility	By when / frequency
3.h.	Disease vectors	• Hire local workers to the extent possible and inspect worker health prior to plant operation • Apply biological insecticide (e.g., BT *Bacillus thuringiensis*) to control mosquitoes • Apply molluscides to control snail intermediates (carriers of schistosomiasis) in ponds and lagoons • Coordinate with the MoH	• WWTP operator in cooperation with MoH and the Malaria and Schistosomiasis Dept at Ministry of Health	• Prior to WWTP operation • Frequencies to be determined by relevant authorities for disease control
4.	**Risks to the WWTP structures and its operation**			
4.a.	Earthquakes	• Adhere strictly to the requirements stipulated in National Building Code for Loads and Forces (for Region A)	• Project team and construction contractor	• During detailed design and construction (supervision and testing)
		• Incorporate various built-in design mitigations • Provision of stand-by controls to enable isolating WW in intact units, redirect flows and/or to a standby nearby on-farm irrigation storage reservoir • Develop emergency response procedures	• Project team	• During detailed design • Revisited and refined if needed after initial operation
		• Implement emergency response and contingency plans	• WWTP operator	
4.b.	Non-residential septage and/or sudden deteriorations in effluent quality	• Incorporate various built-in design mitigations • Develop emergency response procedures	• Project team	• During detailed design • Revisited and refined if needed after initial operation
		• Raise community awareness and involve them in tanker monitoring and enforcement. • Implement targeted awareness raising for non-residential septage generators	• WWTP operator and/or other local civil society	• During construction (awareness) • Continuously during operations (awareness & enforcement)
		• Implement emergency response and contingency plans	• WWTP operator	
4.c.	Volumetric flow imbalance and sub-optimal operating capacity	• Incorporate various built-in design mitigations • Develop emergency response procedures	• Project team	• During detailed design • Revisited and refined if needed after initial operation
		• Public awareness raising to help regulate pumping (provide more balanced discharges)	• WWTP operator and/or other local civil society	• Continuously during operations
		• Develop tanker regulations	• Project team/WWTP operator and relevant stakeholders	• During Task 4, revisited annually by WWP operator and relevant stakeholders
		• Carry out routine maintenance and ensure immediate access to spare parts	• WWTP operator, monitored by WAJ	• Regularly during operations, frequencies TBD during development of O&M manual by project team
		• Implement emergency response and contingency plans	• WWTP operator	
4.d.	Flooding and soil erosion	• Incorporate various built-in design mitigations including stabilizing slopes with plants and any compaction of any non-structural fill • Develop emergency response procedures	• Project team	• During detailed design • Revisited and refined if needed after initial operation
		• Carry out routine inspection and ensure roadside drainage ditches are maintained • Implement emergency response and contingency plans	• WWTP operator	• Inspections after every summer
4.e.	Total power failure	• Investigate emergency power needs and incorporate into design as needed • Develop emergency response procedures	• Project team	• During detailed design • Revisited and refined if needed after initial operation
4.f.	Restricted access to the WWTP	• Design provisions for a dedicated off-site receiving facility to be built in the future if needed	• Project team	• During detailed design
		• Prepare designs for the off-site receiving facility and conveyor	• WWTP operator and WAJ	• After construction
		• Implement emergency response and contingency plans	• WWTP operator in cooperation with Military	• After construction

7. CONCLUSIONS

The WWT&R project will generate a number of positive impacts. The overall **net impact of the project in North Shouneh on the environment in the wider study area will be positive.** Several enhancements are proposed that will further maximize the project benefits. The project planning process included measures to enhance the positive impacts. The design will provide further enhancement of positive impacts as will the EMMP, which will need continuous revisiting, through long-term operations.

7.1. Positive impacts

The most significant of the positive impacts are that the project will:

- **Reduce the costs borne by households to empty cesspits** by providing a nearby, long-term WWTP solution that will receive and treat septage in an environmentally friendly manner; and
- **Improve public health and sanitation and protect soil and water resources in the region by minimizing current cesspit overflows and curbing current tanker disposal practices** – this is expected to help reduce the burden of some diseases in the area.

As such, the project is considered to be **respecting and upholding the environmental objectives in the Jordan-Israel Peace Treaty.**

The project will also:

- Generate local employment opportunities;
- Strengthen local institutions and forge community esteem and public/private partnerships; and
- Accommodate future sewered influents (via sewer system) at minimal additional investment.

The project may have a positive effect on land values in the long run through providing a source of irrigation water without adding pressures on scarce water resources. It will demonstrate water reuse and improve public perception in relation to TWW reuse.

7.2. Potential adverse impacts and their mitigation

Despite the overall net environmental benefit expected from the project, potential adverse impacts, **mostly limited to the area immediately surrounding the WWTP** (the localized study area), have been comprehensively identified and assessed. **All of the potential adverse impacts will be minimized and can be considered insignificant on condition of implementing the EMMP.** The EMMP must be continuously revisited by the project team, contractor, Municipality and other concerned stakeholders to ensure it is being implemented, remains up to date and is adjusted where and when necessary to keep potential adverse impacts at a minimum.

7.2.a. During construction

Unless mitigated, the potentially significant adverse impacts during construction include:

- **Noise and air quality deterioration** from earthworks and transportation;
- Impacts from the **disposal of excavated materials and construction waste**; and
- **Health and safety hazards.**

With the mitigation measures proposed all residual adverse impacts during construction will be insignificant. These measures include strict coordination with the military; carefully designing and planning earth works and a construction transport management plan; implementing various measures to minimize dust generation and noise; ensuring appropriate separation, handling and disposal of wastes;

health screening of labor for infectious diseases as well as requiring various other health and safety measures to be implemented. The site borders a restricted area with landmines that will be securely blocked off. Potential disturbance of archaeological sites and risks to the construction site itself from erosion have also been considered and appropriate mitigations proposed.

7.2.b. During operation

Unless mitigated, the potentially significant adverse impacts during operation include:

- **Odor emissions;**
- **Pollution of soil and water resources** from sludge disposal and reuse of TWW as well as potential contamination from accidental spills, overflows and seepages;
- An **increase in parasitic diseases**; and
- **Health and safety hazards.**

The **potential cumulative impact from reuse of TWW in irrigation on the water resources in the immediate area are insignificant** in comparison with those from other stressors.

With the mitigation measures proposed all residual adverse impacts during operation will be insignificant. These measures include a major focus on odor minimization and control in the WWTP design; conservative design with high operational flexibility to ensure being able to continuously meet effluent and sludge standards (including several hydraulic safeguards as appropriate); contingency plans; disease vector and pest control management in coordination with the MoH, as well as requiring various other standard health and safety procedures. Planned groundwater monitoring and early warning systems will help protect the water resources in the immediate area. These systems and other mitigation measures (discussed below), including emergency and contingency plans will also assure rapid remediation of any unanticipated adverse effects. Changes in ecology, namely a potential increase in the occurrence of pests, were also considered and mitigations proposed.

7.2.c. Risks to the WWTP structures and its appropriate operation

In combination with the impacts and mitigation measures discussed above, several risks to the safe and appropriate operation of the WWTP were also considered:

- The project area is within one of the **most active earthquake zones in Jordan** and will therefore be designed and built with strict adherence to the relevant Jordanian building codes (Zone A).
- The **military may temporarily restrict access to the site** for security reasons. Therefore, the project will include provision for building a dedicated off-site receiving facility if needed in the future.
- Several other risks that may hinder normal operations include:
    - **Receiving non-residential septage**
    - **Volumetric flow imbalances and sub-optimal operating capacity;**
    - **Flooding; and**
    - **Power failures.**

The project design will include several safeguards and operating procedures will include **emergency response procedures and specific contingency plans** in relation to the above potential risks to assure environmental protection.

7.3. Environmental management and monitoring plan

A fully detailed environmental management and monitoring plan (EMMP) has been developed as a tool to help ensure environmentally sound project implementation. It details specific mitigation measures for each impact, proposes assigned responsibilities for implementation and monitoring as well timing required for implementation. **Implementation of the EMMP will ensure all impacts are managed to ensure minimal potential adverse impacts and maximum enhancement of positive impacts. The EMMP will need to be revisited on a regular basis to ensure it remains up to date, addresses emerging issues and remains as effective as possible.**

The project team will use this **EMMP as a basis for incorporating various mitigation measures and responsibilities into one or more of the following binding project documents:**

- **The detailed design;**
- **The construction contract bid documents;**
- **The WWTP operating procedures; and/or**
- **The various cooperative institutional agreements** being drafted as part of the work under Task 4 of this project that will be agreed to and signed prior to construction.

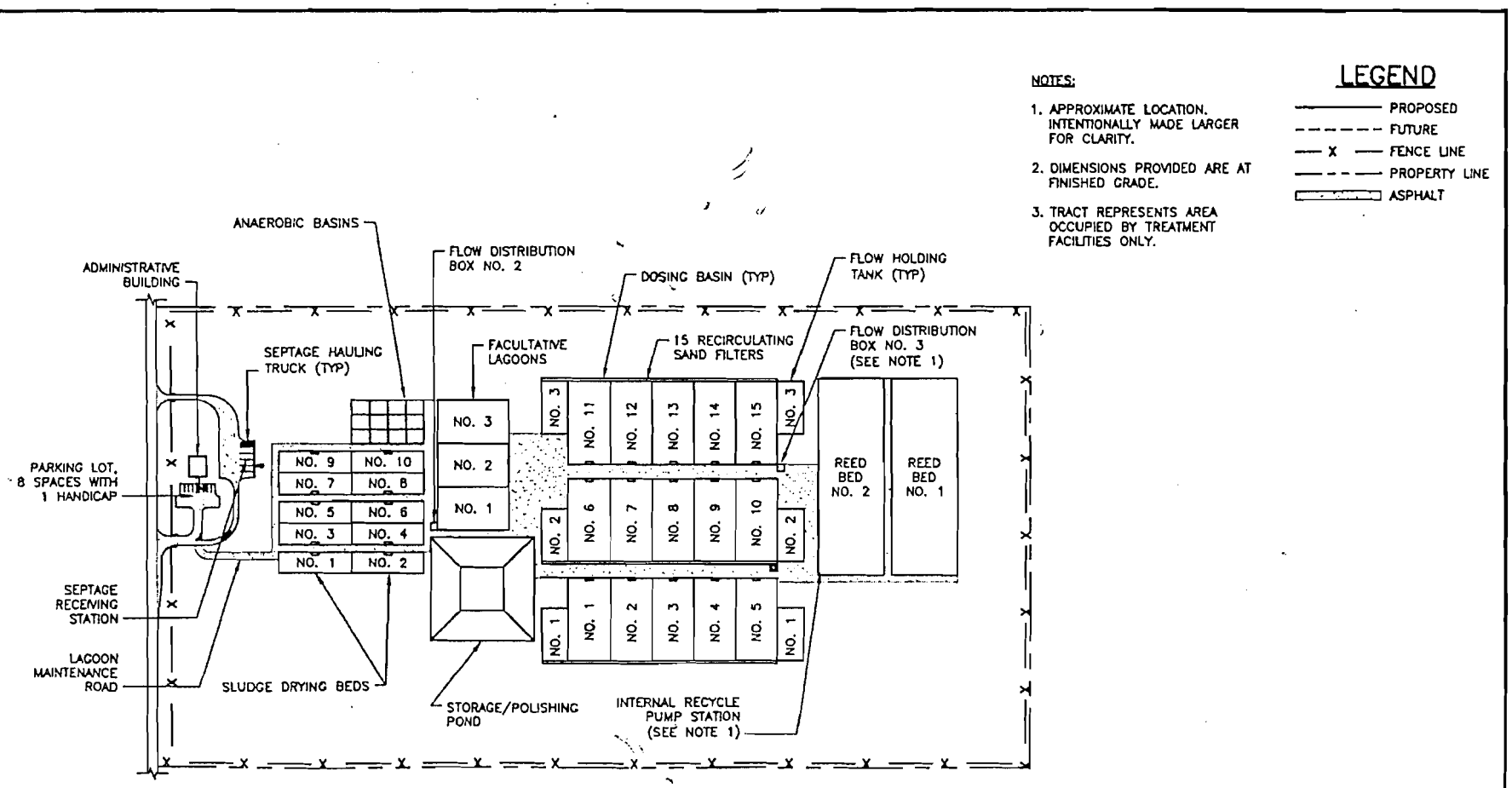
The EMMP's construction transport plan will be specified in the bid documents. This plan will take into account public health and safety; road quality; dust and exhaust emissions; traffic; noise; and waste disposal sites. Other specific plans and procedures will be developed as part of the WWTP operating manual and refined and revisited regularly by the WWTP operator covering issues such as accidental spills, snake/scorpion/spider bites, potential parasitic illnesses, earthquakes and other risks to WWTP operations discussed previously.

Several specific monitoring requirements are also spelled out and will be referred to in the cooperative agreements. These cover effluent and sludge quality monitoring, groundwater monitoring and disease monitoring and prevention. The construction bid documents and supervision of construction activities will also contain health and safety requirements and inspection details.

Appendix A

WWTP conceptual layouts, Process flow sheets & Hydraulic profiles

Figure 13
Preliminary WWTP layout



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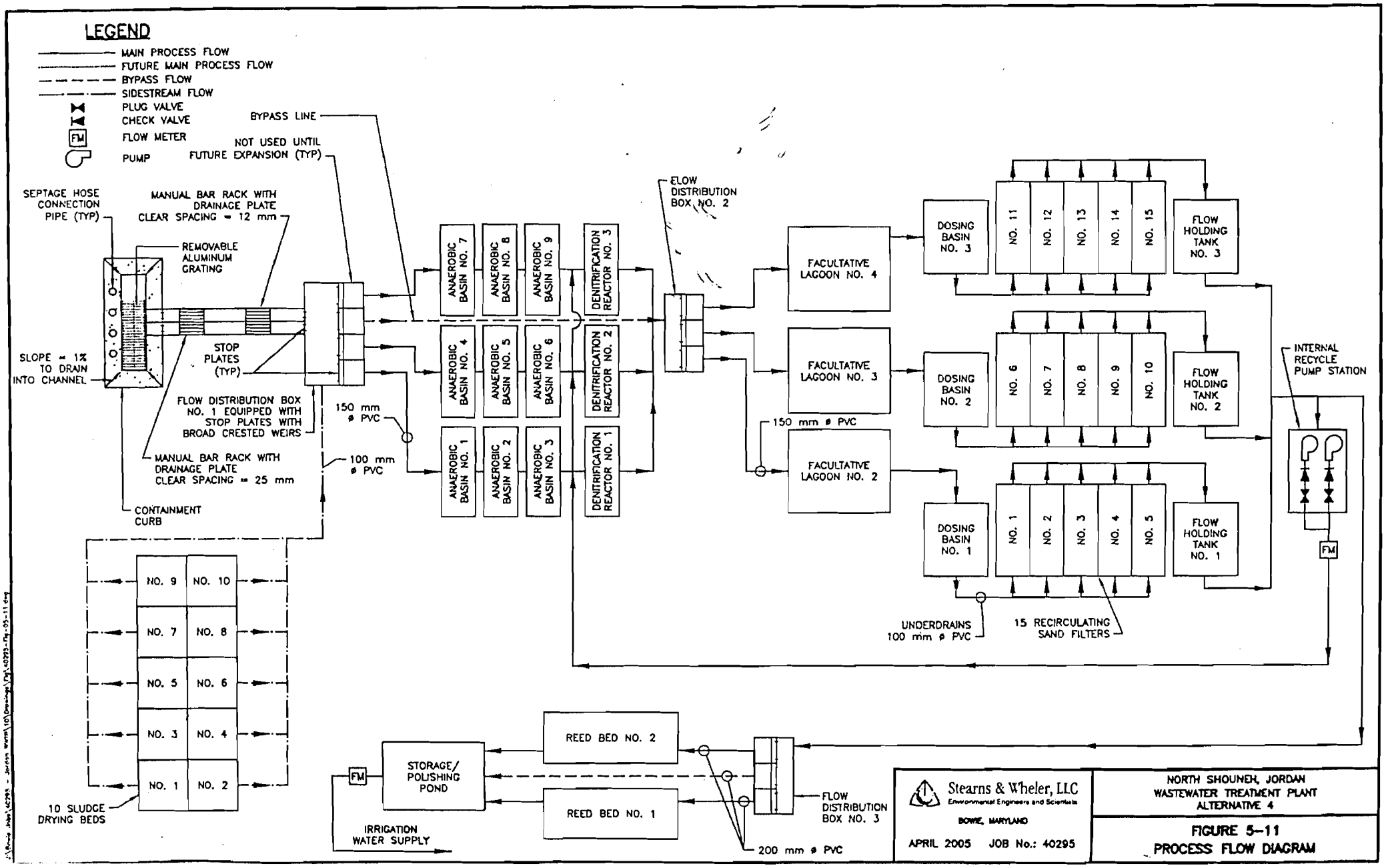
BOWIE, MARYLAND
APRIL 2005 JOB No.: 40295

NORTH SHOUNEH, JORDAN
WASTEWATER TREATMENT PLANT
ALTERNATIVE 4

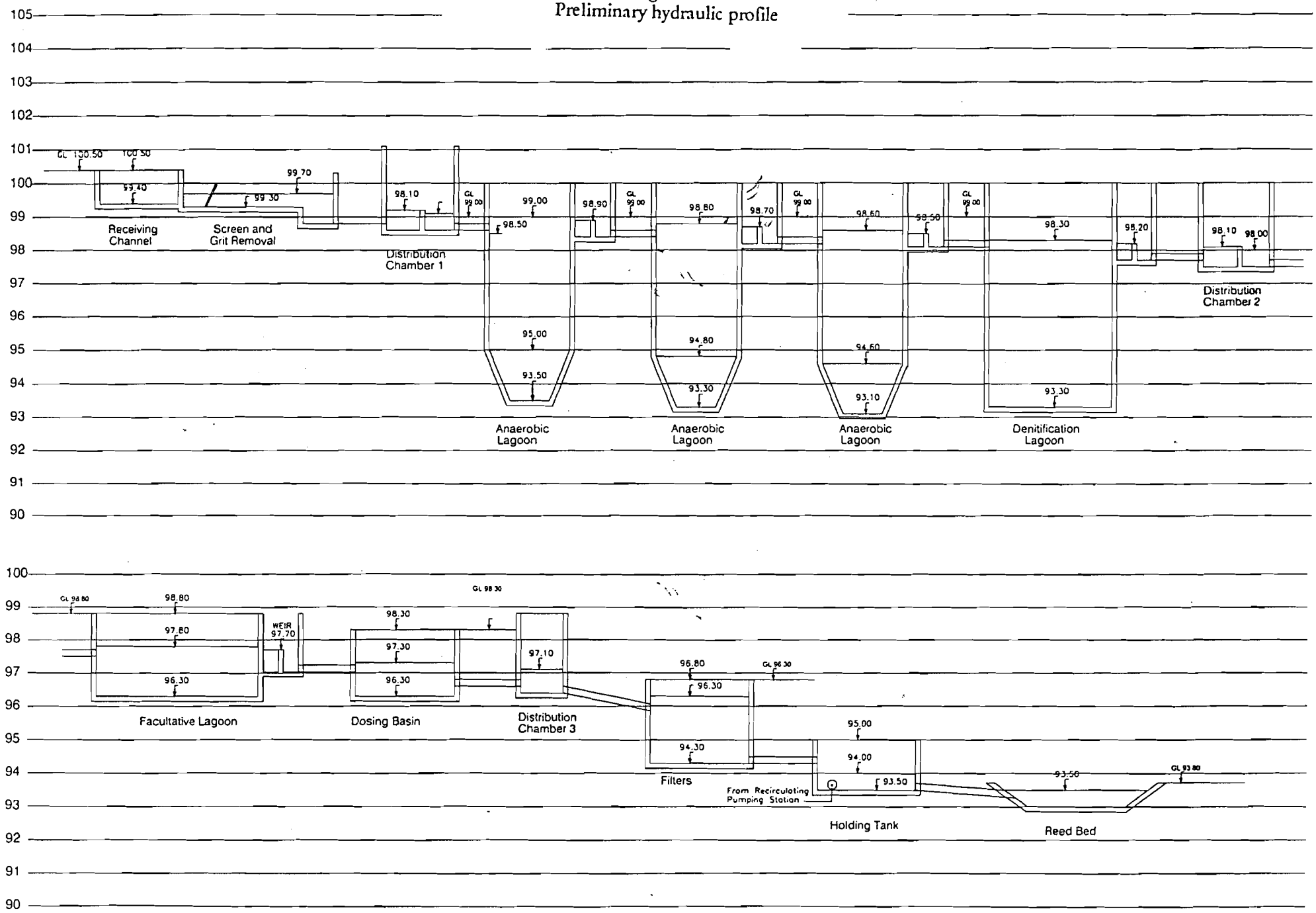
FIGURE 5-12
SITE PLAN

Figure 14
Preliminary process flow diagram



AutoDWG DWGSee Trial Version

Figure 15
Preliminary hydraulic profile



Appendix B

Water Reuse and Sludge Standards

Reclaimed Domestic Wastewater (JS893)

This Standard Replaces Standard JS 893:1995

Introduction

The Institution for Standards and Metrology is the national entity responsible for Issuing standards in Jordan. Standards are set by technical committees formulated by The Institution for Standards and Metrology from members representing main parties concerned with the subject. All concerned parties have the right to express their opinion and comments on the final draft of the subject standard during the notification period in order to make the Jordanian standards in harmony with international standards, to alleviate any technical boundaries facing trade and to facilitate flow of commodities between countries.

Based on this, the permanent technical committee for water and wastewater No.17 has set the Jordanian Standard 893/1995 dealing with "Water-Reclaimed Domestic Wastewater" and recommended its approval as a Jordanian Technical base No. 893/2002 in accordance with article (11) paragraph (b) of the Standards and Metrology Law No. 22 for the year 2000.

Water: Reclaimed Domestic Wastewater

1. Scope

This Jordanian standard is purposely set to specify the conditions that the reclaimed domestic wastewater discharged from wastewater treatment plants should meet in order to be discharged or used in the various fields mentioned in this standard.

2. Standard References

The following standard references become conditions of this standard when referenced. When a documented reference is dated, the amendments after that date do not apply despite the fact that any contractual party depending on these references recommends using the latest edition of the listed references. In the case that the reference is not dated then the latest edition would prevail. The library at the Institute for Standards and Metrology contains current standards.

-Standard Methods for the Examination of Water and Wastewater APHA. 1998

-Health Guidelines for the Use in Agriculture and Aquaculture, WHO. 1989.

3. Definition

The following definitions are used for the purpose of this standard:

3-1 Domestic wastewater

Is the water produced from domestic usages and it could contain industrial wastewater that comply in terms of quality to the ordinance issued by the official parties for the connection to the public sewer system.

3-2 Reclaimed Water

Is the treated wastewater to be reused according to the conditions of this standard provided it is not mixed with water from other sources.

3-3 landscape Areas

Is the green areas intended to be used for decoration and landscaping and not for recreational purposes.

3-4 Mechanical Treatment Systems

Systems that use mechanical processes for treating water such as the activated sludge system, the rotating biological contactors system, the biological filters system, and others.

3-5 Natural Treatment Systems

Systems that use natural processes for treating water by using aerobic or anaerobic ponds, maturation ponds or others.

3-6 Disinfection

Is a process for the removal or reduction of pathogenic and indicator microorganisms that can be found in the water by using disinfectants such as chlorine or chlorine dioxide or ultraviolet rays or the ozone or any other disinfectant approved by the official parties.

3-7 Industrial Crops
Crops used for industrial purposes such as wood trees and olive trees

3-8 Field Crops
Crops that are planted on large areas and harvested once a year and includes:

3-8-1 Forages
Crops planted in order to utilize its vital aggregate (stems and roots) such as berseem, sweet corn, sudan grass, Alfa Alfa, ...

3-8-2 Grains
Crops planted for its high content of carbohydrate and used in the nutrition of humans and animals and includes wheat, barely, oats, corn (white).

3-8-3 Legumes
Crops planted to utilize its seeds after drying such as lintel. fenugreek and lupine.

3-8-4 Fibers
Crops planted in order to utilize its fibers such as cotton and linseed.

3-8-5 Oils
Crops planted to produce oil such as sesame, soya bean and olives.

3-8-6 Sugar
Crops planted to produce sugar such as sugar beet and sugarcane.

3-9 Cooked Vegetables
Vegetables that are usually eaten after cooking and includes: eggplant, squash, beans, cornflower, potato, okra, pees, broad beans, turnip, spinach, jew's mallow, artichoke.

3-10 Uncooked Vegetables
Vegetables that are usually eaten raw and includes the following: tomato, cucumber, Egyptian cucumber, pepper, cabbage, onion, carrot, radish, lettuce, parsley, mint, rocket (watercress), coriander, purslane, strawberry, watermelon and cantaloupe.

4. General Requirements:
4-1 The Reclaimed Domestic Wastewater standard has two primary components

a) Reclaimed water discharged to streams, wadis or water bodies.
b) Reclaimed water for reuse.

4-2 Reclaimed water must comply with the conditions stated in this standard for each of its planned end uses.

4-3 It is not permitted to dilute or mix reclaimed water discharged from wastewater treatment plants with pure water intentionally to comply with the requirement set in this standard.

4-4 Should reclaimed water be used for purposes other than those mentioned in this standard (such as for cooling or for fire distinguishing), special standards or guidelines are to be applied in each case after conducting the necessary studies taking into consideration the health and environmental dimension.

4-5 Official and specialized concerned parties overseeing the operation and development of wastewater treatment plants must always work towards improving the effluent quality to levels, maybe, exceeding those presented in this standard to ideally use the reclaimed water and protect the environment.

5. Standard Requirements:
5-1 Reclaimed Water to be discharged to streams, wadis or water bodies.

5-1-1 It is allowed to discharge reclaimed wastewater to streams or wadis or water bodies when its quality complies with the properties and criteria mentioned in table (1) and it is prohibited to discharge it into wadis draining to the gulf of Aqaba.

5-1-2 When reclaimed water passes on areas that are above or leading to ground water aquifers, measures must be taken to prevent the leakage of the reclaimed water to ground waters.

5-1-3 When discharging reclaimed water to streams, wadis or water bodies that are in direct contact with the public it is preferred to use any of the suitable types of disinfectants to protect the public health. When Chlorine is used, the free residual chlorine concentration shall not exceed 1 mg/l.

5-1-4 Natural treatment plants are permitted to exceed the specified values for *E Coli* numbers when water is discharged to wadis leading to storage dams where the water is stored and used totally for irrigation purposes. In the event that this water is used prior to reaching the dam, then the criteria specified for the reclaimed wastewater for the purpose of reuse and according to the nature of the end use must be applied.

5-1-5 Table 1 – Allowable limit for properties and criteria for discharge of water to streams or wadis or water bodies

Parameters	Abbreviation	Unit	Allowable Limit
Group A			
Biological Oxygen Demand	BOD_5	mg/l	60*
Chemical Oxygen Demand	COD	mg/l	150**
Dissolved Oxygen	DO	mg/l	>1
Total suspended solids	TSS	mg/l	60**
pH	pH	mg/l	6-9
Nitrate	NO_3	mg/l	45
Total Nitrogen	T-N	mg/l	70
Escherishia Coli	*E. coli*	Most probable number or colony forming unit/ 100 ml	1000
Intestinal Helminthes Eggs	Intestinal Helminthes Eggs	egg/l	<or =1
Fat and grease	FOG	mg/l	8.0

Table 1. Continued

Parameters	Abbreviation	Unit	Allowable Limit
Group B			
Phenol	Phenol	mg/l	<0.002
Detergent	MBAS	mg/l	25
Total Dissolved Solids	TDS	mg/l	1500
Total Phosphate	$T\text{-}PO_4$	mg/l	15
Chloride	Cl	mg/l	350
Sulfate	SO_4	mg/l	300
Bicarbonate	HCO_3	mg/l	400
Sodium	Na	mg/l	200
Magnesium	Mg	mg/l	60
Calcium	Ca	mg/l	200
Sodium Adsorption Ration	SAR	-	6.0
Aluminium	Al	mg/l	2.0
Arsenic	As	mg/l	0.05
Berelium	Be	mg/l	0.1
Copper	Cu	mg/l	0.2
Floride	F	mg/l	1.5
Iron	Fe	mg/l	5.0
Lithium	Li	mg/l	2.5
Manganese	Mn	mg/l	0.2
Molibdinum	Mo	mg/l	0.01
Nikel	Ni	mg/l	0.2

Parameters	Abbreviation	Unit	Allowable Limit
Group B			
Lead	Pb	mg/l	0.2
Selenium	Se	mg/l	0.05
Cadmium	Cd	mg/l	0.01
Zinc	Zn	mg/l	5.0
Chrome	Cr	mg/l	0.02
Mercury	Hg	mg/l	0.002
Vanadium	V	mg/l	0.1
Cobalt	Co	mg/l	0.05
Boron	B	mg/l	1.0
Cyanide	CN	mg/l	0.01

* For biological Treatment Plants or Treatment plants with polishing ponds BOD_5 is considered as the filtered BOD

** For biological Treatment Plants or Treatment plants with polishing ponds the allowable limits is twice this number

5-2-2 Reclaimed water reuse for Irrigation

5-2-2-1 The item concerned with reclaimed water reuse for irrigation purposes consists of two main groups; standards group and guidelines group:
- Standards group: is the group of properties and standards that are presented in Table 3 and where operating parties must produce water complying to it and according to the usages mentioned in this standard.
- Guidelines group: The guidelines group shown in Table 4 is considered for guidance only and in case of exceeding it values the end user must carry out scientific studies to verify the effect of that water on public health and the environment and suggest ways and means to prevent damage to either.

5-2-2-2 It is prohibited to use reclaimed water for irrigating vegetables that are eaten uncooked (raw).

5-2-2-3 It is prohibited to use sprinkler irrigation except for irrigating golf courses and in that case irrigation should practiced at night and the sprinklers must be of the movable type and not accessible for day use.

5-2-2-4 When using reclaimed water for irrigating fruit trees, irrigation must be stopped two weeks prior to fruits harvesting and any falling fruits in contact with the soil must be removed.

Table 3 – Allowable Limit for properties and criteria for reuse in irrigation

Allowable limits per end use				
Parameter	Unit	Cooked Vegetables, Parks, Playgrounds and Sides of Roads within city limits	Fruit Trees, Sides of Roads outside city limits, and landscape	Field Crops, Industrial Crops and Forest Trees
		A	B	C
Biological Oxygen Demand	mg/l	30	200	300
Chemical Oxygen Demand	mg/l	100	500	500
Dissolved Oxygen	mg/l	>2	-	-
Total suspended solids	mg/l	50	150	150
pH	unit	6-9	6-9	6-9
Turbidity	NTU	10	-	-
Nitrate	mg/l	30	45	45
Total Nitrogen	mg/l	45	70	70
Escherishia Coli	Most probable number or colony forming unit/100 ml	100	1000	-
Intestinal Helminthes Eggs	Egg/l	<or = 1	<or = 1	<or = 1

Table 4 – Guidelines for Reuse in Irrigation

Group B			
Fat And grease	FOG	mg/l	8
Phenol	Phenol	mg/l	<0.002
Detergent	MBAS	mg/l	100
Total Dissolved Solids	TDS	mg/l	1500
Total Phosphate	T-PO_4	mg/l	30
Chloride	Cl	mg/l	400
Sulfate	SO_4	mg/l	500
Bicarbonate	HCO_3	mg/l	400
Sodium	Na	mg/l	230
Magnesium	Mg	mg/l	100
Calcium	Ca	mg/l	230
Sodium Adsorption Ration	SAR	-	9
Aluminium	Al	mg/l	5
Arsenic	As	mg/l	0.1
Berelium	Be	mg/l	0.1
Copper	Cu	mg/l	0.2
Floride	F	mg/l	1.5
Iron	Fe	mg/l	5.0
Lithium	Li	mg/l	2.5(0.075 for citrus crops)
Manganese	Mn	mg/l	0.2
Molibdinum	Mo	mg/l	0.01
Nikel	Ni	mg/l	0.2
Lead	Pb	mg/l	5.0
Selenium	Se	mg/l	0.05
Cadmium	Cd	mg/l	0.01
Zinc	Zn	mg/l	5.0
Chrome	Cr	mg/l	0.1
Mercury	Hg	mg/l	0.002
Vanadium	V	mg/l	0.1
Cobalt	Co	mg/l	0.05
Boron	B	mg/l	1.0
Cyanide	CN	mg/l	0.01

6- Quality Monitoring

6-1 The Wastewater Treatment Plant Owner Party must ensure that the reclaimed water quality complies to the standards and according to its end use. And must carry out the required laboratory tests and document results in official logbooks and present them whenever requested by the governmental monitoring parties.

6-2 The operating party must take composite samples every 2 hr for a period of 24 hrs in accordance with the frequency indicated in Table 5. Monitoring parties can collect samples in any way found suitable.

6-3 The frequency of collecting samples for both the operating and monitoring parties is as indicated in Table 5.

6-4 Collecting, preserving, transporting and analyzing samples will be as stated in the Standard Methods for the Examination of Water and Wastewater issued by APHA and the federal American Association for Water Research and Pollution Control and any of its amendments or any other approved method if it is not mentioned in the above mentioned reference.

6-5 For natural treatment plants or for mechanical treatment plants with polishing ponds BOD_5 is calculated after filtration step.

6-6 In evaluating the quality of reclaimed water geometric mean is used for calculation of Thermotolerant coliforms or *Escherichia coli* results.

6-7 In evaluating the content of reclaimed water for total Nitrogen, the Geometric mean is used provided that at least 5 samples are included in the calculation.

6-8 Results of the Thermotolerant coliforms can replace those of the *Escherichia coli* when the *Escherichia coli* test cannot be performed due to the absence of technical capabilities.

6-9 When there is a need to define a standard value for a criterion not mentioned in this Standard then the Institution for Standards and Metrology must be contacted to take the proper action.

6-10 In case of epidemics the monitoring and operational parties must investigate the presence of intestinal pathogenic microorganisms that may be found in the water.

7- Evaluation Mechanism

7-1 For the purpose of evaluating the quality of reclaimed water as per the different uses mentioned in this standard the periods shown in Table 5 are approved.

7-2 When any value violate the standards set for discharge of reclaimed water to streams, wadis or water bodies an extra-confirmatory sample must be taken. If the two samples exceeded the allowable standard limits the concerned party will be notified in order to conduct the necessary correction measures in the shortest possible time. And if the violation persist for more than 3 months then the reuse of reclaimed water for that purpose should be stopped until the water quality stabilized.

Table 5 - Number of Reclaimed Water Samples to be collected for the purpose of quality control and evaluation, and the required chemical, physical and biological analysis to be done on the samples

Treatment Plants	Sampling Frequency		Evaluation Period
Type	Operating Party	Monitoring Party	
Mechanical	•Routine Tests: 8 samples / month (composite) •Physical & Chemical Properties: 3 samples /day (grab) •Intestinal Helminthes Eggs: 4 samples/month (composite) •Escherichia coli: 8 samples/month (grab)	•Routine Tests: 2 samples/month •Physical & Chemical Properties: 2 samples /month •Intestinal Helminthes Eggs: 2 samples /month •Escherichia coli: 2 samples /month	3 months*
Natural	•Routine Tests: 4 samples / month (composite) •Physical & Chemical Properties: 3 samples /day (grab) •Intestinal Helminthes Eggs: 2 samples/month (composite) •Escherichia coli: 4 samples/month (grab)	•Routine Tests: 1 samples / month •Physical & Chemical Properties: 1 samples /month •Intestinal Helminthes Eggs: 1 samples/month •Escherichia coli: 1 samples/month	6 months**

- Routine Tests: T-N, NH_4, TSS, COD, BOD_5, NO_3
- Physical & Chemical Properties: pH, DO, RCL_2, Turbidity, Temperatur

* According to seasons (Dec – Feb) , (Mar – May), (Jun – Aug), (Sep – Nov)

** Winter and Summer (Summer: Start of May – Oct, Winter: Start of Nov – Apr)

9- References

- Standard Methods for the Examination of Water and Wastewater, APHA,1998
- Jordanian Standard No. (202/1991)
- Irrigation with Reclaimed Municipal Wastewater, A guidance Manual, Stuart Pettygrove *et al.*, 1984.
- Health Guidelines for the USE of Wastewater in Agriculture and Aquaculture, WHO, 1989.
- Standards, Regulations & Legislation for Water Reuse in Jordan, USAID/ARD, 2001
- Translated by Rsabella/WRE office (Sept 15,2002) based on the previous translation of the older version by Najla Al Ali.
- U:\rsabella\standards\Translated 893-2002 standard-final

Jordanian standard) No. 1145/1996

Sludge: Uses of treated sludge in agriculture Specifications and Standards Organization

1- Scope

This standard is concerned with the conditions that must be available in the sludge resulting from the stations for the treatment of sewage water intended to be used in agricultural land.

2- Definition

Sludge: The solid substance which are characterized by a damp or dry texture resulting from the treatment process of sewage water treatment stations.

Sewage water: The water resulting from domestic uses, and which may intermix with industrial water waste having a quality which conforms to the linking instructions issued by official authorities.

Treated Sludge: Sludge that has been exposed to one of the treatment methods indicated in the appendix to this standard.

Dry Sludge weight: The weight of the totally solid substances after dehydration of the sludge at a temperature of (103 - 105) C for a period of 24 hours

3- General Conditions

3.1- It shall not be allowed to use untreated sludge for agricultural purposes.

3.2- The uses of sludge treated to **the first level** (as indicted in the attachment).

3.2.1- It shall be allowed to use the sludge for the purpose of improving the properties of the Badiya soil not used for agricultural provided that it will be immediately ploughed, in the lands set for forestation.

3.2.2- The treated sludge shall be added during the period between the beginning of April and the end of June.

3.3- The use of the sludge treated to the second level (as indicated in the **attachment**).

3.3.1- It shall be permitted to use the sludge in the cases indicated in item (3-2).

3.3.2- It shall be allowed to use it at the beginning of soil preparation until the planting of fruit trees, fodder, and field crops, taking into account not to harvest the fodder and field crops, or grazing before the lapse of three months from the date of fertilization.

3.3.3- It shall not be permitted to use it for fertilizing the vegetables, green areas, parks, nurseries, and greenhouses, and the lands situated between residential compounds.

3.4- When adding the sludge, the sensitivity of the water reservoirs and their susceptibility to contamination must be observed. The distance of the land to which the treated sludge is intended to be added, from the water of dams and valleys as well as surface water, and water harvest projects, must be also observed.

3.5- The sludge treated for agricultural purposes must not be added, unless approval of the competent official authorities has been obtained.

4- Standard Conditions

- The following standard conditions must be available in the treated sludge, when it is used for agricultural purposes.
- The maximum limit for the sludge properties must be as shown in schedule No. (1).

- The quantity of the treated sludge added to the soil annually shall be calculated according to the concentration of the element of lesser value, in accordance with the following formula :

$$\textbf{Average of the annual sludge addition (Metric ton/Hectare/365 day)} = \frac{\text{Average of addition to the elements level (kg/Hectare/365 day)}}{\text{Element concentration in the sludge sample (mg/kg-dry)X0.001}}$$

- The bio-contaminants, when using the sludge treated for agricultural purposes, must be as shown in schedule No. (2).
- The geometrical average must be taken for seven different samples of the treated sludge before using it or disposing thereof immediately.

Schedule No. (1) - The Maximum of the Chemical Elements Concentration in the Treated Sludge:

Particularity	Concentration of Elements in The Sludge (Mg/Kg-dry) (1)	Addition rate to the elements level Kg/Hectare */ 365 days) (2)	Maximum Limits of the Elements Accumulation in soil (Kg/Hectare) (3)
As (Arsenic)	75	2	41
Cd (Cadmium)	85	1.9	39
Cr (Chromium)	3000	150	3000
Cu (Copper)	4300	75	1500
Pb (Lead)	840	15	300
Hg (Mercury)	57	0.85	17
Mo (Molybdenum)	75	0.9	18
Ni (Nickel)	420	21	420
Se (Selenium)	100	5	100
Zn (Zinc)	7500	140	2800
Co (Cobalt)	150	1.8	36

* One hectare = 10 dunums

Schedule No. (2) - The limits of Bio Contaminants of the sludge when used for Agricultural Purposes

Bio-contaminants	Limits of Contaminants in sludge treated to the first level	Limits of contaminants in sludge treated to the second level
Colon fecal bacteria (the most probable number)	2 X 10^6 bacilli per gram	1 X 10^3 Bacilli per gram
Salmonella (The most probable number)	Unlimited	< 3 bacilli per 4 dry grams*
Worm live ova	Unlimited	< 1ovum per 4 dry grams*
Intestinal viruses	Unlimited	< 1 (one) per 4 day grams*

* Dry: The totally dry solid substances

5- References

- USEPA, Code of federal regulation, criteria for classification: of solid waste disposal practices (1992).
- USEPA, "Standards for the use or disposal of sewage sludge 1992".
- The European community "council directive on the protection of the environment, and in particular the soil, when sludge is used in agriculture, 1989".
- FAO paper No. 47 Wastewater treatment and use in agriculture 1992.

Appendix (1) Sludge Treatment Levels

(1) The first level aims at largely reducing the sludge content of pathogenetics. This can be achieved through one of the following processes:

1- Aerial:

Digestion:

This process shall be performed by stirring the sludge in the existence of air or oxygen, while maintaining the air conditions for a period of 40 days at a temperature of 20° C, or for a period of 60 days at a temperature of 15° C, with a decrease of not less than 38% for the volatile solid substances.

2- Aerial dehydration:

The liquid sludge shall be allowed to infiltrate and / or to be dried up in sand infiltration basins, or in paved or unpaved (tiled) basins, provided that the thickness of the sludge will not exceed (23 cm). However, the sludge must remain in the said basins at least for a period of 3 months, provided that the daily temperature will be above zero degree centigrade for a period of two months out of three months.

3- Non - aerial digestion:

This process shall be performed in the absence of air, provided that the sludge will remain for a period of 15 days at a temperature of (30 - 33) °C or for 60 days at a temperature of 20° C and with a reduction of not less than 38% of the volatile solid substances.

4- Fermentation:

This process shall be performed by using a container with a fixed ventilation shaft, or by placing the fertilizer in heaps, where the solid mass shall remain at a temperature of 40°C for a period of (5) days, provident that the temperature will reach more than 55°C for a period of not less than four hours during that period.

5- Treatment by raising the figure of interaction (the hydrogen exponent) of the liquid sludge.

This process shall be performed by adding a sufficient quantity of lime, in order to give a basic degree equal to 12(PH= 12) for a period of no less than two hours.

6- Other methods:

Any method which is capable of achieving the levels indicated in the previous methods, concerning the reduction of the volatile solid substances, or presenting the attraction of the pathogenetics thereto.

2) The second level aims at a larger reduction in the sludge content of the pathogenetics than that of the first level this can be achieved through one of the following processes:

1- Fermentation / This method may be performed as follows:

A- By using the containers method, where by the sludge will be kept at temperature of not less than 55° C for a period of three days.

B- By using the method of fixed ventilation tube, whereby the sludge will the kept at temperature of not less than 55° C for a period of 3 days.

C- By using the method of finding (stacking) the sludge, whereby it will be kept at temperature of not less than 55° C for a period of 15 days during the sludge fermentation period.

(Stirring must be maintained for at least 5 times during the high temperature period).

2- Thermal dehydration:

the sludge shall be dried up by removing the water there from through direct or indirect it contact with hot gases, where by the rate of humidity will be decreased to 10% or less, so that the sludge temperature will exceed 80°C, or that the damp temperature of the sludge heating gas will not be less than 80°C at the end of the heating process.

3- Thermal operation:

The liquid sludge shall be heated to a temperature of 180°C for or period of 30 minutes.

4- Thermal Arial digestion:
The liquid sludge must be stirred in the existence of air or oxygen, while maintaining the air condition for a period of 10 days at a temperature of (55 - 60) °C, with a reduction for the volatile solid substances at rate of not less than 38%.

5- Other methods:
Any method which is capable of achieving the abovementioned levels, concerning the reduction of the levels of volatile solid substances and prevention of the attract on of the pagthogenetics thereto.

The following methods, when added to the above-mentioned treatment methods, will reinforce the reduction of the pagthogenetics:

A- **Treatment by beta rays:** The sludge shall be exposed to beta rays from the nuclear accelerator with doses of not less than (1) megarad at room temperature (20°C).

B- **Treatment by gamma rays:** The sludge shall be treated by gamma rays from specific isotopes, such as Cobalt 60 or Cesium 137 with doses of not less than (1) megarad at room temperature (20°C).

C- **Pasteurization:** The sludge shall be kept for a period of 30 minutes at a temperature of not less than 70°C.

D- **Other methods:** Any other methods or acceptable operating conditions, if they lead to a reduction in the pathogenetics to the extent that we obtain by using any of the aforementioned methods.

Reference:
USEPA, code of federal regulation, criteria for classification of solid waste disposal peacetimes (1992).

Appendix C

Population & Monthly Wind Data

Table 20
Population and household data by community

Municipality	Community	Number of Households	Population
Kura	JIFFIN	475	3,134
	KAFR KIFYA	108	602
	AS SAMAT	259	1,584
	MARHABA	228	1,397
	SAMOU	989	6,221
	KAFR RAKIB	691	4,220
	BAYT IDIS	818	4,815
	KAFR AL MA	1,600	9,841
	ABU AL QUN	79	511
	ZIMAL	490	2,999
	JININ AS SAFA	609	3,652
	AL ASHRAFIYYA	1,387	8,525
	DAYR ABI SAID	2,361	13,789
	TIBNA	923	5,625
	AR REQQA	33	209
Taybeh	MAKHRABA	214	1,313
	SAMA	1,336	8,179
	MANDAH	137	837
	DAYR AS SINA	788	4,828
	ZIBDA AL WASATIYYA	66	404
	IBSAR ABU ALI	51	312
	AT TAYYIBA	1,893	11,594
MBJ	N Shouneh	2,599	14,353
	AL MANSHIYYA	1,109	6,387
	WAQQAS	896	5,245
	AL ADASIYYA	418	2,413
	AL BAQOURA	122	554
	AL FIDDIYYIN	113	700
	AS SAKHINA	64	398
	MURSHID	45	245
	ABU-Ziad (Kura Town)	15	49
T.Fahel	TABAQIT FAHL	138	847
	SAYL AL HIMMA	56	323
	AL MASHARI	3,036	18,228
	ASH SHAYKH HUSAYN	1,253	7,105
	AZ ZIMALIYYA	163	873
Sharhabeel	WADI AL YABIS	978	5,407
	AL MARAZZA	154	975
	AL QERN	129	750

Source: October 2004 Census, Department of Statistics

Table 21
Prevailing Monthly Wind Direction (Degree)

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yearly
Baqoura	117	150	134	251	257	268	266	261	254	209	098	103	185°

0 = North, 90 = East, 180 = South, 270 = West

Table 22
Mean Monthly Wind Speed "Knot"

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yearly	Period
Baqoura	3.3	2.5	2.2	1.9	1.8	1.7	1.6	1.7	1.2	1.3	2.6	2.9	2.1	1978 2000
Wadi El-Rayyan*	1.2	1.4	1.3	1.6	1.9	2.0	1.9	1.5	1.1	0.9	0.8	1.3	1.4	1984 2000

* Wind direction data not available at Wadi El-Rayyan

Source: Jordan Climatological Handbook, 2000, The Hashemite kingdom of Jordan, Meteorological Department, Climate Division

Appendix D

Jordan Archaeological Data Information System (JADIS)

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  JADIS / Jordan Antiquities Database and Information System          06-07-2005
  Full JADIS Report
1. Site no.:   2022-004
2. English Name:      SUWWAN
3. UTM zone:     36     4. UTM east:       742260       5. UTM north:   3609330
6. UTM calculated       7. UTM sited
8. PG calculated        9. PG sited
10. Palestine grid east:   204,800          11. Palestine grid north:    222,180
12. K737:        3155.3.SW        13. Other map no.:
14. Air photo series:   15. Air photo no.:
16. Satellite photo no.:
17. Site size:          18. Max elevation:
19. Type of Site and 20. Period and Type of Use
UNSPECIFIED EB       01)SHERD/FLINT SCATTER
IRON IIC             01)SHERD/FLINT SCATTER   ?
PERSIAN (IRON III)             01)SHERD/FLINT SCATTER   ?
EARLY HELLENISTIC    01)SHERD/FLINT SCATTER
UNSPECIFIED NABATAEAN          01)SHERD/FLINT SCATTER   ?
EARLY ROMAN          01)SHERD/FLINT SCATTER
UNSPECIFIED BYZANTINE          01)SHERD/FLINT SCATTER
UNSPECIFIED AYYUBID/MAMLUK     01)SHERD/FLINT SCATTER
UNSPECIFIED PERIOD FLINTS      01)SHERD/FLINT SCATTER
UNSPECIFIED PERIOD POTTERY     01)SHERD/FLINT SCATTER
21. Topographic location:     03)VALLEY BOTTOM
22. Site condition: 00)NO INFORMATION
23. Disturbances:   00)NO INFORMATION
     Other Disturbances
24. Inventory rating:
Dam:          Quarry:
Cul25. Type & level of threat of destruction by:  Cultivation: Other:  Cultivation:
    Erosion
Construction:
Road work:
Development:
26. Archaeology of Jordan References:
DE CONTENSON H.         1964       34    SITE 8
GLUECK N.     1945          a        13      18
GLUECK N.     1951          a     239    SITE 137
IBRAHIM M. ET ALII      1976       48    SITE 20
32. Other reference:
 27. Visited by:        28. Visit date:
 29. Encoded by:        30. Encoding date:     16-06-1993
 31. Notes:
```

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  JADIS / Jordan Antiquities Database and Information System          06-07-2005
  Full JADIS Report
1. Site no.:   2022-009
2. English Name:      MANSHIYA
3. UTM zone:     36     4. UTM east:       742000       5. UTM north:   3608100
6. UTM calculated       7. UTM sited
8. PG calculated        9. PG sited
10. Palestine grid east:   204,500          11. Palestine grid north:    221,000
12. K737:        3155.3.SW        13. Other map no.:
14. Air photo series:   15. Air photo no.:
16. Satellite photo no.:
17. Site size:          18. Max elevation:
19. Type of Site and 20. Period and Type of Use
MODERN (1915-1950)   11)VILLAGE SITE (NO FORTIFICATIONS)
21. Topographic location:     0)UNKNOWN LOCATION
22. Site condition: 00)NO INFORMATION
23. Disturbances:   00)NO INFORMATION
     Other Disturbances
24. Inventory rating:
Dam:          Quarry:
    Cultivation:       Other:
25. Type & level of threat of destruction by:
```

Construction: Erosion
Road work:
Development:
26. Archaeology of Jordan References:
32. Other reference:
27. Visited by: 28. Visit date:
29. Encoded by: 30. Encoding date: 03-04-1994
31. Notes: No bibliography; No information.

JADIS / Jordan Antiquities Database and Information System 06-07-2005
Full JADIS Report
1. Site no.: 2022-018
2. English Name: MUSA
3. UTM zone: 36 4. UTM east: 742400 5. UTM north: 3608900
6. UTM calculated 7. UTM sited
8. PG calculated 9. PG sited
10. Palestine grid east: 204,900 11. Palestine grid north: 221,700
12. K737: 3155.3.SW 13. Other map no.:
14. Air photo series: 15. Air photo no.:
16. Satellite photo no.:
17. Site size: 18. Max elevation:
19. Type of Site and 20. Period and Type of Use
UNSPECIFIED PERIOD STRUCTURE 25)OTHER/UNSPECIFIED STRUCTURE OR WALL
21. Topographic location: 0)UNKNOWN LOCATION
22. Site condition: 00)NO INFORMATION
23. Disturbances: 00)NO INFORMATION
Other Disturbances
24. Inventory rating:
Dam: Quarry:
Cultivation: Other:
25. Type & level of threat of destruction by:
Construction: Erosion
Road work:
Development:
26. Archaeology of Jordan References:
32. Other reference:
27. Visited by: 28. Visit date:
29. Encoded by: HA 30. Encoding date: 20-04-1994
31. Notes: No bibliography; No information.

JADIS / Jordan Antiquities Database and Information System 06-07-2005
Full JADIS Report
1. Site no.: 2022-020
2. English Name: SASIYYAH
3. UTM zone: 36 4. UTM east: 743370 5. UTM north: 3609770
6. UTM calculated 7. UTM sited
8. PG calculated 9. PG sited
10. Palestine grid east: 205,920 11. Palestine grid north: 222,600
12. K737: 3155.3.SW 13. Other map no.:
14. Air photo series: 15. Air photo no.:
16. Satellite photo no.:
17. Site size: 18. Max elevation:
19. Type of Site and 20. Period and Type of Use
UNSPECIFIED EB 02)SHERD/FLINT SCATTER (UNCERTAIN PRESENCE)
UNSPECIFIED AYYUBID/MAMLUK 03)SHERD/FLINT SCATTER (MAIN PRESENCE)
UNSPECIFIED PERIOD POTTERY 01)SHERD/FLINT SCATTER
UNSPECIFIED PERIOD STRUCTURE 43)MILL
UNSPECIFIED PERIOD STRUCTURE 51)AQUEDUCT OR WATER CHANNEL
21. Topographic location: 0)UNKNOWN LOCATION
22. Site condition: 00)NO INFORMATION
23. Disturbances: 00)NO INFORMATION
Other Disturbances
24. Inventory rating:
Dam: Quarry:

25. Type & level of threat of destruction by: Cultivation: Other:
Erosion
Construction:
Road work:
Development:
26. Archaeology of Jordan References:
GLUECK N. 1951 a 240 SITE 138
IBRAHIM M. ET ALII 1976 48 SITE 17
32. Other reference:
27. Visited by: 28. Visit date:
29. Encoded by: HA 30. Encoding date: 21-04-1994
31. Notes:

Full JADIS Report
1. Site no.: 2022-021
2. English Name: ABU QAMEL
3. UTM zone: 36 4. UTM east: 742130 5. UTM north: 3608770
6. UTM calculated 7. UTM sited
8. PG calculated 9. PG sited
10. Palestine grid east: 204,660 11. Palestine grid north: 221,620
12. K737: 3155.3.SW 13. Other map no.:
14. Air photo series: 15. Air photo no.:
16. Satellite photo no.:
17. Site size: 18. Max elevation:
19. Type of Site and 20. Period and Type of Use
IRON I 01)SHERD/FLINT SCATTER
PERSIAN (IRON III) 02)SHERD/FLINT SCATTER (UNCERTAIN PRESENCE)
UNSPECIFIED HELLENISTIC 01)SHERD/FLINT SCATTER
EARLY ROMAN 01)SHERD/FLINT SCATTER
EARLY BYZANTINE 01)SHERD/FLINT SCATTER
LATE BYZANTINE 02)SHERD/FLINT SCATTER (UNCERTAIN PRESENCE)
UNSPECIFIED AYYUBID/MAMLUK 01)SHERD/FLINT SCATTER
UNSPECIFIED PERIOD POTTERY 01)SHERD/FLINT SCATTER
21. Topographic location: 0)UNKNOWN LOCATION
22. Site condition: 00)NO INFORMATION
23. Disturbances: 00)NO INFORMATION
Other Disturbances
24. Inventory rating:
Dam: Quarry:
25. Type & level of threat of destruction by: Cultivation: Other:
Erosion
Construction: Construction:
Road work:
Development:
26. Archaeology of Jordan References:
GLUECK N. 1951 a 239 240 SITE 136
IBRAHIM M. ET ALII 1976 48 SITE 19
ZWICKEL W. 1990 316
32. Other reference:
28. Visit date:
29. Encoded by: HA 30. Encoding date: 21-04-1994
31. Notes:

Full JADIS Report
1. Site no.: 2022-033
2. English Name: ABU BISSEH
3. UTM zone: 36 4. UTM east: 743200 5. UTM north: 3609400
6. UTM calculated 7. UTM sited
8. PG calculated 9. PG sited
10. Palestine grid east: 205,700 11. Palestine grid north: 222,200
12. K737: 3155.3.SW 13. Other map no.:
14. Air photo series: 15. Air photo no.:
16. Satellite photo no.:
17. Site size: 18. Max elevation:

19. Type of Site and 20. Period and Type of Use
UNSPECIFIED AYYUBID/MAMLUK 01)SHERD/FLINT SCATTER
UNSPECIFIED ISLAMIC 43)MILL
21. Topographic location: 0)UNKNOWN LOCATION
22. Site condition: 00)NO INFORMATION
23. Disturbances: 12)PLOWING
Other Disturbances
24. Inventory rating:
Dam: Quarry:
25. Type & level of threat of destruction by: Cultivation: Other:
Erosion
Construction:
Road work:
Development:
26. Archaeology of Jordan References:
IBRAHIM M. ET ALII 1976 48 SITE 18
32. Other reference:
27. Visited by: 28. Visit date:
29. Encoded by: GP 30. Encoding date: 15-08-1994
31. Notes:

Full JADIS Report
1. Site no.: 2022-034
2. English Name: SUWWAN - (2)
3. UTM zone: 36 4. UTM east: 742600 5. UTM north: 3609900
6. UTM calculated 7. UTM sited
8. PG calculated 9. PG sited
10. Palestine grid east: 205,100 11. Palestine grid north: 222,700
12. K737: 3155.3.SW 13. Other map no.:
14. Air photo series: 15. Air photo no.:
16. Satellite photo no.:
17. Site size: 18. Max elevation:
19. Type of Site and 20. Period and Type of Use
UNSPECIFIED EB 02)SHERD/FLINT SCATTER (UNCERTAIN PRESENCE)
IRON IIC 02)SHERD/FLINT SCATTER (UNCERTAIN PRESENCE)
PERSIAN (IRON III) 02)SHERD/FLINT SCATTER (UNCERTAIN PRESENCE)
UNSPECIFIED BYZANTINE 01)SHERD/FLINT SCATTER
UNSPECIFIED AYYUBID/MAMLUK 03)SHERD/FLINT SCATTER (MAIN PRESENCE)
MODERN (1915-1950) 01)SHERD/FLINT SCATTER
21. Topographic location: 0)UNKNOWN LOCATION
22. Site condition: 00)NO INFORMATION
23. Disturbances: 00)NO INFORMATION
Other Disturbances
24. Inventory rating:
Dam: Quarry:
25. Type & level of threat of destruction by: Cultivation: Other:
Construction: Erosion
Road work:
Development:
26. Archaeology of Jordan References:
32. Other reference:
27. Visited by: 28. Visit date:
29. Encoded by: GP 30. Encoding date: 15-08-1994
31. Notes:

Appendix E

List of Observed and Known Species

Table 23
Plant Species Recorded/Observed in Study Area

Species	Family	English Name	Arabic Name	Status/Remarks
Echium jadaeum	Boraginaceae	Judean Viper's Bugloss	Himhim el Ghor	C
Silene rubella	Caryophyllaceae	Catchfly	Qrunful	C
Chenopodium album	Chenopodiacea	Common Goosefoot	Fas el Kelab	C
Anthemis palaestina	Compositae	Palestine chamomile	Aqhowan Falasteni	C
Calendula arvensis	Compositae	Field Marigold	Honwa	C
Centaurea hyalolepis	Compositae	Centaury	Murrar Shahfafi	C
Chrysanthemum coronarium	Compositae	Crown Daisy	Oqhowan/Qandol	C/O
Cichorium pumilum	Compositae	Dwarf Chicory	Hindbeh	C/Ed
Crepis aspera	Compositae	Rough Hawkweed	Sfaira	C/Ed
Lactuca seriola	Compositae	Pickly Lettuce	Lubbain	C/M
Notobasis syriaca	Compositae	Syrian Plumed Thistle	Khorfaish Jmal	C
Onopordum cynarocephalum	Compositae	Artichoke Cotton Thistle	Shouk El Jimal	C
Senecio vernalis	Compositae	Spring Groundsel	Sfaira	C
Sonchus oleceras	Compositae	Common Sow Thistle	Lubbain	C
Sylibum marianum	Compositae	Holy Thistle	Khorfaish Jmal	C
Convolvulus arvensis	Convulvulaceae	Bind Weed	Muddad Abyad	C
Diplotaxis erucoides	Cruciferae	Dwarf Rocket	Hwaira	C
Eruca sativa	Cruciferae	Garden Rocket	Jarjeer	C/Ed
Erucaria boveana	Cruciferae	Erucaria	Slaihi	C/Ed
Sinapis alba	Cruciferae	White Mustard	Khardal Abyad	C
Cucumis prophetarum	Cucurbitaceae	Globe Cucumber	Khyar Barri	P
Ricinus communis	Euphorbiaceae	Caster Tree	Karwaá	M
Hypecoum procumbens	Fumariaceae	Hypecom	Qrain	R
Bromus fasciculatus	Gramineae	Brome Grass	Shwaiáreh	C/F
Cynodon dactylon	Gramineae	Bermuda Grass	Nageel	C/F
Lolium rigidum	Gramineae	Rye Grass	Hashishet el Faras	C/F
Phragmites australis	Gramineae	Reed	Qusaib	C
Gladiolus italicus	Iridaceae	Gladiolus	Jladiolus	C/O
Moluccella laevis	Labiatae	Shell Flower	Ajras Beit Lahm	R
Salvia aegyptiaca	Labiatae	Egyptian Sage	Mairameyieh	C/M
Acacia cyanophylla	Leguminoseae	Wattle	Sant Azraq	Cultivated
Ceratonia siliqua	Leguminoseae	Karob	Kharroub	Ed
Melilotus indicus	Leguminoseae	Indian Melilot	Handagoog	C/Ed
Prosopis fracta	Leguminoseae	Mesquite	Yanbout	C/W
Vicia peregrina	Leguminoseae	Purple Vetch	Jolban	C/Ed
Androcymbium palaestinum	Liliaceae	Androcymbium	Zanbaq el Ghor	R
Malva nicaeensis	Malvaceae	Bull Mallow	Khobaizeh	C/Ed
Fraxinus syriaca	Oleaceae	Syrian Ash	Lsan El Asafeer	Cultivated
Orobanche cernua	Orobanchaceae	Drooping Broomrape	Halook	C/Parasitic
Papaver rhoeas	Papveraceae	Corn Poppy	Shaqaiaq	C
Portulaca oleracea	Portulacaceae	Common Purslane	Baqleh	C/Ed
Anagalis arvensis	Primulaceae	Pimpernel	Ein el Qot	C/P
Ammi majus	Umbelliferae	Bishop's Weed	Khilah Shaytanieh	C
Urtica pilulifera	Urticaceae	Roman Nettle	Qurais	C/M

Table 24
Mammal Species Recorded/Observed in Study Area

Common name	Scientific name	Arabic name	Observed	Previous Records
Black Rat	*Rattus rattus,*	الجرذ الأسود		×
House mouse	*Mus musdus*	فأر المنزل		×
Wagner Gerbil	*Gerbillus dasyurus*	يربوع واجنر		×
Egyptian mongoose	*Herpestes ichneumon*	النمس المصري		×
Asian Jackal	*Canis aureus,*	الواوي		×
Jungle Cat	*Felis chaus*	قط الادغال		×
Wild Boar	*Sus scrofa*	الخنزير البري		×
Rock Hyrax	*Procavia capensis*	الوبر		×

Table 25
Land Amphibians Species Recorded in the Study Area (Reptiles)

Common Name	Scientific Name	Arabic Name	Observed	Previous Records
Green Frog	*Rana rudibunda*	الضفدع الشائع	×	
Tree Frog	*Hyla savigni*	ضفدع الأشجار	×	
	Mabuya vittata	السحلية الخضراء الناعمة	×	
	Chalcides ocelatus,	السحلية البراقة		×
	Laudakia stellio	الحرذون	×	
	Ptypdactylus puiseuxi	الوزغة		×
	Chamaeleo chamaeleon	الحرباء		×
	Ophisops elegans	السحلية الشائعة		×
	Lacerta laevis	السحلية المخططة		×
Black Whip Snake	*Coluber jugularis*	العربيد		×
Montpelier Snake	*Malpolon monspessularus*	الحية الحمراء		×
Dice Water Snake	*Natrix tessellata.*	حية الماء		×
Palestine Viper	*Vipera palaestina*	ثعبان فلسطين		×

Table 26
Potential Bird Species in Project Area

Common Name	Scientific name	Arabic Name	Observed	Previous Records
Levant Sparrowhawk	*Accipiter brevipes*	البيدق		×
Goshawk	*Accipiter gentilis*	الباز الصداح		×
Sparrowhawk	*Accipiter nisus*	الباشق	×	
Great Reed Warbler	*Acrocephalus arundinaceus*	هازجة القصب الكبيرة	×	
Sedge Warbler	*Acrocephalus schoenobaenus*	هازجة السعد		×
Reed Warbler	*Acrocephalus scirpaceus*	هازجة القصب		×
Clamorous Reed Warbler	*Acrocephalus stentoreus*	هازجة القصب الصيّاحة		×
Common Sandpiper	*Actitis hypoleucos*	الطيطوي		×
Skylark	*Alauda arvensis*	الزرعي	×	
Chukar	*Alectoris chukar*	الشنار		×
Desert Lark	*Ammomanes deserti*	قبرة الصحراء		×
Sand Partridge	*Ammoperdix heyi*	الحجل		×
Shoveler	*Anas clypeata*	الكيش		×
Teal	*Anas crecca*	الشرشير الشتوي		×
Falcated Duck	*Anas falcata*	حذف منجلي		×

Common Name	Scientific name	Arabic Name	Observed	Previous Records
Wigeon	*Anas penelope*	المصوة		×
Mallard	*Anas platyrhynchos*	ابو حشيش		×
Garganey	*Anas querquedula*	الشرشير الصيفي		×
Gadwall	*Anas strepera*	السماري		×
Red-throated Pipit	*Anthus cervinus*	ابو تمرة احمر الزور		×
Meadow Pipit	*Anthus pratensis*	ابو تمرة الحقول		×
Long-billed Pipit	*Anthus similis*	ابو تمرة طويل المنقار	×	
Water Pipit	*Anthus spinoletta*	ابو تمرة الماء		×
Pintail	*Anas acuta*	البلبول		×
Little Swift	*Apus affinis*	السمامة الصغيرة		×
Swift	*Apus apus*	السمامة	×	
Alpine Swift	*Apus melba*	السمامة الجبلية		×
Pallid Swift	*Apus pallidus*	السمامة الباهتة	×	
Golden Eagle	*Aquila chrysaetos*	العقاب الذهبي		×
Spotted Eagle	*Aquila clanga*	العقاب الأسفع الكبير	×	
Imperial Eagle	*Aquila heliaca*	ملك العقبان		×
Steppe Eagle	*Aquila nipalensis*	عقاب البادية		×
Lesser Spotted Eagle	*Aquila pomarina*	العقاب الأسفع الصغير		×
Grey Heron	*Ardea cinerea*	مالك الحزين الرمادي		×
Squacco Heron	*Ardeola ralloides*	الواق الابيض		×
Turnstone	*Arenaria interpres*	قبرة الماء		×
Short-eared Owl	*Asio flammeus*	البومة الصمعاء		×
Long-eared Owl	*Asio otus*	البومة الاذناء		×
Little Owl	*Athene noctua*	البومة الصغيرة		×
Pochard	*Aythya ferina*	الحمراوي		×
Tufted Duck	*Aythya fuligula*	ابو خصلة		×
Ferruginous Duck	*Aythya nyroca*	الحمراوي ابيض العين		×
Bittern	*Botaurus stellaris*	الواق الكبير		×
Eagle Owl	*Bubo bubo*	البومة النسارية		×
Cattle Egret	*Bubulcus ibis*	أبو قردان	×	
Trumpeter Finch	*Bucanetes githagineus*	الزمّير الوردي		×
Stone-curlew	*Burhinus oedicnemus*	الكروان الصحراوي	×	
Buzzard	*Buteo buteo*	الصقر الحوام	×	
Long-legged Buzzard	*Buteo rufinus*	الحميق	×	
Short-toed Lark	*Calandrella brachydactyla*	قبرة السهوب		×
Lesser Short-toed Lark	*Calandrella rufescens*	قبرة السهوب الصغيرة		×
Dunlin	*Calidris alpina*	الدرّيجة		×
Curlew Sandpiper	*Calidris ferruginea*	كروان الماء		×
Little Stint	*Calidris minuta*	الفطيرة الصغيرة		×
Temminck's Stint	*Calidris temminckii*	فطيرة تمنك		×
Linnet	*Carduelis cannabina*	التفح	×	
Goldfinch	*Carduelis carduelis*	الحسون الذهبي	×	
Greenfinch	*Carduelis chloris*	الحسون الاخضر	×	
Rufous Bush Robin	*Cercotrichas galactotes*	الحمرة		×
Pied Kingfisher	*Ceryle rudis*	السمّاك الابقع		×
Cetti's Warbler	*Cettia cetti*	هازجة ستي		×
Kentish Plover	*Charadrius alexandrinus*	الزقزاق الاسكندراني		×
Caspian Plover	*Charadrius asiaticus*	الزقزاق القزويني		×

Common Name	Scientific name	Arabic Name	Observed	Previous Records
Little Ringed Plover	*Charadrius dubius*	الزقزاق المطوق الصغير		×
Ringed Plover	*Charadrius hiaticula*	الزقزاق المطوق		×
Greater Sand Plover	*Charadrius leschenaultii*	زقزاق الرمل الكبير		×
Dotterel	*Charadrius morinellus*	القطقاط الاغبر		×
Sociable Plover	*Chettusia gregaria*	زقزاق السهول		×
White-tailed Plover	*Chettusia leucura*	الزقزاق ابيض الذيل		×
White-winged Black Tern	*Chlidonias leucopterus*	ابو رقة		×
Black Tern	*Chlidonias niger*	خطاف المستنقعات الاسود		×
White Stork	*Ciconia ciconia*	اللقلق الابيض	×	
Black Stork	*Ciconia nigra*	اللقلق الأسود		×
Short-toed Eagle	*Circaetus gallicus*	عقاب الحيات	×	
Marsh Harrier	*Circus aeruginosus*	مرزة البطائح	×	
Hen Harrier	*Circus cyaneus*	مرزة الدجاج		×
Pallid Harrier	*Circus macrourus*	المرزة الباهتة	×	
Montagu's Harrier	*Circus pygargus*	مرزة مونتاكو		×
Fan-tailed Warbler	*Cisticola juncidis*	الهازجة مروحية الذنب		×
Roller	*Coracias garrulus*	الشقراق		×
Raven	*Corvus corax*	الغراب الاسود الكبير		×
Hooded Crow	*Corvus corone*	الغراب الابقع	×	
Quail	*Coturnix coturnix*	الفري		×
Corncrake	*Crex crex*	الصفرد		×
Cream-coloured Courser	*Cursorius cursor*	الدرج الصحراوي		×
House Martin	*Delichon urbica*	خطاف البيوت		×
Crab Plover	*Dromas ardeola*	الحنكور		×
Great White Egret	*Egretta alba*	البلشون الابيض الكبير		×
Little Egret	*Egretta garzetta*	البلشون الابيض الصغير	×	
Cretzschmar's Bunting	*Emberiza caesia*	دُرّسة زرقاء الراس		×
Yellowhammer	*Emberiza citrinella*	درسة صفراء		×
Ortolan Bunting	*Emberiza hortulana*	دُرّسة الشعير		×
House Bunting	*Emberiza striolata*	الدُرّسة المنزلية		×
Robin	*Erithacus rubecula*	ابو الحن		×
Indian Silverbill	*Euodice malabarica*	الحبّاك الهندي	×	
Lanner	*Falco biarmicus*	الحر العربي		×
Saker	*Falco cherrug*	صقر الغزال		×
Merlin	*Falco columbarius*	اليوبو		×
Barbary Falcon	*Falco pelegrinoides*	الشاهين المغربي		×
Peregrine	*Falco peregrinus*	الشاهين		×
Hobby	*Falco subbuteo*	الشويهين		×
Kestrel	*Falco tinnunculus*	العوسق	×	
Collared Flycatcher	*Ficedula albicollis*	خاطف الذباب المطوق		×
Pied Flycatcher	*Ficedula hypoleuca*	خاطف الذباب الابقع		×
Black Francolin	*Francolinus francolinus*	السنبت		×
Chaffinch	*Fringilla coelebs*	العصفور الظالم		×
Brambling	*Fringilla montifringilla*	الشرشور الجبلي		×
Coot	*Fulica atra*	الكوت	×	
Crested Lark	*Galerida cristata*	القبرة المتوجة	×	
Snipe	*Gallinago gallinago*	الشنقب		×
Moorhen	*Gallinula chloropus*	دجاجة الماء		×

Common Name	Scientific name	Arabic Name	Observed	Previous Records
Collared Pratincole	*Glareola pratincola*	ابو اليسر المطوق		×
Griffon Vulture	*Gyps fulvus*	النسر البني		×
Oystercatcher	*Haematopus ostralegus*	صياد المحار		×
Smyrna Kingfisher	*Halcyon smyrnensis*	السمّاك ابيض الصدر	×	
Bonelli's Eagle	*Hieraaetus fasciatus*	عقاب بونللي		×
Booted Eagle	*Hieraaetus pennatus*	العقاب المسير الشاحب		×
Black-winged Stilt	*Himantopus himantopus*	ابو مغازل		×
Icterine Warbler	*Hippolais icterina*	الخنشع الليموني		×
Red-rumped Swallow	*Hirundo daurica*	السنونو احمر العجز	×	
Swallow	*Hirundo rustica*	السنونو	×	
Spur-winged Plover	*Hoplopterus spinosus*	الزقزاق أبو ظفر	×	
White-throated Robin	*Irania gutturalis*	ابو الحن ابيض الزور		×
Little Bittern	*Ixobrychus minutus*	الواق الصغير		×
Brown Fish Owl	*Ketupa zeylonensis*	بومة السمك السمراء		×
Red-backed Shrike	*Lanius collurio*	الصرّد احمر الظهر		×
Isabelline Shrike	*Lanius isabellinus*	الصرد الاشهب		×
Southern Grey Shrike	*Lanius meridionalis*	الصرّد الرمادي		×
Masked Shrike	*Lanius nubicus*	الصرّد المقنع		×
Woodchat Shrike	*Lanius senator*	الصرّد احمر القنة		×
Armenian Gull	*Larus armenicus*	نورس ارمني		×
Yellow-legged Gull	*Larus cachinnans*	النورس ابيض الراس		×
Common Gull	*Larus canus*	النورس		×
Lesser Black-backed Gull	*Larus fuscus*	النورس اسود الظهر الصغير		×
Black-headed Gull	*Larus ridibundus*	النورس اسود الراس		×
Broad-billed Sandpiper	*Limicola falcinellus*	طيطوي منجلي		×
Black-tailed Godwit	*Limosa limosa*	بقويقة سلطانية		×
Thrush Nightingale	*Luscinia luscinia*	الهزّاز		×
Nightingale	*Luscinia megarhynchos*	العندليب		×
Bluethroat	*Luscinia svecica*	المسهر		×
Jack Snipe	*Lymnocryptes minimus*	الشنقب الصغير		×
Marbled Duck	*Marmaronetta angustirostris*	الحذف المرقط		×
Bee-eater	*Merops apiaster*	الوروار	×	
Blue-cheeked Bee-eater	*Merops superciliosus*	الوروار ازرق الخد		×
Corn Bunting	*Miliaria calandra*	دُرّسة المحاصيل	×	
Black Kite	*Milvus migrans*	الحدأة السوداء	×	
White Wagtail	*Motacilla alba*	الذعرة البيضاء		×
Grey Wagtail	*Motacilla cinerea*	الذعرة الرمادية		×
Citrine Wagtail	*Motacilla citreola*	ذعرة ليمونية		×
Yellow Wagtail	*Motacilla flava*	الذعرة الصفراء	×	
Spotted Flycatcher	*Muscicapa striata*	خاطف الذباب المنقط		×
Orange-tufted Sunbird	*Nectarinia osea*	التمير الفلسطيني	×	
Egyptian Vulture	*Neophron percnopterus*	الرخمة		×
Red-crested Pochard	*Netta rufina*	الكوشرة		×
Cotton Pygmy-goose	*Nettapus coromandelianus*	البط الاخضر		×
Curlew	*Numenius arquata*	كروان الماء		×
Night Heron	*Nycticorax nycticorax*	غراب الليل		×
Namaqua Dove	*Oena capensis*	الحمامة طويلة الذنب	×	
Desert Wheatear	*Oenanthe deserti*	ابلق البادية		×

Common Name	Scientific name	Arabic Name	Observed	Previous Records
Black-eared Wheatear	*Oenanthe hispanica*	الابلق اسود الاذن		×
Isabelline Wheatear	*Oenanthe isabellina*	الابلق الاشهب		×
Mourning Wheatear	*Oenanthe lugens*	الابلق الحزين		×
Wheatear	*Oenanthe oenanthe*	الابلق	×	
Golden Oriole	*Oriolus oriolus*	الصقير		×
Osprey	*Pandion haliaetus*	العقاب النساري		×
House Sparrow	*Passer domesticus*	العصفور الدوري	×	
Spanish Sparrow	*Passer hispaniolensis*	العصفور الاسباني	×	
Dead Sea Sparrow	*Passer moabiticus*	عصفور البحر الميت		×
Honey Buzzard	*Pernis apivorus*	صقر العسل	×	
Pygmy Cormorant	*Phalacrocorax pygmeus*	الغاق ألا قزم		×
Red-necked Phalarope	*Phalaropus lobatus*	طيطوي الماء		×
Ruff	*Philomachus pugnax*	الحجوالة		×
Black Redstart	*Phoenicurus ochruros*	الحميراء السوداء		×
Redstart	*Phoenicurus phoenicurus*	الحميراء	×	
Bonelli's Warbler	*Phylloscopus bonelli*	نقشارة بونلي الشرقية		×
Chiffchaff	*Phylloscopus collybita*	النقشارة	×	
Plain Leaf Warbler	*Phylloscopus neglectus*	النقشارة الصغيرة		×
Wood Warbler	*Phylloscopus sibilatrix*	نقشارة الغابة		×
Willow Warbler	*Phylloscopus trochilus*	نقشارة الصفصاف		×
Spoonbill	*Platalea leucorodia*	أبو ملعقة		×
Glossy Ibis	*Plegadis falcinellus*	أبو منجل الأسود		×
Grey Plover	*Pluvialis squatarola*	القطقاط الرمادي		×
Little Crake	*Porzana parva*	المرعة الصغيرة		×
Spotted Crake	*Porzana porzana*	المرعة المنقطة		×
Baillon's Crake	*Porzana pusilla*	مرعة بيلون		×
Graceful Warbler	*Prinia gracilis*	الهازجة طويلة الذنب	×	
Ring-necked Parakeet	*Psittacula krameri*	الببغاء المطوقة		×
Rock Martin	*Ptyonoprogne fuligula*	خطاف الصخور		×
Crag Martin	*Ptyonoprogne rupestris*	خطاف الشواهق		×
Yellow-vented Bulbul	*Pycnonotus xanthopygos*	البلبل	×	
Water Rail	*Rallus aquaticus*	مرعة الماء		×
Avocet	*Recurvirostra avosetta*	النكات		×
Desert Finch	*Rhodospiza obsoleta*	العصفور الوردي الصحراوي		×
Sand Martin	*Riparia riparia*	خطاف الشواطئ		×
Whinchat	*Saxicola rubetra*	القليعي الاحمر	×	
Stonechat	*Saxicola torquata*	القليعي المطوق		×
Scrub Warbler	*Scotocerca inquieta*	هازجة الشجيرات	×	
Serin	*Serinus serinus*	النعار الاوروبي		×
Collared Dove	*Streptopelia decaocto*	الحمامة المطوقة	×	
Laughing Dove	*Streptopelia senegalensis*	حمامة النخيل	×	
Turtle Dove	*Streptopelia turtur*	الحمامة الرقطية	×	
Tawny Owl	*Strix aluco*	الخبل		×
Hume's Tawny Owl	*Strix butleri*	الخبل الصخري		×
Rose-coloured Starling	*Sturnus roseus*	الزرزور الوردي		×
Starling	*Sturnus vulgaris*	الزرزور		×
Blackcap	*Sylvia atricapilla*	عصفور التين		×
Garden Warbler	*Sylvia borin*	دُخلة البساتين		×

Common Name	Scientific name	Arabic Name	Observed	Previous Records
Whitethroat	*Sylvia communis*	زريقة فيرانية	×	
Lesser Whitethroat	*Sylvia curruca*	زريقة فيرانية صغرى		×
Orphean Warbler	*Sylvia hortensis*	الدُخلة المغنية	×	
Sardinian Warbler	*Sylvia melanocephalus*	هازجة سردينيا	×	
Cyprus Warbler	*Sylvia melanothorax*	هازجة قبرص		×
Barred Warbler	*Sylvia nisoria*	الدّخلة الموشمة		×
Rüppell's Warbler	*Sylvia rueppelli*	دُخلة روبيل		×
Little Grebe	*Tachybaptus ruficollis*	الغطاس الصغير		×
Shelduck	*Tadorna tadorna*	الشهرمان		×
Spotted Redshank	*Tringa erythropus*	الطيطوي الداكن		×
Wood Sandpiper	*Tringa glareola*	طيطوي الغاب		×
Greenshank	*Tringa nebularia*	الطيطوي اخضر الساق		×
Green Sandpiper	*Tringa ochropus*	الطيطوي الاخضر		×
Marsh Sandpiper	*Tringa stagnatilis*	طيطوي البطائح		×
Redshank	*Tringa totanus*	الطيطوي احمر الساق		×
Redwing	*Turdus iliacus*	السمنة المغردة		×
Blackbird	*Turdus merula*	الشحرور	×	
Song Thrush	*Turdus philomelos*	السمنة المطربة		×
Fieldfare	*Turdus pilaris*	سمنة الحقول		×
Mistle Thrush	*Turdus viscivorus*	سمنة الدبق		×
Barn Owl	*Tyto alba*	البومة البيضاء		×
Hoopoe	*Upupa epops*	الهدهد	×	
Lapwing	*Vanellus vanellus*	الزقزاق الشامي		×

101

Appendix F

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Appendix G

The EA Team

ECODIT, IRG and MWHAJ mobilized a multi-disciplinary team of core specialists with significant EA experience in Jordan and internationally to conduct the EA and produce the EA report, under the direction of Mr. Bob Katz, the Chief of Party on the Small Communities Project. The team leader for this task was Mr. Karim El-Jisr. The table below presents the core assessment team including degrees, qualifications and proposed position.

Name	Proposed Position	Qualifications	Years Experience
Nazih Bandak	Quality Control, Health/Safety & Emergency Specialist	MSc Environmental Engineering BSc Civil Engineering	20
Karim El-Jisr	EIA Team Leader	MSc Environment BE Agricultural Engineering	7
Zuheir El Amr	Fauna Specialist	PhD, MS, BSc Zoology	20
Ahmad Abu Hijleh	Hydro-geologist	MSc, BSc Geology & Water Resources	18
Ibrahim Al Khader	Flora & Biodiversity Specialist	MSc Plant Taxonomy BSc Biological Sciences	8
Sherif Al Jbour	Avifauna Specialist	BSc Biological Sciences	5
Osama Abu Rayyan	Project Technical Coordinator and Economist	MSc Environmental Economics BSc Resource Conservation	8

106

Appendix H

Stakeholder consultations and approvals

Documents attached:

- Scoping Brief provided to stakeholders prior to the Scoping Session
- Scoping Statement and Scoping Session Report submitted to USAID and the MoE (plus list of attendee signatures)
- Comments received from the MoE on the Scoping Statement
- USAID BEO approval of the Scoping Statement
- Site selection approval letter from WAJ based on Inter-ministerial site visits and subsequent approvals
- Highlights of the Workshop on the Draft Feasibility, Environmental Assessment and Institutional & Cost Recovery Reports (plus list of attendee signatures)
- USAID comments on the Draft EA
- MoE comments on the Draft EA
- The Consultants responses to USAID and MoE comments received on the Draft EA
- MoE Approval of the proposed responses to USAID and MoE comments on the Draft EA

Prime Contract EPP-I-00-03-00013-00
EPIQ II Task Order 800

Wastewater Treatment Facilities For Small Communities in Jordan

Task 3
Environmental Assessment Scoping Brief (North Shouneh)

February 2005

This publication was produced for review by the United States Agency for International Development and the Water Authority of Jordan. It was prepared by ECODIT under subcontract with IRG.

DISCLAIMER

The Author's views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

109

INVITATION TO THE SCOPING SESSION

Project: Wastewater Treatment Facilities for Small Communities

Subject: Scoping Session in North Shouneh

Dear Sir:

The Water Authority of Jordan with the support of USAID plans to implement a low-cost low-maintenance wastewater (septage) treatment and reuse project (WWT&R) in North Shouneh.

A feasibility study is currently examining alternative treatment and reuse technologies and site locations. At the same time, a full Environmental Impact Assessment (EIA) will determine the project's potential adverse impacts and possible mitigation measures, and help select the most suitable technology and site location.

As part of this EIA, a Scoping Session will be held in North Shouneh to identify and discuss potential impacts with various government agencies, local citizens, environmental and civil society NGOs, as well as local and international experts. This scoping session will be held on Wednesday, February 23rd, 2005, from 10:00 AM till 14:00 PM, in North Shouneh at the Offices of the Administrative Governor for the Northern Jordan Valley (Mutasarrifiya). Please find attached the proposed agenda.

Thank you for your participation or nominating a representative(s) to attend this Scoping Session.

Sincerely,

Eng. Munther Khleifat
Water Authority of Jordan/Secretary General

المشروع: محطات تنقية المياه العادمة للتجمعات الصغيرة

الموضوع: جلسة تحديد إطار تقييم الأثر البيئي للمشروع في الشونه الشمالية

تحية وإحترام،

تسعى سلطة المياه بدعم من الوكالة الأمريكية للتنمية الدولية لإنشاء محطة لمعالجة مياه صهاريج النضح العادمة وإعادة إستخدامها للري في منطقة الشونه الشمالية.

ستحدد دراسة الجدوى تقنيات المعالجة وإعادة الإستعمال والمواقع البديلة الممكنة. أما دراسة تقييم الأثر البيئي فستحدد الآثار السلبية المحتملة للمشروع وسبل الحد منها كما ستساهم في إختيار أنسب تقنية وموقع للمشروع.

وفي إطار دراسة الأثر البيئي هذه، ستعقد جلسة تشاورية في الشونه الشمالية يوم الاربعاء الواقع في 23 شباط لعام 2005 (من الساعة 10:00 صباحاً حتى 14:00 مساءً) في متصرفية الأغوار الشمالية، هدفها تحديد نطاق تقييم الأثر البيئي عن طريق إستشارة الحاضرين من المؤسسات الحكومية المعنية والمجتمع المحلي والجمعيات غير الحكومية البيئية وغيرها وخبراء محليين ودوليين وذلك حسب البرنامج المرفق.

نرجو حضوركم أو من تنتدبونه للمشاركة في هذة الجلسة لتحديد إطار تقييم الأثر البيئي.

مع خالص الاحترام،

المهندس منذر خليفات
أمين عام سلطة المياه

110

SCOPING SESSION AGENDA

"Wastewater Treatment Facilities for Small Communities" Project

مشروع محطات تنقية المياه العادمة للتجمعات الصغيرة

Scoping Session in North Shouneh
Workshop Program

جدول اعمال جلسة تحديد إطار تقييم الاثرالبيني للمشروع في الشونه الشمالية

Offices of the Northern Jordan Valley Administrative Governor (Mutasarrifiya)

February 23rd, 2005

الاربعاء 23 شباط 22005

متصرفية الأغوار الشمالية
الشونه الشمالية

9:45 10:15	Registration
10:15 10:30	Introductions Workshop Objectives
10:30 11:45	The "Small Communities" Project • Presentation □ Discussion
11:45 12:00	Break
12:00 13:30	Potential Impacts of the Proposed Project in Shobak • Types of Impacts • Brainstorming □ Open Discussion
13:30 14:00	Conclusions Next Steps
14:00	Lunch

الوقت	*لجلسة*
9:45 1 0:15	تسجيل المشاركين
10:15 10:30	تعارف أهداف الجلسة
10:30 11:45	مشروع محطات تنقية المياه العادمة للتجمعات الصغيرة • عرض • نقاش
11:45 12:00	استراحة
12:00 13:30	الاثار المحتملة للمشروع في لبشوبك • أنواع الاثار الممكنة • عصف فكري □ نقاش مفتوح
13:30 14:00	الخلاصة الخطواط اللاحقة
14:00	غذاء

Table of Contents

Invitation to the Scoping Session i

Scoping Session Agenda ii

1. Introduction 1

1.1. Purpose of this Brief and the Scoping Session 1
1.2. Overview of The Small Communities Project 1

2. description of The North Shouneh WWT&R Project 2

2.1. The Project Area 2
2.2. The Project Components 3
2.2.a. Planning and Design 3
2.2.b. Construction 4
2.2.c. Operation 4
2.2.d. Institutional Activities 5
2.3. WWT&R System Alternatives for North Shouneh 5
2.3.a. Service Area and Design Capacity 5
2.3.b. Wastewater Treatment Technology 6
2.3.c. Water Reuse Alternatives 7
2.3.d. Location of WWTP and Reuse Sites 8
2.3.e. Potential Future Adaptations / Complementary Projects 10

3. Potential Impacts 10

3.1. Potential Positive Benefits 10
3.2. Potential Adverse Impacts 11

1. INTRODUCTION

The Water Authority of Jordan with the support of USAID plans to implement a low-cost low-maintenance wastewater treatment and reuse (WWT&R) project in North Shouneh. This WWT&R project is part of the wider USAID-funded activity, Wastewater Treatment Facilities for Small Communities in Jordan (the "Small Communities Project"). According to the initial environmental examination (IEE) prepared by USAID Jordan in August 2004, the project requires a full environmental impact assessment (EIA).

1.1. Purpose of this Brief and the Scoping Session

As a result of the IEE determination, the project team drafted this scoping brief based on the current definition of the project alternatives and understanding of the local situation. This brief provides the background and starting point for a Scoping Session scheduled on February 23rd, 2005 at the Offices of the Northern Jordan Valley Administrative Governor (Mutasarrifiya) in North Shouneh. The scoping session, and resulting scoping statement, will provide the building blocks for preparing the EIA by defining its scope such that the most important (significant) issues are focused on.

This scoping brief describes the project and details its various components and activities that may present potential environmental, social and health impacts. It also provides a preliminary outline of potential impacts from such activities. In particular, potential impacts during construction, operation and maintenance of the proposed WWT&R project are presented. The scoping session will solicit opinions, new ideas and valuable feedback on the project alternatives and potential impacts associated from a variety of local and national stakeholders. This will help define the scope of the EIA that will inform the identification and assessment of project alternatives and the selection and design of the most suitable alternative. In parallel with the EIA, a feasibility study is examining the project alternatives from a technical, economic and institutional point of view. The ultimate objective of these studies is to select the most appropriate and sustainable project alternative.

1.2. Overview of The Small Communities Project

The Small Communities project will design, supervise and construct proven low-cost/low-maintenance, wastewater treatment plants (WWTP) to serve Shobak and North Shouneh, develop local capacity to operate and maintain the facilities in a sustainable manner after the project ends, turn over the operation and maintenance of these facilities to local bodies (Municipality, Village Councils, Private Sector, etc.), and eventually reuse the treated wastewater (TWW). This will serve as a model for other areas in Jordan.

The project is working in rural communities that lack sewage collection networks. Trucking wastewater to the two planned central treatment plants will eliminate the need for expensive collection infrastructure and provide flexibility in siting the WWTP. It will also facilitate a "community cluster approach," serving several neighboring rural communities.

Over the four years of the project, the following tasks will be carried out:

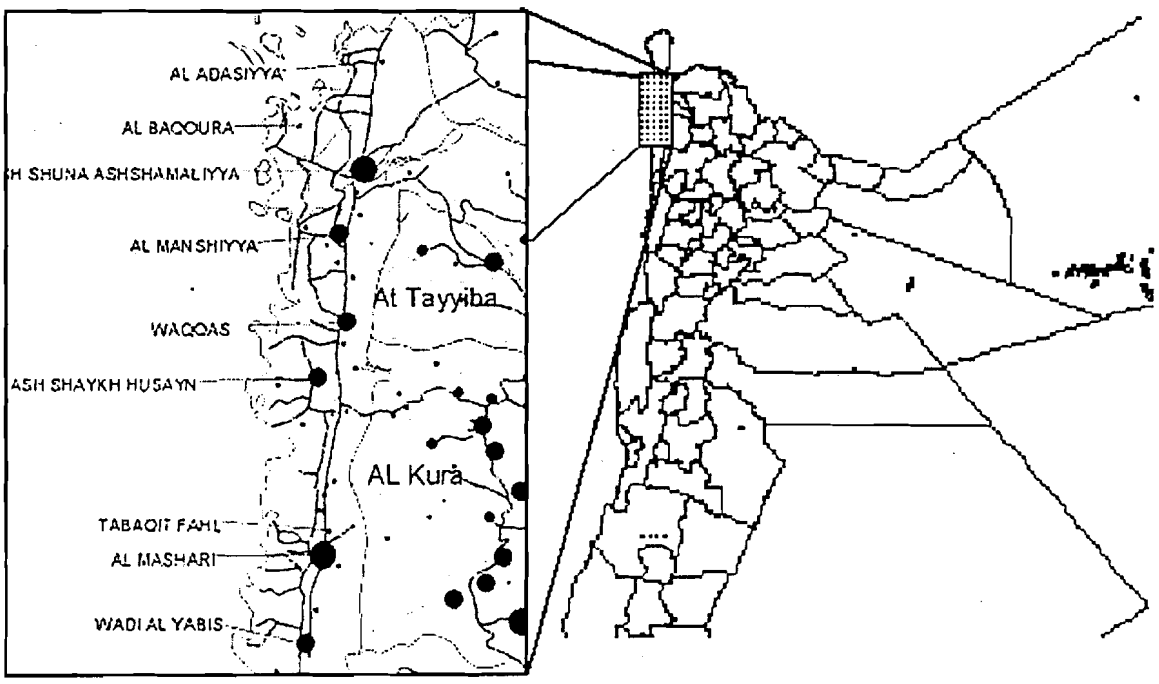
- Task 1: Conduct preliminary planning activities (& select communities to work in);
- Task 2: Prepare a feasibility study, conduct a Scoping Session and prepare an EIA;
- Task 4: Establish "institutional partnerships" and cost recovery mechanisms;
- Task 5: Prepare detailed engineering design/drawings and bid documents;
- Task 6: Select contractors and supervise construction;
- Task 7: Monitor plant operations and the quality of treated effluents;
- Task 8: Implement the wastewater reuse components;
- Task 9: Provide capacity building and training related to the projects;
- Task 10: Assist the Government of Jordan in the formulation of policies, guidelines, and standards related to WWT&R; and
- Task 11: Prepare final report including lessons learned.

2. DESCRIPTION OF THE NORTH SHOUNEH WWT&R PROJECT

2.1. The Project Area

North Shouneh, with a population of approximately 15,000 people, is one of the largest towns in the Northern Jordan Valley (NJV) sub-district ("Liwa'a"). It is part of the Municipality of Mu'ath Bin Jabal, the northern most municipality of the Jordan Valley with a total registered population of over 30,000 people. Other municipalities in the NJV also include the Municipality of Tabqit Fahel, just south of Mu'ath Bin Jabal, and then the Municipality of Sharhabeel Bin Hasna as the furthest the south. Tabqit Fahel has over 27,000 registered people and includes towns such Mashari and Sheikh Hussien. Sharhabeel Bin Hasna has over 28,000 people and includes towns such as Abu Sido and Kraymah, the southernmost town in the NJV. Population density is relatively high in some of the larger town-centers such as North Shouneh, but is less so in other smaller residential areas. Residential space is quite limited in the NJV since the valley falls within a narrow strip of highly agricultural lands surrounded by steep hills to the east and the Jordan River to the West. The area borders Syria to the North and the Occupied Territories / Israel to the West.

In the hills to the east, the NJV is bordered by the Municipalities of Taybeh and Kura (part of Irbid Governorate) and are home to over 100,000 people combined. The figure below shows the main towns and roads in these areas.



Within the NJV, five private septic tankers currently operate full-time, disposing of 400 to 500 m3 of septage per day and as high as 700 m3/day in the summer. There are also a few other tankers that occasionally work in the area from Kura and Taybeh as well as tankers owned and operated by two hospitals and the civil defense. On average, households in the NJV normally pay anywhere between 5 and 20 JD for this service (each tanker trip) when disposal is within the NJV, depending on the distance tankers must travel.

Until very recently (December 2004), tanker drivers disposed of septage in the lower reaches of Wadi Al Arab, just before its confluence with the Jordan River. They are currently banned from disposing there due to environmental and health concerns in the vicinity and are now required to either discharge into Tell Al Mantah WWTP, much further to the south in Dier Allah, or at the Akayder WWTP east of Irbid. Tankers refuse to go up to Akayder unless paid 40 to 50 JD's per trip, and even then they still prefer not to go there due to the strain that the long climb and drive place on their vehicles. Tankers are therefore

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charging around 20 JDs from the southern most towns and up to 45 JD's from towns in the north like North Shouneh and Addassieh to deliver at Tell Al Mantah.
Most households have relatively small cesspits relative to their family size, especially in the higher density areas. Others that live in government-built housing complexes often share one cesspit between multiple households (up to 11 households sharing a 60 m3 communal cesspit). As a result, many households have to pump their cesspits quite regularly (once every 2 to 3 months, some once every 3 to 4 weeks). Mostly dependent on farm work, the financial strain on most households from this septage situation is tremendous. With the recent increase in tanker costs, many households could no longer afford to pump their cesspits, and have left them to overflow into the streets. This situation is most severe in the Municipality of Mu'ath Bin Jabal, and particularly in the town of North Shouneh.

The NJV is in one of the lowest places on earth, with elevations ranging from 200 m below sea level (or -200 asl) in the northeast, down to -300 m asl southwest of Kraymeh. Immediately to the east of the area is the foot hills of the Jordan Valley Escarpment, where elevations first increase at a rate of about 100 m every 1 km, then level out a gradually until getting to Irbid, which is at around 600 m asl. North Shouneh is one of the warmer places in the Kingdom with mean monthly temperature ranging from 13 °C in the winter up to 30 °C in the summer months, with maximums reaching as high as 47 °C. Frost is rare, but does occasionally destroy crops in the lowest lying areas. Total annual rainfall is at around 400 mm in the north, dropping to around 300 mm further in the south. Relative humidity can reach 100% in the summer (partially due to the vast extent of surface waters in the area) and winds are Northerly most of the time. As a result of such climatic conditions, the area's fauna and flora is characteristic of Afro-subtropical and Mediterranean bio-geographical zones.

There are also a few springs in the area, a few permanent surface water flows (e.g., the Jordan River, the Yarmouk River) as well as Wadi Al Arab, in which TWW from Irbid WWTPs also flows. The headwaters of the King Abdullah Canal (KAC) are also located in this area, from which much of the vast surface irrigation water supplies in the NJV are taken from. The KAC is also one of Amman's major water supply sources; water from the canal is pumped up to Zai water treatment plant before distribution to Amman. Several dams and well fields in the foothills and side-wadis also supply the KAC and other demands in the NJV. Extensive surface irrigation networks and supplies (and developed farms as a result) exist in areas west (downstream) of the KAC, whereas the areas to the east of the KAC must rely on wells or tanker-delivered water to supplement rainfall for irrigation. In general, however, dependence of farmers on well water is very low in the area.

2.2. The Project Components

The project consists of four types of main activities conducted over a four-year period:

a. Planning and design;

b. Construction;

c. Operation and maintenance; and

d. Institutional strengthening and capacity building activities.

The following sections outline the main activities that will take place under each of the above four types of activities.

2.2.a. Planning and Design

Impacts from the planning and design activities *per se* (office work, site visits, meeting, report preparation etc.) are negligible. Nonetheless, the environmental impact of the proposed facilities must be carefully considered during the planning and design phase to ensure that environmental impacts are identified and appropriate mitigation measures are incorporated into the planning and design. The planning and design activities are therefore not discussed further.

2.2.b. Construction

The project team will supervise construction of a WWTP for receiving and treating domestic septage, along with associated facilities and infrastructure (e.g., administration and labor residence buildings, necessary utility and road infrastructure). In addition, the project also will provide the infrastructure required to deliver WTTP effluents to farmers for reuse.

The main facilities and infrastructure to be constructed include:

- A WWTP & associated facilities (additional details on likely facilities are provided in Section 2.3.b on Wastewater Treatment Technology);
- Access roads (either new roads or upgrade of existing roads and/or dirt tracks), internal roads and parking;
- Electricity supplies from the nearest power grid (depending on the available voltage, this may also require a transformer);
- Water supplies from the nearest municipal network sources (for domestic use by labor and for certain WWTP maintenance activities);
- Any necessary preparations required to enable future expansion of the WWTP;
- Temporary housing, including water and power, for construction labor may also be required; and
- The transmission network to deliver treated wastewater (TWW) from the WWTP to the farms, pumps to deliver this TWW under pressure (may be necessary for drip irrigation), meters and valves, and potentially TWW tanker filling station depending on the reuse strategy (see Section 2.3.c below on Water Reuse Alternatives).

The main construction activities are those generally associated with typical construction sites, such as:

- Land preparation (excavation, filling, compacting, and soil stabilization);
- Quarrying for construction materials (sand and gravel) ex-situ;
- Transportation of construction materials (sand, cement bags, pipes, steel, etc.);
- Transportation of construction workers and supervisors; and
- Transportation and operation of construction equipment (bulldozers, loaders, compressors, etc.); and
- Scaffolding, mixing and pouring of reinforced concrete, posing of synthetic liners and piping, etc.

2.2.c. Operation

Following commissioning of the WWT&R systems, the main operational activities will include:

- Hauling of septage from the sources (e.g., residential cesspits) to the WWTP in tanker trucks;
- Discharge of the septage from the tankers into the receiving station within the WWTP;
- Use of water and electricity at the WWTP to run pumps, wash equipment, etc.;
- Operation of the WWTP (e.g., opening valves, raking sand filters, sludge drying and treatment, visual inspections and routine WW quality sampling and analysis, both in-situ and at an outside lab, etc.);
- Maintenance of the WWTP and associated facilities (cleaning, removing sludge, replacing piping, replacing sand/gravel filter materials, etc.);
- Sludge disposal and or reuse;

116

- Transport of replacement materials (piping, sand/gravel, etc.) and labor;
- Movement of on-site vehicles (e.g., for sludge dredging/removal, etc.); and
- Reuse of TWW in irrigation (on-farm activities).

2.2.d. Institutional Activities

The project team will facilitate and encourage partnerships among local and national stakeholders as appropriate to achieve long-term project sustainability. The team will identify and work with relevant GOJ institutions, at the local and national levels, municipalities, local community groups, NGOs, and private sector groups to define roles and responsibilities. The project team will help draft a collective agreement that will formalize institutional roles and responsibilities for project construction, operation, and maintenance to ensure long-term sustainability. This agreement will define the obligations and responsibilities of each of the signatory partners, such as for project construction, treated wastewater distribution and reuse, monitoring of influents and effluents, billing and financial operations, environmental compliance, and operation and maintenance of the WWTP.

The institutional activities are essential to identify organizations and individuals who will ensure project success during the "Small Communities" project and beyond. They will establish responsibility, authority, and accountability of these organizations and individuals to operate and maintain the WWT&R facilities; obtain a commitment from them to abide by the technical operating guidelines and procedures, ensuring effective and efficient plant operations to supply safe and reliable water to farmers within an economically and environmentally sustainable system.

Septage delivery to the WWTP may require tanker certification procedures and enforcement of safety and environmental regulations. Monitoring systems will ensure compliance with TWW effluent quality standards and will mitigate potential adverse impacts on soil and ground water quality, crops, public health, workers' health and safety. Appropriately designed and implemented environmental management procedures will facilitate the monitoring process and minimize adverse impacts. Sound institutional arrangements and a program of institutional capacity building will support the above goals.

2.3. WWT&R System Alternatives for North Shouneh

The WWT&R system alternatives envisioned for North Shouneh depend on the choice of:

a. Wastewater treatment technology (low-cost low-maintenance);

b. Water reuse alternatives; and

c. Location of the WWTP and reuse sites.

Varying the WWTP service area and design capacity does not appear to present any viable alternatives as will be discussed in the next section; the related implementation phasing (e.g., capacity expansion) does however provide for alternatives.

The comparative economic analysis of the alternatives, carried out as part of the feasibility study, will determine which alternatives makes more sense from an economic point of view. In all cases, the study assumes that the plant will begin operations in 2008 and continue to operate properly over a 20-year time horizon (i.e., through 2027).

2.3.a. Service Area and Design Capacity

In light of the relatively large populations in the region, and the most pressing need for such a WWTP to serve North Shouneh in particular, the service area, and accordingly the design capacity of the WWTP, should target the Municipality of Mu'ath Bin Jabal in the long-run. The WWTP would be designed to receive septage from this service area for the next 20 years (20-year time horizon); after that, additional

expansion or another WWTP would be required to meet the additional septage being generated by further increases in population. To meet this objective, the design flow capacity for the plant should be 1,200 m3/day.

A regional WWTP in the area is not envisaged due to the significant risks associated with plant size (without needing to resort to high-cost and high-tech./maintenance), siting, etc. Furthermore, implementing a single WWTP for such a large area (e.g. to include the municipalities of Tabqit Fahel, Sharhabeel Bin Hasna, and potentially even adding Taybeh and Kura) would be not be economic in the long run as the average distances that tankers would need to travel would remain high (and will not cease to place a burden on households).

However, during the first few years of operations, because Mu'ath Bin Jabal will produce much less septage than the flow design capacity of 1,200 m3/day, the WWTP would be able to accept septage from other communities in the NJV (e.g. the municipalities of Tabqit Fahel, Sharhabeel Bin Hasna) as well perhaps some septage from Kura and Taybeh in the higher elevations. Based on the preliminary projections, these communities would be able to use the North Shouneh WWTP for around five to ten years before treatment capacity limits would require some communities to start being phased out (or gradually disallowed) from using the "North Shouneh Only" WWTP. Therefore, another WWTP would need to be built to serve those nearby communities starting between 2013 and 2018 depending on which of those communities dispose of their septage in the North Shouneh WWTP.

Phasing

The entire plant could be built at full capacity upfront (1,200 m3/day), or it may be implemented in two phases: e.g., 900 m3/day upfront plus a 300 m3/day extension (i.e., plus one-third the initial capacity) after five years or so depending on the actual quantities of septage received. The feasibility study will study the phasing alternatives and recommend the most feasible one.

2.3.b. Wastewater Treatment Technology

The project team has examined several possible WWT technologies: stabilization ponds, Recirculating Sand Filters, activated sludge, Up-flow Aerobic Sludge Blanket (UASB), Advanced Integrated Pond Systems (AIPS), etc. After a careful evaluation, the project team has eliminated several of these alternative technologies already because the proposed North Shouneh WWTP:

- Must be proven low-cost/low-maintenance technology; and
- Will treat septage collected by tankers from cesspits, which:
  - Varies in quality from tanker to tanker;
  - Varies in quantity being received at the plant from day to day and even week to week; and
  - Carries higher pollutant loads (namely BOD, COD and suspended solids) than raw sewage (i.e., sewage collected and transported via a sewer network).

For example, AIPS does not operate optimally. It would require significantly higher maintenance, given the concentration of suspended solids in septage. Similarly, UASB is sensitive to variations in quality and quantity, as well as requiring advanced technical capability on the part of plant operators. Mechanical aeration and other similar technologies cost too much to construct and more importantly, to operate and maintain, for the size of WWTP that would be appropriate for such communities. Technical capacity and experience required for efficient operation is again relatively high. Mechanical equipment has a shorter useful life, requires significantly more energy, is prone to breakdown, and is more expensive to repair. Some of the systems considered also require the addition of chemicals, all adding to the costs and making the technical and financial sustainability of any of these options questionable as a result.

Essentially, the only proven way to meet the low-cost/low-maintenance objective, and to be able to treat septage generated from such communities, is to use technology similar to that implemented in Drarga, Morocco, adapted to the specific situation in North Shouneh. The Drarga WWTP includes influent

screening, grit removal, anaerobic lagoons, denitrification lagoons, and flow holding basins. The effluent passes through recirculating sand filters and reed beds (man-made constructed wetlands) to further reduce solids, organics, pathogens, and nitrogen to levels that comply with standards for unrestricted agricultural irrigation water. This treatment process requires no chemicals and no complex mechanical equipment.

The Basic WWTP Elements

The basic elements the WWTP being considered for Shouneh, similar to the one built and operating in Drarga, Morocco include:

- Screening and grit removal
- Anaerobic Lagoons
- Facultative Lagoons
- Recirculating Sand Filters
- Dosing Basins
- Effluent Storage Ponds and Pump Station
- Sludge Drying Beds

Furthermore, in addition to or as an adaptation to the above basic elements:

- A septage receiving facility will be required, this may be covered to minimize odors;
- Some of the lagoons may also be covered with floating covers to minimize odors and/or collect methane gas;
- Reed drying beds may be used for passive sludge drying as opposed to normal sludge drying beds;
- Other variants to the system design may relate to:
    - The layout of the facilities on the site, maximizing gravity flow in order to minimize the need for pumping;
    - The depth and shape of the lagoons; and
    - Choice of construction materials may also vary (concrete, zeo-lites, soils, piping materials, etc.)

2.3.c. Water Reuse Alternatives

The reuse alternatives pertain mainly to the recipients of the TWW. Consequently, the types of crops that can be grown will depend on this. Therefore, the three options for reuse alternatives being considered thus far are to:

1. **Deliver the TWW to farmers in the vicinity of the WWTP** through a transmission and distribution line for treated wastewater (but not install on-farm irrigation networks) and assist them in getting started (e.g., adapting to restricted irrigation) and in applying safe reuse practice or to larger, commercial farms that face higher marginal KAC irrigation water prices in light of their high consumption;
2. **Make the TWW available to users not in the vicinity of the WWTP.** For example, to farmers east of the KAC as supplemental to tanker-delivered water, well water, and/or rain fed irrigation. This would require tankers to collect the TWW and deliver it to reuse locations; and/or
3. **Directly reuse the TWW on-site** to grow fodder or other, potentially more-valuable crops requiring higher technology and know-how, such as flowers, as a part of the WWTP and related operations.

2.3.d. Location of WWTP and Reuse Sites

The project team has identified five potential site alternatives for the North Shouneh WWTP. Two of these sites are on government-owned land, the other two are on privately owned lands and would require acquisition by WAJ. Specific sites within two of these five location areas have not been delineated yet. The five potential WWTP locations are:

Site 1. Approximately 5 km south west of North Shouneh, adjacent to the Jordan River, just north (parallel) of Wadi Al Arab;

Site 2. Approximately 3 – 5 km south west of North Shouneh, in the same vicinity of Site 1 but not as close to the Jordan River;

Site 3. Approximately 3 – 5 km west (slightly north) of North Shouneh, along the main road from North Shouneh to the Jordan River near Al Baqour Al Musta'adeh;

Site 4. East of the KAC, just north of Waqqas; and

Site 5. East of the KAC, just north of Fiddeen and west of Al A'aramsheh

Figure 2.1 overleaf shows the five potential site location areas. Table 2.1 summarizes the key advantages and disadvantages of each of these general site locations.

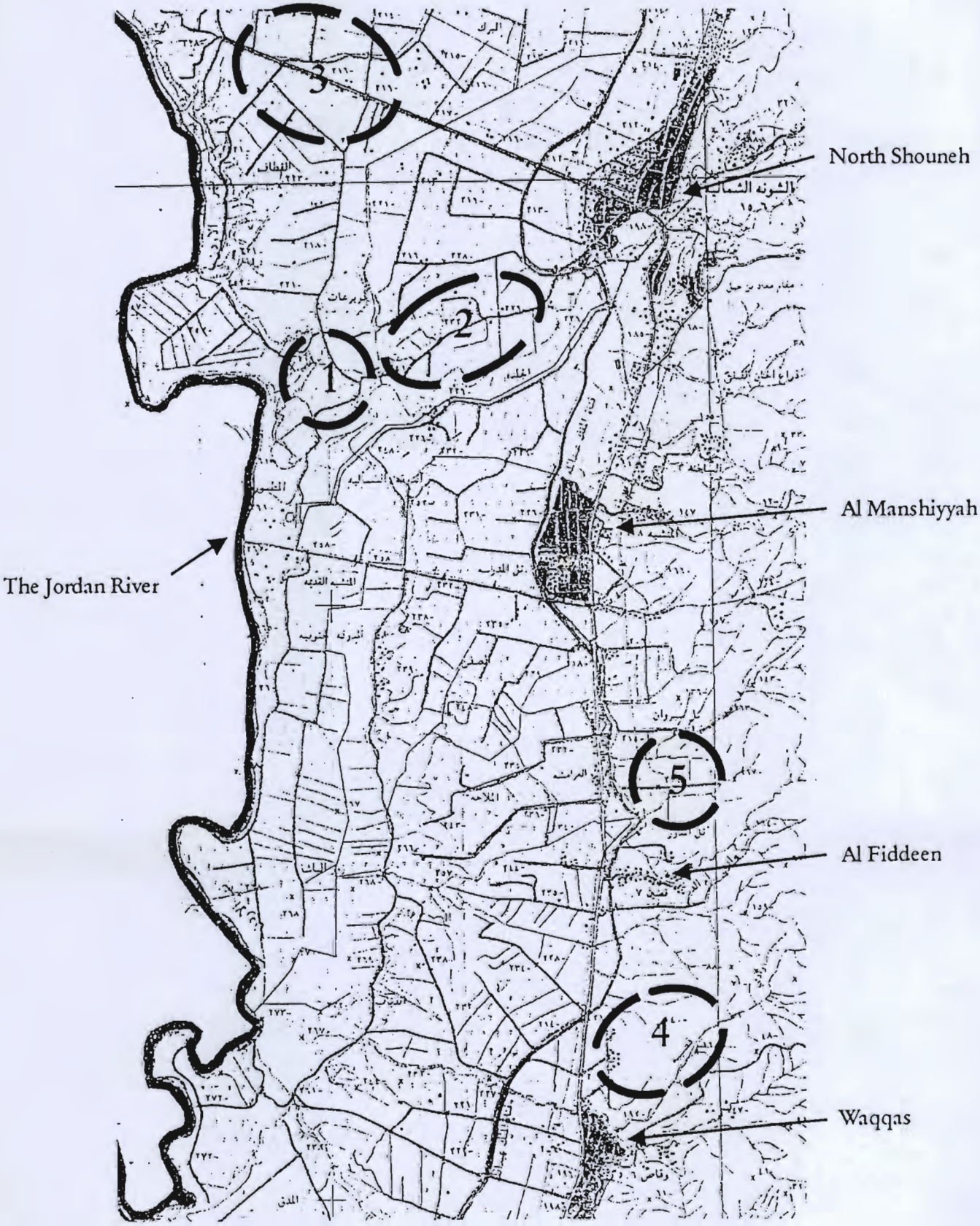
Table 2.1: Key Advantages & Disadvantages of Site Location Alternatives in N. Shouneh

Site	Advantages	Disadvantages
Site 1.	• Government owned property • Potential future sewerage for North Shouneh	• Will require costly land preparations in light of topography and geo-technical instability • Inducing farmers in the vicinity to switch to TWW for reuse may prove difficult • Very close to military border zones
Site 2.	• Potential future sewerage for North Shouneh	• Private owned properties • Inducing farmers in the vicinity to switch to TWW for reuse may prove difficult
Site 3.	• Potential future sewerage for North Shouneh	• Private owned properties • Inducing farmers in the vicinity to switch to TWW for reuse may prove difficult • May be too close to a main road • Less accessible for towns south of Shouneh (e.g. Mashari, Waqqas) than Sites 1 & 2
Site 4.	• Inducing farmers in the vicinity to switch to TWW for reuse may prove relatively easier • Relatively close to towns south of North Shouneh	• Private owned properties • Relatively far from North Shouneh (costly transportation) • Potential flooding risks from adjacent wadi • A few houses on hilltops surrounding the site • Quite close and potentially upwind of Waqqas
Site 5.	• Inducing farmers in the vicinity to switch to TWW for reuse may prove relatively easier • A reasonable distance from most towns, with the exception of those north of N. Shouneh	• Private owned properties • Quite close and upwind of Fiddeen • Upstream of the King Abdullah Canal

As a result of the above preliminary assessment, the Project Team recommends excluding Sites No. 4 and 5 from further consideration for the following reasons:

- Site No. 4 is potentially prone to annual flooding, is far from North Shouneh, would not be able to receive raw sewage transported by gravity from a major residential area (via a future sewer line), is surrounded by a few dwellings and is quite close / upwind of Waqqas; and
- Site No. 5 is within 1 km upwind of Fiddeen and is potentially too close to the KAC and may present an unacceptable risk to the head waters of this valuable water carrier.

Figure 2.1: The five potential general site locations for North Shouneh



121

2.3.e. Potential Future Adaptations / Complementary Projects

There are also other potential projects or sub-projects which are not necessarily directly relevant to the "Small Communities Project" in isolation, but which are worthy of consideration as they offer additional benefits to this project or to the communities being served. Some of the complementary developments and issues that have already been considered include:

- Potential future sewerage of towns with enough housing density and enough population relative to their distance from this WWTP (for sewerages to be economical) - since this treatment plant is designed for septage (higher concentration but with lower influent volumes than sewered WW), if in the future a certain village/town is sewered, the WWTP will, within limits, be able to handle the additional volume since the concentrations will be lower (resulting in little difference in overall loading to the WWTP);
- In the event that a new sewerage system and a separate WWTP are constructed as a result of demand in a particular town, this project's WWTP will remain in use as there will always be residential areas that will not be sewered;
- Intermediate septage collection points conceivably could be built for towns/villages that are relatively far from the WWTP to reduce transport costs; allowing smaller or municipal tankers to discharge at these closer points for conveyance to the WWTP via larger tankers or via pipes;
- Cesspit improvement program and/or stricter enforcement of cesspit construction standards to minimize potential groundwater pollution from these sources; and
- Awareness raising and best practice implementation of, for example, fat and grease separation at households and restaurants, blood separation/removal at chicken and sheep slaughter-houses/shops.

3. POTENTIAL IMPACTS

Several impacts associated with the project activities and alternatives can be identified, some positive others negative or adverse, and some much more significant than others. Below is a preliminary listing of potential impacts. The scoping session will help determine which of these impacts, and possibly others, may be potentially significant and which may not. As part of the EIA, the project team then will focus on assessing the significant impacts of the proposed project relative to the existing situation. To the extent applicable and relevant, the magnitude, duration, frequency, extent and reversibility of each impact will be assessed. The main objective of the EIA will be to help design appropriate measures to mitigate the adverse impacts and enhance the positive impacts through the development of an effective environmental management and monitoring plan.

3.1. Potential Positive Benefits

The WWT&R project will generate several significant positive impacts. It will provide a reliable location for septage disposal at reasonable costs, reducing the potentially disastrous overflows from cesspits that regularly plague North Shouneh. This site will also provide a controlled sink for the treatment of septage in the area. Tanker business will also benefit from being able to charge reasonable prices, make more trips per day and not have to drive as far. The project will strengthen institutional ties among different stakeholders to ensure the project's sustainability and will mobilize local resources during implementation (e.g., project committees, truck drivers, workers to build the plant). The project will also provide a source of water for irrigated agriculture, providing financial benefits to farmers without access to irrigation networks or by relieving pressures on surface water resources that may become more costly or more valuable for other uses (e.g., drinking water) in the near future.

3.2. Potential Adverse Impacts

The WWT&R project may also generate a number of adverse (negative) impacts during the expected construction and operation activities, which may include accidents, spills, and unforeseen events associated with typical construction activities. An outline of some of the key potential adverse impacts is provided below.

During construction

- Dust and vehicle emissions
- Surface and irrigation water contamination
- Reduction in aesthetics (noise and degradation of visual amenity)
- Removal of plant and soil cover
- Disruption to or loss of biodiversity and archeology
- Alteration of surface run-off and associated impacts (e.g. erosion, land-slides, sedimentation, etc.)
- Pollution from temporary storage and/or disposal of workers' and construction wastes
- Increased traffic due to construction related transport and vehicle movement

During operation and maintenance

- Increased traffic of septic tanker trucks and associated impacts (noise, accidental spills, odors)
- Soil, surface, spring and groundwater contamination from the WWTP and from water reuse
- Acceptability of and willingness to use TWW reuse by farmers and consumers
- Odors inside and outside the WWTP
- Health and safety risks to on-site personnel and the public

Consistent with the IEE, the reuse component is not expected to result in any significant adverse impacts with appropriate mitigation measures and associated monitoring and enforcement. Nonetheless, the unsafe use of TWW may pose a risk to public health (e.g., farmers) and may result in the accumulation of salts and other elements in soils and pollution of ground water (e.g., nitrates).

123

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WASTEWATER TREATMENT FACILITIES FOR SMALL COMMUNITIES IN JORDAN

TASK 3
ENVIRONMENTAL ASSESSMENT
SCOPING STATEMENT (NORTH SHOUNEH)

سلطة المياه
WATER AUTHORITY

March 2005

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ECODIT

MWH ARABTECH JARDANEH

IRG

124

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SCOPING STATEMENT (NORTH SHOUNEH)

Prime Contract EPP-I-00-03-00013-00
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DISCLAIMER

The Author's views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

125

WASTEWATER TREATMENT FACILITIES FOR SMALL COMMUNITIES IN JORDAN

TASK 3
ENVIRONMENTAL ASSESSMENT SCOPING STATEMENT (NORTH SHOUNEH)

March 2005

Table of Contents

1. INTRODUCTION 1

1.1 PURPOSE OF THE SCOPING STATEMENT 1
1.2 PROJECT DESCRIPTION 1

2. THE PROJECT ALTERNATIVES 2

2.1 SERVICE AREA 2
2.2 SITE LOCATION 2
2.3 TREATMENT TECHNOLOGY 2
2.4 REUSE 3

3. SCOPE OF ENVIRONMENTAL IMPACTS 4

3.1 POTENTIAL POSITIVE IMPACTS 4
3.2 POTENTIAL ADVERSE IMPACTS 5
3.2.1 Potential adverse impacts during construction 5
3.2.2 Potential adverse impacts during operation 6

4. EA APPROACH 7

4.1 METHODOLOGY 7
4.1.1 Conduct scoping session 7
4.1.2 Submit this scoping statement for review and approval 7
4.1.3 Conduct field visits and collect baseline data 7
4.1.4 Assess impacts and propose mitigation measures 7
4.1.5 Conduct a workshop to present preliminary EA findings 8
4.1.6 Develop an Environmental Management and Monitoring Plan (EMMP) 8
4.1.7 Submit draft and final EA to USAID 8
4.2 PROPOSED EA REPORT TABLE OF CONTENTS 8
4.3 THE ASSESSMENT TEAM 10

APPENDIX A Scoping Session Report (incl. list of participants)

APPENDIX B Evaluation of Candidate Sites

1. INTRODUCTION

The Water Authority of Jordan with the support of USAID plans to implement a low-cost low-maintenance wastewater treatment and reuse (WWT&R) project in North Shouneh. The WWT&R project in North Shouneh is part of the wider activity, Wastewater Treatment Facilities for Small Communities in Jordan (the "Small Communities Project"). According to the initial environmental examination (IEE) prepared by USAID Jordan in August 2004, the project requires a full environmental impact assessment (EIA).

1.1 Purpose of the Scoping Statement

This scoping statement outlines the potentially significant positive and adverse impacts of the WWT&R project in North Shouneh and presents a proposed outline of the EIA report as well our methodology and the assessment team. It thereby serves as the scope of work for the EA study in North Shouneh that will be carried out by the team mobilized by ECODIT, IRG and MWHAJ.

1.2 Project Description

The Small Communities Project will design, supervise and construct proven low-cost/low-maintenance, wastewater treatment plants (WWTP) to serve North Shouneh and North Shouneh (both communities lack sewage collection networks), develop local capacity to operate and maintain the facilities in a sustainable manner after the project ends, turn over the operation and maintenance of these facilities to local bodies (Municipality, Village Councils, Private Sector, etc.), and eventually reuse the treated wastewater (TWW). This will serve as a model for other areas in Jordan. The project began in the summer of 2004 and will span four years.

The detailed project tasks are:

- **Task 1:** Conduct preliminary planning activities (& select communities to work in);
- **Task 2:** Prepare a feasibility study;
- **Task 3:** **Conduct a Scoping Session and prepare an EIA;**
- **Task 4:** Establish "institutional partnerships" and cost recovery mechanisms;
- **Task 5:** Prepare detailed engineering design/drawings and bid documents;
- **Task 6:** Select contractors and supervise construction;
- **Task 7:** Monitor plant operations and the quality of treated effluents;
- **Task 8:** Implement the wastewater reuse components;
- **Task 9:** Provide capacity building and training related to the projects;
- **Task 10:** Assist the Government of Jordan in the formulation of policies, guidelines, and standards related to WWT&R; and
- **Task 11:** Prepare final report including lessons learned.

2. THE PROJECT ALTERNATIVES

The project team has analyzed several project alternatives to define the service area, site location, technology and water reuse system. Our preliminary analysis narrowed down the project alternatives substantively. For example, several candidate sites to host the WWTP were eliminated because they are too far, too small or upwind of the nearest residential areas; and several technologies were also eliminated because they are too expensive to operate, too complex to run or unable to handle septage. The feasibility study and EA will refine this analysis and determine the final alternatives selected. The following sections summarize our analysis so far and highlight stakeholder preferences.

2.1 Service Area

In North Shouneh, the service area is for Mu'ath Bin Jabal alone. Stakeholders made reference to the problems with the local Solid Waste dumpsite that is servicing a regional area. Concerns were also raised, in line with concerns of the project team, that controlling the service area will be challenging - i.e., there are many residential areas in the region that will find the N. Shouneh WWTP the closest WWTP (or acceptable septage discharge point) to them. Participants suggested that we should increase the WWTP design without over sizing it, as a means to mitigating this risk.

2.2 Site Location

The Municipality in cooperation with the JVA and Land Registration department in North Shouneh originally proposed 8 potential sites for the WWTP. They and the project team quickly eliminated 6 of these sites for various reasons not discussed here. The project team then proposed an additional 3 site areas for consideration. The resulting 5 potential site alternatives for the North Shouneh WWTP are discussed and evaluated in *Appendix B*.

Out of these 5 remaining sites, there is a unanimous preference expressed by stakeholders that Site No. 1 is the preferred site for the N. Shouneh WWTP. Delineation of the precise site boundaries or additional acquisition required is pending confirmation of the area required. Currently this is estimated at anywhere between 200 and 250 Dunums, depending on the final effluent standards adopted, the required setback limits and the amount of on-site reuse / demonstration land area requirements.

2.3 Treatment Technology

The project team has examined several possible WWT technologies including: Waste Stabilization Ponds, Recirculating Sand Filters, Activated Sludge, Anaerobic Up-flow Sludge Blanket (UASB), Advanced Integrated Pond Systems (AIPS), etc. After careful technical feasibility evaluation we eliminated some of the technologies. We have opted for Waste Stabilization ponds and Recirculating Sand Filters because many because such system is low-cost/low-maintenance and is capable of handling the higher concentration of parameters and variability in quantity and quality associated with septage.

The WWTP will tentatively consist of the following elements:

- Screening

- Anaerobic lagoons
- Facultative Lagoons
- Recirculating Sand Filters
- Duplex Pumping Station
- Effluent Storage Ponds and Water Reuse Pumping Station
- Reed Sludge Drying Beds

Imhoff Tanks may be used instead of the Anaerobic lagoons as a more appropriate pre-treatment process, a choice to be informed by the feasibility study and EA. If Imhoff tanks are deemed more appropriate, then grit removal will be required in addition to screening. Otherwise, grit will accumulate in the anaerobic lagoons and periodically removed with sludge from the bottom of these lagoons. Constructed Wetlands, though not necessarily required, may be considered as an ecologically sound means of effluent disposal during periods when water reuse is not possible and effluent storage is insufficient. If needed, discharge to the Jordan River may also be acceptable, perhaps even beneficial, in light of the existing levels of pollution in the River.

2.4 Reuse

There is an overall preference for reuse alternatives to remain flexible. During the scoping session, there was almost unanimous agreement to combine three reuse alternatives:

1. Provide TWW to farmers in the vicinity of the WWTP;
2. Provide TWW to farmers and other users far from the WWTP; and
3. Reuse TWW as part of (or ancillary to) the WWTP operations.

Quantities of effluent available and on-site land availability will be a limiting factor in determining the precise combination. A preference was expressed by stakeholders for using the TWW on-site as demonstration and an opportunity to generate more income for the WWTP or organization involved (e.g. municipality). With more confidence in TWW reuse and the quality of effluents, then farmers in the vicinity of the WWTP would become the first priority. In the event that it was needed, disposal of TWW to *wadis* (or the Jordan River) was not perceived by most local stakeholders as a major obstacle, perhaps even beneficial to the River's water quality.

Transfer to other areas - via canals was also suggested as an option, as was mixing the TWW with fresh supplies for distribution with the irrigation system. Many also suggested using TWW to irrigate trees/forests in and around residential areas (to help reduce temperatures) or to support municipal projects (e.g., parks).

The most likely crops to be irrigated, at least in the short-medium term, include forage crops, trees and palm trees, with the possibility of irrigating citrus in the future.

3. SCOPE OF ENVIRONMENTAL IMPACTS

The WWT&R project is expected to generate a number of positive and adverse impacts. In principle, the positive impacts should outweigh the project's potential adverse impacts; the environmental assessment will address the adverse impacts and identify ways to mitigate them or limit their significance.

3.1 Potential positive impacts

The WWT&R project will generate a number of positive impacts. For a start, it will provide a controlled sink for the collection and treatment of septage in the area; thereby discontinue current practices and associated environmental and health impacts. The project will strengthen institutional ties among the different stakeholders to ensure the project's sustainability and will mobilize local resources during implementation (e.g., project committees, truck drivers, workers, technicians). The project will also provide an additional and reliable source of water for irrigated agriculture, thereby generating financial benefits to farmers while relieving pressure on fresh surface water resources.

During the scoping session in North Shouneh on February 23rd, the participants identified a number of broad as well as specific impacts. Based on the results of the brainstorming session, the proposed WWT&R project in North Shouneh will potentially:

- Reduce expenses borne by households for emptying their cesspits
- End the problem of septage flowing in the streets and help the municipality of Mu'ath bin Jabal maintain a clean environment
- Confine septage to one location thereby protect agricultural lands from pollution
- Provide a new source of irrigation water for agriculture
- Contribute to improving environmental conditions in residential communities
- Organize/streamline the work of tanker trucks
- Provide new jobs for local residents
- Increase the price of land surrounding the WWTP
- Generate revenues to support the municipality
- Protect local communities by averting an environmental disaster in the future
- Provide fertilizers and fertilization at a low cost
- Attract birds around the WWTP
- Protect ground and surface water from pollution
- Limit pollution and contamination of agricultural crops
- Reduce the incidence of disease outbreaks
- Facilitate/encourage the construction of a sewage system in the future
- Encourage replication in other areas of the Kingdom (based on project success)
- Handle/treat all waste products either biologically or physically
- Invigorate the community (based on project success), open communication channels within the community, encourage voluntarism and mobilize the media
- Plant forest trees for shade and cooling effects

3.2 Potential adverse impacts

The project can lead to several potential adverse impacts affecting the human, biological and physical environment. It is important to consider and analyze the merit and significance of all these potential impacts at the planning stage and identify corresponding mitigation measures. The following sections outline potential adverse impacts during planning, construction and operation. These impacts incorporate/include the feedback and concerns expressed at the scoping session in North Shouneh. The impacts/concerns as identified by participants during the scoping session are presented in Appendix A (including English translation).

Participants at the scoping session identified six impacts/concerns that they considered potentially significant: (1) insects and rodents, (2) improper use of TWW, (3) removal of plant cover, (4) discharge of TWW during periods of low water demand, (5) overloading the WWTP and (6) failure by local management to properly operate the WWTP. Potential long-term impacts include: (6) land value surrounding the WWTP declines; and (8) reuse of TWW affects agricultural marketing and practices. Other impacts that may also be considered significant include potential increases in accidents with changes in tanker traffic, trans-boundary impacts, etc.

The EA will ascertain which potential impacts are significant and which are not. The impacts identified by stakeholders will not limit the scope of the EA, which will consider a broad spectrum of environmental parameters and will be based on the experience of multidisciplinary specialists in addition to further consultations.

3.2.1 *Potential adverse impacts during construction*

The EA will assess the following potential impacts of the construction phase:

Socio-economic Environment

- Health and safety risks (public and workers)
- Noise pollution and nuisance to nearby residents/farmers
- Increased traffic/congestion due to construction related transport
- Disruption to or loss of archaeology
- Reduction in aesthetics/landscape degradation
- Effects of dust and vehicle emissions on orchards and crops

Physical Environment

- Dust and vehicle emissions
- Alteration of surface run-off and associated impacts
- Pollution from temporary storage/disposal of workers' and construction wastes

Biological Environment

- Removal of plant and soil cover
- Disruption to local ecosystem and loss of biodiversity

3.2.2 *Potential adverse impacts during operation*

The EA will assess the following potential impacts of the operation phase:

Socio-economic Environment

- Increased costs of septage collection / disposal
- Health and safety risks to the public and on-site personnel
- Changes in traffic, risk of accidents and impacts on road quality
- Unsustainably O&M costs
- Acceptability of TWW and sludge reuse by farmers
- Reduced marketability of agricultural produce
- Impacts of TWW on crop quality
- Effects of tanker truck emissions on orchards and crops

Biological Environment

- Impact on wildlife, including birds
- Insects, pests and disease vectors

Physical Environment

- Soil and water contamination
- Odors and gaseous emissions
- Changes in soil physical and chemical properties (from reuse of TWW)

4. EA APPROACH

ECODIT, IRG and MWHAJ have mobilized a 6-member team to conduct the environmental assessment over the coming two months, as explained below.

4.1 Methodology

We propose a simple but effective methodology to conduct the EA comprised of the following major tasks:

4.1.1 *Conduct scoping session*

Held February 23rd 2005, the aim of this workshop was to solicit feedback and comments from relevant stakeholders regarding potential project impacts and gauge their concerns. The Scoping Session report is available in Appendix A.

4.1.2 *Submit this scoping statement for review and approval*

Following its review and approval procedure, USAID will forward this document to the MOE and other relevant institutions for their feedback.

4.1.3 *Conduct field visits and collect baseline data*

The EA team (see Section 4.3) will visit the preferred candidate sites in North Shouneh and collect baseline data including population and economic activities, septage generation and collection (part of feasibility study), important recreational, cultural and historic areas, topography, hydrogeology, climate, biodiversity (fauna, flora, avifauna) and ecosystem as relevant to the defined study area and potential impacts outlined in Section 3.

To the extent possible, we will seek these data from primary sources. For example, we will communicate with WAJ directly to obtain data that will help us describe the site's hydro-geological situation. Other deliverables under the "Small Communities Project" will provide valuable information and clarifications to the EA including the report "Institutional and Legal Policy Review" (submitted) and the feasibility study (pending).

4.1.4 *Assess impacts and propose mitigation measures*

Specific impacts within the broader scope of impacts identified in Section 3 will be defined on the basis of information known about the potentially impacting activities as well as those that may occur from potentially unforeseen or unplanned events (e.g. accidents and emergencies). Impacts will be characterized according to their predicted magnitude, frequency of occurrence, reversibility/irreversibility, spatial extent, duration, etc. as needed to help determine their significance. Where possible, impacts will be assessed against relevant standards (e.g. air quality, water quality, etc.). Mitigation strategies will be investigated and options proposed where needed and practical. Strategies will also be proposed to enhancements the positive impacts.

4.1.5 *Conduct a workshop to present preliminary EA findings*

After collecting the baseline data and analyzing project impacts, we will present and discuss our preliminary findings and recommendations during a workshop in North Shouneh to share information and obtain feedback.

4.1.6 *Develop an Environmental Management and Monitoring Plan (EMMP)*

The project activities, their impacts and specific mitigations will be summarized in tabular format along with any necessary monitoring requirements, indicating the roles and responsibilities for implementing the mitigations/monitoring etc. This environmental management and monitoring plan (EMMP) will be practical and will need to be periodically reviewed and perhaps updated during the life of the project. As such, it will serve as the cornerstone for ensuring implementation of the EA recommendations and any adjustments to these where and when deemed necessary in the future.

4.1.7 *Submit draft and final EA to USAID*

Based on the comments and feedback obtained during the workshop, we will finalize and submit the draft EIA report, including the EMMP to USAID for review and comments. It is our understanding that USAID will share the report with MOE and other concerned agencies for their review as well. Based on USAID's comments, we will revise and submit 5 copies of the Final EIA report within 10 working days of receiving final comments.

4.2 Proposed EA report table of contents

The proposed outline below is based on USAID regulation CFR 216 and the Government of Jordan draft EIA guidelines.

Executive Summary (2 pages)

1. INTRODUCTION
   - 1.1. Background to the *Small Communities Project* (objectives, tasks, etc.)
   - 1.2. Purpose of the EIA Study (e.g., CFR 216 and Jordanian regulations)
   - 1.3. Methodology and EIA Team
   - 1.4. Report Organization
2. LEGAL AND INSTITUTIONAL FRAMEWORK
   - 3.1 Relevant Legislation
   - 3.2 Relevant Institutions
   - 3.3 Permitting requirements (for project implementation)
   - 3.4 Trans-boundary Agreements
3. ANALYSIS OF ALTERNATIVES AND RATIONALE FOR THE SELECTED ALTERNATIVE
   - 4.1 No action
   - 4.2 Service area alternatives
   - 4.3 Alternative sites

4.4 Alternative treatment technologies
4.5 Water reuse alternatives
4. DETAILED DESCRIPTION OF THE PROPOSED PROJECT AND STUDY BOUNDARIES
2.1. Construction phase
2.2. Operation phase
Including a description of activities, facilities being built, etc. and defining the temporal and spatial scope of each: time period, frequency and the potentially affected areas (e.g. roads and lands being used)
5. DESCRIPTION OF THE EXISTING ENVIRONMENT (AFFECTED AREAS)
5.1 Socio-economic Environment
5.1.a Demographics
5.1.b Septage generation, collection and disposal
5.1.c Regional Economy
5.1.d Community Infrastructure & Services
5.1.e Land-use, agriculture and irrigation infrastructure
5.1.f Archeology and cultural heritage
5.2 Physical Environment
5.2.a Topography
5.2.b Water Resources and Hydrogeology
5.2.c Climate
5.3 Biological Environment
5.3.a Flora (incl. protected/endangered species)
5.3.b Fauna (incl. protected/endangered species)
5.3.c Avifauna (incl. protected/endangered species)
5.3.d Unique or rare ecosystems
5.4 Trans-boundary receptors
6. ASSESSMENT OF IMPACTS
6.2. Potential impacts during construction
6.3. Potential impacts during operation
6.4. Potential trans-boundary impacts
7. MITIGATION MEASURES
7.1 Mitigations for construction impacts
7.2 Mitigations for operation impacts
8. ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN
8.1 Roles and responsibilities
8.2 Trans-boundary considerations
8.3 Environmental monitoring requirements
8.4 Emergency response and contingency plan
8.5 Institutional capacity and technical assistance requirements
8.6 EMMP summary table (impacts, mitigations, monitoring, roles, etc.)
9 CONCLUSIONS

35

4.3 The assessment team

ECODIT, IRG and MWHAJ have mobilized a multi-disciplinary team of specialists with significant EA experience in Jordan and internationally to conduct the EA and produce the EA report, under the direction of Mr. Bob Katz, the Chief of Party on the Small Communities Project. The team leader for this task will be Mr. Karim El-Jisr. Table 1 presents the assessment team including degrees, qualifications and proposed position.

Table 1
The EA Team and Qualifications

Name	Proposed Position	Qualifications	Years Experience
Nazih Bandak	Quality Control	MSc Environmental Engineering BSc Civil Engineering	20
Karim El-Jisr	EIA Team Leader	MSc Environment BE Agricultural Engineering	7
Helena Naber	Public Health, Socio-Economics & General Support	MSc Environmental Economics BSc Environmental Health	7
Zuheir El Amr	Fauna Specialist	PhD, MS, BSc Zoology	20
Ahmad Abu Hijleh	Hydro-geologist	MSc, BSc Geology & Water Resources	18
Ibrahim Al Khader	Flora & Biodiversity Specialist	MSc Plant Taxonomy BSc Biological Sciences	8
Sherif Al Jbour	Avifauna Specialist	BSc Biological Sciences	5
Osama Abu Rayyan	Project Technical Coordinator and Economist	MSc Environmental Economics BSc Resource Conservation	8

136

Appendix A
Scoping Session Report

North Shouneh, 23 February 2005

1. Scoping Session Participants

The project team organized and facilitated a scoping session in North Shouneh on February 23rd, 2005. The workshop was held at the Office of the Administrative Governor for the Northern Jordan Valley and was attended by about 55 participants representing the following stakeholder groups:

• Administrative Governor (North Jordan Valley)	عطوفة متصرف الاغوار الشمالية
• US Agency for International Development	الوكالة الاميركية للتنمية الدولية
• Water Authority of Jordan (WAJ)	سلطة مياه الاردن
• Jordan Valley Authority (JVA)	سلطة وادي الاردن
• Ministry of Agriculture	وزارة الزراعة
• Ministry of Water & Irrigation	وزارة المياه
• Ministry of Environment	وزارة البيئة
• Ministry of Tourism / Dept. of Antiquities	وزارة السياحة
• Ministry of Housing and Public Works	وزارة الاشغال العامة
• Ministry of Health	وزارة الصحة
• Ministry of Planning and Int. Cooperation	وزارة التخطيط
• North Shouneh Municipal Council	المجلس البلدي لبلدية الشونة الشمالية
• The Civil Defense	الدفاع المدني
• Property/Land Department	دائرة الاراضي
• Natural Resources Authority	سلطة المصادر الطبيعية
• Association of Women Committees	تجمع لجان المرأة
• Charity organizations	جمعيات خيرية
• Association for Social Development	جمعية التنمية الاجتماعية
• University of Jordan	جامعة الاردن
• Jordan University of Science and Tech.	الجامعة الاردنية للعلوم والتكنولوجيا
• Farmers and Farmer Cooperatives	مزارعين وتعاونيات زراعية
• Jordan Environment Society	جمعية البيئة الاردنية
• Royal Scientific Society (RSS)	الجمعية العلمية الملاكية
• Ministry of Education and Learning	مديرية التربية والتعليم
• Department of *Awqaf*	مديرية الاوقاف
• Department of Social Development	مديرية التنمية الاجتماعية
• Department of Antiquities	مديرية الآثار

About 15 participants (including USAID, WAJ and Ministries) came from Amman and the remaining participants were from the Jordan Valley. Owners and drivers of tanker trucks were invited but did not attend. The overwhelming majority of the participants stayed till the end of the workshop. A full list of the names of participants and the organizations they represented is available in Table A4.

2. Objectives of Scoping Session

The objectives of the scoping session were two-folds:

1. Define the scope of the EA study
2. Present and discuss project alternatives in relation to WWTP site locations, available technologies and water reuse systems.

3. Scoping Session Program

The scoping session spanned four hours (10:15 - 14:15) and was divided into four sessions, including one break and lunch at the end. The program is presented below, *as executed.*

Table A1
Scoping Session Program (As Executed)

Session	*Time*	*Session*
9:45 - 10:15		**Registration**
One	*10:15 - 10:45*	Opening word by WAJ Introductions Workshop Objectives and Program
Two	*10:45 - 11:45*	The "Small Communities" Project, by Osama Abu Rayyan • Proposed WWT&R project in North Shouneh including project alternatives and an overview of WWT technologies • Q&A on the proposed project
11:45 - 12:10		**Break**
Three	*12:10 - 13:30*	Potential Impacts of the Proposed Project in North Shouneh, by Karim El-Jisr • Types of Impacts • Brainstorming • Open discussion on environmental impacts
	13:30 - 14:00	Open discussion on project alternatives
Four	*14:00 - 14:15*	Conclusions Next Steps
14:15		**Lunch**

Mr. Karim El-Jisr of ECODIT was the workshop facilitator.

138

4. Key Comments and Feedback from the Participants

The participants raised a number of questions/concerns during the discussions the most pertinent of which are presented below.

Re the WWTP size

- What is the capacity of the WWTP? How can we guarantee that the plant will not be undersized and/or overloaded during operation (i.e., communities far away haul and discharge their septage in Shouneh which comes under political pressure to receive it regardless of the plant's design capacity).

Re site selection

- Proposed site should be located on lowlands to facilitate sewage hookup in the future; currently, proposed sites No. 4 and 5 (east of the canal) are hydraulically disconnected from septage generators further down.
- Site No.1 is a military zone and may lead to some restrictions. If the WWTP were to be built on site No. 1, then we need to be extra safe to prevent cross-border pollution.
- *Other comments regarding candidate sites are incorporated in Section 3.2*

Re treatment technologies

- What it is the difference between aerobic and anaerobic ponds?
- What would happen if the WWTP received septage from industries? There was a general consensus however that industrial activity in Shouneh is very modest.

Re TWW and water reuse crops

- Will the water reuse component comply with the Jordanian standards?
- Can we use TWW to irrigate banana?
- There are perceptions that international experience suggests that TWW, no matter the type and level of treatment, remains unsafe and cannot be used in aquaculture.
- TWW is culturally unacceptable
- Although we have a lot of water, additional water sources are crucial in summer when irrigation water becomes critically limiting
- Is it safe to introduce TWW in the food chain?
- All the proposed sites are very close to agricultural lands; the crops produced using TWW should be labeled to differentiate them from crops grown using conventional irrigation water.
- How much TWW will the plant generate? Could that disrupt agricultural activity in the area by creating unfair competition by using (cheaper) irrigation water?
- What would happen if the TWW is mixed in the irrigation canals?
- The project needs to educate potential users of TWW.
- Interested stakeholders were encouraged by USAID to visit the USAID-supported pilot water reuse sites in Irbid (near Shouneh), Wadi Musa and Aqaba.

5. Results of Brainstorming Session

The participants were asked to identify potential project impacts, either positive and/or adverse. The results of the brainstorming session are listed below as presented by the participants.

The positive impacts were:

- تقليل الكلفة المادية على الأسر
- التخلص من المياه العادمة من الشوارع ومساعدة بلدية معاذ بن جبل على الحفاظ على بيئة نظيفة
- تجميع المياه العادمة من مكان واحد يحافظ على الوحدات الزراعية وعدم تلوثها
- توفير مصدر جديد لمياه الري للوحدات الزراعية
- المساهمة في تحسين الظروف البيئية في التجمعات السكانية
- تنظيم عمل أصحاب الصهاريج
- إيجاد فرص عمل لأبناء اللواء
- إرتفاع أسعار الأراضي حول المحطة
- توفير رسوم شهرية لدعم البلدية
- حماية المجتمع المحلي من كارثة بيئية في المستقبل
- تساعد على تنمية الثروة الحيوانية من خلال زراعة الأعلاف
- الحد من الرعي الجائر و زيادة الثروة الحرجية
- جلب الطيور حول المحطة
- حماية المياه الجوفية والسطحية من التلوث
- الحد من تلوث المزروعات
- التخفيف من الامراض الوبائية
- تساعد على أنشاء مشروع صرف صحي في المنطقة مستقبلا
- نجاح المشروع وسيلة لتعميم الفكرة في مناطق أخرى في المملكة
- معالجة كافة المخلفات أما فيزيائيا او بيولوجياً
- تشجيع الإعلام حول المشروع
- يفتح قنوات الإتصال بين المجتمع المحلي ويساهم في فكرة العمل التطوعي والعمل في رحابة
- إنعاش المنطقة نتيجة إنجاز المشروع
- زراعة أشجار حرجية حول المحطة مما تساعد على التخفيف من الروائح

The potential adverse impacts are presented in Table A2 (English translation) and Table A3 (Arabic). At the end of the brainstorming session, the participants were asked to evaluate the impacts in terms of their perceived significance. Each impact was read out loud and the participants voted high, medium or low, by a show-of-hands. The stars "*" in Table A2 and A3 reflect how the majority of the participants voted. According to the participants, the *significant* project impacts/concerns are: spread of insects and rodents; faulty use of TWW; removal/destruction of plant cover during construction; fate of TWW during periods of low-water demand; operating the WWTP above its design capacity; failure to set up a local management team to operate the plants.

Table A2
Results of Scoping Session on Potential Adverse Project Impacts (English Translation)

Impact	High	Medium	low
Adverse impacts on the biological environment			
1. Spread of insects and rodents	×		
2. Degradation of the natural landscape			×
3. Erroneous usage of treated water (growing illegal crops)	×		
4. Loss of biodiversity			×
Adverse impacts on the physical environment			
5. Desertification enhanced			
6. Emission of foul odors from WWTP		×	
7. Inadequate discharge of septage by tanker trucks			×
8. Irrigation using TWW causes salinity buildup in the soil		×	
9. Haphazard disposal of solid waste		×	
10. Removal of plant cover during construction	×		
11. Zero demand for TWW during winter	×		
12. Increased traffic causes dust and lead to accidents			×
13. Damage to agricultural roads		×	
14. WWTP receives septage from non-residential sources			×
Adverse impacts on society and local economy			
15. WWTP receives septage above its design capacity (from far away generators) reducing its design lifetime	×		
16. By-products from WWTP impacts public health (TWW, sludge)		×	
17. Selected site is unsuitable/inadequate			×
18. Lack of funds to operate and maintain the WWTP		×	
19. Project is unable to establish a local body to manage the WWTP	×		
20. Farmers are reluctant/hesitant to use TWW			×
21. TWW affect agricultural activities/dynamics			×
22. Charges are imposed on TWW			×
23. Lack of occupational safety standards for the plant workers		×	
24. Project causes the value of land surrounding the WWTP to drop			×
25. Acceptability of local agricultural products declines			×
26. Site selected results in higher operational cost			×

141

Table A3
Potential Adverse Impacts of Proposed WWT&R Project in North Shouneh

الرقم	الأثر	قوي	وسط	ضعيف
الأثار السلبية على البيئة البيولوجية				
.1	إنتشار الحشرات والقوارض(بيئة مناسبة لإنتشار الباعوض)	×		
.2	تشويه المناظر الطبيعية في المنطقة			×
.3	الإستهمال الخاطئ للمياه المعالجة (خارج قائمة المحاصيل)	×		
.4	تأثير سلبي على التنوع الحيوي والمناظر الطبيعية,وزيادة التصحر.			×
الأثار السلبية على البيئة الفزيائية				
.5	إنبعاث الروائح الكريهة من المحطة		×	
.6	عدم تفريغ الصهاريج في المحطة بشكل جيد			×
.7	زيادة الملوحة في التربة نتيجة إعادة إستخدام المياه المعالجة		×	
.8	التخلص العشوائي من المخلفات الصلبية			×
.9	عدم التطرق إلى مشكلة الحفر الإمتصاصية	×		
.10	تدمير البيئة وإزالة الغطاء النباتي أثناء الإنشاء	×		
.11	عدم إستعمال المياه المعالجة خلال فصل الشتاء	×		
.12	حركة السير المتزايدة تؤدي إلى إنتشار الغبار.وحركة التنكات تؤدي إلى جوادث السير			×
.13	تدمير الطرق الزراعية		×	
.14	إستخدام المحطة لمعالجة المياه غير المنزلية			×
الأثار البيئية على المجتمع المحلي والإقتصاد				
.15	تحميل المحطة كميات اكبر من قدرتها التصميمية وإحتمال إستخدام المحطة من قبل المناطق المجاورة لعدم وجود محطات مما يؤدي إلى تكسير خدمتها	×		
.16	تخوف المجتمع المحلي من سلبيات المشروع			×
.17	الأثار السلبية على الصحة العامة الناتجة عن منتج المحطة		×	
.18	عدم ملائمة الموقع المقترح		×	
.19	عدم توفير المال لتشغيل وصيانة المحطة		×	
.20	عدم تكوين جهة محلية قادرة على إدارة المحطة	×		
.21	تخوف المزارعين لإستعمال المياه المعالجة			×
.22	تغيير النمط الزراعي حسب المياه المستخدمة			×
.23	فرض رسوم او تعرفة على المياه المعالجة			×
.24	عدم توفير الحماية الذاتية للعاملين داخل المحطة		×	
.25	إنخفاض أسعار الأراضي حول المحطة			×
.26	التأثير على سمعة المنتج الزراعي في المنطقة			×
.27	موقع المشروع يؤدي إلى إرتفاع تكلفة التشغيل			×

Table A4
List of Participants
مشروع محطات تنقية المياه العادمة للتجمعات الصغيرة
كشف باسماء المشاركين في جلسة تحديد إطار تقييم الأثر البيئي للمشروع في الشونة الشمالية
2005/2/23

الرقم	الإسم	الجهة
1.	محمد سعدالعامري	مديرية الأوقاف
2.	إسماعيل موسى أبراهيم	متقاعد
3.	محمد عز ابو عيد	تربية/متقاعد
4.	المهندس قيس عويس	سلطة وادي الأردن
5.	المهندس محمود القماز	سلطة وادي الأردن
6.	عبد الرحمن ذيب ابراهيم	مديرية معاذ بن جبل
7.	نضال كايد هندي	مدير أثار الأغوار الشمالية
8.	المهندس غسان عبيدات	بلدية معاذ بن جبل
9.	المهندس عدنان غرايبة	سلطة وادي الأردن
10.	المهندس محمود أبو جابر	رئيس بلدية معاذ بن جبل
11.	موسى احمد الشامان	عضو بلدية معاذ بن جبل
12.	ناصر أحمد عبيد النادب	مختار عشيرة العبيدية
13.	محمد أحمد الضباري	عضو مجلس بلدية معاذ بن جبل
14.	حمد سليمان بن عبد الرحمن	مدير تسجي أراضي الشونة الشمالية
15.	المهندس احمد بن ياسين	مدير هندسة البلديات
16.	ماجد نواف عبد اللطيف المنسي	مختار الباقورة
17.	محمود خليل ابراهيم خليل	مختار عشيرة المحادلة
18.	الدكتور منجد الشريف	مدير مركز الملكة رانيا العبد الله لعلوم وتكنولوجيا البيئة/جامعة العلوم/أربد
19.	مازن عز الإبراهيم	مديرية التربية والتعليم
20.	صالح عبد الوحد تعشري	مختار عشيرة المشارقة
21.	محمد أحمد طارق	جمعية الشونة الزراعية
22.	المهندس وجدي مساعدة	رئيس بلدية طبقة فحل
23.	منذر يوسف بلعاوي	التربية والتعليم/الاغوار الشمالية
24.	المهندس ماجد أحمد جودة	رئيس قسم تشغيل محطات التنقية
25.	محمد خير عبابنة	دراسات/سلطة المياه
26.	ثائر ظاهر نايف	جمعية الشونة الزراعية
27.	المهندس على عبيدات	وزارة التخطيط/مديرية المشاريع
28.	المهندس وائل سليمان	الجمعية العلمية الملكية
29.	المهندس محمود العلاونة	سلطة المياه
30.	المهندس ايمن أبو جلمة	وزارة السياحة
31.	المهندس عماد أبو عباس	بلدية معاذ بن جبل
32.	الدكتور هاشم أحمد الزعبي	سلطة المصادر الطبيعية

143

مشروع محطات تنقية المياة العادمة للتجمعات الصغيرة

كشف باسماء المشاركين في جلسة تحديد إطار تقييم الأثر البيئي للمشروع في الشونة الشمالية

2005/2/23

الرقم	الأسم	الجهة	الهاتف	التوقيع
1	محمد رصد العامري	مدير الاوقاف	٠٧٧٠٤٢٤٢١٢	
2	[illegible]	متقاعد	٦٥٨٧١١١	
3	محمد نمر ابو عبيد	ترسيم متقاعد	٦٥٨٧٧٠٦	
4	م. قيس عويس	سلطة وادي الاردن	٠٧٩/٥٦٦٩٨٢٢	
5	م. محمود الصقار	سلطة وادي الاردن	٠٧٩/٥٣٠٥٩٦٧	
6	عبد الرحمن زبيد ابراهيم	مدير بلدية جبل	٠٧٩/٥٧٠٠٢٧٥	
7	[illegible]	[illegible]	[illegible]	
8	[illegible]	مدير [illegible]	[illegible]	
9	م. غسان عبيدات	بلدية معاذ بن جبل	٠٧٩٥٢٠٢٩٧٢	
10	م. [illegible]	سلطة وادي الاردن	٠٧٩٥٣٠٣٦٧٥	
11	م. محمود ابو جابر	رئيس بلدية معاذ بن جبل	079/5059645	
12	[illegible]	عضو بلدية معاذ بن جبل	٦٥٨٠١١٩	
13	ناصر احمد عبيد الادب	مختار عشائر العبينة	٦٥٨٧١١٩	
14	محمد احمد الفارس	عضو مجلس بلدية معاذ بن جبل	٦٥٨٧٨٧٥	
15	محمد سليمان بني عبد الرحمن	مدير سجل الشونة الشمالية	٦٥٨٧٠٦٠	
16	م. احمد بني ياسين	مدير هندسة البلديات	٠٧٩٥٩٨٦٣٠١	
17	[illegible]	مختار الباقورة	٦٥٨٠٤١٦	
18	محمود خليل ابراهيم خليل	مختار عشيرة المحارمة	٦٥٨٠٢٤٧	
19	[illegible]	مدير مركز التنمية [illegible]	٠٢/٧٢٠١٠٠ ext 2299	
20	[illegible]	مختار عشيرة [illegible]	٦٥٨٧٩٥٤	
21	[illegible]	[illegible]	٠٧٧٧٩٢٦٠٠٥	
22	[illegible]	[illegible]	٠٠٧٧٤٥٠٥٢٦٥	

مشروع محطات تنقية المياه العادمة للتجمعات الصغيرة

كشف باسماء المشاركين في جلسة تحديد إطار تقييم الأثر البيئي للمشروع في الشونة الشمالية

2005/2/23

الرقم	الأسم	الجهة	الهاتف	التوقيع
٢٢	م. وحيد مساعدة	رئيس بلدية طبقة فحل	٦٥٦٠٠٦٤	
٢٤	منذر يوسف بلعاوي	التربية والتعليم/الأغوار الشمالية	٦٥٨٧٦٥٨	
٢٥	م. ماجد أحمد جوده	رئيس قسم تشغيل محطات التنقية	٥٦٨٠١٠٠	
٢٦	محمد خير عبابنة	دائرة سلطة المياه	٥٦٣٠٣٠/٤٦	
٢٧	م. علي عبيدات	وزارة التخطيط/مديرية المشاريع	٠٧٧٧٧٢١١٤٨	
٢٨	م. وائل سلمان	الجمعية العلمية الملكية	٠٧٧٧٤٢٣٤١٨	
٢٩	ح. محمود العدوان	سلطة المياه	٠٧٧٧٤٨١٢٠٨	
٣٠	م. أيمن محمد البرجي	وزارة المياه	٠٧٩/٥٢٠٥٢٨	
٣١	م. عماد أبو عباس	بلدية معاذ بن جبل	٠٧٩/٥١٢٥٨٤	
٣٢	د. حاكم محمد الزعبي	سلطة المصادر المائية	٠٧٧٧٢٢٨٢٦٥	
٣٣	صالح البطيخات	" "	٠٧٩٥٧٢٢٤٤٥	
٣٤	راضي أحمد حماد أبو الكر	ضابط متقاعد	٠٧٧٧٤٦٢٩٠٤	
٣٥	المقدم سمير مرعي حمادنة	رئيس مركز الأغوار الجنوبي	٠٧٧٧٤٠١١٦	
٣٦	صبحي محمد الهلالات	باحث في مركز البحوث المائية/كلية الزراعة	0795253373	
٣٧	سعاد أسعد	سلطة المياه	0795177088	
٣٨	م. أحمد الصرايرة	الجمعية العلمية الملكية	0777441721	
٣٩	م. محمد الكوز	سلطة المياه	0777484714	
٤٠	رزق سابيلا	الوكالة الأمريكية للتنمية الدولية	٥٩٠٦١٣٤	
٤١	د. آمال قحاز	الوكالة الأمريكية للتنمية الدولية	٥٩٠٦٦٩٤	
٤٢	زياد محمد المراوزة	جمعية البيئة الأردنية	٦٥٨٧٠٢٩	
٤٣	م. عبد الله البطيخات	مدير الإدارة البيئية/وزارة المياه	٠٧٧٧٦٥٦٦٨٦	
٤٤	خالد محمد عبد الرضوان	مكتب استشاري	٠٧٧٧٢٠٦٩٦٦	
٤٥	بلال القضاة	مزارع/الشونة	٠٧٩٥٩٥٧٤٥٦	

مشروع محطات تنقية المياة العادمة للتجمعات الصغيرة

كشف باسماء المشاركين في جلسة تحديد إطار تقييم الأثر البيئي للمشروع في الشونة الشمالية

2005/2/23

الرقم	الأسم	الجهة	الهاتف	التوقيع
٤٦	[illegible]	الدفاع المدني	٦٥٨٧٢٧	
٤٧	م. [illegible]	وزارة الاستثمار [illegible]	٥٨٥٠٤٧٠	
٤٨	م. أوديليا [illegible]	" " "	٥٨٥٠٤٧٠	
٤٩	م. [illegible]	سلطة المياه	٥٦٨٠٦٠٠	
٥٠	م. [illegible]	"	"	
٥١	م. [illegible]	"	"	
٥٢	د. بلال [illegible]	مديرية صحة الأغوار الشمالية	٦٥٨٧٤٢	
٥٣				
٥٤				
٥٥				

بسم الله الرحمن الرحيم

THE HASHEMITE KINGDOM OF JORDAN

Ministry of Environment

AMMAN

المملكة الأردنية الهاشمية

وزارة البيئـــــــة

عمـــان

Ref. : 1/1/1621

Date : 2/5/2005

الرقم :

التاريخ :

الموافق :

سعادة الدكتور أمل حجازي .

Mr. James Franckiewicz
Director, Office of Water Resources
& Environment
USAID

Subject. Comments on Scoping Documents for the Small Communities Wastewater Treatment Plants projects' at Shoubak and North Shouneh.

Dear Mr. Franckiewicz,

In reference to your letter dated 15 March 2005 regarding the above mentioned subject, we would like to inform you that we agree in principle to your scoping documents. However, the following comments are expected to be accounted for in the next phase of the study:

1) A copy of "The institutional and legal policy review" report was not submitted to the Ministry of Environment

2) The documents do not mention:
   - The necessity for baseline studies and data gaps coverage when needed.
   - Assessment of the abnormal and emergency cases.
   - The impacts of the decommissioning phase.
   - The situation if the public sewerage system is to be applied.
   - The project duration.

هاتف ٥٥٦٠١١٣ - فاكس ٥٥٦٠٢٥٨ - ص.ب ١٤٠٨ عمان - ١١٩٤١ - الأردن

Tel. 5560113 - Fax 5560258 - P.O. Box 1408 Amman - 11941 - Jordan

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بسم الله الرحمن الرحيم

THE HASHEMITE KINGDOM OF JORDAN

Ministry of Environment

AMMAN

المملكة الأردنية الهاشمية

وزارة البيئـــــــة

عمان

Ref : 1 / 1 / 1621

Date : 2 / 5 / 2005

الرقم :

التاريخ :

الموافق :

- The EA study duration.
- The estimated wastewater quantities for the North Shouneh plant

3) Usually 15 copies of the EA report are required by the Ministry of Environment to be reviewed by the reviewing committee.

Sincerely,

Khaled Anis Irani

Minister of Environment

C.C. Secretary General
CC. EIA Director

هاتف ٥٥٦٠١١٣ - فاكس ٥٥٦٠٢٨٨ - ص.ب ١٤٠٨ عمان ١١٩٤١ - الأردن

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U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT
BUREAU FOR ASIA AND THE NEAR EAST
WASHINGTON, D.C. 20523

RECORD OF ENVIRONMENTAL DECISION

ANE 05-144 Jordan ROD EA Scoping

Country Code-SO: 278-0288

SO Name: Wastewater Treatment Facilities for Small Communities in Jordan

Country or Region: Jordan

Activity Name: Record of Decision (ROD), Scoping Statement for Environmental Assessment (EA), Rural Wastewater Treatment and Reuse Project (North Shouneh)

Funding Begin: 2004 **Funding End:** 2008 **Funding Amount:** $4,973,548

Approval Issue: **Scoping Statement for Environmental Assessment, approved with condition**

CLEARANCES

ANE Bureau Environmental Officer
Approval: John O. Wilson — July 11, 2005
John O. Wilson — Date

Acting Mission Director
Approval: (signed) — June 6, 2005
David Barth — Date

Water Resources and Environmental Office Director
Approval: (signed) — June 7, 2005
James Franckiewicz — Date

Regional Legal Advisor
Approval: (signed) — June 10, 2005
David Barth — Date

Mission Environmental Officer
Approval: (signed) — June 7, 2005
Amal Hijazi — Date

OVERVIEW

USAID/Jordan plans to fund the Water Authority of Jordan to implement a low-cost, low-maintenance wastewater treatment and reuse (WWT&R) project in North Shouneh as a "Rural Wastewater Treatment and Reuse Project." The project will design, supervise, and construct a proven low-cost, low-maintenance wastewater treatment plant, develop local capacity to operate and maintain the facilities in a sustainable manner after the project ends, turn over the operation and maintenance of the facility to local bodies, and eventually reuse the treated wastewater. The scoping statement for the Environmental Assessment (EA) identifies potential significant direct, indirect, and cumulative adverse environmental impacts: 1) during construction (excavation, site erosion, air pollution from dust, health and safety, noise, removal of vegetative cover, alteration of surface hydrology); 2) during operation and maintenance (methane generation, sludge production, traffic, wildlife, pests, unplanned events and risks to treatment plant); and 3) wastewater reuse (health and safety, soil and crop contamination).

DECISION

The scoping statement for the EA for the "Rural Wastewater Treatment and Reuse Project (North Shouneh)" is **approved** per 22 CFR 216 with the **condition** that there is a participatory process to review and refine the nitrate standard for treated wastewater reuse in agriculture or discharge into wadis and national rivers, and that the results from that process becomes part of the final design of the proposed WWT&R project.

File No: ANE 05-144 Jordan ROD EA Scoping

DISTRIBUTION:

Mission Environmental Officer
ROD File

USAID

RECORD OF ENVIRONMENTAL DECISION
ANE 05-144 JORDAN

Country Code-SO: 278-0288
SO Name: Wastewater Treatment Facilities for Small Communities in Jordan
Country or Region: Jordan (North Shouneh)
Activity Name: Rural Wastewater Treatment & Reuse Project (North Shouneh)

Funding Begin: 2004	**Funding End:** 2008	**Funding Amount:** $4,173,548.00 for Technical Assistance Component for both communities for North Shouneh and Shobak 8,000,000 Construction Cost Estimate for both Wastewater Treatment Plants

Approval Issue: Scoping Statement for Environmental Assessment, approved with conditions

ANE Bureau Environmental Officer
Approval: (John O. Wilson)
John O Wilson — 7/11/05
Date

Acting Mission Director
Approval: (David Barth)
6/10/5
Date

Mission Environmental Officer
Approval: (Amal Hijazi)
Amal Hijazi — June 7, 2005
Date

CLEARANCES:

Water Resources & Environment Office Director
Approval: (James Franckiewicz)
6/7/05
Date

Regional Legal Advisor
Approval: (David Barth)

OVERVIEW

BEST AVAILABLE COPY

The Water Authority of Jordan with the support of USAID plans to implement a low-cost low-maintenance wastewater treatment and reuse (WWT&R) project in North Shounch. The WWT&R project in North Shounch is part of the wider activity, Wastewater Treatment Facilities for Small Communities in Jordan (the "Small Communities Project"). According to the initial environmental examination (IEE) prepared by USAID Jordan in August 2004, the project requires a full environmental impact assessment (EIA).

The Small Communities Project will design, supervise and construct proven low-cost/low-maintenance, wastewater treatment plant (WWTP) to serve North Shounch (a residential community that lacks sewage collection networks), develop local capacity to operate and maintain the facilities in a sustainable manner after the project ends, turn over the operation and maintenance of the facility to local bodies (e.g., Municipality, Village Councils, Private Sector), and eventually reuse the treated wastewater. This will serve as a model for other areas in Jordan. The project will span four years.

Currently, approximately 15,000 residents in the town of North Shounch rely on cesspits (not septic tanks). These pits are generally permeable leading to seepage of septage and potential groundwater contamination. Nevertheless, residents need to empty their cesspits every couple of months (depending on permeability, storage volume and family size) because they frequently overflow. Tanker trucks in the area get paid by households to empty the cesspits. Although tanker drivers are required to discharge the septage in designated dumpsites, they frequently do so haphazardly in these and other locations, causing environmental and health pollution problems.

DISCUSSION

The scoping statement for the EA identifies potentially significant direct, indirect and cumulative environmental impacts during: (i) construction: excavation and site erosion, air pollution from dust, health & safety, noise, removal of plant cover, alteration of surface hydrology; and (ii) operation and maintenance: methane generation, sludge production, traffic, wildlife, pests, unplanned events and risks to treatment plant; and (iii) water reuse: health & safety, soil and crop contamination. The Jordanian Ministry of Environment has already communicated its approval of the Scoping Statement.

DECISION

The scoping statement for the EA for the "Wastewater Treatment Facilities for Small Communities in Jordan" Project is **approved with these conditions as considerations**:

> Participate in the process to review and refine the nitrate standard for treated wastewater reuse in agriculture or discharge into Wadis and national rivers, and take into account the results from this review process as part of the final design of the proposed WWT&R project.

DISTRIBUTION:
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ROD File

FINAL

SCOPING STATEMENT
for the
ENVIRONMENTAL ASSESSMENT
of the
WASTEWATER TREATMENT FACILITIES FOR SMALL COMMUNITIES IN JORDAN PROJECT IN NORTH SHOUNEH

JUNE 2005

INTRODUCTION

In support of the people and Government of Jordan, USAID plans to finance the implementation of a low-cost low-maintenance wastewater treatment and reuse (WWT&R) project in North Shouneh. This is a four-year project implemented for the Water Authority of Jordan by IRG and ECODIT under the USAID Environmental Policy and Institutional Strengthening Indefinite Quantity Contract II (EPIQ II). In accordance with USAID (22 CFR 216) environmental review requirements, an initial environmental examination (IEE) prepared by USAID Jordan in August 2004 requires a full environmental assessment (EA) to be carried out for the proposed project. An EA is a detailed study of the reasonably foreseeable significant effects, both beneficial and adverse, of a proposed action on the environment of a foreign country. The first step in this process is the preparation of a Scoping Statement, which is a document used to anticipate potentially significant issues, issues that are potentially not significant, and to determine how and by whom the EA study will be conducted. The purpose of this scoping statement is also to set forth clear understandings between USAID and the Water Authority of Jordan / Ministry of Environment with respect to these issues for this project in North Shouneh.

BACKGROUND

The WWT&R project in North Shouneh is part of the wider activity, Wastewater Treatment Facilities for Small Communities in Jordan (the "Small Communities Project"). The Small Communities Project will design, supervise and construct proven low-cost/low-maintenance, septage-based wastewater treatment plants (WWTP) to serve Shobak and North Shouneh (both communities lack sewage collection networks). The Jordanian Wastewater Management Policy states that central treatment plants shall be built to serve semi-urban and rural communities and collection of wastewater shall be made initially through trucking until such a time when collection systems (such as an underground piping network) are justified. Trucking wastewater to the central treatment plants eliminates the need for expensive collection infrastructure and provides flexibility in selecting sites. It also facilitates a "community cluster approach," serving several neighboring rural communities.

North Shouneh, with a population of approximately 15,000 people, is one of the largest towns in the Northern Jordan Valley (NJV) sub-district ("Liwa'a"). It is part of the Municipality of Mu'ath Bin Jabal, the northern most municipality of the Jordan Valley with a total registered population of over 30,000 people. Other municipalities in the NJV also include the Tabqit Fahel with approximately 27,000 people and then the Sharhabeel Bin Hasna with over 28,000 people. Population density is relatively high in some of the larger town-centers such as North Shouneh, but is less so in other smaller residential areas. Residential space is quite limited in the NJV since the valley falls within a narrow strip of highly agricultural lands surrounded by steep hills to the east

and the Jordan River to the West. The area borders Syria to the North and the Occupied Territories / Israel to the West. In the hills to the east, the NJV is bordered by the Municipalities of Taybeh and Kura that are home to over 100,000 people.

Within the NJV, five private septic tankers currently operate full-time, disposing of 400 to 500 m3 of septage per day and as high as 700 m3/day in the summer. On average, households in the NJV normally pay anywhere between 5 and 20 JD for this service (each tanker trip) when disposal is within the NJV, depending on the distance tankers must travel. Until very recently (December 2004) however, tanker drivers disposed of septage in the lower reaches of a nearby Wadi that empties into the Jordan River. They are currently banned from disposing there due to environmental and health concerns in the vicinity and are now required to discharge at WWTP's much further away. As a result, tankers are now charging between 20 and 45 JD's unless they discharge illegally. Many households have to pump their cesspits quite regularly (once every 2 to 3 months, some once every 3 to 4 weeks). Mostly dependent on farm work, the financial strain on most households from this septage situation is tremendous. With the recent increase in tanker costs, many households could no longer afford to pump their cesspits, and have left them to overflow into the streets. This situation is most severe in the Municipality of Mu'ath Bin Jabal, and particularly in the town of North Shouneh. The quantities requiring disposal are increasing over time and without this project, would increasingly cause significant pollution of soils, important water resources in the area as well as a further risk to the already fragile public health situation and a further unbearable drain on meager family incomes.

The Small Communities Project will also develop local capacity to operate and maintain the facilities in a sustainable manner after the project ends, turn over the operation and maintenance of these facilities to local bodies (Municipality, Village Councils, Private Sector, etc.), and eventually reuse the treated wastewater (TWW This will serve as a model for other areas in Jordan. The Project began in the summer of 2004, will span four years and covers a scope of work comprised of the following detailed tasks:

- Task 1: Conduct preliminary planning activities (& select communities to work in);
- Task 2: Prepare a feasibility study;
- Task 3: Conduct a Scoping Session and prepare an EIA;
- Task 4: Establish "institutional partnerships" and cost recovery mechanisms;
- Task 5: Prepare detailed engineering design/drawings and bid documents;
- Task 6: Select contractors and supervise construction;
- Task 7: Monitor plant operations and the quality of treated effluents;
- Task 8: Implement the wastewater reuse components;
- Task 9: Provide capacity building and training related to the projects;
- Task 10: Assist the Government of Jordan in the formulation of policies, guidelines, and standards related to WWT&R; and
- Task 11: Prepare final report including lessons learned.

According to the IEE prepared by USAID Jordan in August 2004, all of the above tasks with the exception of Task 6 and Task 8 qualify for "Categorical Exclusions" per 22 CFR 216.2(c)(2)(iii) as "analysis, studies, academic or research workshops and meetings"; per 22 CFR 216.2(c)(2)(xiv) as "studies, projects or programs intended to develop the capability of recipient countries to engage in development planning"; per 22 CFR 216.2(c)(2)(xv) as "activities which involve the application of design criteria or standards developed and approved by AID"; or as per 22 CFR 216.2(c)(2)(i) as "education, technical assistance, or training programs. Task 6 is given a "Positive Determination" requiring the design, feasibility, and construction management contractor to prepare a combined scoping session and full EA per 22 CFR 216.2(d)(xi) as "classes of actions normally having a significant effect on the environment". Task 8 qualified for a "Negative Determination" as i is not expected to have a negative impact on the environment, as proposed mitigation measures will eliminate/minimize negative impacts. Nonetheless, reuse design and operational considerations will be addressed in the EA.

DIRECT, INDIRECT AND CUMMULATIVE POTENTIALLY SIGNIFICANT EFFECTS DURING CONSTRUCTION

1) **Health and safety risks (to the public and to workers)**
   Scope – transport and movement of construction vehicles and equipment in addition to excavations and other construction activities will potentially pose a health and safety risk to construction workers in addition to their potential exposure to venomous snakes and scorpions. Some members of the public, especially local farmers/ shepherds and military personnel will also be exposed to these additional vehicle movements and risk falling into some of the excavations for example.
   Significance – this is potentially significant if appropriate construction transport, site safety and workers health/safety signage and procedures are not put place and enforced. Working conditions in the area can also be quite harsh with high humidity and hot temperatures during the summer.

2) **Noise pollution and nuisance to nearby residents/farmers**
   Scope – construction activities will generate noise that poses a risk to workers health and may be a nuisance to local farmers and military personnel.
   Significance – this temporary impact is potentially significant in light of the trans-boundary nature and if loud construction activities are allowed to start before dawn and to persist after the late evening.

3) **Increased traffic/congestion and road wear due to construction related transport**
   Scope – construction-related traffic could cause disruptions to traffic along roads and damage to small agricultural roads in the area.
   Significance – this temporary impact is a potentially significant since there are few main access roads in the area (many of which are small agricultural roads in poor condition) especially if off-site earth disposal quantities are significant and their transport is not well planned.

4) **Disruption to or loss of archaeology**
   Scope – construction related vehicle movement and excavations could cause damage or destroy any potential archaeological sites in and around the site.
   Significance – this permanent impact is potentially significant since the site is near the historical Jordan River and if a survey by the department of antiquities reveals any known sites of potential importance or if others of lesser importance are discovered during construction without taking appropriate action (e.g. notification of relevant authorities, documentation).

5) **Reduction in aesthetics/landscape degradation**
   Scope – the construction site and WWTP that results may be considered a degradation of visual aesthetics / landscape.
   Significance – this impact is potentially significant in light of the site's vicinity to an international border. Failure to plant trees and ornamental vegetation around the perimeter of the site would also work to make the WWTP less aesthetically attractive.

6) **Dust and vehicle emissions**
   Scope – excavations, vehicle movement and transport/disposal of excavated materials can generate dust that can affect the health of workers, nearby farmers, military personnel and receptors on the other side of the border (as well as cause a nuisance). Dust and vehicle emissions can also negatively impact farmers' crops in the vicinity, especially citrus orchards.
   Significance – although winds are generally calm, especially during the summer, this temporary impact is potentially significant due to the large number of citrus orchards in the area and on both sides of most access roads. Vehicle emissions may be significant if large earth-moving operations are required as they may also impact crop yields. Trans-boundary concerns are not expected to be significant since southwesterly and calm winds dominate.

7) **Alteration of surface run-off and associated impacts**
Scope – land leveling, excavations, waste disposal and construction of facilities can affect the local topography and potentially put the construction site itself at risk.
Significance – this temporary impact is potentially significant if construction activities persist through to the winter, a large amount of surface water passes through the site and if appropriate drainage precautions are not built into the construction plan.

8) **Pollution from temporary storage/disposal of workers' and construction wastes**
Scope – construction activities and workers generate solid and liquid wastes that can cause contamination of soils and water as well as temporary alteration of surface run-off.
Significance – this is potentially significant if wastes are not appropriately separated and disposed of in safe, designated locations and in light of the vicinity of the Jordan River, an international watercourse.

9) **Removal of plant and soil cover**
Scope – construction activities will result in the removal of soil and vegetation cover, often permanently.
Significance – this is potentially significant in light of the loose topsoils in the area.

10) **Disruption to local ecosystem and loss of biodiversity**
Scope – construction activities can alarm local fauna and in combination with 9) above, result in changes to the specific localized ecology and biodiversity.
Significance – this is potentially significant if the area is relatively a large portion of a unique, undisturbed habitat with sensitive faunal species or cuts across an important migratory or regular faunal movement corridor.

DIRECT, INDIRECT AND CUMMULATIVE POTENTIALLY SIGNIFICANT EFFECTS DURING OPERATION

1) **Positive Impacts**
The WWT&R project will generate a number of potential positive impacts. The most significant of these include, but are not limited to the following:
- Reducing the costs borne by households to empty cesspits through providing a nearby, long-term WWTP solution that treats their wastes in an environmentally friendly manner;
- Improving public health/sanitation and protecting soil and water resources in the region by minimizing current cesspit overflows, that often flow into streets and residences, and controlling current disposal practices that also put agricultural lands at risk;
- Creating a source of irrigation water (TWW) that may release freshwater for other purposes and/or improve the productivity of farms in the vicinity that suffer irrigation water shortages in the summer;
- Strengthening local institutions and community participation.

2) **Inequality of socio-economic impacts**
Scope – the presence of a WWT&R project can affect the value of surrounding land and the beneficiaries of the WWTP may be different people from those benefiting from reuse and/or those burdened by the WWTP's presence.
Significance – this is potentially significant if large disparities in the incidence of such issues result from the WWT&R project's location and operations, and if such disparities are not addressed - either through participatory agreements (formal or informal), raised awareness with regards to the public/social benefit versus the private benefit/harm of such a project, and/or financial incentives - as part of the institutional and operational development associated with the project.

3) **Health and safety risks (to the public and to workers)**
Scope – the presence of a WWTP poses a danger to people with access to it as they may fall into lagoons or come into contact with microbiologically contaminated waters /sludge (around the facilities or as reuse workers). Wild boars may also visit the reuse site and cause injury to workers. There may be other occupation health and safety risks associated with running a WWTP. Transport risks are dealt with separately under 4) below.
Significance – this is potentially significant if appropriate signage, site safety and workers health/safety and procedures are not put place and enforced. TWW quality and safe reuse practices must also be adhered to according to standards.

4) **Changes in traffic, risk of accidents and impacts on road quality**
Scope – tanker trucks will be funneled towards the WWTP and will therefore result in a permanent change in traffic, which may affect road wear and cause an increase in accidents along particular roads and junctions.
Significance – this impact is potentially significant as tanker traffic is expected to be heavy in relation to normal traffic levels in the vicinity of the WWTP and most roads are not appropriately sized or built for such a change in overall traffic as a result of the change in tanker routes. Specific access routes will need to be designated, speed restrictions imposed and it is likely that they will need to be upgraded and/or renovated in the near future in light of their existing state, especially if construction related traffic damage to roads is significant.

5) **Agronomic Risks Associated with TWW Reuse**
Scope – water reuse may not be acceptable to farmers and consumers; marketing produce may be difficult.
Significance – this impact is potentially significant as it may affect the viability of reuse, especially if monitoring and enforcement mechanisms are weak and farmers/consumers have little faith in such regulation. Farms in the area may also suffer in terms of reputation in general, even though they may not be reusing TWW themselves. Raising awareness, providing information campaigns, training and a demonstration reuse site can also mitigate such risks.

6) **Tanker truck vehicle emissions**
Scope – diesel-operated septage tanker trucks, often poorly maintained and generating significant particulate emissions, will be using a limited number of access roads that run between several farms. This can negatively impact crop quality.
Significance –this impact is potentially significant due to the large number of citrus orchards on both sides of most access roads and the relatively high number of tanker tucks expected to arrive at the WWTP. Encouraging appropriate maintenance of tanker trucks to reduce emissions and minimizing traffic loads by providing multiple access routes can mitigate this impact.

7) **Impact on wildlife, including birds**
Scope – the presence of lagoons and changes in vegetation as a result of reuse, may influence wildlife and bird habitats and movements.
Significance – this impact is potentially significant if vegetation and/or presence of large lagoons result in non-localized changes such as changes in migratory or major feeding/roosting grounds.

8) **Insects, pests and disease vectors**
Scope – the presence of lagoons and changes in vegetation as a result of reuse, may influence the populations of insects, pests and disease vectors.
Significance – this impact is potentially significant since the potential for pest/disease vector infestation already exists in the area and the WWTP may trigger an infestation. There are also several foreign laborers in the area, many of whom may be disease carriers (any labor brought into the area, including during construction, must be screened for diseases). This impact also potentially has trans-boundary implications. Appropriate integrated pest control management must be considered as part of regular operations.

9) **Soil and water contamination**

Scope – in general, the impact on water quality and soils in the region is expected to be positive (e.g. leakages and accidental spills from tankers or illegal discharges off-site are expected to be reduced). However there is also an increased risk in the vicinity of the WWT&R sites from leakages, seepages, overflows and inappropriate sludge treatment/disposal. Effluent will also be discharged and will ultimately flow into the Jordan River. Accumulation of salts and other elements in the soil can also result from irrigation with TWW.

Significance – this impact is potentially significant in light of the shallow groundwater levels and trans-boundary nature of water resources in the area. Any TWW discharges must respect international agreements. Treatment units must be appropriately lined and appropriate emergency response capacity and procedures put in place in the event of treatment plant malfunction. Water and sludge reuse/disposal must also conform to standards, with proper irrigation/soil management. Incentives for tankers to conform to regulations and reductions in the burden of septage transport on households will bring about an improvement in the regional environment.

10) **Odors**

Scope – odors in and around households will be reduced as a result of less cesspit overflows and improved tanker regulation. The receiving facilities and front-end units of the WWTP however often give rise to odors that can be offensive to local farmers and military personnel, possibly affecting residential areas further away.

Significance – this impact is potentially significant unless the WWTP is conservatively designed and/or able to buffer variable influent loadings. Odor control will also be incorporated into the design at points in the treatment system as appropriate. Trans-boundary impacts are not expected to be significant in light of the generally calm, southwesterly winds in the area.

11) **Risks to the WWTP and its operation**

Scope – the facilities built can potentially be themselves at risk from flooding, geo-technical stability and earthquakes. Power failures and influent shocks (quality and/or quantity) can also jeopardize the treatment process resulting in foul odors and failure to meet effluent standards. Being in a border / militarized zone also has special considerations.

Significance – such risks are potentially significant if appropriately designed internal drainage and external flood protection precautions are not built into design, careful investigation and the geo-technical and seismic conditions are not accounted for during the civil design. In addition, standby power generators and operational flexibility / adaptability of the treatment trains will minimize the risks of prolonged malfunctions. Cooperation with the military in respect of access permits and mitigating any possible/unforeseen restrictions must also be carefully planned for.

DESCRIPTION OF HOW THE ANALYSIS WILL BE CONDUCTED

The EA team will visit the preferred candidate sites in North Shouneh and collect baseline data including population and economic activities, septage generation and collection (part of feasibility study), important recreational, cultural and historic areas, topography, hydrogeology, climate, biodiversity (fauna, flora, avifauna) and ecosystem as relevant to the defined study area and potential impacts outlined above). To the extent possible, we will seek these data from primary sources. For example, we will communicate with WAJ directly to obtain data that will help us describe the site's hydro-geological situation. Other deliverables under the "Small Communities Project" will provide valuable information and clarifications to the EA including the report "Institutional and Legal Policy Review" (submitted) and the feasibility study (pending). The project activities, their impacts and specific mitigations will be summarized in tabular format along with the necessary monitoring requirements, indicating the roles and responsibilities for implementing the mitigations/monitoring etc. This environmental management and monitoring plan (EMMP) will be practical and will need to be periodically reviewed and updated during the lifetime of the project. As such, it will serve as the cornerstone for ensuring

the implementation of the EA recommendations and any adjustments where and when deemed necessary in the future.

VARIATIONS IN THE FORMAT OF THE EA

The format of the EA will be based on USAID regulation CFR 216 and the Government of Jordan's draft EIA guidelines without any significant variations.

SCHEDULE OF PLANNING AND DECISION MAKING

Early February	Scoping briefs prepared by the Project Team and reviewed by USAID for distribution prior to the scoping session
End of February	Public Scoping Session carried out
Early March	Draft Scoping Statement submitted to USAID and forward to the MOE and other relevant institutions for their feedback
Mid June	Final Scoping Statement Submitted
Early July	Draft EA submitted to USAID and forwarded to the MOE and other relevant institutions for their feedback. A public presentation of the draft findings will also be carried out at the community during this period to obtain any other feedback. The feedback period will be limited to 3 weeks.
End of July	Final EA submitted and approved within 2 weeks of submission

DISCIPLINES THAT WILL PARTICIPATE IN THE ANALYSIS

ECODIT, IRG and MWHAJ have mobilized a multi-disciplinary team of core specialists with significant EA experience in Jordan and internationally to conduct the EA and produce the EA report, under the direction of Mr. Bob Katz, the Chief of Party on the Small Communities Project. The team leader for this task will be Mr. Karim El-Jisr. The table below presents the core assessment team including degrees, qualifications and proposed position.

Name	Proposed Position	Qualifications	Years Experience
Nazih Bandak	Quality Control, Health/Safety & Emergency Specialist	MSc Environmental Engineering BSc Civil Engineering	20
Karim El-Jisr	EIA Team Leader	MSc Environment BE Agricultural Engineering	7
Zuhair El Amir	Fauna Specialist	PhD, MS, BSc Zoology	20
Ahmad Abu Hijleh	Hydro-geologist	MSc, BSc Geology & Water Resources	18
Ibrahim Al Khader	Flora & Biodiversity Specialist	MSc Plant Taxonomy BSc Biological Sciences	8
Sherif Al Ibour	Avifauna Specialist	BSc Biological Sciences	5
Osama Abu Rayyan	Project Technical Coordinator and Economist	MSc Environmental Economics BSc Resource Conservation	8

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وزارة المياه والري
سلطة المياه
Ministry of Water & Irrigation
Water Authority
The Hashemite Kingdom
Of Jordan

Ref. WA/7/2/ 13198 Date 27/8/2005 التاريخ الرقم

Ms. Anne Aarnes
Mission Director
United States Agency for International Development
American Embassy
Amman,
Fax No. 5920143

Project: Wastewater Treatment Facilities for Small Communities in Jordan
Subject; WWTP site at North Shouneh

Dear Ms. Aarnes,

Reffering to the recommended WWTP site for North Shouneh.

Please be informed that the inter- ministerial committee has studied the recommended site at North Shouneh (site no. 1) and found it suitable. Therefore, WAJ has no objection to the recommended site which located on a Governmental JVA owned property, approximately 5-km south west of the North Shouneh center and about (100m) from Jordan River. The consultant is requested to provide WAJ with the necessary data to proceed with the land allocation as soon as possible.

Regards,

Eng. Munther Khleifat
Secretary General / WAJ

Cc: Deputy Secretary General
Cc: Assistant Wastewater Affairs/Studies Department
Cc: Consultant ECODIT FAX: 5682285

هاتف ٥٦٨٠١٠٠ - ٥٦٨٣١٠٠ فاكس ٥٦٧٩١٤٣ ص.ب ٢٤١٢ عمان ١١١٨٣ الأردن أو ص.ب ٥٠١٢ عمان ١١١٨١ الأردن
Tel. 5680100 - 5683100 Fax. 5679143 P.O.Box 2412 Amman 11183 Jordan Or P.O.Box 5012 Amman 11181 Jordan

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1. HIGHLIGHTS FROM THE WORKSHOP ON THE DRAFT FEASIBILITY STUDY, DRAFT EA AND DRAFT INSTITUTIONAL & COST RECOVERY REPORTS' KEY FINDINGS

Tuesday August 30 (North Shouneh), 2005

1.1 Workshop on Draft FS, EIA findings and introduction to I&CR work at North Shouneh - Administrative Governor

54 Attendees - Various ministries, local members of the public, NGO's etc. Full List Attached.

- Few suggestions to hand over the WWTP to Joint Services Council, but JSCs are legally established under the Ministry of Municipalities and charged with solid waste management only (not water or sanitation). Towards the end of the discussion most participants converged on the option of charging the Municipality with the responsibility for plant management and O&M. The Municipality would require Technical Support / Supervision from WAJ.
- Some raised important concerns about what would happen if the Municipality failed - how would the situation be rectified. WAJ started responding in terms of monitoring and enforcement, eventually taking back control of the WWTP if municipality consistently failed.
- Mayor and others confirmed most of the findings from previous meetings meeting with Pat Bakir in relation to why Municipal management and O&M would be the best option. (These conclusions are documented in the I&CR Report.)
- Audience aware that tanker costs would be significantly less than the current minimal cost of 25 JD to dump at the Tell Al-Mantah WWTP. Nonetheless, some participants were skeptical that the poorest could afford to pay and encouraged the team to put in place cross-subsidies in favor of the poorest. It was not clear, though, how this would be done (see bullet after next).
- Discussion with a Tanker Driver after the workshop revealed he thinks the cost will be 10 - 12 JD for his 12 m3 tanker - more than willing to give 1 JD of this to the WWTP.
- Many suggested getting a Tanker (or more) for the Municipality to service the poorest / possible keep costs down (the Municipality already asked for 5 tankers from the government to alleviate existing problems, but does not expect this request to be granted) - USAID/WAJ expressed valid concerns after the workshop that such a tanker could easily become a political tool for a future Mayor (favoritism), and is an option that should be avoided unless concerns can be avoided.
- Some audience members supported the idea expressed by the ex-Joint Service Council member of a monthly tanker fee that varies with truck capacity (e.g., 20 JD for 8m3, 25 JD for 10 m3, etc.) in addition to an equally variable tipping fee as a good way to recover costs.

- Suggestion to involve future WWTP technicians/workers during construction as means for them to learn about the plant and help guarantee their commitments in the long run
- Currently Mutasarif holds a guarantee from all Tankers to ensure no illegal discharges
- Requests similar to Shobak about trying our best to phase in construction in order to provide some temporary solution as soon as possible.
- Hamamreh, a village where residents claimed several hundred people live (Al Madraseh according to GIS / MWI maps, with no record of population, probably around 10 to 20 households) - within 1 km (resident claimed several hundred meters) to the South East of the site, not picked up on during the EIA. Very concerned about odors - their representative did not attend previous workshops. Has some faith in the technical and EMMP safeguards against odors but wants some sort of long-term guarantees that odors will not affect his community, and what would happen if they did. Note: Possible compensation for Hamamreh residents could be free septage disposal or free reuse water. Joseph made clear that he, and more generally the local community, has the responsibility to ensure the WWTP is operated properly (e.g., the influent does not exceed the plant capacity) and hold the municipality responsible. One suggestion from audience was to allow this particular community to get septage pumped for free (regardless of odors).
- Some participants wondered if water reuse, and more generally wastewater treatment and reuse in North Shouneh, would not generate a bad reputation for the area. The team explained that most water would be reuse onsite or offsite in a controlled manner. Participants understood this but still think reputation will be tainted and are worried. Concern about effluent reuse in the winter and the need for winter effluent storage.
- There was a discussion of the Municipality's cost sharing: access roads to the plant, storage reservoir, etc.
- Recommendation and agreement to have a tour of a few treatment plants in the Kingdom so participants could observe operations and find out more about smells - WAJ suggested that community pick the WWTPs to be visited to ensure randomness.

كشف بأسماء المشاركين في جلسة تقييم الاثر البيئي

الشونة 30\8\2005

الرقم	الاسم	الجهة	الهاتف	التوقيع
١	[illegible]	[illegible]	5355000/[illegible]	
٢	[illegible]	[illegible]	0799[illegible]	
٣	[illegible]	[illegible]	0799[illegible]	
٤	[illegible]	[illegible]	[illegible]	
٥	[illegible]	سلطة المياه	[illegible]	
٦	م. اياد [illegible]	سلطة المياه	079/[illegible]	
٧	م. حاتم [illegible]	الجمعية الملكية لحماية الطبيعة	079/014[illegible]	
٨	كامل [illegible]	[illegible]	079/[illegible]	
٩	[illegible]	مركز [illegible]	079/[illegible]	
١٠	[illegible]	مزارع		
١١	[illegible]	مزارع	[illegible]	
١٢	[illegible]	[illegible]	[illegible]	
١٣	[illegible]		[illegible]	
١٤	[illegible]	مزارع	079[illegible]	
١٥	[illegible]	مزارع	[illegible]	
١٦	[illegible]	[illegible]	6508119	

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كشف بأسماء المشاركين في جلسة تقييم الاثر البيئي

الشونة 30\8\2005

الرقم	الاسم	الجهة	الهاتف	التوقيع
١٧	شريف محمد محمود	مركز الحسين للسرطان		
١٨	عمر [illegible] محمد ابو [illegible]	الموئل الشمالي		
١٩	د. [illegible]	[illegible]		
٢٠	م. عبير البلاونة	المركز الوطني للبحوث الزراعية		
٢١	م. محمد عابدين	=	"	
٢٢	م. سعيد [illegible]	المركز الوطني للبحوث الزراعية	٠٩٥١٧٠	
٢٣	د. محمد [illegible]	المركز الوطني للبحوث الزراعية [illegible]	٠٦٤٧٢٠٥٧١	
٢٤	[illegible]	[illegible]	٦٥١٠٧٠٤	
٢٥	ابو الهدى حسن شكوا	وزارة الصحة [illegible]	٦٥٥٠٢٦٠	
٢٦	م. صالح ملكاوي	سلطة البيئة	٠٦/٥٦٨٦٩٥٠	صالح
٢٧	[illegible]	الحسين	٠٧٧٧٢٢١٠٥٨	
٢٨	راضي احمد ابو [illegible]	عميد متقاعد	٠٧٧٧٤٦٢٩٠٤	
٢٩	م. جهاد الجالودي	سلطة البيئة	٠٧٧٧٤٨٠٢٩٣	
٣٠	م. عاصم بطاينة	سلطة البيئة	[illegible]	
٣١	م. حسام الخطيب	سلطة البيئة	٠٧٧٧٤٨٨٦٣٦	
٣٢	[illegible]	الوكالة الامريكية للانماء الدولي	٠٧٩/٦٥٦٢٦٥٧	

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كشف بأسماء المشاركين في جلسة تقييم الاثر البيئي

الشونة 2005\8\30

الرقم	الاسم	الجهة	الهاتف	التوقيع
٣٩	محمد خير عباينه	سلطة مياه	٠٧٧٧٢٤٦١١١	
٣٤	مازن سموه	مديرية البلديات	٠٧٧٧٢٤٣٣٠٠	
٤٠	حسن حسانه	مديرية البلديات	٠٧٧٢٢٩٤٤٩	
٤١	محمود فؤاد العمار	سلطة وادي الاردن	٠٧/٥٢٠٢٩٢٧	
٤٢	عمار عبيدات	سلطة وادي الاردن	٠٧٩٥٢٠٢٩٧٢	
٤٣	م. احمد نايف	مديرية البلديات	٠٧٩٥٩٨٦٣٠١	
٤٤	السيد عبد الله	امانة عمان الكبرى	٠٧٧٧٨١٥٠١٤	
٤٥	صافي محمد سليم الحمزي	مديرية الاوقاف	٠٧٧٧/٢٥١٩٩٩	
٤٦	قاسم ابو سيف	مواطن / خاص	٦٥٥٠٠٢٧	
٤٧	رضية كرابسه	مدير آثار محافظة اربد	٧٢٧٧٠٦٦	
٤٨	نضال العدواني	مدير آثار سوق الزرقاء	٠٤٦٥٦٠٨٤٩	
٤٩	عبد العزيز العرادي	مدير مياه لواء الاغوار الشمالية	٠٢٦٥٥٠٦٩٥	
٥٠	محمود خليل ابراهيم برهومة	مختار عشيرة ابو برهومة	٦٥٨٠٢٢٢	
٥١	عبد الرحمن زيت الكرمل	مدير مديرية زيت الكرمل	٠٧/٥١٢٢٧٣	
٥٢	[illegible]	مختار [illegible]	٠٧٩١٠٠٢٦١٠	
٥٣	[illegible]	[illegible]	٠٧٧/[illegible]	

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كشف بأسماء المشاركين في جلسة تقييم الاثر البيئي

الشونة 30\8\2005

الرقم	الاسم	الجهة	الهاتف	التوقيع
٥	ماجد نواف عبد اللطيف العنزي	محمية الشونة	٦٥٨٠٤١٦	

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Abu Rayyan

Sabella, Ramzi (JORDAN/WRE) [rsabella@usaid.gov]
Monday, September 19, 2005 10:25 AM
Osama Abu Rayyan; Joseph Karam
FW: Barney Popkin's comments, draft EA, WWTF for Small Communities in Jordan, Task 3, No. Shouneh

a d Osama:

have a look at the emails from Dr. Hijazi and Barney and let me
at you can do.

gards,

riginal Message-----
ijazi, amal (JORDAN/WRE)
Monday, September 19, 2005 11:20 AM
bella, Ramzi (JORDAN/WRE)
: RE: Barney Popkin's comments, draft EA, WWTF for Small
ties in Jordan, Task 3, No. Shouneh

make sure if possible that the project team try to respond ASAP
ey and cc us so that we can send Barney the revised document in
order him to give us the EA approval prior to his departure. As you
will be all down at the dead sea Wed and Thursday, if the
team can pull an answer by tomorrow COB and you give them
s e-mail, then maybe he can finish the review prior to his
re.

iginal Message-----
arney Popkin [mailto:bppopkin@yahoo.com]
onday, September 19, 2005 11:14 AM
azi, amal (JORDAN/WRE); Sabella, Ramzi (JORDAN/WRE); Popkin,
AM /TS)
: arney Popkin's comments, draft EA, WWTF for Small Communities
an, Task 3, No. Shouneh

l nd Ramzi,

e my few comments on the draft "Environmental
ent, Wastewater Treatment Facilities for Small
ities in Jordan, Task 3, No. Shouneh, August
addition to Amal's review comments. I am
eased to see this program.

ch a copy of the BEO-approved scoping statement
ppendix for completeness.

s soil erosion control and dust control more
y.

water Odors, ugh - An early doss of chlorine
ewater infulent often reduces odors
ally; another but costly approach is to
enclose and double-door the treatment
s as was done in the San Francisco Oceanside
at expense. Oxygenation is effective in
ation, but doesn't seem to do much on odor
For human health and safety purposes,
ous chlorine is effective, but a sodium or
chlorine solution is preferred.

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167

بسم الله الرحمن الرحيم

THE HASHEMITE KINGDOM OF JORDAN

Ministry of Environment

AMMAN

المملكة الأردنية الهاشمية

وزارة البيئة

عمان

Ref. 1-5-3770

Date 29-9-2005

الرقم

التاريخ

الموافق

Mr. Roy R. Ventura, Jr.
Acting Director Water Resources
and Environment Office
USAID – Amman

Subject: Comments on the Environmental Assessment Report for the Small Communities Waste Water Treatment Plants Project at North Shouneh

Dear Sir,

With reference to your letter dated on 25 August 2005, along with the copies of the report regarding the above mentioned subject, please find attached our comments on the said report.
We will be waiting for your responses on our comments for further steps.
Thank you for your continuous collaboration.

Sincerely yours

Khaled Irani

Minister of Environment

Attention:-

- Mr. Bob Katz
- Mr. Osama Abu Rayyan.

هاتف ٥٥٦٠١١٢ - فاكس ٥٥٦٠٢٨٨ - ص.ب ١٤٠٨ عمان - ١١٩٤١ - الأردن

Tel. 5560112 - Fax 5560288 - P.O. Box 1408 Amman - 11941 - Jordan

E-mail: moenv@moenv.gov.jo

Web site: www.moenv.gov.jo

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Comments on the EIA report of the proposed wastewater treatment plant in North Shouneh

1. For the treatment scheme shown in Figure 5 page 16, I will suggest placing the denitrification reactors immediately after the Recirculating Sand Filters (RSF) for two reasons: the first is that when the denitrification reactors are placed after the RSFs, all the influent to the denitrification reactors will have been nitrified in the RSFs and in the facultative lagoons, which will result in a higher nitrogen removal, while at the current location only part of the influent to the denitrification reactors has been nitrified, the other part that comes from the anaerobic lagoon has not. The second reason is that placing the denitrification unit after the RSFs eliminates the need for pumping the wastewater back to the denitrification reactors which should result in a considerable reduction in the operation cost. However, there may be a need to recycle part of the effluent from the facultative lagoons back to the inlet of the facultative lagoons to improve their nitrification ability.
2. As some shallow springs are downstream of the proposed treatment plant, a disinfection step that brings total and fecal coliform counts to levels where the water can be used for groundwater recharge is necessary to protect groundwater from biological contamination.
3. The statement at the bottom of page 14 which describes the difference between alternatives one and two in terms of their efficiency in nitrogen removal is not really clear. Indeed the statement says that both systems are expected to reduce nitrogen concentration to 45 mg/l as nitrate which is equivalent to about 10 mg/l as nitrogen.
4. The per capita domestic water use which is the basis for estimating wastewater flow looks very low. Table 11 shows that the projected population of MBJ town in the year 2,028 which is the design year is 46,267 capita. By dividing the design wastewater flow of 1,200 m^3/d on the projected population assuming that 80 % of the water used for domestic purposes goes to the septic tank, it is found that the assumed per capita domestic water use is 32.4 l/d for the year 2028 which very low. Even if the current population (2004) is considered and by doing the same calculation, the per capita use for the year 2004 is 49.4 l/d which is also low. The report states that surrounding small communities other than MBJ may dispose their wastewater into this treatment plant which should make the design

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flow even larger. I think that the basis for calculating the design flow should be checked.

5. The captions of Figures 9 and 10 are separated from the Figures which creates some confusion.
6. Figures 13, 14, and 15 are missing from Appendix A.
7. An influent design criteria of BOD = 1850 mg/L for septage might be very low, the real value might be so higher.
8. It is mentioned that the plant will include two constructed wetlands. Some times this unit is not mentioned.
9. Appendix A is blank.
10. Sludge processing and treatment must be considered in details. Drying in beds is not a treatment and it will be problematic in terms of odor, insect breeding and final usage or disposal. Suitable approach for sludge treatment must be considered.
11. It is mentioned that BOD loading in the anaerobic lagoons will be less than 300 g/m^3. This is not understood.
12. Noting is mentioned about the methodology or technology that will be used to treat odors and gaseous pollutants.
13. Legal and institutional framework has to be revised.
14. Source of fig. (11) is Metcalf & Eddy, 1999. Does Metcalf & Eddy give the Jordanian map? Isn't there any official reference institution for such a map?
15. There were no any base line studies for the existing environment.
16. There was no any quantitative assessment for different environmental impacts.
17. The possibility of flood of Jordan River during winter time should be considered. The proposed site is only 50 m away from the river.
18. The odor caused by sewage loading tankers while traveling on the roads should be considered and mitigated.

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1. CONSULTANT RESPONSES TO COMMENT RECEIVED FROM USAID AND THE MOE ON THE NORTH SHOUNEH WWT&R PROJECT DRAFT EA

1.1 Comments received from USAID in an email dated 19th September, 2005

1. *"Attach a copy of the BEO-approved scoping statement as an appendix for completeness."*

   Response:
   - A copy of the BEO-approved scoping statement has been attached as in Appendix H to the Final EA

2. *"Address soil erosion control and dust control more explicitly."*

   Response:
   - We have explicitly mentioned soil erosion as a potential impact under the heading "Change in local hydrology,..." during construction, and will add Erosion to the "Flooding" heading under operations "Risks to the WWTP structures" and the site. Additional mitigation measures pertaining to soil erosion now include slope stabilization with planting and compaction of any non-structural fill to prevent erosion, in addition to the hydrological mitigation measures already included in the report. Dust control has been made more explicit under Air quality during construction and specifically addressed during operations (under Health and Safety) through ensuring that all internal routes are graded and maintained including roadside drainage ditches. The EA also encourages paving and maintaining external access routes.

3. *"Wastewater Odors - An early doss of chlorine to the wastewater influent often reduces odors considerably; another but costly approach is to entirely enclose and double-door the treatment facilities as was done in the San Francisco Oceanside WWTP at great expense. Oxygenation is effective in biodegradation, but doesn't seem to do much on odor control. For human health and safety purposes, non-gaseous chlorine is effective, but a sodium or calcium chlorine solution is preferred."*

   Response:
   - Our project team places mitigation of potential odor impacts as a top priority. The design team has gone to great lengths to ensure the WWTP is designed conservatively to minimize and eventually eliminate odor problems. Covering potential odor generating units, though normally not required with such conservative designs, are nonetheless added at a calculated reasonable cost. As indicated in the comment above, covering the entire plant would be at an additional, probably unreasonable cost in relation to what is already proposed. Our detailed design engineers are also looking at odor control at other points in the WWTP (e.g., receiving station, sludge transfer) and will propose such additional mitigation measures if they see the need to and in consultation with WAJ. Chlorination of the influent has been considered, but not opted for as it would detrimentally affect the microbial populations essential for such "natural" treatment processes, thereby jeopardizing the treatment efficiency. Chlorination also would not facilitate water reuse in irrigation. Finally chlorination is not deemed necessary, as the overall hydraulic residence time is long enough to ensure that fecal coliforms and E-coli will be within standards.

4. *"Disinfection of treated wastewater - If disinfection of treated wastewater to reduce the concentration micro-organisms in the effluent is envisioned (which may be unnecessary for exclusively irrigation use) again, ANE BEO is encouraging chlorine liquid solutions rather than gaseous chlorine for human health and safety reasons. If the disinfected effluent will be discharged to where there is aquatic life, it should be de-chlorinated after disinfection has been effected because many aquatic life forms are stressed if not killed by chlorine."*

Response:

- Since the submittal of the Draft EA and in response to JVA's expressed desire to avoid any potential discharges to the Wadi during times when full reuse is not possible, we have had further discussions with the JVA, several local farmers, the local MoA's irrigation sites director and the Municipality and we have been able to assure full reuse of the TWW. This development allowed the project to withdraw all discharge to Wadi contingency-related measures presented in the 1st Draft EA. Accordingly, the design of the WWT&R project has been modified to meet a lower effluent standard (Class B Reuse instead of Discharge to Wadis). Chlorination of effluents will no longer be a potential issue, as all of the effluents will be used in irrigation. The version of the Draft EA (2nd Draft) that was subsequently submitted to the MoE (15 copies) upon the request of USAID included these changes.

5. ***"Attach documentation to demonstrate Jordanian government, ministries, local government, communities, and other stakeholder input to the process, as such input and communications is important to the 22 CFR 216 process."***

Response:

- We have attached in Appendix H of the final report: a) the scoping session workshop report (Arabic & English) with participant registration sheets and previous scoping brief, b) a copy of the MoE and its 15 member inter-ministerial committee feedback on the scoping statement, c) a copy of the inter-ministerial site selection committee's site approval that visited the candidate sites and concurred with the project team's and local stakeholders' preferred site (among the five candidates). We have also attached d) a short report on stakeholder feedback on the draft EA and d) the MoE's feedback on the Draft EA among other documentation supporting the extensive stakeholder involvement and relevant approvals.

1.2 Comments received on the 12th of October from the Ministry of Environment in their letter to USAID dated 9th September, 2005

1. *"For the treatment scheme shown on Figure 5 page 16, I will suggest placing the denitrification reactors immediately after the Recalculating Sand Filters (RSF) for two reasons: the first is that when the denitrification reactors are placed after the RSFs, all the influent to the denitrification reactors will have been nitrified in the RSFs and the facultative lagoons, which will result in a higher nitrogen removal, while at the current location only part of the influent to the denitrification reactors has been nitrified the other part that comes from the anaerobic lagoon has not. The second reason in that placing the denitrification unit after the RSFs eliminates the need for pumping the wastewater back to the denitrification reactors, which should result in a considerable reduction in the operation cost. However, there may be a need to recycle part of the effluent from the facultative lagoons back to the inlet of the facultative lagoons to improve their nitrification ability"*

   Response:
   - We cannot place the denitrification reactor after the RSF, because we need the carbon content found in the settled, relatively untreated septage from the anaerobic basins. If the unit were located after the RSF, then all of the wastewater would need to be pumped back to the front of the WWTP for full treatment. Like in Biological Nutrient Removal Plants (BNR), there are alternatives, and nitrate recycle is sometimes pumped back to the head of the plant. With low strength wastewater, methanol is sometimes dosed to provide appropriate conditions for denitrification to proceed. The proposed location of the denitrification reactors is the most efficient location for obtaining the appropriate C:N ratios for denitrification.

2. *"As some shallow springs are downstream of the proposed treatment plant, a disinfection step that brings total fecal coliform counts to level where the water can be used for groundwater recharge is necessary to protect groundwater from biological contamination."*

   Response:
   - Pathogens will be reduced well below the required regulatory limits (JS 893 2002) for the proposed wastewater use as the WWTP design includes very conservative hydraulic retention times (HRT) in all units of 43 days. If however, sometimes in the future, aquifer recharge is to be considered, then we could add a chemical or UV disinfection unit. Until now, the proposed design includes adding provision for the addition of such a unit in the future by WAJ if needed. We will put this question to WAJ and they should tell us what preference they have, and we will provide electrical connections for a UV (if UV is selected), or chlorine disinfection (if chlorine is desired) now or for the future.

3. *"The statement at the bottom of page 14 which describes the difference between alternatives one and two in terms of their efficiency in nitrogen removal is not really clear. Indeed the statement says both systems are expected to reduce nitrogen concentration to 45mg/l as nitrate which is equivalent to about 10 mg/l as nitrogen"*

   Response:
   - This paragraph has been made more clear by changing it to the following:
     - Alternatives 1 & 2 use the same design concept with the exception that Alternative 2 will meet the current standard of 10 mg/l of nitrate in the form of nitrogen (N) - which is equivalent to 45 mg/l nitrate in the form of nitrate (NO_3^-) -- whereas Alternative 1 will meet a less stringent standard of 45 mg/l of nitrate in the form of nitrogen. The same applies to Alternatives 3 & 4, with Alternative 4 being designed to meet the current, more stringent nitrate standard and Alternative 3 meeting the less stringent standard.

4. *"The per capita domestic waster use which is the basis for estimating wastewater flow looks very low. Table 11 shows that the projected population of MBJ town in the year 2028 which is the design year is 46,267 capita. By dividing the design wastewater flow of 1,200 m3/d on the projected population assuming that 80% of the water used for domestic purposes goes to the septic tank, it is found that the assumed per capita domestic water use id 32.4l/d for the year 2028 which very low. Even if the current population (2004) is considered and by doing the same calculation, the per capita use for the year 2004 is 49.4 l/d which is very low. The report states that surrounding small communities other than MBJ may dispose their wastewater into this treatment plant, which should make the design, flow even larger. I think that the basis for calculating the design flow should be checked."*

Response:

- Initial project studies determined that water consumption does not directly correlate to septage generation (pumping requirements) as it does to sewered flows. Whereas 80% of water consumption is useful for estimating sewered flow rates, and possibly for estimating the quantities entering a cesspit, the quantity being pumped from a cesspit are significantly lower (due to infiltration, differing wastewater habits of households with cesspits that are costly to empty – e.g. divert a lot of washing water to the garden, - etc.). Often, more relevant factors influencing septage generation include:
    - Size and construction of the cesspit;
    - Geo-technical characteristics;
    - Age and condition of the cesspit;
    - Household size;
    - Extent of drinking water use for purposes of small-scale, garden irrigation; and
    - Diligence of cesspit owners in scheduling their pumping.
- Since none of these factors are amenable to practical data gathering, evaluation and analysis, the study methodology employed tanker surveys and actual septage pumping reports from households to estimate the quantities of septage that would be generated in the prospective service areas. Additional details on the methodology employed are available in the Final Feasibility Study submitted to WAJ and USAID.
- The WWTP design is also amenable to a future upgrade if needed to accommodate unexpected changes in future flow rates.

5. *"The captions of Figures9 and 10 are separated from the Figures which creates some confusion."*

Response:

- This has been rectified and the captions (references) to the figures in the text have been placed immediately preceding the figures themselves.

6. *"Figures 13, 14 and 15 are missing from Appendix A"*

Response:

- This has been rectified.

7. *"An influent design criteria of BOD = 1850 mg/L for septage might be very low, the real value might be higher."*

Response:

- We used 45 samples taken from cesspits and from septage tankers from this and other projects. Also analyzed were data reported from another 29 sample results from other projects and WAJ data. The average for all of these 45 data points was 1,170 mg/l. We based our design value of

1,850 mg/l BOD on the average of 22 data points where the BOD concentrations were higher than the mode. Thus our criteria is again conservative.

- WAJ reports average septage concentrations of 1,600 mg/l BOD at Ain Ghazal. 2,000 mg/l was used for the design of Al Akayder Septage-based WWTP, where they assumed that around 20% of all septage brought in by tankers is greater than 1,500 mg/l. We believe that 1,850 mg/l is very close to the WAJ endorsed Akayder value; in addition, we are treating septage from a rural community, with very few, if any, major strong septage contributors.
- The proposed WWTP design also contains sufficient buffering / equalization capacity throughout the system, and especially in the front-end units, such that a few tankers with BOD concentrations much higher than the average, can be handled without disruption to the treatment process, especially when most tankers bring in septage that is lower than the average.

8. ***"It is mentioned that the plant will include two constructed wetlands. Some times this unit is not mentioned."***

Response:

- This has been rectified.

9. ***"Appendix A is blank"***

Response:

- This has been rectified.

10. ***"Sludge in beds is not a treatment and it will be problematic in terms of odor, insect breeding and final usage or disposal. Suitable approach for sludge treatment must be considered."***

Response:

- The sludge entering the drying beds will be stable as the original source comes from cesspits and since additional digestion time is provided under anaerobic conditions prior to transfer to the drying beds to ensure it will be stable. Odors will therefore be minimized.
- JS 1145/1996 recognizes Air Drying (i.e. drying beds) as a form of First Level treatment.
- We will also included space for composting on-site (e.g., by windrow) after drying - which according to JS 1145/1996, takes it to the Second Treatment Level.
- The project is planning to bring in a sludge treatment specialist to help design the precise treatment and application system during the first year of operations. Sampling and analysis will also be carried out in addition to consultations with the relevant authorities on the proposed treatment and application / disposal methods.
- It is also our understanding also that Jordanian Standards are currently being revised. The revisions will be taken into account during the detailed design of the sludge treatment and application system.

11. ***"It is mentioned that BOD loading in the anaerobic lagoons will be less than 300 g/m3. This is not understood"***

Response:

- This has been explained further in the text as:
    - The volumetric BOD loading (mass of BOD per anaerobic volume per day) is the basis for anaerobic lagoon/basin designs. In other words, the influent BOD loading of 2,220 kg/day is used to obtain the required volume of the anaerobic reactors. International literature on WWTP designs recommend specific values based on design temperatures and that the BOD loading should be limited to 300 mg/m3 in order to minimize odor potential and for more consistent organic degradation.

12. *"Nothing is mentioned about the methodology or technology that will be used to treat odors and gaseous pollutants."*

Response:

- These will be simple technology and are being developed as part of the detailed design in consultation with WAJ.

13. *"Legal and institutional framework has to be revised"*

Response:

- It is not clear what is exactly required here.

14. *"Source of Fig (11) is Metcalf and Eddy, 1999. Does Metcalf & Eddy give the Jordanian map? Isn't there any official reference institution for such a map"*

Response:

- Metcalf & Eddie do not provide a reference for the map used.

15. *"There were not any base line studies for the existing environment."*

Response:

- The baseline studies included a review of available data and literature relevant to the impacted areas (mostly localized when dealing with the negative impacts) and was based on site visits by recognized experts as originally proposed in the Scoping Statement. Gathering of original data was and is not deemed necessary as part of the Impact Assessment stage, but is recommended for specific impacts and baseline monitoring as part of implementing the Environmental Management and Monitoring Plan.

16. *"There was no any quantitative assessment for different environmental impacts"*

Response:

- A quantitative assessment of impacts was not deemed necessary for making the assessments (relative to the existing situation) and proposing the mitigations (that are on the safe-side) presented in the report. Furthermore, localized data (e.g. groundwater or air quality) is not available to allow such an assessment.

7. *"The possibility of flood of Jordan River during winter time should be considered. The proposed site if only 50m away from the river."*

Response:

- Section 5.2.d. of the EA report states: "Flooding from nearby rivers and wadis is not expected to be a problem as the site is 5 meters higher in elevation". We will add to this statement that "... the site is 5 meters higher in elevation at its lowest points, with most of the site being at least 10 meters higher in elevation."

8. *"The odor caused by sewage loading tankers while traveling on the roads should be considered and mitigated."*

Response:

- Tankers are vacuum tankers with closed valves. This prevents emission of odors from them while traveling. Licensing and inspection by WAJ and the Traffic Department ensures that all tankers meet required specifications.

بسم الله الرحمن الرحيم

THE HASHEMITE KINGDOM OF JORDAN

Ministry of Environment

AMMAN

المملكة الأردنية الهاشمية

وزارة البيئة

عمان

Ref: 1/1/4309

Date: 17/11/2005

الرقم :

التاريخ :

الموافق :

Mr. James Franckiewicz
Director, Office of Water Resources
& Environment
USAID

Subject: The Small Communities Wastewater Treatment Plants project at North Shounch.

Dear Mr. Franckiewicz,

In reference to your letter dated 30 Oct 2005 regarding the above mentioned subject, we would like to inform you that we agree on the related draft EA document. However, the draft EA document should be read together with your attached response to the National EIA Committee's comments.

Sincerely,

Khaled Anis Irani

Minister of Environment

CC: EIA Director

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