



Belgische Technische Coöperatie nv
Coopération Technique Belge sa

The Palestinian National Authority and the Kingdom of Belgium

**CONSTRUCTION OF AN APPROPRIATE LOW COST
TECHNOLOGY WASTE WATER TREATMENT PLANT IN
ARTAS**

Formulation Report, February 2003

DGDC IN	18449/02
BTC Project number	PZA/02/009/01
Implementing agency	Ministry of Local Government (MoLG)
Estimated starting date	July 2003
Duration of the project	20 months
Total cost of the project	507,910 EUR
Belgian contribution	402,910 EUR
Sector	Water Supply and Sanitation (Code # 140)
Sub-sector	Small-scale water supply and sanitation (Code # 14030)

Brief description of the project

The aim of the project is to complete the sanitation system in the village of Artas through the implementation of a wastewater treatment plant and its sustainable management.

This objective will be achieved through:

- The construction of a low cost technology treatment plant, based on an anaerobic reactor and a biological secondary treatment in wetlands. The plant is designed for 6.000 inhabitants in order to facilitate the connection of other villages in the near future.
- The connection of at least 250 households of the centre of Artas to the plant through the construction of interceptor tanks at household level, and their connection to the existing sewage network.
- Capacity building for the Village Council responsible for operation and maintenance of the sewage network and treatment plant.
- The development of the villagers' awareness and the elaboration of a by-law authorising the Village Council to run the system with obligatory financial contributions of the users.

The MoLG, the Palestinian Water Authority, Village Council of Artas and BTC will implement the project in partnership. The Palestinian Hydrology Group will assist these partners at daily management of the project and at training levels.

The project will drain and recycle all sewage water of the village centre, and therefore contributes to: i) safeguard the horticulture development in the valley; ii) improve the health situation; iii) improve the attractiveness of the area for tourism; iv) reduce the costs of the actual evacuation of sewage; v) make the recycled water available for tree planting.

ABBREVIATIONS

BOD	Biochemical Oxygen Demand
BTC	Belgian Technical Co-operation
COD	Chemical Oxygen Demand
DGDC	(Belgian) Directorate General for Development Co-operation
EC	Executive Committee
EC	Electro-conductivity (Technical study)
EWOC	Emergency Water Operations Centre
FAO	Food and Agriculture Organisation
GDP	Gross Domestic Product
HDPE	High Density Poly-Ethylene
HRT	Hydraulic Retention Time
IDCP	Indicative Development Co-operation Programme
IDF	Israeli Defence Forces
JLCB	Joint Local Consultative Body
JWC	Joint Water Committee
JWU	Jerusalem Water Undertaking
LICP	Local Infrastructure and Capacity building Project
LRDP	Local Rural Development Policy
Mcm	Million cubic meters
MoLG	Ministry of Local Government
MoPIC	Ministry of Planning and International Co-operation
MoU	Memorandum of Understanding
NGO	Non Governmental Organisation
NIS	New Israeli Shekel
NWC	National Water Council
O & M	Operation and Maintenance
PA	Palestinian Authority
PCBS	Palestinian Central Bureau of Statistics
PHG	Palestinian Hydrology Group
PVC	Poly-Vinyl-Chloride
PWA	Palestinian Water Authority
RWU	Regional Water Utility
SC	Steering Committee
SWTP	Sewage Water Treatment Plant
TAC	Technical Advisory Committee
TS	Total Solids
TDS	Total Deposit of Solids
TSS	Total Suspended Solids
UASB	Up-flow Anaerobic Sludge Blanket
UNDP	United Nations Development Programme
USD	United States Dollar
WBWD	West Bank Water Department
WHO	World Health Organisation
WSSA	Water Supply and Sanitation Authority

Exchange rate during the mission: 1 USD = 0,94 EUR = 4,8 NIS

Exchange rate for the elaboration of the budget: 1 USD = 1 EUR = 4,8 NIS

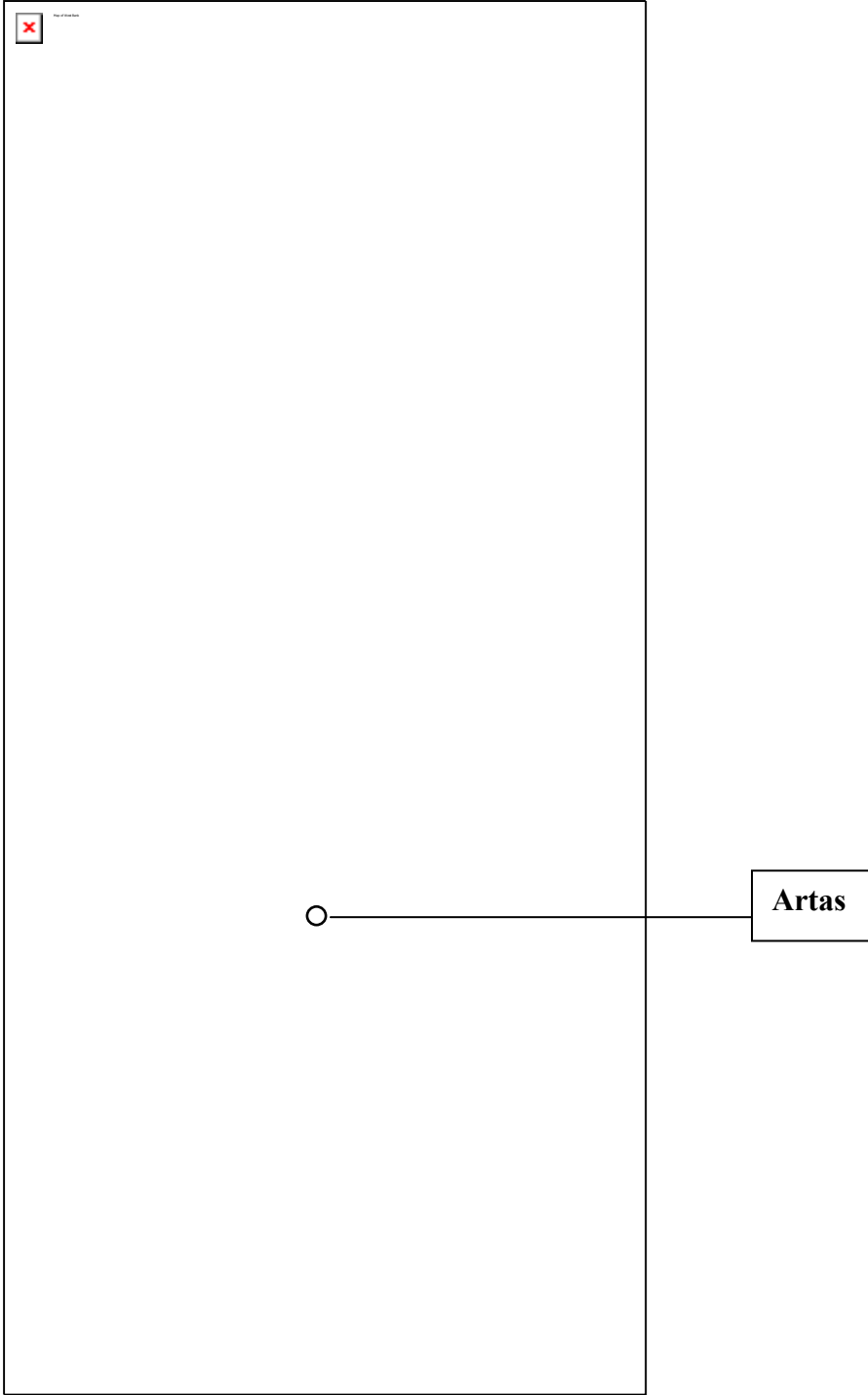
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Map of the Palestinian West Bank

Figure 1: Map of the West Bank



1. EXECUTIVE SUMMARY

Context

Since 1998, the co-operation between the Belgian Government and the Palestinian Authorities has been intensified. The actual Belgian strategy for co-operation with Palestine is formulated in the Indicative Development Co-operation Programme 2002-2006 that has been approved by both governments in November 2001.

The overall policy objectives of the Belgian development co-operation in Palestine are:

- to contribute to the establishment of strong, sustainable and well managed Palestinian Institutions and Public Services in the spirit of good governance and a viable economy for the future Palestinian State;
- to alleviate the suffering of the Palestinian People during the current crisis through the reduction of poverty and the provision of basic services and inputs.

In the framework of institutional building at local level, the IPDC has foreseen a second Belgian intervention in the sewage collection and treatment for the village of Artas with the construction of an appropriate wastewater treatment plant.

The first phase of the project was realised under the “Bethlehem 2000” programme, co-ordinated by the UNDP and financed by several donors through a basket funding. During this first phase the Belgian Government financed the rehabilitation of the Artas spring and the implementation of a sewage network.

The formulation mission for this intervention has been conducted from February 14th to 25th by engineer Stef Lambrecht and dr. Ayman Rabi.

Problem analysis

Sanitation conditions in Artas are bad due to the poor management of solid waste and the lack of treatment of the sewage water. Almost all of the 600 households are connected to a cesspit for the sewage water. Most of the pits are leaking in the ground and the overflow goes in the streets or to the land. This results in:

- Contamination of the irrigation water, being a threat for the famous vegetable gardens in the Artas valley.
- Risk for water- and sanitation-related diseases.
- Excessive costs for the households with a waterproof cesspit, as they have to empty the pit regularly.
- Limited appeal for tourists so that the attractiveness of Artas can't be valorised.

In 2001, under the lead of PHG, a Belgian funded sewage network has been built in the main streets of Artas, but there is still no treatment plant for the sewage and the households are not yet connected to the existing network. Therefore, sewage continues to infiltrate in the ground and to run in the streets. On the other hand, it is obvious that capacities of the local actors have to be improved to sustain evacuation and treatment of sewage and sound sanitation behaviour.

Logical framework

The project aims to improve living conditions in the Artas village through a sustainable sanitation and improved management capacities in the village.

Specific objective: *Build a wastewater treatment plant in Artas and ensure its sustainable operation and management.*

Results:

1. *A low cost technology wastewater treatment plant is constructed and functional in Artas.* Plant includes an aerobic treatment in UASB reactors and a further biological treatment in wetlands. Treated water will be used for tree irrigation.
2. *At least 250 households are connected to the wastewater treatment plant through the existing sewage water network.* Households with waterproof cesspits can connect directly; others have to build interceptor tanks with the support of the project.
3. *The Village Council of Artas has the capacities and the means to sustain the efficient working of the treatment plant and the sewage network.* Village Council will run the network and the plant and will be trained accordingly during the project. PWA and MoLG guarantee follow-up.
4. *The inhabitants of Artas are aware of the risks of bad sanitation and contribute to sustainable improved sanitary conditions and behaviour.* Awareness development is organised by the project. A specific by-law will be elaborated to specify the ownership and the contributions of the villagers.

Means

The overall capital cost of the project is estimated at 497,910 EUR, from which 402,910 EUR will be provided by the Belgian Government as a grant. The Palestinian financial contribution consists of:

- 35,000 USD for the purchase of 3 dunums (3,000 m²) of land for the construction of the plant, provided by the beneficiaries through the Village Council of Artas;
- an estimated 60,000 USD contribution by the households benefiting from the project for the construction of the interceptor tanks at household level and for the connection.

The in kind contribution of the Palestinian Authorities includes:

- the part-time involvement of the Project Manager, assigned by the MoLG, for an estimated time investment of 50 days;
- the participation of senior staff members of MoLG, PWA and LICP to the different meetings of the Steering and the Technical Advisory Committee for an estimated investment of 40 days.

Together with small expenses for travelling, office supplies and miscellaneous, this represents an in kind contribution of an estimated 10,000 EUR.

Technical assistance and support will be required for the smooth execution of the project and relate to:

- technical backstopping and support missions, by an international consultant;
- part-time involvement of the international construction advisor of BTC-Jerusalem;
- contracting of PHG for design, control of the works, training and overall assistance;
- contracting of local firms for the construction of the plant and interceptor tanks.

Organisational set up

A Steering Committee will be formed for the overall policy guidance and the feedback of the project.

Under its umbrella, an Executive Committee will act as the implementing body of the project. This Committee includes a Project Manager, appointed by the Ministry of Local Government and an Assistant Project Manager, appointed by BTC.

PHG will be contracted as the Assistant to the Executive Committee. It will be responsible for final technical design, the preparation of tenders and contracts, the control of civil works and training.

In order to facilitate the participation and co-ordination of all stakeholders, a Technical Advisory Committee is formed with:

- the Project Manager and the Assistant Project Manager;
- a representative, appointed by the Palestinian Water Authority;
- the Head of the Village Council of Artas;
- the LICP Project Manager and the representative of PHG will participate to the meetings, without voting power.

The TAC will give advice to the Executive Committee with respect to the work plan, the final design of the plant, the training programs proposed by PHG, the tendering documents and procedures, the bidding proposals for the civil works, the monthly reports to be prepared by PHG, the provisional and final delivery of the civil works.

The Village Council will be the owner of the plant and responsible for its operation and maintenance.

When the proposed southern water and wastewater utility in Bethlehem Governorate will be established, the management and ownership of the plant might be transferred to the RWU in accordance with the by-law that will be developed. The Artas Village Council will then be part of this utility and participate in the decision making process related to the water and wastewater sector at the Bethlehem governorate level.

Modalities

Anticipating time-consuming procedures for construction licences, the duration of the project is foreseen to be 20 months.

Contracts with PHG as the assistant for implementation and with local building contractors will be elaborated according to the EC-regulations, signed and paid by BTC as the Authorising Officer of the project, after clearance by the Project Manager appointed by MoLG.

Risks and prerequisites

The critical project-specific risks relate to an eventual continuation of the closures and further degradation of the social and economic context in the West Bank. This may hinder the smooth implementation of the works, the financial sustainability of the treatment plant and the planned extension of the sewage network to El Khader and the Solomon's Pool Resort.

Prerequisites discussed during the formulation mission relate to:

- the availability of at least 3.000 m² of appropriated land, to be purchased by the Village Council with a financial contribution of the project;
- permits and licences for the construction of the plant;
- a written agreement between the Village Council and PWA specifying conditions under which ownership of the plant will eventually be transferred to the RWU once established.

2. CONTEXT

2.1. Belgian co-operation strategy

The policy framework and institutional set up of the Belgian co-operation result from the new law on Belgian International Co-operation passed in May 25th 1999. The law stresses the concept of international co-operation and partnership aiming a sustainable human development and poverty reduction. The number of partner-countries or territories with which Belgium can have a long-standing bilateral co-operation is limited to 25, and the Palestinian Territories are one of these partner-regions.

In general, the bilateral co-operation programmes are concentrated on five sectors: public health, education and training, agriculture and food security, small-scale infrastructures, and, finally, institutional development. Three cross-sector themes are stressed in most of the programmes: gender, environment and social economy.

Since 1998, the co-operation between Belgian Government and Palestinian Authorities has been intensified. A first programme, focused on poverty alleviation in the rural areas has been adopted at the First Meeting of the Belgo – Palestinian Joint Committee in November 1998. The actual Belgian strategy for co-operation with Palestine is formulated in the Indicative Development Co-operation Programme 2002-2006 that has been approved by both governments in November 2001.

The overall policy objectives of the Belgian development co-operation in Palestine are:

- to contribute to the establishment of strong, sustainable and well managed Palestinian Institutions and Public Services in the spirit of good governance and a viable economy for the future Palestinian State;
- to alleviate the suffering of the Palestinian People during the current crisis through reduction of poverty and the provision of basic services and inputs.

The areas of co-operation in the IDCP are:

- 1° The health sector, with an emphasis on cardiology and neonatology facilities and human capacities.
- 2° The education sector, with an emphasis on schoolbooks, rehabilitation and construction of schools and the development of vocational and technical education curricula.
- 3° Institutional building at local level, through the construction of basic local infrastructures and, eventually in a second phase, through employment generation, community participation, capacity strengthening of rural municipalities and the promotion of the decentralisation process. These are key elements of this strategy.
- 4° Institutional building at the level of the Ministry of Planning and International Co-operation in order to improve the technical, organisational and management capacity and to strengthen the aid co-ordination.
- 5° The electrification of rural villages.
- 6° Scholarships in Belgium and short training programmes at local and regional institutions.

In the framework of the third area of co-operation (institutional building at local level), the IPDC states:

“A second phase of the intervention in the village of Artas could be envisaged on PA proposition with the construction of an appropriate low cost technology waste water treatment plant. This phase would complete the ongoing project.”

The first phase of the project in Artas was realised under the “Bethlehem 2000” programme, co-ordinated by the UNDP and financed by several donors through a basket funding. The

activities undertaken during this first phase and financed by the Belgian contribution of 1,350,000 EUR consisted in the rehabilitation of the “Salesian Street”, the rehabilitation of the Artas spring and the implementation of a sewage system.

2.2. Context

2.2.1. Political, social and economic context

In September 1993 Israel and the Palestine Liberation Organisation signed the Declaration of Principles (also known as the first Oslo Accords) that started a peace process between the two parties after long years of belligerency, confrontation and conflict. Under the terms of the Oslo Accords, both parties agreed to establish a Palestinian Interim self-government Authority and to elect a Legislative Council for the Palestinian people in the West Bank and Gaza Strip for a transitional period not exceeding five years, to be followed by a permanent settlement based on UN Security Council Resolutions 242 and 338.

Mr Arafat and his Fatah faction gained clear majorities in the presidential and legislative elections in January 1996. Since the outbreak of Palestinian-Israeli violence in September 2000, the ability of the PA to govern has been eroded by Israeli’s destruction of PA-related institutions and by the cantonisation of the Territories.

Characteristics¹:

Land area West Bank	approx 5,800 km ²
Land area Gaza Strip	365 km ²
Total population in West Bank and Gaza Strip (Sept 2000)	3,224,000
Population growth (2000)	3%
Rural population	68%
Population density in West Bank	347 Inh./ km ²
Child population (under 15 years)	47%
Percentage of population with refugee status	41%
Average household size in West Bank	6.1 persons
Literacy	89%
Infant mortality	40 per 1000 live births
Live expectancy	66 years
Doctors	1.1 per 1000 inhabitants
Households connected to piped water in West Bank	84,8%
Households connected to sewer network in West Bank	34%
Mortality rate of diarrhoea and gastro-enteritis	1% (ca. 100 deaths/year)

The Palestinian economy suffers from a number of structural imbalances, many of which are a direct result of Israeli occupation. Since 1967 the West Bank and Gaza have been cut off from their traditional markets, living Israel as the only outlet for trade. High dependence on Israel for employment and trade makes the Palestinians vulnerable to restrictions on the movement of labour and goods.

Since the beginning of the second *intifada* in September 2000, the Israeli army has imposed almost continuous internal and external closures of the Territories in an attempt to curb Palestinian attacks against Israeli civilian and military targets. The transport of goods and people has consequently been hampered or banned depending on the severity of the closure and the availability of alternative roads. Internal closures have divided the West Bank into 64 clusters, as well as preventing people from travelling between the areas for work or other

¹ Sources: Palestinian Central Bureau of Statistics and Ministry of Health [Ref 1, 2 and 3]

activities. In addition, the cost of transporting goods doubled as trucks have to take longer routes along poor roads and tracks to get to their destination.

Table 1: Main economic indicators, 1999-2001²

	1999	2000	2001
Real GDP growth (%)	5,9	-10,0	-15,7
Growth in investments (%)	16,1	-19,1	-29,8
Export growth (%)	3,3	-7,4	-7,6
Unemployment rate (%)	11,8	14,1	25,5
GDP per capita (USD)	1,447	1,263	1,029

The economic problems since September 2000 have sharply pushed up the poverty rate. The World Bank estimates actually that almost half the Palestinian population lives under the 2.1 USD/day poverty line.

The Palestinian Territory is divided in 14 Governorates in addition to two Districts (Tubas and Silfit). Artas makes part of the Governorate of Bethlehem. The Governorate of Bethlehem counts 10 municipalities and 27 villages. With the support of UNDP and under the leadership of MoLG, two Micro Regional Planning Committees have been created since 5 years in order to give support to the councils of the 27 villages.

2.2.2. The village of Artas

Artas comes originally from the Latin word “HORTUS”, which means public garden, because of its many streams and green valley surrounded by arid mountains.

Agriculture was known in Wadi Artas (Artas valley) since the Canaanites, 5500 years ago. The village lies in a valley surrounded by the western mountains of Palestine and on the east by the Jerusalem wild desert. It is 4 kilometres from Bethlehem city and its total land area is nearly 21 km². The inhabited area is 325 acres (160 hectares), surrounded by Beit Jala, Bethlehem and Al-Khader. The population according to the 1997 census is of 2,686 people, 1,371 male and 1,315 females and the number of families is of 423 families. There are 347 buildings with a total of 492 housing units. Artas has a village council, which was appointed by the Ministry of Local Government in 1995. It is headed by Mr. Jamal Ahmad Khalil Abu Suwai and consist of nine male members. The members are volunteers and they are not allocated a proper budget by the Authority. However, they can generate some little income from some property taxation or commercial activity license fees.

Wadi Artas used to represent the end of the old passage, which connected the Al Jazeera Al Arabiah with the South of Jordan and the Holy City. Artas was the prime water source for Jerusalem, especially the water that was used for irrigation. This irrigation system was known as the biggest in Palestine. In the Mamluk times Artas used to be called Ras Al A'rkub, responsible for 24 villages and cities till the Lod and Al Ramleh borders. It used to have a court and a well-known prison at the eastern side of Omar's Mosque. In 1848 four missionaries, from France, Germany, Britain and United States of America came to Artas. They established a study centre which went on till 1936. In the year 1750 Artas was attacked and people massacred. In 1931 a battle took place between the rebels and the occupiers.

² Sources: PCBS, [Ref 1 and 2]

The village is considered one of the most important sources of fresh vegetables to the city of Bethlehem and nearby cities. The presence of a natural spring in the village has formulated the agricultural character of it. The discharge of the spring has a strong seasonal variation. Water is distributed to the agricultural plots downstream of the spring through a cement canal. Each plot is getting its water share from the canal through time division, for example a plot may get half an hour of the spring water while another plot may get one hour. This variation is pretty much related to the area of the plot. Irrigation is rotated over 24 hours and each farmer must go and divert the water from the canal to acquire his water share even if his turn comes at mid night or even later in the night.

However, many people left working in agriculture during the past two decades and went to work in areas that generate fast cash. Many of them started to work in Israel as cheap labourers and their life was built on this fast and relatively higher income. Yet, they are faced with the reality that such income is not sustainable and is function of the non-stable political situation in the area. Therefore, many of them start to go back to their lands to restart cultivating.

The village has a strategic location in the valley. It is very close to Bethlehem and adjacent to Solomon pools. A resort is being established near the pools and it has a monastery. The village has many attractions and has a good potential at tourism development level, may be eco-tourism.

The Jerusalem District Electricity Company is the main provider of electricity in the village. Artas has a telephone network which works through an electronic extension, which is out of the village. There is boys and girls school, with 26 branches, 406 for boys and 391 for girls, 13 male teachers and 19 female teachers. Artas has a sport club and a charitable institute, a mosque and a church, plus one clinic.

Together with 18 other villages Artas makes part of the Western Micro Region Planning Committee of the Governorate of Bethlehem. Recently implemented projects through the MRPC are: asphaltting 4 km roads; opened a path of 5 km long to be used for agricultural purposes; the rehabilitation of the water network; the construction of the Artas secondary school for Girls. In the framework of the LRDP, a public headquarter for the Village Council has been built in August 2002.

Through the UNDP co-ordinated "Bethlehem 2000" programme, the Belgian Co-operation funded already three small projects in Artas:

- the rehabilitation of the Al-Ein Street (Salesians Street);
- the rehabilitation of the spring;
- the construction of a sewage water collector system in 2001.

2.3. Water supply and sanitation sector

2.3.1. Background

West Bank and Gaza have surface areas of 5572 and 365 km² respectively. Both areas are enjoying a typical Mediterranean weather conditions, dry and hot summer and mild and wet winters. Rainfalls occur only during winter season, which lasts for approximately five months (November - March). Average rainfall varies between 550 - 600mm/year and 400mm/year in the West Bank and Gaza respectively.

Average temperature varies from 38°C in summer to 16°C in winter. Relative humidity varies from 55% in summer and nearly 70% in winter. Wind is blowing predominantly from west and northwest to east and southeast at an average speed of 11 knots. The average potential evaporation was estimated by Rofe and Raffety (1965) at 2088 mm for the period 1963-1965. Currently, data on potential evaporation is only recorded at five weather stations in the West Bank.

The West Bank is a hilly area, with elevation varying from 400m below sea level in the Jordan Valley to 1000m above sea level in the hills. The surface geology of the West Bank is comprised of well fractured and karstified carbonate rocks, both limestone and dolomite. Moreover, the elevation in Gaza varies from 0m at the Mediterranean Sea to nearly 80m at sand dunes in the east. The surface geology is comprised of sand and sandstone.

The lack of natural resource planning, inadequate water infrastructure and the absence of appropriate sewage treatment facilities have resulted in serious contamination of water resources. In Palestinian rural areas the sewage problem is even more complicated and wastewater management at all stages is inadequate.

2.3.2. Water resources

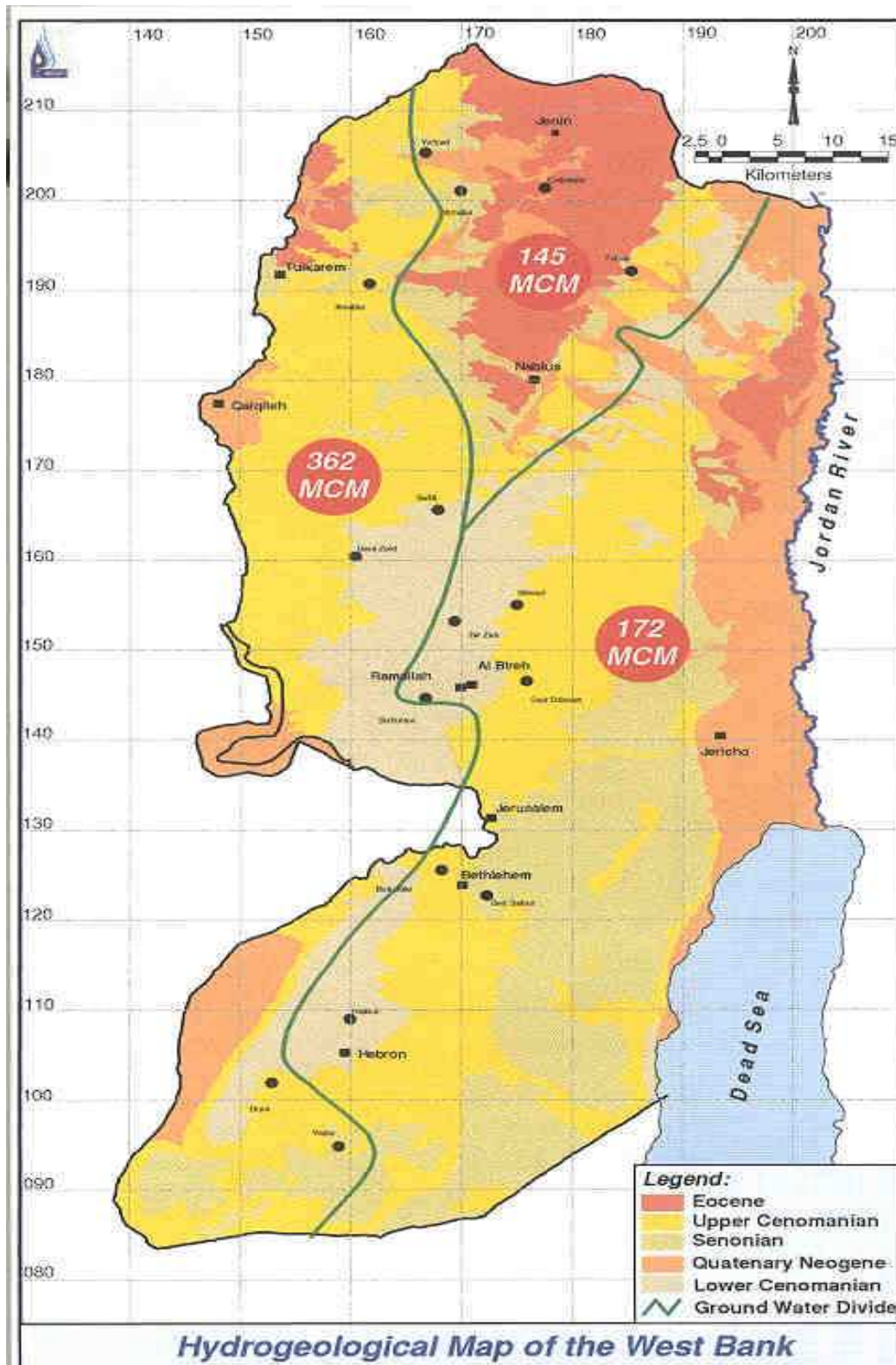
Groundwater is the major water resources in the West Bank and Gaza. Average annual groundwater replenishment that was agreed under the Oslo interim peace agreement is 679 million cubic meters per year (Mcm/year) distributed in accordance with the groundwater flow direction into three basins Western, Eastern and Northeastern Basins with replenishment capacities of 362 Mcm/year, 172 Mcm/year and 145 Mcm/year respectively, Figure 2. Meanwhile, the total renewable groundwater resources in Gaza are 46 Mcm/year (MOPIC, 1996).

In relation to surface water, the only surface water resource is the Jordan River. El-Musa (1996) reported that the exploitable water quantity from the river system is estimated at 1.3 billion m³/year. However, the flow in the lower part of the river that reaches the Dead Sea is of poor quality and doesn't exceed 100 Mcm/year, Rabi (1997). In the meantime Palestinians believe that their share in the river is nearly 200 Mcm/year, (Elmusa, 1996), though this share is still under negotiations with Israel.

Groundwater quality in the West Bank varies from one place to another. The water quality of wells varies from "hard" to "very hard" water categories. However, all wells are in compliance with the WHO standards. However, many wells show bacterial contamination, mainly Faecal Coliform, which implies proper treatment before they can be used for domestic purposes (Abdul-Jaber et al., 1999). Moreover, large number of springs in the West Bank has shown high concentration of nitrates and Faecal Coliform bacteria which restrict their use for domestic purposes (Abed Rabbo et al., 1999). This pollution is probably the result of contamination by seepage from the non-proper containment and treatment of wastewater and/or leakage from dumpsites.

However, the situation is different in Gaza. The salinity of most of the wells in the south is greater than 2,500 ppm, and in some areas reach up to 7,000 ppm (PHG, 1994). The Ministry of Planning and International Cooperation concluded that 55 percent of the water produced in Gaza lies within the poor quality category defined by WHO, 38 percent is deteriorated and only 7 percent is of potable quality ($Cl^- < 250\text{mg/l}$ & $NO_3^- < 50\text{ mg/l}$).

Figure 2: Hydrogeological map of the West Bank



The magnitude of potentially available water from the different non-conventional resources was estimated differently in the literature. However, the estimated treated wastewater quantities are nearly 16 million cubic meter per year (16 Mcm/year), (MOPIC, 1998), the potential surface runoff is nearly 45 Mcm/year and the brackish water mainly from springs is estimated at nearly 50 Mcm/year (Guttman, 1995).

2.3.3. Water use and demand

Total water use in the West Bank and Gaza is estimated at nearly 130 Mcm/year and 120 Mcm/year respectively. Water supply to all Palestinian use in the West Bank is mostly secured through nearly 320 wells and almost 32 major fresh springs. Agriculture uses almost 70% of this total and the remaining 30% are being used for domestic uses. These 30% include also the commercial and industrial use. It is estimated that industry uses 30% of the domestic water use (CDM/Morganti, 1997).

However, the average per capita domestic water use, as recorded in some of the major water utilities in the West Bank and Gaza, is 20 m³/year (54.5 l/c/d). The closure of the Territories by Israel since the outbreak of unrest and property damage has led to severe water shortages in some areas. As a result, the price of tanked water has increased from 2,5 USD/m³ to 7,5 USD.

Yet, the water demand will reach 482 Mcm/year toward the year 2010 for all purposes. The domestic part of it will be in the proximity of 180 Mcm/year on the basis that the population will be around 4.95 million people and that water use is nearly 100 l/c/d. This means that water supply allocation to the Palestinians needs to be nearly doubled toward the year 2010.

2.3.4. Sector strategy

Therefore, adequate water strategies and plans need to be developed to accommodate this demand properly. Palestinian Water Authority, being the main body entrusted to manage and develop water resources, has developed a water strategy that aims at ensuring the sustainable development of water resources and ensuring their efficient management. The strategy comprises of eight major elements as follows:

1. Secure Palestinian Water Rights
2. Strengthen National Policies and regulations
3. Build Institutional Capacity and Develop Human Resources
4. Improve Information Services and Assessment of Water Resources
5. Regulate and Co-ordinate Integrated Water and Wastewater Investments Operations
6. Enforce Water Pollution Control and Ensure Protection of Water Resources
7. Build Public Awareness and Participation
8. Promote Regional and International Co-operation

To pursue the main goal and elements of the strategy, PWA has developed scenarios and master plans. All scenarios developed consider collection, treatment and reuse of wastewater as a priority issue and accounts the anticipated treated wastewater quantities as part of the overall water use budget in Palestine. Therefore, the current proposed project in Artas lies within the priority issues of the National Palestinian Water Strategy.

It is good to mention that there have been several activities undertaken to develop the water supplies and improve the water and wastewater infrastructure in Palestine since the

establishment of PWA. Investments in the sector between “1995 – 1999” exceeded 250 Million USD.

2.3.5. Water supply and sanitation in Artas

Water is supplied to the village by Water Supply and Sanitation Authority of Bethlehem (WSSA) and solid waste collection is organised by the Village Council.

Nearly each household is connected to one cesspit. According to a survey conducted during the formulation mission in 30 households, the minimum volume of cesspits was 16m³ and the maximum was 120m³ while the average was 59m³.

The average monthly payment for emptying the cesspits was 9 NIS/month (1,8 Euro/Month), or nearly 1,000 EURO/month for the whole village. It is obvious that this amount can easily be collected to insure project sustainability. It is worth noticed that half of the households never empty their cesspit, and that the actual monthly investment of the households who do so varies between 15 and 30 NIS.

The fact that most of these cesspits were constructed long time ago means that they reached to a level where by the accumulated solid will theoretically not permit any further infiltration. Therefore, the cesspits will need frequent emptying. This supports the idea of getting rid of them and connect to the project.

The fact that nearly all houses are owned by people in the village is strongly supporting the idea of removing the cesspits and using their place for expanding their houses.

The regularity in paying bills, especially in the case of solid waste collection bill, is a strong indicator that people are willing to pay for service that will improve their socio-economic and hygiene conditions. It is good to mention here that paying for solid waste collection accounts for 0.34% of average monthly income. Furthermore, the average monthly water used was found to be 17.5 m³/ household (74 litre / capita / day). This means that total monthly water used in the village is nearly 6685 m³.

If we assume that 80% of the used water will be transformed into wastewater, it potentially means that we have almost 5350 m³ / month of wastewater that can be treated and made available for reuse once the project is constructed. This will encourage more land reclamation and more income generation. Yet, under the current conditions, this quantity of untreated wastewater or part of it is potentially infiltrating down and polluting the groundwater.

It was also found that the average monthly income in the village now is nearly 840 NIS (168 Euro) while it was nearly 2743 NIS (548 Euro) prior to Intifada. Water bill accounts nearly for 9.85% of this income (82.8 NIS / month or 16.56 EURO) while it use to be 3% before and the electricity bill also accounts for 10.41% while it used to be 3.2% (87.5 NIS or 17.5 Euro). These percentages are much higher than the agreed international standards, which allows up to 5% of average monthly income to go for water bill.

In relation to regular bill payments it was shown that almost 66.7% of people are paying their water bills regularly while 83.3% are paying electricity bills and 100% are paying solid waste bills. The fact that paying for water constitutes the least percentage among the payments of the other services is simply because there is an alternative water source in the village that people can use if the service will be shut down. Therefore, people prefer to pay for electricity because they don't have alternative, and will live with a limited quantity of water that can be fetched from the spring. Yet this situation is temporary and will diminish with the improvement in the economic conditions of people. The fact that average income in the village has dropped by almost 60% has certainly a grave impact on the people's ability to pay.

Table 2: Sector indicators in Artas

Tenure of housing units	Owned	90%
	Without payment	8%
	Rented	2%
Water supply	Public network	88%
	Private system	4%
Cesspit		98%
Toilet	With piped water	78%
	Without piped water	16%
	Units without toilet	6%
Bathroom	With piped water	69%
	Without piped water	5%
	No bathroom	25%
Kitchen	With piped water	79%
	Without piped water	10%
Electricity		99%

Source : PCBS, [Ref 3]

2.4. Other interventions in the sector

The World Bank, the Netherlands, Germany and Norway are the main funding agencies for the institutional development of the water and wastewater sector, giving support to the preparation of the Regional Water Utilities, support to the PWA and the National Water Council.

Main sanitation and wastewater projects include:

- the sanitation and wastewater project in Rafah, supported by the EC for 19 M €;
- the water supply and sanitation project in Ramallah, the wastewater project in Al Bireh, water supply and sanitation in Nablus, the sewerage system in central Gaza, the sewerage system in Tulkarem, the sewerage system in Salfit, all supported by Germany for an overall amount of more than 170 M €;
- the sewerage and treatment plant for northern Gaza, supported by Sweden for 13 M €;
- the development of the wastewater master plan in Hebron, supported by Finland for 3 M €;
- the Bethlehem sewage system supported by Italy and Germany for 45 M €;
- the Gaza water and sanitation program supported by the World Bank and USAID for 65 M €.

PHG implements 4 small-scale non-conventional treatment plants of the same type of the Artas project with funds from Save the Children among others. Other relevant experience of PHG concerns the Ecological Sanitation Pilot Project at household level, funded by Sweden.

2.5. Legal and institutional framework

2.5.1. Background

For the past 3 decades, water management in the West Bank and Gaza was constrained by several political, technical and economic factors. Such constraints have adversely affected the overall performance of the water sector and resulted in creating a large gap between the services provided and the demand. The lack of investments in improving infrastructures (physical water losses reach 50% in some areas), the scattered nature of the water supply and management utilities with the absence of adequate rules and regulations and the absence of stakeholder participation in managing the supply has resulted in the deterioration of the entire water system.

However, article 40 of the Oslo Interim Peace agreement acknowledged the Palestinian Water Rights and also acknowledged their rights to create Palestinian Water Authority (PWA) that can manage and regulate the sector. According to article 40 both Palestinians and Israelis agreed to establish a joint water committee (JWC) with as main task to discuss and approve the implementation of water and wastewater projects in the West Bank. The official Palestinian representative in the JWC is the Palestinian Water Authority (PWA). Therefore, a presidential decree was issued to establish Water Authority in 1995. The decree was followed by the law number 2, to organise the work of PWA, and eventually a new water law (Law # 3) has been approved by the legislative council on the 18/2/02. The law has been approved by the President of PNA on 17/7/02 and was then published in the official newspaper on 5/9/2002. Law #3 overrules all previous laws and decrees. By the virtue of article 2 of the law (page 9) all water resources have been declared public property. In addition, article 4 prohibits any abstraction, drilling, desalination or wastewater treatment without permits.

Section 2, article 6 of the law deals with the establishment of the Water Authority and article 7 defines its responsibilities. According to article 7, PWA has full responsibility over managing water resources and sanitation in Palestine. In addition, PWA is responsible for regulating, supervising and coordinating all water and wastewater research in Palestine.

Section 3, article 8 deals with the creation of the National Water Council (NWC) which is the main body responsible for setting water policies and supervising the work of PWA.

Section 7, article 25 states that Regional Water Utilities (RWU) will be established, based on the desire of the local utilities and water user associations, to provide water and wastewater services for Palestinian communities. A special by-law will be established for this purpose. In the mean time Section 11, article 41 states that local village and municipal councils, government bodies and NGOs continue to provide water and wastewater services until the RWUs are established.

Accordingly, local municipal and village councils continue to manage the water supply and basic sanitation services in Palestine. Most of these councils lack adequate infrastructures, technical skills, and human and financial resource capacity. They can't attain cost recovery and therefore, are operating under deficits all year around. Salih (1998) reported that only one utility in the West Bank attains cost recovery while the rest don't. The average price per cubic meter (m^3) is estimated at 0.6 USD/ m^3 . However, it may reach nearly 3 USD/ m^3 in some localities where no proper water supply system exists. Water obtained by tankers may cost 5-6 USD/ m^3 in the areas lacking water supply services and at the same time its quality is much lower.

In the mean time only a minor percentage of the produced wastewater effluent is being collected in the West Bank and Gaza and almost none of it is being treated. The existing on-site sewage disposal in rural areas (almost 96% of households in the West Bank villages use cesspits) does not accommodate the vast increase in wastewater generated by the population. Thus, untreated sewage contaminates groundwater, wadi beds, and agricultural fields and this causes critical community and environmental health risks.

Furthermore, there is no systematic and continuous monitoring for the wastewater quality in most of the urban areas in the West Bank. However, data obtained from some spatial monitoring programs (done either by institutions or individual experts) reveals that seasonal variations in wastewater quality are high due to the high seasonal variation in the per capita water use as well as the mix of industrial wastewater with the municipal wastewater in some urban areas. In general, the wastewater in Palestine is being characterized as of highly concentrated strength. BOD ranges from 500 to 800 mg/l depending on the season and locality. The concentration of suspended solids is also high in the wastewater.

The current statistics reveals that 29% of the Palestinian communities (7% of Population) are not connected to drinking water supply. Furthermore, in the areas connected to water supply, 15% of the population are not served. This results in 23% of the total population being not served with water supply in the West Bank, PHG (2003). In addition, 60 percent of the urban areas are being connected to sewerage systems while almost all rural areas and 40 percent of the urban areas are not yet connected.

2.5.2. Main water supply and sanitation actors

The existing situation shows that almost 43% of the population connected to water supply is served by six main utilities while 57% are served by 218 municipal or village councils. Water supply to these utilities and councils are secured from local sources (wells and springs) and /or purchased from the Israeli water company Mekorot through the West Bank Water Department (Salih 98). In the mean time wastewater services is not yet developed in most of these councils.

The current and future setup of the water supply and sanitation management is organised under four levels: decision-making level, regulatory level, development and supply level and service provision level, Figure 2.

As can be seen from Figure 2 the first level, the National Water Council is headed by the President of Palestinian National Authority (PNA) and includes 11 representatives of almost all ministries, authorities, civil society organisations, research and development institutions that directly relate to the water and sanitation sector and one representative of the proposed future regional water utilities. Even if the NWC has been created officially, it is not really functional for the moment.

The second level includes Palestinian Water Authority as a regulator and the third level includes the West Bank Water Department and a similar one in Gaza, which are responsible for the monitoring and bulk supply development. The fourth level includes the water service providers. There are eight major water utilities that supply water to the public in the West Bank. Two of them are semi public water supply utilities: Jerusalem Water Undertaking (JWU) and Bethlehem Water Supply & Sewage Authority (WSSA) while six are water divisions of large municipalities (Nablus, Hebron, Jenin, Tulkarem, Qalqilya, Jericho municipalities).

Figure 3: Current and Future Institutional Setup in the Water and Wastewater Sector

	<u>CURRENT SETUP</u>	<u>FUTURE SETUP</u>																																								
LEVEL																																										
Decision Making	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">President</div> <div style="border: 1px solid black; padding: 5px;">National Water Council (NWC)</div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">President</div> <div style="border: 1px solid black; padding: 5px;">NWC</div>																																								
Regulatory	<div style="border: 1px solid black; padding: 5px;">Palestinian Water Authority (PWA)</div>	<div style="border: 1px solid black; padding: 5px;">PWA</div>																																								
Monitoring and Development of Supply (Bulk)	<table border="1" style="width: 100%;"> <tr> <td style="width: 50%; text-align: center;">West Bank Water Department</td> <td style="width: 50%; text-align: center;">Gaza Hydrology Dep. Ministry of Agriculture</td> </tr> </table>	West Bank Water Department	Gaza Hydrology Dep. Ministry of Agriculture	<table border="1" style="width: 100%;"> <tr> <td style="width: 50%; text-align: center;">West Bank Water Department</td> <td style="width: 50%; text-align: center;">Gaza Water Department</td> </tr> </table>	West Bank Water Department	Gaza Water Department																																				
West Bank Water Department	Gaza Hydrology Dep. Ministry of Agriculture																																									
West Bank Water Department	Gaza Water Department																																									
Service Provision	<div style="border: 1px solid black; padding: 5px;"> Water Utilities Village Councils Municipalities NGOs Private Investors </div>	<table border="1" style="width: 100%;"> <tr> <th colspan="5" style="text-align: center;">Regional Water Utilities</th> </tr> <tr> <th style="width: 20%; text-align: center;">GAZA</th> <th colspan="4" style="text-align: center;">WEST BANK</th> </tr> <tr> <td style="text-align: center;">N</td> <td style="text-align: center;">M</td> <td style="text-align: center;">S</td> <td style="text-align: center;">S</td> <td></td> </tr> <tr> <td style="text-align: center;">O</td> <td style="text-align: center;">I</td> <td style="text-align: center;">O</td> <td style="text-align: center;">O</td> <td></td> </tr> <tr> <td style="text-align: center;">R</td> <td style="text-align: center;">D</td> <td style="text-align: center;">U</td> <td style="text-align: center;">U</td> <td></td> </tr> <tr> <td style="text-align: center;">T</td> <td style="text-align: center;">L</td> <td style="text-align: center;">T</td> <td style="text-align: center;">T</td> <td></td> </tr> <tr> <td style="text-align: center;">H</td> <td style="text-align: center;">L</td> <td style="text-align: center;">H</td> <td style="text-align: center;">H</td> <td></td> </tr> <tr> <td></td> <td style="text-align: center;">E</td> <td></td> <td></td> <td></td> </tr> </table>	Regional Water Utilities					GAZA	WEST BANK				N	M	S	S		O	I	O	O		R	D	U	U		T	L	T	T		H	L	H	H			E			
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Source: Compiled from PWA Background Materials, 1998.

The proposed future institutional setup almost preserves the first three levels as they are while anticipating some changes at the service provision level as provided by the water law #3. It proposes to create 4 or 5 Regional Water Utilities (RWU), 3 or 4 in the West Bank and one in Gaza to provide water and wastewater services in more efficient manner. The proposed RWU will potentially absorb all councils and utilities currently providing services in the sector. It will unify the service levels and will develop common regulations.

It is likely that the current proposed project in Artas will be managed by the Village Council of Artas until the proposed southern water and wastewater utility in Bethlehem governorate is established. After that the management of the plant might be transferred to the RWU in accordance with the by-law that will be developed. It is also good to mention that Artas village council will be part of this utility and participate in the decision making process related to the water and the wastewater sector at the Bethlehem governorate level.

Table 3: Size of the major water supply companies in West Bank

<i>Company</i>	<i>Service volume m³/year</i>	<i>Staff Number</i>	<i>Served Communities</i>	<i>Connection Number</i>	<i>Served People</i>	<i>% of total people*</i>
JWU	9051957	145	49	37823	204845	13.0%
WSSA	2605829	81	10	8968	68028	4.3%
Nablus	5763810	200	11	23327	135306	8.6 %
Hebron	4112295	29	9	11025	186500	11.9%
Jenin	1209759	39	2	6266	32864	2.1%
Tulkarem	3334000	31	3	8558	46052	2.9%
WBWD/ Mekorot			80		132097	8.4%
Total	26241694	496	164		805692	51.2%

Source: Salih (1998)

*: The total population considered is 1,572,000 people

Palestinian Water Authority (PWA)

PWA was established in 1996 to regulate and manage the water sector in the West Bank and Gaza. PWA is governed by the National Water Council (NWC), which sets the water policy. The NWC is chaired by the President Arafat. It includes the Minister of Agriculture, the Minister of Local Government, Finance Minister, Health Minister, Planning and International Co-operation, Head of Environmental Authority, Head of Water Authority, Governor of Jerusalem, Representative of Local communities, Representative of Palestinian Universities, Representative of water associations and representative of regional water utilities.

Bethlehem Water Supply & Sewage Authority (WSSA)

WSSA was established in July 1963 as the water authority for Bethlehem, Beit Jala and Beit Sahour. In July 1992, the Water Authority was entrusted with finalizing the construction of a wide sewerage system and then became known as the Water Supply and Sewage Authority in 1996.

The WSSA is a non-profit, public water supply and sewage utility. Throughout the period of occupation (1967-1995), WSSA was controlled by the Israeli Civil Administration (ICA) office, but operated, in principle, independently. Now, WSSA is responsible to provide water and wastewater service to five municipalities (Bethlehem, Beit Jala, Beit Sahour, Doha and Elkhader).

The WSSA is governed by a council (board of directors) that consists of representatives from the municipalities. It employs 85 permanent staff members working on a daily basis. Its coverage area is 21 km², and serves about 62,238 inhabitants or 4.3% of the total population of Palestine.

The West Bank Water Department (WBWD)

The WBWD was established during the period of Jordanian control over the West Bank in 1965. After the Israeli occupation of the West Bank, in 1967, the WBWD fall under the Israeli control. It maintained its function as the main body responsible for water production, distribution and monitoring in the West Bank. The WBWD was placed under the responsibility of the Israeli military government and its Civil Administration. It was governed

by military orders. The WBWD has four divisions: Hydrology, Design and Planning, Maintenance, and Administration. The activities of the first three divisions are as follows:

1. Hydrology Division: This department measures all water levels in West Bank and springs of the area. From wells (360) and springs (300) samples are either taken once a month, or once every two months, or once every three months, depending on the size of the wells and springs. The Hydrology Division also supports the municipalities in the West Bank, since none of these municipalities have much experience in this field.
2. Design and Planning division: This division prepares project designs and prepares tender documents for the local municipalities and village councils.
3. Maintenance division: Maintenance of pipelines, meters and pumping stations it supervises.

Following to the Palestinian-Israeli interim peace agreement (Oslo B, Article 40), the WBWD was linked practically to PWA as of January April 1997. However, WBWD is still controlled by the Israeli Civil Administration.

Mekorot

Mekorot is the Israeli Water Company. Although it is not directly involved in water supply to Palestinian communities, it is good to show the link between Mekorot and the WBWD. There are nearly 80 Palestinian communities supplied with water through the West Bank Water Department. Mekorot is selling water to the communities at around 0.82 USD/m³. These 80 communities represent 10.4% of the population of the WB (164,000 inhabitants). WBWD is responsible for collecting the revenue and transfer it to Mekorot.

2.5.3. Other stakeholders

The Ministry of Local Government (MoLG)

This Ministry was established in 1994, prior to the establishment of Palestinian Water Authority (1995). The responsibilities of MoLG are to organise the affairs of local authorities through controlling, regulating, and developing municipalities, refugee camps and villages. The involvement of MoLG in the water sector is basically through the municipalities and village councils that run water and sanitation projects.

The law of the Palestinian Local Government gives, among others, the following responsibilities and duties to the local Councils :

- town and street planning;
- building and construction permits;
- supply residents with potable water, define specifications, regulate distribution and prevent the pollution of natural water resources;
- set up, manage and control sewage;
- garbage and waste collection and disposal;
- public health monitoring.

Water charges are considered as one of the important income sources for these councils.

The Ministry of Health

The Palestinian Ministry of Health maintains formal relations with municipalities and water utilities. The Ministry takes random water samples and checks them in its laboratory to ensure that they meet WHO standards.

Non Governmental Organization (NGOs)

Prior to the establishment of the Palestinian Authority, many NGOs were founded in Palestine. These institutions shared the responsibility to run activities related to the water and wastewater sectors. The main NGOs involved in the water and wastewater sector are:

Palestinian Hydrology Group (PHG): PHG is considered the main actor on the non-governmental side of the water and wastewater sector. PHG's main goal is to protect and develop water and environmental resources and to ensure just and equal provision of water and sanitation services to the rural and marginal communities in the West Bank and Gaza. PHG is also working to promote water research capacity and infrastructures in Palestine.

The activities of the PHG were expanded substantially over the past few years. Currently, PHG is the main implementing organisation in the water and wastewater sector. It has activities in 73 locations in the West Bank and Gaza. The activities include enhancing freshwater availability through rainwater harvesting, improving sanitation conditions in the rural areas, developing existing water sources (springs and wells), promoting public awareness and water conservation and many other related issues.

Palestinian Agricultural Relief Committees (PARC): they are engaged in water for agriculture mainly. They carry several activities related to water harvesting and household sanitation.

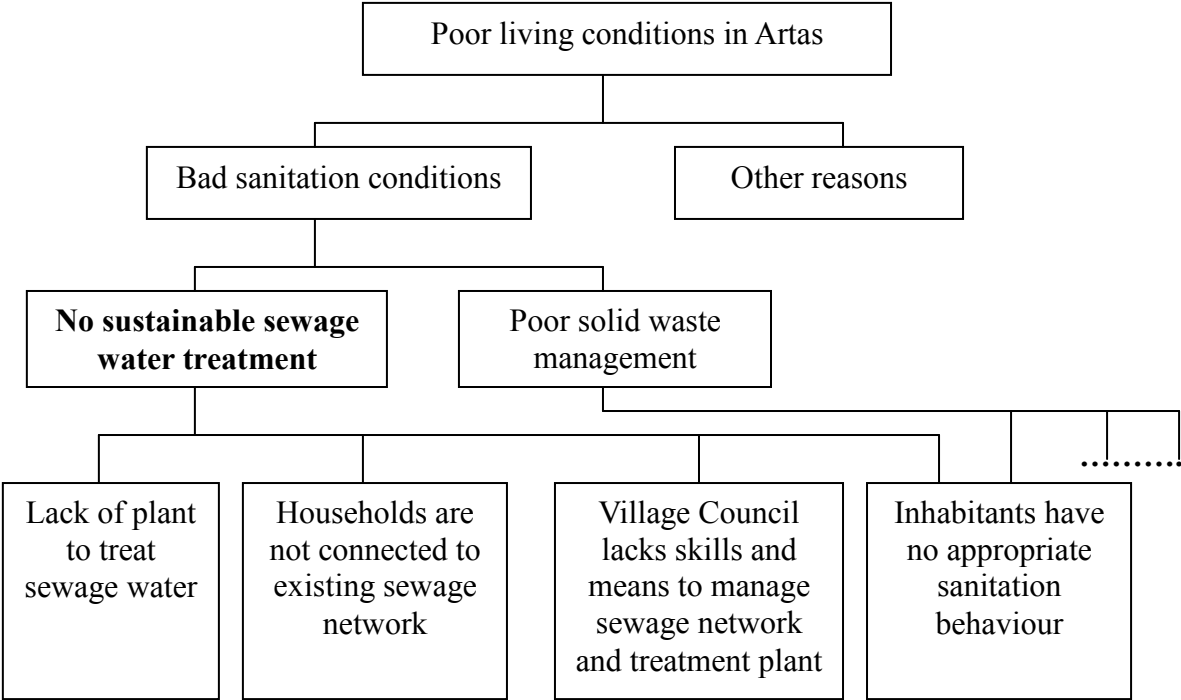
Palestinian universities specially Birzeit and Al Najah universities: they are engaged in different activities in the field of water supply tests, training and other research and development activities.

Other NGOs like the Applied Research Institution of Jerusalem (ARIJ) are engaged in research.

Most of the Palestinian water NGO's, together with international NGO's as Oxfam and Save the Children are now member of the EWASH-network, collecting data from NGO actors and sharing experiences and expertise.

3. INTERVENTION

3.1. Problem tree



Bad sanitation conditions in Artas relate to:
 ⇒ Poor management of solid waste and garbage.

The Village Council is responsible for the collection and evacuation of the garbage at household level. People are supposed to deposit their garbage in small collectors, emptied twice a week. A truck, donated by the Japanese Government and owned by the Village Council, evacuates the solid waste to a garbage dump near Jerusalem. Households pay 10 NIS/month for the service. Running costs of the truck, deposit fee at the dump (20 NIS/ton) and the salaries of the driver and the two garbage collectors are paid by these contributions. The rate of payment of the households used to be around 80% and the garbage used to be collected on regular basis.

Nowadays, a lot of households can no longer afford to pay for the service due to unemployment. On the other hand, garbage collection is no longer done on regular basis due to the nearly permanent “closure” of the area, curfew and roadblocks. The Council continues to do its best for the collection and evacuation of garbage. Part of the household garbage, especially the items that can’t be burned nor composted, are scattered in the streets and on unoccupied parcels.

⇒ Lack of sustainable and effective sewage water treatment.

Almost all households are connected to a cesspit for the sewage water. A lot of the pits, considered by many inhabitants as the “good” ones, are leaking and the contaminated sewage water filters into the ground. The survey conducted at grassroots’ level during the mission shows that nearly half of the pits are not emptied frequently enough. Some of them are emptied only once a year, but pits built in concrete or almost waterproof brickwork don’t leak and must in theory be emptied each 2 to 4 months, depending on their volume. The cost of the operation is of 100 to 150 NIS per unit, but many cesspits are out of reach for the tanker. The

average cost for evacuation is of 107 NIS/household/year (22 EUR) while half of the households spend less than 50 NIS/year.

The overflow of the pits goes into the streets or to the land.

The average volume of the cesspits is 59 m³ while average production of sewage must be around 15 m³/month/household.

In 2001, under the lead of PHG, a Belgian funded sewage network has been built in the main streets of Artas. The main pipes are in PVC DN 200 or 250; the secondary net is HDPE 4". A small waiting-pipe in HDPE 2" has been foreseen for each household situated along the piped streets.

Treatment of the sewage water is nor effective nor sustainable due to the fact that:

i. The existing sewage network lacks a treatment facility.

The first phase of the sanitation project only considered the construction of a sewage water collection network. It is not clear whether project initiators hoped to build a treatment facility in a second phase, or if the initial idea was to evacuate the untreated sewage water in free nature.

ii. Households are not connected to the sewage network.

Since the sewage water could not yet be treated, the Village Council prohibited the households to connect their cesspit to the network. Some households made pirate connections through the existing waiting pipes. According to a survey made by the Village Council during the formulation mission, from the 500 to 600 households³ of Artas, some 250 households can actually be connected to the system.

iii. The Village Council lacks technical, management skills and capabilities to manage the sanitation activities in the village.

According to the decentralisation process, the Village Council is responsible for sanitation matters in the village. Being a small village with less than 5,000 inhabitants, Artas has a D-status. The members of the Council are working on a voluntary basis and have no authority to collect taxes. The decentralisation law allows the High Planning Council of Bethlehem Governorate to collect taxes. The taxes' money should be redistributed to the small villages through the Ministry of Finance, but due to the bad situation of the Palestinian Authority budget, this redistribution is not effective.

iv. Some practices of inhabitants are not appropriate for a sound sanitary situation.

Cesspits are not always waterproof; cesspits are not emptied regularly; fees for garbage collection and evacuation are not always paid; garbage is not always deposited in the collectors; pirate connections are made to the sewage network; rainwater from roofs and platforms is drained to the streets without any protection against erosion...

Reasons for this behaviour are numerous: lack of funds, irregularity of public services, lack of convincing power on the part of the Council... but also a lack of responsibility at the level of some households.

The effects of bad sanitation conditions are:

⇒ Contamination of the irrigation water

The leakage and overflow water of the cesspits contaminates the springs and irrigation scheme that covers the valley of Artas with his extensive horticulture. Pathogenic agents, excess of nitrates and other polluting minerals come also in the human cycle. Artas is famous

³ According to the census of 1997, Artas counts 497 housing units. According to the Village Council, the actual number of housing units reaches 600.

for its vegetables. As sensitivity is growing for safe agricultural products, the peasants have high interest in protecting their gardens from contaminated water.

⇒ Risk of water- and sanitation-related diseases

The untreated sewage water can contaminate the aquifers. Polluted water is a hotbed of diseases through insects, larvae or worms. Erratic garbage, especially in combination with stagnant water attracts rats and vermin.

In the centre of Artas especially, where the density of households is very high, sound sanitation practices are important to avoid water-related diseases.

⇒ Excessive costs

Households with a waterproof cesspit have to empty the pit frequently. The cost can amount to 100 USD/year. The running cost of the sewage network and treatment plant is evaluated at 35 USD/year/household; this includes a two-yearly turnout of the interceptor tank. Important savings can thus be realised⁴.

⇒ Limited appeal for tourists

Close to Bethlehem and Jerusalem, Artas has some interesting attractions, such as the monastery, the valley, the Solomon's Pools... Once the present political crisis will be solved, tourism development can be stimulated by sound sanitation plans and practices. Later on the planned Salomon's Pools Resort will also need a treatment device for its sewage water.

3.2. Objectives

3.2.1. Objectives compared to the problems

In order to improve the sanitation conditions in Artas, the project focuses on the treatment of the wastewater, for the following reasons:

Relevance: The treatment of wastewater is one of the priorities in the strategy of the Palestinian Authorities in order to protect the aquifers and to recycle the water in a water-stressed context. Evacuation and treatment of wastewater is also a priority for the Council and the inhabitants of Artas dealing with a very dense population and the risks for contamination of the vegetable gardens. The important financial contribution of the villagers is an indicator of the priority given to this project. The project fits in the sector strategy of Belgian co-operation (basic infrastructure, health) and in the thematic priorities (environment, social economy).

Effects and impact: Direct effects of the project are: a better protection of the horticulture in the valley of Artas, a reduction of the risks for water-related diseases, economic savings and improved attractiveness for tourists. Treated water can be used for tree irrigation downstream the plant. On a larger scale, the full implication and capacity building of the Village Council through the whole process may lead to improved capabilities for a locally managed development. The sensitisation of all inhabitants on sanitation aspects may lead to an overall improvement of hygiene and sanitary behaviour.

⁴ It should be noticed that households with a leaking pit and those ones allowing the overflow of the cesspits into the streets represent half of the village. They will have to pay more for sewage evacuation and treatment than nowadays.

Feasibility: The sewage network already exists in the centre of the village. Appropriated land for the treatment plant can be made available situated in the Area A zone, under Palestinian control, with a limited external contribution. Skills and materials can be found in Bethlehem – Jerusalem area. With similar projects in Hebron and Nablus, PHG is a reliable partner to assist other stakeholders.

Sustainability: The chosen technology is easy and cheap in operation and maintenance. Running costs can be supported by users and are lower than the present costs for evacuation of the sewage for the individual households. Organisational set-up fits in the present decentralisation policy and mechanisms and can be integrated in the framework of planned Water Utilities. PWA and MoLG are ready to continue giving support after project completion.

Synergy with other Belgian funded projects: Artas has benefited from Belgian support for rehabilitation projects and for construction of the sewage network. The project follows an approach similar to the Belgian funded LICP.

Eventual spin-off as a pilot project: Monitored by PHG, PWA and MoLG, the technology of anaerobic wastewater treatment will be better documented and may lead to duplication in other villages. The Belgian government has recently shown its interest to co-operate with Palestinian Authorities in the water and sanitation sector. A broad sector analysis is actually conducted by the Centre for Sustainable Development of the University of Ghent. The Artas project can be a first field experience for Belgian authorities to understand the sector, its problems and opportunities.

Objective tree

Development goals:

Improved living conditions in Artas

Sustainable sanitation,
managed by the village

Specific Objective:

**Sustainable managed wastewater
treatment plant**

Results:

Wastewater
treatment
plant is
constructed

Households are
connected to
sewage network

Village Council
gets skills and
means to manage
sewage network
and treatment plant

Inhabitants have
appropriate
sanitation
behaviour

3.2.2. Effects and impact of the project

As a result of the intervention all the wastewater of the centre of Artas will be evacuated and treated before been released. The design of the plant will also allow the treatment of the wastewater of the other neighbourhoods of Artas not yet served by the sewage network, of the planned Solomon's Pool Resort and of part of the households of El Khader.

Benefits relate to:

Health improvement through a reduction of diseases produced by stagnant wastewater and pathogens agents from human faeces and through the protection of the water used for the irrigation system of the horticultural plantations.

In second instance, the development of small-scale wastewater treatment plants over the West Bank can decrease the risks of contamination of the aquifers. The awareness growing and the training of the villagers will improve their hygiene and sanitation behaviour and have a broader impact on their health.

Economic benefits by reducing the costs of emptying the cesspits. It is estimated that the running cost of the present system of cesspits varies from 10 to 100 USD/year per household, while the running cost of the treatment plant is evaluated at 35 USD/household/year.

Other economic benefits relate to the reuse of the treated wastewater for plantation of olive trees downstream the plant. When fully operational, the plant will produce 300 m³ of treated water daily; especially in the warm and dry season, when the treatment performance of the anaerobic tank will be optimal, this water can be used for the irrigation of 10 to 15 hectares (100 to 150 dunums) of olive plantations.

Protection of the environment: It is obvious that the treatment of 300 m³ waste water daily has an important impact on the protection of soil and water. A sound environment in the village and the valley of Artas may induce a better attractiveness for tourists, a better quality for the vegetables and the overall improvement of the living conditions.

An indirect impact can be expected through the improvement of the management capabilities of the villagers and of the Village Council of Artas. Their full implication in the implementation and in the management of this project and of the sewage treatment system can create a better co-operation between the villagers who will be more aware of the sanitation problem and the Council, and will help the Council to improve its performance in the management of other public services or community projects.

3.3. Strategy

The strategy proposed by the formulation mission is based on:

- Full implication of the Village Council of Artas in the different stages of preparation and implementation of the project and in the management of the treatment plant after completion. The decentralisation policy of the Palestinian Authorities aims at transferring the responsibility for water supply, sewage, garbage, waste collection and evacuation, among others, to local authorities. At a later stage, they can eventually integrate their hydraulic installations into the Regional Water Utilities, where the Village and Municipality Councils will be shareholders. The project will prepare the Village Council to this set-up and improve its management capacities, its negotiation and mobilisation capabilities and its expertise in project management. At the same time, a good co-operation between local and national authorities is essential for reasons of efficiency, good

governance and sound position of both levels in a very complex political context where different sides try to undermine all central authority.

- Full participation of the villagers to the implementation and sustainability of the project. Even if the political and economic situation in West Bank is highly uncertain at the moment, the project will not backslide to a pure assistance approach. Benefits of the project are obvious for the villagers. Their financial contribution will be needed to sustain operation and maintenance, a good governance of operation and maintenance will need appropriate sanitation behaviour of the villagers and good co-operation between villagers and Council. Therefore, an active implication of the villagers is possible and unavoidable. This implication relates to: a grassroots survey during the formulation phase in order to assess the interest of the people concerned, a financial contribution for the purchase of the necessary land, the responsibility for the first step of sewage collection (in the interceptor tanks at household level), the training and awareness development on sanitation and hygiene. On the other hand, management skills and practices will be developed at Council level in order to manage the plant in full transparency with the users.
- Easy access technology, affordable by the villagers from technical, management and financial point of view. Materials and equipment for operation and maintenance have to be locally available to avoid import and access problems; needed skills can be transferred to local technicians; running costs are far below the present costs for regular cesspit emptying; PHG has experience with the construction and start up of similar plants.
- Labour intensive work plan. Design, work plan and tendering documents highlight the importance of a labour intensive approach. Some 500 man-days of unskilled labour will be needed on the building-site. Materials needed for the wetlands generate another important quantity of local labour. In a context of unemployment, the project therefore contributes to provide a minimal economic income to several families in Artas.
- PHG as assistant for the implementation. PHG is a local NGO with an important experience in the water sector. They have recently constructed 7 anaerobic treatment plants in the West Bank. The sewage network in Artas has also been built by PHG. MoLG and PWA insist on the implication of Palestinian private partners in order to strengthen their capabilities and experience, to guarantee appropriate training and to ensure the follow-up after completion.
For these reasons, PHG will be contracted by BTC as the assistant for the implementation of the project. Terms and conditions for the assisting agency have been negotiated during the formulation mission and are given in Annex C. All participants of the February 23th stakeholders meeting in Ramallah agreed on the choice for a negotiated contract with PHG as the assistant for implementation.

3.4. Logical framework

3.4.1. Development goals

To improve living conditions in the Artas village through a sustainable sanitation and improved management capacities in the village.

3.4.2. Specific objective

To build a wastewater treatment plant in Artas and ensure its sustainable operation and management.

3.4.3. Results and activities

Result 1: A low cost technology wastewater treatment plant is constructed and functional in Artas.

- Act. 1.1. Finalise the technical design of the wastewater treatment plant.
- Act. 1.2. Prepare the tender documents for the construction works.
- Act. 1.3. Manage the contracting process for the construction works.
- Act. 1.4. Build the wastewater treatment plant, including a UASB reactor tank, additional treatment in wetlands, a reservoir for the effluent and a storage tank for the sludge.
- Act. 1.5. Control the progress of the construction.
- Act. 1.6. Provisional delivery of the wastewater treatment plant.
- Act. 1.7. Start-up the plant
- Act. 1.8. Final delivery of the wastewater treatment plant.

Result 2: At least 250 households are connected to the wastewater treatment plant through the existing sewage network.

- Act. 2.1. Identify the good working cesspits that can be connected directly to the sewage collectors.
- Act. 2.2. Prepare the tender documents for the construction of interceptor tanks and their connection.
- Act. 2.3. Manage the contracting process for these works.
- Act. 2.4. Construct new interceptor tanks for the houses that can't be connected directly to the sewage collectors.
- Act. 2.5. Connect the approved cesspits and the interceptor tanks to the sewage collectors.

Result 3: The Village Council of Artas has the capacities and the means to sustain the efficient working of the treatment plant and the sewage network.

- Act. 3.1. Train at least 5 people of Artas in Operation & Maintenance of the low cost technology treatment plant and the sewage network.
- Act. 3.2. Train the Village Council in project management.
- Act. 3.3. Train the Village Council in management and cost recovery mechanisms to sustain the effective functioning of the treatment plant and the sewage network.
- Act. 3.4. Elaborate a detailed Operation and Maintenance Plan and handbook for the Village Council and his technical staff.
- Act. 3.5. Elaborate a Management Plan for the Village Council, including price policy, cost recovery mechanisms, saving mechanisms for the non-recurrent maintenance and eventual rehabilitation and up-grading at its own expenses...
- Act. 3.6. Assist the Village Council with technical and management advice during the first year of operation of the plant.

Result 4: The inhabitants of Artas are aware of the risks of a bad sanitation and contribute to sustainable improved sanitary conditions and behaviour.

- Act. 4.1. Inform the inhabitants of Artas of the importance of safe water, hygiene and good sanitation practices.
- Act. 4.2. Elaborate a by-law that enables the Village Council to run the sewage system and treatment plant with obligatory financial contributions from the inhabitants of Artas.
- Act. 4.3. Inform the inhabitants of Artas of the by-law, the obligation to be connected to the sewage network where possible, and the possible fines incurred for not doing so.
- Act. 4.4. Monitor the efficiency of the treatment plant during the first year of operation and give feed back to the Village Council and the population of Artas.

3.4.4. Indicators

The duration of the project is too short, the budget too limited and the context too complex to quantify and measure specific indicators at the level of the development goals. It should be too expensive and of relatively limited relevance to isolate the impact of this project on the overall living conditions of the villagers of Artas when the overall political and economic context and evolutions in the West Bank are the key elements for any change in the long term living conditions of the Palestinians in this area.

Table on next page gives quantified and qualified indicators for the Specific Objective, the four Results and at the level of the three Thematic Priorities of the Belgian co-operation. Sources of Verification can be consulted in the Logical Framework Table in Annex 1.

Framework	Description	Indicators
Specific Objective	A wastewater treatment plant is constructed in Artas and sustainable operated and managed.	<ul style="list-style-type: none"> - Plant functions at least 350 days/year - Plant treats 90% of wastewater of at least 250 households in 2004 - Quality of discharge water after treatment fits in FAO-guidelines for tree irrigation for at least 300 days/year - Village Council has feasible business-plan for plant management before end 2004
Results	<p>R1: A low cost technology wastewater treatment plant is constructed and functional in Artas.</p> <p>R2: At least 250 households are connected to the wastewater treatment plant through the existing sewage network.</p> <p>R3: The Village Council of Artas has the capacities and the means to sustain the efficient working of the treatment plant and the sewage network.</p> <p>R4: The inhabitants of Artas are aware of the risks of a bad sanitation and contribute to sustainable improved sanitary conditions and behaviour</p>	<ul style="list-style-type: none"> - Two UASB-reactors of 62,5 m³, reservoir, sludge drying bed and 2 wetlands of 1.000 m² are built according to plans and standards. - 200 new interceptor tanks constructed - 250 households connected - Management Plan, based on cost recovery, exists and is implemented by Council members - O&M Plan exists and is implemented by 2 local technicians - Plant functions at least 350 days/years according to guidelines - At least 500 inhabitants have followed training - All leaking cesspits are eliminated in centre of Artas - At least 90% of users pay contribution for O&M according to Management Plan - All interceptor tanks are emptied by users when full - By-law regulating sub-sector in Artas exists and is respected
Thematic indicators	<ol style="list-style-type: none"> 1) Gender equity 2) Environment 3) Social economy 	<ul style="list-style-type: none"> - Number of women in workshops - Efficiency of water treatment - Improvement of water quality for horticulture - Number of local workers employed in construction and in O&M of the plant

3.5. Description of the activities

Result 1: A low cost technology wastewater treatment plant is constructed and functional in Artas.

1.1. Finalise the technical design of the wastewater treatment plan.

A tentative design of the plant has been made during the identification phase and the formulation mission. It is based on a general scheme for this type of treatment plants, developed by EP&RC Foundation for PHG.

The scheme works on gravity and includes:

- an inlet with a screen chamber and a first sedimentation of gravel and heavy suspended solids in an open channel in brick-work of 0.50 m width and 8 m length;
- anaerobic treatment in two UASB reactors in reinforced concrete of 62.5 m³ each; hydraulic retention time in the reactor is 10 hours;
- secondary treatment in wetlands with reed (duckweed or *lemna gibba*) with an overall surface of 2.000 m² and a hydraulic retention time of 5 days;
- a small storage tank, in concrete with a capacity of 62,5 m³ for the treated water;
- a sludge drying bed in bricks, with a surface of 20m².

The design is based on the following parameters:

- designed flow of sewage = 300 m³/day;
- BOD₅ of influent = 700 mg/l;
- BOD₅ of effluent = 50 mg/l so that it can be re-used for tree irrigation downstream of the plant;
- modular design that allows to add new reactors, more wetland and an extension of storage tank and sludge drying bed when the inlet exceeds 300 m³/day.

Details and draft drawings of the design are given in Annex B. Pictures of a similar plant under construction in Kharas can also be consulted in Annex B.

Once the exact location of the plant is decided, PHG will finalise the design. This includes:

- An Environment Impact Assessment (for details see Annex C).
- Topographic map of the proposed location, on 1:2500 or larger.
- Layout of the plant on the topographic map.
- Technical drawing of the UASB reactor, the wetland, reservoir and sludge drying bed including all needed cross sections showing all dimensions and steel.
- Preparation of the bill of quantities and a detailed estimation of costs.

The final design will be proposed for control to an international consultant assigned by BTC, and to PWA in order to verify that national norms and standards are respected. Non-objection of these two parties is required before final decision on the design.

The final design of the plant is needed to obtain construction permit.

This is the responsibility of the Village Council, assisted by the MoLG and PWA. Since the plant will be built in Area A zone, the Joint Water Committee also has to give its green light to the design.

1.2. Prepare the tender documents for the construction works.

1.3. Manage the contracting process for the construction works.

The construction work of the Artas treatment plant will be implemented through local and qualified contractors. Selection of these contractors will be conducted through a

restricted bidding process according to the European regulation for public contracting. A contract will be signed between BTC and the winning contractors, after clearance by the Executive Committee.

PHG is in charge of preparation of tender documents and assisting the Village Council and the Executive Committee of the project in the contracting process.

This includes:

- Preparation of the tender documents with the technical and administrative specifications, in accordance to the PWA specifications and the European regulation for public tendering.
- Announcing a call for interest in the local newspapers in the name of the Executive Committee and after its approval.
- Propose to the Executive Committee a selection of at least 6 interested building contractors who will be invited to make a technical and financial proposal according to the tendering documents.
- Clarification meeting with the candidates.
- At least three (3) contractors have to apply. If not, it will be re-tendered. The offers will be opened and evaluated by the Technical Advisory Committee. The Executive Committee takes the final decision and BTC signs the contracts as the Authorising Officer of this project.

1.4. Build the wastewater treatment plant.

1.5. Control the progress of the construction.

Delivery of materials and civil construction works are contracted in one package to a local firm.

It is expected that civil works of the plant can take 6 to 8 months.

The supervision and control of the building contractor will be guaranteed by PHG and include:

- Technical assistance to the local contractor with respect to the more complex key elements of the civil works: de UASB reactor, respect of gradients in wetland, making the reactor and storage tank waterproof...
- Tracking of project work plan and outputs ensuring quality of work, according to the applicable standards.
- A fulltime site engineer of PHG will follow up the implementation of works in details. He will write reports on daily progress basis. Field visits will be carried out on a regular basis by the overall project co-ordinator of PHG; spot checks and field reports will be made.

1.6. Provisional delivery of the wastewater treatment plant.

PHG will prepare the provisional and final delivery of the civil works.

BTC and MoLG representing the Executive Committee, PWA representing the sector regulator, and the Village Council Will assist to the provisional and final delivery. A detailed report will be made by PHG and signed by all parties, including the contractor.

The main amount of the contract will be paid directly to the contractor by BTC as authorising officer. 10% of the contract cost will be deposited on a specific project account, owned by the Village Council, and co-signed by BTC. These 10% can only be paid to the contractor after final delivery.

1.7. Start-up of the plant

The plant has to be initiated before it can be linked to the sewage network of the village. The initiation process has to take place during the hot period (summer-autumn of 2004). It will take about three months for the UASB reactor to reach steady state conditions in order to make sure that it will function efficiently. The start up process will be performed by filling up the UASB with septage from existing septic tanks and keep it for two months to facilitate the rapid growth of the bio-mass. After two months the reactor may start receive the village sewage loads in a continuous flow mode. Once the UASB operates in a continuous mode with the village sewage, it will take one month to reach its operational or dynamic steady state.

After these three months, the installation will officially be handed over to the Village Council.

During the three months of start-up and during the first three months of continuous operation, a supervisor of PHG will ensure follow-up on the field at least twice a month. A visit of the plant, a meeting with the local technicians and an evaluation meeting with the villagers will be planned for each visit.

1.8. Final delivery of the wastewater treatment plant.

One year after the provisional delivery, the final delivery will be made. Same stakeholders will be invited. After clearance by the PWA, MoLG and BTC, the Village Council will pay the 10% guarantee deposit to the contractor.

Result 2: At least 250 households are connected to the wastewater treatment plant through the existing sewage water network.

2.1. Identify the good working cesspits that can be connected directly to the sewage collectors.

The exact number of existing cesspits is not known, but it is generally accepted that nearly all housing-units of Artas have their own pit. Most of them are leaking. The grassroots survey shows clearly that the volume of the pits and the frequency of emptying them don't fit with the water consumption (and thus the production of sewage).

Nevertheless, some housing units have waterproof pits that can immediately be connected to the sewage network. PHG and the Village Council will identify these pits through an in dept analysis of water consumption, dimensions, construction materials of the pits and emptying frequency.

2.2. Prepare the tender documents for the construction of interceptor tanks and their connection.

2.3. Manage the contracting process for these works.

2.4. Construct new interceptor tanks for the houses that can not be immediately connected to the sewage collectors.

2.5. Connect the approved cesspits and the interceptor tanks to the sewage collectors.

Small interceptor tanks of 1 m³ per household will be constructed in place of the leaking cesspits. They act as a first settling and treatment facility and prevent the small sewage pipes of clogging. Tanks are made of reinforced concrete and made waterproof with tar or epoxy coating. The excavation is the responsibility of the households and they will have also to contribute financially to the construction works. They are the owners of the tanks, and responsible for their maintenance and eventual reparations.

Connection to the existing sewage network is done through the small HDPE waiting pipes laid in the previous phase of the project. The existing 250 waiting pipes can connect all housing units in the main streets of Artas.

The Village Council will first conduct a survey in order to identify the number of housing units that have to build a new interceptor tank. It must be clear that all leaking interceptor tanks have to be eliminated. Families living in the same compound and neighbours will be invited to share an interceptor tank of bigger capacity in order to reduce the costs. In that case their financial contribution will be reduced.

It is estimated that the equivalent of 200 interceptor tanks of 1 m³ each will be constructed during this project.

PHG will prepare tender documents for the interceptor tanks and their connection to the existing sewage network. Two or three lots will be tendered in order to give a chance to local contractors. The selection of these contractors will be conducted through a restricted bidding process according to the European regulation for public contracting. PHG will assist contractors for the more difficult aspects of the construction (waterproof) and for the connections to the sewage system.

The Village Council will sign the contracts, after clearance by the two members of the Executive Committee (MoLG and BTC).

The project will transfer its contribution for the interceptor tanks to the project account owned by the Village Council, after signature of the contracts and payment by the villagers of their financial contribution for the interceptor tanks.

PHG will control the contractors and delivery will be made immediately after completion of the works.

Result 3: The Village Council of Artas has the capacities and the means to sustain the efficient working of the treatment plant and the sewage network.

3.1. Training in Operation & Maintenance.

The Village Council will pre-select 5 local technicians for training in operation and maintenance. They will be involved in the construction works of the plant according to a work plan agreed between PHG and the contractor. The contractor will pay them as unskilled labour for this job.

During the civil works, theoretical training sessions will also be conducted by PHG on water and sanitation aspects and on construction topics.

During the first months of operation of the plant, a second series of workshops will be conducted regarding operation and maintenance aspects. After these workshops, two of the five local technicians will be selected by the Council and PHG. They will sign a contract with the Council as part time employees for operation and maintenance of the plant and the sewage network.

Six months later, a last training session will be organised for the five pre-selected technicians in order to improve their capacities for sound and sustainable running of the plant and sewage network.

3.2. Training in project management.

3.3. Training in management and cost recovery mechanisms.

The Village Council capacity building will be conducted by PHG staff members through training courses and on-the-job training.

Most of the training is conducted by the permanent project staff of PHG or by its general staff. The workshops will be held in the headquarter of the Village Council in Artas or on the ground.

At least the following training and workshops will be organised:

<i>Workshop</i>	<i>Target</i>	<i># of participants</i>	<i># of days</i>
Project management	Village Council	10	3
Financial management	Village Council	10	3
Water and sanitation management	Village Council + Local technicians	15	5
Tariff structure, cost recovery...	Village Council	10	3
Bookkeeping, reporting etc.	Local manager	2	3

Exchange visits are also planned with other villages or municipalities where similar treatments plants are in operation, such as Kharas.

Building plans will be handed over to the Village Council, to the Executive Committee and to PWA, together with the final report.

3.4. Elaborate a detailed Operation and Maintenance Plan and a handbook for the Village Council and its technical staff.

3.5. Elaborate a Management Plan for the Village Council, including price policy, cost recovery mechanisms, saving mechanisms for the non-recurrent maintenance and eventual rehabilitation and up-grading at its own expenses...

PHG will elaborate different documents for operation, maintenance and management of the sewage network and the treatment plant. They relate to:

- A technical handbook for the local technicians trained during the project implementation. The handbook will explain the different procedures and techniques, with simple drawings where needed, so that local technicians have a reference guide for all activities related to the operation and maintenance of the interceptor tanks at household level, the sewage network and the treatment plant.
- A logbook for the operation and maintenance activities. The logbook will indicate the periodicity of different interventions, the materials and equipment used for each of the main interventions, the important indicators with respect to the performance of the treatment plant... The logbook is a means for the Village Council and PHG to control the running of the plant, the performance of local technicians, the costs for maintenance and operation and some of the efficiency indicators of the treatment process.
- Management tools for the Village Council: financial means, management means for the local technicians, elaboration of a simplified business plan based on a cost recovery strategy...

3.6. Assist the Village Council with technical and management advices during the first year of the plan operation.

During the first six months of operation, an intensive follow up will be provided by PHG. At least twice a month, a staff member will follow the running of the plant and the management performance of the Council. After six months, these visits will take place on a monthly basis.

PHG commits itself to guarantee to the Village Council the technical assistance that could be needed after project completion. In case of problems the MoLG commits itself to provide management assistance to the Council through the Micro Region Planning Committee of the Bethlehem area.

Result 4: The inhabitants of Artas are aware of the risks of a bad sanitation and contribute to sustainable improved sanitary conditions and behaviour.

4.1. Inform the inhabitants of Artas of the importance of safe water, hygiene and good sanitation practices.

Workshops will be conducted for all habitants of Artas on sanitation, hygiene and the different components of the sewage network and the treatment plant. These workshops will be organised in smaller groups of 50 to 70 participants and each group will be invited to participate in two sessions, one dealing with topics such as safe water and hygiene, the other one focussing on the sewage network and treatment plant.

The sessions will be conducted by PHG in the headquarter of the Village Council or in school buildings. A special attention will be given to facilitate the participation of women in the workshops.

4.2. Elaborate a by-law that enables the Village Council to run the sewage network and treatment plant with obligatory financial contributions from the inhabitants of Artas.

MoLG will assist the Village Council in the elaboration of a by-law giving the latter the responsibility of the operation, maintenance and management of the treatment plant and sewage network. The by-law will also enable the Council to collect connection fees and regular contributions of users. Rules have to be adopted in order to force households living in the streets equipped with the sewage network to connect to the system and to pay fees and tariffs.

4.3. Inform the inhabitants of Artas of the by-law, the obligation to be connected to the sewage network where it is possible, and the eventual fines to pay for not doing so.

The Village Council will conduct an awareness campaign in the village. Connection fees and tariffs will be communicated. The MoLG will assist the Council in this campaign so that inhabitants understand the importance of connecting to the network and the risks of not doing so.

4.4. Monitor the efficiency of the treatment plant during the first year of operation and give feed back to the Village Council and the population of Artas.

The project co-ordinator of PHG will organise a mid-term evaluation to ensure the proper implementation of the activities. Six months after completion of the civil works, a second internal evaluation will be conducted by the project co-ordinator of PHG in order to assess the immediate effects, the impact and sustainability of the project. Results of these evaluations will be communicated to the Village Council.

3.6. Beneficiaries

Direct beneficiaries of the project are the households connected to the sewage network of Artas. In a first phase it will be the 250 families (nearly 1.600 inhabitants) living in the centre of the village. They can be immediately connected through the existing wait-pipes in the main roads of the village.

In a second phase, an extension of the system has to be planned to the outskirts of the village in order to reach all inhabitants of Artas. The present plant design can serve 4,000 people while the total population of Artas is estimated at 3,600. The streets outside the dense populated centre of Artas are not yet equipped with sewage pipes, while the existing main pipe can easily evacuate the sewage of at least 10,000 inhabitants. The Village Council of Artas will have to develop extension plans for the connection of the outskirts in the near

future. It is understood by all stakeholders that this project and the Belgian contribution are limited to the construction of the plant and the connection of the households to the existing sewage network in the equipped streets.

In a third phase the south-east parts of the village of El Khader and the Salomon's Pool Resort, a planned 200 beds hotel south-west of the village, should also be connected to the plant. A new module, with an additional UASB reactor and extension of the wetlands will then be needed to guarantee the same treatment efficiency.

	<i>Locations</i>	<i>Number of beneficiaries</i>	<i>Flow (2004)</i>	<i>Flow (2008)</i>	<i>Flow (2025)</i>
<i>1st phase</i>	Artas-centre	1,600	96 m ³ /day	115 m ³ /day	238 m ³ /day
<i>2nd phase</i>	Artas-outskirts	2,000		144 m ³ /day	298 m ³ /day
<i>3rd phase</i>	El Khader Resort centre	3,000 200 beds			446 m ³ /day 100 m ³ /day
		Overall flow	96 m ³ /day	260 m ³ /day	1080 m ³ /day

Design assumptions are:

- per capita water consumption of 75 l/day in 2004; 80 l/day in 2008 and 100 l/day in 2025;
- discharge factor of 0.80;
- yearly population growth of 3%.

Design flow of the main sewage pipe allows the 1080 m³/day or 12.5 l/sec.

Design of UASB reactors and wetlands is based on 300 m³/day or 3.5 l/sec. Addition modules can be added when El Khader and Solomon's Pool Resort get connected to the system.

Indirect beneficiaries are:

- ⇒ The Village Council of Artas will be the owner of the treatment plant. The plant can generate some income for the Council through connection fees and bimonthly contributions for operation and maintenance. The implication of the Council in the construction and the management of the plant, together with the workshops and training provided by this project, will help the Council to tackle other community problems and to improve its position in front of the population of Artas and of the different ministries. It is not yet clear under which conditions the sewage network and the treatment plant will eventually be transferred to the Regional Water Utility of Bethlehem-Hebron area when this Utility will be created. It is expected by PWA and by the formulation mission that operation and maintenance can remain the responsibility of the Council if it proves its effectiveness. On the other hand, the transfer of ownership of these assets to the inter-urban Utility will probably not include an evaluation of the overall value of the construction works, in order to prevent an unbalanced voting power of Artas in the board of the Utility in comparison to other villages and municipalities.
- ⇒ The landowners of the olive gardens downstream the treatment plant. They are 14 with 276 dunums (27.6 hectares) of land partly cultivated with olive trees. An important part of this land (estimated at 10 to 15 hectares) can be irrigated by gravity with the outflow of the treatment plant. It is understood by all stakeholders that the organisation of the irrigation scheme is the responsibility of the Village Council. Control of the quality of the outflow will be needed to guarantee that the level of minerals and pathogen elements fits to the norms acceptable for olive tree irrigation. If treatment efficiency will be higher than expected during the hot season, one can also consider irrigation of more valuable crops on part of this land.

3.7. Special considerations

- ⇒ Gender: Men and women will benefit equally from the effects and impact of this project on household level. Since women are the main responsible for water and hygiene in the Palestinian household, improved sanitation conditions are one of their priorities. PHG will carefully make sure that women can equally participate to the different workshops and training planned by the project. Unfortunately, the role of women in the Village Council is presently undervalued (only one of the nine members is a woman). The timeframe of this project is too short to change this imbalance.
- ⇒ Social economy: The construction of the plant will generate local employment, estimated at 500 man-days of unskilled labour, some 100 to 200 man-days of skilled labour and an equal quantity of unskilled indirect jobs for materials used in the concrete and wetlands. Given the small scale of the civil works, it is expected that only locally based contractors will be interested in the job. The construction of the interceptor tanks at household level will be given to a local small contractor, preferably from Artas, generating another 500 to 1,000 man-days of labour. Under the lead and control of PHG, with the technical assistance from BTC-engineer and external support missions, these local contractors will improve their skills at the level of waterproof constructions and treatment plants. Ownership, operation and maintenance of this public service will be the responsibility of the local actors, under the lead and control of the Village Council.
- ⇒ Environment: The project contributes to a healthier and cleaner environment in the densely populated centre of the village. Treatment of sewage prevents contamination of the vegetable gardens, of the spring in the Artas valley and eventually of soil and aquifers. On a larger scale, the water-stressed area of West Bank has no other choice than recycling its water resources as much as possible in order to allow social and economic development without excessive use of its aquifers. This project experiments low cost, locally managed treatment plants capable of offering good value for water recycling for small communities.

4. ASSUMPTIONS, RISKS and PREREQUISITES

4.1. General risks and assumptions

- ⇒ In the Palestinian context, the main risk of this project relates to the political environment. The most important general hope is therefore that further occupation, violence and closure will not reach a point that the implementation of the project will have to be halted altogether.
- ⇒ A second set of risks relates to the institutional context and general policy of the Palestinian Authorities. Unforeseen developments at that level can eventually lead to the giving up of the current decentralisation policy or to important changes in the composition and the strategy of the involved ministries and agencies. The ongoing decentralisation process, the capability and commitment of all stakeholders and a good synergy between the involved ministries, the PWA and the local authorities are key factors for the relevance and feasibility of this project.
- ⇒ Linked to the above risks, it is assumed that the economic situation in the West Bank as a whole and in Artas especially doesn't further deteriorate so that the users of the sewage network and the Village Council can afford the running costs of the system, and that all material and human resources needed for the project will still be available.

4.2. Project risks and assumptions

The table below summarises the critical project-specific risks and outlines the measures of strategy and management that have been taken during the preparation or will have to be taken during the project implementation.

<i>Risks</i>	<i>Rating</i>	<i>Project strategy and proposed management measures</i>
1) Continuing "closures" of the Palestinian Territories may prevent movement of goods, materials and persons, constrain contractor performance and generate delays and cost overruns.	High	<ul style="list-style-type: none"> ⇒ An appropriate technology has been chosen, based on materials and knowledge available in the Jerusalem-Bethlehem area. ⇒ Contract with contractors and PHG must specify responsibilities in case of delays or over cost due to circumstances beyond one's control. ⇒ Proposed planning takes into account reasonable time margin.
2) The new sector strategy that is actually studied may integrate all water supply and sewage networks in the Bethlehem area in one operational utility, given in concession to a private partner. If this should occur in the first years of operation, and when the sewage network of Artas will also make part of this integrated network, the relevance of the project oriented capacity building of the Village Council may be questioned.	Low	<ul style="list-style-type: none"> ⇒ A MoU exists between WWSA and Council giving the latter authorisation of running system. ⇒ A MoU between Village Council and PWA will be elaborated to fix conditions of eventual transfer to utility (see prerequisites) ⇒ If the new strategy should be implemented during the project, the capacity building activities have to be reoriented.

<i>Risks</i>	<i>Rating</i>	<i>Project strategy and proposed management measures</i>
3) The technology of anaerobic sewage water treatment is relatively new and not well documented for areas with the climate conditions of the West Bank. Temperatures in the winter may be too low for an efficient and reliable degradation of the sewage.	Medium	<ul style="list-style-type: none"> ⇒ Results of recently constructed anaerobic plants are promising. ⇒ A secondary biological treatment in wetlands is integrated in the project design. ⇒ Design of the plant is modular: Hydraulic Retention Time in the reactor (and thus treatment performance) can be increased with the construction of an additional reactor in the future.
4) Economic and political context may hinder the inhabitants of El Khader or the projected Salomon's Pool Resort to be connected to the sewage network. As a result, the plant will be oversized in the first years.	High	<ul style="list-style-type: none"> ⇒ In the modular design, the actual project provides the construction of two small UASB reactors. In the start up phase, only one may be connected. ⇒ MoLG, PWA and the Village Council of Artas have to sensitise the Council of El Khader. ⇒ All parties accept that DGDC nor BTC have any responsibility for extension of the sewage network.
5) The Village Council of Artas may not manage to convince all habitants to connect to the sewage network and to pay the proposed fees.	Medium	<ul style="list-style-type: none"> ⇒ A by-law will be elaborated with assistance of MoLG, authorising the Village Council to impose fees, taxes and fines. ⇒ Project provides awareness development activities for inhabitants. ⇒ Capacity building in transparent management and communication will be provided for Village Council.
6) The duration of the project is too short to evaluate the technical performance of the plant (and implement eventual corrections) or to strengthen the management capacities of the Village Council enough for a sustainable and efficient operation of the sewage network and the plant.	High	<ul style="list-style-type: none"> ⇒ PHG will ensure follow-up for at least 2 years after project completion. A MoU between the Village Council and PHG will be signed for a free follow-up by PHG. PWA and MoLG will be witnesses of the agreement. ⇒ MoLG continues its support to Council through Micro-Regional Planning Committee ⇒ PWA can give technical support to Village Council in case of complex problems

<i>Risks</i>	<i>Rating</i>	<i>Project strategy and proposed management measures</i>
7) The existing sewage system may be clogged or have leakages or other defaults.	Low	<p>⇒ PHG conducted design and construction of the network, and will now be involved in design and control of plant construction and connections.</p> <p>⇒ PHG accepts the responsibility for all eventual construction defaults on the existing sewage network.</p> <p>⇒ All parties accept that DGDC nor BTC have any responsibility at the level of the already built sewage network.</p>
8) The plant will be constructed in an Area A where PA has full authority but where decisions related to water have to be approved by the Joint Water Committee. It is assumed that this situation will not change and that the policy of the JWC to prioritise water treatment will not change.	Medium	<p>⇒ Duration of the project has been fixed at 20 months anticipating delays in approval procedures by the JWC.</p>

4.3. Prerequisites

- ⇒ It is a conditionality of Belgian support that at least three dunums of land (3.000 m²), situated at close distance to the present outlet of the existing sewage network, can be officially purchased by the Village Council of Artas at a price that doesn't exceed the available budget. A MoU between the Village Council and the landowner(s), signed also by a representative of the MoLG as witness, shall be handed over to the BTC before the project starts. The contribution of the Village Council for the purchase of the land, as specified in § 5.1, shall be deposited on a specific account before the first disbursement of the Belgian contribution can take place.
- ⇒ It is also a conditionality of Belgian support that all permits and licences for the construction of the treatment plant can be given by the Palestinian Authorities. The Ministry of Local Government will support the Village Council to obtain these permits and licences from the relevant ministries and agencies. PWA will defend the proposal at the Joint Water Committee in order to obtain that the Israeli side will not object to the project.
- ⇒ Before the Belgian support can be made available, a MoU must be signed between the Village Council and PWA, with MoLG as witnesses, stating that the plant is owned by the Village Council until the foreseen Regional Water Utility is established and specifying the conditions under which the ownership of the plant will eventually be transferred from the Village Council to the Utility.
- ⇒ A last conditionality relates to the exemption by the Palestinian Authorities of all taxes related to the construction of the treatment plant, all service contracts or other costs related to the Belgian contribution to this project.

5. IMPLEMENTATION

5.1. Means

Capital inputs

The overall cost of the project is estimated at 507,910 EUR, from which 402,910 EUR provided as a grant by the Belgian Government.

The Palestinian financial contribution consists of:

- 30,000 USD for the purchase of 3 dunums (3,000 m²) of land for the construction of the SWTP, provided by the beneficiaries through the Village Council of Artas;
- an estimated 65,000 USD contribution by the benefiting households for the construction of the interceptor tanks at household level and for the connection.

In addition to this capital investment, the Palestinian Authorities assure:

- participation of the officers from the different ministries and authorities at the meetings of the Technical Advisory Committee, the Executive Committee and the SC, as stipulated in § 5.2. This participation is evaluated at 100 person-days; together with the running costs, this in kind contribution of the Palestinian Authorities can be evaluated at 10,000 EUR.

Furthermore, the PA guarantees:

- tax exemption for all the works, deliveries and services related to the project;
- follow-up of the SWTP and the Village Council of Artas as its operator after completion of the project.

The breakdown of the Belgian financial contribution is as follows:

Contribution to the purchase of land	40.000 EUR
Construction of the SWTP and connection of the network	234.510 EUR
Contribution for tanks and connections at household level	25.000 EUR
Service contract for design, control and training by PHG	41.000 EUR
Technical assistance by international consultants	44.400 EUR
Miscellaneous, documentation and training materials	18.000 EUR

In addition to this capital investment, the Belgian Government assures:

- the participation of the officers of BTC and DGDC at the meetings as stipulated in § 5.2. and estimated at 20 person-days;
- the costs of the formulation of the project;
- the overall financial and administrative management of the project.

Human resources and support

Technical assistance and support will be required for the smooth execution of the project and relate to:

- two technical backstopping and monitoring missions, by a BTC-appointed international consultant, specialised in sewage water treatment plants and tender procedures;
- the part-time involvement of the international technical assistant of BTC-Jerusalem in charge of the construction projects;
- the contracting of PHG as a specialised local institution for design, control of the works, training and overall assistance to the implementing agencies;
- the contracting of a specialised firm for the construction of the sewage water treatment plant;

- the contracting of small local building contractors for the construction of the interceptor tanks at household level and the connection to the existing sewage network.

5.2. Modalities and responsibilities

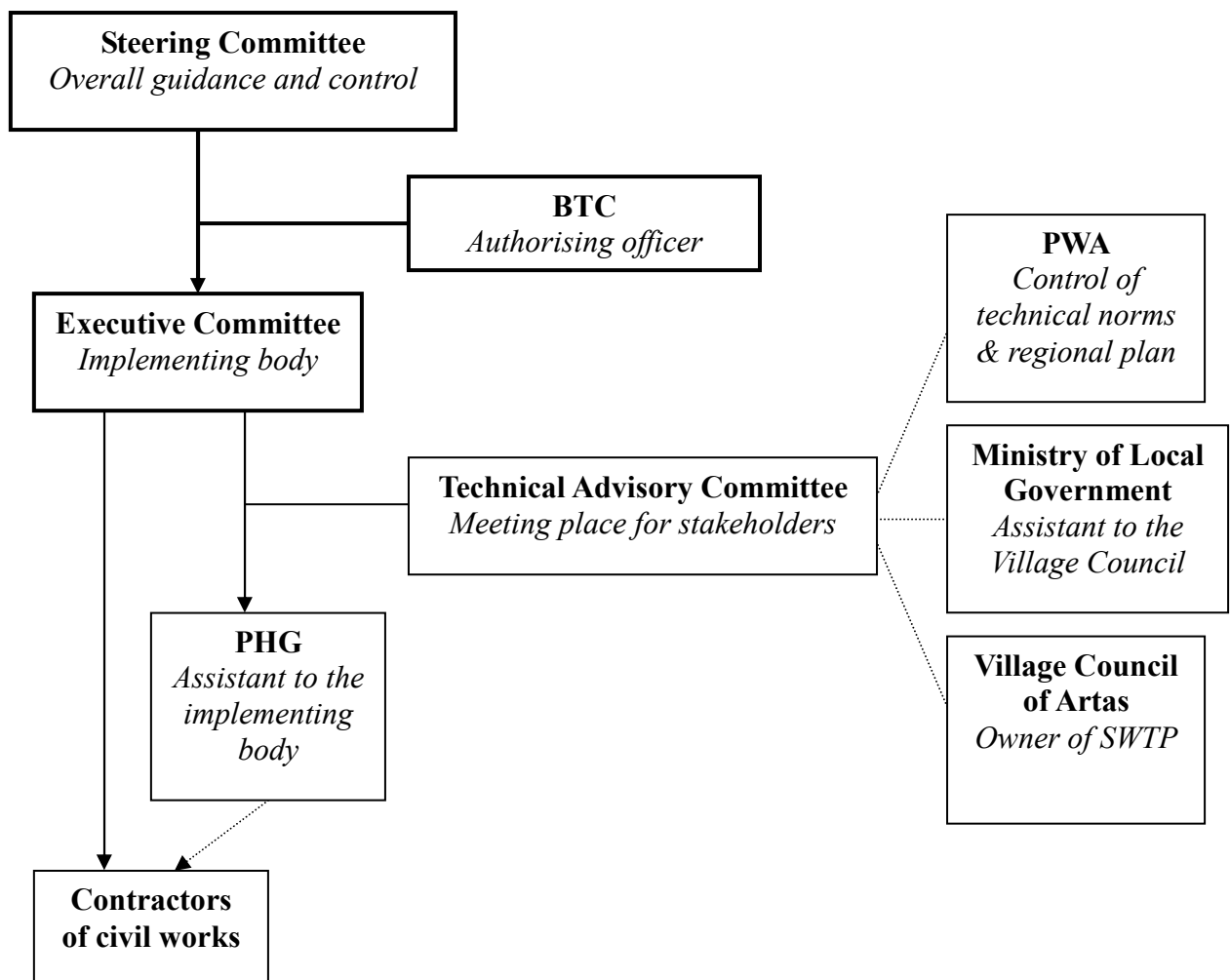
The Palestinian Authority, represented by the Ministry of Planning and International Co-operation (MoPIC), designates the Ministry of Local Government (MoLG) as the administrative entity responsible for the implementation of the project.

The Belgian Government designates the Directorate General for Development Co-operation, hereafter referred to as “DGDC”, under the Federal Public Service Foreign Affairs, Foreign Trade and Development Co-operation, as the administrative and financial entity responsible for the contribution of the Belgian Government. In the Palestinian Territories DGDC is represented by the Counsellor for Co-operation Development at the Belgian Consulate of Jerusalem.

DGDC charges the Belgian Technical Co-operation, a Belgian public-law company with social purposes, hereafter referred to as “BTC”, with performing its commitments in terms of implementation and follow up of the project.

DGDC designates the Resident Representative of BTC in Jerusalem as the authorising officer, responsible for all direct payments and account replenishments under the project.

Organisational structure



A Joint Local Consultative Body, hereafter called *Steering Committee*, will be formed, including as members:

- The Deputy Minister of Local Government (Chair)
- The Deputy Minister of Planning and International Co-operation
- A representative of the Palestinian Water Authority, being the regulator of the sector
- The Counsellor for Development Co-operation by the Belgian Consulate of Jerusalem
- The Resident Representative of BTC for the Palestinian Territories.

The Steering Committee may invite, as observers or experts, any other person contributing to the project.

The Steering Committee will be responsible for:

- Setting up the structures required to carry out the project.
- Overseeing the execution of the commitments undertaken by the respective parties.
- Providing overall policy guidance and feedback to the Executive Committee.
- Assessing the project progress and the results achieved on the basis of the reports presented by the Executive Committee.
- Approving any adjustments or modifications to the intermediate results or activities, while both adhering to the specific objective and the overall budget as presented in the TFF.
- Approving eventual work plan modifications proposed by the Executive Committee.
- Resolving all management problems concerning financial or material resources that may arise to ensure that the project runs smoothly.
- Resolving all eventual problems with respect to the interpretation of the Specific Agreement or the Technical and Financial File.
- Approving the final report and concluding the project.

The Steering Committee will have the following ordinary sessions:

- at the beginning of the project to adopt the definitive work plan and procedures, proposed by the Executive Committee;
- semi-annual meetings to appreciate the progress of the project;
- an evaluation meeting after the accomplishment of the project.

The SC can also be convoked on demand of one of the two Parties.

The SC will meet in Ramallah and will be convoked and chaired by the Deputy Minister of Local Government or its representative. Decisions are taken by consensus.

The BTC representative will assure the secretariat.

Under the umbrella of the Steering Committee, an *Executive Committee* will be formed, including:

- a Project Manager, assigned by the Deputy Minister of Local Government;
- an Assistant Project Manager, assigned by the Resident Representative of BTC in Jerusalem.

The Executive Committee acts as the implementing body of the project. Its responsibilities are:

- to prepare a definitive work plan;
- to comment and accept the definitive design of the SWTP prepared by PHG;
- to manage the tender and contract procedures for the civil works;
- to sign the contracts with PHG, the contractor for the civil works and eventually all other contractors;
- to guide and control PHG and the Village Council in the daily management of the project;
- to appreciate the monthly progress reports prepared by PHG;
- to manage the provisional and final delivery of the works;

- to manage the external assistance for evaluation and complementary studies if needed;
- to elaborate the reports to be presented to the Steering Committee every six months;
- to propose to the Steering Committee, if needed, any modification of the Technical and Financial File, respecting the results, the specific objective and the budget as agreed in the Specific Agreement.

The Executive Committee will meet at least once a month, and in special occasions according to the work plan. In case the Executive Committee cannot come to a consensus, the Steering Committee will be convoked for final decision.

Since the Palestinian Hydrology Group will be contracted as assistant to the implementing body for the whole project duration, it is estimated that the functions of the Project Manager and Assistant Manager will correspond to a time investment of maximum 4 days a month.

In addition to these common responsibilities,

- the Ministry of Local Government will assist the Village Council in the land purchase and in the elaboration of the by-law as described in § 3.4.3. It will provide training and assistance to the Village Council when needed, and will guarantee the follow-up of the work of the SWTP and of the Village Council after completion of the project;
- BTC will provide specific technical assistance through, at least, 2 short time consultancies: one to finalise and adopt the technical design, work-plan and training scheme proposed by PHG and to assist in the elaboration of the tendering documents and procedures; one at time of the provisional delivery of the civil works;
- the BTC resident representative in Jerusalem is the authorising officer for the Belgian contribution to this project; he/she will sign the contracts with contractors and guarantee the replenishment of accounts and the payment of invoices after clearance by the Project Manager and the Assistant Project Manager.

In order to facilitate the participation and co-ordination of all stakeholders, a **Technical Advisory Committee** is formed with:

- the Project Manager assigned by the Ministry of Local Government;
- the Assistant Project Manager assigned by BTC;
- a representative, assigned by the Palestinian Water Authority;
- the Head of the Village Council of Artas;
- the LICP Project Manager will participate in the meetings, without voting right, in order to facilitate synergies between the two Belgian funded and similar projects;
- the representative of PHG, in charge of this project, will participate in the meetings and assures the secretariat.

The main role of the TAC is to co-ordinate the contributions of all stakeholders:

- the Project Manager and Assistant Project Manager representing the implementing agencies;
- PWA as the national regulator of the water supply and sanitation sector;
- the Head of the Village Council of Artas as the representative of the beneficiaries and as the owner and manager of the SWTP;
- PHG as the assistant of the implementing agencies.

The TAC gives advice to the Executive Committee on matters related to the work plan, the final design of the plant, the training programs proposed by PHG, the tendering documents and procedures, the bidding proposals for the civil works, the monthly reports prepared by PHG, the provisional and final delivery of the civil works. All problems that could arise between the stakeholders will be discussed in the TAC so that the Executive Committee can take decisions.

The representative of the Ministry of Local Government chairs the TAC. It meets in Artas, Bethlehem or Ramallah, on the proposal of the BTC, depending on the agenda and the travel possibilities of the members.

Regular meetings of the TAC are organised each month, as much as possible immediately before the regular meetings of the Executive Committee. Specific meetings can be arranged during the contracting process and for the provisional and final delivery of the works.

The Executive Committee assigns *PHG as the Assistant to the implementing agencies*. Among others, it will therefore:

- conduct an Environment Impact Assessment for the proposed location of the SWTP;
- finalise the technical design of the SWTP, according to the specifications of the land that will be purchased by the Village Council;
- propose a detailed planning to the EC;
- prepare the Tendering Documents for the civil works, including the bill of quantities and the technical and administrative specifications;
- supervise and control the execution of the civil works;
- conduct the training specified under Result # 3 and Result # 4;
- elaborate a manual for O&M of the plant and for the management of the whole sewage system;
- participate in the meetings of the TAC without voting right and guarantee the meetings secretariat.

The detailed Terms of Reference for the PHG are given in Annexe C. PHG reports to the Executive Committee on a monthly basis.

PHG will be assigned for this job through a negotiated contract for the different reasons developed under § 3.3. on page 29.

The village of Artas is represented in the process through the *Village Council* which will become the owner⁵ of the SWTP after completion. The Council therefore will:

- with a limited financial support from the Belgian Government contribution, provide the land for the construction of the SWTP;
- guarantee the access to the construction site for all stakeholders (see organisational sheet);
- solve all the problems that can arise with the landowners where the sewage system goes through and the ones downstream of the SWTP;
- elaborate a by-law for the management of the sewage network and treatment plant, including the cost recovery mechanisms through the contribution of the users;
- develop the awareness of the population of Artas to convince them to connect to the sewage system and see that all illegal dumping of sewage is stopped;
- be responsible for the local contribution, specified in § 3.4.5;
- participate at the training as described in § 3.4.3;
- appoint and take charge of at least 5 villagers who will follow all technical training and civil works progress on a daily basis;
- select between these 5 villagers the staff responsible for O & M of the plant after completion;
- run the SWTP after completion.

The Head of the Village Council of Artas participates in the meetings of the TAC and gives feedback to all members of the Village Council. He participates in the contracting process, the

⁵ It is noticed that the ownership of the plant can in the future be transferred to the planned Regional Water Utility once established, according to the terms and conditions specified in the MoU between the Village Council and PWA as specified in § 4.3.

supervision and payment procedure for the civil works contractor and in the delivery of the works, as specified under § 5.3.

The **Palestinian Water Authority**, being the official regulator of the sector, will:

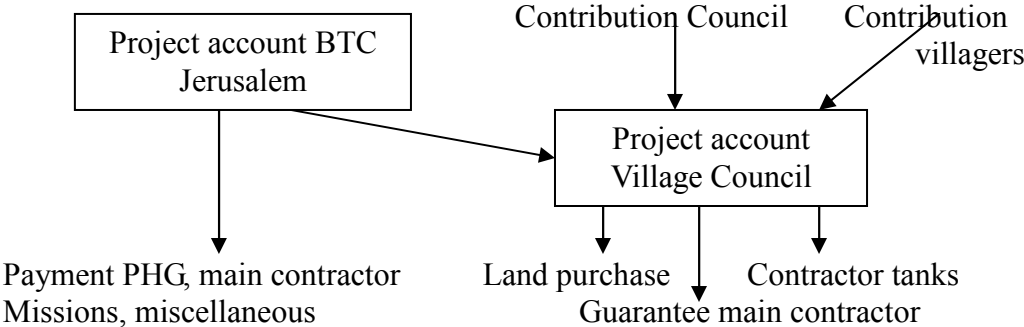
- control if the technical design, proposed by PHG, fits with national standards and regional plans;
- control if the civil works are executed according to the national standards and specifications;
- integrate all relevant information on this project in national statistics and plans.

5.3. Organisation and procedures

Implementation procedures are based on :

- ⇒ The regulation of the European Commission for public contracting. This concerns a contract with PHG as assistant for implementation of the project according to the Terms of Reference in Annex C, another contract with the main contractor for the construction of the treatment plant, and one or two contracts with small local contractors for the construction of the interceptor tanks and their connection to the sewage network. The contract with PHG and with the main contractor will be signed by BTC after clearance from the Executive Committee. The contract with the small local contractors will be signed by BTC and the Head of the Village Council of Artas. The main contractor and the local contractors for interception tanks will be selected through a restricted tendering procedure coached by PHG according to the Terms of Reference given in Annex C.
- ⇒ The shared responsibility for the implementation of the project between the Project Manager, representing MoLG, and the Assistant Project Manager, representing BTC. All decisions related to the daily management of the project are taken by consensus in the Executive Committee, on the proposal of PHG, and with the advice of the TAC.
- ⇒ BTC as authorising officer for the Belgian contribution is responsible for all financial transactions related to the Belgian grant. BTC authorises all payments of contractors.
- ⇒ The purchase of land and the construction of the interceptor tanks and household connections are co-funded by the Belgian grant and local contributions and are therefore the shared responsibility of BTC and the Village Council. The payment of these items comes from a specific account, owned by the Village Council, with a double signature (Head of Council and BTC-representative) and replenished with the contribution of the Village Council, the beneficiaries of the interceptor tanks and the project contribution for land purchase and tanks construction.

The management of the funds can be visualised as follows:



The Project Account in Jerusalem is owned by BTC. It is in USD or EUR and with double signature (Resident Representative and Head of Financial section). It is replenished by the contribution of DGCD and used for all direct payments, except for :

- the project contribution for land purchase, at a maximum of 40,000 EUR;
- the project contribution for the interceptor tanks, at a maximum of 25,000 EUR;
- the guarantee for the final delivery of works by the main contractor, at 10% of the contract value or a maximum of 23,451 EUR.

These three items are paid from the Project account at village level, at a bank in Bethlehem, and legally owned by the Village Council. The account is exclusively used for activities in the framework of this project and has double signatures: the signature of the Head of the Village Council and the signature of the Resident representative of BTC or its delegate. The account is replenished by the contribution of the Village Council for the land (estimated at 35,000 USD), the contribution of the households for the interceptor tanks and connections (estimated at 300 USD per household), the contribution of the project for these two items and the 10% guarantee for the final delivery of the civil works on the plant.

The set-up for the 10% guarantee enables BTC to hand over officially the plant to the Village Council before the final delivery, planned only 12 months after completion of the works.

5.4. Planning

It is anticipated that the project will be implemented in 20 months from the approval time. However, PHG will continue to monitor the project for at least two years after completion to insure its proper operation and performance.

A detailed planning is given in Annex D.

Three steps are taken :

- The preparation with Environmental Impact Assessment, final designs, tendering preparation, licencing procedures... are foreseen to take 6 months, anticipating time consuming procedures to obtain licences and permits;
- The construction works will last for 8 months;
- The start-up of the plant, the final capacity building on the ground and the official hand over to the Village Council can take 6 months.

5.5. Budget

The detailed budget per result is given in Annex E.

Quantities and unit prices for the construction of the treatment plant are given in Annex B, § 12.

The breakdown of the cost of PHG assistance is given in Annex C § 10 and discussed with PHG staff during the formulation mission.

Below, the breakdown in grant and local contribution is given for the main items of the budget.

Item	Cost	Belgian grant	Local contrib.
Purchase of 3 dunums land	75.000	40.000	35.000
Construction of SWTP	234.510	234.510	
Construction & connection of 200 interceptor tanks	85.000	25.000	60.000
Service contract for PHG	41.000	41.000	
Technical backstopping	44.400	44.400	
Documentation, training materials & miscellaneous	18.000	18.000	
	497.910	402.910	95.000

Some important changes with respect to the identification budget have to be highlighted:

- 3 dunums of land will be purchased (instead of the 4 dunums originally planned) with an important contribution of the Village Council; 3 dunums are sufficient for the two modules of the construction presently planned and designed for at least 600 households; extension can always be implemented by Village Council when El Khader and Salomon's Pool are ready to get connected; land is available but expensive and the formulation mission limits the purchased land to the present needs;
- an important component of capacity building, for an overall cost of 26,000 EUR, has been added in order to guarantee the sustainability of the project and the impact on the overall sanitation behaviour of the villagers;
- some items were omitted in the identification budget for plant construction: access road, fencing, ground samples... for an overall cost of around 35,000 EUR;
- technical assistance was not counted for in the identification budget;
- cost and breakdown of the interceptor tanks was not clear in the identification budget; during the formulation, an agreement was made with the Village Council providing a limited project contribution for their construction while the main cost will be supported by the beneficiary families.

The cost for technical assistance is relatively high and linked to:

- the necessity of a daily control of the construction works by a staff member of PHG, due to the relatively new technology; since the construction cost is relatively low, the supervision by a full-time engineer is relatively expensive;
- the training component;
- the technical backstopping by international consultants, needed for a sound control of the results and procedures, but relatively expensive for a project of this scale.

The Belgian contribution exceeds the identification budget with 62,910 EUR. In the case this budget has to be reduced, savings have to be made on the following items:

- i. The elimination of the storage tank for the effluent => saving of 12,140 EUR. Impact of this saving will be that the re-use of the effluent water for tree irrigation will be difficult.
- ii. The elimination of the second backstopping mission => saving of 8.100 EUR. This is only acceptable if an experienced Technical Assistant can be available at BTC-Jerusalem for the delivery and coaching of PHG at that moment.
- iii. The budget for documentation, manuals and training materials can eventually be reduced from 14,000 to 10,000 EUR => saving of 4,000 EUR.
- iv. The access road can be made on a provisional basis, reducing the cost from 25,000 EUR to 15,000 EUR => saving of 10,000 EUR. The Village Council must then find additional funds in the next years to improve the road for a sustainable access.
- v. The dimensions of the wetland can be reduced from 50 x 18.20 m to 40 x 18.20 m => saving of 24,000 EUR. The design flow will then be 240 m³/day instead of 300 m³/day and thus already reached in 2007, which implies an extension of the wetlands at that time.

Each of these savings reduces the performance or viability of the plant and the formulation mission highly recommends to increase the Belgian contribution to the proposed budget.

6. SUSTAINABILITY

6.1. Institutional and organisational set-up

The system in Artas is divided into two parts, one is private and one is public. Connections between houses, interceptor tanks and tertiary sewers would be considered as private connections. Therefore, the householders will be the owners and the ones responsible for their management and maintenance. In the mean time the main sewer lines, the secondary sewer lines and the treatment plants are considered as public properties.

It is likely that the public part of the network and the treatment plant will be managed by the Village Council of Artas until the proposed southern water and wastewater utility in Bethlehem Governorate is established. Later on, the management of the plant might be transferred to the RWU in accordance with the by-law that will be developed.

The Village Council will contract two part time staff members for daily operation and management, including billing and basic administration. They will be selected after completion of the plant, from a batch of 5 local technicians, proposed by the Council and trained during the project by PHG.

With the support of MoLG a specific by-law will be elaborated before the project start in order to authorise the Village Council to run the plant, to collect connection and operation fees and to penalise people who may not be willing to pay or to connect to the network. This by-law fits within the responsibilities and duties given to local councils according to the local government law of Palestinian Authority.

Artas is part of the Western Micro Region Planning Committee of Bethlehem Governorate that will give technical, legal and organisational support to the Council in case of problems. The MRPL has engineers and experienced staff; Artas is very close to the office of the MRPL and co-operation between both institutions has already been experienced with success in other projects.

6.2. Technical sustainability

The regular operation and maintenance activities for the system can be summarised as follows:

Collection System

- primary and secondary sewer network inspection
- advise on tertiary sewer maintenance and construction
- inspection of interceptor tanks
- supervise new connections to main network

UASB Reactor

- cleaning of the flow splitters
- cleaning of the down flow pipes in case of obstruction
- cleaning of effluent gutter
- removal of a scum layer from the surface of the tank
- removal of excess sludge
- regular record keeping of flow rates into and out of the reactor
- monitoring of the quality of influents and effluents at the reactor

The removal of the scum layer can in principle be done manually or by means of a vacuum pump. The removal of excess sludge should only be carried out regularly during the warmer

seasons (not in winter) when the sludge is well stabilized. During the winter and early spring the reactor may contain poorly stabilized sludge. When spread on the sludge treatment units this sludge may cause an abnormally high loading rate and probably some problems of malodours.

Wetland

- to monitor the water level in the wetland to ensure that there is no clogging
- to monitor the growth of the plants and to cut it from time to time
- to monitor the effluent water quality
- to monitor the flow from the wetland

The tasks at financial and administration level include the following:

- issue bills
- collect fees and tariffs;
- deal with users' queries and complaints
- arrange the desludging of interceptor tanks
- deal with the requests for new connections

In addition, there are some technical risks involved in operating this kind of treatment technology.

Table below summarises risk assessment and mitigation measures:

No.	Risk	Mitigation measures
Operation phase		
1.	During the period of the cold season the UASB is poorly operating	Additional reactor or wetland can be implemented in the future to increase treatment performance in cold season. Since the cold season coincidences with the wet season, treated water will not be used for irrigation during the cold season.
2.	The hydraulic load by wet weather is very high	Householders are not allowed to use the sewer network for carrying the roof, yards or streets runoff. However the village council should monitor the process.
3.	Odour release from the system	Measure the sludge in all units and remove any extra sludge accumulated. Use bituminous filter for gas absorption in case the gas (from UASB) is not burned
4.	Rain water is percolating in the sludge drying beds	This unit should be tightly covered by plastic sheets during rainy days.

No.	Risk	Mitigation measures
5.	People are using the treated effluent which overflows in the wadi for uncontrolled irrigation	Farmers should receive training and licenses for this purpose from local councils and under PHG and the ministry of agriculture supervision. Analysis of water and ground quality will be done by the project.
6.	The bacterial biomass in the UASB are killed	Check the water quality for toxins, don't allow effluent reuse for 1 month, check the source of pollution at the upstream polluters connections; the local council should charge those who dispose of unapproved material in the sewage. N. B. each householder should sign and agreement with the local council before to be allowed to connect to the sewer. This agreement contains annexes showing what liquids should not be disposed of in the sewers.

6.3. Financial sustainability

The expected O&M expenses are low and can be summarized in the following table:

Table: Expected Monthly Operation and Maintenance Cost

<i>Item</i>	<i>Monthly cost (\$)</i>
2 Technicians (25% in start-up phase, 50% in 2008)	400 – 800
Pumping cost for sludge withdrawal (onsite)	5
Sludge and debris transportation	25
Troubleshooting for sewers and SWTP	20
Miscellaneous needs for system improvement	50
Total	500 – 900

In a first phase, the project will serve 250 households for an O&M cost of 500 USD/month. The contribution per household must therefore be fixed at least 2 USD/month. Today The average investment for emptying the cesspits is 1,8 USD/month per household, but half of the families never empty their pit and let sewage infiltrate in the ground and run in the street. It is therefore obvious that strict rules and control will be needed in order to obtain a payment rate of + 90%.

From 2008 on, running cost will be 900 USD for 600 connected households. Even with a monthly average contribution of 2 USD and a payment rate of +90%, income will be around 1,100 USD/month and sufficient for running costs.

It is anticipated that monthly fees have to increase when the political and economic crisis in the West Bank finds a solution and when the income of people returns to normal. The tariff should then be fixed at the average amount households invest for emptying their cesspit⁶. With 600 connections and a monthly fee of 4 USD, a monthly saving of 1,000 to 1,500 USD can be realised for further investments in extension and rehabilitation.

The treated sewage water will be valorised for irrigation downstream the plant. Licences have to be elaborated with the interested farmers and limited contributions will have to be paid for this water. The price of these licences has to be fixed after analyses of water and ground quality in order to appreciate the added value of the treated water on agriculture. Licence payment will be an additional income to sustain the running of the plant.

The 'Willingness to Pay' for the installation of a sewage collection network and treatment plant by the citizens of Artas was assessed in a May 1999 survey, in an attempt to gauge the reaction towards the project, and the possible level of community involvement. Ninety six percent of the households questioned agreed with the principle of paying for sewage services (monthly bills, maintenance) in proportion to their level of water consumption. The others agreed on a fix contribution.

⁶ We remember that half of households never empty their cesspit and that the other half invest an average monthly amount of nearly 4 USD for regular emptying, bringing the overall average to 1,8 USD.

7. MONITORING and EVALUATION

A baseline survey will be conducted by PHG prior to the implementation of the project. This data will be used to measure the project impact at the evaluation stage.

Daily supervision and monitoring of the implementation are also the responsibility of PHG as assistant of the implementing body. This includes :

- ❑ Technical monitoring and tracking of project plan work and outputs.
- ❑ Financial accountability of financial resources disbursed to PHG by the donor, as well as accounting of cash and/or in-kind contributions from the local community.
- ❑ The PHG staff is responsible for the overall supervision of site work, and will regularly monitor and ensure the quality of the work funded in this Project Plan.
- ❑ PHG will prepare the provisional and final delivery of the civil works.
- ❑ Reports: Monthly Reports, Semi-Annual reports, and a final report at the end of project will be provided to the Executive Committee. Monthly Reports will reflect accomplishments to date according to the Project Plan and previous Monthly Report, and determine the implementation targets for the next month. A final project report will be submitted one month after the end of works.

The project co-ordinator of PHG will organise a mid-term evaluation to ensure the proper implementation of the activities. Six months after completion of the civil works, a second internal evaluation will be conducted by the project co-ordinator of PHG in order to assess the immediate effects, impact and sustainability of the project.

PHG will report to the Executive Committee, which will prepare the semi-annual reports to be presented to the Steering Committee.

The Logical Framework as presented in Annex 1 will be the framework for progress reports and evaluations.

BTC provides two support missions :

- one 3 months after the project starts, in order to appreciate the final work plan, technical design, tender documents and training curricula prepared by PHG;
- one after completion of the construction works at the treatment plant, in order to assist at the provisional delivery of works, to assess the progress at capacity building level, to draft a O&M and work plan guidelines' version and management tools and to prepare the framework of the final report according to BTC guidelines.

The missions will be conducted by an international consultant, assigned by BTC. Their budget is based on 20 days presence of the consultant in West Bank and 4 days for briefing and reports.

ANNEXES

A. Logical framework

	Intervention	Indicators	Sources of verification	Assumptions
Development Goals	Improve living conditions in Artas through a sustainable sanitation and improved management capacities			
Specific Objective	Build a wastewater treatment plant in Artas and ensure its sustainable operation and management	<ul style="list-style-type: none"> - Plant functions at least 350 days/year - Plant treats 90% of wastewater of at least 250 households in 2004 - Quality of discharged water after treatment fits with FAO-guidelines for tree irrigation for at least 300 days/year - Village Council has feasible business-plan for plant management before the end 2004 	<ul style="list-style-type: none"> - Monitoring report from PHG - Business Plan - Mission report of international consultant 	<ul style="list-style-type: none"> - PHG, PWA and MoLG assure backstopping of the Village Council after project implementation
Results	<ol style="list-style-type: none"> 1. A low cost technology wastewater treatment plant is constructed and functional 2. At least 250 households are connected to the wastewater treatment plant through the existing network 3. The Village Council of Artas has the capacities and the means to sustain the efficient working of the treatment plant and the sewage network 4. The inhabitants of Artas are aware of the risks of bad sanitation and contribute to sustainable improved sanitary conditions and behaviour 	<ul style="list-style-type: none"> - Two UASB-reactors of 62,5 m³, reservoir, sludge drying bed and 2 wetlands built according to plans - 200 new interceptor tanks have been constructed - 250 households are connected - The management and O&M Plan, based on cost recovery is implemented by Council members - 500 inhabitants are trained - Leaking cesspits are eliminated - Contribution for O&M is paid - Interceptor tanks are maintained - By-law is respected 	<ul style="list-style-type: none"> - Delivery report from PHG - Mission report of international consultant - Monitoring report from PHG - Monitoring report from PHG - Management tools of Village Council - Reports of the workshops - Management tools of the Village Council 	<ul style="list-style-type: none"> - The existing network is of good quality - The RWU doesn't take over the daily management of the plant

	Intervention	Indicators	Sources of verification	Assumptions												
Result 1	A low cost technology wastewater treatment plant is constructed and functional	Two UASB-reactors of 62,5 m ³ , reservoir, sludge drying bed and 2 wetlands of 1.000 m ² are built according to plans and standards														
		Means	Costs (EUR) Belgian contribution													
Activities	<p>Act. 1.1. Finalise the technical design of the wastewater treatment plant.</p> <p>Act. 1.2. Prepare the tender documents for the construction works.</p> <p>Act. 1.3. Manage the contracting process for the construction works.</p> <p>Act. 1.4. Build the wastewater treatment plant, including a UASB reactor tank, additional treatment in wetlands, a reservoir for the effluent and a storage tank for the sludge.</p> <p>Act. 1.5. Control the progress of the construction.</p> <p>Act. 1.6. Provisional delivery of the wastewater treatment plant.</p> <p>Act. 1.7. Start-up of the plant</p> <p>Act. 1.8. Final delivery of the wastewater treatment plant.</p>	<ul style="list-style-type: none"> - Purchase of 3,000 m³ land - Connection pipe to sewage line - Inlet channel, storage tank and 3 UASB-reactors in reinforced concrete - 2 wetlands with gravel bed - access road, fencing... - technical support by PHG engineers - backstopping mission for design, work-plan, tenders - part-time involvement of BTC Technical Assistant 	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 60%;">Land</td> <td style="text-align: right;">40,000 €</td> </tr> <tr> <td>Construction works</td> <td style="text-align: right;">234,510 €</td> </tr> <tr> <td>Support PHG</td> <td style="text-align: right;">25,000 €</td> </tr> <tr> <td>Support missions</td> <td style="text-align: right;">19,400 €</td> </tr> <tr> <td>TA of BTC (50%)</td> <td style="text-align: right;">12,500 €</td> </tr> <tr> <td>TOTAL</td> <td style="text-align: right; border-top: 1px solid black;">331,410 €</td> </tr> </table>	Land	40,000 €	Construction works	234,510 €	Support PHG	25,000 €	Support missions	19,400 €	TA of BTC (50%)	12,500 €	TOTAL	331,410 €	<ul style="list-style-type: none"> - Movement of goods, materials and persons is possible - The Joint Water Committee approves the proposed project
Land	40,000 €															
Construction works	234,510 €															
Support PHG	25,000 €															
Support missions	19,400 €															
TA of BTC (50%)	12,500 €															
TOTAL	331,410 €															

	Intervention	Indicators	Sources of verification	Assumptions
Result 2	At least 250 households are connected to the wastewater treatment plant through the existing network	-200 new interceptor tanks are constructed - 250 households are connected		
		Means	Costs (EUR) Belgian contribution	
Activities	Act. 2.1. Identify the good working cesspits that can be connected directly to the sewage collectors. Act. 2.2. Prepare the tender documents for the construction of interceptor tanks and their connection. Act. 2.3. Manage the contracting process for these works. Act. 2.4. Construct new interceptor tanks for the houses that cannot be connected directly to the sewage collectors. Act. 2.5. Connect the approved cesspits and the interceptor tanks to the sewage collectors.	- 200 interceptor tanks in masonry - connections in HDPE to sewage line - technical support by PHG	Contribution to interceptor tanks 25,000 € Support PHG 4,000 € <u>TOTAL 29,000 €</u>	- The Village Council convinces all habitants to connect and to pay the fees - The families can and will contribute for the construction of the interceptor tank for an amount of nearly 300 USD per household

	Intervention	Indicators	Sources of verification	Assumptions
Result 4	The inhabitants of Artas are aware of the risks of bad sanitation and contribute to sustainable improved sanitary conditions and behaviour	<ul style="list-style-type: none"> -At least 500 inhabitants trained - All leaking cesspits are eliminated in the centre of Artas - At least 90% of users pay their contribution for O&M - All interceptor tanks are emptied by users when full - By-law regulating sub-sector in Artas exists and is respected 		
		Means	Costs (EUR) Belgian contribution	
Activities	<p>Act. 4.1. Inform the inhabitants of Artas of the importance of safe water, hygiene and good sanitation practices.</p> <p>Act. 4.2. Elaborate a by-law that enables the Village Council to run the sewage system and treatment plant with obligatory financial contributions from the inhabitants of Artas.</p> <p>Act. 4.3. Inform inhabitants of Artas of the by-law, obligation to be connected to the sewage network where it is possible, and the possible fines if not doing so.</p> <p>Act. 4.4. Monitor the efficiency of the treatment plant during the first year of operation and give feedback to the Village Council and population of Artas.</p>	<ul style="list-style-type: none"> - Documentation and training materials - Information and communication tools - Support by PHG staff members - Workshops 	<p>Documentation and training materials 3,000 €</p> <p>Information and communication tools 3,000 €</p> <p>Support by PHG 2,700 €</p> <p>Workshops 1,300 €</p> <p>TOTAL 10,000 €</p>	
Support and management activities		<ul style="list-style-type: none"> - part-time involvement of TA from BTC-Jerusalem - local costs of BTC-office in Jerusalem 	<p>TA (50%) 12,500 €</p> <p>Office costs 4,000 €</p> <p>TOTAL 16,500 €</p>	<p style="text-align: center;">Prerequisites</p> <ul style="list-style-type: none"> - Purchase of land with a contribution from the V.C. - Construction permits - MoU between Village Council and PWA with respect to ownership and eventual transfer to the RWU - Tax exemption

B. Technical study

1. Introduction

In April and May 1999 a team of Palestinian and international sanitary engineers and public health workers conducted a survey and design study for Artas. This interdisciplinary team, led by PHG, collected data and observations which formed the basis of the design and implementation of the first phase of the appropriate low-cost sanitation technologies project at Artas.

The assignment was carried out in the framework of the collaboration between the Palestinian Hydrology Group and the village council of Artas. On the specific topic of sewage treatment the Palestinian Hydrology Group had invited Mr. Kevin Taylor, consultant of *GHK Research & Training* and Mr. Joost van Buuren, consultant of *EP&RC Foundation* in The Netherlands to assist in the design of the non-conventional wastewater collection as well as the low cost treatment systems.

This design has taken into account the larger regional infrastructure projects, which were being implemented as part of the Bethlehem 2000 master plan. One component of the master plan is the Salomon Pool tourism project, which consists of building shopping-handicraft facilities, a conference centre and a hotel near the historic Salomon Pools situated up-stream in the valley that leads to Artas. After various discussions Salomon Pools Resort Ltd. decided to connect its new facility to the Artas Sewage System. This decision opened up the possibility to also connect the households of the village of El Khader that cannot be served by the WSSA sewer system.

Following to the design phase, the project was introduced for funding to the Belgian Co-operation who showed high interest in the project within the context of the Bethlehem 2000 program, which they support. The implementation of the first phase of small diameter sewage collection system started through a grant from the co-operation made through UNDP. This was followed by the construction of the main sewer line. The over all grant that was made available to the project by the Belgian Co-operation through UNDP was in the order of 230,000USD. At the middle of August 2001 the main sewer line that will convey the wastewater to the proposed treatment site was completed.

The current stage involves the construction of the wastewater treatment plant and the connection of the households to the network as described in the subsequent sections.

2. Actual and expected flows of sewage

The flow of sewage is determined by the population number, the percentage of households connected to the sewer system, the flow of drinking water used and the discharge factor. The latter factor expresses the fraction of the drinking water that is collected in the sewer system and should be treated and eventually re-used.

Table 1 presents estimations of the present and the expected flow to the sewage water treatment plant (SWTP).

Design assumptions are:

- per capita water consumption of 75 l/day in 2004; 80 l/day in 2008 and 100 l/day in 2025;
- discharge factor of 0.80;
- yearly population growth of 3%.

Per capita water consumption is based on the results of the base line survey conducted during the formulation mission (74 l/cap/day for 30 families interviewed). The number of inhabitants and the population growth are based on the census published by PCBS.

The Solomon's Pools Resort is expected to have a hotel with 200 beds housing 500 people.

Table 1. Population and sewage flow in the Artas region in 2004 and 2025.

	<i>Locations</i>	<i>Number of beneficiaries</i>	<i>Flow (2004)</i>	<i>Flow (2008)</i>	<i>Flow (2025)</i>
<i>1st phase</i>	Artas-centre	1,600	96 m ³ /day	115 m ³ /day	238 m ³ /day
<i>2nd phase</i>	Artas-outskirts	2,000		144 m ³ /day	298 m ³ /day
<i>3rd phase</i>	El Khader	3,000			446 m ³ /day
	Resort centre	200 beds			100 m ³ /day
		Overall flow	96 m ³ /day	260 m ³ /day	1080 m ³ /day

The SWTP of Artas is designed for a flow that should be reached in 5 years time (2008). In view of the uncertainties about the water supply in the region it did not seem reasonable to plan for a further project horizon. The population served by that time will be around 4000 people. The sewage flow at that time is expected be 260 m³/d.

The existing main sewage pipe, diameter 250 mm, allows the 1080 m³/day or 12.5 l/sec expected in 2025.

The design of the plant is based on 300 m³/day or 3.5 l/sec. Addition modules can be added when El Khader and Solomon's Pool Resort get connected to the network.

3. Quality of sewage

In Artas at present the quality of domestic sewage cannot be measured directly.

To obtain a brief impression of the sewage quality five samples were taken from cesspits spread over the village of Artas, May 3, 1999. The results of the analysis of these samples are given in table 2.

Table 2 Results of an analysis of samples from 5 cesspits in Artas village [TSS = TS-TDS]

Parameter	Unit	Samples				
		1	2	3	4	5
PH		6.62	8.08	7.43	6.86	7.29
TS	mg/l	1,812	2,394	1,126	1,232	1,360
TDS	mg/l	1,808	2,292	1,108	1,200	1,288
TSS	mg/l	4	102	18	32	72
COD	mg/l	4,452	1,562	1,875	n.n.	1,149
EC	mS/cm	4.06	7.00	3.25	2.49	3.06

During the sampling of the cesspits no thick scum layers were observed. Only one tank had a shallow scum layer consisting of fibrous material and coarse wastes.

Since this sampled water had been kept for an unknown period of time in the cesspits, the concentrations of the biodegradable substances and also the COD value are lower than the concentrations in fresh sewage.

The EC value, indicating the concentration of salts in the water, is supposed to give a rather correct indication of the salts in the fresh sewage. The degradation of waste and evaporation (not strong because tanks are closed) may have enhanced the values to some extent. The EC

values 2.49 – 7.00 indicate a salt content of the sewage that renders it less suitable for irrigation, since an upper EC limit of 2 mS/cm is often maintained. Water having an EC of around 2 mS/cm is applicable on salt tolerant crops. The TDS values (average 1,500 mg/l) however are somewhat lower than what might be expected on the basis over the EC-values.

The concentration of suspended solids (TSS) is low (4 – 102 mg/l) which is to be expected in water that has rested for a long time in a cesspit.

Observation of the samples showed the presence of the typical black anaerobic sludge in sample 1 and 2. The volume of this sludge was low. These samples also had a typical smell of anaerobic digestion and the presence of fatty acids. The three other samples had a yellowish colour and a low sludge content. All samples had a high turbidity indicating the presence of colloidal matter.

It was concluded that due to the relatively low consumption the wastewater is relatively concentrated presently, and will remain so in the future. The expected salt content (1,100 mg/l) yields an EC value around 2 mS/cm. The sewage is rather saline. Under certain precautions it can be used for irrigation.

4. Effluent discharge standards

Since it is assumed that the effluent of the wastewater treatment works of Artas and El Khader is to be used for irrigation, agricultural re-use standards should be taken as treatment objective.

Irrigation water has to satisfy microbiological (pathogenic organisms) and chemical standards. The most important chemical standards refer to salts (especially Na⁺ and Cl⁻), boron and heavy metals.

The question of appropriate standards can first be approached by finding out which treatment system is expedient to specific re-use requirements. This is the approach used in the WHO standards in table 3 below.

Table 3 WHO guidelines for wastewater use in irrigation (WHO, 1989) (in: L. Sasse, DEWATS, Decentralised Wastewater Treatment in Developing Countries 1998)

Category	Re-use conditions	Treatment required
A	Irrigation of crops eaten Uncooked, sports fields, public parks	Series of stabilisation ponds
B	Irrigation of cereal, industrial and fodder crops, pasture and Trees	10 days retention in stabilisation ponds
C	Localised irrigation of crops Category B, no contact by workers or public	At least primary sedimentation

Some countries that use effluent irrigation on a large scale (such as Israel) use another approach in which the effluent used for irrigation should comply with certain water quality standards.

Given the characteristics of the wastewater in the villages Artas and El Khader and the low-cost nature of the project it will be difficult to attain an effluent quality as required for unrestricted irrigation. The WHO approach seems justifiable as long as sufficient hygienic precautions for the protection of the agricultural workers and their families and a proper crop choice can be warranted.

At the level of the microbiological contamination, it was concluded that in Artas Sewage Project effluent reuse according to category B of the WHO standards is attainable. The sewage should undergo primary and secondary treatment. The total hydraulic retention time in the treatment system should amount to at least 10 days. The crops to be irrigated are trees (citrus, olive, etc).

For the chemical parameters the standards mentioned in table 4 are adopted:

Table 4 Chemical water quality standards for agricultural re-use

Parameter	Permissible maximum value
BOD ₅	50 mg/l
EC	2 mS/cm
Boron	3 mg/l

5. Overall design

The existing sewage network in Artas is non-conventional. It includes:

- a main sewage line that follows the valley of Artas, in PVC DN 200 and 250;
- a secondary network of pipes ranging from DN 100 to DN 200 in all main streets of the village;
- a tertiary network at household level with small HDPE-pipes to be connected to interceptor tanks.

The idea of the interceptors is to retain already a part of the sludge in the interceptor tanks, where it can partly be converted. The interceptor tanks have a Hydraulic Retention Time (HRT) of at least one day and their design is based on a minimum volume of 1 m³ per household.

This allows a sewage network of relatively small diameters without risks of clogging. On the other hand, construction of waterproof interceptor tanks for each individual housing unit is also expensive.

After this first treatment at household level in the interceptor tank, sewage is evacuated to the treatment plant that consists of two treatment steps:

- an anaerobic treatment in UASB reactor;
- an aerobic biological treatment in wetlands with reeds.

The treatment plant involves following components:

- a coarse screening channel to retain suspended foreign substances;
- a channel for sedimentation of grit and gravel;
- two Up-flow Anaerobic Sludge Blanket (UASB) reactors;
- two units of wetland with reeds;
- effluent storage reservoir
- sludge drying bed.

On next pages, a drawing of the lay out is given, together with a picture of a similar plant under construction in Kharas.

Treatment plant under construction in Kharas



6. Coarse screening, grit and gravel channel

The channel is made in brickwork, on a ground of concrete, with the following dimensions:

Parameter	Value
Design flow	300 m ³ /d
BOD ₅ influent	700 mg/l
Channel width	0.5 m
Channel length – coarse screen	2.40 m
Channel length – grit and gravel sedimentation	6.00 m
Sides height	0.30 m
Thickness of sides	0.20 m
Coarse screen	1.00 x 0.50 m
Distance between bars	0.03 m
Inclination angle of screens	30°
Concrete	2.1 m ³
Brickwork	5.2 m ²

7. Up-flow Anaerobic Sludge Blanket (UASB) reactor design.

Theoretical background:

The UASB process has been developed in 1972 at the Agriculture University of Wageningen, the Netherlands, for the treatment of medium and high strength wastewaters. In the last ten years, the UASB process has gone beyond development phase and has been successfully applied worldwide in many full-scale plants.

The process is based on the capabilities of anaerobic bacteria to reduce the organic compounds in the wastewater to energy-rich methane (70 to 80%), carbon dioxide (20 to 30%) and a small amount of cell material (1 to 5%).

□ The raw wastewater is fed through a distribution system at the bottom of the reactor and is forced to percolate upwards through a blanket of anaerobic sludge. Biogas, sludge and the treated wastewater are separated at the top of the reactor by a three-phase separator.

Drawing on next page shows the cross-section of a UASB-reactor.

Performance of the reactor depends on temperature and the characteristics of the seed biomass and removal efficiency is around 65 to 75% for COD, 70 to 80% for BOD⁷, 70 to 80% for TSS and up to 90% of pathogens (depending on the type of pathogens).

Even if the effluent quality of aerobic treatment is mostly better, the UASB reactor shows the following advantages:

- low costs for investment and for operation and maintenance;
- no external energy needed;
- small land area required
- between 5 and 10 times less biosolids (sludge) than aerobic processes, and sludge is much more compact.

Nutrient removal (nitrogen and phosphorus) is equally low as well. This is one of the reasons for applying a second stage treatment in lagoons with reeds, which absorbs excess nutrients.

⁷ Studies show that COD and BOD removal is still efficient with temperatures between 20 and 15°C (65 and 70%), but is significantly lower at temperatures below 12°C.

Design parameters:

Parameter	Value
Design flow	300 m ³ /d
BOD ₅ influent	700 mg/l
COD influent	1000 mg/l
Hydraulic Retention Time	10 hrs
Total required volume	125 m ³
No. of tanks	2
Volume of each tank	62.5m ³
Water depth	4 m
BOD ₅ removal efficiency	> 70%
BOD ₅ effluent	< 210 mg/l
COD removal efficiency	> 65%
COD effluent	< 350 mg/l
Surface dimensions (in)	4.00 x 4.00 m
Height	4.30 m
Reinforced concrete	70 m ³

8. Wetland design

Parameter	Value
Design flow	300 m ³ /d
BOD ₅ influent	< 210 mg/l
Hydraulic Retention Time	5 days
Water depth	0.8 m
Surface required	1,875 m ²
Effective porosity for gravel	0.35
BOD ₅ removal efficiency	> 70%
Effluent BOD ₅	< 60 mg/l
Effluent BOD ₅ required	50 mg/l
Plants used	Reeds : duckweed <i>Lemna gibba</i>
No. of wetlands	2
Length x Width of each one	50 x 18.20 m
Concrete for ground beam under side walls	18 m ³
Brick work for side walls	110 m ²

A cross section of the ponds is shown on next page.

By gravity, the water flows from the UASB, through the wetland to an effluent storage reservoir of 100 m³. Its role is to collect the treated water as a buffer before it will be used, by gravity or pumped, to irrigate tree plantations in the neighbourhood of the plant.

9. Effluent storage reservoir

Parameter	Value
Design flow	300 m ³ /d
Hydraulic Retention Time	8 hours
Volume of the reservoir	100 m ³
Water depth	1.50 m
Surface required	67 m ²
Length x Width	8.20 x 8.20 m
Reinforced concrete	50 m ³

10. Sludge drying bed

A small drying bed will be made for the excess sludge that will be produced in the reactor. An open construction in brickwork of 6 to 3.50 m will be made. A drain with perforated PVC-pipes and gravel lays under the sludge. After a few weeks, the sludge will be sufficiently reduced and solid to be handled by spade and used as fertiliser in the gardens.

11. Operation & Maintenance

UASB reactor

Regular operation and maintenance activities are:

- cleaning of the flow splitters
- cleaning of the down flow pipes in case of obstruction
- cleaning of effluent gutter.

If deemed necessary the following activities will also be performed:

- removal of a scum layer from the surface of the tank
- removal of excess sludge.

The removal of the scum layer can in principle be done manually or by means of a vacuum pump. The removal of excess sludge should only be carried out regularly during the warmer seasons (not in winter) when the sludge is well stabilised. During the winter and early spring the reactor may contain poorly stabilised sludge, which when spread on the sludge treatment units may cause an abnormally high loading rate and probably problems of malodours. All elements of the SWTP are easily accessible for operation and maintenance

Wetland

The maintenance of the ponds consists of the following items:

- Trimming of the vegetation growing on the pond embankments. The vegetation should not extend into the ponds.
- Damages to embankments and influent or effluent pipes should be repaired.
- An eventual scum layer should be removed.

It is generally accepted that facultative ponds require periodic desludging, but in this project sludge accumulation in the facultative ponds is not expected, due to the low loading rate. It is therefore expected that the ponds will not have to be desludged.

Sludge treatment

Septage should be spread evenly onto the vegetated bed surfaces. The dried septage may accumulate for a period of four to five years. After a period of resting in order to bring about die-off of pathogens, the whole dry bed contents, including the helophyte vegetation, is

removed. This material can be used as fertiliser. Before usage, new beds should be planted with reed. For sufficient growth of the young reed it should be wetted preferably with effluent from the wastewater treatment plant.

12. Budget (in EUR)

Component	Unit	Price/unit	Quantity	Total
Connection & channel				
Excavation	m3	8	200	1600
PVC drain pipe DN 250	meter	10	300	3000
Reinforced concrete	m3	120	3	360
Brickwork	m2	20	6	120
Taps, screen, etc.	LS			1000
Labour	day	30	100	3000
Total connection & channel				9080
Two UASB reactors				
Excavation	m3	8	200	1600
Concrete	m3	80	70	5600
Steel	ton	420	9	3780
Manholes	unit	250	2	500
5 mm steel plate + coating	m2	18	75	1350
Coating of walls	m2	4	400	1600
Taps, pipes, etc.	LS			2000
Labour	day	30	250	7500
Total UASB-reactors				23930
Wetland				
Mechanical excavation	m3	6	3000	18000
Reinforced concrete	m3	120	18	2160
Brickwork	m2	20	110	2200
Gravel	m3	35	2000	70000
Lining : clay, sand, HDPE	m2	18	2700	48600
Labour for planting and gravel	day	20	400	8000
Labour for construction	day	30	150	4500
Taps, screen, etc.	LS			2000
Total wetland				155460
Storage tank				
Excavation	m3	8	150	1200
Concrete	m3	80	50	4000
Steel	ton	420	7	2940
Taps, pipes, etc.	LS			1000
Labour	day	30	100	3000
Total storage tank				12140
Other works				
Fencing	l.m.	15	260	3900
Sludge drying bed				5000
Unimproved access road	l.m.	50	500	25000
Total others				33900
OVERALL TOTAL				234.510

C. Terms of Reference for the Assistant to the implementing agencies

Background

PHG has developed a good practical experience in wastewater collection, treatment and reuse. It implemented seven pilot projects in different parts of the West Bank and Gaza for wastewater treatment. Such pilot projects utilise various treatment technologies but mainly low cost natural treatment technologies. Among the technologies used are the UASB, UAF, Constructed wetland, Septic tank and others. PHG aims at developing the most appropriate technologies for wastewater treatment that best fits the local climate as well as water use conditions in the West Bank.

In the village of Artas, PHG implemented in 2001 a wastewater collection system with a Belgian grant. Due to the knowledge and experience gained throughout the implementation of the previous projects (Phase I), PHG will take the role of presenting a complete wastewater project. The importance of this project originates from the idea that the collection system is a non-conventional⁸ one and that its combination with the proposed treatment technology would give a different result and perspective than other pilot projects implemented by PHG in the other areas. Hence, it will give a better chance to the different stakeholders to do the comparison among the various technologies in use.

PHG has a demonstrated experience in the implementation and management of such projects. Under the umbrella of the Executive Committee of the Artas Low Cost Wastewater Treatment Plant Project, PHG will be contracted for:

- a participatory Environmental Impact Assessment;
- the elaboration of the final design of the treatment plant with respect to the specifications of the available land and the Palestinian norms and standards, and the design of interceptor tanks and connections;
- the preparation of the tendering documents and assistance to the Executive Committee during the tendering process;
- the monitoring and supervision of the civil works;
- the internal evaluation of the project;
- the capacity building for the Village Council, the local technicians assigned for Operation and Maintenance, and the inhabitants;
- the elaboration of a manual for O&M of the plant and the management of the whole system;
- assisting the Village Council and local technicians during the start-up phase of the plant.

1. Environmental Impact Assessment

PHG will conduct an EIA in the location of the project. PHG has the experience in such studies. EIA's are conducted by a specialised PHG team.

EIA is required:

- to ensure that the decision of implementing the project is true and based on EI;

⁸ The sewage and treatment system of Artas comprises the following components:

- a first sedimentation in interceptor tanks at household level;
- collection and evacuation of the sewage through a small pipe network;
- anaerobic treatment in UASB reactor;
- further biological treatment in wetlands.

The small pipe collection and evacuation network has been built in 2001. The other components make part of this project.

- to reduce the expected negative impact;
- to optimise the project economically and environmentally;
- to ensure the sustainable use of resources and the environmental soundness of the project.

This study needs to identify the following items:

- topography of the area
- water resources available and related problems, including ownership and actual use
- wastewater: collection and disposal system and problems
- analysis of ground quality at construction site
- analysis of ground quality downstream for irrigation opportunities
- topography of the site
- population and urban development
- economical development
- agricultural development
- social aspects
- legal environment
- tourism
- public health.

A scoring sheet including different indicators will be designed to help measuring the environmental impact of the project on the area. Scooping sessions and focus group meetings will be organised to get a better understanding of the public perception of the project and its likely impact.

2. Final design

Once the land made available by the Village Council for the construction of the treatment plant, PHG will finalise the technical study of the plant.

This relates to:

- Investigation visits to the sites of the project and data collection.
- Design the project, work timeline and preparation of the required maps and detailed drawings. This includes:
 - Topographic map of the proposed location, on 1:2500 scale or larger.
 - Layout of the plant on the topographic map.
 - Technical drawing of the UASB reactor and a cross section showing the dimensions. The cross section will also show the wall thickness and the steel required. It will also define the layout of the scum gutters.
 - Technical drawing of the wetland. A cross section defining the materials that will be used and the grading of the gravel along the wetland. The section will also define the inclination of the wetland edges from all directions.
 - Technical drawing of the reservoir that shows its dimensions. A cross section will define the wall thickness and the required steel. In addition, a detailed scheme will define the sealing steel layout and diameter.
- Preparation of the bills of quantities.
- Detailed specifications for materials and equipment.
- Estimation of costs

It is noticed that the design will take into account the different strategic choices as described in the TFF: technology that can easily be operated and maintained by local technicians, that use intensive local labour during construction, that uses local materials as much as possible...

The final design will be proposed for control to an international consultant assigned by BTC, and to PWA in order to verify that national norms and standards are respected. Non-objection of these two parties is required before final decision on the design by the Executive Committee.

Five copies of the final design will be handed over to the Executive Committee.

3. Tendering, contracting and supervision procedures

The construction work of the Artas treatment plant will be implemented through local and qualified contractors (classified as A or B in the water and sanitation sector) who are monitored and supervised by the PHG staff. The selection of these contractors will be conducted through a restricted bidding process according to the European regulation for public contracting. A contract will be signed between BTC and the winning contractors, after clearance by the Executive Committee, and a letter of go ahead will be issued to them to officially allow the start of the work.

PHG will also prepare a Memorandum of Understanding between the Executive Committee, PHG and the Village Council of Artas prior to the start of the project. Such agreement details the roles and responsibilities of the local communities, of PHG and of the Executive Committee. It also defines the procedures for opening joint bank account and collection of beneficiary contributions and depositing them in the account.

The major steps taken by PHG in preparing the tenders and contracts can be summarised as follows:

- ❑ To prepare the tender documents in accordance to the PWA specifications and the European regulation for public tendering.
- ❑ To advert a call for interest in the local newspapers in the name of the Executive Committee and after its approval.
- ❑ To propose to the Executive Committee a selection of at least 6 interested building contractors who will be invited to make a technical and financial proposal according to the tendering documents.
- ❑ To send all documentation to the pre-selected candidates.
- ❑ To organise a clarification meeting with the candidates.
- ❑ To organise a field visit for the candidates to explain to them what needs to be done on the ground and give them a feeling of the work environment.
- ❑ At least three (3) contractors have to apply. If it is not the case, it will be re-tendered. The offers will be opened and evaluated by the Technical Advisory Committee. The Executive Committee takes the final decision and BTC signs the contracts as the Authorising Officer of this project.
- ❑ The Technical Advisory Committee will propose the firm based on a comparative table, taking into account price, capacity, and technical capability. Other factors may also be taken into consideration:
 - Unit rates for materials.
 - Previous experience of the contractor in similar work (very good track record).
 - Contractor's legal status.
 - Contractor's level of commitment and co-operation: high level of commitment is needed for executing the required activities; this can be assured by reviewing the contractors profile and track record.
 - Contractor availability per planned timeframe of activity.
- ❑ Each bid will be fairly evaluated, using an open process with the participation of all stakeholders of the TAC, and the results properly documented in writing.

- ❑ The starting dates will be agreed upon in the contract signed between the Executive Committee and the winning firm and witnessed by the Head of the Village Council and the representative of PWA.

4. Monitoring and supervision

Baseline survey will be conducted prior to the implementation of the project. The data collected will be used to measure project impact at the evaluation stage. Appropriate qualitative and quantitative indicators must also be developed prior to funding dissemination. These indicators will need to provide verifiable means for assessing the effectiveness of the activities carried out.

PHG will use a process of strict monitoring to ensure proper and full implementation of the project plan (technically, administratively and financially) and its compliance with the objectives, expected results, activity plan, and project plan timeframe, along with the policies and procedures. The monitoring process will track and gather qualitative and quantifiable outputs to obtain a reasonable evaluation of the project's accomplishments, as well as to measure them and their impact in relation to the proposed targets and to the fulfilment of the objectives stated in the project plan.

The supervision and monitoring process will include:

- ❑ Technical monitoring and tracking of project plan work and outputs ensuring the quality of the work, in accordance with the applicable standards.
 - ❑ At financial level, control the accountability of the financial resources disbursed to PHG by the donor, as well as account for cash and/or in-kind contributions from the local community.
 - ❑ At administrative level: PHG will administer the implementation of all activities in this project, including monitoring the activities and performance of its staff's work teams and contractors. Moreover, PHG will monitor the participation and contributions from the local community (represented by the local village council) through participatory methods and by conducting discussion sessions to identify the community roles and responsibilities during the project implementation and beyond the project lifetime. PHG will hold different training courses to build the community capacity to run and sustain the implemented projects in the future, as specified under 6. capacity building.
 - ❑ Site monitoring by PHG staff: PHG staff are responsible for the overall supervision of site work, and will regularly monitor and ensure the quality of the work funded in this Project Plan. The Executive Committee and other members of the TAC may visit at any moment and observe the implemented work to verify PHG's compliance with the project plan, activity time-line and work standards. The Executive Committee will be invited to attend the awareness and training activities as well as visit the other work sites.
 - ❑ PHG will prepare the provisional and final delivery of the civil works.
 - ❑ Reports: Monthly Reports, Semi-Annual reports, and a final report at the end of project will be provided to the Executive Committee. Monthly Reports will reflect accomplishments to date according to the Project Plan and previous Monthly Report, and determine the implementation targets of its activities for the next month. A final project report will be submitted one month after the end of the works.
- Field visits will be carried out on a regular basis by the project co-ordinator of PHG; spot checks and field reports will be taken. A fulltime site engineer will also follow up

in details the implementation of works. He will also write reports on daily progress basis.

5. Evaluation

Internal evaluation: The project co-ordinator of PHG will organise a mid-term evaluation to ensure the proper implementation of the activities. Six months after completion of the civil works, a second internal evaluation will be conducted by the project co-ordinator of PHG in order to assess the immediate effects, impact and sustainability of the project.

Other indicators or areas to be considered, but not limited to those in the project plan, include:

- ❖ Quality of work and appropriateness of the targets: did the work address the needs?
- ❖ Impact on farmers, women, school children and their families.
- ❖ What were the opinions of the stakeholders on the project? Are they prepared to take the initiative to sustain the project?

Other quantitative indicators such as the following may also be used (more indicators may be added through the implementation process):

- The quantity of local unskilled labour involved in the construction works
- The community participation and co-operation
- The managerial capacity level of the local organisation
- The community contribution level
- The level of consistency with other plans and strategies
- The level of women participation
- The level of employment (number of job created)
- The number of cubic meters of treated and reused wastewater for agriculture production
- The number of dunums of land irrigated
- The number of participants in awareness development sessions and training
- The number of jobs created in the cadre of the various activities.

6. Capacity building

It is important to ensure that the proposed project is sustainable. The success of any project can be reflected in its sustainability and continuity. Therefore the sustainability of the activities implemented under this project will be achieved through the following approach:

- An agreement will be signed between the Village Council and PHG. This includes: the commitment from the Council that they will recruit technical staff to be responsible for operating and maintaining the plant. The Village Council capacity building will be conducted by PHG staff members through training courses and on-the-job training.
- Involving members from local organisations such as the Village Council and the local committees in the implementation of the proposed project in co-operation with the team of the program, which will enhance and strengthen their ownership of the project.
- Workshops will be conducted for all habitants of Artas on sanitation, hygiene and the different components of the sewage network and treatment plant.
- After implementing the project, the project committee of PHG will keep providing follow up. Current local staff will be trained on the way to operate the system. This will enhance the sustainability of the project. On the other hand, the involvement in all the phases of the project of the local community representatives who are the Village Council members: the planning, implementation and monitoring will empower their sense of ownership and will enhance the project sustainability.

- ❑ Palestinian Hydrology Group is expected to carry out water and environment conservation and agricultural awareness campaigns for the locals in the targeted villages. These campaigns will motivate the idea of sustainability.
- ❑ Plans of the project will be handed over to the Village Council, to the Executive Committee and to PWA, together with the final report.

At least the following training and workshops will be organised:

<i>Workshop</i>	<i>Target</i>	<i># of participants</i>	<i># of days</i>
Awareness on hygiene and sanitation (different workshops in small groups)	Villagers	400	2
Project management	Village Council	10	3
Financial management	Village Council	10	3
Water and sanitation management	Village Council + Local technicians	15	5
Tariff structure, cost recovery...	Village Council	10	3
Operation and Maintenance	Local technicians	5	10
Bookkeeping, reporting etc.	Local manager	2	3

Most of the training will be conducted by the regular project staff of PHG or by its general staff. A limited budget is available for external trainers and the running costs of the training. The workshops will be held in the headquarter of the Village Council in Artas or on the ground.

Exchange visits are also planned to other villages or municipalities where similar treatments plants are in operation, such as Kharas.

7. Elaboration of manual for O&M

PHG will elaborate different documents for operation, maintenance and management of the sewage network and the treatment plant. They relate to:

- ❖ A technical manual for the local technicians trained during the project implementation. The manual will explain the different procedures and techniques, with simple drawings where needed, so that local technicians have a reference guide for all activities related to the operation and maintenance of the interceptor tanks at household level, the sewage network and the treatment plant.
- ❖ A logbook for the operation and maintenance activities. The logbook will indicate the periodicity of different interventions, the materials and equipment used for each of the main interventions, the important indicators with respect to the performance of the treatment plant... The logbook is an instrument for the Village Council and PHG to control the running of the plant, the performance of local technicians, the costs for maintenance and operation and some of the efficiency indicators of the treatment process.
- ❖ Management instruments for the Village Council: financial instruments, management instruments for the local technicians, elaboration of a simplified business plan based on a cost recovery strategy...

8. Assist the Village Council during the start-up of the plant

The first six months of operation of the plant are crucial.

The plant has to be initiated before it can be connected to the sewage system of the village. The initiation has to take place during the hot period (summer-autumn). It takes about three

months for the UASB reactor to reach steady state conditions in order to make sure that it will function efficiently. The start up process will be performed by filling up the UASB with septage from existing septic tanks and keep it for two months. The reactor will operate as a batch or semi-continuous one with this seeding because it will facilitate the rapid growth of the bio-mass. After two months the reactor may start to receive the village sewage loads in a continuous flow mode. Once the UASB is operated in a continuous mode with the village sewage, it will take one more month to reach its operational or dynamic steady state.

During the three months of the starting period and the first three months of continuous operation, a supervisor of PHG will ensure the follow-up in the village at least twice a month. A visit of the plant, a meeting with the local technicians and a restitution meeting with the village have to be planned for each visit. A short report will be addressed to the MoLG, PWA and BTC.

9. Procedures

Taking into account the experience of PHG with the proposed technology, its experience of a participatory approach, its involvement in the first phase of the sanitation plan of Artas and the request from the involved Palestinian ministries and authorities to work on capacity building of the Civil Society through the involvement of local organisations such as PHG, the Executive Committee assigns PHG as responsible for the tasks described under 1 to 8.

This assignment is based on the tentative task description and on the budget as developed in this section. Once the project is approved by the different authorities, PHG will elaborate a detailed planning of its involvement, the profile and the job description of each staff member to be involved in the project and a final detailed budget that will not exceed a contribution of 41,000 EUR from the project.

Changes in the assignment of the project co-ordinator or site engineer have to be approved by the Executive Committee. These two key staff members will keep time sheets of their involvement in the project and report it to the Executive Committee on a three months basis.

Payment of the project contribution will be on a three months basis. PHG will join time sheets and all invoices of third parties paid by PHG in the framework of this project, to the financial report, presented to the Executive Committee, and paid by BTC in the two weeks following the presentation of report with documentation.

10. Project personnel and management cost

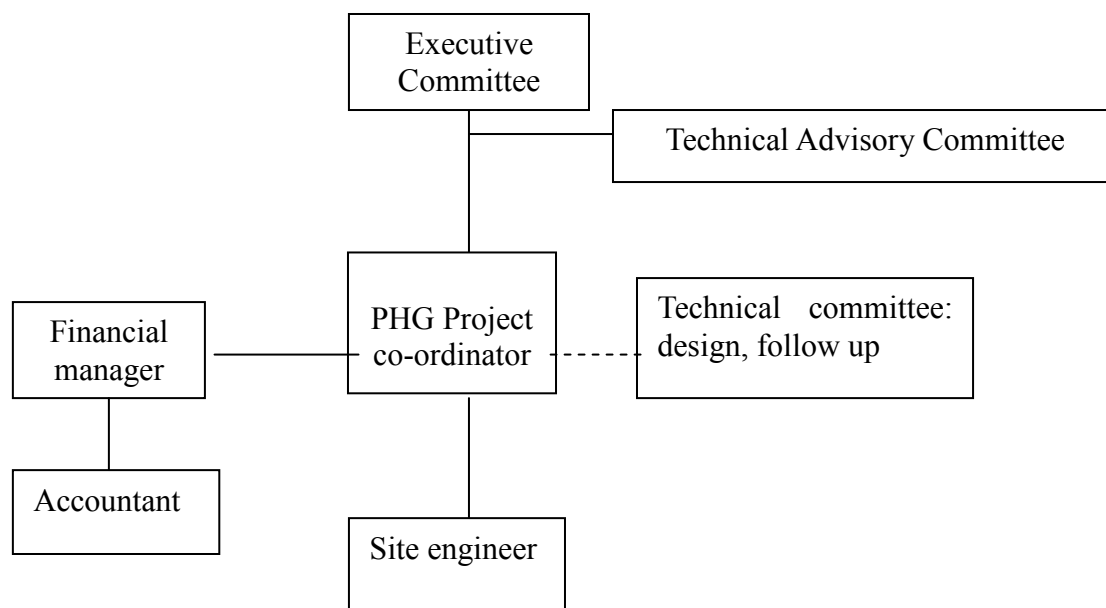
The project will be implemented and supervised by the following PHG staff. Cost breakdown is described below.

Item	Unit	Quantity	Cost /unit EUR	Granter Contribution	PHG Contribution
Project co-ordinator Part time 20% for 18 m.	month	18	350	6,300	
Site engineer (civil or sanitary engineer) Full time for 12 months	month	12	1200	14,400	
Accountant	month	18	100	1,800	

Item	Unit	Quantity	Cost /unit EUR	Granter Contribution	PHG Contribution
Part time 10% for 18 m.					
Finance manager Part time 10% for 18 m.	month	18	150	2,700	
Technical support	month	18	200		3,600
PHG Executive manager (advisory committee)	month	18	200		3,600
PHG technical committee support	month	18	200		3,600
Transportation	month	18	200	3,600	
Communication	month	18	100	1,800	
Occupancy cost (electricity, rent...)	LS	1	1200	1,200	
Office supply	LS	1	800	800	
Follow up technical expert Part time 30% for 12 m.	month	12	300	3,600	
Water quality testing and analysis		12	100	1,200	
Ground quality testing				1,000	
Workshops				2,600	
Total				41,000 EUR	10,800

It has to be noticed that most of the workshops will be conducted by the above mentioned PHG staff. For special sessions, PHG can hire the services of external experts, respecting the available budget for that item.

11. Artas Project Management structure



D. Detailed planning

Results and activities	Month															
	1	2	3	4	5	6	7	8	9	10	11	12	13-14	15-16	17-18	19-20
Result # 1 : A low cost technology wastewater treatment plant is constructed and functional																
1.1. Finalise the technical design of the wastewater treatment plant	X	X														
1.2. Prepare the tender documents for the construction works			X	X												
1.3. Manage the contracting process for the construction works					X	X										
1.4. Build the wastewater treatment plant							X	X	X	X	X	X	X			
1.5. Control the progress of the construction							X	X	X	X	X	X	X			
1.6. Provisional delivery of the wastewater treatment plant														X		
1.7. Start-up of the plant														X		
1.8. Final delivery of the wastewater treatment plant																X
Result # 2 : At least 250 households are connected to the wastewater treatment plant through the existing sewage network																
2.1. Identify the good working cesspits that can be connected.								X								
2.2. Prepare the tender documents for the construction of interceptor tanks and their connection to the sewage network									X							
2.3. Manage the contracting process for these works										X						
2.4. Construct new interceptor tanks											X	X	X	X		
2.5. Connect the approved cesspits and the interceptor tanks to the sewage collectors													X	X	X	
Result # 3 : The Village Council of Artas has the capacities and means to sustain the efficient working of treatment plant and sewage network																
3.1. Train at least 5 people of Artas in Operation & Maintenance							X						X	X		
3.2. Train the Village Council in project management				X			X			X						
3.3. Train the Village Council in management and cost recovery mechanisms													X		X	
3.4. Elaborate a detailed Operation and Maintenance Plan and manual											X	X				
3.5. Elaborate a Management Plan for the Village Council													X	X		
3.6. Assist the Village Council with technical and management advices													X	X	X	X

Results and activities	1	2	3	4	5	6	7	8	9	10	11	12	13-14	15-16	17-18	19-20
Result # 4 : The inhabitants of Artas are aware of the risks of bad sanitation and contribute to sustainable improved sanitary conditions and behaviour																
4.1. Inform the inhabitants of Artas of the importance of safe water, hygiene and good sanitation practices	X	X											X	X		
4.2. Elaborate a by-law	X	X														
4.3. Inform inhabitants of Artas of the by-law			X	X												
4.4. Monitor the efficiency of the treatment plant and give feedback													X	X	X	X
Management and support activities																
Steering Committee	X					X						X				X
Backstopping missions			X											X		
Executive Committee	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

E. Detailed budget

Result	Means	Justification	Detailed cost	Overall	Grant	Local
Result 1 : SWTP constructed					331.410	35.000
	Purchase of land	3 dunums x 25,000 USD		75.000	40.000	35.000
	Construction works			234.510	234.510	
		Connection to sewage line	4000			
		Inlet channel	5080			
		UASB-reactors	23930			
		Wetland	155460			
		Storage tank	12140			
		Other works	33900			
	Technical support PHG	60% of contract cost PHG		25.000	25.000	
	Consultancy for design, work plan and tender documents			11.300	11.300	
		12 days in Palestine	7800			
		international flight	800			
		local costs	1800			
		briefing and debriefing	900			
	Consultancy for provisional delivery			8.100	8.100	
		8 days in Palestine	5200			
		international flight	800			
		local costs	1200			
		briefing and debriefing	900			
	Technical support by international TA of BTC-Jerusalem			12.500	12.500	
		20 months at 1,250 € (50%)				
Result 2 : Households connected					29.000	60.000
	Interceptor tanks	200 tanks of 1 m3		85.000	25.000	60.000
	Technical support PHG	10% of contract cost PHG		4.000	4.000	
Result 3 : Capacity building Village Council					16.000	-
	Documentation and training materials			3.000	3.000	
	Manuals and management tools			5.000	5.000	
	Technical support PHG	20% of contract cost PHG		8.000	8.000	
Result 4 : Villagers awareness					10.000	-
	Documentation and training materials			3.000	3.000	
	Information and communication tools			3.000	3.000	
	Technical support PHG	10% of contract cost PHG		4.000	4.000	
Management and support activities					16.500	-
	Local costs of BTC-office Jerusalem			4.000	4.000	
		20 months x 200 EUR				
	Technical support by international TA of BTC-Jerusalem			12.500	12.500	
		20 months at 1,250 € (50%)				
OVERALL BUDGET					402.910	95.000

F. Monthly expenses

(Belgian contribution in €)

Results and nature of costs	Month												Year 1	Year 2	TOTAL	
	1	2	3	4	5	6	7	8	9	10	11	12				
Result # 1 : A low cost technology wastewater treatment plant is constructed and functional																
- purchase of land	40.000													40.000	0	40.000
- construction works							23.451	23.451	23.451	23.451	23.451	23.451	23.451	140.706	93.804	234.510
- technical support PHG (60%)				3.600			3.600			3.600				10.800	14.200	25.000
- backstopping missions			11.300											11.300	8.100	19.400
- TA of BTC-Jerusalem (50%)	625	625	625	625	625	625	625	625	625	625	625	625	625	7.500	5.000	12.500
Result # 2 : At least 250 households are connected to the wastewater treatment plant through the existing sewage network																
- construction of tanks												12.500		12.500	12.500	25.000
- technical support PHG (10%)				600			600			600				1.800	2.200	4.000
Result # 3 : The Village Council of Artas has the capacities and means to sustain the efficient working of treatment plant and sewage network																
- documentation materials			500		500		500		500		500			2.500	500	3.000
- manuals and management tools			500							1.000		1.000		2.500	2.500	5.000
- technical support PHG (20%)				1.200			1.200			1.200				3.600	4.400	8.000
Result # 4 : The inhabitants of Artas are aware of the risks of bad sanitation and contribute to sustainable improved sanitary conditions and behaviour																
- documentation and training materials	1.000												1.000	2.000	1.000	3.000
- information and communication tools	1.000												1.000	2.000	1.000	3.000
- technical support PHG (10%)				600			600			600				1.800	2.200	4.000
Management and support activities																
- local costs BTC-office	200	200	200	200	200	200	200	200	200	200	200	200	200	2.400	1.600	4.000
- TA of BTC-Jerusalem (50%)	625	625	625	625	625	625	625	625	625	625	625	625	625	7.500	5.000	12.500
Overall budget	43.450	1.450	13.750	7.450	1.950	1.450	31.401	24.901	25.401	31.901	37.901	27.901	248.906	154.004	402.910	

G. Persons consulted

ABU JARAEISH Issa	Municipality Council of Kharas; Major
ABU HASHISH Lufti	PHG Bethlehem; Project Coordinator
ABU SUWAY Jamal	Village Council of Artas; Chairman
AL-A'RAJ Hussein	MoLG; Deputy Minister
AL-ATRASH Khaled	MoPIC; Director Western Europe Department
AWADAALLAH Wael	PHG; Engineer Hebron Department
AWAYES Yousef	PWA; Co-ordination with NGO's
AYESH Ahmad	Owner of the land suitable for the construction of the treatment plant
BARGHOTHI Ihab	PWA; Director of the Programme Management Unit
BARGHOUTI Siham	MoLG; Director of the Rural Development Department
COUVREUR Yves	BTC; Resident Representative in Jerusalem
DECONINCK Stefan	University of Ghent; Researcher of the Centre for Sustainable Development,
DELIE Antoon	DGDC; Counsellor for Co-operation Development in Jerusalem
HANTOULI Rabii	MoPIC; Director Europe Department
HEMEID Kamel	MoLG Bethlehem Directorate; General Director
MATTA Mona	BTC; Programme Officer in Jerusalem
RABAYEAH Ahmad	Village Council of Artas; Member
RABI Ayman	PHG; Executive Director
SAED Mohammed Ahmad	Village Council of Artas; Secretary
VAN VAERENBERGH Stanislas	BTC; International Technical Assistant (civil works)
YAQOUB Iyad	PWA; Head of Research and Development Department

H. Minutes of the stakeholder meeting in Ramallah on February 24th

Briefing Meeting Artas Wastewater Treatment Project PWA Office – Al- Bireh 23 February 2003 at 12:00

Participants

PWA: Dr. Ihab Bargouthy, Director General; Mr. Yousef Awayes and Eng. Iyad Yaqoub
MLG: Ms. Siham Bargouthy, DG Rural Development
MOPIC: Mr. Rabii' Hantouli, Desk Officer for Belgium
BELGIUM CONSULATE (DGCD):
Mr. Antoon Delie, Attaché, Head of the International Cooperation
BTC: Mr. Yves Couvreur, Mr Stanislas Van Vaerenbergh,
Consultants: Eng. Stephan Lambrecht, Dr. Ayman Rabi (PHG)

Objective of the Meeting

The meeting aimed at discussing the proposed institutional set-up proposed for the implementation of Artas Wastewater treatment project with PWA, MLG and MOPIC and to agree on a final set-up as well as other project related issues.

General Discussion

The meeting started by giving a background on BTC activities in the West Bank and the importance of linking and coordinating these activities together, whenever possible, to maximize the benefits.

Following this introduction, a brief description was given on the main activities and meetings held by the formulation mission. Meetings were held with the Village Council of Artas three times, the MLG in Ramallah and Bethlehem and with PWA. The proposed institutional set-up was then introduced. The main comment was on the role of PWA. It was agreed to include PWA in the *Joint Local Consultative Body* of the project as a full member. It was also suggested to use the term 'Steering Committee' instead.

Plant Ownership

Another major issue of discussion was the plant ownership. PWA raised concerns on this issue. They argued that if this substantial infrastructure will be provided to the Village Council of Artas, it will create an unbalance in the decisions of the proposed future Regional Water Utility in Bethlehem (RWU). They suggested to declare the plant a public property under the auspices of PWA and managed by the Village Council of Artas. This suggestion might create management problem that might jeopardize the sustainability of the project. Therefore, it was eventually agreed that the plant will be owned and managed by the Village Council until the planed future regional water utility in Bethlehem will be established. An agreement will have to be signed between PWA, MLG and the Village Council of Artas

stating that all assets provided under this project will be moved to the RWU in Bethlehem once it is established.

Project Implementation

All participants agreed on the institutional set-up for the project implementation. Furthermore, it was agreed that the project will be implemented by the Palestinian Hydrology Group (PHG) due to the fact that PHG has implemented the first project phase and has sufficient technical knowledge of the proposed treatment technology. PWA requested that a memorandum of understanding be signed between PWA and PHG prior to the implementation of the project.

Budget and Duration

As it is generally difficult to change the project implementation period and Budget, after the signature of the specific agreement, it was recommended to develop a reliable budget for the project with some safety factors to accommodate any unexpected price rise or any other uncertainty. The formulation document could propose a different budget than the one suggested in the Identification file. In addition, the duration of the project needs to take into account the time necessary to obtain all licences and for other preparation issues required. Therefore, it is recommended to implement the project over a 20 months period.

Other Issues

The other issues that were discussed and emphasized by some participants were as follows:

PWA will facilitate the whole licensing process (related with the Israeli authority). PHG will assist the Village Council of Artas in preparing all technical documents required for the license. The village council will submit the application to PWA, which will then submit it to the Joint Water Committee for approval. It was stated that since the project will be implemented in Area “A” its approval procedure will be easier.

PWA was concerned about the feasibility of the project. Therefore, detailed information will be provided to PWA on the proposed treatment technology.

The Attaché insisted on the institutional environment and issues related to the infrastructure ownership that should be clearly defined before the start of the project.

PWA

MLG

MOPIC

**BELGIUM
CONSULATE**

BTC

I. Documents consulted

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[Ref 2] The status of health in Palestine; 2000 Annual report. Ministry of Health, the Health Management Information System Directorate; Gaza and Nablus; July 2001.

[Ref 3] Population, Housing and Establishment Census 1977, Final results Housing Report Bethlehem Governorate, First part. Palestinian Central Bureau of Statistics; Ramallah; May 1999.

[Ref 4] Quality in Solidarity, a partnership for sustainable development. DGDC; Brussels; March 2000.

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[Ref 6] Ecological sanitation, Pilot project in Palestine – a project appraisal. SIDA; Stockholm; December 2002.

[Ref 7] Proposed Wastewater Treatment Works at Artas – Bethlehem. PHG; Jerusalem; 2002.

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