EasyChair Preprint

№ 10473

Climate Change and the Impact of Waste Water Management in Palestine

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June 30, 2023

بسم الله الرحمن الرحيم

PALESTINIAN NATIONAL AUTHORITY. MINISTRY OF EDUCATION &HIGHER EDUCATION. DIRECTORATE OF EDUCATION. TUBAS. AL FARA SECONDARY SCOOL.

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Keywords:

Climate Change, Waste Water Management, Palestine.

ABSTRACT

Climate change refers to long-term shifts in temperatures and weather patterns. Mostly caused by human activities, as most scientists agree, climate change will have a substantial impact on our planet as we move ahead in time. Since Palestine is a country with limited water resources, with a growing population and increasing urbanization and rapid growth, agriculture requires better development of the available resources. Most water resources are the scarcity of precipitation and ground water only. This research discusses a mitigation effort to the impact of climate change by considering a better utilization of waste water. Water, which is a scarce resource in vast locations across the earth, can prove very valuable again if purified and reused. Taking a concrete example within an agricultural village in Palestine, Fara' is an agricultural village that is impacted by the passage of waste waters coming from the nearby Nablus city. A wastewater treatment project is discussed alongside the environmental impact and how it relates to climate change. The research addresses the

purposes of wastewater treatment, descriptions of quantity and quality of wastewater that will be treated, and a description of the environmental impact of the project on agriculture and ground water and the acceptance of people to the idea of the reuse of wastewater after treatment.

Introduction:

Examples of greenhouse gas emissions that are causing climate change include carbon dioxide and methane. These come from using gasoline for driving a car or coal for heating a building, for example. Clearing land and forests can also release carbon dioxide. Landfills for garbage are a major source of methane emissions. Energy, industry, transport, buildings, agriculture and land use are among the main emitters.

Wastewater is defined as the combination of liquid or water carried wastes removed from residential, commercial, and storm water. Wastewater contain some heavy metals that have dangerous effects on life, micro-organisms and dissolved gases such as nitrogen and carbon dioxide

The impact of climate change on humanity.

climate change is the greatest threats facing humanity. The effective of climate change include:

1- Decreasing precipitation.

2- Rising average tempreatures.

3- More scarcity of water resources in certain areas, especially in the Middle East and North Africa.

4- Accelerated rise in sea level and changes in regional precipitation patterns

The impact of increasing temperature on water in Palestine

Climate change as a global phenomenon has substantial impacts globally, that extends differently across various climactic regions. The Middle East and North Africa is expected to be one of the less fortunate areas regarding expected rainfall and food supplies available to general populations. In Palestine, various expected impacts are expected. Including:

1- Water availability and quantity of surface and ground water well be more scare as rainfall decrease.
2- Reduced rainfall will make extracting water more costly and require more energy.
3- Climate change increases the likelihood of intense shorter periods of rainfall extended net seasoned flash floods, and droughts.
4- Heavy rainfall causes flooding in urban area due to over flooded drainage and sewage systems.
5- Less water resources are causing a decrease of Dead Sea and Jordan river water.
6- Changing rainfall put agricultural production under higher pressure, could require more pesticides, raise the prices of food, and cause more pressure on soil and resources.

Considering all the above mentioned, adaptation efforts are indeed urgently needed. This paper focuses on wastewater treatment as a very considerable effort.

The significance of wastewater treatment:

Efficient conventional treatment of wastewater is important. Infiltration through sandy soil back to ground water is most desirable because of water quality enhancement effected in viral and bacterial removed. Also, organic

Even after the waste water undergoes the purification processes, the treatment effluent is not entirely free of undesirable constituents (Avnimelech,1993). Interns of a land - oriented waste water disposal practice, any on category of the above mentioned contaminants may limit the soil's ability to receive the waste water (Arar 1988) . However, since the advent of community waste water treatment systems, the attention of land disposal of waste water has invariably been focused a pathogenic organisms (Okun and Schulz 1984. Waste water reclamation and reuse is of interest in the Mediterranean region, particularly for irrigation. In Mediterranean environments, uneven distribution of precipitation and runoff specially and temporally.

Table number 2 shows concentrations of the major constituents of typical wastewater from(FAO) for different strength levels.

Constituent	Concentration mg/litter(strong)	Concentration, Medium	Concentration, weak
Total solids(TS)	1200	700	350
Dissolved Solids(DS)	850	500	250
Suspended Solids(SS)	350	200	100
Nitrogen	85	40	20
Phosphorous	20	10	6
Chloride	100	50	30
Alkalinity as (CaCO3)	200	100	50
Grease	150	100	50
BOD(5-days,20˚)	300	200	100
COD	900	500	250

Table number 2- 2: Major Constituents of Typical wastewater.
Source: FAO Irrigation and Drainage, paper number 47.

From these tables:

Wastewater from Nablus contains a high percentage of nitrate and a high percentage of sodium and chloride compared with the concentration from who.

If wastewater used for irrigation it will effect soil, and increase high –salinity water, sodium hazard from soils and plant presence of other soluble anions in irrigation water lowers the value of sodium absorption ratio(SAR).

If we compare these results from table number 1 with concentration in table number 2 which shows concentration of the major constituents of typical municipal wastewater for different strength levels.

Comparing results of untreated wastewater we find:

* The percentage of phosphorus in wastewater is very high.

* The percentage of nitrogen is very high.

* The concentration of BOD and COD is high.

*The concentration of chlorides in wastewater is very high.

2 – 6 : Description of Geology and climate and Topography

a- Topography:

Nablus is situated at a height over 500 meters above sea level in the hills of Nablus, 64 kilometers, north of Jerusalem and 45 kilometers east of the Mediterranean.

The Military Government area at the eastern side of the town forms the ridge and divider for the flow of the rain water as well as for the flow of the wastewater.

The west basin of the town which includes all parts western of the Military government area drain to the west.

While the east basin of the city in addition to Balata and asker camps drain to the east.

b- Geology:

The eastern site is located on a thin layer of too soil, below this layer limestone and dolomite,

And these layers are very permeable and these layers are very permeable.

The route of the effluent from the eastern side which flows over the Beit Dajan ridge to Wadi Sajur and Wadi Badan, passes through outcrops of limestone and dolomite

.c - : Climate:

The average annual temperature for this area between(18˚-20˚) centigrade with an average temperature (25-28) centigrade during the hottest month, August, and (8˚-10˚) centigrade for the coldest month, January.

The maximum temperature can reach (44˚) centigrade in summer and minimum of zero during the winter months.

Methodology & sampling

METHOLOGY:

Sampling and Target group:

The samples that conducted in this research is not random, the total number of population is 230 from different area in the west Bank (Al'Fara, Al Badan, Tumoon, Aqaba and Tubass).

Appendix 1

Questionnaire for survey about the awareness among people about reusing of wastewate

Questions of the survey:

1- في اعتقادك تحتوي المياه العادمة على أي من المواد التالية:

أ-) جراثيم تسبب أمراضا صحية ب-) مواد كيميائية ضارة ج-) ملوثات عامة د-) لا يوجد

2- برأيك ما هي مضار المياه العادمة:

أ-) روائح كريهة ب-)مصدر للحشرات والقوارض ج-) تلويث البيئة د-) جميع ما ذكر

ب) معرفة طرق التنقية:

3- هل تعلم عن طرق لتنقية المياه العادمة حتى يتم استخدامها ثانية:

أ) لا ب) نعم

4- إذا أجبت بنعم فما هي مصادر معلوماتك:

أ)الحديث بين الناس ب)وسائل الإعلام {التلفزيون والإذاعة}
ج)وسائل الإعلام {صحف,كتب,تقارير} د)غير ذلك

ج) مجالات الاستخدام:

5- هل لديك معرفة عن المجالات التي يمكن استخدام المياه العادمة بعد معالجتها:

أ)نعم ب)لا

6- لو توفر في منطقة سكناك محطة لمعالجة المياه العادمة ففي أي المجالات يمكن أن تستخدم:

أ)الاستخدام المنزلي ب)ري المزروعات ج)ري الحدائق البيتية

د)لا يمكن استخدامها حتى بعد معالجتها

المساهمة في دفع المصاريف:

7- هل تؤيد أن تزيد فاتورة المياه لتشمل جزءا من المصاريف:

أ)نعم ب)لا

8- هل توافق أن يدفع المزارع تكلفة المياه المعالجة:

أ)10% ب)50% ج)70% د)100%

ذ) مستوى الخدمات:

9-هل يوجد شكوى من تلوث المياه في منطقة سكناك:

أ)نعم ب)لا

10- هل تتأكد عند شراء الخضراوات بأنها لم تسقى بمياه عادمة :

أ)نعم ب)لا

11- لو علمت بأنها تسقى بمياه معالجة فهل تشتريها:

أ)نعم ب)لا

ر) المؤسسات المسؤولة في فلسطين:

12- هل تعرف المؤسسات المسؤولة عن تصريف و معالجة المياه العادمة:

أ)قسم الهندسة في البلدية ب)سلطة المياه الفلسطينية ج)سلطة البيئة الفلسطينية
د)غير ذلك

13- هل تعتقد أن أجهزة السلطة المختصة تقوم بدور ايجابي في توعية المواطن في استخدام المياه.

أ)نعم ب)لا

ز) وجود بئر:

14- هل يوجد خزان مياه مطر {بئر} في المنزل:

أ)نعم ب)لا

15- ما هو موقع البئر من الحفرة الامتصاصية:

أ)على بعد اقل من 5 متر من الحفرة الامتصاصية. ب- على بعد أكثر من 5 متر من الحفرة الامتصاصية

ج- غير ذلك.

16- هل تقوم بفحص دوري لمياه البئر:

أ)نعم ب)لا

ت)حالات الأمراض و خصوصا الإسهال

17- ما هي عدد حالات الإسهال في الثلاث أشهر الماضية في العائلة:

أ)لا يوجد ب)4 حالات ج) 5-8 حالات د)أكثر من 9 حالات

Appendices 2:

Data analysis of the survey about wastewater treatment.

To obtain the base line information for the survey, structured interview with key manager. The instrument that used to conduct this survey is questionnaire that divided into seven categories and these are as the following:

1- Awareness among people about the

hazard of wastewater.

2- Knowledge among people about wastewater treatment and recycling method.

3- Some question deals with people's participation if they want financial support if there is any future plan concern wastewater reuse.

4- Awareness among people about the governmental institution who deals with this topic and it service.

5-Knowledge about diseases that may have a relationship with using untreated water.

6- Final topics if they are watching film about reusing of wastewater.

Data analysis

First our analysis deals with basic data about the target population was sharing in providing us about their opinion in this subject.

-About question that concern knowledge about recycling method we found that 22% of them they dose not know, and78% they have an idea about this subject, in addition to source of information see Fig(1).

Representing the area that can be used the wastewater a treatment.

	لا يمكن استعمالها	ري المزروعات	ري الحدائق	الاستخدام المنزلي	طرق الاستعمال
230	35	56	166	23	المجموع
100%	15.23%	24.34%	50.43%	10%	النسبة المئوية

Table (1) : Represent the area that can be used the wastewater a treatment.

In question that deal with knowledge about the institution we see that- 14% of them agree that engineering department in municipal, 30% of them agree that Palestinian water authority, 56% see that environmental authority responsibility.
((For more detail see Fig(3 -2)))..

-About the diseases among family especially diarrhea we found that 37% of people they don't have any history of occurrence of the disease, 63% of this target group have history of 1-4 times only, for more detail see Fig(3-3).

About date that concern about sharing in cases that government want to make project for building institution for reusing the wastewater.

	100%	70%	50%	10%	نسبة المساهمة في المصاريف
230	8	14	51	157	total
100%	3.47%	6%	22.17%	68.26%	Total percentage

Table (3-5):Show the percentage that public can agree to pay in case if there is project about reuse of wastewater.

Environmental Impact:

1-Ground Water:

We have long believed that ground water is in general quite pure and safe to drink, so we give the ground water value of W=25.

Wastewater of Nablus is flowing to the east and then to Jordan Valley where the depth in range of 40-60 meters the depth is very high for wastewater to pollute the ground water, in

addition to the average rainfall from (550 –650 mm) which will decrease the pollution of ground water. V1=V2=0.5

V1:Value in environmental quality with project.

V2:Value in environmental quality without project.

W: Relative weight of parameter.

2- Surface Water:

Pollution of surface water occurs when too much of an undesirable or harmful substance flows into a body of water, exceeding the natural ability of that water body to remove the10

undesirable material, dilute it to a harmless concentration, or convert it to a harmless form.

So we give W=20

Untreated wastewater is combined with storm water in Winter flowing to the east along Wadi Sajur then to Jordan Valley, so surface water will be polluted with wastewater.

So V1=0.5,V2=0.8

3-Agriculture Impact:

Agriculture is very important for people and it depends at water. So W=35

Using wastewater for irrigation of crops make many problems for the soil and the crops, because wastewater contains a lot of salts especially sodium which will cause soil permeability problems, low permeability reduces soil aeration, so when treated wastewater is recycling for irrigation there are many purposes such as:

Increasing the irrigated area in Palestine which lead to improve economy.

Provide enough water for domestic purposes.

Reduce water shortage problems.

So V1=0.4, V2=0.5

4- Social Impact:

The people income in this area is from their land, so W=15

Wastewater treatment plant will be build at a large land nearly 6000m2,these lands are suitable for agriculture and we will not used them for building a plant, so the project will make economic problem and social problems.

So V1=0.6, V2=0.1

5- Air Pollution:

Air pollution has considerable effects on many aspects of our environment: Visually aesthetic resources , vegetation, animals, soils, water quality and human health. So W=5.

Wastewater causes bad smell and air pollution, treatment of wastewater in the plant will cause bad smell and air pollution for people working in the plant.

So V1=0.6,V2=0.1

Parameter	W	V1	V2	WV1	WV2
Ground water	25	0.5	0.5	12.5	12.5
Surface water	20	0.5	0.8	10	16
Agriculture impact	35	0.4	0.5	14	17.5
Social impact	15	0.8	0.2	12	3
Air pollution	5	0.6	0.1	3	0.5
Total	100	2.8	2.1	51.5	49.5

Table number(3-6): Environmental Impact by using Battle System.

Battle System:

E=V1W-V2W

E=51.5-49.5

E=2

Environmental impact of the project is good.

Budget

Total volume of water = 6 million meter cubic.

Total cost = 8 million sequel.

The area of the Lands = 6 dunum.

Total volume of wastewater generate in once year is about 660Mm^3

Wastewater Treatment plant (For the Project) :

Wastewater treatment occurs at specially designed plant that accept municipal sewage from homes, businesses, and industrial sites. The raw sewage is delivered to the plant through a network of sewer pipes. Following treatment the wastewater is discharged into the surface-water environment, or in some limited cases may be used for crop irrigation.

A simplified diagram of a wastewater treatment plant is shown in figure number (3-4) and figure number (3-5) a description of the stages of treatment at the plant are follows:

Primary Treatment:

Incoming raw sewage enters the plant from the municipal sewer line and at first it passes through a series of screens, the purpose of which is to remove large floating materials. The sewage next enters the grit chamber, where sand, small stones, and grit are removing and will be disposed off. The sewage then enters the primary sedimentation pit, where the particular matter settles out to form a sludge. The sludge is removed and transported to the digester for further processing. Primary treatment removes large sizes of pollutants from wastewater which depend at the type of the screens.

Secondary Treatment:

The wastewater from the primary sedimentation pit enters the aeration pit, where the wastewater is mixed with air and some of the sludge from the final sedimentation pit, which contains aerobic bacteria that consume organic material in the waste. After several hours the wastewater enters the final sedimentation pit, where sludge settles out. Most of the sludge is transported to the sludge digester, it is treated by anaerobic bacteria, which further degrade the sludge by microbial digestion. Methane gas is a product of the anaerobic digestion. Wastewater from the final sedimentation pit is then disinfected by chlorinating to eliminate disease-causing organisms.

Project Site:

The proposal site for a wastewater treatment plant is Al-Faria north to Nublos in West Bank.

In addition to source of information see figure number (3-6).

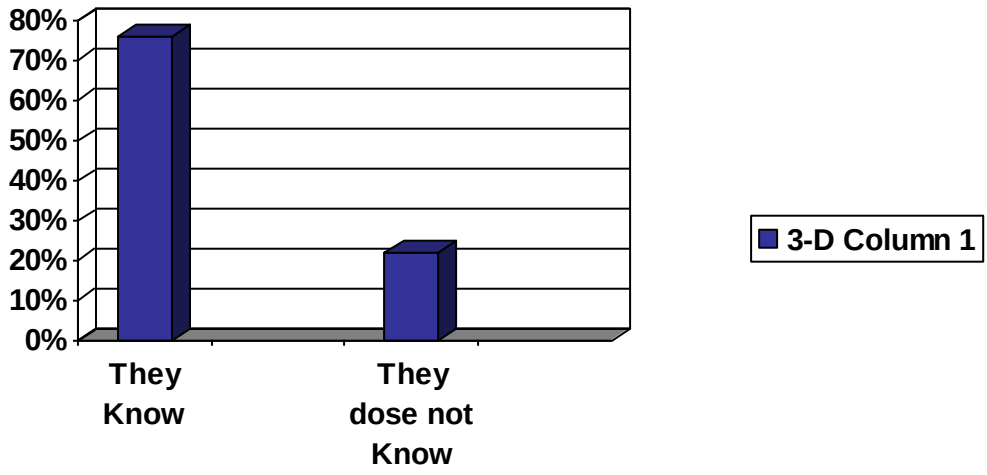

Figure: Knowledge about recycling methods.

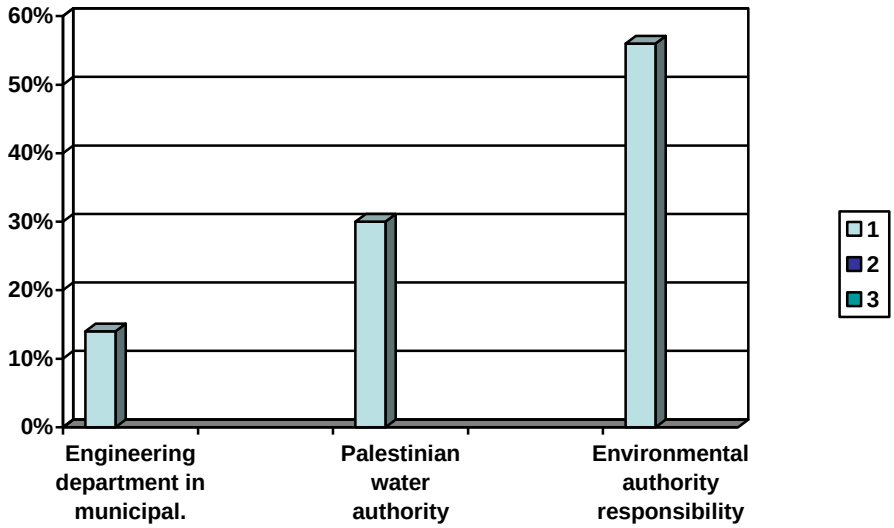

Figure: Knowledge about the institution.

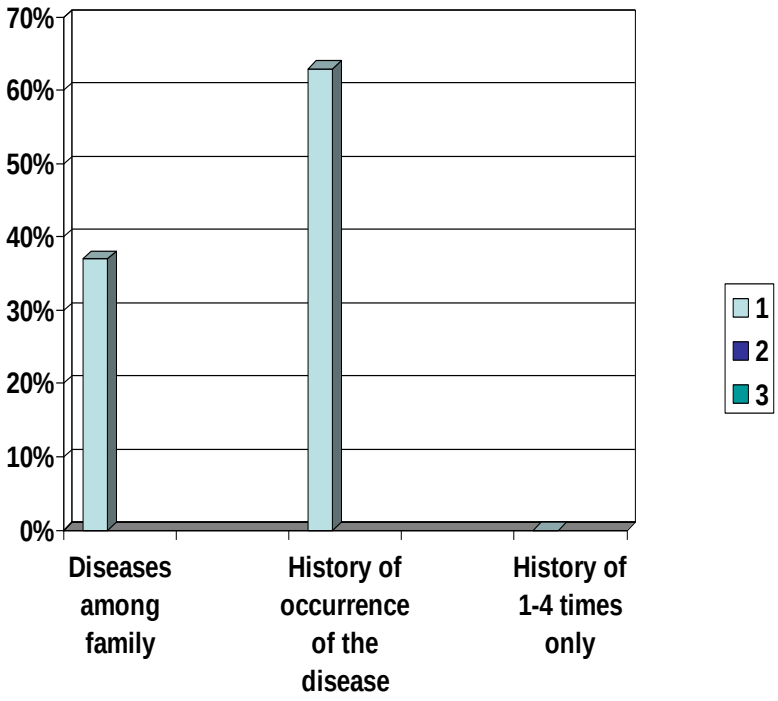

Fig: Diseases among family

Water treatment:

The treatment and potable and waste water utilizing filtration, inert chemicals, aerobic and other newly developed processes are approaches in relationship to local jurisdictional requirements and dents needs.

- Controlling non point source pollution of ground water.

-Poliovirus distribution in the soil-plant system under reuse of secondary wastewater.

-Sewage treatment and recycling:-

- From raw wastewater valuable effluents and energy resources.

-Sequencing batch reactor (SBR) biological treatment and high-rate sand filtration..

-Intensive efforts have been pursued to optimize the use of scarce water resources available in arid and semi -arid regions. Water-supply constraints restrict Agricultural production, which must increase to support the growing world population and elevated demands for food. Saline water, runoff water and treated domestic wastewater are potential sources in areas with limited conventional water sources .

One of the preferable sources is the reuse of treated wastewater for agricultural immigration this wastewater also be used for other purposes, such as industrial cooling, structural fire fighting just control dust on roads and streets, in concrete and soil compaction.

Application of treated wastewater for irrigation of industrial crops, including vegetables for processing or fresh production is gradually becoming a common practice world wide. In addition to studying health risks associated with treated wastewater reuse for irrigation, further research is needed to determine whether applying treated .

Domestic wastewater can solve disposal problems.

** Wastewater treatment and reuse is an important component in meeting the increasing demands for water in the Middle-East region. As urban populations grows and their demand rise. In order to still maintain the desired level of agriculture, the reduction in availability of potable water should be compensated by providing treated wastewater for agriculture and additional purposes.

** Reuse of reclaimed wastewater for irrigation simultaneously also alleviates environmental problems caused by effluent disposal into public areas.

** Wastewater treatment level is determined by a number of combined considerations. The effluent should not pose any human health risk. When disposed to public sites the effluent should not contaminate the environment or endanger soil and water resources. When reusing the effluent for irrigation characteristics related to soil properties, crop, cultivation technology must be taken into account.

Scientific and propsessional collaboration among experts in the prevailing field of wastewater treatment and reclamation can stimulate better water use and environment control.

** The new political developments in the middle east have led to the recognition that water shortages in Palestine and in neighboring countries should be solved by a careful water resource management that incorporates advanced technologies. Desalination of seawater

and brackish ground water and reclamation and reuse of municipal wastewater are the main strategies that have been often need on investigation and application.

The core of most municipal wastewater treatment plants is the biological process, also known as the secondary treatment stage. Wide reuse including edible crops, therefore requires the additional of tertiary treatment stage. The sequencing batch reactor(SBR) activated sludge system has been shown to be a system with simple operation and a highly-efficient process for the treatment of municipal wastewater, as well as of industrial and agricultural waste.

Sewage treatment and recycling from raw wastewater to valuable effluent and energy resources, also about poliovirus distribution in the soil-plant system under reuse of secondary wastewater.

Conclusions & Recommendations :

Conclusions :

The result indicate in this survey that there is still deficiency in knowledge among people to reusing of wastewater and they need more program to increase their awareness to ward this subject and this is the responsibility of the environmental and engineering institution. This program includes television, radio, newspaper and pamphlets about reusing wastewater area and recycling method. Yet it is clear that the impact of the waste water treatment facility will enable a greater utilization of the existing water resources in the village of Fara', alongside a better disposal of the wastewater produced by one of the major cities in the West Bank. Considering the expected future impacts of climate change, and the great expectation of higher pressure on water resources in the region, the research includes the validity of the approach of considering the treatment of waste water as an alternative for the utilization of waste water for agricultural purposes, while saving the scarce water resources. The capacity of the treatment of waste water to facilitate the solution of two major problems in one course of action validates this approach even further.

Recommendations :

**** A climate change adaptation strategy within Palestine must have the treatement of waste water as one of the policy priorities. Given that it contributes to solving three major issues: Climate change, the problems of waste water, and the scarcity of clean water.

**** Better climate adaptation policies must be included in the action plans and these include better harvesting systems of rainfall water, the usage of more water sustainable methods for agriculture, and the incorporation of climate change in future planning, and the preparation for prolonged periods of heat and drought.

****Palestinians should have their own plans for using treated wastewater for irrigation. We should get benefit from the variation climate among Palestine, there is no need to treat the wastewater in order to reach 20mg/Litter BOD. Where various variety of crops can be easily and safety irrigated by wastewater of BOD of 60 mg/Litter as fodder crops.

****There should be more input from the Palestine National Authority (PNA) in this project due to tow reasons:

A- To reduce the health hazard from sewage water.

B- This treated wastewater is considered highly important in water resources to Palestinian especially that irrigating by wastewater will minimize the need of fertilizers.

***Where there is lack of irrigated areas near by the treatment plants, industrial factories that consume a lot of water, such as stone cuttings, plastic manufacture should be established to consume the treated wastewater.

**** where possible, storage reservoir should be built to store the treated water during Winter and to store rainwater, so dilution takes place, and these reservoirs will store rainwater.

**** Training programs for farmers, agronomist as well as plant operators should start soon, as example, local university should learn recycling of treated wastewater for irrigation.

***** Public education and warning should be carried out soon.

**** In the cases where treatment plant is found near by rain fed crops, supplementary irrigation should planned soon.

**** Close cities and villages to be served by one treatment plant, to reduce the capital and costs.

**** There should be a plan of the use of treated wastewater for irrigation or industrial purposes.

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