Syria National Report on

The actual statues of wastewater and Reuse for agriculture in Syria

1. Introduction

The Syrian Arab Republic is characterised by a semi desert or desert plateau, although the coastal zones at the Mediterranean Sea in northwest part of the country are fairly green. The country covers 185,180 km² and it boarders to Turkey, Iraq, Lebanon, Palestine at the occupied Golan Heights, and the Mediterranean Sea. The Euphrates is the most important river, crossing the country in the east.

The present population is estimated at 22 million and the current population growth rate is rather high with 2.2%. Most people live in the Euphrates River valley, along the coastal zone, and around the capital Damascus. About two thirds live in urban areas. Syria is a middle income country (GDP of USD 4,300 per capita), with an economy based on agriculture, oil, industry, and tourism.
The agricultural sector cultivates 32% of the total area or 5.91 million ha of which 25% are irrigated and contributes 22% to the GDP. The Eastern region (Hassakeh governorate / Khabour river basin) is the major agricultural area, especially for the cultivation of cereals and cotton. Fruits are mainly produced in the coastal and the southern region, while vegetables are grown in the Northern region and sugar beets are the main crops in the Central region.

Water related figures are presented for 7 river basins, although Syria is divided into 14 governorates. Syria's national water balance is already facing a water deficit. The renewable water resources of 15,208 Mm³ are exceeded by a total water consumption of 17,669 Mm³, which results in a water deficit of 2,461 Mm³ or 14% of total water consumption in 2004. In 2001, 59% of the population and 61% of the irrigated area were located in river basins that were characterized by a water deficit. Due to its large surface water resources, the Euphrates & Tigris river basin, which comprises about one third of irrigated area, still has a positive water balance. However, another major agricultural area Al Khabour is characterized by an extreme deficit.

Due to Euphrates and Tigris rivers two thirds of the national renewable water supply originates from surface water, while in the other river basins groundwater is the major source of water. The agricultural sector consumes on average 88% of the total water supply. There is a relative low regional variation among the river

basins, even in the populous coastal zones this share reaches 72%. The water consumed by the agricultural sector originates from treated domestic and industrial wastewater (3%), agricultural drainage water (13%), and fresh water (84%). The price of irrigation water is low and not based on volumetric charging.
It is estimated that industries and domestic households generate about 1,200 Mm³ of wastewater, of which on average 75% is collected. Figures for the wastewater sector are not consistent. The amount of treated wastewater varies between 273 and 550 Mm³ corresponding to a treatment rate between 23 and 46% of generated domestic and industrial wastewater. Syria has at present 40 WWTP, but there are only three large scale WWTPs in urban areas. It is estimated, that one quarter of wastewater is neither treated nor used for irrigation and is discharged into surface water bodies or the sea (AGRG*/2008-01/FTF)*

There is a long tradition in Syria to use wastewater, either treated or untreated for irrigation. Farmers use the outflow of wastewater treatment plants, but in addition wastewater is often taken uncontrolled from sewage channels or polluted rivers. A recent estimate states that 473 Mm³ or 3% of the irrigation water demand is satisfied by treated wastewater. In addition, 416 Mm³ of untreated wastewater are applied. In total 6% of the irrigation water demand is supplied by both types of wastewater.

The responsibilities in the water sector for wastewater reuse are shared among 4 ministries: Ministry of Irrigation, Ministry of Housing and Construction, Ministry of Local Administration and Environment, and Ministry of Agriculture and Agrarian Reform.

Syria has wastewater specific laws and regulations. In general, the reuse of wastewater in agriculture is permitted with specific restrictions. The Syrian standards provide for three classes of wastewater quality determining the crops to be irrigated. These standards are relatively high and in one case even more stringent than WHO guidelines: vegetables that are consumed uncooked are excluded from irrigation with polluted water sources.

2. National Bodies Involved in the Water and Wastewater Sector

The water sector in Syria is administered by a number of ministries and establishments, with a slight overlap of responsibilities. These ministries are all represented in the Higher Water Committee, which is presided over by the vice prime minister for services' affairs.
The responsibility for water resources management lies within a number of ministries, which are all represented in the Council of General Commission for Water Resource Management. Each Ministry has local bodies (local directorates or local institutions) related to the central body of each Ministry and distributed over the 14 administrative units.

The Ministry of Irrigation (MoI)

The Ministry of Irrigation (MoI) is the central institution for managing, developing and protecting the water resources, supervising the investments and the establishments in all water basins, setting strategic plans for executing the water policies to achieve the sustainable development for water resources. The ministry is responsible for making available suitable water resources for all water using sectors. It is also responsible for controlling drilled wells, and for licensing future wells and the installation of pumping devices.
The General Commission for Water Resources (GCWR) is the central body within the Ministry.

The Ministry of Housing and Construction (MHC)
The MHC is responsible for supplying drinking water from surface and underground water resources by building, operating and investing in water networks, and water purification stations, and building sewage-water networks and its treatment plants, enhancing the efficiency of water and sewage networks in all regions of Syria.
MHC has a Directorate of Sewerage which deals with wastewater issues. Main tasks of this directorate focus on design of sewage treatment plants and main sewer networks as well as approval the plans prepared by other organizations and supervision of construction projects.

The Ministry of Local Administration and Environment (MLAE)
The MLAE is responsible for monitoring and controlling water quality through its laboratories and observatory networks, and for issuing national standards for the protection of water resources, and tracking the source of pollution in order to implement Environmental Law.
MLAE also has a directorate working with sewer networks and treatment plants for small villages (less than 4,000 inhabitants). Its role is to approve designs of pipelines, treatment plants and construction contracts. MLAE has subdivisions in each Governorate.
The General Commission for Environmental Affairs (GCEA) is the central body within the Ministry
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The Ministry of Agriculture and Agrarian Reform (MAAR)
The Ministry of Agriculture and Agrarian Reform (MAAR) is the main consumer of water resources. It is responsible for the rational use of water for agricultural purposes, minimizing water consumption, encouraging the usage of modern irrigation techniques.
• Preparing new agricultural plans to accommodate the changes and provide respective advice to the MoI;
• Provide farmers with feasibility studies on the conversion to modern irrigation techniques including estimates on the investment requirements;
• Provide loans to farmers through its own banks for the implementation of the new techniques;

• Implement training programmes for both staff and farmers on modernisation concepts and technology management.

Governorate and Municipality Level

There are organisational units of the MLEA in each Governorate which are important regional administration bodies responsible for planning and implementing all governmental tasks at regional and local levels. They play an important role as offering services, especially for small local authorities, which do not have the necessary technical competence of their own. The Governor (Mohafez) represents the central executive authority in the Governorate and supervises and approves work plans for all ministers at the local level including wastewater projects. The Governorate and its municipalities have their own budgets and undertake investments in the field of wastewater and waste management, mainly for small sewer networks but they will be phasing out in the near future, transforming these tasks to the **Public Establishment of Drinking Water and Sewerage** (Establishment) in each Governorate.

In 2006 all drinking water and wastewater projects already executed or under execution were under the control of the **Establishments** across Syria, although several large central projects are still under the responsibility of MHC. An Establishment is responsible for drinking water supply and sanitation in its Governorate. In the Governorate where the Sewerage Company exists, however, the Establishment only deals with drinking water issues. At present, 9 Governorates do not have the Sewerage Company yet. Water supply services throughout Syria are thoroughly provided by the 14 Establishments, while the sewerage service administration is rather fragmented.

The **Sewerage Companies** (Companies) under these Establishments have been set up in cities which have WWTP, for implementing O&M of their sewerage facilities, i.e. WWTP and sewer networks. They carry out minor construction such as expansion of networks on the order basis from the local administration, and O&M of all the sewerage facilities including WWTP. One of the important tasks for O&M will be the monitoring of industrial wastewater discharged to the sewer networks, in order to check whether it conforms to the SASMO 2580/2002. However, such activities have not been practiced so far, and this could be a risk for the proper operation of WWTP and production of environmentally safe treated wastewater.

The MAAR has established sub-administrative bodies throughout Syria representing the Ministry almost in each village. An Agricultural Supervisor is available for each town. These supervisors have high education and are predominantly agricultural engineers. The Agricultural Supervisors have wide knowledge of the area, the resident farmers and all relevant problems. In some areas, veterinary doctors are also employed to:

• Control and stop all illegal practices regarding the use of water and the application of chemical fertilisers and pesticides;
• Support all statistic's upgrading for the agriculture products and animal husbandry in all district towns;
• Apply the annual plan for the agriculture circle in each town;
• Provide advisory services and assistance in case of diseases related to plants or cattle.

3. Wastewater Reuse

3.1 Actual Status / Types of Reuse

There is a long tradition in Syria to use wastewater for irrigation and in comparison to other countries of the study a relatively high share of wastewater is used for irrigation purposes.
Today, due its insufficient water supply, Syria uses all available sources of water for irrigation, which includes wastewater and drainage water, either treated or untreated. In general, the reuse of wastewater is largely unplanned and mainly untreated wastewater is used.

Farmers use the outflow of WWTP (Adra, Aleppo, Salamieh, Harranil Awamid, Ras El Ein) for irrigation, but in addition, wastewater is often taken uncontrolled from sewage channels or polluted rivers. However, there are neither estimates on the quantity of sewage used nor the related cultivation area.
In 2001, the total available water quantified, consisted of 13,332 Mm³ or 83% of fresh water, 2,031 Mm³ or 14% of agricultural drainage water, and 695 Mm³ or 4% of domestic and industrial wastewater. Figures for 2003 show a similar distribution by source: 84%, 13%, and 3% (Figure 2).and figure 1 shows water windrow by sector.

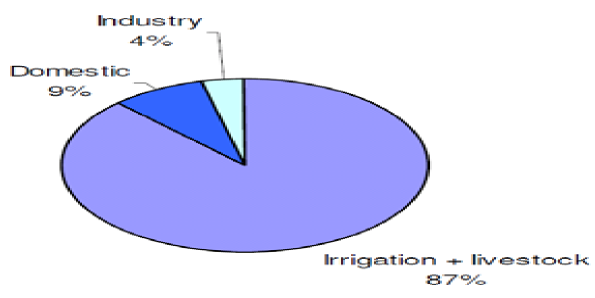

Figure 1: Water withdrawal by sector in 2003
Source: AG*RG/2008-01/FTF - Identification and removal of bottlenecks for extended use of wastewater for irrigation or for other purposes*

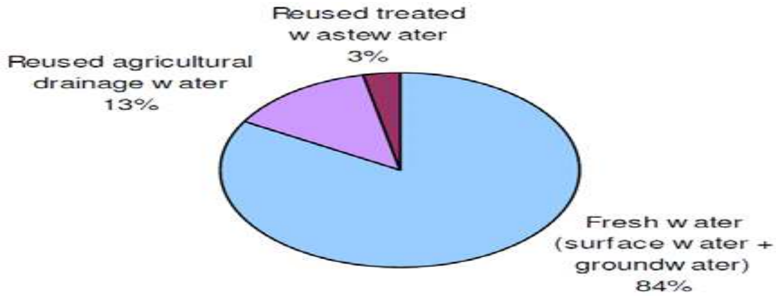

Figure 2: Water withdrawal by source in 2003
Source: AG*RG/2008-01/FTF - Identification and removal of bottlenecks for extended use of wastewater for irrigation or for other purposes*

There are substantial regional differences to what extent agricultural drainage water and wastewater could contribute to satisfy the irrigation water demand (Table 1). The agricultural drainage water could contribute about 10% to the irrigation water in most of the river basins, but there is no clear explanation for the high potential contribution of 47% in Barada & Awag. The estimated potential contribution of wastewater (695 Mm^3) is only 4% of the total irrigation water demand. Barada & Awag hosts 29% of the population and only 6% of the irrigated area is located there. For that reason, in this river basin wastewater could contribute 21% to the irrigation water demand, while in the main agricultural areas this share is insignificant, even in the populous Euphrates & Tigris basin it would be only 2%.

Table 1 Agricultural Drainage Water, Generated Domestic and Industrial Wastewater, and its Potential Contribution to Irrigation Water Use by River Basin in 2001

River Basin	Agricultural drainage water (Mm^3)	Generated domestic & industrial wastewater (Mm^3)	Irrigation water use (Mm^3)	Potential contribution of agricultural drainage water to irrigation water demand	Potential contribution of generated wastewater to irrigation water demand
Barada & Awag	568	257	1,207	47%	21%
Yarmouk	36	50	360	10%	14%
Al Badia	0	8	43	0%	19%
Orontos	231	214	2,306	10%	9%
Coastal	43	**0**	433	10%	0%
Al Khabour	428	36	4,283	10%	1%
Euphrates & Tigris	725	130	7,228	10%	2%
Total	2,031	695	15,860	13%	4%

Other sources estimate the total generated wastewater to 1,200 Mm^3. This amount would increase the potential contribution of wastewater to 8% of the irrigation water demand. However, a recent scientific study estimates that 889

Mm³ of wastewater are used for irrigation of which 473 Mm³ are treated wastewater. About 311 Mm³ are discharged without prior treatment into surface water bodies or into the sea. These figures indicate a contribution of 6% by the treated and untreated wastewater on the irrigation water demand.

Estimates of controlled wastewater reuse are based on the treatment capacity and performance of WWTP.

Figures for 2002 estimate, that 1,354 Mm³ of wastewater are generated of which 550 Mm³ are treated and all of it is reused directly or indirectly for irrigation purposes. Reports on the actual amount of directly and indirectly reused wastewater are inconsistent, but it can be stated that in comparison to the countywide irrigation water consumption, the amount of treated wastewater is less than 5% of the countrywide demand on irrigation water (15,608 Mm³ in 2004). The size of cultivated areas irrigated with WWTP outflows and cultivated crops show regional differences. Based on the national average water supply per irrigated area, the presented irrigated area with wastewater (31,852 ha) corresponds to 390 Mm³ of wastewater (Table 2).

Table 2: Farming area irrigated with wastewater

Governorate	**Irrigated area (ha)**	**Crops**
Rural Damascus	3,654	Fruit trees, fodder crops, and uneatable raw vegetables
Quneitra	-	No WWTPs, except for Ba'ath city, Khan Arnabeh and Qahtanieh where wastewater is delivered to Al-Raqad valley
Deraa	-	Wastewater is discharged into valleys
Sweida	-	Wastewater is discharged into surface water bodies
Homs	1,960	Winter and summer crops, fruit trees (wastewater is discharged within irrigation canals branching from the Orontes)
Hama	159	Wheat, cotton, maize, sunflower, ground peanuts, fruit trees
Al-Ghab	224	Wastewater is discharged into the Orontes river.
Idleb	2,000	Cotton, wheat, sunflower
Aleppo	19,400	Wheat, cotton, maize, fruit trees, and uneatable raw vegetables. Wastewater is discharged into Qweiq, Sajjour and Affrin rivers.
Raqqa	2,155	Winter and summer crops and a small portion of vegetables
Dayr az Zor	-	
Hassakeh	1,800	Cereals, cotton, vegetables
Tartous	-	Wastewater is discharged into the sea
Lattakia	500	Citrus, summer vegetables. Wastewater is discharged into the sea
Total	**31,852**	

In addition, there is an estimate indicating that 416 Mm³ of untreated wastewater are used for irrigation. Furthermore, about 200 Mm³ of industrial drainage water is discharged into the Assi River and is used for irrigation after treatment. There is no further information available on the level of treatment and the irrigated area.

Main sewage networks and drainage complexes are being executed by the governorates under supervision and financial support from the ministry of housing. Sub-networks on the level of municipality are being executed by the ministry of Local Administration and Environment. Although the execution of sewage networks have been executed on a country level, the treatment of sewage water is still limited on the main cities as shown in table 3:

Table 3: operating treatment plants

Source: the Ministry Of Housing and construction 2007.

Region	Capacity m3/day	Number of served people	Financing source	Operating year	Treatment method
Damascus	485000	1800000	Kuwaiti Bank	1997	Activated mud
Damascus countryside	2000	-	GTZ	2000	Wet land
Homs	133900	550000	World Bank	1998	Activated mud
Hama	140000	270000	World Bank	2004	Activated mud
Hama- Al Salameia	4500	-	Ministry of Housing	1993	Oxidizing pools
Aleppo	345600	1800000	World Bank	2000	Ventilated oxidizing lakes
Al Hasaka-Ras Al'ein	2130	-	Ministry of Housing		Ventilated oxidizing lakes

Tables 4 and 5 show under-construction treatment plants and those whose studies have been finished or still pending in different region.

Table 4: under-construction plants

Region	Name of plant	Finalizing date	Number of benefiting people	Plant capacity	Method of treatment	Water quality before and after treatment BOD mg/l	
						Incoming water	Outgoing water
Damascus countryside	Yabroud	2006	47,000	3,910 /7,040	Ventilated lakes	-	-
	Dair Ateiah	2010 /2025	22,000	2,400 /3,600	Ventilated lakes	540	25
	Bait Jen	-	4,000	-	Ventilated lakes	-	-
	Altawani	2006	15,420	792	Activated mud	625	20
	Isal Alward	2006	30,840	960	Activated mud	625	20
	Maida'aa	2006	9,000	480	Activated mud	416	20
	Midani	2006	9,000	480	Activated mud	416	20
	Marj Asultan	2006	7,000	450	Activated mud	416	20

	Bait Saber	2006	9,500	750	Activated mud	500	20
	Dair Maker	2006	7,500	500	Activated mud	500	20
		2007	7,000	450	Activated mud	500	20
	Haijana	2006	23,000	1,485	Activated mud	500	20
	Jdida Alkhas	2006	15,000	900	Activated mud	500	20
	Nabek	-	48,000	3,264	Activated mud	520	30
Dar'aa	Dar'aa	2015 /2020	250,000	21,800 /45,540	Activated mud	232	30
	Da'el	2020	207,296	15,960	Ventilated lakes	-	-
	Um	-	55,905	-	Ventilated lakes	-	-
	Tartoous	-	250,000	-	Activated mud	-	-
Tartoous	Safita	-	35,490	-	Ventilated lakes	-	-
	Barmaya		5000	-	Ventilated lakes	-	-
Lattakia	Lattakia	2007/2015	700,000	117,070 /208,500	Activated mud	280	25

Table 5: plants whose studies are finished or still being conducted

Region	Name of plant	Finalizing date	Number of benefiting people	Plant capacity	Method of treatment	Water quality before and after treatment BOD mg/l	
						Incoming water	Outgoing water
Damascus Countryside	Sarghaia	Study finished	13,700	-	Prolonged ventilation	-	-
	Nabek	Study finished	48,000	3,264	Activated mud	30	520
	Zabdani	Study finished	261,000	128,000		20	600
	Dariia	pending		3,264		30	520
	Khan Eshieh-Khan Dannun	pending	-	-		-	-
	Barada-western Guta	pending	616,000 (2025)	-	Activated mud	-	-
	Mzeirib	Study finished	47,545	-	Prolonged ventilation	-	-
	Sheikh Miskeen	Pending	96463	-	Prolonged ventilation	-	-
	Um	Pending	55905	-	Prolonged ventilation	-	-
	Alsaysana	Pending	14000	-	Prolonged ventilation	-	-
	Banyas	Pending	-	-	Oxidizing lakes	-	-
	Alrakka	Pending	-	7,040	Ventilated lakes	-	-
	Deir Ezzur	pending	220000-	2,130	Prolonged ventilation	30-	317
	Alhasaka	Being advertised	157000 (2025)	45,360/ 67,824	Prolonged ventilation	20	306

Also tables 6, 7, 8 shows the specifications of the treated water in case it was discharged to the main drainage pipe or reused for irrigation or drained to water courses or the surroundings.

Table 6: the specification of water resulting from industrial activities which can be discharged to public water:

Receiving water sources				Unit	Water quality index
Surrounding lands	Agricultural lands	Rivers	Sea		
9.0 – 6.0	9.0 – 6.0	9.0 – 6.0	9.0 – 6.0	-	pH
20	60	40	60	Mg/l	BOD
30	100	150	200	Mg/l	COD
30	60	30	60	Mg/l	TSS
2500	5000	100	5000	Count/100ml	Coliform Group

Table 7: the specifications of treated wastewater when being used for irrigation:

Irrigated crops kind			Unit	The index
C	B	A		
9.0 – 6.0	9.0 – 6.0	9.0 – 6.0	-	pH
150	100	30	Mg/l	BOD
300	200	75	Mg/l	COD
150	150	50	Mg/l	SS
10000	<100000	<100000	Number of Bacteria /100ml	Coliform Group

A = fresh vegetables, meadows and trees within cities
B = crops not eaten raw, meadows and trees outside cities
C = Forests

Table 8: the specification of industrial water which can be drained to the sewage system:

the maximum limit	Unit	The index
6.5 – 9.5	-	pH
800	Mg/l	BOD
1600	Mg/l	COD
500	Mg/l	TSS

The government is constructing sewage system networks and sewage water treatment plants in order to protect the environment and provide a secure usage of water in agriculture. It is worth mentioning that a big part of sewage water is currently being used directly without any kind of treatment, in addition, 2004 statistics about the status of sewage water services in Syria showed that 90% of the houses in Syria are connected to the sewage system, this percentage becomes 93% in cities and decrease in the countryside. Although these figures give positive image about sewage system services, most of those systems are executed with low quality and can be permeable. Furthermore, some cities and all towns and suburbs lack an effective sewage system and stations for treating sewage water; sewage water is still drained either to valleys and water bodies or to the uninhabited lands or both. However, this leads to polluting surface and ground water sources by germs. (Rasol Agha 2005)

Reality seems tragic especially in Damascus and Aleppo countryside where the ends of sewage lines form big swamps where swage water accumulate polluting ground water and spreading diseases. The accumulated water is usually pumped to be used to irrigate vegetables as in Dariia, Sbeineh and Harasta and other regions in Damascus countryside. Figure 4 shows how sewage water is being used to irrigate lettuce in Sbeineh.

Figure 4: sewage water used to irrigate lettuce field in Sbeineh – Damascus countryside

Although a number of sewage water treatment plants exist in most of cities, treatment efficiency in some of them is still under the desired level. Consider Aleppo and Damascus plants, which are the biggest plants, as an example as they treat 60% from the total treated water in Syria in accordance with their capacities. With the assumption that all executed and under-construction plants are working with their full capacity, we find that Damascus plant is the only one that gives treated water of acceptable quality, despite the presence of high nitrate concentration in the water treated for agricultural purposes). The water coming out of this plant irrigates about 15 to 19 thousand hectares in Al Guta that are planted with fruit and vegetables mainly. Up till now, farmers have not sticked to irrigating trees and some specific corps and not irrigating vegetables and other crops by this water according to instruction, leading to a reduction in the benefits of Damascus plant.

On the other hand, quality of treated water in Aleppo plant does not comply with the requirements of agriculture, yet this water is being used in agriculture regardless of the effects it may have on contaminating water sources, corps and soil. One of the reasons of maltreatment is the high percentage of

industrial drainage water in the treatment besides other administrative reasons.
Moreover, treatment plant in Homs (which treats 10% of the total treated water in Syria) suffers from operating difficulties due to its treatment of sewage and industrial drainage; this leads us to realize the unconvincing status of treatment plants. It is useful to point out to the necessity of taking the measures that would ensure preventing draining industrial liquid wastes into sewage system especially those connected with treatment plants.
Finally, we should assert that the number of those plants and their capacities is still below the required level, and that they have a great role in protecting the environment on one hand and in providing safe reuse of sewage water on the other.

3.2 Reusing Treated Sewage Water in Agriculture:

Syrian Arab Republic has wide areas being used for agriculture and there are still many projects under-executing to increase and reclamate the area of agricultural land. Consequently, we should exploit all the available water, in addition to that, long hot summer requires using big quantities of water to meet the needs of agriculture, especially in economical crops such as sugar beet and feed crops.

We have to use sewage water after being treated for agriculture, and even it's being used without treating in some areas such as Al Guta and the southern plains of Aleppo (Al Shawaf- reusing treated water 2001)

When Syrian cities were served by sewage system in the 50th, especially in Damascus and its countryside, sewage water was drained into water courses and Barada branches without treatment. After that, it was used to irrigate different crops, especially eaten-raw vegetables. Consequently, some intestinal diseases, like dysentery and diarrhea have spread in Damascus and its countryside. This caused locals to be very careful in buying those vegetables. The use of sewage water decreased due to governmental procedures, yet the locals still doubt some corps planted in Al Guta. Although it is treated in treating plant and reused in Damascus countryside, the quality of sewage water is still unsuitable to be used in irrigating vegetables because it consists of germs and worms eggs despite being disinfected by chloride.

The ministry of Irrigation and the ministry of Environment and Local Administration are moving towards implementing the laws of environment and water legislation in order to restrict treated sewage water for irrigating trees and feed crops and use spotting irrigation methods to prevent health hazards out of such use.

The biggest project for reusing water treated in Damascus treatment plant located in Adra, north of Damascus. This water is used to irrigate about 18000 hectare of Al Guta Al Sharqeia lands.

Benefits of Wastewater Reuse in Syria

For Syria as a whole, the potential for additional irrigation water through the use of treated wastewater from new wastewater treatment plants is negligible in comparison to the introduction of more efficient irrigation technologies. The benefits of reuse lay mainly in the substitution of untreated sewage by safe and treated wastewater.(: AG*RG/2008-01/FTF)*

Hindrances of Safe Wastewater Reuse in Syria

There are neither cultural nor social hindrances for the use of treated wastewater, but this sector faces the following hindrances:

• Water Sector Policy: Conflicting interests of different stakeholders limit the efforts to implement a consistent water policy;

• Capacity and Performance of Wastewater Collection and Treatment: The current low wastewater collection rate and the insufficient capacity and performance of the wastewater treatment plants do not allow any increase in reuse of treated wastewater. Nearly half of the reused wastewater is untreated wastewater. Industrial wastewater affects the treatment process negatively;

• Institutional Management: Four ministries are involved in the water and agricultural sector. There is a lack on cooperation and coordination in wastewater related issues;

• Standards for Irrigation Water: Relative high standards, lack in differentiation of water quality and application to crops limit the controlled and safe reuse. There is an unclear definition of "contaminated" wastewater, which is excluded from reuse. Too little flexibility of regulations avoids legal reuse, but due to weaknesses in law enforcement illegal use of wastewater of all treatment levels to all kind of crops is practiced.

Water Tariff System: Low water tariffs do not cover the full costs of operation and maintenance, which neither provide a budget to increase performance of existing facilities nor stimulate investments in new wastewater collection and treatment facilities. Also irrigation water tariffs are to low to simulate efficient use of scarce water resources.

3.3 Health Effects of Reusing Treated Water for Irrigation:

Sewage water usually contains the morbids found in human excrement (germs, parasites, viruses, protozoa) which causes contagious diseases when moved to ready for illness human being. (intestinal diseases, diarrhea, cholera, dysentery/Shigla, barimat disease, viral hepatitis E&A, typhus , intestinal

parasites) and others among this long list in addition to the respiratory diseases caused by inhaling polluted water spray leading to inflammations in eye and nose mucous membranes.
Morbid viruses and germs pass from infected people through their wastes and may reach others orally (by eating vegetables) or through skin (as in bilharzias). Liquid wastes (sewage water) usually contain high concentrations of morbids that cause important diseases related to public health. Those diseases are divided into 5 categories by virtue of their way of passing:
First category is caused by morbids that are contagious when being disposed (not potential) with low contagious dose. This category can not reproduce in the environment and it mainly consists of viruses, porotoza, tapeworms and pork tapeworms.

Second category is caused by germs that can cause infection when disposed, unlike the first category. Yet, they need greater dosage in order to cause illness, i.e. greater number of germs must be there to cause illness and infection. They can reproduce out of their host having the ability to saty in the environment, and this means that it can be alive for longer periods required by special ways of passage. Consequently, they can cause health hazards that are potential in the projects of using liquid wastes. Cholera, which is caused by irrigating vegetable crops by untreated liquid wastes, is an example of them.

Third category is caused by circle worms which pass through the soil needless of any host and whose eggs need the period of developing latency in the environment before they are able to cause infection. On the other hand, we find that the minimum of infecting dose is one worm only like Iskaris, Inklestoma and others. All of these worm pass easily through agricultural use of not-good treated or untreated liquid wastes, and they contain morbids of great importance for public health in the projects of reusing liquid wastes for agricultural purposes (corps irrigation).

The danger of health effects resulting from using sewage water in irrigation differs according to many factors, the most important among which are the contagious dose, staying period (latency), individual health status (quality resistance) and the most important is the latency which makes the morbid more dangerous when staying period is longer.

The available evidences indicates that almost all disposed morbids can stay alive in soil for a period of time that is enough to cause potential hazards to corps, farm workers and plant consumer. The current knowledge of the passage of morbids disposed by using liquid wastes in irrigation suggests that worm infection is the most dangerous one because such worms is the most durable (with longer staying periods), have long latency (the period between disposal and passing infection) and they have low infecting dose. Virus infection is the least important while we find germ and protozoa infection to be in the middle. However, contagious evidences are the only way to determine the trueness of this theoretical type.

Health hazards resulting from the use of liquid wastes in agricultural irrigation can be summarized as follows:

- Irrigating crops with untreated liquid wastes remarkable increase in intestinal circle worm infection on the part of consumers and farm workers, especially when those workers are working barefooted. The treatment of these wastes reduces infection limits to a great degree.
- Cholera and maybe Typhus can be passed effectively through irrigating vegetables with untreated liquid wastes.

No documented data concerning the health effects of reusing treated water in irrigation for this matter mainly depends on the quality of treated water on the part of germs and parasites and on the quality of irrigated corps. As for the quality of treated water, observation results clearly show a high number of Colphorm germ in treated water (see table 9) to more than 300000 bacterium/ml, while specification determine the existence of 1000 bacterium/ml in the treated water used for irrigation purposes, taking into consideration that treated water is being used for irrigating raw-eaten vegetables. This indicates the size of health hazards due to eating vegetables irrigated by treated water besides the existence of worm eggs in such water. Analysis conducted in the laboratories of the General Commission of Water Resources indicate the existence of more than one egg per 100 ml of treated water while specification determine the existence of less than 1 egg per 100 ml.

It is enough to look at the data stated in table 23 concerning the diseases passed by water and that are registered in the years 1991-2003 to see the hazard of using untreated or not-good treated sewage water

Table 9: water-borne diseases and number of cases per year

	1991	1992	1993	1994	1995	2003
Typhus	428	1252	2824	12724	11249	4747
Hepatitis	225	413	2508	2365	3420	2929
Diarrhea under 5 yaers	100532	103768	166707	154581	178250	184046

Suggestions:

- Advising not to use fertilizers when irrigating with treated sewage water.

- Controlling fertilizing processes by the ministry of Agriculture and issuing a report concerning irrigation with treated sewage water and the fertilizers needed for each plant when irrigated by such water.
- Controlling polluters before reaching treatment plants and doing the best to reduce pollution carried through them.
- Executing treatment plants in cities and suburbs as soon as possible and considering them among priorities in state plans and providing the necessary financing.
- Executing laws and regulations issued recently and implementing them by water regulator especially water legislation and the law no. 50 concerning the environment and the use of untreated sewage water.
- Developing and increasing the efficiency of the current treatment plants especially in Damascus and Aleppo for the specifications of treated water to be valid for use in unrestricted irrigation.

3.4 Water-borne diseases and their classification:

The bad quality of drinking water and its contamination are still considered a threat to public health; diarrhea diseases still account for 4.1% of the diseases infecting man as they lead to the death of 1.8 millions around the world every year (World Health Organization 2004). And it was estimated that 80% of these diarrheas are caused by drinking contaminated water and most of the infections are amongst children in the developing countries. Most of these diseases could be avoided by providing healthy and safe drinking water along with drainage systems, in addition to applying general health and safety rules. A study conducted by the World Health Organization showed that the revenues of investing in the water and drainage sector in 14 provinces around the world were 5-25 dollars for every spent dollar.

In Syria there was no investigation for the health risks caused by the systematic contamination of water. Moreover, there is no sufficient evidence as to the magnitude of health problems caused by the contamination of water. For example, 203398 cases of water-borne diseases were reported in the year 2006; nonetheless, it is very possible that many similar cases have gone unreported. Table (10) shows the number of infections related to water contamination in the country between 2000 and 2006.

Table 10: the number of infections related to water contamination in Syria

The year\ name of the disease	**Number of infections**						
	2000	2001	2002	2003	2004	2005	2006

Summer epidemical diarrheas	0	0	0	0	0	0	0
Malaria	6	61	15	2	1	0	0
Viral hepatitis	3576	4166	4050	2843	2929	3315	2574
Skin Leishmania	19837	24839	21560	28881	26878	21950	18741
Intestinal Leishmania	37	29	37	36	20	17	4
Bilharzias	81	14	5	1	1	5	0
Typhus	5101	5781	4777	4169	4747	4789	4029
Non-bleeding diarrhea	90758	111885	135837	144690	184046	146907	171422
Bleeding diarrhea	9388	9438	11928	13323	15410	13638	7628

Number of confirmed measles cases: (316) cases
Number of confirmed rubella cases: (4) cases
Source: the Department of ecological and chronic diseases

Table (11) shows the number of registered infections related to water contamination in all regions except for diarrheas cases. Looking at the number of infectious hepatitis cases, we find that Homs City has the biggest number of infections, which goes with the biggest number of contaminated water samples and the water which does not conform to the standards in Homs City, and this is an obvious indicator to the connection between the contamination of the drinking water and disease infections. This subject goes along with the increasing number of diseases in the cities: Aleppo, Damascus countryside, Hamah, Lattakia, Tartous; as we explained earlier, these cities have high percentages of water contamination.

We can notice that the number of skin Leishmania cases in Aleppo was 10714 cases exceeding the total of all cases in other cities. It is known that this disease is widespread in Aleppo and it is strongly connected to contamination of the Quaik River with sewages, and we explained earlier that the treatment plant in Aleppo works with a low performance, therefore, the contamination is still great in the processed water which goes to Quaik River and we hope that this situation will be improved after pumping the clean water from Al-Assad Lake to Quaik River. It is expected that this project - carried out by the ministry of irrigation - will be inaugurated in 2008.

Table 11: The list of the reported contagious diseases according to regions for the year 2006.

Diseases Regions	Viral Hepatitis	Malaria	Skin Leishmania	Intestinal Leishmania	Bilharzias	Typhus

Damascus	322	0	435	0	0	46
Damascus countryside	121	0	441	0	0	286
Aleppo	337	0	10714	2	0	605
Lattakia	202	0	1220	1	0	43
Tartous	217	0	1031	0	0	275
Idleb	194	0	2168	1	0	338
Homs	443	0	181	0	0	302
Hamah	289	0	1875	0	0	366
Al- Rakka	310	0	57	0	0	468
Deir Ezzor	24	0	249	0	0	12
Hasakeh	49	0	289	0	0	768
Dar'aa	54	0	54	0	0	501
Sweida	2	0	9	0	0	4
Qunaitera	10	0	18	0	0	15
Total	2574	0	18741	4	0	4029
Death Toll	0	0	0	0	0	0

- The confirmed number of measles cases: (444) cases
- The confirmed number of rubella cases: (4) cases

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