ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT OF THE NORTHERN TUNIS WASTEWATER PROJECT (ESIA)

Executive Summary

1 CONTEXT

Tunisia has established a National Strategy for Wastewater Reuse, whose main objectives are:

1. To preserve Public Health and the Environment;
2. To improve the quality of treated wastewater (TWW) as a prerequisite to promote its reuse in irrigation;
3. To promote the reuse of treated wastewater in agriculture and aquifer recharge and effectively monitor treated wastewater reuses.

In this context, and as a first stage, the TWW generated by the treatment pole - wastewater treatment plants (WWTP) of Choutrana and Charguia - will be transferred next to the irrigation perimeter of Borj Touil where a portion of it can be reused in agriculture. The remaining TWW would be discharged in an improved manner in the Mediterranean Sea, through a submarine outfall. In a second stage, TWW from Greater Tunis would be transferred to in-land areas for reuse in agriculture and aquifer recharge.

Under this program, ONAS has set up a plan of investments to improve the quality and availability to farmers of treated wastewater in Tunis, which includes:

- Closure of the Côtières Nord WWTP and transfer of raw sewage into Choutrana. This project is ongoing, funded by KFW and is expected to be completed by June 2011.
- Construction of the EL ATTAR WWTP and conveyance of the wastewater currently from the Northern Tunis WWTPs towards the new El Attar WWTP, located West of Tunis (reducing the wastewater load in existing WWTP of Charguia-Choutrana). This project is ongoing, financed by the World Bank, under the West Tunis Sewerage Project. El Attar WWTP is expected to start operating in January 2011.
- Rehabilitation and capacity increase of the sewage aeration system in Choutrana I WWTP. Funding for this project was provided by Swiss banks. The end of this project is scheduled for June 2012
- Rehabilitation of the entire Choutrana I WWTP, with financing from KfW. The completion is scheduled for December 2014.
- Ongoing rehabilitation of the upstream section of the canal Khélij located between the pole Choutrana and pumping station MARH, financed by the EIB (in the project ONAS 4). The new infrastructure is expected to be operational by June 2013.
- Developments of the TWW transfer system including construction of a submarine outfall under the proposed Project. Commissioning is scheduled for late 2014.

The proposed project, subject of this ESIA report, will finance ONAS-implemented investments of the aforementioned first stage of the strategy, namely TWW transfer, storage and improved discharge in the Mediterranean Sea, through a submarine outfall.

Executing Agency

The National Sanitation Utility (ONAS – Office National de l'Assainissement) is the Project Implementation Agency.

In the meantime, Tunisia has developed a Presidential Program aiming at increasing the national TWW reuse ratio from the current 30% to reach 50% of the TWW generated nationwide by 2014, through rehabilitation and extension of irrigation perimeter reusing TWW. The first tranche of this program will include the rehabilitation, and possibly the extension of the Borj Touil irrigation perimeter for reuse of TWW. This first tranche will build on the investments under the proposed project, which will make TWW available at the immediate vicinity of the area of the Borj Touil irrigation perimeter where irrigation with current infrastructure is the most challenging. These investments will be carried out through a separate project implemented by the Ministry of Agriculture and Hydraulic Resources and Fisheries (MARH). The Government of Tunisia is requesting World Bank support to fund these investments.

2 PROJECT DESCRIPTION

2.1 Objectives of the project:

The higher level objectives of this project are twofold: (i) reduce the environmental impact of the wastewater discharge in the Gulf of Tunis, in particular with respect to seawater quality in the northern Tunis seashore; ii) support the implementation of Tunisia's National Program for Wastewater Reuse. . The proposed project will support the first phase of this program, to be implemented by ONAS, which aims at developing necessary infrastructure allowing to transfer and make available better quality treated wastewater to farmers at critical points of irrigation perimeters, hence contributing to encourage its reuse in agriculture.

The **global environmental objective** of the Project – a part of the SUSTAINABLE Med Program - is to finance additional infrastructure which allow increasing the reuse of treated wastewater in agriculture, thereby reducing treated wastewater discharge from Greater Tunis into the Gulf of Tunis, an environmentally sensitive area of the Mediterranean Sea.

The **specific objectives** of this project are to: i) providing an environmentally safe disposal system for the treated wastewater which will not be reused in agriculture in the North of Tunis; and ii) increase the quantity and quality of treated wastewater made available to farmers to encourage its reuse in agriculture in the Borj Touil area.

The project will generate positive externalities in that it will contribute to improve seawater quality at the seashore of the Gulf of Tunis located in the North of Tunis, in particular Raoued beach and Gammarth touristic area. The project will also strengthen capacity and monitoring frameworks, contribute to increase institutional coordination among agencies involved in wastewater reuse and foster dissemination of lessons learned and regional partnerships towards the implementation of the priorities of the National Strategic Action Program.

The outcome indicators are the following:

GEF Global Objective	GEF outcome Indicators

Develop additional infrastructure which allow increasing the reuse of TWW in agriculture, thereby reducing TWW discharge from Greater Tunis into the Gulf of Tunis, an environmentally sensitive area of the Mediterranean Sea.	• Volume (m^3) of TWW available for potential reuse in agriculture at the storage basin. • Volume (m^3) of TWW consumed in the Borj Touil irrigation perimeter, as measured by ONAS.
Project Development Objective	**Output/outcome Indicators**
(i) To provide an environmentally safe disposal system for the treated wastewater which will not be reused in agriculture in the North of Tunis	• Percentage of TWW from Northern Tunis WWTP discharged at the Raoued beach per annum • Adequate dilution and dispersion of TWW in the Mediterranean Sea at the discharge point of the submarine outfall (Percentage of seawater samples meeting the norm NT106.02 in terms of fecal coliforms in the surrounding of the outfall)
(ii) To increase the quantity and quality of treated wastewater made available to farmers to encourage its reuse in agriculture in the Borj Touil area	• Volume (m^3) of TWW available for potential reuse in agriculture, measured at the storage basin • Percentage of samples of TWW made available for irrigation complying with the Tunisian water quality norm NT106.03 (BOD_5, COD, Suspended Solids) at the outflow of the storage basin

The % of the quantity reused and the quantity discharged in seashore, cannot be specified actually. The studies relating to these aspects are not finished yet (rehabilitation and extension of irrigated perimeter of Borj Touil)

2.2 Preliminary Description of the Project

Baseline situation:

The TWW from the pole of Charguia / Choutrana and the North Coast are currently discharged by gravity through concrete pipes in the Khélij irrigation canal, located about 5 km away from the shoreline, from where it flows open air through residential area and marshland to reach the sea at Roued beach. Since 1983, 70 million m3 per year with about 3 million tons of suspended solids are dumped to the sea. This volume takes into account the forthcoming launch of the El Attar WWTP (which will unload the Charguia WWTP). The TWW from the four WWTP of the pole of Charguia / Choutrana represent most of the time, the main flow of El Khelij canal.

Evolution of daily volumes in the WWTP of Chotrana treatment pole

WWTP	2006	2011	2016	2021	2026
Choutrana I	76 000	76 545	89 343	90 747	91 503
Choutrana II	40 000	65 205	76 107	77 303	77 947
Côtière Nord	32 750	0	0	0	0
Charguia	46 000	25 000	25 000	25 000	25 000
Total Daily **(m3/day)**	**194 750**	**166 750**	**190 450**	**193 050**	**194 450**
Total Annual (million m3/year)	**71**	**61**	**69,5**	**70,5**	**71**

The quality of effluent from existing WWTPs is very poor. Some of these WWTP (Choutrana1 and Côtière nord) are saturated and providing poor treatment quality, while the treated

wastewater from Choutrana and Charguia WWTP deliver a better quality TWW (see table below). The maximum concentration of fecal coliforms in the TWW from Northern Tunis WWTPs amounts to 4.6 * 10^5 germs/100ml (Analysis carried out as part of the Gulf of Tunis Pollution Assessment Study, carried out under the responsibility of the Ministry of Environment and Sustainable Development).

WWTPs	Daily concentrations in 2009 (mg/l)										
	BOD5			COD			SS			Ntot	Ptot
	min	max	Avg.	min	max	Avg.	min	max	Avg.	Avg.	Avg.
NT 106-02 standards	30			90			30			30	0,1
Choutrana I	18	48	25	65	119	85	24	42	28	28	2
Choutrana II	10	25	17	33	87	64	12	34	24	11	3
Côtière Nord	35	80	50	100	250	161	40	100	62	34	9
Charguia	12	30	18	54	90	75	16	32	23	28	4

While the DBO, DCO and suspended solids levels are acceptable at the output of WWTP, the analysis campaign carried out by ONAS on August 2007 ('Campaign measurement and analysis in the canal El Khélij - ONAS/PPE-August 2007) showed that the value of these parameters deteriorated significantly along the canal El Khelij, with levels above the standards for TWW discharge into the Sea (See table below).

Quality of TWW in the canal El Khélij

Sampling point	Nitrogen (mg/l)		Nitrates (mg/l)		Nitrites (mg/l)		Phosphorus (mg/l)	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
At the entrance of canal Khélij	32	30	0,6	90	0,258	5	4,4	0,1
In the middle of canal Khélij (before intersection with canal Hissiène)	41,3		0,5		0,183		4,7	
At the end of the canal khélij	14		0,067		0,0343		4,2	

Sampling point	BOD5 mgO2/l		COD mgO2/l		SS mg/l		fecal Coliforms /100ml	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
At the entrance of canal Khélij	46	30	102	90	75	30	$2,5.10^3$	2. 10^3/100ml
In the middle of canal Khélij (before intersection with canal Hissiène)	53		110		82		$4,5.10^3$	
At the end of the canal khélij	177		372		32,8		$1,5.10^6$	

(1) Values analyzed; (2) Values of the NT 106-02 standard

The values of BOD5 and COD at the end of canal El Khelij are very high and do not represent the actual quality of TWW. Indeed, the analysis was undertaken on August 3rd, 2008, during the summer period, and it is likely that a significant share of this concentration be generated by human activity. On the contrary, the SS concentration seems to be underestimated.

A previous campaign conducted in April 2004 as part of "*the action study for development of Coastal areas surrounding the Méliane river and canal El Khélij*" gave values of average concentrations of 94 mg / l for TSS and 80 mg / l for BOD5.

With respect to heavy metals (Pb, Cr, Ni, Cd), analyses conducted as part of "*pre-investment study on the pollution abatement of the Gulf of Tunis, Phase I, Part II*", during the period from 24 to June 27, 2008, gave results which are consistently lower than the NT 106-02 standard.

The table below provides a summary of the quantification of current and future volumes of pollutants discharged into the sea, estimated on the basis of the values mentioned above. COD analysis is missing because it has not been analyzed during aforementioned previous campaign.

After completion of the project and the comprehensive plan to improve the quality of TWW launched by ONAS (See Part 1: context), the quality of TWW rejected by the submarine outfall is expected to be broadly consistent with the values of NT 106-02 Standard, except for Phosphorus and coliforms. However, it will meet the requirement of the TWW reuse standards (NT 106-03), which does not set a limit for Nitrate and Phosphorus. In terms of bacteriological quality, the submarine outfall has been designed to prevent that pathogens reach bathing areas of Raoued and Gammarth beaches.

Average of the pollutants discharged in 2009 from Northern Tunis WWTP and future quantities

	Nitrogen mg/N/l	Nitrates mg/N/l	Nitrites mg/N/l	P total mgP/l	BDO5 mgO2/l	DCO mgO2/l	SS Mg/l
Flows	71 000 000 m3/year						
Current Concentrations	14	0,07	0,03	4,2	80	-	94
TWW discharge standard NT 106-002	30	90	5	0.1	30	90	30
TWW reuse Standard NT 106-003	No limits				30	90	30
Pollutant quantity (T/year)	994	4,97	2,13	298,2	5680	-	6674
Concentrations after the completion of the plan to improve the quality of the TWW	14	0,07	0,03	4,2*	30	80	30
Pollutants quantity T/year Kg /j	 994 2720	 4,97 13,6	 2,13 5,8	 298,2 817	 2130 5836	 5680 15562	 2130 5836

* This concentration is greater than the value of the standard NT 106-02, because it is very difficult to achieve given the technical limitations of secondary treatment and the additional cost ot the tertiary treatment, useless in the event of TWW reuse in agriculture.

Concerning heavy metals (Pb, Cr, Ni, Cd), the analyses realized in "the study of pre investment relating to the depollution of the gulf of Tunis, phase I, part II", during the period from the 24

to June 27, 2008, *gave contents which are systematically lower than the threshold of detection of the method used*.

<u>Compliance with standards</u>: the future quality of TWW will be globally in accordance with the standards NT106-02, in exception of Phosphorus and coliforms. On the other hand, this future quality of TWW will be meeting the standard of reuse NT 106-03 (no limit for Nitrates, Phosphorus, and coliforms).

Regarding phosphorus, the NT 106-02 standard is very severe compared to international standards. For example, EU norms sets the maximum value for this parameter from 1 to 2 mg / l, and the World Bank "*Pollution Prevention and Abatement Handbook*" recommends a limit of 2mg/l, which are from 10 to 20 times higher than those of the Tunisian standard.

Limit of the concentration of phosphorus in municipal wastewater		
Directive 91/271/CEE on the treatment of urban waste water		Pollution Prevention and Abatement Handbook 1998
Concentration (annual average)	Minimum reduction	
2 mg/l (EH between 10 000 et 100 000) 1 mg/l (EH > 100 000)	80%	2 mg/l

The Directive 91/271/EEC does not provide the systematic application of limit values. It depends on the size of the WWTP and the sensitivity of the environment to eutrophication. In the case of a sensitive area, one or both of these parameters (N and/or P) can be applied using the average concentration or the minimum abatement depending on local conditions.

2.3 Project Components

<u>Component 1: TWW transfer from the current discharge to the storage and regulation basin</u>

This component will be implemented by ONAS. It will fund the following infrastructure, which design has been optimized through consultation with the Department of the Ministry of Agriculture in charge of irrigation perimeters:

- TWW Transfer: from the existing discharge points, TWW from WWTPs will be segregated based on TWW quality into two HDPE pipelines of 1800 mm of diameter, which will convey the TWW under the El Khelij Canal, through a siphon, and along an existing dirt road until a storage and regulation basin located about 2.5 km north from the current discharge point;
  (In upstream point, at the output of WWTP, the TWW will be separated according to their quality in two HDPE pipe diameter 1800 mm. This section is committed by ONAS (not included in the project) as a first action in order to provide irrigation water according the standards at the existing pump station to the ARDC.)
- Storage Basin: A two-compartment basin will segregate and store TWW based on its quality, allowing to make available only the better quality to farmers for reuse for irrigation in the neighborhing irrigation perimeter of Borj Touil. The storage basin will also regulate the daily flow ot TWW, allowing to optimize the diameter of the forced

pipeline and submarine outfall and thereby reducing the associated costs. The storage time may allow some decantation in the basin, hence improving the TWW quality;

- Pumping Station: With a capacity of about 2,7 m3/s, the pumping station will feed the second transfer pipes and the submarine outfall;

Component 2: TWW Transfer to the sea

- TWW transfer: one pressure HDPE pipeline of 1600mm of diameter will convey the TWW for about 5km from the pumping station to the submarine outfall. It will follow the left side of the El Hissiène Oued (temporary river);
- Submarine Outfall: A 6 km long submarine outfall will discharge the TWW at a depth of 20 meters, designed to maximize dilution and mixing with sea water with the objective of improving ecosystem health of key habitats and species in the coastal and marine areas of the Gulf of Tunis and reducing eutrophication.

After the implementation of the overall plan by ONAS, to improve the quality of TWW (See project context), the quality of all TWW of the WWTPs of Choutrana will comply with TWW discharge and reuse standards

Component 3: Technical assistance, monitoring and capacity strengthening.

This component will fund important accompanying measures for the implementation of the project, including consulting services to strengthen: (i) water quality monitoring systems in the project area; and (ii) coordination mechanisms among agencies involved in wastewater reuse, in particular ONAS and MARH. This component will also finance key studies related to the second phase of the Presidential Program implemented by ONAS for wastewater transfer for reuse, namely the detailed design for the improved discharged through a submarine outfall in the South of Tunis, and detailed design of a new WWTP to in the North of Tunis Metro; and (v) dissemination of Tunisia TWW reuse experience in IW Learn international dissemination events and contribution to regional partnerships towards the implementation of the priorities of the National Strategic Action Programs.

ONAS carried out a study of possible alternatives which looked into a number of options in terms of size and possible locations of the storage basin, possible locations of the submarine outfall in terms of bathymetry and possible effects of wind, wave and streams on the effluents, as well as possible pipe layouts. This study led to the proposed design, which will be confirmed on the basis of the results of an on-going year-long stream measurement campaign. Further alternative options are being studied.

2.4 Project Cost

The project cost is estimated at U.S. $ 70 m. Estimated costs per component are as follows:

Project components	Total (m US$)	IBRD (m US$)	GEF (m US$)	GOT (m US$)
Component 1	23,13	13,16	7,58	2,39
Component 2	42,07	36,61	0	5,46
Component 3	3,43	2,23	0,45	0,75
Total cost of the project	68,63	52	8,03	8,6

2.5 Environment state of the project region

Whole terrestrial environment is highly degraded by the increase in aridity and, more specifically, the soil salinization. It is therefore possible, at present, to consider it as insensitive.

Throughout the radial, observed in all cases a very low biodiversity, tapering gradually as one moves away from the shore.

This is an area marked by strong environmental destabilization where biodiversity, very low, is particularly characterized by species belonging to the biotic environments heavily silted (sticky vessels), biological communities that cannot meet so normal in funds depth much greater. In addition, the project area shows more hydrodynamic activity than in southern areas of the Gulf of Tunis. It is considered not prone to eutrophication (pre-investment study on the pollution abatement of the Gulf of Tunis, MEDD (DGEQV) - Comete Eng - BCEOM - IHE February 2009)

The region includes a shallow water table, slightly used and characterized by a relatively poor quality (high salinity, bacterial and nitrate contamination, etc.).

In other words, there seems to be in this area a rapid deterioration of environmental conditions that fully justifies the decision by government to address as soon as possible to this situation.

3 Safeguard policies that might apply

3.1 OP.4.01: Environmental assessment

The Project is classified in category A for the following reasons:

- Construction of a submarine outfall of wastewater and its potential environmental and social impact, and because of the vulnerability of the receiving water is the Gulf of Tunis
- The large size of the project
- TWW reuse for irrigation of Borj Touil perimeter and the need to ensure consistent quality standards and environmental health.
- The acquisition of a parcel of 9 acres, flat to private.

The project requires a detailed complete ESIA, according to OP 4.01

3.2 OP 4.04 Natural Habitats

The project will not generate loss or degradation of natural habitat, but rather it will contribute to regeneration of the Tunis gulf's marine ecosystem, which is currently degraded. In this case this policy may not be triggered.

3.3 OP 4.09 Pest management

As the irrigation component and this project are separated, the influenced area identified in the ESIA doesn't include irrigation perimeter of Borj Touil.

OP 4.09 should be detailed in the ESIA project implementation and rehabilitation of Borj Touil irrigation perimeter. A draft has been initiated and recently updated by MARH.

This policy will not be applied to this project.

3.4 OP 4.12 Involuntary resettlement

The project requires acquisition of private land but doesn't generate involuntary resettlement of people. The safeguard policy 4.12 therefore applies to this project.

Nine ha (9 ha) of land has been identified and needs to be acquired for the construction of the storage and regulation basin. 171 co-owners are currently listed on the national land register. ONAS has already prepared the requested information in relation to land acquisition of this parcel and has submitted it, after expertise, to the committee for recognition and reconciliation of local courts to make a mutually agreed acquisition, in accordance with the provisions of in accordance with the applicable Tunisian regulation, namely N° 26-2003 of April 14, 2003. The normal procedure is ongoing to request potential other owners to make themselves known to the authorities A Land Acquisition Plan has been prepared to ensure the land acquisition procedure is in compliance with provisions of OP 4.12 and to ensure appropriate compensation is provided to land owners in due time, including in the case where amicable land acquisition cannot be reached with some owners.

3.5 OP 4.36 Forest

This policy will not be triggered since the concerned area of the project doesn't include natural forests, critical forest sites or area which can be considered as forests according to the OP 4.36, annex A

The others safeguard policies of the bank are not concerned by this project, as shown below:

Triggering Safeguard Policies	Yes	No
OP.4.01: Environmental assessment	X	
OP 4.04 Natural Habitats		X
OP / BP 4.36 Forests		X
OP 4.09 Pest management		X
OP / BP 4.11 Cultural Heritage		X
OP / BP 4.10 Indigenous Peoples		X
OP 4.12 Involuntary resettlement	X	
OP / BP 4.37 Safety of Dams		X
OP / BP 7.50 International Waterways		X
OP / BP 7.60 Projects in conflict zones		X

4 Compliance with national standards and international conventions

- It should be recalled that following the realization of the various components of improvement of TWW quality of Choutrana pole, TWW will be in conformity with standards, NT 106-02 for discharging in marine domain except maybe for the concentrations of Phosphorus and bacteriological quality;

- Modelisation confirms that the bacteriological quality of the TWW discharged reaching at the coast and the bathing water, will meet Tunisian standard NT11- 09 relating to the bathing water quality.
- The project is in conformity with the Action plan for the Mediterranean and the Barcelona Convention, to which the Government of Tunisia is a signatory. Indeed, the Barcelona Convention of 1976, amended in 1995, and the protocols of this convention aim at reducing pollution in the zone of the Mediterranean and to protect and improve the marine environment in this zone in order to contribute to its durable development. This project contributes directly to the protection of the Gulf of Tunis against pollution of telluric origin, and includes a continuous monitoring system of pollution in this zone of the Mediterranean allowing measuring such reduction during and beyond the Project implementation period.
- Concerning the convention of the United Nations relative to Biological Diversity (CDB), which is an international treaty adopted at the time of the Summit of the Earth in Rio de Janeiro in 1992, its objective is to develop national strategies for the conservation and the durable use of biological diversity. The project respects this convention, in particular in conservation of biological diversity (or biodiversity). Indeed, among the objectives of the realization of a submarine outfall equipped with a diffuser (aiming at maximizing dilution and dispersion of discharged TWW) figure the regeneration of the marine ecosystem (fauna and flora) in the marine zone of the current rejection of TWW, currently strongly degraded.

5 Alternatives Analysis

Three submarine outfall alternatives have been analyzed. Each alternative includes the following structures, only the lengths vary depending on the alternative considered: i) a transfer by gravity into the storage basin provided by dual pipe HDPE PN6 Φ1800 ; ii) a storage basin 6ha surface with a gross volume of 160 000m^3; iii) a transfer of the effluent to the sea, using a pumping station and pipe HDPE PN6 Φ1600; and iv) a submarine outfall HDPE Φ1600 length 6 km.

- The V1 alternative: submarine outfall in the current discharge point to the Sea.
- The V2 alternative: submarine outfall in the embouchure of the old river bed of Medjerda River.
- The V3 alternative: submarine outfall in the embouchure of the current river bed of Medjerda River.

The results of comparison of these alternatives showed that they are equivalent:

- Technically : the same flow, same types of works (land and sea)
- Environmentally : same environment affected by the project, deleting the current discharge, new discharge by a submarine outfall in the Gulf of Tunis, where the same importance of the environmental and social impacts

But the economic analysis showed that the alternative 1 is the most favorable (as shown below):

- V1: TND 70 million
- V2: TND 115 million
- V3: TND 145 million

ONAS carried out a study of possible alternatives which looked into a number of options in terms of size and possible locations of the storage basin, possible locations of the submarine outfall in terms of bathymetry and possible effects of wind, wave and streams on the effluents, as well as possible pipe layouts. This study led to the proposed design, which will be confirmed on the basis of the results of an on-going year-long stream measurement campaign.

6 SUMMARY OF MAJOR IMPACTS

Impact analysis focuses on the effects of the TWW of the Choutrana's WWTPs transfer to the sea. The impact of the TWW reuse in the Borj Touil irrigation perimeter will be analyzed in the context of ESIA of the proposed rehabilitation and extension of this area, under the responsibility of MARH.

6.1 Positive Impacts

The main positive impacts of the project are directly related to the objectives for which it was initiated, including: i) Improving the quality of TWW; ii) suppression of current discharge at sea by the creation of a submarine outfall, promoting the dispersion of pollutants; iii) the regeneration of the marine ecosystem and improving the quality of bathing water and iv) improving the quality of life.

The positive economic impacts of the project are: i) the revalorization of land bordering the canal Khélij and the beach of Raoued; ii) tourism development in the region; iii) the creation of job opportunities during the work phase, and operation phase

6.2 Negative Impacts

6.2.1 Impacts of construction phase

The main activities likely to generate significant adverse impacts are:

a. The construction of the first km of the submarine outfall, including the excavation and dredging operations, estimated to generate about 7500 m3 of mud.

   This operation will increase water turbidity, which can affect a relatively large area depending on the agitation of the water, and generate negative impacts on the quality of bathing waters and increase the current deterioration of the marine ecosystem. In addition to the mitigation measures described below (paragraph 6.1.). The construction of the submarine outfall is scheduled to be implemented avoiding periods of high heat to avoid adverse impacts during the summer period and the risk of development of toxic phytoplankton organisms.

b. The management of dredged sludge: analysis of seabed sediments shows the existence of 50 cm of mud. This mud is contaminated and not appropriate disposal can lead to water, air and soil pollution.

Generally, earthworks, pipe installation and civil engineering constructions generate impacts caused principally by dust, noise and solid waste.

Considering the location of the project, distant from dwellings and the agricultural vocation, these impacts on population in residential areas are not significant.

6.2.2 Impact of operation phase

In normal operation, the project doesn't generate potential negative impacts; except in cases of equipments failure and/or pollution accidents (breakdowns of electromechanical equipment, pipe ruptures, etc…)

The submarine outfall (length 6 km) will dilute pollutants to avoid contamination of bathing waters, which will be in compliance with Tunisian and international standards.

A first simulation of the dispersion of pollutants, based on bibliographic stream data, carried on software CORMIX2 confirmed these results (*the concentration expected in pathogens after the completion of the effluent is estimated less than 100 coliforms / 100 ml)*.

A marine courant's monitoring, in the project area, has been initiated by ONAS, since December 2009, and will span a period of 12 months. The main purposes of this monitoring are to provide measured data:
- To calibrate simulation model (marine stream and sea water quality)
- To refine the results of the simulation before starting work.
- To use the calibrated simulation model for the monitoring of sea water quality during the operation phase

The cost of this monitoring is estimated at 200 000 dinars, supported by the Executing Agency (ONAS).
Others common nuisances project facilities and wastewater treatment, particularly noise, odors, sludge from storage basin could be generated by the project, but are not significant, given that the distance to the residential area is over 2 Km.

With regard to eutrophication, the area of the project is considered as presenting low risk of eutrophication and benthic microflora is totally absent there (see paragraph 2.5). It is a relatively open bay which contributes to the mixing of water and the project will further improve the current situation by improving the dispersion of pollution and reduction of turbidity of water and minimize the potential risks of eutrophication. It is worth mentioning that according to the results of the study of pollution abatement in the Gulf of Tunis (MEDD (DGEQV) - Comete Eng - BCEOM - IHE February 2009), the distribution of the pollutant load in watershed shows that the watershed drained by the canal El Khelij contributes for only 5% of the total input of nutrients discharged by the various watersheds in the Gulf of Tunis.

Review of the dispersion modeling studies *[Updated January 2015]*

The modeling of the dispersion of the treated wastewater discharged from the submarine outfall, completed by a consortium of engineering firms (Artelia and Serah) from September 2013 to June 2014, has confirmed that the proposed design of the outfall (size and material characteristics), namely a length of 6,030 meters from the coast line, ensures that the coast in the North of Tunis is efficiently protected (coliform concentrations under 100 coliforms per 100 ml at the Raoued and Kalâat Andalous beaches, the closest to the current discharge area). Given these results, the impacts identified, mitigation measures and environmental management plan developed under the original ESIA, are unchanged and remain valid.

7 Environmental Management Plan

7.1 Mitigation Plan

The following mitigation measures are identified to reduce potentially significant adverse environmental impacts to acceptable level:

- **Construction phase:**

a. Installation of an anti-turbulence geo-membrane screen to limit the suspended matters propagation generated by dredging operation and excavation works for the laying of the submarine outfall on the first mile. These screens will be arranged 20 m on both sides of the trenches.

b. Management of Dredged Material: The quantity of dredged materials is estimated at 12.000 m ^{3}, containing part of mud. These mud will be managed as follows:
- achievement of a sealed storage tank as appropriate size;
- Disposal of clean fill into feeding;
- Removal of contaminated organic debris to the sludge discharge of Choutrana;
- Removal of debris (mud) contaminated by hazardous substances to the Jradou plant.

c. Buried and apparent marks of transfer pipes

Other mitigation measures are planned to avoid or mitigate the less significant terrestrial work impacts, including solid waste, noise and dust management and total reuse of excess cutting.

All these measures will be included as specific clauses in the contract to be met by the construction firm

- **Operation phase**

a. Establishment of a procedural manual for operation and maintenance works (Care and Maintenance of equipments, flushing and cleaning, etc)
b. Acquisition of maintenance equipment (Zodiac, various tools, utility vehicle equipped)
c. Regular monitoring of the volume of sediments accumulating into the storage and regulation basin and a full sediment removal operation every five years. Sediments removed will be disposed of in an appropriate landfill ("mono décharge" for WWTP sludge). The first sediment removal operation is planned for 2020. The "mono décharge" will be implemented and operational by that time (currently in the execution study phase at ONAS).

➢ **Compensation measures**

The cost of measures to compensate owners of land to be acquired is estimated at 470 000 DT.

Action	Action or expected deliverable	Frequency	Budget in DT	Finance Source	Schedule	Responsibility
Installation of anti turbidity screen (geomembrane) in work phase	works	-	100,000	project	During marine works	EMP Responsible ONAS/ construction company
Dredged material management	works	-	150,000	project	During dredging works	
Buried and apparent marks of transfer pipes installation	works		50,000	project	During works	
Establishment of Maintenance and exploitation procedure And urgent intervention plan	Establishment of reports	2 months	40,000	project	1 month before beginning exploitation	ONAS EMP Responsible and Operations Manager
Cleaning of storage and regulation basin	Sludge removal	once every five years		ONAS		
Material and equipment acquisition for maintenance intervention, to the PME cellule	Material and equipment acquisition	-	101,000	project	before beginning exploitation	
Total cost of the mitigation plan			**401,000 40,000**	Project ONAS		

7.2 Monitoring plan:

a. During the work: i) monitoring the air quality (air, noise and dust), ii) monitoring of waste management, and iii) Analysis of dredged materials to assess their quantities and degree of contamination. These measures are under the joint responsibility of the construction firm and ONAS and their applications will be integrated as specific clauses in the contract.

b. During operation: i) monitoring the quality evolution of the marine ecosystem and bathing water, ii) monitoring the quality of treated wastewater iii) monitoring the quality of the underground water upstream and downstream the storage basin

Action	Action or expected deliverable	Frequency	Budget in DT	Finance Source	Schedule	Responsibility
Monitoring of works	Monitoring and support	1 time /week	18,100 /year (27,150 for 18 months)	project	During works phase	ONAS staff in charge of EMP
Monitoring of TWW quality indicators: the upstream storage basin (on the WWTP) and in the pumping station	Analysis campaign	 1 time/day 1 time /week	 ensured by the WWTP 5,000 /year	ONAS	During operations	WWTP Operations Manager Pumping Station Operations Manager/ EMP Responsible staff
Air Pollution	Analysis campaign	1 time /month	-	ONAS	During operations	EMP Responsible staff / Operations Manager ONAS
Noise Pollution	Analysis campaign	1 time /month	6,000 /year	ONAS	During operations	EMP Responsible staff / Operations Manager ONAS
Monitoring of bathing water quality indicators and the effectiveness of the submarine outfall (dilution and dispersion of pollution)	Analysis campaign	8 time /year (every month between june and september)	8,000 DT/year (1,000 DT by measurement operation)	ONAS	During operations	EMP Responsible staff / Operations Manager ONAS
Monitoring of marine ecosystem indicators	Analysis campaign	Submarine observations and expertise by a marine biologist (Once/2years)	10,000 DT/2 years	ONAS	During operations	EMP Responsible staff / Operations Manager ONAS /consultant
Groundwater quality monitoring indicators	Analysis campaign	2 times /year	2,000 /year	ONAS	Every year since the start of operations	EMP Responsible staff / Operations Manager ONAS
Total cost of the monitoring plan			**27,150 DT 26,000 /year (5 years)**	**Project ONAS**		

7.3 Capacity development and training

Given that ONAS has a long experience and good competence in managing and monitoring the implementation and operation of treatment facilities for wastewater, actions identified for capacity building are mainly:

a. Technical Support Program: i) technical support for controlling and monitoring the work of the submarine outfall construction; ii) Technical support for implementation and monitoring of the EMP.
b. Training: i) specific training in monitoring the marine ecosystem and bathing water; ii) training in remote management system, and iii) training in TWW quality management in the WWTPs.

Capacity strengthening plan

Action	Action or expected deliverable	Frequency	Budget in DT	Finance Source	Schedule	Responsibility
Technical support						
Expert in Dredged sludge management	support and supervision	1 HM	35,000	project	During submarine outfall construction	international Expert
Expert in marine ecosystems	support and supervision	2 HM	15,000 (2x7,500)	project	During the project	national Expert
Expert in EMP implementation	support and supervision	18 HM	135,000 (18x7,500)	project	During the project	national Expert
Other Expert	support and supervision	2 HM	15,000 (2x7,500)	project	During the project	national Expert
Subtotal technical support			**200,000**			
Training						
EMP and implications	Workshop	2 days	3,000	project	Before works beginning	national Expert
Marine ecosystem and bathing water quality	Workshop	3 days	4,500	project	Before works beginning	national Expert
Remote management and alert system	Workshop	1 week	10,000	project	Before exploitation beginning	national Expert
TWW quality management	Workshop	3 days	4,500	project	Before exploitation beginning	national Expert
Subtotal training			**22,000**	project		
Total cost of capacity strengthening			**222,000**	project		

Summary of EMP costs

EMP ACTION	Financed by projet	Financed by ONAS
Mitigation Plan	**401,000 DT**	**40,000**
Monitoring plan	**27,150 DT**	**130,000**
capacity strengthening	**222,000DT**	
Technical Assistance	200,000 DT	
Training	22,000 DT	0
TOTAL	**650,500 DT**	**170,000**

8 PUBLIC CONSULTATIONS

As a part of project preparation, ONAS organized two public consultations to which were invited representatives of groups that might be affected by the project, local NGOs, communities and public authorities concerned and the owners of land to be acquired. The first one was held on October 25th 2009 after the preliminary ESIA's report, and the second one on January 8th, 2010, following the submission of interim report of the ESIA. During those consultations some landowners present volunteered to support ONAS with the other owners and facilitate the acquisition procedures by appointing agents to represent the families of the owners. It should be noted that there was no objection or opposition against the project which was welcomed by the participants because of its beneficial effects.

[Updated January 2015] Upon completion of the dispersion modeling studies, ONAS held a third public consultation on December 26, 2014 to present the findings from the revised ESIA. The consulted population confirmed its appreciation of the project and its expected benefits, as well as the soundness of the environmental management plan.

9 GRIEVANCE REDRESS MECHANISM *[Updated January 2015]*

During Project execution, ONAS will set up a grievance redress mechanism (GRM) which will define the procedures for the capture, compilation, management and treatment of complaints and grievances of citizens and affected persons.

10 CONCLUSION

The project is important for several reasons:

i) The importance of financing involved;
ii) Improvement of the state of the environment of the project area;
iii) Improvement of the TWW quality;
iv) Improvement of the life quality.

The ESIA was conducted in accordance with the safeguard policies of the World Bank, in particular Operational Policy OP4.01. The main negative impacts are mitigated to acceptable level using appropriate measures to be compliant with environmental standards and regulations.