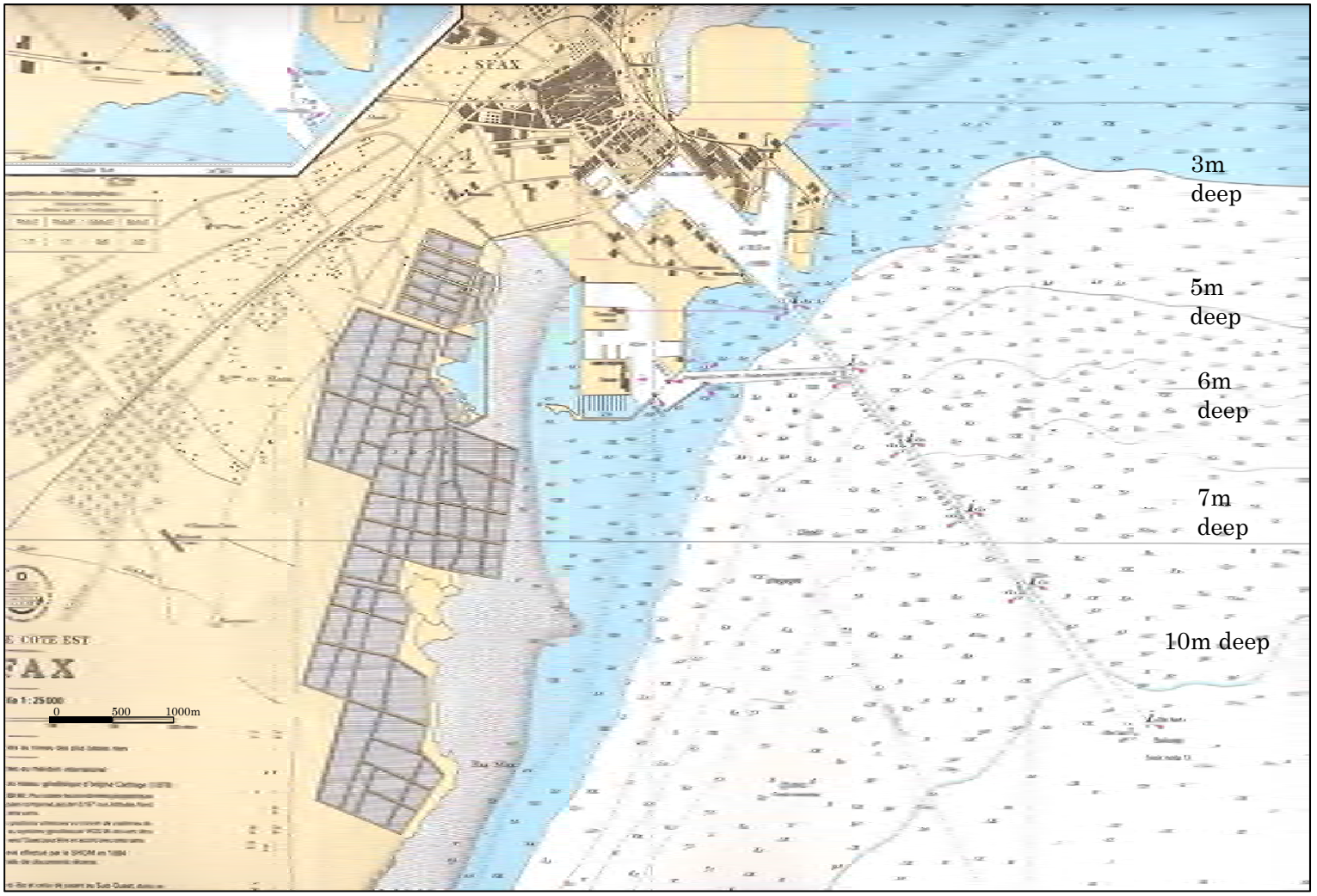
CHAPTER 2

REVIEW OF EXISTING INFORMATION AND EXPLORATION

2.1-1 Sfax Port



CHAPTER 4

WATER SUPPLY PLAN FOR GREATER SFAX

4.1-1 Presentation Material for International Donors Conference in Marseille, France

REPUBLIQUE TUNISIENNE
MINISTERE DE L'AGRICUTURE
SOCIETE NATIONALE D'EXPLOITATION ET DE DISTRIBUTION DES EAUX

Marseille, 4 et 5 Février 2014

Projet National d'investissement de Renforcement et de Sécurisation de l'Alimentation d'Eau Potable

Présenté par : Adnan BOUBAKER

DIRECTEUR CENTRAL DES ETUDES

IV.3. Chronogramme de Réalisation du Projet :

COMPOSANTE	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
RENFORCEMENT SYSTÈME DE TRANSFERT DES EAUX DU NORD										
- Barrage réservoir Saida et infrastructures y afférentes										
- Système de transfert des eaux brutes										
RENFORCEMENT CAPACITE DE RESERVE ET DE TRAIT. EAUX DU NORD										
- Renforcement réseaux, pompage et réserves à Belli										
- Infrastructures séparation des deux conduites EN (Tr. et Brt.)										
- Retenue de Sahel et infrastructures y afférentes										
RENFORCEMENT CAPACITE DE PRODUCTION DU GRAND TUNIS										
- Création du pôle de traitement Bejoua										

LEGENDE

- Elaboration des études détaillés + DAO
- Procédure de passation des marchés
- Exécution des travaux

30

Construction du barrage réservoir Saida (1/4)

RESPONSABLE DE MISE EN OEUVRE : DGBGTH

EXPLOITANT : SONEDE ou DGBGTH

OBJET : Construction d'un barrage réservoir à Saida dans la région de Béjaoua (à l'Ouest du Grand Tunis) pour stocker une eau prélevée du canal Medjerda Cap y compris l'infrastructure d'alimentation

POPULATION CONCERNEE: 5.5 million d'habitants

OBJECTIFS :

- **Régulation saisonnière pour combler le déficit en ressources en période estivale.**
- **Sécurisation de l'approvisionnement en eau potable en cas de problème au niveau du canal Medjerda Cap Bon.**

35

Construction du barrage réservoir Saida (2/4)

CONSISTANCE DES TRAVAUX :

1/ Construction d'un barrage réservoir à Saida (45 Mm^3),

2/ Réalisation d'adduction d'alimentation,

3 / Construction de stations de pompage.

4/ Construction d'un réservoir de mise en charge

5/ Raccordement au réseau électrique MT de la STEG.

COUT ESTIMATIF : 121.3 MDT HT (54.0 million €)

Sous composante	Coût (MDT)
Retenue de régulation (45 Mm^3)	81.4
Adductions	22.1
Pompage	13.3
Réservoir	4.1
Electrification	0.5
TOTAL	121.3

36

Construction du barrage réservoir Saida (3/4)

ETAT D'AVANCEMENT DES ETUDES :

- **APD achevé en 1999 par VODNIIINFORMPROEKT Mouscou.**
- **Les TDR de l'Etude d'impact sur l'environnement, sont en cours de préparation par la DGBGTH.**

PLANNING DE REALISATION :
(2016-2018)

37

Construction du barrage réservoir Saida (4/4)

38

Système de transfert des eaux brutes de Saida vers Belli (1/3)

RESPONSABLE DE MISE EN OEUVRE : SONEDE

EXPLOITANT : SONEDE ou SECADENORD

OBJET : Transférer pendant la période de faible demande en eau les eaux brutes depuis le barrage réservoir à réaliser à Saida vers la station de pompage El Kouine au pied du complexe Belli

POPULATION CONCERNEE: 3.0 million d'habitants

OBJECTIFS :

Satisfaire les besoins en eau potable pour les régions du Grand Tunis et de Sahel.

CONSISTANCE DES TRAVAUX :

1/ Pose de conduites de transfert.

2/ Construction de stations de pompage.

39

Système de transfert des eaux brutes de Saida vers Belli (2/3)

COUT ESTIMATIF : 90 MDT HT (40.0 million €)

Désignation	Coût (MDT)
Adductions	78.1
Pompage	8.7
Acquisition de terrain	3.4
TOTAL	90.2

ETAT D'AVANCEMENT DES ETUDES :

- **Etude de faisabilité SOGREAH-STUDI –IDEA CONSULT, 2005.**
- **Etude stratégique, SONEDE 2013.**
- **Etudes d'exécution et DAO en cours par SONEDE**

PLANNING DE REALISATION :
(2016-2018)

40

Système de transfert des eaux brutes de Saida vers Belli (3/3)

41

Construction du barrage réservoir Sahel (1/3)

RESPONSABLE DE MISE EN OEUVRE : DGBGTH

EXPLOITANT : SONEDE

OBJET : Construction d'un barrage réservoir dans la région de Kalaa Kébira pour stocker une eau prélevée du système de transfert des eaux du Nord

POPULATION CONCERNEE: 2.3 million d'habitants

OBJECTIFS :

- **Stocker des quantités d'eaux importantes et de les restituer au réseau après traitement en période de forte demande.**
- **Sécurisation de l'approvisionnement en eau potable de la région du Sahel et en partie de Sfax en cas de problème au niveau du canal Medjerda, d'interruption accidentelle de la production dans la station de traitement de Belli ou incident sur l'adduction des Eaux du Nord**

42

Construction du barrage réservoir Sahel (2/3)

CONSISTANCE DES TRAVAUX :

1/ Construction d'un barrage réservoir (26 Mm³),

2/ Réalisation d'adduction d'alimentation et une station de pompage

COUT ESTIMATIF : 113.6 MDT HT (50.5 million €)

Désignation	Coût (MDT)
Retenue de régulation (26 Mm³)	88.2
Adductions	21.1
Pompage	4.3
TOTAL	113.6

ETAT D'AVANCEMENT DES ETUDES :

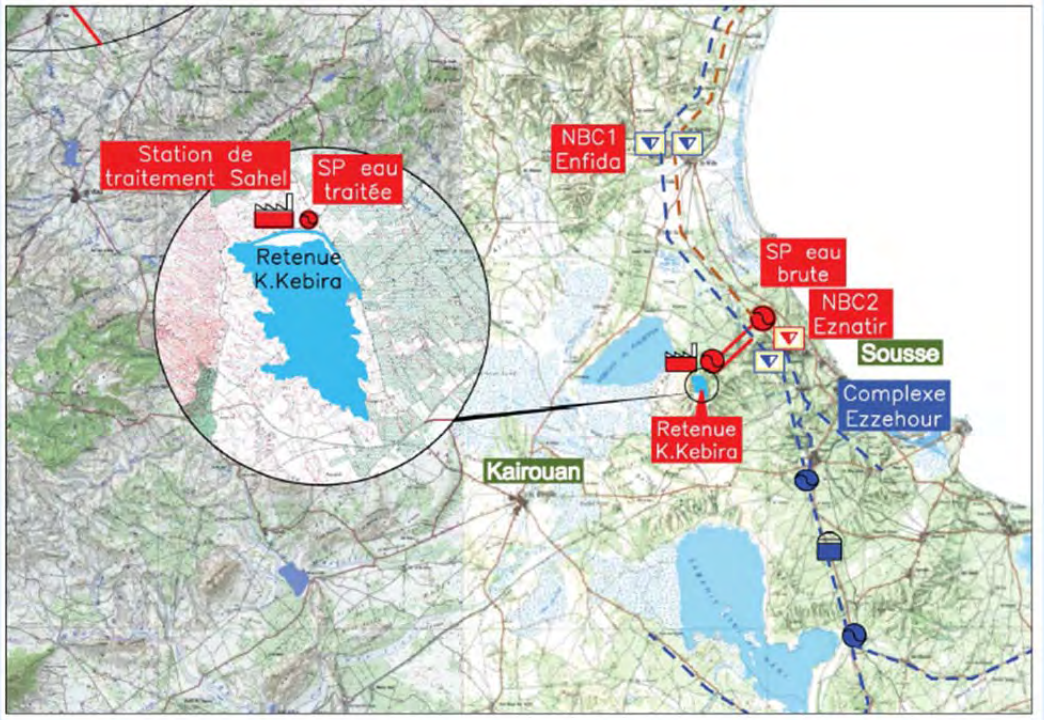
- Etude de faisabilité SOGREAH-STUDI –IDEACONSULT, 2005.
- Etude d'avant projet sommaire, groupement STUKY – CONCEPT, 2011
- Etude d'impact sur l'environnement, groupement STUKY – CONCEPT, transmis à l'ANPE depuis le 26 mars 2013.
- Etude d'avant projet détaillé en cours, groupement STUKY – CONCEPT.

PLANNING DE REALISATION :

(2016-2018)

43

Construction du barrage réservoir Sahel (3/3)



44

Renforcement des réseaux et capacité de réserve des eaux du Nord pour les régions de Sahel et Sfax (1/2)

RESPONSABLE DE MISE EN OEUVRE : SONEDE

EXPLOITANT : SONEDE

OBJET : Transférer les eaux brutes pendant la période de faible demande en eau depuis la station de pompage El Khouine située au pied du complexe Belli vers un barrage réservoir à réaliser dans la région du Sahel

POPULATION CONCERNEE: 2.3 million d'habitants

OBJECTIFS :

Satisfaire les besoins en eau potable pour les régions du Cap Bon, Sahel et Sfax jusqu'à l'horizon 2030

CONSISTANCE DES TRAVAUX :

1/ Renforcement réseaux, capacités de pompage et réserves à Belli

2 / Séparation des deux conduites des eaux du Nord (traitée et brutes)

45

Renforcement des réseaux et capacité de réserve des eaux du Nord pour les régions de Sahel et Sfax (2/2)

COUT ESTIMATIF : 38.3 MDT HT (17.0 million €)

Désignation	Sous composante	Coût (MDT)	
Renforcement des réseaux et capacités de pompage et des réserves au complexe Belli	Adductions	7.8	30.9
	Pompage	17.7	
	Réservoirs	5.4	
Infrastructure de séparation des deux conduites des eaux du Nord (traitée et brutes)	Adductions	4.7	7.4
	Réservoirs	2.7	
TOTAL			38.2

ETAT D'AVANCEMENT DES ETUDES :

- **Etude de faisabilité SOGREAH-STUDI –IDEACONSULT, 2005**
- **Etude stratégique, SONEDE 2013.**
- **Etudes d'exécution et DAO en cours par SONEDE**

PLANNING DE REALISATION :
(2016-2018)

46

Construction de la station de traitement de Sahel (1/3)

RESPONSABLE DE MISE EN OEUVRE : SONEDE

EXPLOITANT : SONEDE

OBJET : Construction d'une station de traitement des eaux brutes et son raccordement au système de transfert des eaux du Nord au niveau de la région de Sahel

POPULATION CONCERNEE: 2.3 million d'habitants

OBJECTIFS :

Satisfaire les besoins en eau potable pour la région de Sahel et Sfax

CONSISTANCE DES TRAVAUX :

1/ Construction d'une station de traitement des eaux brutes de capacité 4 m^3/s

2/ Réalisation d'adduction de raccordement au système de transfert des eaux du Nord,

3/ Construction d'une station de pompage

47

Construction de la station de traitement de Sahel (2/3)

COUT ESTIMATIF : 69.2 MDT HT (31.0 million €)

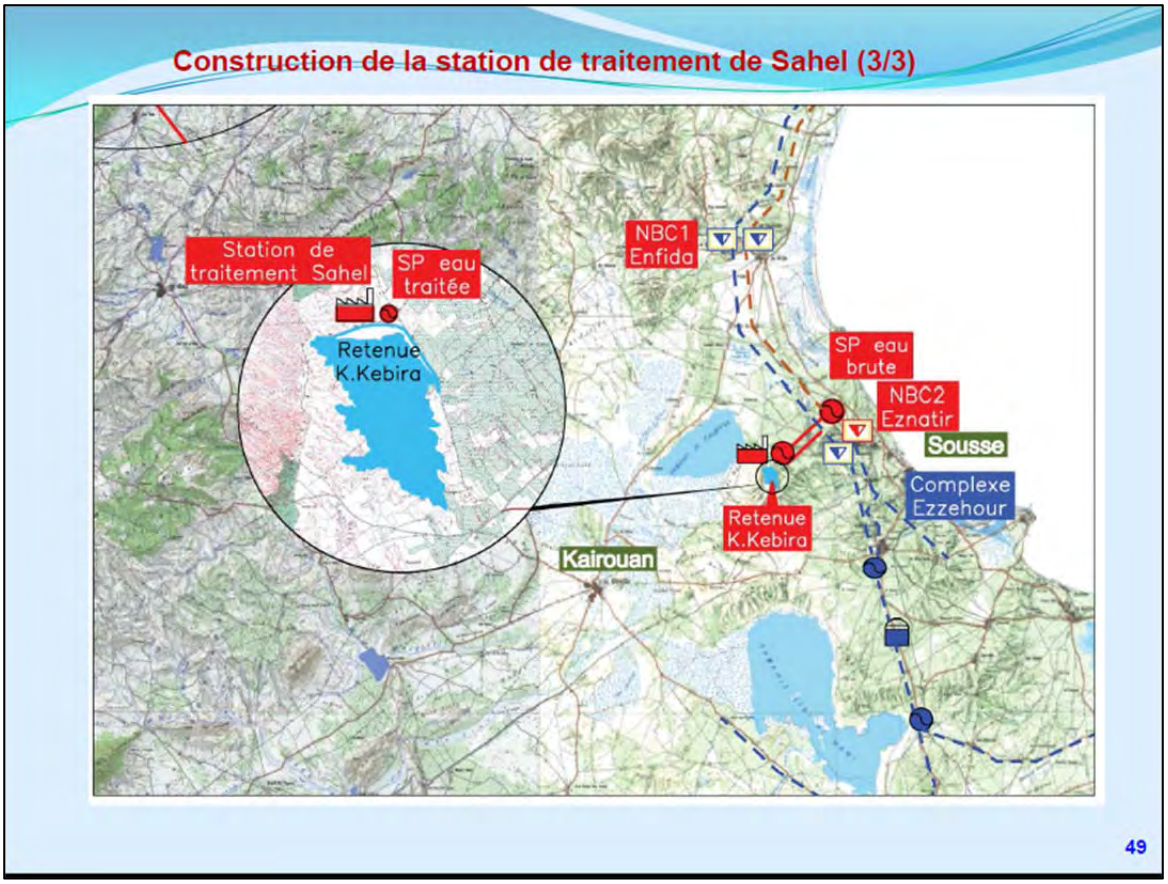
Désignation	Coût (MDT)
Station de traitement (4 m^3/s)	35.3
Adductions	21.1
Pompage	6.0
Foncier	6.8
TOTAL	69.2

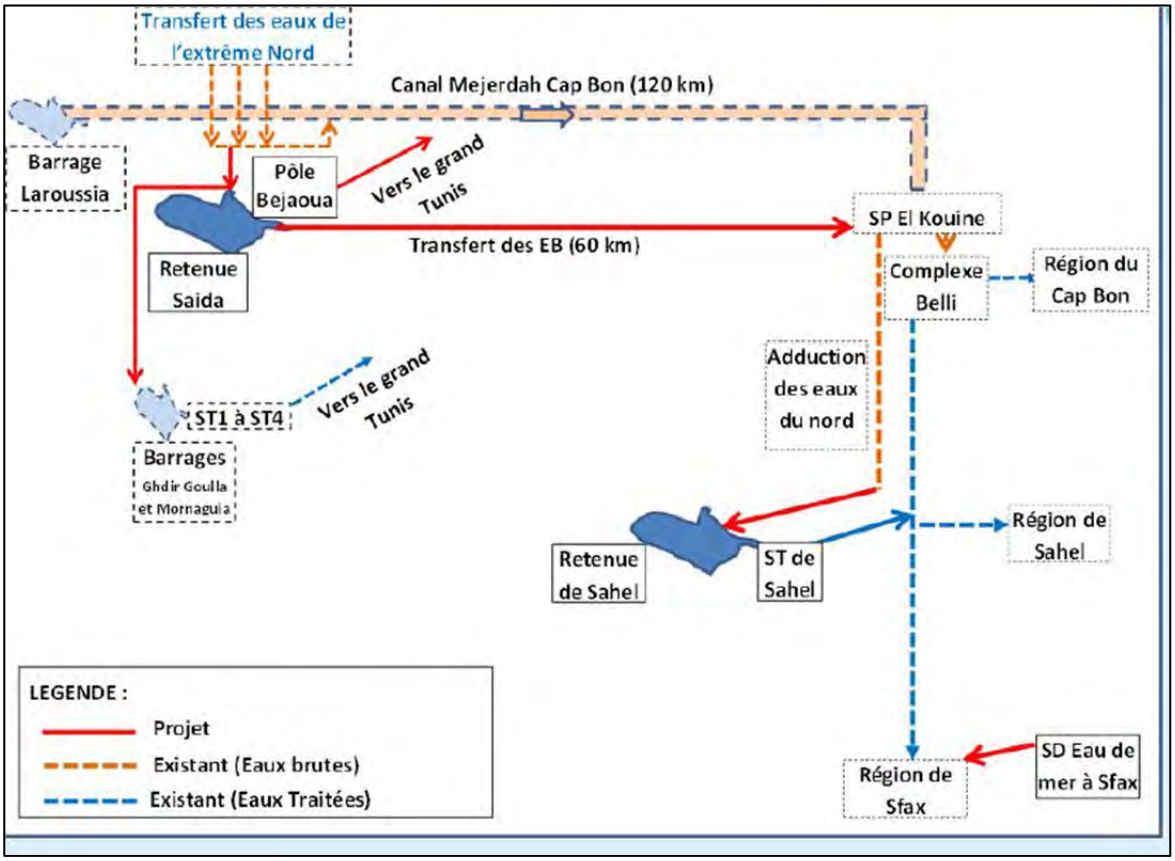
ETAT D'AVANCEMENT DES ETUDES :

- Etude de faisabilité faite par la SONEDE en 2013.
- Etudes d'exécution et DAO en cours par SONEDE

PLANNING DE REALISATION :
(2016-2018)

48


Construction de la station de traitement de Sahel (3/3)
Station de traitement Sahel
SP eau traitée
Retenue K.Kebira
NBC1 Enfida
SP eau brute
NBC2 Eznatir
Sousse
Complexe Ezzehour
Retenue K.Kebira
Kairouan
49


Transfert des eaux de l'extrême Nord
Canal Mejerdah Cap Bon (120 km)
Barrage Laroussia
Pôle Bejaoua
Vers le grand Tunis
Retenue Saida
Transfert des EB (60 km)
SP El Kouine
Complexe Belli
Région du Cap Bon
Adduction des eaux du nord
ST1 à ST4
Vers le grand Tunis
Barrages Ghdir Goulla et Mornaguia
Retenue de Sahel
ST de Sahel
Région de Sahel
Région de Sfax
SD Eau de mer à Sfax
LEGENDE :
Projet
Existant (Eaux brutes)
Existant (Eaux Traitées)

4.3-1 Existing Water Supply Facilities in Greater Sfax

Table of Contents

4.3-1 Existing Water Supply Facilities in Greater Sfax

1. Outline

There are three water sources for water supply in Greater Sfax as follows:

- Treated water transferred by pumping trough the North Water Transfer System for about 200 km, from Belli water treatment plant with the water resource originated in Medjerda River.
- Groundwater transferred from Jelma and Sbeitla, and
- Groundwater pumped up in Sfax

The transferred water and groundwater are stored at distribution reservoirs located inland of Sfax and distributed to two water distribution districts, i.e. high and low distribution districts, from respective reservoirs by gravity. Water from each reservoir is distributed to high or low distribution districts. Further subdivision is not introduced.

2. Groundwater

(1) Groundwater Well

In recent years, water demand in upstream areas of the North Water Transfer System and the Jelma-Sbeitla Groundwater Transfer System has being increased, and consequently available water volume is decreased in Greater Sfax where no large water source exist, and then serious continuous water interruption happened. To cope with the situation in Sfax, SONEDE drilled wells at its reservoir sites as emergency measures though groundwater pumped up through those wells has high salinity. Groundwater pumped up in Sfax is distributed after mixing with the water transferred from the north water transfer system and Jelma-Sbeitla Groundwater transfer system. SONEDE evaluated its available water volume from those groundwater sources in Sfax at 491 ℓ/second or about 42,400m^3/day.

(2) Groundwater treatment facility

1) Purpose of the installation and capacity

Recently, on purpose to reinforce the supply capacity of water services, a well and groundwater treatment facility was installed in the plot of the PK10. The water yield is a fairly large quantity of 60ℓ/s (216 m^3/h), and the facility is operated 200-250 days a year. In Sfax region, there are totally 5 similar groundwater treatment facilities installed in the other service reservoirs and so on.

2) Outline of the facility

The treatment facility is for iron removal of groundwater composed of the aeration tower and sand filter. The aeration tower is for oxidation of iron in the water by the air-liquid contact technique; the raw groundwater falls down from the top and the air blows from the bottom in up- flow direction promoting the contact between

the air and water.

The aerated water is pumped through the sand filter and oxidized suspended iron is removed at the filter. The sand filter is pressure system in the horizontal tank. The accumulated iron at the filter layer is washed by periodical backwashing and discharged to the out of filter. The series of the operation such as filtration and backwash are all automatic.

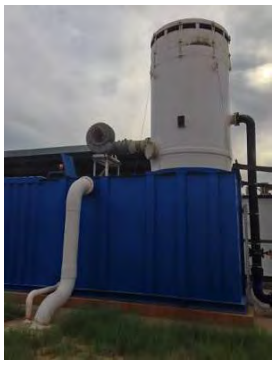


Photo 1 Aeration tower

Photo 2 Sand filter

3. Pumping Station

The Sfax service areas are divided into two zones: one is the lower zone lying along the coast at the lower elevations, and the other, the upper zone located inland at the higher elevations. Each service area receives water supply from a couple of service reservoirs by gravity. Accordingly the Greater Sfax has no pump stations for transmission and distribution.

4. Service Reservoir

SONEDE installed service reservoirs in various parts of the Greater Sfax area, among which those in service to the city zone are listed in Table 1 including those now under repair and in planning.

Table 1 Principal Reservoirs

Name of Reservoir	Volume (m^3)	Service Zone	HWL (m)	LWL (m)	Remarks
Bou Merra	500	Higher	84.0	79.0	Bou Merra_N +1,500m^3
PK11	22,000	Lower	59.0	53.0	5000m^3x4+1000x2
PK14	10,000	Higher	78.8	73.0	5000m^3x2
PK10	20,000	Lower	58.0	52.0	5000m^3x4
Sidi Salah_Haut	2,500	Higher	79.0	73.0	
Sidi Salah_Bas (plan)	-	Lower	59.0	53.0	Plan+5000m^3

Source: SONEDE

One of the major reservoirs, PK10, was examined under this study for its operation and maintenance, as follows:

(1) Water source and quality

The water sources of PK10 are the surface water in the north transmitted to and purified at Belli Treatment Plant, the groundwater from Jelma and Sbeitla in the west, and the groundwater pumped up from the well inside the plot as described later.

The water from those three water sources is blended and equalized in quality in the mixing basin, reserved in the four (4) distribution basins, and then distributed to each distribution areas in lower service zone.
The salinity (TDS) of the water sources are; the surface water 1.3-1.4 g/ℓ, groundwater 3.5-4 g/ℓ, and the blended water of the PK10, 2 to 2.1 g/ℓ which is under the drinking water standard of 2.5g/ℓ.

Photo 3 Mixing basin (right)

Photo 4 Inside of the mixing basin

(2) Specifications of the distribution basin

Each distribution basin is constructed above ground, shape of cylindrical and reinforced-concrete made.
For the prevention of temperature rise of the wall, upper slab and reserved water of the basin, the wall and upper slab are covered by soil protecting the concrete from the direct sunlight. Also grasses are planned on the protecting soil which presents a fine spectacle.
The above specifications of the distribution basin are the standard design of SONEDE.

Photo 5 Distribution Basins

CHAPTER 5

STUDY ON SEA WATER DESALINATION PLANT

5.2-1 Selection of Site for Sea Water Desalination Plant, and Route for Transmission Pipeline

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5.2-1 Selection of Sea Water Desalination Plant Construction Site

1. Candidate sites for seawater desalination plant

Before starting this survey, SONEDE has picked up candidate sites by their own idea, mainly from viewpoints of distance from city of Sfax (Refer to Site 1 – Site4 in Table 1 and Figure 1). Candidate sites were evaluated in accordance with agreed "Selection Criteria" with SONEDE. Further 3 sites (Refer to Site 4 – Site7 in Table 1 and Figure 1) were added from viewpoints of accessibility to intake/discharge points.

Firstly, these sites were evaluated from viewpoints of general situation of site location, and after selection of four (4) sites, actual "Construction cost" and "Electric cost for product water transmission pump operation" for each candidate sites were evaluated. Finally two (2) candidate sites are selected. This is the Phase 1, and final selection was studied in Phase 2 afterward.

Table.1 Candidate sites for seawater desalination plant

No.	Loation	Governorte	North Latitude	East Longitude
SITE 1	El Amra Nord	Sfax	34.921381	10.921379
SITE 2	El Amra Sud	Sfax	34.847586	10.885692
SITE 3	Agareb	Sfax	34.617982	10.624981
SITE 4	Chebba Sud	Mahdia	35.189466	11.097065
SITE 5	Nakta	Sfax	34.554409	10.594427
SITE 6	Chebba Nord	Mahdia	35.258148	11.112843
SITE 7	Mahres	Sfax	34.506152	10.446425

Note: Latitude and longitude are based on GPS data
Source: JICA Survey Team

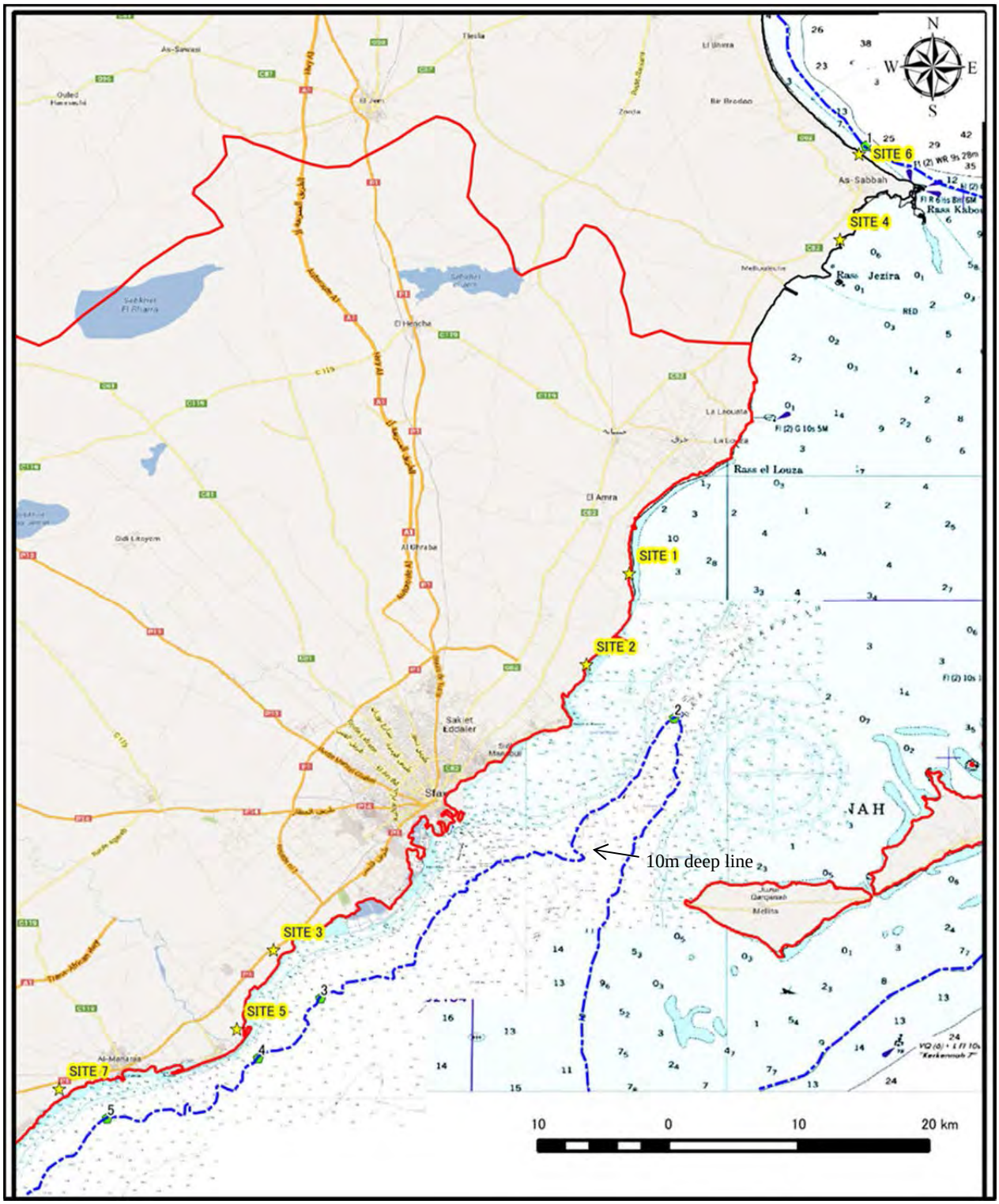
2. Topography and water quality of the sea in front of candidate sites

The 10m deep contour line in the sea is show on Figure 1. Depth of 10m is considered to be suitable for direct intake method, which is recommendable for the project because of volume of intake. Topography f seabed in front of Sfax is shallow to a considerable distance from the shore. There are no sea deeper than 10m in the area of northern are of Sfax (around Site 1, 2 and 4).

Topography of the sea at each candidate site are presented in Annexed Figures 1 o 4.

(2) Water Quality

Due to pollution of coastal areas, and consequently a possibility of elution of heavy metals from deposited pollution sediment, it is necessary to check the water quality for planned seawater desalination facility construction projects. Since it is necessary to secure a depth of 8m to 10m for installation of intake facility, and intake point will be located at approximately 5m in depth, the sampling points are selected at the location of approximately 10m depth near the seawater desalination facility candidate sites. Samples were taken from 5m depth at each point. It was also decided to check the water quality of a position of 50cm above seabed. Selected sampling points are shown in Figure 2. Table 2 presents the position information of each sampling points. Five sampling points were selected in total. For candidate sites 4 and 6, sampling point No. 1 was selected, and for candidate sites Nos. 1 and 2, sampling point No. 2 was selected, while sampling points Nos. 3, 4 and 5 corresponds to candidate sites Nos. 3, 5 and 7 respectively. Analytical results of water quality in each place are shown in Table 2. The minimum requirement to select the desalination plants site analyzed in this Phase 1 Survey. Detailed analysis of heavy metals and other items, etc. on the selected site will be conducted in Phase 2.



Source: JICA Survey Team

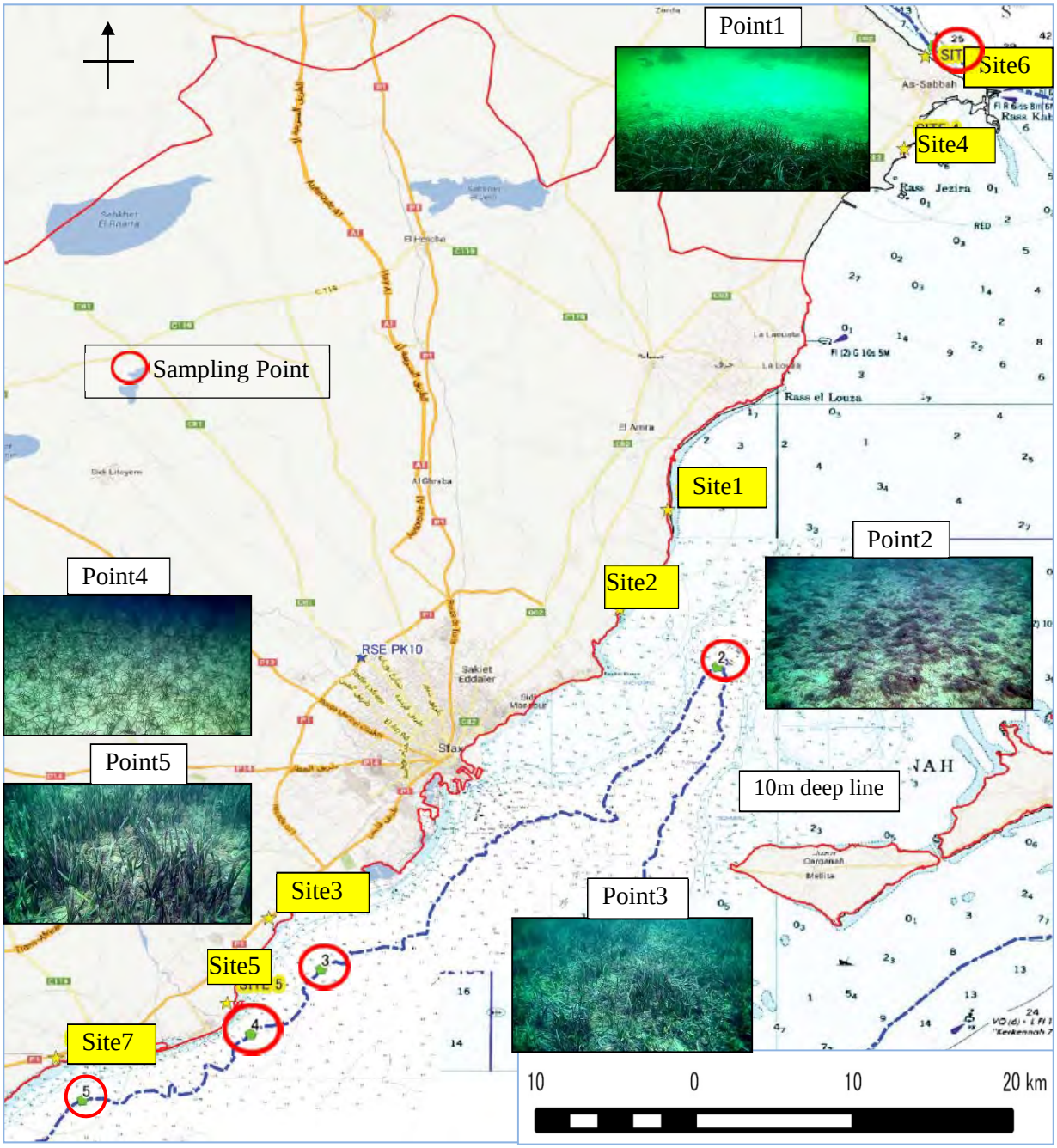
Figure1 Location of Candidate Sites

Considering the water quality analysis results of Table.2, noteworthy analysis results are not shown except TDS. TDS had been estimated to be 33,000 mg/ℓ to 38,000 mg/ℓ in this area, but results showed 43,000 mg/ℓ to 50,000 mg/ℓ in each data collection point.

Table.2 Sampling Points and Sea Water Quality

Analysis items		Point 1		Point 2		Point 3		Point 4		Point5	
Location data (by GPS)		N:35.2648413 E:011.1184828		N:34.8085109 E:010.9516900		N:34.5836229 E:010.6553259		N:34.5362839 E:010.6054000		N:34.4905769 E:010.4849709	
Seawater samples											
Analysis items	Unit	Depth		Depth		Depth		Depth		Depth	
		5m	~10m	5m	~10m	5m	~10m	5m	~10m	5m	~10m
Temperature	°C	25	25	26	26	25	24.8	25	24.4	24.9	25
pH	-	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.7
EC (Electric Conductivity)	S/cm	47.3	47.6	48.2	48.4	47.7	48.5	47.9	47.4	47.7	47.2
TDS (Total Dissolved Solid)	mg/ℓ	43,282	43,430	43,364	43,547	56,579	45,938	45,471	44,057	50,613	43,092
Turbidity	NTU	0	0	0	0	0	0	0	0	0	0
SS (Suspended Solid)	mg/ℓ	29	75.5	70	77.5	85.5	78.5	20.5	74.5	67	76.5
Na^+ (Sodium)	mg/ℓ	12,901.5	12,394.5	13,072	12,326.5	13,278	13,140.5	12,582	15,386.5	14,433	12,717
Cl^- (Chloride)	mg/ℓ	22,680.5	21,650	21,717	21,446	22,661	21,929	2,1405.5	25,986	25,057	21,685.5
SiO_2 (Silica)	mg/ℓ	0.563	0.570	0.313	0.671	0.404	0.301	0.508	0.528	0.755	0.563
B (Boron)	mg/ℓ	0.157	0.529	0.165	0.236	0.987	0.469	0.381	0.315	0.602	0.236
TOC (Total Organic Carbon)	mg/ℓ	0.43	0.77	＜0.1	＜0.1	0.88	0.48	0.34	0.28	0.4	0.14

Source：JICA Survey Team



Source：JICA Survey Team

Figure 2　Locations of Sampling Points

(3) Analysis of Sediments

There is a possibility that the sediment deposited on the seabed is contaminated by heavy metals. Upon water quality sampling, seabed mud samples wire simultaneously collected from sampling point, which were analyzed for radioactive materials and heavy metals. Results are shown in Table 3. Except the seawater sampling point No.4, the lead concentration of each candidate site were slightly above that of the reference. It shall be noted that there is a possibility sediments is rolled up when the ocean is rough.

Table 3 Analysis of Sediment

Analysis item	unit	Point 1	Point 2	Point 3	Point 4	Point 5	Referential data of comparison *
Cu^{++} (Copper)	mg/kg	2.28	5.36	6.07	2.78	6.51	≦ 60
Pb^{++} (Lead)	mg/kg	208.79	154.77	127.63	53.28	234.54	≦ 110
Zn^{++} (Zinc)	mg/kg	23.22	20.11	28.92	16.31	46.11	≦ 365
Cd^{++} (Cadmium)	mg/kg	0.04	0.08	0.06	0.06	0.06	≦ 4
Ni^{++} (Nickel)	mg/kg	17.51	30.56	29.63	10.76	41.23	≦ 45
Cr^{++} (Chromium)	mg/kg	7.96	5.05	12.14	11.58	23.36	≦ 120
Radioactivity	Bq/s	0	0	0	0.198	0.395	≦ 100
Uranium	Bq/s	ND	ND	ND	ND	ND	≦ 0.183

※ : Limits of Acceptability for sediment discharge into the sea in Tunisia.
Source: JICA Survey Team

(4) Benthic Plant

It is seaweed [posidonia] is a kind of famous submarine plants in Ibiza which is registered as a world heritage in Spain Country Balearic Islands in Sfax coastal waters. It inhabit near Kerkennah Island especially. In addition it inhabits in Sfax coastline. We had confirmation of this fact on each site survey of seabed mud sample. (refer to Figures 2 and 3). And thus concentrated water discharge pipe and raw water intake pipe is construction on the seabed. It will be affected by digging of pipeline for intake line and discharge line. But, I considered it have a low impact on the posidonia with the course of time after construction work. Further investigation is needed about this problem.

Source：SONEDE

Figure 3

Posidonia Glowing Location

3. Method of Site Selection

Upon discussions with SONEDE, the method for site selection was decided as follows;

(1) Selection Policy

1) Basic Prerequisite for the study

Intake process is preliminary studied from the data of similar plant, and concluded as follows.

Direct intake process with pipeline shall be is adopted for this project because of its required quantity.

There are two types of direct intake. i.e. Surface seawater intake and Deep sea water intake with pipeline transmission. In case of surface intake, intake area near the coast should be dredged around 10meter depth for preventing from absorption of sand and/or sediment on the seabed. When considering the construction cost and future maintenance cost for this Surface intake, Deep sea intake may be cheaper that dredging the seabed. Therefore Deep sea water intake method is selected for this project.

2) Selection Criteria

(i) Authorization procedure

Draft of Selection Criteria was prepared by the JICA Survey Team and discussed with SONEDE. The key points for the Criteria are as follows.

a) Each check items have different evaluation points of view, and different importance. Therefore different score was allocated to each check item.
b) By this different scoring allocation, candidate sites were evaluated with different points. Score/Points for each item are shown in Figure 1.

(ii) Evaluation items

Sites are reviewed and evaluated from following viewpoints.

a) Accessibility to reliable seawater source

- Stable obtaining of high quality sea water

b) Easy land acquisition

- Public land or Private land

c) Accessibility to adequate Energy sources

- Enough electricity is available near the sites

d) Minimize environ impacts

- Brine discharge

- Impact to ecosystem

e) Easy access to water distribution

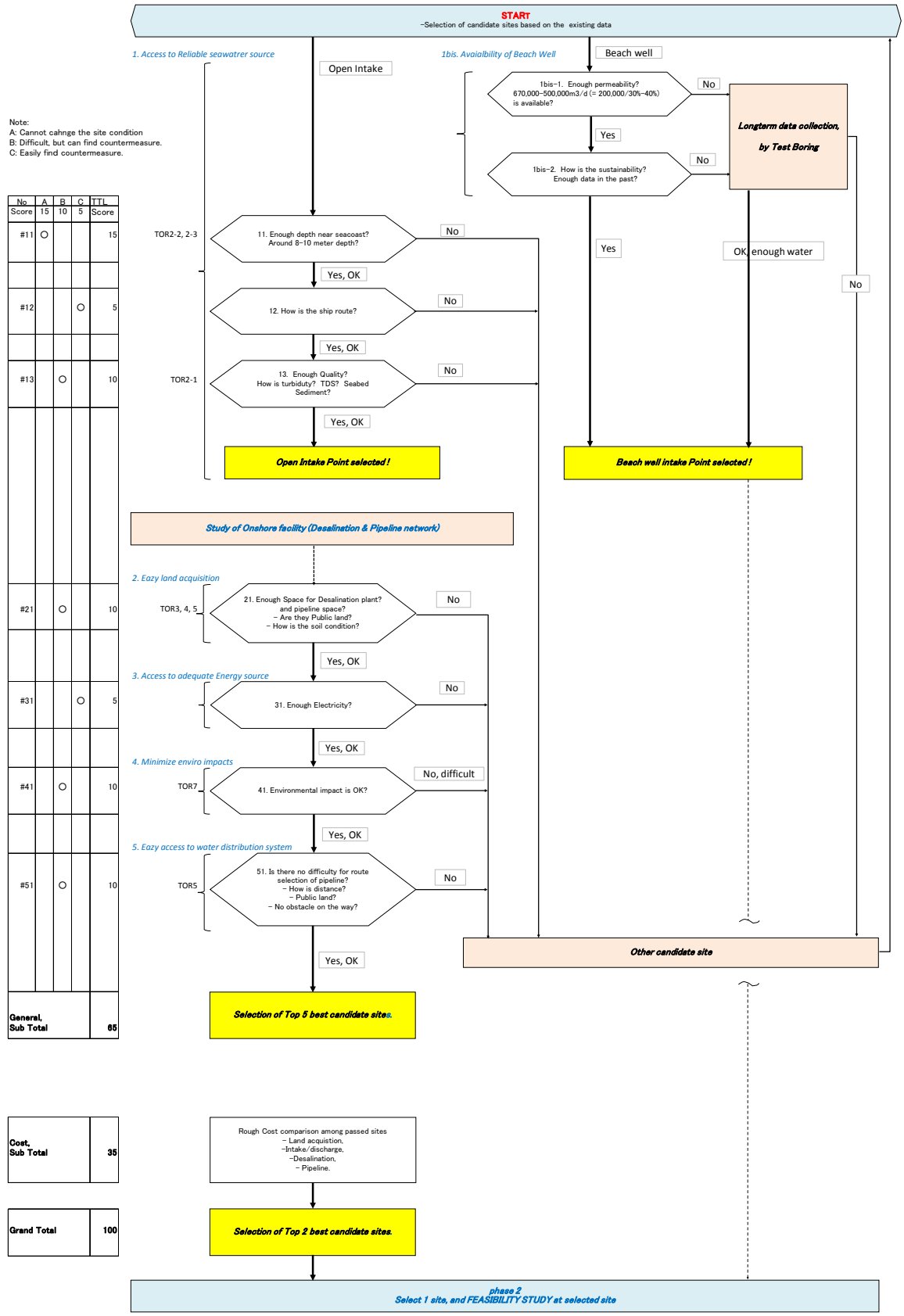
- Distance to reservoir for water distribution network for consumer

3) Scoring criteria in each evaluation items

Evaluation items of #11 (distance from intake and discharging point), #31 (distance from electric grid), and #51 (distance for reservoirs) are important for the site selection.

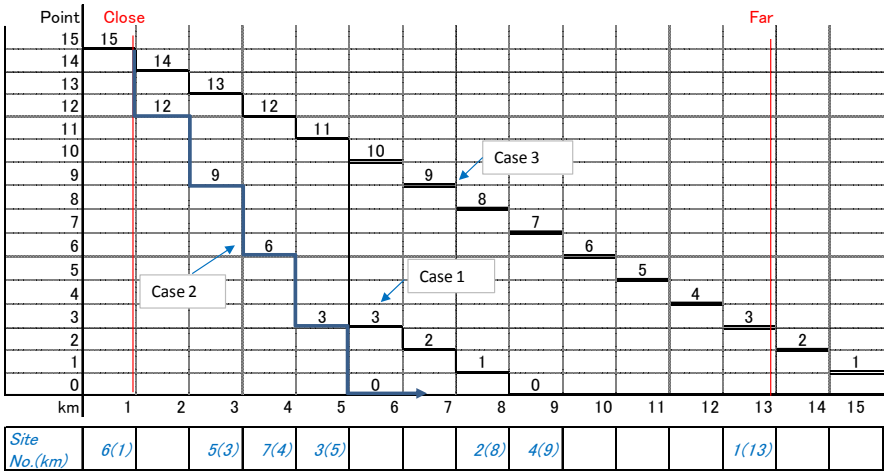
Therefore scoring criteria for these important evaluation items are separately studied. Item #11 and #31 are evaluated by its distance, and #51 is evaluated by the estimated construction cost for pipeline to reservoirs. Refer to Figure 5 and Figure 6.

Especially #11 is further confirmed any differences by giving different scoring point as per Figure 5. As the result, not so big difference was obtained by different scoring system, which means some site always gets high score and some site gets low score. From this fact, scoring case one (1) is applied to this #11.



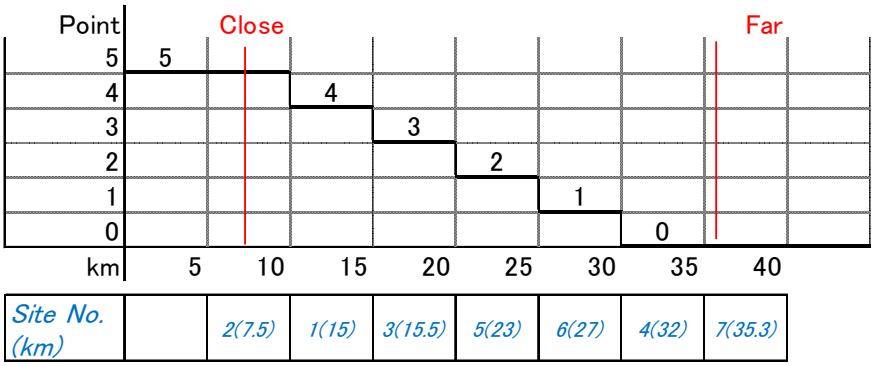
Source: JICA Survey team

Figure 4 Selection Criteria



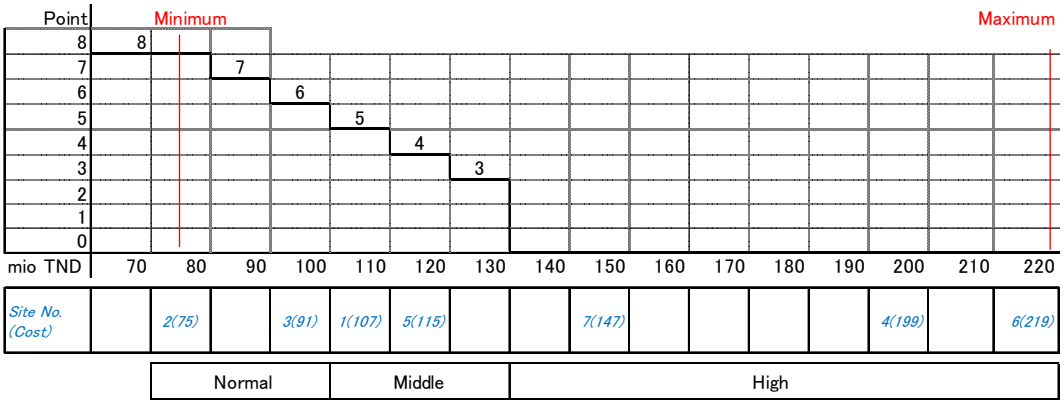
Source: JICA Survey team

Figure 5 #11- Distance from Intake Point vs. Scoring Point



Source: JICA Survey team

Figure 6 #31- Distance from Grid vs. Scoring Point



Source: JICA Survey team

Figure 7 #51- Cost for Pipeline to Reservoirs vs. Scoring Point

4. Candidate Site Comparison and Evaluation Result

Site space requires not only for 200,000 m^3/d desalination plant, but also, seawater receiving pit, product water tank, electric power receiving equipment, stock house for chemicals and necessary materials for operation, general administration building and parking space, etc. Actual space will be studied in next Phase 2, but based on the data from other similar desalination plant, around 200,000m^2 are estimated to be necessary for this project.

Seven (7) sites in Figure 1 were evaluated in accordance with the selection method.

(1) 1st Evaluation

Firstly, based on three (3) cases shown in Figure 5, scoring sensitivity for #11 are studied. Result is shown in the Graph in Table 4. From this result, not big difference is obtained. i.e. Site 1, 2 and 4 are always in low score. Total score, based on case 1 for #11, is shown in Table 5

As the conclusion, site 3, 5, 6 and 7 have passed this 1st evaluation, and these are further studied from view point of construction cost as 2nd evaluation.

Table5 Result of 1st Evaluation

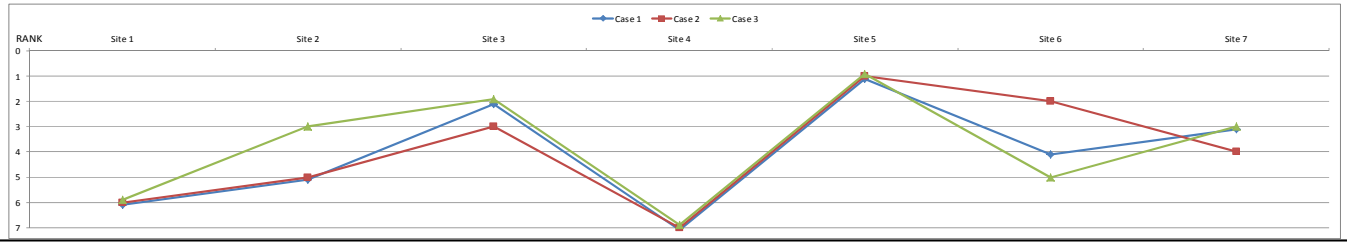
Site No	Site name	Score (Case 1 in #11) 65 point perfect	Propriety	Reference
1	El Amra Nord（Sfax）	37	disqualify	
2	El Amra Sud（Sfax）	41	disqualify	
3	Agareb（Sfax）	51		To 2nd evaluation
4	Chebba Sud（Mahdia）	29	disqualify	
5	Nakta（Sfax）	53		To 2nd evaluation
6	Chebba Nord(Mahdia)	47		To 2nd evaluation
7	Mahres(Sfax)	48		To 2nd evaluation

Source: JICA Survey team

Table 4 Evaluation Result in Each Site

Ref No	Site No.		Point	1	Point Case1	Case2	Case3	2	Point Case1	Case2	Case3	3	Point Case1	Case2	Case3	4	Point Case1	Case2	Case3	5	Point Case1	Case2	Case3	6	Point Case1	Case2	Case3	7	Point Case1	Case2	Case3	Scoring standard
	Name			El Amra Nord				El Amra Sud				Agareb				Chebba Sud				Nakta				Chebba Nord				Mahres				
	Governorates			SFAX				SFAX				SFAX				MAHDIA				SFAX				MAHDIA				SFAX				
0	Distance from Center of SFAX (Straight)			25km				17km				18km				60km				25km				67km				40km				
11	Depth of Intake/Discharge Point	10 meter depth point	15	13km	0	0	3	8km	1	0	8	5km	11	3	11	9 km	0	0	7	3km	13	9	13	1km	15	15	15	4km	12	6	12	Refer to Fig 5.2-2
12	Ship route	Ferry	4	Care	3			Care	3			OK	4			OK	4			OK	4			OK	4			OK	4			OK: P4, Care: P3
		Fishing boat	1	Care	0			Care	0			Care	0			Care	0			OK	1			Care	0			OK	1			OK: P1, Care: P0
13	Seawater Quality	TDS	2		2				2				2				2				2				2				2			
		Contamination of Industrial waste water, city sewerage	6	No Possibility? (Close to SFAX city area.)	5			No Possibility? (Close to SFAX city and industrial area.)	4			No Possibility? (Close to SFAX city and industrial area.)	4			No Possibility	6			No Possibility	6			No Possibility	6			No Possibility	6			Far from Big City : P6, Near Big City: P5, Near Big City & Industrial area: P4
		Sediment at seabed	2	(Far from phospherous industrial area.)	2			(Far from phospherous industrial area.)	2			(Close to phospherous industrial area.)	1			(Far from phospherous industrial area.)	2			(Far from phospherous industrial area.)	2			(Far from phospherous industrial area.)	2			(Far from phospherous industrial area.)	2			Far: P2. Near: P1
1bis	Possibilty of Beach Well			?				?				?				?				?				?				?				
21	Land acquisition	Desalination plant (Land ownership)	8	Public	8			Public	8			Public	8			Public (to be confirmed)	7			Public	8			Public	8			Public	8			Public: P8, Public (to be confirmed): P7, Public/Private mix: P6, Private: P3
	Soil condition	Hight from sealevel (meter)	2	1-2m	1			1-2m	1			1-2m	1			1-2m	1			1-2m	1			1-2m	1			1-2m	1			1-5m: P1, 5m<: P2
		Soil condition		?				?				?				?				?				?				?				
31	Energy	Electricty supply	5	15km	4			7.5km	5			15.5km	3			32km	0			23km	2			27km	1			35.3km	0			Refer to Fig 5.2-3
41	Environment aspects	Historical Remains		Nothing				Nothing				Nothing				Nothing				Nothing				Nothing				Nothing				
		Wood, Animal, Bird		No impact				No impact				No impact				No impact				No impact				No impact				No impact				
		Sea bed plant, Fish,..	8	MIddle impact (Posidonies)	4			MIddle impact (Posidonies)	4			No impact	8			MIddle impact (Posidonies)	4			Small impact (Posidonies)	6			Small impact (Tuna)	6			No impact	8			No: P8, Small: P6, Middle: P4, Impact: P0
		Sediment pollution		Small impact	0			Small impact	0			Small-Middle impact	▲ 1			Small impact	0			Small impact	0			Small impact	0			Small impact	0			Small: P0, Small-Medium: P(-1)
	Human aspects Impact, during marine facility onstruction	Fishing industry	2	Middle	1			Middle	1			Few	2			Middle-Large	1			Few	2			Middle	1			Few	2			OK: P2, If any suspiciou: P1, Big problem: P0
		Tourism industry		None				None				None				None				Few				Few				None				
51	Access to distribution system	Cost	8	Middle	5			Normal	8			Normal	6			High	0			Middle	4			High	0			High	0			Refer to Fig 5.2-4
		Obstacle, at Pipeline route	2		2				2				2				2				2				2				2			If nothing: P2, If serious: P0
Sub Total	Case 1	Full score	65		37				41				51				29				53				48				48			
	Case 2	Full score	65			37				40				43				29				49				48				42		
	Case 3	Full score	65				40				48				51				36				53				48				48		

note: Figure in red is more than point 45.



Source: JICA Survey team

(2) 2nd Evaluation

Site 3, 5, 6 and 7 which passed 1st evaluation are further studied form following costs viewpoints.

a) Marine construction cost

- Intake quantity: 500,000m^3/d
- Discharge quantity: 300,000m^3/d
- Both pipelines will be laid in same line from land and separated at end of pipe. Intake and discharge tower will be installed at different point.

b) Seawater Desalination plant

- Desalination process with RO membrane will be adopted.
- Product water: 200,000m^3/d,
- Recovery: 40%

c) Electric Receiving Equipment

- From STEG grid of 150KV
- Necessary electric power: 40MW capacity

d) Product water transmission pipeline

- Transmission of 200,000m^3/d water to existing 5 reservoirs
- Transmission route shall be decided by the discussion with SONEDE

e) Transmission pump

- 200,000m^3/d

f) Transmission pump operation Cost

- Electric consumption cost for project life (20 years) is compared

Estimated cost for each sites are shown in Table 6. It should be noted that these cost is only for comparison among candidate site, and not based on detail specification, and may be changed after progress of Feasibility Study. Also should be noted that land acquisition and/or reclamation cost, Environment Impact Assessment fee, etc. Consultant service fee for the period of project implementation are not included.

Table 6 Cost Comparison among Candidate Site

Candidate Site No.			3	5	6	7
Location Name			Agareb	Nakta	Chebba Nord	Mahres
Governorates			SFAX	SFAX	MAHDIA	SFAX
Distance from Center of SFAX (Straight)			18 km	25 km	67 km	40 km
Distance to 10m deep offshore point			5 km	3 km	1 km	4 km
CAPEX: Construction Cost (mio JPY)	Intake/Discharge	Intake	6,500	3,000	1,000	4,800
		Outfall	4,000	2,000	600	3,000
	Desalination Plant		25,000	24,000	24,000	24,000
	Electricity Service Connection		2,870	4,250	4,990	6,470
	Transmission Pump		1,050	1,070	1,080	1,070
	Pipeline		5,510	7,030	13,330	8,980
	Sub Total		44,930	41,350	45,000	48,320
		ratio	*100%*	*92%*	*100%*	*108%*

Source: JICA Survey Team

According to above cost comparison in Table 6, cost at site 5 is minimum and 93% of site 3. Site 6 and site 7 are 100% and 108% of site 3 respectively.

Further, electric consumption cost by transmission pump, which are different in each site due to the difference of transmission distance, are studied in the following assumption. This study in this section is only confirming whether the difference of initial project cost is reversed by 20 years operation cost or not, therefore, this operation cost is not converted to Net Present Value.

a) Operation period: 12 months /years

Desalination plant is expected to be operated at the peak demand only, and not in 100%, which means transmission pump is not operated in 100% for whole year. But in this study, 100% operation is assumed.

b) Project life: 20 years for study, which is generally used in feasibility studies

Result is shown in Table 7. From this result, the difference in initial construction cost is not reversed by the electric consumption cost.

Table 7 Initial Construction Cost and Electric Consumption Cost for Transmission Pump

Candidate Site No.	3	5	6	7
CAPEX (Plant construction cost)	44,930	41,350	45,000	48,320
Pump Electric cost x 12months/year x 20years (mio JYE)	*4,300*	*4,570*	*5,530*	*4,940*
CAPEX + Electric cost for transmission pump	*49,230*	*45,920*	*50,530*	*53,260*
ratio	*100%*	*93%*	*103%*	*108%*

Source: JICA Survey team

Evaluation results for four (4) candidate sites are summarized as per Table 8.

Table 8 Evaluation Result

Candidate Site No.	3	5	6	7
Location Name	Agareb	Nakta	Chebba Nord	Mahres
Governorates	SFAX	SFAX	MAHDIA	SFAX
Distance from Center of SFAX (Straight)	18 km	25 km	67 km	40 km
Distance to 10m deep offshore point	5 km	3 km	1 km	4 km
Land Ownership	Public	Public	Public	Public
Height above Sea Level	around 2m	around 2m	around 2m	around 2m
Construction Cost (in %)	100%	92%	100%	108%
Total Evaluation Rank	2	1	3	4

Source: JICA Survey team

From above Table 8, it is concluded that;

1) Site #5 is the best candidate site.
2) From costing view point, #3 and #6 follow #5.
3) Due that land owner for #6 is not yet confirmed, and also belong to Mahdia governorate, the JICA Survey Team recommends #3 as 2nd best candidate site

Since sites #3 and #5 are located in the ”Public Maritime Domain”, approval of APAL is necessary for development in those area.

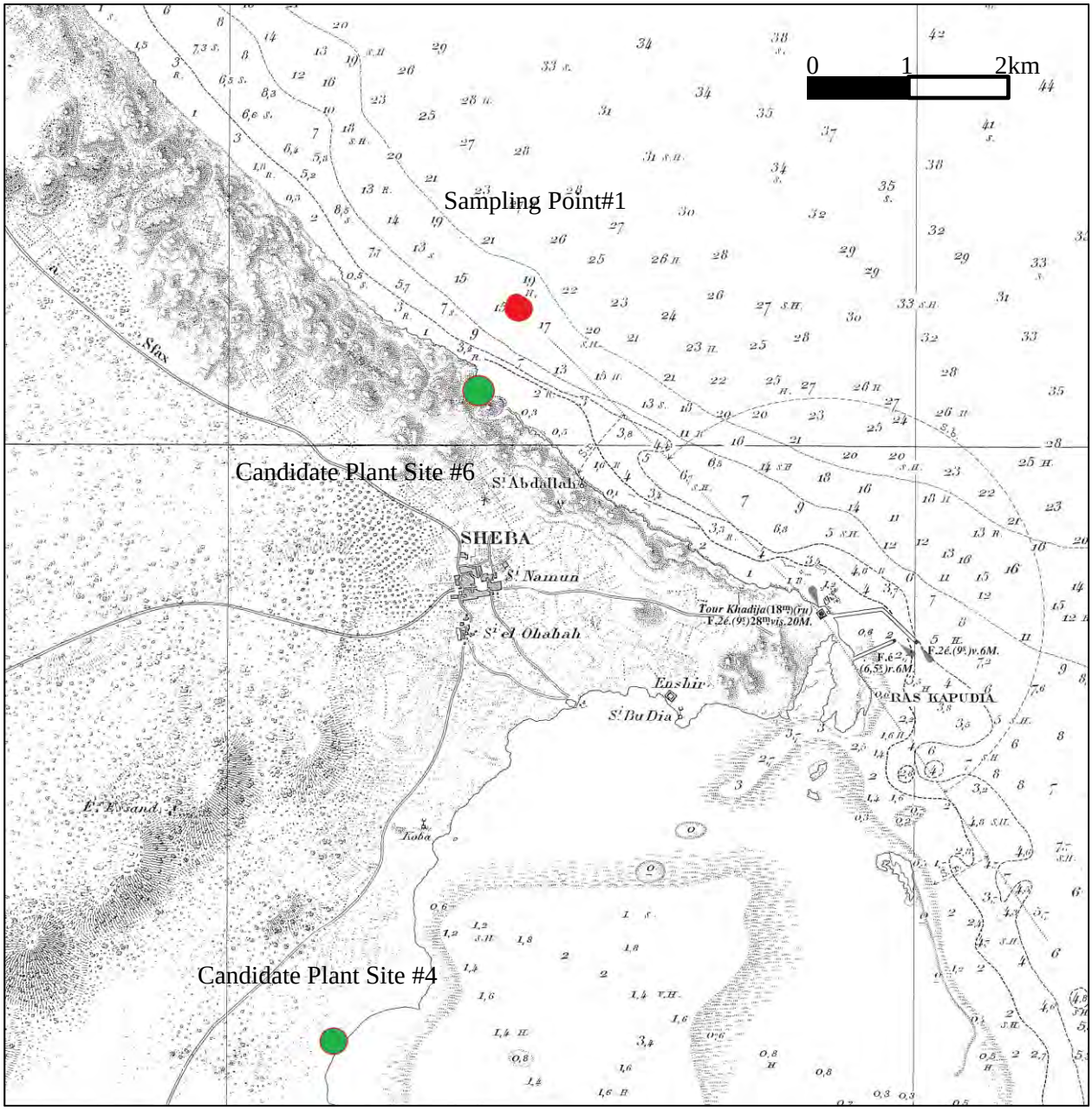
(3) Conclusion

During Phase I of the Survey, the conclusion stated in above (2) was obtained without consultation with related authorities because implementation of the project was not yet decided. As a result of Phase 1 Survey, necessity of the project was confirmed, consequently several examinations bout #3 and #5 were conducted with related authorities at the beginning of Phase 2 of the Survey.

APAL expressed their opinion that Site #5 cannot be approved because of frangibility of coastal features. While, APAL approved Site # 3 for development. After that, the area located south of initial site # 3 was indicated for use (refer to Figure 8). The JICA survey team started the study based on the site shown on Figure 8 as the project site. Official approval of APAL for use of the site will be provided upon approval of EIA by ANPE.

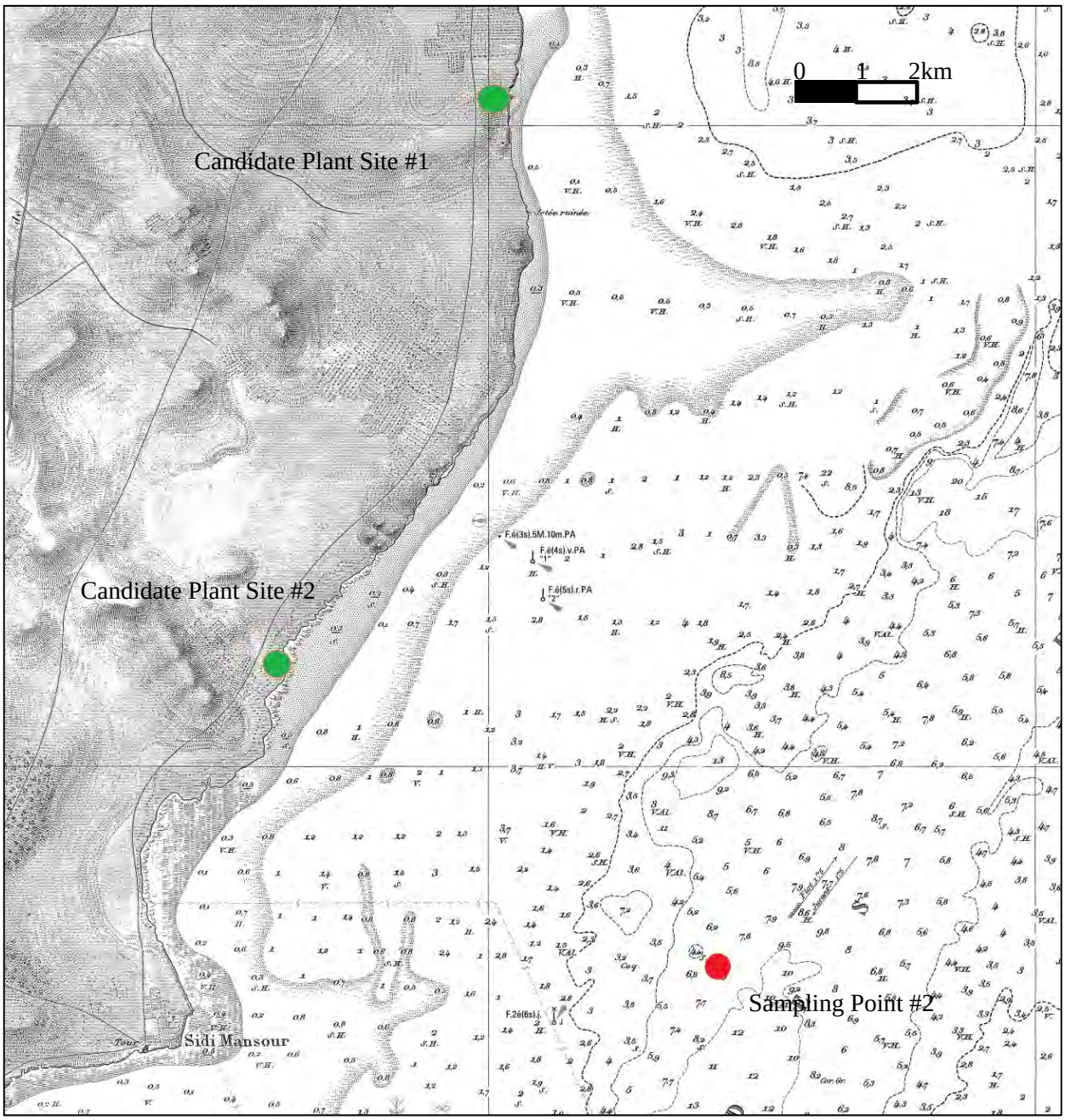
Source：APAL/SONEDE/JICA Survey Team

Figure 8　Site approved by APAL



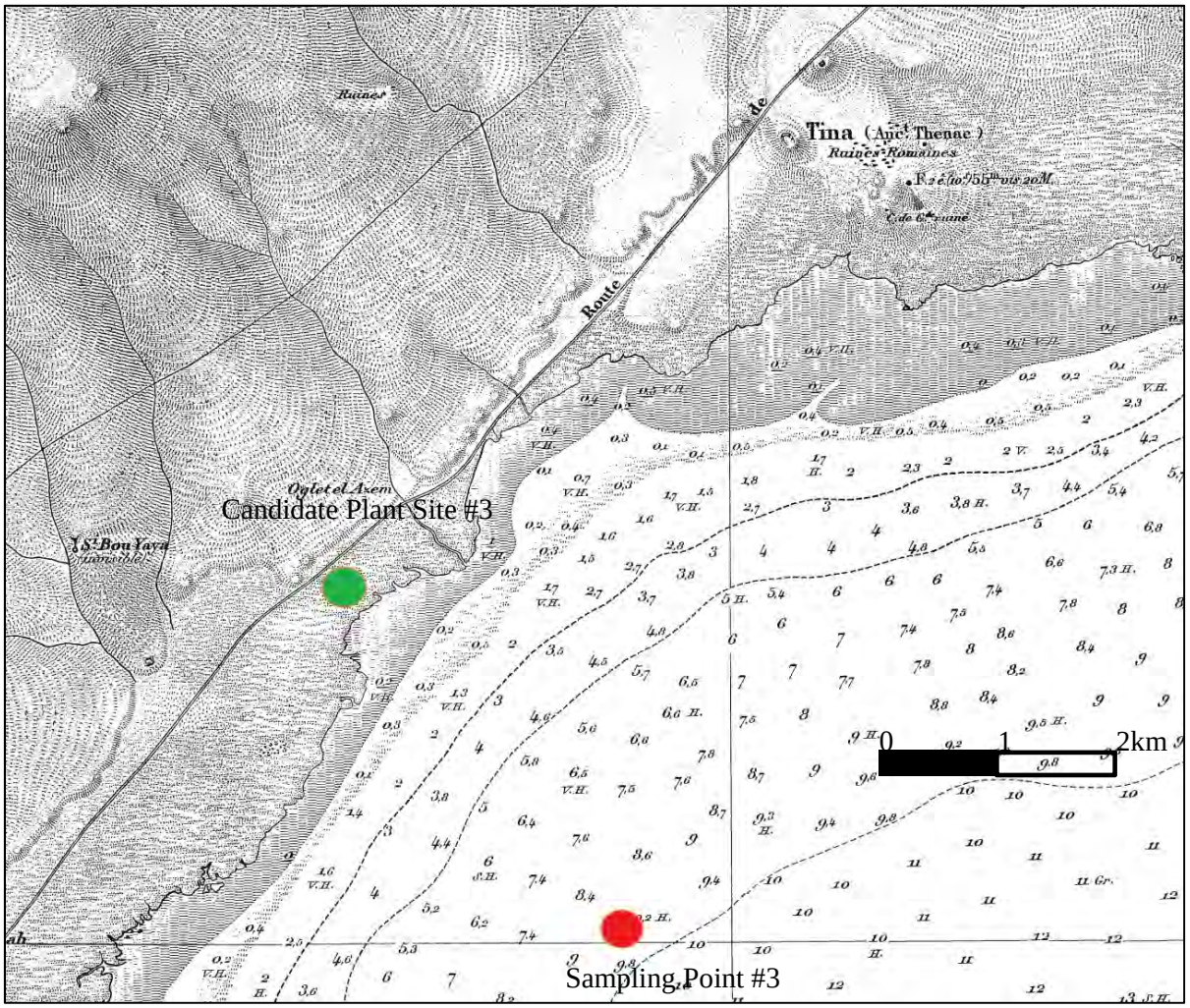
ID	Location	Latitude	Longitude
Site 4	Chebba Sud	N:35.189466	E:011.097065
Site 6	Chebba Nord	N:35.258148	E:011.112843
Sampling Point 1	-	N:35.2648413	E:011.1184828

Annexed Figure 1 Sea Water Desalination Plants Candidate Site and Sampling Points (1)



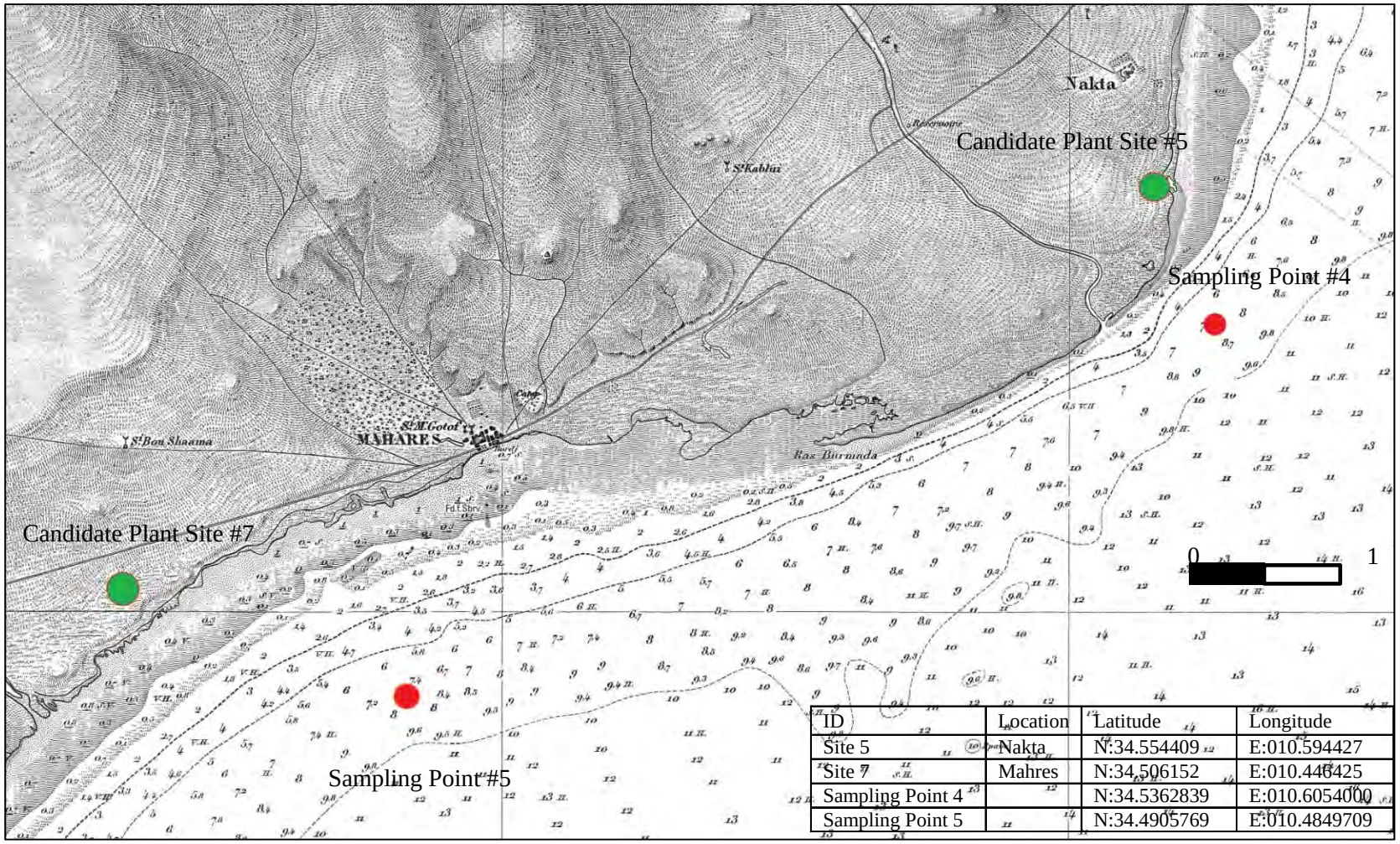
ID	Location	Latitude	Longitude
Site 1	El Amra Nord	N: 34.921381	E: 010.921379
Site 2	El Amra Sud	N: 34.847586	E:010.885692
Sampling Point 2	-	N:34.8085109	E:010.9516900

Annexed Figure 2 Sea Water Desalination Plants Candidate Site and Sampling Points (2)



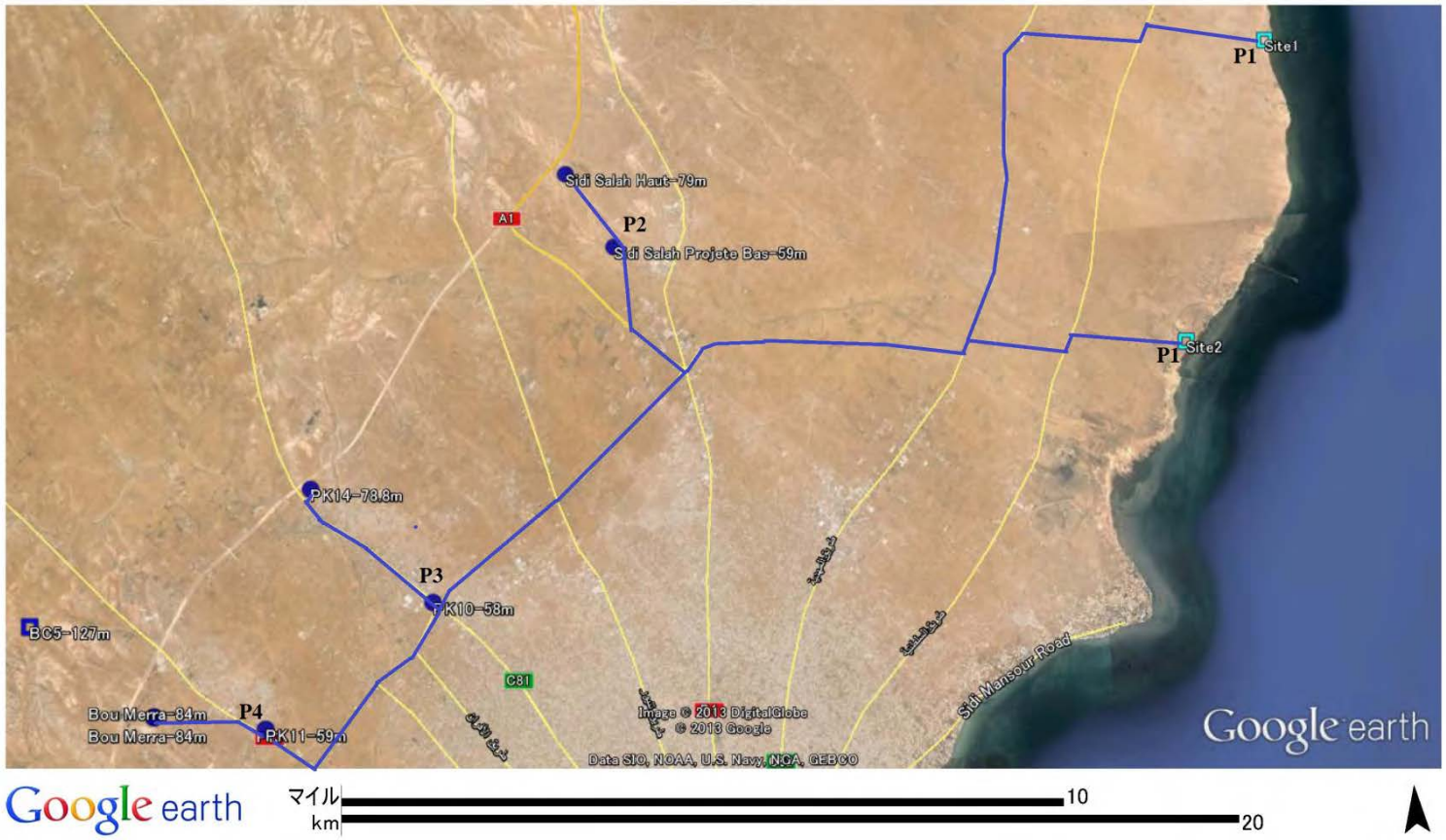
ID	Location	Latitude	Longitude
Site 3	Agareb	N: 34.617982	E: 010.624981
Sampling Point 3	-	N:34.5836229	E:010.6553259

Annexed Figure 3 Sea Water Desalination Plants Candidate Site and Sampling Points (3)

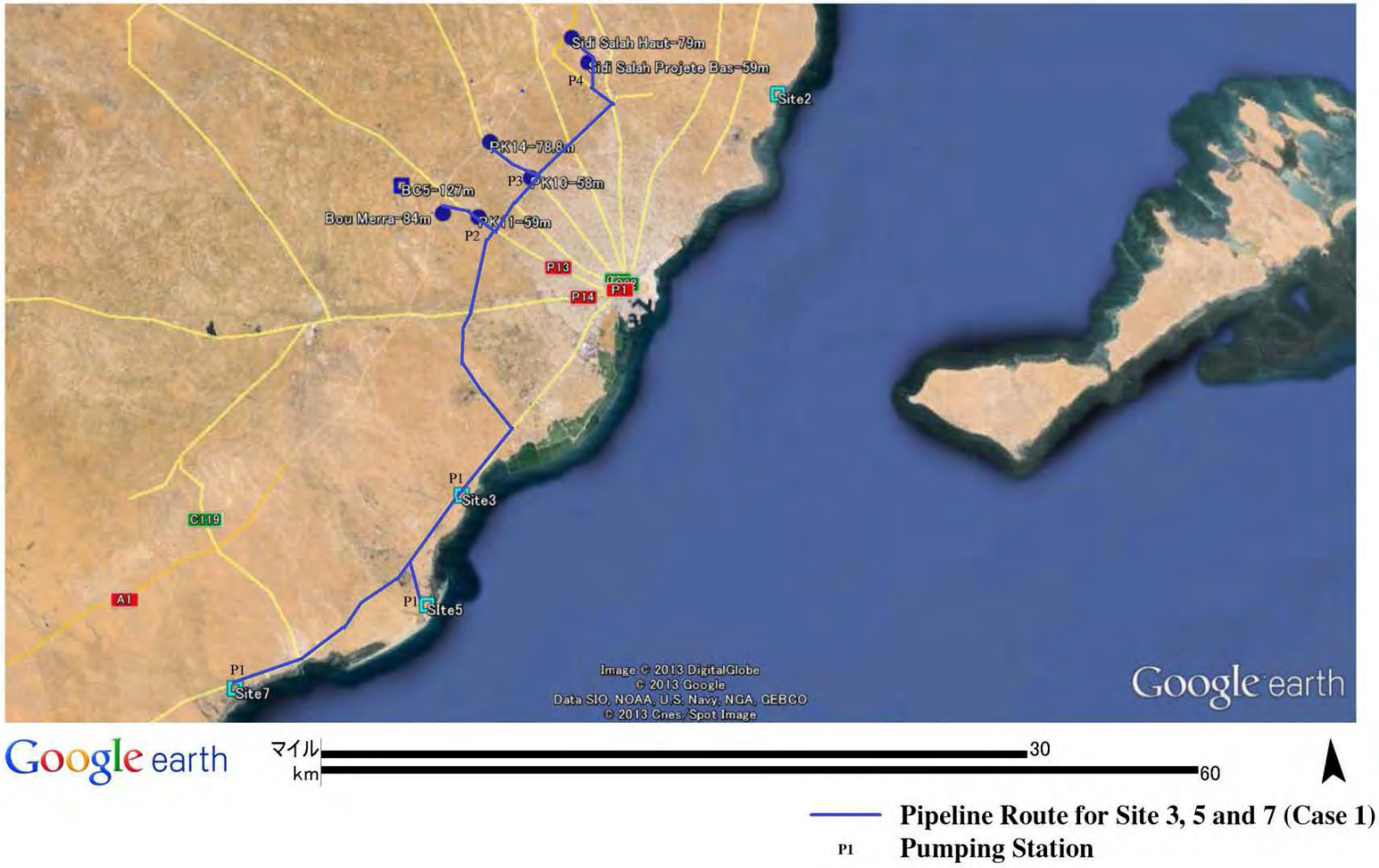


ID	Location	Latitude	Longitude
Site 5	Nakta	N:34.554409	E:010.594427
Site 7	Mahres	N:34.506152	E:010.446425
Sampling Point 4		N:34.5362839	E:010.6054000
Sampling Point 5		N:34.4905769	E:010.4849709

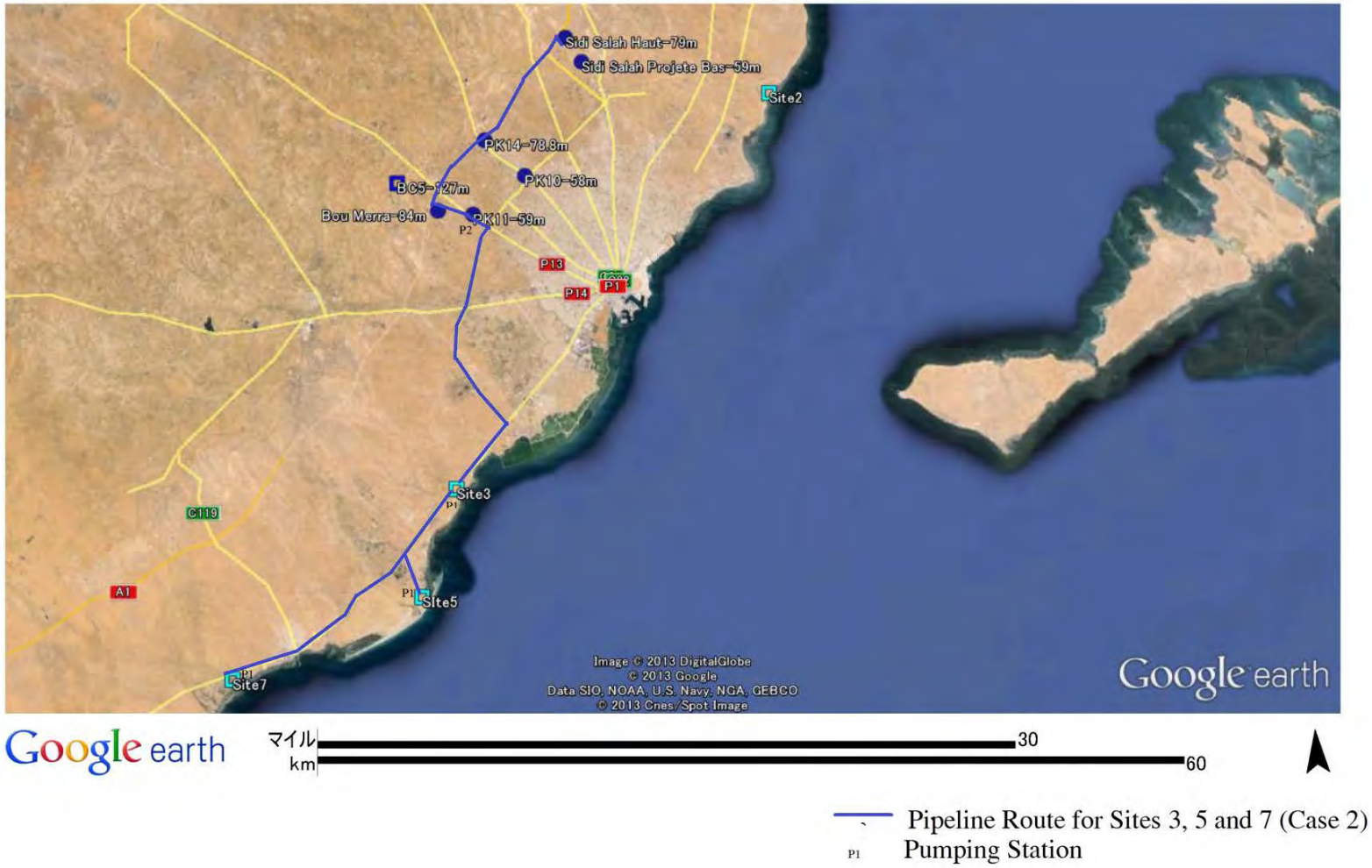
Annexed Figure 4 Seawater Desalination Plants Candidate Site and Sampling Points (4)



Annexed Figure 5 Transmission Pipeline Route from Respective Site by Case (1)



Annexed Figure 6 Transmission Pipeline Route from Respective Site by Case (2)



Annexed Figure 7 Transmission Pipeline Route from Respective Site by Case (3)

Annexed Figure 8 Transmission Pipeline Route from Respective Site by Case (4)

Annexed Figure 9 Transmission Pipeline Route from Respective Site by Case (5)

Annexed Table 1 Rough Cost Estimates of Transmission Pipeline from Respective Site by Case

Pumpig Stations & Pipeline for Each Site (1)

Site 1		km	mm	m3/d	m/s	H-W	0/00	m		TND/m	1000TND			
	P. St.	Length	Dia.	Q	V	C	Grade	Head Loss		Unit C.	Amount		Elevation	Q (m3/d)
Site - Main Road	1	9.0	1600	200,000	1.15	136	0.58	5.19		2,721	24,489	Sidi Salah H	79m	16,000
Main R.		17.8	1600	200,000	1.15	136	0.58	10.27		2,721	48,434	Sidi Salah B	59m	37,000
Main R. - S. Salah B		4.0	800	53,000	1.22	136	1.45	5.79	21.25	879	3,516	PK14	79m	32,000
S. Salah B - S. Salah H	2	2.3	500	16,000	0.94	136	1.56	3.58	3.58	429	987	PK10	58m	55,000
Mai. R.		7.8	1400	147,000	1.11	136	0.63	4.88		2,193	17,105	Bou Merra	84m	16,000
Mai R. - PK10		0.1	1000	87,000	1.28	136	1.22	0.12	20.47	1,229	123	PK11	59m	44,000
PK10 - PK14	3	4.3	800	32,000	0.74	136	0.57	2.45	2.45	879	3,780			200,000
Mai. R.		4.5	1000	60,000	0.88	136	0.61	2.76		1,229	5,531	Pump St.1	200,000	83m
Mai R. - PK11		1.2	1000	60,000	0.88	136	0.61	0.74	23.84	1,229	1,475	Pump St.2	16,000	29m
PK11 - Bou Merra	4	3.0	500	16,000	0.94	136	1.56	4.67	4.67	429	1,287	Pump St.3	32,000	29m
		54.0									**106,726**	Pump St.4	16,000	35m

Site 2		km	mm	m3/d	m/s	H-W	0/00	m		TND/m	1000TND			
	P. St.	Length	Dia.	Q	V	C	Grade	Head Loss		Unit C.	Amount		Elevation	Q (m3/d)
Site - Main Road	1	5.8	1600	200,000	1.15	136	0.58	3.35		2,721	15,782	Sidi Salah H	79m	16,000
Main R.		9.3	1600	200,000	1.15	136	0.58	5.37		2,721	25,305	Sidi Salah B	59m	37,000
Main R. - S. Salah B		4.0	800	53,000	1.22	136	1.45	5.79	14.50	879	3,516	PK14	79m	32,000
S. Salah B - S. Salah H	2	2.3	500	16,000	0.94	136	1.56	3.58	3.58	429	987	PK10	58m	55,000
Mai. R.		7.8	1400	147,000	1.11	136	0.63	4.88		2,193	17,105	Bou Merra	84m	16,000
Mai R. - PK10		0.1	1000	87,000	1.28	136	1.22	0.12	13.72	1,229	123	PK11	59m	44,000
PK10 - PK14	3	4.3	800	32,000	0.74	136	0.57	2.45	2.45	879	3,780			200,000
Mai. R.		4.5	1000	60,000	0.88	136	0.61	2.76		1,229	5,531	Pump St.1	200,000	77m
Mai R. - PK11		1.2	1000	60,000	0.88	136	0.61	0.74	17.09	1,229	1,475	Pump St.2	16,000	29m
PK11 - Bou Merra	4	3.0	500	16,000	0.94	136	1.56	4.67	4.67	429	1,287	Pump St.3	32,000	29m
		42.3									**74,890**	Pump St.4	16,000	35m

Site 3 Case 1		km	mm	m3/d	m/s	H-W	0/00	m		TND/m	1000TND			
	P. St.	Length	Dia.	Q	V	C	Grade	Head Loss		Unit C.	Amount		Elevation	Q (m3/d)
Site - Main Road	1	0.0	1600	200,000	1.15	136	-	0.00		2,721	0	Sidi Salah H	79m	16,000
Main R.		21.6	1600	200,000	1.15	136	0.58	12.45		2,721	58,692	Sidi Salah B	59m	37,000
Main R. - PK11		1.2	800	60,000	1.38	136	1.82	2.18	14.63	879	1,055	PK14	79m	32,000
PK11 - Bou Merra	2	3.0	500	16,000	0.94	136	1.56	4.67	4.67	429	1,287	PK10	58m	55,000
Main R.		4.5	1400	147,000	1.11	136	0.63	2.82		2,193	9,869	Bou Merra	84m	16,000
Main R. - PK10		0.1	1000	87,000	1.28	136	1.22	0.12	15.39	1,229	123	PK11	59m	44,000
PK10 - PK14	3	4.3	800	32,000	0.74	136	0.57	2.45	2.45	879	3,780			200,000
Mai. R.		7.8	1000	53,000	0.78	136	0.49	3.81		1,229	9,586	Pump St.1	200,000	80m
Main R. - S. Salah B		4.0	1000	53,000	0.78	136	0.49	1.95	21.02	1,229	4,916	Pump St.2	16,000	35m
S. Salah B - S. Salah H	4	2.3	500	16,000	0.94	136	1.56	3.58	3.58	429	987	Pump St.3	32,000	29m
		48.8									**90,294**	Pump St.4	16,000	29m

Pumpig Stations & Pipeline for Each Site (2)

Site 3 Case 2		km	mm	m3/d	m/s	H-W	0/00	m		TND/m	1000TND			
	P. St.	Length	Dia.	Q	V	C	Grade	Head Loss		Unit C.	Amount		Elevation	Q (m3/d)
Site - Main Road	1	0.0	1600	200,000	1.15	136	-	0.00		2,721	0	Sidi Salah H	79m	16,000
Main R.		21.6	1600	200,000	1.15	136	0.58	12.45		2,721	58,692	Sidi Salah B		37,000
Main R. - PK11		1.2	1600	200,000	1.15	136	0.58	0.69	13.14	2,721	3,265	PK14	79m	32,000
PK11 - Bou Merra	2	3.0	1400	156000	1.17	137	0.69	2.07		2,193	6,579	PK10		55000
Bou Merra - PK14 jct		6.2	1400	140,000	1.05	138	0.56	3.45		2,193	13,597	Bou Merra	84m	16,000
PK14 jct - PK14		0.5	1000	87,000	1.28	139	1.17	0.59		1,229	615	PK11	59m	44,000
PK14 jct - Sidi Salah Hault		9.9	1000	53,000	0.78	136	0.49	4.83	10.35	1,229	12,167			200,000
		42.4									94,914	Pump St.1	200,000	73m
												Pump St.2	156,000	36m

Site 4 Case 1		km	mm	m3/d	m/s	H-W	0/00	m		TND/m	1000TND			
	P. St.	Length	Dia.	Q	V	C	Grade	Head Loss		Unit C.	Amount		Elevation	Q (m3/d)
Site - Main R.1	1	1.0	1600	200,000	1.15	136	0.58	0.58		2,721	2,721	Mahrouga	132m	200,000
Main R.1		5.7	1600	200,000	1.15	136	0.58	3.29		2,721	15,510	Sidi Salah H	79m	16,000
Main R2		24.7	1600	200,000	1.15	136	0.58	14.25		2,721	67,209	PK14	79m	32,000
Main R3 Jebeniana (40m)		1.0	1600	200,000	1.15	136	0.58	0.58	18.70	2,721	2,721	Bou Merra	84m	16,000
Jebeniana Mahrouga (132m)		14.5	1600	200,000	1.15	137	0.57	8.26	8.26	2,721	39,455			264,000
Mahrouga - S.Salah H		13.5	1000	103,300	1.52	136	1.68	22.64	22.64	1,229	16,592		Q (m3/d)	Head
S.Salah H - S.Salah B		2.3	500	35,000	2.06	137	6.53	15.02	37.66	429	987	Pump St.1	200,000	160
S.Salah H - PK14 jct		9.9	1000	74,700	1.10	138	0.90	8.87		1,229	12,167			
PK14 jct - PK14		0.2	500	44,000	2.59	139	9.71	1.94	33.45	429	86			
PK14 jct - Bou Merra		6.2	1000	61,300	0.90	140	0.61	3.75	35.26	1,229	7,620			
		79.0									165,066			

This is not recommendable because 15km long land acquisition for pipeline installation is needed, and very high pump head.

Site 4 Case 2		km	mm	m3/d	m/s	H-W	0/00	m		TND/m	1000TND			
	P. St.	Length	Dia.	Q	V	C	Grade	Head Loss		Unit C.	Amount		Elevation	Q (m3/d)
Site - Main R.1	1	1.0	1600	200,000	1.15	136	0.58	0.58		2,721	2,721	Sidi Salah H	79m	16,000
Main R.1		5.7	1600	200,000	1.15	136	0.58	3.29		2,721	15,510	Sidi Salah B	59m	37,000
Main R2		24.7	1600	200,000	1.15	136	0.58	14.25		2,721	67,209	PK14	79m	32,000
Main R3		22.2	1600	200,000	1.15	136	0.58	12.81		2,721	60,406	PK10	58m	55,000
Main R4		7.1	1600	200,000	1.15	136	0.58	4.10		2,721	19,319	Bou Merra	84m	16,000
Main R. - S. Salah B		4.0	800	53,000	1.22	136	1.45	5.79	40.81	879	3,516	PK11	59m	44,000
S. Salah B - S. Salah H	2	2.3	500	16,000	0.94	136	1.56	3.58	3.58	429	987			200,000
Mai. R.		7.8	1400	147,000	1.11	136	0.63	4.88		2,193	17,105		Q (m3/d)	Head
Mai R. - PK10		0.1	1000	87,000	1.28	136	1.22	0.12	40.03	1,229	123	Pump St.1	200,000	103m
PK10 - PK14	3	4.3	800	32,000	0.74	136	0.57	2.45	2.45	879	3,780	Pump St.2	16,000	29m
Mai. R.		4.5	1000	60,000	0.88	136	0.61	2.76		1,229	5,531	Pump St.3	32,000	29m
Mai R. - PK11		1.2	1000	60,000	0.88	136	0.61	0.74	43.41	1,229	1,475	Pump St.4	16,000	35m
PK11 - Bou Merra	4	3.0	500	16,000	0.94	136	1.56	4.67	4.67	429	1,287			
		87.9									**198,968**			

Pumpig Stations & Pipeline for Each Site (3)

Site 5 Case 1		km	mm	m3/d	m/s	H-W	0/00	m		TND/m	1000TND			
	P. St.	Length	Dia.	Q	V	C	Grade	Head Loss		Unit C.	Amount		Elevation	Q (m3/d)
Site - Main Road	1	3.1	1600	200,000	1.15	136	0.58	1.79		2,721	8,435	Sidi Salah H	79m	16,000
Main R.		27.7	1600	200,000	1.15	136	0.58	15.97		2,721	75,290	Sidi Salah B	59m	37,000
Main R. - PK11		1.2	800	60,000	1.38	136	1.82	2.18	19.94	879	1,055	PK14	79m	32,000
PK11 - Bou Merra	2	3.0	500	16,000	0.94	136	1.56	4.67	4.67	429	1,287	PK10	58m	55,000
Main R.		4.5	1400	147,000	1.11	136	0.63	2.82		2,193	9,869	Bou Merra	84m	16,000
Main R. - PK10		0.1	1000	87,000	1.28	136	1.22	0.12	20.69	1,229	123	PK11	59m	44,000
PK10 - PK14	3	4.3	800	32,000	0.74	136	0.57	2.45	2.45	879	3,780			200,000
Mai. R.		7.8	1000	53,000	0.78	136	0.49	3.81		1,229	9,586	Pump St.1	200,000	86m
Main R. - S. Salah B		4.0	1000	53,000	0.78	136	0.49	1.95	26.33	1,229	4,916	Pump St.2	16,000	35m
S. Salah B - S. Salah H	4	2.3	500	16,000	0.94	136	1.56	3.58	3.58	429	987	Pump St.3	32,000	29m
		58.0									**115,327**	Pump St.4	16,000	29m

Site 5 Case 2		km	mm	m3/d	m/s	H-W	0/00	m		TND/m	1000TND			
	P. St.	Length	Dia.	Q	V	C	Grade	Head Loss		Unit C.	Amount		Elevation	Q (m3/d)
Site - Main Road	1	3.1	1600	200,000	1.15	136	0.58	1.79		2,721	8,435	Sidi Salah H	79m	16,000
Main R.		27.7	1600	200,000	1.15	136	0.58	15.97		2,721	75,290	Sidi Salah B		37,000
Main R. - PK11		1.2	1600	200,000	1.15	136	0.58	0.69	18.45	2,721	3,265	PK14	79m	32,000
PK11 - Bou Merra	2	3.0	1400	156000	1.17	137	0.69	2.07		2,193	6,579	PK10		55000
Bou Merra - PK14 jct		6.2	1400	140,000	1.05	138	0.56	3.45		2,193	13,597	Bou Merra	84m	16,000
PK14 jct - PK14		0.5	1000	87,000	1.28	139	1.17	0.59		1,229	615	PK11	59m	44,000
PK14 jct - Sidi Salah Hault		9.9	1000	53,000	0.78	136	0.49	4.83	10.35	1,229	12,167			200,000
		51.6									119,948	Pump St.1	200,000	78m
												Pump St.2	156,000	36m

Site 6 Case 1		km	mm	m3/d	m/s	H-W	0/00	m		TND/m	1000TND			
	P. St.	Length	Dia.	Q	V	C	Grade	Head Loss		Unit C.	Amount		Elevation	Q (m3/d)
Site - Main R.1	1	8.2	1600	200,000	1.15	136	0.58	4.73		2,721	22,312	Mahrouga	132m	200,000
Main R.1		5.7	1600	200,000	1.15	136	0.58	3.29		2,721	15,510	Sidi Salah H	79m	16,000
Main R2		24.7	1600	200,000	1.15	136	0.58	14.25		2,721	67,209	PK14	79m	32,000
Main R3 Jebeniana (40m)		1.0	1600	200,000	1.15	136	0.58	0.58	22.85	2,721	2,721	Bou Merra	84m	16,000
Jebeniana Mahrouga (132m)		14.5	1600	200,000	1.15	137	0.57	8.26	8.26	2,721	39,455			264,000
Mahrouga - S.Salah H		13.5	1000	103,300	1.52	136	1.68	22.64	22.64	1,229	16,592		Q (m3/d)	Head
S.Salah H - S.Salah B		2.3	500	35,000	2.06	137	6.53	15.02	37.66	429	987	Pump St.1	200,000	160m
S.Salah H - PK14 jct		9.9	1000	74,700	1.10	138	0.90	8.87		1,229	12,167			
PK14 jct - PK14		0.2	500	44,000	2.59	139	9.71	1.94	33.45	429	86			
PK14 jct - Bou Merra		6.2	1000	61,300	0.90	140	0.61	3.75	35.26	1,229	7,620			
		86.2									184,657			

This is not recommendable because 15km long land acquisition for pipeline installation is needed, and very high pump head.

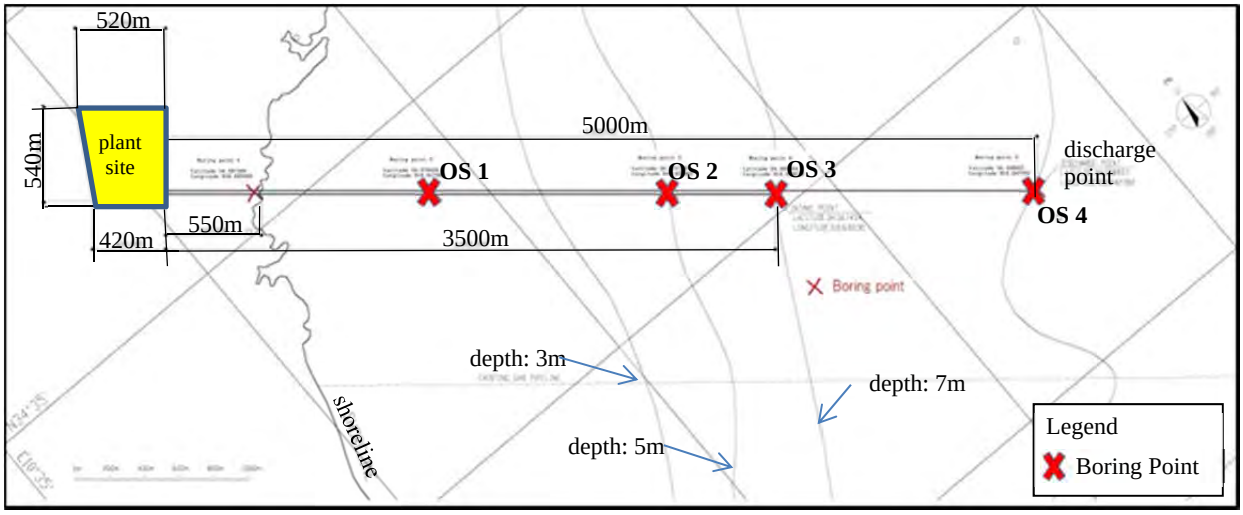
Pumpig Stations & Pipeline for Each Site (4)

Site 6 Case 2		km	mm	m3/d	m/s	H-W	0/00	m		TND/m	1000TND			
	P. St.	Length	Dia.	Q	V	C	Grade	Head Loss		Unit C.	Amount		Elevation	Q (m3/d)
Site - Main R.1	1	8.2	1600	200,000	1.15	136	0.58	4.73		2,721	22,312	Sidi Salah H	79m	16,000
Main R.1		5.7	1600	200,000	1.15	136	0.58	3.29		2,721	15,510	Sidi Salah B	59m	37,000
Main R2		24.7	1600	200,000	1.15	136	0.58	14.25		2,721	67,209	PK14	79m	32,000
Main R3		22.2	1600	200,000	1.15	136	0.58	12.81		2,721	60,406	PK10	58m	55,000
Main R4		7.1	1600	200,000	1.15	136	0.58	4.10		2,721	19,319	Bou Merra	84m	16,000
Main R. - S. Salah B		4.0	800	53,000	1.22	136	1.45	5.79	44.97	879	3,516	PK11	59m	44,000
S. Salah B - S. Salah H	2	2.3	500	16,000	0.94	136	1.56	3.58	3.58	429	987			200,000
Mai. R.		7.8	1400	147,000	1.11	136	0.63	4.88		2,193	17,105		Q (m3/d)	Head
Mai R. - PK10		0.1	1000	87,000	1.28	136	1.22	0.12	44.19	1,229	123	Pump St.1	200,000	107m
PK10 - PK14	3	4.3	800	32,000	0.74	136	0.57	2.45	2.45	879	3,780	Pump St.2	16,000	29m
Mai. R.		4.5	1000	60,000	0.88	136	0.61	2.76		1,229	5,531	Pump St.3	32,000	29m
Mai R. - PK11		1.2	1000	60,000	0.88	136	0.61	0.74	47.56	1,229	1,475	Pump St.4	16,000	35m
PK11 - Bou Merra	4	3.0	500	16,000	0.94	136	1.56	4.67	4.67	429	1,287			
		95.1									**218,559**			

Site 7 Case 1		km	mm	m3/d	m/s	H-W	0/00	m		TND/m	1000TND			
	P. St.	Length	Dia.	Q	V	C	Grade	Head Loss		Unit C.	Amount		Elevation	Q (m3/d)
Site - Main Road	1	0.0	1600	200,000	1.15	136	0.00	0.00		2,721	0	Sidi Salah H	79m	16,000
Main R.		42.5	1600	200,000	1.15	136	0.58	24.51		2,721	115,561	Sidi Salah B	59m	37,000
Main R. - PK11		1.2	800	60,000	1.38	136	1.82	2.18	26.69	879	1,055	PK14	79m	32,000
PK11 - Bou Merra	2	3.0	500	16,000	0.94	136	1.56	4.67	4.67	429	1,287	PK10	58m	55,000
Main R.		4.5	1400	147,000	1.11	136	0.63	2.82		2,193	9,869	Bou Merra	84m	16,000
Main R. - PK10		0.1	1000	87,000	1.28	136	1.22	0.12	27.45	1,229	123	PK11	59m	44,000
PK10 - PK14	3	4.3	800	32,000	0.74	136	0.57	2.45	2.45	879	3,780			200,000
Mai. R.		7.8	1000	53,000	0.78	136	0.49	3.81		1,229	9,586	Pump St.1	200,000	86m
Main R. - S. Salah B		4.0	1000	53,000	0.78	136	0.49	1.95	33.08	1,229	4,916	Pump St.2	16,000	35m
S. Salah B - S. Salah H	4	2.3	500	16,000	0.94	136	1.56	3.58	3.58	429	987	Pump St.3	32,000	29m
		69.7									**147,163**	Pump St.4	16,000	29m

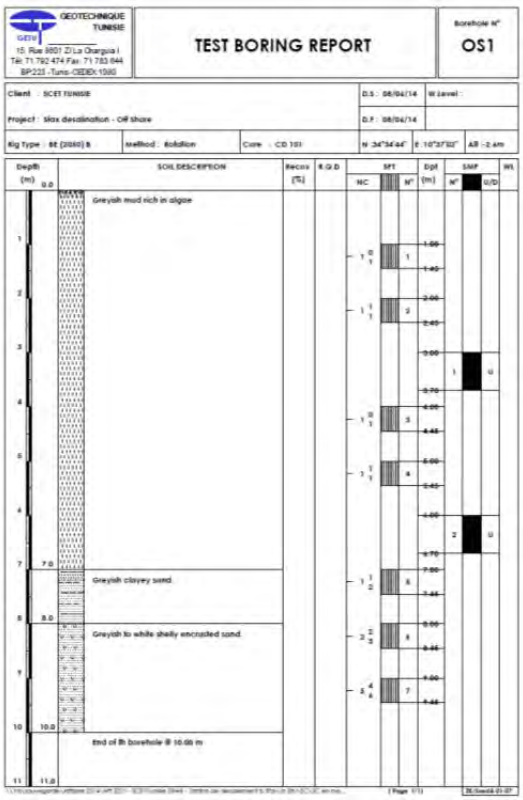
Site 7 Case 2		km	mm	m3/d	m/s	H-W	0/00	m		TND/m	1000TND			
	P. St.	Length	Dia.	Q	V	C	Grade	Head Loss		Unit C.	Amount		Elevation	Q (m3/d)
Site - Main Road	1	0.0	1600	200,000	1.15	136	0.00	0.00		2,721	0	Sidi Salah H	79m	16,000
Main R.		42.5	1600	200,000	1.15	136	0.58	24.51		2,721	115,561	Sidi Salah B		37,000
Main R. - PK11		1.2	1600	200,000	1.15	136	0.58	0.69	25.20	2,721	3,265	PK14	79m	32,000
PK11 - Bou Merra	2	3.0	1400	156000	1.17	137	0.69	2.07		2,193	6,579	PK10		55000
Bou Merra - PK14 jct		6.2	1400	140,000	1.05	138	0.56	3.45		2,193	13,597	Bou Merra	84m	16,000
PK14 jct - PK14		0.5	1000	87,000	1.28	139	1.17	0.59		1,229	615	PK11	59m	44,000
PK14 jct - Sidi Salah Hault		9.9	1000	53,000	0.78	136	0.49	4.83	10.35	1,229	12,167			200,000
		63.3									151,783	Pump St.1	200,000	85m
												Pump St.2	156,000	36m

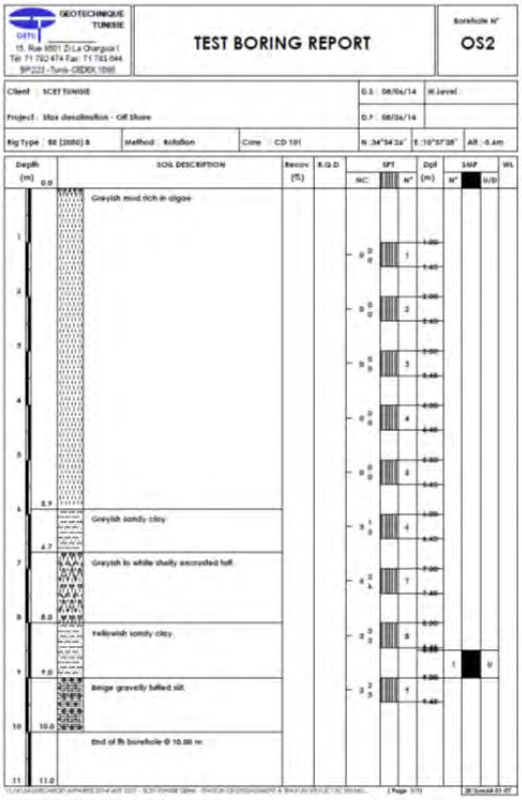
5.3-1 Geotechnical Investigation in Seabed

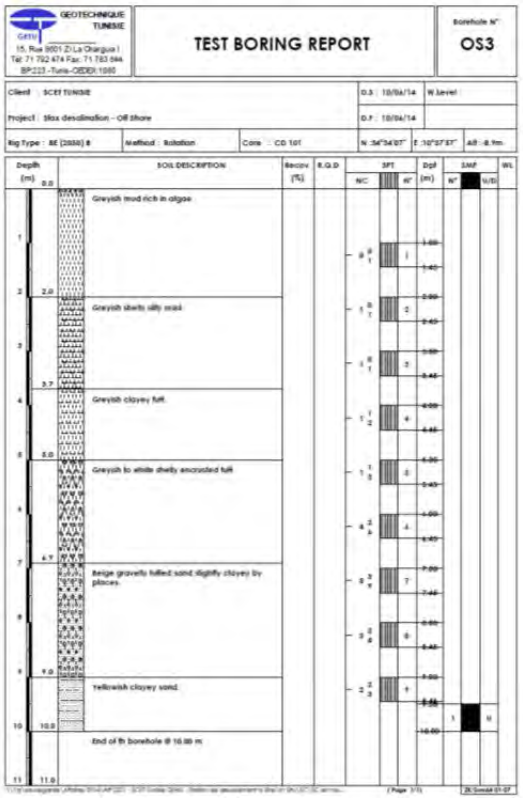


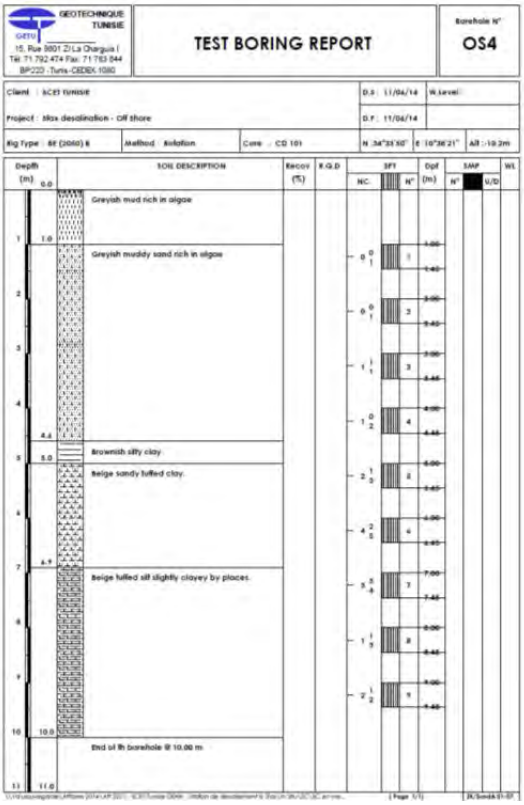
Source: JICA Survey Team

Boring Point for Geotechnical Investigation in Seabed









Source: JICA Survey Team

Result of Geotechnical Investigation on Seabed

5.3-2 Calculation for Diamater of Intake and Discharge Pipes

Calculation for diameter of HDPE

Project name: Tunisia, Sfax desalination plant project
Calculation: Headloss

		Intake					Intake			Brine Discharge			
		HDPE x 2					HDPE x 1			HDPE x 1			
		Allowable head loss: Less than 2mH					Allowable head loss: Less than 2mH			Allowable head loss: Less than 3mH			
Total flow rate	Q=	444,445	m3/day=	5.144	m3/sec		444,445	m3/day=	5.144 m3/sec	Total flow rate	Q=	244,445	m3/day= 2.829 m3/sec
Pipeline No.	Pn=	2		Capacity	100%		1		Capacity 100%	Pipeline No.	Pn=	1	Capacity 100%
Design flow rate/line	Q p =	2,572	m3/sec				5,144	m3/sec		Design flow rate/line	Q p =	2.829	m3/sec
Roughness coefficient	n=	0.016					0.016			Roughness coefficient	n=	0.012	
Additional thickness	ld=	0	mm				0	mm		Additional thickness	ld=	0	mm
Specific weight of seawater	γw=	10.1	kN/m3				10.1	kN/m3		Specific weight of seawater	γw=	10.1	kN/m3
Anode No.	An=		pcs					pcs		Anode No.	An=		pcs
Anode section area	Aa=		m2					m2		Anode section area	Aa=		m2
Chlori pipe support No.	Cn=		pcs	(Assumed setting interval 2m)				pcs	(Assumed setting interval 2m)				
Chlori pipe OD	Dc=		mm	(4inch)				mm	(4inch)	Nozzle no.	Nn=	4	nozzles
Chlori pipe section area	Ac=		m2					m2		Nozzle dia	Dn=	0.55	m
Chlori support section area	As=		m2					m2		Flow rate per one nozzle	Qn=	0.707	m3/sec
										放水流速	Vn=	3	m/sec

		PipeLife	KWH	KWH	PipeLife	PipeLife	KWH	KWH	KWH			PipeLife	PipeLife	KWH	KWH
			2,020	*2,240*		Max	*2,690*	*2,804*	*2,920*					*2,020*	*2,240*
Pipe ND (mm)	D=	2,100	1,800	2,000	2,300	2,500	2,400	2,500	2,600	Pipe ND (mm)	D=	2,000	2,100	1,800	2,000
SDR		17	--	--	17	17	--	--	--	SDR		17	17	--	--
Pipe thickness(mm)	t=	123.5	110	120	135.3	147.1	145	152	160	Pipe thickness(mm)	t=	117.6	123.5	110	120
Pipe Inner Diameter (mm)	Dc=	1,853	1,800	2,000	2,029	2,206	2,400	2,500	2,600	Pipe ID (mm)	Dc=	1,765	1,853	1,800	2,000
Pipe section area(m^2)	Ap=	2.697	2.545	3.142	3.235	3.821	4.524	4.909	5.309	Pipe section area(m^2)	Ap=	2.446	2.697	2.545	3.142
Flow section area(m^2)	Acp=	2.697	2.545	3.142	3.235	3.821	4.524	4.909	5.309	Flow section area(m^2)	Acp=	2.446	2.697	2.545	3.142
Flow velocity(m/sec)	V=	0.954	1.011	0.819	0.795	0.673	1.137	1.048	0.969	Flow velocity(m/sec)	V=	1.157	1.049	1.112	0.9
Wetted perimeter(m)	S=	5.821	5.655	6.283	6.376	6.93	7.54	7.854	8.168	Wetted perimeter(m)	S=	5.544	5.821	5.655	6.283
Hydraulic radius(m)	R=	0.463	0.45	0.5	0.507	0.551	0.6	0.625	0.65	Hydraulic radius(m)	R=	0.441	0.463	0.45	0.5
Pipeline length(m)	L=	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	Pipeline length(m)	L=	4,400	4,400	4,400	4,400
Inlet headloss(m)	h_e=	0.046	0.052	0.034	0.032	0.023	0.066	0.056	0.048	Inlet headloss(m)	h_e=	0.068	0.056	0.063	0.041
Coefficient of friction		50.43	52.382	45.517	44.681	39.988	35.694	33.803	32.081	Coefficient of friction		36.996	34.671	36.013	31.293
Friction headloss(m)	h_f=	2.342	2.732	1.558	1.441	0.924	2.354	1.894	1.537	Friction headloss(m)	h_f=	2.527	1.947	2.272	1.293
Coefficient of anode		0	0	0	0	0	0	0	0	Bend pipe headloss(m)	h_b=	0	0	0	0
Anode headloss(m)	h_c=	0	0	0	0	0	0	0	0	Coefficient of anode		0	0	0	0
Bend pipe headloss(m)	h_b=	0	0	0	0	0	0	0	0	Anode headloss(m)	h_c=	0	0	0	0
Coefficient of chlori support		0	0	0	0	0	0	0	0	Nozzle outlet headloss(m)	h_n=	0.689	0.689	0.689	0.689
Chlori support headloss(m)	h_a=	0	0	0	0	0	0	0	0	Discharge head headloss(m)	h_s=	0.068	0.056	0.063	0.041
Outlet headloss(m)	h_s=	0.046	0.052	0.034	0.032	0.023	0.066	0.056	0.048	**Total headloss(m)**	H=	3.352	2.748	3.087	2.064
Total headloss(m)	H=	2.434	2.836	1.626	1.505	0.97	2.486	2.006	1.633						

Source: JICA Survey Team

Calculation for diameter of steel pipe

Project name: Tunisia, Sfax desalination plant project

Calculation: Headloss

Intake
Coated steel with cathodic protection
Allowable head loss : Less than 2mH

Total flow rate	Q=	444,445	m3/day=	5.144	m3/sec
Pipeline No.	Pn=	1			
Design flow rate/line	Q p =	5.144	m3/sec		

Roughness coefficient	n=	0.016		
Additional thickness	Id=	0	mm	
Specific weight of seawater	γw=	10.1	kN/m3	
Anode No.	An=	450	pcs	Design life 10years
Anode section area	Aa=	0.0204	m2	
Chlori pipe support No.	Cn=	1,800	pcs	(Assumed setting interval 2m)
Chlori pipe OD	Dc=	114	mm	(4inch)
Chlori pipe section area	Ac=	0.0103	m2	
Chlori support section area	As=	0.033	m2	

		Outer diamet	2,828	
		wall thickness	14.0	
Pipe ND (mm)	D=	2,700	2,800	2,900
Pipe Inner Diameter (mm)	Dc=	2,700	2,800	2,900
Pipe section area(m^2)	Ap=	5.726	6.158	6.605
Flow section area(m^2)	Acp=	5.716	6.148	6.595
Flow velocity(m/sec)	V=	0.9	0.837	0.78
Wetted perimeter(m)	S=	8.84	9.155	9.469
Hydraulic radius(m)	R=	0.647	0.672	0.696
Pipeline length(m)	L=	3,600	3,600	3,600
Inlet headloss(m)	h_e=	0.041	0.036	0.031
Coefficient of friction		32.279	30.688	29.286
Friction headloss(m)	h_f=	1.334	1.097	0.909
Coefficient of anode		12.24	13.161	14.123
Anode headloss(m)	h_c=	0.506	0.47	0.438
Bend pipe headloss(m)	h_b=	0	0	0
Coefficient of chlori support		10.392	9.662	9.007
Chlori support headloss(m)	h_a=	0.429	0.345	0.28
Outlet headloss(m)	h_s=	0.041	0.036	0.031
Total headloss(m)	H=	2.351	1.984	1.689

Brine Discharge
Coated steel with cathodic protection
Allowable head loss : Less than 3 mH

Total flow rate	Q=	244,445	m3/day=	2.829	m3/sec
Pipeline No.	Pn=	1			
Design flow rate/line	Q p =	2.829	m3/sec		

Roughness coefficient	n=	0.012		
Additional thickness	Id=	0	mm	
Specific weight of seawater	γw=	10.1	kN/m3	
Anode No.	An=	550	pcs	Design life 10years
Anode section area	Aa=	0.0204	m2	

Nozzle no.	Nn=	4	nozzles
Nozzle dia	Dn=	0.55	m
Flow rate per one nozzle	Qn=	0.707	m3/sec
放水流速	Vn=	3	m/sec

		Outer diamet	1,920	
		wall thickness	10.0	
Pipe ND (mm)	D=	1,800	1,900	2,000
Pipe Inner Diameter (mm)	Dc=	1,800	1,900	2,000
Pipe section area(m^2)	Ap=	2.5447	2.835	3.142
Flow section area(m^2)	Acp=	2.5447	2.835	3.142
Flow velocity(m/sec)	V=	1.112	0.998	0.9
Wetted perimeter(m)	S=	5.655	5.969	6.283
Hydraulic radius(m)	R=	0.45	0.475	0.5
Pipeline length(m)	L=	4,400	4,400	4,400
Inlet headloss(m)	h_e=	0.063	0.051	0.041
Coefficient of friction		36.013	33.508	31.293
Friction headloss(m)	h_f=	2.272	1.703	1.293
Bend pipe headloss(m)	h_b=	0	0	0
Coefficient of anode		12.108	13.491	14.96
Anode headloss(m)	h_c=	0.764	0.686	0.618
Nozzle outlet headloss(m)	h_n=	0.689	0.689	0.689
Discharge head headloss(m)	h_s=	0.063	0.051	0.041
Total headloss(m)	H=	3.851	3.18	2.682

Source: JICA Survey Team

Relation between intake pipe diameter and head loss

Summary of intake pipe specification

Material				HDPE			Steel
Manufacturer				Uponor	PipeLife	Agru	Many
Head Quarter				Finland	Norway	Austria	many
Application	Targeted head loss	Adjusted at,		Inner dia	Outer dia	Outer dia	Inner dia
Intake	2.0 mH	Number of pipes		1	1	1	1
		Outer Dia	mm	2,804	(Max2,500)		2,828
		Wall thickness	mm	152	--		14
		Inner Dia	mm	**2,500**	--		**2,800**
		Expected delta H	mH	2.01	--		1.98
		Number of pipes		2	2	2	
		Outer Dia	mm	2,240	**2,300**	**(Max 2,250)**	
		Wall thickness	mm	120	135.3		
		Inner Dia	mm	**2,000**	2,029		
		Expected delta H	mH	1.63	1.51		

Note:
Specification of products is based on their catalogue, etc.

Stabdard Products	Adjusted at Inner	Ajusted at Outer	Ajusted at Outer
	1,600	1,600	
	1,800	1,800	
	2,000	2,000	
		2,100	
	2,200		2,250
		2,300	(MAX)
	2,400		
		2,500	
	2,600	(MAX)	
	2,800		
	3,000		
	(MAX)		

Source: JICA Survey Team

Relation between internal diameter of discharge pipe and head loss

Summary of discharge pipe specification

Material				HDPE			Steel
Manufacturer				Uponor	PipeLife	Agru	Many
Head Quarter				Finland	Norway	Austria	many
Application	Targeted head loss	Adjusted at,		Inner dia	Outer dia	Outer dia	Inner dia
Brine discharge		Number of pipes		1	1	1	1
		Outer Dia	mm	2,020	**2,100**	Available	1,920
		Wall thickness	mm	110	123.5		10.0
		Inner Dia	mm	**1,800**	1,853		**1,900**
	3.0 mH	Expected delta H	mH	3.09	2.75		3.18

Note:
Specification of products is based on their catalogue, etc.

Stabdard Products	Adjusted at Inner	Ajusted at Outer	Ajusted at Outer
	1,600	1,600	
	1,800	1,800	
	2,000	2,000	
		2,100	
	2,200		2,250
		2,300	(MAX)
	2,400		
		2,500	
	2,600	(MAX)	
	2,800		
	3,000		
	(MAX)		

Source: JICA Survey Team

Calculation for Diameter of Sodium Hypochlorite Injection Pipe Diameter

Condition:

Injection Rate: Sodium Hypochlorite 2 mg/L

Flow Rate: Sodium Hypochlorite Solution (concentration 5,000mg/L)

Sodium Hypochlorite to be Injected 0.88889m^3/day (=Intake volume 444,445m^3/day x 2mg/L /1,000,000)

Sodium Hypochlorite Injection Solution 0.0021m^3/sec (=0.88889m^3/day/(5,000/1,000,000)mg/L = 177.8m^3/day)

Pipe Materials: PVC or HDPE (Injection Nozzle at the Intake head is PVC with FRP reinforcement)

Roughness Coefficient: Friction headloss by Hazen-Williams formula. C=120 for plastice pipe for long term use.

$$h_f = \frac{10.67 \quad L \quad Q^{1.85}}{C^{1.85} \quad d^{4.87}}$$

d^4.87=(10.67 x L x Q^1.85) / (C^1.85 x hf)

where:

hf: Headloss for pipe length (L) (m)	8	
L: Pipe length (m)	3600	
Q: Flow quantity (m^3/s)	0.0021	
C: Croughness cosfficeient for Hazen-Williams Formula	120	
d: Internal diameter of Pipe (m)		
d^4.87=	0.0000076	
d=	89 mm	4" pipe I.D. about 100mm

CHAPTER 6

PLAN OF WATER SUPPLY FACILITIES

6.1-1 TDS Concentrations of Existing Reservoirs and Water Sources

(1) TDS Concentraion by Reservoir (Upper: date, Lower:TDS concentration mg/L)

	Reservoir	PK10				PK11				PK14				Sidi Salah	Bou Merra
2010	January														
	February														
	March														
	April	1				1				1					
		1364				1416				1400					
	May														
	June														
	July	6				6				6					
		1716				1694				1518					
	August														
	September	21	28			21	28			21	28				
		1410	1504			1970	1710			1462	1602				
	October	8	12	19		8	12	19		8	12	19			
		1150	1250	1434		1450	1500	1522		1350	1250	1636			
	November														
	December														
	Average				1404				1609				1460		
2011	January	4	20	25		4	20	25		4	20	25			
		1430	-	1070		1324	1368	1402		1461	-	1069			
	February	1	8	17	23	1	8	17	23	1	8	17	23	28	
		1763	1980	1497	1456	1560	1774	1893	1622	1788	1926	1577	1505	1224	
	March	1	8	15	29	1	8	15	29	1	8	15	29	23	17
		1387	1216	1414	1418	1588	1588	1626	1613	1439	1190	1417	1378	1474	1290
	April	5	12	19	26	5	12	19	26	5	12	19	26		
		1432	1480	1688	1615	1738	1878	1864	1614	1487	1490	1677	1661		
	May	11	17	24	31	11	17	24	31	11	17	24	31	30	
		1349	1548	1262	1435	1581	1438	1422	1608	1391	1533	1240	1485	1932	
	June	21	28			21	28			21	28			28	14
		1488	1624			1860	1792			1611	1561			1820	1452
	July	12	19	26		12	19	26		12	19	26			25
		1718	1663	1646		1769	1642	1636		1542	1634	1526			1390
	August	2	11	26		2	11	26		2	11	26		11	23
		1700	1675	1659		1590	1558	1780		1572	1600	-		2000	1392
	September	13	22	27		13	22	27		13	22	27		19	7
		1643	1544	1664		1600	1760	1627		1608	1552	1595		1808	1426
	October	4	18	25	31	4	18	25	31	4	18	25	31		
		1420	1453	1780	1851	1361	1650	1464	1803	1475	1511	1802	1567		
	November	8	15	22		8	15	22		8	15	22		21	
		1293	1125	1388		1389	1702	1780		1289	1015	1424		1434	
	December	1	15	29		1	15	29		1	15	29		15	19
		1551	-	1629		1839	2050	1763		1583	-	1649		1448	1480
	Average				1525				1648				1509	1643	1405
2012	January	3	13	24		3	13	24		3	13	24			
		1640	2240	2150		1780	2270	2190		1654	2070	1991			
	February	7	15	22		7	15	22		7	15	22		27	
		1028	1636	1408		1620	2090	2000		1120	1869	1436		1606	
	March	6	21	29		6	21	29		6	21	29			
		1041	1253	1261		2050	1401	1955		1268	1398	1392			
	April	17	30			17	30			17	30				16
		1641	1556			2050	2000			1753	1771				1490
	May	11	24			11	24			11	24			17	
		1975	1987			2180	2040			2160	2040			1880	
	June	5	19			5	19			5	19				
		1901	1900			2030	2210			1795	1630				
	July	3	12	20	30	5									
		2040	2090	1850	1924	1824									
	August	3	16	24	31					3				3	
		1947	1900	2030	2060					1874				2188	
	September	5	15	21	29										
		1913	1742	1769	2090										
	October	3	11	20	31	19									4
		2420	1866	1481	1780	1868									1936
	November	5	12	20	30									12	
		1877	1734	1880	1734									2006	
	December	8	15	21	28					17				5	18
		1533	1530	1557	2000					1714				2014	1738
	Average				1779				1974				1702	1939	1721
2013	January	9	16	25	31	17									
		1450	1800	2002	2500	1690									
	February	4	9	16	25									14	
		2400	1600	820	1915									1146	
	March	4	9	18	29					7					7
		2150	1760	1990	2300					1666					2302
	April	11	23	29		11	23	29		11	23	29			8
		2100	2500	2400		2200	2300	2400		2100	2300	2300			1776
	May	17	21	28		17	21	28		17	21	28		27	
		2200	2150	2300		2400	2500	2300		2200	2000	2200		2336	
	June	4	20	29		4	20	29		4	20	29			10
		2100	2400	2300		2400	2450	2300		2000	2400	2450			1630
	July	9	16	24	30	9	16	24	30	9	16	24	30		
		2400	2150	2200	2200	2200	-	2150	2200	2500	2150	2300	2200		
	August	6	15	21		6	15	21		6	15	21		23	22
		2050	2000	2110		2150	2100	2380		2350	2200	2400		1850	1582
	September	17	24			17	24			17	24				
		2300	2370			-	2480			2630	2410				
	October	8	29			8	29			8	29				2
		2130	2520			2320	2300			2270	2630				1732
	November	19	26			19	26			19	26			22	
		2330	2170			2060	2250			2140	2150			2106	
	December	3	10	30		3	10	30		3	10	30			2
		2180	2390	2290		2230	2380	2020		2050	2440	2210			2092
	Average				2133				2257				2256	1860	1852
2014	January	7	17	22		7	17	22		7	17	22			
		2270	2210	2740		2060	1924	2050		2450	2350	2650			
	February	4	11	18	25	4	11	18	25	4	11	18	25		
		2120	2060	2510	2410	1883	1883	2100	2040	1913	2080	2300	2280		
	March	11	18	24	31	11	18	24	31	11	18	24	31		
		2390	2260	1795	1810	2170	2180	1892	2070	2220	2200	1935	1790		
	April	8	22	29		8	22	29		8	22	29			
		1976	2170	2140		2130	2060	2120		1858	2340	2380			
	Average				2204				2040				2196		
	Reservoir	PK10				PK11				PK14				Sidi Salah	Bou Merra

Source : SONEDE

(2) TDS Concentration by Water Source (Upper: date, Lower:TDS concentration mg/L)

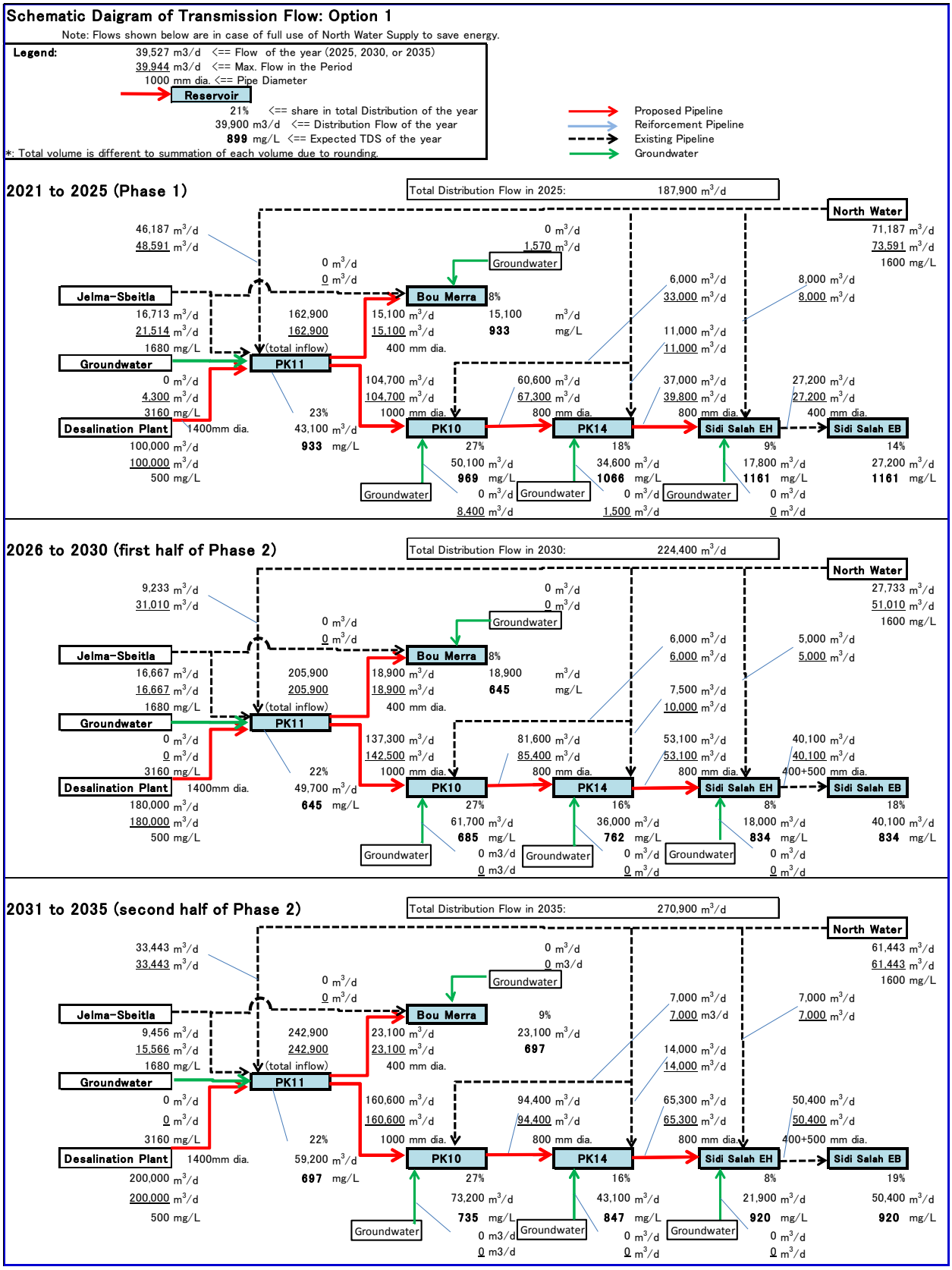
Dsitrict		D32					D33					D34	
Site		Arrivé Eaux du Nord	Arrivé Jelma	Arrivé Sbeitla	PK13	PK15	Forage Sidi Saleh	Forage Heicha	Forage Jebeniana	Forage Mahrouga	Forage Saint Louis	Forage Sidi Boukthir	Forage Sidi Allouch Aguereb
2012	January	30 1130	30 1540	30 1536									
	February												
	March				5 2988			1 3154	1 3460				
	April											5 3978	
	May						14 3138						
	June												
	July	10 1430	10 1502										
	August	3 1110			9 3142		3 3101	7 3104	7 3476			6 3908	
	September												
	October	4 1900											
	November						19 3176						
	December												
	Average	1393	1521	1536			3138	3129	3468			3943	
2013	January	23 1290	23 1430	23 1772									
	February				19 3092		14 3162	18 3588	18 3486				
	March									11 3846		11 4054	
	April	8 1828	8 1524	10 1848									
	May					13 3110	27 3156						
	June												
	July	16 1582	16 1676	16 1944									
	August						23 3172	26 3634	29 3514	26 3842	29 3660		29 2950
	September				5 3198	5 3202							
	October	4 1668	4 1644	4 1918									
	November						22 3152						
	December												
	Average	1592	1569	1871	3145	3156	3161	3611	3500	3844	3660	4054	2950
2014	January												
	February	4 1928	4 1616	4 1856				17 3610	17 3598				
	March												
	April	8 1296	8 1600	10 1790	19 3088		4 3208						
	Average	1612	1608	1823	3088		3208	3610	3598				

	North	Jelma	Sbeitla	Well
	Moyenne	Moyenne		Moyenne
	1599	31Mm3	16.1Mm3	say
say	1600	1582	1855	
			1675	
		say	1680	

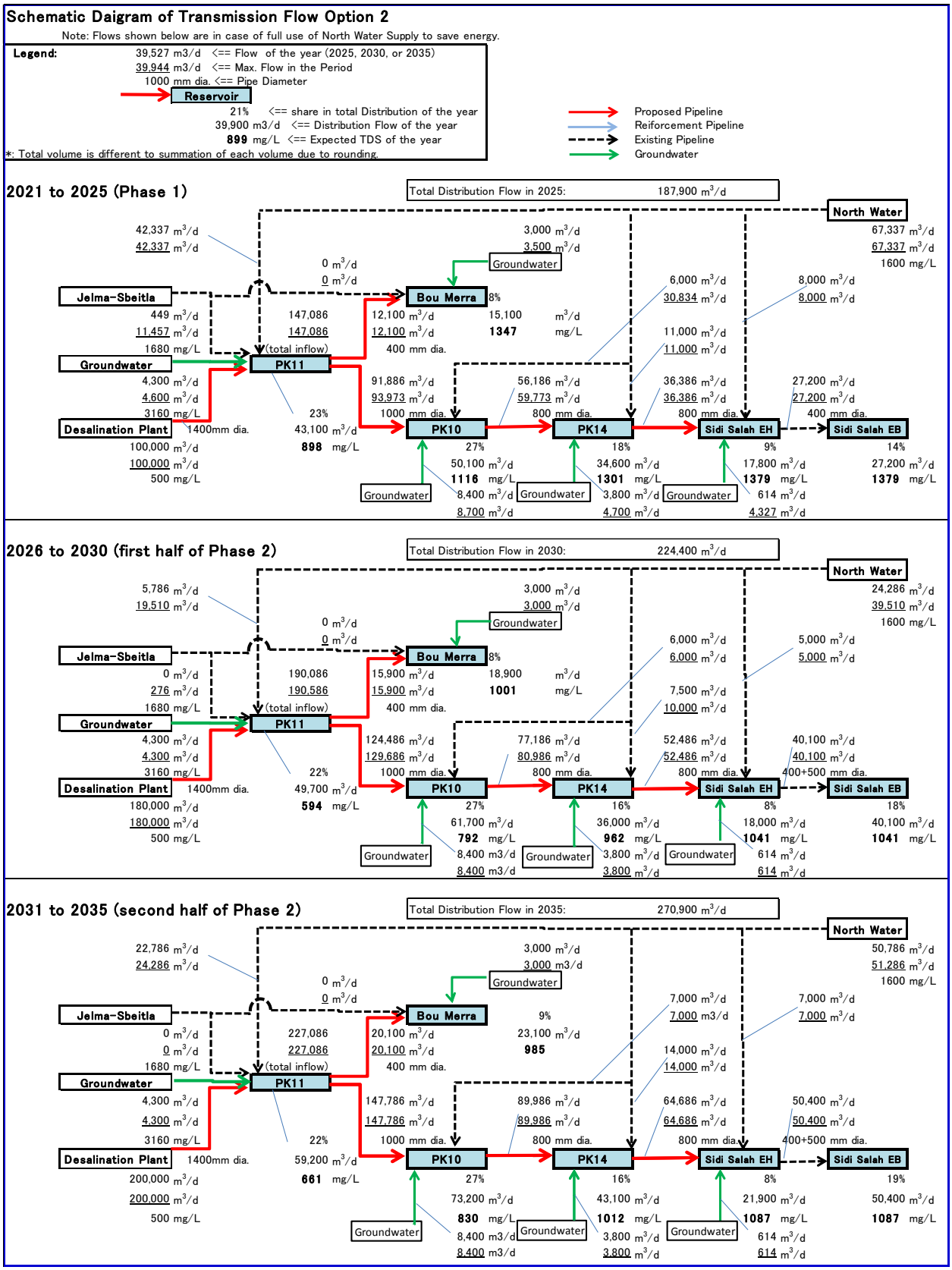
Source：SONEDE

6.1-2 Schematic Diagram of Transmission Flow of Each Option

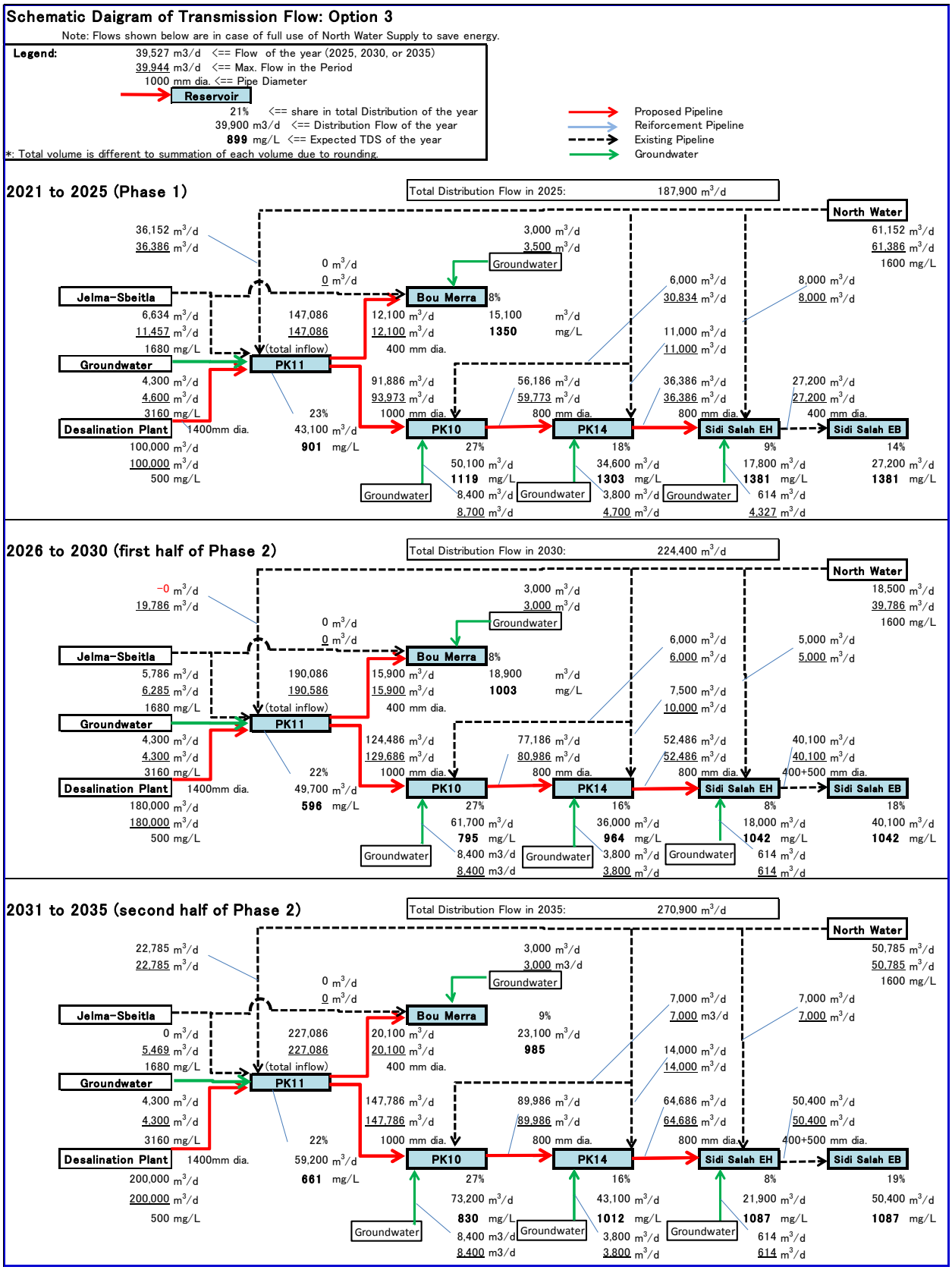
(1) Option 1



(2) Option 2


Schematic Daigram of Transmission Flow Option 2
Note: Flows shown below are in case of full use of North Water Supply to save energy.
Legend:
39,527 m3/d <== Flow of the year (2025, 2030, or 2035)
39,944 m3/d <== Max. Flow in the Period
1000 mm dia. <== Pipe Diameter
Reservoir
21% <== share in total Distribution of the year
39,900 m3/d <== Distribution Flow of the year
899 mg/L <== Expected TDS of the year
*: Total volume is different to summation of each volume due to rounding.
Proposed Pipeline
Reiforcement Pipeline
Existing Pipeline
Groundwater
2021 to 2025 (Phase 1)
Total Distribution Flow in 2025: 187,900 m3/d
North Water
Jelma-Sbeitla
Groundwater
Desalination Plant
1400mm dia.
Bou Merra
PK11
PK10
PK14
Sidi Salah EH
Sidi Salah EB
(total inflow)
1000 mm dia.
800 mm dia.
400 mm dia.
2026 to 2030 (first half of Phase 2)
Total Distribution Flow in 2030: 224,400 m3/d
2031 to 2035 (second half of Phase 2)
Total Distribution Flow in 2035: 270,900 m3/d

(3) Option 3


Schematic Daigram of Transmission Flow: Option 3
Note: Flows shown below are in case of full use of North Water Supply to save energy.
Legend:
39,527 m3/d <== Flow of the year (2025, 2030, or 2035)
39,944 m3/d <== Max. Flow in the Period
1000 mm dia. <== Pipe Diameter
Reservoir
21% <== share in total Distribution of the year
39,900 m3/d <== Distribution Flow of the year
899 mg/L <== Expected TDS of the year
*: Total volume is different to summation of each volume due to rounding.
Proposed Pipeline
Reiforcement Pipeline
Existing Pipeline
Groundwater
2021 to 2025 (Phase 1)
Total Distribution Flow in 2025: 187,900 m3/d
North Water
Jelma-Sbeitla
Groundwater
Desalination Plant
1400mm dia.
Bou Merra
PK11
PK10
PK14
Sidi Salah EH
Sidi Salah EB
(total inflow)
400 mm dia.
1000 mm dia.
800 mm dia.
2026 to 2030 (first half of Phase 2)
Total Distribution Flow in 2030: 224,400 m3/d
2031 to 2035 (second half of Phase 2)
Total Distribution Flow in 2035: 270,900 m3/d

6.1-3 Distribution Flow and TDS Concentration of Each Reservoir in Option 1 and Option 2

Allocation of Water Source and TDS Concentrations by Reservoir (Option 1: Groundwater; maximum reduction, Jelma-Sbeitla & North; possible reduction)

Phase	Actual				Pre-Construction								Phase 1				Phase 2									
Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Available Quantity from Water Sources																										
North Water Transmission System	62,208	62,813	70,589	72,144	70,243	95,213	81,648	66,182	50,458	34,819	128,390	102,816	65,059	38,016	86,659	75,082	62,554	46,483	13,651	23,846	29,462	48,902	51,494	56,765	62,294	67,219
Jelma-Sbeitla Groundwater Trans. System	29,808	27,994	29,635	19,699	31,450	31,018	30,586	30,154	29,722	29,376	28,858	28,685	21,686	21,514	20,909	20,563	20,390	19,699	19,094	18,749	18,317	17,539	17,194	16,416	15,811	15,206
Groundwater in Greater Sfax	20,563	26,093	19,786	25,142	25,142	25,142	25,142	25,142	25,142	25,142	25,142	25,142	25,142	25,142	25,142	25,142	25,142	25,142	25,142	25,142	25,142	25,142	25,142	25,142	25,142	25,142
Total Distribution Volume (m^3/d)	112,752	116,813	120,701	117,158	129,100	133,700	138,400	142,600	147,800	152,600	157,900	163,300	169,500	175,300	181,500	187,900	194,900	201,900	209,200	216,800	224,400	233,200	242,400	251,400	261,000	270,900
PK11 (distribution flow*)	24,125	26,514	28,777	23,602	33,700	36,200	36,500	36,000	36,600	36,900	36,700	36,600	37,300	38,800	41,000	43,100	44,100	45,100	46,500	48,100	49,700	51,100	52,900	54,500	56,700	59,200
Wells	4,048	4,330	4,610	4,373	4,600	4,000	4,600	4,600	4,600	4,600	4,600	4,600	0	4,300	0	0	0	0	0	0	0	0	0	0	0	0
North Water	0	0	0	0	0	18,913	4,748	1,272	0	0	17,777	8,256	11,413	27,016	48,591	46,187	31,010	19,301	7,555	8,408	9,233	17,260	21,306	28,834	26,738	33,443
Jelma-Sbeitla Water	20,077	22,184	24,167	19,229	29,100	13,288	27,152	26,654	25,222	23,876	22,358	21,185	18,086	21,514	7,909	16,713	8,890	12,599	15,844	15,899	16,667	10,939	14,094	15,566	7,261	9,456
Sfax Desalination													90,000	100,000	100,000	100,000	135,000	150,000	180,000	180,000	180,000	180,000	180,000	180,000	200,000	200,000
Mixed Water Transmission													-82,200	-114,030	-115,500	-119,800	-130,800	-136,800	-159,900	-156,207	-156,200	-157,100	-162,500	-169,900	-177,300	-183,700
Total	24,125	26,514	28,777	23,602	33,700	36,200	36,500	32,526	29,822	28,476	44,735	34,041	37,300	38,800	41,000	43,100	44,100	45,100	43,500	48,100	49,700	51,100	52,900	54,500	56,700	59,200
TDS (mg/l)	**1,609**	**1,648**	**1,974**	**2,257**	**1,882**	**1,802**	**1,856**	**1,886**	**1,908**	**1,919**	**1,800**	**1,861**	**784**	**935**	**901**	**933**	**755**	**698**	**633**	**637**	**645**	**653**	**686**	**723**	**662**	**697**
Bou Merra (max. dist. flow*)	4,062	4,651	3,548	4,081	5,100	6,100	7,100	8,100	9,100	10,100	11,100	12,100	13,100	13,800	14,400	15,100	15,900	16,600	17,400	18,100	18,900	19,700	20,600	21,400	22,300	23,100
Wells	4,062	4,651	3,548	4,081	4,600	4,000	3,739	4,600	4,600	4,600	4,600	4,600	0	1,570	0	0	0	0	0	0	0	0	0	0	0	0
North Water																										
Jelma-Sbeitla Water	0	0	0	0	500	2,100	3,361	3,500	4,500	5,500	6,500	7,500	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mixed Water													13,100	12,230	14,400	15,100	15,900	16,600	17,400	18,100	18,900	19,700	20,600	21,400	22,300	23,100
Total	4,062	4,651	3,548	4,081	5,100	6,100	7,100	8,100	9,100	10,100	11,100	12,100	13,100	13,800	14,400	15,100	15,900	16,600	17,400	18,100	18,900	19,700	20,600	21,400	22,300	23,100
TDS (mg/l)	**-**	**1,405**	**1,721**	**1,852**	**3,015**	**2,650**	**2,459**	**2,520**	**2,428**	**2,354**	**2,293**	**2,243**	**784**	**1,188**	**901**	**933**	**755**	**698**	**633**	**637**	**645**	**653**	**686**	**723**	**662**	**697**
PK10 (max. distribution flow*)	40,845	36,374	42,089	42,824	43,400	44,000	44,600	45,300	45,900	46,500	47,100	47,700	48,300	48,900	49,500	50,100	52,400	54,700	57,100	59,400	61,700	64,000	66,300	68,600	70,900	73,200
Wells	3,918	8,726	8,086	8,401	8,700	8,000	8,700	8,700	8,700	8,700	8,700	8,700	0	8,400	0	0	0	0	0	0	0	0	0	0	0	0
North Water	33,714	26,200	32,985	33,951	32,543	36,000	35,900	20,910	18,300	6,086	38,400	35,650	33,000	6,000	6,000	6,000	6,000	6,000	0	0	6,000	6,000	6,000	6,000	6,000	7,000
Jelma-Sbeitla Water	3,213	1,448	1,018	472	0	0	0	0	0	0	0	0														
Mixed Water													69,100	101,800	101,100	104,700	114,900	120,200	142,500	138,107	137,300	137,400	141,900	148,500	155,000	160,600
Mixed Water Transmission												0	-53,800	-67,300	-57,600	-60,600	-68,500	-71,500	-85,400	-78,707	-81,600	-79,400	-81,600	-85,900	-90,100	-94,400
Total	40,845	36,374	42,089	42,824	41,243	44,000	44,600	29,610	27,000	14,786	47,100	44,350	48,300	48,900	49,500	50,100	52,400	54,700	57,100	59,400	61,700	64,000	66,300	68,600	70,900	73,200
TDS (mg/l)	**1,404**	**1,525**	**1,779**	**2,133**	**1,929**	**1,884**	**1,904**	**2,058**	**2,103**	**2,518**	**1,888**	**1,906**	**1,048**	**1,131**	**940**	**969**	**797**	**741**	**633**	**637**	**685**	**693**	**723**	**757**	**697**	**735**
PK14 (max. distribution flow*)	29,515	34,971	35,404	31,200	31,500	31,800	32,000	32,300	32,600	32,900	33,100	33,400	33,700	34,000	34,300	34,600	34,900	35,200	35,400	35,700	36,000	37,400	38,800	40,300	41,700	43,100
Wells	4,728	4,287	3,834	3,805	4,700	3,800	4,700	4,700	4,700	4,700	4,700	4,700	0	1,500	0	0	0	0	0	0	0	0	0	0	0	0
North Water	18,270	26,286	27,091	27,395	26,800	28,000	27,300	27,600	17,058	13,033	28,400	28,700	11,000	5,000	11,000	11,000	10,000	10,000	0	7,493	7,500	14,000	14,000	14,000	14,000	14,000
Jelma-Sbeitla Water	6,517	4,398	4,479	0	0	0	0	0	0	0	0	0														
Mixed Water													53,800	67,300	57,600	60,600	68,500	71,500	85,400	78,707	81,600	79,400	81,600	85,900	90,100	94,400
Mixed Water Transmission													-31,100	-39,800	-34,300	-37,000	-43,600	-46,300	-50,000	-50,500	-53,100	-56,000	-56,800	-59,600	-62,400	-65,300
Total	29,515	34,971	35,404	31,200	31,500	31,800	32,000	32,300	21,758	17,733	33,100	33,400	33,700	34,000	34,300	34,600	34,900	35,200	35,400	35,700	36,000	37,400	38,800	40,300	41,700	43,100
TDS (mg/l)	**1,460**	**1,509**	**1,702**	**2,256**	**1,833**	**1,786**	**1,829**	**1,827**	**1,937**	**2,013**	**1,822**	**1,820**	**1,141**	**1,204**	**1,046**	**1,066**	**899**	**847**	**633**	**721**	**762**	**829**	**852**	**875**	**819**	**847**
Sidi Salah EH (max dist. flow*)	14,088	14,471	13,817	15,248	15,400	15,600	15,700	15,900	16,100	16,200	16,400	16,500	16,700	17,100	17,400	17,800	17,800	17,900	17,900	18,000	18,000	18,800	19,600	20,300	21,100	21,900
Wells	3,838	4,111	3,267	4,488	4,500	3,300	4,500	4,500	4,500	4,500	4,500	4,500	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North Water	10,250	10,360	10,550	10,760	10,900	12,300	13,700	16,400	15,100	15,700	25,400	29,000	6,000	0	8,000	8,000	4,000	4,000	2,800	5,000	5,000	5,000	7,000	7,000	7,000	7,000
Jelma-Sbeitla Water																										
Mixed Water													31,100	39,800	34,300	37,000	43,600	46,300	50,000	50,500	53,100	56,000	56,800	59,600	62,400	65,300
Mixed Water Transmission							-2,500	-5,000	-7,500	-10,000	-13,500	-17,000	-20,400	-22,700	-24,900	-27,200	-29,800	-32,400	-34,900	-37,500	-40,100	-42,200	-44,200	-46,300	-48,300	-50,400
Total	14,088	14,471	13,817	15,248	15,400	15,600	15,700	15,900	12,100	10,200	16,400	16,500	16,700	17,100	17,400	17,800	17,800	17,900	17,900	18,000	18,000	18,800	19,600	20,300	21,100	21,900
TDS (mg/l)	**-**	**1,643**	**1,939**	**1,860**	**2,056**	**1,930**	**1,986**	**1,936**	**1,958**	**1,948**	**1,835**	**1,810**	**1,215**	**1,204**	**1,151**	**1,161**	**958**	**907**	**684**	**800**	**834**	**892**	**934**	**952**	**897**	**920**
Sidi Salah EB (max. dist. flow*)							2,500	5,000	7,500	10,000	13,500	17,000	20,400	22,700	24,900	27,200	29,800	32,400	34,900	37,500	40,100	42,200	44,200	46,300	48,300	50,400
Wells																										
North Water																										
Jelma-Sbeitla Water																										
Mixed Water (thru SS EH)							2,500	5,000	7,500	10,000	13,500	17,000	20,400	22,700	24,900	27,200	29,800	32,400	34,900	37,500	40,100	42,200	44,200	46,300	48,300	50,400
Total							2,500	5,000	7,500	10,000	13,500	17,000	20,400	22,700	24,900	27,200	29,800	32,400	34,900	37,500	40,100	42,200	44,200	46,300	48,300	50,400
TDS (mg/l)							**1,986**	**1,936**	**1,958**	**1,948**	**1,835**	**1,810**	**1,215**	**1,204**	**1,151**	**1,161**	**958**	**907**	**684**	**800**	**834**	**892**	**934**	**952**	**897**	**920**

Allocation of Water Source and TDS Concentrations by Reservoir (Option 2: Groundwater; 20% Reduction, Jelma-Sbeitla; GW 100% Reduction)

Phase	Actual				Pre-Construction								Phase 1				Phase 2									
Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Available Quantity from Water Sources																										
North Water Transmission System	62,208	62,813	70,589	72,144	70,243	95,213	81,648	66,182	50,458	34,819	128,390	102,816	65,059	38,016	86,659	75,082	62,554	46,483	13,651	23,846	29,462	48,902	51,494	56,765	62,294	67,219
Jelma-Sbeitla Groundwater Trans. System	29,808	27,994	29,635	19,699	31,450	31,018	30,586	30,154	29,722	29,376	28,858	28,685	21,686	21,514	20,909	20,563	20,390	19,699	19,094	18,749	18,317	17,539	17,194	16,416	15,811	15,206
Groundwater in Greater Sfax	20,563	26,093	19,786	25,142	25,142	25,142	25,142	25,142	25,142	25,142	25,142	25,142	25,142	25,142	25,142	25,142	25,142	25,142	25,142	25,142	25,142	25,142	25,142	25,142	25,142	25,142
Total Distribution Volume (m^3/d)	112,752	116,813	120,701	117,158	129,100	133,700	138,400	142,600	147,800	152,600	157,900	163,300	169,500	175,300	181,500	187,900	194,900	201,900	209,200	216,800	224,400	233,200	242,400	251,400	261,000	270,900
PK11 (distribution flow*)	24,125	26,514	28,777	23,602	33,700	36,200	36,500	36,000	36,600	36,900	36,700	36,600	37,300	38,800	41,000	43,100	44,100	45,100	46,500	48,100	49,700	51,100	52,900	54,500	56,700	59,200
Wells	4,048	4,330	4,610	4,373	4,600	4,000	4,600	4,600	4,600	4,600	4,600	4,600	4,300	4,600	4,300	4,300	4,300	4,300	4,300	4,300	4,300	4,300	4,300	4,300	4,300	4,300
North Water	0	0	0	0	0	18,913	4,748	1,272	0	0	17,777	8,256	9,979	27,016	35,591	42,337	19,510	11,786	6,286	4,193	5,786	8,086	15,286	24,286	13,886	22,786
Jelma-Sbeitla Water	20,077	22,184	24,167	19,229	29,100	13,288	27,152	26,654	25,222	23,876	22,358	21,185	1,572	11,457	795	449	276	0	0	0	0	0	0	0	0	0
Sfax Desalination													90,000	100,000	100,000	100,000	135,000	150,000	180,000	180,000	180,000	180,000	180,000	180,000	200,000	200,000
Mixed Water Transmission													-68,552	-104,273	-99,686	-103,986	-114,986	-120,986	-144,086	-140,393	-140,386	-141,286	-146,686	-154,086	-161,486	-167,886
Total	24,125	26,514	28,777	23,602	33,700	36,200	36,500	32,526	29,822	28,476	44,735	34,041	37,300	38,800	41,000	43,100	44,100	45,100	46,500	48,100	49,700	51,100	52,900	54,500	56,700	59,200
TDS (mg/l)	**1,609**	**1,648**	**1,974**	**2,257**	**1,882**	**1,802**	**1,856**	**1,886**	**1,908**	**1,919**	**1,800**	**1,861**	**729**	**888**	**866**	**898**	**709**	**647**	**596**	**585**	**594**	**606**	**642**	**683**	**622**	**661**
Bou Merra (max. dist. flow*)	4,062	4,651	3,548	4,081	5,100	6,100	7,100	8,100	9,100	10,100	11,100	12,100	13,100	13,800	14,400	15,100	15,900	16,600	17,400	18,100	18,900	19,700	20,600	21,400	22,300	23,100
Wells	4,062	4,651	3,548	4,081	4,600	4,000	3,739	4,600	4,600	4,600	4,600	4,600	3,000	3,500	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
North Water																										
Jelma-Sbeitla Water	0	0	0	0	500	2,100	3,361	3,500	4,500	5,500	6,500	7,500	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mixed Water													10,100	10,300	11,400	12,100	12,900	13,600	14,400	15,100	15,900	16,700	17,600	18,400	19,300	20,100
Total	4,062	4,651	3,548	4,081	5,100	6,100	7,100	8,100	9,100	10,100	11,100	12,100	13,100	13,800	14,400	15,100	15,900	16,600	17,400	18,100	18,900	19,700	20,600	21,400	22,300	23,100
TDS (mg/l)	**-**	**1,405**	**1,721**	**1,852**	**3,015**	**2,650**	**2,459**	**2,520**	**2,428**	**2,354**	**2,293**	**2,243**	**1,286**	**1,464**	**1,344**	**1,347**	**1,171**	**1,101**	**1,038**	**1,012**	**1,001**	**995**	**1,008**	**1,030**	**964**	**985**
PK10 (max. distribution flow*)	40,845	36,374	42,089	42,824	43,400	44,000	44,600	45,300	45,900	46,500	47,100	47,700	48,300	48,900	49,500	50,100	52,400	54,700	57,100	59,400	61,700	64,000	66,300	68,600	70,900	73,200
Wells	3,918	8,726	8,086	8,401	8,700	8,000	8,700	8,700	8,700	8,700	8,700	8,700	8,400	8,700	8,400	8,400	8,400	8,400	8,400	8,400	8,400	8,400	8,400	8,400	8,400	8,400
North Water	33,714	26,200	32,985	33,951	32,543	36,000	35,900	20,910	18,300	6,086	38,400	35,650	30,834	6,000	6,000	6,000	6,000	6,000	0	0	6,000	6,000	6,000	6,000	6,000	7,000
Jelma-Sbeitla Water	3,213	1,448	1,018	472	0	0	0	0	0	0	0	0														
Mixed Water													58,452	93,973	88,286	91,886	102,086	107,386	129,686	125,293	124,486	124,586	129,086	135,686	142,186	147,786
Mixed Water Transmission												0	-49,386	-59,773	-53,186	-56,186	-64,086	-67,086	-80,986	-74,293	-77,186	-74,986	-77,186	-81,486	-85,686	-89,986
Total	40,845	36,374	42,089	42,824	41,243	44,000	44,600	29,610	27,000	14,786	47,100	44,350	48,300	48,900	49,500	50,100	52,400	54,700	57,100	59,400	61,700	64,000	66,300	68,600	70,900	73,200
TDS (mg/l)	**1,404**	**1,525**	**1,779**	**2,133**	**1,929**	**1,884**	**1,904**	**2,058**	**2,103**	**2,518**	**1,888**	**1,906**	**1,213**	**1,109**	**1,097**	**1,116**	**932**	**867**	**752**	**747**	**792**	**803**	**829**	**858**	**796**	**830**
PK14 (max. distribution flow*)	29,515	34,971	35,404	31,200	31,500	31,800	32,000	32,300	32,600	32,900	33,100	33,400	33,700	34,000	34,300	34,600	34,900	35,200	35,400	35,700	36,000	37,400	38,800	40,300	41,700	43,100
Wells	4,728	4,287	3,834	3,805	4,700	3,800	4,700	4,700	4,700	4,700	4,700	4,700	3,800	4,700	3,800	3,800	3,800	3,800	3,800	3,800	3,800	3,800	3,800	3,800	3,800	3,800
North Water	18,270	26,286	27,091	27,395	26,800	28,000	27,300	27,600	17,058	13,033	28,400	28,700	11,000	5,000	11,000	11,000	10,000	10,000	0	7,493	7,500	14,000	14,000	14,000	14,000	14,000
Jelma-Sbeitla Water	6,517	4,398	4,479	0	0	0	0	0	0	0	0	0														
Mixed Water													49,386	59,773	53,186	56,186	64,086	67,086	80,986	74,293	77,186	74,986	77,186	81,486	85,686	89,986
Mixed Water Transmission													-30,486	-35,473	-33,686	-36,386	-42,986	-45,686	-49,386	-49,886	-52,486	-55,386	-56,186	-58,986	-61,786	-64,686
Total	29,515	34,971	35,404	31,200	31,500	31,800	32,000	32,300	21,758	17,733	33,100	33,400	33,700	34,000	34,300	34,600	34,900	35,200	35,400	35,700	36,000	37,400	38,800	40,300	41,700	43,100
TDS (mg/l)	**1,460**	**1,509**	**1,702**	**2,256**	**1,833**	**1,786**	**1,829**	**1,827**	**1,937**	**2,013**	**1,822**	**1,820**	**1,395**	**1,283**	**1,294**	**1,301**	**1,126**	**1,066**	**860**	**929**	**962**	**1,020**	**1,036**	**1,051**	**992**	**1,012**
Sidi Salah EH (max dist. flow*)	14,088	14,471	13,817	15,248	15,400	15,600	15,700	15,900	16,100	16,200	16,400	16,500	16,700	17,100	17,400	17,800	17,800	17,900	17,900	18,000	18,000	18,800	19,600	20,300	21,100	21,900
Wells	3,838	4,111	3,267	4,488	4,500	3,300	4,500	4,500	4,500	4,500	4,500	4,500	614	4,327	614	614	614	614	614	614	614	614	614	614	614	614
North Water	10,250	10,360	10,550	10,760	10,900	12,300	13,700	16,400	15,100	15,700	25,400	29,000	6,000	0	8,000	8,000	4,000	4,000	2,800	5,000	5,000	5,000	7,000	7,000	7,000	7,000
Jelma-Sbeitla Water																										
Mixed Water													30,486	35,473	33,686	36,386	42,986	45,686	49,386	49,886	52,486	55,386	56,186	58,986	61,786	64,686
Mixed Water Transmission							-2,500	-5,000	-7,500	-10,000	-13,500	-17,000	-20,400	-22,700	-24,900	-27,200	-29,800	-32,400	-34,900	-37,500	-40,100	-42,200	-44,200	-46,300	-48,300	-50,400
Total	14,088	14,471	13,817	15,248	15,400	15,600	15,700	15,900	12,100	10,200	16,400	16,500	16,700	17,100	17,400	17,800	17,800	17,900	17,900	18,000	18,000	18,800	19,600	20,300	21,100	21,900
TDS (mg/l)	**-**	**1,643**	**1,939**	**1,860**	**2,056**	**1,930**	**1,986**	**1,936**	**1,958**	**1,948**	**1,835**	**1,810**	**1,457**	**1,487**	**1,379**	**1,379**	**1,192**	**1,134**	**926**	**1,014**	**1,041**	**1,089**	**1,118**	**1,128**	**1,072**	**1,087**
Sidi Salah EB (max. dist. flow*)							2,500	5,000	7,500	10,000	13,500	17,000	20,400	22,700	24,900	27,200	29,800	32,400	34,900	37,500	40,100	42,200	44,200	46,300	48,300	50,400
Wells																										
North Water																										
Jelma-Sbeitla Water																										
Mixed Water (thru SS EH)							2,500	5,000	7,500	10,000	13,500	17,000	20,400	22,700	24,900	27,200	29,800	32,400	34,900	37,500	40,100	42,200	44,200	46,300	48,300	50,400
Total							2,500	5,000	7,500	10,000	13,500	17,000	20,400	22,700	24,900	27,200	29,800	32,400	34,900	37,500	40,100	42,200	44,200	46,300	48,300	50,400
TDS (mg/l)							**1,986**	**1,936**	**1,958**	**1,948**	**1,835**	**1,810**	**1,457**	**1,487**	**1,379**	**1,379**	**1,192**	**1,134**	**926**	**1,014**	**1,041**	**1,089**	**1,118**	**1,128**	**1,072**	**1,087**

Planned TDS Concentration : Option 1

Allocation of Water Source and TDS Concentrations by Reservoir
(Option 1: Groundwater; maximum reduction, Jelma-Sbeitla & North; possible reduction)

TDS Concentration of Each Reservoir

TDS(mg/l)			Phase 1				
Reservoir	2020	2021	2022	2023	2024	2025	
PK11	1,800	1,861	784	935	901	933	
Bou Merra	2,293	2,243	784	1,188	901	933	
PK10	1,888	1,906	1,048	1,131	940	969	
PK14	1,822	1,820	1,141	1,204	1,046	1,066	
Sidi Salah EH	1,835	1,810	1,215	1,204	1,151	1,161	
Sidi Salah EB	1,835	1,810	1,215	1,204	1,151	1,161	
Highest TDS	2,293	2,243	**1,215**	1,204	1,151	1,161	< 1,215
Lowest TDS	1,800	1,810	784	935	901	933	
Highest/Lowest	127%	124%	**155%**	129%	128%	124%	< 155%
Desalination Q	0	0	90,000	100,000	100,000	100,000	

TDS(mg/l)	Phase 2-1					
Reservoir	2026	2027	2028	2029	2030	
PK11	755	698	633	637	645	
Bou Merra	755	698	633	637	645	
PK10	797	741	633	637	685	
PK14	899	847	633	721	762	
Sidi Salah EH	958	907	684	800	834	
Sidi Salah EB	958	907	684	800	834	
Highest TDS	**958**	907	684	800	834	< 958
Lowest TDS	755	698	633	637	645	
Highest/Lowest	127%	**130%**	108%	126%	129%	< 130%
Desalination Q	135,000	150,000	180,000	180,000	180,000	

TDS(mg/l)	Phase 2-2					
Reservoir	2031	2032	2033	2034	2035	
PK11	653	686	723	662	697	
Bou Merra	653	686	723	662	697	
PK10	693	723	757	697	735	
PK14	829	852	875	819	847	
Sidi Salah EH	892	934	952	897	920	
Sidi Salah EB	892	934	952	897	920	
Highest TDS	892	934	**952**	897	920	< 952
Lowest TDS	653	686	723	662	697	
Highest/Lowest	**137%**	136%	132%	136%	132%	< 137%
Desalination Q	180,000	180,000	180,000	200,000	200,000	

Planned TDS Concentration : Option 2

Allocation of Water Source and TDS Concentrations by Reservoir
(Option 2: Groundwater; 20% Reduction, Jelma-Sbeitla; GW 100% Reduction)

TDS Concentration of Each Reservoir

TDS(mg/l)			Phase 1					
Reservoir	2020	2021	2022	2023	2024	2025		
PK11	1,800	1,861	729	888	866	898		
Bou Merra	2,293	2,243	1,286	1,464	1,344	1,347		
PK10	1,888	1,906	1,213	1,109	1,097	1,116		
PK14	1,822	1,820	1,395	1,283	1,294	1,301		
Sidi Salah EH	1,835	1,810	1,457	1,487	1,379	1,379		
Sidi Salah EB	1,835	1,810	1,457	1,487	1,379	1,379		
Highest TDS	2,293	2,243	1,457	**1,487**	1,379	1,379	<	1,487
Lowest TDS	1,800	1,810	729	888	866	898		
Highest/Lowest	127%	124%	**200%**	168%	159%	154%	<	200%
Desalination Q	0	0	90,000	100,000	100,000	100,000		

TDS(mg/l)	Phase 2-1						
Reservoir	2026	2027	2028	2029	2030		
PK11	709	647	596	585	594		
Bou Merra	1,171	1,101	1,038	1,012	1,001		
PK10	932	867	752	747	792		
PK14	1,126	1,066	860	929	962		
Sidi Salah EH	1,192	1,134	926	1,014	1,041		
Sidi Salah EB	1,192	1,134	926	1,014	1,041		
Highest TDS	**1,192**	1,134	1,038	1,014	1,041	<	1,192
Lowest TDS	709	647	596	585	594		
Highest/Lowest	168%	**175%**	174%	173%	175%	<	175%
Desalination Q	135,000	150,000	180,000	180,000	180,000		

TDS(mg/l)	Phase 2-2						
Reservoir	2031	2032	2033	2034	2035		
PK11	606	642	683	622	661		
Bou Merra	995	1,008	1,030	964	985		
PK10	803	829	858	796	830		
PK14	1,020	1,036	1,051	992	1,012		
Sidi Salah EH	1,089	1,118	1,128	1,072	1,087		
Sidi Salah EB	1,089	1,118	1,128	1,072	1,087		
Highest TDS	1,089	1,118	**1,128**	1,072	1,087	<	1,128
Lowest TDS	606	642	683	622	661		
Highest/Lowest	**180%**	174%	165%	172%	165%	<	180%
Desalination Q	180,000	180,000	180,000	200,000	200,000		

CHAPTER 8

SOCIO-ENVIRONMENTAL CONSIDERATIONS

8.7-1 Environmental Checklist

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the host country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(a) N (b) N (c) - (d) N	(a) The EIA including the one for power distribution line will be implemented by SONEDE from February to September 2015. (b) The EIA report shall be approved by ANPE(National Environment Agency) until December 2015. The TOR of the EIA are already approved by ANPE. (c) Not applicable. (d) The concession decree for the use of the maritime domain is scheduled for September 2016.また、The project will be implemented by SONEDE. Tunisian Electricity and Gas Supply Corporation (STEG), however, will construct the power distribution line. Since construction cost of it will be shouldered by SONEDE, necessary procedures have been started between SONEDE and STEG, and cost estimates offered by STEG is counted in the project cost.
	(2) Explanation to the Local Stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders? (b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	(a) Y (b) Y	(a) The first stakeholder meeting has been hold on the 22nd of May 2014. Considering the scope of the project, additional meetings will be scheduled during the EIA in 2015. STEG will prepare the plan of power distribution line. Based on it, SONEDE will make documents to explain the outline of the plan and collect opinions of residents from representatives of related areas, and then those opinions will be reflected in the plan of power distribution line. (b) The comments from the citizens have been reflected on the compensation policy.
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) Y	(a) A comparison analysis, taking into account environmental items, considering different sites and processes, including the zero option, has been implemented.
2 Pollution Control	(1) Air Quality	(a) Is there a possibility that chlorine from chlorine storage facilities and chlorine injection facilities will cause air pollution? Are any mitigating measures taken? (b) Do chlorine concentrations within the working environments comply with the country's occupational health and safety standards?	(a) N (b) Y	(a) Liquid chlorine solutions are used so no air pollution is anticipated. (b) The plant will be built according to Tunisian specifications complying with applicable standards.
	(2) Water Quality -1	(a) Do pollutants, such as SS, BOD, COD contained in effluents discharged by the facility operations comply with the country's effluent standards? (b) Does untreated water contain heavy metals?	(a) Y (b) N	(a) The brine discharge into the sea is complying with the Tunisian standard NT 106-002. (b) Almost all of heavy metals contained in brine discharged from the desalination plant originate in sea water, and is condensed to 100/45=2.22times. It, however, conforms to effluent quality standard. (for example: Zn++ in sea water = 38ug/l × 2.22 = 85ug/L; discharge <10,000ug/L; NT106-002).

8.7-1 Environmental Checklist

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
2 Pollution Control	(2) Water Quality -2	(c) Is there a possibility that soil runoff from the bare lands resulting from earthmoving activities, such as cutting and filling will cause water quality degradation in downstream water areas? If water quality degradation is anticipated, are adequate measures considered?	(c) N	(c) Plan of power distribution line is made by STEG. It is assumed that the line is led from 150kV national grid by aerial line, and tower interval is around 400m. Since it will be constructed on the flat olive field, large earth work and wood cutting are not necessary. Therefore, no impact on water quality and hydrology is anticipated.
	(3) Wastes	(a) Are wastes, such as sludge generated by the facility operations properly treated and disposed in accordance with the country's regulations?	(a) Y	(a) The membrane use is evaluated to 200m3/year, and these are considered as usual burnable wastes.
	(4) Noise and Vibration	(a) Do noise and vibrations generated from the facilities, such as pumping stations comply with the country's standards?	(a) Y	(a) The pumping facilities will be located within the existing reservoir facilities, so no noise nor vibrations are anticipated.
	(5) Subsidence	(a) In the case of extraction of a large volume of groundwater, is there a possibility that the extraction of groundwater will cause subsidence?	(a) N	(a) Sea water will be the only feed water used, so there is no risk of subsidence.
3 Natural Environment	(1) Protected Areas	(a) Is the project site or discharge area located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	(a) N	(a) The project area is not including any RAMSAR area.
	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site or discharge area encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? (d) Is there a possibility that the amount of water used (e.g., surface water, groundwater) by project will adversely affect aquatic environments, such as rivers? Are adequate measures taken to reduce the impacts on aquatic environments, such as aquatic organisms? (e) Are adequate measures taken to prevent disruption of migration routes and habitat fragmentation of wildlife, and livestock? (f) Is there a possibility that improved access by the project will cause impacts, such as destruction of forest, poaching, desertification, reduction in wetland areas, and disturbance of ecosystem due to introduction of exotic (non-native invasive) species and pests? Are adequate measures for preventing such impacts considered? (g) In cases where the project site is located in undeveloped areas, is there a possibility that the new development will result in extensive loss of natural environments?	(a) Y (b) Y (c) Y (d) N (e) N (f) N (g) N	(a) The intake and discharge head are planned within a sea area including sea-grass meadows. The brine discharge will be done in an area with sea-grass meadows. (b) The sea-grass "posidonia oceanica" is considered a species to be protected under the Barcelona conference, (c) No significant impact on sea-grass meadows are anticipated, furthermore the discharge head allow for an efficient dilution of the brine, and offset mitigation measures are planned. (d) The intake head is planned within a depth of 8m, and is designed to take water at 2 to 3m height from the bottom, within a speed of max 0.2m/s, so that no fish nor organisms should be sucked up. (e) Plan of power distribution line is made by STEG. It is assumed that the line is led from 150kV national grid by aerial cable, tower interval is around 400m. No intercept of moving route of animals and livestock. (f) Since it will be constructed on the flat olive farming field, large earth work and wood cutting are not necessary. Therefore, no impact on ecosystem is anticipated. (g) Power distribution line will be constructed through developed environment, i.e. olive field.
	(3) Hydrology	(a) Is there a possibility that the amount of water used (e.g., surface water, groundwater) by the project will adversely affect surface water and groundwater flows?	(a) N	(a) Sea water will be the only feed water used, so there will be no affection on surface water nor on groundwater flow.

8.7-1 Environmental Checklist

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
3 Natural Environment	(4)Topography and Geology	(a) Is there a soft ground on the route of power transmission lines that may cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides, where needed? (b) Is there a possibility that civil works, such as cutting and filling will cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides? (c) Is there a possibility that soil runoff will result from cut and fill areas, waste soil disposal sites, and borrow sites? Are adequate measures taken to prevent soil runoff?	(a,b,c) N	(a,b,c) The route of power distribution line is not decided yet by STEG as of December 2014. The area within a radius of 15.5km has gentle slope of 0.6% from 5m to 100m in elevation. No fear of landslide and no large scale earth work is needed for aerial power distribution line.
4 Social Environment	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement? (b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement? (c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? (d) Is the compensations going to be paid prior to the resettlement? (e) Is the compensation policies prepared in document? (f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples? (g) Are agreements with the affected people obtained prior to resettlement? (h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan? (i) Are any plans developed to monitor the impacts of resettlement? (j) Is the grievance redress mechanism established?	(a) N (b) Y (c) Y (d) Y (e) Y (f) - (g) - (h) Y (i) Y (j) Y	(a) The desalination plant is located with the public maritime domain, so no resettlement is anticipated. Also the pumping stations, reservoirs are planned within the existing reservoirs areas, so no resettlement is anticipated. Finally the distribution line route is planned along existing roads, so no resettlement is anticipated but some land acquisitions are required (ex: surge tanks). (b) No resettlement is anticipated but a stakeholder meeting has already been implemented with the purpose to explain about the project. Additional stakeholder meetings will be hold during the EIA. (c) No resettlement is anticipated but the compensation concept of the Tunisian law about expropriation is complying with the full replacement cost policy and a compensation procedure is established. (d) The payment of a compensation is a condition for expropriation according to Tunisian law. (e) The procedure for expropriation and land acquisition is described in the report of the preparatory survey for this project. (f) No resettlement is anticipated, so not applicable. (g) No resettlement is anticipated, so not applicable. (h) The land acquisition will be implemented by the land affairs department at SONEDE, the organisation is also including the participation of civil affairs court. In order to prepare an appropriate budget, the land acquisition scope has been estimated and is given in the report of the preparatory survey. (i) A monitoring plan (organization and monitoring form) including the state and progress of land acquisition has been established. (j) A complain management mechanism is established under the Tunisian law.

8.7-1 Environmental Checklist

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
4 Social Environment	(2) Living and Livelihood	(a) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary? (b) Is there a possibility that the amount of water used (e.g., surface water, groundwater) by the project will adversely affect the existing water uses and water area uses? (c) Is there a possibility that diseases, including communicable diseases, such as HIV will be introduced due to immigration of workers associated with the project? Are adequate considerations given to public health, if necessary? (d) Is there a possibility that installation of structures, such as power line towers will cause a radio interference? If significant radio interference is anticipated, are adequate measures considered? (e) Is compensation for construction of transmission line , such like compensation for underline executed in accordance with domestic law.	(a) Y (b) N (c) N (d) N (e) Y	(a) The construction of the intake and discharge pipe will affect the fishing activities. A compensation plan based on the activity time loss is established. (b) Sea water will be the only feed water used, so there will be no impact on current water uses. (c) Since Sfax is developed as the second largest population city in Tunisia, and rapid immigration of population is not anticipated. It will be developed in accordance with the population increase. Therefore, occurrence of disease caused by immigration will not be anticipated. (d) There are existing power lines in the project area. Therefore, new facilities will not affect on the present situation of radio. (e) The power distribution line is constructed by STEG, and land acquisition and underline compensation will be conducted in accordance with the law of Tunisia.
	(3) Heritage	(a) Is there a possibility that the project will damage the local archaeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country' s laws?	(a) N	(a) The project area is not including the Thyna archaeological park. Registered archeologic ruins are not located in the project site.
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a) N	(a) The project is not located within a touristic area and existing high tension power line exists. Therefore, impact on landscape by the facilities is small.
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples? (b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	(a) - (b) -	(a) There is no ethnic minorities within the project area. (b) Not applicable.
	(6) Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project? (b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials? (c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.? (d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?	(a) Y (b) Y (c) Y (d) Y	(a) The project will be implemented by SONEDE (public water supply company) and STEG (public power and gas supply company), so the Tunisian laws regarding working conditions will be enforced. (b) The project has been established considering present experience of SONEDE in the management of desalination facilities, and the project is not including any hazardous facility. (c) Upon completion of desalination plant, the plant maker will train the staff of SONEDE to the operation and maintenance of facilities. (d) The security guards will work from within the enclosed area of the facility and basically be at the guard post at the entrance of the plant. They will have to lay down their defence equipment into deposit at the guard post before leaving work.

8.7-1 Environmental Checklist

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
5 Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? (b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts? (c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts? (d) If the construction activities might cause traffic congestion, are adequate measures considered to reduce such impacts?	(a) Y (b) Y (c) Y (d) N	(a) Measures to reduce turbidity during construction of intake and discharge pipes, are planned. (b) The living sea grass meadows will be destroyed by the construction of intake and discharge pipes. The development of artificial reefs is planned as a mitigation measure. (c) As the fishing activities will be affected by the construction of intake and discharge pipes, a compensation plan based on activity time loss, has been established. (d) The distribution line is planned along the existing roads, but the construction space will not include the pavement section, so no particular impact on traffic is anticipated.
	(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? (b) What are the items, methods and frequencies of the monitoring program? (c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? (d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	(a) Y (b) Y (c) Y (d) Y	(a) A monitoring plan of the water quality and sea grass meadows during construction and operation, will be implemented. (b) The items and methods of the monitoring program have been established according to Tunisian law on water quality and according to the expertise of the INSTM for the sea-grass, the frequencies have been set to monitor impacts during construction and operation. (c) The monitoring organization is established around SONEDE, including the ANPE, the INSTM, and the UTAP. (d) A monitoring form, easily usable by the PIU in SONEDE and defining format and frequency of reports, has been established.
6 Note	Reference to Checklist of Other Sectors	(a) Where necessary, pertinent items described in the Dam and River Projects checklist should also be checked.	(a) N	(a) This checklist is made based on JICA's forms of checklists for water supply, and power transmission and distribution lines.
	Note on Using Environmental Checklist	(a) If necessary, the impacts to trans-boundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as trans-boundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a) N	(a) There is no trans-boundary or global issues related to the project.

1) Regarding the term “Country’s Standards” mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards, appropriate environmental considerations are required to be made.

In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan's experience).

2) Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which the project is located.

CHAPTER 9

LAND ACQUISITION AND RESETTLEMENT

9.10-1 Documents delivered to Residents for Explanation about Power Transmission Line

الشركة الوطنية لاستغلال وتوزيع المياه
SOCIETE NATIONALE D'EXPLOITATION ET DE DISTRIBUTION DES EAUX

تونس في 12 ديسمبر 2014

29036

إلى السيد والي صفاقس

الموضوع: - مشروع انجاز محطة تحلية مياه البحر بسعة 200 ألف متر مكعب في اليوم بصفاقس الكبرى
- حول ربط المحطة بالكهرباء

المصاحيب: - ملحق عدد1 حول المسار الأولي لخط الجهد العالي،
- ملحق عدد2 حول وثيقة استشارة (الملاحظات و التساؤلات حول المشروع)
- ملحق عدد3 حول العناصر الأساسية للمشروع،

تحية طيبة وبعد،

في إطار تدعيم تزويد صفاقس الكبرى بالماء الصالح للشرب، كما تعلمون برمجت الشركة الوطنية لاستغلال وتوزيع المياه انجاز محطة لتحلية مياه البحر بسعة 100 ألف متر مكعب في اليوم كمرحلة اولى. وتبعا لذلك ستقوم الشركة التونسية للكهرباء و الغاز بجلب الطاقة الكهربائية اللازمة لكافة المنشآت التابعة للمشروع عن طريق مد خط كهربائي جهد عالي.

كما نفيد سيدتكم علما بأن الشركة التونسية للكهرباء و الغاز تقوم حاليا بإعداد الدراسات الضرورية لتحديد مسار خط الجهد العالي لربط محطة التحلية بالكهرباء. وعند الانتهاء من هذه الدراسة و تحديد المسار النهائي، سيتم انجاز دراسة المؤثرات البيئية التي ستشمل منشآت محطة التحلية وخط الكهرباء ذات الجهد العالي من قبل مكتب دراسات مختص. وخلال الدراسة البيئية سيتم تنظيم يوم إعلامي للعموم قصد شرح كل تفاصيل المشروع و خاصة الجزء المتعلق بربط المحطة بالكهرباء.

وبهدف الإعلام المسبق للسكان المعنيين بهذا المشروع، تجدون صحبة هذا ملخصا للعناصر الأساسية للمشروع (ملحق عدد3). كما نطلب من سيادتكم مدنا بملاحظاتكم و تساؤلاتكم بخصوص عناصر المشروع وذلك طبقا لوثيقة الاستشارة المصاحبة (ملحق عدد2).

وحتى نتمكن من إدراج ملاحظاتكم في الدراسة البيئية للمشروع، الرجاء موافاتنا بإجاباتكم في أقرب الآجال.

تقبلوا سيدي الوالي فائق عبارات التقدير و الاحترام.

المدير المركزي للدراسات
لخدان بوبكر

إدارة الدراسات

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المنار II - تونس 2092
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Matricule Fiscal 1455 J/A/M/000
المعرف الجبائي
البريد الالكتروني

Tunis, December 12, 2014.

To the attention of the Governor of Sfax

Subject : - Seawater desalination plant construction project with a capacity of 200,000 m^3/d in the Grand Sfax.

- Connection of the desalination station to the HV power network of STEG

PJ : -Annex N°1 : Preliminary outline of the high voltage power line,

-Annex N°2: Survey form (comments and questions),

-Annex N°3: Project's key components.

Greetings,

In the framework of reinforcing the drinking water supply throughout the Grand Sfax, SONEDE has planned a construction project of a seawater desalination station with a capacity of 100,000 m^3/d for the first phase. Electrical power required for the Project's different components will be transferred by means of a high voltage electrical line that will be built by STEG.

We would like to inform you that STEG is currently preparing all studies required for the choice of the high voltage power line's outline, which will feed power to the desalination station. Once all details are determined, an impact study covering the desalination plant and the high voltage line will be conducted by a specialized Consultant. In the course of this impact study, an open-to-the public information day will be held to explain the project's details and mainly the part related to the connection of the desalination plant to the HV power network.

Nevertheless, in order to provide preliminary information to concerned populations, we are summarizing below the project's key components (Annex 3) and we ask you to please share with us your comments or possible questions about these components, according to the Survey Form attached herewith (Annex 2).

In order to reflect all different statements and opinions about the Project and those that will be collected during the impact study, we hope to receive your answer in the near future.

Please accept Mr. Governor our best regards.

Studies Central Manager

Adnen BOUBAKER

(Attached 1) STEG Transmission line

Source: STEG

Annex 2 Comments and questions concerning the Desalination Plant in Sfax

Recipient: Sfax Agency, SONEDE
To the kind attention of Mr. Youssef Shel (email: y.shel@sonede.com.tn, fax: 74297335)
Or Mr. Charfeddine Sliti (email: c.sliti@sonede.com.tn, fax: 71494185)

My comments about the Project of the Plant and the construction of the high voltage transmission line are the following:

☐I have the following comment:

....
....
.....

☐I don't have any comment

☐I have the following question:

....
....
.....

☐I have no question

Date:. December …, 2014
Name : M /Ms.....
Function/Title :.....
Delegation :.....
Occupation/Employment: .....
Tel:……Fax:……
Email:……@.....

Annex 3

Seawater Desalination Plant Construction Project of Sfax

Key Components:

1 Desalination Installations

1.1 Components

- Seawater Desalination Plant
- Transmission pipelines (from the plant to water tanks)

1.2 Desalination Plant

- Ultimate Capacity: 200,000m3/day (phase I , 100,000m3/day)
- Location: Sfax Governorate, Delegation of Agareb, on the shore across from British Gas

1.3 Expected Results

- Increase the quantity of drinking water
- Improve the quality of drinking water

1.4 Expected operation date

- In the course of 2020

2 Power Installations

2.1 Required power: 40MW (phase I , 20MW)

2.2 Supply method (under study)

- The required power will be transmitted up to the Plant by means of a high voltage line from STEG's existing electrical lines (existing 150 kV line starting from Sfax towards the West)

3 - Impacts induced by the high voltage line and compensation method

3.1 Expected impacts

- The outline of the high voltage line has not been determined yet ; however the line will likely be oriented towards the North on an approximate distance of 16 km to join existing lines. The line will be mainly crossing olive groves, and no significant impact on buildings is expected (the temporary outline is shown in the Annex).

3.2 Compensation method

- Nearly 40 electrical towers will be required for the line construction. The acquisition of lands required for the installation of electrical towers will be carried out by STEG.
- Compensations for the acquisition of lands will be carried out according to the Tunisian Law which is in compliance with the Donor's guidelines in this regard.

4 Comments on this document

4.1 Please fill in the attached Annex 2 to share your possible comments and questions. If you have no comment and no question, please fill in the attached Annex 2 with the statements: "No Comments, No questions".

4.2 Recipient: SONEDE, Sfax Regional Department or Desalination and Environment Department.

4.3 Deadline: December 31, 2014

Annex 2 related to comments may be filled in by the regional and local authorities (Delegation, Equipment, telecoms, ONAS …) or any other person that is likely to be affected by the passage of the high voltage power line.

Answer FAX of Sfax Governor to SONEDE
(Check at No question on the matter.)

04-02-2015 17:49 GOUVERNORAT DE SFAX 74 403 625 P.01/01
FAX NO. :216 71 494185 04 Feb. 2015 11:37 P 3

Annexe 2 : Commentaires et questions à propos du projet de la stetion de dessalement de Sfax

Destinataire: Direction régionale de Sfax ou Direction de dessalement et d'environnement (SONEDE) (email : [illegible]@sonede.com.tn, fax: 74297335)
Ou M. Charfeddine Sliti (email : c.sliti@sonede.com.tn fax : 71494185)

Mes commentaires à propos du projet de la centrale et de la construction de la ligne à haute tension sont les suivants:

☐J'ai le commentaire suivant:
.....
.....
.....

☒Je n'ai pas de commentaire

☐J'ai la question suivante:
.....
.....
.....

☒Je n'ai pas de question

Date:le.....décembre 2014
Nom: M /Mme.....
Fonction/Titre :.....
Délégation :.....
Occupation/Emploi:.....
Tel:.....Fax:.....
Email:.....@.....

الوالي
مهدي شلبي

وزارة الداخلية

TOTAL PAGE(S) 01

CHAPTER 10

IMPLEMENTATION PLAN

10.3-1 TOR for Consulting Service (draft)

Sfax Sea Water Desalination Plant Construction Project in the Republic of Tunisia
Terms of Reference on Consulting Service

1. Background

One half of Tunisia belongs to semi-dry climate. The annual average of the rainfall is about a little less than 500mm. Consequently, groundwater contributes to about 40% of water intake. The water supply system in Tunisia has been developed in accordance with an economic growth of 4% in average during the last 15 years. The service area of water supply covers 97.8% in total, i.e. 100% of urban areas, 93.4% of rural areas (SONEDE, 2012). In Tunisia, the Ministry of Agriculture defines the water sector policy. Water supply in rural area is based on the communal faucet method and is operated by the Ministry of Agriculture. SONEDE (Société Nationale d'Exploitation et de Distribution des Eaux) is responsible for water supply in urban areas and in some rural areas using individual supply systems including water supply for domestic use and development, and the maintenance of conveyance and transmission systems.

Greater Sfax is the second largest city in Tunisia with an approximate population of about 621000. Water supply volume amounts to about 190,000m^3/day for SONEDE's coverage area with a served population of about 810,000 in 2012. Because of rapid increase in population at 1.37% per annum over the last ten years, it is projected that serious water shortage will happen in 2018, and the development of a new water source is requested. Greater Sfax currently relies on groundwater in the central-western region for its water supply. However, it is projected that water supply from the region will be decreased in order to spare groundwater resources in the central-western regions and the increase of demand in the region. In order to cope with this situation, it is requested to develop water resource only for Sfax governorate and to provide related infrastructure. SONEDE studied the construction of a sea water desalination plant in Sfax in the feasibility study for water supply in south regions conducted in 2005.

SONEDE also prepared the Strategic Plan in 2013 to enhance water supply capacity and to improve water quality by 2030. In the plan, the Sfax Desalination Plant Construction Project was planned. In this framework, the preparatory survey was conducted with JICA funding. Based on the survey, this project was formulated.

2. Objectives of Consulting Services

The objective of the consulting services is to provide design, evaluation of bids, and construction supervision ensuring the design and the construction quality and fairness, and achieving the efficient project implementation.

3. Scope of Consulting Services

The scope of consulting services on Sfax Sea Water Desalination Plant Construction Project in the Republic of Tunisia cover designing, tender assistance, and management of construction services for 7

lots and eight (08) contracts. Each lot is explained below followed by a description of services to provide:

(1) Project Component
The project consists of 7 lots. Each lot is explained as follows:

i) Lot 1: Construction of the Seawater Desalination Plant
(a) Sea Water Desalination Plant
a1) Land Acquisition: Approximately 20ha
a2) Desalination Method: Reverse Osmosis Membrane Method (RO)
a3) Treated Water: 100,000m^3/d
a4) RO Units: 25,000m^3/day × 4 units
a5) Transmission Pump Facility 100,000m^3/d
a6) Required Electricity: Approximately 20MVA
(b) Sea Water Intake Pipe
b1) Intake Volume: 222,200m^3/d (capable of flowing 444,400 m^3/d for Phase 2)
b2) Pipe Material: HDPE
b3) φ2000mm x 2 (HDPE), L=3.6km (Buried Pipe: 3.2 km offshore, and 0.4 km onshore))
b4) Transmission pump facility 100,000 m^3/d
b5) Submerged Water Intake Tower 2 units
(c) Brine Effluent Pipe
c1) Effluent Volume: 122,000m^3/d (capable of flowing 244,000 m^3/d for Phase 2)
c2) Pipe Material: HDPE
c3) φ1800mm, L=4.4km (Buried Pipe: 4.0 km offshore, 0.4 km onshore))
c4) Submerged Water Effluent Tower 1 unit

ii) Lot 2: Procurement of Pipes
(a) Procurement of Pipe for Transmission to be installed for Lot 4
a1) Pipe Material: Ductile Cast Iron Pipe
a2) φ1400mm: L＝26.1km (Desalination Plant - PK11 Reservoir)
a3) φ1000mm: L＝6.1km (PK10 Reservoir)
a4) φ800mm: L＝4.8km (PK10 Reservoir－PK14 Reservoir)
a5) φ800mm: L=9.4km (PK14 Reservoir－Sidi Salah EH Reservoir)
a6) φ400mm: L=2.9km (PK11 Reservoir－Bou Merra Reservoir)

This lot can be subject of two contracts (sub-lot 2.1 and sub-lot 2.2)

iii) Lot 3: Procurement of Valves and Other Equipment
(a) Procurement of valves and other equipment to be installed for Lot 4

iv) Lot 4: Installation of Pipeline including valves and other equipment

(a) Construction of Transmission Pipeline and valves whose materials are procured through Lot 2 and Lot 3.
(b) Construction of One-Way Surge Tanks or other anti–water-hammer equipment
b1) Desalination Plant Site - PK11 Reservoir
Tank dimension: diameter 10m x height 15m, site: 20m x 30m x 2 locations

v) Lot 5: Construction of Reservoir
(a) Construction of Reservoir
a1) Capacity of 5,000m^3 existing precinct of Bou Merra Reservoir
(b) Construction of Receiving and Mixing Chambers
b1) PK11: 9.0 W x 15.0 L x 5.0 D
b2) Bou Merra: 4.0W x 3.0L x 5.0D
b3) PK10: 7.0W x 10.0L x 5.0D
b4) PK14: 7.0W x 7.0L x 5.0D
b5) Sidi Salah EH: 6.0W x 5.0L x 5.0D
(internal dimension; W: width, L: length, D: water depth; unit: m)

vi) Lot 6: Construction of Pumping Stations
(a) Pumping Station
a1) Relay Pumping Station: 3 (in PK10, PK11, and PK14 Reservoir Sites)

vii) Lot 7: Power Transmission Construction and Power Connection Works(Executed by STEG)
(a) Construction of electrical power supply facility necessary for the Sea Water Desalination Plant
a1) power line
a2) power line tower
a3) facility for transformation of energy
a4) other necessary facilities
(b) Electrical power connection work (pumping stations of Pk10, Pk11 and Pk14)
(c) Assistance for the installation of Sea Water Desalination Plant electrical facility

The Consultants shall include the following items as subjects in their engineering works required for the facilities stipulated in (1) Project Component:
(a) Associated reservoirs, all piping, valves, special parts, pumping mains, overflow pipeline, scour pipes etc. in construction of pumping stations;
(b) Associated inlet chamber, over flow pipeline, pumping main and other ancillary structures in construction of pumping stations;
(c) Roads and other networks, street lighting, water supply, sanitation, fencing compound wall, etc., within the premises of the water treatment plant and reservoirs; and
(d) River/Canal crossings, pipe supports, cradle support, thrust and anchor blocks, valve chambers, road crossings, fabrication of manholes, expansion joints, and installation of valves along the outline.

(2) Detailed description of the consulting services

Design and preparation of bidding documents

1) The Consultant shall perform the duties for designing and preparation of the bidding documents according to contracts to be signed between SONEDE and the Consultant. The conceptual design for Lots 1 and 6, and the detailed design for Lots 2 to 5 and Lot 7 shall be performed by the responsibility of the Consultant. Standard Bidding Documents of JICA shall be applied for International Competitive Bidding. The Consultant shall function with the authorities and responsibilities of the Engineer in case it is provided in this Project's Contract Documents. In this context, the Consultant shall;

   a) Prepare hydraulic, structural, mechanical and electrical systems designs;
   b) Prepare specifications for civil works, mechanical and electrical equipment, including instrumentation, control and regulation systems;
   c) Prepare tender drawings for civil work;
   d) Prepare general arrangement drawings incorporating equipment layout, piping layout and instrumentation and control schemes for tender purpose;
   e) Prepare technical specifications for electrical drawings such as single line diagrams, equipment layout, cable networks layout, and lighting networks layout;
   f) Prepare cost estimate for civil works and mechanical and electrical equipment and works;
   g) Prepare process flow sheets, process design, process criteria, hydraulic diagram and design; civil and structural design criteria, mechanical and electrical and instrumentation system requirements;
   h) Conduct surge suppression studies and recommend appropriate surge protection system; and
   i) Design arrival hydraulic structures and calculation of needs.

2) The Consultant shall carry out process design and engineering studies for Lot 1 including the following:
   a) Prepare conceptual design (i.e. process, hydraulic, mechanical and electrical equipment designs);
   b) Prepare specifications;
   c) Prepare sea water desalination plant flow chart with its different levels;
   d) Prepare sea water desalination plant preliminary hydraulics with control levels;
   e) Prepare sea water desalination plant implantation plans; and
   f) Prepare process and hydraulic designs, parameters, structural design criteria, mechanical and electrical system requirements.

3) The Consultants shall provide assistance in Pre-Qualification (PQ) for Lot 1 (based on the JICA's standard document related to prequalification). The Consultant shall assist SONEDE to;

   a) Define technical and financial requirements, capacity and/or experience for PQ criteria taking into consideration technical features of the Project;
   b) Prepare PQ documents in accordance with the Standard Prequalification Documents under

Japanese ODA Loans;

c) Carry out PQ announcement, addendum/corrigendum, and clarifications to bidders' queries;
d) Evaluate PQ applications in accordance with the criteria set forth in PQ documents; and
e) Prepare a PQ evaluation report for approval by the competent committee.

4) The Consultants shall provide assistance in preparation of bidding documents. The Consultant shall assist SONEDE to;

a) Prepare bidding documents in accordance with the latest version of Standard Bidding Documents under Japanese ODA Loans for Procurement ("PLANT" for Lots 1 and 6, "GOODS" for Lot 2, "WORKS" for Lots 4 and 7), together with all relevant technical document such as specifications, drawings and other documents, which are prepared during the detailed design period; and
b) Prepare bidding documents which include i) the clauses that the Contractors is to comply with the requirement of the Environmental Management Plan (EMP) and JICA Guidelines for environmental and social considerations (April 2010) (JICA Environmental Guidelines), ii) the specification clearly stipulating the safety requirements in accordance with the laws and regulations in Tunisia, relevant international standards (including guidelines of international organization), if any, and also in consideration of "the Guidance for the Management of Safety for Construction Works in Japanese ODA Projects of JICA," iii) the requirement to furnish a safety plan to meet the safety requirements, iv) the requirement for the personnel for key positions to include an accident prevention officer, and v) the requirement to submit method statements of safety to SONEDE and the consultant at the construction stage.

Tendering Assistance

The Consultants shall provide assistance to the tendering procedure listed below in accordance with the JICA Guidelines for Procurement under Japanese ODA Loans (April 2012). The Consultant shall assist SONEDE to;

a) Carry out issuing bid advertising, conducting pre-bid conferences, issuing codicils, and clarifications to bidders' inquiries;
b) Evaluate bids in accordance with the criteria set forth in the bidding documents. In such evaluation, the Consultant shall carefully confirm that bidders' submissions in their technical proposal including, but not limited to, site organization, mobilization schedule, method statement, construction schedule, safety plan, and EMP have been prepared in harmony each other and will meet such requirements set forth in applicable laws and regulations, specifications and other parts of the bidding documents;
c) Prepare bid evaluation reports for approval of the competent committee;
d) Carry out contract negotiation by preparing agenda and facilitating negotiations including preparation of minutes of negotiation meeting; and
e) Prepare a draft and final contract agreement.

Construction Supervision

1) Lots 1 and 6

The Consultant shall perform his duties during the implementation period of the contracts to be executed by SONEDE and the Contractors (Lots 1 and 6). In this context, the Consultant shall;

a) Act as SONEDE's Representative to execute construction supervision and contract administration services in accordance with the power and authority to be delegated by SONEDE;
b) Provide assistance to SONEDE concerning variations and claims which are to be ordered/issued at the initiative of SONEDE;
c) Advise SONEDE on resolution of any dispute with the Contractors;
d) Issue instructions, approvals and notices as appropriate;
e) Provide recommendations to SONEDE for acceptance of the Contractor's performance security, advance payment security and required insurances;
f) Assess adequacy of all inputs such as materials, labor and equipment provided by the Contractors;
g) Check and approve the Contractors' method of work, including site organization, program of performance, quality assurance system, safety plan and environmental monitoring plan so that the requirements set forth in the applicable laws and regulations, the specifications or other parts of the contract are to be duly respected;
h) Monitor as appropriate physical and financial progress, and take appropriate action to expedite progress if necessary, so that the time for completion set forth in the contract will be duly respected;
i) Explain and/or adjust ambiguities and/or discrepancies in the Contract Documents and issue any necessary clarifications or instructions;
j) Review and approve the Contractor's design for the works to be constructed, working drawings, shop drawings and drawings for temporary works;
k) Liaise with the appropriate authorities to ensure that all the affected utility services are promptly relocated;
l) Carry out field inspections on the Contractor's setting out of the works in relation to original points, lines and levels of reference specified in the contract;
m) Organize, as necessary, management meetings with the Contractors to review the arrangements for future work. Prepare and deliver minutes of such meetings to SONEDE and the Contractors;
n) Supervise the works so that all the contractual requirements are met by the Contractor, including those in relation to i) quality of the works, ii) safety and iii) protection of the environment. Confirm that an accident prevention officer proposed by the Contractor is duly assigned at the project site;
o) Supervise field tests, sampling and laboratory test to be carried out by the Contractors;
p) Inspect construction methods, equipment to be used, workmanship at the site, and attend factory inspection and manufacturing tests in accordance with SONEDE's Requirements;
q) Verify payment applications submitted by the Contractor;
r) Coordinate the works among different contractors employed for the Project;

s) Modify the Employer's Requirements as may be necessary in accordance with the actual site conditions, and issue variation orders with the approval of SONEDE (including necessary actions in relation to the works performed by other contractors working for other projects or other facility operators, if any);
t) Carry out timely reporting to SONEDE for any inconsistency in executing the works and suggesting appropriate corrective measures to be applied;
u) Inspect, verify and comment on claims issued by the Contractors;
v) Supervise Pre-commissioning carried out by the Contractors, check and comment on the Contractor's Pre-commissioning report, and suggest the Completion Certificate as specified in the contract;
w) Supervise Commissioning and Guarantee Test carried out by the Contractors, check and comment on the Contractor's report on the Commissioning and Guarantee Test, and suggest the Operational Acceptance Certificate as specified in the Contract;
x) Provide periodic inspection services during defect liability period and if any defects are noted, instruct first SONEDE and second the Contractors to rectify;
y) Check and suggest the approval of as-built drawings prepared by the Contractors; and
z) Check and suggest the approval of the operation and maintenance manual prepared by the Contractor.

2) Lots 4 and 5

The Consultant shall perform his duties during the contract implementation period of the contracts to be executed by SONEDE and the Contractors (Lots 4 and 5). In this context, the Consultant shall;

a) Act as SONEDE's Representative to execute construction supervision and contract administration services in accordance with the power and authority delegated by SONEDE;
b) Provide assistance to SONEDE concerning variations and claims which are to be ordered/issued at the initiative of SONEDE;
c) Advise SONEDE on resolution of any dispute with the Contractor;
d) Issue instructions and notices, and suggest approvals as appropriate;
e) Provide recommendation to SONEDE for acceptance of the Contractors' safety plan, performance security, advance payment security and required insurances;
f) Evaluate compliance of all inputs such as equipment, working staff, and materials provided by the Contractors;
g) Provide commencement order to the Contractors;
h) Check and approve the Contractors' method of work, including site organization, program of performance, quality assurance system, safety plan, method statement of safety and environmental monitoring plan so that the requirements set forth in the applicable laws and regulations, the specifications or other parts of the contract are to be duly respected;
i) Regularly monitor physical and financial progress, and take appropriate action to expedite progress if necessary, so that the time for completion set forth in the contract will be duly respected by the Contractor;
j) Explain and/or adjust ambiguities and/or discrepancies in the Contract Documents and issue

any necessary clarifications or instructions. Issue further drawings and give instructions to the Contractors for any works which may not be sufficiently detailed in the contract documents, if any;

k) Review and approve the Contractor's working drawings, shop drawings and drawings for temporary works;

l) Liaise with the appropriate authorities to ensure that all the affected utility services are promptly relocated;

m) Carry out field inspections on the Contractor's setting out of the works in relation to original points, lines and levels of reference specified in the contract;

n) Organize, as necessary, management meetings with the Contractors to review the arrangements for future work. Prepare and deliver minutes of such meetings to SONEDE and the Contractors;

o) Supervise the works so that all the contractual requirements are met by the Contractors, including those in relation to i) quality of the works, ii) safety and iii) protection of the environment. Confirm that an accident prevention officer proposed by the Contractors is duly assigned at the project site. Require the contractors to take appropriate remedies if any questions are recognized regarding the safety measures;

p) Supervise field tests, sampling and laboratory test to be carried out by the Contractors;

q) Inspect the construction method, equipment to be used, workmanship at the site, and attend shop inspection and manufacturing tests in accordance with the specifications;

r) Survey and measure the work output performed by the Contractors verify statements submitted by the Contractor and issue payment certificates such as interim payment certificates and final payment certificate as specified in the contract;

s) Coordinate the works among different contractors employed for the Project;

t) Modify the designs, technical specifications and drawings, relevant calculations and cost estimates as may be necessary in accordance with the actual site conditions, and issue variation orders (including necessary actions in relation to the works performed by other contractors working for other projects, if any);

u) Carry out timely reporting to SONEDE for any inconsistency in executing the works and suggesting appropriate corrective measures to be applied;

v) Inspect, verify and approve or disapprove claims issued by the parties to the contract (i.e. SONEDE and Contractors) in accordance with the civil works contract;

w) Perform the inspection of the works, including Test on Completion, and to issue certificates such as the Taking-Over Certificate, Performance Certificate as specified in the contract;

x) Supervise the preliminary operation conducted by the Contractors, check and approve the initial operation report issued by the Contractors and issue the completion report as specified in the Contract;

y) Supervise commissioning and carry out tests during the commissioning, if applicable;

z) Provide periodic and/or continuous inspection services during defects notification period and if any defects are noted, instruct the Contractors to rectify;

aa) Prepare as-build drawings for the parts of the works constructed in accordance with the design provided by SONEDE;

ab) Check and certify as-built drawings for the parts of the works designed by the Contractors, if

any; and

ac) Prepare an operation and maintenance manual for the works constructed in the Project.

3) Lot 7

The Consultant shall perform the following tasks throughout the execution of the Contract between SONEDE and STEG (Lot 7). In this regard, the Consultant shall;

a) Monitor the progress of works carried out by STEG; and
b) Coordination with STEG.

Safety measures

The Consultants shall;

a) Review the safety plans submitted by the contractors securing the safety during the construction. (Refer to Paragraph (2), Section 4.02 Scope of the Project and of the Consulting Services of the Guidelines for the Employment of Consultants under Japanese ODA Loans, March 2009), and require them to submit the revision if necessary; and
b) Confirm that an accident prevention officer proposed by the contractor is duly assigned at the project site during the supervision of the construction works and ensure the work is carried out according to the safety plan as well as the safety measures prescribed in the Program. If Consultants recognize any questions regarding the safety measures in general including the ones mentioned above, the Consultants shall requires the contractors to make appropriate improvements.

Facilitation of implementation of Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMoP)

The Consultant shall;

a) Update EMP as appropriate;
b) Assist SONEDE in dissemination and explanation of additionally confirmed and identified environmental issues to public including holding public consultations;
c) During the preparation of bidding documents, clearly identify environmental responsibilities as explained in the EIA and EMP;
d) Assist SONEDE to review the Construction Contractor's Environmental Program to be prepared by the contractor in accordance with EMP, relevant plans and JICA Environmental Guidelines and to make recommendations to SONEDE regarding any necessary amendments for its approval;
e) Assist SONEDE to implement the measures identified in the EMP;
f) Monitor the effectiveness of EMP and negative impacts on environment caused by the construction works and provide technical advice, including a feasible solution, so that SONEDE can improve situation when necessary;
g) Assist SONEDE in monitoring the compliance with conditions stated in the Environmental Permit Certification (EPC) and the requirements under EMP and JICA Environmental Guidelines;
h) Assist SONEDE in the capacity building of SONEDE staff on environmental management

through on-the-job training on environmental assessment techniques, mitigation measure planning, supervision and monitoring, and reporting.

Technology transfer

The Consultant shall carry out the technology transfer as an important aspect in design and supervision works. The Consultant shall provide the opportunity to SONEDE officers and staffs to be involved in the working team of the Consultant during the designing, contract administration and supervision works for their capacity building wherever possible. If requested by SONEDE, the Consultant shall brief and demonstrate the survey and design procedure, the construction supervision and contract management process and procedures. The consultant shall assist SONEDE and its staff to build their capacity as a part of on the job training under the Project.

4. Man-Month Schedule and Expected Time Schedule

The consultants will be engaged over 87 months as a consulting service period. The team shall comprise Foreign and Local Professional Staff with man-month presented below.

		Man-Month			
No	Position	DD[1)]	TA[2)]	CS[3)]	Total
Foreign Professional Staff					
1	Team Leader	12.0	10.0	35.5	57.5
2	Desalination Plant Process Engineer	9.0	4.0	18.5	31.5
3	Civil Engineer	12.0	4.0	33.0	49.0
4	Pipeline Engineer	12.0	1.5	28.0	41.5
5	Mechanical Engineer (Desalination Plant)	4.0	3.5	9.5	17.0
6	Mechanical Engineer (Transmission Pumps)	3.0	2.0	7.0	12.0
7	Electrical Engineer	3.0	3.5	9.0	15.5
8	Instrumentation Engineer	3.0	2.0	9.0	14.0
9	Structural Engineer	6.0	0.0	2.0	8.0
10	Contract Specialist	5.0	5.5	5.0	15.5
11	Quantity Surveyor	4.0	0.0	34.0	38.0
12	Specification specialist	4.0	0.0	0.0	4.0
Subtotal: Foreign Professional Staff		77.0	36.0	190.5	303.5
Local Professional Staff					
1	Deputy Team Leader	13.0	14.0	36.5	63.5
2	Environmental Specialist	2.0	1.0	38.0	41.0
3	Geo-technical Engineer	3.0	0.0	3.0	6.0
Lot 1. Construction of Sea Water Desalination Plant					
4	Resident Engineer 1 / Civil Engineer (1) for Lot 1	9.0	0.0	48.0	57.0
5	Civil Engineer (2) for Lot 1	0.0	0.0	29.0	29.0
6	Mechanical Engineer for Lot 1, 6	4.0	0.0	9.0	13.0
7	Electrical Engineer for Lot 1, 6, 7	3.0	0.0	9.0	12.0
8	Structural Engineer for Lot 1, 4, 5, 6	4.0	0.0	3.0	7.0

9	Architect	4.0	0.0	4.0	8.0
10	Building Utilities Engineer	3.0	0.0	4.0	7.0
11	Quantity Surveyor for Lot 1	0.0	0.0	33.0	33.0
Lot 2 & 3 Procurement of Pipes / Valves and Other Equipment Lot 4. Construction of Pipeline					
12	Resident Engineer 2 / Civil Engineer (1) for Lot 2, 3, 4	12.0	0.0	33.0	45.0
13	Civil Engineer (2) for Lot 2, 3, 4	10.0	0.0	32.0	42.0
14	Procurement Specialist	4.0	0.0	0.0	4.0
15	Quantity Surveyor for Lot 2, 3, 4	0.0	0.0	32.0	32.0
Lot 5 & 6. Reservoirs/Pump Facility Construction					
16	Resident Engineer 3 / Civil Engineer (1) for Lot 5, 6	8.0	0.0	33.0	41.0
17	Civil Engineer (2) for Lot 5, 6	6.0	0.0	30.0	36.0
18	Quantity Surveyor for Lot 5, 6	0.0	0.0	30.0	30.0
Subtotal: Local Professional Staff		85.0	15.0	406.5	506.5
Local support staff					
1	Assistant Engineer	13.0	14.0	69.0	96.0
2	Inspector/Surveyor	0.0	0.0	156.0	156.0
3	CAD Operator	60.0	0.0	36.0	96.0
4	Interpreter/Translator	29.0	16.0	86.0	131.0
5	Office Manager	13.0	14.0	36.0	63.0
6	Accountant	12.0	0.0	36.0	48.0
7	Clerk	12.0	0.0	36.0	48.0
8	Office Boy	13.0	14.0	36.0	63.0
Subtotal: Local Support Staff		152.0	58.0	491.0	701.0
Total Technical and support staff		314.0	109.0	1088.0	1511.0

1) Conceptual Design and Detailed Design

2) Tendering Assistance

3) Construction Supervision

All technical and support staff required for the mission must be provided by the Consultant and includes the following profiles.

It is envisaged that the Consultant will provide adequate Technical and Administrative supporting staff. It is the Consultant's responsibility to select the optimum team and to propose the professionals which are believed to the best meets and needs of SONEDE without exceeding total man-month proposed for each category.

5. Basic professional requirements of key expert

The key expert requirements with qualification and experience for each position are given in the table below.

(1) Foreign Professional Staff

Position	Minimum requirement
Team Leader	Education Master Degree in civil engineering or construction management, or a national-registered professional engineer in his country. Professional Experience At least 20 years professional experience including 18 years at least in infrastructure. Experience of team leader for 5 or more projects in the field of water and sewerage, each of which is amounted at a project cost of more than 30 million US dollars.
Desalination Plant Process Engineer	Education Master Degree in civil engineering or a national-registered professional engineer in his country. Professional Experience At least 10 years professional experience including at least 8 years as a plant process engineer. Experience on desalination plant for 2 or more projects.
Civil Engineer	Education Master Degree in civil engineering or a national-registered professional engineer in his country. Professional Experience At least 10 years' professional experience including at least 8 years in development. Experience during construction period for 3 or more projects in the field of water and sewerage.
Pipeline Engineer	Education E Bachelor's Degree in civil engineering or mechanical engineering.. Professional Experience At least 10 years professional experience including at least 8 years in the field of pipeline design/construction. Experience during construction period of pipeline for 3 or more projects with a total period of 3 or more years.
Mechanical Engineer (Desalination Plant)	Education Bachelor's Degree in civil engineering or mechanical engineering. Professional Experience At least 10 years professional experience including at least 8 years of experience in the design and/or construction of water treatment plants. Experience on desalination plant for 2 or more projects.
Mechanical Engineer (Transmission Pumps)	Education Bachelor's Degree in mechanical engineering. Professional Experience At least 10 years professional experience including at least 8 years in the design and/or construction of pumping stations. Experience during construction period of pumping station for 3 or more projects with a total period of 3 or more years.
Electrical Engineer	Education Bachelor's Degree in electrical engineering. Professional Experience At least 10 years professional experience including at least 8 years in the design and/or construction of desalination plants and pumping station. Experience during construction period of desalination plant and pumping station for 5 or more projects with a total period of 3 or more years.
Instrumentation Engineer	Education Bachelor's Degree in electrical engineering. Professional Experience

	At least 10 years professional experience including at least 8 years in instrumentation engineering for any plant. Experience in the operation of desalination plant on 3 or more years.
Structural Engineer	Education Master Degree in civil engineering or a national-registered professional engineer in his country. Professional Experience At least 10 years professional experience including at least 8 years in the design and/or construction of desalination plant and pumping stations. Experience during construction period of desalination plants and pumping stations for 5 or more projects with a total period of 3 or more years.
Contract Specialist	Education Bachelor's Degree in engineering or related field. Professional Experience At least 10 years professional experience including at least 8 years as a contract specialist for any type of plants or infrastructure development. At least 5 or more projects as a contract specialist.
Quantity Surveyor	Education Bachelor's Degree in engineering or related field. Professional Experience At least 10 years professional experience including at least 8 years as a quantity surveyor or relevant specialist for any type of plants or infrastructure development. At least 5 or more projects for surveying quantity.
Specification Specialist	Education Bachelor's Degree in engineering or related field. Professional Experience Preferably more than 10 years, at least 8 years' professional experience as a specification specialist or engineer for any type of plants or infrastructure development. At least 5 or more projects as a specification specialist.

(2) Local Professional Staff

Position	Minimum requirement
(responsible for all lots)	
Deputy Team Leader	Education Master Degree in civil engineering or construction management, or a national-registered professional engineer in his country. Professional Experience At least 20 years professional experience of infrastructure development. Experience of team leader for 5 or more projects in the field of water and sewerage.
Environmental Specialist	Education Master Degree in civil/environmental engineering or related fields, or a national-registered professional engineer in his country. Professional Experience At least 20 years professional experience of environmental infrastructure development. Experience during construction period for 5 or more projects in the field of water and sewerage.
Geo-technical Engineer	Education Bachelor's Degree in civil engineering or related fields. Professional Experience

	At least 10 years professional experience of geo-technical engineering.
(responsible for Lot 1. Desalination Plant) (Additional responsibility to Mechanical Engineer for Lot 6, and Electrical Engineer for Lots 6 and 7)	
Resident Engineer 1 / Civil Engineer (1) for Lot 1	Education Master Degree in civil engineering or a national-registered professional engineer in his country. Professional Experience At least 15 years professional experience of civil engineering work. Preferably 5 years experience in the field of water supply during construction period.
Civil Engineer (2) for Lot 1	Education Bachelor's Degree in civil engineering. Professional Experience At least 10 years professional experience of civil engineering work. Preferably 5 years experience in the field of water supply during construction period.
Mechanical Engineer for Lot 1, 6	Education Bachelor's Degree in mechanical engineering. Professional Experience At least 5 years professional experience related to design and/or construction of pumping stations. Experience during construction period of pumping station for 3 or more projects with a total period of 3 or more years.
Electrical Engineer for Lot 1, 6, 7	Education Bachelor's Degree in electrical engineering. Professional Experience At least 5 years professional experience related to the design and/or construction of desalination plants and pumping stations. Experience during construction period of desalination plant and pumping station for 3 or more projects with a total period of 3 or more years.
Structural Engineer	Education Bachelor's Degree in civil engineering. Professional Experience At least 10 years' professional experience related to design and/or construction of desalination plants and pumping stations. Experience during construction period of desalination plant and pumping station for 5 or more projects with a total period of 3 or more years.
Architect	Education Bachelor's Degree in architecture. Professional Experience At least 10 years' professional experience related to the construction design of any plant and pumping station. Preferably experience on 5 or more projects with a total period of 3 or more years.
Building Utilities Engineer	Education Bachelor's Degree in any engineering or related fields. Professional Experience At least 5 years' professional experience related to design and construction management of building utilities at any plant and pumping station. Preferably experience on 3 or more projects with a total period of 3 or more years.
Quantity Surveyor for Lot 1	Education Bachelor's Degree in civil engineering or relevant. Professional Experience

	At least 10 years' professional experience of infrastructure development. Experience during construction period for 5 or more projects in the field of water and sewerage.
(responsible for Lot 4. Pipeline Installation, and Lots 2 and 3)	
Resident Engineer 2 / Civil Engineer (1) for Lot 2, 3, 4	Education Bachelor's Degree in civil engineering. Professional Experience At least 15 years' professional experience of civil engineering work. Preferably 5 years' experience in the field of water supply during construction period.
Civil Engineer (2) for Lot 2, 3, 4	Education Bachelor's Degree in civil engineering. Professional Experience At least 10 years' professional experience of civil engineering work. Preferably 5 years' experience in the field of water supply during construction period.
Procurement Expert	Education Bachelor's Degree in civil engineering. Professional Experience At least 10 years' professional experience including 8 years at least in civil engineering work. Preferably 5 years' experience in the field of water supply during construction period.
Quantity Surveyor for Lot 2, 3, 4	Education Bachelor's Degree in civil engineering or relevant. Professional Experience At least 10 years' professional experience of infrastructure development. Experience during construction period for 5 or more projects in the field of water and sewerage.
(responsible for Lots 5 and 6. Reservoirs / Pump Facility Construction)	
Resident Engineer 3 / Civil Engineer (1) for Lot 5, 6	Education Bachelor's Degree in civil engineering. Professional Experience At least 15 years' professional experience of civil engineering work. Preferably 5 years' experience in the field of water supply during construction period.
Civil Engineer (2) for Lot 5, 6	Education Bachelor's Degree in civil engineering. Professional Experience At least 10 years' professional experience of civil engineering work. Preferably 5 years' experience in the field of water supply during construction period.
Quantity Surveyor for Lot 5, 6	Education Bachelor's Degree in civil engineering or relevant. Professional Experience At least 10 years professional experience of infrastructure development. Experience during construction period for 5 or more projects in the field of water and sewerage.

6. Task of Professional Staff

(1) Foreign Professional Staff

1) Team Leader

a) Shall take the overall responsibility, and shall represent the project Consultant's Team in all matters relating to the performance of services, coordinating with all other consultant's staff to deliver excellent product during the stipulated time schedule;
b) Shall oversee, and supervise the Consultant's services;
c) Assume direct responsibility for day-to-day consulting services including day-to-day management of all consultants' staff and co-ordination among and with them;
d) Review existing studies / documents and other resources available and formulate the best implementation approach including programmatic project schedule;
e) Develop and implement quality assurance program;
f) Recommend contract payments;
g) Review, analyze and make recommendations to SONEDE concerning variations and claims which are to be ordered/issued by SONEDE;
h) Recommend to issue the commencement order to the Contractors;
i) Evaluation of time extension claims and make recommendations;
j) Provide recommendation to SONEDE for acceptance of the Contractor Performance security, advance payment security and required insurances;
k) Explain and/or adjust ambiguities and/or discrepancies in the Contract Documents and recommend issuing any necessary clarifications or instructions;
l) Review, verify and further detail the design of the works, recommend to approve the Contractors' working drawings and if necessary, issue further drawings and/or give instructions to the Contractor;
m) Review and recommend to approve the proposals submitted by the Contractors;
n) Make necessary design changes and amendments at site;
o) Provide guidance for unforeseen matters;
p) Progress reporting;
q) Prepare institutional arrangement and training program for O&M;
r) Certify all the drawings, BOQs, cost estimates and specifications;
s) Ensure the safety conditions at work sites;
t) Supervise commissioning, and carry out testing during commissioning;
u) Review O&M manuals; and
v) Develop a course module on project management including project coordination, contract administration, over-all supervision over the implementation of the project and conduct 3 days Project Management Training Course for SONEDE’s project staff.

2) Desalination Plant Process Engineer

a) Prepare conceptual design of the desalination process including the flow chart with levels;
b) Prepare the specifications of the desalination process;
c) Evaluate the proposed unit of the desalination plant;
d) Supervise the installation procedure of the unit; and
e) Assist the commissioning and guarantee test of the desalination plant, and evaluate the performance of the plant’s equipment.

3) Civil Engineer

a) Direct civil engineers assigned as national professional staff for any his/her responsible work;
b) Prepare specifications of civil engineering works;
c) Evaluate the proposed desalination plant, pipe installation, and reservoir work;
d) Supervise civil work for desalination plant, pipe installation, and reservoir work;
e) Assess the applicability of products proposed by the contractors;
f) Attend the test operation of mechanical and electrical equipment;
g) Evaluate the performance of the water transmission system; and
h) Support training on O&M on facility related to facilities and civil engineering works.

4) Pipeline Engineer

a) Direct the civil engineer for Lot 1 assigned as national professional staff regarding his/her responsible work;
b) Prepare specifications related to pipes;
c) Evaluate the proposed pipe materials and installation;
d) Supervise pipeline installation work;
e) Assess the applicability of products proposed by the contractors;
f) Attend the test and commencement of pipeline operation; and
g) Support training on O&M on pipeline facility.

5) Mechanical Engineer (Desalination Plant)

a) Direct the mechanical engineer assigned as national professional staff for any his/her responsible work;
b) Assist Team Leader for preparing O&M manuals on desalination plant;
c) Prepare specifications of mechanical equipment and works;
d) Evaluate the proposed mechanical facilities at the desalination plant;
e Assess the applicability of product proposed by the contractors related to desalination plant;
f) Supervise the installation works of mechanical equipment for desalination plant;
g) Attend the commissioning and guarantee test of mechanical equipment for desalination plant; and
h) Support training on O&M on mechanical equipment for desalination plant.

6) Mechanical Engineer (Transmission Pumps)

a) Direct the mechanical engineer assigned as national professional staff for any his/her responsible work;
b) Assist Team Leader for preparing O&M manuals on transmission pumps;
c) Prepare specifications of mechanical equipment and works;
d) Evaluate the proposed mechanical facilities of transmission pumps;
e) Assess the applicability of product proposed by the contractors related to transmission pumps;
f) Supervise the installation works of mechanical equipment for transmission pumps;
g) Attend the test operation of mechanical equipment for transmission pumps; and
h) Support training on O&M on mechanical equipment for transmission pumps.

7) Electrical Engineer

a) Direct the electrical engineer assigned as national professional staff for any his/her responsible work;
b) Assist Team Leader for preparing O&M manuals related to electrical equipment;
c) Prepare a specification of electrical equipment and works;
d) Evaluate the proposed electrical equipment at desalination plant and of transmission pumps;
e) Assess the applicability of product proposed by the contractors;
f) Supervise the installation works of electrical equipment;
g) Attend the test operation and guarantee test of electrical equipment; and
h) Support training on O&M on electrical equipment.

8) Instrumentation Engineer

a) Conduct conceptual design on instrumentation system of desalination plant and transmission pumps;
b) Prepare technical specifications of instrumentation systems;
c) Evaluate the proposed instrumentation system for the desalination plant and transmission pumps; and
d) Attend the commissioning and guarantee test of the desalination plant and transmission pumps, and evaluate the performance of the instrumentation system.

9) Structural Engineer

a) Conduct structural design on desalination plant and transmission pumps for a contract of design - build construction;
b) Prepare specifications related to the structural design;
c) Identify the necessary soil investigations required for the structural design and administer that work; and
d) Provide necessary advice to implement all construction works in order to comply with the design code.

10) Specification / Contract Specialist

a) Prepare bidding documents including prequalification documents;
b) Evaluate the bidders' proposals;
c) Carry out activities described in and/or that follows from the activities described in the scope of work related to procurement and contract management; and those assigned by Team Leader;
d) Review Guidelines for preparation of Bid documents, and contracts for all lots of the project; and
e) Proactively anticipate and carry out any other activity as per the scope of work.

11) Cost Estimation / Quantity Surveyor

a) Estimate cost for each lot;
b) Evaluate financial proposals;
c) Review BOQs according to Guideline of SONEDE;
d) Prepare work standards and material / day work schedules;
e) Evaluate relevant documents for contractors' claims and variations; and

f) Evaluate and report to Team Leader on the progress of the works and periodical payment requested by Contractors.

(2) Local Professional Staff
(responsible for all lots)

1) Deputy Team Leader
a) Support Team Leader;
b) Inform data/report from national professional staff to Team Leader; and
c) Supervise all National Professional Staff.

2) Environmental Specialist
a) Review conceptual design based on the result of EIA;
b) Update Environmental Management Plan (EMP) if necessary;
c) Assist SONEDE to implement the measure identified in EMP;
d) Monitor the works on the view point of the EMP and negative impacts on environment caused by the construction works;
e) Assist SONEDE in monitoring the compliance with the requirements under the EMP, JICA Environmental Guidelines and the Tunisian Regulations; and
f) Prepare report for environment and social environment and submit it to SONEDE.

3) Geo-technical Engineer
a) Prepare a document for geo-technical conditions on site based on the existing data;
b) Evaluate the foundation design of facilities; and
c) Review geo-technical conditions on site, and foundation design of facilities.

(responsible for Lot 1. Desalination Plant)

4) Resident Engineer 1 / Civil Engineer (1) for Lot 1
a) Conduct conceptual design of civil works for sea water desalination plant;
b) Supervise civil work for Intake/Discharge at the level of the Desalination Plant;
c) Assess the applicability of product proposed by the contractors;
d) Attend the test operation, commissioning and guarantee test of desalination plant;
e) Evaluate the performance of the desalination system; and
f) Support training on O&M of facilities related to civil engineering work.

5) Civil Engineer (2) for Lot 1
a) Conduct conceptual design of civil works for intake and brine effluent pipe;
b) Assess the applicability of product proposed by the contractors;
c) Attend the test operation of the desalination system;
d) Evaluate the performance of the desalination system; and
e) Support training for O&M on facility related to civil engineering work.

6) Mechanical Engineer (for Lots 1, 6)

a) Conduct conceptual design of mechanical engineering works for Lot 1 and 6;
b) Direct the mechanical engineer assigned as national professional staff for any his/her responsible work;
c) Assist Team Leader for preparing O&M manuals on mechanical equipment;
d) Assess the applicability of products proposed by the contractors related to mechanical equipment;
e) Supervise the installation works of mechanical equipment;
f) Attend the test operation of mechanical equipment;
g) Evaluate the performance of the mechanical equipment; and
h) Support training for O&M on mechanical equipment.

7) Electrical Engineer (for Lots 1, 6, 7)

a) Conduct conceptual design of mechanical engineering works for Lot 1, 6 and 7;
b) Assist Team Leader for preparing O&M manuals related to electrical equipment;
c) Assess the applicability of product proposed by the contractors;
d) Supervise the installation works of electrical equipment;
e) Attend the test operation of electrical equipment;
f) Evaluate the performance of the electrical equipment; and
g) Support training for O&M on electrical equipment.

8) Structural Engineer

a) Conduct conceptual design of structural engineering works;
b) Identify the necessary soil investigations required for the structural design and administer that work; and
c) Provide necessary advice to implement all construction works in order to comply with the design code.

9) Architect

a) Conduct conceptual design of architect works;
b) Review building design in consideration of energy efficiency and operational environment;
c) Supervise building construction ensuring safety condition; and
d) Evaluate and approve the applicability of the building.

10) Building Utilities Engineer

a) Conduct conceptual design of building utilities in consideration of energy efficiency and operational environment;
b) Supervise building utility construction ensuring safety condition; and
c) Attend the building utility tests, and report to Team Leader.

11) Quantity Surveyor for Lot 1

a) Review BOQs according to Guideline of SONEDE;
b) Preparation of work standards and material / day work schedules;

c) Evaluate relevant documents for contractors' claims and variations; and
d) Evaluate and report to Team Leader for the progress of the works and periodical payment requested by Contractors.

(responsible for Lots 2, 3, 4. Pipeline Installation)

12) Resident Engineer 2 / Civil Engineer (1) for Lots 2, 3, 4
a) Prepare a design for civil engineering works of Lot 4;
b) Calculate the work volume and estimate costs;
c) Assess the applicability of product proposed by the contractors;
d) Attend the test operation of the transmission system;
e) Evaluate the performance of the transmission system; and
f) Support training on O&M on facility related to civil engineering work.

13) Civil Engineer (2) for Lots 2, 3, 4
a) Prepare a design for civil engineering works of Lot 4;
b) Calculate the work volume and estimate costs;
c) Assess the applicability of product proposed by the contractors;
d) Attend the test operation of the transmission system;
e) Evaluate the performance of the transmission system; and
f) Support training on O&M on facility related to civil engineering work.

14) Procurement Specialist for Lots 2, 3, 4
a) Prepare detailed design, specifications and BoQ for transmission pipelines.

15) Quantity Surveyor for Lots 2, 3, 4
a) Review BOQs according to SONEDE’s guidelines;
b) Preparation of work standards and material / day work schedules;
c) Evaluate relevant documents for contractors' claims and variations; and
d) Evaluate and report to Team Leader for the progress of the works and periodical payment requested by Contractors.

(responsible for Lots 5, 6. Reservoirs / Pump Facility Construction)
16) Resident Engineer 3 / Civil Engineer (1) for Lots 5, 6
a) Conduct conceptual design of civil works for Lot 6;
b) Supervise civil work for reservoir and pump facilities;
c) Assess the applicability of product proposed by the contractors;
d) Attend the test operation of mechanical and electrical equipment;
e) Evaluate the performance of the transmission system; and
f) Support training for O&M on facility related to civil engineering work,

17) Civil Engineer (2) for Lots 5, 6
a) Conduct conceptual design of civil works for Lot 6;

b) Assess the applicability of product proposed by the contractors;
c) Attend the test operation of mechanical and electrical equipment;
d) Evaluate the performance of the transmission system; and
e) Support training on O&M on facility related to civil engineering work.

18) Quantity Surveyor for Lots 5, 6
a) Review BOQs according to Guideline of SONEDE;
b) Preparation of work standards and material / day work schedules;
c) Evaluate relevant documents for contractors' claims and variations; and
d) Evaluate and report to Team Leader for the progress of the works and periodical payment requested by Contractors.

7. Reporting

Within the scope of consulting services, the Consultant shall prepare and submit reports and documents to SONEDE as shown below. The Consultant shall provide electronic copy of each of these reports.

(Example)

Category	**Type of** Report	Timing	**No.** of **Copies**
Consultancy Services	Inception Report	Within1 month after commencement of the services	10
	Monthly Progress Report	Every month	10
	Quarterly Progress Report	Every quarter	10
	Project Completion Report (for submission to JICA)	At the end of Services	10
Tender Assistance	Bid Evaluation Report (Technical & Price)	After evaluation of Bids	15 each
Construction Supervision	Quality Control Report	Every month	10
	Completion Report (and As-built Drawings, if any)	At the end of the Project	5
Training	Training Plan	At appropriate timing in accordance with the Inception Report	10
	Training Execution and Evaluation Report	Within 1 month after training	10
Environment and Social Safeguard	Environmental Monitoring Report	Every quarter	10
	Land Acquisition Monitoring Report	Every month	10
	Environmental and Social Safeguard Evaluation Report	At the end of the Project	20
Other Report	Technical Report	As required or upon request	As required

Contents to be included in each report are as follows:

(Monthly Progress report and Inception report)

a) Monthly Progress Report: Describes briefly and concisely all activities and progress for the

previous month by the 10th day of each month. Problems encountered or anticipated will be clearly stated, together with actions to be taken or recommendations on remedial measures for correction. Also indicates the work to be performed during the coming month.

b) Inception Report: To be submitted within 1 month after the commencement of the services, presenting the methodologies, schedule, organization, etc.

(Detailed Design/ Conceptual Design)

a) Project Definition Report (20 copies), to be submitted in the 3rd month after the commencement of services, presenting the design criteria and standards.

b) Draft Detailed Design/ Conceptual Design Report (20 copies), to be submitted in the 8th month for Lot 1 and the 11th month for Lots 2 to 6, after the commencement of services, presenting detailed engineering design and conceptual design.

c) Cost Estimate Report (20 copies), to be submitted in the 9th month for Lot 1, and the 12th month for Lots 2 to 6, after the commencement of services, presenting detailed cost estimates.

d) Final Detailed Design/ Conceptual Design Report (20 copies), to be submitted in the 9th month for Lot 1, and the 11th month for Lots 2 to 6 after the commencement of services, compiling all the items carried out during services.

e) Final Design Report (20 copies), to be submitted in the 12th month after the commencement of services, finalizing detailed design, cost estimate, bid plan, bid evaluation criteria, technical evaluation criteria and bidding documents through the incorporation of comments on the Draft Design Report, provided by SONEDE

f) Pre-qualification Document Report (20 copies), to be submitted in the 3rd month after the commencement of the services, presenting the pre-qualification documents for Lot 1 and its evaluation criteria.

g) Pre-qualification Evaluation Report (15 copies) to present the results of the evaluation and to select the qualified applicants.

h) Bidding Document Report (20 copies), to be submitted in the 9th month for Lot 1, and the 12th month for Lots 2 to 6, after the commencement of the services, presenting the bidding documents and bid evaluation criteria.

(Tender Assistance)

a) Bid Evaluation Report （Technical） (15 copies) to present the results of technical evaluation and to recommend the qualified applicants.

b) Bid Evaluation Report (Financial) (15 copies) to present the results of the tenders to select the qualified applicants with lowest evaluated price bid .

(Assistance in Environment Monitoring)

a) Environmental Monitoring Report (10 copies), to be submitted at every three (3) months after the commencement of the services, presenting the environmental impacts and implementation of environmental mitigation measures during and [at the completion of / after] the construction stage. Environmental monitoring forms attached as Appendix # will be filled and attached to the Report.

b) Land Acquisition Report (10 copies), to be submitted at every month during land acquisition period.

c) Environmental and Social Safeguard Evaluation Report (20 copies), to be submitted by the end of the consulting services, presenting the EMP and EMoP prepared.

(Construction Supervision)

a) Quarterly Progress Report (15 copies), to be submitted at every three (3) months during construction, presenting the progress status of the Project.

b) Operation and Maintenance Manual (20 copies) containing technical procedures for the appropriate operation and maintenance of all project facilities.

c) Construction Completion Report (20 copies), to be submitted within three (3) month after completion of construction, which comprises a full size of as-built drawings for all the structures and facilities completed, and the final details of the construction completed together with all data, records, material tests results, field books.

10.3-2 TOR for Consulting Service (draft)

Tendering Assistance and Construction Supervision

Sfax Sea Water Desalination Plant Construction Project in the Republic of Tunisia
Terms of Reference on Consulting Service

1. Background

One half of Tunisia belongs to semi-dry climate. The annual average of the rainfall is about a little less than 500mm. Consequently, groundwater contributes to about 40% of water intake. The water supply system in Tunisia has been developed in accordance with an economic growth of 4% in average during the last 15 years. The service area of water supply covers 97.8% in total, i.e. 100% of urban areas, 93.4% of rural areas (SONEDE, 2012). In Tunisia, the Ministry of Agriculture defines the water sector policy. Water supply in rural area is based on the communal faucet method and is operated by the Ministry of Agriculture. SONEDE (Société Nationale d'Exploitation et de Distribution des Eaux) is responsible for water supply in urban areas and in some rural areas using individual supply systems including water supply for domestic use and development, and the maintenance of conveyance and transmission systems.

Greater Sfax is the second largest city in Tunisia with an approximate population of about 621000. Water supply volume amounts to about 190,000m^3/day for SONEDE's coverage area with a served population of about 810,000 in 2012. Because of rapid increase in population at 1.37% per annum over the last ten years, it is projected that serious water shortage will happen in 2018, and the development of a new water source is requested. Greater Sfax currently relies on groundwater in the central-western region for its water supply. However, it is projected that water supply from the region will be decreased in order to spare groundwater resources in the central-western regions and the increase of demand in the region. In order to cope with this situation, it is requested to develop water resource only for Sfax governorate and to provide related infrastructure. SONEDE studied the construction of a sea water desalination plant in Sfax in the feasibility study for water supply in south regions conducted in 2005.

SONEDE also prepared the Strategic Plan in 2013 to enhance water supply capacity and to improve water quality by 2030. In the plan, the Sfax Desalination Plant Construction Project was planned. In this framework, the preparatory survey was conducted with JICA funding. Based on the survey, this project was formulated.

2. Objectives of Consulting Services

The objective of the consulting services is to provide assistance to the bidding process and construction supervision ensuring the design and the construction quality and fairness, and achieving the efficient project implementation.

3. Scope of Consulting Services

The scope of consulting services on Sfax Sea Water Desalination Plant Construction Project in the

Republic of Tunisia cover tender assistance, and management of construction services for 7 lots and eight (08) contracts. Each lot is explained below followed by a description of services to provide:

(1) Project Component
The project consists of 7 lots. Each lot is explained as follows:

i) Lot 1: Construction of the Seawater Desalination Plant
(a) Sea Water Desalination Plant
a1) Land Acquisition: Approximately 20ha
a2) Desalination Method: Reverse Osmosis Membrane Method (RO)
a3) Treated Water: 100,000m^3/d
a4) RO Units: 25,000m^3/day × 4 units
a5) Transmission Pump Facility 100,000m^3/d
a6) Required Electricity: Approximately 20MVA
(b) Sea Water Intake Pipe
b1) Intake Volume: 222,200m^3/d (capable of flowing 444,400 m^3/d for Phase 2)
b2) Pipe Material: HDPE
b3) φ2000mm x 2 (HDPE), L=3.6km (Buried Pipe: 3.2 km offshore, and 0.4 km onshore))
b4) Transmission pump facility 100,000 m^3/d
b5) Submerged Water Intake Tower 2 units
(c) Brine Effluent Pipe
c1) Effluent Volume: 122,000m^3/d (capable of flowing 244,000 m^3/d for Phase 2)
c2) Pipe Material: HDPE
c3) φ1800mm, L=4.4km (Buried Pipe: 4.0 km offshore, 0.4 km onshore))
c4) Submerged Water Effluent Tower 1 unit

ii) Lot 2: Procurement of Pipes
(a) Procurement of Pipe for Transmission to be installed for Lot 4
a1) Pipe Material: Ductile Cast Iron Pipe
a2) φ1400mm: L＝26.1km (Desalination Plant - PK11 Reservoir)
a3) φ1000mm: L＝6.1km (PK10 Reservoir)
a4) φ800mm: L＝4.8km (PK10 Reservoir－PK14 Reservoir)
a5) φ800mm: L=9.4km (PK14 Reservoir－Sidi Salah EH Reservoir)
a6) φ400mm: L=2.9km (PK11 Reservoir－Bou Merra Reservoir)

This lot can be subject of two contracts (sub-lot 2.1 and sub-lot 2.2)

iii) Lot 3: Procurement of Valves and Other Equipment
(a) Procurement of valves and other equipment to be installed for Lot 4

iv) Lot 4: Installation of Pipeline including valves and other equipment

(a) Construction of Transmission Pipeline and valves whose materials are procured through Lot 2 and Lot 3.
(b) Construction of One-Way Surge Tanks or other anti–water-hammer equipment
b1) Desalination Plant Site - PK11 Reservoir
Tank dimension: diameter 10m x height 15m, site: 20m x 30m x 2 locations

v) Lot 5: Construction of Reservoir
(a) Construction of Reservoir
a1) Capacity of 5,000m^3 existing precinct of Bou Merra Reservoir
(b) Construction of Receiving and Mixing Chambers
b1) PK11: 9.0 W x 15.0 L x 5.0 D
b2) Bou Merra: 4.0W x 3.0L x 5.0D
b3) PK10: 7.0W x 10.0L x 5.0D
b4) PK14: 7.0W x 7.0L x 5.0D
b5) Sidi Salah EH: 6.0W x 5.0L x 5.0D
(internal dimension; W: width, L: length, D: water depth; unit: m)

vi) Lot 6: Construction of Pumping Stations
(a) Pumping Station
a1) Relay Pumping Station: 3 (in PK10, PK11, and PK14 Reservoir Sites)

vii) Lot 7: Power Transmission Construction and Power Connection Works (Executed by STEG)
(a) Construction of electrical power supply facility necessary for the Sea Water Desalination Plant
a1) power line
a2) power line tower
a3) facility for transformation of energy
a4) other necessary facilities
(b) Electrical power connection work (pumping stations of Pk10, Pk11 and Pk14)
(c) Assistance for the installation of Sea Water Desalination Plant electrical facility

(2) Detailed description of the consulting services

<u>Tendering Assistance</u>

The Consultants shall provide assistance to the tendering procedure listed below in accordance with the JICA Guidelines for Procurement under Japanese ODA Loans (April 2012). The Consultant shall assist SONEDE to;

a) Evaluate bids in accordance with the criteria set forth in the bidding documents. In such evaluation, the Consultant shall carefully confirm that bidders' submissions in their technical proposal including, but not limited to, site organization, mobilization schedule, method statement, construction schedule, safety plan, and EMP have been prepared in harmony each other and will meet such requirements set forth in applicable laws and regulations, specifications and other parts of the bidding documents;

b) Prepare bid evaluation reports for approval of the competent committee;
c) Assist SONEDE in contract negotiation by preparing agenda and facilitating negotiations including preparation of minutes of negotiation meeting; and
d) Prepare a draft and final contract agreement.

Construction Supervision

1) Lots 1 and 6

The Consultant shall perform his duties during the implementation period of the contracts to be executed by SONEDE and the Contractors (Lots 1 and 6). In this context, the Consultant shall;

a) Act as SONEDE's Representative to execute construction supervision and contract administration services in accordance with the power and authority to be delegated by SONEDE;
b) Provide assistance to SONEDE concerning variations and claims which are to be ordered/issued at the initiative of SONEDE;
c) Advise SONEDE on resolution of any dispute with the Contractors;
d) Issue instructions, approvals and notices as appropriate;
e) Provide recommendations to SONEDE for acceptance of the Contractor's performance security, advance payment security and required insurances;
f) Assess adequacy of all inputs such as materials, labor and equipment provided by the Contractors;
g) Check and approve the Contractors' method of work, including site organization, program of performance, quality assurance system, safety plan and environmental monitoring plan so that the requirements set forth in the applicable laws and regulations, the specifications or other parts of the contract are to be duly respected;
h) Monitor as appropriate physical and financial progress, and take appropriate action to expedite progress if necessary, so that the time for completion set forth in the contract will be duly respected;
i) Explain and/or adjust ambiguities and/or discrepancies in the Contract Documents and issue any necessary clarifications or instructions;
j) Review and approve the Contractor's design for the works to be constructed, working drawings, shop drawings and drawings for temporary works;
k) Liaise with the appropriate authorities to ensure that all the affected utility services are promptly relocated;
l) Carry out field inspections on the Contractor's setting out of the works in relation to original points, lines and levels of reference specified in the contract;
m) Organize, as necessary, management meetings with the Contractors to review the arrangements for future work. Prepare and deliver minutes of such meetings to SONEDE and the Contractors;
n) Supervise the works so that all the contractual requirements are met by the Contractor, including those in relation to i) quality of the works, ii) safety and iii) protection of the environment. Confirm that an accident prevention officer proposed by the Contractor is duly assigned at the project site;

o) Supervise field tests, sampling and laboratory test to be carried out by the Contractors;
p) Inspect construction methods, equipment to be used, workmanship at the site, and attend factory inspection and manufacturing tests in accordance with SONEDE's Requirements;
q) Verify payment applications submitted by the Contractor;
r) Coordinate the works among different contractors employed for the Project;
s) Modify the Employer's Requirements as may be necessary in accordance with the actual site conditions, and issue variation orders with the approval of SONEDE (including necessary actions in relation to the works performed by other contractors working for other projects or other facility operators, if any);
t) Carry out timely reporting to SONEDE for any inconsistency in executing the works and suggesting appropriate corrective measures to be applied;
u) Inspect, verify and comment on claims issued by the Contractors;
v) Supervise Pre-commissioning carried out by the Contractors, check and comment on the Contractor's Pre-commissioning report, and suggest the Completion Certificate as specified in the contract;
w) Supervise Commissioning and Guarantee Test carried out by the Contractors, check and comment on the Contractor's report on the Commissioning and Guarantee Test, and suggest the Operational Acceptance Certificate as specified in the Contract;
x) Provide periodic inspection services during defect liability period and if any defects are noted, instruct first SONEDE and second the Contractors to rectify;
y) Check and suggest the approval of as-built drawings prepared by the Contractors; and
z) Check and suggest the approval of the operation and maintenance manual prepared by the Contractor.

2) Lots 4 and 5

The Consultant shall perform his duties during the contract implementation period of the contracts to be executed by SONEDE and the Contractors (Lots 4 and 5). In this context, the Consultant shall;

a) Act as SONEDE's Representative to execute construction supervision and contract administration services in accordance with the power and authority delegated by SONEDE;
b) Provide assistance to SONEDE concerning variations and claims which are to be ordered/issued at the initiative of SONEDE;
c) Advise SONEDE on resolution of any dispute with the Contractor;
d) Issue instructions and notices, and suggest approvals as appropriate;
e) Provide recommendation to SONEDE for acceptance of the Contractors' safety plan, performance security, advance payment security and required insurances;
f) Evaluate compliance of all inputs such as equipment, working staff, and materials provided by the Contractors;
g) Provide commencement order to the Contractors;
h) Check and approve the Contractors' method of work, including site organization, program of performance, quality assurance system, safety plan, method statement of safety and environmental monitoring plan so that the requirements set forth in the applicable laws and

regulations, the specifications or other parts of the contract are to be duly respected;

i) Regularly monitor physical and financial progress, and take appropriate action to expedite progress if necessary, so that the time for completion set forth in the contract will be duly respected by the Contractor;

j) Explain and/or adjust ambiguities and/or discrepancies in the Contract Documents and issue any necessary clarifications or instructions. Issue further drawings and give instructions to the Contractors for any works which may not be sufficiently detailed in the contract documents, if any;

k) Review and approve the Contractor's working drawings, shop drawings and drawings for temporary works;

l) Liaise with the appropriate authorities to ensure that all the affected utility services are promptly relocated;

m) Carry out field inspections on the Contractor's setting out of the works in relation to original points, lines and levels of reference specified in the contract;

n) Organize, as necessary, management meetings with the Contractors to review the arrangements for future work. Prepare and deliver minutes of such meetings to SONEDE and the Contractors;

o) Supervise the works so that all the contractual requirements are met by the Contractors, including those in relation to i) quality of the works, ii) safety and iii) protection of the environment. Confirm that an accident prevention officer proposed by the Contractors is duly assigned at the project site. Require the contractors to take appropriate remedies if any questions are recognized regarding the safety measures;

p) Supervise field tests, sampling and laboratory test to be carried out by the Contractors;

q) Inspect the construction method, equipment to be used, workmanship at the site, and attend shop inspection and manufacturing tests in accordance with the specifications;

r) Survey and measure the work output performed by the Contractors verify statements submitted by the Contractor and issue payment certificates such as interim payment certificates and final payment certificate as specified in the contract;

s) Coordinate the works among different contractors employed for the Project;

t) Modify the designs, technical specifications and drawings, relevant calculations and cost estimates as may be necessary in accordance with the actual site conditions, and issue variation orders (including necessary actions in relation to the works performed by other contractors working for other projects, if any);

u) Carry out timely reporting to SONEDE for any inconsistency in executing the works and suggesting appropriate corrective measures to be applied;

v) Inspect, verify and approve or disapprove claims issued by the parties to the contract (i.e. SONEDE and Contractors) in accordance with the civil works contract;

w) Perform the inspection of the works, including Test on Completion, and to issue certificates such as the Taking-Over Certificate, Performance Certificate as specified in the contract;

x) Supervise the preliminary operation conducted by the Contractors, check and approve the initial operation report issued by the Contractors and issue the completion report as specified in the Contract;

y) Supervise commissioning and carry out tests during the commissioning, if applicable;

z) Provide periodic and/or continuous inspection services during defects notification period and if any defects are noted, instruct the Contractors to rectify;
aa) Prepare as-build drawings for the parts of the works constructed in accordance with the design provided by SONEDE;
ab) Check and certify as-built drawings for the parts of the works designed by the Contractors, if any; and
ac) Prepare an operation and maintenance manual for the works constructed in the Project.

3) Lot 7

The Consultant shall perform the following tasks throughout the execution of the Contract between SONEDE and STEG (Lot 7). In this regard, the Consultant shall;

a) Monitor the progress of works carried out by STEG; and
b) Coordination with STEG.

Safety measures

The Consultants shall;

a) Review the safety plans submitted by the contractors securing the safety during the construction. (Refer to Paragraph (2), Section 4.02 Scope of the Project and of the Consulting Services of the Guidelines for the Employment of Consultants under Japanese ODA Loans, March 2009), and require them to submit the revision if necessary; and
b) Confirm that an accident prevention officer proposed by the contractor is duly assigned at the project site during the supervision of the construction works and ensure the work is carried out according to the safety plan as well as the safety measures prescribed in the Program. If Consultants recognize any questions regarding the safety measures in general including the ones mentioned above, the Consultants shall requires the contractors to make appropriate improvements.

Facilitation of implementation of Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMoP)

The Consultant shall;

a) Update EMP as appropriate;
b) Assist SONEDE in dissemination and explanation of additionally confirmed and identified environmental issues to public including holding public consultations;
c) During the preparation of bidding documents, clearly identify environmental responsibilities as explained in the EIA and EMP;
d) Assist SONEDE to review the Construction Contractor's Environmental Program to be prepared by the contractor in accordance with EMP, relevant plans and JICA Environmental Guidelines and to make recommendations to SONEDE regarding any necessary amendments for its approval;
e) Assist SONEDE to implement the measures identified in the EMP;
f) Monitor the effectiveness of EMP and negative impacts on environment caused by the construction works and provide technical advice, including a feasible solution, so that

SONEDE can improve situation when necessary;

g) Assist SONEDE in monitoring the compliance with conditions stated in the Environmental Permit Certification (EPC) and the requirements under EMP and JICA Environmental Guidelines;
h) Assist SONEDE in the capacity building of SONEDE staff on environmental management through on-the-job training on environmental assessment techniques, mitigation measure planning, supervision and monitoring, and reporting.

Technology transfer

The Consultant shall carry out the technology transfer as an important aspect in design and supervision works. The Consultant shall provide the opportunity to SONEDE officers and staffs to be involved in the working team of the Consultant during the designing, contract administration and supervision works for their capacity building wherever possible. If requested by SONEDE, the Consultant shall brief and demonstrate the survey and design procedure, the construction supervision and contract management process and procedures. The consultant shall assist SONEDE and its staff to build their capacity as a part of on the job training under the Project.

4. Man-Month Schedule and Expected Time Schedule

The consultants will be engaged over 74 months as a consulting service period. The team shall comprise Foreign and Local Professional Staff with man-month presented below.

		Man-Month			
No	Position	DD[1)]	TA[2)]	CS[3)]	Total
Foreign Professional Staff					
1	Team Leader	-	10.0	35.5	45.5
2	Desalination Plant Process Engineer	-	4.0	18.5	22.5
3	Civil Engineer	-	4.0	33.0	37.0
4	Pipeline Engineer	-	1.5	28.0	29.5
5	Mechanical Engineer (Desalination Plant)	-	3.5	9.5	13.0
6	Mechanical Engineer (Transmission Pumps)	-	2.0	7.0	9.0
7	Electrical Engineer	-	3.5	9.0	12.5
8	Instrumentation Engineer	-	2.0	9.0	11.0
9	Structural Engineer	-	0.0	2.0	2.0
10	Contract Specialist	-	5.5	5.0	10.5
11	Quantity Surveyor	-	0.0	34.0	34.0
Subtotal: Foreign Professional Staff		-	36.0	190.5	226.5
Local Professional Staff					
1	Deputy Team Leader	-	14.0	36.5	50.5
2	Environmental Specialist	-	1.0	38.0	39.0
3	Geo-technical Engineer	-	0.0	3.0	3.0
Lot 1. Construction of Sea Water Desalination Plant					
4	Resident Engineer 1 / Civil Engineer (1) for Lot 1	-	0.0	48.0	48.0

5	Civil Engineer (2) for Lot 1	-	0.0	29.0	29.0
6	Mechanical Engineer for Lot 1, 6	-	0.0	9.0	9.0
7	Electrical Engineer for Lot 1, 6, 7	-	0.0	9.0	9.0
8	Structural Engineer for Lot 1, 4, 5, 6	-	0.0	3.0	3.0
9	Architect	-	0.0	4.0	4.0
10	Building Utilities Engineer	-	0.0	4.0	4.0
11	Quantity Surveyor for Lot 1	-	0.0	33.0	33.0
Lot 2 & 3 Procurement of Pipes / Valves and Other Equipment Lot 4. Construction of Pipeline					
12	Resident Engineer 2 / Civil Engineer (1) for Lot 2, 3, 4	-	0.0	33.0	33.0
13	Civil Engineer (2) for Lot 2, 3, 4	-	0.0	32.0	32.0
14	Quantity Surveyor for Lot 2, 3, 4	-	0.0	32.0	32.0
Lot 5 & 6. Reservoirs/Pump Facility Construction					
15	Resident Engineer 3 / Civil Engineer (1) for Lot 5, 6	-	0.0	33.0	33.0
16	Civil Engineer (2) for Lot 5, 6	-	0.0	30.0	30.0
17	Quantity Surveyor for Lot 5, 6	-	0.0	30.0	30.0
Subtotal: Local Professional Staff		-	15.0	406.5	421.5
Local support staff					
1	Assistant Engineer	-	14.0	69.0	83.0
2	Inspector/Surveyor	-	0.0	156.0	156.0
3	CAD Operator	-	0.0	36.0	36.0
4	Interpreter/Translator	-	13.0	69.0	82.0
5	Office Manager	-	14.0	36.0	50.0
6	Accountant	-	0.0	36.0	36.0
7	Clerk	-	0.0	36.0	36.0
8	Office Boy	-	14.0	36.0	50.0
Subtotal: Local Support Staff		-	55.0	474.0	529.0
Total Technical and support staff		-	106.0	1071.0	1177.0

1) Conceptual Design/Detailed Design: to be conducted by SONEDE

2) Tendering Assistance

3) Construction Supervision

All technical and support staff required for the mission must be provided by the Consultant and includes the following profiles.

It is envisaged that the Consultant will provide adequate Technical and Administrative supporting staff. It is the Consultant's responsibility to select the optimum team and to propose the professionals which are believed to the best meets and needs of SONEDE without exceeding total man-month proposed for each category.

5. Basic professional requirements of key expert

The key expert requirements with qualification and experience for each position are given in the table

below.

(1) Foreign Professional Staff

Position	Minimum requirement
Team Leader	Education Master Degree in civil engineering or construction management, or a national-registered professional engineer in his country. Professional Experience At least 20 years professional experience including 18 years at least in infrastructure. Experience of team leader for 5 or more projects in the field of water and sewerage, each of which is amounted at a project cost of more than 30 million US dollars.
Desalination Plant Process Engineer	Education Master Degree in civil engineering or a national-registered professional engineer in his country. Professional Experience At least 10 years professional experience including at least 8 years as a plant process engineer. Experience on desalination plant for 2 or more projects.
Civil Engineer	Education Master Degree in civil engineering or a national-registered professional engineer in his country. Professional Experience At least 10 years' professional experience including at least 8 years in development. Experience during construction period for 3 or more projects in the field of water and sewerage.
Pipeline Engineer	Education E Bachelor's Degree in civil engineering or mechanical engineering.. Professional Experience At least 10 years professional experience including at least 8 years in the field of pipeline design/construction. Experience during construction period of pipeline for 3 or more projects with a total period of 3 or more years.
Mechanical Engineer (Desalination Plant)	Education Bachelor's Degree in civil engineering or mechanical engineering. Professional Experience At least 10 years professional experience including at least 8 years of experience in the design and/or construction of water treatment plants. Experience of desalination plant for 2 or more projects.
Mechanical Engineer (Transmission Pumps)	Education Bachelor's Degree in mechanical engineering. Professional Experience At least 10 years professional experience including at least 8 years in the design and/or construction of pumping stations. Experience during construction period of pumping station for 3 or more projects with a total period of 3 or more years.
Electrical Engineer	Education Bachelor's Degree in electrical engineering. Professional Experience At least 10 years professional experience including at least 8 years in the design and/or construction of desalination plants and pumping station. Experience during construction period of desalination plant and pumping

	station for 5 or more projects with a total period of 3 or more years.
Instrumentation Engineer	Education Bachelor's Degree in electrical engineering. Professional Experience At least 10 years professional experience including at least 8 years in instrumentation engineering for any plant. Experience in the operation of desalination plant on 3 or more years.
Structural Engineer	Education Master Degree in civil engineering or a national-registered professional engineer in his country. Professional Experience At least 10 years professional experience including at least 8 years in the design and/or construction of desalination plant and pumping stations. Experience during construction period of desalination plants and pumping stations for 5 or more projects with a total period of 3 or more years.
Contract Specialist	Education Bachelor's Degree in engineering or related field. Professional Experience At least 10 years professional experience including at least 8 years as a contract specialist for any type of plants or infrastructure development. At least 5 or more projects as a contract specialist.
Quantity Surveyor	Education Bachelor's Degree in engineering or related field. Professional Experience At least 10 years professional experience including at least 8 years as a quantity surveyor or relevant specialist for any type of plants or infrastructure development. At least 5 or more projects for surveying quantity.

(2) Local Professional Staff

Position	Minimum requirement
(responsible for all lots)	
Deputy Team Leader	Education Master Degree in civil engineering or construction management, or a national-registered professional engineer in his country. Professional Experience At least 20 years professional experience of infrastructure development. Experience of team leader for 5 or more projects in the field of water and sewerage.
Environmental Specialist	Education Master Degree in civil/environmental engineering or related fields, or a national-registered professional engineer in his country. Professional Experience At least 20 years professional experience of environmental infrastructure development. Experience during construction period for 5 or more projects in the field of water and sewerage.
Geo-technical Engineer	Education Bachelor's Degree in civil engineering or related fields. Professional Experience At least 10 years professional experience of geo-technical engineering.
(responsible for Lot 1. Desalination Plant)	

(Additional responsibility to Mechanical Engineer for Lot 6, and Electrical Engineer for Lots 6 and 7)	
Resident Engineer 1 / Civil Engineer (1) for Lot 1	Education Master Degree in civil engineering or a national-registered professional engineer in his country. Professional Experience At least 15 years professional experience of civil engineering work. Preferably 5 years experience in the field of water supply during construction period.
Civil Engineer (2) for Lot 1	Education Bachelor's Degree in civil engineering. Professional Experience At least 10 years professional experience of civil engineering work. Preferably 5 years experience in the field of water supply during construction period.
Mechanical Engineer for Lot 1, 6	Education Bachelor's Degree in mechanical engineering. Professional Experience At least 5 years professional experience related to design and/or construction of pumping stations. Experience during construction period of pumping station for 3 or more projects with a total period of 3 or more years.
Electrical Engineer for Lot 1, 6, 7	Education Bachelor's Degree in electrical engineering. Professional Experience At least 5 years professional experience related to the design and/or construction of desalination plants and pumping stations. Experience during construction period of desalination plant and pumping station for 3 or more projects with a total period of 3 or more years.
Structural Engineer	Education Bachelor's Degree in civil engineering. Professional Experience At least 10 years' professional experience related to design and/or construction of desalination plants and pumping stations. Experience during construction period of desalination plant and pumping station for 5 or more projects with a total period of 3 or more years.
Architect	Education Bachelor's Degree in architecture. Professional Experience At least 10 years' professional experience related to the construction design of any plant and pumping station. Preferably experience on 5 or more projects with a total period of 3 or more years.
Building Utilities Engineer	Education Bachelor's Degree in any engineering or related fields. Professional Experience At least 5 years' professional experience related to design and construction management of building utilities at any plant and pumping station. Preferably experience on 3 or more projects with a total period of 3 or more years.
Quantity Surveyor for Lot 1	Education Bachelor's Degree in civil engineering or relevant. Professional Experience At least 10 years' professional experience of infrastructure development. Experience during construction period for 5 or more projects in the field of

	water and sewerage.
(responsible for Lot 4. Pipeline Installation, and Lots 2 and 3)	
Resident Engineer 2 / Civil Engineer (1) for Lot 2, 3, 4	Education Bachelor's Degree in civil engineering. Professional Experience At least 15 years' professional experience of civil engineering work. Preferably 5 years' experience in the field of water supply during construction period.
Civil Engineer (2) for Lot 2, 3, 4	Education Bachelor's Degree in civil engineering. Professional Experience At least 10 years' professional experience of civil engineering work. Preferably 5 years' experience in the field of water supply during construction period.
Quantity Surveyor for Lot 2, 3, 4	Education Bachelor's Degree in civil engineering or relevant. Professional Experience At least 10 years' professional experience of infrastructure development. Experience during construction period for 5 or more projects in the field of water and sewerage.
(responsible for Lots 5 and 6. Reservoirs / Pump Facility Construction)	
Resident Engineer 3 / Civil Engineer (1) for Lot 5, 6	Education Bachelor's Degree in civil engineering. Professional Experience At least 15 years' professional experience of civil engineering work. Preferably 5 years' experience in the field of water supply during construction period.
Civil Engineer (2) for Lot 5, 6	Education Bachelor's Degree in civil engineering. Professional Experience At least 10 years' professional experience of civil engineering work. Preferably 5 years' experience in the field of water supply during construction period.
Quantity Surveyor for Lot 5, 6	Education Bachelor's Degree in civil engineering or relevant. Professional Experience At least 10 years professional experience of infrastructure development. Experience during construction period for 5 or more projects in the field of water and sewerage.

6. Task of Professional Staff

(1) Foreign Professional Staff

1) Team Leader

a) Shall take the overall responsibility, and shall represent the project Consultant's Team in all matters relating to the performance of services, coordinating with all other consultant's staff to deliver excellent product during the stipulated time schedule;
b) Shall oversee, and supervise the Consultant's services;
c) Assume direct responsibility for day-to-day consulting services including day-to-day

management of all consultants' staff and co-ordination among and with them;

d) Review existing studies / documents and other resources available and formulate the best implementation approach including programmatic project schedule;
e) Develop and implement quality assurance program;
f) Recommend contract payments;
g) Review, analyze and make recommendations to SONEDE concerning variations and claims which are to be ordered/issued by SONEDE;
h) Recommend to issue the commencement order to the Contractors;
i) Evaluation of time extension claims and make recommendations;
j) Provide recommendation to SONEDE for acceptance of the Contractor Performance security, advance payment security and required insurances;
k) Explain and/or adjust ambiguities and/or discrepancies in the Contract Documents and recommend issuing any necessary clarifications or instructions;
l) Review, verify and further detail the design of the works, recommend to approve the Contractors' working drawings and if necessary, issue further drawings and/or give instructions to the Contractor;
m) Review and recommend to approve the proposals submitted by the Contractors;
n) Make necessary design changes and amendments at site;
o) Provide guidance for unforeseen matters;
p) Progress reporting;
q) Prepare institutional arrangement and training program for O&M;
r) Certify all the drawings, BOQs, cost estimates and specifications;
s) Ensure the safety conditions at work sites;
t) Supervise commissioning, and carry out testing during commissioning;
u) Review O&M manuals; and
v) Develop a course module on project management including project coordination, contract administration, over-all supervision over the implementation of the project and conduct 3 days Project Management Training Course for SONEDE’s project staff.

2) Desalination Plant Process Engineer

a) Evaluate the proposed unit of the desalination plant;
b) Supervise the installation procedure of the unit; and
c) Assist the commissioning and guarantee test of the desalination plant, and evaluate the performance of the plant’s equipment.

3) Civil Engineer

a) Direct civil engineers assigned as national professional staff for any his/her responsible work;
b) Evaluate the proposed desalination plant, pipe installation, and reservoir work;
c) Supervise civil work for desalination plant, pipe installation, and reservoir work;
d) Assess the applicability of products proposed by the contractors;
e) Attend the test operation of mechanical and electrical equipment;
f) Evaluate the performance of the water transmission system; and
g) Support training on O&M on facility related to facilities and civil engineering works.

4) Pipeline Engineer

a) Direct the civil engineer for Lot 1 assigned as national professional staff regarding his/her responsible work;
b) Evaluate the proposed pipe materials and installation;
c) Supervise pipeline installation work;
d) Assess the applicability of products proposed by the contractors;
e) Attend the test and commencement of pipeline operation; and
f) Support training on O&M on pipeline facility.

5) Mechanical Engineer (Desalination Plant)

a) Direct the mechanical engineer assigned as national professional staff for any his/her responsible work;
b) Assist Team Leader for preparing O&M manuals on desalination plant;
c) Evaluate the proposed mechanical facilities at the desalination plant;
d) Assess the applicability of product proposed by the contractors related to desalination plant;
e) Supervise the installation works of mechanical equipment for desalination plant;
f) Attend the commissioning and guarantee test of mechanical equipment for desalination plant; and
g) Support training on O&M on mechanical equipment for desalination plant.

6) Mechanical Engineer (Transmission Pumps)

a) Direct the mechanical engineer assigned as national professional staff for any his/her responsible work;
b) Assist Team Leader for preparing O&M manuals on transmission pumps;
c) Evaluate the proposed mechanical facilities of transmission pumps;
d) Assess the applicability of product proposed by the contractors related to transmission pumps;
e) Supervise the installation works of mechanical equipment for transmission pumps;
f) Attend the test operation of mechanical equipment for transmission pumps; and
g) Support training on O&M on mechanical equipment for transmission pumps.

7) Electrical Engineer

a) Direct the electrical engineer assigned as national professional staff for any his/her responsible work;
b) Assist Team Leader for preparing O&M manuals related to electrical equipment;
c) Evaluate the proposed electrical equipment at desalination plant and of transmission pumps;
d) Assess the applicability of product proposed by the contractors;
e) Supervise the installation works of electrical equipment;
f) Attend the test operation and guarantee test of electrical equipment; and
g) Support training on O&M on electrical equipment.

8) Instrumentation Engineer

a) Evaluate the proposed instrumentation system for the desalination plant and transmission pumps;

and

b) Attend the commissioning and guarantee test of the desalination plant and transmission pumps, and evaluate the performance of the instrumentation system.

9) Structural Engineer

a) Provide necessary advice to implement all construction works in order to comply with the design code.

10) Contract Specialist

a) Evaluate the bidders' proposals;
b) Carry out activities described in and/or that follows from the activities described in the scope of work related to procurement and contract management; and those assigned by Team Leader; and
c) Proactively anticipate and carry out any other activity as per the scope of work.

11) Cost Estimation / Quantity Surveyor

a) Evaluate financial proposals;
b) Review BOQs according to Guideline of SONEDE;
c) Prepare work standards and material / day work schedules;
d) Evaluate relevant documents for contractors' claims and variations; and
e) Evaluate and report to Team Leader on the progress of the works and periodical payment requested by Contractors.

(2) Local Professional Staff
(responsible for all lots)

1) Deputy Team Leader

a) Support Team Leader;
b) Inform data/report from national professional staff to Team Leader; and
c) Supervise all National Professional Staff.

2) Environmental Specialist

a) Review conception design based on the result of EIA;
b) Update Environmental Management Plan (EMP) if necessary;
c) Assist SONEDE to implement the measure identified in EMP;
d) Monitor the works on the view point of the EMP and negative impacts on environment caused by the construction works;
e) Assist SONEDE in monitoring the compliance with the requirements under the EMP, JICA Environmental Guidelines and the Tunisian Regulations; and
f) Prepare report for environment and social environment and submit it to SONEDE.

3) Geo-technical Engineer

a) Evaluate the foundation design of facilities; and
b) Review geo-technical conditions on site, and foundation design of facilities.

(responsible for Lot 1. Desalination Plant)

4) Resident Engineer 1 / Civil Engineer (1) for Lot 1

a) Supervise civil work for Intake/Discharge at the level of the Desalination Plant;
b) Assess the applicability of product proposed by the contractors;
c) Attend the test operation, commissioning and guarantee test of desalination plant;
d) Evaluate the performance of the desalination system; and
e) Support training on O&M of facilities related to civil engineering work.

5) Civil Engineer (2) for Lot 1

a) Assess the applicability of product proposed by the contractors;
b) Attend the test operation of the desalination system;
c) Evaluate the performance of the desalination system; and
d) Support training for O&M on facility related to civil engineering work.

6) Mechanical Engineer (for Lot 1, 6)

a) Direct the mechanical engineer assigned as national professional staff for any his/her responsible work;
b) Assist Team Leader for preparing O&M manuals on mechanical equipment;
c) Assess the applicability of products proposed by the contractors related to mechanical equipment;
d) Supervise the installation works of mechanical equipment;
e) Attend the test operation of mechanical equipment;
f) Evaluate the performance of the mechanical equipment; and
g) Support training for O&M on mechanical equipment.

7) Electrical Engineer (for Lot 1, 6, 7)

a) Assist Team Leader for preparing O&M manuals related to electrical equipment;
b) Assess the applicability of product proposed by the contractors;
c) Supervise the installation works of electrical equipment;
d) Attend the test operation of electrical equipment;
e) Evaluate the performance of the electrical equipment; and
f) Support training for O&M on electrical equipment.

8) Structural Engineer

a) Identify the necessary soil investigations required for the structural design and administer that work; and
b) Provide necessary advice to implement all construction works in order to comply with the design code.

9) Architect

a) Review building design in consideration of energy efficiency and operational environment;

b) Supervise building construction ensuring safety condition; and
c) Evaluate and approve the applicability of the building.

10) Building Utilities Engineer
a) Supervise building utility construction ensuring safety condition; and
b) Attend the building utility tests, and report to Team Leader.

11) Quantity Surveyor for Lot 1
a) Evaluate relevant documents for contractors' claims and variations; and
b) Evaluate and report to Team Leader for the progress of the works and periodical payment requested by Contractors.

(responsible for Lots 2, 3, 4. Pipeline Installation)

12) Resident Engineer 2 / Civil Engineer (1) for Lot 2, 3, 4
a) Assess the applicability of product proposed by the contractors;
b) Attend the test operation of the transmission system;
c) Evaluate the performance of the transmission system; and
d) Support training on O&M on facility related to civil engineering work.

13) Civil Engineer (2) for Lot 2, 3, 4
a) Assess the applicability of product proposed by the contractors;
b) Attend the test operation of the transmission system;
c) Evaluate the performance of the transmission system; and
d) Support training on O&M on facility related to civil engineering work.

14) Quantity Surveyor for Lot 2, 3, 4
a) Evaluate relevant documents for contractors' claims and variations; and
b) Evaluate and report to Team Leader for the progress of the works and periodical payment requested by Contractors.

(responsible for Lot 5, 6. Reservoirs / Pump Facility Construction)
15) Resident Engineer 3 / Civil Engineer (1)for Lot 5, 6
a) Supervise civil work for reservoir and pump facilities;
b) Assess the applicability of product proposed by the contractors;
c) Attend the test operation of mechanical and electrical equipment;
d) Evaluate the performance of the transmission system; and
e) Support training for O&M on facility related to civil engineering work,

16) Civil Engineer (2) for Lot 5, 6
a) Assess the applicability of product proposed by the contractors;
b) Attend the test operation of mechanical and electrical equipment;
c) Evaluate the performance of the transmission system; and

d) Support training on O&M on facility related to civil engineering work.

17) Quantity Surveyor for Lot 5, 6

a) Evaluate relevant documents for contractors' claims and variations; and
b) Evaluate and report to Team Leader for the progress of the works and periodical payment requested by Contractors.

7. Reporting

Within the scope of consulting services, the Consultant shall prepare and submit reports and documents to SONEDE as shown below. The Consultant shall provide electronic copy of each of these reports.

(Example)

Category	**Type of** Report	Timing	**No.** of **Copies**
Consultancy Services	Inception Report	Within1 month after commencement of the services	10
	Monthly Progress Report	Every month	10
	Quarterly Progress Report	Every quarter	10
	Project Completion Report (for submission to JICA)	At the end of Services	10
Tender Assistance	Bid Evaluation Report (Technical & Price)	After evaluation of Bids	15 each
Construction Supervision	Quality Control Report	Every month	10
	Completion Report (and As-built Drawings, if any)	At the end of the Project	5
Training	Training Plan	At appropriate timing in accordance with the Inception Report	10
	Training Execution and Evaluation Report	Within 1 month after training	10
Environment and Social Safeguard	Environmental Monitoring Report	Every quarter	10
	Land Acquisition Monitoring Report	Every month	10
	Environmental and Social Safeguard Evaluation Report	At the end of the Project	20
Other Report	Technical Report	As required or upon request	As required

Contents to be included in each report are as follows:

(Monthly Progress report and Inception report)

a) Monthly Progress Report: Describes briefly and concisely all activities and progress for the previous month by the 10th day of each month. Problems encountered or anticipated will be clearly stated, together with actions to be taken or recommendations on remedial measures for

correction. Also indicates the work to be performed during the coming month.

b) Inception Report: To be submitted within 1 month after the commencement of the services, presenting the methodologies, schedule, organization, etc.

(Tender Assistance)

a) Bid Evaluation Report (technical) (15 copies) to present the results of technical evaluation and to recommend the qualified applicants.

b) Bid Evaluation Report (price) (15 copies) to present the results of the tender to select the qualified applicants with lowest evaluated price bid.

(Assistance in Environment Monitoring)

a) Environmental Monitoring Report (10 copies), to be submitted at every three (3) months after the commencement of the services, presenting the environmental impacts and implementation of environmental mitigation measures during and [at the completion of / after] the construction stage. Environmental monitoring forms attached as Appendix # will be filled and attached to the Report.

b) Land Acquisition Monitoring Report (10 copies), to be submitted at every month during land acquisition period.

c) Environmental and Social Safeguard Evaluation Report (20 copies), to be submitted by the end of the consulting services, presenting the EMP and EMoP prepared.

(Construction Supervision)

a) Quarterly Progress Report (15 copies), to be submitted at every three (3) months during construction, presenting the progress status of the Project.

b) Operation and Maintenance Manual (20 copies) containing technical procedures for the appropriate operation and maintenance of all project facilities.

c) Construction Completion Report (20 copies), to be submitted within three (3) month after completion of construction, which comprises a full size of as-built drawings for all the structures and facilities completed, and the final details of the construction completed together with all data, records, material tests results, field books.

10.5-1 Project Cost Estimates

T1 Cost Estimates Total

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Lot 1 Desalination Plant (ICB)	including intake/discharge									
Intake & Discharge Facilities		Ls	1		4,420,968,000		74,815,000	8,986,179,000	147,266,000	L1-1
Desalination Plant		Ls	1		8,785,042,000		84,084,000	13,915,848,000	228,054,000	L1-2
Transmission Pump Facility		Ls	1		738,940,000		5,327,000	1,063,994,000	17,437,000	L1-3
Guarantee Test		Ls	1		218,003,000		26,916,000	1,860,417,000	30,489,000	L1-4
Lot 1 Sub-Total					**14,162,953,000**		**191,142,000**	**25,826,438,000**	**423,245,000**	
	FCP:LCP				55%		45%			
Lot 2-1 Pipe Procurement (ICB) 1000 & 1400										
Transmission Pipe Material		Ls	1		2,189,020,000		3,986,000	2,432,246,000	39,860,000	L2-1
Lot 2-1 Sub-Total					**2,189,020,000**		**3,986,000**	**2,432,245,720**	**39,860,000**	
	FCP:LCP				90%		10%			
Lot 2-2 Pipe Procurement (ICB) less than 1000										
Transmission Pipe Material		Ls	1		435,557,000		793,000	483,945,860	7,931,000	L2-2
Lot 2-2 Sub-Total					**435,557,000**		**793,000**	**483,945,860**	**7,931,000**	
	FCP:LCP				90%		10%			
Lot 2 Sub-Total					**2,624,577,000**		**4,779,000**	**2,916,191,580**	**47,791,000**	
	FCP:LCP				90%		10%			

T1 Cost Estimates Total

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Lot 3 Valve and Other Equipment Procurement (LCB)										
Valve Material		Ls	1		510,792,000		930,000	567,540,600	9,301,000	L3
Lot 3 Sub-Total					**510,792,000**		**930,000**	**567,540,600**	**9,301,000**	
	FCP:LCP				90%		10%			
Lot 4 Pipe Installation (ICB)										
Transmission Pipe Installatiom		Ls	1		0		40,270,000	2,457,275,400	40,270,000	L4-1
Valve Installation		Ls	1		0		615,000	37,527,300	615,000	L4-2
Pipe Jacking		Ls	1		0		4,369,000	266,596,380	4,369,000	L4-3
Surge Tank	10mx15mx2	Ls	1		40,430,000		2,262,000	178,457,240	2,925,000	L4-4
Lot 4 Sub-Total					**40,430,000**		**47,516,000**	**2,939,856,320**	**48,179,000**	
	FCP:LCP				1%		99%			
Lot 5 Reservoirs Construction (LCB)										
Mixing Chmber	PK11	Ls	1		0		1,501,000	91,591,020	1,501,000	L5-1
Mixing Chmber	Bou Merra	Ls	1		0		281,000	17,146,620	281,000	L5-2
Mixing Chmber	PK10	Ls	1		0		560,000	34,171,200	560,000	L5-3
Mixing Chmber	PK14	Ls	1		0		472,000	28,801,440	472,000	L5-4
Mixing Chmber	Sidi Salah EH	Ls	1		0		319,000	19,465,000	319,000	L5-5
Reservoir	Bou Merra 5 000m3	Ls	1		0		1,890,000	115,327,800	1,890,000	L5-6
Lot 5 Sub-Total					**0**		**5,023,000**	**306,503,460**	**5,023,000**	
	FCP:LCP				0%		100%			

T1 Cost Estimates Total

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Lot 6 Pump Facilities Construction (ICB)										
PK11（for PK10 & Bou Merra)		Ls	1		789,808,000		6,059,000	1,159,528,000	19,002,000	L6-1
PK10 (for PK14)		Ls	1		469,333,000		4,543,000	746,546,860	12,234,000	L6-2
Pk14 (for Sidi Salah EH)		Ls	1		306,074,000		3,167,000	499,324,340	8,183,000	L6-3
Lot 6 Sub-Total					**1,565,215,000**		**13,769,000**	**2,405,399,380**	**39,420,000**	
	FCP:LCP				65%		35%			
Lot 7 Power Supply Line (by STEG)										
Power Supply Line Construction	150kV - 15km	Ls	1		0		4,350,000	265,437,000	4,350,000	L7-1
Travées		Ls	1		0		2,400,000	146,448,000	2,400,000	L7-2
Assistance		Ls	1		0		533,000	32,523,660	533,000	L7-3
Lot 7 Sub-Total					**0**		**7,283,000**	**444,408,660**	**7,283,000**	
	FCP:LCP				0%		100%			
Total Cost					18,903,967,000		270,442,000	35,406,337,840	580,242,000	
Total Cost (rounded)					**18,903,967,000**		**270,442,000**	**35,406,338,000**	**580,242,000**	
	FCP:LCP				53%		47%			

L1 Desalination Plant

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Intake & Discharge Facilities		Ls	1		4,420,968,000		74,815,000	8,986,179,000	147,266,000	L1-1
Desalination Plant		Ls	1		8,785,042,000		84,084,000	13,915,848,000	228,054,000	L1-2
Transmission Pump Facility		Ls	1		738,940,000		5,327,000	1,063,994,000	17,437,000	L1-3
Guarantee Test (for Desalination Plant)		Ls	1		218,003,000		26,916,000	1,860,417,000	30,489,000	L1-4 12months
Total					14,162,953,000		191,142,000			
Total Cost (rounded)	**to T1**				**14,162,953,000**		**191,142,000**	**25,826,438,000**	**423,245,000**	**L1**
	FCP:LCP				55%		45%			

L1-1 Intake & Discharge Facilities

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)	LC Portion (TND)	Total		Reference
						(JPY)	(equiv. TND)	
Intake & Discharge Pipelines	HDPE 2000mm x 2	Ls	1	4,420,968,000	67,193,000	8,521,085,000	139,644,000	L1-1-1
Intake Pit	42x20x8.3m	Ls	1	0	6,037,000	368,378,000	6,037,000	L1-1-2 Work
Outfall Pit	22x7.8x11m	Ls	1	0	1,585,000	96,717,000	1,585,000	L1-1-3 Work
Total				4,420,968,000	74,815,000			
Total Cost (Rounded)	**to L1**			**4,420,968,000**	**74,815,000**	**8,986,179,000**	**147,266,000**	**L1-1**
	FCP:LCP			49%	51%			

L1-1-1 Intake & Discharge Pipelines

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)	LC Portion (TND)	Total		Reference
						(JPY)	(equiv. TND)	
Pipe material								
Intake HDPE φ2000mm (ID)	3600m×2lines	Ls	1	2,782,676,160	0	2,782,676,160	45,602,690	ID: Internal Diameter
Discharge HDPE φ1800mm (ID)	4400m	Ls	1	1,458,292,000	0	1,458,292,000	23,898,591	ID: Internal Diameter
Intake head	Type TK-2000 x 2 heads	Ls	1	0	3,528,000	215,278,560	3,528,000	cost
Discharge head	Multi Nozzle 1800	Ls	1	0	1,960,000	119,599,200	1,960,000	cost
Intake Pipe Assembly	3600m×2	Ls	1	0	4,403,000	268,671,060	4,403,000	
Discharge Pipe Assembly	4400m	Ls	1	0	2,285,000	139,430,700	2,285,000	
Pipe Material sub-total				4,240,968,160	12,176,000	4,983,947,680	81,677,281	
Pipe Installation								
Intake Pipe	ID2000x3600x2	Ls	1	0	5,179,000	316,022,580	5,179,000	
Discharge Pipe	ID1800x4400x1	Ls	1	0	3,105,000	189,467,100	3,105,000	
Intake head	Type TK-2000 x 2	Ls	1	0	94,000	5,735,880	94,000	
Discharge head	Multi Nozzle 1800	Ls	1	0	47,000	2,867,940	47,000	
Pipe Installation sub-total				0	8,425,000	514,093,500	8,425,000	Work
On-shore part civil work	& backfilling	Ls	1	0	7,559,000	461,250,000	7,559,000	L1-1-1-1 Work
Off-shore part civil work	& backfilling	Ls	1	180,000,000	31,857,000	2,123,914,000	34,807,000	L1-1-1-2 Work
Other Miscellaneous. Work	15% of Work	Ls	1	0	7,176,150	437,888,673	7,176,150	2
Total				4,420,968,160	67,193,150			
Total Cost (Rounded)	**to L1-1**			**4,420,968,000**	**67,193,000**	**8,521,085,000**	**139,644,000**	**L1-1-1**
	FCP:LCP			52%	48%			

L1-1-1-1 On-shore Pipeline Civil Work

49000 Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Excavation	sandy soil	m^3	23,500	0	0	16.500	387,750	23,660,505	387,750	
Backfilling	excavated soil	m^3	16,700	0	0	11.000	183,700	11,209,374	183,700	
Surplus Soil Transport		m^3	6,800	0	0	23.100	157,080	9,585,022	157,080	
Foundation	Gravel	m^3	2,900	0	0	74.800	216,920	13,236,458	216,920	Material, Placing,
Sheet Pile	IV Type L=17m	ton	2,717	0	0	1760.000	4,781,920	291,792,758	4,781,920	purchase x 80% (scrap 20%) x
Sheet Pile Driving		pcs	2,100	0	0	280.500	589,050	35,943,831	589,050	
Sheet Pile Removal		pcs	2,100	0	0	56.100	117,810	7,188,766	117,810	20% of driving
Tie-rod, waling and H pile		ton	475	0	0	1536.700	729,933	44,540,512	729,933	purchase x 80% (scrap 20%)
Anchor Pile Driving	H300 L=12m	pcs	420	0	0	230.000	96,600	5,894,532	96,600	
Anchor Pile Removal		pcs	420	0	0	46.000	19,320	1,178,906	19,320	20% of driving
Tie-rod & waling Setting		ton	119	0	0	1560.000	185,640	11,327,753	185,640	
Tie-rod & waling Removal		ton	119	0	0	780.000	92,820	5,663,876	92,820	50% of driving
Total					0		7,558,543			
Total Cost (Rounded)	**to L1-1-1**				**0**		**7,559,000**	**461,250,000**	**7,559,000**	**L1-1-1-1**
	FCP:LCP				0%		100%			

L1-1-1-2 Off-shore Pipeline Civil Work

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Excavation	sandy soil	m^3	389,600	0	0	27.400	10,675,040	651,390,941	10,675,040	
Backfilling	excavated soil	m^3	288,000	0	0	27.400	7,891,200	481,521,024	7,891,200	
Surplus Soil Transport		m^3	101,600	0	0	9.800	995,680	60,756,394	995,680	
Foundation Material & Placing	Gravel	m^3	28,300	0	0	96.000	2,716,800	165,779,136	2,716,800	
Foundation Levelling	Gravel	m^2	40,400	0	0	92.100	3,720,840	227,045,657	3,720,840	
Armour Stone	Rubble Stone	m^3	55,600	0	0	94.100	5,231,960	319,254,199	5,231,960	
Turbid Water Protection Barrier	floating silt curtains	lot	1	180,000,000	180,000,000	327,761.390	327,761	200,000,000	3,277,614	
Artificial Reef	Concrete Blocks	lot	1	0	0	297,922.000	297,922	18,179,200	297,922	
Total					180,000,000		31,857,203			
Total Cost (Rounded)	**to L1-1-1**				**180,000,000**		**31,857,000**	**2,123,914,000**	**34,807,000**	**L1-1-1-2**
	FCP:LCP				8%		92%			

L1-1-2 Intake Pit

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Pile driving work	300×300, L = 10m Including Materials	m	740	0	0	77.000	56,980	3,476,920	56,980	74pcs x 10m
Pile Head Treatment	300x300	pcs	74	0	0	4.400	326	19,893	326	
Excavation		m^3	10,660	0	0	16.500	175,890	10,732,808	175,890	
Backfilling		m^3	3,065	0	0	11.000	33,715	2,057,289	33,715	
Surplus Soil Transport		m^3	7,595	0	0	23.100	175,445	10,705,654	175,445	
Gravel		m^3	171	0	0	74.800	12,791	780,507	12,791	
Lean Concrete		m^3	86	0	0	440.000	37,840	2,308,997	37,840	
Reinforced Concrete		m^3	3,070	0	0	935.000	2,870,450	175,154,859	2,870,450	
Formwork		m^2	4,063	0	0	62.700	254,750	15,544,845	254,750	
Rebar Fabrication and Assembly		ton	614	0	0	1,320.000	810,480	49,455,490	810,480	200kg/m3
Sheet Pile Driving	Type IV 17m	pcs	340	0	0	280.500	95,370	5,819,477	95,370	
Sheet Pile removing	Type IV 17m	pcs	340	0	0	56.100	19,074	1,163,895	19,074	20% of driving
Sheet Pile	Type IV 17m	ton	440	0	0	0.000	0	0	0	reuse of sheet pile used for on-shore pipe civil work
Waling and Strut Installation	H300*300*10*15	ton	118	0	0	1,430.000	168,740	10,296,515	168,740	
Waling and Strut Removal	H300*300*10*15	ton	118	0	0	715.000	84,370	5,148,257	84,370	
Waling & Strut	H300*300*10*15	ton	118	0	0	286.000	33,748	2,059,303	33,748	purchase x 20%
Other Miscellaneous Work	25% of Structure Work	Ls	1		0		1,207,492	73,681,162	1,207,492	
Total					0		6,037,461			
Total Cost (Rounded)	**to L1-1**				**0**		**6,037,000**	**368,378,000**	**6,037,000**	**L1-1-2**
	FCP:LCP				0%		100%			

L1-1-3 Outfall Pit

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Pile driving work	300×300, L = 10m Including Materials	m	180	0	0	77.000	13,860	845,737	13,860	18pcs x 10m
Pile Head Treatment	300x300	pcs	18	0	0	4.400	79	4,821	79	
Excavation		m^3	2,853	0	0	16.500	47,075	2,872,517	47,075	
Backfilling		m^3	1,237	0	0	11.000	13,607	830,299	13,607	
Surplus Soil Transport		m^3	1,616	0	0	23.100	37,330	2,277,877	37,330	
Gravel		m^3	41	0	0	74.800	3,067	187,148	3,067	
Lean Concrete		m^3	20	0	0	440.000	8,800	536,976	8,800	
Reinforced Concrete		m^3	778	0	0	935.000	727,430	44,387,779	727,430	
Formwork		m^2	1,265	0	0	62.700	79,316	4,839,862	79,316	
Rebar Fabrication and Assembly		ton	156	0	0	1,320.000	205,920	12,565,238	205,920	200kg/m3
Sheet Pile Driving	Type IV 17m	pcs	189	0	0	280.500	53,015	3,234,975	53,015	
Sheet Pile removing	Type IV 17m	pcs	189	0	0	56.100	10,603	646,995	10,603	20% of driving
Sheet Pile	Type IV 17m	ton	245	0	0	0.000	0	0	0	reuse of sheet pile used for on-shore pipe civil work
Waling and Strut Installation	H300*300*10*15	ton	28	0	0	1,430.000	40,040	2,443,241	40,040	
Waling and Strut Removal	H300*300*10*15	ton	28	0	0	715.000	20,020	1,221,620	20,020	
Waling & Strut	H300*300*10*15	ton	28	0	0	286.000	8,008	488,648	8,008	purchase x 20%
Other Miscellaneous Work	25% of Structure Work	Ls	1		0		317,043	19,345,964	317,043	
Total					0		1,585,213			
Total Cost (Rounded)	**to L1-1**				**0**		**1,585,000**	**96,717,000**	**1,585,000**	**L1-1-3**
	FCP:LCP				0%		100%			

L1-2 Desalination Plant

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Foundation		Ls	1		0		4,817,000	293,933,000	4,817,000	L1-2-1
Buildings		Ls	1		774,904,000		39,576,000	3,189,832,000	52,275,000	L1-2-2
Desalination Plant		Ls	1		6,661,213,000		18,819,000	7,809,548,000	127,983,000	L1-2-3
Filtered Water Tank	15mx50mx5mH	Ls	1		0		1,737,000	105,992,000	1,737,000	L1-2-4
Drain Tank	15m38mx5mH	Ls	1		0		1,316,000	80,302,000	1,316,000	L1-2-5
Brine Tank	12mx40mx5mH	Ls	1		0		1,132,000	69,075,000	1,132,000	L1-2-6
Water Reservoir	V=5,000m3 x 5	Ls	1		0		10,640,000	649,253,000	10,640,000	L1-2-7
In-yard Pipe		Ls	1		0		2,145,000	130,888,000	2,145,000	L1-2-8
Electrical Facilities		Ls	1		1,348,925,000		3,902,000	1,587,025,000	26,008,000	L1-2-9
Total					8,785,042,000		84,084,000			
Total Cost (Rounded)	**to L1**				**8,785,042,000**		**84,084,000**	**13,915,848,000**	**228,054,000**	**L1-2**
	FCP:LCP				63%		37%			

L1-2-1 Foundation for Equipment

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Foundation										
Dual Media & Polishing Filter	18x70x0.3m height		4							
Pile Driving Work	500×500, L = 10m Including Materials	m	2,500	0	0	110.000	275,000	16,780,500	275,000	L=250pcs×10m
Pile Head Treatment	500×500	pcs	250	0	0	6.600	1,650	100,683	1,650	
Reinforced Concrete		m^3	1,512	0	0	935.000	1,413,720	86,265,194	1,413,720	
Formwork		m^2	53	0	0	62.700	3,323	202,776	3,323	
Rebar Fabrication and Assembly		ton	257	0	0	1,320.000	339,293	20,703,647	339,293	Rebar/Concrete = 170kg/m3
Cartridge Filter	3x6x0.3m height		4							
Reinforced Concrete		m^3	22	0	0	935.000	20,570	1,255,181	20,570	
Formwork		m^2	6	0	0	62.700	376	22,956	376	
Rebar Fabrication and Assembly		ton	4	0	0	1,320.000	4,937	301,244	4,937	Rebar/Concrete = 170kg/m3
High Pressure Pump	3x8x0.3m height		4							
Reinforced Concrete		m^3	29	0	0	935.000	27,115	1,654,557	27,115	
Formwork		m^2	7	0	0	62.700	439	26,782	439	
Rebar Fabrication and Assembly		ton	5	0	0	1,320.000	6,508	397,094	6,508	Rebar/Concrete = 170kg/m3
RO system	6x10x0.3m height		4							
Reinforced Concrete		m^3	72	0	0	935.000	67,320	4,107,866	67,320	
Formwork		m^2	10	0	0	62.700	627	38,260	627	
Rebar Fabrication and Assembly		ton	12	0	0	1,320.000	16,157	985,888	16,157	Rebar/Concrete = 170kg/m3
Ground levelling		m^3	200,000	0	0	13.200	2,640,000	161,092,800	2,640,000	
Total					0		4,817,034			
Total Cost (Rounded)	**to L1-2**				**0**		**4,817,000**	**293,933,000**	**4,817,000**	**L1-2-1**
	FCP:LCP				0%		100%			

L1-2-2 Building (Desalination Plant)

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Pre-treatment system Building										
Structure	130x80x7.5m height	m^2	10,400	24,667	256,536,800	1155.000	12,012,000	989,509,040	16,216,143	Structure
overhead crane& misc. work		Ls	1		128,268,400		6,006,000	494,754,520	8,108,071	Structure x 50%
waterproofing		m^2	10,400	0	0	42.900	446,160	27,224,683	446,160	
Pile Driving Work	500×500, L = 20m Including Materials	m	11,560	0	0	110.000	1,271,600	77,593,032	1,271,600	L=578pcs×20m
Pile Head Treatment	500×500	pcs	578	0	0	6.600	3,815	232,779	3,815	
sub-total					**384,805,200**		**19,739,575**	**1,589,314,054**	**26,045,789**	
RO system Building										
Structure	630x86x12m height	m^2	5,418	24,667	133,645,806	1155.000	6,257,790	515,496,152	8,447,987	Structure
overhead crane& misc. work		Ls	1		66,822,903		3,128,895	257,748,076	4,223,993	Structure x 50%
waterproofing		m^2	5,418	0	0	42.900	232,432	14,183,013	232,432	
Pile Driving Work	500×500, L = 20m Including Materials	m	6,020	0	0	110.000	662,200	40,407,444	662,200	L=301pcs×20m
Pile Head Treatment	500×500	pcs	301	0	0	6.600	1,987	121,222	1,987	
sub-total					**200,468,709**		**10,283,304**	**827,955,907**	**13,568,599**	

L1-2-2 Building (Desalination Plant)

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Administration Building										
Structure	16x40x8m height	m^2	1,800	49,335	88,803,000	2310.000	4,158,000	342,524,160	5,613,310	three stories 200%
Pile Driving Work	500×500, L = 20m Including Materials	m	840	0	0	110.000	92,400	5,638,248	92,400	L=42pcs×20m
Pile Head Treatment	500×500	pcs	42	0	0	6.600	277	16,915	277	
sub-total					**88,803,000**		**4,250,677**	**348,179,323**	**5,705,987**	
Warehouse Building										
Structure	50x20x5m height	m^2	1,000	19,981	19,981,000	990.000	990,000	80,390,800	1,317,450	Structure
overhead crane& misc. work		Ls	1		9,990,500		495,000	40,195,400	658,725	Structure x 50%
ground improvement	1m x 100kg/m3	m^3	1,000	0	0	41.000	41,000	2,501,820	41,000	
sub-total					**29,971,500**		**1,526,000**	**123,088,020**	**2,017,175**	
GIS Sub-station Building										
Structure-1	15x11x7.5m height	m^2	165	24,667	4,070,055	1155.000	190,575	15,698,942	257,275	Structure
overhead crane& misc. work	for Structure 1	Ls	1		2,035,028		95,288	7,849,471	128,638	Structure x 50%
Structure-2	(15x20+7x20)x5m height	m^2	440	24,667	10,853,480	1155.000	508,200	41,863,844	686,068	
waterproofing		m^2	605	0	0	42.900	25,955	1,583,744	25,955	
Pile Driving Work	500×500, L = 20m Including Materials	m	680	0	0	110.000	74,800	4,564,296	74,800	L=34pcs×20m
Pile Head Treatment	500×500	pcs	34	0	0	6.600	224	13,693	224	
sub-total					**16,958,563**		**895,041**	**71,573,989**	**1,172,960**	

L1-2-2 Building (Desalination Plant)

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Intake Sub-station Building										
Structure	36x24x5m height	m^2	864	24,667	21,312,288	1155.000	997,920	82,205,366	1,347,187	
waterproofing		m^2	864	0	0	42.900	37,066	2,261,743	37,066	
Pile Driving Work	500×500, L = 20m Including Materials	m	960	0	0	110.000	105,600	6,443,712	105,600	L=48pcs×20m
Pile Head Treatment	500×500	pcs	48	0	0	6.600	317	19,331	317	
sub-total					**21,312,288**		**1,140,902**	**90,930,152**	**1,490,170**	
RO Sub-station Building										
Structure	54x24x5m height	m^2	1,296	24,667	31,968,432	1155.000	1,496,880	123,308,050	2,020,781	
waterproofing		m^2	1,296	0	0	42.900	55,598	3,392,614	55,598	
Pile Driving Work	500×500, L = 20m Including Materials	m	1,440	0	0	110.000	158,400	9,665,568	158,400	L=72pcs×20m
Pile Head Treatment	500×500	pcs	72	0	0	6.600	475	28,997	475	
sub-total					**31,968,432**		**1,711,354**	**136,395,229**	**2,235,254**	
Gate Keeper House	**5x5x4m height**	**m^2**	**25**	**24,667**	**616,675**	**1155.000**	**28,875**	**2,378,628**	**38,981**	
Total					774,904,367		39,575,728			
Total Cost (Rounded)	**to L1-2**				**774,904,000**		**39,576,000**	**3,189,832,000**	**52,275,000**	**L1-2-2**
	FCP:LCP				24%		76%			

L1-2-3 Desalination Plant

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= #######

Items	Specification	Unit	Qt'ty	FC Portion (JPY)	LC Portion (TND)	Total		Reference
						(JPY)	(equiv. TND)	
Pre-treatment system								
Feed Pump		units	5	142,500,000	122,900	149,999,358	2,458,200	
Backwash Pump		units	3	26,600,000	22,900	27,997,358	458,823	
Air wash Blower		units	3	4,800,000	4,100	5,050,182	82,763	
Drain Pump		units	2	142,500,000	122,900	149,999,358	2,458,200	
Dual media Filter		units	24	931,000,000	803,000	979,999,060	16,060,293	
Polishing Filter		units	16	617,500,000	532,600	649,999,252	10,652,233	
Valves		Ls	1	216,600,000	186,800	227,998,536	3,736,456	
Pipes		Ls	1	456,000,000	393,300	479,999,166	7,866,260	
sub-total				**2,537,500,000**	**2,188,500**	**2,671,042,270**	**43,773,228**	
RO system								
RO Feed Pump		units	5	142,500,000	122,900	149,999,358	2,458,200	
Cartridge Filter		units	10	78,000,000	67,300	82,106,646	1,345,569	
Booster Pump		units	6	110,200,000	95,100	116,003,002	1,901,065	
High Pressure Pump		units	5	456,000,000	393,300	479,999,166	7,866,260	
Pressure Exchanger Unit		units	4	330,600,000	285,200	348,002,904	5,703,096	

L1-2-3 Desalination Plant

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= #######

Items	Specification	Unit	Qt'ty	FC Portion (JPY)	LC Portion (TND)	Total (JPY)	Total (equiv. TND)	Reference
RO Unit		Ls	1	1,121,000,000	966,900	1,180,000,238	19,337,926	
Chemical dosing system (Pre-treatment)		Ls	1	15,500,000	13,400	16,317,668	267,415	NaClO, FeCl3
Chemical dosing system (After-treatment)		Ls	1	17,800,000	15,400	18,739,708	307,108	
Cleaning Pump		units	2	19,000,000	16,400	20,000,728	327,773	
Valves		Ls	1	173,000,000	149,200	182,104,184	2,984,336	
Pipes		Ls	1	332,500,000	286,800	350,000,536	5,735,833	
Stages		Ls	1	97,000,000	83,700	102,107,374	1,673,343	
sub-total				**2,893,100,000**	**2,495,600**	**3,045,381,512**	**49,907,924**	
Electrical system								
Panels for pre-treatment		Ls	1	86,000,000	74,200	90,527,684	1,483,574	
Panels for RO		Ls	1	340,000,000	293,300	357,897,166	5,865,244	
Panels for others		Ls	1	140,000,000	120,800	147,371,216	2,415,130	
Instruments		Ls	1	232,500,000	200,500	244,734,510	4,010,726	
sub-total				**798,500,000**	**688,800**	**840,530,576**	**13,774,674**	

L1-2-3 Desalination Plant

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= #######

Items	Specification	Unit	Qt'ty	FC Portion (JPY)	LC Portion (TND)	Total (JPY)	Total (equiv. TND)	Reference
Engineering Work								
Mechanical design		Ls	1	137,000,000	0	137,000,000	2,245,166	
Electrical design		Ls	1	90,000,000	0	90,000,000	1,474,926	
sub-total				**227,000,000**	**0**	**227,000,000**	**3,720,092**	
Installation								
Mechanical for pre-treatment		Ls	1	80,131,000	5,252,800	400,656,856	6,565,992	15% of Pre-treatment system
Mechanical for RO		Ls	1	91,361,000	5,989,000	456,809,780	7,486,230	15% of RO system
Electrical installation		Ls	1	33,621,000	2,203,900	168,102,978	2,754,883	20% of RO system
sub-total				**205,113,000**	**13,445,700**	**1,025,569,614**	**16,807,105**	
Total				6,661,213,000	18,818,600			
Total Cost (Rounded)	**to L1-2**			**6,661,213,000**	**18,819,000**	**7,809,548,000**	**127,983,000**	**L1-2-3**
	FCP:LCP			85%	15%			

L1-2-4 Break Tank 15mx50mx5mH (V=3,000m3) Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Pile Driving Work	500×500, L = 30m Including Materials	m	1,080	0	0	110.000	118,800	7,249,176	118,800	L=36pcs×30m
Pile Head Treatment	500×500	pcs	36	0	0	6.600	238	14,498	238	
Excavation		m^3	530	0	0	16.500	8,745	533,620	8,745	
Backfilling		m^3	80	0	0	11.000	880	53,698	880	
Surplus Soil Transportation		m^3	450	0	0	23.100	10,395	634,303	10,395	
Gravel		m^3	75	0	0	74.700	5,603	341,865	5,603	
Concrete		m^3	75	0	0	440.000	33,000	2,013,660	33,000	1
Reinforced Concrete		m^3	889	0	0	935.000	831,215	50,720,739	831,215	2
Formwork		m^2	2,230	0	0	62.700	139,821	8,531,877	139,821	3
Rebar Fabrication and Assembly		ton	151	0	0	1,320.000	199,492	12,172,977	199,492	4 Rebar/Concrete = 170kg/m3
Waterproofing		m^2	1,400	0	0	42.900	60,060	3,664,861	60,060	
Scaffolding		m^2	260	0	0	107.800	28,028	1,710,269	28,028	
Other Miscellaneous works		Ls	1		0		300,882	18,359,814	300,882	sum of (1~4) x 25%
Total					0		1,737,158			
Total Cost (Rounded)	**to L1-2**				**0**		**1,737,000**	**105,992,000**	**1,737,000**	**L1-2-4**
	FCP:LCP				0%		100%			

L1-2-5 Drain Tank 15mx38mx5mH

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Pile Driving Work	500×500, L = 30m Including Materials	m	780	0	0	110.000	85,800	5,235,516	85,800	L=26pcs×30m
Pile Head Treatment	500×500	pcs	26	0	0	6.600	172	10,471	172	
Excavation		m^3	408	0	0	16.500	6,732	410,787	6,732	
Backfilling		m^3	66	0	0	11.000	726	44,301	726	
Surplus Soil Transportation		m^3	342	0	0	23.100	7,900	482,070	7,900	
Gravel		m^3	57	0	0	74.700	4,258	259,817	4,258	
Concrete		m^3	57	0	0	440.000	25,080	1,530,382	25,080	1
Reinforced Concrete		m^3	668	0	0	935.000	624,580	38,111,872	624,580	2
Formwork		m^2	1,790	0	0	62.700	112,233	6,848,458	112,233	3
Rebar Fabrication and Assembly		ton	114	0	0	1320.000	149,899	9,146,849	149,899	4 Rebar/Concrete = 170kg/m3
Waterproofing		m^2	1,100	0	0	42.900	47,190	2,879,534	47,190	
Scaffolding		m^2	220	0	0	107.800	23,716	1,447,150	23,716	
Other Miscellaneous Works		Ls	1		0		227,948	13,909,390	227,948	sum of (1~4) x 25%
Total					0		1,316,234			
Total Cost (Rounded)	**to L1-2**				**0**		**1,316,000**	**80,302,000**	**1,316,000**	**L1-2-5**
	FCP:LCP				0%		100%			

L1-2-6 Brine Tank 12mx40mx5mH

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Pile Driving Work	500×500, L = 30m Including Materials	m	540	0	0	110.000	59,400	3,624,588	59,400	L=18pcs×30m
Pile Head Treatment	500×500	pcs	18	0	0	6.600	119	7,249	119	
Excavation		m^3	353	0	0	16.500	5,825	355,411	5,825	
Backfilling		m^3	65	0	0	11.000	715	43,629	715	
Surplus Soil Transportation		m^3	288	0	0	23.100	6,653	405,954	6,653	
Gravel		m^3	48	0	0	74.700	3,586	218,793	3,586	
Concrete		m^3	48	0	0	440.000	21,120	1,288,742	21,120	1
Reinforced Concrete		m^3	576	0	0	935.000	538,560	32,862,931	538,560	2
Formwork		m^2	1,640	0	0	62.700	102,828	6,274,565	102,828	3
Rebar Fabrication and Assembly		ton	98	0	0	1,320.000	129,254	7,887,103	129,254	4 Rebar/Concrete = 170kg/m3
Waterproofing		m^2	1,000	0	0	42.900	42,900	2,617,758	42,900	
Scaffolding		m^2	210	0	0	107.800	22,638	1,381,371	22,638	
Other Miscellaneous Works		Ls	1		0		197,941	12,078,335	197,941	sum of (1~4) x 25%
Total					0		1,131,538			
Total Cost (Rounded)	**to L1-2**				**0**		**1,132,000**	**69,075,000**	**1,132,000**	**L1-2-6**
	FCP:LCP				0%		100%			

L1-2-7 Product Water Tank (V=5,000m3 x 5) Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amoun	Unit Price	Amount	(JPY)	(equiv.	
Pile Driving Work	ϕ 500, L = 30m Including Materials	m	2,160	0	0	110.000	237,600	14,498,352	237,600	L=72pcs×30m
Pile Head Treatment	ϕ 500	pcs	72	0	0	6.600	475	28,997	475	
Excavation		m^3	2,036	0	0	16.500	33,594	2,049,906	33,594	
Backfilling		m^3	428	0	0	11.000	4,708	287,282	4,708	
Surplus Soil Transportation		m^3	1,608	0	0	23.100	37,145	2,266,576	37,145	
Gravel		m^3	241	0	0	74.700	18,003	1,098,525	18,003	
Concrete		m^3	161	0	0	440.000	70,840	4,322,657	70,840	1
Reinforced Concrete		m^3	930	0	0	935.000	869,550	53,059,941	869,550	2
Formwork		m^2	3,500	0	0	62.700	219,450	13,390,839	219,450	3
Rebar Fabrication and Assembly		ton	158	0	0	1,320.000	208,692	12,734,386	208,692	4 Rebar/Concrete = 170kg/m3
Waterproofing		m^2	1,500	0	0	42.900	64,350	3,926,637	64,350	
Scaffolding		m^2	200	0	0	107.800	21,560	1,315,591	21,560	
Other Miscellaneous Works		Ls	1		0		342,133	20,876,956	342,133	sum of (1~4) x 25%
Total Cost/1unit					0		2,128,100			
Total Cost/5units					0		10,640,499			
Total Cost (Rounded)	**to L1-2**				**0**		**10,640,000**	**649,253,000**	**10,640,000**	**L1-2-7 for 5 units**
	FCP:LCP				0%		100%			

L1-2-8 In-Yard Pipelines

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Diameter(mm)	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
1200	HDPE	m	250	0	0	1,481	370,250	22,592,655	370,250	Local Market
1400	HDPE	m	420	0	0	1,906	800,688	48,857,982	800,688	Local Market
1800	HDPE	m	320	0	0	3,045	974,400	59,457,888	974,400	Local Market
including materials and works										
Total					0		2,145,338			
Total Cost (Rounded)	**to L1-2**				**0**		**2,145,000**	**130,888,000**	**2,145,000**	**L1-2-8**
	FCP:LCP				0%		100%			

L1-2-9 Electrical Facility for Desalination Plant

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
150kV GIS Sub-station and Power Supply Facilities										GIS: Gas Insulated Switchgear
150kV Gas Insulated Switchgear		*lot*	*1*	*136,000,000*	*136,000,000*	*393,000*	*393,000*	*160,000,000*	*2,622,091*	1
Power Transformer	*oil type 40MVAx2*	*lot*	*1*	*255,000,000*	*255,000,000*	*737,000*	*737,000*	*300,000,000*	*4,916,421*	2
30kV Switchgear		*lot*	*1*	*42,500,000*	*42,500,000*	*123,000*	*123,000*	*50,000,000*	*819,403*	3
Power Cable		*lot*	*1*	*127,500,000*	*127,500,000*	*369,000*	*369,000*	*150,000,000*	*2,458,210*	4
Earthing System		*lot*	*1*	*8,500,000*	*8,500,000*	*25,000*	*25,000*	*10,000,000*	*163,881*	5
Control & Protection		*lot*	*1*	*170,000,000*	*170,000,000*	*492,000*	*492,000*	*200,000,000*	*3,277,614*	6
Other Miscellaneous Works		*lot*	*1*		*73,950,000*		*214,000*	*87,008,280*	*1,425,898*	*7. Sum of (1~6) x 10%*
150kV Sub-station total	**to Total**				**813,450,000**		**2,353,000**	**957,030,000**	**15,683,874**	**a. sum of (1~7)**
	FCP:LCP				85%		15%			
Intake Facilities Sub-station and Power Supply Facilities										
30kV Switchgear		**Ls**	**1**		**36,720,000**		**105,895**	**43,200,000**	**707,965**	**8**
30kV DS, LA Panel		*set*	*1*	*4,250,000*	*4,250,000*	*12,000*	*12,000*	*5,000,000*	*81,940*	DS: Disconnecting Switch LA: Lightning Arrester
30kV VT Panel		*set*	*1*	*4,250,000*	*4,250,000*	*12,000*	*12,000*	*5,000,000*	*81,940*	VT: Voltage Transformer
30kV VCB Panel		*set*	*1*	*7,225,000*	*7,225,000*	*20,895*	*20,895*	*8,500,000*	*139,299*	VCB: Vacuum Circuit Breaker
30kV/6kV Transformer	*oil type 4MVA*	*set*	*1*	*20,995,000*	*20,995,000*	*61,000*	*61,000*	*24,700,000*	*404,785*	
6kV & LV Switchgear		**Ls**	**1**		**128,945,000**		**372,327**	**151,700,000**	**2,486,070**	**9** LV: Low Voltage
6kV VCB Panel		*set*	*8*	*4,845,000*	*38,760,000*	*14,000*	*112,000*	*45,600,000*	*747,296*	
6kV VT Panel		*set*	*1*	*3,825,000*	*3,825,000*	*11,000*	*11,000*	*4,500,000*	*73,746*	
Intake Pump Panel	*6kV VFD 240kW*	*set*	*5*	*10,200,000*	*51,000,000*	*29,400*	*147,000*	*60,000,000*	*983,284*	VFD: Variable Frequency Drive
LV Transformer	*dry type 500kVA*	*set*	*1*	*7,225,000*	*7,225,000*	*21,000*	*21,000*	*8,500,000*	*139,299*	
LV Main Switchgear	*5 units*	*set*	*1*	*11,050,000*	*11,050,000*	*31,957*	*31,957*	*13,000,000*	*213,045*	

L1-2-9 Electrical Facility for Desalination Plant

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
MCC for Intake-1	*5 units*	*set*	*1*	*14,535,000*	*14,535,000*	*42,000*	*42,000*	*17,100,000*	*280,236*	MCC: Motor Control Centre
Local Panel		*set*	*10*	*255,000*	*2,550,000*	*737*	*7,370*	*3,000,000*	*49,164*	
Instrumentation & Monitoring		**Ls**	**1**		**62,985,000**		**182,636**	**74,100,000**	**1,214,356**	**10**
Intake Flow -1	*electro-magnetic 2000mm*	*set*	*2*	*11,305,000*	*22,610,000*	*32,694*	*65,388*	*26,600,000*	*435,923*	
Brine Discharge Flow -1	*electro-magnetic 1800mm*	*set*	*1*	*10,115,000*	*10,115,000*	*29,253*	*29,253*	*11,900,000*	*195,018*	
Water Level	*Ultrasonic*	*set*	*2*	*680,000*	*1,360,000*	*1,967*	*3,934*	*1,600,000*	*26,221*	
Water Quality	*Turbidity, pH, Electric Conductivity*	*set*	*3*	*1,275,000*	*3,825,000*	*3,687*	*11,061*	*4,500,000*	*73,746*	
Instrumentation Panel		*set*	*1*	*2,550,000*	*2,550,000*	*7,000*	*7,000*	*3,000,000*	*49,164*	
PLC Panel		*set*	*2*	*6,375,000*	*12,750,000*	*18,500*	*37,000*	*15,000,000*	*245,821*	PLC: Programmable Logic Controller
Remote SCADA		*set*	*1*	*8,500,000*	*8,500,000*	*25,000*	*25,000*	*10,000,000*	*163,881*	
UPS	*10kVA*	*set*	*1*	*1,275,000*	*1,275,000*	*4,000*	*4,000*	*1,500,000*	*24,582*	UPS: Uninterruptive Power Supply
Other Miscellaneous Works		**Ls**	**1**		**22,865,000**		**66,000**	**26,892,320**	**440,713**	**11 Sum of (8~10) x 10%**
Intake Sub-station total	**to Total**				**251,515,000**		**726,858**	**295,868,000**	**4,848,705**	**b. sum of (8~11)**
	FCP:LCP				85%		15%			
RO Facilities Sub-station and Power Supply Facilities										
30kV Switchgear		**Ls**	**1**		**124,950,000**		**361,790**	**147,000,000**	**2,409,046**	**12**
30kV DS, LA Panel		*set*	*2*	*4,250,000*	*8,500,000*	*12,500*	*25,000*	*10,000,000*	*163,881*	
30kV VT Panel		*set*	*2*	*4,250,000*	*8,500,000*	*12,500*	*25,000*	*10,000,000*	*163,881*	
30kV VCB Panel		*set*	*2*	*7,225,000*	*14,450,000*	*20,895*	*41,790*	*17,000,000*	*278,597*	
30kV/6kV Transformer	*oil type 15MVA*	*set*	*2*	*46,750,000*	*93,500,000*	*135,000*	*270,000*	*110,000,000*	*1,802,688*	
6kV & LV Switchgear		**Ls**	**1**		**80,495,000**		**232,957**	**94,700,000**	**1,551,950**	**13**
6kV VCB Panel		*set*	*11*	*4,845,000*	*53,295,000*	*14,000*	*154,000*	*62,700,000*	*1,027,532*	

L1-2-9 Electrical Facility for Desalination Plant

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
6kV VT Panel		*set*	*2*	*3,825,000*	*7,650,000*	*11,000*	*22,000*	*9,000,000*	*147,493*	
LV Transformer	*dry type 250kVA*	*set*	*2*	*4,250,000*	*8,500,000*	*12,500*	*25,000*	*10,000,000*	*163,881*	
LV Main Switchgear	*5 units*	*set*	*1*	*11,050,000*	*11,050,000*	*31,957*	*31,957*	*13,000,000*	*213,045*	
Other Miscellaneous Works		**Ls**	**1**		**20,545,000**		**59,000**	**24,145,180**	**395,693**	**14 Sum of (12,13) x 10%**
RO Facilities Sub-station total	**to Total**	**Ls**	**1**		**225,990,000**		**653,747**	**265,881,642**	**4,357,287**	**c. sum of (12~14)**
	FCP:LCP				85%		15%			
SCADA System										
Central SCADA		*lot*	*1*	*29,750,000*	*29,750,000*	*86,000*	*86,000*	*35,000,000*	*573,582*	15
PLC for RO		*lot*	*1*	*12,750,000*	*12,750,000*	*37,000*	*37,000*	*15,000,000*	*245,821*	16
Remote SCADA for RO		*lot*	*1*	*8,500,000*	*8,500,000*	*25,000*	*25,000*	*10,000,000*	*163,881*	17
UPS	*20kVA*	*set*	*1*	*1,700,000*	*1,700,000*	*5,000*	*5,000*	*2,000,000*	*32,776*	18
Other Miscellaneous Works		*Ls*	*1*		*5,270,000*		*15,000*	*6,185,300*	*101,365*	*19 Sum of (15~18) x 10%*
SCADA System total	**to Total**	**Ls**	**1**		**57,970,000**		**168,000**	**68,221,360**	**1,118,016**	**d. sum of (15~19)**
	FCP:LCP				85%		15%			
Total					1,348,925,000		3,901,605			sum of (a,b,c,d)
Total Cost (Rounded)	**to L1-2**				**1,348,925,000**		**3,902,000**	**1,587,025,000**	**26,008,000**	**L1-2-9**
	FCP:LCP				85%		15%			

L1-3 Transmission Pump Facility

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Buildings		Ls	1		64,234,000		3,378,000	270,360,000	4,431,000	L1-3-1
Mechanical Facilities		Ls	1		269,897,000		780,000	317,493,000	5,203,000	L1-3-2
Electrical Facilities		Ls	1		404,809,000		1,169,000	476,141,000	7,803,000	L1-3-3
Total					738,940,000		5,327,000			
Total Cost (Rounded)	**to L1**				**738,940,000**		**5,327,000**	**1,063,994,000**	**17,437,000**	**L1-3**
	FCP:LCP				69%		31%			

L1-3-1 Building (Transmission Pump House)

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Transmission Pump House										
Structure	51.8x19.2x5.8m height	m^2	995	24,667	24,543,998	1155.000	1,149,225	94,669,708	1,551,454	Structure
Miscellaneous work		Ls	1		4,908,800		229,845	18,933,942	310,291	Structure x 20%
waterproofing		m^2	995	0	0	42.900	42,686	2,604,669	42,686	
Pile Driving Work	500×500, L = 20m Including Materials	m	1,120	0	0	110.000	123,200	7,517,664	123,200	L=56pcs×20m
Pile Head Treatment	500×500	pcs	56	0	0	6.600	370	22,553	370	
sub-total				**0**	**29,452,798**		**1,545,325**	**123,748,536**	**2,028,001**	
Transmission Sub-station Building										
Structure	36x24x5m height	m^2	864	24,667	21,312,577	1155.000	997,920	82,205,656	1,347,192	
waterproofing		m^2	864	0	0	42.900	37,066	2,261,743	37,066	
Pile Driving Work	500×500, L = 20m Including Materials	m	960	0	0	110.000	105,600	6,443,712	105,600	L=48pcs×20m
Pile Head Treatment	500×500	pcs	48	0	0	6.600	317	19,331	317	
sub-total					**21,312,577**		**1,140,586**	**90,911,111**	**1,489,858**	
Generator Building										
Structure		m^2	364	24,667	8,978,910	1155.000	420,420	34,632,938	567,567	Structure
over head crane& misc.		Ls	1		4,489,455		210,210	17,316,469	283,784	Structure x 50%
waterproofing		m^2	364	0	0	42.900	15,616	952,864	15,616	
Pile Driving Work	500×500, L = 20m Including Materials	m	420	0	0	110.000	46,200	2,819,124	46,200	L=21pcs×20m
Pile Head Treatment	500×500	pcs	21	0	0	6.600	139	8,457	139	
sub-total					**13,468,365**		**692,584**	**55,729,853**	**913,306**	
Total					64,233,740		3,378,495			
Total Cost (Rounded)	**to L1-3**				**64,234,000**		**3,378,000**	**270,360,000**	**4,431,000**	**L1-3-1**
	FCP:LCP				24%		76%			

L1-3-2 Mechanical Facility for Transmission Pump (100,000 m3/d) Exchange Rate: 1.00US$= 119.60JPY 1.000TND= #######

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Transmission pump station	**Plant Site - PK11**									
Transmission Pump	34.8m3/min x 95m	set	3	57,962,000	173,886,000	167,600	502,800	204,566,856	3,352,456	
Suction Valve	Dia. 500mm	set	3	1,845,000	5,535,000	5,300	15,900	6,505,218	106,608	
Check Valve	Dia. 500mm	set	3	2,769,000	8,307,000	8,000	24,000	9,771,480	160,136	
Discharge Valve	Dia. 500mm	set	3	3,668,000	11,004,000	10,600	31,800	12,944,436	212,134	Motorized
Maintenance Valve	Dia. 500mm	set	3	1,845,000	5,535,000	5,300	15,900	6,505,218	106,608	
Maintenance Valve	Dia. 1400 mm	set	2	5,477,000	10,954,000	15,800	31,600	12,882,232	211,115	Butterfly Valve
Pump Lifting Equipment	suspension crane: 5 ton	set	1	19,472,000	19,472,000	56,300	56,300	22,907,426	375,408	
Pipes		lot	1	35,204,000	35,204,000	101,800	101,800	41,415,836	678,726	
Total					269,897,000		780,100			
Total Cost (Rounded)	**to L1-3**				**269,897,000**		**780,000**	**317,493,000**	**5,203,000**	**L1-3-2**
	FCP:LCP				85%		15%			

L1-3-3 Electrical Facility for Transmission Pump

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Transmission Sub-station and Power Supply Facilities										
30kV Switchgear		**Ls**	**1**		**49,725,000**		**142,895**	**58,500,000**	**958,702**	**1**
30kV DS, LA Panel		*set*	*1*	*4,250,000*	*4,250,000*	*12,000*	*12,000*	*5,000,000*	*81,940*	DS: Disconnecting Switch LA: Lightning Arrester
30kV VT Panel		*set*	*1*	*4,250,000*	*4,250,000*	*12,000*	*12,000*	*5,000,000*	*81,940*	VT: Voltage Transformer
30kV VCB Panel		*set*	*1*	*7,225,000*	*7,225,000*	*20,895*	*20,895*	*8,500,000*	*139,299*	VCB: Vacuum Circuit Breaker
30kV/6kV Transformer	*oil type 10MVA*	*set*	*1*	*34,000,000*	*34,000,000*	*98,000*	*98,000*	*40,000,000*	*655,523*	
6kV & LV Switchgear		**Ls**	**1**		**142,587,500**		**412,327**	**167,750,000**	**2,150,115**	**2** LV: Low Voltage
6kV VCB Panel		*set*	*6*	*4,845,000*	*29,070,000*	*14,000*	*84,000*	*34,200,000*	*560,472*	
6kV VT Panel		*set*	*1*	*3,825,000*	*3,825,000*	*11,000*	*11,000*	*4,500,000*	*73,746*	
Transmission Pump Panel		*set*	*3*	*23,800,000*	*71,400,000*	*68,667*	*206,000*	*84,000,000*	*1,376,598*	VFD: Variable Frequency Drive
LV Transformer	*dry type 500kVA*	*set*	*1*	*7,225,000*	*7,225,000*	*21,000*	*21,000*	*8,500,000*	*139,299*	
LV Main Switchgear	*5 units*	*set*	*1*	*11,050,000*	*11,050,000*	*31,957*	*31,957*	*13,000,000*	*213,045*	
MCC for Transmission-1	*6 units*	*set*	*1*	*17,467,500*	*17,467,500*	*51,000*	*51,000*	*20,550,000*	*336,775*	MCC: Motor Control Centre
Local Panel		*set*	*10*	*255,000*	*2,550,000*	*737*	*7,370*	*3,000,000*	*49,164*	
Instrumentation & Monitoring		**Ls**	**1**		**41,395,000**		**119,717**	**48,700,000**	**363,814**	**3**
Transmission Flow	*electro-magnetic 1400mm*	*set*	*1*	*7,820,000*	*7,820,000*	*22,616*	*22,616*	*9,200,000*	*150,770*	
Water Level	*Ultrasonic*	*set*	*5*	*680,000*	*3,400,000*	*1,967*	*9,835*	*4,000,000*	*65,552*	
Water Quality	*Turbidity, pH, Res. Chlorine*	*set*	*4*	*1,275,000*	*5,100,000*	*3,687*	*14,748*	*6,000,000*	*98,328*	
Instrumentation Panel		*set*	*1*	*2,550,000*	*2,550,000*	*7,375*	*7,375*	*3,000,000*	*49,164*	
PLC Panel		*set*	*2*	*6,375,000*	*12,750,000*	*18,437*	*36,874*	*15,000,000*	*245,821*	Programmable Logic Controller

L1-3-3 Electrical Facility for Transmission Pump

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Remote SCADA		*set*	*1*	*8,500,000*	*8,500,000*	*24,582*	*24,582*	*10,000,000*	*163,881*	
UPS	*10kVA*	*set*	*1*	*1,275,000*	*1,275,000*	*3,687*	*3,687*	*1,500,000*	*24,582*	UPS: Uninterruptive Power
Other Miscellaneous Works		**Ls**	**1**		**23,371,000**		**67,000**	**27,459,340**	**450,006**	**4 Sum of (1~3) x 10%**
Transmission Sub-station total	**to Total**	**Ls**	**1**		**257,078,500**		**741,939**	**302,351,618**	**4,954,959**	**a. sum of (1~4)**
	FCP:LCP				85%		15%			
Emergency Power Facilities										
Stand-by Generator	*Diesel 2000kVA*	*set*	*1*	*129,200,000*	*129,200,000*	*374,000*	*374,000*	*152,000,000*	*2,490,987*	*5*
DC Power		*set*	*2*	*1,275,000*	*2,550,000*	*3,500*	*7,000*	*3,000,000*	*49,164*	*6*
UPS	*10kVA*	*set*	*2*	*1,275,000*	*2,550,000*	*3,500*	*7,000*	*3,000,000*	*49,164*	*7*
Other Miscellaneous Works		*Ls*	*1*	*13,430,000*	*13,430,000*	*39,000*	*39,000*	*15,809,780*	*259,092*	*8 Sum of (5~7) x 10%*
Emergency Power Facilities total	**to Total**	**Ls**	**1**		**147,730,000**		**427,000**	**173,785,540**	**2,848,010**	**b. sum of (5~8)**
	FCP:LCP				85%		15%			
Total					404,808,500		1,168,939			a+b
Total Cost (Rounded)	**to L1-3**				**404,809,000**		**1,169,000**	**476,141,000**	**7,803,000**	**L1-3-3**
	FCP:LCP				85%		15%			

L1-4 Guarantee Test (for Desalination Plant for 12 Months)

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Power Cost	**provisional**	**month**	**12**	0	**0**	1,885,380	**22,625,000**	**1,380,578,000**	**22,625,008**	(Demand+Consumption) for 90,000m3/day in average
Chemicals	**provisional**	**month**	**12**	11,843,982	**142,128,000**	0	**0**	**142,128,000**	**2,329,204**	for 90,000m3/day in average
NaClO, FeCl3, Na2S2O5, Antiscalant, NaOH										
RO Membrane Unit Replacement		Ls	-	0	**0**	0	**0**	**0**	**0**	No charged replacement because of 3 years guarantee
Remuneration										
Foreign Engineer	5 persons	MM	30	2,412,500	72,375,000	0	0	72,375,000	1,186,087	Manager 12, Plant 12, Mech 2, Elec 2, Instrument 2
Local Engineer	2 persons	MM	24	0	0	13,500	324,000	19,770,480	324,000	Mechanical , Electrical
Support/Administrative Staff	30 persons	MM	360	0	0	10,000	3,600,000	219,672,000	3,600,000	8, guards 4, ope.supervisor 4, operator 8
sub-total					**72,375,000**		**3,924,000**	**311,817,480**	**5,110,087**	
Direct Cost										Accommodation and per diem, Travel for Foreign Engineer
International Travel		trip	5	700,000	3,500,000	0	0	3,500,000	57,358	
Accommodation & Per Diem of Foreign Engine		MM	30	0	0	8,000	240,000	14,644,800	240,000	
Accommodation & Per Diem of Local Engineer		MM	24	0	0	4,800	115,200	7,029,504	115,200	
Communication		M	12	0	0	1,000	12,000	732,240	12,000	
sub-total					**3,500,000**		**367,200**	**25,906,544**	**424,558**	
Total					218,003,000		26,916,200			
Total Cost (Rounded)	**to L1**				**218,003,000**		**26,916,000**	**1,860,417,000**	**30,489,000**	**L1-4**
	FCP:LCP				12%		88%			

L2-1 Transmission Pipe Material (1000mm & 1400mm) (ICB)

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Pipe Material	Dia 1000mm DIP	m	6,070	32,041	194,491,043	58.344	354,148	216,101,158	3,541,481	1. PK11 - PK10
Pipe Material	Dia 1400mm DIP	m	26,280	56,673	1,489,370,430	103.196	2,711,990	1,654,856,033	27,119,896	2. Plant - PK11
Pipe Fittings Material		Ls	1		505,158,442		919,841	561,287,157	9,198,413	Sum of (1 & 2) x 30%
Total					2,189,019,914		3,985,979			
Total (Rounded)	**to T1**				**2,189,020,000**		**3,986,000**	**2,432,246,000**	**39,860,000**	**L2-1**
	FCP:LCP				90%		10%			

L2-2 Transmission Pipe Material (Less than 1000mm）(ICB)

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Pipe Material	Dia 400mm DIP	m	2,860	7,677	21,955,005	13.978	39,978	24,394,451	399,778	1. PK11- Bou Merra
Pipe Material	Dia 800mm DIP	m	9,360	22,095	206,810,945	40.233	376,581	229,789,939	3,765,813	2. PK14 - Sidi Salah EH
Pipe Material	Dia 800mm DIP	m	4,810	22,095	106,277,847	40.233	193,521	118,086,496	1,935,210	3. PK10 - PK14
Pipe Fittings Material		Ls	1		100,513,139		183,024	111,681,266	1,830,240	Sum of (1~3) x 30%
Total					435,556,936		793,104			
Total (Rounded)	**to T1**				**435,557,000**		**793,000**	**483,946,000**	**7,931,000**	**L2-2**
	FCP:LCP				90%		10%			

L3 Valves Material (LCB)

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Air Valve Material	Dia 100mm	pcs	6	82,039	492,235	149.385	896	546,928	8,963	
Air Valve Material	Dia 150mm	pcs	29	193,116	5,600,362	351.644	10,198	6,222,625	101,977	
Air Valve Material	Dia 200mm	pcs	64	471,609	30,182,959	858.751	54,960	33,536,621	549,600	
Butterfly Valve Material	Dia 400mm	pcs	3	1,063,373	3,190,118	1,936.292	5,809	3,544,575	58,089	2,860m/1,000m
Butterfly Valve Material	Dia 800mm	pcs	10	2,585,604	25,856,041	4,708.118	47,081	28,728,934	470,812	9,360m/1,000m
Butterfly Valve Material	Dia 800mm	pcs	5	2,585,604	12,928,020	4,708.118	23,541	14,364,467	235,406	4,810m/1,000m
Butterfly Valve Material	Dia 1000mm	pcs	12	4,113,777	49,365,319	7,490.762	89,889	54,850,355	898,891	6,070m/500m
Butterfly Valve Material	Dia 1400mm	pcs	53	6,842,165	362,634,744	12,458.875	660,320	402,927,493	6,603,204	26,280m/500m
Gate Valve Material	Dia 75mm	pcs	6	42,455	254,729	77.306	464	283,032	4,638	
Gate Valve Material	Dia 150mm	pcs	29	96,591	2,801,149	175.883	5,101	3,112,388	51,006	
Gate Valve Material	Dia 300mm	pcs	64	273,219	17,486,037	497.504	31,840	19,428,930	318,403	
Total					510,791,713		930,099			
Total (Rounded)	**to T1**				**510,792,000**		**930,000**	**567,541,000**	**9,301,000**	**L3**
	FCP:LCP				90%		10%			

L4 Pipe Installation (ICB)

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Transmission Pipe Installatiom		Ls	1		0		40,270,000	2,457,275,400	40,270,000	L4-1
Valve Installation		Ls	1		0		615,000	37,527,300	615,000	L4-2
Pipe Jacking		Ls	1		0		4,369,000	266,596,380	4,369,000	L4-3
Surge Tank	10mx15mx2	Ls	1		40,430,000		2,262,000	178,457,240	2,924,570	L4-4
Total					40,430,000		47,516,000			
Total (Rounded)	**to T1**				**40,430,000**		**47,516,000**	**2,939,856,000**	**48,179,000**	**L4**
	FCP:LCP				1%		99%			

L4-1 Transmission Pipe Installation

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Pipe Installation	Dia 400mm DIP	m	2,860	0	0	121.780	348,291	21,252,705	348,291	1.PK11- Bou Merra
Pipe Installation	Dia 800mm DIP	m	9,360	0	0	436.360	4,084,330	249,225,792	4,084,330	2.PK14 - Sidi Salah EH
Pipe Installation	Dia 800mm DIP	m	4,810	0	0	436.360	2,098,892	128,074,365	2,098,892	3.PK10 - PK14
Pipe Installation	Dia 1000mm DIP	m	6,070	0	0	549.140	3,333,280	203,396,733	3,333,280	4.PK11 - PK10
Pipe Installation	Dia 1400mm DIP	m	26,280	0	0	821.440	21,587,443	1,317,265,784	21,587,443	5.Plant - PK11
Pipe Fittings Installation		Ls	1		0		1,572,612	95,960,769	1,572,612	Sum of (1~5) x 5%
Pipe Connecting	Dia 400mm DIP	joint	477	0	0	110.000	52,470	3,201,719	52,470	2,860m/6m
Pipe Connecting	Dia 800mm DIP	joint	1,560	0	0	264.000	411,840	25,130,477	411,840	9,360m/6m
Pipe Connecting	Dia 800mm DIP	joint	802	0	0	264.000	211,728	12,919,643	211,728	4,810m6m
Pipe Connecting	Dia 1000mm DIP	joint	1,012	0	0	330.000	333,960	20,378,239	333,960	6,070m6m
Pipe Connecting	Dia 1400mm DIP	joint	4,380	0	0	660.000	2,890,800	176,396,616	2,890,800	26,280m/6m
MiscellaneousWorks		Ls	1		0		3,692,564	225,320,284	3,692,564	Sum of other items x 10%
Total					0		40,269,918			
Total (Rounded)	**to L4**				**0**		**40,270,000**	**2,457,275,000**	**40,270,000**	**L4-1**
	FCP:LCP				0%		100%			

L4-2 Valves Installation

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Air Valve Installation	Dia 100mm	pcs	6	0	0	550.000	3,300	201,366	3,300	2,860m/500m
Air Valve Installation	Dia 150mm	pcs	29	0	0	660.000	19,140	1,167,923	19,140	(9,360m+4810m)/500m
Air Valve Installation	Dia 200mm	pcs	64	0	0	770.000	49,280	3,007,066	49,280	(6,070m+26,280m)/500m
Butterfly Valve Installation	Dia 400mm	pcs	3	0	0	1,100.000	3,300	201,366	3,300	2,860m/1,000m
Butterfly Valve Installation	Dia 800mm	pcs	10	0	0	2,420.000	24,200	1,476,684	24,200	9,360m/1,000m
Butterfly Valve Installation	Dia 800mm	pcs	5	0	0	2,420.000	12,100	738,342	12,100	4,810m/1,000m
Butterfly Valve Installation	Dia 1000mm	pcs	12	0	0	2,970.000	35,640	2,174,753	35,640	6,070m/500m
Butterfly Valve Installation	Dia 1400mm	pcs	53	0	0	3,520.000	186,560	11,383,891	186,560	26,280m/500m
Gate Valve Installation	Dia 75mm	pcs	6	0	0	550.000	3,300	201,366	3,300	
Gate Valve Installation	Dia 150mm	pcs	29	0	0	660.000	19,140	1,167,923	19,140	
Gate Valve Installation	Dia 300mm	pcs	64	0	0	880.000	56,320	3,436,646	56,320	
MiscellaneousWorks		Ls	1		0		206,140	12,578,663	206,140	Sum of other items x 50%
Total					0		615,120			
Total (Rounded)	**to L4**				**0**		**615,000**	**37,527,000**	**615,000**	**L4-2**
	FCP:LCP				0%		100%			

L4-3 Pipe Jacking

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Pipe Jacking	Dia 400mm	lot	1	0	0	1,100.000	55,000	3,356,100	55,000	unit price x 50m/lot PK11 - Bou Merra
Pipe Jacking	Dia 800mm	lot	5	0	0	2,420.000	605,000	36,917,100	605,000	unit price x 50m/lot PK14 - SSEH
Pipe Jacking	Dia 800mm	lot	1	0	0	2,420.000	121,000	7,383,420	121,000	unit price x 50m/lot PK10 - PK14
Pipe Jacking	Dia 1000mm	lot	5	0	0	2,970.000	742,500	45,307,350	742,500	unit price x 50m/lot PK11 - PK10
Pipe Jacking	Dia 1400mm	lot	11	0	0	3,850.000	2,117,500	129,209,850	2,117,500	unit price x 50m/lot Plant - PK11
Other Works		Ls	1		0		728,200	44,434,764	728,200	Sum of Other Items x 20%
Total					0		4,369,200			
Total (Rounded)	**to L4**				**0**		**4,369,000**	**266,596,000**	**4,369,000**	**L4-3**
	FCP:LCP				0%		100%			

L4-4 Surge Tank

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
1200 m3 (10m dia x 15m H)	**1200m3/Tank x 2 tanks**									Plant - PK11
Structure	**2 tanks**	tank	2	0	0	1,031,000	2,062,000	125,823,240	2,062,000	L4-4-1
Piping	**for 2 tanks**	lot	2	20,215,000	40,430,000	100,000	200,000	52,634,000	862,570	L4-4-2
Total					40,430,000		2,262,000			
Total (Rounded)	**to L4**				**40,430,000**		**2,262,000**	**178,457,000**	**2,925,000**	**L4-4**
	FCP:LCP				23%		77%			

L4-4-1 Structure of Surge Tank

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
1200 m3 (10m dia x 15m H)										
Excavation		m^3	937	0	0	16.500	15,461	943,430	15,461	
Backifilling/Filling		m^3	408	0	0	11.000	4,488	273,858	4,488	
Waste Soil Removal		m^3	529	0	0	23.100	12,220	745,664	12,220	
Gravel		m^3	35	0	0	74.800	2,618	159,750	2,618	
Waterproofing		m^2	110	0	0	42.900	4,719	287,953	4,719	
Formwork		m^2	1,758	0	0	62.700	110,227	6,726,052	110,227	
Lean Concrete		m^3	17	0	0	440.000	7,480	456,430	7,480	
Reinforced Concrete		m^3	686	0	0	935.000	641,410	39,138,838	641,410	
Scaffolding		m^2	1,289	0	0	107.800	138,954	8,478,973	138,954	
Other Miscellaneous Works	incl. Rebar	Ls	1		0		93,758	5,721,095	93,758	Sum of above items x 10%
Total	1200 m3				0		1,031,335			for 1200m3
Total (Rounded)	**to L4-4**				**0**		**1,031,000**	**62,912,000**	**1,031,000**	**L4-4-1 per tank**
	FCP:LCP				0%		100%			

L4-4-2 Piping for Surge Tank φ10x15m

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
piping for φ10x15m One-way Surge Tank										
Butterfly Valve Materials	Dia. 800mm	set	4	2,585,604	10,342,416	4,708.118	18,832	11,491,545	188,324	
Check Valve Materials	Dia. 800mm	set	2	2,585,604	5,171,208	4,708.118	9,416	5,745,772	94,162	
Pipe Materials	Dia. 800mm	m	30	22,095	662,856	40.233	1,207	736,507	12,070	
Pipe Materails	Dia. 600mm	m	100	14,018	1,401,809	25.526	2,553	1,557,593	25,526	
Butterfly Valve Installation	Dia. 800mm	set	4	0	0	2,420.000	9,680	590,674	9,680	
Check Valve Installation	Dia. 800mm	set	2	0	0	2,420.000	4,840	295,337	4,840	
Pipe Installation	Dia. 800mm	m	30	0	0	436.360	13,091	798,813	13,091	
Joint Connection	Dia. 800mm	joint	5	0	0	440.000	2,200	134,244	2,200	
Pipe Installation	Dia. 600mm	m	100	0	0	193.090	19,309	1,178,235	19,309	
Joint Connection	Dia. 600mm	joint	17	0	0	330.000	5,610	342,322	5,610	
Other Miscellaneous Works	15%	lot	1		2,636,743		13,011	3,430,656	56,222	15% of above total
Total					20,215,032		99,749			
Total (Rounded)	**to L4-4**				**20,215,000**		**100,000**	**26,317,000**	**431,000**	**L4-4-2 per Tank**
	FCP:LCP				77%		23%			

L5 Reservoirs Construction

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Mixing Chamber (PK11)		Ls	1		0		1,501,000	91,591,020	1,501,000	L5-1
Mixing Chamber (Bou Merra)		Ls	1		0		281,000	17,146,620	281,000	L5-2
Mixing Chamber (PK10)		Ls	1		0		560,000	34,171,200	560,000	L5-3
Mixing Chamber (PK14)		Ls	1		0		472,000	28,801,440	472,000	L5-4
Mixing Chamber (Sidi Salah EH)		Ls	1		0		319,000	19,465,380	319,000	L5-5
Distribution Reservoir (Bou Merra, V=5,000 m3)		Ls	1		0		1,890,000	115,327,800	1,890,000	L5-6
Total					0		5,023,000			
Total Cost (Rounded)	**to T1**				**0**		**5,023,000**	**306,503,000**	**5,023,000**	**L5**
	FCP:LCP				0%		100%			

L5-1 Mixing Chamber (PK11)

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Excavation		m^3	280	0	0	16.500	4,620	281,912	4,620	
Backifilling/Filling		m^3	5048	0	0	11.000	55,528	3,388,319	55,528	
Waste Soil Removal		m^3	230	0	0	23.100	5,313	324,199	5,313	
Gravel		m^3	59	0	0	74.800	4,413	269,281	4,413	
Waterproofing		m^2	582	0	0	42.900	24,968	1,523,547	24,968	
Formwork		m^2	2280	0	0	62.700	142,956	8,723,175	142,956	
Lean Concrete		m^3	29	0	0	440.000	12,760	778,615	12,760	
Reinforced Concrete		m^3	970	0	0	935.000	906,950	55,342,089	906,950	
Reinforcement Bar		ton	97.0	0	0	1320.000	128,040	7,813,001	128,040	100kg/m3
Scaffolding		m^2	729	0	0	107.800	78,586	4,795,318	78,586	
Other Miscellaneous Works		Ls	1		0		136,413	8,323,946	136,413	above items x 10%
Above quantities includes those for Valve Chamber										
Total					0		1,500,547			
Total Cost (Rounded)	**to L5**				**0**		**1,501,000**	**91,591,000**	**1,501,000**	**L5-1**
	FCP:LCP				0%		100%			

L5-2 Mixing Chamber (Bou Merra)

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Excavation		m^3	183	0	0	16.500	3,020	184,280	3,020	
Backifilling/Filling		m^3	48	0	0	11.000	528	32,219	528	
Waste Soil Removal		m^3	136	0	0	23.100	3,142	191,725	3,142	
Gravel		m^3	15	0	0	74.800	1,122	68,464	1,122	
Waterproofing		m^2	165	0	0	42.900	7,079	431,961	7,079	
Formwork		m^2	670	0	0	62.700	42,009	2,563,389	42,009	
Lean Concrete		m^3	7	0	0	440.000	3,080	187,942	3,080	
Reinforced Concrete		m^3	159	0	0	935.000	148,665	9,071,538	148,665	
Reinforcement Bar		ton	15.9	0	0	1320.000	20,988	1,280,688	20,988	100kg/m3
Scaffolding		m^2	243	0	0	107.800	26,195	1,598,419	26,195	
Other Miscellaneous Works		Ls	1		0		25,583	1,561,062	25,583	Sum of above items 10%
Above quantities includes those for Valve Chamber										
Total					0		281,411			
Total Cost (Rounded)	**to L5**				**0**		**281,000**	**17,147,000**	**281,000**	**L5-2**
	FCP:LCP				0%		100%			

L5-3 Mixing Chamber (PK10)

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Excavation		m^3	93	0	0	16.500	1,535	93,666	1,535	
Backifilling/Filling		m^3	393	0	0	11.000	4,323	263,789	4,323	
Waste Soil Removal		m^3	72	0	0	23.100	1,663	101,476	1,663	
Gravel		m^3	31	0	0	74.800	2,319	141,505	2,319	
Waterproofing		m^2	339	0	0	42.900	14,543	887,414	14,543	
Formwork		m^2	1,122	0	0	62.700	70,349	4,292,696	70,349	
Lean Concrete		m^3	16	0	0	440.000	7,040	429,581	7,040	
Reinforced Concrete		m^3	343	0	0	935.000	320,705	19,569,419	320,705	
Reinforcement Bar		ton	34.3	0	0	1320.000	45,276	2,762,742	45,276	100kg/m3
Scaffolding		m^2	387	0	0	107.800	41,719	2,545,693	41,719	
Other Miscellaneous Works		Ls	1		0		50,947	3,108,798	50,947	Sum of above items x 10%
Above quantities includes those for Valve Chamber										
Total					0		560,419			
Total Cost (Rounded)	**to L5**				**0**		**560,000**	**34,171,000**	**560,000**	**L5-3**
	FCP:LCP				0%		100%			

L5-4 Mixing Chamber (PK14)

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Excavation		m^3	93	0	0	16.500	1,535	93,666	1,535	
Backifilling/Filling		m^3	465	0	0	11.000	5,115	312,117	5,115	
Waste Soil Removal		m^3	72	0	0	23.100	1,663	101,476	1,663	
Gravel		m^3	26	0	0	74.800	1,945	118,684	1,945	
Waterproofing		m^2	272	0	0	42.900	11,669	712,042	11,669	
Formwork		m^2	962	0	0	62.700	60,317	3,680,543	60,317	
Lean Concrete		m^3	13	0	0	440.000	5,720	349,034	5,720	
Reinforced Concrete		m^3	285	0	0	935.000	266,475	16,260,305	266,475	
Reinforcement Bar		ton	28.5	0	0	1320.000	37,620	2,295,572	37,620	100kg/m3
Scaffolding		m^2	342	0	0	107.800	36,868	2,249,685	36,868	
Other Miscellaneous Works		Ls	1		0		42,893	2,617,313	42,893	Sum of above items x 10%
Above quantities includes those for Valve Chamber										
Total					0		471,820			
Total Cost (Rounded)	**to L5**				**0**		**472,000**	**28,801,000**	**472,000**	**L5-4**
	FCP:LCP				0%		100%			

L5-5 Mixing Chamber (Sidi Salah EH)

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Excavation		m^3	248	0	0	16.500	4,092	249,694	4,092	
Backifilling/Filling		m^3	48	0	0	11.000	528	32,219	528	
Waste Soil Removal		m^3	200	0	0	23.100	4,620	281,912	4,620	
Gravel		m^3	19	0	0	74.800	1,421	86,709	1,421	
Waterproofing		m^2	196	0	0	42.900	8,408	513,056	8,408	
Formwork		m^2	754	0	0	62.700	47,276	2,884,782	47,276	
Lean Concrete		m^3	10	0	0	440.000	4,400	268,488	4,400	
Reinforced Concrete		m^3	178	0	0	935.000	166,430	10,155,559	166,430	
Reinforcement Bar		t	18	0	0	1320.000	23,496	1,433,726	23,496	100kg/m3
Scaffolding		m^2	275	0	0	107.800	29,645	1,808,938	29,645	
Other Miscellaneous Works	incl. Rebar	Ls	1		0		29,032	1,771,508	29,032	Sum of above items x 10%
Above quantities includes those for Valve Chamber										
Total					0		319,348			
Total Cost (Rounded)	**to L5**				**0**		**319,000**	**19,465,000**	**319,000**	**L5-5**
	FCP:LCP				0%		100%			

L5-6 Distribution Reservoir (Bou Merra, V=5,000m3)

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Pile Driving Work		m	0	0	0	110.000	0	0	0	
Pile Head Treatment		pcs	0	0	0	6.600	0	0	0	
Excavation		m^3	2,036	0	0	16.500	33,594	2,049,906	33,594	
Backfilling		m^3	428	0	0	11.000	4,708	287,282	4,708	
Surplus Soil Transport		m^3	1,608	0	0	23.100	37,145	2,266,576	37,145	
Gravel		m^3	241	0	0	74.800	18,027	1,099,995	18,027	
Concrete		m^3	161	0	0	440.000	70,840	4,322,657	70,840	structure
Reinforced Concrete		m^3	930	0	0	935.000	869,550	53,059,941	869,550	structure
Formwork		m^2	3,500	0	0	62.700	219,450	13,390,839	219,450	structure
Rebar Fabrication and Assembly		t	158	0	0	1320.000	208,692	12,734,386	208,692	Rebar/Concrete = 170kg/m3
Waterproofing		m^2	1,500	0	0	42.900	64,350	3,926,637	64,350	
Scaffolding		m^2	200	0	0	107.800	21,560	1,315,591	21,560	
Other Mischellaneous Works		Ls	1				342,133	20,876,956	342,133	Structure x 25%
Total					0		1,890,049			
Total Cost (Rounded)	**to L5**				**0**		**1,890,000**	**115,328,000**	**1,890,000**	**L5-6**
	FCP:LCP				0%		100%			

Lot 6 Pump Facilities Construction (ICB)

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
PK11（for PK10 & Bou Merra)		Ls	1		789,808,000		6,059,000	1,159,528,180	19,002,428	L6-1
PK10 (for PK14)		Ls	1		469,333,000		4,543,000	746,546,860	12,234,462	L6-2
Pk14 (for Sidi Salah EH)		Ls	1		306,074,000		3,167,000	499,324,340	8,182,962	L6-3
Total					1,565,215,000		13,769,000			
Total Cost (Rounded)	**to T1**				**1,565,215,000**		**13,769,000**	**2,405,399,000**	**39,420,000**	**L6**
	FCP:LCP				65%		35%			

L6-1 Pumping Fcilities (PK11)

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Pumping Station		Ls	1		0		3,070,000	187,331,400	3,070,000	L6-1-1
Sub-Station		Ls	1		0		706,000	43,080,120	706,000	L6-1-2
Mechanical Work (incl. Air Chamber)		Ls	1		423,054,000		1,223,000	497,681,460	8,156,038	L6-1-3
Electrical Work		Ls	1		366,754,000		1,060,000	431,435,200	7,070,390	L6-1-4
Total					789,808,000		6,059,000			
Total Cost (Rounded)	**to L6**				**789,808,000**		**6,059,000**	**1,159,528,000**	**19,002,000**	**L6-1**
	FCP:LCP				68%		32%			

L6-1-1 Pump Station (PK11)

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Excavation		m^3	5,928	0	0	16.500	97,812	5,968,488	97,812	
Backifilling/Filling		m^3	2,862	0	0	11.000	31,482	1,921,032	31,482	
Waste Soil Removal		m^3	3,066	0	0	23.100	70,825	4,321,742	70,825	
Gravel		m^3	180	0	0	74.800	13,464	821,573	13,464	
Waterproofing		m^2	726	0	0	42.900	31,145	1,900,468	31,145	
Formwork		m^2	5,702	0	0	62.700	357,515	21,815,565	357,515	
Lean Concrete		m^3	266	0	0	440.000	117,040	7,141,781	117,040	
Reinforced Concrete		m^3	1,665	0	0	935.000	1,556,775	94,994,411	1,556,775	
Scaffolding		m^2	3,540	0	0	107.800	381,612	23,285,964	381,612	
Other Miscellaneous Works	incl. Rebar	Ls	1		0		265,767	16,217,102	265,767	Sum of above items x 10%
Engineering Cost		Ls	1		0		146,172	8,919,406	146,172	Sum of other items x 5%
Total					0		3,069,609			
Sub-Total (rounded)	**to L6-1**				**0**		**3,070,000**	**187,331,000**	**3,070,000**	**L6-1-1**
	FCP:LCP				0%		100%			

L6-1-2 Sub-station (PK11)

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Excavation		m^3	248	0	0	16.500	4,092	249,694	4,092	
Backifilling/Filling		m^3	57	0	0	11.000	627	38,260	627	
Waste Soil Removal		m^3	191	0	0	23.100	4,412	269,220	4,412	
Gravel		m^3	66	0	0	74.800	4,937	301,256	4,937	
Waterproofing		m^2	366	0	0	42.900	15,701	958,075	15,701	
Formwork		m^2	1,627	0	0	62.700	102,013	6,224,833	102,013	
Lean Concrete		m^3	121	0	0	440.000	53,240	3,248,705	53,240	
Reinforced Concrete		m^3	323	0	0	935.000	302,005	18,428,345	302,005	
Scaffolding		m^2	1,156	0	0	107.800	124,617	7,604,129	124,617	
Other Miscellaneous Works	incl. Rebar	Ls	1		0		61,164	3,732,252	61,164	Sum of above items x 10%
Engineering Cost		Ls	1		0		33,640	2,052,738	33,640	Sum of other items x 5%
Total					0		706,449			
Total Cost (Rounded)	**to L6-1**				**0**		**706,000**	**43,080,000**	**706,000**	**L6-1-2**
	FCP:LCP				0%		100%			

L6-1-3 Mechanical Facility for PK11 Pump Station

Foreign Portion: 85%, Local Portion: 15% (Installation) Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Intermediate transmission pump station										
PK11-1	PK11-B,Merra									
Transmission Pump	6.7m3/min x 61m	set	3	37,095,000	111,285,000	107,000	321,000	130,872,000	2,144,739	
Inlet Valve	Dia. 300mm	set	3	910,000	2,730,000	3,000	9,000	3,279,000	53,736	
Check Valve	Dia. 200 mm	set	3	224,000	672,000	1,000	3,000	855,000	14,012	
Discharge Valve	Dia. 200 mm	set	3	2,142,000	6,426,000	6,000	18,000	7,524,000	123,304	Motorized
Maintenance Valve	Dia. 200 mm	set	3	570,000	1,710,000	1,600	4,800	2,003,000	32,825	
Maintenance Valve	Dia. 400 mm	set	2	1,420,000	2,840,000	4,000	8,000	3,328,000	54,539	Butterfly Valve
Pipes		lot	1	18,849,000	18,849,000	55,000	55,000	22,205,000	363,897	
sub-total					**144,512,000**		**418,800**	**170,066,000**	**2,787,053**	
Air Chamber (Mechanical)	**approx, 3m3 (ϕ 1.5 x 1.7m)**	**lot**	**1**		**3,213,000**		**9,292**	**3,780,000**	**61,947**	

L6-1-3 Mechanical Facility for PK11 Pump Station

Foreign Portion: 85%, Local Portion: 15% (Installation) Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
PK11-2	PK11-PK10									
Transmission Pump	37.1m3/min x 38m	set	4	46,369,000	185,476,000	134,000	536,000	218,183,000	3,575,598	
Inlet Valve	Dia. 500 mm	set	4	1,845,000	7,380,000	5,000	20,000	8,600,000	140,937	
Check Valve	Dia. 500 mm	set	4	2,769,000	11,076,000	8,000	32,000	13,029,000	213,520	
Discharge Valve	Dia. 500 mm	set	4	3,668,000	14,672,000	11,000	44,000	17,357,000	284,448	Motorized
Maintenance Valve	Dia. 500 mm	set	4	1,845,000	7,380,000	5,000	20,000	8,600,000	140,937	
Maintenance Valve	Dia. 1000 mm	set	2	5,900,000	11,800,000	17,000	34,000	13,875,000	227,384	Butterfly Valve
Pump Lifting Equipment	Suspension crane : 3.2ton	set	1	1,632,000	1,632,000	5,000	5,000	1,937,000	31,744	
Pipes		lot	1	35,913,000	35,913,000	104,000	104,000	42,259,000	692,543	
sub-total					**275,329,000**		**795,000**	**323,840,000**	**5,307,112**	
Total					423,054,000		1,223,092			
Total (Rounded)	**to L6-1**				**423,054,000**		**1,223,000**	**497,681,000**	**8,156,000**	**L6-1-3**
	FCP:LCP				85%		15%			

L6-1-4 Electrical Facility for PK11 Pump Station

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
PK-11										
30kV Switchgear		**Ls**	**1**		**32,640,000**		**94,396**	**38,400,000**	**629,302**	**a.**
30kV DS, LA Panel		*set*	*1*	*4,250,000*	*4,250,000*	*12,291*	*12,291*	*5,000,000*	*81,940*	DS: Disconnecting Switch LA: Lightning Arrester
30kV VT Panel		*set*	*1*	*4,250,000*	*4,250,000*	*12,291*	*12,291*	*5,000,000*	*81,940*	VT: Voltage Transformer
30kV VCB Panel		*set*	*2*	*7,225,000*	*14,450,000*	*20,895*	*41,790*	*17,000,000*	*278,597*	VCB: Vacuum Circuit Breaker
30kV/400V Transformer	*oil type 2MVA*	*set*	*1*	*9,690,000*	*9,690,000*	*28,024*	*28,024*	*11,400,000*	*186,824*	
LV Switchgear		**Ls**	**1**		**71,527,500**		**206,857**	**84,150,000**	**1,379,056**	**b.**
LV Main Switchgear	*5 units*	*set*	*1*	*11,050,000*	*11,050,000*	*31,957*	*31,957*	*13,000,000*	*213,045*	LV: Low Voltage
Transmission Pump for Bou Merra	*400V VFD 132kW*	*set*	*3*	*3,060,000*	*9,180,000*	*8,850*	*26,550*	*10,800,000*	*176,991*	VFD: Variable Frequency Drive
Transmission Pump for PK-10	*400V VFD 355kW*	*set*	*4*	*7,820,000*	*31,280,000*	*22,616*	*90,464*	*36,800,000*	*603,081*	
MCC for Transmission-1	*6 units*	*set*	*1*	*17,467,500*	*17,467,500*	*50,516*	*50,516*	*20,550,000*	*336,775*	MCC: Motor Control Centre
Local Panel		*set*	*10*	*255,000*	*2,550,000*	*737*	*7,370*	*3,000,000*	*49,164*	
Instrumentation & Monitoring		**Ls**	**1**		**67,745,000**		**195,922**	**79,700,000**	**1,306,129**	**c.**
Transmission Flow	*electro-magnetic 1400mm*	*set*	*1*	*7,820,000*	*7,820,000*	*22,616*	*22,616*	*9,200,000*	*150,770*	
Transmission Flow	*electro-magnetic 1000mm*	*set*	*1*	*5,270,000*	*5,270,000*	*15,241*	*15,241*	*6,200,000*	*101,606*	
Transmission Flow	*electro-magnetic 400mm*	*set*	*1*	*2,125,000*	*2,125,000*	*6,146*	*6,146*	*2,500,000*	*40,970*	
Water Level	*Ultrasonic*	*set*	*6*	*680,000*	*4,080,000*	*1,967*	*11,802*	*4,800,000*	*78,663*	
Water Quality	*Turbidity, pH, Res. Chlorine Electric Conductivity*	*set*	*9*	*1,275,000*	*11,475,000*	*3,687*	*33,183*	*13,500,000*	*221,239*	Inflow: TDS x 5, Outflow:
Instrumentation Panel		*set*	*1*	*2,550,000*	*2,550,000*	*7,375*	*7,375*	*3,000,000*	*49,164*	
PLC Panel		*lot*	*2*	*6,375,000*	*12,750,000*	*18,437*	*36,874*	*15,000,000*	*245,821*	PLC: Programmable Logic Controller
Telemetry System	*Plant-PK11, PK11-PK10, PK11-Bou Merra*	*lot*	*3*	*6,800,000*	*20,400,000*	*19,666*	*58,998*	*24,000,000*	*393,314*	

L6-1-4 Electrical Facility for PK11 Pump Station

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
UPS	*10kVA*	*set*	*1*	*1,275,000*	*1,275,000*	*3,687*	*3,687*	*1,500,000*	*24,582*	UPS: Uninteruptive Power Supply
Emergency Power Facilities		**Ls**	**1**		**161,500,000**		**467,060**	**190,000,000**	**3,113,733**	**d.**
Stand-by Generator	*Diesel 2500kVA*	*set*	*1*	*161,500,000*	*161,500,000*	*467,060*	*467,060*	*190,000,000*	*3,113,733*	
Other Miscellaneous Works		**Ls**	**1**		**33,341,000**		**96,000**	**39,199,000**	**642,396**	Sum of (a~d) x 10%
Total					366,753,500		1,060,235			
Total (Rounded)	**to L6-1**				**366,754,000**		**1,060,000**	**431,435,000**	**7,070,000**	**L6-1-4**
	FCP:LCP				85%		15%			

L6-2 Pumping Fcilities (PK10)

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Pumping Station		Ls	1		0		1,580,000	96,411,600	1,580,000	L6-2-1
Sub-Station		Ls	1		0		706,000	43,080,120	706,000	L6-2-2
Mechanical Work (incl. Air Chamber)		Ls	1		228,523,000		663,000	268,979,000	4,408,047	L6-2-3
Electrical Work		Ls	1		240,810,000		1,594,000	338,075,880	5,540,411	L6-2-4
Total					469,333,000		4,543,000			
Total Cost (Rounded)	**to L6**				**469,333,000**		**4,543,000**	**746,547,000**	**12,234,000**	**L6-2**
	FCP:LCP				63%		37%			

L6-2-1 Pump Station (PK10)

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Excavation		m^3	2,874	0	0	16.500	47,421	2,893,629	47,421	
Backifilling/Filling		m^3	1,477	0	0	11.000	16,247	991,392	16,247	
Waste Soil Removal		m^3	1,398	0	0	23.100	32,294	1,970,580	32,294	
Gravel		m^3	80	0	0	74.800	5,984	365,144	5,984	
Waterproofing		m^2	462	0	0	42.900	19,820	1,209,416	19,820	
Formwork		m^2	3,056	0	0	62.700	191,611	11,692,103	191,611	
Lean Concrete		m^3	119	0	0	440.000	52,360	3,195,007	52,360	
Reinforced Concrete		m^3	828	0	0	935.000	774,180	47,240,464	774,180	
Scaffolding		m^2	2,115	0	0	107.800	227,997	13,912,377	227,997	
Other Miscellaneous Works	incl. Rebar	Ls	1		0		136,791	8,347,011	136,791	Sum of above items x 10%
Engineering Cost		Ls	1		0		75,235	4,590,856	75,235	Sum of other items x 5%
Total					0		1,579,941			
Sub-Total (rounded)	**to L6-2**				**0**		**1,580,000**	**96,412,000**	**1,580,000**	**L6-2-1**
	FCP:LCP				0%		100%			

L6-2-2 Sub-station (PK10)

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Excavation		m^3	248	0	0	16.500	4,092	249,694	4,092	
Backifilling/Filling		m^3	57	0	0	11.000	627	38,260	627	
Waste Soil Removal		m^3	191	0	0	23.100	4,412	269,220	4,412	
Gravel		m^3	66	0	0	74.800	4,937	301,256	4,937	
Waterproofing		m^2	366	0	0	42.900	15,701	958,075	15,701	
Formwork		m^2	1,627	0	0	62.700	102,013	6,224,833	102,013	
Lean Concrete		m^3	121	0	0	440.000	53,240	3,248,705	53,240	
Reinforced Concrete		m^3	323	0	0	935.000	302,005	18,428,345	302,005	
Scaffolding		m^2	1,156	0	0	107.800	124,617	7,604,129	124,617	
Other Miscellaneous Works	incl. Rebar	Ls	1		0		61,164	3,732,252	61,164	Sum of above items 10%
Engineering Cost		Ls	1		0		33,640	2,052,738	33,640	Sum of other items x 5%
Total					0		706,449			
Total Cost (Rounded)	**to L6-2**				**0**		**706,000**	**43,080,000**	**706,000**	**L6-2-2**
	FCP:LCP				0%		100%			

L6-2-3 Mechanical Facility for PK10 Pump Station

Foreign Portion: 85%, Local Portion: 15% (Installation) Exchange Rate: 1.00US$= 119.60JPY .000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Intermediate transmission pump station										
PK10	PK10 - PK14									
Transmission Pump	32.9m3/min x 53m	set	3	52,165,000	156,495,000	151,000	453,000	184,137,000	3,017,650	
Inlet Valve	Dia. 450mm	set	3	1,704,000	5,112,000	5,000	15,000	6,027,000	98,771	
Check Valve	Dia. 300mm	set	3	347,000	1,041,000	1,000	3,000	1,224,000	20,059	
Discharge Valve	Dia. 300mm	set	3	2,380,000	7,140,000	7,000	21,000	8,421,000	138,004	Motorized
Maintenance Valve	Dia. 300mm	set	3	612,000	1,836,000	2,000	6,000	2,202,000	36,087	
Maintenance Valve	Dia. 600 mm	set	2	2,367,000	4,734,000	7,000	14,000	5,588,000	91,577	Butterfly Valve
Maintenance Valve	Dia. 800 mm	set	1	3,551,000	3,551,000	10,000	10,000	4,161,000	68,191	Butterfly Valve
Pump Lifting Equipment	Suspension crane : 5.0ton	set	1	19,270,000	19,270,000	56,000	56,000	22,687,000	371,796	
Pipes		lot	1	29,344,000	29,344,000	85,000	85,000	34,531,000	565,896	
Total					228,523,000		663,000			
Total (Rounded)	**to L6-2**				**228,523,000**		**663,000**	**268,979,000**	**4,408,000**	**L6-2-3**
	FCP:LCP				85%		15%			

L6-2-4 Electrical Facility for PK10 Pump Station

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
PK-10										
30kV Switchgear		**Ls**	**1**		**32,640,000**		**94,396**	**38,400,000**	**629,302**	**a.**
30kV DS, LA Panel		set	1	*4,250,000*	*4,250,000*	*12,291*	*12,291*	*5,000,000*	*81,940*	DS: Disconnecting Switch LA: Lightning Arrester
30kV VT Panel		set	1	*4,250,000*	*4,250,000*	*12,291*	*12,291*	*5,000,000*	*81,940*	VT: Voltage Transformer
30kV VCB Panel		set	2	*7,225,000*	*14,450,000*	*20,895*	*41,790*	*17,000,000*	*278,597*	VCB: Vacuum Circuit Breaker
30kV/400V Transformer	oil type 2MVA	set	1	*9,690,000*	*9,690,000*	*28,024*	*28,024*	*11,400,000*	*186,824*	
LV Switchgear		**Ls**	**1**		**61,412,500**		**993,975**	**122,065,000**	**2,000,410**	**b.**
LV Main Switchgear	5 units	set	1	*11,050,000*	*11,050,000*	*31,957*	*31,957*	*13,000,000*	*213,045*	LV: Low Voltage
Transmission Pump for PK-14	400V VFD 450kW	set	3	*10,455,000*	*31,365,000*	*302,360*	*907,080*	*86,715,000*	*1,421,091*	VFD: Variable Frequency Drive
MCC for Transmission-1	6 units	set	1	*17,467,500*	*17,467,500*	*50,516*	*50,516*	*20,550,000*	*336,775*	MCC: Motor Control Centre
Local Panel		set	6	*255,000*	*1,530,000*	*737*	*4,422*	*1,800,000*	*29,499*	
Instrumentation & Monitoring		**Ls**	**1**		**35,615,000**		**102,999**	**41,900,000**	**686,660**	**c.**
Transmission Flow	electro-magnetic 1000mm	set	1	*5,270,000*	*5,270,000*	*15,241*	*15,241*	*6,200,000*	*101,606*	
Transmission Flow	electro-magnetic 800mm	set	1	*4,335,000*	*4,335,000*	*12,537*	*12,537*	*5,100,000*	*83,579*	
Water Level	Ultrasonic	set	2	*680,000*	*1,360,000*	*1,967*	*3,934*	*1,600,000*	*26,221*	
Water Quality	*Turbidity, pH, Res. Chlorine Electric Conductivity*	set	6	*1,275,000*	*7,650,000*	*3,687*	*22,122*	*9,000,000*	*147,493*	Inflow: TDS x 2, Outflow: 4
Instrumentation Panel		set	1	*2,550,000*	*2,550,000*	*7,375*	*7,375*	*3,000,000*	*49,164*	
PLC Panel		lot	1	*6,375,000*	*6,375,000*	*18,437*	*18,437*	*7,500,000*	*122,911*	PLC: Programmable Logic
Telemetry System	PK10-PK14	lot	1	*6,800,000*	*6,800,000*	*19,666*	*19,666*	*8,000,000*	*131,105*	
UPS	10kVA	set	1	*1,275,000*	*1,275,000*	*3,687*	*3,687*	*1,500,000*	*24,582*	UPS: Uninteruptive Power Supply

L6-2-4 Electrical Facility for PK10 Pump Station

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Emergency Power Facilities		**Ls**	**1**		**89,250,000**		**258,112**	**105,000,000**	**1,720,747**	
Stand-by Generator	Diesel 1250kVA	set	1	*89,250,000*	*89,250,000*	*258,112*	*258,112*	*105,000,000*	*1,720,747*	
Other Miscellaneous Works		**Ls**	**1**		**21,892,000**		**145,000**	**30,740,000**	**503,769**	Sum of (a~d) x 10%
Total					240,809,500		1,594,482			
Total (Rounded)	**to L6-2**				**240,810,000**		**1,594,000**	**338,076,000**	**5,540,000**	**L6-2-4**
	FCP:LCP				71%		29%			

L6-3 Pumping Fcilities (PK14)

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Pumping Station		Ls	1		0		1,580,000	96,411,600	1,580,000	L6-3-1
Sub-Station		Ls	1		0		706,000	43,080,120	706,000	L6-3-2
Mechanical Work (incl. Air Chamber)		Ls	1		106,124,000		303,000	124,613,060	2,042,167	L6-3-3
Electrical Work		Ls	1		199,950,000		578,000	235,219,560	3,854,794	L6-3-4
Total					306,074,000		3,167,000			
Total Cost (Rounded)	**to L6**				**306,074,000**		**3,167,000**	**499,324,000**	**8,183,000**	**L6-3**
	FCP:LCP				61%		39%			

L6-3-1 Pump Station (PK14)

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Excavation		m^3	2,874	0	0	16.500	47,421	2,893,629	47,421	
Backifilling/Filling		m^3	1,477	0	0	11.000	16,247	991,392	16,247	
Waste Soil Removal		m^3	1,398	0	0	23.100	32,294	1,970,580	32,294	
Gravel		m^3	80	0	0	74.800	5,984	365,144	5,984	
Waterproofing		m^2	462	0	0	42.900	19,820	1,209,416	19,820	
Formwork		m^2	3,056	0	0	62.700	191,611	11,692,103	191,611	
Lean Concrete		m^3	119	0	0	440.000	52,360	3,195,007	52,360	
Reinforced Concrete		m^3	828	0	0	935.000	774,180	47,240,464	774,180	
Scaffolding		m^2	2,115	0	0	107.800	227,997	13,912,377	227,997	
Other Miscellaneous Works	incl. Rebar	Ls	1		0		136,791	8,347,011	136,791	Sum of above items x 10%
Engineering Cost		Ls	1		0		75,235	4,590,856	75,235	Sum of other items x 5%
Total					0		1,579,941			
Sub-Total (rounded)	**to L6-3**				**0**		**1,580,000**	**96,412,000**	**1,580,000**	**L6-3-1**
	FCP:LCP				0%		100%			

L6-3-2 Sub-station (PK14)

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Excavation		m^3	248	0	0	16.500	4,092	249,694	4,092	
Backifilling/Filling		m^3	57	0	0	11.000	627	38,260	627	
Waste Soil Removal		m^3	191	0	0	23.100	4,412	269,220	4,412	
Gravel		m^3	66	0	0	74.800	4,937	301,256	4,937	
Waterproofing		m^2	366	0	0	42.900	15,701	958,075	15,701	
Formwork		m^2	1,627	0	0	62.700	102,013	6,224,833	102,013	
Lean Concrete		m^3	121	0	0	440.000	53,240	3,248,705	53,240	
Reinforced Concrete		m^3	323	0	0	935.000	302,005	18,428,345	302,005	
Scaffolding		m^2	1,156	0	0	107.800	124,617	7,604,129	124,617	
Other Miscellaneous Works	incl. Rebar	Ls	1		0		61,164	3,732,252	61,164	Sum of above items x 10%
Engineering Cost		Ls	1		0		33,640	2,052,738	33,640	Sum of other items x 5%
Total					0		706,449			
Total Cost (Rounded)	**to L6-3**				**0**		**706,000**	**43,080,000**	**706,000**	**L6-3-2**
	FCP:LCP				0%		100%			

L6-3-3 Mechanical Facility for PK14 Pump Station

Exchange Rate: 1.00US$= 119.60JPY .000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Intermediate transmission pump station										
PK14	PK14-S,Salah H									
Transmission Pump	22.8m3/min x 38m	set	3	16,529,000	49,587,000	48,000	144,000	58,374,000	956,637	
Inlet Valve	Dia. 450mm	set	3	1,420,000	4,260,000	4,000	12,000	4,992,000	81,809	
Check Valve	Dia. 300mm	set	3	1,188,000	3,564,000	3,000	9,000	4,113,000	67,404	
Discharge Valve	Dia. 300mm	set	3	2,881,000	8,643,000	8,000	24,000	10,107,000	165,634	Motorized
Maintenance Valve	Dia. 300mm	set	3	1,204,000	3,612,000	3,000	9,000	4,161,000	68,191	
Maintenance Valve	Dia. 500 mm	set	2	2,367,000	4,734,000	7,000	14,000	5,588,000	91,577	Butterfly Valve
Maintenance Valve	Dia. 700 mm	set	1	2,841,000	2,841,000	8,000	8,000	3,329,000	54,556	Butterfly Valve
Pump Lifting Equipment	Suspension crane : 3.2ton	lot	1	15,720,000	15,720,000	45,000	45,000	18,466,000	302,622	
Pipes		set	1	13,163,000	13,163,000	38,000	38,000	15,482,000	253,720	
Total					106,124,000		303,000			
Total (Rounded)	**to L6-3**				**106,124,000**		**303,000**	**124,613,000**	**2,042,000**	**L6-3-3**
	FCP:LCP				85%		15%			

L6-3-4 Electrical Facility for PK14 Pump Station

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
PK-14										
30kV Switchgear		**Ls**	**1**		**25,925,000**		**74,976**	**30,500,000**	**499,836**	**a.**
30kV DS, LA Panel		*set*	*1*	*4,250,000*	*4,250,000*	*12,291*	*12,291*	*5,000,000*	*81,940*	DS: Disconnecting Switch LA: Lightning Arrester
30kV VT Panel		*set*	*1*	*4,250,000*	*4,250,000*	*12,291*	*12,291*	*5,000,000*	*81,940*	VT: Voltage Transformer
30kV VCB Panel		*set*	*2*	*7,225,000*	*14,450,000*	*20,895*	*41,790*	*17,000,000*	*278,597*	VCB: Vacuum Circuit Breaker
30kV/400V Transformer	*oil type 0.5MVA*	*set*	*1*	*2,975,000*	*2,975,000*	*8,604*	*8,604*	*3,500,000*	*57,358*	
LV Switchgear		**Ls**	**1**		**44,837,500**		**129,668**	**52,750,000**	**864,471**	**b.**
LV Main Switchgear	*3 units*	*set*	*1*	*8,500,000*	*8,500,000*	*24,582*	*24,582*	*10,000,000*	*163,881*	LV: Low Voltage
Transmission Pump for Sidi Salah EH	*400V VFD 250kW*	*set*	*3*	*5,780,000*	*17,340,000*	*16,716*	*50,148*	*20,400,000*	*334,317*	VFD: Variable Frequency Drive
MCC for Transmission-1	*6 units*	*set*	*1*	*17,467,500*	*17,467,500*	*50,516*	*50,516*	*20,550,000*	*336,775*	MCC: Motor Control Centre
Local Panel		*set*	*6*	*255,000*	*1,530,000*	*737*	*4,422*	*1,800,000*	*29,499*	
Instrumentation & Monitoring		**Ls**	**1**		**47,260,000**		**136,678**	**55,600,000**	**911,177**	**c.**
Transmission Flow	*electro-magnetic 800mm*	*set*	*1*	*4,335,000*	*4,335,000*	*12,537*	*12,537*	*5,100,000*	*83,579*	
Transmission Flow	*electro-magnetic 800mm*	*set*	*1*	*4,335,000*	*4,335,000*	*12,537*	*12,537*	*5,100,000*	*83,579*	
Water Level	*Ultrasonic*	*set*	*3*	*680,000*	*2,040,000*	*1,967*	*5,901*	*2,400,000*	*39,331*	
Water Quality	*Turbidity, pH, Res. Chlorine*	*set*	*6*	*1,275,000*	*7,650,000*	*3,687*	*22,122*	*9,000,000*	*147,493*	Inflow: TDS x 2, Outflow: 4
Instrumentation Panel		*set*	*3*	*2,550,000*	*7,650,000*	*7,375*	*22,125*	*9,000,000*	*147,493*	
PLC Panel		*lot*	*1*	*6,375,000*	*6,375,000*	*18,437*	*18,437*	*7,500,000*	*122,911*	PLC: Programmable Logic

L6-3-4 Electrical Facility for PK14 Pump Station

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Telemetry System	*PK14-SS. EH/EB*	*lot*	*2*	*6,800,000*	*13,600,000*	*19,666*	*39,332*	*16,000,000*	*262,209*	
UPS	*10kVA*	*set*	*1*	*1,275,000*	*1,275,000*	*3,687*	*3,687*	*1,500,000*	*24,582*	UPS: Uninteruptive Power Supply
Emergency Power Facilities		**Ls**	**1**		**63,750,000**		**184,366**	**75,000,000**	**1,229,105**	**d.**
Stand-by Generator	*Diesel 750kVA*	*set*	*1*	*63,750,000*	*63,750,000*	*184,366*	*184,366*	*75,000,000*	*1,229,105*	
Other Miscellaneous Works		**Ls**	**1**		**18,177,250**		**52,569**	**21,384,998**	**350,459**	Sum of (a~d) x 10%
Total					199,949,750		578,257			
Total (Rounded)	**to L6-3**				**199,950,000**		**578,000**	**235,220,000**	**3,855,000**	**L6-3-4**
	FCP:LCP				85%		15%			

L7 Power Supply Line (by STEG)

Exchange Rate: 1.00US$= 119.60JPY 1.000TND= 61.02JPY

Items	Specification	Unit	Qt'ty	FC Portion (JPY)		LC Portion (TND)		Total		Reference
				Unit Price	Amount	Unit Price	Amount	(JPY)	(equiv. TND)	
Power Supply Line Construction by STEG		Ls	1		0		4,350,000	265,437,000	4,350,000	
150kV x 15km										
Travées	150kV	Ls	2		0		2,400,000	146,448,000	2,400,000	
Assistance		Ls	1		0		532,500	32,493,150	532,500	
Total					0		7,282,500			
Total (Rounded)	**to T1**				**0**		**7,283,000**	**444,409,000**	**7,283,000**	**L7**
	FCP:LCP				0%		100%			

10.12-1 Cash Flows of FIRR Calculation

(1) FIRR with Present Water Rate at 0.382TND/m^3

		1TND=	61.02	JPY			UNIT:JPY
0.382	YEAR	Project Cost	Non-eligible Cost to be financed by SONEDE	Operartion & Maintenance Cost	Revenue	Net Benefit With CAPEX	Net Benefit Without CAPEX
		a	b (included in a)	c	d	d-a-c	d-b-c
Construction	2015	0	0	0	0	0	0
	2016	0	0	0	0	0	0
	2017	701,738,436	111,086,679	0	0	-701,738,436	-111,086,679
	2018	346,429,763	76,845,491	0	0	-346,429,763	-76,845,491
	2019	5,752,699,567	540,549,751	0	0	-5,752,699,567	-540,549,751
	2020	9,892,306,518	1,065,375,471	0	0	-9,892,306,518	-1,065,375,471
	2021	9,403,934,920	983,924,237	0	0	-9,403,934,920	-983,924,237
	2022	8,516,748,025	901,726,138	0	136,736,013	-8,380,012,012	-764,990,125
Operartion & Maintenance	2023	7,888,928,826	805,443,700	391,979,012	562,136,943	-7,718,770,895	-635,285,769
	2024	1,820,589,502	182,022,124	1,676,743,126	607,715,614	-2,889,617,013	-1,251,049,636
	2025	144,100,349	13,587,337	1,676,743,126	607,715,614	-1,213,127,861	-1,082,614,849
	2026	0	0	1,676,743,126	607,715,614	-1,069,027,512	-1,069,027,512
	2027	0	0	1,676,743,126	607,715,614	-1,069,027,512	-1,069,027,512
	2028	0	0	1,676,743,126	607,715,614	-1,069,027,512	-1,069,027,512
	2029	0	0	1,676,743,126	607,715,614	-1,069,027,512	-1,069,027,512
	2030	0	0	1,676,743,126	607,715,614	-1,069,027,512	-1,069,027,512
	2031	0	0	1,676,743,126	607,715,614	-1,069,027,512	-1,069,027,512
	2032	0	0	1,676,743,126	607,715,614	-1,069,027,512	-1,069,027,512
	2033	0	0	1,676,743,126	607,715,614	-1,069,027,512	-1,069,027,512
	2034	0	0	1,676,743,126	607,715,614	-1,069,027,512	-1,069,027,512
	2035	0	0	1,676,743,126	607,715,614	-1,069,027,512	-1,069,027,512
	2036	0	0	1,676,743,126	607,715,614	-1,069,027,512	-1,069,027,512
	2037	0	0	1,676,743,126	607,715,614	-1,069,027,512	-1,069,027,512
	2038	0	0	1,676,743,126	607,715,614	-1,069,027,512	-1,069,027,512
	2039	0	0	1,676,743,126	607,715,614	-1,069,027,512	-1,069,027,512
	2040	0	0	1,676,743,126	607,715,614	-1,069,027,512	-1,069,027,512
	2041	0	0	1,676,743,126	607,715,614	-1,069,027,512	-1,069,027,512
	2042	0	0	1,676,743,126	607,715,614	-1,069,027,512	-1,069,027,512
	2043	0	0	1,676,743,126	607,715,614	-1,069,027,512	-1,069,027,512
	2044	0	0	1,676,743,126	607,715,614	-1,069,027,512	-1,069,027,512
	2045	0	0	1,676,743,126	607,715,614	-1,069,027,512	-1,069,027,512
	2046	0	0	1,676,743,126	607,715,614	-1,069,027,512	-1,069,027,512
	2047	0	0	1,676,743,126	607,715,614	-1,069,027,512	-1,069,027,512
	2048	0	0	1,676,743,126	607,715,614	-1,069,027,512	-1,069,027,512
	2049	0	0	1,676,743,126	607,715,614	-1,069,027,512	-1,069,027,512
	2050	0	0	1,676,743,126	607,715,614	-1,069,027,512	-1,069,027,512
	2051	0	0	1,676,743,126	607,715,614	-1,069,027,512	-1,069,027,512
	2052	0	0	1,676,743,126	607,715,614	-1,069,027,512	-1,069,027,512
TOTAL		44,467,475,906	4,680,560,928	49,017,529,664	18,322,625,771	-75,162,379,800	-35,375,464,822
FIRR						-	-

(2) FIRR with Water Rate at 1.154TND/m^3

TND.1.0 = JPY61.02

1.154	YEAR	Project Cost	Non-eligible Cost to be financed by SONEDE	Operartion & Maintenance Cost	Revenue	Net Benefit With CAPEX	Net Benefit Without CAPEX
		a	b (included in a)	c	d	d-a-c	d-b-c
Construction	2015	0	0	0	0	0	0
	2016	0	0	0	0	0	0
	2017	701,738,436	111,086,679	0	0	-701,738,436	-111,086,679
	2018	346,429,763	76,845,491	0	0	-346,429,763	-76,845,491
	2019	5,752,699,567	540,549,751	0	0	-5,752,699,567	-540,549,751
	2020	9,892,306,518	1,065,375,471	0	0	-9,892,306,518	-1,065,375,471
	2021	9,403,934,920	983,924,237	0	0	-9,403,934,920	-983,924,237
	2022	8,516,748,025	901,726,138	0	192,003,135	-8,324,744,890	-709,723,003
Operartion & Maintenance	2023	7,888,928,826	805,443,700	391,979,012	1,016,555,498	-7,264,352,340	-180,867,214
	2024	1,820,589,502	182,022,124	1,676,743,126	1,344,610,569	-2,152,722,059	-514,154,682
	2025	144,100,349	13,587,337	1,676,743,126	1,590,242,220	-230,601,255	-100,088,243
	2026	0	0	1,676,743,126	1,835,873,871	159,130,745	159,130,745
	2027	0	0	1,676,743,126	1,835,873,871	159,130,745	159,130,745
	2028	0	0	1,676,743,126	1,835,873,871	159,130,745	159,130,745
	2029	0	0	1,676,743,126	1,835,873,871	159,130,745	159,130,745
	2030	0	0	1,676,743,126	1,835,873,871	159,130,745	159,130,745
	2031	0	0	1,676,743,126	1,835,873,871	159,130,745	159,130,745
	2032	0	0	1,676,743,126	1,835,873,871	159,130,745	159,130,745
	2033	0	0	1,676,743,126	1,835,873,871	159,130,745	159,130,745
	2034	0	0	1,676,743,126	1,835,873,871	159,130,745	159,130,745
	2035	0	0	1,676,743,126	1,835,873,871	159,130,745	159,130,745
	2036	0	0	1,676,743,126	1,835,873,871	159,130,745	159,130,745
	2037	0	0	1,676,743,126	1,835,873,871	159,130,745	159,130,745
	2038	0	0	1,676,743,126	1,835,873,871	159,130,745	159,130,745
	2039	0	0	1,676,743,126	1,835,873,871	159,130,745	159,130,745
	2040	0	0	1,676,743,126	1,835,873,871	159,130,745	159,130,745
	2041	0	0	1,676,743,126	1,835,873,871	159,130,745	159,130,745
	2042	0	0	1,676,743,126	1,835,873,871	159,130,745	159,130,745
	2043	0	0	1,676,743,126	1,835,873,871	159,130,745	159,130,745
	2044	0	0	1,676,743,126	1,835,873,871	159,130,745	159,130,745
	2045	0	0	1,676,743,126	1,835,873,871	159,130,745	159,130,745
	2046	0	0	1,676,743,126	1,835,873,871	159,130,745	159,130,745
	2047	0	0	1,676,743,126	1,835,873,871	159,130,745	159,130,745
	2048	0	0	1,676,743,126	1,835,873,871	159,130,745	159,130,745
	2049	0	0	1,676,743,126	1,835,873,871	159,130,745	159,130,745
	2050	0	0	1,676,743,126	1,835,873,871	159,130,745	159,130,745
	2051	0	0	1,676,743,126	1,835,873,871	159,130,745	159,130,745
	2052	0	0	1,676,743,126	1,835,873,871	159,130,745	159,130,745
TOTAL		44,467,475,906	4,680,560,928	49,017,529,664	53,712,005,950	-39,772,999,620	13,915,358
FIRR						-10.54%	0.02%

(3) FIRR with Water Rate at 1.258TND/m^3

TND.1.0 = JPY61.02

1.258	YEAR	Project Cost	Non-eligible Cost to be financed by SONEDE	Operartion & Maintenance Cost	Revenue	Net Benefit With CAPEX	Net Benefit Without CAPEX
		a	b (included in a)	c	d	d-a-c	d-b-c
Construction	2015	0	0	0	0	0	0
	2016	0	0	0	0	0	0
	2017	701,738,436	111,086,679	0	0	-701,738,436	-111,086,679
	2018	346,429,763	76,845,491	0	0	-346,429,763	-76,845,491
	2019	5,752,699,567	540,549,751	0	0	-5,752,699,567	-540,549,751
	2020	9,892,306,518	1,065,375,471	0	0	-9,892,306,518	-1,065,375,471
	2021	9,403,934,920	983,924,237	0	0	-9,403,934,920	-983,924,237
	2022	8,516,748,025	901,726,138	0	199,448,447	-8,317,299,578	-702,277,692
Operartion & Maintenance	2023	7,888,928,826	805,443,700	391,979,012	1,077,772,506	-7,203,135,332	-119,650,206
	2024	1,820,589,502	182,022,124	1,676,743,126	1,443,881,391	-2,053,451,236	-414,883,859
	2025	144,100,349	13,587,337	1,676,743,126	1,722,603,317	-98,240,158	32,272,854
	2026	0	0	1,676,743,126	2,001,325,243	324,582,117	324,582,117
	2027	0	0	1,676,743,126	2,001,325,243	324,582,117	324,582,117
	2028	0	0	1,676,743,126	2,001,325,243	324,582,117	324,582,117
	2029	0	0	1,676,743,126	2,001,325,243	324,582,117	324,582,117
	2030	0	0	1,676,743,126	2,001,325,243	324,582,117	324,582,117
	2031	0	0	1,676,743,126	2,001,325,243	324,582,117	324,582,117
	2032	0	0	1,676,743,126	2,001,325,243	324,582,117	324,582,117
	2033	0	0	1,676,743,126	2,001,325,243	324,582,117	324,582,117
	2034	0	0	1,676,743,126	2,001,325,243	324,582,117	324,582,117
	2035	0	0	1,676,743,126	2,001,325,243	324,582,117	324,582,117
	2036	0	0	1,676,743,126	2,001,325,243	324,582,117	324,582,117
	2037	0	0	1,676,743,126	2,001,325,243	324,582,117	324,582,117
	2038	0	0	1,676,743,126	2,001,325,243	324,582,117	324,582,117
	2039	0	0	1,676,743,126	2,001,325,243	324,582,117	324,582,117
	2040	0	0	1,676,743,126	2,001,325,243	324,582,117	324,582,117
	2041	0	0	1,676,743,126	2,001,325,243	324,582,117	324,582,117
	2042	0	0	1,676,743,126	2,001,325,243	324,582,117	324,582,117
	2043	0	0	1,676,743,126	2,001,325,243	324,582,117	324,582,117
	2044	0	0	1,676,743,126	2,001,325,243	324,582,117	324,582,117
	2045	0	0	1,676,743,126	2,001,325,243	324,582,117	324,582,117
	2046	0	0	1,676,743,126	2,001,325,243	324,582,117	324,582,117
	2047	0	0	1,676,743,126	2,001,325,243	324,582,117	324,582,117
	2048	0	0	1,676,743,126	2,001,325,243	324,582,117	324,582,117
	2049	0	0	1,676,743,126	2,001,325,243	324,582,117	324,582,117
	2050	0	0	1,676,743,126	2,001,325,243	324,582,117	324,582,117
	2051	0	0	1,676,743,126	2,001,325,243	324,582,117	324,582,117
	2052	0	0	1,676,743,126	2,001,325,243	324,582,117	324,582,117
TOTAL		44,467,475,906	4,680,560,928	49,017,529,664	58,479,487,218	-35,005,518,352	4,781,396,625
FIRR						-7.67%	4.79%

(4) FIRR with Water Rate at 2.022TND/m^3

TND.1.0 = JPY61.02

2.022	YEAR	Project Cost	Non-eligible Cost to be financed by SONEDE	Operartion & Maintenance Cost	Revenue	Net Benefit With CAPEX	Net Benefit Without CAPEX
		a	b (included in a)	c	d	d-a-c	d-b-c
Construction	2015	0	0	0	0	0	0
	2016	0	0	0	0	0	0
	2017	701,738,436	111,086,679	0	0	-701,738,436	-111,086,679
	2018	346,429,763	76,845,491	0	0	-346,429,763	-76,845,491
	2019	5,752,699,567	540,549,751	0	0	-5,752,699,567	-540,549,751
	2020	9,892,306,518	1,065,375,471	0	0	-9,892,306,518	-1,065,375,471
	2021	9,403,934,920	983,924,237	0	0	-9,403,934,920	-983,924,237
	2022	8,516,748,025	901,726,138	0	254,142,852	-8,262,605,173	-647,583,286
Operartion & Maintenance	2023	7,888,928,826	805,443,700	391,979,012	1,527,482,060	-6,753,425,778	330,059,348
	2024	1,820,589,502	182,022,124	1,676,743,126	2,173,140,129	-1,324,192,499	314,374,878
	2025	144,100,349	13,587,337	1,676,743,126	2,694,948,300	874,104,825	1,004,617,837
	2026	0	0	1,676,743,126	3,216,756,471	1,540,013,345	1,540,013,345
	2027	0	0	1,676,743,126	3,216,756,471	1,540,013,345	1,540,013,345
	2028	0	0	1,676,743,126	3,216,756,471	1,540,013,345	1,540,013,345
	2029	0	0	1,676,743,126	3,216,756,471	1,540,013,345	1,540,013,345
	2030	0	0	1,676,743,126	3,216,756,471	1,540,013,345	1,540,013,345
	2031	0	0	1,676,743,126	3,216,756,471	1,540,013,345	1,540,013,345
	2032	0	0	1,676,743,126	3,216,756,471	1,540,013,345	1,540,013,345
	2033	0	0	1,676,743,126	3,216,756,471	1,540,013,345	1,540,013,345
	2034	0	0	1,676,743,126	3,216,756,471	1,540,013,345	1,540,013,345
	2035	0	0	1,676,743,126	3,216,756,471	1,540,013,345	1,540,013,345
	2036	0	0	1,676,743,126	3,216,756,471	1,540,013,345	1,540,013,345
	2037	0	0	1,676,743,126	3,216,756,471	1,540,013,345	1,540,013,345
	2038	0	0	1,676,743,126	3,216,756,471	1,540,013,345	1,540,013,345
	2039	0	0	1,676,743,126	3,216,756,471	1,540,013,345	1,540,013,345
	2040	0	0	1,676,743,126	3,216,756,471	1,540,013,345	1,540,013,345
	2041	0	0	1,676,743,126	3,216,756,471	1,540,013,345	1,540,013,345
	2042	0	0	1,676,743,126	3,216,756,471	1,540,013,345	1,540,013,345
	2043	0	0	1,676,743,126	3,216,756,471	1,540,013,345	1,540,013,345
	2044	0	0	1,676,743,126	3,216,756,471	1,540,013,345	1,540,013,345
	2045	0	0	1,676,743,126	3,216,756,471	1,540,013,345	1,540,013,345
	2046	0	0	1,676,743,126	3,216,756,471	1,540,013,345	1,540,013,345
	2047	0	0	1,676,743,126	3,216,756,471	1,540,013,345	1,540,013,345
	2048	0	0	1,676,743,126	3,216,756,471	1,540,013,345	1,540,013,345
	2049	0	0	1,676,743,126	3,216,756,471	1,540,013,345	1,540,013,345
	2050	0	0	1,676,743,126	3,216,756,471	1,540,013,345	1,540,013,345
	2051	0	0	1,676,743,126	3,216,756,471	1,540,013,345	1,540,013,345
	2052	0	0	1,676,743,126	3,216,756,471	1,540,013,345	1,540,013,345
TOTAL		44,467,475,906	4,680,560,928	49,017,529,664	93,502,138,069	17,132,499	39,804,047,477
FIRR						0.00%	21.96%

(5)FIRR with Water Rate at 3.035TND/m^3

TND.1.0 = JPY61.02

3.035	YEAR	Project Cost	Non-eligible Cost to be financed by SONEDE	Operartion & Maintenance Cost	Revenue	Net Benefit With CAPEX	Net Benefit Without CAPEX
		a	b (included in a)	c	d	d-a-c	d-b-c
Construction	2015	0	0	0	0	0	0
	2016	0	0	0	0	0	0
	2017	701,738,436	111,086,679	0	0	-701,738,436	-111,086,679
	2018	346,429,763	76,845,491	0	0	-346,429,763	-76,845,491
	2019	5,752,699,567	540,549,751	0	0	-5,752,699,567	-540,549,751
	2020	9,892,306,518	1,065,375,471	0	0	-9,892,306,518	-1,065,375,471
	2021	9,403,934,920	983,924,237	0	0	-9,403,934,920	-983,924,237
	2022	8,516,748,025	901,726,138	0	326,663,051	-8,190,084,973	-575,063,087
Operartion & Maintenance	2023	7,888,928,826	805,443,700	391,979,012	2,123,759,258	-6,157,148,580	926,336,546
	2024	1,820,589,502	182,022,124	1,676,743,126	3,140,076,124	-357,256,503	1,281,310,874
	2025	144,100,349	13,587,337	1,676,743,126	3,984,196,294	2,163,352,819	2,293,865,831
	2026	0	0	1,676,743,126	4,828,316,464	3,151,573,338	3,151,573,338
	2027	0	0	1,676,743,126	4,828,316,464	3,151,573,338	3,151,573,338
	2028	0	0	1,676,743,126	4,828,316,464	3,151,573,338	3,151,573,338
	2029	0	0	1,676,743,126	4,828,316,464	3,151,573,338	3,151,573,338
	2030	0	0	1,676,743,126	4,828,316,464	3,151,573,338	3,151,573,338
	2031	0	0	1,676,743,126	4,828,316,464	3,151,573,338	3,151,573,338
	2032	0	0	1,676,743,126	4,828,316,464	3,151,573,338	3,151,573,338
	2033	0	0	1,676,743,126	4,828,316,464	3,151,573,338	3,151,573,338
	2034	0	0	1,676,743,126	4,828,316,464	3,151,573,338	3,151,573,338
	2035	0	0	1,676,743,126	4,828,316,464	3,151,573,338	3,151,573,338
	2036	0	0	1,676,743,126	4,828,316,464	3,151,573,338	3,151,573,338
	2037	0	0	1,676,743,126	4,828,316,464	3,151,573,338	3,151,573,338
	2038	0	0	1,676,743,126	4,828,316,464	3,151,573,338	3,151,573,338
	2039	0	0	1,676,743,126	4,828,316,464	3,151,573,338	3,151,573,338
	2040	0	0	1,676,743,126	4,828,316,464	3,151,573,338	3,151,573,338
	2041	0	0	1,676,743,126	4,828,316,464	3,151,573,338	3,151,573,338
	2042	0	0	1,676,743,126	4,828,316,464	3,151,573,338	3,151,573,338
	2043	0	0	1,676,743,126	4,828,316,464	3,151,573,338	3,151,573,338
	2044	0	0	1,676,743,126	4,828,316,464	3,151,573,338	3,151,573,338
	2045	0	0	1,676,743,126	4,828,316,464	3,151,573,338	3,151,573,338
	2046	0	0	1,676,743,126	4,828,316,464	3,151,573,338	3,151,573,338
	2047	0	0	1,676,743,126	4,828,316,464	3,151,573,338	3,151,573,338
	2048	0	0	1,676,743,126	4,828,316,464	3,151,573,338	3,151,573,338
	2049	0	0	1,676,743,126	4,828,316,464	3,151,573,338	3,151,573,338
	2050	0	0	1,676,743,126	4,828,316,464	3,151,573,338	3,151,573,338
	2051	0	0	1,676,743,126	4,828,316,464	3,151,573,338	3,151,573,338
	2052	0	0	1,676,743,126	4,828,316,464	3,151,573,338	3,151,573,338
TOTAL		44,467,475,906	4,680,560,928	49,017,529,664	139,939,239,263	46,454,233,693	86,241,148,671
FIRR						4.77%	35.16%

CHAPTER 11

CONFIRMATION OF VIABILITY AND RISK ANALYSYS

11.3-1 Request Letter to STEG from SONEDE regarding Power Provision of 40MW (issued on May 28, 2013)

الشركة الوطنية لاستغلال وتوزيع المياه
SOCIETE NATIONALE D'EXPLOITATION ET DE DISTRIBUTION DES EAUX

تونس في: 28 ماي 2013

إلى

السيد المدير العام للشركة التونسية للكهرباء و الغاز 26170/

الموضوع: مشروع إنجاز محطة لتحلية مياه البحر بصفاقس

تحية طيبة و بعد،

في إطار مشروع إنجاز محطة لتحلية مياه البحر بصفاقس و ربطها بشبكة التوزيع، قام وفد من الوكالة اليابانية للتعاون الدولي بزيارة إلى البلاد التونسية خلال الفترة الممتدة من 13 إلى 17 ماي 2013 قصد التحضير لإعداد دراسة أولية للمشروع الذي سيتم تمويله من طرف الجانب الياباني، وقد طالب الفريق الياباني بمده ببعض المعطيات المتعلقة بتزويد ولاية صفاقس بالطاقة الكهربائية التالية:

- إجمالي وتفصيل حجم الطاقة الكهربائية بولاية صفاقس،
- الزيادة المنتظرة من إمدادات الطاقة الكهربائية في السنوات القليلة القادمة بولاية صفاقس.

نالرجاء منكم بالمعطيات المطلوبة في أقرب الآجال لتيسير انطلاق دراسة المشروع علما و أن الطاقة الضرورية لتشغيل المحطة المزمع إنجازها تقارب 40 ميغاوات.

تقبلوا فائق عبارات التقدير و السلام.

الرئيس المدير العام
الهادي بالحاج

ARRIVEE LE 28 MAI 2013

شارع سليمان بن سليمان
1002 تونس - البلفيدير
Bd. Slimane Ben Slimane
El Manar II - Tunis 2092

Tél. : 71.887.000 الهاتف
Fax : 71.871.000 الفاكس
E-mail sonede@sonede.com.tn البريد الإلكتروني

R.C. : C01115926/8 السجل التجاري عدد
Matricule Fiscal 1455 M/A/M/000 المعرف الجبائي

11.3-2 Translation of 11.3-1 in English

SONEDE

Tunis, May 28, 2013

To the kind attention of the General Manager of STEG, Tunisian Power Company

Subject: Construction project of the sea water desalination project in Sfax

Greetings,

In the framework of the sea water desalination plant construction project and its subsequent connection to the distribution network, a delegation representing the Japan International Cooperation Agency visited Tunisia on May 13-17, 2013 to set the framework for a preliminary study of a project that will be funded by the Japanese part, and the Japanese team requested some information concerning power supply to the Sfax Governorate as follows:

- Total and detailed power supply to the Governorate of Sfax;
- Possible increase of electrical power supply in the few next years in the Sfax Governorate;4

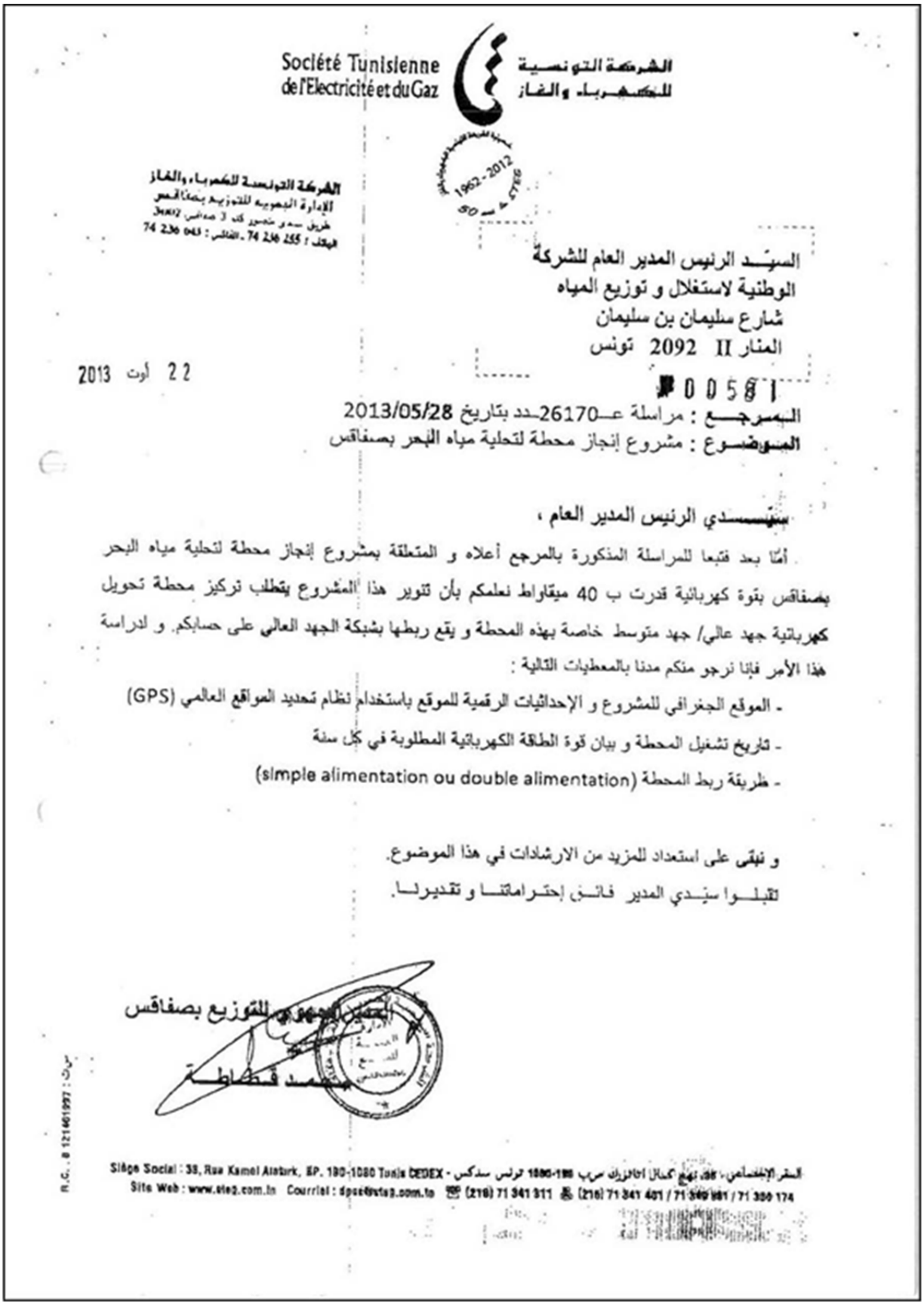
Therefore, we would appreciate you providing us with these data in the best possible time to ensure smooth beginning of the project, knowing that power required for the operation of the planned station would be about 40 MW.

Please accept my best regards

General Manager

Hedi Belhaj

11.3-3 Answer from STEG to SONEDE regarding Request Letter on May 28, 2013 (issued on August 22, 2013)



Société Tunisienne de l'Electricité et du Gaz

الشركة التونسية للكهرباء والغاز

1962 - 2012

الشركة التونسية للكهرباء والغاز
الإدارة الجهوية للتوزيع بصفاقس
طريق سيدي منصور كلم 3 صفاقس 3060
الهاتف : 74 236 255 - الفاكس : 74 236 043

السيّـد الرئيس المدير العام للشركة
الوطنية لاستغلال و توزيع المياه
شارع سليمان بن سليمان
المنار II 2092 تونس

2013 أوت 22

0058

المرجـع : مراسلة عـ26170ـدد بتاريخ 2013/05/28
الموضـوع : مشروع إنجاز محطة لتحلية مياه البحر بصفاقس

سيّـدي الرئيس المدير العام ،

أمّا بعد فتبعا للمراسلة المذكورة بالمرجع أعلاه و المتعلقة بمشروع إنجاز محطة لتحلية مياه البحر بصفاقس بقوة كهربائية قدرت ب 40 ميقاواط نعلمكم بأن تنوير هذا المشروع يتطلب تركيز محطة تحويل كهربائية جهد عالي/ جهد متوسط خاصة بهذه المحطة و يقع ربطها بشبكة الجهد العالي على حسابكم. و لدراسة هذا الأمر فإنا نرجو منكم مدنا بالمعطيات التالية :

- الموقع الجغرافي للمشروع و الإحداثيات الرقمية للموقع باستخدام نظام تحديد المواقع العالمي (GPS)
- تاريخ تشغيل المحطة و بيان قوة الطاقة الكهربائية المطلوبة في كل سنة
- طريقة ربط المحطة (simple alimentation ou double alimentation)

و نبقى على استعداد للمزيد من الارشادات في هذا الموضوع.

تقبلـوا سيّـدي المدير فائـق إحتـراماتنـا و تقديرنـا.

المدير الجهوي للتوزيع بصفاقس
محمد قطاطة

R.C. : B 1214611997

Siège Social : 38, Rue Kamel Ataturk, BP. 190-1080 Tunis CEDEX - المقر الاجتماعي : 38، نهج كمال أتاتورك ص.ب 190-1080 تونس سدكس
Site Web : www.steg.com.tn Courriel : dpse@steg.com.tn (216) 71 341 911 (216) 71 341 401 / 71 340 881 / 71 350 174

11.3-4 Translation of 11.3-3 in English

STEG

August 22, 2013

To the kind attention of the Director General of SONEDE

Reference: Letter n. 26170 dated May 28, 2013

Subject: Construction project of the sea water desalination project in Sfax

Mr. Director General:

Further to your letter referenced above concerning the sea water desalination construction project in Sfax with a total power of 40 MW, we inform you that this project will require the construction of a high voltage/middle voltage power transformation station that will be connected to the high voltage station at your expense. In order to further study this subject, we kindly ask you to provide us with the following information:

- Geographic location of the project and the digital coordinates based on GPS;
- Date of project operation and electrical power required per year;
- Connection pattern of the station: simple supply or double supply.

We remain prepared to provide you with additional information.

Please accept our best regards.

Sfax Regional Distribution Director

Mohamed Ketata

11.3-5 Answer of STEG about Power Supply Cost and Method（2013/11/20）

21-NOV-2013 THU 10:11 SONEDE. DTTS FAX NO. 216 74 223303 P. 01/02

à l'attention de M^r A. Boussoffara

Société Tunisienne de l'Electricité et du Gaz
الشركة التونسية للكهرباء والغاز

Le Chef Service Travaux Equipements
M.F MAALEJ

STEG
Direction Régionale
Distribution de Sfax
Route de Mahdia Km 3 - SFAX 3002
Tél. 74 225 450 Fax 74 636 843

SONEDE
Division Equipement Sud
Rue Ibn Badis 3029 Sfax

20 NOV 2013

N° 00845

OBJET : Raccordement de la station de dessalement projetée à Sfax.
Réf : Votre note du 04/11/2013

Monsieur

Suite à votre note du 04/11/2013 relative au raccordement de la station de dessalement projetée à Sfax et en réponse à l'enquête avancée par l'équipe japonaise chargé de l'étude de la dite station nous vous transmettons ci-après les éléments de réponse relatifs à cette enquête.

1) Les coupures sur le réseau 150 kV sont minimes du fait que le réseau HTB est maillé. Cependant la puissance demandée par le projet est disponible actuellement en termes de production.
2) La puissance maximale du transformateur qui peut être raccordé sur le réseau 150 kV est de 40 MVA.
3) La distance et le coût actuel d'extension de la ligne électrique dépendent de l'emplacement du site. Le calcul du coût s'est fait sur la base d'un câble souterrain. Le tableau suivant résume ces différentes quantités.

Site N°	Distance	Coût d'extension (DT HTVA)
1	2x3.6 km	11 million
2	2x5.6 km	17 million
3.1	2x11.1 km	34 million
3.2	2x15.5 km	47 million
3.3	2x18.2 km	55 million
5	2x26 km	78 million
6	2x35.3 km	106 million

4) L'alimentation sera en double ligne (entrée sortie) à partir du point le plus proche du réseau 150 kV. Il n'y aura pas de ligne spécialisé ni d'alimentation duplex à partir d'une autre station. Cependant il est possible que la ligne soit en partie en souterrain et en partie en aérien.

Le Directeur Régional de la
Distribution de Sfax

Direction Régionale de Distribution de Sfax

Mohammed KETATA

11.3-6 Translation of 11.3-5 in English

From: STEG Regional Distribution Department, SFAX

To: SONEDE Equipment Division – SOUTH

20 November, 2013

Subject: Connection of the Sfax desalination station project
Reference: Your note dated November 4, 2013

Dear Sir,

Further to your note dated November 4, 2013 related to connection of the Sfax Desalination Station and in response to the survey questions raised by the Japanese team in charge of the study of subject station, please find below answers related to questions raised:

1- Power cutoffs on the 150 kV network are scarce as the HTB (High Voltage) network is meshed. And capacity currently requested by the project is available.

2- The maximal power of the transformer that can be connected to the 150 kV network is 40 MVA.

3- The distance and the current extension cost of the electrical line depend on the project location. The cost calculation is made based on an underground cable. The following table summarizes the different quantities:

Site n.	Distance	Extension Cost
1	2 x 306 km	11 million
3.1	2 x 11.1 km	34 million
3.2	2 x 15.5 km	47 million
3.3	2 x 18.2 km	55 million
5	2 x 26 km	78 million
6	2 x 35.3 km	106 million

4- Supply will be in double line (incoming/outgoing) from the closest point of the 150 kV network. There will be neither specialized line nor dual supply from a different power plant. However, the line may be partly buried and partly airborne.

Mohamed Ketata
Regional Director