Appendix 2-3 Water Quality Survey

1. Report

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2. Outline of the Survey Results

Since the Team obtained the wastewater quality data of Al Bireh and Nablus, but did not obtain that in Jericho, we took and analyzed the sample from Intercontinental Hotel(ICH) and Presidential Guard Camp(PGC), which have a wastewater treatment facility, and withdrawn wastewater of cesspit from residential houses and buildings. The samples from ICH and PGC were two(2) each, Inflow and outflow, on 16th February, and that from cesspits taken by vacuum cars were total six(6) on 21st February.

The analysis results are shown in Table 2-2-1 and 2-2-2. The concentration of ICH's inflow data was much lower than the design values for inflow water quality, while that of PGCs was similar with the design value, with both of poor quality of treated water. The other hand, BOD of the withdrawn wastewater cesspit was relatively low and majority samples of TSS were 10 times higher than design value. It may shown that water and resolved organic material were penetrated in underground, and only solid is remain in the cesspit as TSS. The T-N values to BOD of wastewater were analyzed to be high, while the ratio of BOD : T-N = 5 : 1 (in this design, unit pollution load of BOD : T-N = 60 : 12 = 5 : 1) . We confirmed to analysts that the procedure is right or not, and since the answer was right, the results were shown in the table, even though the value is doubtful. Because the value of T-N is important, it needs to be confirmed in the detailed design stage.

Table 2-3-1 Inflow and Outflow Quality of WWTF

Place	ICH		PGC	
Division	Inflow	Outflow	Inflow	Outflow
Sampling Date	11/2/16	11/2/16	11/2/21	11/2/21
pH(--)	7	7.5	6.1	7.6
EC(μs/cm)	2,050	2,430	1,800	2,040
BOD(mg/L)	167	26	540	64
COD(mg/L)	320	224	960	320
TSS(mg/L)	120	48	286	18
PO_4(mg/L)	6.2	2.0	11.8	11.0
T-N(mg/L)	134	46	152	33

Table 2-3-1 Cesspit Wastewater Quality

Place	House1	House2	House3	House4	Building1	House5
Sampling Date	11/2/21	11/2/21	11/2/21	11/2/21	11/2/21	11/2/21
pH(--)	6.3	7	6.5	6.7	6.1	6.8
EC(μs/cm)	1,640	1,697	1,920	2,440	2,390	1,650
BOD(mg/L)	312	182	400	248	616	208
COD(mg/L)	800	720	640	480	1,500	960
TSS(mg/L)	4,240	1,090	4,310	3,680	8,390	3,010
PO_4(mg/L)	2.1	1.9	3.2	4.1	10.1	6.5
T-N(mg/L)	140	123	176	162	184	128

Japan International
Cooperation Agency (JICA)

An-Najah National University
Water and Environmentand
Studies Institute (WESI)

FINAL REPORT

WATER QUALITY SURVEY
For the Basic Study On
The Jericho Wastewater Collection,
Treatment System And Reuse Project

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Submitted to

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ABBREVIATIONS

JICA: Japan International Cooperation Agency
WESI: Water and Environmental Studies Institute
WW: Wastewater
WWTP: Wastewater Treatment Plant

0. Executive Summary

Within the preliminary study necessary to implement this project, wastewater samples from the targeted communities were planned to be collected and analyzed. Therefore, JICA Study Team had contracted Water and Environmental Studies Institute (WESI) at An-Najah National University-Nablus to collect and analyze these samples.

For the purpose of this study, wastewater samples from the influent and effluent of the wastewater treatment plants WWTPs at the Intercontinental Hotel and the Presidential Guard, were collected and chemically analyzed. Another set of wastewater samples, from cesspits in different areas of Jericho district, were also collected and analyzed.

Results indicated that removal percentage of BOD5, COD, TSS, and Total nitrogen in the WWTP of the Intercontinental Hotel was 84.4%, 30%, 60%, and 65.7%, respectively. Whereas values of the same parameters in the WWTP of the Presidential Guard were 88%, 66.6%, 93.7%, and 78.3%, respectively. These results indicate that the efficiency of the WWTP of the Presidential Guard is higher than that of the WWTP at the Intercontinental Hotel.

Results of the chemical analysis of the samples collected from the cesspits showed that the average of the BOD5, COD, TSS, PO4, and Total-N was 328, 850, 4120, 4.7, and 152 mg/l, respectively.

Studying of more wastewater samples is recommended in order to form a comprehensive picture about wastewater characteristics in WWTPs at the governmental and non-governmental institutions and at cesspits in houses as well.

1. Introduction

Jericho is one of the smallest cities in the Palestinian Territories. It is located in the far east of the West Bank with the lowest altitude (250 meters below sea level) of any city. The population is about 20,000, with a large part of the population engaged in agriculture as Jericho is considered a green oasis located in the Jordan Valley. Figure-1 depicts Jericho City and the surrounding communities.

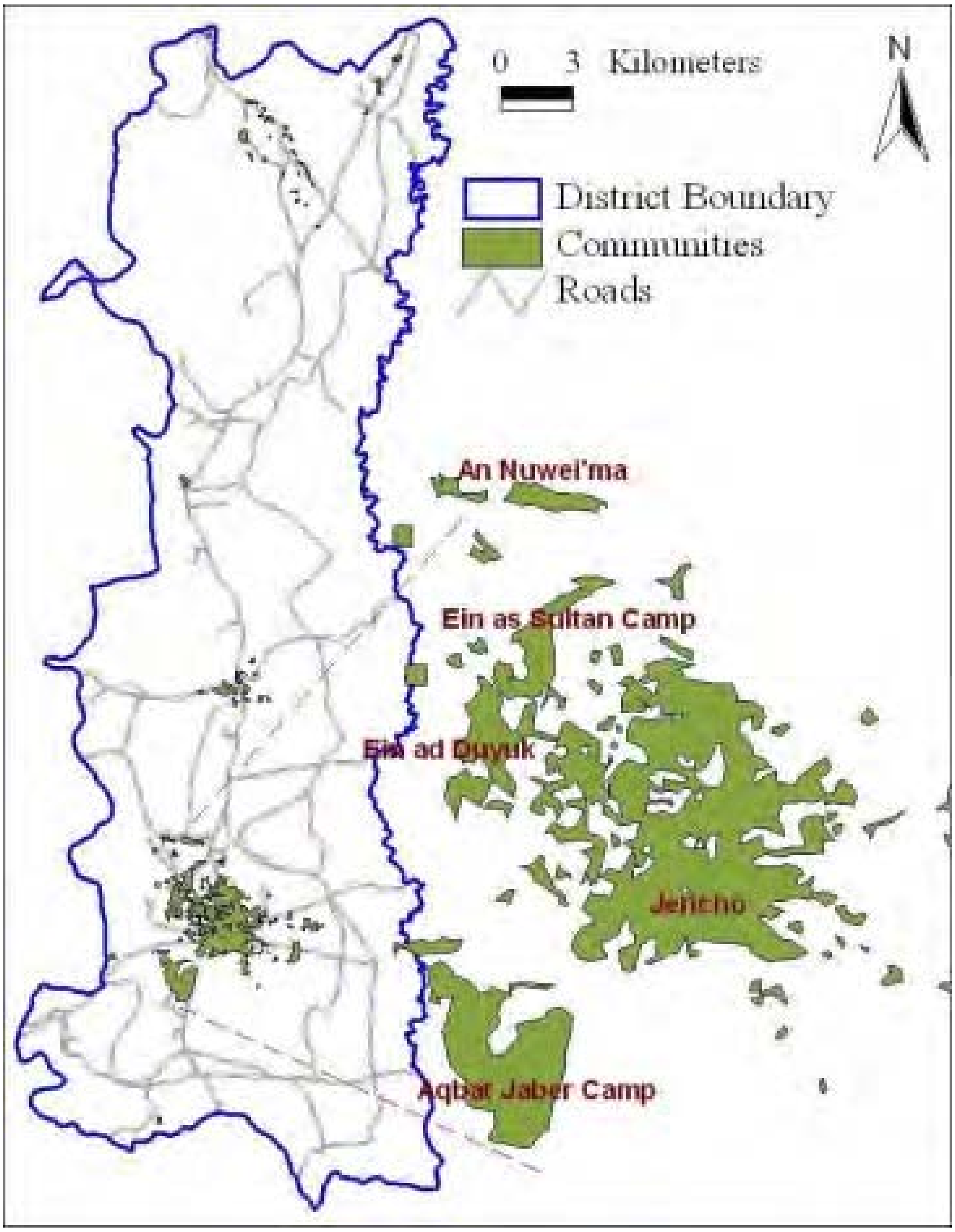


Figure-1 Jericho City and the surrounding communities

Jericho is located on the crossroads of the east–west tourist corridor from Jerusalem to Amman and the north-south tourist corridor from Tiberias to Eliat, having an immense potential to attract tourists who have diversified tourism objectives, such as pilgrimage tourism, cultural tourism, resort tourism and nature tourism including eco-tourism.

Jericho is suffering from many problems related to poor infrastructure. It is, as a touristy city, still lacking to basic services in the field of sufficient drinking water of acceptable quality, sewerage systems and wastewater treatment plant systems, suitable roads, solid waste collection and disposal systems, affordable hotels and resorts, etc…

2. Background

Wastewater collection in the Palestinian Territory is mostly limited to major cities and refugee camps. Jericho is one of the cities which have no wastewater collection system, and wastewater is discharged into septic tanks and/or emptied into Wadis. In most cities including Jericho, rainwater is allowed to runoff on the surface and eventually reaches the Wadis.

Overall, it was recently estimated that sewage networks serve only about 30% of the West Bank populations. The remaining population uses cesspits and open channels for wastewater collection. Most of the cesspits are left without a cement basement of liner so that sewage infiltrates into the earth layers and the owners avoid using the expensive services of the vacuum tankers to empty the cesspits. These non-lined cesspits exacerbate the pollution of groundwater aquifers.

Currently, wastewater treatment and reuse in the Palestinian Territory is limited because of high cost and limited financial resources, Israeli authority approval of such projects, people's acceptance and involvement, and technological and experience needs.

Wastewater management is a very important issue to consider, from environmental protection of public health, soil, and groundwater and from conserving the treated effluent and its potential reuse as a supplementary source of water in various purposes including agriculture.

3. Objectives

The specific objective of this study, carried out by Water and Environmental Studies Institute (WESI) at An-Najah National University, is to give an updated picture and a comprehensive understanding about wastewater characteristics currently treated or disposed of in cesspits. Data obtained from this study will be used during planning and constructing the wastewater networks and treatment plants in Jericho City and the surrounding communities such as Aqbat Jabr refugee camp, Ain Al Sultan, Al Doyouk, and Al Nuwai'meh. This important project is funded by Japan government.

It is anticipated that this study will also help innovating or at least applying appropriate methods to improve wastewater treatment technologies maintaining acceptable levels of wastewater standards and enabling Jericho Municipality to utilize some of the treated wastewater for irrigation or/and industrial purposes.

4. Wastewater in Jericho City

Jericho is one of the Palestinian cities lacking to sewerage networks and central wastewater treatment plants (WWTP). Wastewater in Jericho and the surrounding communities is almost being disposed of in cesspits. Some governmental and non-governmental institutions are exceptional examples where wastewater is treated and reused in their vicinities.

The Intercontinental Hotel, as an example of the non-governmental institutions, has a WWTP using activated carbon as the appropriate technology for treating wastewater. Meanwhile, the Presidential Guard as an example of the governmental institutions has a WWTP using trickling filter method.

5. Sample Collection

Ten wastewater Samples were collected from Jericho City. Four of them were collected from WWTPs and six from infiltration cesspits. Sample collection was carried out as follows:

a) Two wastewater samples were collected from the influent and effluent of the WWTP of the Intercontinental Hotel and another two from the influent and effluent of the Presidential Guard WWTP. Collection of these samples was conducted on 16th February, 2011. The four samples were transported in a cooling box to WESI laboratories at the university campus in Nablus.

b) Six samples were collected, on 21st February, 2011, from house cesspits in different areas of Jericho City. These samples were also transported in a cooling box to WESI laboratories.

Using the cooling box is of great importance to minimize any changes or reactions in the sample bottles during transportation.

6. Laboratory Analysis

As soon as the samples were received in the laboratory, the following chemical tests were carried out:

1- BOD_5
2- COD
3- TSS
4- Total-N
5- pH
6- EC
7- PO_4

Methods used in the laboratory to test these samples were according to "*Standard Methods for the Examination of Water and Wastewater, APHA, 21st ed., 2005*".

Carrying out these tests aimed at highlighting the chemical characteristics of wastewater which decide the appropriate technology to be applied when planning and constructing the WWTPs in Jericho.

7. Results and Discussion

All the obtained results of the chemical analysis of the wastewater samples are shown in the table in the ANNEX.

Results of wastewater samples are classified into two groups:

7.1 Samples collected from the WWTPs

Results of samples collected from the WWTPs of the Intercontinental Hotel and the Presidential Guard are shown in Table-1.

From Table-1 and Figure-2, it is evident that in the WWTP of the Intercontinental Hotel:

(i) BOD5 dropped from 167 to 26 mg/l after treatment
(ii) COD dropped from 320 to 224 mg/l after treatment
(iii) TSS dropped from 1,120 to 48 mg/l after treatment
(iv) BOD5 to COD ratio is 0.52 which means that the WW is considered to be highly biodegradable;

Whereas in the WWTP of the Presidential Guard:

(i) BOD5 dropped from 540 to 64 mg/l after
(ii) COD dropped from 960 to 320 mg/l after treatment
(iii) TSS dropped from 286 to 18 mg/l after treatment
(iv) BOD5 to COD ratio is 0.56 which means that the WW is considered to be highly biodegradable, too.

Table-1 Results of WW Samples Collected from the Intercontinental Hotel And the Presidential Guard At Jericho on 16th February, 2011

Location	Date	pH unit	EC µs/cm	BOD_5 mg/l	COD mg/l	TSS mg/l	PO_4 mg/l	Total-N mg/l
Intercontinental (Influent)	16/2/2011	6.97	2,050	167	320	120	6.2	**134**
Intercontin-ental (Effluent)	16/2/2011	7.51	2,430	26	224	48	2.0	**46**
Presidential Guard (Influent)	16/2/2011	6.61	1,800	540	960	286	11.8	**152**
Presidential Guard (Effluent)	16/2/2011	7.63	2,040	64	320	18	11.0	**33**

Figure-2 BOD and COD in Influent and Effluent of WWTP in the Intercontinental Hotel and the Presidential Guard

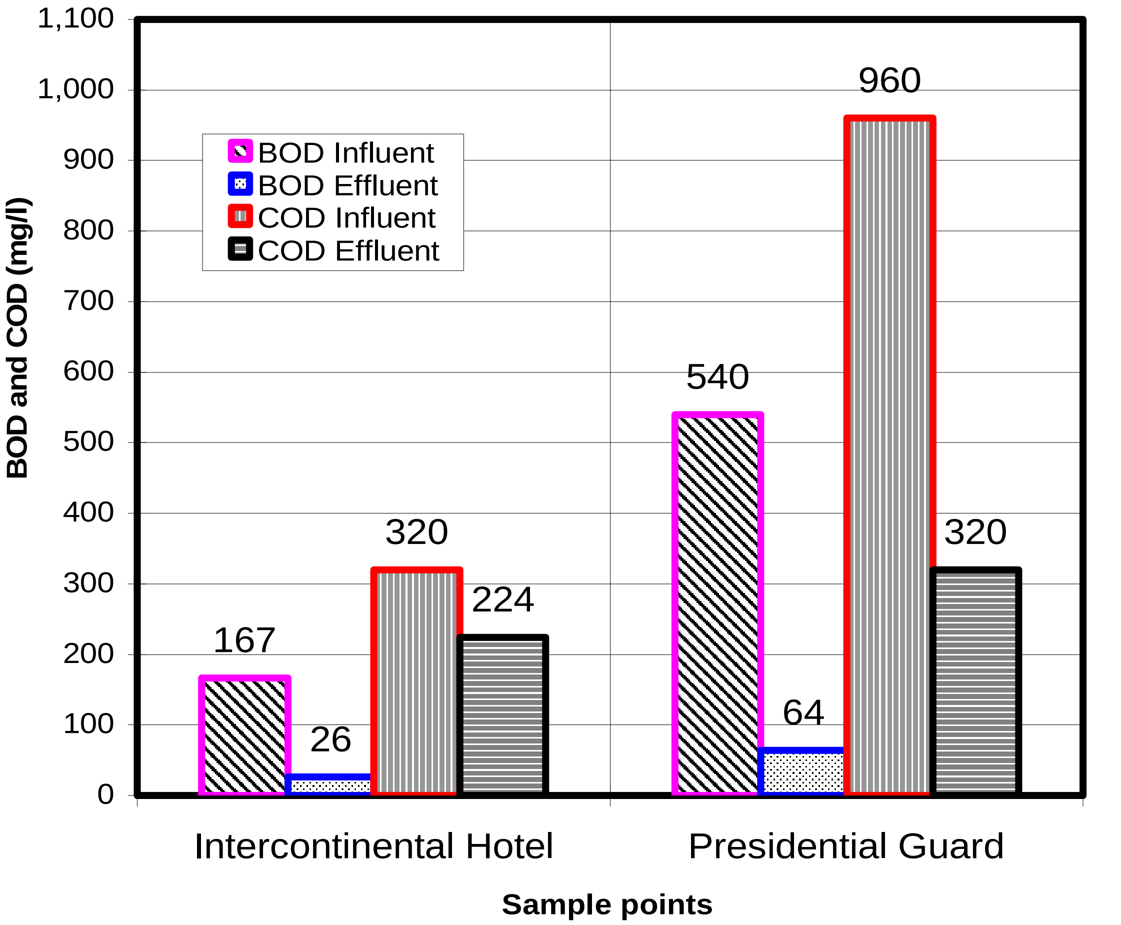
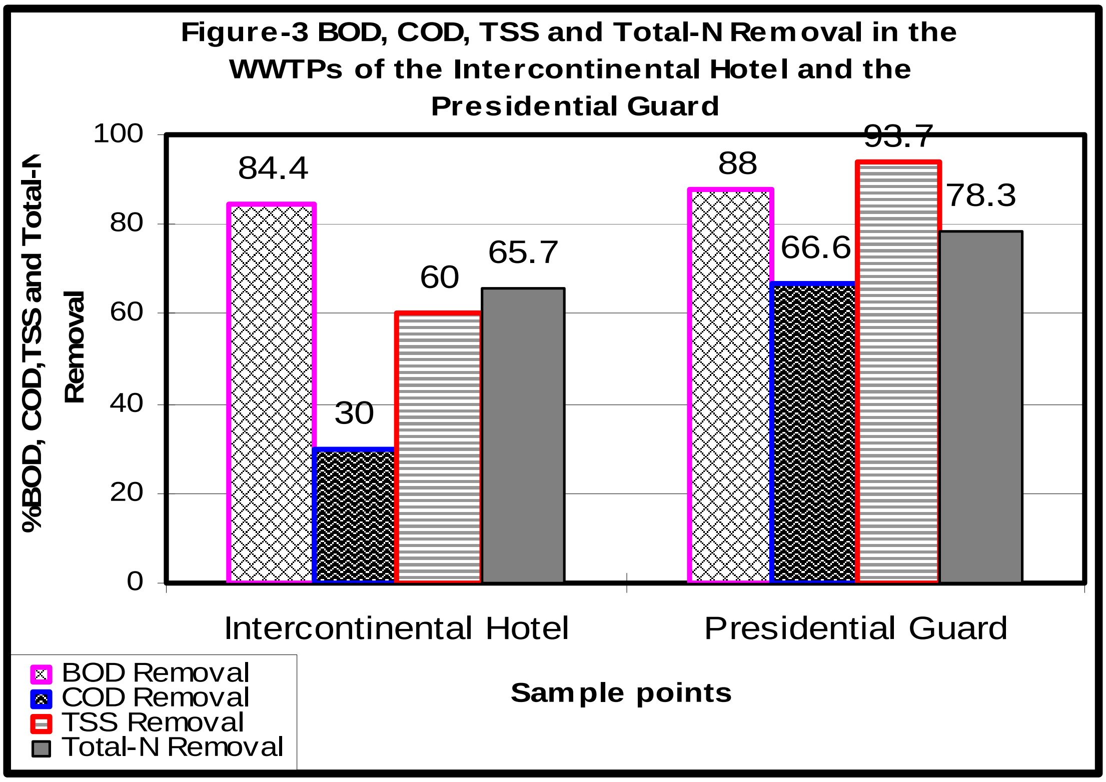


Table-2 Removal Percentage of BOD5, COD, and TSS in the WWTP in the Intercontinental Hotel and the Presidential Guard

Location	%BOD5 removal	%COD removal	%TSS removal	%Total-N removal
Intercontinental Hotel	**84.4**	**30.0**	**60.0**	**65.7**
Presidential Guard	**88.0**	**66.6**	**93.7**	**78.3**

From Table-2 and Figure-3 it is clear that the removal percentage of BOD5, COD, TSS and Total-N are higher in the WWTP of the Presidential Guard in comparison to that of the Intercontinental Hotel. Consequently, the WWTP of the Presidential Guard is more efficient than that of the Intercontinental Hotel.



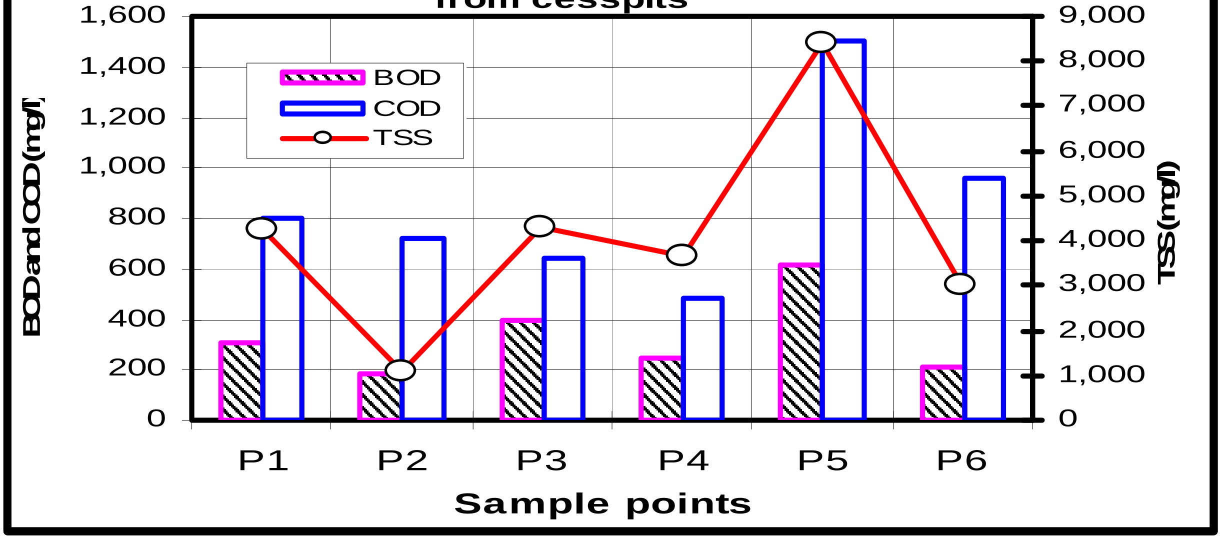
7.2 Samples collected from cesspits

Results of samples collected from the infiltration cesspits distributed in different areas of Jericho City are shown in Table-3.

Table-3 Results of WW Samples Collected from the Infiltration Cesspits Distributed in Different Areas of Jericho City on 21st February, 2011

No.	Location	Date	pH unit	EC µs/cm	BOD_5 mg/l	COD mg/l	TSS mg/l	PO_4 mg/l	Total-N mg/l
1	Palestine St. (house)	21/2/2011	6.27	1640	312	800	4240	2.1	140
2	Sabiha area (house)	21/2/2011	6.97	1697	182	720	1090	1.9	123
3	El Sultan St. (house)	21/2/2011	6.54	1920	400	640	4310	3.2	176
4	El Sultan St. (house)	21/2/2011	6.71	2440	248	480	3680	4.1	162
5	Al Maghtas St. (Building)	21/2/2011	6.13	2390	616	1500	8390	10.1	184
6	Hisham Palace St. (house)	21/2/2011	6.76	1650	208	960	3010	6.5	128

Figure-4 BOD, COD, and TSS in the WW collected from cesspits



P1: *Palestine street (house)*
P2: *Sabiha area (house)*
P3: *El Sultan street (house)*
P4: *El Sultan street (house)*
P5: *Al Maghtas street (building)*
P6: *Hisham Palace street (house)*

From Table-3 and Figure-4, the BOD5, COD, TSS and Total-N of the various cesspits showed values in the range of 208-616, 480-1,500, and 3,010-8,390, 123-184 mg/l, respectively.

Table-4 shows the range and average of BOD5, COD, TSS, EC, PO4, and Total-N in the abovementioned cesspits.

Table-4 Range and Average of the Concentration of BOD5, COD, TSS, PO4 and Total-N in the Cesspits

Parameter	Range (mg/l)	Average (mg/l)
BOD5	208-616	328
COD	480-1,500	850
TSS	3,010-8,390	4,120
EC (μs/cm)	1,640-2440	1956
PO4	1.9-6.5	4.7
Total-N	123-184	152

8. Conclusions

From the chemical analysis of the wastewater samples collected from the WWTPs in the Intercontinental Hotel and the Presidential Guard and from the house cesspits used to dispose of wastewater, it can be concluded that:

1- As BOD5 to COD ratio was > 0.5 in both influent of the Intercontinental Hotel and the Presidential Guard, then wastewater there is considered to be highly biodegradable.

2- As BOD5 to COD ratio in the samples collected from cesspits in Sabiha area and Hisham Palace was <0.3, then wastewater is deemed to undergo a chemical treatment before the routine biological treatment..

3- Removal percentage of BOD5, COD, TSS and Total-N in the WWTP of the Presidential Guard was higher than that in the Intercontinental Hotel which indicates that the WWTP in the Presidential Guard is more efficient.

9. Recommendations

1- The technology used to treat wastewater in the Presidential Guard WWTP should be studied carefully in order to make use of its application in designing and constructing the anticipated central WWTP for the whole city of Jericho and its surrounding communities.

2- WW characteristics in cesspits should be studied in more cesspits (i.e. more than 30 cesspits in different areas of the city).

ANNEX

Results of the WW samples collected from Jericho City During February 2011

No	Location	Date	pH unit	EC µs/cm	BOD_5 mg/l	COD mg/l	TSS mg/l	PO_4 mg/l	Total-N mg/l
1	Intercontinental Hotel (influent)	16/2/2011	6.97	2050	167	320	120	6.2	134
2	Intercontinental Hotel (Effluent)	16/2/2011	7.51	2430	26	224	48	2	46
3	Presidential Guard (influent)	16/2/2011	6.61	1800	540	960	286	11.8	152
4	Presidential Guard (Effluent)	16/2/2011	7.63	2040	64	320	18	11	33
5	Palestine St. (house)	21/2/2011	6.27	1640	312	800	4240	2.1	140
6	Sabiha area (house)	21/2/2011	6.97	1697	182	720	1090	1.9	123
7	El Sultan St. (house)	21/2/2011	6.54	1920	400	640	4310	3.2	176
8	El Sultan St. (house)	21/2/2011	6.71	2440	248	480	3680	4.1	162
9	Al Maghtas St. (Building)	21/2/2011	6.13	2390	616	1500	8390	10.1	184
10	Hisham Palace St. (house)	21/2/2011	6.76	1650	208	960	3010	6.5	128

Appendix 2-4 Range of Topography Survey

1. Map of Topography Survey Range

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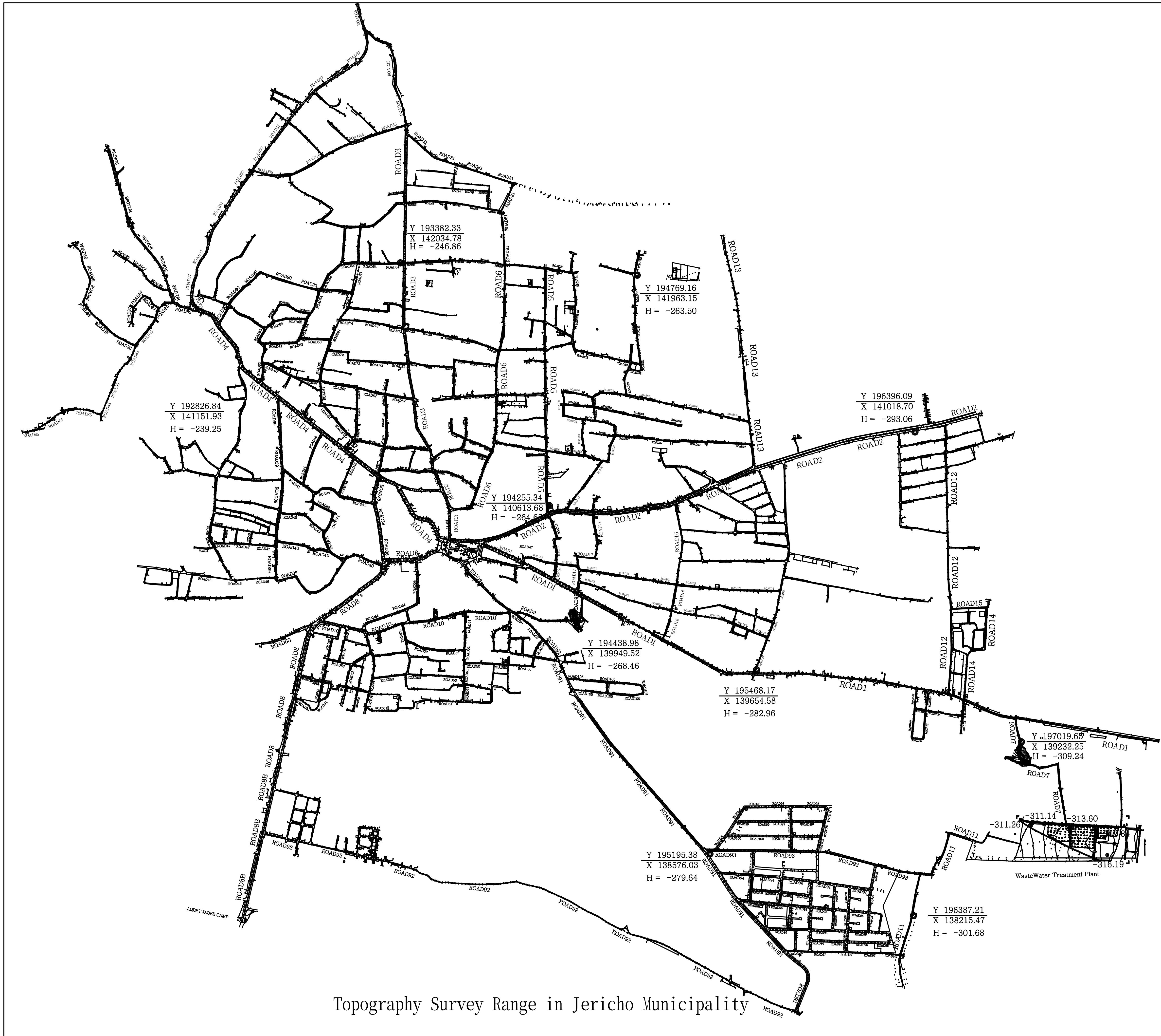
2. Outline of Topography Survey

Topography survey was originally decided to be; 18ha for the WWTP, 4 ha for the access road and 1 ha for two places of crossing Wadi of the topography survey, and 80km of the centerline and profile survey for the pipeline route. Then since later PWA asked to carry out regal survey for the WWTP site and the access road area, and this was executed. In addition, PWA again asked to extend the centerline and profile survey for the future pipeline route of 62km and the Team executed the required survey. The range is shown the map at next page.



Topography Survey Range in Jericho Municipality

Appendix 3 Examinations

Appendix 3-1 Capacity Calculations for WWTP

1. BASIC CONDITIONS

1-1 BASIC ITEMS

(1) Name	:		**Jericho**	Sewage Treatment Plant		
(2) Land Area	:	Approximately	13.0	ha		
(3) Ground Level	:		-313～-317	m		
(4) Inlet Pipe Diameter :			Dia 700 mm	33000m3/d	0.3819444 m3/s	0.5694
(5) Land Use	:		Farm			
(6) Collection System :			Separate Sewer System			
(7) Treatment Metho		**[Sewage Treatment]**	Extended Aeration			
		[Sludge Treatment]	Sludge drying bed			
(8) Effluent Discharge Point :			Qelt Wadi			
(9) Discharge Point Wadi Bed level :			-320	m		
(10) Design Target Year	:		2020			

1-2 Design Population

Design Population (STP)	Ultimate	60,400
	Design	36,000

1-3 Design Sewage Flow

Ultimate	(1) Daily Average	Proposed:	9,900	m^3/day
	(2) Daily Maximum	Proposed:	14,400	m^3/day
	(3) Hourly Maximun	Proposed:	29,000	m^3/day
Design	(1) Daily Average	Proposed:	6,600	m^3/day
	(2) Daily Maximum	Proposed:	9,800	m^3/day
	(3) Hourly Maximun	Proposed:	19,100	m^3/day

1-4 Design Sewage Quality

(1) BOD	Influent:	500 mg/L	Effluent:	20 mg/L
(2) SS	Influent:	500 mg/L	Effluent:	30 mg/L
(3) T-N	Influent:	75 mg/L	Effluent:	25 mg/L

2 DESIGN CALCULATION

2-1 DESIGN CONDITIONS AND CRITERIA

2-1-1 Design Sewage Flow

	ITEM	m^3/day	m^3/hr	m^3/min	m^3/sec
2020	Daily Maximum (Q_1)	9,800 (Q_{1-D})	408 (Q_{1-H})	6.81 (Q_{1-M})	0.113 (Q_{1-S})
	Hourly Maximum (Q_2)	19,100 (Q_{2-D})	796 (Q_{2-H})	13.26 (Q_{2-M})	0.221 (Q_{2-S})
Ultimate	Daily Maximum (Q_1)	14,400 (Q_{1-D})	600 (Q_{1-H})	10.00 (Q_{1-M})	0.167 (Q_{1-S})
	Hourly Maximum (Q_2)	29,000 (Q_{2-D})	1,208 (Q_{2-H})	20.14 (Q_{2-M})	0.336 (Q_{2-S})

2-1-2 Design Sewage Quality

ITEM	Influent	Clarifier Treatment		Remarks
	Sewage (mg/L)	Removal Ratio	Effluent (mg/L)	
BOD (Q_1BOD)	500	96.0%	20	
SS (Q_1SS)	500	94.0%	30	
T-N(Q_1T-N)	75	66.7%	25	

2-1-3 Design Criteria

ITEMS	UNIT	Formula or Value	Application
2-1-3-1 Oxidation Ditch(for Daily Average Flow)			
(1) BOD-SS Load	kg/kg/day	0.1～0.3	0.2
(2) Nitrification rate	kgN/kgMLSS/d	0.02-0.05	0.036
(3) Adopted temperature	kg/kg/day	13-30	13
(4) MLSS Concentration	mg/l	2,000 - 4,000	by calculation
(5) Return Sludge Ratio	%	-	100
(6) SRT	day	20-30	by calculation
(7) Hydraulic Retention Time (HRT)	hour	>24	by calculation
2-1-3-2 Gravity Thickener			
(1) Solid Matter Load	kg/day		60
(2) Solids Content	%		1.3
(3) Sludge Recovery	%		90
(4) Operation Time	-		24/1day
2-1-3-3 Sludge Drying Beds			
(1) Water Content	%		70.0
(2) Sludge Recovery	%		99
(4) Operation Time	-		

2-2 MATERIAL BALANCE CALCULATION(2020)

2-2-1 DESIGN CONDITION

Inlet Quantity	m^3/d	9,800
Inlet SS	mg/l	500
Inlet BOD	mg/l	500
Inlet T-N	mg/l	75
Outlet SS after Clarifier	mg/l	15
Solid Content of Waste Sludge	%	0.6
Converting Ratio of SS	%	75
Solid Content of Thickened Sludge	%	1.3
Recovery Ratio of Thickener	%	90.0
Water Content of Sludge Cake	%	50.0
Filtration Water Ratio of Sludge Drying	%	50.0
Solid Recovery of Sludge Drying	%	99.0

2-2-2 RESULT

2-2-2.1 GRIT CHAMBER

Grit Chamber Quantity	m^3/d	10,182
Grit Chamber DS	kg/d	5,292
Grit Chamber SS	mg/L	520

2-2-2.2 CLARIFIER

Waste Sludge Solid Content	%	0.6
Waste Sludge Generation (dry solid)	kg/d	3,920
Waste sludge Volume	m^3/d	653

2-2-2.3 GRAVITY THICKENER

Thickened Sludge Generation (dry solid)	kg/d	3,528
Thickened Sludge Volume	m^3/d	271
Supernatant SS	kg/d	392
Supernatant Flow	m^3/d	382

2-2-2.4 SLUDGE DRYING BED

Water Content of Sludge Cake	%	50.0
Sludge Cake Generation (dry solid)	kg/d	3,493
Sludge Cake Volume(daily max)	m^3/d	7.0
Sludge Cake Volume(Average)	m^3/d	5.0
Supernatant SS	kg/d	35
Supernatant Flow 50%	m^3/d	136

2-2-2.5 RETURN FROM THICKENER

Quantity	m^3/d	382
SS Loading	kg/d	392
SS	mg/L	1,026

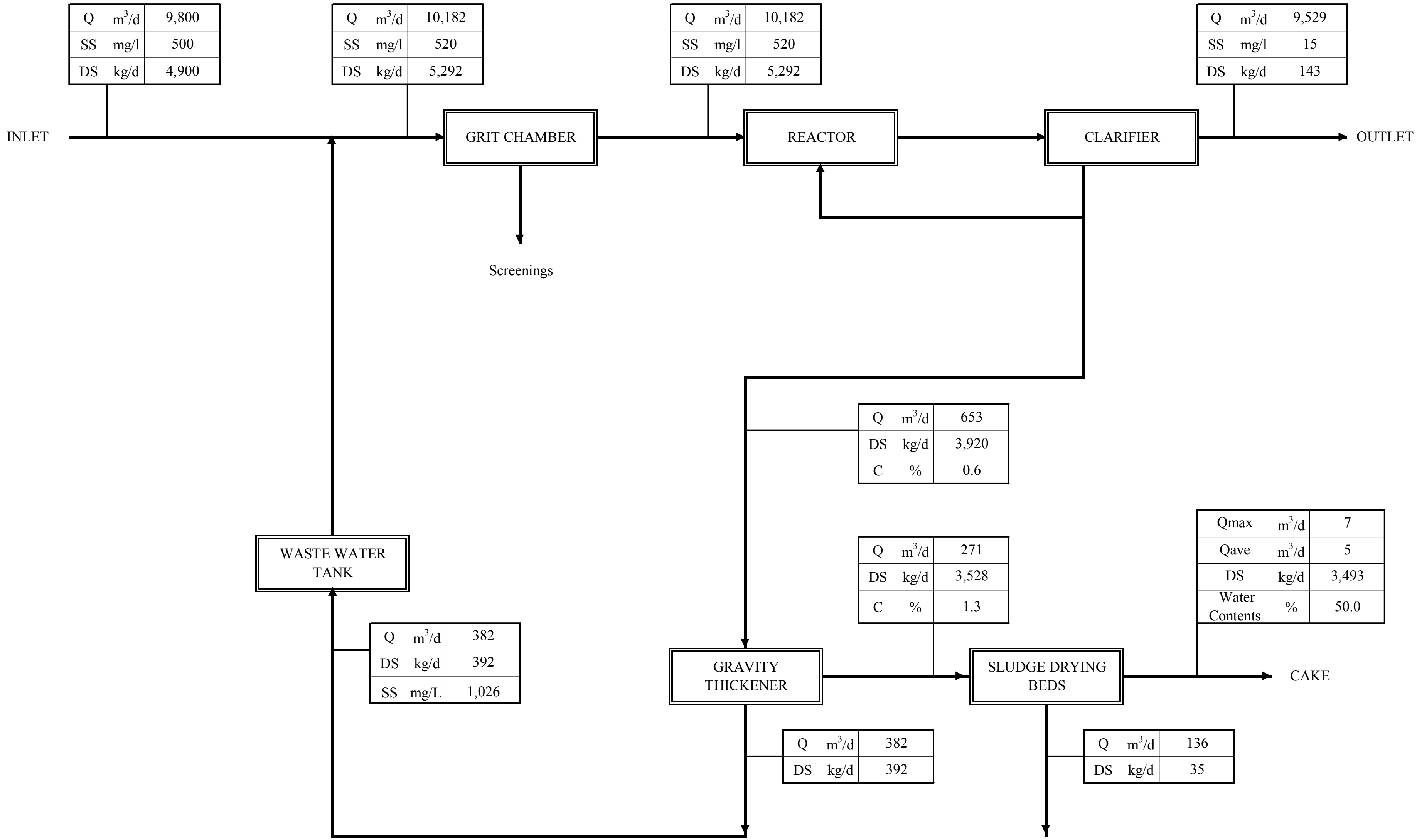
2-2-2.6 INLET CONDITION TO OXIDATION DITCH

Sewage Flow	m^3/d	10,182
SS Loading	kg/d	5,292
Inlet SS	mg/L	520
Inlet BOD	mg/L	450
Inlet T-N	mg/L	75

2-2-2.7 OUTLET OF CLARIFIER

Treated Water Flow	m^3/d	9,529
SS Loading	kg/d	143
Outlet SS	mg/L	15

2-2-3 MASS BALANCE DIAGRAM(2020)



2-3 MATERIAL BALANCE CALCULATION(Ultimate)

2-3-1 DESIGN CONDITION

Inlet Quantity	m^3/d	14,400
Inlet SS	mg/l	500
Inlet BOD	mg/l	500
Inlet T-N	mg/l	75
Outlet SS after Clarifier	mg/l	15
Solid Content of Waste Sludge	%	0.6
Converting Ratio of SS	%	75
SS Removal Ratio in Primary Clarifier	%	55
Solid Content of Thickened Sludge	%	1.3
Recovery Ratio of Thickener	%	90.0
Digested Ratio to DS	%	40.0
Gas Generation Ratio to Reduced DS	m3/kg	1.0
Water Content of Sludge Cake	%	50.0
Solid Recovery of Dewatering	%	99.0

2-3-2 RESULT

2-3-2.1 GRIT CHAMBER

Grit Chamber Quantity	m^3/d	14,797
Grit Chamber DS	kg/d	7,878
Grit Chamber SS	mg/L	532

2-3-2.2 Primary Clarifier

Primary Clarifier Outlet Quantity	m^3/d	14,508
Primary Clarifier DS	kg/d	3,545
Primary Clarifier SS	mg/L	244
Primary Clarifier Sludge Quantity	m^3/d	289
Primary Clarifier density	%	1.5
Primary Clarifier Sludge DS	kg/d	4,333

2-3-2.3 Thickener for Primary Clarifier

Thickened Sludge Quantity	m^3/d	130
Thickened Sludge DS	kg/d	3,900
Thickened Sludge Density	%	3.0
Supernatant Quantity	m^3/d	159
Supernatant DS	kg/d	433
Supernatant SS	mg/L	2,727

2-4-2.4 Digester

Digested Sludge Quantity	m^3/d	130
Digested Sludge DS	kg/d	2,340
Digested Sludge Density	%	1.8
Digested Gas Quantity	m3/d	1,560

2-3-2.3 CLARIFIER

Waste Sludge Solid Content	%	0.6
Waste Sludge Generation (dry solid)	kg/d	2,443
Waste sludge Volume	m^3/d	407

2-3-2.4 GRAVITY THICKENER

Thickened Sludge Volume	m^3/d	169
Thickened Sludge Generation (dry solid)	kg/d	2,199
Thickened Sludge Density	%	1.3
Supernatant Flow	m^3/d	238
Supernatant SS	kg/d	244
Supernatant SS	mg/L	1,026

2-3-2.4 SLUDGE DRYING BED

Water Content of Sludge Cake	%	50.0
Sludge Cake Generation (dry solid)	kg/d	4,493
Sludge Cake Volume(daily max)	m^3/d	9.0
Sludge Cake Volume(daily averaga)	m^3/d	5.8
Supernatant SS	kg/d	45
Supernatant Flow 50%	m^3/d	145

2-3-2.5 RETURN FROM THICKENER & Drying Bed

Quantity	m^3/d	397
SS Loading	kg/d	678
SS	mg/L	1,708

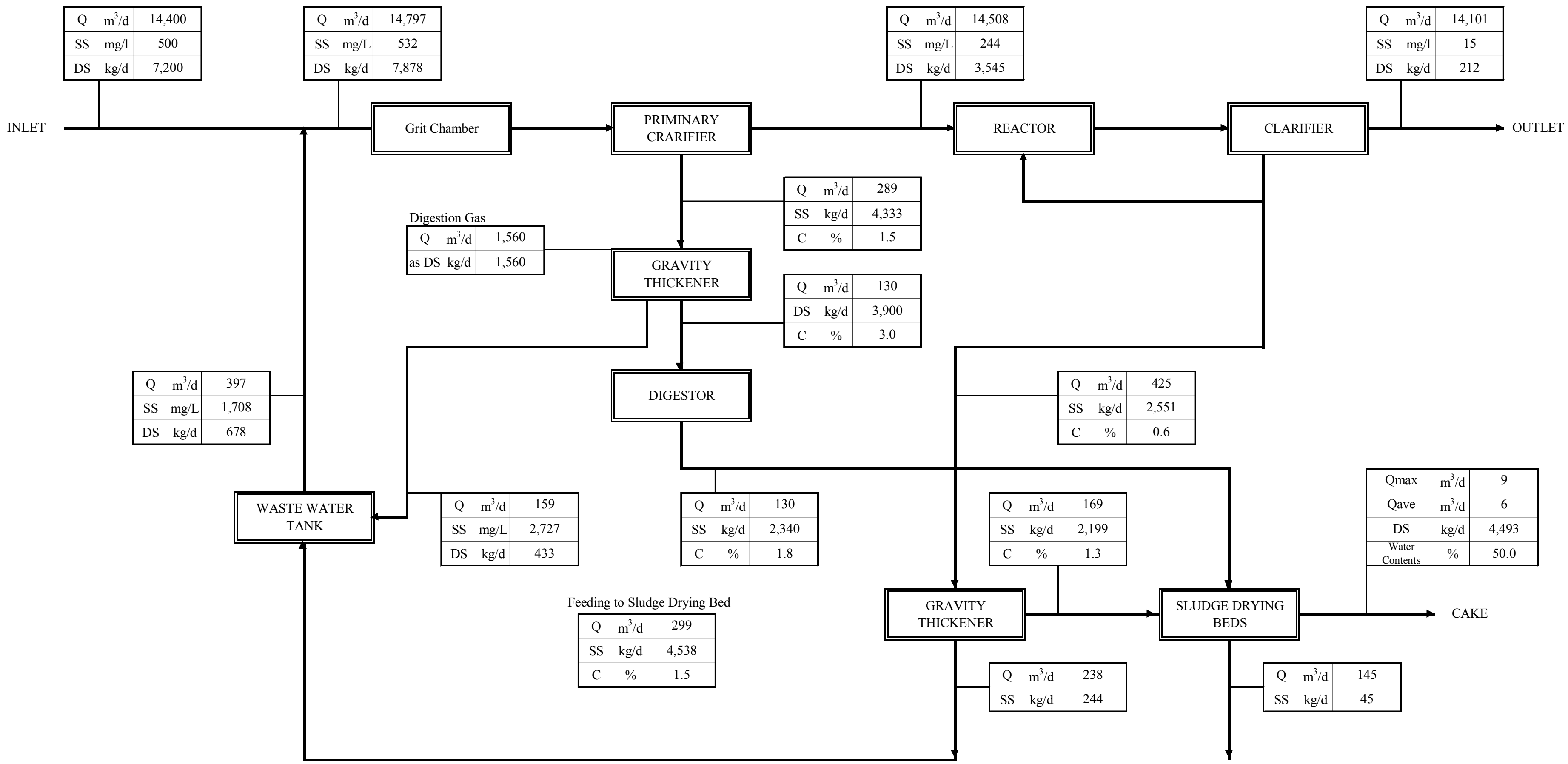
2-3-2.6 INLET CONDITION TO OXIDATION DITCH

Sewage Flow	m^3/d	14,508
SS Loading	kg/d	3,545
Inlet SS	mg/L	244
Inlet BOD	mg/L	250
Inlet T-N	mg/L	63

2-3-2.7 OUTLET OF CLARIFIER

Treated Water Flow	m^3/d	14,101
SS Loading	kg/d	212
Outlet SS	mg/L	15

2-3-3 MASS BALANCE DIAGRAM (Ultimate)



3. CAPACITY CALCULATION(2020)

3.1 Wastewater Receiving Tank

3.1.1 Design Condition

(1) Design Flow (Hourly Maximum) $Q_{1\text{-}H}$ = 40 m^3/hr

$Q_{1\text{-}M}$ = 0.667 m^3/min

3.1.2 Design Criteria

(1) Surface Road SR ≤ 2 $m^3/m^2/hr$

(2) Retention Time T≧ 1 hr

3.1.3 Capacity Calculation

ITEM	SYMBOL	DESIGN			
Structure					
Type	-	Rectangular Type			
Required Area	V	$Q_{1\text{-}H}$/SR ≦	20.0 m^3		
Required Volume	V	$Q_{1\text{-}H}$x T ≧	40.0 m^3		
Basin	BN		1 basin		
Width	W		5.0 m		
Length	L		5.0 m		
Water Depth	H		3.1 m		
Check					
Tank Surface	A	W x L =	25.0 m^2		
Tank Volume	V	W x L x H =	50.8 m^3		
Surface Road	SR	A / $Q_{1\text{-}H}$ =	1.6 $m^3/m^2/hr$		
			Less than	2	…OK
Retention Time	T	V/ $Q_{1\text{-}H}$ =	1.3 hr		
			More than	1	…OK

3.1.4 Result

Dimension **=W5.0mxL5.0mxWH3.5m**

3.2 Grit Chamber

3.2.1 Design Condition

(1) Design Flow (For Weekend Hourly Maximum) Q_{2-D} = 29,000 m^3/day(for ultimate)

Q_{2-S} = 0.336 m^3/sec

3.2.2 Design Criteria

(1) Hydraulic Load WSL ≤ 5,000 m^3/m^2/day

(2) Retention Time T≧ 15 sec

3.2.3 Capacity Calculation

ITEM	SYMBOL	DESIGN
Structure		
Type		Vortex Circle Radiation-Flow Type
Required Surface Area	RSA1	Q_{2-D} / WSL ≥ 5.8 m^2
Channel Number	CN	2 chamber (stand-by 1)
Diameter	D	$(RSA1/CN \times 4/3.14)^{1/2}$= 2.72 m^2 adopt 3 m
Depth	H	Q_{2-S} x T/(D^2 x 3.14 / 4)= 0.71 m adopt 0.75 m
Check		
Hydraulic Load		Q_{2-D} /(D^2x3.14/4) /CN = 4,103 m^3/m^2/day
		Less than 5,000 …OK
Retention Time		(D^2 x 3.14 / 4 x H) x CN / Q_{2-S} = 16 sec
		More than 15 …OK

3.2.4 Result

Dimension **Diameter 3m x Depth 0.75m x 2 chamber**

Note : The grit chamber shall be redesigned by the contractor.

3.3 Distribution Chamber (attached in Grit Chamber)

3.3.1 Design Condition

(1) Design Flow for This Project $Q_{2\text{-}D}$ = 29,000 m^3/day

$Q_{2\text{-}M}$ = 20.14 m^3/min

3.3.2 Design Criteria

(1) Retention Time T ≥ 2 min

3.3.3 Capacity Calculation

ITEM	SYMBOL	DESIGN
Structure		
Type	-	Rectangular Type
Required Volume	V	$Q_{2\text{-}M}$ x T ≥ 40.3 m^3
Basin	BN	1 basin
Width	W	4.3 m
Length	L	3.5 m
Water Depth	H	3.1 m
Check		
Tank Volume	V	W x L x H = 47 m^3
Retention Time		(W x H x L x BN) / $Q_{2\text{-}M}$ = 2.3 min
		More than 2 …OK

3.3.4 Result

Dimension **Width 4.3m x Length 3.5m x Depth 3.1m x 1 basin**

3.4 Reactor (Extended Activated Sludge Process)

3.4.1 Design Condition

(1) Design Flow 1 (Winter : 1/1.2) $Q_{3\text{-}avD}$ = 8,200 m^3/day From water supply data

Design Flow 2 (Other Season: Daily Max) $Q_{3\text{-}mxD}$ = 9,800 m^3/day

(2) Water Quality

	Influent			Effluent	
BODin	500	mg/L	BODout	20	mg/L
SSin	500	mg/L	SSout	30	mg/L
T-Nin	75	mg/L	T-Nout	25	mg/L

3.4.2 Design Criteria

(1) Nitrification Rate Kn= 0.036 kgN/kgMLSS/d

(2) Influent Sewage Temperature T = 13 ºC Winter Season

(3) Necessary Volume Ti ≥ 2.0 times to Nitrifucation time

(4) BOD-SS Load BOD_{SSR}≦ 0.2 kg/kg/d

3.4.3 Nacessary Volume Calculation

In the case of Jericho, the water consumption in winter season has been reduced, and then the average flow is adopted to the design flow for the nitrification because the efficiency of nitrification is drastically lowered in the case of low temperature.

(1) Retained MLSS density based on the surface load

From design standard for activated sludge system in Japan

X≦[4.90 / **r** ×10^6× **T**^0.95×(SVI)^(-0.77)/ **S**]^(1/1 2,799 mg/L→ 2,500 mg/L

X: Limit of MLSS 0.

r: Fluctuation ratio of daily max/daily ave.= 1.9 --

SVI: Sludge volume index= 200 mL/g

S: Final clarifier surface load= 10.8 $m^3/m^2/d$ by chapter 3.4

(2) Kj N (to be nitrificated N) load

Lkj=α*Qav*T-Nin= 461.25 kg/d

α: the rate of Kj-N in T-n= 0.75

(3) Necessary Reactor Volume by Nitrogen Load

V=Lkj/(Kn*X/1000)*Ti= 10,250 m^3 ⟸ Selected

(4) Necessary Reactor Volume by BOD-SS Load

V=Qmx*BODin/(X/1000)/BOD_{SSR} 9,800 m^3

3.4.4 Capacity Calculation

ITEM	SYMBOL	DESIGN
Structure		
Type	-	Unlimitted Circular
Tank number	TN	2 basins
Necessary Volume	Vn	10,250 m^2
Ditch Width	W	8 m adopt
Water Depth	WH	5.5 m
Effective Section Area	Af	Af=W*WH-1/2*(0.3*0.9+0.3*0.3)=
		43.8 m^2
Necessary Ditch Length	Lt	Lt=V/Af= 117.0 m
Length of the round Parts	Lr	Lr =8.3* π = 26.0 m
Length of the Strait Parts	Ls	Ls=(Lt-Lr)/2= 45.5 m→ 49.0 m
Actual Volume	Va	Va=(Lr+2Ls)*2= 10,867 m3

ITEM	SYMBOL	DESIGN
<u>Check</u>		
Volume		Va=10,867m3>Vn=10,250 More than …OK
Retention Time		$Va/Q_{3\text{-}mxD}$*24= 26.61 hr

3.4.5 Result

Dimension **Width of Ditch 8.0m x Water depth 5.5m x Strait Parts 49m +Round Parts Dia. 8.3m(The part of center)**

3.5 Final Clarifier

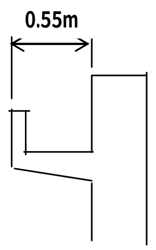
3.5.1 Design Condition

(1) Design Flow (For Weekend Hourly Maxir $Q_{3\text{-}D}$ = 9,800 m^3/day

3.5.2 Design Criteria

(1) Hydraulic Load	L ≤	12	m^3/m^2/day
(2) Settling Time	T ≥	3.0	hr
(3) Water Depth	h =	3.5	m
(4) Influent Sewage Temperature	TT =	20	℃
(5) Weir Loading	WL ≤	150	m^3/m/day

3.5.3 Capacity Calculation

ITEM	SYMBOL	DESIGN
Structure		
Type	-	Circular Radiation-Flow Type
Tank number	TN	2 basins
Required Surface Area	A	$Q_{3\text{-}D}$ / L ≥ 817 m^2
Diameter	D	$(A/TN \times 4/3.14)^{1/2}$= 22.8 m adopt 24.0 m
Water Depth	H	3.5 m
Necessary Weir Length	L0	L0= 32.7 m
Weir Length	L1	L1= 71.9 m
		

ITEM	SYMBOL	DESIGN
Check		
Hydraulic Load		$Q_{3\text{-}D}$ / (D^2 x 3.14 / 4) / TN = 10.8 m^3/m^2/day
		Less than 12 …OK
Settling Time		TN x D^2 x 3.14 / 4 x H x 24/ $Q_{2\text{-}D}$ = 7.75 hr
		More than 3.0 …OK
Weir Loading		$Q_{3\text{-}D}$ / L1 = 68 m^3/m/day
		Less than 150 …OK

3.5.4 Result

Dimension **Diameter 24m x Depth 3.5m x 2 basins**

Weir Length for 1 basin : 71.9m

3.6 Sludge Thickener

3.6.1 Design Condition (From Balance Sheet)

Waste Activated Sludge

(1) Solid	S2 =	3,920 kg/day
(2) Sludge	V2 =	653 m^3/day

3.6.2 Design Criteria

(1) Retention Time	T1 ≥	8 hr
(2) Sludge Load	SR=	60 $kg/m^2/d$

3.6.3 Capacity Calculation

ITEM	SYMBOL	DESIGN			
Sludge Thikener					
Type	-	RC Rectangular Tank			
Unit Number	UN1		2 units		
Required Tank Area	Ar1	S2/SR=	32.7 m^2	1 basin	
Required Tank Volume	Vo1	V2 x T1 / 24 / UN1 ≥	108.9 m^3		
Diameter	W1		7.0 m		
Depth	H1		3.5 m		
Surface Area	A1		38.5 m^2		
Volume	V1	1/4*W1^2*π*H1＝	134.7 m^3		
Check					
Retention Time	T1	(W1 x H1 x L1 x UN1) / V2 =		9.9 hr	
			More than	8.0	…OK
Surface load	SL1	S2/A1＝		50.9 $kg/m^2/d$	
			Less than	60	…OK

3.6.4 Result

Dimension **Diameter7m x Depth 3.5mx 2 units**

3.7 Utility Water

3.7.1 Treated Water Tank

3.7.1.1 Design Condition

(1) Deforming Water Supply Amount Q1 = 0.40 m^3/min (See Mechanical Equipment Calculation)

(1) Utility Water Supply Amount Q1 = 0.50 m^3/min (See Mechanical Equipment Calculation)

3.7.1.2 Design Criteria

(1) Retention Time T1 ≥ 10 min

3.7.1.3 Capacity Calculation

ITEM	SYMBOL	DESIGN
Treated Water Tank for Deforming Pump		
Type		RC Rectangular Tank
Unit Number	UN1	1 unit
Required Tank Volume	Vo	Q1 x T1 / UN1 = 0.0 m^3
Width	W1	2.5 m
Length	L1	2.0 m
Depth	H1	2.50 m
		adopt 12.5 m^3
Check		
Retention Time		(W1 x H1 x L1 x UN1) / Q1 = 31.3 min
		More than 10 …OK

3.7.1.4 Result

Dimension **Width 2.5m x Length 2m x Depth 2.5m (13m3) x 1 unit**

Treated Water Tank for Utility Pump		
Type		RC Rectangular Tank
Unit Number	UN1	1 unit
Required Tank Volume	Vo	Q1 x T1 / UN1 = 5.0 m^3
Width	W1	2.0 m
Length	L1	6.5 m
Depth	H1	2.00 m
		adopt 26.0 m^3
Check		
Retention Time		(W1 x H1 x L1 x UN1) / Q1 = 65.0 min
		More than 10 …OK

3.7.1.4 Result

Dimension **Width 2m x Length 6.5m x Depth 2m (26m3) x 1 unit**

3.7.2 Water Measurement Channel

3.7.2.1 Design Condition

(1) Treated Water volume Q2 = 9,800 m^3/d

7.0 m^3/min

3.7.2.2 Mesurement

(1) Weir W=1.5m

(1) Channel W2.5mxL4.0m

3.8 Irrigation Tank

3.8.1 Design Condition

(1) Design Flow (For Weekend Hourly Maxir Q_{3-D} = 9,800 m^3/day

Q_{3-H} = 408 m^3/hr

3.8.2 Design Criteria

(1) Retention Time T1 ≥ 2 hr

3.8.3 Capacity Calculation

ITEM	SYMBOL	DESIGN
Irrigation Tank		
Type	-	RC Rectangular Tank
Unit Number	UN1	1 units
Required Tank Volume	Vo1	Q_{3-H} x T1 / 24 / UN1 ≥ 816.7 m^3
Width	W1	14.0 m
Length	L1	18.0 m
Depth	H1	4.00 m Effective
		adopt 1,008.0 m^3
Volume	V1	=W1xL1xH1 1,008.0 m^3
Check		
Retention Time	T1	(W1 x H1 x L1 x UN1) / Q_{3-H} = 2.5 hr
		More than 2.0 …OK

3.6.4 Result

Dimension **W14m x L18m x WH 4m(V=1,008m3) x 1unit**

ITEM	SYMBOL	DESIGN				
3.9 Sludge Drying Bed						
3.9.1 Design Condition						
(1) Feeding Sludge Solid(ma	S4	From Mass-balance Sheet		3,528	kg/day	
(1)' Feeding Sludge Solid(ave)				2,520	kg/day	
(2) Feeding Sludge Volume(ma	V4			271	m^3/day	
(2)' Feeding Sludge Volume(ave)				194	m^3/day	
(3) Dried Sludge Solid(max)	S5	From Mass-balance Sheet		3,493	kg/day	
(3)' Dried Sludge Solid(ave)				2,495	kg/day	
(4) Dried Sludge Volume(max.)	V5			7.0	m^3/day	
(4)' Dried Solid Volume(ave.)	V5'			5.0	m^3/day	
3.9.2 Design Criteria						
(1) Retention Time	R			21	days	Winter
(2) Sludge Depth	SD			0.3	m	
(1)' Retention Time	R			14	days	Summer
(2)' Sludge Depth	SD			0.3	m	
3.9.3 Capacity Calculation						
Structure						
Type		**RC, Yard**				
Number	N			12	unit	
Required Area	RA	V4 x R /N/SD	$\geq$	13,569	m^2	Winter
				12,665	m^2	Summer
Dimension Width	W			31.0	m	effective
Length	L			43	m	
Depth	D			0.3	m	
Check Retention Time	R'	W x L x D /V4	=	2.1	days	Winter
			=	1.5		Summer
Result Dimension		**W31m x L43m x D 0.3m x 12units**		15,996	m^2	
			Bed	1,333.0	m^2/bed	

4. CAPACITY CALCULATION(Ultimate)

Wastewater Receiving Tank and Grit Chamber were neglected because these are

Designed by Ultimate Flow

4.1 Preliminary Clarifier

4.1.1 Design Condition

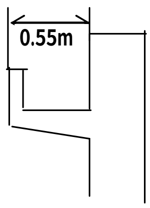
(1) Design Flow (For Weekend Hourly Maxir $Q'_{2\text{-}D}$ = 14,400 m^3/day

4.1.2 Design Criteria

(1) Hydraulic Load	L	≤	50	m^3/m^2/day
(2) Settling Time	T	≥	1.0	hr
(3) Water Depth	h	=	3.0	m
(4) Influent Sewage Temperature	TT	=	20	ºC
(5) Weir Loading	WL	≤	250	m^3/m/day

4.1.3 Capacity Calculation

ITEM	SYMBOL	DESIGN
Structure		
Type	-	Circular Radiation-Flow Type
Tank number	TN	2 basins
Required Surface Area	A	$Q'_{2\text{-}D}$ / L ≥ 288 m^2
Diameter	D	$(A/TN \times 4/3.14)^{1/2}$= 13.5 m adopt 14.0 m
Water Depth	H	3.0 m
Necessary Weir Length	L0	L0= 57.6 m
Weir Length	L1	L1= 81.1 m



ITEM	SYMBOL	DESIGN
Check		
Hydraulic Load		$Q'_{2\text{-}D}$ / (D^2 x 3.14 / 4) / TN = 46.8 m^3/m^2/day
		Less than 50 …OK
Settling Time		TN x D^2 x 3.14 / 4 x H x 24/ $Q_{2\text{-}D}$ = 1.54 hr
		More than 1.0 …OK
Weir Loading		$Q'_{2\text{-}D}$ / L1 = 178 m^3/m/day
		Less than 250 …OK

4.1.4 Result

Dimension **Diameter 14m x Depth 3m x 2 basins**

Weir Length for 1 basin : 40.5m

4.2 Sludge Thickener for Preliminary Sludge

4.2.1 Design Condition (From Balance Sheet)

Raw Sludge

(1) Solid	S2 =	3,900	kg/day
(2) Sludge	V2 =	130	m^3/day

4.2.2 Design Criteria

(1) Retention Time	T1 ≥	12	hr
(2) Sludge Load	SR=	60	kg/m^2/d

4.2.3 Capacity Calculation

ITEM	SYMBOL	DESIGN		
Sludge Thikener				
Type	-	Circular Radiation-Flow Type		
Unit Number	UN1		1 units	
Required Tank Area	Ar1	S2/SR=	65.0 m^2	
Required Tank Volume	Vo1	V2 x T1 / 24 / UN1 ≥	65.0 m^3	
Diameter	W1		10.0 m	
Depth	H1		3.0 m	
Surface Area	A1		78.5 m^2	
Volume	V1	1/4*W1^2*π*H1＝	235.6 m^3	
Check				
Retention Time	T1	(W1 x H1 x L1 x UN1) / V2 =		43.5 hr
Surface load	SL1	S2/A1＝		49.7 kg/m^2/d

4.2.4 Result

Dimension **Diameter10m x Depth 3mx 1 units**

4.3 Reactor (Extended Activated Process)

4.3.1 Design Condition

(1) Design Flow 1 (Winter : 1/1.2) Qav = 12,000 m^3/day From water supply data

Design Flow 2 (Other Season: Daily Max) Q_{mx} = 14,400 m^3/day

(2) Water Quality

	Influent			Effluent	
BODin	250	mg/L	BODout	15	mg/L
SSin	225	mg/L	SSout	20	mg/L
T-Nin	52.5	mg/L	T-Nout	25	mg/L

4.3.2 Design Criteria

(1) Nitrification Rate Kn= 0.036 kgN/kgMLSS/d at 13℃

(2) Influent Sewage Temperature T = 18 ºC Winter Season

(3) Necessary Volume= Ti ≥ 2.0 times to Nitrifucation time

(4) BOD-SS Load BOD_{SSR}≦ 0.2 kg/kg/d

4.3.3 Nacessary Volume Calculation

In the case of Jericho, the water consumption in winter season has been reduced, and then the average flow is adopted to thedesign flow for the nitrification because the efficiency of nitrification is drastically lowered in the case of low temperature.

(1) Retained MLSS density based on the surface load

From design standard for activated sludge system in Japan

X≦[4.90 / **r** ×10^6× **T** ^0.95×(SVI)^(-0.77)/ **S**]^(1/1 2,583 mg/L→ 2,500 mg/L

X : Limit of MLSS

r: Fluctuation ratio of daily max/daily ave.= 2.0 --

SVI: Sludge volume index= 200 mL/g

S: Final clarifier surface load= 15.9 $m^3/m^2/d$ by chapter 3.4

(2) Kj N (to be nitrificated N) load

Lkj=α*Qav*T-Nin= 472.5 kg/d

α:the rate of Kj-N in T-n= 0.75

(3) Necessary Reactor Volume

V=Lkj/(Kn*X/1000)*Ti= 10,385 m^3

(4) Necessary Reactor Volume by BOD-SS Load

V=Qmx*BODin/(X/1000)/BOD_{SSR} 7,200 m^3

4.3.4 Capacity Calculation

ITEM	SYMBOL	DESIGN
Structure		
Type	-	Unlimitted Circular
Tank number	TN	2 basins
Necessary Volume	Vn	10,385 m^2
Ditch Width	W	8 m adopt
Water Depth	WH	5.5 m
Effective Section Area	Af	Af=W*WH-1/2*(0.3*0.9+0.3*0.3)=
		43.8 m^2
Necessary Ditch Length	Lt	Lt=V/Af= 118.5 m
Length of the round Parts	Lr	Lr =8.3* π = 26.1 m
Length of the Strait Parts	Ls	Ls=(Lt-Lr)/2= 46.2 m→ 49.0 m
Actual Volume	Va	Va=(Lr+2Ls)*2= 10,874 m^3

ITEM	SYMBOL	DESIGN
<u>Check</u>		
Volume		Va=10,874m3>Vn=10,385 More than …OK
Retention Time		Va/Qmx*24= 18.1 hr

4.3.5 Result

Dimension **Width of Ditch 8.0m x Water depth 5.5m x Strait Parts 49m +Round Parts Dia. 8.3m**

4.4 Final Clarifier

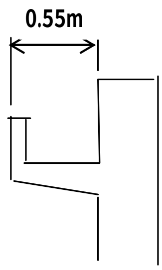
4.4.1 Design Condition

(1) Design Flow Q'_{2-D} = 14,400 m^3/day

4.4.2 Design Criteria

(1) Hydraulic Load	L ≤	18	m^3/m^2/day
(2) Settling Time	T ≥	3.0	hr
(3) Water Depth	h =	3.5	m
(4) Influent Sewage Temperature	TT =	20	ºC
(5) Weir Loading	WL ≤	150	m^3/m/day

4.4.3 Capacity Calculation

ITEM	SYMBOL	DESIGN
Structure		
Type	-	Circular Radiation-Flow Type
Tank number	TN	2 basins
Required Surface Area	A	Q'_{2-D} / L ≥ 818 m^2
Diameter	D	$(A/TN \times 4/3.14)^{1/2}$= 22.8 m adopt 24.0 m
Water Depth	H	3.5 m
Necessary Weir Length	L0	L0= 48.0 m
Weir Length	L1	L1= 71.9 m
		

ITEM	SYMBOL	DESIGN
Check		
Hydraulic Load		Q'_{2-D} / (D^2 x 3.14 / 4) / TN = 15.9 m^3/m^2/day
		Less than 18 …OK
Settling Time		TN x D^2 x 3.14 / 4 x H x 24/ Q_{2-D} = 5.28 hr
		More than 3.0 …OK
Weir Loading		Q'_{2-D} / L1 = 100 m^3/m/day
		Less than 150 …OK

4.4.4 Result

Dimension **Diameter 24m x Depth 3.5m x 2 basins**

Weir Length for 1 basin : 71.9m

4.5 Digester

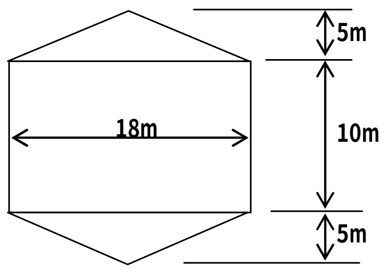
4.5.1 Design Condition

(1) Design Sludge Load	Qs,mx =	289 m^3/day	Daily Maximum
	Qs.av. =	206 m^3/day	Daily Average
(2) Sludge Density	Ds=	1.5 %	

4.5.2 Design Criteria

(1) Retention time	L ≤	30 day	
(2) Water Depth	Ts=	10 m	Strait Trunk Part
	Tc=	5 m	Conic Part

4.5.3 Capacity Calculation

ITEM	SYMBOL	DESIGN
Structure		
Type	-	Cylinder Type
Tank number	TN	2 Tank
Required Volume	V	Qs.av*90 ≥ 6,190 m^2
Diameter	D	$(V/TN /(Ts+1/3*Tc*2)x\ 4/3.14)^{1/2}$=
		17.2 m adopt 18.0 m
Actual	Va	TN*D^2*3.1416/4*(Ts+Tc/3*2)=
		6,786 m3
		
ITEM	SYMBOL	DESIGN
Check		
Retention Time		Va/Qs-sv / TN = 32.9 days
		More than 30 …OK

4.5.4 Result

Dimension **Diameter 18m x Depth 10m x 2 tanks**

4.6 Sludge Thickener for Excess Sludge

4.6.1 Design Condition (From Balance Sheet)

Waste Activated Sludge

(1) Solid	S2 =	2,340 kg/day
(2) Sludge	V2 =	130 m^3/day

4.6.2 Design Criteria

(1) Retention Time	T1 ≥	8 hr
(2) Sludge Load	SR=	60 kg/m^2/d

4.6.3 Capacity Calculation

ITEM	SYMBOL	DESIGN		
Sludge Thikener				
Type	-	RC Rectangular Tank		
Unit Number	UN1		2 units	
Required Tank Area	Ar1	S2/SR=	19.5 m^2	
Required Tank Volume	Vo1	V2 x T1 / 24 / UN1 ≥	21.7 m^3	
Diameter	W1		6.5 m	
Depth	H1		3.0 m	
Surface Area	A1		33.2 m^2	
Volume	V1	1/4*W1^2*π*H1＝	99.5 m^3	
Check				
Retention Time	T1	(W1 x H1 x L1 x UN1) / V2 =		18.4 hr
Surface load	SL1	S2/A1＝		35.3 kg/m^2/d

4.6.4 Result

Dimension **Diameter6.5m x Depth 3mx 2 units**

4.7 Utility Water

4.7.1 Treated Water Tank

4.7.1.1 Design Condition

(1) Deforming Water Supply Amount	Q1 =	0.40 m^3/min	(See Mechanical Equipment Calculation)
(1) Utility Water Supply Amount	Q1 =	0.50 m^3/min	(See Mechanical Equipment Calculation)

4.7.1.2 Design Criteria

(1) Retention Time	T1 ≥	10 min

4.7.1.3 Capacity Calculation

ITEM	SYMBOL	DESIGN
Treated Water Tank for Deforming Pump		
Type		RC Rectangular Tank
Unit Number	UN1	1 unit
Required Tank Volume	Vo	Q1 x T1 / UN1 = 0.0 m^3
Width	W1	2.5 m
Length	L1	2.0 m
Depth	H1	2.50 m
		adopt 12.5 m^3
Check		
Retention Time		(W1 x H1 x L1 x UN1) / Q1 = 31.3 min
		More than 10 …OK

4.7.1.4 Result

Dimension **Width 2.5m x Length 2m x Depth 2.5m (13m3) x 1 unit**

ITEM	SYMBOL	DESIGN
4.8 Sludge Drying Yard		
4.8.1 Design Condition		
(1) Feeding Sludge Solid(max)	S4	From Mass-balance Sheet 4,538 kg/day
(1)' Feeding Sludge Solid(ave)		3,242 kg/day
(2) Feeding Sludge Volume(max)	V4	316 m^3/day
(2)' Feeding Sludge Volume(ave)		226 m^3/day
(3) Dried Sludge Solid(max)	S5	From Mass-balance Sheet 4,493 kg/day
(3)' Dried Sludge Solid(ave)		3,209 kg/day
(4) Dried Sludge Volume(max.)	V5	9.0 m^3/day
(4)' Dried Solid Volume(ave.)	V5'	5.8 m^3/day
4.8.2 Design Criteria		
(1) Retention Time	R	21 days Winter
(2) Sludge Depth	SD	0.3 m
(1)' Retention Time	R	14 days Summer
(2)' Sludge Depth	SD	0.3 m
4.8.3 Capacity Calculation		
Structure		
Type		**Soil bank**
Number	N	14 unit
Required Area	RA	V4 x R /N/SD ≥ 15,817 m2 Winter
		14,763 Summer
Dimension Width	W	31.0 m effective
Length	L	43.0 m
Depth	D	0.3 m
Check Retention Time	R'	W x L x D /V4 = 1.8 days Winter
		= 1.3 days Summer
Result Dimension		**W31m x L43m x D 0.3m x 14units** 18,662 m2
		Bed 1,333.0 m2/bed

Appendix 3-2 Calculations of O&M Costs and Balance with Tariff

Balance between O&M costs and income of teriff charge without depriciation

1-1 Condition

Common Condition ; Set Charge from Domestic	1	NIS/m^3
Set Charge from Ago-industrial Park	1.5	NIS/m^3

1-2 Calculation in the case of original plan of best connection rate

Balance between O&M costs and income from charge

	Target Year	2010	2015	Target 2020	2025	Ultimate
Waste Water Flow	Population	39,983	46,055	52,764	60,158	60,400
	Domestic (m3/d)	—	2,403	5,358	7,273	8,709
	Connection Ratio (%) of Domestic	—	31	68	82	100
	Agro-Industrial Park (m3/d)	—	270	1,180	1,180	1,180
	Connection Ratio (%) of Agriculture Sector	—	23	100	100	100
	Total Flow (m3/d)	—	2,673	6,538	8,453	9,889
1.Electricity Cost	Consumption. (Thou.$ /year)	—	89	180	211	274
	Solar Generation (Thou.$ /year)	—	-27	-41	-41	-41
	Total (Thou.$ /year)	—	61	139	170	233
2.Chemical Cost for Disinfection	Hypochlorine solution (Thou.$ /year)	—	9	23	30	35
3.Staff Cost	Total Cost (Thou.$ /year)	—	238	384	384	384
	Number of Staff	—	Total 11 persons (=3+5+3)	Total 20 persons (=3+9(+2)+6)	Total 20 persons (=3+9(+2)+6)	Total 20 persons (=3+9(+2)+6)
4.Repair Cost	1% of Mechanical & Electrical Cost (Thou.$ /year)	—	0	75	75	75
Total O & M Cost	Thou.$ /year	—	309	621	659	727
Total O & M Cost	NIS /year	—	1,111,824	2,237,206	2,372,119	2,617,908
Check Unit Cost	$/m3	—	0.32	0.26	0.21	0.20
Check Unit Cost	NIS/m3	—	1.14	0.94	0.77	0.73
Set Charge Domestic	NIS/m3	—	1	1	1	1
Set Charge Agro.	NIS/m3	—	1.5	1.5	1.5	1.5
Income Charge Domestic	NIS/year	—	877,095	1,955,670	2,654,645	3,178,785
Income Charge Agro.	NIS/year	—	147,825	646,050	646,050	646,050
Total Income Charge	NIS/year	—	1,024,920	2,601,720	3,300,695	3,824,835
Total Blance	NIS/year	—	-86,904	364,514	928,576	1,206,927

1-3 Calculation in n the case of the worst connection rate

The rate of domestic is half, and that of agro-industriral park is also half

Balance between O&M costs and income from charge

	Target Year	2010	2015	Target 2020	2025	Ultimate
Waste Water Flow	Population	39,983	46,055	52,764	60,158	60,400
	Domestic (m3/d)	–	1,202	2,679	3,637	4,355
	Connection Ratio (%) of Domestic	–	16	34	41	50
	Agro-Industrial Park (m3/d)	–	270	590	590	590
	Connection Ratio (%) of Agriculture Sector	–	23	50	50	50
	Total Flow (m3/d)	–	1,472	3,269	4,227	4,945
1.Electricity Cost	Consumption. (Thou.$ /year)	–	49	91	105	137
	Solar Generation (Thou.$ /year)	–	-27	-41	-41	-41
	Total (Thou.$ /year)	–	22	50	64	96
2.Chemical Cost for Disinfection	Hypochlorine solution (Thou.$ /year)	–	5	10	13	15
3.Staff Cost	Total Cost (Thou.$ /year)	–	238	384	384	384
	Number of Staff	–	Total 11 persons (=3+5+3)	Total 20 persons (=3+9(+2)+6)	Total 20 persons (=3+9(+2)+6)	Total 20 persons (=3+9(+2)+6)
4.Repair Cost	1% of Mechanical & Electrical Cost (Thou.$ /year)	–	0	75	75	75
Total O & M Cost	Thou.$ /year	–	264	519	537	570
Total O & M Cost	NIS /year	–	950,217	1,867,731	1,931,661	2,053,331
Check Unit Cost	$/m3	–	0.49	0.19	0.16	0.14
Check Unit Cost	NIS/m3	–	1.77	0.68	0.56	0.52
Set Charge Domestic	NIS/m3	–	1	1	1	1
Set Charge Agro.	NIS/m3	–	1.5	1.5	1.5	1.5
Income Charge Domestic	NIS/year	–	438,548	977,835	1,327,323	1,589,393
Income Charge Agro.	NIS/year	–	147,825	323,025	323,025	323,025
Total Income Charge	NIS/year	–	586,373	1,300,860	1,650,348	1,912,418
Total Blance	NIS/year	–	-363,845	-566,871	-281,314	-140,914

1-4 Calculation in the case of the middle connection rate

The rate of Agro-industriral park is half, while that of domestice is same with the Plan.

Balance between O&M costs and income from charge

	Target Year	2010	2015	Target 2020	2025	Ultimate
Waste Water Flow	Population	39,983	46,055	52,764	60,158	60,400
	Domestic (m3/d)	–	1,602	3,572	4,849	5,806
	Connection Ratio (%) of Domestic	–	21	45	55	67
	Agro-Industrial Park (m3/d)	–	270	590	590	590
	Connection Ratio (%) of Agriculture Sector	–	23	50	50	50
	Total Flow (m3/d)	–	1,872	4,162	5,439	6,396
1.Electricity Cost	Consumption. (Thou.$ /year)	–	62	115	136	177
	Solar Generation (Thou.$ /year)	–	-27	-41	-41	-41
	Total (Thou.$ /year)	–	35	74	95	136
2.Chemical Cost for Disinfection	Hypochlorine solution (Thou.$ /year)	–	6	13	17	20
3.Staff Cost	Total Cost (Thou.$ /year)	–	238	384	384	384
	Number of Staff	–	Total 11 persons (=3+5+3)	Total 20 persons (=3+9(+2)+6)	Total 20 persons (=3+9(+2)+6)	Total 20 persons (=3+9(+2)+6)
4.Repair Cost	1% of Mechanical & Electrical Cost (Thou.$ /year)	–	0	75	75	75
Total O & M Cost	Thou.$ /year	–	278	546	571	615
Total O & M Cost	NIS /year	–	1,002,567	1,966,651	2,053,852	2,214,119
Check Unit Cost	$/m3	–	0.41	0.36	0.29	0.26
Check Unit Cost	NIS/m3	–	1.47	1.29	1.03	0.95
Set Charge Domestic	NIS/m3	–	1	1	1	1
Set Charge Agro.	NIS/m3	–	1.5	1.5	1.5	1.5
Income Charge Domestic	NIS/year	–	584,730	1,303,780	1,769,763	2,119,190
Income Charge Agro.	NIS/year	–	147,825	323,025	323,025	323,025
Total Income Charge	NIS/year	–	732,555	1,626,805	2,092,788	2,442,215
Total Blance	NIS/year	–	-270,012	-339,846	38,936	228,096

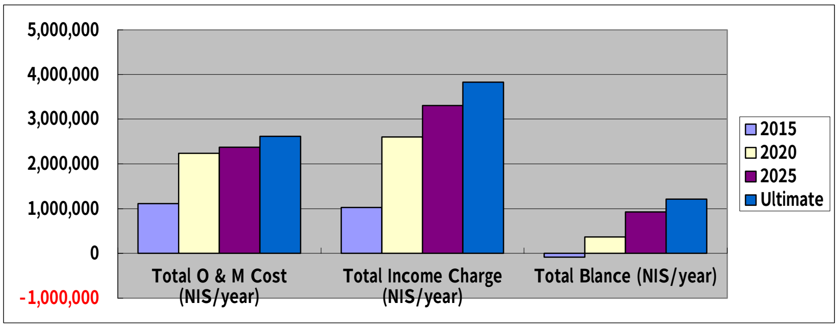
1-5 Comparison by Graph

(1) Charge of Agro-industrial Park 1.5NIS/m^3

Common Condition ; Set Charge from Domestic Flow 1 NIS/m3
Set Charge from Agriculture Sector Flow 1.5 NIS/m3

Case-1; Best Case (In case current design)

	2015	Target 2020	2025	Ultimate
Connection Ratio of Domenstic (%)	31	68	82	100
Connection Ratio of Agri.Park (%)	23	100	100	100
Total O & M Cost (NIS/year)	1,111,824	2,237,206	2,372,119	2,617,908
Total Income Charge (NIS/year)	1,024,920	2,601,720	3,300,695	3,824,835
Total Blance (NIS/year)	-86,904	364,514	928,576	1,206,927

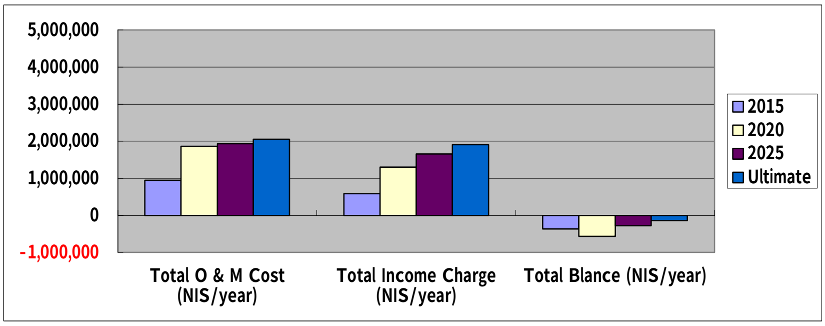


※1. Connection Ratio of Domestic is the same as design ratio.

※2. Connection Ratio of Agro-Industrial Park:
23% in 2015, 100% in 2020

Case-2; Worst Case (In case all connection ratio is not good.)

	2015	Target 2020	2025	Ultimate
Connection Ratio of Domenstic (%)	16	34	41	50
Connection Ratio of Agri.Sector (%)	23	50	50	50
Total O & M Cost (NIS/year)	950,217	1,867,731	1,931,661	2,053,331
Total Income Charge (NIS/year)	586,373	1,300,860	1,650,348	1,912,418
Total Blance (NIS/year)	-363,845	-566,871	-281,314	-140,914

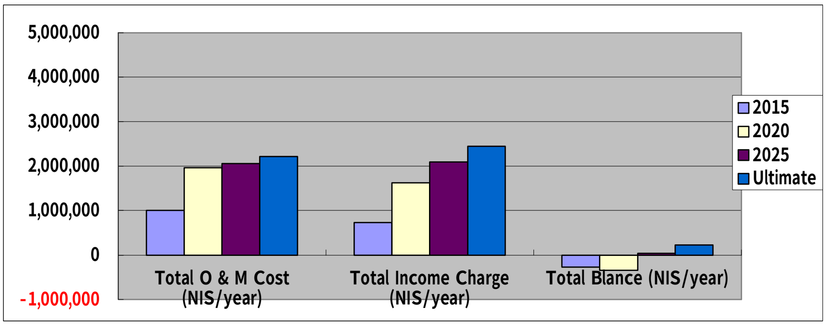


※1. Connection Ratio of Domestic is assumed 50% of design ratio.

※2. Connection Ratio of Agro-Industrial Park:
23% in 2015, 50% in 2020

Case-3; Intermitted Case (In case connection ratio of only Agro. is not good.)

	2015	Target 2020	2025	Ultimate
Connection Ratio of Domenstic (%)	21	45	55	67
Connection Ratio of Agri.Sector (%)	23	50	50	50
Total O & M Cost (NIS/year)	1,002,567	1,966,651	2,053,852	2,214,119
Total Income Charge (NIS/year)	732,555	1,626,805	2,092,788	2,442,215
Total Blance (NIS/year)	-270,012	-339,846	38,936	228,096



※1. Connection Ratio of Domestic is 2/3to design ratio

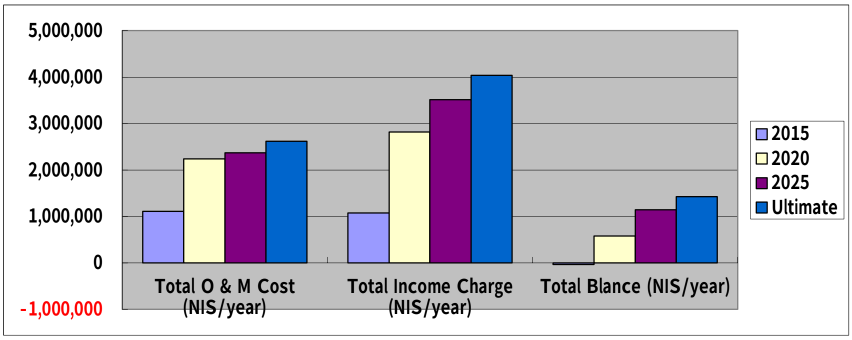
※2. Connection Ratio of Agro-Industrial Park:
23% in 2015, 50% in 2020

(2) Charge of Agro-industrial Park 2NIS/m^3

Common Condition ; Set Charge from Domestic Flow	1	NIS/m3
Set Charge from Agriculture Sector Flow	2	NIS/m3

Case-1; Best Case (In case current design)

	2015	Target 2020	2025	Ultimate
Connection Ratio of Domenstic (%)	31	68	82	100
Connection Ratio of Agri.Park (%)	23	100	100	100
Total O & M Cost (NIS/year)	1,111,824	2,237,206	2,372,119	2,617,908
Total Income Charge (NIS/year)	1,074,195	2,817,070	3,516,045	4,040,185
Total Blance (NIS/year)	-37,629	579,864	1,143,926	1,422,277

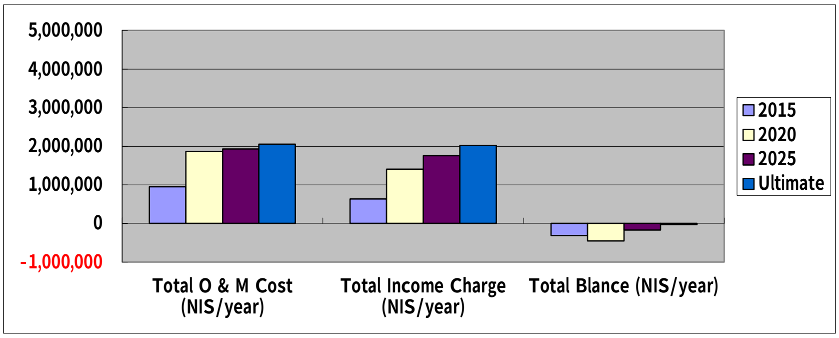


※1. Connection Ratio of Domestic is the same as design ratio.

※2. Connection Ratio of Agro-Industrial Park:
23% in 2015, 100% in 2020

Case-2; Worst Case (In case all connection ratio is not good.)

	2015	Target 2020	2025	Ultimate
Connection Ratio of Domenstic (%)	16	34	41	50
Connection Ratio of Agri.Sector (%)	23	50	50	50
Total O & M Cost (NIS/year)	950,217	1,867,731	1,931,661	2,053,331
Total Income Charge (NIS/year)	635,648	1,408,535	1,758,023	2,020,093
Total Blance (NIS/year)	-314,570	-459,196	-173,639	-33,239

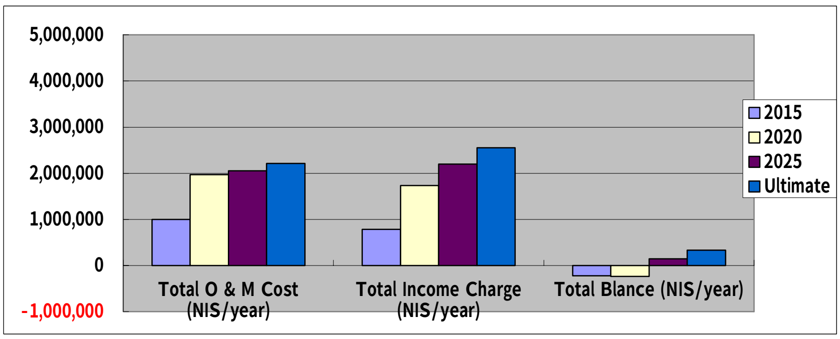


※1. Connection Ratio of Domestic is assumed 50% of design ratio.

※2. Connection Ratio of Agro-Industrial Park:
23% in 2015, 50% in 2020

Case-3; Intermitted Case (In case connection ratio of only Agro. is not good.)

	2015	Target 2020	2025	Ultimate
Connection Ratio of Domenstic (%)	21	45	55	67
Connection Ratio of Agri.Sector (%)	23	50	50	50
Total O & M Cost (NIS/year)	1,002,567	1,966,651	2,053,852	2,214,119
Total Income Charge (NIS/year)	781,830	1,734,480	2,200,463	2,549,890
Total Blance (NIS/year)	-220,737	-232,171	146,611	335,771



※1. Connection Ratio of Domestic is 2/3to design ratio

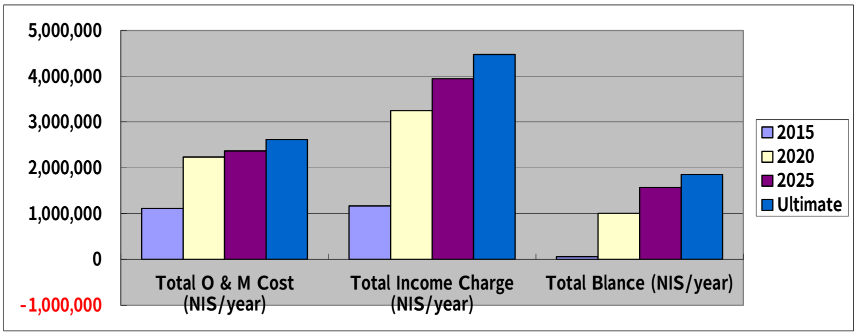
※2. Connection Ratio of Agro-Industrial Park:
23% in 2015, 50% in 2020

(3) Charge of Agro-industrial Park 3NIS/m^3

Common Condition ; Set Charge from Domestic Flow 1 NIS/m3
Set Charge from Agro. Flow 3 NIS/m3

Case-1; Best Case (In case current design)

	2015	Target 2020	2025	Ultimate
Connection Ratio of Domenstic (%)	31	68	82	100
Connection Ratio of Agri.Park (%)	23	100	100	100
Total O & M Cost (NIS/year)	1,111,824	2,237,206	2,372,119	2,617,908
Total Income Charge (NIS/year)	1,172,745	3,247,770	3,946,745	4,470,885
Total Blance (NIS/year)	60,921	1,010,564	1,574,626	1,852,977

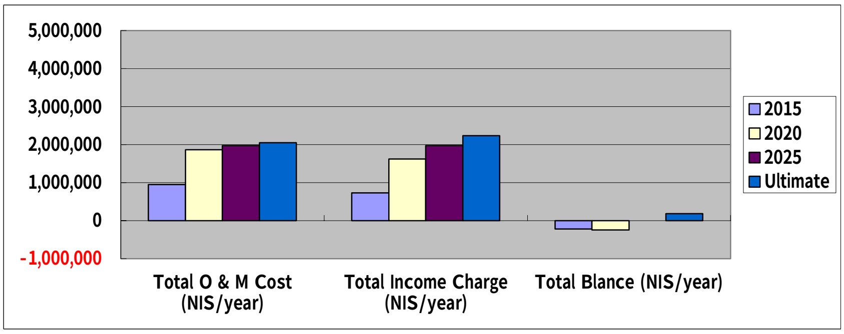


※1. Connection Ratio of Domestic is the same as design ratio.

※2. Connection Ratio of Agro-Industrial Park:
23% in 2015, 100% in 2020

Case-2; Worst Case (In case all connection ratio is not good.)

	2015	Target 2020	2025	Ultimate
Connection Ratio of Domenstic (%)	16	34	41	50
Connection Ratio of Agri.Sector (%)	23	50	50	50
Total O & M Cost (NIS/year)	950,217	1,867,731	1,973,796	2,053,331
Total Income Charge (NIS/year)	734,198	1,623,885	1,973,373	2,235,443
Total Blance (NIS/year)	-216,020	-243,846	-424	182,111

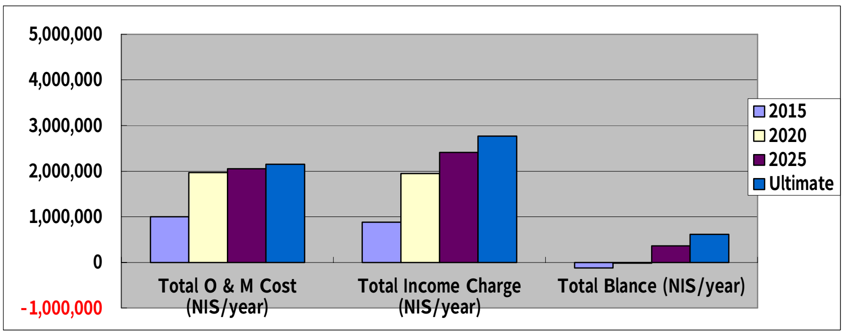


※1. Connection Ratio of Domestic is assumed 50% of design ratio.

※2. Connection Ratio of Agro-Industrial Park:
23% in 2015, 50% in 2020

Case-3; Intermitted Case (In case connection ratio of only Agro. is not good.)

	2015	Target 2020	2025	Ultimate
Connection Ratio of Domenstic (%)	21	45	55	67
Connection Ratio of Agri.Sector (%)	23	50	50	50
Total O & M Cost (NIS/year)	1,002,567	1,966,651	2,053,852	2,150,355
Total Income Charge (NIS/year)	880,380	1,949,830	2,415,813	2,765,240
Total Blance (NIS/year)	-122,187	-16,821	361,961	614,885



※1. Connection Ratio of Domestic is 2/3to design ratio

※2. Connection Ratio of Agro-Industrial Park:
23% in 2015, 50% in 2020

2.Balance between O&M costs and income of teriff charge with depriciation

2-1 Condition

Common Condition ; Set Charge from Domestic		1	NIS/m^3
	Set Charge from Ago-industrial Park	1.5	NIS/m^3

Construction Cost (Tentative)

Division	Item	Design		
		Yen(mil.)	$(Thou.)	NIS(Thou.)
Construction Costs	Structures	410	4,824	17,365
	Sewer	616	7,247	26,089
	Solar Panel	150	1,765	6,353
	Mechanical Facilities	420	4,941	17,788
	Electrical Facilities	182	2,141	7,708
	total	1,778	20,918	75,304

Depreciation Cost (Tentative)

Division	Item	Design		
		Dep. year	$(Thou./year)	$(Thou./year)
Depreciation Costs	Structures	50	87	313
	Sewer	50	130	470
	Solar Panel	20	79	286
	Mechanical Facilities	20	222	800
	Electrical Facilities	20	96	347
	total	-	615	2,215

2-2 Calculation in the case of original plan of best connection rate

Balance between O&M costs and income from charge

	Target Year	2010	2015	Target 2020	2025	Ultimate
Waste Water Flow	Population	39,983	46,055	52,764	60,158	60,400
	Domestic (m3/d)	—	2,403	5,358	7,273	8,709
	Connection Ratio (%) of Domestic	—	31	68	82	100
	Agro-Industrial Park (m3/d)	—	270	1,180	1,180	1,180
	Connection Ratio (%) of Agriculture Sector	—	23	100	100	100
	Total Flow (m3/d)	—	2,673	6,538	8,453	9,889
1.Electricity Cost	Consumption. (Thou.$ /year)	—	89	180	211	274
	Solar Generation (Thou.$ /year)	—	-27	-41	-41	-41
	Total (Thou.$ /year)	—	61	139	170	233
2.Chemical Cost for Disinfection	Hypochlorine solution (Thou.$ /year)	—	9	23	30	35
3.Staff Cost	Total Cost (Thou.$ /year)	—	238	384	384	384
	Number of Staff	—	Total 11 persons (=3+5+3)	Total 20 persons (=3+9(+2)+6)	Total 20 persons (=3+9(+2)+6)	Total 20 persons (=3+9(+2)+6)
4.Repair Cost	1% of Mechanical & Electrical Cost (Thou.$ /year)	—	0	75	75	75
Total O & M Cost	Thou.$ /year	—	309	621	659	727
I) Total O & M Cost	NIS /year	—	1,111,824	2,237,206	2,372,119	2,617,908
II) Depreciation Cost	NIS/year	—	2,215,000	2,215,000	2,215,000	2,215,000
I)+II) Total Cost	NIS/year	—	3,326,824	4,452,206	4,587,119	4,832,908
Check Unit Cost	$/m3	—	0.32	0.26	0.21	0.20
Check Unit Cost	NIS/m3	—	1.14	0.94	0.77	0.73
Set Charge Domestic	NIS/m3	—	1	1	1	1
Set Charge Agro.	NIS/m3	—	1.5	1.5	1.5	1.5
Income Charge Domestic	NIS/year	—	877,095	1,955,670	2,654,645	3,178,785
Income Charge Agro.	NIS/year	—	147,825	646,050	646,050	646,050
Total Income Charge	NIS/year	—	1,024,920	2,601,720	3,300,695	3,824,835
Total Blance	NIS/year	—	-2,301,904	-1,850,486	-1,286,424	-1,008,073

2-3 Calculation in n the case of the worst connection rate

The rate of domestic is half, and that of agro-industriral park is also half

Balance between O&M costs and income from charge

	Target Year	2010	2015	Target 2020	2025	Ultimate
Waste Water Flow	Population	39,983	46,055	52,764	60,158	60,400
	Domestic (m3/d)	—	1,202	2,679	3,637	4,355
	Connection Ratio (%) of Domestic	—	16	34	41	50
	Agro-Industrial Park (m3/d)	—	270	590	590	590
	Connection Ratio (%) of Agriculture Sector	—	23	50	50	50
	Total Flow (m3/d)	—	1,472	3,269	4,227	4,945
1.Electricity Cost	Consumption. (Thou.$ /year)	—	49	91	105	137
	Solar Generation (Thou.$ /year)	—	-27	-41	-41	-41
	Total (Thou.$ /year)	—	22	50	64	96
2.Chemical Cost for Disinfection	Hypochlorine solution (Thou.$ /year)	—	5	10	13	15
3.Staff Cost	Total Cost (Thou.$ /year)	—	238	384	384	384
	Number of Staff	—	Total 11 persons (=3+5+3)	Total 20 persons (=3+9(+2)+6)	Total 20 persons (=3+9(+2)+6)	Total 20 persons (=3+9(+2)+6)
4.Repair Cost	1% of Mechanical & Electrical Cost (Thou.$ /year)	—	0	75	75	75
Total O & M Cost	Thou.$ /year	—	264	519	537	570
I) Total O & M Cost	NIS /year	—	950,217	1,867,731	1,931,661	2,053,331
II) Depreciation Cost	NIS/year	—	2,215,000	2,215,000	2,215,000	2,215,000
I)+II) Total Cost	NIS/year	—	3,165,217	4,082,731	4,146,661	4,268,331
Check Unit Cost	$/m3	—	0.49	0.19	0.16	0.14
Check Unit Cost	NIS/m3	—	1.77	0.68	0.56	0.52
Set Charge Domestic	NIS/m3	—	1	1	1	1
Set Charge Agro.	NIS/m3	—	1.5	1.5	1.5	1.5
Income Charge Domestic	NIS/year	—	438,548	977,835	1,327,323	1,589,393
Income Charge Agro.	NIS/year	—	147,825	323,025	323,025	323,025
Total Income Charge	NIS/year	—	586,373	1,300,860	1,650,348	1,912,418
Total Blance	NIS/year	—	-2,578,845	-2,781,871	-2,496,314	-2,355,914

2-4 Calculation in the case of the middle connection rate

The rate of Agro-industriral park is half, while that of domestice is same with the Plan.

Balance between O&M costs and income from charge

	Target Year	2010	2015	Target 2020	2025	Ultimate
Waste Water Flow	Population	39,983	46,055	52,764	60,158	60,400
	Domestic (m3/d)	―	1,602	3,572	4,849	5,806
	Connection Ratio (%) of Domestic	―	21	45	55	67
	Agro-Industrial Park (m3/d)	―	270	590	590	590
	Connection Ratio (%) of Agriculture Sector	―	23	50	50	50
	Total Flow (m3/d)	―	1,872	4,162	5,439	6,396
1.Electricity Cost	Consumption. (Thou.$ /year)	―	62	115	136	177
	Solar Generation (Thou.$ /year)	―	-27	-41	-41	-41
	Total (Thou.$ /year)	―	35	74	95	136
2.Chemical Cost for Disinfection	Hypochlorine solution (Thou.$ /year)	―	6	13	17	20
3.Staff Cost	Total Cost (Thou.$ /year)	―	238	384	384	384
	Number of Staff	―	Total 11 persons (=3+5+3)	Total 20 persons (=3+9(+2)+6)	Total 20 persons (=3+9(+2)+6)	Total 20 persons (=3+9(+2)+6)
4.Repair Cost	1% of Mechanical & Electrical Cost (Thou.$ /year)	―	0	75	75	75
Total O & M Cost	Thou.$ /year	―	278	546	571	615
Total O & M Cost	NIS /year	―	1,002,567	1,966,651	2,053,852	2,214,119
II) Depreciation Cost	NIS/year	―	2,215,000	2,215,000	2,215,000	2,215,000
I)+II) Total Cost	NIS/year	―	3,217,567	4,181,651	4,268,852	4,429,119
Check Unit Cost	$/m3	―	0.41	0.36	0.29	0.26
Check Unit Cost	NIS/m3	―	1.47	1.29	1.03	0.95
Set Charge Domestic	NIS/m3	―	1	1	1	1
Set Charge Agro.	NIS/m3	―	1.5	1.5	1.5	1.5
Income Charge Domestic	NIS/year	―	584,730	1,303,780	1,769,763	2,119,190
Income Charge Agro.	NIS/year	―	147,825	323,025	323,025	323,025
Total Income Charge	NIS/year	―	732,555	1,626,805	2,092,788	2,442,215
Total Blance	NIS/year	―	-2,485,012	-2,554,846	-2,176,064	-1,986,904

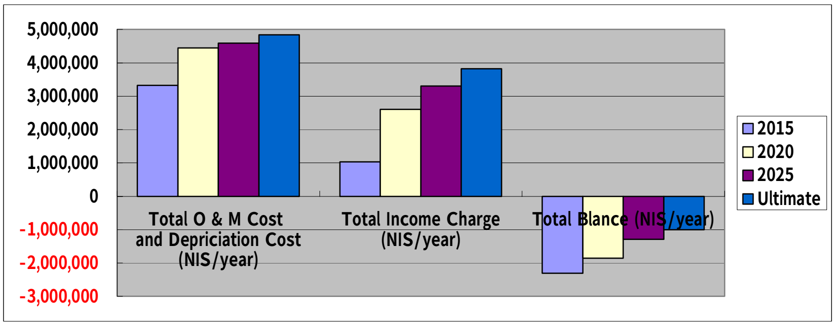
1-5 Comparison by Graph

(1) Charge of Agro-industrial Park 1.5NIS/m^3

Common Condition ; Set Charge from Domestic Flow 1 NIS/m3
Set Charge from Agriculture Sector Flow 1.5 NIS/m3

Case-1; Best Case (In case current design)

	2015	Target 2020	2025	Ultimate
Connection Ratio of Domenstic (%)	31	68	82	100
Connection Ratio of Agri.Park (%)	23	100	100	100
Total O & M Cost and Depriciation Cost (NIS/year)	3,326,824	4,452,206	4,587,119	4,832,908
Total Income Charge (NIS/year)	1,024,920	2,601,720	3,300,695	3,824,835
Total Blance (NIS/year)	-2,301,904	-1,850,486	-1,286,424	-1,008,073

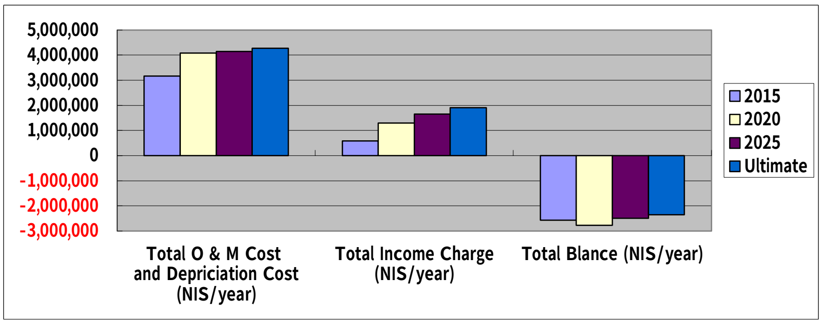


※1. Connection Ratio of Domestic is the same as design ratio.

※2. Connection Ratio of Agro-Industrial Park:
23% in 2015, 100% in 2020

Case-2; Worst Case (In case all connection ratio is not good.)

	2015	Target 2020	2025	Ultimate
Connection Ratio of Domenstic (%)	16	34	41	50
Connection Ratio of Agri.Sector (%)	23	50	50	50
Total O & M Cost and Depriciation Cost (NIS/year)	3,165,217	4,082,731	4,146,661	4,268,331
Total Income Charge (NIS/year)	586,373	1,300,860	1,650,348	1,912,418
Total Blance (NIS/year)	-2,578,845	-2,781,871	-2,496,314	-2,355,914

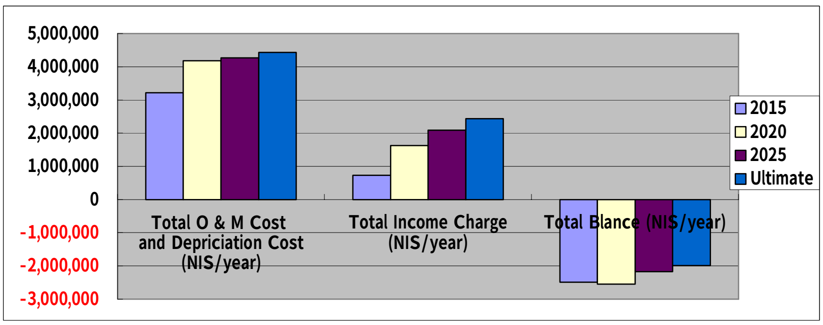


※1. Connection Ratio of Domestic is assumed 50% of design ratio.

※2. Connection Ratio of Agro-Industrial Park:
23% in 2015, 50% in 2020

Case-3; Intermitted Case (In case connection ratio of only Agro. is not good.)

	2015	Target 2020	2025	Ultimate
Connection Ratio of Domenstic (%)	21	45	55	67
Connection Ratio of Agri.Sector (%)	23	50	50	50
Total O & M Cost and Depriciation Cost (NIS/year)	3,217,567	4,181,651	4,268,852	4,429,119
Total Income Charge (NIS/year)	732,555	1,626,805	2,092,788	2,442,215
Total Blance (NIS/year)	-2,485,012	-2,554,846	-2,176,064	-1,986,904



※1. Connection Ratio of Domestic is 2/3to design ratio

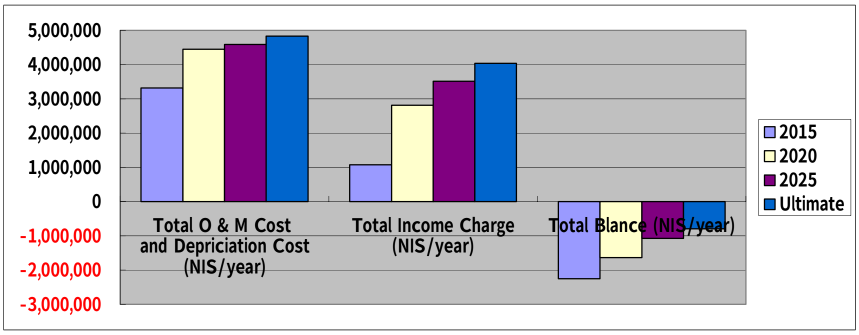
※2. Connection Ratio of Agro-Industrial Park:
23% in 2015, 50% in 2020

(2) Charge of Agro-industrial Park 2NIS/m^3

Common Condition ; Set Charge from Domestic Flow 1 NIS/m3
Set Charge from Agriculture Sector Flow 2 NIS/m3

Case-1; Best Case (In case current design)

	2015	Target 2020	2025	Ultimate
Connection Ratio of Domenstic (%)	31	68	82	100
Connection Ratio of Agri.Park (%)	23	100	100	100
Total O & M Cost and Depriciation Cost (NIS/year)	3,326,824	4,452,206	4,587,119	4,832,908
Total Income Charge (NIS/year)	1,074,195	2,817,070	3,516,045	4,040,185
Total Blance (NIS/year)	-2,252,629	-1,635,136	-1,071,074	-792,723

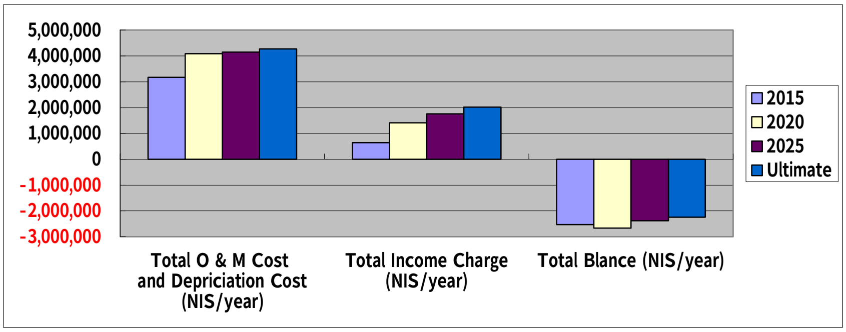


※1. Connection Ratio of Domestic is the same as design ratio.

※2. Connection Ratio of Agro-Industrial Park:
23% in 2015, 100% in 2020

Case-2; Worst Case (In case all connection ratio is not good.)

	2015	Target 2020	2025	Ultimate
Connection Ratio of Domenstic (%)	16	34	41	50
Connection Ratio of Agri.Sector (%)	23	50	50	50
Total O & M Cost and Depriciation Cost (NIS/year)	3,165,217	4,082,731	4,146,661	4,268,331
Total Income Charge (NIS/year)	635,648	1,408,535	1,758,023	2,020,093
Total Blance (NIS/year)	-2,529,570	-2,674,196	-2,388,639	-2,248,239

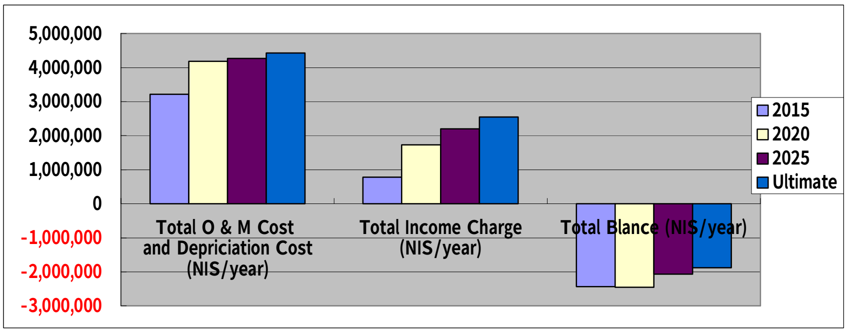


※1. Connection Ratio of Domestic is assumed 50% of design ratio.

※2. Connection Ratio of Agro-Industrial Park:
23% in 2015, 50% in 2020

Case-3; Intermitted Case (In case connection ratio of only Agro. is not good.)

	2015	Target 2020	2025	Ultimate
Connection Ratio of Domenstic (%)	21	45	55	67
Connection Ratio of Agri.Sector (%)	23	50	50	50
Total O & M Cost and Depriciation Cost (NIS/year)	3,217,567	4,181,651	4,268,852	4,429,119
Total Income Charge (NIS/year)	781,830	1,734,480	2,200,463	2,549,890
Total Blance (NIS/year)	-2,435,737	-2,447,171	-2,068,389	-1,879,229



※1. Connection Ratio of Domestic is 2/3to design ratio

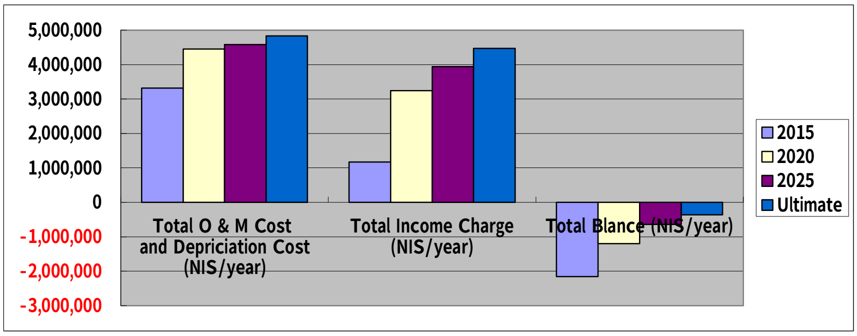
※2. Connection Ratio of Agro-Industrial Park:
23% in 2015, 50% in 2020

(3) Charge of Agro-industrial Park 3NIS/m^3

Common Condition ; Set Charge from Domestic Flow	1	NIS/m3
Set Charge from Agro. Flow	3	NIS/m3

Case-1; Best Case (In case current design)

	2015	Target 2020	2025	Ultimate
Connection Ratio of Domenstic (%)	31	68	82	100
Connection Ratio of Agri.Park (%)	23	100	100	100
Total O & M Cost and Depriciation Cost (NIS/year)	3,326,824	4,452,206	4,587,119	4,832,908
Total Income Charge (NIS/year)	1,172,745	3,247,770	3,946,745	4,470,885
Total Blance (NIS/year)	-2,154,079	-1,204,436	-640,374	-362,023

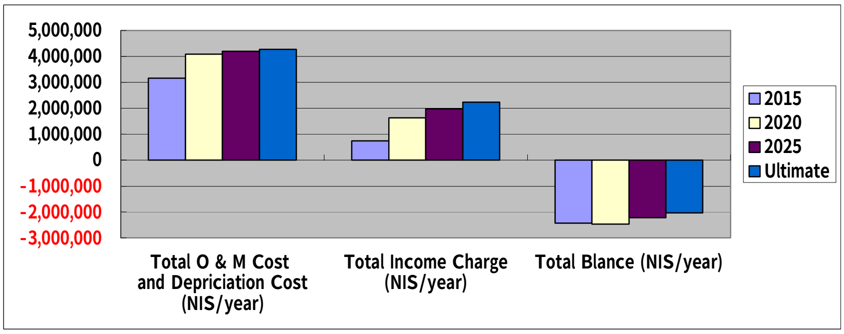


※1. Connection Ratio of Domestic is the same as design ratio.

※2. Connection Ratio of Agro-Industrial Park: 23% in 2015, 100% in 2020

Case-2; Worst Case (In case all connection ratio is not good.)

	2015	Target 2020	2025	Ultimate
Connection Ratio of Domenstic (%)	16	34	41	50
Connection Ratio of Agri.Sector (%)	23	50	50	50
Total O & M Cost and Depriciation Cost (NIS/year)	3,165,217	4,082,731	4,188,796	4,268,331
Total Income Charge (NIS/year)	734,198	1,623,885	1,973,373	2,235,443
Total Blance (NIS/year)	-2,431,020	-2,458,846	-2,215,424	-2,032,889

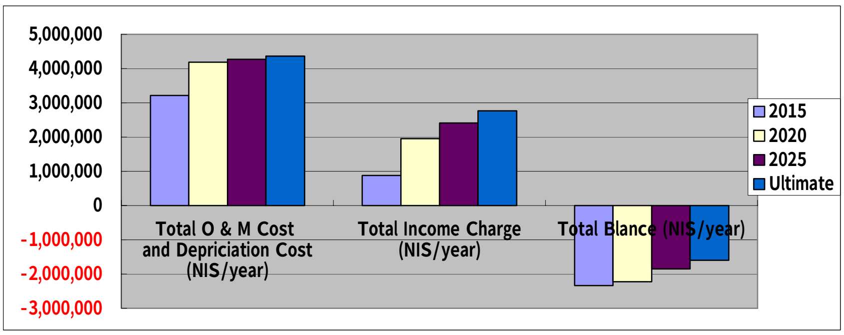


※1. Connection Ratio of Domestic is assumed 50% of design ratio.

※2. Connection Ratio of Agro-Industrial Park: 23% in 2015, 50% in 2020

Case-3; Intermitted Case (In case connection ratio of only Agro. is not good.)

	2015	Target 2020	2025	Ultimate
Connection Ratio of Domenstic (%)	21	45	55	67
Connection Ratio of Agri.Sector (%)	23	50	50	50
Total O & M Cost and Depriciation Cost (NIS/year)	3,217,567	4,181,651	4,268,852	4,365,355
Total Income Charge (NIS/year)	880,380	1,949,830	2,415,813	2,765,240
Total Blance (NIS/year)	-2,337,187	-2,231,821	-1,853,039	-1,600,115



※1. Connection Ratio of Domestic is 2/3to design ratio

※2. Connection Ratio of Agro-Industrial Park: 23% in 2015, 50% in 2020

Appendix 3-3 Environmental Check List

Environmental Check Lists：Sewerage（1）

Category	Environmental Item	Main Check Items	Yes or No	Confirmation of Environmental Considerations
1. Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been officially completed? (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) Y (b) N (c) N (d) N	(a) It was already made and submitted to EQA (b) The limit duration which EQA shall answer to proponent was expired, then now PWA is inquiring the result to EQA (c) Any attached condition was not expected (d) Not necessary
	(2) Explanation to the Public	(a) Are contents of the project and the potential impacts adequately explained to the public based on appropriate procedures, including information disclosure? Is understanding obtained from the public? (b) Are proper responses made to comments from the public and regulatory authorities?	(a) Y (b) Y	(a) The contents and influences of the Project had already explained in the stakeholder meetings in Jericho Municipality, and the approval of acquisition for WWTP site was already got from Ministry of Religious Affairs (b) Proper response was already done
	(3)Study of Alternative plans	(a) Did examine several alternative plan for the Project including items related to environmental/socio conditions	(a) Y	(a) The location of WWTP site and the wastewater treatment process were examined
2. Policies for prevention of pollution	(1)Water Quality	(a) Do pollutants, such as SS, BOD, COD, pH contained in treated effluent from a sewage treatment plant comply with the country's effluent standards? (b) Does heavy metal include in inflow water?	(a) Y (b) N	(a) The T-N value of effluent is exceeded the standard of agreement with Israel, but Israel authority agreed the value (b) Any factory which discharges such a material is not located
	(2) Wastes	(a) Are wastes, such as sludge generated by the facility operations properly treated and disposed of in accordance with the country's standards?	(a) -	(a) Dried solid will be stored at the WWTP site and then it will be used for farmlands
	(3) Soil Contamination	(a) If wastes, such as sludge are suspected to contain heavy metals, are adequate measures taken to prevent contamination of soil and groundwater by leachates from the wastes?	(a) Y	(a) Heavy metal will not be contained in sewage
	(4) Noise and Vibration	(a) Do noise and vibrations generated from the facilities, such as sludge treatment facilities and pumping stations comply with the country's standards?	(a) Y	(a) There is standard for noise level, and the standard for industrial area will be cope with in WWTP because it will be adopted
	(5) Odor	(a) Are adequate control measures taken for odor sources, such as sludge treatment facilities?	(a) Y	(a) Grit chamber and sludge thickener, which provably generate smell, will be located the canter of the cite far away from boundary line, and trees will be planted surrounding these
3.Natural Environment	(1) Protected Areas	(a) Is the project site 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) There is no protect area, and the site is currently a farmland
	(2) Ecosystem	(a) Does the project site and discharge area encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site 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 project will adversely affect aquatic environments, such as rivers? Are adequate measures taken to reduce the impacts on aquatic environments, such as aquatic organisms?	(a) N (b) N (c) - (d) N	(a) There is no such area (b) There is no such area (c) No impact is anticipated (d) There is no surface aquatic environment. The discharge water properly treated and most of it is used for irrigation. Therefor there are no possibility of adversely affect

Environmental Check Lists：Sewerage（2）

Category	Environmental Item	Main Check Items	Yes or No	Confirmation of Environmental Considerations
4.Social Environment	(1)Transfer of people	(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 relocation and conpensation given to affected persons prior to resettlement? (c) Is the resettlement plan, including proper conpensation, relocation of livlihoods and living standards developed based on socioeconomic studies on resettlement? (d) Will compensation mony pay before resetlement? (e) The policy of compansation is stipulated in a certain document? (f)Does the resettlement plan pay any particular attention to vulnerable groups or persons, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous people? (g)Are agreements with the affected persons 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)Is a plan developed to monitor the impacts of resettlement? (j) Is the system of complaint hadiling was established?	(a) N (b) - (c) - (d) - (e) - (f) - (g) - (h) - (i) - (j) -	(a) No resettlement (b) Not necessary (c) Not necessary (d) Not necessary (e) Not necessary (f) Not necessary (g) Not necessary (h) Not necessary (i) Not necessary (j) Not necessary
	(2) Living and Livelihood	(a) Is there a possibility that changes in land uses and water uses due to the project will adversely affect the living conditions of inhabitants? (b) 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?	(a) N (b) Y	(a) No possibility of adversely affect, and there is only advantages which wastewater dischared directly will be properly treated and the treated water can be used for irrigation (b) Though there is no housing surrounding WWTP site, there is little possibility of noise and odor problem in construction and operation stage, but the countermeasures of traffic jam and dust during constriction need to be prepared
	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage sites? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a) Y	(a) When sewer pipes are installed in a specific area, it is possible that some ruin or relic will be found, but it will be dealt with properly
	(4)Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a) N	(a) There was a farmland, and since the height of structures in WWTP is low and in addition tree will be planted in the site, the landscape which can be looked down the Jordan River Basin will not be negatively affected
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce the impacts on culture and lifestyle of ethnic minorities and indigenous peoples? (b) Are the rights of ethnic minorities and indigenous peoples to their lands and resources respected in the Project?	(a) N (b) -	(a) There is no ethnic minorities (b) Not necessary
	(6)Work Condition	(a) Will be the law on the work condition, which shall be observed in the host country, complied with in the Project? (b) Will hard safety procedures to relevant people of the Project, such as installation of the safety facilities and proper management for hazard materials for prevention of work disasters be considered? (c) Will soft procedures to the relevant people of the Project, such as formulation of safety plan and safety education (including traffic safety and public health) be implemented? (d) Will proper procedures for security staff of the Project not to violate safety of local people and relevant people of the Project be formulated?	(a) Y (b) Y (c) Y (d) Y	(a) Project will be carried out under the law in Palestine (b) Every necessary facilities will be prepared (c) Every necessary procedures will be prepared and carried out (d) Safety staff will be assigned and he/her will formulated a proper safety plan

Environmental Check Lists：Sewerage（3）

Category	Environmental Item	Main Check Items	Yes or No	Confirmation of Environmental Considerations
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) Will traffic jams by the construction be caused? Will the mitigation method be prepared?	(a) Y (b) N (c) Y (d) Y	(a) Necessary measures will be prepared (b) No adversely affect (c) Countermeasures for traffic jam and dust nuisance will be prepared (d) Traffic of the target area is not so busy, but countermeasures, such as detour, will be prepared
	(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? (b) How to be decided the items, methods and frequencies included in 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) - (c) Y (d) -	(a) A program will be prepared (b) Shown in attachment (c) Adequate framework will be established (d) Proper system and format shall be formulated
	Note on Using Environmental Checklist	(a) If necessary, the impacts to transboundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a) -	(a) Influent by the water contamination to Jordan River and Dead Sea is considered, but this problem will not be taken place because the effluent water will be treated properly and used for irrigation. Since wastewater directly discharged from this area is treated properly, this Project will be contribute to the global environment

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 made, if necessary. 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' 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 it is located.

Appendix 3-4 Draft Environmental Monitoring Form

A. Plan for Environmental Monitoring

Division	Items	Contents	Agency	Frequency	Timing
Grasping of Present Condition	Along the Sewer-pipes	・Facilities required paying special attention; such as hospitals and schools	PWA	At preliminary survey in EIA	EIA
		・Traffic density and noise by the hour			
		・Situation of Traffic congestion generation			
		・Locations and kinds of historical heritage			
	Surrounding conditions of WWTP	・Land utilization conditions			
		・Facilities in surrounding areas			
		・Surrounding housings and others			
		・Dust generation situation by wind			
		・Landscape			
	Effluent Water	・Condition of effluent point			
		・Groundwater quality （Survey of Wells）			
		・Water quality of Dead Sea			
	Solid Waste Management	・Collection and disposal methods for domestic solid waste in municipality			
		・Collection and disposal methods for industrial solid waste in municipality			
		・Reusing ways for dried sludge from WWTP			
Mitigation Countermeasures and check	Installation of Sewer-pipes	・Countermeasure for noise/vibration	Prepared by the Contractor and reviewed by Consultant/PWA	The Contractor shall prepare as "Environment Protection plan" in the planning of Construction Plan	Formulation of Construction Plan
		・Traffic countermeasures including detour			
		・Historical ruins and procedures of handling when			
		・Construction time scheduling			
	Construction of WWTP	・Countermeasure for noise/vibration			
		・Traffic countermeasures			
		・Countermeasures to facilities requiring paying attention			
		・Prevention measure for dust			
		・Consideration to landscape			
	Treated Water	・Treated water quality, quality of groundwater, influence to quality of Dead sea			EIA
	Solid Waste Management	・Solid Waste Management Plan (Recycling, Disposal of domestic waste and industrial waste)			Formulation
		・Treatment and disposal/reuse of dried sludge and screenings in operation phase			of Construction
Monitoring during Construction	Installation of Sewer-pipes	・Noise/vibration during construction(working points and nearby facilities requiring paying attention	Prepared by construction contractor and reviewed by Consultants/PWA	Daily	During Construction
		・Generation of traffic congestion by construction and effect by countermeasures		Daily	
		・Finding ruin/relic and handling procedures when		Daily	
	Construction of WWTP	・Nuisance by Noise/vibration and influence to surrounding		Daily	
		・Generation of traffic congestion by vehicles for		Daily	
		・Generation condition of dust and effect of mitigation		Daily	
	Solid Waste Management	・Observance situation of Solid Waste Management Plan		Weekly	
		・Disposal methods and quantities of domestic/industrial		Weekly	
		・Recycling methods and quantities		Weekly	
Monitoring in Commissioning Operations	WWTP	・Detection of odor by monitor	Conducted by construction contractor and	As required	During Test Operations
		・Measurement of Noise/Vibration		Moring,Evening, Night	
		・Quality tests of wastewater and treated water		Weekly	
		・Water content and odor measurement for dried sludge		Every Disposal	
Monitoring in operation phase	Sewer-pipe	・Occurrence of odor nuisance and clogging	Conducted by Jericho Municipality and reviewed by EQA	As required	Operation Phase
		・Generation of caving–in		As required	
	WWTP	・Complaint for odor/noise/vibration		As required	
		・Regular analysis for treated water		Monthly	
		・Quantity/purpose of reused treated water, complaint by		As required	
		・Quantity/purpose of reused dried sludge, complaint by		As required	

B. Monitoring Form

1. Grasping of Present Condition

1-1 Stakeholder Meeting

Items	Situation of Monitoring Period		
Pointed items by stakeholders in the first meeting	Speaker	Contents	Countermeasures
Pointed items by stakeholders in the second meeting	Speaker	Contents	Countermeasures

1-2 Grasping Condition in the Surrounding Area

Facilities	Situation of Monitoring Period		
	Items	Condition	Note
WWTP Site	Natural condition		
	Landscape		
	Water environment		
	Collection/Disposal of solid waste		
	Land-use condition		
	Houses/facilities in surrounding area		
Along the sewer installation route	Natural condition		
	Land-use condition		
	Soil condition		
	Traffic network		
	Traffic condition		

1-3Water Quality of Wells（No of well, sampling date, temperature）

Item	unit	value	Standard for farmland	Analysis method	Note
pH	(--)				
SS	(mg/L)				
BOD	(mg/L)				
COD	(mg/L)				
T-N	(mg/L)				
T-P	(mg/L)				
Iron	(mg/L)				
Oil & Grease	(mg/L)				
Total dissolved solid	(mg/L)				
Temperature	℃				

1-4　Noise Level at WWTP Site

Item	time	Value range (dB)	Standard at site	Measured Method	Note
Noise at morning					
Noise at daytime					
Noise at night					

1-5　Condition of EIA　Approval

Proposed entity	Items	Contents	Countermeasure

2. Monitoring for Construction Stage

2-1 Check for EMP(Environmental Management Plan)

Category	item	Results/pointed items	Countermeasure
General	Policies		
	Organization		
	Connection system		
Construction for WWTP	Traffic		
	Noise/vibration		
	Dust		
	Sludge disposal		
	Domestic wastewater		
	Littering in the site		
	Monitoring plan		
	Correction		
Sewer installation	Traffic		
	Noise/vibration		
	Dust		
	Sludge disposal		
	Littering in the site		
	House along the load		
	Monitoring plan		
	Correction		
Solid-waste management Plan	Generation projection		
	Segregation/disposal of domestic waste		
	Recycling of package materials		
	Treatment and disposal of construction waste		
	Safety storage and disposal of hazardous waste		
	Monitoring plan		
	Correction		

2-2 Monthly Monitoring Sheet

Category	Item		Contents	Countermeasure /note
Construction of WWTP	Problems and Complaint			
	Traffic	Traffic jam		
		Noise/vibration		
		Dust		
		Others		
	Construction	Noise/vibration		
		Dust		

		Soil disposal				
		Clearing up of site				
		others				
	Construction office	Clearing up				
		Domestic wastewater				
		others				
Sewer installation	Problems and Complaint					
	Traffic	Detour				
		Traffic jam				
		Noise/vibration				
		Dust				
		Others				
	Excavation	Breasting				
		Influence to traffic				
		Influence to along structures				
		Ruin/relic				
		Soil disposal site				
		Others				
Solid-waste Management	Problems and Complaint					
	Generation amount(t/m)	Domestic				
		Package				
		Construction				
		Hazardous				
	Disposal (t/m)	Contents	Amount	Place of disposal		
		Domestic				
		Package				
		Construction				
		hazardous				
	Recycling	Contents	Amount(t/m)	Ratio (%)	Method	
		Domestic				
		Package				
		Construction				
		Hazardous				
Evaluation	Construction of WWTP					
	Sewer installation					
	Solid-waste management					
	Others					

3. Monitoring for Commissioning after Completion of Construction

3-1 Water quality

Item	unit	Inflow	Outflow	Effluent standard	Analysis method	Note
pH	(--)					
SS	(mg/L)					
BOD	(mg/L)					
COD	(mg/L)					
T-N	(mg/L)					
T-P	(mg/L)					
Oil & Grease	(mg/L)					
Total dissolved solid	(mg/L)					
Coliform	(n/100cc)					
Chlorine ion	(mg/L)					
Boron	(mg/L)					
Na	(mg/L)					
Silver(Ag)	(mg/L)					
Arsenic(As)	(mg/L)					
Cadmium(Cd)	(mg/L)					
Chromium(Cr)	(mg/L)					
Cobalt(Co)	(mg/L)					
Copper(Cu)	(mg/L)					
Fluorine(Fl)	(mg/L)					
Iron(Fe)	(mg/L)					
Mercury(Hg)	(mg/L)					
Lithium(Li)	(mg/L)					
temperature	℃					

3-2 Noise in the Site

Item	Time	Place	Value range (dB)	Measured Method	Note
Noise at daytime		Outside of blower room			
Noise at morning, daytime and night		North boundary at daytime			
		At morning			
		At night			
		South boundary at daytime			
		At morning			
		At night			
		East boundary at daytime			
		At morning			
		At night			

3-3 Oder Perception Test in WWTP Site

Place	Measured results	Method	Note
3m away from grit chamber			
3m away from sludge thickener			
3m away from sludge drying bed			
Front of administration building			
North boundary			
South boundary			
East boundary			
West boundary			

4. Monitoring for Operation Stage

4-1 Water Quality

Item	unit	Inflow	Outflow	Effluent standard	Analysis method	Note
pH	(--)					
SS	(mg/L)					
BOD	(mg/L)					
COD	(mg/L)					
T-N	(mg/L)					
T-P	(mg/L)					
Oil & Grease	(mg/L)					
Total dissolved solid	(mg/L)					
Coliform	(n/cc)					
temperature	℃					

4-2 Environmental Monitoring Monthly Sheet

Items		Situation	Countermeasure /note
Problems and Complaint			
Traffic			
Operation	Inflow quality		
	Wastewater by Tanker		
	Treatment at grit chamber		
	Treatment at reactor		
	Reusing for irrigation		
	Noise/vibration		
	Sludge treatment/reuse		
	Environment in the site		
	Others		