APPENDIX 4, PART I (B/P)

Water Quality Analysis

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APPENDIX 4 WATERQUALITY ANALYSIS

4.1 Self-purification Rate of Vardar River

The pollution load runoff to the Vardar River (i.e., pollution load entering the Vardar River) is naturally purified while it flows down the Vardar River. BOD concentration decreases as explained below according to the Streeter-Phelps.

The pollution load runoff that enters the Vardar River is naturally purified while it flows along the main river. BOD concentration decreases as given below according to the Streeter-Phelps.

Decreasing Reduction Rate of BOD: $dC/dt = - K \cdot C$

C: BOD concentration (mg/l),
t: time (day),
K: self-purification constant (1/day)

The self-purification constant *k* of the Vardar River through the Skopje City is estimated to be 1.46 (1/day), based on the water quality data at Vlae Bridge and Taor monitoring stations. For the runoff coefficient and calculation methods, see Table 4.1.

Table 4.1 Calculate of Purification Coefficient

Purification Coefficient

NODE	Sampling Point	Location (km)	Accumuloation Length (km)	Velocity (m/s)	Travel time (d)	Flow rate (m3/s)	BOD (mg/l)	Pollution Load Vardar (kg/d)	Pollution Load Inlet (kg/d)	Pollution Load Net (kg/d)	Vardar Net BOD (mg/l)	Purification coefficient (k)
N1	Vlae Bridge	202.000	18.230	0.800	0.098	19.600	1.51	2,557				
R1	Lepenece River (MP4)	200.600	16.830	0.800	0.078	3.900	3.09	-	1,041	-	-	**1.74**
P1	Bardovci (MP6)	200.400	16.630	0.800	0.075	0.150	*71.50*	-	927	-	-	
R2	Serava River	197.585	13.815	0.830	0.033	1.000	*4.00*	-	346	-	-	
P2	Park	196.296	12.526	0.830	0.015	1.000	*0.00*	-	0	-	-	
N5	Stone Bridge	195.200	11.430	0.830	0.099	25.650	2.06	4,565		2,251	1.02	
P3	Iron Bridge	194.790	11.020	0.830	0.093	*0.170*	*71.50*	-	1,050	-	-	**1.18**
P4	Keramidnica (MP9)	192.040	8.270	0.770	0.059	0.205	174.25	-	3,086	-	-	
P5	Pivara	192.040	8.270	0.770	0.059	Included in P4						
P6	Blvd Serbia, Bridge (MP12)	191.159	7.389	0.770	0.046	0.365	71.52	-	2,255	-	-	
P7	Novo Lisice	191.100	7.330	0.770	0.045	*0.050*	114.93	-	496	-	-	
P8	Vardariste 1 (MP10)	190.100	6.330	0.770	0.030	0.935	63.00	-	5,089	-	-	
P9	Usje channel	188.900	5.130	0.770	0.012	*0.100*	62.00	-	536	-	-	
N9	Vardariste 2	188.093	4.323	0.770	0.065	27.982	4.45	10,759		347	0.14	
P10	Vardariste 2 (MP15)	188.093	4.323	0.770	0.065	*0.100*	55.30	-	478	-	-	**0.02**
R3	Karpos channel (MP16)	188.100	4.330	0.770	0.065	*0.190*	*4.00*	-	66	-	-	
P11	Ohis	188.100	4.330	0.770	0.065	0.028	100.00	-	242	-	-	
R4	Markova River	187.145	3.375	0.770	0.051	1.500	*4.00*	-	518	-	-	
N11	Jurumleri Bridge (MP17/CS5)	183.770	0.000	0.770	0.000	29.800	4.95	12,745		11,441	4.44	

APPENDIX 5, PART I (B/P)

Alternative Study

on Peripheral Sewer District Arrangement

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APPENDIX 5 ALTERNATIVE STUDY ON PERIFERICAL SEWER DISTRICT ARRANGEMENT

5.1 Cost Comparison of North Gorce Petrov Sewer District and Dracevo Sewer District

5.1.1 North Gorce Petrov Sewer District

Table 5.1 Cost Comparison of North Gorce Petrov Sewer District

	Independent (Alternative A)	Combined (Alternative B)
Construction Cost (EUR)		
Trunk Sewer (Dia. 450 mm, Length 1.5km)	0	180,000
NGP WWTP (New) (Cap: 3,220 m^3/d)	1,771,000	-
Expansion of Central WWTP (Cap: add 3,220 m^3/d)	-	1,328,000
Total	1,771,000	1,508,000
	(Large)	(Small)
Operation and Maintenance Cost (EUR/year)		
WWTP (Cap: 3,220 m^3/d)	29,400	29,400

Unit Cost and Calculation:
Trunk Sewer (Dia. 450mm, 1,500m): 120EUR/m × 1,500m = 180,000 EUR
NGP WWTP (New) (Cap: 3,220 m^3/d): 550EUR/(m^3/d) × 3,220m^3/d= 1,771,000 EUR
Expansion of Central WWTP (Cap: add 3,220 m^3/d): 412EUR/(m^3/d) × 3,220m^3/d= 1,508,000 EUR
O&M Cost of WWTP: 0.025 EUR/m^3 × 3,220m^3/d× 365d/year = 29,400EUR/year

5.1.2 Dracevo Sewer District

Table 5.2 Cost Comparison of Dracevo Sewer District

	Independent (Alternative A)	Combined (Alternative B)
Construction Cost (EUR)		
Dracevo WWTP (Cap: 8,000 m^3/d)	4,400,000	
Expansion of Central WWTP (Cap: add 8,000 m^3/d)		3,300,000
Trunk Sewer (Dia. 1500mm, Length: 7,000m)		2,520,000
3 Pumping Stations (Cap: 8,000 m^3/d)		1,200,000
Total	4,400,000 (Small)	7,020,000 (Large)
Operation and Maintenance Cost (EUR/year)		
WWTP (Cap: 8,000 m^3/d)	73,000	73,000
3 Pumping Stations	0	47,000
合計	73,000 (Small)	120,000 (Large)

Unit Cost and Calculation:
Trunk Sewer (Dia. 1500mm, 7,000m): 360EUR/m × 7,000m = 2,520,000 EUR
Dracevo WWTP (New): 550EUR/(m^3/d) × 8,000m^3/d= 4,400,000 EUR
Expansion of Central WWTP (New) (Cap: 8,000 m^3/d): 412EUR/(m^3/d) × 8,000m^3/d= 2,200,000 EUR
Pumping Station (8,000 m^3/日): 400,000EUR× 3 =1,200,000 EUR
O&M Cost of WWTP: 0.025 EUR/m^3 × 8,000m^3/d× 365d/year = 73,000EUR/year
O&M Cost of Pumping Station (Cap: 8,000 m^3/d)
- 12kW× 24hr/d = 288kWh/d
- 288kWh/d× 365d/year × 0.1EUR/kWh× 1.5 × 3 = 47,000EUR/year

APPENDIX 6, PART I (B/P)

Sewerage Facility Planning on Central Sewer District

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APPENDIX 6 SEWERAGE FACILITY PLANNING ON CENTRAL SEWER DISTRICT

6.1 Flow Calculation Sheet

Table 6.1 Flow Calculation Sheet

(1) Flow Calculation by Node

Node	Munucipality	Area	Residential Area	Population Density	Domestic Sewage				Industrial Wastewater	Total	Total
					Population	Unit Generation	Peak Factor	Amount			
		(km^2)	(km^2)	(Person/ km^2)	(Person)	(lpcd)	(-)	(m^3/d)	(m^3/d)	(m^3/d)	(m^3/s)
Right Bank Trunk Sewer											
65	Aerodrom	2.64	1.84	14,226	26,177	200	2.0	10,471	1,669	12,140	0.14
	Kisela Voda	3.80	3.17	16,822	53,324	200	2.0	21,330	0	21,330	0.25
	Centar	5.06	4.41	11,163	49,230	200	2.0	19,692	3,695	23,387	0.27
	Karpos	7.67	6.06	11,785	71,420	200	2.0	28,568	2,857	31,425	0.36
	Gorce Petrov	5.55	3.79	10,897	41,300	200	2.0	16,520	3,285	19,805	0.23
	Sub-total	24.72	19.27		241,451			96,581	11,506	108,087	1.25
69	Aerodrom	1.78	0.82	14,226	11,666	200	2.0	4,666	0	4,666	0.05
	Sub-total	1.78	0.82		11,666			4,666	0	4,666	0.05
70	Aerodrom	5.06	3.48	14,226	49,507	200	2.0	19,803	0	19,803	0.23
	Kisela Voda	4.78	0.92	16,822	15,476	200	2.0	6,190	2,361	8,551	0.10
	Sub-total	9.84	4.40		64,983			25,993	2,361	28,354	0.33
Right Bank Total		36.34	24.49		318,100			127,240	13,867	141,107	1.63
Left Bank Trunk Sewer											
106	Centar	1.48	0.71	11,225	7,970	200	2.0	3,188	0	3,188	0.04
	Karpos	1.87	0.12	11,500	1,380	200	2.0	552	0	552	0.01
	Gazi Baba	2.20	0.66	12,169	8,031	200	2.0	3,212	5,673	8,885	0.10
	Cair	3.43	3.20	25,469	81,501	200	2.0	32,600	408	33,008	0.38
	Butel	9.51	3.11	14,630	45,500	200	2.0	18,200	1,304	19,504	0.23
	Suto Orizari	2.20	1.77	15,650	27,700	200	2.0	11,080	561	11,641	0.13
	小計	20.69	9.57		172,082			68,832	7,946	76,778	0.89
111	Gazi Baba	4.18	0.44	12,169	5,354	200	2.0	2,142	8,252	10,394	0.12
	小計	4.18	0.44		5,354			2,142	8,252	10,394	0.12
126	Gazi Baba	11.67	4.94	12,169	60,114	200	2.0	24,046	4,775	28,821	0.33
	小計	11.67	4.94		60,114			24,046	4,775	28,821	0.33
Left Bank Total		36.54	14.95		237,550			95,020	20,973	115,993	1.34
Overall		72.88	39.44		555,650			222,260	34,840	257,100	2.97

(2) Flow Calculation Sheet of Right Bank and Left Bank Trunk Sewer

Node		Sewage Generation				Cumulative Flow	Sewer Information						Capacity Margin	Remarks
Up Stream	Down Stream	Domestic	Industrial	Total	Total		Diameter	Length	Slope	Roughness	Velocity	Flow Capacity		
		(m^3/d)	(m^3/d)	(m^3/d)	(m^3/d)	(m^3/s)	(mm)	(m)	(permil)	(-)	(m/s)	(m^3/s)	(%)	
Right Bank Trunk Sewer														
65	69	96,581	11,506	108,087	1.25	1.25	1,500	3,000	1.0	0.013	1.26	2.24	78.8	
69	70	4,666	0	4,666	0.05	1.30	1,500	200	1.0	0.013	1.26	2.24	72.0	
70	A	25,993	2,361	28,354	0.33	1.63	1,650	100	1.0	0.013	1.35	2.88	76.8	
A	B					1.63	1,000	130	Level					Syphon, Vardar River
Total Length								3,430						
Left Bank Trunk Sewer														
106	111	68,832	7,946	76,778	0.89	0.89	1,350	1,390	1.0	0.013	1.18	1.69	89.6	
111	126	2,142	8,252	10,394	0.12	1.01	1,350	2,930	1.0	0.013	1.18	1.69	67.1	
126	B	24,046	4,775	28,821	0.33	1.34	1,500	780	1.0	0.013	1.26	2.24	66.8	
B	WWTP					2.97	2,000	130	1.0	0.013	1.53	4.81	62.1	
Total Length								5,230						

6.2 Design basis for the comparison of treatment processes

6.2.1 CSAP

Conventional Activated Sludge Process

1 DESIGN BASIS

1.1 DESIGN PARAMETERS

(1) Flow (in 2020)		
Design Flow (Average)	166,000	m^3/d
Number of Streams	4	stream
Design flow per stream (Average)	41,500	m^3/d/stream
(2) Influent Qualities		
BOD concentration	240	mg/l
SS concentration	270	mg/l
(3) Efflunet Qualities		
BOD concentration	25	mg/l
SS concentration	35	mg/l
(4) Removal Efficiencies		
BOD removal efficiency at primary settling tank	40.0	%
BOD removal efficiency at aeration tank and final settling tank	82.7	%
Overall BOD removal efficiency	89.6	%
SS removal efficiency at primary settling tank	40.0	%
SS removal efficiency at aeration tank and final settling tank	78.4	%
Overall SS removal efficiency	87.0	%

(5) Dssign Wastewater Characteristics

		Cncentration (mg/l)	Load (kg/d)
(a) BOD	Primary Settling Tank, influent	240.0	39,840
	Aeration tank, influent	144.0	23,904
	Final effluent	24.9	4,135
(b) SS	Primary Settling Tank, influent	270.0	44,820
	Aeration tank, influent	162.0	26,892
	Final effluent	35.0	5,809

1.2 DESIGN CRITERIA

(1) Primary Settling Tank		
Surface loading rate	50	$m^3/m^2/d$
Hydraulic retention time	1.5	hr
Effective depth	3.0	m
(2) Aeration Tank		
BOD-SS loading (0.2～0.4)	0.30	kg-BOD/kg-SS/d
MLSS (1,500～2,000)	2,000	mg/l
HRT (6～8)	6.0	hr
Effective depth	5.0	m
(3) Final Settling Tank		
Surface loading rate	25	$m^3/m^2/d$
Hydraulic retention time	3.5	hr
Effective depth	3.0	m
(4) Disinfection		
Chlorine contact time	15	minutes
(5) Sludge Thickeners (Gravity)		
Inflow raw sludge solids concentration	1.0	%
Thickened sludge solids concentration (2.0～4.0)	3.0	%
Solids surface loading (60～90)	75	kg-DS/m^2/d
Effective depth	4.0	m
(6) Anaerobic Sludge Digesters		
Hydraulic retention time	24	day
Sludge heating temperature	35	dgree in C
Raw sludge solids concentration	3.0	%
Supernatant solids concentration	2,000	mg/l
Digested sludge solids concentration	3.0	%
Volatile material contents of SS	70	%
Volatile solids reduction rate (50～70)	50	% of input TS
Sludge gas calorific value	22,400	kJ/m^3
Sludge gas production rate	0.425	m^3/kg VS destroyed
(7) Sludge Drying Bed		
Sludge depth	0.20	m
Drying days	20	day

6.2.2 ODP

Oxidation Ditch Process

1 DESIGN BASIS

1.1 DESIGN PARAMETERS

(1) Flow (in 2020)

Design Flow (Average)	166,000	m^3/d
Number of Streams	4	stream
Design flow per stream (Average)	41,500	m^3/d/stream

(2) Influent Qualities

BOD concentration	240	mg/l
SS concentration	270	mg/l

(3) Efflunet Qualities

BOD concentration	25	mg/l
SS concentration	35	mg/l

(4) Removal Efficiencies

BOD removal efficiency at primary settling tank	0.0	%
BOD removal efficiency at aeration tank and final settling tank	89.6	%
Overall BOD removal efficiency	89.6	%
SS removal efficiency at primary settling tank	0.0	%
SS removal efficiency at aeration tank and final settling tank	87.1	%
Overall SS removal efficiency	87.1	%

(5) Dssign Wastewater Characteristics

		Cncentration (mg/l)	Load (kg/d)
(a) BOD	Primary Settling Tank, influent		
	Aeration tank, influent	240.0	39,840
	Final effluent	25.0	4,143
(b) SS	Primary Settling Tank, influent		
	Aeration tank, influent	270.0	44,820
	Final effluent	34.8	5,782

1.2 DESIGN CRITERIA

(1) Primary Settling Tank		
Surface loading rate		$m^3/m^2/d$
Hydraulic retention time		hr
Effective depth		m
(2) Aeration Tank		
BOD-SS loading	0.07	kg-BOD/kg-SS/d
MLSS (3,000～4,000)	3,000	mg/l
HRT (24～48)	24.0	hr
Effective depth	3.0	m
(3) Final Settling Tank		
Surface loading rate	20	$m^3/m^2/d$
Hydraulic retention time	9.0	hr
Effective depth	3.0	m
(4) Disinfection		
Chlorine contact time	15	minutes
(5) Sludge Thickeners (Gravity)		
Inflow raw sludge solids concentration	1.0	%
Thickened sludge solids concentration (2.0～4.0)	3.0	%
Solids surface loading (60～90)	75	kg-DS/m^2/d
Effective depth	4.0	m
(6) Anaerobic Sludge Digesters		
Hydraulic retention time	20	day
Sludge heating temperature	35	dgree in C
Raw sludge solids concentration	3.0	%
Supernatant solids concentration	1,500	mg/l
Digested sludge solids concentration	3.0	%
Volatile material contents of SS	70	%
Volatile solids reduction rate (50～70)	50	% of input TS
Sludge gas calorific value	22,400	kJ/m^3
Sludge gas production rate	0.425	m^3/kg VS destroyed
(7) Sludge Drying Bed		
Sludge depth	0.20	m
Drying days	14	day

6.2.3 EAP

Extended Aeration Process

1 DESIGN BASIS

1.1 DESIGN PARAMETERS

(1) Flow (in 2020)

Design Flow (Average)	166,000	m^3/d
Number of Streams	4	stream
Design flow per stream (Average)	41,500	m^3/d/stream

(2) Influent Qualities

BOD concentration	240	mg/l
SS concentration	270	mg/l

(3) Efflunet Qualities

BOD concentration	25	mg/l
SS concentration	35	mg/l

(4) Removal Efficiencies

BOD removal efficiency at primary settling tank	0.0	%
BOD removal efficiency at aeration tank and final settling tank	89.6	%
Overall BOD removal efficiency	89.6	%
SS removal efficiency at primary settling tank	0.0	%
SS removal efficiency at aeration tank and final settling tank	87.1	%
Overall SS removal efficiency	87.1	%

(5) Dssign Wastewater Characteristics

		Cncentration (mg/l)	Load (kg/d)
(a) BOD	Primary Settling Tank, influent		
	Aeration tank, influent	240.0	39,840
	Final effluent	25.0	4,143
(b) SS	Primary Settling Tank, influent		
	Aeration tank, influent	270.0	44,820
	Final effluent	34.8	5,782

1.2 DESIGN CRITERIA

(1) Primary Settling Tank		
Surface loading rate		$m^3/m^2/d$
Hydraulic retention time		hr
Effective depth		m
(2) Aeration Tank		
BOD-SS loading (0.03～0.10)	0.07	kg-BOD/kg-SS/d
MLSS (3,000～4,000)	3,000	mg/l
HRT (16～24)	24.0	hr
Effective depth	6.0	m
(3) Final Settling Tank		
Surface loading rate(8～12)	20	$m^3/m^2/d$
Hydraulic retention time (6～12)	9.0	hr
Effective depth (3～4)	3.5	m
(4) Disinfection		
Chlorine contact time	15	minutes
(5) Sludge Thickeners (Gravity)		
Inflow raw sludge solids concentration	1.0	%
Thickened sludge solids concentration (2.0～4.0)	3.0	%
Solids surface loading (60～90)	75	kg-DS/m^2/d
Effective depth	4.0	m

6.2.4 ALP

Aerated Lagoo : Aerobic Flow-through type

1 DESIGN BASIS

1.1 DESIGN PARAMETERS

(1) Flow (in 2020)

Design Flow (Average)	166,000	m^3/d
Number of Streams	4	stream
Design flow per stream (Average)	41,500	$m^3/d/stream$

(2) Influent Qualities

BOD concentration	240	mg/l
SS concentration	270	mg/l

(3) Efflunet Qualities

BOD concentration	25	mg/l
SS concentration	35	mg/l

(4) Removal Efficiencies

BOD removal efficiency at primary settling tank	0.0	%
BOD removal efficiency at aerated lagoon and sedimentation lagoon	89.6	%
Overall BOD removal efficiency	89.6	%
SS removal efficiency at primary settling tank	0.0	%
SS removal efficiency at aerated lagoon and sedimentation lagoon	87.1	%
Overall SS removal efficiency	87.1	%

(5) Dssign Wastewater Characteristics

		Cncentration (mg/l)	Load (kg/d)
(a) BOD	Aerated lagoon, influent	240.0	39,840
	Final effluent	25.0	4,143
(b) SS	Aerated lagoon, influent	270.0	44,820
	Final effluent	34.8	5,782

1.2 DESIGN CRITERIA

(1) Aerated Lagoon

MLSS (50～100)	100	mg/l
Hydraulic retention time	5.0	day
Effective depth (2～5)	3.0	m

(2) Sedimentation Lagoon

Hydraulic retention time	2.0	day

(3) Disinfection

Chlorine contact time	15	minutes

1.3 SLUDGE PRODUCTION

(1) Excess Sludge	-	dbt/d

6.2.5 CTFP

Trickling Filters :Low Rate

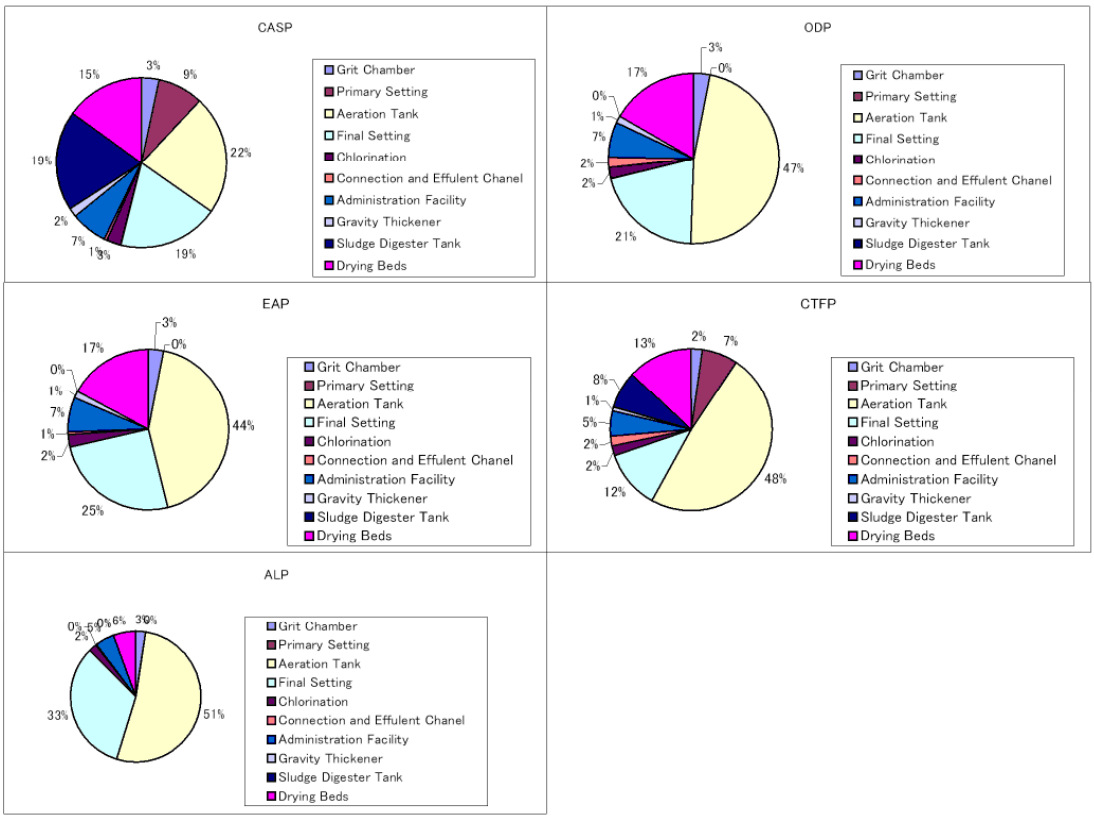
1	DESIGN BASIS		
1.1	DESIGN PARAMETERS AND CRITERIA		
	Design Flow (Average)	166,000	m^3/day
	Design Flow (Average, per stream)	41,500	m^3/day
	Number of Streams	4	Stream
	Influent concentration		
	BOD concentration	240	mg/l
	SS concentration	270	mg/l
	Design effluent concentration (target)		
	BOD concentration	25	mg/l
	SS concentration	35	mg/l
	Wastewater Quantity and Characteristics		
	Average daily flow	166,000	m^3/day
	BOD concentration	240	mg/L
	SS concentration	270	mg/L
	Removal Efficiencies		
	BOD removal efficiency with primary settling tank	40.0	%
	BOD removal efficiency with Trickling Filter	82.7	%
	Overall BOD removal efficiency	89.6	%
	SS removal efficiency with primary settling tank	40.0	%
	SS removal efficiency with Trickling Filter	78.4	%
	Overall SS removal efficiency	87.0	%
	Effluent Qualities		
	BOD concentration	24.9	mg/l
	SS concentration	35.0	mg/l
	Component Facilities		
	(a) Primary Settling Tank		
	Surface loading rate(35～70)	50	$m^3/m^2/d$
	Hydraulic retention time	1.5	hr
	Effective depth	3.0	m
	(b) Trickling Filter		
	Hydraulic Loading (1～4)	2.50	$m^3/m^2/d$
	Organic Loading (0.07～0.22)	0.15	kgBOD/m^3/d
	Recirculation ratio	0.0	
	Effective depth	2.0	m
	(c) Final Settling Tank		
	Surface loading rate	25	m^3/m^2/day
	Hydraulic retention time	3.0	hr
	Effective depth	3.0	m
	(f) Disinfection		
	Chlorine contact time	15	minutes
	(d) Sludge Thickeners (Gravity)		
	Inflow raw sludge solids concentration	1.0	%
	Thickened sludge solids concentration (2.0～4.0)	3.0	%
	Solids surface loading (60～90)	75	kg/m^2/day
	Effective depth	4.0	m
	(e) Anaerobic Sludge Digesters		
	Hydraulic retention time	20	days
	Sludge heating temperature	35	dgree in C
	Raw sludge solids concentration	3.0	%
	Supernatant solids concentration	1,500	mg/L
	Digested sludge solids concentration	3.0	%
	Volatile material contents of SS	70	%
	Volatile solids reduction rate (50～70)	50	% of input TS
	Sludge gas calorific value	22,400	kJ/m^3
	Sludge gas production rate	0.425	m^3/kg VS destroyed
	(f) Sludge Drying Bed		
	Sludge depth	0.20	m
	Drying days	14	days
	(g) Sludge Dewatering (Belt press filter)		
	Per unit solids loads of filter	140	kg/m/hr
	Belt filter width	3.0	m
	Solids content of sludge cake	20	%
	Operation days a week	6	days
	Operation time a day	7	hr/day

6.3 Comparison for each sewage treatment process

6.3.1 Construction Cost

(Euro)

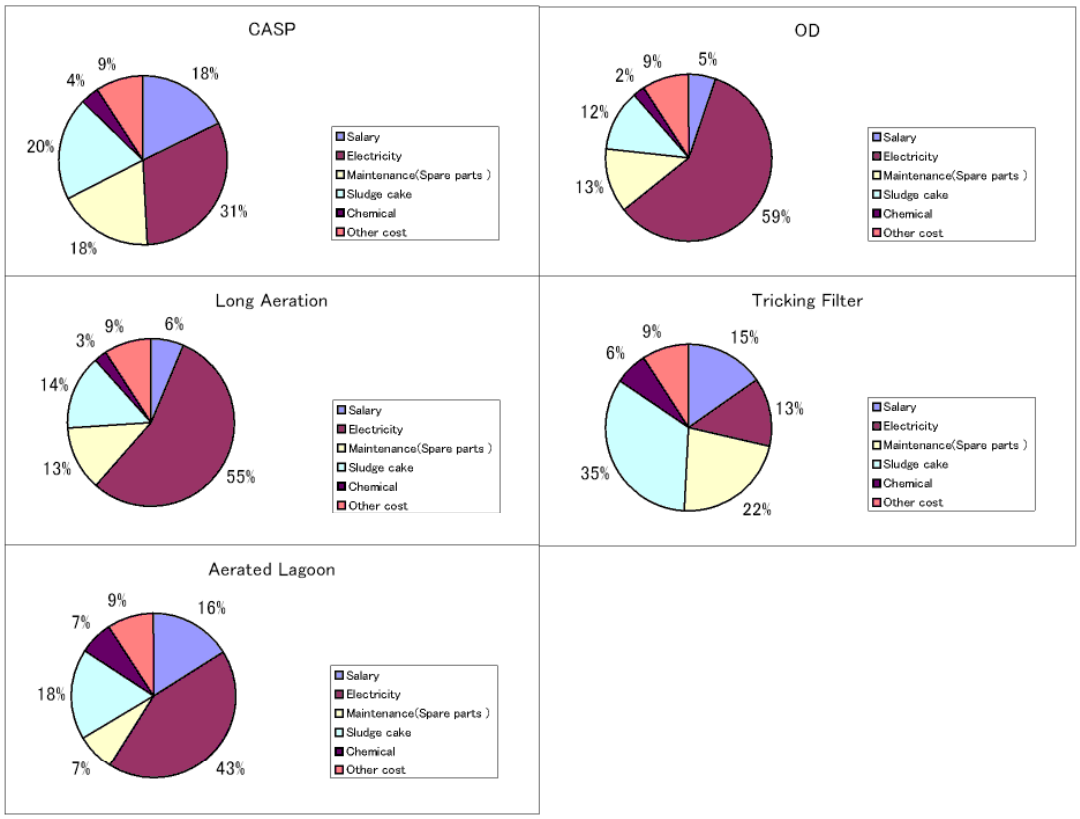
Item	CASP	ODP	EAP	ALP	CTFP
Grit Chamber	1,615,000	1,626,000	1,615,000	1,730,000	1,615,000
Primary Setting	4,389,000				4,918,000
Aeration Tank	11,438,000	25,864,000	22,876,000	35,690,000	33,917,000
Final Setting	9,686,000	11,220,000	13,384,000	22,506,000	8,029,000
Chlorination	1,286,000	1,280,000	1,277,000	1,286,000	1,286,000
Connection and Effulent Chanel	275,000	989,000	392,000	166,000	1,437,000
Administration Facility	3,492,000	3,689,000	3,661,000	3,258,000	3,401,000
Gravity Thickener	868,000	737,000	732,000		550,000
Sludge Digester Tank	9,641,000				5,253,000
Drying Beds	7,546,000	9,107,000	9,108,000	3,773,000	9,108,000
Total	50,236,000	54,512,000	53,045,000	68,409,000	69,514,000
Percentage	100	109	106	136	138



6.3.2 O&M Cost

(Euro)

Item	CASP	ODP	EAP	ALP	CTFP
Salary	288,000	144,000	144,000	144,000	144,000
Electricity	508,412	1,559,545	1,226,585	382,607	127,474
Maintenance(Spare parts)	292,820	333,687	281,346	64,844	208,567
Sludge cake	320,103	320,103	320,103	160,052	320,103
Chemical	59,860	59,860	59,860	59,860	59,860
Other cost	146,920	241,720	203,189	81,136	86,000
Total	1,616,115	2,658,915	2,235,084	892,499	946,005
Percentage	100	165	138	55	59



6.3.3 Annual Cost

Comparison of Annual Cost (Euro)

Item	CASP	ODP	EAP	CTFP	ALP
Civil and Building Work	25,112,000	27,378,000	28,203,000	39,358,000	60,303,000
Mech and Elec Work	25,124,000	27,134,000	24,842,000	30,156,000	8,106,000
Construction Cost	50,236,000	54,512,000	53,045,000	69,514,000	68,409,000
Percentage	100	109	106	138	136

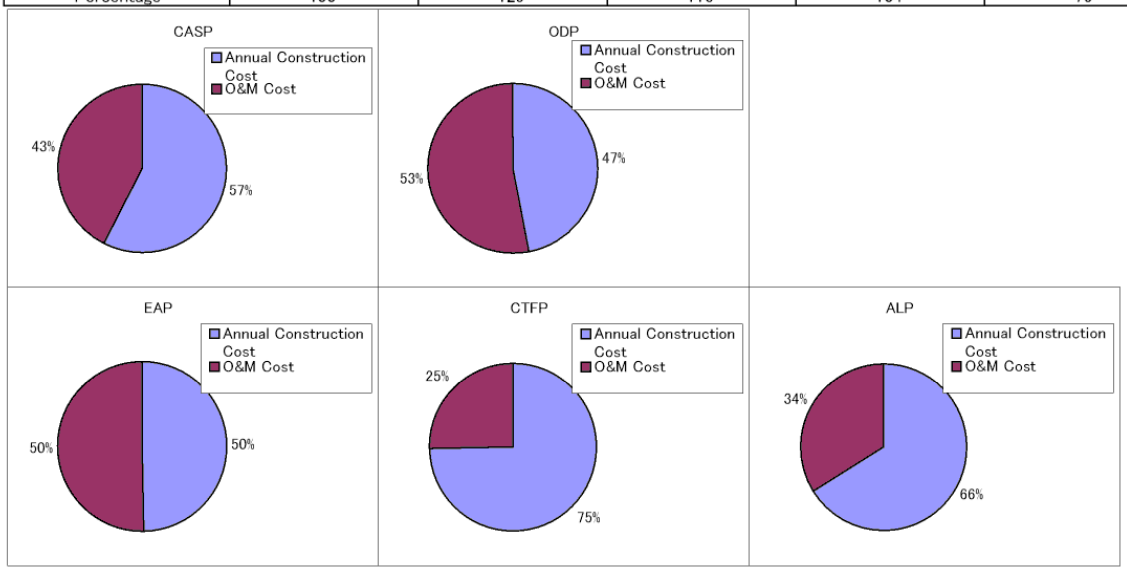
redemption price

$$A = P \times \frac{i \cdot (1+i)^N}{(1+i)^N - 1}$$

A:annual cost、P:price、 N:life period (civil : 50, mech.elec. : 15)

(Euro)

Item	CASP	ODP	EAP	CTFP	ALP
Civil and Building Work	799,144	871,256	897,510	1,252,498	1,919,035
Mech and Elec Work	1,955,287	2,111,716	1,933,340	2,346,905	630,853
Annual Construction Cost	2,754,431	2,982,972	2,830,850	3,599,403	2,549,888
O&MCost	1,616,115	2,658,915	2,235,084	946,005	892,499
Total	4,370,546	5,641,887	5,065,934	4,545,408	3,442,387
Percentage	100	129	116	104	79



6.4 Comparison of sludge treatment processes

6.4.1 Detail of capacity and economical efficiency

There are belting press type, centrifuge type, rotary-press type, in machine dewatering system. In this examination, the belting press system is adopted for the following reasons.

- The belt-press type is adopted in the other WWTP plants of the Macedonia.
- Since there are no special parts, maintenance at its own country is possible.
- Since it is few operating electric energy as compared with other systems, maintenance expense is cheap.

Conparison of sludge dewater processes 1／3 ※digested sludge

item	Natural Drying Drying bed	Mechanical Dewatering beit press
1) assumption sewage flow	166,000m3/day	166,000m3/day
coagulant	—	polymer coagulant
input sludge amount of sludge	separated CASP digested input: sludge 1,437 m3/d, moisture content 98.0 %, dry sludge 28,023 kg・DS/d coagulant: dry sludge 0 kg・DS/d total: sludge 1,437 m3/d, moisture content 98.0 %, dry sludge 28,023 kg・DS/d	separated CASP digested input: sludge 1,437 m3/d, moisture content 98.0 %, dry sludge 28,023 kg・DS/d coagulant: dry sludge 364 kg・DS/d total: sludge 1,437 m3/d, moisture content 98.0 %, dry sludge 28,387 kg・DS/d
2) performance	moisture content 65 % drying day 14 days	moisture content 80 % filtration rate 80 kg・DS/m・h ratio of chemical 1.3 %
3) Capacity	drying bed	belt press dewatering
number	10m×20m×0.2m×10tank×5lane	5 nos (standby 2nos) filter width 3.0m
utilization		24hr, 7days/week
capacity	1,437 ×14days÷0.2m= 100,590 → 10,000 m2	3.0m×80×24×5nos= 28,800 kg・DS/d
quantity of coagulant		28,023 × (1.3 /100)= 364 kg/d
amaount of dehydrated cake	28,023 ×100/(100-65)= 80 ton/d	28,387 ×100/(100-80)= 142 ton/d
4) economical efficiency	civil・arch 5,600,000 Euro mecha・elec 0 Euro Land 1,500,000 Euro Total 7,100,000 Euro (100 %)	civil・arch 2,420,000 Euro mecha・elec 9,572,640 Euro Land 16,500 Euro Total 12,009,140 Euro (169 %)
	O&M 345,000 Euro/year (100 %)	O&M 1,438,000 Euro/year (417 %)
(annual cost) durability civil 50years equipment 15years	civil・arch 112,000 Euro/year mecha・elec 0 Euro/year O&M 345,000 Euro/year Total 457,000 Euro/year (100 %)	civil・arch 48,400 Euro/year mecha・elec 638,176 Euro/year O&M 1,438,000 Euro/year Total 2,124,576 Euro/year (465 %)

Conparison of sludge dewater processes　2／3

initial cost

項　目		Natural Drying drying bed					Mechanical Dewatering belt press				
1)	Civil・architecture	item	specific	unit cost	quantity	cost	item	specific	unit cost	quantity	cost
		drying bed	10m×20m×1.0m	11,200	500	5,600,000	sludge dewatering facility	1,100m2×2F	1,100	2,200	2,420,000
		Total(Civil&architecture)				5,600,000 (Euro)	Total(Civil&architecture)				2,420,000 (Euro)
2)	machanical	item	specific	unit cost	quantity	cost	item	specific	unit cost	quantity	cost
							belt press	3m	440,000	7	3,080,000
							auxiliary	main*0.2			616,000
							Sub total (equipment)				3,696,000
							customs	Total*0.25			924,000
							installation cost	Total*0.6			2,217,600
		Total (mechanical equipmemt)				0 (Euro)	Total (mechanical equipmemt)				6,837,600 (Euro)
3)	electrical	item	specific	unit cost	quantity	cost	item	specific	unit cost	quantity	cost
							equipment	mech Total ×40%			1,478,400
							customs	equipment*0.25			369,600
							installation cost	equipment*0.3			887,040
		Total (electricity equipment)				0 (Euro)	Total (electricity equipment)				2,735,040 (Euro)
4)	Land	item	specific	unit cost	quantity	cost	item	specific	unit cost	quantity	cost
		land	100,000m2	15	100,000	1,500,000	land	1,100m2	15	1,100	16,500
		Total				1,500,000 (Euro)	Total				16,500 (Euro)
	Total					7,100,000 (Euro)					12,009,140 (Euro)

Conparison of sludge dewater processes 3／3

項 目		Natural Drying drying bed	Mechanical Dewatering belt press
O & M cost	1) electric cost	item / power (kW) / quantity / utilization h/d / factor / electric energy kwh/d Total: 0 0 kWh/d×365×0.025EUR/kWh= 0 (EUR/year)	item / power (kW) / quantity / utilization h/d / factor / electric energy kwh/d belt press: 8.2 / 5 / 24 / 0.8 / 787 auxiliary: main×2 / 1,574 Total: 2,361 2,361 kWh/d×365×0.025EUR/kWh= 22,000 (EUR/year)
	2) salaries	2person×4team 8 person×12month×250EUR/month= 24,000 (EUR/year)	3person×3team 9 person×12month×250EUR/month= 27,000 (EUR/year)
	3) chemical cost	0 kgDS/d×3.5EUR/kg×365 = 0 (EUR/year)	364 kgDS/d×5EUR/kg×365 = 664,000 (EUR/year)
	4) rework cost	maintenance equipment cost×3% 0 (EUR/year)	maintenance equipment cost×3% 155,000 (EUR/year)
	5) cost of disposal sludge cake @11EUR/ton	80 t/d×11EUR/t×365 = 321,000 (EUR/year)	142 t/d×11EUR/t×365 = 570,000 (EUR/year)
	O & M Total	electrial 0 salaries 24,000 chemical 0 rework 0 disposal 321,000 Total 345,000 (EUR/year)	electrial 22,000 salaries 27,000 chemical 664,000 rework 155,000 disposal 570,000 Total 1,438,000 (EUR/year)

6.5 Evaluation of Greenhouse Gas Emission of Each Treatment Process

6.5.1 Comparison of Total CO_2 Emission per year

Item	CASP	ODP	EAP	ALP	CTFP
1. Emission from energy consumption					
a) Use of electricity					
Wastewater treatment	8,380	25,750	20,260	6,320	2,140
b) Truck run					
Sludge transportation	24	24	24	12	12
2. Emission from treatment process of wastewater and sludge					
Wastewater treatment	4,126	4,126	4,126	4,126	4,126
Sludge landfill	28,539	28,539	28,539	14,280	14,280
3. Effective utilization of sub-product from treatment process					
Digestion gas	0	0	0	0	0
Total emission (t-CO_2/year)	41,100	58,400	52,900	24,700	20,600
	200%	**280%**	**260%**	**120%**	**100%**

6.5.2 Evaluation Method

The emission of greenhouse gas (GHG) from the sewerage system is generated through construction and operation of sewerage facilities and disposal of sludge. At the B/P stage, it is difficult to calculate how much GHG will be emitted during construction period, thus the evaluation was done for the GHG from the operation of sewerage facilities and disposal of sludge.

The emission source and target GHG during operation of facilities and disposal of sludge are as follows.

(1) Emission source
  1) Emission from the energy consumption (electricity, fuel etc.)
  2) Emission from treatment process of wastewater and sludge
(2) Target GHG
  1) CO_2
  2) CH_4
  3) N_2O

Total emission was calculated using the formula below.

Total emission per year = Σ (yearly activity* × emission coefficient)
* yearly activity: consumption of electricity and fuel etc.

The measurement of actual emission coefficient in Macedonia is difficult, thus the emission coefficient in Japan is used for the evaluation.

Table 6.2 Emission Coefficient

Item	Emission coefficient of CO_2		Emission coefficient of CH_4		Emission coefficient of N_2O	
Wastewater treatment	-	t-CO_2/m^3	0.00000088	t-CH_4/m^3	0.00000016	t-N_2O/m^3
Sludge landfill	-	t-CO_2/ds-t	0.133	t-CH_4/ds-t	-	t-N_2O/ds-t
Purchased Electricity	0.000555	t-CO_2/kWh	-	t-CH_4/kWh	-	t-N_2O/kWh
Gasoline combustion	0.00232	t-CO_2/ l	-	t-CH_4/ l	-	t-N_2O/ l
Truck run	-	t-CO_2/km	0.000000035	t-CH_4/km	0.000000039	t-N_2O/km

* The emission coefficient is as of 2006 (Ministry of Environment, Japan)
* The emission coefficient may be changed according to the treatment process, however, there is no published value nor measured value, thus the same coefficient is adopted.
* Sludge is landfilled as anaerobic condition.
* The electricity for operation of facilities will be purchased.

* The amount of gasoline is transportation from WWTP to landfill site.

Table 6.3 Comparison of amount of Activity

Item		CASP	ODP	EAP	ALP	CTFP
Amount of wastewater	m^3	60,590,000	60,590,000	60,590,000	60,590,000	60,590,000
Amount of sludge	ds-t	10,220	10,220	10,220	5,110	5,110
Electricity consumption	kwh	15,100,000	46,400,000	36,500,000	11,388,000	3,850,000
Gasoline combustion	l	10,220	10,220	10,220	5,110	5,110
Truck run	km	51,100	51,100	51,100	25,550	25,550

* CASP and CTFP includes the digestion process as primary sedimentation is necessary. CASP, ODP and EAP generate the same amount of sludge, CTFP generates less surplus sludge, half amount of CASP.

* The gasoline combustion is calculated using 20km for total distance and 5km/l for mileage using truck with capacity four tons.

1. CASP

	Emission of GHG			CO_2 conversion			Emission (CO_2 conversion)
	CO_2	CH_4	N_2O	CO_2 1	CH_4 21	H_2O 310	
	(t-CO_2/y)	(t-CH_4/y)	(t-N_2O/y)	(t-CO_2/y)	(t-CO_2/y)	(t-CO_2/y)	(t-CO_2/y)
1. Emission from energy consumption							
a) Use of electricity							
Wastewater treatment	8,380.0			8,380.0	–	–	8,380
b) Truck run							
Sludge transportation	23.7	0.00179	0.00199	23.7	0.04	0.62	24
2. Emission from treatment process of wastewater and sludge							
Wastewater treatment		53.3	9.7	–	1,119.3	3,007.0	4,126
Sludge landfill		1359.0		–	28,539.0	–	28,539
3. Effective utilization of sub-product from treatment process							
Digestion gas				–	–	–	0
Total emission (t-CO_2/year)							**41,070**

* The electricity generated by the digestion gas is calculated as the reduction of CO_2

2. ODP

	Emission of GHG			CO_2 conversion			Emission (CO_2 conversion)
	CO_2	CH_4	N_2O	CO_2 1	CH_4 21	H_2O 310	
	(t-CO_2/y)	(t-CH_4/y)	(t-N_2O/y)	(t-CO_2/y)	(t-CO_2/y)	(t-CO_2/y)	(t-CO_2/y)
1. Emission from energy consumption							
a) Use of electricity							
	25750.0			25,750.0	–	–	25,750
b) Truck run							
	23.7	0.00179	0.00199	23.7	0.04	0.62	24
2. Emission from treatment process of wastewater and sludge							
		53.3	9.7	–	1,119.3	3,007.0	4,126
		1359.0		–	28,539.0	–	28,539
3. Effective utilization of sub-product from treatment process							
				–	–	–	0
Total emission (t-CO_2/year)							**58,440**

* The electricity generated by the digestion gas is calculated as the reduction of CO_2

3. EAP

	Emission of GHG			CO_2 conversion			Emission (CO_2 conversion)
	CO_2	CH_4	N_2O	CO_2 1	CH_4 21	H_2O 310	
	(t-CO_2/y)	(t-CH_4/y)	(t-N_2O/y)	(t-CO_2/y)	(t-CO_2/y)	(t-CO_2/y)	(t-CO_2/y)
1. Emission from energy consumption							
a) Use of electricity	20,260.0			20,260.0	—	—	20,260
b) Truck run	23.7	0.00179	0.00199	23.7	0.04	0.62	24	24
2. Emission from treatment process of wastewater and sludge		53.3	9.7	—	1,119.3	3,007.0	4,126
		1359.0		—	28,539.0	—	28,539
3. Effective utilization of sub-product from treatment process				—	—	—	0
Total emission (t-CO_2/year)							**52,950**

* The electricity generated by the digestion gas is calculated as the reduction of CO_2

4. ALP

	Emission of GHG			CO_2 conversion			Emission (CO_2 conversion)
	CO_2	CH_4	N_2O	CO_2 1	CH_4 21	H_2O 310	
	(t-CO_2/y)	(t-CH_4/y)	(t-N_2O/y)	(t-CO_2/y)	(t-CO_2/y)	(t-CO_2/y)	(t-CO_2/y)
1. Emission from energy consumption							
a) Use of electricity	6,320.0			6,320.0	—	—	6,320
b) Truck run	11.9	0.00089	0.00100	11.9	0.02	0.31	12
2. Emission from treatment process of wastewater and sludge		53.3	9.7	—	1,119.3	3,007.0	4,126
		680.0		—	14,280.0	—	14,280
3. Effective utilization of sub-product from treatment process				—	—	—	0
Total emission (t-CO_2/year)							**24,739**

* The electricity generated by the digestion gas is calculated as the reduction of CO_2

5. CTFP

	Emission of GHG			CO_2 conversion			Emission (CO_2 conversion)
	CO_2	CH_4	N_2O	CO_2 1	CH_4 21	H_2O 310	
	(t-CO_2/y)	(t-CH_4/y)	(t-N_2O/y)	(t-CO_2/y)	(t-CO_2/y)	(t-CO_2/y)	(t-CO_2/y)
1. Emission from energy consumption							
a) Use of electricity	2,140.0			2,140.0	—	—	2,140
b) Truck run	11.9	0.00089	0.00100	11.9	0.02	0.31	12
2. Emission from treatment process of wastewater and sludge	53.3	9.7	—	1,119.3	3,007.0	4,126	4,126
	680.0		—	14,280.0	—	14,280	28,539
3. Effective utilization of sub-product from treatment process				—	—	—	0
Total emission (t-CO_2/year)							**20,559**

* The electricity generated by the digestion gas is calculated as the reduction of CO_2

APPENDIX 7, PART I (B/P)

Environmental and Social Considerations

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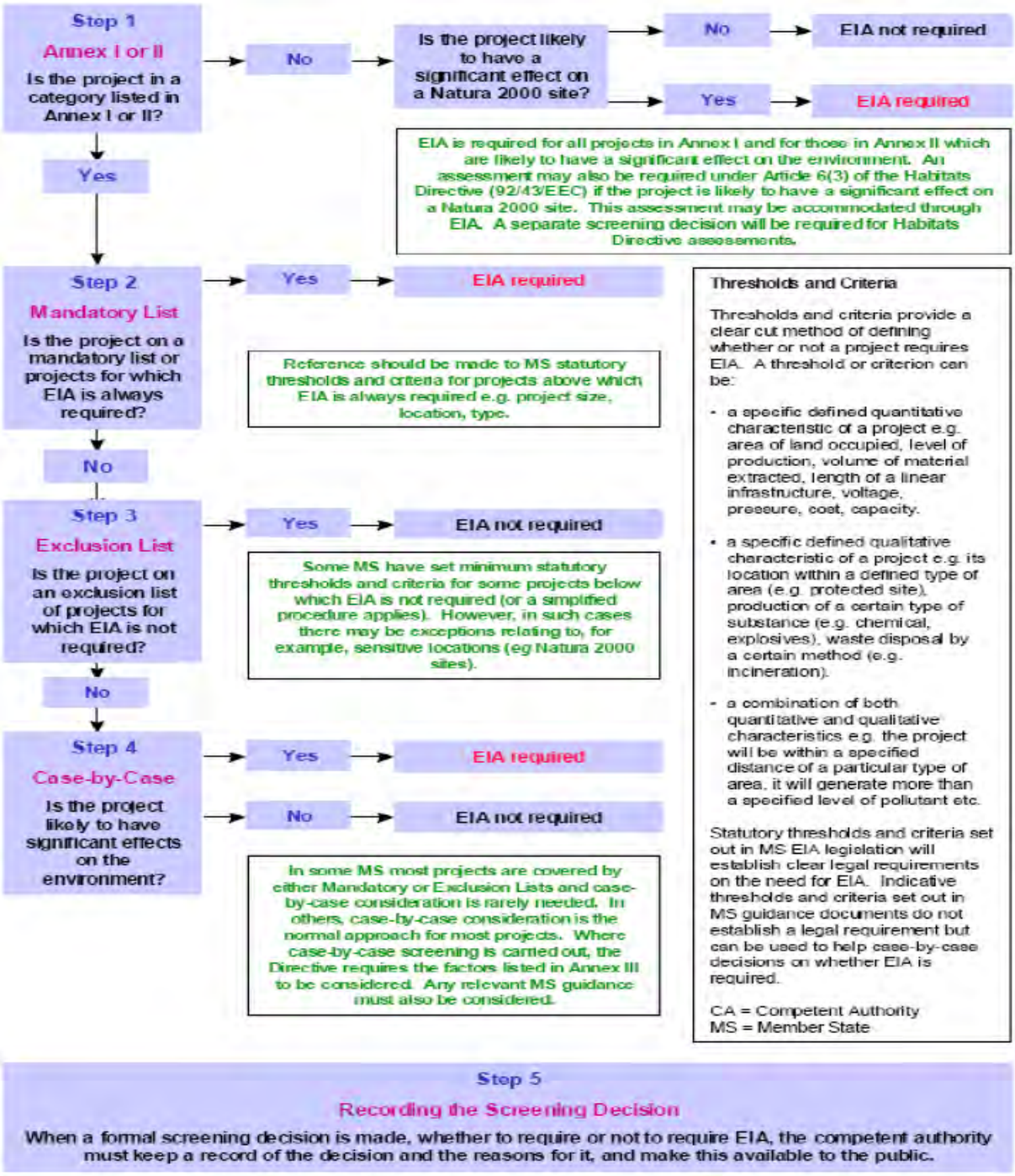
APPENDIX 7 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

7.1 Legal Framework of Environmental and Social Considerations

7.1.1 EIA Process in Macedonia



7.1.2 Requirements for EIA Report

The requirements for EIA report is prescribed in the "*Ordinance on the content of the requirements that need to be fulfilled by the study on environmental impact assessment*". The EIA study shall fulfil the following requirement:

- Description of the project with the information on location, character and the size of the project

and the land area needed,
- Description of the environment and its media on the location,
- Description of the historic and cultural heritage and the landscape,
- Description of the type and quantity of emissions and wastes expected, especially emissions in the air, solid wastes and wastewater, as well as other information necessary for evaluation of significant effects of the project on the environment,
- Description of the measures for prevention, diminishing and elimination of the impact on the environment, as well as the substitution measures in case of intervention in the natural environment and landscape,
- Description of the effects of the project on the environment having in mind the level of scientific development and accepted evaluation methods,
- Description of the characteristics of the technology used,
- Description of the alternative solutions for realization of the project that the investor had considered and the main reasons for the choice of the proposed option, the zero-option shall always be included,
- Summary of the study submitted without technical details,
- Review of the difficulties (technical defects or lack of knowledge) that the investor or the expert were faced with in the course of the study preparation, and
- Suggestion for the size and the characteristics under which the study on project environmental impact assessment should be updated.

7.1.3 Emission Standards

(1) Water

The Decree on Water Classification (Official Gazette No. 18/99) classifies waters. Limit values have been specified for each of the above indicators, with regard to five water classes.

Table 7.1 Limit values of some indicators for classification of waters into the 4 Classes

Indicators	Limit values of the indicators for different Class of Water			
	1st Class	2nd Class	3rd Class	4th Class
1. Dissolved oxygen mg / l O2 (non apply of the ground water)	8	6	4	3
2. Saturation %	90 - 105	75 - 90	50 - 75	30 - 50
	-	105 - 115	115 - 125	125 - 130
3. Biochemical oxygen demand BOD mg/l	2	4	7	20
4. Chemical oxygen demand COD permanganate index mg/l KMnO4	10	12	20	40
5. Total suspended matters mg/l	10	30	80	100
6. Total dissolved matters mg/l				
surface water	350	1000	1500	1500
ground water	350	1000	1500	
7. pH	6.8 - 8.5	6.8 - 8.5	6.0- 9.0	6.0- 9.0
8. Total coliform bacteria MPN	2000	100 000	200 000	-
bathing	-	20 000	-	-
9.Stage of saprogenic according to Liberman (non applicable for under ground water and lakes	Oligo saprogenic	Mezo sap-rogenic	Mezo sap-rogenic	a -b mezo saprogenic poli-saprogenic
10. Stage of biological productivity (only for lakes)	oligo trofni	moderate	– eutrofni	–

Table 7.2 Maximum allowed levels of different pollutants in to the waters

Dangerous Substances	Unit	Maximum allowed level of pollution substances in water	
		Class	
		I - II	III - IV
1. Ammonia	mg/l N	0.1	0.5
2. Ammonia ion	mg/l N	1	10
3. Nitrate	mg/l N	10	15
4. Nitrite	mg/l N	0.05	0.5
5. Hydrogen sulfide	mg/l	-	0.1
6. Arsenic	mg/l	0.05	0.05
7. Antimony	mg/l	0.05	0.05
8. Copper	mg/l	0.1	0.1
9. Iron	mg/l	0.3	1.0
10. Mercuric	mg/l	0.001	0.001
11. Cadmium	mg/l	0.005	0.01
12. Cobalt	mg/l	0.2	2.0
13. Molybden	mg/l	0.5	0.5
14. Nickel	mg/l	0.05	0.1
15. Lead	mg/l	0.05	0.1
16. Argentum	mg/l	0.01	0.02
17. Chromium Cr-III	mg/l	0.1	0.5
Chromium Cr-VI	mg/l	0.05	0.1
18. Zinc	mg/l	0.2	1.0
19. Phenols	mg/l	0.001	0.3
20. Cyanide	mg/l	0.01	0.1

(2) Effluent Quality Standards

At present, there are no effluent quality standards in Macedonia.

(3) Air

The air quality is specified in the Law on Ambient Air Quality (Official Gazette No. 67/04) and Decree on limit values (Official Gazette No. 50/05).

Table 7.3 Limit Values of Different Pollutants into the Air

Polluting Substances	Max. allowed concentrations-Limit values	
	Max. limit values	*Daily average*
SO2	500 µg/m^3	150 µg/m^3
Smoke	150 µg/m^3	50 µg/m^3
NO2	80 µg/m^3	85 µg/m^3
SPM (EU Directive 80/779/EEC)		120 µg/m^3
Ozone-O3 (EU Directive 92/72/EEC)		110 µg/m^3
CO	3 µg/m^3	1 µg/m^3
Pb		0,7 µg/m^3
Cd		0,7 µg/m^3

Source: Decree on limit values (Official Gazette No. 50/05)

(4) Noise

The Law on Noise, Rulebook on noise in working conditions (Official Gazette No. 29/97) and Decision on terms and conditions for noise annoyance on citizens (Official Gazette No. 64/93) set noise emission limit values.

Table 7.4 Max allowed level of noise dB (A)around different facilities

Type of objects	Max. Allowed Level of Noise dB (A)	
	Day	Night
Living and working Facilities	40	35
Schools other Educational Facilities	40	40
Hospitals	35	30

Purpose of the area	Max allowed level I from dB (A)		Max allowed level I from dB (A)	
	Day	Night	L 10*	L 5
Areas of health institutions, spas, resting areas	45	40	60	60
Tourist-recreational areas, hospital surroundings	50	45	60	75
Living places, schools, educational institutions, public green and recreational areas	55	45	65	75
Commercial-living-working areas with surrounding streets with 50 m depth from the middle of the street	60	50	70	75
Commercial, administrative institutions without living facilities, or as an exception, some living facilities	65	50	70	85
Production, warehouses, service or transport areas without living facilities	70	70	80	90

*L10 – level of noise in duration of 10% of measurement time
*L5 – level of noise in duration of 5% of measurement time
Source: Decision on terms and conditions for noise annoyance on citizens (Official Gazette No. 64/93)

(5) Odour

The Waste Framework Directive specifies that the Member States have to take the necessary measures to ensure that waste is recovered or disposed of without endangering human health and without using processes or methods which could harm the environment, without causing a nuisance through noise or odours. The Law on environment also provides that within the scope of work of the Inspector for the environment has the right to supervise the implementation of the measures for protection against odor, through ascertaining whether:

- measures for protection against odour have been undertaken in the premises and the surrounding where people stay and move,
- catering and tourist activities are performed in a manner preventing odour spread in the environment;
- articles causing odour have been eliminated and activities causing odour have been prevented;
- ascertains other conditions under his/her responsibility.

However specific emission standards for odour have not been set yet.

(6) Soil

The Law on Agricultural Land tackles the issue for soil protection, however currently there is no subsequent legislation regarding emission standards for soil.

7.2 Description of the Project Area

The detail of physical environment, socio-economic condition and public hazard in the project area and Skopje City is described in the section 2 of Appendix 10.4, IEE (page A10-274).

7.3 Initial Environmental Examination (IEE)

7.3.1 Scoping Checklist

Table 7.5 Scoping Checklist: Questions on Project Characteristics

No.	Questions to be considered in Scoping	Yes/No/?	Which Characteristics of the Project Environment could be affected and how?	Is the effect likely to be significant? Why?
1. Will construction, operation or decommissioning of the Project involve actions which will cause physical changes in the locality (topography, land use, changes in water bodies, etc)?				
1.1	Permanent or temporary change in land use, landcover or topography including increases in intensity of land use?	YES	**Land use** - The project will require intensive land use for WWTP and possible for new landfill for sludge disposal. The proposed project will not impact on the topography of the area.	YES- Impact on land ownership Significant locally- change in land use, increased traffic, noise, reduction of vegetation. Positive: improved local water quality in Vardar River
1.2	Clearance of existing land,	YES	**Land use** – The project will change	Not significant- The

No.	Questions to be considered in Scoping	Yes/No/?	Which Characteristics of the Project Environment could be affected and how?	Is the effect likely to be significant? Why?
	vegetation and buildings?		the purposes of the land use refer to the vegetation that already exists.	surrounding land is used almost (?) exclusively for industrial purpose with no intermixing among other companies located there. Not significant – the area affected is not significant for biodiversity or richness of vegetation.
1.3	Creation of new land uses?	YES	Land use, vegetation	Not significant – the area affected is not significant for biodiversity or richness of vegetation.
1.4	Pre-construction investigations e.g. boreholes, soil testing?	YES	Land on the WWTP location site – soil testing investigations The project is in close vicinity to River Vardar. Underground water connections should be tested to prevent any leakage to River Vardar.	Not significant – There is a proper analytical method that needs small quantities of soil and water for analytical analysis.
1.5	Construction works?	YES	**Land use** – The construction (both for collection system and WWTP itself) activities will influent the land use especially the WWTP location. Noise-The construction machinery will cause noise both during the construction of the collection system and WWTP. **Air emissions**-The construction activities will initiate exhaust gases emissions of dust (PM10), emissions of mobile sources (vehicles and tracks) of CO2 , NOx, PAH, SO2,; **Waste** – Creation of the inert waste from the construction works, communal waste from the temporary houses for workers (if they are not citizens of Skopje City); **Traffic and access** – The project will increase the number and frequency of vehicles in the several Skopje City municipalities-Karpos, Gazi Baba, Kisela Voda and Aerodrom. Existing access roads will be utilised and the additional infrastructure will be required only for the new WWT plant. **Energy and water supply** – The machinery used for the project will need the new energy infrastructure if the already existing in not enough. The water supply is also essential for construction works and accommodated workers into the temporary houses. **Sensitive Area**-The proposed land for WWTP location with all services facility (around 37 ha) is a State Hunting Area. The 21 ha are under the management of the Faculty of Forest and around 3.3 ha are dedicated to the ARBORETUM . The Arboretum has been established at "60-ties with planting more than 100 different trees	YES – The ownership of the land is very important. YES – There is exceedance of the noise level into the Skopje City, so the additional noise caused by the project activities (construction phase only) will increase noise level. YES Not significant YES Not significant YES, significant

No.	Questions to be considered in Scoping	Yes/No/?	Which Characteristics of the Project Environment could be affected and how?	Is the effect likely to be significant? Why?
			from the whole world for educational and research purposes. After the Skopje earthquake in 1963 the ground water level decrease and the dry periods cause the reduction of the trees in around 100. The Faculty of Forest use this ARORETUM for students visits and there are projects for re-cultivation of the ARBORETUM. The other areas are dedicated to the forest and lake as well as the land for cultivating the planting trees and selling them. There are different species-birds and foxes for hunting.	
1.6	Demolition works?	NO	Not expected (if needed very limited)	No
1.7	Temporary sites used for construction works or housing of construction workers?	YES	**Land use**-The project will cause the construction of the temporary houses for accommodation of the construction workers(if they are not citizens from Skopje City). **Waste** – The temporary accommodated workers will create communal waste that should be take to the Drisla Landfill. **Energy and water supply** – The temporary sites will required new energy and water infrastructure	Not significant – temporary with conditions regulated by law Not significant Not significant
1.8	Above ground buildings, structures or earthworks including linear structures, cut and fill or excavations?	YES	Earthworks: pipe trenches along all new and reconstructed/rehabilitated pipelines/collectors; River & street crossings; Excavations at the WWTP site for structures with deep foundations, etc Above ground structures/objects: WWTP objects, as well as other structures for the WW collection network & collectors. Below ground structures/objects: Pipelines and structures for the WW collection network & collectors.	Construction phase: significant traffic congestion, land- use changes (outside of urban boundary), noise, temporary service problems, air pollution etc.. Operation: WWTP – change in land use, noise, smell, temporary storage areas etc…
1.9	Underground works including mining or tunneling?	YES	**Land use** – The project will require intensive underground activities for construction of collector system	Construction Phase: significant impact – along collector lines
1.10	Reclamation works?	NO		
1.11	Dredging?	NO		
1.12	Coastal structures e.g. seawalls, piers?	NO		
1.13	Offshore structures?	NO		
1.14	Production and manufacturing processes?	NO		
1.15	Facilities for storage of goods or materials?	YES	**Land use**-The project will require construction of the facilities for storage of chemicals, materials and tools for the maintenance of the technology equipment, large pipes, excavated material and machinery During the operational phase the storage facilities will be within the	Construction Phase: significant impact – along collector lines Operation: Not significant – contained within WWTP limits. However, might become

No.	Questions to be considered in Scoping	Yes/No/?	Which Characteristics of the Project Environment could be affected and how?	Is the effect likely to be significant? Why?
			WWTP site boundaries.	significant if storage/transport of sand & sludge needs large temporary storage facilities.
1.16	Facilities for treatment or disposal of solid wastes or liquid effluents?	YES	**Land use**-The project will involve construction of the facilities for disposal of solid/liquid waste from the screen, grit chamber and after sludge dewatering equipment. Construction Phase: possible temporary spills of storm water and WW during construction into the recipient river	Operation WWTP: Not significant Sand & sludge disposal shall be organized in special landfill location. Landfill: Significant local effect to overall environment: change in land-use, vegetation cover, increased traffic and associated effects; Construction Phase: not significant- temporary spills not expected often.
1.17	Facilities for long term housing of operational workers?	YES/NO	**Land use** – There is a need for new temporary buildings for operational workers as well as the service facilities (if they are not citizens of Skopje City).	Not significant
1.18	New road, rail or sea traffic during construction or operation?	YES	The new access roads will be needed for WWT plant location+inner. No new roads expected within the urban area	Not significant: short access road lines are needed as the main roads exist
1.19	New road, rail, air, waterborne or other transport infrastructure including new or altered routes and stations, ports, airports etc?	YES	The new access roads will be needed for WWT plant location+inner. No new roads expected within the urban area	Not significant: short access road lines are needed as the main roads exist
1.20	Closure or diversion of existing transport routes or infrastructure leading to changes in traffic movements?	YES	**Traffic and access** – The project will increase the number and frequency of vehicles in the several Skopje City municipalities-Karpos, Gazi Baba, Kisela Voda and Aerodrom. Existing access roads will be utilised and the additional infrastructure will be required only for the new WWT plant. Construction phase: Temporary closing of streets during excavation works, laying of the pipelines and refilling of trenches & asphalting is expected – creating local diversion of traffic	Slightly significant: Short duration if well organized, however, may cause traffic congestions (air pollution increase)
1.21	New or diverted transmission lines or pipelines?	YES	Separation of storm water and WW networks: New pipelines construction Reconstruction of structures/objects	Construction phase: Slightly significant
1.22	Impoundment, damming, culverting, realignment or other changes to the hydrology of watercourses or aquifers?	YES	**RIVER** Construction phase: large siphon structure to be constructed across Vardar River (Right hand side collector connection to WWTP). Cofferdams to be constructed during construction shall constrict water bed and flow. No permanent changes in watercourse and river beds expected. Expected overall improvement of water quality of river Vardar	Construction phase: Slightly significant: Cofferdams & constrict water flow – may cause spills and floods locally. Increased sediment load in river Vardar – not significant; All above - temporary
1.23	Stream crossings?	YES	**RIVER** Construction phase: large siphon structure to be constructed across Vardar River (Right hand side	Construction phase: Slightly significant: Cofferdams & constrict water flow – may cause spills and floods locally.

No.	Questions to be considered in Scoping	Yes/No/?	Which Characteristics of the Project Environment could be affected and how?	Is the effect likely to be significant? Why?
			collector connection to WWTP). Cofferdams to be constructed during construction shall constrict water bed and flow. No permanent changes in watercourse and river beds expected. Expected overall improvement of water quality of river Vardar	Increased sediment load in river Vardar – not significant; All above - temporary
1.24	Abstraction or transfers of water from ground or surface waters?	YES	**GROUNDWATER** Positive Impact:	Reduced seepage from rehabilitated wastewater network –reduced pollution of groundwater
1.25	Changes in water bodies or the land surface affecting drainage or run-off?	NO		
1.26	Transport of personnel or materials for construction, operation or decommissioning?	YES	The project will involve intensive transport of personnel, tools and materials for all phases.	Not significant impact
1.27	Long term dismantling or decommissioning or restoration works?	NO		
1.28	Ongoing activity during decommissioning which could have an impact on the environment?	YES	The decommissioning process will have an impact on the environment especially during the demolition works, waste disposal and transport of used equipment	Not significant impact
1.29	Influx of people to an area in either temporarily or permanently?	YES	There is an influx of people expected as staff engaged for the construction and operation of the WWTP	Not significant impact
1.30	Introduction of alien species?	NO		
1.31	Loss of native species or genetic diversity?	NO		
1.32	Any other actions?	NO		

2. Will construction or operation of the Project use natural resources such as land, water, materials or energy, Especially any resources which are non-renewable or short supply

No.	Questions to be considered in Scoping	Yes/No/?	Which Characteristics of the Project Environment could be affected and how?	Is the effect likely to be significant? Why?
2.1	Land especially undeveloped or agricultural land?	YES/NO	The project location will include the parcels as an agricultural land and the future usage has been propose as an industrial one.	YES- Significant local land use change
2.2	Water?	YES	The project will use the water natural resources for operation of WWTP + sanitary water from WS network.	Not significant quantities pf water.
2.3	Minerals?	NO		
2.4	Aggregates?	YES	Construction phase: Aggregate for concrete works & structures – both pipelines and WWTP	Not significant
2.5	Forests and timber?	NO		
2.6	Energy including electricity and fuels?	YES	The project activities with a large number of vehicles and equipment will involve extensive energy – electricity and fuels consumption. Construction phase: FUEL: Transport & installation – both pipelines and WWTP Operation: FUEL: Transport of sludge Operation: ELECTRICITY:	FUEL: Slightly significant-Temporary during construction; During operation – depending on sludge quantities & water content, as well as the transporting distance to landfill site Electricity: Significant – large quantities of electricity for

No.	Questions to be considered in Scoping	Yes/No/?	Which Characteristics of the Project Environment could be affected and how?	Is the effect likely to be significant? Why?
			Consumption increase	treatment at WWTP
2.7	Any other resources?	NO		

3. Will the Project involve use, storage, transport, handling or production of substances or materials which could be harmful to human health or the environment or raise concerns about actual or perceived risks to human health?

No.	Questions to be considered in Scoping	Yes/No/?	Which Characteristics of the Project Environment could be affected and how?	Is the effect likely to be significant? Why?
3.1	Will the project involve use of substances or materials which are hazardous or toxic to human health or the environment (flora, fauna, and water supplies)?	YES	The project will use hazardous chemicals needed for the technology process as well as for the on-site laboratory. Process: Chlorine, hypochlorious acid and hydrochloric acid.	Not significant
3.2	Will the project result in changes in occurrence of disease or affect disease vectors (e.g. insect or water borne diseases)?	YES	The sludge will cause adverse impact in the environment-foul odours, development of insects, health hazards and if it is generated in large quantities may cause ground water contamination in cases of uncontrolled disposal into environment On other hand the waste water treatment facility will have a positive impact on the improvement of Vardar River water quality and consequently will decrease water borne diseases.	YES, if not treated according the strict provisions from the Law on Environment, Law on Water and Law on Waste Management YES positive impact
3.3	Will the project affect the welfare of people e.g. by changing living conditions?	YES	The project will positively affect the welfare of people through the new employments, decreasing the health costs for water borne diseases and improvement of the agriculture with clean ground water for irrigation. Surface and groundwater: Decreased leakage from sewage pipes, elimination of sewage discharges into recipients and decrease in number of sewage pits The higher communal and water supply collection fees will affect the household budget.	YES YES YES significant negative economic effect
3.4	Are there especially vulnerable groups of people who could be affected by the project e.g. hospital patients, the elderly?	NO		
3.5	Any other causes?	NO		

4. Will the Project produce solid wastes during construction or operation or decommissioning?

No.	Questions to be considered in Scoping	Yes/No/?	Which Characteristics of the Project Environment could be affected and how?	Is the effect likely to be significant? Why?
4.1	Spoil, overburden or mine wastes?	NO		
4.2	Municipal waste (household and or commercial wastes)?	YES	The project activities (construction phase) with temporary accommodation of workers will cause municipal waste (communal and commercial wastes) that should be disposed on Drisla Landfill.	Not significant impact

No.	Questions to be considered in Scoping	Yes/No/?	Which Characteristics of the Project Environment could be affected and how?	Is the effect likely to be significant? Why?
4.3	Hazardous or toxic wastes (including radioactive wastes)?	YES	The mixing of the communal waste water and un-treated industrial waste waters will cause the appearance of the hazardous sludge.	YES – The issue related to the final sludge disposal should be investigate in more details within the EIA preparation phase. The information about the industrial facilities with outlets into Vardar River, existing pre-treatment facilities, concentrations of the pollutant substances into the industrial waste water streams are essential information about the hazardous type of sludge.
4.4	Other industrial process wastes?	YES	The different processes within the WWT Plant will create the different wastes like screening material, material from the grit chamber, oils and waste chemicals from the laboratory.	YES – the oils and waste chemicals belong to the hazardous waste and there should be specific (according the legislation) management of this type of waste.
4.5	Surplus product?	YES	Methane gas from the digester	YES if not treated
4.6	Sewage sludge or other sludge from effluent treatment?	YES	The WWT Plant with the technology used will create sewage sludge after digester and the sludge dewatering unit.	YES – the sewage sludge treatment and final disposal seems to be the most important issue within the EIA Study
4.7	Construction or demolition wastes?	YES	The construction activities will generate inert waste.	Not significant impact
4.8	Redundant machinery or equipment?	YES	The redundant machinery or equipment can create the end-of-life equipment waste.	Not significant impact
4.9	Contaminated soils or other material?	YES	There is possibility for soil contamination due to the seepage of material from vehicles or facility for chemicals storage. Also waste water seepage into the soil at the plant may occur at connecting points of cannels and tanks and other locations due to the cracks on structures.	YES – The contamination can be expected if there is not a good management procedure for chemicals handling and construction procedure
4.10	Agricultural wastes?	NO		
4.11	Any other solid wastes?	NO		

5. Will the Project release pollutants or any hazardous, toxic or noxious substances to air?

No.	Questions to be considered in Scoping	Yes/No/?	Which Characteristics of the Project Environment could be affected and how?	Is the effect likely to be significant? Why?
5.1	Emissions from combustion of fossil fuels from stationary or mobile sources?	YES	The project activities will include the usage of vehicles for transportation and the combustion of fossil fuels will cause emissions into the air.	Not significant impact
5.2	Emissions from production processes?	YES	The technology process will cause emissions into the air (emissions from screen, grit chamber, primary, secondary clarifiers, digesters and sludge dewatering unit (especially methane gas).	Not significant impact
5.3	Emissions from materials handling including storage or transport?	YES	There is possibility for emissions from storage and transport of materials and chemicals.	Not significant impact
5.4	Emissions from construction activities including plant and equipment?	YES	The emissions of dust and suspended particulars can occur during the construction and operating activities.	Not significant impact
5.5	Dust or odors from handling of	YES	During the construction phase as well	YES

No.	Questions to be considered in Scoping	Yes/No/?	Which Characteristics of the Project Environment could be affected and how?	Is the effect likely to be significant? Why?
	materials including construction materials, sewage and waste?		as on day-by-day operational activities the dust, odours can occur. Especially odorous substances due to the composition and concentration of waste substances in waste water in sewage sludge.	
5.6	Emissions from incineration of waste?	NO		
5.7	Emissions from burning of waste in open air (e.g. slash material, construction debris)?	NO		
5.8	Emissions from any other sources?	NO		

6. Will the Project cause noise and vibration or release of light, heat energy or electromagnetic radiation?

No.	Questions to be considered in Scoping	Yes/No/?	Which Characteristics of the Project Environment could be affected and how?	Is the effect likely to be significant? Why?
6.1	From operation of equipment e.g. engines, ventilation plant, crushers?	YES	The project activities and technological process will involve great number of equipment that will cause the noise and vibration (pump stations with electromotor drives, ventilators, diffusers, etc).	Not significant – limited within the plant – the mitigation measures may apply on that impact
6.2	From industrial or similar processes?	NO		
6.3	From construction or demolition?	YES	The construction activities will cause noise due to the machinery for digging of the collector system and dredging for WWT Plant construction. Noise, vibration, dust – Construction phase of WW network & collector The construction works will affect the spices within the Arboretum and the Hunting Area in surrounding the WWTP location at Trubarevo.	YES YES, significant impact
6.4	From blasting or piling?	NO		
6.5	From construction or operational traffic?	YES	The project involves intensive vehicle fleet that will cause noise during the transportation. Noise, vibration – Construction phase of WW network & collectors Noise, vibration – Operation: transport of residues & sludge	 Partly significant – with limited duration Partly significant –limited to transport routes only
6.6	From lighting or cooling systems?	NO		
6.7	From sources of electromagnetic radiation (consider effects on nearby sensitive equipment as well as people)?	NO		
6.8	From any other sources?	NO		

7. Will the Project lead to risks of contamination of land or water from releases of pollutants onto the ground or into sewers, surface waters, groundwater, coastal waters or the sea?

No.	Questions to be considered in Scoping	Yes/No/?	Which Characteristics of the Project Environment could be affected and how?	Is the effect likely to be significant? Why?
7.1	From handling, storage, use or spillage of hazardous or toxic materials?	YES	The spillage of hazardous materials and release of pollutants onto the ground or underground may occur.	YES
7.2	From discharge of sewage or other effluents (whether treated or	YES	The industrial waste water sewage untreated will be discharged into the	YES

No.	Questions to be considered in Scoping	Yes/No/?	Which Characteristics of the Project Environment could be affected and how?	Is the effect likely to be significant? Why?
	untreated) to water or the land?		municipal waste water and mixed waste water will enter the WWT Plant.	
7.3	By deposition of pollutants emitted to air, onto the land or into water?	YES	The air, land and water quality will be changed due to the deposition of pollutants emitted.	YES
7.4	From any other sources?			
7.5	Is there a risk of long term build up of pollutants in the environment from these sources?	YES	Generated sludge and gases can be a cause for long term build up. Example: the WWTP in Struga-Vraniste	YES

8. Will there be any risk of accidents during construction or operation of the Project which could affect human health or the environment?

No.	Questions to be considered in Scoping	Yes/No/?	Which Characteristics of the Project Environment could be affected and how?	Is the effect likely to be significant? Why?
8.1	From explosions, spillages, fires etc from storage, handling, use or production of hazardous or toxic substances?	YES	The WWT Plant will have the facilities with dangerous chemicals and one of the products – sludge can contain the hazardous waste. The traffic safety, public health provided for project personnel including workers as well as health and safety education are essential.	NO - the Risk and Emergency Management Plan will ensure the minimization of risk
8.2	From events beyond the limits of normal environmental protection e.g. failures of pollution control systems?	YES	There is possible risk of failures into the laboratory equipment and on-line instruments for water quality analysis, flow, temp. measurements and emissions of pollutant substances into the water effluent.	NO - the Risk and Emergency Management Plan will ensure the minimization of risk
8.3	From any other causes?	NO		
8.4	Could the project be affected by natural disasters causing environmental damage (e.g. floods, earthquakes, landslip, etc)?	YES	There are always unpredictable situation for natural disasters that can affected the project causing the environmental changes. The flood will directly affect the water quantity and has been elaborated into the Feasibility Study. For sure the development should be done within the Floodplan.	NO-The Floodplan will ensure the minimization of risk

9. Will the Project result in social changes, for example, in demography, traditional lifestyles, employment?

No.	Questions to be considered in Scoping	Yes/No/?	Which Characteristics of the Project Environment could be affected and how?	Is the effect likely to be significant? Why?
9.1	Changes in population size, age, structure, social groups etc?	NO		
9.2	By resettlement of people or demolition of homes or communities or community facilities e.g. schools, hospitals, social facilities?	YES	The closest residential area to the proposed WWTP site is the village Trubarevo. The public complaints can be expected for the odours and noise during the construction and operation phases , so this can cause the movement of the people to other places.	Not significant impact. The settlement is far away from the WWTP
9.3	Through in-migration of new residents or creation of new communities?	NO		
9.4	By placing increased demands on local facilities or services e.g. housing, education, health?	YES	The new WWT Plant will impose new higher water and wastewater taxes for all Skopje City citizens	YES

No.	Questions to be considered in Scoping	Yes/No/?	Which Characteristics of the Project Environment could be affected and how?	Is the effect likely to be significant? Why?
9.5	By creating jobs during construction or operation or causing the loss of jobs with effects on unemployment and the economy?	YES	The construction and operation phases of the project will create new jobs and will directly effect the unemployment and the economy.	YES - Positive impact as the unemployment is very high (almost 36%)
9.6	Any other causes?			

10. Are there any other factors which should be considered such as consequential development which could lead to environmental effects or the potential for cumulative impacts with other existing or planned activities in the locality?

10.1	Will the project lead to pressure for consequential development which could have significant impact on the environment e.g. more housing, new roads, new supporting industries or utilities, etc?	NO		
10.2	Will the project lead to development of supporting facilities, ancillary development or development stimulated by the project which could have impact on the environment e.g.: • supporting infrastructure (roads, power supply, waste or waste water treatment, etc) • housing development • extractive industries • supply industries • Other?	YES	WWTP: Supporting Infrastructure- roads & power supply	Partly significant – energy consumption
10.3	Will the project lead to after-use of the site which could have an impact on the environment?	NO		
10.4	Will the project set a precedent for later developments?	YES	The project will be a precedent for other large scale WWT plants that are needed to be constructed in Macedonia according the EU Directives.	YES, There is necessity for additional large scale waste water treatment plants for bigger sities in Macedonia (Bitola, Kumanovo) that can use the lessons learned from construction and operation of the WWT Plant in Skopje City.
10.5	Will the project have cumulative effects due to proximity to other existing or planned projects with similar effects?	NO		

PART 2 OF THE SCOPING CHECKLIST: CHARACTERISTICS OF THE PROJECT ENVIRONMENT

For each project characteristic identified in Part 1 consider whether any of the following environmental components could be affected.

Question - Are there features of the local environment on or around the Project location which could be affected by the Project?		
Areas which are protected under international or national or local legislation for their ecological, landscape, cultural or other value, which could be affected by the project?	No	
Other areas which are important or sensitive for reasons of their ecology e.g.		
Wetlands,	Yes	Katlanovo marsh – positive impact – improved river Vardar WQ
Watercourses or other waterbodies,	Yes	Improved river Vardar WQ
the coastal zone,	No	
mountains,	No	
forests or woodlands	YES	ARBORETUM, Hunting Area near by the WWTP location
Areas used by protected, important or sensitive species of fauna or flora e.g. for breeding, nesting, foraging, resting, overwintering, migration, which could be affected by the project?	YES	ARBORETUM, Hunting Area near by the WWTP location
Inland, coastal, marine or underground waters?	No	
Areas or features of high landscape or scenic value?	No	
Routes or facilities used by the public for access to recreation or other facilities?	No	
Transport routes which are susceptible to congestion or which cause environmental problems?	No	
Areas or features of historic or cultural importance?	No	
Question - Is the Project in a location where it is likely to be highly visible to many people?		
No		
Question - Is the Project located in a previously undeveloped area where there will be loss of greenfield land?		
Yes – however, not of great environmental, socio-historical or economic significance		
Question - Are there existing land uses on or around the Project location which could be affected by the Project? For example:		
Homes, gardens, other private property,	No	
Industry,	No	
Commerce,	No	
Recreation,	Yes	Potential due to vicinity to river, presently undeveloped
public open space,	No	
community facilities,	No	
agriculture,	Yes	
forestry,	No	
tourism,	No	
mining or quarrying	No	
Question - Are there any plans for future land uses on or around the location which could be affected by the		
Project?		
No		
Question - Are there any areas on or around the location which are densely populated or built-up, which could be affected by the Project?		
No		
Question - Are there any areas on or around the location which are occupied by sensitive land uses which could be affected by the Project?		
hospitals,	No	

schools,	Yes	Not in the vicinity
places of worship,	No	
community facilities	No	
Question - Are there any areas on or around the location which contain important, high quality or scarce resources which could be affected by the Project? For example:		
groundwater resources,	No	
surface waters,	No	
forestry,	No	
agriculture,	No	Not significant: Agriculture exists but the resources (land) are neither scarce or high quality
fisheries,	No	
tourism,	No	
minerals.	No	
Question - Are there any areas on or around the location of the Project which are already subject to pollution or environmental damage e.g. where existing legal environmental standards are exceeded, which could be affected by the project?		
Yes. – Vardar river is currently classified as III or IV class (polluted). The project will positively affect WQ in the river.		
Question - Is the Project location susceptible to earthquakes, subsidence, landslides, erosion, flooding or extreme or adverse climatic conditions e.g. temperature inversions, fogs, severe winds, which could cause the project to present environmental problems?		
Earthquakes – in zone 9 Fogs – often in winter -not significant for the Project		
Question - Is the Project likely to affect the physical condition of any environmental media?		
The atmospheric environment including microclimate and local and larger scale climatic conditions?	No	
Water - eg quantities, flows or levels of rivers, lakes, groundwater. Estuaries, coastal waters or the sea?	No	
Soils - eg quantities, depths, humidity, stability or erdodibility of soils?	No	
Geological and ground conditions?	No	
Question - Are releases from the Project likely to have effects on the quality of any environmental media?		
Local air quality?	Yes	Odor
Global air quality including climate change and ozone depletion	Yes	Methane emissions
Water quality - rivers, lakes, groundwater. Estuaries, coastal waters or the sea?	Yes	Improvement of water quality-Vardar
Nutrient status and eutrophication of waters?	Yes	Tertiary treatment (nutrient removal of total N and Total P) not planned in this phase
Acidification of soils or waters?	No	
Soils	Yes	Improvement of GW quality in urban area covered by WW collection network
Noise?	Yes	Locally in the vicinity of the WWTP, and due to sludge transport
Temperature, light or electromagnetic radiation including electrical interference?	No	
Productivity of natural or agricultural systems?	No	
Question - Is the Project likely to affect the availability or scarcity of any resources either locally or globally?		
Fossil fuels?	Yes	Increased electricity consumption (produced from coal in Thermal Power Plant)
Water?	No	
Minerals and aggregates?	No	
Timber?	No	
Other non-renewable resources?		
Infrastructure capacity in the locality - water, sewerage, power generation and transmission, telecommunications, waste disposal roads, rail?	Yes	Power infrastructure to be constructed – however it is not expected to affect nearby settlements/installations
Question - Is the Project likely to affect human or community health or welfare?		

The quality or toxicity of air, water, foodstuffs and other products consumed by humans?	Yes	Improved water quality – Vardar river
Morbidity or mortality of individuals, communities or populations by exposure to pollution?	Yes	Potential positive effect – result of better sanitation
Occurrence or distribution of disease vectors including insects?	No	
Vulnerability of individuals, communities or populations to disease?	No	
Individuals' sense of personal security?	No	
Community cohesion and identity?	No	
Cultural identity and associations?	No	
Minority rights?	No	
Housing conditions?	Yes	Positive effect
Employment and quality of employment?	No/Yes	
Economic conditions?	Yes	Increased service prices might affect businesses with high water consumption
Social institutions?	No	

7.3.2 Leopold impact matrix

Table 7.6 LEOPOLD IMPACT MATRIX - Identification of the potential interactions between project actions/effects and environmental elements

PROJECT ACTIONS/EFFECTS	Physical / Natural Environment elements													Public Hazardous Elements										Social Environment Elements										
	Topography and geology	Groundwater	Bottom Sediment	Hydrological situation-quantities, flows or levels of rivers, lakes, etc.	Wildlife and Ecosystem	Meteorology	Landscape and visual environment	Existing or future land use	Sensitive areas	Soils-quantities, humidity, stability or erodibility of soils	Water and energy supply	Climate and Global Warming	Air quality	Water quality	Soil pollution	Waste (construction)	Waste (solid liquid)	Noise and Vibration	Electromagnetic	Ground subsidence	Offensive odors	Involuntary resettlement and Land acquisition	Livelihood and local economic conditions	Local decision-making institutions	Social infrastructure and services	Housing conditions	Socially vulnerable groups	Misdistribution of benefits and loss/damage	Cultural, historical heritage	Local conflicts of interest	Water use	Gender, children's rights	Infectious diseases such as HIV/AIDS,etc.	Employment and quality of employment	Demography	Economy development	SMEs	Farming/Community development
1 Permanent or temporary change in land use, landcover or topography including increases in intensity of land use					*			*	*				*	*				*															
2 Clearance of existing land, vegetation and buildings								*																										
3 Creation of new land uses					*			*	*																									
4 Pre-construction investigations e.g. boreholes, soil testing				*						*																								
5 Construction works		*	*	*			*	*	*	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*			*	*					*
6 Temporary sites used for construction works or housing of construction workers								*		*							*																	
7 Above ground buildings, structures or earthworks including linear structures, cut and fill or excavations		*	*				*	*		*			*				*	*	*														
8 Underground works including mining or tunneling								*		*																								
9 Facilities for storage of goods or materials	*						*	*																										
10 Facilities for treatment or disposal of solid wastes or liquid effluents		*	*		*			*					*		*	*	*				*	*											
11 Facilities for long term housing of operational workers								*			*					*	*																	
12 New road, rail or sea traffic during construction or operation		*			*		*			*	*		*		*	*	*				*	*											
13 Closure or diversion of existing transport routes or infrastructure leading to changes in traffic movements					*								*		*			*															
14 New or diverted transmission lines or pipelines			*																															
15 Impoundment, damming, culverting, realignment or other changes to the hydrology of watercourses or aquifers			*	*										*	*																			
16 Stream crossings			*	*										*	*																			
17 Abstraction or transfers of water from ground or surface waters		*																																
18 Transport of personnel or materials for construction, operation or decommissioning		*			*									*			*																	
19 Ongoing activity during decommissioning which could have an impact on the environment					*		*	*									*																	
20 Influx of people to an area in either temporarily or permanently										*																								
21 Usage of natural resources such as land, water, materials or energy				*	*	*	*	*		*	*	*	*			*	*					*					*			*				
22 Usage, storage, transport, handling or production of substances or materials which could be harmful to human health or the environment		*			*		*	*			*	*	*	*	*	*									*	*								
23 Production of solid wastes during construction or operation or decommissioning		*			*			*		*	*		*																					

	PROJECT ACTIONS/EFFECTS	Physical / Natural Environment elements													Public Hazardous Elements											Social Environment Elements												
		Topography and geology	Groundwater	Bottom Sediment	Hydrological situation-quantities, flows or levels of rivers, lakes, etc.	Wildlife and Ecosystem	Meteorology	Landscape and visual environment	Existing or future land use	Sensitive areas	Solis-quantities, humidity, stability or erodibility of soils	Water and energy supply	Climate and Global Warming	Air quality	Water quality	Soil pollution	Waste (construction)	Waste (solid liquid)	Noise and Vibration	Electromagnetic	Ground subsidence	Offensive odors	Involuntary resettlement and Land acquisition	Livelihood and local economic conditions	Local decision-making institutions	Social infrastructure and services	Housing conditions	Socially vulnerable groups	Misdistribution of benefits and loss/damage	Cultural, historical heritage	Local conflicts of interest	Water use	Gender, children's rights	Infectious diseases such as HIV/AIDS,etc.	Employment and quality of employment	Demography	Economy development	SMEs	Farming/Community development
24	Release pollutants or any hazardous, toxic or noxious substances to air			*									*	*		*						*		*	*	*						*				
25	Increase noise and vibration or release of light, heat energy or electromagnetic radiation									*									*	*				*	*	*										
26	Release of pollutants onto the ground or into sewers, surface waters, groundwater, coastal waters or the sea?		*			*	*						*		*	*							*	*	*	*										
27	Resettlement of people or demolition of homes or communities or community facilities e.g. schools, hospitals, social facilities																						*	*	*	*	*						*		*	*	*
28	Placing increased demands on local facilities or services e.g. housing, education, health																															*			*		
29	Creating jobs during construction or operation or causing the loss of jobs with effects on unemployment and the economy																																		*		*

7.4 Minutes of Stakeholder Meeting

7.4.1 First Stakeholder Meeting

MINUTES OF THE 1ST STAKEHOLDER MEETING

THE STUDY ON
WASTEWATER MANAGEMENT
IN SKOPJE CITY
IN THE REPUBLIC OF MACEDONIA

Skopje City, MTC (Ministry of Transport and Communication), MEPP (Ministry of Environment and Physical Planning) in collaboration with JICA Study Team organized a 1st Stakeholder Meeting on 9th November, 2007 at City Hall in Skopje.

Mrs. Cvetanka Ikonomova, Skopje City, opened the meeting at 10:00 AM and invited Dr. Kostadin Dimitrovski, City Council and Mr. Mile Jakimovski, MEPP.

Prof. Kostadin Dimitrovski, City Council, on behalf of the mayor welcomed JICA and JICA Study Team and other stakeholder. City of Skopje will benefit from this excellent study, which is related to urban and economic life in the city. The companies must take care about the environment, and to implement solutions for treatment of the waste waters. Now we have valuable assistance from Japanese government who is assisting Macedonia, and we expect this assistance to result in construction of WWTP and to protect waters in Macedonia. We will cooperate with the two relevant ministries, and will provide data and assistance to the JICA Study team, as well as logistical support. From this place we will inform about additional information about this Study, and during the activities you can place your requests or remarks that the experts did not consider.

Mr. Mile Jakimovski, Environmental Agency, MEPP welcomed JICA and JICA Study Team and was pleased to see many participant. MEPP was and will be involved in this Study, which is related to regulations, and Law on Waters is in adoption process. Skopje as a capital must solve the problem of pollution of river Vardar. This Study is about to make basic plan, feasibility study and action plan related to wastewater management. Anybody who expresses interest to cooperate with the MEPP as relevant ministry is welcome to the MEPP.

1. Presentation 1: Introduction of JICA Study

Mr. Momose, Project Manager of JICA Study Team, introduced the JICA Study on Wastewater Management in Skopje City in the Republic of Macedonia. He outlined the present situation in Skopje, study objectives, study component and schedule.

2. Presentation 2: Environmental and Social Considerations Procedure

Ms. Yamada, Environmental and Social Considerations of JICA Study Team, explained the objectives, procedures and schedule of environmental and social considerations. Environmental and social considerations are part of JICA Study and will be conducted based on Macedonian Laws and regulations and JICA's Guidelines.

3. Presentation 3: Draft Scoping of Initial Environmental Examination (IEE)

Ms. Yamada, Environmental and Social Considerations of JICA Study Team, explained the draft scoping of IEE. Based on the scoping, IEE study will be conducted.

4. Questions and Answers

(1) **Dr. Josif Taneski**- director of "Farmahem"

He asked if the JICA Study Team will consider the removal of the nutrients such as Nitrogen and Phosphorus, and biodiversity on the area where the WWTP will be located.

Mr. Momose answered that nutrients will be considered during the Study but the significant portion of Vardar River is organic matters. Biodiversity will be considered at this region to some extent.

(2) **ZORAN KARAMANOLEV**- Hydro-meteorological issues Administration

He greeted to Study Team and mentioned about the categorization of the water. He said that in some parts of Skopje, the third categorization is shown in the map, but Team should keep in mind that in future, the water categorization of the river after Skopje might change so that the calculation of WWTP should consider the parameters of outlet from WWTP as second class category. As another qualification, he mentioned that quality of Vardar River is deteriorated, but this situation was from 1980 to 1990, but from 1990, since the industry and economy went down and the water quality is improved in Vardar River. He also ask the Team to keep in mind in future, industrial wastewater should be separated from domestic wastewater, because sewer system is accepting part of industrial wastewater. He asked the Team will propose separate sewerage system in the Study.

Mr. Momose answered that if the water quality categorization is mistaken or changed, we surely will change it. He agreed that the water quality of Vardar River is not bad because of decrease of factories. But in near future, industries might come back and river water will be deteriorated again. So in the Basic Plan, the industrial wastewater should also take into consideration. Separate or combined sewerage system is one of the topics of the Study. He agreed that industrial wastewater from such as chemical industries should be separated from domestic wastewater. But some wastewater from like food industry can be incorporated in domestic sewer system as they have only organic particles, and treatment of these wastewaters will increase PE W&S revenue.

(3) **PROF. ZIVKO VELJANOVSKI**- Faculty of Civil Engineering

He said that Skopje City is divided in 10 municipalities and now, for Saraj and Gjorce Petrov are planned for independent WWTP. Although in the urban planning these municipalities should have independent WWTP, the question is if the Study will consider the option for these wastewater to be treated in one WWTP (in Trubarevo), that is the option the Professor is proposing.

Mr. Momose answered that this matter will be considered in the Study as alternative. From the view point of keeping the Vardar River clean, wastewater from Saraj and Gjorce Petrov should be treated in the downstream. On the other hand, if wastewater of upstream will be treated downstream in Trubarevo, additional collector will be required and it will cost. After comparison, the Team will decide the independent or combined system for Saraj and Gjorce Petrov. Part of Gjorce Petrov is already connected to sewerage system and Saraj already proposed some independent system. At the end of the Basic Plan, it will be concluded.

(4) FACULTY OF CIVIL ENGINEERING**- PELIVANOVSKI**

He said his opinion that the effluent must abide to EU Directive and standards. This EU Directive is also considering formulation of sensitive and non-sensitive areas, and Macedonia should define this. In less sensitive areas, according to EU Directive, is recommended to treat only organic matters (BOD

25mg/L, Suspended material 35 mg/L, COD 125 mg/L), and for sensitive areas is necessary for Phosphorus and Nitrogen to be treated as well.
My second statement is that we need to consider wider view of treatment of waters, since the benefit will be downstream Trubarevo, not in Skopje city. However, we should not neglect the fact that from the spring of Vardar (Vrutok) until Saraj there is population about 300,000 populations, or 400,000 PE, there is daily discharge of 25-30 t organic material (BOD), or with suspended material about 30t. In this sense the central Government should make Study for regional protection of Vardar River, and with prioritisation for construction of WWTP, or to others, in order to reduce river pollution.

Mr. Momose agreed his opinion and introduced one example regarding conflict between upstream and downstream region in Japan. Kyoto which is located in upstream cleaning their sewerage for the purpose of Osaka which is located in downstream, as Osaka use the river as water source.

(5) **MIHAIL KOCUBOVSKI-** Health Protection Institute- Skopje

He commented that citizens will have benefits from these projects, and they will feel the difference, eating healthy food, because that water, water from the River Vardar is going to be use for irrigation the land, land for agricultural use.

Mrs. Cvetanka Ikonomova, Skopje City, closed the meeting with thanks to the participants.

Participants List

No.	Institution	Name
1	MTC	Bozidar Stojcev
2	MEPP	Ilber mirta
3		Vlatko trpeski
4		Vesna Indova
5		Mile Jakimovski
6	MAFW	Bojan Durnev
7		Blagoja stoilov
8	City of Skopje	Cvetanka Ikonomova
9		Toni Kostov
10		Lovren Markic
11	Municipality Aerodrom	Vilma Spasevska
12		Jasmina Danilova
13		AleksaNDAR sPASOV
14	Municipality Centar	Vesna JankovSka
15	Municipality Kisela Voda	Angel Panov
16		Mirjana Jordanova
17	Municipality Gjorec Petrov	Dimitar Rumenov
18	Municipality Karpos	Gjorgjija Simonovski
19	Municipality Gazi Baba	Mitevski Saso
20		Kiev Blagoj
21	Municipality Saraj	Hidai Ameti
22	Municipality Cair	Recica Arben
23		Dzengis Hani
24	Faculty of Civil Engineering	prof. Zivko Veljanovski
25		Petko Pelivanovski
26	Faculty of Machine Engineering	Zoran Markov

No.	Institution	Name
27	Health Protection Institute- Skopje	Mihail Cobukovski
28		Vladimir Petrovski
29		Sasko Jovanov
30	P.E. Komunalna Higiena	Zlatko Dimovski
31		Milco Biljanovski
32		Branko Nikolovski
33	P.E. Vodovod	Slobodan Dimitrovski
34		Zlatko Ikonomov
35		Saso Atanasov
36		Sanja Spirovska
37	Hydro-meteorological issues Administration	Josif Milevski
38		Zoran Karamanolev
39	Water Management Office	Ivanco Kaevski
40	FARMAHEM	Josif Tanevski
41	Honorary Consul of Japan	Kosta Balabanov
42	Regional Centar for Environment	Vladimir Stavric
43	EEM	Ruska Miceva
44	ORT	Vesna Jankova
45	Aco Group	Lambro Karcicki
46	Daily magazine ”Spic”	Natasha Georgieva
47	Independent consultant	Slavjanka Pejcinovska-Andonova
48	GEING	Julijana Nikova
49		Dragan Dimitrievski
50	Toplifikacija	Nadica Lokvenec
51	Makstil	Elena ivankova Vidinova
52	Krafting Group	Natasha kormushoska
53		Pejcinovska Andonova
54	Macedonian Green Centar	Aleksandra karakasova
55	JICA Skopje Contact Office	Ladislav Lesnikovski
56	JICA Expert	Nahomi Nishio
	JICA Study Team	Mr. Momose
		Mr. izawa
		Mr. tomono
		Mr. saito
		Ms. yamada
		Ms. inoue

7.4.2 Second Stakeholder Meeting

MINUTES of
2nd STAKEHOLDER MEETING

1. Date and Time : 10:00 ~ 13:30, February 22nd, 2008

2. Place : City of Skopje conference room

The opening speech was by the moderator of the meeting, Mr. Toni Kostov from the City of Skopje. He explained the purpose of the Study, the aims and the agenda of the 2nd meeting and the contents of the presentation.

The next person to speak was the Director of the Office for Environmental in MEPP Mr. Mile Jakimovski. He explained the needs of this Study and its connection to the overall policy of the MEPP and the Government of the Republic of Macedonia. He stressed that it is a joined effort of the JICA Study Team, the City of Skopje and the MEPP.

After that Mr. Momose started the presentation with the explanation of the JICA Study and the Basic Plan. It included the explanation about the Study objectives, components and schedule, brief information about the existing sanitary sewer network, discharging points, a review of the existing plan and the proposal of four treatment districts as well as the plan for sewerage development in the central treatment district. He also gave an overview on the WWTP, such as the flow quantity and quality and its design and also the main collector route and the sludge disposal.
The presentation continued with the presentation about the Environmental and Social Considerations by Ms. Yamada. It included explanation about procedures, cost/benefits/impacts review presentation of what will happen if the project is not implemented and the overall project benefits. The next to present was Ms. Pejcinovska Andonova from Krafting Group. She presented the IEE, the steps, methodology, summary of evaluation and major impacts and mitigation measures, as well as monitoring plan. The presentation was closed by Mr. Momose, who presented the Priority Projects for Feasibility Study.

After the short coffee break there was Q/A session.

Q/A Session

Q1. Mr. Goran Atanasosvski, representative from Trubarevo Community Council

The project is very good, but as a citizen of Trubarevo I would like to know what will we do with the odour, knowing that the other negative effects will be treated. The aerial distance is short, I think large number of population will be affected so I want an answer regarding the techniques to mitigate the offensive odour.

Answer by Ms. Pejcinovska, she said that she is correct about the location and the distance from the area and that she already gave explanation about the impact, the distance is between 1 and 2 km, the offensive odor can be removed with bio-filters which absorb the odor, and as technical solutions are common in the world. The JICA Study Team will include it in the Study as technical measures. Other measures are construction of green belt around the area, the outlets should be well constructed to avoid leakage, and also control the emission of odor.

As an additional information Mr. Kosta Trajkovski, Head of Unit for Preparation of Projects in MEPP in the context of the answer to the previous question, the location of the WWTP has also been chosen taking into consideration the dominant winds - west-east and northwest - southeast will help the evacuation of the odor. Ms. Pejcinovska added that the location was identified during the Kruger study in 1999, we are only continuing what has already been investigated before. In order to assure that all these measures will be taken, the monitoring of the odor is taken into consideration since the designing and revising phases and all the other phases.

Q2. Mr. Rumenov from Gorce Petrov Municipality.

In the presentation of Mr. Momose he mentioned that there are three location for treatment plants,

Trubarevo, Gorce Petrov and Saraj. Please confirm whether this will be included in the feasibility study. The second question is to Ms. Andonova the IEE is for Trubarevo, why not the other areas. The third is actually a suggestion, through the feasibility study it should be emphasized that this is an urgent matter to speed up the construction of these WWTP, to give priority for protection of the water-well area, since we have made research and came up with fact that there are 4000 septic pits, I would appeal to install ground water monitoring stations, from the MEPP.

Answer by. Mr. Momose, we know the importance of Gorce Petrov WWTP, we know about the referendum and the contribution from the citizens and you have already started the construction of the collectors and it will be completed this year. The remaining part is the WWTP, we also know that, we have compared the alternatives which are construction of WWTP in your municipality or connect to the central sewerage system, and as a result we concluded that separate independent system is better. However for the feasibility study which is financed by Japanese Government its purpose is seeking possibilities of financing and for Trubarevo large amount is needed, compared to Gorce Petrov. The situation is the same regarding Saraj municipality, also Rasce spring and Treska River and that is being assisted by the EU. We know the importance of Gorce Petrov and Saraj and that is why we excluded them. We assume that that they will be helped by EU.

Answer from Ms. Pejcinovska regarding the scope, she said that the scope of their task was to analyze whole Skopje, construction of collector system and WWTP and their impact to the environment. I agree with you about the monitoring of ground waters, we have it in our monitoring plan, we took the parameters given in the Draft Law on Waters and bylaws according to the EU Directives, the parameters are level, chemical status, conductivity, PH, content of oxygen, nitrates, etc and also we have mentioned the frequency of monitoring and by whom it should be done. Bylaws are needed to monitor these monitoring parameters for ground water.

Mr. Rumenov again stressed that this feasibility study will be document that will serve to the Government of republic of Macedonia. The question of financing of Trubarevo WWTP is one thing. This study should include whole area of the city in order to solve all the problems. IPARD fund are not applicable if the investment is smaller than 10 million Euros. I think that in this study also the other two WWTP should be included – the Saraj and Gorce Petrov. I emphasize because of the water supply problem that will occur in Skopje. It is important to separate the financing from the Study.

Answer from Mr. Momose: It is very hard question, we understand your opinion, but in the agreed Scope of Work between Japanese and Macedonian Governments, in the first phase we have conducted basic plan, and the final phase is the selection of the priority project. Only for the selected project we can continue with the feasibility study and also for we have evaluated the relative importance, we have evaluated these items, (the 4 districts). Anyhow consideration the relative priorities we have decided that Trubarevo has the priority.

Answer from Ms. Pejcinovska: Related to the IPARD funds, there are many candidate projects and budget is small, if Gorce Petrov and Saraj are IPARD project who knows when they will be implemented. I don't know when but if this project can make feasibility study also for Gorce Petrov and Saraj, at least take into consideration to include one option to dispose these waters in Trubarevo. The financial framework maybe will not be significantly affected, but the effect will be much bigger and this question might be resolved in a shorter period.

Mr. Momose answered that such option was considered and there will not be any need of WWTP in Gorce Petrov. It requires extension pipes over Lepenec River and UN bridge. When we compared the cost we concluded that separate WWTP is better. Saraj is different case since they have already conducted Feasibility Study, and due to the nature of the area and its rural settlements, around 22 settlements are scattered through Saraj municipality, the feasibility study selected 17 WWTP small ones as best option. If we collect the waste water from Saraj to Trubarevo we must ask them to change the economical justification. That is why we proposed separate WWTP.

Q3. Question by the Zelezara municipality representative, formed for protection of the environment to save the forest Gazi Baba forest.
I would like to thank this Team about this project, we have the same goal to give our citizens better environment. Sensitive question related to these projects, dynamics of the projects. (Since there was no specific question Mr. Toni Kostov asked a specific question to be asked) The question was who will be responsible for the measures of the negative impacts.

Answer from Ms. Pejcinovska: As a team we are proposing the responsible institution. The investor is also responsible, the sub-contractors will also be responsible. Depending on the measures that we have proposed, different institution is responsible.

Q4. Civil engineering faculty, Mr. Petko Krivanovski.
The importance of this Study is big, but even more important is the follow up, I hope that it will not end after this like some other studies. At the beginning I would like to ask the organizer to distribute more materials and handouts in order to improve the discussion. My questions are related to several aspects. The first is only my opinion. The establishment of this study is based on several elements; the existing situation of the sewerage network and several previously established studies and projects. It is my opinion that this study should emphasize the positive and negative aspects of the treatment of the waste water in city of Skopje. It shouldn't rely much on previously done studies and projects which have been done for Saraj, Novo Selo or Dracevo and so on, since it is a fact that the errors made on paper are smaller than the errors that might appear in the realization of the Study. So this study should give options for treatment and then the relevant institutions and ministries should decide which option is the best for protection of Vardar River. It is no clear for me why is Dracevo excluded from the central WWTP since it is close to Trubarevo. Second question is about the sewerage network. As it was mentioned there are 50 outlets in Vardar River in Skopje area. My question is how many of these outlets are storm water outlets and how many are sanitary waste water, and also about the ratio between the storm water and sanitary waste water in the existing network.

Answer by Mr. Momose. We have considered this option, but Dracevo is downstream so that two pumping stations are required and that means extra energy and if it is independent we can use natural gravity, so that we proposed separate WWTP. The second question regarding the outlets, we found that out of 50 there are only few working and the largest one is from the steel factory, the second one is next to the Serbian boulevard bridge for the right bank of Vardar and for the left bank are from food related industries. Vodovod is planning to stop the discharge and collect the waste water and according to our proposal about the main collectors to divert it downstream towards Trubarevo. More than 90% of the waste water will be diverted towards the WWTP. All the rest is storm water. You asked about storm water drainage. We have noticed that the coverage of the network, the storm water coverage is 50% which is small, both Vodovod and also we recognize the necessity of the storm water drainage but due to financial reasons it is of second priority.

Q5. Civil Engineering Faculty, Mr. Petko Krivanovski.

The level of storm water should be in acceptable limits in order for the WWTP to function properly. My question is regarding the conventional method for sludge treatment. I have to say that I accept this method. The difference between this method and the more advanced method is in the biological treatment. It is a fact that these methods have been used in the 70's of the last century that shows us where are we and how late we are in the treatment of waste water. The WWTP constructed at that time are nowadays upgraded in order to treat the N and P. It is my opinion that this study should show other methods with rough financial estimation and leave it to the politicians to decide which methods will be implemented. Related to the sludge treatment line, I would object to the sludge drying bed which is proposed since the total area is 35 hectare and according to the population equivalent of Skopje for drying bed we would need from 12-15 ha and if other methods for sludge treatment the area will be smaller and better environmental conditions, maybe these processes might be financially more demanding, but this study should give us more options available out of which we should choose the best available solution. At this moment one of the students is working on his

graduation work about WWTP, the difference between this study is the last method for sludge treatment, the student is proposing the belt filter press.

Answer from Mr. Momose. For the first one, we have already compared it in our Study. Regarding the conventional method, we have also considered the N and P Vardar river is not sensitive area like Ohrid and Prespa. Regarding the sludge we have proposed the sludge drying bed and I agree that the area for the sludge drying bed is large, if we implement the filter press the area will be smaller, and the odor problems might be reduced, but the cost estimation and the area for construction is large and the dominant winds, the location is good and that is why we proposed the sludge drying bed.

Q6. Mr. Risto Andov, coming from the same Zelezara municipality organization.

We have heard that the category of Vardar River according some of the presentations is of III category. However, I have one neighbor which is fisherman, he says that even his cat does not eat the fish that he catches in Vardar anymore. It is an organoleptic indicator that the water is pollute. I want to ask the following question. How much will the water improve after the construction of the WWTP. From previous knowledge and study I have heard that the water in Vardar river has the natural ability to clean itself. I want to ask whether these capabilities have been planned in this study.

Answer by Ms. Pejcinovska. Regarding the discharge of waste water from steel factory, Makstil have already submitted request for IPPC. One part of the IPPC is regarding the waste water treatment, giving criteria for treatment and quality of the waste water that Makstil discharges. Makstil have stipulated in the request for IPPC the threshold values for the waste water that they intend to discharge in the recipient. It will be inspected by MEPP. Regarding the second question the technological process will enable that the treated water will satisfy the standards of the country and the EU Directives.

Q7. Mr. Goran Simovski from the Faculty of Forestry.
I would like to express my support for this project and would like to say that I hope that I will have the opportunity to experience what the older generations have experience long time ago and that is bath and swim in the Vardar River, something which was possible 40-50 years ago. I know that some of the team members have already met professor Acevski from our faculty, but unfortunately due to his health condition he was not able to come here today. I apologize if some of these questions have already been answered. First I want to ask whether the treatment plant will be on the location of the arboretum and the hunting area, if it is yes I have to say that a very important part of the education and science process for the students. The second question is about the ground water distribution. It is important because of the vegetation in the area, something similar has happened after the earthquake in 1963 and also it happened during the construction of the city park. It stopped the flow of the ground water. If the WWTP will do that the environmental conditions will deteriorate and will affect the vegetation. The third one is related to the type of plants of the in the green belt and its effect on the arboretum.

Answer by Ms. Pejcinovska. WWTP will not be on the arboretum but a small part of the hunting area, which is not commercial area but educational and science hunting area. Regarding the flow of ground water it will not be changed since it has already been regulated with the construction of the river bed. In addition to this, we have evaluated this as B- in our EIA since it deserves serious treatment. The people that will develop this study will have it in mind.

Answer by Mr. Momose: In Japan we are utilizing treated water for the irrigation purposes, with construction of channels of pipes.

Since there were no other questions Mr. Toni Kostov closed the 2nd Stakeholder Meeting.

ATTENDANCE RECORD OF THE SECOND STAKEHOLDER MEETING

No.	Name	Organization
1	Sasa Atanasov	PE Vodovod i Kanalizacija
2	Rumenov Dimitar	Gorce Petrov Municiplity
3	Risto Andov	Citizens Association Zelezara
4	Svetlana Andonova	Independent Environmental Consultant
5	Teodora Andreeva	European Commission
6	Saso Mladenovski	City of Skopje
7	Time Andonov	City of Skopje
8	Joze Jovanovski	MEPP
9	Igor Atanasovski	Trubarevo Community
10	Zlatan Ikonomov	PE Vodovod i kanalizacija
11	Ana Stojanova	Silmak
12	Irena Zlatanova Damcevska	GAMA – Skopje
13	Eleonora B. Markovska	Aerodrom Municipality
14	Jasmina Danilova	Aerodrom Municipality
15	Vladimir Stavric	Krafting Group
16	Emilija Spirovska	Water Economy Institute
17	Liljana Peeva	Consultant
18	Kosta Trajkovski	MEPP
19	Mirjana Jordanova	Kisela Voda Municipality
20	Bojan Simovski	Faculty of Forestry
21	Aleksandra D. Avramovska	Gazi Baba Municipality
22	Pece Simjanovski	City Health Protection Institute
23	Vladimir Petrovski	Republic Health Protection Institute
24	Sandra Andovska	GEING KREBS UND KIEFER
25	Elena Jankova	EMA DEKONS
26	Maja Mihajlovska	Spic daily newspaper
27	Biljana Dzartova Petrovska	Embassy of Sweden
28	Lidija Klimovska	City of Skopje
29	Blasko Mitkovski	EKO Misija
30	Snezana Mitkovska	City of Skopje
31	Petko Pelivanovski	Civil Engineering Faculty
32	Slobodan Dimitrievski	PE Vodovod i Kanalizacija
33	Mihail Kocubovski	Republic Health Protection Institute
34	Sanja Spirovska	PE Vodovod i Kanalizacija
35	Mile Jakimovski	MEPP
36	Vesna Jankova	Centar Municipality
37	Ljubomir Veljkovic	Centar Municipality
38	Kristina Buzaroska	DREN-Student Association of Faculty of Forestry
39	Vesna Indova	MEPP
40	Verce Mitevska	MTM TV
41	Dimitar Mihajlovski	EAR
42	Vladimir Janevski	Faculty of Technology and Metalurgy
43	Aleksandar Cefnov	Kisela Voda Municipality
44	Marija Smiljanovska	DREN-Student Association of Faculty of Forestry
45	Sanja Naumovska	Utrinski Vesnik newspaper
46	Saso Mitevski	Gazi Baba Municipality
47	Dzeljalj Jakupi	Saraj Municipality
48	Roza Petkova	Vreme Daily Newspaper
49	Donka Gruevska	Citizens Association Zelezara
50	Hristijan Bilinski	Vreme Daily Newspaper

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51	Vladimir Petrovski	Sector for Planing of Skopje City
52	Ljuljzim Imeri	Ministry of Finance
53	Stance Cvetanovska	EKO Misija
54	Zoran Markov	Mechanical Engineering Faculty
55	Darko Babunski	Mechanical Engineering Faculty
56	Vesna Ognenovska	City of Skopje
57	Vlatko Trpeski	MEPP
58	Kazufumi Mommose	JICA Study Team
59	Tetsuo Izawa	JICA Study Team
60	Norio Tanaka	JICA Study Team
61	Keniichi Saito	JICA Study Team
62	Shoko Yamada	JICA Study Team
63	Mihajlo Burzevski	JICA Study Team
64	Kiril Cupev	JICA Study Team
65	Saso Dimitrov	JICA Study Team