CHAPTER 11

SEWERAGE SYSTEM MASTER PLAN

(UP TO 2022)

CHAPTER 11 SEWERAGE SYSTEM MASTER PLAN (UP TO 2022)

11.1 General

This Chapter describes and evaluates the proposed sewerage M/P up to 2022.

11.2 Proposed Sewerage System Components

The following sewerage facilities will be constructed in three consecutive stages:

1) Main and branch sewers;
2) Intercepting weirs at connection points to trunk sewers;
3) Connection points to trunk sewers (vertical shafts of trunk sewers);
4) Trunk sewers;
5) Pumping stations;
6) Sewage treatment facilities; and
7) Sludge treatment facilities.

Tables 11.2.1 through *11.2.5* outline general specifications of the major facilities. *Figure 11.2.1* shows a general plan for the proposed sewerage facilities. *Figure 11.2.2* shows the flow schematic of the STPs. *Figures 11.2.3* and *Figure 11.2.4* present proposed layout plans for the STPs.

Table 11.2.1 General Specifications of Sewers

Item		Dimensions	Construction Method	Pipe Material
1.	Sewers to Kashar STP			
1.1	Branch Sewer	Diameter: 200 mm, Length: 60 km	Open-cut	Plastic
1.2	Main Sewer	Diameter: 200 to 600 mm, Length: 49 km	Open-cut	Plastic
1.3	Trunk Sewer	Diameter: 450 to 1650 mm, Length 14.8 km	Jacking and Open-cut	Plastic or Concrete
2.	Sewers to Berxulle STP			
2.1	Branch Sewer	Diameter: 200 mm, Length: 22 km	Open-cut	Plastic
2.2	Main Sewer	Diameter: 200 to 800 mm, Length: 52 km	Open-cut	Plastic
2.3	Trunk Sewer	Diameter: 450 to 1350 mm, Length 5.9km	Jacking and Open-cut	Plastic or Concrete
3.	Total			
3.1	Branch Sewer	Diameter: 200 mm, Length: 82 km	Open-cut	Plastic
3.2	Main Sewer	Diameter: 200 to 800 mm, Length: 101 km	Open-cut	Plastic
3.3	Trunk Sewer	Diameter: 450 to 1650 mm, Length 20.7 km	Jacking and Open-cut	Plastic or Concrete

Source: JICA Study Team

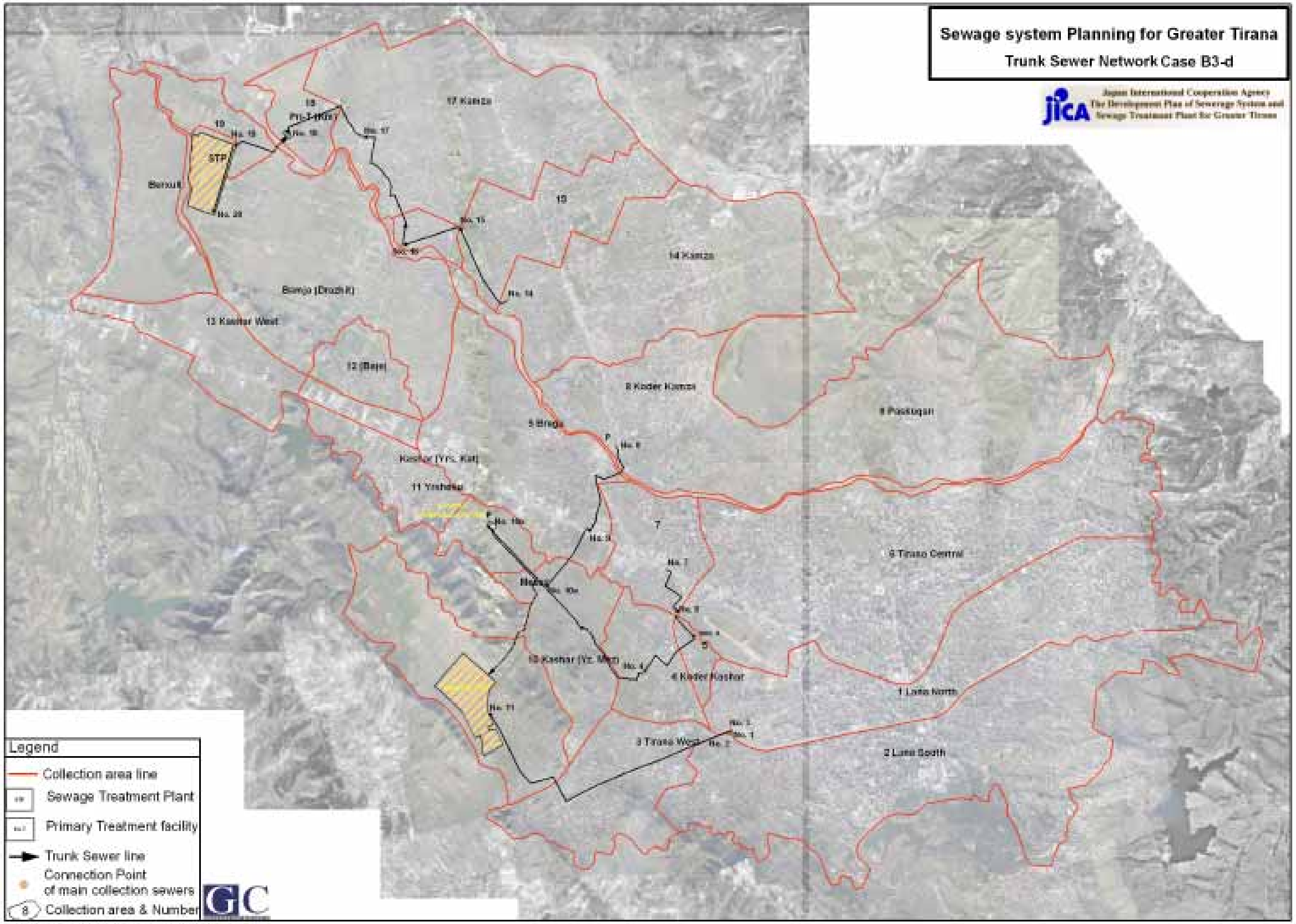


Figure 11.2.1 General Plan of Sewerage System

Table 11.2.2 Kashar Pumping Station Facilities

Facility	Facility Type	Quality	Size, Capacity, Specs	Remarks
1. Preliminary Facility				
	1.1 Screening chamber	4 units		
	1) Coarse screen	4 units	(W) 1.2m	Manual raking
	2) Fine screen	4 units	Rectangular tank, (W) 1.2m	Mechanical raking
	1.2 Grit chamber	4 units	Rectangular tank, (L)12.0m ×(W) 2.5m, with mechanical grit collector.	Hydraulic loading: 1,800 m^3/m^2/day
	1.3 Influent pumps			
	1) Vertical shaft type flow pumps	2 units	(Dia.) 500mm, 25.0 m^3/min	
	2) Vertical shaft type flow pumps	3 units, inc. 1standby	(Dia.) 700mm, 50.0 m^3/min	

Source: JICA Study Team
Note: (W) width; (L) length, (H) height, and (Dia.) diameter.

Table 11.2.3 Kamza Pumping Station Facilities

Facility	Facility Type	Quality	Size, Capacity, Specs	Remarks
1. Preliminary Facility				
	1.1 Screening chamber	2 units		
	1) Coarse screen	2 units	(W) 1.2m	Manual raking
	2) Fine screen	2 units	Rectangular tank, (W) 1.2m	Mechanical raking
	1.2 Grit chamber	2 units	Rectangular tank, (L) 12.0m ×(W) 1.2m, with mechanical grit collector.	Hydraulic loading: 1,800 m^3/m^2/day
	1.3 Influent pumps			
	1) Vertical shaft type flow pumps	2 units	(Dia.) 300mm, 9.0 m^3/min	
	2) Vertical shaft type flow pumps	2 units, inc. 1standby	(Dia.) 400mm, 18.0 m^3/min	

Source: JICA Study Team
Note: (W) width; (L) length, (H) height, and (Dia.) diameter.

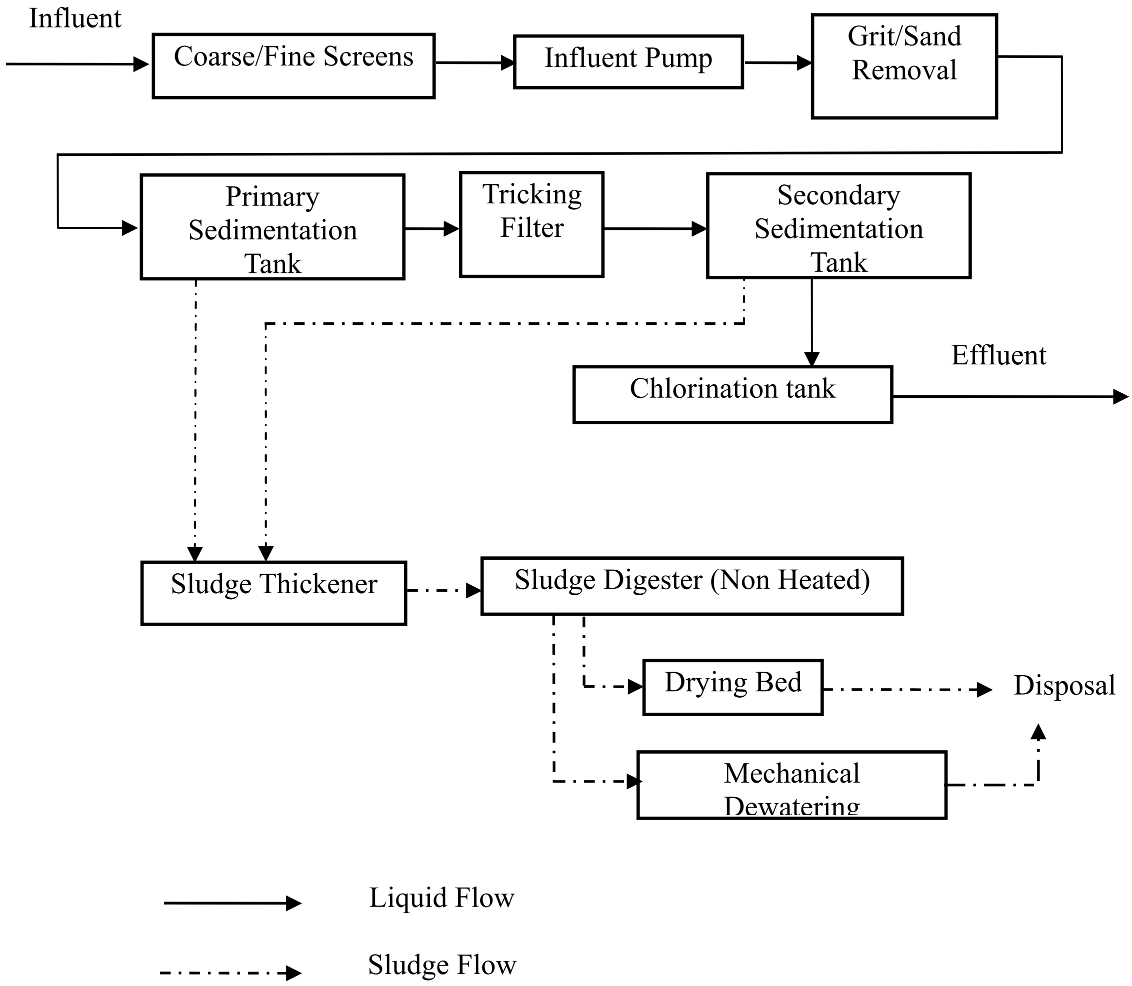


Figure 11.2.2 Flow Schematic of Sewerage Treatment Plant

Table 11.2.4 Kashar STP Facilities

Facility	Facility Type	Quality	Size, Capacity, Specs	Remarks
1. Preliminary Facility				
	1.1 Screening chamber			
	1) Coarse screen	4 units	(W) 1.2m	Manual raking
	2) Fine screen	4 units	(W) 1.2m, with mechanical cleaning equipment.	
	1.2 Grit chamber	4 units	Rectangular tank, (L) 20.5m×(W) 2.5m, with mechanical grit collector.	Hydraulic loading: 1,800 m^3/m^2/day
	1.3 Influent pumps			
	1) Vertical shaft type flow pumps	2 units	300mm dia.,33.0 m^3/min	
	2) Vertical shaft type flow pumps	4 units, inc. 1standby	700mm dia., 63.0 m^3/min	
2.Primary sedimentation tank	Rectangular type	32 units	(L) 40.5m×(W) 4.0m×(H) 3.0m, with a chain-and-flight type sludge collector	Overflow rate: 50 m^3/m^2/day
3.Trickling Filter	Circular type	64 units	(Dia.) 41.5m×(H) 1.5m	BOD_5 Loading: 0.3kgBOD/m^3/day Hydraulic loading: 3.0m^3/m^2/day
4. Secondary sedimentation tank	Circular radial flow type	24units	(Dia.) 26.2m×(H) 3.5m,with mechanical sludge collector	Overflow rate: 20 m^3/m^2/day
5. Chlorination contact tank	Rectangular type	1unit	(L) 224.0m×(W) 4.0m×(H) 3.0m	Contact time: 15minutes
6. Sludge thickener	Circular radial flow type	4 units	(Dia.) 15.0m×(H) 4.0m,with mechanical sludge collector	Solids loading: 60kg/m^2/day
7. Sludge digester	Circular type	16units	(Dia.) 19.6m×(H) 9.8m,without heating system	Retention time: 40 days
8.Sludge drying bed		15units, inc. 3stadby	1unit; (W) 6.0m×(L) 20.0m×(H) 0.2m × 20beds	Drying day:25days
9. Mechanical dewatering	Belt filter press	11units	Filter width: 3m	Filtration rate: 120kg/m/hour Ordinary Operaton: 6 days a week, 6 hours a day (Maximum 12 hours), 312 days/year

Source: JICA Study Team
Note: (W) width; (L) length, (H) height, and (Dia.) diameter.

Table 11.2.5 Berxulle STP Facilities

Facility	Facility Type	Quality	Size, Capacity, Specs	Remarks
1. Preliminary Facility				
	1.1 Screening chamber			
	1) Coarse screen	2 units	(W) 1.2m	Manual raking
	2) Fine screen	2 units	(W) 1.2m with mechanical cleaning equipment	
	1.2 Grit chamber	2 units	Rectangular tank, (L) 17.5m×(W) 1.2m, with mechanical grit collector.	Hydraulic loading: 1,800 $m^3/m^2/day$
	1.3 Influent pumps			
	1) Vertical shaft type flow pumps	2 units	(Dia.) 300mm, 13.0 m^3/min	
	2) Vertical shaft type flow pumps	3 units, inc. 1standby	(Dia.) 500mm, 26.0 m^3/min	
2.Primary sedimentation tank	Circular radial flow type	4 units	(Dia.) 18.5m×(H) 3.0m, with mechanical sludge collector	Overflow rate: 50 $m^3/m^2/day$
3.Tricking filter	Circular type	16 units	(Dia.) 37.5m×(H) 1.5m	BOD_5 Loading: 0.3kgBOD/m^3/day Hydraulic loading: 3.0$m^3/m^2/day$
4.Secondary sedimentation tank	Circular radial flow type	8 units	(Dia.) 20.5m×(H) 3.5m, with mechanical sludge collector	Hydraulic loading rate: 20 $m^3/m^2/day$
5. Chlorination tank	Rectangular type	1unit	(L) 46.0m×(W) 4.0m×(H) 3.0m	Contact time: 15miniute
6. Sludge thickener	Circular radial flow type	4 units	(Dia.) 10.0m×(H) 4.0m, with mechanical sludge collector	Solids loading: 60kg/m^2/day
7. Sludge digester	Circular type	4 units	(Dia.) 18.2m×(H) 9.2m, without heating system	Retention time: 40days
8.Sludge drying bed		12units, inc. 2stadby	1unt; (W) 6.0m×(L) 20.0m×(H) 0.2m×20beds	Drying day: 25days
9. Mechanical dewatering(Emergency)	Belt filter press	2 units	Filter width: 3.0m	Filtration rate: 120kg/m/hour Maximu Operaton: 6 days a week, 12 hours a day, maximum 55 days/year

Source: JICA Study Team
Note: (W) width; (L) length, (H) height, and (Dia.) diameter.

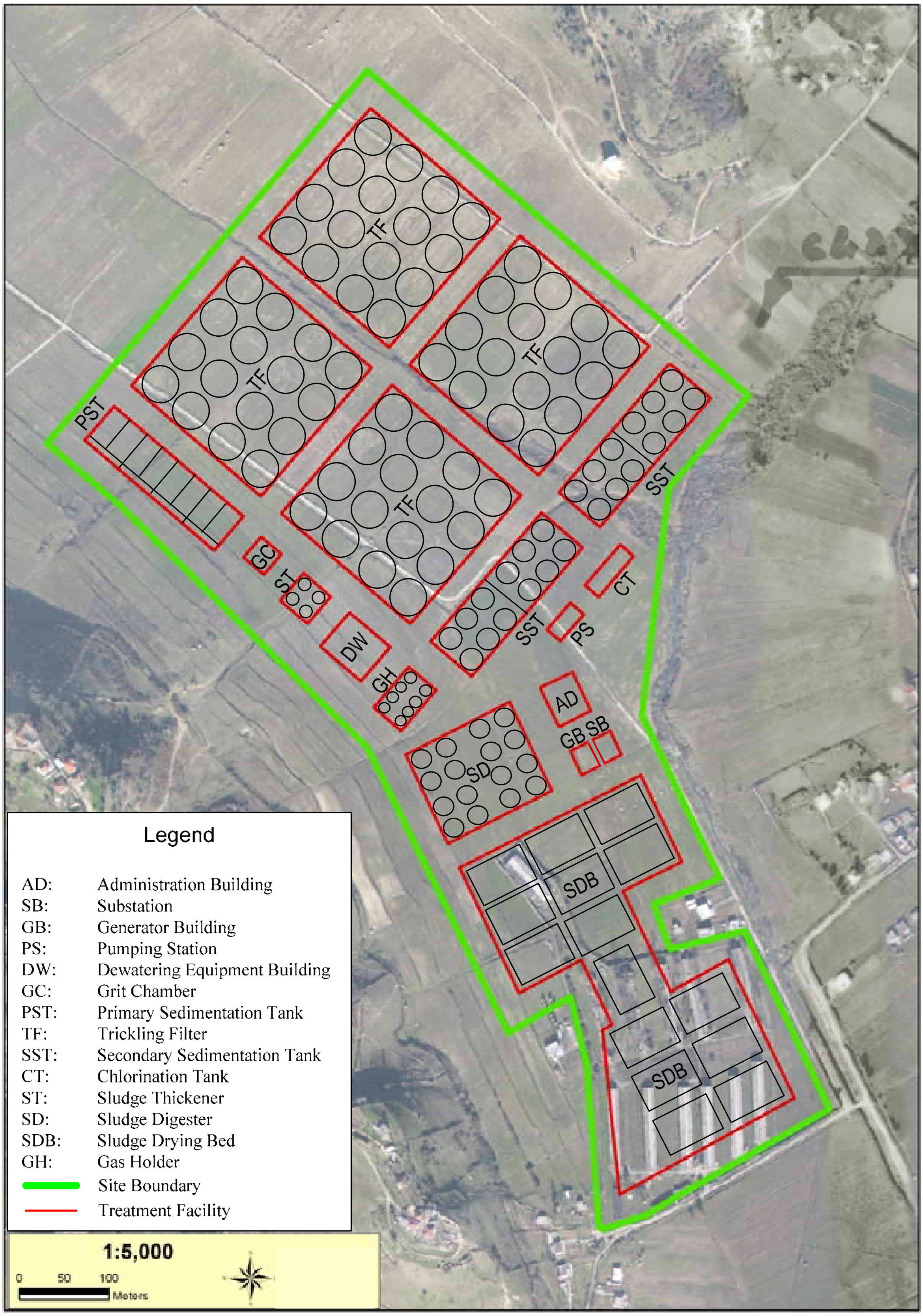


Figure 11.2.3 Layout Plan for Kashar STP

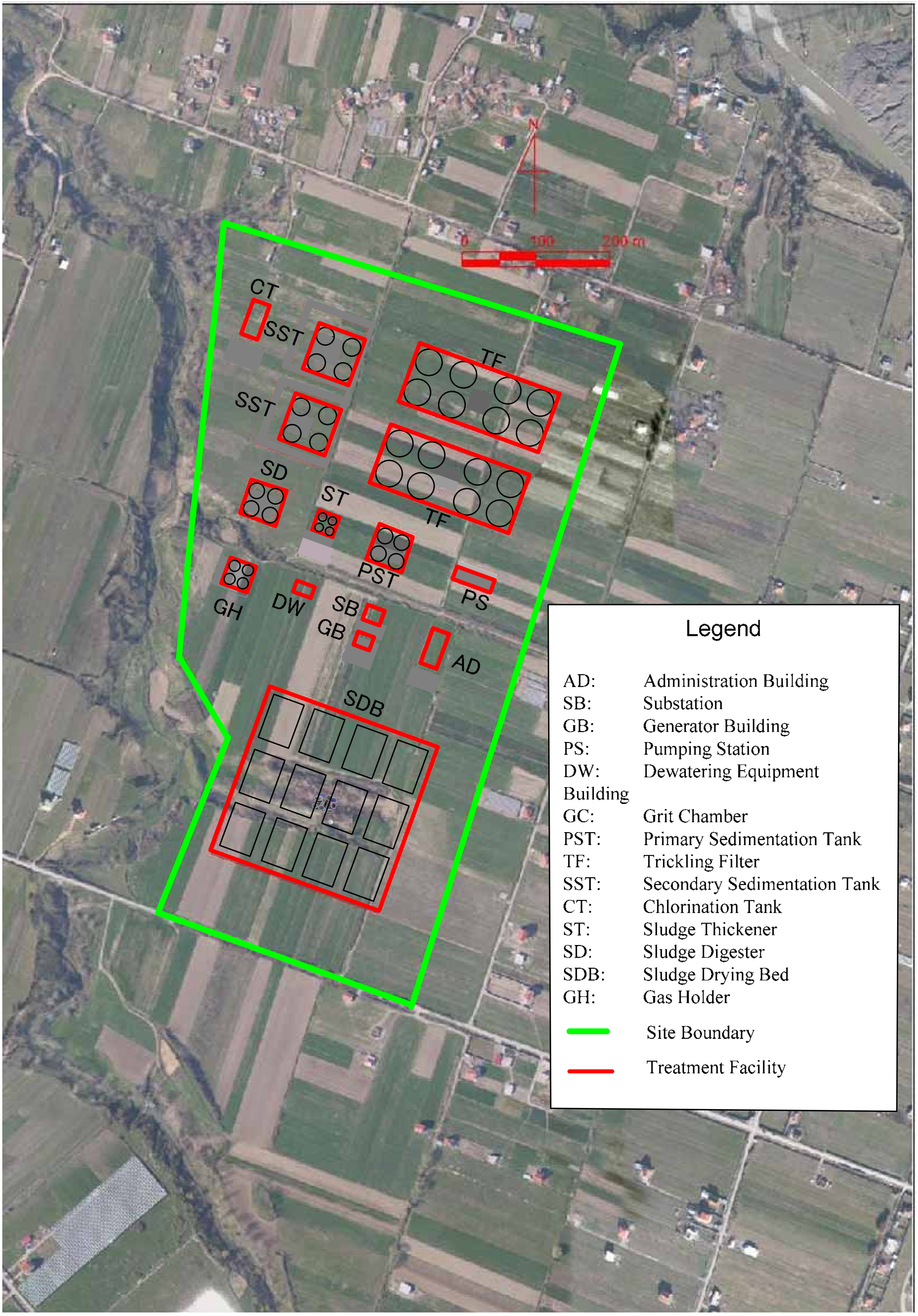


Figure 11.2.4 Layout Plan for Berxulle STP Staged Implementation Programs

11.3 Staged Implementation Programs

(1) General Implementation Schedule

Staging the construction of the proposed sewerage facilities will mean that the capital expenditure can be spread over a number of years. A 13-year sewerage implementation program has been proposed and is shown in Figure 11.3.1. The implementation program consists of three consecutive construction stages beginning (at best) in 2009 and ending in 2021.

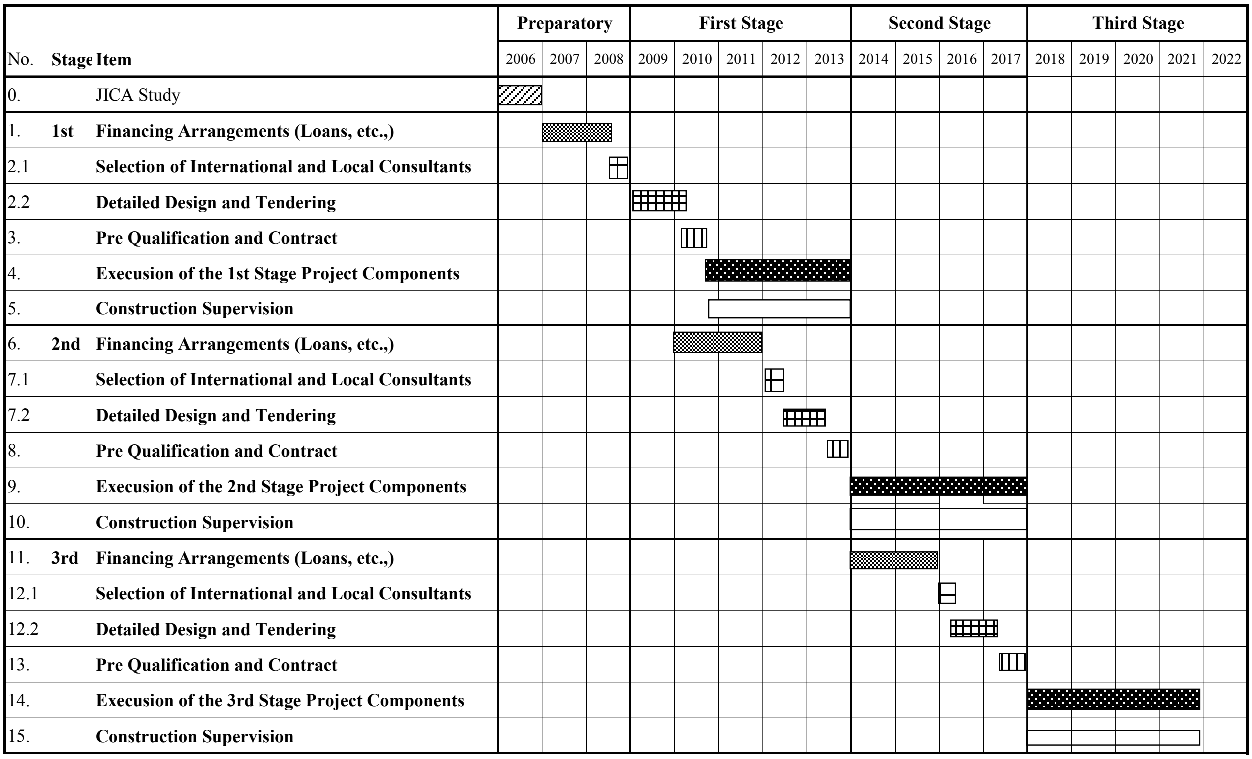


Figure 11.3.1 General Implementation Schedule

(2) Staged Development of Sewerage Facilities

The construction stages for the sewerage facilities are summarized in *Table 11.3.1*:

Table 11.3.1 Staged Development Plan for Sewerage Facilities

Item	Construction Stage		
	First stage (Target 2013)	Second stage (Target 2022)	Third stage (Target 2022)
1. Service Area	2,343 ha	6,090 ha	3,030 ha
2. Service Population	342,500 person	830,320 person	169,680 person
3. Sewage Flow 3.1 Design Average Daily Flow 3.2 Design Maximum Daily Flow	 77,100 m^3/day 95,900 m^3/day	 207,600 m^3/day 257,400 m^3/day	 42,400 m^3/day 52,600 m^3/day
4. Construction of Main and Branch Sewer, Diameter, Length	200 to 600 mm, 29.4 km	200 to 600 mm,79.6 km	200 to 800 mm,74 km
5. Improvement Measures for the Existing Sewer	Installation of manhole with weirs and other measures related the Lana interceptors	Installation of manhole with weirs and other measures related to the Tirana Interceptors	—
6.Construction of Trunk Sewer Diameter, Length	900 to 1,500 mm, 4.4 km	450 to 1650mm, 10.4km	450 to1,350mm, 5.9km
7. Pumping Station Capacity (Maximum Hourly Flow)	No PS required.	Kashar Pumping Station, 213,500 m^3/day	Kamza Pumping Station, 50,700 m^3/day
8. Sewage Treatment Plant	Kashar STP	Kashar STP	Berxulle STP
8.1 Capacity (Maximum Daily Flow)	95,900 m^3/day	257,400 m^3/day (Extension: 161,500 m^3/day)	52,600 m^3/day
8.2 Sewage Treatment Facilities	Secondary sewage treatment facilities, Trickling Filter Process	Extension of the Secondary treatment facilities.	Secondary treatment facilities, Trickling Filter Process
8.3 Sludge Treatment Facilities	Sludge treatment facilities, Anaerobic Digestion, Sludge Drying Beds and Belt Filter Press.	Extension of the sludge treatment facilities	Sludge treatment facilities Anaerobic Digestion, Sludge Drying Beds and Belt Filter Press.

11.4 Expected River Water Quality Improvements

11.4.1 Fundamentals for Predicting Water Quality Improvements

The main purpose for predicting water quality is to verify and justify the proposed project. The following water quality impacts have been predicted:

- Estimation of pollution load entering the rivers for scenarios with and without the project; and
- River water quality changes based on pollution load and flow rate at each reference point.

Water quality impacts have been estimated for the "with project" (Case B-3d). Since the projects are proposed to be implemented in a staged manner, the water quality impacts have been predicted for the final target year as well as for each stage (2014, 2018 and 2022).

BOD was used as the key parameter when predicting water quality. The existing (yr 2005) BOD was estimated as well as the BOD expected at the end of each phase (2014, 2018 and 2022). The predictions assumed a low flow rate, taken from "The Study on the Sewerage System in Metropolitan Tirana in the Republic of Albania, Final Report" (Former JICA Study Report 1998).

Reference points for the predicted water quality impacts are summarized in *Table 11.4.1* and *Figure 11.4.1*. The table lists the four reference points that were selected for pollution load estimation and water quality predictions.

Table 11.4.1 Reference Points for Water Quality Projection

River	Location	Description
Lana River	F1	Crossroad of "Rruga Konferenca e Pezes" and "Bulevardi Bajram Curri"
	R5	Before the confluence of Lana & Tirana Rivers, on the Lana River side.
Tirana River	R4	Before the confluence of Lana & Tirana Rivers on the Tirana River side.
	R6	After the discharge point from the proposed STP in Berxulle

11.4.2 Value Setting for Water Quality Projection

(1) Present and Future Population

The population size was estimated for each milestone: year 2005 (present condition), 2014 (first stage of the project), 2018 (second stage of the project) and 2022 (third stage of the project and the final target year).

(2) Setting for Low Flow

The predicted water quality impacts have been determined assuming there is low flow in the river. The flow rate was determined by reviewing the last 10 years of flow record. The Albanian Institute of Hydrometeorology (IHM) has measured flow rates in Lana and Tirana Rivers, as mentioned in *Chapter 4*. However, the study team was not able to obtain the flow data for this study. Therefore, flow rate data presented in the former JICA study report was used.

The low flow was estimated as follows:

1) Estimation for Block Area

The study area was divided into four blocks (Block F1, Block R5, Block R4 and Block R6) based on the area covered for each reference point. The size of each area is summarized in *Table 11.4.2* and *Figure 11.4.1*.

Table 11.4.2 Size of each Block that Corresponds to Each Reference Point

Block	Area Covered by Reference Point	Note
F1	3,054 ha	1,454 ha are within the study area. 1,600 ha are outside of the study area (1,100 ha is covered by R1, leaving 500 ha).
R5	2,923 ha	250 ha are outsie of the study area.
R4	10,681 ha	7,665 ha are outside of the study area (this area is covered by R3).
R6	2,131 ha	

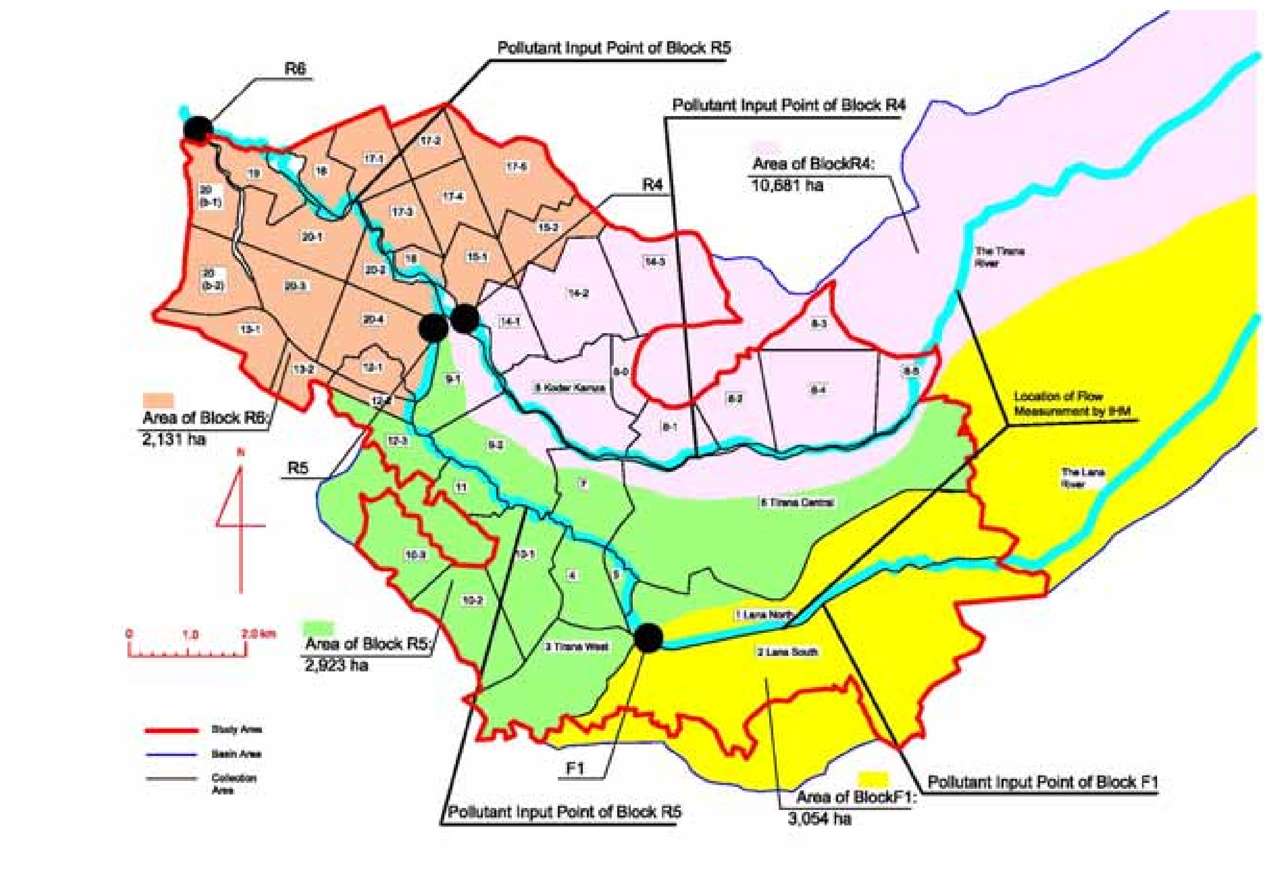


Figure 11.4.1 Area of each Block and Location of each Reference Point

2) Estimation of Specific Low Flow

The Former JICA study report presents the monthly flow rate data for Lana River (from 1966 to 1985) and Tirana River (from 1976 to 1985). This information is reproduced here in *Table 11.4.3*.

Table 11.4.3 Flow Rate Data for Tirana and Lana Rivers (taken from the former JICA Study Report, 1998)

Monthly Flow Rate at the Tirana River (avg. 1976 to 1985)

Unit: m³/sec

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Avg.
1976	3.46	2.84	3.13	3.64	2.66	1.05	3.72	1.99	2.75	1.06	1.25	2.44	2.50
1977	2.13	4.87	5.98	2.01	5.34	2.54	2.59	0.87	0.57	0.46	0.47	1.30	2.43
1978	1.00	4.10	2.64	3.26	8.27	8.70	3.38	6.41	1.94	8.68	0.69	2.15	3.60
1979	1.00	0.71	5.54	7.81	5.94	5.17	5.78	1.26	1.07	0.80	1.43	0.62	3.09
1980	0.61	5.88	5.11	4.78	2.36	2.84	1.74	5.03	0.90	0.22	0.18	0.22	2.49
1981	3.02	7.20	6.92	2.74	10.50	7.85	3.06	4.28	1.74	0.24	0.19	0.66	4.03
1982	2.70	2.47	15.30	3.16	0.94	3.01	1.55	1.51	0.30	0.15	0.11	0.24	2.62
1983	0.69	1.32	7.32	2.28	4.80	1.52	1.78	1.21	2.28	0.43	0.30	0.52	2.04
1984	0.48	3.13	4.63	5.82	4.32	6.26	3.73	2.22	1.40	1.07	3.16	1.54	3.15
1985	1.09	1.56	0.84	6.78	4.68	4.11	3.24	1.65	0.18	0.18	0.12	0.09	2.04
Avg.	1.62	3.41	5.74	4.23	4.98	4.31	3.06	2.64	1.31	1.33	0.79	0.98	2.80

Monthly Flow Rate at the Lana River (avg. 1966 to 1985)

Unit: m³/sec

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Avg.
1966	0.06	0.44	1.06	1.31	0.45	0.35	0.31	0.20	0.18	0.20	0.15	0.16	0.41
1967	0.13	1.31	1.28	0.86	0.23	0.12	0.55	0.22	0.13	0.15	0.06	0.25	0.44
1968	0.20	0.30	0.61	1.15	0.83	0.70	0.47	0.54	0.78	0.46	0.38	0.35	0.56
1969	0.30	0.26	0.59	0.47	1.30	1.34	0.69	0.33	0.38	0.16	0.15	0.14	0.51
1970	0.14	0.24	1.03	0.81	1.25	0.41	0.33	0.35	0.12	0.30	0.52	0.06	0.46
1971	0.28	0.51	0.41	0.51	0.25	0.98	0.96	0.14	0.34	0.16	0.13	0.37	0.42
1972	0.18	0.26	0.26	0.43	0.40	0.33	0.66	0.26	0.16	0.26	0.25	0.50	0.33
1973	0.28	0.27	0.18	0.21	0.72	0.34	0.47	0.19	0.26	0.16	0.18	0.38	0.30
1974	0.18	0.18	0.63	0.26	0.29	0.22	0.54	1.25	0.28	0.14	0.12	0.23	0.36
1975	0.59	0.50	0.33	0.19	0.17	0.18	0.14	0.06	0.09	0.08	0.08	0.13	0.21
1976	0.43	0.49	0.37	0.54	0.63	0.33	0.45	0.25	0.42	0.19	0.19	0.19	0.37
1977	0.24	0.52	0.66	0.37	0.83	0.22	0.20	0.20	0.17	0.16	0.15	0.18	0.33
1978	0.18	0.39	0.49	0.56	0.92	0.98	0.74	0.85	0.39	0.23	0.20	0.40	0.53
1979	0.38	0.39	0.57	0.61	0.47	0.60	0.60	0.22	0.24	0.23	0.22	0.18	0.39
1980	0.20	1.00	0.54	0.47	0.39	0.38	0.28	0.59	0.26	0.21	0.20	0.21	0.39
1981	0.45	0.82	0.81	0.37	0.52	0.81	0.32	0.34	0.18	0.17	0.17	0.23	0.43
1982	0.24	0.31	0.66	0.32	0.27	0.28	0.22	0.20	0.19	0.28	0.14	0.20	0.28
1983	0.20	0.24	0.53	0.26	0.46	0.56	0.58	0.40	0.58	0.30	0.27	0.25	0.39
1984	0.26	0.43	0.48	1.16	1.25	1.00	0.74	0.63	0.64	0.70	0.66	0.82	0.73
1985	0.56	0.43	0.51	1.26	0.67	0.85	0.52	0.46	0.44	0.38	0.35	0.43	0.57
Avg.	0.27	0.46	0.60	0.61	0.62	0.55	0.49	0.38	0.31	0.25	0.23	0.28	0.42

The flow measurement point on Tirana River is located in the upper part of the river (R2 point). The flow measurement point on Lana River is located in the central part of Tirana city (at Shetitorja Deshmort Bridge, near the Dajti Hotel).

The Former JICA study report indicates that the specific low flow rate in Lana River is 7.61×10^{-5} m^3/sec/ha. This was calculated as follows:

(specific low flow) = {(low flow at the measurement point) - (sewage inflow at the measurement point)} / (basin area covered by the measurement point)

This specific low flow rate does not include sewage inflow. Therefore, this value would not change with time. The resulting existing specific low flow rate for Lana River is 7.61×10^{-5} m^3/sec/ha.

The specific low flow rate for Tirana River is 1.70×10^{-4} m^3/sec/ha. This figure is based on the following:

- The third-smallest average monthly flow rate (from the former JICA study report) is 1.31 m^3/sec.
- This 1.31 m^3/sec flow rate can be regarded as a low flow in Tirana River because its flow measurement point is located at R3 (= T1 point defined by IEP). There is sparse population upstream of this point, therefore no or negligible sewage inflow is expected.
- The specific low flow rate can be calculated by dividing 1.31 m^3/sec by the area covered by R3 (7,665 ha).

3) Estimation of Low Flow Rate

The original low flow rate (i.e. excluding any sewage inflow volume) at each reference point was calculated by multiplying the above specific low flow rate with its respective basin area, as shown in *Table 11.4.4*. Since this original flow ("Base Flow") excludes sewage inflow, it can be assumed to be constant over time.

Table 11.4.4 Base Flow at Each Reference Point

Name of the River	Reference Point	Low Base Flow Rate (excluding sewage inflow, m^3/sec)	Inflow from Tributary, m^3/s	(e) x (f)	Block Area (ha)				Specific Low Flow
					Within Study Area	Out of Study Area	Area by Block	Cummurative	(m^3/sec/ha)
		(a) + (b)	(a)	(b)	(c)	(d)	(c) + (d)	(e)	(f)
Lana	F1	**0.23**	0.00	0.23	1,454	1,600	3,054	3,054	7.61E-05
	R5	**0.45**	0.00	0.45	2,673	250	2,923	5,977	7.61E-05
Tirana	R4	**1.82**	0.00	1.82	3,016	7,665	10,681	10,681	1.70E-04
	R6	**2.63**	0.45	2.18	2,131	0	2,131	12,812	1.70E-04

The low flow at each reference point can be calculated by adding the sewage inflow volume at each reference point to the above base flow. The existing (year 2005) low flow rate calculated in this way is presented in *Table 11.4.5*. The future low flow rate is expected to change according to the future sewage inflow volume at each reference point.

Table 11.4.5 Low Flow Rate at each Reference Point

Name of the River	Reference Point	Total Low Flow (m^3/sec)	Low Base Flow Rate (excluding sewage inflow, m^3/sec)	Sewage Inflow			Industrial Effluent		
				Inflow by Block (m^3/d)	Cummulative (m^3/d)	Cummulative (m^3/sec)	Inflow by Block (m^3/d)	Cummulative (m^3/d)	Cummulative (m^3/sec)
		(a) + (b) + (c)	(a)			(b)			(c)
Lana	R1 (=L1)	0.12	0.12	0	0	0.00	0	0	0.00
	F1 (=L2)	0.69	0.23	39,743	39,743	0.46	0	0	0.00
	R5	1.49	0.45	48,437	88,180	1.02	1,500	1,500	0.02
Tirana	R3 (=T1)	1.30	1.30	0	0	0.00	0	0	0.00
	R4 (≒T3)	2.33	1.82	44,270	44,270	0.51	0	0	0.00
	R6	4.31	2.63	11,203	143,654	1.66	0	1,500	0.02

(3) Existing Water Quality and Flow Time

The existing water quality (BOD_5) used to describe the existing condition is presented in *Table 11.4.6*. The selection process was explained in Chapter 4. Data for F1 (same as point L2 that was set by IEP), R5 (almost the same as point L3 that was set by IEP), and R4 (almost the same as point T3 that was set by

IEP) was taken from the last two years of data provided by IEP. This data represents the dry season when there are low flow conditions. R6 was obtained through subcontract work conducted as part of this study.

Table 11.4.6 Water Quality used in the Existing Condition Analysis

River	Reference Point	Present Water Quality (BOD_5 concentration)
Lana River	Boundary Condition	4.0 mg/L
	F1	95 mg/L
	R5	125 mg/L
Tirana River	Boundary Condition	1.4 mg/L
	R4	31 mg/L
	R6	53 mg/L

The average low flow velocity for each section was calculated as follows:

- The river bed gradient was determined by a subcontractor who prepared cross-sections and a longitudinal survey for Lana and Tirana Rivers.
- The friction coefficient at each reference point was based on the present condition.
- The Hydraulic radius at the each reference point was estimated based on field measurements of water depth at specific locations. These measurements were conducted by the study team on 11and 12 November 2005. These measurements were made during dry weather conditions (there had been no rainfall for more than 10 days).
- The flow velocity was calculated using Manning's Formula:

  $$V = \frac{1}{n} R_h^{\frac{2}{3}} \cdot S^{\frac{1}{2}}$$

  where,
  V: Cross-sectional average velocity (m/sec)
  n: Manning coefficient of roughness
  R_h: Hydraulic radius (m)
  S: gradient of designated section of the river
- The calculated flow velocity at each reference point is shown in Table 10.4.7:

Table 11.4.7 Flow Velocity at each Reference Point

Reference Point	Gradient of River Bed	Friction Coef.	Section Area (m^2)	Wetted Perimeter (m)	Hydraulic Radius (m)	Measured Depth (m)	**Flow Velocity (m/sec)**
F1	0.0025	0.05	1.78	6.80	0.26	0.35	**0.4**
R5	0.0018	0.03	2.45	9.48	0.26	0.37	**0.6**
R4	0.0084	0.05	4.04	26.81	0.15	0.20	**0.5**
R6	0.0031	0.05	7.40	19.18	0.39	0.72	**0.6**

Note: Based on subcontract work for river survey and field measurement by the Study Team conducted in the the Study

The flow time at each reference point was estimated based on the calculated flow velocity and the measured flow distance in each section. The results are presented in *Table 11.4.8*.

Table 11.4.8 Flow Time for each Section

Name of the River	Reference Point	Section	Flowing Time			Total Low Flow (m^3/sec)
				Average Flow Rate	Flow Distance	
			(day)	(m/sec)	(km)	(a) + (b)
Lana	R1 (=L1)	From R1Block Pollutant Input Point to R1				0.12
	F1 (=L2)	From F1 Block Pollutant Input Point to F1	**0.09549**	0.4	3.3	0.69
	R5	From F1 to R5	**0.15818**	0.6	8.2	
		From R5 Block Pollutant Input Point to R5	**0.07909**	0.6	4.1	1.49
Tirana	R3 (=T1)	From R3 Block Pollutant Input Point to R3				1.30
	R4 (≒T3)	From R4 Block Pollutant Input Point to R4	**0.11806**	0.5	5.1	2.33
	R6	From R4 to R6	**0.13503**	0.6	7.0	
		From R5 to R6 (input Lana River)	**0.13503**	0.6	7.0	
		From R6 Block Pollutant Input Point to R6	**0.06752**	0.6	3.5	4.31

(4) Runoff Pollution Load Reaching the River

1) Sewage Pollution Load

The unit pollution load per capita and sewage volume used in this analysis are shown in *Table 11.4.19*. Details about these aspects are provided in section 9.4 *(Sewage Generation)* in *Chapter 9*. Sewage includes domestic, commercial, institutional sewage and small scale, non-toxic industrial wastewater. An additional 50 L/capita/day is included as infiltration from groundwater and unaccounted-for water (such as leakage from the water supply system).

Table 11.4.9 Unit Pollution Load and Sewage Volume

Item	2005 (Present)	2014	2018	2022
Pollution Load per Capita (BOD kg/capita/day)	0.040	0.045	0.048	0.050
Sewage Volume per Capita (Liter/Capita/day)	200	226	238	250

The total pollutant load and sewage volume generated from each block under existing conditions and future conditions for the “Without Project” scenario were calculated based on the above unit values. The results of the calculations are shown in *Table 11.4.10*.

Table 11.4.10 Pollution Load and Sewage Volume Generated from each Block (Without Project)

		Population			
		2005	2014	2018	2022
Lana River	F1	198,715	219,482	228,712	237,941
	R5	242,187	281,917	299,574	317,232
Tirana River	R4	221,351	282,439	309,588	336,738
	R6	56,015	83,583	95,836	108,089
		718,268	867,420	933,709	1,000,000
		Generated Pollution Load (kg/d)			
		2005	2014	2018	2022
Lana River	F1	7,949	9,941	10,897	11,897
	R5	9,687	12,769	14,273	15,862
Tirana River	R4	8,854	12,792	14,750	16,837
	R6	2,241	3,786	4,566	5,404
		28,731	39,287	44,486	50,000
		Gemerated Sewage Volume (m^3/d)			
		2005	2014	2018	2022
Lana River	F1	39,743	49,603	54,433	59,485
	R5	48,437	63,713	71,299	79,308
Tirana River	R4	44,270	63,831	73,682	84,185
	R6	11,203	18,890	22,809	27,022
		143,653	196,037	222,223	250,000

The standard value for the coefficient of pollution load in runoff reaching the river is presented in the "Guidelines for Comprehensive Basin-wide Planning of Sewerage Systems, Ministry of Construction, Japan, 1999" (Japanese Guidelines). The Japanese Guidelines are widely referenced in sewerage planning. The coefficient for the runoff pollution load reaching the river is set as shown in *Table 11.4.11*.

Table 11.4.11 Setting the Value for the Runoff Coefficient for each Collection Area

Collection Area	Coefficient of Runoff Pollution Load Reaching River	Collection Area	Coefficient of Runoff Pollution Load Reaching River
No.1	0.8	No.15	0.6
No.2	0.8	No.16	0.6
No.3	0.8	No.17	0.6
No.4	0.7	No.18	0.5
No.5	0.7	No.19	0.5
No.6	0.8	20 (a-1), 20 (a-2)	0.5
No.7	0.7	20 (a-3), 20 (a-4)	0.5
No.9	0.7	20 (b-1)	0.5
10-1, 11, 12-3	0.7	20 (b-2)	0.5
10-2	0.7	12-1, 12-2	0.5
10-3	0.7	No.13	0.5
8 Koder Km	0.7		
8-0 to 8-5	0.7		
No.14	0.7		

The runoff pollution load reaching the river under existing and future conditions for the "Without Project" scenario was calculated based on the pollution load and runoff coefficient outlined above. The results are presented in *Table 11.4.12*.

Table 11.4.12 Runoff Pollution Load Reaching the River in Each Block (Without Project)

			Pollution Load reaching River (kg/d)			
			2005	2014	2018	2022
Without Project	Lana River	F1	6,359	7,953	8,717	9,518
		R5	7,589	9,988	11,159	12,395
	Tirana River	R4	6,629	9,504	10,932	12,453
		R6	1,215	2,056	2,481	2,938
		Total	21,793	29,501	33,289	37,303

2) Other Unspecified Pollution Load

Other pollutants enter the rivers. These originate from industries (whose wastewater is not accepted by the sewerage system), garbage dumping and agriculture. These pollutants are called "unspecified pollution load". Data regarding the amount of these pollutants being generated is not available. Therefore, the unspecified pollution load for the existing conditions was estimated as follows:

- Unspecified pollution load from F1 block is assumed to be 3% of the existing sewage pollution load. F1 block is located in the upper part of the Lana River catchment, in the central part of the urban area of Tirana city. This area is being targeted for the "Green & Clean Project". This project is being assisted by UNDP. This project is expected to reduce the amount of garbage being dumped in the area, hence the lower estimated load.
- Unspecified pollution loads from the R4, R5, and R6 are assumed to be 12.5% of the generated sewage pollution load solid.
- In case of R5, industrial wastewater pollution loads are also considered because in this bloc there are some factories such as meat processing, beer and soft drinks. About 2,200 kg/d are estimated as the current industrial pollution loads based on the estimated water consumption of UKT data available and effluent quality available from reference.

Table 11.4.13 presents the unspecified pollution load values.

Table 11.4.13 Unspecified Pollution Load from each Block

River	Reference Point	Generate BOD Load of Sewage (kg/d)	Assumed Unspecified BOD Load (kg/d)
Lana River	F1	7,949	248
	R5	9,687	3,456
Tirana River	R4	8,854	1,107
	R6	2,241	280

3) Existing Pollution Loads

Figure 11.4.2 summarizes the existing condition, based on the above assumptions and calculations.

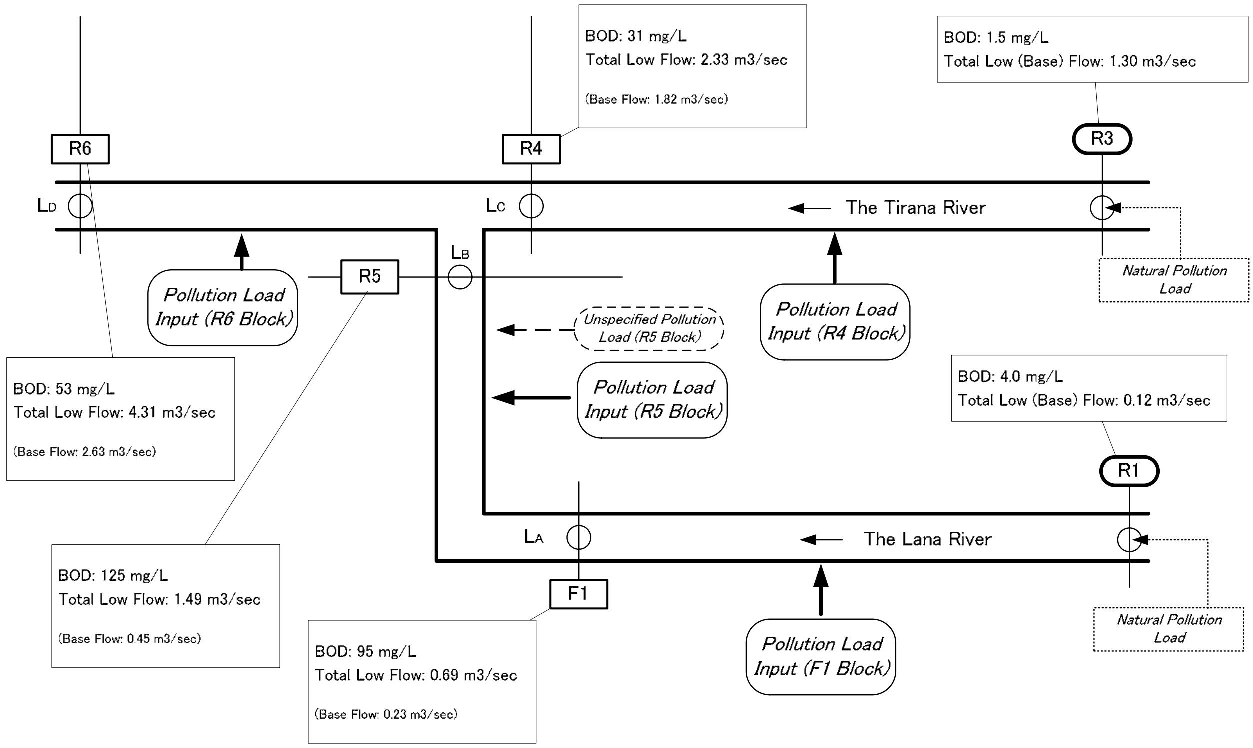


Figure 11.4.2 Schematic Diagram of Existing Conditions

(5) Calculation of Self-purification Coefficient

The following model was applied when analyzing the pollution in the rivers.

- **Runoff coefficient reaching river**
  = (Pollution load reaching river) / (Generated pollution load)
- **Self-purification rate**
  = (Runoff pollution load reaching reference point) / (Pollution load reaching river)

Figure 11.4.3 shows a general schematic of this concept.

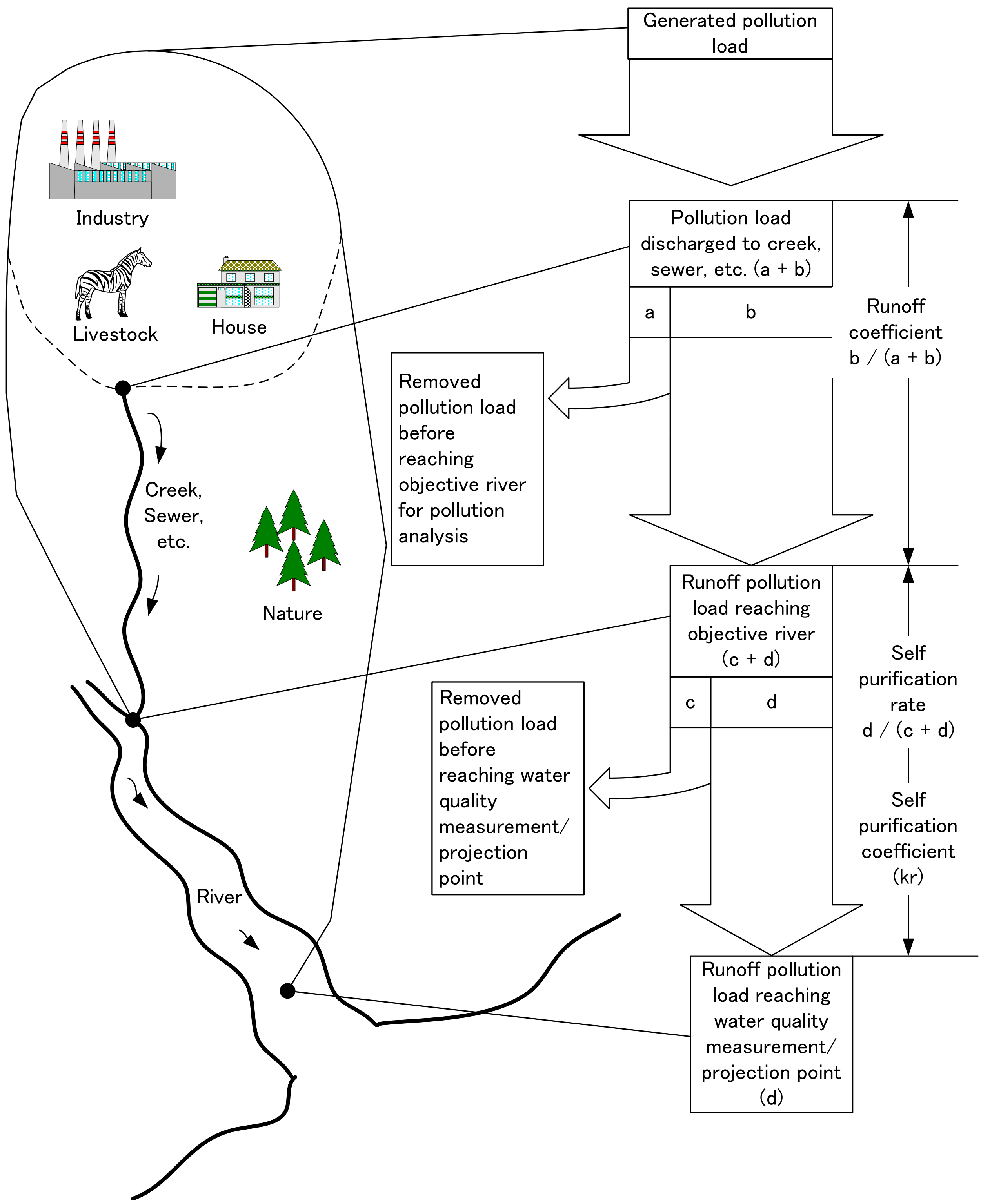


Figure 11.4.3 Schematic Diagram for Runoff Pollution Load

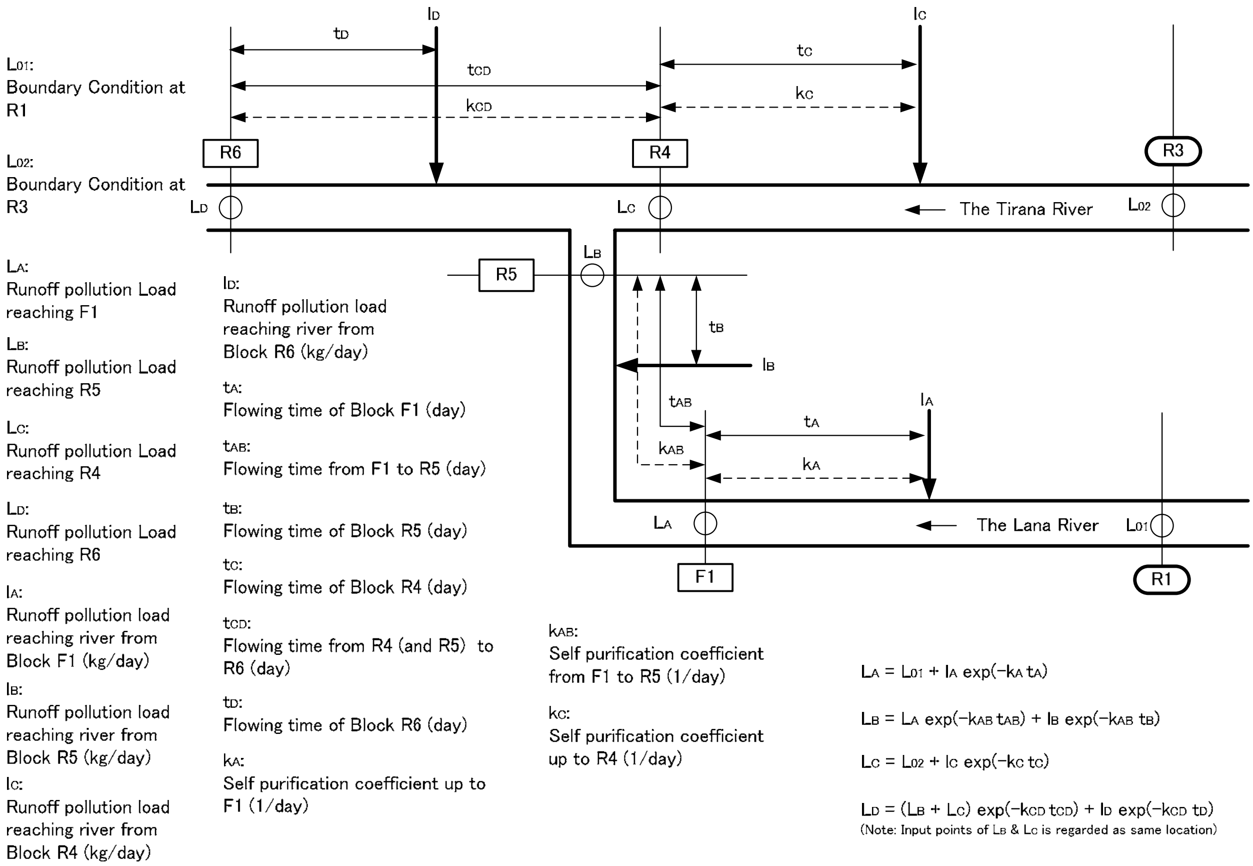
The runoff pollution load reaching the river is naturally purified as it flows downstream. The expected decreases in BOD5 concentration are calculated using the Streeter-Phelps equation:

Rate of decrease in BOD concentration: $dC / dt = - k \times C$, where,

- C: BOD concentration (mg/L)
- t: Time (day)
- k: self-purification coefficient (1/day)

The following schematic diagram (*Figure 11.4.4)* presents the self-purification coefficient for each section.

Figure 11.4.4 Calculation Formula for Self-purification Coefficient



The self-purification coefficient for each section was calculated using the above equation. The results are presented in *Table 11.4.14*.

Table 11.4.14 Self-purification Coefficient for each Section

River	Reference Point	Section	Runoff Pollution Load Reaching River (kg/d)				Average Flow Rate	Flow Distance	Flowing Time	Present Water Quality	Total Low Flow	Runoff Pollution Load Reaching Reference Point	Purification Rate	**Self-purification Coefficient**
			Sewage	Unspecified Pollutant	Total	Cummula-tive	(m/sec)	(km)	(day)	(mg/L)	(m3/sec)	(kg/d)		**(1/d)**
			①				②	③	④ = ③/②	⑤	⑥	⑦ = ⑤ x ⑥	⑧ = ⑦/Σ①	
Lana	R1	From R1 Block Pollution Load Input Point to R1					0	0.0	0	4.0	0.12	42		
	F1	R1 to F1			42									
		From F1 Block Pollution Load Input Point to F1	6,359	248	6,607	6,649	0.4	3.3	0.09549	95	0.69	5,683	0.855	**1.644**
	R5	F1 to R5			5,683		0.6	8.2	0.15818					
		From R5 Block Pollution Load Input Point to R5	7,589	3,456	11,045	16,729	0.6	4.1	0.07909	125	1.49	16,122	0.964	**0.350**
Tirana	R3	From R3 Block Pollution Load Input Point to R3					0	0.0	0	1.5	1.30	169		
	R4	R3 to R4			169		0	0.0	0					
		From R4 Block Pollution Load Input Point to R4	6,629	1,107	7,736	7,905	0.5	5.1	0.11806	31	2.33	6,236	0.789	**2.009**
	R6	R4 to R6			6,236		0.6	7.0	0.13503					
		R5 to R6			16,122		0.6	7.0	0.13503					
		From R6 Block Pollution Load Input Point to R6	1,215	280	1,496	23,854	0.6	3.5	0.06752	53	4.31	19,749	0.828	**1.446**

11.4.3 Predicted Future Water Quality

Future water quality predictions were made for without Project vs. with Project of CaseB-3d (the proposed M/P).

(1) Without Project

Table 11.4.15 through Table 11.4.17 show the runoff pollution (BOD_5) load reaching each reference point during 2014, 2018 and 2022 when the projects are not implemented.

(2) With Project (Case B-3d)

Table 11.4.15 through Table 11.4.17 also summarizes the predicted future pollution (BOD_5) load (including STP discharge) reaching the river under the scenario of with the project during 2014, 2018 and 2022. The calculation for each case is presented here for comparison purposes. Schematic diagrams illustrating the BOD_5 load runoff with the project in operation were prepared to help understand the water quality situation for each case during 2014, 2018 and 2022. The diagrams for each case are shown in *Figure 11.4.5*, *Figure 10.4.6,* and *Figure 11.4.7*.

Table 11.4.15 Runoff Pollution (BOD_5) Load Reaching the River in 2014

Without Project

Reference Point	Section	Runoff Pollution Load Reaching River (kg/d)			Flowing Time	Self-purification Coefficient	Runoff Pollution Load Reaching Reference Point		Total Low Flow	BOD_5
		Sewage	Unspecified Pollutant	Total	(day)	(1/d)	(kg/d)		(m3/sec)	(mg/L)
R1	From R1Block Pollutant Input Point to R1							42	0.12	4.0
F1	R1 to F1			42	0	1.644	42			
	From F1 Block Pollutant Input Point to F1	7,953	248	8,201	0.09549	1.644	7,009	7,051	0.81	**101**
R5	F1 to R5			7,051	0.15818	0.350	6,672			
	From R5 Block Pollutant Input Point to R5	9,988	3,456	13,444	0.07909	0.350	13,078			
	Kashr STP Discharge	0		0	0.09491	0.200	0	19,750	1.78	**128**
R3	From R3 Block Pollutant Input Point to R3							169	1.30	1.5
R4	R3 to R4			169	0	2.009	169			
	From R4 Block Pollutant Input Point to R4	9,504	1,107	10,611	0.11806	2.009	8,371	8,539	2.55	**39**
R6	R4 to R6			8,539	0.13503	1.446	7,025			
	R5 to R6			19,750	0.13503	1.446	16,247			
	From R6 Block Pollutant Input Point to R6	2,056	280	2,336	0.06752	1.446	2,119			
	Berxulle STP Discharge	0		0	0	0.200	0	25,392	4.92	**60**

With Project

Reference Point	Section	Runoff Pollution Load Reaching River (kg/d)			Flowing Time	Self-purification Coefficient	Runoff Pollution Load Reaching Reference Point		Total Low Flow	BOD_5
		Sewage	Unspecified Pollutant	Total	(day)	(1/d)	(kg/d)		(m3/sec)	(mg/L)
R1	From R1Block Pollutant Input Point to R1							42	0.12	4.0
F1	R1 to F1			42	0	1.644	42			
	From F1 Block Pollutant Input Point to F1	0	248	248	0.09549	1.644	212	254	0.23	**13**
R5	F1 to R5			254	0.15818	0.350	241			
	From R5 Block Pollutant Input Point to R5	6,264	3,456	9,720	0.07909	0.350	9,455			
	Kashr STP Discharge	1,174		1,174	0.09491	0.200	1,152	10,848	1.78	**70**
R3	From R3 Block Pollutant Input Point to R3							169	1.30	1.5
R4	R3 to R4			169	0	2.009	169			
	From R4 Block Pollutant Input Point to R4	9,504	1,107	10,611	0.11806	2.009	8,371	8,539	2.55	**39**
R6	R4 to R6			8,539	0.13503	1.446	7,025			
	R5 to R6			10,848	0.13503	1.446	8,924			
	From R6 Block Pollutant Input Point to R6	2,056	280	2,336	0.06752	1.446	2,119			
	Berxulle STP Discharge	0		0	0	0.200	0	18,068	4.92	**43**

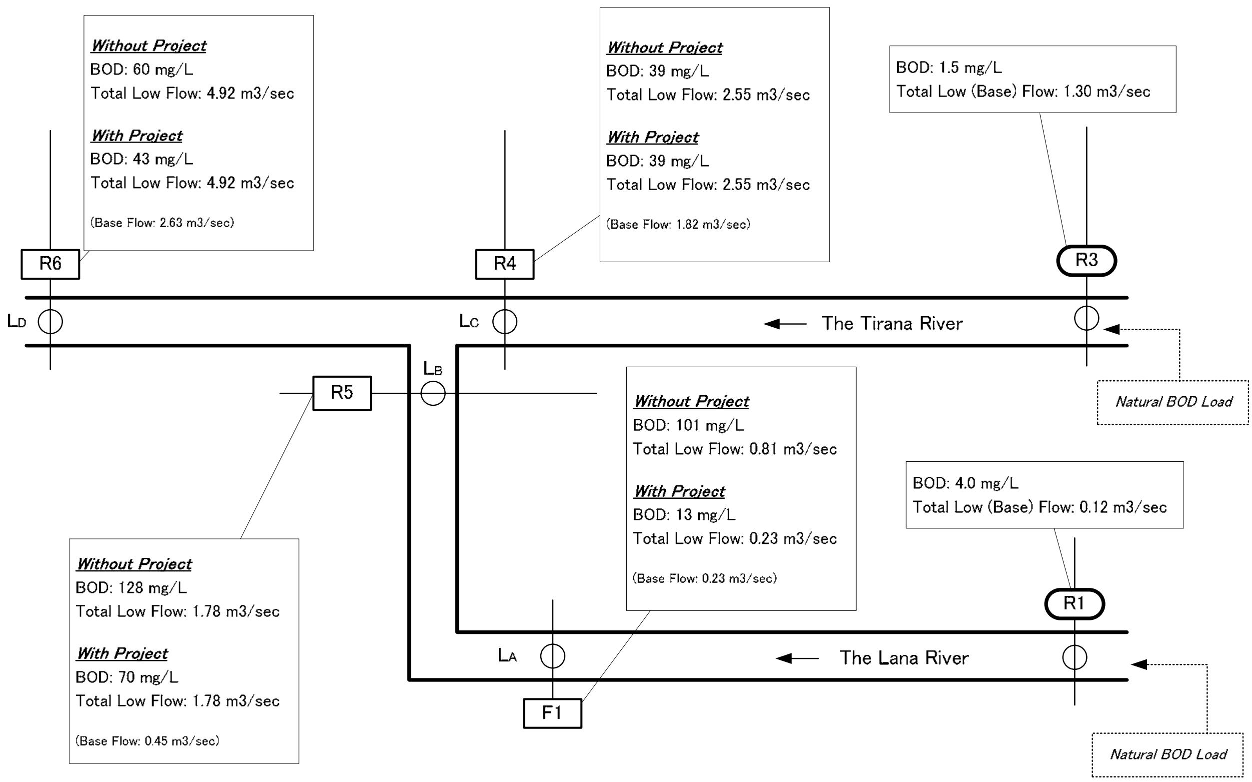


Figure 11.4.5 Schematic Diagram of Runoff Pollution (BOD_5) Load in 2014

Table 11.4.16 Ruoff Pollution (BOD_5) Load Reaching the River in 2018

2018 Without Project

Name of the River	Reference Point	Section	Runoff Pollution Load Reaching River (kg/d)			Flowing Time	Self-purification Coefficient	Runoff Pollution Load Reaching Reference Point		Total Low Flow	BOD_5
			Sewage	Unspecified Pollutant	Total	(day)	(1/d)	(kg/d)		(m3/sec)	(mg/L)
Lana	R1	From R1Block Pollutant Input Point to R1							42	0.12	4.0
	F1	R1 to F1			42	0	1.644	42			
		From F1 Block Pollutant Input Point to F1	8,717	248	8,966	0.09549	1.644	7,663	7,705	0.86	**103**
	R5	F1 to R5			7,705	0.15818	0.350	7,291			
		From R5 Block Pollutant Input Point to R5	11,159	3,456	14,615	0.07909	0.350	14,217			
		Kashar STP Discharge	0		0	0.09491	0.200	0	21,507	1.93	**129**
Tirana	R3	From R3 Block Pollutant Input Point to R3							169	1.30	1.5
	R4	R3 to R4			169	0	2.009	169			
		From R4 Block Pollutant Input Point to R4	10,932	1,107	12,038	0.11806	2.009	9,497	9,666	2.67	**42**
	R6	R4 to R6			9,666	0.13503	1.446	7,951			
		R5 to R6			21,507	0.13503	1.446	17,693			
		From R6 Block Pollutant Input Point to R6	2,481	280	2,761	0.06752	1.446	2,504			
		Berxulle STP Discharge	0		0	0	0.200	0	28,149	5.22	**62**

2018 With Project

Name of the River	Reference Point	Section	Runoff Pollution Load Reaching River (kg/d)			Flowing Time	Self-purification Coefficient	Runoff Pollution Load Reaching Reference Point		Total Low Flow	BOD_5
			Sewage	Unspecified Pollutant	Total	(day)	(1/d)	(kg/d)		(m3/sec)	(mg/L)
Lana	R1	From R1Block Pollutant Input Point to R1							42	0.12	4.0
	F1	R1 to F1			42	0	1.644	42			
		From F1 Block Pollutant Input Point to F1	0	248	248	0.09549	1.644	212	254	0.23	**13**
	R5	F1 to R5			254	0.15818	0.350	241			
		From R5 Block Pollutant Input Point to R5	0	3,456	3,456	0.07909	0.350	3,362			
		Kashar STP Discharge	3,034		3,034	0.09491	0.200	2,977	6,580	2.63	**29**
Tirana	R3	From R3 Block Pollutant Input Point to R3							169	1.30	1.5
	R4	R3 to R4			169	0	2.009	169			
		From R4 Block Pollutant Input Point to R4	1,764	1,107	2,871	0.11806	2.009	2,265	2,434	1.97	**14**
	R6	R4 to R6			2,434	0.13503	1.446	2,002			
		R5 to R6			6,580	0.13503	1.446	5,413			
		From R6 Block Pollutant Input Point to R6	2,481	280	2,761	0.06752	1.446	2,504			
		Berxulle STP Discharge	0		0	0	0.200	0	9,919	5.22	**22**

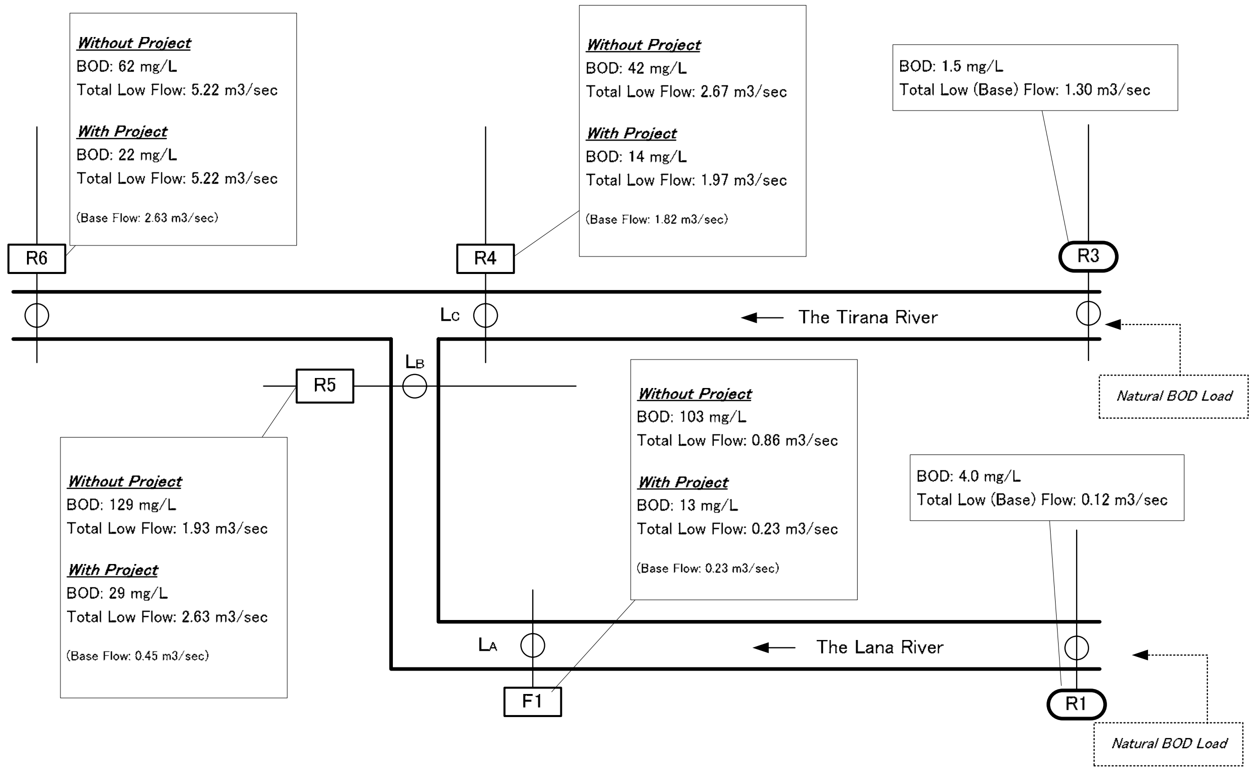


Figure 11.4.6 Schematic Diagram of Runoff Pollution (BOD_5) Load in 2018

Table 11.4.17 Ruoff Pollution (BOD_5) Load Reaching the River in 2022

2022 Without Project

Name of the River	Reference Point	Section	Runoff Pollution Load Reaching River (kg/d)			Flowing Time	Self-purification Coefficient	Runoff Pollution Load Reaching Reference Point		Total Low Flow	BOD_5
			Sewage	Unspecified Pollutant	Total	(day)	(1/d)	(kg/d)		(m3/sec)	(mg/L)
Lana	R1	From R1Block Pollutant Input Point to R1							42	0.12	4.0
	F1	R1 to F1			42	0	1.644	42			
		From F1 Block Pollutant Input Point to F1	9,518	248	9,766	0.09549	1.644	8,347	8,389	0.92	**105**
	R5	F1 to R5			8,389	0.15818	0.350	7,938			
		From R5 Block Pollutant Input Point to R5	12,395	3,456	15,851	0.07909	0.350	15,419			
		Kashar STP Discharge	0		0	0.09491	0.200	0	23,357	2.08	**130**
Tirana	R3	From R3 Block Pollutant Input Point to R3							169	1.30	1.5
	R4	R3 to R4			169	0	2.009	169			
		From R4 Block Pollutant Input Point to R4	12,453	1,107	13,559	0.11806	2.009	10,697	10,866	2.79	**45**
	R6	R4 to R6			10,866	0.13503	1.446	8,938			
		R5 to R6			23,357	0.13503	1.446	19,215			
		From R6 Block Pollutant Input Point to R6	2,938	280	3,218	0.06752	1.446	2,918			
		Berxulle STP Discharge	0		0	0	0.200	0	31,072	5.54	**65**

2022 With Project

Name of the River	Reference Point	Section	Runoff Pollution Load Reaching River (kg/d)			Flowing Time	Self-purification Coefficient	Runoff Pollution Load Reaching Reference Point		Total Low Flow	BOD_5
			Sewage	Unspecified Pollutant	Total	(day)	(1/d)	(kg/d)		(m3/sec)	(mg/L)
Lana	R1	From R1Block Pollutant Input Point to R1							42	0.12	4.0
	F1	R1 to F1			42	0	1.644	42			
		From F1 Block Pollutant Input Point to F1	0	248	248	0.09549	1.644	212	254	0.23	**13**
	R5	F1 to R5			254	0.15818	0.350	241			
		From R5 Block Pollutant Input Point to R5	0	3,456	3,456	0.07909	0.350	3,362			
		Kashar STP Discharge	3,409		3,409	0.09491	0.200	3,345	6,947	2.87	**28**
Tirana	R3	From R3 Block Pollutant Input Point to R3							169	1.30	1.5
	R4	R3 to R4			169	0	2.009	169			
		From R4 Block Pollutant Input Point to R4	0	1,107	1,107	0.11806	2.009	873	1,042	1.82	**7**
	R6	R4 to R6			1,042	0.13503	1.446	857			
		R5 to R6			6,947	0.13503	1.446	5,715			
		From R6 Block Pollutant Input Point to R6	0	280	280	0.06752	1.446	254			
		Berxulle STP Discharge	767		767	0	0.200	767	7,594	5.54	**16**

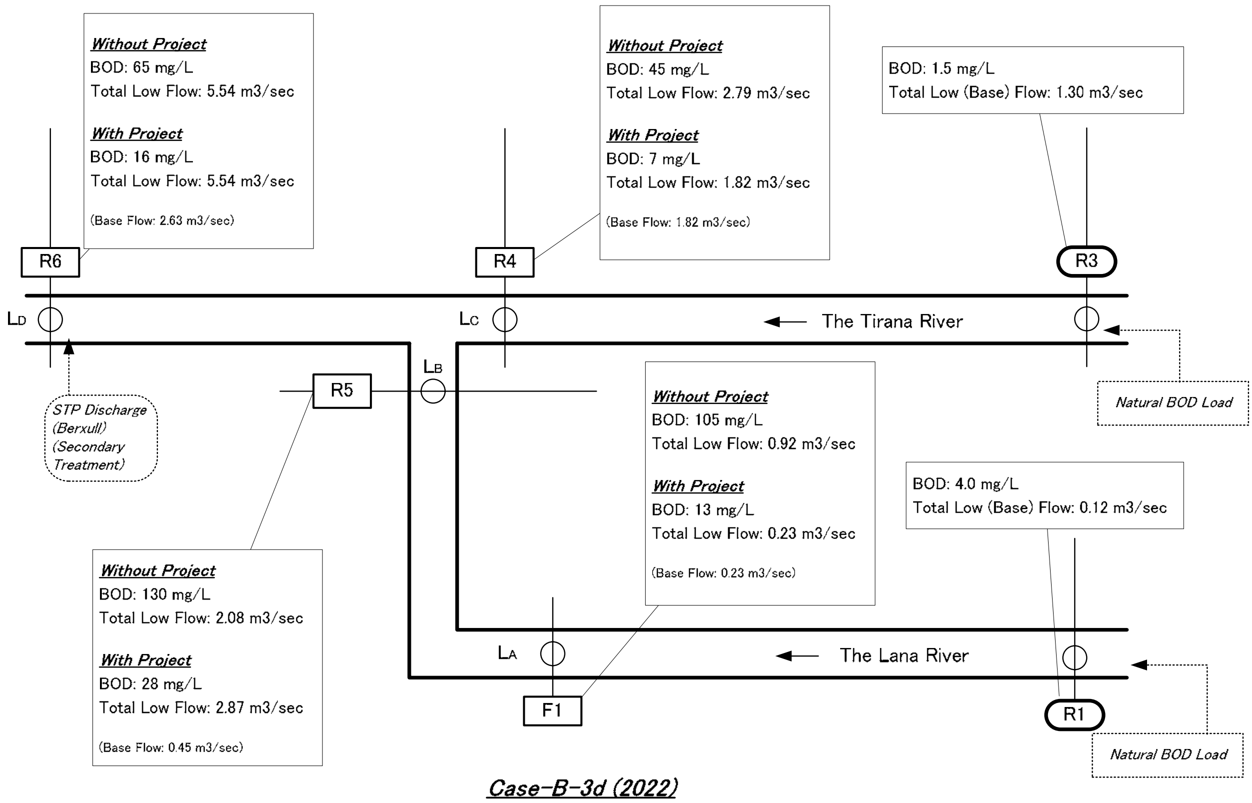


Figure 11.4.7 Schematic Diagram of Runoff Pollution (BOD_5) Load in 2022

11.4.4 Summary of the Predicted River Water Quality Impacts

Table 11.4.18 summarizes the predicted water quality at each reference point under the estimated low flow conditions. The results (0% reduction of unspecified pollution load) are summarized:

- At F1 of the Lana River in the urban center of Tirana Municipality, the BOD_5 would be decreased to about 13 mg/L after the first stage project, which is higher than 10 mg/L that would be acceptable level for conservation of environment.
- At R5 of the Lana Rive just before joining into the Tirana River, the water quality improvement would be expected after the second stage project. And the expected BOD concentration would be 29 mg/L that is higher than the effluent quality for STPs. This would be caused by that the almost all of river water flow under the low flow conditions would be the treated sewage flow from the Kashar STP and the remained pollution loads are the effluent of Kashar STP and the unspecified pollution loads (mainly of industrial wastewater) as shown in *Table 11.4.16 and Table 11.4.17*.
- AT R4 of the Tirana River, the expected BOD_5 concentration would be 14 mg/L after implementation of the second project which cover the entire area of Tirana Municipality and would be reached to 7 mg/L that would be acceptable level for the conservation of envirnment.
- At R6 of the Tirana River, the expected BOD5 concentration would be 22 mg/L after the second stage project by which the Kashar STP can be operated by full capacity and 17mg/L after the third stage project by which the Berxulle STP will be operated.

To achieve further improvement at each reference point, mitigation measures to address unspecified pollution loads (such as unregulated garbage dumping or direct discharge of industrial wastewater) should be developed and enforced in combination with the sewerage projects.

Table 11.4.18 Effect on Water Quality Improvement Assuming Reduction of Unspecified Pollution Loads by 0 %, 50 % and 66 %

		BOD (mg/L)			
		2005	2014	2018	2022
F1	W/O Project	95	101	103	105
	0%	95	13	13	13
	50%	95	7	7	7
	66%	95	6	6	6
R5	W/O Project	125	128	129	130
	0%	125	70	29	28
	50%	125	59	21	21
	66%	125	55	19	18
R4	W/O Project	31	39	42	45
	0%	31	39	14	7
	50%	31	37	12	4
	66%	31	36	11	3
R6	W/O Project	53	60	62	65
	0%	53	43	22	16
	50%	53	38	18	12
	66%	53	36	16	10

Trials to estimate water quality for Cases B-3d were undertaken using a simulation model based on the following assumptions:

- 50 % reduction of unspecified pollution loads; and
- 66 % reduction of unspecified pollution loads.

The results (shown in *Table 11.4.18)* indicate that significant water quality improvements can be expected at F1 after the first stage project, and at R4 and R6 after the third stage project.

11.5 Operation and Maintenance Plan

11.5.1 Facilities

The proposed sewerage development plan recommends the following sewerage facilities:

- Trunk Sewer: 20.7 km, Pipe diameters ranging between 450mm and 1650mm, vertical shafts with depths between 7m and 25m;
- Two pumping stations (one in Kashar and one in Kamza); and
- Two sewage treatment plants (one in Kashar and one in Berxulle).

11.5.2 Operation and Maintenance Tasks

The two key roles of the sewerage system are: to collect sewage; and to treat the collected sewage to meet certain standards. Facilities such as sewers, pumping stations and sewage treatment plants only function efficiently if they are operated and maintained appropriately.

Sewers: The operation and maintenance of sewers involves three main tasks: regular inspection, cleaning, and repairing (as required).

Pumping Stations: To enable pumps to operate 24 hours a day, daily (or periodic) inspection and maintenance of the pumping facilities, screens and degriting facilities is required. The removal of screening waste and sands from the facility are required to reduce odor.

Sewage Treatment Plant: The sewage system must operate 24 hours a day. It is therefore necessary for the facilities to be adequately controlled and daily (or periodic) inspections of the mechanical and electrical equipment be undertaken. Also, the water quality of the plant influent and effluent for the primary and secondary treatment facilities must be measured.

11.5.3 Sewerage Operation and Maintenance Staff

Figure 11.5.1 lists the maintenance staff that would be required to adequately operate and maintain the sewerage facilities. It is proposed that the organizational structure consists of a director oversees six sections (administration, water quality, STP operation, STP maintenance, operation and maintenance of pumping stations, and sewer maintenance). The director is responsible for all operation and maintenance matters. It is estimated that 120 staff would be required to operate and maintain the system.

- The administration section consists of a manager and two engineers who manage all the O&M tasks and manage the operational data (which is prepared by others in the organization).
- The water quality section consists of three chemists who are responsible for the measurement of water quality at the two STPs and provide advice to the STP operation crew.
- The STP operation and maintenance sections are responsible for the performance of STPs in Kashar

and Berxulle. The section is also responsible for the disposal of grit and sludge.

- The PS operation and maintenance section is responsible for operation and maintenance of two the pumping stations.
- The sewer maintenance section includes the inspection subsection (responsible for checking the condition of sewers) and the cleaning/repairs subsection (responsible for cleaning and repairing the system).

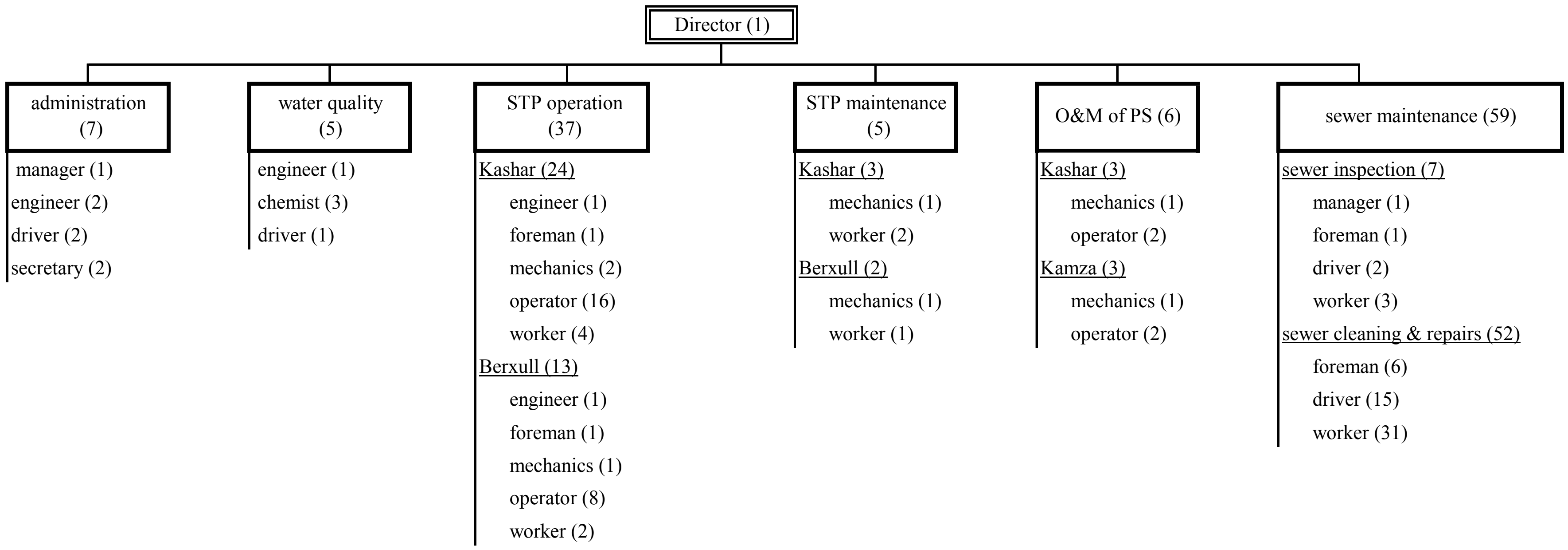


Figure 11.5.1 Organization Chart for Sewer Operation and Maintenance

11.6 Project Cost Estimate

11.6.1 General

The cost of each project component has been estimated and allocated in accordance with the implementation schedule shown in the *Figure 11.3.1*.

The project cost consists of estimates for the following items:

1) Direct Construction Cost
2) Indirect Construction Cost
    - Land Acquisition and Compensation;
    - Administration;
    - Engineering Services;
    - Physical Contingency; and
    - Capacity Building.

11.6.2 Basis of Cost Estimate

The project cost was estimated based on the following conditions:

(1) Price Level

Prices were estimated based on the exchange rates as at 1st of November, 2005, which were:

1 US Dollar = 107.23 Albanian Lek = 115.74 Japanese Yen
1 Euro = 129.463 Albanian Lek

(2) Foreign and Local Currency Portions

The project cost includes a Foreign Currency (F.C.) portion and a Local Currency (L.C.) portion. The imported goods and services are estimated in the F.C. portion. The F.C. portion and L.C. portions are allocated applying their assumed ratios for each work item. Both portions are presented in terms of Albanian Leks.

11.6.3 Direct Construction Cost

The construction costs for sewage treatment plants and pumping stations were estimated using Japanese experiences. The construction cost of new main sewers and new trunk sewers were estimated using the "Cost function" in the "Guidelines and Commentary on the Comprehensive Basin-wide Program for the Development of Sewerage Systems" published by the Japan Sewage Works Association. Cost information was also sourced from Nihon Suido Consultants (based on the real cost of constructed sewerage facilities). The estimated cost was modified to reflect a realistic amount that could be applied to facilities within the Albanian Republic. This process is explained below.

(1) Sewers

1) Main and Branch Sewers

Pipe materials used in the construction of main sewers and sewer networks are locally available and pipes can be installed using the open-cut method. This would mean that the construction cost can be fully estimated as L.C. The total construction cost for the sewers was estimated to be 20% of the Japanese guideline cost. This is based on the actual construction cost experienced in Kamza municipality. It should be noted that the costs for branch sewers exclude the costs required to install house connections that are the pipes and accessories carrying the sewage from individual houses or buildings to a common/public sewer. Because it is practiced that the existing house connections are installed by the owners of the buildings and houses in the planning area. For the installation of new branch sewers, this practice will also be continued; the costs of house connections are paid by the private owners.

2) Trunk Sewers

Construction cost required to enhance the existing main sewers by the installation of intercepting structures and to install new trunk sewers is estimated. Trunk sewers could be constructed using the pipe jacking method as well as the open cut construction method. The pipe jacking method should be applied when the depth of earth over the pipe is greater than 5m, or when the pipe crosses beneath rivers, streams, highways and railways. The pipe jacking method requires specific construction materials, machinery, and engineers/operators. This cost is therefore estimated in the F.C. portion. The unit costs for materials and machinery was based on the cost estimate outlined in this study. The personnel cost for engineers/operators was estimated to be approximately 70% of the cost experienced in Japan. The cost of using the open cut method to construct the trunk sewer was estimated using the same techniques as for the main and branch sewers. The construction costs were estimated by multiplying the unit cost by the required length of trunk sewer.

(2) Sewage Treatment Plants

The construction work for the STPs can be divided into civil/architectural work and mechanical/electrical work. These costs were estimated using a cost ratio of 35% for civil/architectural work and 65% for mechanical/electrical work.

1) Civil and Architectural Work

The local cost is estimated to be 50% of the Japanese cost. The local currency portion accounts for 100% of the cost.

2) Mechanical and Electrical Work

The overall local cost for the mechanical and electrical works is estimated to be 50% of the Japanese cost. The imported equipment and materials are included as part of the F.C. portion. The mechanical and electrical installation work is included as part of the L.C. portion.

11.6.4 Indirect Construction Cost

(1) Land Acquisition and Compensation

The land acquisition cost was estimated based on the value of land that is dedicated for public use. The cost is included as 100% of the L.C. The aquision cost was presented in Table 10.4.5. Compensation costs were not estimated because construction of the STPs and PSs would not require any resettlement.

(2) Administration

Administrative costs must be allocated by the Albanian agencies responsible for implementation of the project. The cost is estimated to be 5% of the total direct construction cost and is allocated to the L.C. portion.

(3) Engineering Services

Engineering services include detailed design, preparation of tender documents, bid evaluations, and construction supervision. The costs for engineering services were estimated to be 10% of the direct construction cost of each the F.C. and L.C. portions.

(4) Physical Contingency

The physical contingency is estimated to be 10% of the total direct construction cost. The allocation for F.C. and L.C. portions are the same as for the relevant construction cost.

(5) Capacity Building

The expenditure required implementing the first stage of the three year program and the second and third stages of the five year program have been estimated. The costs for international experts have been included as part of the F.C. portion and others were included as part of the L.C. portion.

11.6.5 Project Cost

Table 11.6.1 shows the project cost required to implement the whole proposed sewerage system development for case B-3d: Two STP System, including the cost required for each construction stage.

Table 11.6.1 Staged Project Cost for the Sewerage M/P

Unit: Million Leks

Component	1st Stage(2009-2013)			2nd Stage(2014-2017)			3rd Stage(2018-2021)			Projects Total		
	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total
Direct Construction Cost												
Trunk Sewer	1,375	298	1,673	807	1,380	2,187	26	454	480	2,208	2,132	4,340
Main Sewers	0	376	376	0	1,644	1,644	0	1,400	1,400	0	3,420	3,420
Kashar PS	0	0	0	328	221	549	0	0	0	328	221	549
Kashar STP	2,292	1,526	3,818	2,950	1,968	4,918	0	0	0	5,242	3,494	8,736
Kamza PS	0	0	0	0	0	0	208	137	345	208	137	345
Berxulle STP	0	0	0	0	0	0	1,419	948	2,367	1,419	948	2,367
Total of Direct Construction Cost	3,667	2,200	5,867	4,085	5,213	9,298	1,653	2,939	4,592	9,405	10,352	19,757
Indirect Construction Cost												
Land Acquisition and Compensation	-	3,068	3,068	-	1,550	1,550	-	0	0	-	4,618	4,618
Administrative Expenses	-	293	293	-	465	465	-	230	230	-	988	988
Engineering Services	367	220	587	409	521	930	165	294	459	941	1,035	1,976
Physical Contingency	367	220	587	409	521	930	165	294	459	941	1,035	1,976
Capacity Building Cost	96	51	147	108	36	144	27	9	36	231	96	327
Total of Indirect Cost	830	3,852	4,682	926	3,093	4,019	357	827	1,184	2,113	7,772	9,885
Total Project Cost	4,497	6,052	10,549	5,011	8,306	13,317	2,010	3,766	5,776	11,518	18,124	29,642

11.6.6 Operational and Maintenance Cost

The O&M costs include the expenditure needed for the following items:

(1) Personnel;
(2) Power;
(3) Chemicals for disinfection, dewatering and water quality measurement;
(4) Sludge Disposal;
(5) Routine Equipment Repairs; and
(6) O&M of Sewers including inspection, cleaning and repairs.

The O&M cost required to operate and maintain the proposed sewerage facilities is summarized in *Figure 11.6.1* and *Table 11.6.2.*

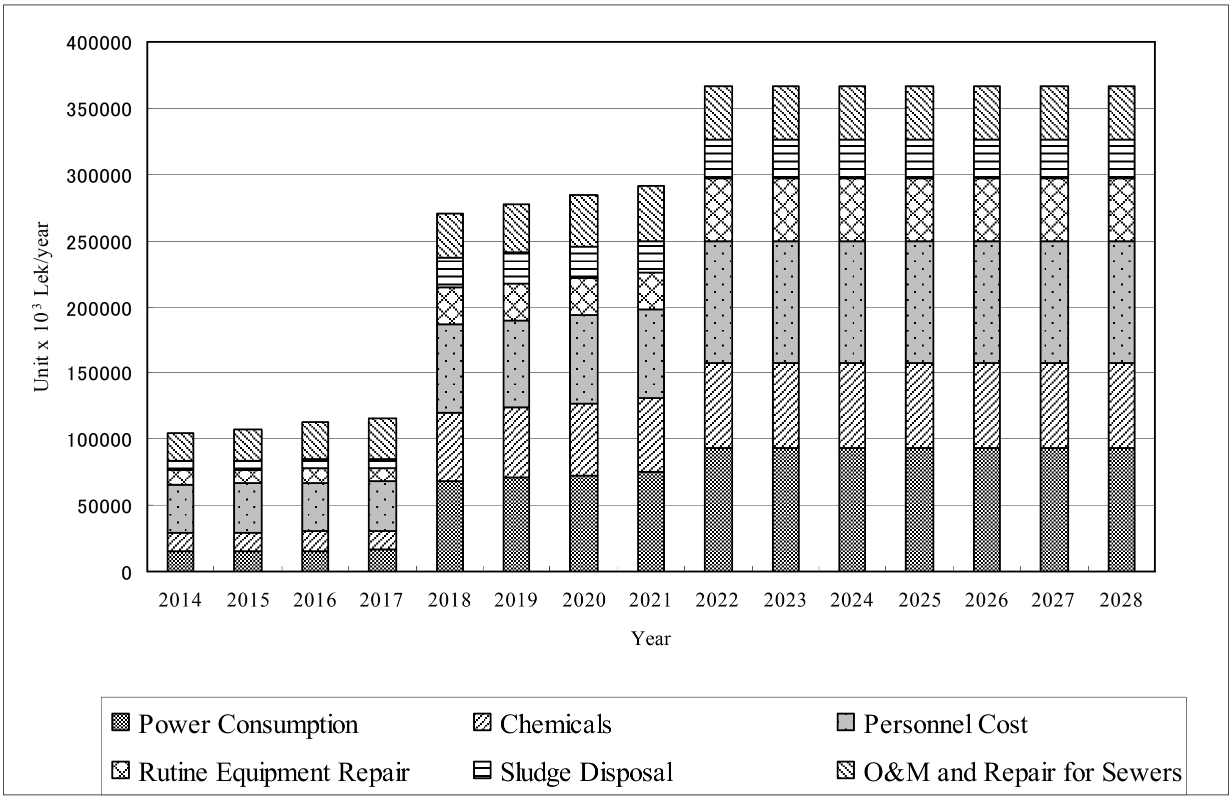


Figure 11.6.1 O&M Costs for the Proposed Sewerage M/P

(1) Personnel Cost

The personnel cost was estimated based on the requirements to operate and maintain the completed branch sewers, main sewers, trunk sewers, pumping stations and sewage treatment plants. The required cost for the staff of the existing sewer maintenance is also estimated about 3,180 thousand Lek per year which included in *Table 11.6.2*. The personnel cost was estimated based on salaries provided by the UKT.

In addition to the staff for operating and maintaining the sewerage facilities, the cost of staff working for management and economic department is also taken into account. Based on the personnel cost for the

UKT staff, the necessary administration cost for operation of sewerage services including collection of sewerage service charges and connection fee for the new sewerage facilities developed by the proposed M/P are estimated.

Table 11.6.2 O&M Cost for the Proposed Sewerage M/P

Unit: ×10^3Lek/year

After the first stage project

Year	2014	2015	2016	2017
Power Consumption	15,573	15,778	15,983	16,188
Chemicals	13,273	13,656	14,040	14､423
Personnel Cost	37,120	37,120	37,120	37,120
Routine Equipment Repair	10,427	10,427	10,427	10,427
Sludge Disposal	6,579	6,739	6,899	7,059
O&M and Repair for sewers	21,072	23,852	27,945	30,808
Total	104,044	107,572	112,414	11,6025

After the second stage project

Year	2018	2019	2020	2021
Power Consumption	68,943	70,998	73,083	75,197
Chemicals	50,943	52,673	54,425	56,199
Personnel Cost	66,340	66,340	66,340	66,340
Routine Equipment Repair	27,849	27,849	27,849	27,849
Sludge Disposal	22,253	22,976	23,708	24,449
O&M and Repair for sewers	33,944	36,857	38,812	40,911
Total	270,272	277,693	284,217	290,945

After the third Stage Project

Year	2022	20223	2024
Power Consumption	93,116	93,116	93,116
Chemicals	64,944	64,944	64,944
Personnel Cost	92,040	92,040	92,040
Routine Equipment Repair	47,129	47,129	47,129
Sludge Disposal	28,838	28,838	28,838
O&M and Repair for sewers	40,911	40,911	40,911
Total	366,978	366,978	366,978

The following present staff of the management department and of finance sector, sales sector and IT administration of the economic department is used for the base cost estimation of current level: general director (1), directors (1), section head (4), section chief or specialist (16), others (158). It is assumed that these numbers of staff will be the same in the first stage project but increase by 40% and 80% for the second and third stage projects. The current number of staff per 1,000 connections of UKT is about 8 having some allowance for reducing the number (the current number of staff of UKT is about 950 (May 2006) and the connection numbers is 117,600 for water supply service (2004)), therefore for the first stage project an increase in administration staff is not proposed. The staff would be enough for the first stage project through strengthening the capacity building of the proposed Operator, GTW&SA.

An assumption of share rate of sewerage services against the whole water supply and sewerage service is set considering the connection number and its increase for each stage of the sewerage project. The sharing rate of sewage services of the proposed projects are set about 32% for first stage, 50% for the second and third stage project.

The resulting annual personnel cost estimates required for the staff of administration and economic department for sewerage services are 19 million Lek for the first stage project, 40.6 million Lek for the second stage project and 55.2 million Lek for third stage project. These cost estimates are included in the personnel cost in *Table 11.6.2*.

(2) Power

Power is required to operate the mechanical equipment at the two proposed pumping stations and the two treatment plants. The amount of power required depends on the volume of sewage pumped and treated. The power estimate is based on the assumed sewage flow rate into the sewerage facilities.

(3) Chemicals

Chemical costs include chlorination of secondary effluent, mechanical sludge dewatering, and water quality measurement.

(4) Sludge Disposal

Sludge disposal costs include the loading of sludge at sewage treatment plants, transportation to the disposal site, and leveling at the disposal site.

(5) Routine Equipment Repair

Mechanical and electrical equipment needs routine lubrication and repairs. This cost includes the purchase and installation of spare parts.

(6) O&M of Sewers including inspection, cleaning and repairs

Sewers must be inspected and cleaned on a regular basis. Repairs are carried out on an as needed basis. The estimate includes the costs of lost or damaged mechanical equipment such as TV cameras, jet cleaning machines and deposit suction pumps.

11.6.7 Replacement Cost

A replacement cost for mechanical and electrical is estimated at Leks 2,482 million for the 1st stage project, Leks 3,552 million for the 2nd stage project and Leks 1,763 million for the 3rd stage project. The replacement cost will be derived at the time of every 15 years after the completion of the works of each construction stage.

11.7 Evaluations

11.7.1 General

This section evaluates the proposed sewerage master plan from technical, economic and financial perspectives.

11.7.2 Technical Evaluation

The technical evaluation considered the following:

- Appropriateness of technology levels;
- O&M requirements to run the proposed sewerage system; and
- The Project impacts.

(1) Sewage Collection System

The proposed sewage collection system will result in water quality improvements, especially in the upper and middle part of Lana and Tirana Rivers (these run through the urban center of Tirana municipality). This water quality would improve because less untreated sewage would be directly discharged into the water courses and rivers.

The proposed sewer system includes the upgrading of the existing sewers and interceptors by installing manholes with weir structures that connect the sewers and interceptors. During dry weather conditions, sewage flows through the interceptor and trunk sewer to the STP. During wet weather conditions, the sewage and rainwater are separated by weir structures. The intercepted sewage flow (which is assumed to be equivalent to the dry weather flow) is directed though the interceptor and trunk sewer to the proposed STP, while the remaining flow is directly discharged to the nearby river.

During dry weather conditions, all sewage is collected and treated at the proposed STP. This results in a reduced pollutant load and therefore an improvement in the water quality in the Lana and Tirana rivers. During wet weather conditions, some pollution is discharged as overflows directly into the rivers. To reduce wet weather pollution, it may be possible to introduce a separate sewer system and use existing sewers as dedicated drainage channels. This was proposed in the former JICA Study, published in 1998.

When new urban areas are being planned, separate sewer and drainage systems should be proposed. New systems can collect sewage efficiently, with lower construction costs (as compared to a combined sewer/storm water system which requires a larger sewer). Both new branch and main sewers can be laid using local recourses.

The proposed trunk sewer system connecting to the Kasha STP would consist of two different routes and systems:

1) gravity flow system (Trunk sewer No.3) to channel the sewage collected from the Lana basin; and
2) Pressurized flow system (pressurized by the Kashar Pumping Station) that conveys the sewage collected from the remaining service area.

As discussed in Section 10.5 of Chapter 10, the proposed sewer system has the lowest O&M costs of all the options. It also has the advantage that more than one third of the sewage generated in Tirana municipality can be conveyed by gravity. This is important considering the poor power supply situation in the Greater Tirana area.

The trunk sewer system connecting the Berxulle STP would be constructed using the open-cut method, (except at the Tirana River crossing) which would reduce the construction costs.

(2) Sewage Treatment Plant (STP)

The study proposes two STPs, one at Kashar and the other at Berxulle. Both plants use a trickling filter process which requires a larger site area but requires less sophisticated operation and maintenance technology than the alternative activated sludge process. The trickling filter process has already been applied to the Kavaje STP. The Kavaje STP has been operating since May 2006. The O&M experience gained through the operation of this plant can be used to improve the implementation of the Kashar and Berxulle STPs.

Sewage treatment produces sludge on a daily basis. Sludge is removed from primary and secondary sedimentation tanks. It is then thickened and digested. This can be carried out by naturally drying the sludge or by undertaking mechanical dewatering. Natural drying (using drying beds) requires a large area, but the energy requirements are low. The study proposes that natural drying be implemented to the extent possible within site area constraints. This would result in less energy, and therefore a lower operational cost.

This approach, of favoring treatment that presents lower costs, will be used in the development of the Master Plan.

11.7.3 Economic Evaluation

The economic evaluation compares the economic benefit and the economic cost of the project in terms of their monetary present value.

(1) Economic Benefit

The expected economic benefits of the project are:

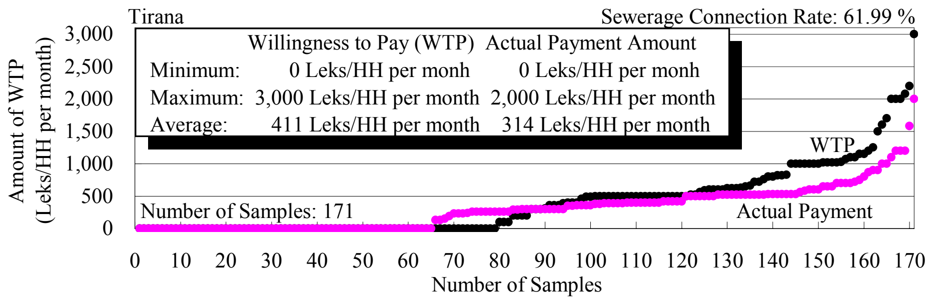
- the willingness of people to pay (WTP);
- savings in medical expenditure due to a reduced infection rates from water borne diseases; and
- savings in salaries/wages because fewer medical staff will be required to treat water borne diseases.

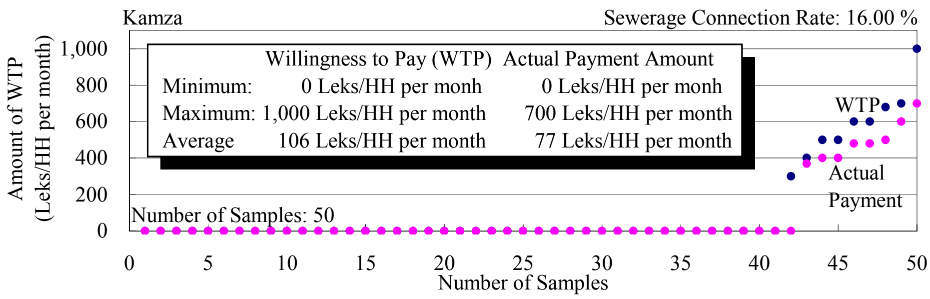
1) Willingness to pay

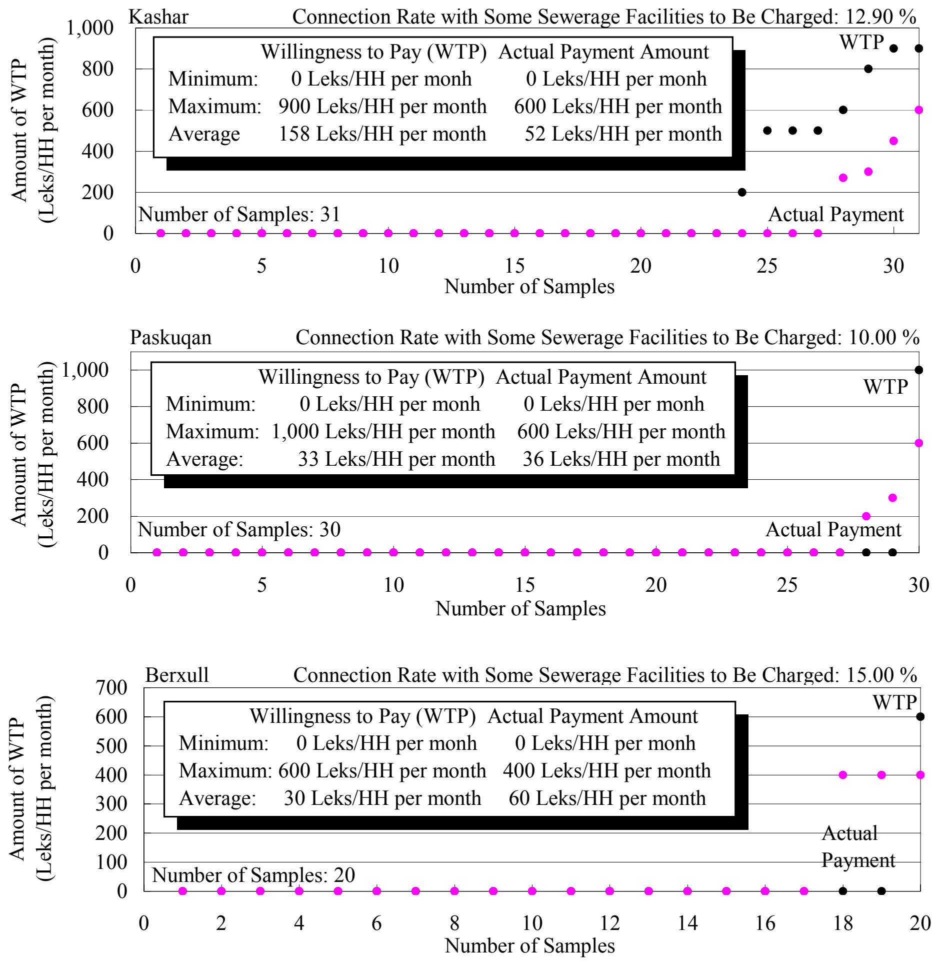
The WTP was determined through a "Social Awareness Survey", which is discussed below.

The JICA study team carried out a Public Awareness Survey in January 2006. An effective 300 samples in total were collected for the survey. A verification of the sample number is examined in the final part of this sub-section.

In a questionnaire of the said Survey, asking "Are you willing to pay more for improved sewerage service?" and "If yes, how much?" This survey includes a question to identify, the people's willingness to pay (the WTP) for the proposed new sewerage services, Figure 11.7.1 shows the results of survey. It also show the actual payment made by individuals for some form of sewerage facilities. The communes of Kashar, Paskuqan and Berxulle pay for sewerage facilities, but do not actually have any facilities.







Sourse: Public Awareness Survey made by JICA Study Team, January 2006.

Figure 11.7.1 Amount of WTP by Each Municipality and Commune

The above monthly WTP results indicate that the average annual WTP for each municipality or commune are estimated to be: Leks 4,926/HH in Tirana, Leks 1,267/HH in Kamza, Leks 1,897/HH in Kashar, Leks 400/HH in Paskuqan and Leks 360/HH in Berxulle, and a population weighted average of Leks 4,193/HH for the targeted area.

Verification of the effective number of samples:

In general, the sample number for household survey is decided based on the required accuracy represented as the following two variables in addition to the size of universe (total household number).

- Confidence level (%)
- Sampling error (%)

The confidence level of sampling survey such as public awareness survey is usually set at 95% which is relatively high level, while its sampling error is set at 10% or less when deciding required sample number.

In this study, the universe of the surveys were the estimated total household number in the study area for the questionnaire survey. The current population in 2005 is about 818,300 and the average number of persons at each household is about 3.97, the estimated total household number is about 180,900. The collected valid sample number is set at 300.

The statistical equation for the calculation of sampling error having 95% of confidence level at given sampling number is show as follows.

$$e = 1.96 \sqrt{\frac{N\text{-}n}{N\text{-}1} \cdot \frac{P(1\text{-}P)}{n}}$$

e : Sampling Error;
N : Universe (180,900);
n : Sample Number (300);
P : Population Rate (0.5: worst condition); and
1.96 : Coefficient at 95% of confidence level.

Based on the equation, the sample error is calculated about 6%, therefore the accuracy of the questionnaire survey can be confirmed.

2) Saving in Medical Expenditure

This project is expected to help improve the communities' living environment. The project is expected to improve the water quality and reduce the prevalence of water borne diseases. This would reduce the burden on medical services. These improvements could indirectly improve the socio economic situation because the purchasing power of the community will increase.

The project benefits can be measured in terms of:

- a reduction in the rate of infection due to water borne disease. This would be expressed as a percentage of the total disease;
- the number of patients who suffer from water borne disease; and
- the financial situation of medical institutions treating water borne disease.

The rate of infection due to water borne diseases as a ratio to the mortality rate is 30 %. Water borne diseases occur when individuals drink polluted water and touch sewage. In this study, it is assumed that 15% of the infection from water sources is caused by contamination with sewage.

The resulting estimated medical expenditure saving is shown in *Table 2.2.12* (Chapter 2). This shows that State healthcare subsidies are 192 Leks/outpatient and 3,946 Leks/inpatient per year. It also shows that personal expenditure is 211 Leks/outpatient and 3,101 Leks/inpatient.

3) Saving of Salaries/Wages Decrease

People suffering from water borne diseases are prevented from working for periods of time. This results in loss of income. Therefore health improvements will translate to increased productivity.

Water borne disease results in loss of individual earnings and reduced business production.

Currently, the average income level in Tirana, Berxulle, Kamza, Kashar and Paskuqan is 662 Leks/capita per day, 510/capita per day, 532 Leks/capita per day, 554 Leks/capita per day, and 536 Leks per day, respectively. These income levels can be used to estimate the savings (since lost income will be reduced as a result of the reduced infection rate).

4) Other Socio-Economic Benefits

Other benefits may be provided as a result of biodiversity conservation, increased pedestrian activity along the Lana and Tirana Rivers, and retail benefits from this increased activity (e.g. the purchase of snacks and drinks).

5) Summary of basic unit for economic benefit

Table 11.7.1 shows a summary of the basic unit estimation for economic benefits. Further details are provided in *Appendix 12.11.1*:

Table 11.7.1 Summary of Basic Unit of Economic Benefit

(As of 2005)

Benefit Items	Expected Willingness of People to Pay for the Whole Tageted Area by Means of Population-Weighted Average[1)] (Leks/HH per Year)	Saving Amount of Medical Expenditure[2)] (Leks/HH per Year)		Saving Amount of Income Decreasing[3)] (Leks/HH per Year)	
		Outpatient	Inpatient	Outpatient	Inpatient
Amount of Unit Benefit	4,193	244	660	4,885	15,368
Remarks & Sources	1. Estimated based on the result of the Public Awareness Survey made by JICA Study Team, January 2006. 2. Basic data and information for the nation and Tirana District are based on the information of the "Albania Poverty Assessment" Report No.26213-AL, November 5, 2003, the World Bank. The figures are the weighted average for the entire targeted areas. Details are shown in Annex. 3. Basic data and information for the nation and Tirana District are based on the information of the "Albania Poverty Assessment" Report No.26213-AL, November 5, 2003, the World Bank. The figures are the weighted average for the entire targeted areas. Details are shown in Annex in the Report.				

(2) Economic Cost

Economic cost was estimated taking into account the followings:

- A Standard Conversion Factor (SCF) for tradable equipment and materials;
- The shadow price for land acquisition and/or housing costs;
- Labor associated with construction works; and
- The cost of transfer items such as personal income tax and corporate income tax.

1) Standard Conversion Factor (SCF):

Standard Conversion Factor (the SCF) for tradable equipment and materials needs to be considered when converting financial cost to economic cost. *Table 11.7.2* shows that the SCF is 0.9380.

Table 11.7.2 Calculation of Standard Conversion Factor

Year	Export	Import	Import Duties (Custom Duties)	Export Tax	Export Subsidies
1995	18,710	60,312	6,231	0	0
1996	22,001	98,060	7,708	0	0
1997	21,044	95,022	8,958	0	0
1998	31,104	126,271	12,615	0	0
1999	48,430	159,465	11,450	0	0
2000	37,037	157,109	13,548	0	0
2001	44,096	190,155	12,795	0	0
Total	222,422	886,394	73,305	0	0
Source: INSTAT.				SCF =	0.93799

$$SCF = \frac{\sum I + \sum E}{(\sum I + \sum I_{customs}) + (\sum E - \sum E_{tax} + \sum E_{subsidy})}$$

Where, $SCF =$ standard conversion factor,
$I =$ import amount,
$E =$ export amount
$I_{customs} =$ import duties (custom duties)
$E_{tax} =$ export tax, and
$E_{subsidy} =$ export subsidies.

2) Income Tax:

According to the Albanian Income Tax Act, corporate income tax is 10% for contractors, and personal income tax is 5%. Corporate income tax is applied to the contractor's net profit. Personal income tax is applied to the total labor cost. The contractor's net profit is assumed to be 10 % of the direct construction cost.

3) Shadow Wage Rate for Unskilled Labor:

The Shadow Wage Rate was estimated to be 0.5971. This was calculated by dividing the average income level in Tirana municipality (42,245 Leks/HH) by the average number of people working in each HH (1.77). The result of this calculation is then divided by the adopted wage rate for the Project (40,000 Leks per person).

4) Shadow Price of Land:

The shadow price for land is estimated to be 0.02115 for a primary treatment plant and 0.01089 for a secondary treatment plant. This is detailed in *Table 11.7.3*.

Table 11.7.3 Calculation of Shadow Price of Land

Kind of Products	Cultivated Area (ha)	Unit Yield (tons/ha) Without Irrigation Area	Unit Yield (tons/ha) With Irrigation Area	Investment Cost in Total under Without-Irrigation Condition (Leks)	Selling Amount in Total under Without-Irrigation Condition (Leks)	Under Non-Irrigated Situation: Unit Investment Cost in Total (Leks/ha)	Under Non-Irrigated Situation: Gross Farmers' Income per Unit Area (Leks/ha)	Under Non-Irrigated Situation: Farmers' Net Income (Leks/ha)	Unit Farm Gate Price (Leks/ton)	Under Irrigated Condition: Unit Investment Cost in Total (Leks/ha)	Under Irrigated Condition: Gross Farmers' Income per Unit Area (Leks/ha)	Under Irrigated Condition: Farmers' Net Income (Leks/ha)	Incremental Farmers' Net Income per Unit Agricultural Area (Leks/ha)
Wheat	20	3	5	900,000	3,000,000	45,000	150,000	105,000	50,000	58,500	250,000	191,500	86,500
Corn	50	5	7	3,250,000	9,100,000	65,000	182,000	117,000	36,400	84,500	254,800	170,300	53,300
Vegetables (Tomates)	60	30	60	4,500,000	14,400,000	75,000	240,000	165,000	8,000	97,500	480,000	382,500	217,500
Grape	15	20	40	1,425,000	36,000,000	95,000	2,400,000	2,305,000	120,000	123,500	4,800,000	4,676,500	2,371,500
Fodder (Lucerne)	95	60	90	3,800,000	68,400,000	40,000	720,000	680,000	12,000	52,000	1,080,000	1,028,000	348,000
Apricot	25	35	50	2,475,000	62,500,000	99,000	2,500,000	2,401,000	71,429	128,700	3,571,429	3,442,729	1,041,729

Source: Kamza Municipality.

Average Land Value in case of agricultural area: 423,097 /ha
= 42 /m^2
Land Value to be acqired for the Project (the First Treatment Plant): 2,000 /m^2
Land Value to be acqired for the Project (the Second Treatment Plant): 3,884 /m^2
Conversion Factor for Shadow Price of Land for the First Treatment Plant: 0.02115
Conversion Factor for Shadow Price of Land for the Second Treatment Plant: 0.01089

5) Economic Cost

Table 11.7.4 summarizes the project's financial and economic costs.

Table 11.7.4 Summary of Project Cost of M/P

(Million Leks)

Description	FC	LC	Total
Direct Construction Cost	9,405	10,352	19,757
Trunk Sewer	2,208	2,132	4,340
Main anad Branch Sewers	0	3,420	3,420
Kashar PS	328	221	549
Kashar STP	5,242	3,494	8,736
Kamza PS	208	137	345
Burxulle STP	1,419	948	2,367
Indirect Construction Cost	2,113	7,772	9,885
Land acquisiotion and Conpensation	0	4,618	4,618
Administrative Expenses	0	988	988
Engineering Services	941	1,035	1,976
Physical Contigency	941	1,035	1,976
Capacity Building	231	96	327
Sub-Total of Financial Cost	11,518	18,124	29,642
Price Escalation	3,373	8,236	11,609
Total Financial Cost	14,891	26,360	41,251
Economic Cost Converted	10,364	8,696	19,060

Table 11.7.5 Annual Disbursement Schedule of M/P

(Million Leks)

Item	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
Financial Cost (incl. Price Escalation)	3,986	1,513	2,099	2,865	2,975	4,842	4,236	5,417	4,151	2,179	2,553	2,148	2,286	41,251
Financial Cost (excl. Price Escalation)	3,415	1,273	1,704	2,335	2,360	3,407	2,957	3,819	2,844	1,316	1,535	1,321	1,356	29,642
Economic Cost Converted (excl. Price	402	903	1,215	1,973	1,999	1,245	2,044	3,008	2,288	830	1,052	1,041	1,061	19,059

The O&M costs are estimated to be Leks 367million per annum (in financial terms) from 2022 and Leks 236 million in economic terms. A replacement cost for mechanical and electrical is estimated at Leks 2,482 million for the 1st stage project, Leks 3,552 million for the 2nd stage project and Leks 1,763 million for the 3rd stage project in financial terms, and Leks 1,596 million, Leks 2,284 million and Leks 1,134 million respectively in economic terms. The replacement cost will be derived at the time of every 15 years after the completion of the works of each construction stage.

(3) Economic Evaluation

1) Evaluation Indices

The economic costs and benefits of the project throughout its life were analyzed in terms of present values. If the total present value of economic costs equals that of the economic benefit (i.e. B/C=1), the resulting discount rate is the "economic internal rate of return (EIRR)". This is the main measure used to evaluate the feasibility of the project. The other two indices are Net Present Value (NPV) and the B/C Ratio.

The EIRR was calculated using the cash flow of economic cost and economic benefit over the project's life. The EIRR is defined by the following formula:

$$\sum_{t=1}^{t=T} \frac{C_t}{(1+R_e)^t} = \sum_{t=1}^{t=T} \frac{B_t}{(1+R_e)^t}$$

- Where, T = the last year of the project's life.
- C_t = an annual economic cost flow for the project during study in year t,
- B_t = an annual benefit flow derived from the project in year t, and
- R_e = the Economic Internal Rate of Return (EIRR) (the discount rate which balances the costs and benefits in terms of their present value).

The NPV is expressed as "B-C" and defined by the following formula:

$$NPV = B - C = \sum_{t=1}^{t=T} \frac{B_t}{(1+R_e)^t} - \sum_{t=1}^{t=T} \frac{C_t}{(1+R_e)^t}$$

If the present value of the benefit is less than the present value of cost, the project is financially viable.

The B/C Ratio is defined by the following formula:

$$B/C = \sum_{t=1}^{t=T} \frac{B_t}{(1+R_e)^t} \Bigg/ \sum_{t=1}^{t=T} \frac{C_t}{(1+R_e)^t}$$

If the present value of the benefit divided by the present value of the cost is greater than "1.00", the project is financially viable.

The project life is assumed to be 35 years. The economic cost and benefit cash flow must be modeled from the first year of construction to the end of the project's life.

The annual O&M cost must be taken into account. This should include replacement costs for materials used during construction of the facility that may need replacement over the project's life.

2) Economic Evaluation

The economic evaluation is based on projected cash flows over the project's life of 35 years.[1] The results are summarized in *Table 11.7.6*:

Table 11.7.6 Result of the Project Economic Evaluation, M/P

NPV	EIRR	B/C
-282 Million Leks	9.59 %	0.96

The above table indicates that the EIRR is 9.59%. This is slightly lower than the applied discount rate (the rate of the opportunity cost of capital of 10 %.

(4) Sensitivity Test

The economic internal rate of return (EIRR) changes its value depending upon the parameters employed for the calculation. Out of these parameters, the construction cost of the Project and its benefit are the most important determinants of the economic evaluation.

The value of the EIRR varies depending on the parameters used in the calculation. Construction cost and the project benefit are the most influential parameters in the calculation.

The Sensitivity Test consisted of 49 combinations of the variables, including:

- Cost increased by 30 %, 20% and 10%;
- Cost reduced by 10 %, 20% and 30%;
- Economic Benefit reduced by 30%, 20% and 10%; and
- Economic Benefit increased by 10 %, 20% and 30%.

The results are shown in *Table 11.7.7.*

[1] Details are shown in Appendix 12.11.2 in Appendix 12 of Volume III "Supporting Report" of this report.

Table 11.7.7 Result of the Sensitivity Test for M/P

Cost	Benefit						
	+ 30 %	+ 20 %	+ 10 %	Base Case	- 10 %	- 20 %	- 30 %
+ 30 %	9.59%	8.70%	7.76%	6.77%	5.72%	4.57%	3.29%
+ 20 %	10.52%	9.59%	8.62%	7.60%	6.52%	5.34%	4.05%
+ 10 %	11.56%	10.60%	9.59%	8.53%	7.41%	6.21%	4.89%
Base Case	12.76%	11.75%	10.70%	**9.59%**	8.42%	7.18%	5.82%
- 10 %	14.15%	13.09%	11.98%	10.82%	9.59%	8.29%	6.89%
- 20 %	15.81%	14.67%	13.49%	12.26%	10.97%	9.59%	8.12%
- 30 %	17.80%	16.59%	15.33%	14.00%	12.62%	11.15%	9.59%

The World Bank[2] states that the discount rate reflects the rate of the reduction in the value of consumption over time. The World Bank recommends that, even in non-commercial projects, the EIRR should be at least 5 % above. The EIRR, for the M/P, which are higher the minimum recommended rate of 5 % except several cases when the benefit reduced by 20% and 30%. Therefore, it can be concluded that the M/P is economically viable and socially responsible.

Figure 11.7.2 illustrates a sensitivity of the Project from the economical viewpoint.

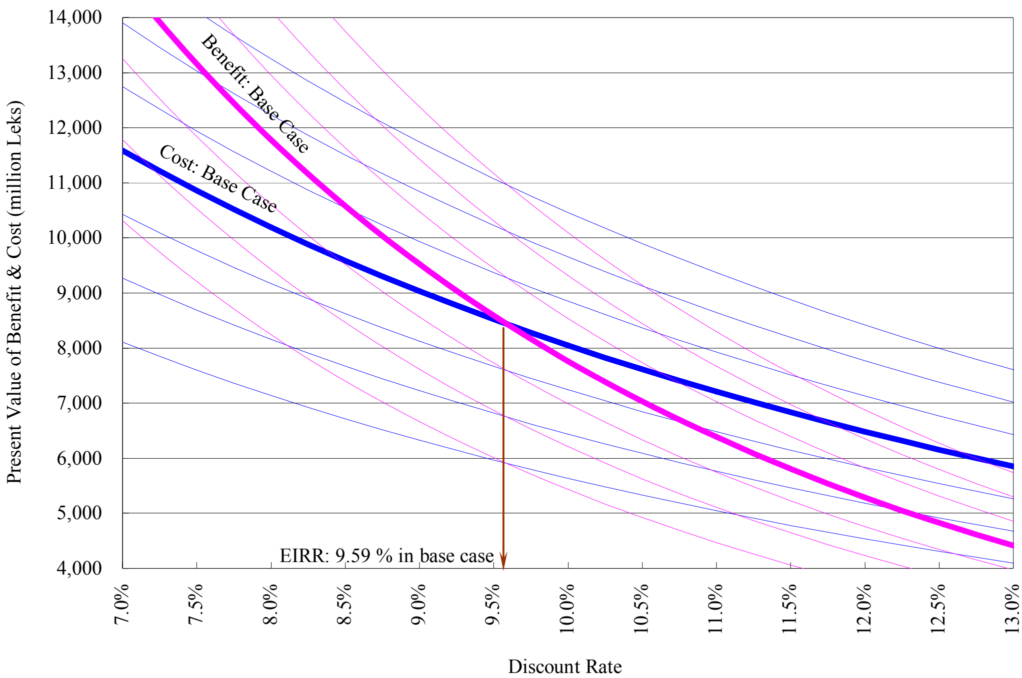


Figure 11.7.2 Economic Sensitivity of the Project

[2] William A. Ward and Barry J. Deren with Emannuel H. D'Silva, 1991 "*The Economics of Project Analysis –A Practitioner's Guide –*" EDI Technical Materials, the World Bank.

11.7.4 Financial Evaluation

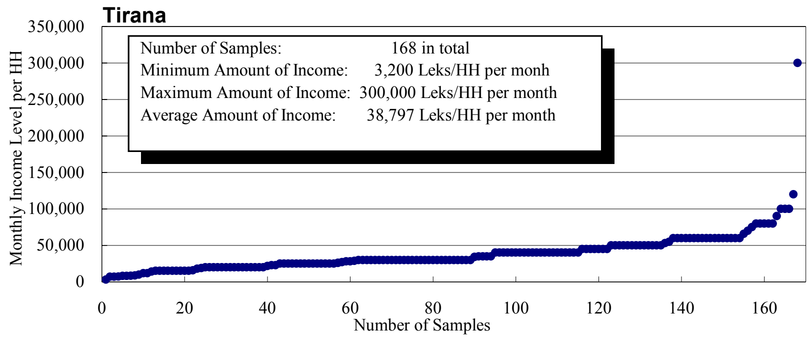
(1) Financial Benefit

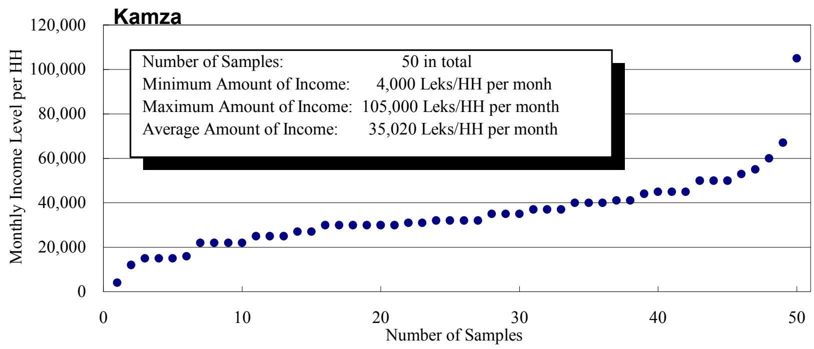
1) Sewerage Service Charge

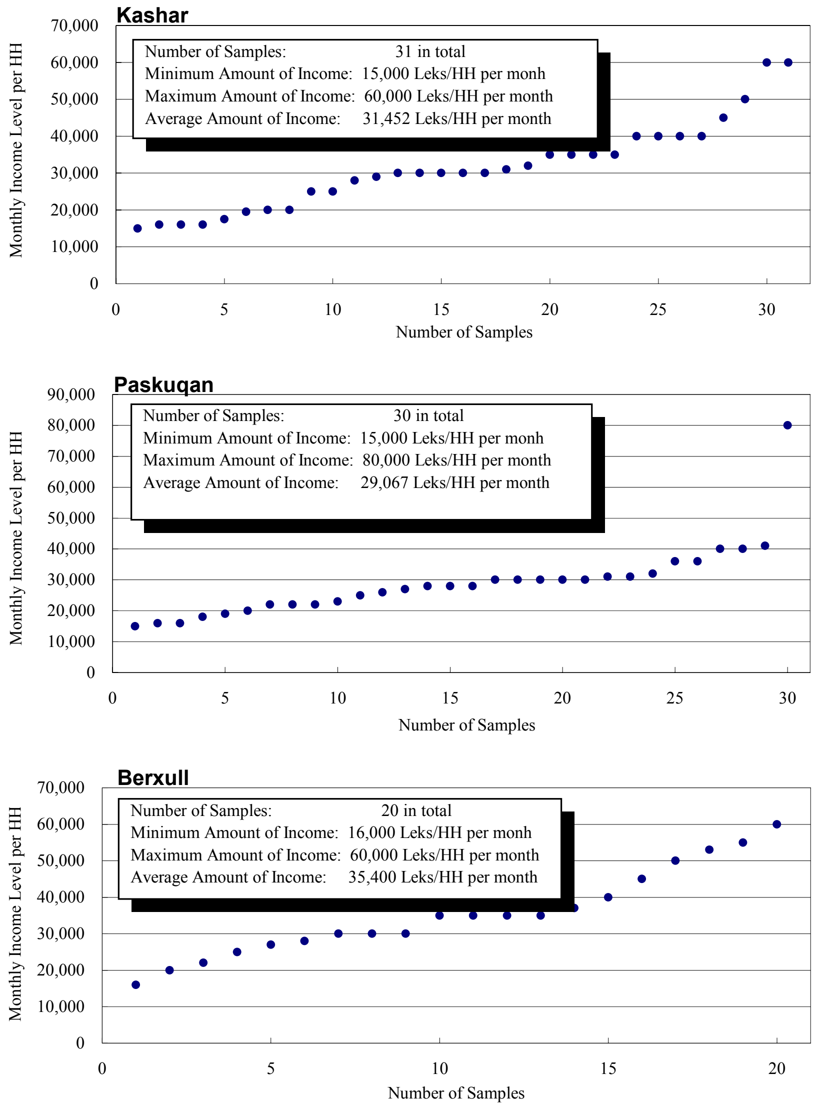
The Pan American Health Organization (PAHO) recommends that the affordability of people to pay for water supply and sewerage services is 5 % of the total HH income. Of this, 3.5 % is for water supply and 1.5 % is for sewerage services. Leading institutions (e.g. World Bank-IBRD, the World Bank-WSP (the Water and Sanitation Program), the EPA (the Environment Protection Agency, US), and the ADB (the Asian Development Bank)) still debate the most appropriate rate. The rate for sewerage service being debated range between 0.75 % and 2 %.

The current average bill (average annual charge collected per customer) in Tirana municipality is Leks 1,048/bill and in Kamza municipality it is Leks 167/bill.

The present tariff level is compared by an average income level for the respective municipality and commune. The average income level was set based on the results of the "Public Awareness Survey", indicated that the average monthly income per household was: Leks 38,797/month per HH in Tirana (annual income: Leks 465,564/HH), Leks 35,020/month per HH in Kamza (Leks 420,240), Leks 31,452/month per HH in Kashar (Leks 377,419), Leks 29,067/month per HH in Paskuqan (Leks 348,800) and Leks 35,400/month per HH in Berxulle (Leks 424,800). *Figure 11.7.3* summarizes these results.







Sourse: Public Awareness Survey made by JICA Study Team, January 2006.

Figure 11.7.3 Average Income Level for Each Municipality and Commune

The income levels shown in the above figure are consistent with those reported by the UNDP[3]. The UNDP reports the average monthly incomes to be: Tirana 42,245 Leks/HH; Berxulle 32,562 Leks/HH; Kamza 33,955 Leks/HH; Kashar 35,391 and Paskuqan 34,200/HH. The figures obtained from the Public Awareness Survey are lower than those reported by the UNDP, and will be used to estimate people's affordability to pay for sewerage services.

Table 11.7.8 indicates that the current sewerage tariff payment is low when compared with average income.

The JICA study team recommends that the tariff level for the sewerage services should be 1 % of the average household income. This is based on consideration of the above range of rates being debated and the current economic situation in Tirana. The affordability to pay level was used as a

[3] "Millennium Development Goals - Global Target – Local Approaches – Tirana Regional Report" UNDP Albania

benchmark to set the tariff level. A tariff revision schedule is recommended to ensure that the proposed tariff level can be reached by the target year of 2022.

Table 11.7.8 shows the calculations used to determine the average tariff level of sewerage charge to Household for each stage, based on the affordability to pay.

Table 11.7.8 Annual Revision Schedule for Tariff Level on Sewerage Service Charge Based on the Affordability of People to Pay

		Annual Revised Schedule of Tariff Level Based on the Affordability of People to Pay														
		Tirana			Kamza			Kashar			Paskuqan			Berxulle		
Year	Annual Growth Rates of Income per House- hold	Estimated Annual Average Income Level (Leks/HH)	Tariff Level per Year	Share Rate to Annual Income per HH	Estimated Annual Average Income Level (Leks/HH)	Tariff Level per Year	Share Rate to Annual Income per HH	Estimated Annual Average Income Level (Leks/HH)	Tariff Level per Year	Share Rate to Annual Income per HH	Estimated Annual Average Income Level (Leks/HH)	Tariff Level per Year	Share Rate to Annual Income per HH	Estimated Annual Average Income Level (Leks/HH)	Tariff Level per Year	Share Rate to Annual Income per HH
2005	5.43%	465,564	1,048	0.23%	420,240	167	0.04%	377,419	0	0.00%	348,800	0	0.00%	424,800	0	0.00%
2006	5.15%	489,535	1,048	0.21%	441,877	2,000	0.45%	396,851	0	0.00%	366,759	0	0.00%	446,672	0	0.00%
2007	4.89%	513,493	1,048	0.20%	463,503	2,000	0.43%	416,274	0	0.00%	384,708	0	0.00%	468,532	0	0.00%
2008	4.66%	537,439	1,048	0.19%	485,118	2,000	0.41%	435,686	0	0.00%	402,649	0	0.00%	490,382	0	0.00%
2009	4.45%	561,374	1,048	0.19%	506,722	2,000	0.39%	455,089	0	0.00%	420,580	0	0.00%	512,221	0	0.00%
2010	4.26%	585,297	1,048	0.18%	528,316	2,000	0.38%	474,483	0	0.00%	438,503	0	0.00%	534,049	0	0.00%
2011	4.09%	609,207	1,048	0.17%	549,899	2,000	0.36%	493,867	0	0.00%	456,417	0	0.00%	555,866	0	0.00%
2012	3.92%	633,106	1,048	0.17%	571,471	2,000	0.35%	513,241	0	0.00%	474,322	0	0.00%	577,672	0	0.00%
2013	3.77%	656,993	1,048	0.16%	593,033	2,000	0.34%	532,605	0	0.00%	492,218	0	0.00%	599,467	0	0.00%
2014	3.63%	680,868	4,267	0.63%	593,033	3,849	0.65%	551,960	2,922	0.53%	510,105	2,701	0.53%	621,252	0	0.00%
2015	3.50%	704,731	4,267	0.61%	636,123	3,849	0.61%	571,305	2,922	0.51%	527,984	2,701	0.51%	643,026	0	0.00%
2016	3.38%	728,583	4,267	0.59%	657,653	3,849	0.59%	590,641	2,922	0.49%	545,853	2,701	0.49%	664,789	0	0.00%
2017	3.27%	752,422	4,267	0.57%	679,171	3,849	0.57%	609,967	2,922	0.48%	563,714	2,701	0.48%	686,541	0	0.00%
2018	3.17%	776,250	6,314	0.81%	700,679	5,426	0.77%	629,283	4,812	0.76%	581,565	4,447	0.76%	708,282	0	0.00%
2019	3.07%	800,066	6,314	0.79%	722,177	5,426	0.75%	648,590	4,812	0.74%	599,408	4,447	0.74%	730,013	0	0.00%
2020	2.98%	823,870	6,314	0.77%	743,664	5,426	0.73%	667,887	4,812	0.72%	617,242	4,447	0.72%	751,733	0	0.00%
2021	2.89%	847,663	6,314	0.74%	765,140	5,426	0.71%	687,175	4,812	0.70%	635,067	4,447	0.70%	773,442	0	0.00%
2022	2.81%	871,443	8,714	1.00%	786,605	7,866	1.00%	706,453	7,065	1.00%	652,884	6,529	1.00%	795,141	7,951	1.00%

The future income level was estimated based on wage and salary growth trends in Albania. *Table 11.7.9* and *Figure 11.7.4* show the annual growth rates of real wage and salary since 1998.

Table 11.7.9 Real Wage and Salary Growth in Albania

1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
26.40	24.40	19.60	-16.90	-0.17	9.90	17.70	11.60	8.10	6.00	11.20

Source: INSTAT

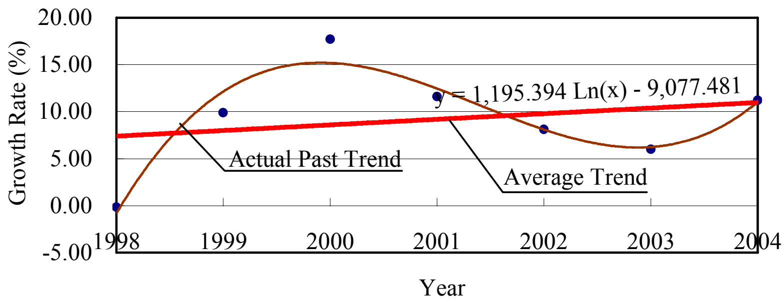


Figure 11.7.4 Real Wage and Salary Growth Trends

For commercial organizations (such as offices, shops, hotels, restaurants and small factories) a tariff of Leks 7,339/annum per organization are applied.

2) Connection Fee

In addition to the above base tariff, a Connection Fee, for the newly constructed sewerage facilities should be levied. This will apply to households once the charge equivalent to the average monthly income per customer. *Table 11.7.10* shows the connection fees to the household. It will apply for commercials at the rate of Leks 200,000 per customer. This charge will apply to new customer as well as the customers living in Tirana municipality who have already connected to the existing sewer network. The first financial benefit will be realized in 2014 after the completion of the first stage project.

Table11.7.10 Connection Fee for the Household

Year	Average Annual Growth Rates of Income per Household	Annual Revised Schedule of Tariff Level Based on the Affordability of People to Pay									
		Tirana		Kamza		Kashar		Paskuqan		Berxull	
		Estimated Annual Average Income Level (Leks/HH)	Estimated Monthly Average Income Level (Leks/HH)	Estimated Annual Average Income Level (Leks/HH)	Estimated Monthly Average Income Level (Leks/HH)	Estimated Annual Average Income Level (Leks/HH)	Estimated Monthly Average Income Level (Leks/HH)	Estimated Annual Average Income Level (Leks/HH)	Estimated Monthly Average Income Level (Leks/HH)	Estimated Annual Average Income Level (Leks/HH)	Estimated Monthly Average Income Level (Leks/HH)
2005	5.43%	465,564	38,797	420,240	35,020	377,419	31,452	348,800	29,067	424,800	35,400
2006	5.15%	489,535	40,795	441,877	36,823	396,851	33,071	366,759	30,563	446,672	37,223
2007	4.89%	513,493	42,791	463,503	38,625	416,274	34,689	384,708	32,059	468,532	39,044
2008	4.66%	537,439	44,787	485,118	40,426	435,686	36,307	402,649	33,554	490,382	40,865
2009	4.45%	561,374	46,781	506,722	42,227	455,089	37,924	420,580	35,048	512,221	42,685
2010	4.26%	585,297	48,775	528,316	44,026	474,483	39,540	438,503	36,542	534,049	44,504
2011	4.09%	609,207	50,767	549,899	45,825	493,867	41,156	456,417	38,035	555,866	46,322
2012	3.92%	633,106	52,759	571,471	47,623	513,241	42,770	474,322	39,527	577,672	48,139
2013	3.77%	656,993	54,749	593,033	49,419	532,605	44,384	492,218	41,018	599,467	49,956
2014	3.63%	680,868	56,739	614,583	51,215	551,960	45,997	510,105	42,509	621,252	51,771
2015	3.50%	704,731	58,728	636,123	53,010	571,305	47,609	527,984	43,999	643,026	53,585
2016	3.38%	728,583	60,715	657,653	54,804	590,641	49,220	545,853	45,488	664,789	55,399
2017	3.27%	752,422	62,702	679,171	56,598	609,967	50,831	563,714	46,976	686,541	57,212
2018	3.17%	776,250	64,688	700,679	58,390	629,283	52,440	581,565	48,464	708,282	59,024
2019	3.07%	800,066	66,672	722,177	60,181	648,590	54,049	599,408	49,951	730,013	60,834
2020	2.98%	823,870	68,656	743,664	61,972	667,887	55,657	617,242	51,437	751,733	62,644
2021	2.89%	847,663	70,639	765,140	63,762	687,175	57,265	635,067	52,922	773,442	64,454
2022	2.81%	871,443	72,620	786,605	65,550	706,453	58,871	652,884	54,407	795,141	66,262

3) Connection rate and Collection rate

The expected revenue from collecting sewerage service charges was estimated using the assumptions listed in *Table 11.7.11*:

Table 11.7.11 Assumptions on Connection Rate and Charge Collection Rate

Description	Current	As of 2022
Connection Rate		
Tirana Municipality	56.20%	90.00%
Kamza Municipality	30.00%	75.00%
Other Communes	0.00%	50.00%
Charge Collection Rate against Bills Sent		
Tirana Municipality	80.85%	95.00%
Kamza Municipality	67.14%	90.00%
Other Communes	0.00%	85.00%

4) Financial Benefit

These tariff settings and assumptions result in the following financial benefit:

Table 11.7.12 Expected Annual Financial Benefit for M/P (Unit: Million Leks)

A. Sewerge Charge

Year	Sewerage Charge for Customers Connected with Kashar STP: Tirana HHs	Tirana Offices, etc.	Kashar HHs	Paskuqan HHs	Sewerage Charge for Customers Connected with Berxulle STP: Kamza HHs	Kashar HHs	Berxulle HHs	Total
2014	235	143	1					378
2015	246	149	1					396
2016	258	156	1					414
2017	270	162	1					433
2018	864	349	9	22				1,243
2019	904	363	10	26				1,303
2020	946	376	12	31				1,365
2021	989	390	14	36				1,429
2022	1,425	403	23	62	183	5	29	2,129

B. Connection Charge

Year	Tirana HHs	Tirana Offices, etc.	Kashar HHs	Paskuqan HHs	Kamza HHs	Kashar HHs	Berxulle HHs	Total
2014	3,121	3,887	10					7,018
2015	156	180	3					339
2016	166	177	3					346
2017	176	175	4					355
2018	4,761	5,087	74	240				10,163
2019	428	373	17	48				867
2020	453	370	20	55				898
2021	479	367	22	63				931
2022	506	365	25	71	1,525	41	241	2,774

C. Total

Year	Tirana HHs	Tirana Offices, etc.	Kashar HHs	Paskuqan HHs	Kamza HHs	Kashar HHs	Berxulle HHs	Grand Total
2014	3,356	4,030	11	0	0	0	0	7,395
2015	402	329	4	0	0	0	0	735
2016	424	333	4	0	0	0	0	761
2017	446	337	5	0	0	0	0	788
2018	5,625	5,436	83	262	0	0	0	11,406
2019	1,332	736	27	74	0	0	0	2,170
2020	1,399	746	32	86	0	0	0	2,263
2021	1,468	757	36	99	0	0	0	2,360
2022	1,931	768	48	133	1,708	46	270	4,905

(2) Financial Cost

Financial cost it’s the O&M cost have already been discussed.

(3) Financial Evaluation

It is assumed that the project life will be 35 years. The financial evaluation was made using cash flows based on defined benefits and costs[4]. The results are summarized in *Table 11.7.13*:

Table 11.7.13 Result of Financial Evaluation for M/P

NPV	FIRR	B/C
-664 Million Leks	9.06 %	0.95

As shown above, the FIRR for M/P is 9.06 %. This is slightly lower than the applied discount rate of 10 %. Therefore, M/P seems financially viable.

(4) Sensitivity Analysis

The FIRR varies depending on the construction cost and the project benefit. The Sensitivity Test for Plan M/P has been conducted and the results are presented below:

Table 11.7.14 Result of Financial Sensitivity Test for M/P

Cost	Benefit						
	+ 30 %	+ 20 %	+ 10 %	Base Case	- 10 %	- 20 %	- 30 %
+ 30 %	9.06%	7.64%	6.18%	4.65%	3.03%	1.25%	-0.80%
+ 20 %	10.54%	9.06%	7.52%	5.93%	4.26%	2.46%	0.44%
+ 10 %	12.25%	10.68%	9.06%	7.38%	5.63%	3.78%	1.76%
Base Case	14.22%	12.56%	10.84%	**9.06%**	7.21%	5.27%	3.20%
- 10 %	16.53%	14.77%	12.93%	11.03%	9.06%	7.00%	4.83%
- 20 %	19.27%	17.39%	15.44%	13.40%	11.27%	9.06%	6.73%
- 30 %	22.54%	20.56%	18.47%	16.28%	13.99%	11.58%	9.06%

These results show that the FIRR is negative for the case which cost reduced by 30% and benefit reduced by 30%. When the benefit is reduced by 30%, the FIRR is 3.20%. When the benefit is reduced by 20% and the cost is increased by 10%, the FIRR is 3.78%. These results are below the benchmark rate of 5%.

When the benefit is reduced by 20%, the FIRR is 5.27%. When the benefit is reduced by 10 % and the cost increased by 10%, the FIRR is 5.63%. Both of these results are above the benchmark rate of 5%[5]. The FIRR of M/P is within the defined rate boundaries and is therefore deemed to be socially responsible.

Figure 11.7.5 illustrates the project's financial sensitivity.

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[4] Details are shown in Appendix 12.11.3 in Appendix 12 of Volume III "Supporting Report" of the report.

[5] William A. Ward and Barry J. Deren with Emannuel H. D'Silva, 1991 "The Economics of Project Analysis –A Practitioner's Guide –" EDI Technical Materials, the World Bank.

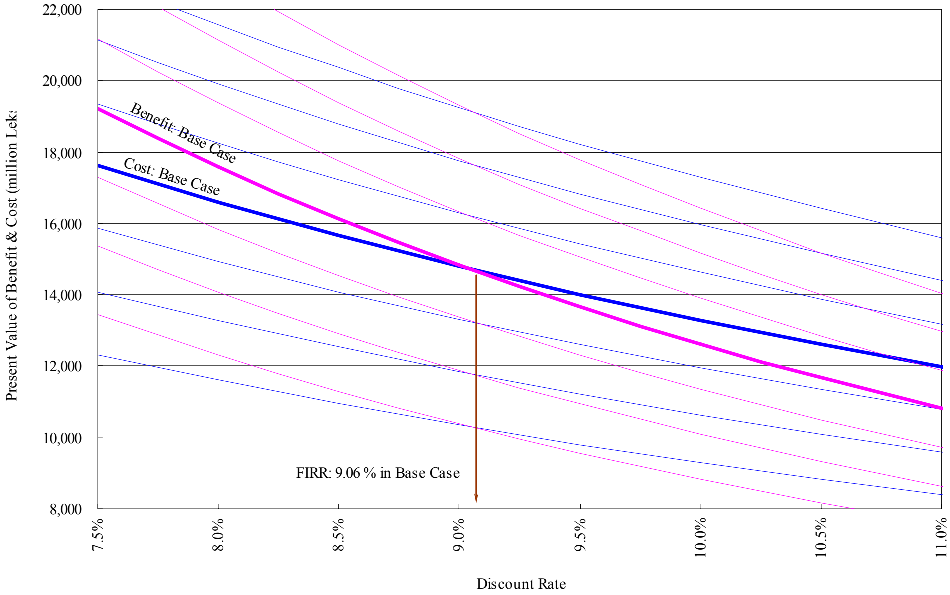

Figure 11.7.5 Financial Sensitivity of the Project

CHAPTER 12

ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

CHAPTER 12 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

12.1 Purpose and Level of Environmental and Social Consideration

12.1.1 Purpose

The purpose of the Environmental and Social Considerations is to ensure that development options under consideration are environmentally and socially sound and sustainable and that the environmental consequences of the project are recognized early and taken into account in the project design. The procedures should follow the Albanian Laws and JICA's Guidelines for Environmental and Social Considerations are also taken into account.

The JICA Study Team is assisting DPUK to consider the environmental and social aspects of the proposed sewerage projects. The role of the JICA Study Team is to:

- help DPUK implement the proper environmental and social considerations;
- prepare an effective sewerage M/P and to select Priority Projects which will not cause significant negative environmental or social impacts;
- assist DPUK consult with stakeholders to generate support for the proposed sewerage projects; and
- ensure the positive information disclosure for accountability and promotion of participation of various stakeholders.

12.1.2 Basic Approaches

The Study Team has assisted the DPUK to implement the proper environmental and social considerations including IEE in M/P stage, environmental and social consideration study at EIA level in F/S stage, and four times stakeholder meetings in accordance with JICA's Guidelines for environmental and social considerations. In the Basic Study and M/P formulation, the Study Team had assisted DPUK to implement the IEE. Throughout the Study, the Study Team had assisted the DPUK with public consultations including informing the public of key issues at each stage of the Study.

12.1.3 Level of Consideration Required by JICA

The preparatory study, which was conducted by JICA in 2005 (prior to this current study), concluded that the proposed sewerage plan was categorized as requiring a "B" level[1] of environmental and social consideration, as defined in the JICA Guidelines for Environmental and Social Considerations. This level of consideration is required because the proposed sewerage facilities could cause some negative environmental and social impacts in terms of land acquisition, hydrological impacts, water pollution and generation of offensive odor.

[1] Based on the JICA Guidelines, the proposed projects are classified into one of three categories: "A", "B" or "C". The project classified as Category "A" is likely to have significant adverse impacts, and the project classified as Category "B" is likely to have less adverse impacts than those of Category "A" project. The project classified as Category "C" is likely to have minimal or no adverse impacts.

12.2 Legal Framework for Environmental and Social Considerations

12.2.1 Law on Environmental Protection

The Law on Environmental Protection, approved in 1993 (amended in 1998 and 2002), is Albania's law that defines the general principles and procedures for environmental management. The Law establishes national and local policies on environmental protection, stipulates requirements for the preparation of environmental impact assessments and strategic environmental assessments, conditions for approving activities that affect the environment, prevention and reduction of environmental pollution, environmental norms and standards, environmental monitoring and controls, duties of the state bodies in relation to environmental issues, role of the public, and penalties that can be imposed for violation of the Law. The Law on Environmental Protection provides for:

- rational use of the environment, reduction of discharges into and pollution of the environment, and the prevention of and where necessary rehabilitation and restoration of environmental damage;
- improvement of environmental conditions related to quality of life and protection of public health;
- preservation and maintenance of natural resources, both renewable and non-renewable, and rational and efficient management to ensure regeneration;
- coordination of state activities to meet environmental protection requirements;
- international cooperation in the field of environmental protection;
- promotion of public participation in environmental protection activities;
- coordination of the economic and social development of the country with the requirements of environmental protection and sustainable development; and
- Establishment and strengthening of the institutional system of environmental protection at the national and local level.

According to the Law all activities that affect the environment should be subject to an Environmental Impact Assessment (EIA) and licensing system. These requirements are further developed in the specific law On Impact Assessment on Environment (the Law on EIA) passed in 2003.

12.2.2 Law on Impact Assessment on Environment (Law on EIA)

Environmental impact assessment (EIA) was introduced in Albania for the first time, when the Law "On Environmental Protection", No. 7664 of January 21, 1993 was passed. The Law establishes the EIA process but does not specify a clear EIA procedure to be followed.

A Law on Environmental Impact Assessment, No. 8990, was passed on 23 January 2003, and requires assessment of environmental impacts for future projects or activities. The aim is to prevent negative environmental impacts. The Law requires the participation of central and local institutions, civil society, NGOs, etc. The Law on EIA defines the rules, procedures and deadlines for identifying and assessing the direct or indirect impacts of projects or activities on the environment, and establishes the steps necessary to implement EIA procedures. The Ministry of Environment, Forest and Water Management (MoEFWM) is the government authority responsible for requesting, reviewing and approving EIA documentation.

A simplified flowchart of the EIA process in Albania is provided in *Figure 12.2.1*.

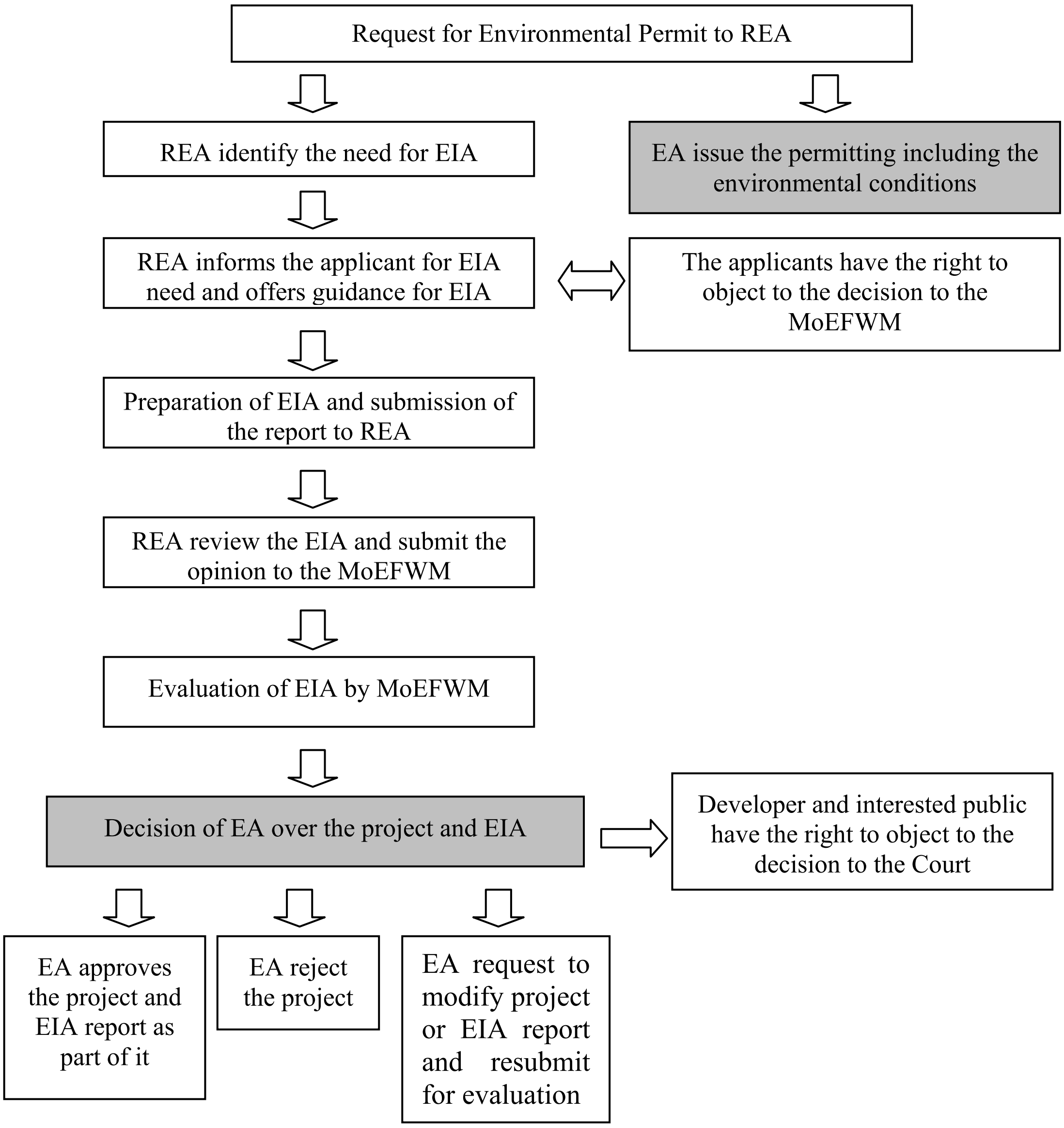

Figure 12.2.1 Flowchart of EIA Process in Albania

Depending on the type activity, projects undergo one of the following two levels of assessment:

- Profound (advance) process of environmental impact assessment; or
- Summary (outlined) process of environmental impact assessment.

Under the regulations (Law No. 8990 on Environmental Impact Assessment, Appendix 1), a waste water treatment plant with a capacity greater than 150,000 equivalent inhabitants must be assessed using a "Profound (advanced) process of impact assessment". The EIA report must be prepared by licensed natural and juridical persons, selected, contracted and paid for by the applicant.

According to the Law on EIA, the EIA report must include:

- Project objective;
- Detailed description of the objective;
- Data on present environment of the area and in the vicinity where the project is implemented;
- Detailed description of all construction to be undertaken as part of the project or during the implementation of the project;
- Construction plan and implementation deadlines;
- Description of construction and augmentation to be undertaken;
- Potential environmental impacts and proposed measures to prevent or mitigate those impacts;
- Environmental impact monitoring program;
- Compliance with the territory adjustment plan and the economic development plan for the area where the project will be implemented;
- Summary of stakeholder consultation undertaken with local government organizations, the general public, and environmental NGOs;
- Description of measures to mitigate pollution and environmental damage including the associated costs;
- A copy of the licence proving the person preparing the report is appropriately qualified in the field of environmental management or judiciary;
- Procedures and reasons for site selection, including at least two alternative locations that were considered;
- The direct and indirect level of impact of the project on the environment;
- Potential impacts of the project options on the environment and public health;
- Description of risks of accidents with could have significant impact on public health or the environment, including measures to prevent these;
- Description of any cross-border environmental impacts;
- Description of technical measures planned to prevent or mitigate negative impacts on the environment;
- Detailed description of the sustainable use of energy, natural and mining resources; and
- A plan outlining the potential liaison required with local government organizations, the general public and environmental not for profit organizations during the planning, review and implementation phases of the project.

Table 12.2.1 outlines the EIA procedure required in Albania.

Table 12.2.1 EIA Procedures of Albania

Procedure	Description
1) Project Planning	Determination of the level of EIA required based on a review of the Law and consultation with MoEFWM. The EIA will either be undertaken at the "Profound" level or or "Summary" level.
2) Preparation and Submission of the EIA Report	Reports must be prepared by licensed natural and juridical persons. Profound reports must contain the items listed in the box below.
3) Initial Review, Inspection and Opinion by the Regional Environmental Agency (REA)	<Within 5 days> The REA shall conduct the initial review. Finalisation of the EIA level for the project. <Within 20 days> Approval / refusal and opionion by REA to be forwarded to the MoEFWM.
4) Review by the MoEFWM	A review by the MoEFWM shall be conducted within three months. The following procedure must be followed for profound EIAs: 1) Establishment of a commission 2) Consultation with Interested Parties (central government organisations, urban and tourism development organisations, local government organsiations, and specialist environmental institutions) 3) Public comment to be coordinated by the government organisations (central and local government organisations), specialized institutions, interested people, environmental NPO and the applicant - The stakeholders will be given one month to review the EIA report - The stakeholders must be notified at least ten days prior to the public exhibition
5) Decision – making and Notice / Appeal of Decision	- Within five days from receiving the commission report, the MoEFWM must announce their decision regarding approval of the development: environmental declaration or permit. - The decision shall be published and shall be delivered to the applicant, state and local organisations - The proponent may appeal the decision within 30 days of its announcement

12.2.3 Expropriation of Private Property

The Law 8561, dated 22.12.1999, "On Expropriations and Temporary Takings of Private Property for a Public Interest" and four Council of Ministers decisions (No. 126 "Composition and Procedures of the Special Committees for Expropriation", No. 127 "On the Content and Procedures for the Submission of the Requests and Notifications for Expropriation and Temporary Utilization of private Property for the Public Interest", No. 138 "On Technical Criteria for Evaluation and Calculation of Compensation for Expropriated Private Property, Devalued Properties and Third Party Rights", No. 147 "On Functioning Rules and modalities for Special Committees for Expropriation") define the procedures for expropriation of property in Albania. The expropriation of private property can only occur in the interest of the public and with fair compensation. In general, expropriation can occur for public projects, for national investment, and for security reasons.

The Valuation Commission is responsible for valuing property. The valuation is determined by averaging the recent prices for purchases and sales registered in the Immovable Property Registration System. Property owners receive either cash compensation or alternative land equivalent. Compensation is provided to the market value of the land being expropriated. If the property owner prefers land compensation they will be provided with land that is equivalent or better than the land being expropriated. If land compensation is not the preferred option, cash compensation can be offered. The compensation amount must be sufficient to replace the land being surrendered and any other assets being lost, as well as moving and other related expenses.

12.3 Public Consultation

12.3.1 Objectives

Public consultation was incorporated into this project at an early stage. This was done in accordance with the new "JICA Guidelines for Environmental and Social Considerations", and Albanian Regulation Nr.1, dated 17.08.2004 on "Public Participation of EIA Process."

The objective of the JICA Guidelines is to encourage the recipient governments to give appropriate consideration to environmental and social impacts. The basic principles for the environmental and social considerations (assessment) are:

- Cover a wide range of environmental and social impacts;
- Ensure accountability and transparency of decision-making;
- Ensure a wide range of meaningful participation of stakeholders;
- Disclose information; and
- Enhance organizational capacity.

The intent of the Albanian Regulations Nr. 1, dated 17.08.2004 is to guarantee public participation in the process of evaluating environmental impacts (based on the new environmental legislation requirements; the Convent of AARHUS[2]; and the respective directives form the European Union (EU)).

Public consultation was undertaken based on the guidelines and regulation.

12.3.2 Public Consultation Process

Stakeholder consultation is required to help generate support for the study. Four stakeholder meetings have been held during the study period. These consultations have been scheduled for each key stage of the study. *Figure 12.3.1* shows the timeline for these public consultation sessions.

[2] The AARHUS Convention on regarding access to information, public participation in decision-making, and access to justice in environmental matters was signed by the Ministries of Environment of EU member states in Aarhus, Denmark, on 25 June 1998. Albania ratified the AARHUS Convention on 27 June 2001.

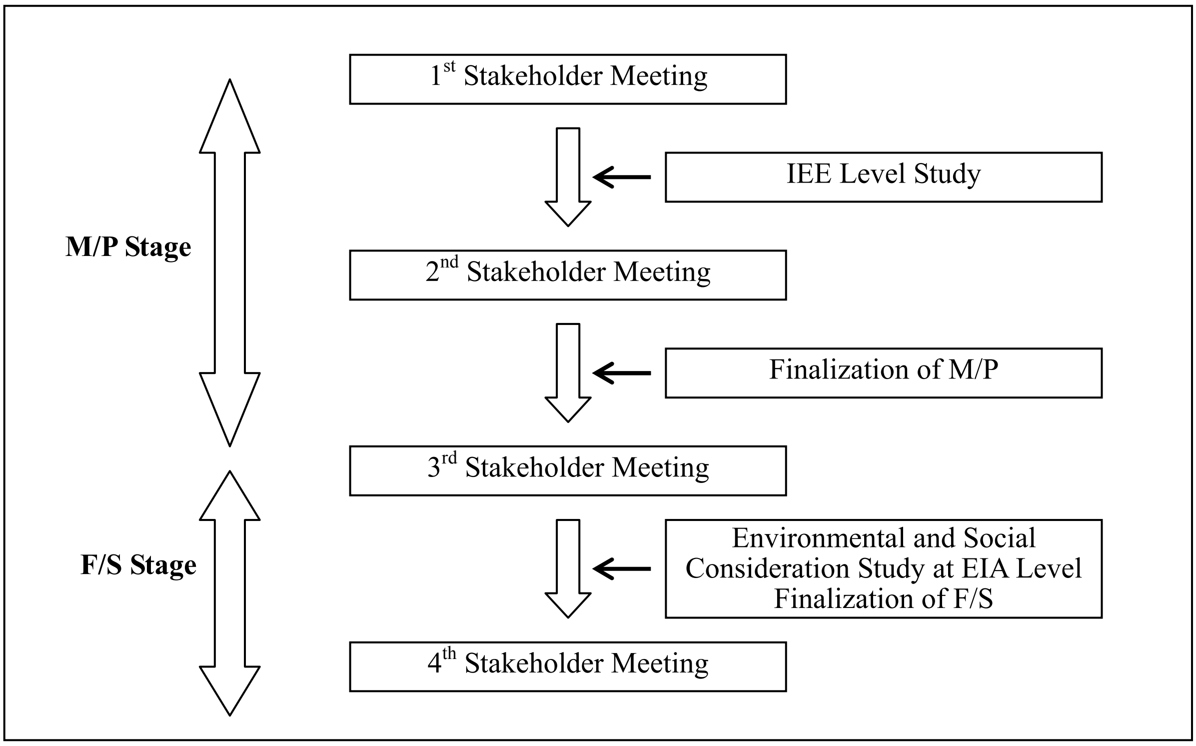

Figure 12.3.1 Timeline for Public Consultation Sessions

Table 12.3.1 shows the schedule for the stakeholder consultation meetings.

Table 12.3.1 Schedule for the Stakeholder Consultation Meetings

Stakeholder Meeting	Agenda	Timing
1st	- Explanation of JICA study - JICA Guidelines for Environmental and Social Considerations - Plan for Public Consultation Sessions, Scope of IEE	4 November 2005
2nd	- Progress of the study - Description of the Proposed Sewerage System - Result of IEE	7 December 2005
3rd	- Overview of the M/P - Description of the Priority Projects selected in M/P - Scope of Environmental and Social Consideration Study at EIA Level	24 February 2006
4th	- Explanation of Priority Projects - Presentation of results from the Environmental and Social Consideration Study at EIA Level - Presentation of results and recommendations of the JICA study	July 2006

12.3.3 Stakeholder Selection

According to the Albanian Regulation, "Public" is defined as the general public, interested public, influenced public, local community, national or local environmental non-profit organizations, and other organizations from civil society. The stakeholders were selected by DPUK in collaboration with the

JICA Study Team. The stakeholders are categorized as follows:

- People in the study area or people who will be affected by the proposed projects;
- Responsible ministries and relevant government agencies;
- Local governments such as municipalities, communes, and councils in the study area;
- International organizations and donors;
- Non-government organizations;
- Universities and research institutes; and
- Private sector organizations.

The individual stakeholders involved in each stage of consultation were reviewed based on their roles and responsibilities to ensure the appropriate stakeholders were consulted on relevant issues.

12.3.4 Stakeholder Meetings

(1) First Stakeholder Meeting

The first stakeholder meeting was organized by DPUK, MoPWTT. It was held on 4 November 2005 at the Cultural Center of the Armed Forces. The aim of the meeting was to inform stakeholders about the JICA study, to explain the JICA Guidelines for Environmental and Social Considerations, scope the level of the IEE study, and to consult with the public.

1) Participants

The stakeholders were selected by DPUK in collaboration with the JICA Study Team. Invitation letters were sent to the invitees directly by DPUK. At the time of this meeting the contents of the M/P were not yet finalized, therefore it was difficult to identify who might be affected by the project. The main objective of this meeting was to inform the pubic about the JICA study and to explain the guidelines. Therefore, the participants at this meeting were the mayor / vice mayor of each municipality and commune.

Table 12.3.2 lists the number of participants in each stakeholder category.

Table 12.3.2 Participants in the First Stakeholder Meeting

Category of Participants	Number
Ministries, relevant government agencies (MPWTT, Min. of Environment, DPUK etc.)	9
Representative from municipalities, communes	3
UKT, UKK	2
Universities, Institute	3
NGOs	3
International Organizations, Donors	1
JICA	1
JICA Study Team	4
Total	**26**

2) Program

The meeting was mainly conducted in Albanian. An English-Albanian translation was provided as necessary. The handout material was also provided in Albanian. *Table 12.3.3* presents the program of the first stakeholder meeting.

Table 12.3.3 Program of the First Stakeholder Meeting

10:00 – 10:10	Opening remarks (Mr. Donard Strazimiri, General Director, DPUK)
10:10 – 10:20	Presentation I: Overview of the JICA Study (Mr. Petrit Koçi, DPUK)
10:20 – 10:40	Presentation II: Explanation of the JICA Guidelines for Environmental and Social Considerations (Mr. H. Uchida, Team Leader, JICA Study Team)
10:40 – 11:00	Coffee Break
11:00 – 11:20	Presentation III: Public Consultation Plan and Scoping of the IEE (Ms. S. Yamada, Environmental and Social Consideration, JICA Study Team)
11:20 – 12:20	Questions and Answers
12:20 – 12:25	Closing Remarks (Mr. Donard Strazimiri, General Director, DPUK)

3) Main Topics Discussed

The main topics discussed in the meeting are summarized as below:

- This project should be based on the Albanian Environmental Standards as well as the EU Environmental Standards. The JICA Guidelines should be reviewed and adapted to Albania's conditions. The impact assessment should be carried out in accordance with Albanian Legislation. Assistance with the Social Impact Assessment was sought during this meeting.
    - The study must consider the Albanian Standards as a priority, and then the EU standards. Other international standards, including the Japanese standards should also be considered. Since this is a JICA study the JICA Guidelines were explained during the presentation. However the emphasis and time spent on explaining these guidelines seemed to confuse some of the participants.
- Concern was expressed that the target year of 2022 is a relatively short-term planning timeframe. It was suggested that the facilities should be designed for a later target date.
    - The target design year was initially forecast by the World Bank to be 2017. This was considered to be too soon, therefore the target year was postponed to 2022. This is the same target year as for the Water Supply Plan. The target year cannot be extended beyond this because the sewerage and water supply systems are closely related.
- Participants asked if the final report would make specific recommendations regarding changes to institutional structures in the wastewater service. Participants also asked if JICA would require the suggested structures to be in place before further funding is provided.
    - The ownership of the project and its longer term sustainability in terms of operation and maintenance is an important issue for this project. This is particularly important because it affects the financial viability of the project, which will be especially relevant during the second phase of the study. This matter will be further discussed with the Albanian counterparts and the study team will then make a recommendation.

(2) Second Stakeholder Meeting

The second stakeholder meeting was organized by DPUK, MPWTT, and was held on 7 December 2005 at the Tirana International Hotel. The purpose of the meeting was to provide an update on the progress of the JICA study, outline the proposed sewerage system, present the results of the IEE level study, and to consult with the public.

1) Participants

The stakeholders were selected by DPUK in collaboration with the JICA Study Team. The invitation letters were sent to the invitees directly by DPUK. By the time this meeting was held the location of the sewerage facilities had been identified, therefore the area that may be affected by this project could be specified. Therefore, in addition to the mayor of each municipality and commune, the head of the village where the facilities are proposed to be constructed and the member of city / commune council were invited to the meeting to represent the affected people.

Table 12.3.4 shows the types of participants at this meeting.

Table 12.3.4 Participants of the Second Stakeholder Meeting

Category of Participants	Number
Ministries, relevant government agencies (MPWTT, Min. of Environment, DPUK etc.)	8
Representative of municipalities, communes	8
UKT, UKK	2
Universities, Institutes	2
NGO	1
International Organizations, Donors	3
JICA Study Team	5
Total	**29**

2) Program

The meeting was conducted in Albanian and an English-Albanian translation was provided as necessary. The handout material was provided in Albanian. *Table 12.3.5* shows the program of the second stakeholder meeting.

Table 12.3.5 Program of the Second Stakeholder Meeting

10:05 – 10:10	Opening remarks (Mr. Fahri Maho, General Director, DPUK)
10:10 – 10:25	Presentation I: Progress of the JICA study (Mr. Petrit Koçi, DPUK)
10:25 – 11:00	Presentation II: Overview of the Proposed Sewerage System (Mr. H. Uchida, Team Leader, JICA Study Team)
11:00 – 11:15	Presentation III: Explanation of the results of the IEE (Ms. S. Yamada, Environmental and Social Consideration, JICA Study Team)
11:15 – 11:30	Coffee Break
11:30 – 12:50	Questions and Answers
12:50– 12:55	Closing Remarks (Mr. Fahri Maho, General Director, DPUK)

3) Main topics discussed

- A large amount of land is required for the construction of the treatment plants. Therefore the location needs to be carefully selected.

- The design for Alternative B requires 102 ha of land for the construction of the plants. This large area means the project costs are lower, suitable technology can be installed and O&M costs will be reduced. The location of the STP will be decided in consultation with each commune and municipality.

- Participants asked for information regarding the level of impact on odor and groundwater pollution resulting from this project.
  - The amount of odor generated depends on the odor characteristics, season, terrain, and wind characteristics (strength, direction etc). The next stage of the study includes further investigation of these issues. If impacts are expected, mitigation measures will be considered.
  - No groundwater contamination is expected to occur.
- Lack of sewage treatment is a significant problem for Tirana area. The participants are keen for this problem to be addressed. Concern was expressed that the areas of Kashari-Berxulle and Vora appropriate area for construction of STP.
  - Two STPs sewerage system is proposed as the best solution to this sewage problem, taken into account financial aspects and possible early start of sewage treatment.

(3) Third Stakeholder Meeting

The third stakeholder meeting was organized by DPUK, MPWTT, and was held on 24 February 2006 at the Tirana International Hotel. The purpose of the meeting was to provide an update on the progress of JICA study, to provide an overview of the M/P, identify the priority projects selected in the M/P, scope the works for the environmental and social consideration study at EIA Level, and to consult with the public.

1) Participants

The stakeholders were selected by DPUK in collaboration with the JICA Study Team. Invitation letters were sent to the participants directly by DPUK. *Table 12.3.6* shows the number of participants in each stakeholder category.

Table 12.3.6 Participants of the Third Stakeholder Meeting

Category of Participants	Number
Ministries, relevant government agencies (MPWTT, Min. of Environment, DPUK etc.)	11
Representative of municipalities, communes	8
UKT, UKK	3
Universities, Institutes	11
NGOs	4
International Organizations, Donors	4
JICA	1
Media	2
Other	1
JICA Study Team	6
Total	**51**

2) Program

The meeting was conducted in Albanian and an English-Albanian translation was provided as necessary. The handout material was provided in Albanian. *Table 12.3.7* shows the program of the third stakeholder meeting.

Table 12.3.7 Program of the Third Stakeholder Meeting

10:00 – 10:05	Opening remarks (Mr. Fahri Maho, General Director, DPUK)
10:05 – 10:15	Presentation I:Overview of JICA Study (Mr. Petrit Koçi, DPUK)
10:15 – 11:05	Presentation II: Explanation of the Master Plan (Mr. H. Uchida, Team Leader, JICA Study Team)
11:05 – 11:30	Coffee Break
11:30 – 11:50	Presentation III: Explanation on the Priority Projects and Scope of the Environmental and Social Consideration Study at EIA Level (Ms. S. Yamada, Environmental and Social Consideration, JICA Study Team)
11:50 – 12:50	Questions and Answers

3) Main topics discussed

The main topics discussed during the meeting are summarized as below:

- Participants asked for clarification regarding the treatment system proposed for the priority projects. It was understood that the priority projects would have a primary treatment system at this stage, and secondary treatment facilities would be provided as a next step.
    - This interpretation is correct. The first stage consists of primary sedimentation facilities together with some disinfection and sludge treatment facilities. This means the pollution load will reduce by 30 % only. To comply with the EU standard more time is required. The secondary treatment can be incorporated during the second stage.
- The presentation indicated that some rainwater would enter the STP. Participants asked how much rainwater will enter the STP.
    - Currently rainwater enters the existing sewer system. The study proposes that in the future rainwater will not enter the STP during the dry season, however some rainwater will continue to enter the STP during the wet season. This will be achieved by constructing some structures that will only receive the first flush of rainfall runoff. The only way to totally solve the problem would be to construct larger sewers, however the cost is prohibitive. The Lana and Tirana Rivers are not used for any specific purpose, therefore they can be used to convey and dilute rainwater. During the F/S this issue will be investigated further.
- One of the participants stated that the Kashar Commune would need to be compensated for the impacts they will experience as a result of locating the STP in their local area. The participant asked whether the proponents have sought agreement from the residents of Kashar. The participant also asked what would happen if the EIA indicated there could be significant negative environmental impacts. The participant was interested to learn whether an EIA was going to be undertaken for the alternatives.
    - The compensation rate for purchase of land was estimated based on commercial rates. These rates are relatively high when compared to the actual price of the land.

- The study team has not yet had sufficient time to fully consult with residents of the Kashar commune. This study will end in July 2006. This meeting, and similar other meetings are carried out for the purpose of public consultation.
- The study team has assessed alternatives but believe that the selected option is preferred. However, the residents will make the final decision. Executing organization for this project should have the power to persuade the residents to accept the project. Understanding the concerns and needs of the residents is a very important component of this process. To date, detailed consultation has not been required because no resettlement issues are associated with the chosen alternative. However, further public consultation will be required for the surrounding communities. Therefore, full involvement of DPUK, the current executing organization, municipalities and communes in the study area are required. Also, the local government will play an important role in generating public support for this project.

- One participant noted that the presentation indicated that the third objective of the project was to reduce risk of disease and to enhance human health. The participant felt there was insufficient information presented to show how this objective would be achieved. The participant would like to know if the terms of reference can be amended to include a health impact assessment to verify the attainment of this objective. The participant offered their services to do this task.
    - The economic assessment included the reduction of waterborne diseases. Data regarding waterborne diseases was taken from a World Bank Report. During the F/S health impacts will be further assessed and the offered assistance would be welcome during that stage.

12.3.5 Information Disclosure

The minutes of the three stakeholder meetings are available for public viewing at DPUK, MoPWTT. The minutes are provided in English and Albanian.

12.4 Initial Environmental Examination (IEE)

12.4.1 Objectives

The IEE is an important and useful tool for the early planning stages of development projects / programs. If significant negative impacts are identified by the IEE the concept design can be modified to minimize the impacts.

The objectives of the IEE were as follows:

- To provide a preliminary review of the existing environmental and social conditions in the project area based on desk top studies and simple field surveys; and
- To identify and predict environmental impacts and to identify suitable mitigation measures and monitoring plans.

To meet the above objectives, the IEE study was undertaken to: