3.2 Result of Water Quality Survey

Water Quality Survey was conducted in accordance with “3.1 Technical Specifications”. The result of Water Quality Survey is as follows.

WATER QUALITY SURVEY REPORT

for
Development Plan of
Sewerage system and Sewage Treatment Plant
for the Greater Tirana

REGIONAL ENVIRONMENTAL CENTER
Albania

15th anniversary

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WATER QUALITY SURVEY REPORT

for
Development Plan of
Sewerage system and Sewage Treatment Plant
for the Greater Tirana

Implementing Organization:

REGIONAL ENVIRONMENTAL CENTER
Albania

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_____
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Country Director
REC Albania

Submission Date: December 14, 2005

TABLE OF CONTENTS

List of Tables

1. SCOPE OF WORK

Scope of **Water Quality Survey** was to evaluate the present water quality of Rivers and sewage pollution level in two Rivers of Tirana (Lana River and Tirana River), information that will be used as a part of the Development Plan of Sewerage system and Sewage Treatment Plant for the Greater Tirana

The survey data presented in this report are result of the work implemented in the frame of the contract signed between Nihon Suido Consultants, Rr. Sami Frasheri, Tirane and REC Albania, Rr. Durresi, P.11, Shk.2, Ap.12, Tirana, Albania, signed between two parties on Nov. 16, 2005.

As presented in the Offer, REC Albania implemented the tasks described in the TORs by providing staff with expertise in similar activities as well as involving Water Monitoring experts of Institute of Public Health (IPH, address: Rr. Aleksander Moisiu, No.80, Tirana, Albania). This Institute is assigned legally by the Government of Albania as the responsible body for Water quality monitoring in the decision of Council of Ministers no. 177, date 31.03.2005.

In the period Nov.20-27, 2005, REC Albania organized several meetings with project experts on discussion the TORs and division of tasks. In addition, a recognition field trip to all 10 (ten) sampling stations described in the TORs is held with Japanese experts on Nov.17, 2005. It aimed at knowing the terrain and develop the sampling plan.
The sampling exercises are carried out according to sampling plan. This plan is developed in close cooperation with JICA team experts and depending on the weather conditions. The sampling exercises took place on November 30, 2005 (wet weather conditions) and December 6, 2005 (dry weather conditions). However, this period, in general is characterized by inconsistent weather, with rainfalls and low temperatures.

2. SITE DESCRIPTION

Tirana River

Tirana River is a branch of Ishmi River which flows into the Adriatic sea at Rodoni Peninsula. The mean capacity flow /year is 3,1 m^3/sek (min. from 0. 94 m^3/sek, to max 4-5 m^3/sek in wet season).

The surface of watershed of Tirana river is about 70,8 km^2. The main source of waters are the rainfalls: 80%- 82% during the wet season and 18-29 % during the dry season. The mean low temperatures during January- February are 4-7^0 C and the mean high temperature during the July-August are 24, 5^0 C.

Lana River

Lana River sources at western part of Priska pass, flow through the Lanabregas and Shkoze villages, Tirana City and after the Yrsheke Bridge, it is connected into confluence point with Tirana River. The surface of watershed is about 67 km^2.

Lana river is 29 km long, with an average altitude of 179 m and with a declination of 24m/km.

Into the Lana river discharged a few number of sewage waters from the different parts of Tirana City, for example (Mine Peza outlet 700 l/sec, Sitki Cico outlet 40l/sek, Arqitekt Sinani outlet 40 L/sec, Dajti Hotel 15 L/sec, etc.)

3. SAMPLING PROGRAM

A series of sampling, served for gathering the information about the characteristics of the water quality, the influence of sewage/wastewater discharged from the different pollution sources into the rivers, for the moment.

Two series of water quality examination are carried out at 10 different locations, covering the Tirana River, the Lana River and two existing sewer discharges. The sampling locations and details of them, (the exact sampling locations are designated by the Client) are shown in Table 3.1 and Figure 1. Water sampling is conducted in **total 20 sampling locations at two different events**: one water sample each **at fine weather conditions** and one water sample each **at wet weather conditions**.

Table 3.1. Sampling Locations, water quality parameters, number of samples

Sampling and Water Quality Analysis	Lana River	Tirana River	Sewage Discharge	Industrial wastewater	River proposed sewage treatment plant
1-Sampling location along the river, upper stream, confluent and downstream of outfalls to the river	**R1** - Upstream **R2** - Upstream sewage **R5** - Upstream of Confluence point with Tirana river	**R3** -Upstream **R4** - Upstream of confluence point with Lana river	**S1**- Sewage discharge, along Lana river **S2** - Sewage discharge of Tirana interceptor	**F1**- Upstream Lana river from industry area **F2**-Downstream Lana river from industry area	**R6**- Downstream
2- Sampling at wet weather	Once	Once	Once	Once	Once
3- Sampling at fine weather	Once	Once	Once	Once	Once
4- Total samples	6	4	4	4	2
5- Water quality analysis: pH, Temp, Colour, BOD_5, COD, NH_4^+-N, T-N, T-P, Total Residua, Total Coli form, Fecal Coli form	Total samples analyzed - 20 Total parameters measured - 220				

3.1. Sampling Campaigns

The sampling campaign is conducted by the specialist of IPH, expert of water quality survey. The team of sampling is formed by 3 persons of the Institute of Public Health (Mrs. Luljeta Leno -Microb9iologist - supervisor of the team, Mrs. Rajmonda Kamberi-

technician of microbiology, sampler gathering, and Mrs. Valentina Pashaj - chemist), two representatives of REC (Mrs. Daniela Tola and Mr. Alken Myftiu) and two specialists of JICA Team. The sampling procedure is carried out smoothly by the team, respecting the sampling procedure, in "wet/rainy weather" conditions, and on "fine weather" conditions.

Wet weather conditions: Nov.30, 2005: rainy day, there was rain phenomena during the sampling process

Fine / dry weather conditions: Dec. 06, 2005: cloudy day. The last rain occurred 4 day before the sampling day. REC reports that during the sampling on "fine weather conditions", some raining began during the sampling procedure of 5 stations (R4, R5, F2, R6, F1)

3.2 Measurements at the sites

The following sampling procedure is followed and measuring in site (at the stations) are made:

- Water temperature and pH of each sample are measured and recorded at the site of sampling locations, immediately of samples taken. Date, time and environmental situation are recorded also Table 3.2.
- All Samples are preserved and transported in about 4^0 C into the thermo-box containing frozen packs, after taken.
- The samples for microbiological examination are taken by the flame sterilized stainless steel can, after that putted in sterilized glass bottles or are taken directly with sterilized glass bottles depending from the sampling point site, and were preserved and transported in about 4^0 C, into the thermo-box containing frozen packs.
- The samples analyses were carried out in the same day were taken, within 2-6 hrs.

Table 3.2 Date and time of sampling

Weather	Tirana River				Lana River					
Sampling point	**R3**	**S2**	**R4**	**R6**	**R1**	**R2**	**S1**	**F1**	**F2**	**R5**
Wet Weather 30th Nov. 2005	8^{45}	11^{40}	12^{55}	14^{15}	9^{35}	10^{00}	10^{15}	10^{40}	13^{25}	12^{40}

Dry/Fine Weather 6-th Dec. 2005	9^{00}	10^{30}	12^{30}	13^{40}	9^{30}	10^{00}	10^{10}	14^{25}	13^{00}	12^{20}

3.3 Environmental conditions at the sites

- During sampling, a site inspection was carried out. In some sampling locations a sewage bed odour was tested, to S1, S2, and F1. The solid wastes were around the vicinity of Tirana River in R3 sampling point. In R6 sampling location, all vicinity of the river was with a huge amount of garbage. The plastics were hanged in the trees along the riverside. The water was very turbid, and the amount of the river flow was very high. The garbage is observed also in the sampling points F1, S2 and R4.
- An oil film in the surface of the water is observed in F1 sampling point. There was a car wash near this sampling location.

3.4 Analytical methods

Table 3.3: Analytical parameters and methods of analyses

No	Parameters	Methods of Analyses	Apparatus
1	PH	SM 4500 - H^+B 18th Edition, APHA	pH Meter
2	Water Temp, ^{0}C	SM 2550 B-18th Edition, APHA	Thermometer
3	Color	SM 2120 B-18th Edition, APHA	Colorimeter- Hazen
4	BOD_5, mg/l	PGPCM 4.1.3 WEQA W. Fresenius	Frigotermostat-20^0 C, for 5 days
5	COD, mg/l	SM 4500- O.D	Spectrophotometer Digestion
6	NH_4^+-N, mg/l	SM 4500 -NH_3 C18th Edition, APHA	Spectrophotometer
7	T-N, mg/l	SM 4500 N-18th Edition, APHA	Spectrophotometer
8	T-P, mg/l	SM 4500 CP-18th Edition, APHA	Spectrophotometer
9	Total Residuals, mg/l	PGPCM 3.1.3 (P199)WEQA W. Fresenius	
10	Total Coli form, MPN/100ml	SM 9222-B 18th Edition, APHA	Filtration apparatus with Vacuum pump
11	Fecal Coli form, MPN/100ml	SM 9222-B 18th Edition, APHA SM - ISO 9308-3	Filtration apparatus with Vacuum pump

4. SURVEY RESULTS

Table 4.1: Results of water analysis (sampled November 30, 2005)

Result of Water Quality Analysis (Sampled on 30th November, 2005)

No.	Parameter	Tirana River				Lana River					
		R3	S2	R4	R6	R1	R2	S1	F1	F2	R5
		upstream	raw sewage	before conjunction	after STP discharge	upstream	before urban area	raw sewage	before factory area	after factory area	before conjunction
	time	8.45	11.40	12.55	14.15	9.35	10.00	10.15	10.40	13.25	12.40
1	pH	7.8	7.2	7.4	7.8	7.6	7.6	7.8	7.6	7.4	7.6
2	Water Temp (℃)	9.3	15.6	11	11.5	11	11	14.5	12.6	11.6	12.4
3	Color (Hazen)	20	40	30	30	20	30	50	30	40	20
4	BOD_5 (mg/L)	12.8	70	46.2	53.1	10.2	20.2	87	45.3	62.3	63.6
5	COD (mg/L)	32	161.3	110.8	138.06	22.4	46.4	183.7	113.2	179.8	184.4
6	NH_4^+-N (mg/L)	0.193	8, 062	2, 038	2, 9	0.46	3.44	24.83	6.77	21.93	19.67
7	T-N (mg/L)	0.656	19.63	3.495	14.64	1.846	8.11	47.24	18.34	40.19	31.24
8	T-P (mg/L)	0.14	6.5	0.3	3.75	0.25	0.42	18.25	10.5	32	6.75
9	Total Residuals (mg/L)	200	254	215	275	210	240	355	255	256	260
10	Total Coliform (MPN/100mL)	29 000	65 000 000	252 000	277 000	100 000	328 000	216 000 000	29 200 000	328 000	2 770 000
11	Fecal Coliform (MPN/100mL)	7000	37 000 000	190 000	192 000	63 000	202 000	205 000 000	23 400 000	202 000	1 260 000
	Remarks		The sewage smell, garbage on the vicinity	Garbage on the vicinity	Garbage on the vicinity			The sewage smell	Film on the surface, fecal particules, sewage smell, garbage on the vicinity of the river		

Table 4.2 Result of Water Quality Analysis (Sampled on 6-th December 2005)

No.	Parameter	Tirana River				Lana River					
		R3	S2	R4	R6	R1	R2	S1	F1	F2	R5
		upstream	raw sewage	before conjunction	after STP discharge	upstream	before urban area	raw sewage	before factory area	after factory area	before conjunction
	time	9:00	10:30	12:30	13:40	9:30	10:00	10:10	14:25	13:00	12:20
1	pH	7.6	7.2	7.6	7.6	7.6	7.6	7.8	7.6	7.6	7.6
2	Water Temp (℃)	11.5	15.6	12.5	13	12	12	14.5	12	13.5	13
3	Color (Hazen)	0	40 (gri)	40(gri)	40	0	20	70	100	70	40
4	BOD_5 (mg/L)	8.1	76.3	47.8	59.7	9.6	24	96	49.7	56.2	58.4
5	COD (mg/L)	17.6	186.9	111.37	157.6	21.1	56.2	211.2	134.19	151.7	161.7
6	NH_4^+-N (mg/L)	0, 18	4.19	3	4.83	0.2	3.212	37.08	2.58	23.86	0.79
7	T-N (mg/L)	0, 636	15.44	4.85	15.99	1.119	6.417	49.07	16.27	57.43	8.606
8	T-P (mg/L)	0.39	2.14	2.51	1.99	1.08	1.96	13.75	1.49	16.25	12.25
9	Total Residuals (mg/L)	264	356	504	300	320	257	368	502	355	340
10	Total Coliform (MPN/100mL)	5 400	22 000 000	1 300 000	8 000 000	200 000	3 600 000	630 000 000	12 000 000	8 600 000	4 200 000
11	Fecal Coliform (MPN/100mL)	300	14 000 000	650 000	5 200 000	68 000	1 600 000	182 000 000	2 200 000	4 500 000	3 600 000
Remarks			The sewage smell, garbage on the vicinity	Garbage on the vicinity	Garbage on the vicinity			The sewage smell	Film on the surface, fecal particules, sewage smell, garbage on the vicinity of the river		

5. INTERPRETATION OF ANALYTICAL RESULTS

The following interpretation of all results of chemical and bacteriological examination is based on the data presented in spreadsheets 1 and 2.

Important water quality parameters relating to wastewaters discharges are dissolved oxygen (DO), suspended solids, bacteria, nutrients, and pH and toxic chemicals.
Dissolved oxygen is important to aquatic life because detrimental effects can occur when DO levels drop below 4-5 mg/L, depending on the aquatic species. Suspended solids affect water column turbidity and ultimately settle to the bottom, leading to possible benthic enrichment, toxicity and sediment oxygen demand.
Coli form bacteria are used as an indicator of other pathogenic organisms of fecal origin and such provide a measure of safety of water for recreational and other uses. Nutrients can lead to eutrophication and DO depletion. The activity of water measured by its pH, affects the chemical and ecological balance of ambient waters.
Toxic chemicals include a range of compounds that, at different concentrations, have detrimental effects on aquatic life or on humans, upon ingestion of water and/or fish and shellfish. Toxic effects on aquatic life are characterized as acute if occur after a short exposure (on order of few hours) to toxic constituent or as chronic if effects require a longer term exposure.

A simultaneous sampling at upstream and downstream of the Tirana River and Lana River is carried out. The same manner of sampling was applied into the sewage outlet, and after the sewage discharge to evaluate the relationship between pollution source and receiving water body.

Nevertheless, sometimes, there are exceptional circumstances in Albania, due to the occurrence of uncontrolled sewage discharges by the individual private houses or by the small artisan industries directly into the rivers. Therefore, it is expected there are fluctuations in the results of analyses in some stations.

A simultaneous sampling at upstream and downstream of the Tirana River and Lana River is carried out. The same manner of sampling was applied also, to the Lana River

and domestic sewage to wit relationship between pollution sources and receiving water body.

In Tirana River, BOD at upstream was only 12, 8 mg/L – 8, 1 mg/L, while at downstream was 46, 2 mg/L - 47, 8 mg/L. the level of COD at upstream was 32, 0 mg/l -17, 6 mg/l, while the downstream was 110, 8 mg/l – 111, 37 mg/l

At the Lana River, BOD at upstream was 10, 2 mg/l to 9. 6 mg/l. In the downstream of Lana River it goes up to 20.2 mg/l. – 24.0 mg/l, while the COD is 21.1 – 22.4 mg /l that goes up to 46.46 – 56.6 mg/l. to downstream of the flow.

In general, water quality (BOD and COD) in rainy day was a little bit higher than in dry day, but during the period of sampling the season was generally wet (rainy), as no real long term dry weather occurred in the period of 2-3 weeks

Table 5.1: BOD and COD levels of Tirana and Lana River

River	Weather	Upstream		Downstream		After STP discharge R6	
		BOD	COD	BOD	COD	BOD	COD
Tirana River	Wet	12. 8	32. 0	46. 2	110. 8	53. 1	138. 6
	Fine	8. 1	17. 6	47. 8	111. 37	59. 7	157. 6
Lana River	Wet	10. 2	22. 4	20. 2	46. 46		
	Fine	9. 6	21. 1	24. 0	56. 6		

As a general picture, it is obvious that the absence of sewage treatment plant is causing serious water pollution at downstream of Tirana River and Lana River.

In the water samples at the most uppers Stream of Lana River, BOD was 8. 1 mg/l. The referred result of monitoring several years ago was BOD: 2mg/l (Environmental research Institute 2-004-2005). In course of the last few years, new individual housing settlement is constructed, which discharge the sewage at upstream locations of Lana River and at the upstream of Tirana River. Therefore, the level of BOD is growing up 8.1 mg/l (Tirana River upstream) and 9.6 mg/l (Lana river upstream).

Domestic sewage S1, S2

Water sampling is carried out at two different locations of raw sewage, namely S1 and S2 sampling locations, in wet and fine weather conditions. BOD and COD analyses results are presented in Table 4.2

It is obvious that high levels of BOD up to 87 - 96 mg/L and COD up to 186. 9 - 211. 2 mg/l from the sewage discharges are the major serious factor of pollution downstream Tirana River and Lana River.

Table 5.2 BOD and COD levels of domestic sewage of Tirana

Sampling Location	BOD mg/L		COD mg/L	
	Wet Weather	Fine Weather	Wet Weather	Fine Weather
S1 Raw Sewage	87	96	183 7	211. 2

S2 Raw Sewage	70	76.3	161. 3	186. 9

In the Lana River, BOD at upstream was 9.6 mg/l (R1), while in the downstream of Lana River it was 24.0 mg/l, while the COD varies from 21.1 to 56.6 mg/l to downstream of the flow. In the Tirana River BOD varied from 8.1 mg/l – 47.8 mg/l and the COD from 17.6 mg/ - 111.37mg/l.

Sampling is carried out also in the Lana River before (station F1) and after (station F2) the food factories complex and before conjunction with Tirana River (station R5). The BOD and COD results in a fine and wet weather are presented in the Table 4.3. Viewing the discharging pollution load, the factory discharge my considered the source of water pollution of Lana River.

Table 5.3: BOD and COD levels before and after factory

Sampling Location	BOD		COD	
	Wet Weather	Fine Weather	Wet Weather	Fine Weather
F1 - Before factory	45.3	49.7	113.2	134.19
F2 - After factory	62.3	56.2	179.8	151.7
R5 - Before conjunction	63.6	58.4	184.4	161.7

In view of discharged pollution load, the levels of different components of Nitrogen, NH_4, and Phosphates also are in high level after the sewage discharges compared with the standards/ guidelines of Albania, Table 5.1 (BOD 25 mg/l, COD 125 mg/l). Total Residuals is recommended 60 mg/l while the results of analyses show values up to 275 mg/l.

The high number of micro-organisms indicators, Total *Coli* form and Fecal *Coli* form not only in sewage discharge points (**S2**: 6.5×10^7 and **S1**: 2.16×10^8), but also in a river water (**R5:** 4.2×10^6 and **R2:** 3.6×10^6) indirectly may show a high level of pathogenic micro organisms.

The level of pH varies from **7.2 (S2)** to **7.8 (S1)**, without much fluctuations. The lack of high fluctuation is due to the fact that there are no important industrial discharges into the Lana and Tirana River, that can influence the level of pH.

The water temperature varies within small range. More specifically:

- Wet weather: min. 9.3^0 C (R3); max. 12.6^0 C (F1) in the river, while at the sewage discharges are higher [14.5^0 C (S1) to 15.6^0 C (S2)]
- Dry weather: min. 11.5^0 C (R3); max. 13.5^0 C (F2) in the river, while at the sewage discharges, the temperatures are higher [14.5^0 C (S1) and 15.6^0 C (S2)]

These differences are within the normal range of variations, as the sewage water are effected by household water, which usually have higher temperature than natural waters.

6. THE REFERENCE TO WATER QUALITY STANDARDS / GUIDELINES USED IN ALBANIA.

Related to the **Decision of Council of Ministers No 177 Data 31.03.2005**, recommended levels of sewage discharged after the treatment plant are shown in Table 6.1.

***Table 6.1: Water* quality standards in Albania**

Parameters	Level	Reference Methods
BOD_5 without nitrification on *(20 grade Celsius)	25 mg /l	Homogenized samples, without filtration and decantation, before. The evaluation of dissolved oxygen before and after 5 days in dark condition in incubator 20 ^{0}C
COD	125 mg/l	Homogenized samples, without filtration and decantation, the oxidation from Potassium dichromate (the digestion method within 2 h)
Total Residua in suspension	35 mg/l > 10 000	The filtration of representative sample through the 0, 45 µm (gravimetric method.) Desiccation in 105^{0}C and weighing
Total Residua in suspension	60 mg/l (2 000 – 10 000)	The centrifugation of the representative sample almost 5 min 2800-3200 g Desiccation in 105^{0}C and weighing
T-N	15 mg/l (10000 – 100000)	Spectrophotometer
T- P	2 mg/l (10000 – 100000) 1 mg/l > 100000	Spectrophotometer

APPENDIXES

APPENDIX I

The exact sampling locations designated by the Client

Table: Sampling Locations and Sample Numbers

SAMPLING LOCATION			SAMPLE NUMBER
1. Six (8) locations along the river			
Upper stream, confluent, and downstream of the outfalls to the rivers	R1	One (1) location at the upstream area of Lana River (same location as the 1st sampling point of Lana River monitored by the Institute of Environment)	2 (1 locations x 1 sample x 2 events)
	R2	One (1) location at the upstream of the sewage inflowing point in Lana River (near Shyqyri Ishmi Street along Lana River)	2 (1 locations x 1 sample x 2 events)
	R3	One (1) location at the upstream of Tirana River (same location as the 1st sampling point of Tirana River monitored by the Institute of Environment)	2 (1 locations x 1 sample x 2 events)
	R4	One (1) location in Tirana River, at the upstream of the confluence point of Lana River and Tirana River	2 (1 locations x 1 sample x 2 events)
	R5	One (1) location in Lana River, at the upstream of the confluence point of Lana River and Tirana River	2 (1 locations x 1 sample x 2 events)
	R6	One (1) location at the downstream of the proposed sewage treatment plant	2 (1 locations x 1 sample x 2 events)
Upstream and downstream of discharging from major industrial area	F1	One (1) point at the upstream of the discharge from industry area in Lana River (Same location as the 2nd sampling point of Lana River monitored by the Institute of Environment)	2 (1 locations x 1 sample x 2 events)
	F2	One (1) point at the downstream of the discharge from industry area in Lana River (Near the crossing of railway and Lana River, just after the discharging point of Stela Beer Factory)	2 (1 locations x 1 sample x 2 events)
Sub-Total		8 locations	**16 samples**
2. Two locations in the existing combined sewers			
Influent wastewater quality to propose sewage treatment plant	S1	One (1) location at the sewage discharging point (near Shyqyri Ishmi Street along Lana River)	2 (1 locations x 1 sample x 2 events)
	S2	One (1) location at the sewage discharging point of Tirana Interceptor	2 (1 locations x 1 sample x 2 events)
Sub-Total		2 locations	**4 samples**
3. Total		10 locations	**20 samples**

The Map of Water sampling Locations designated by the Client

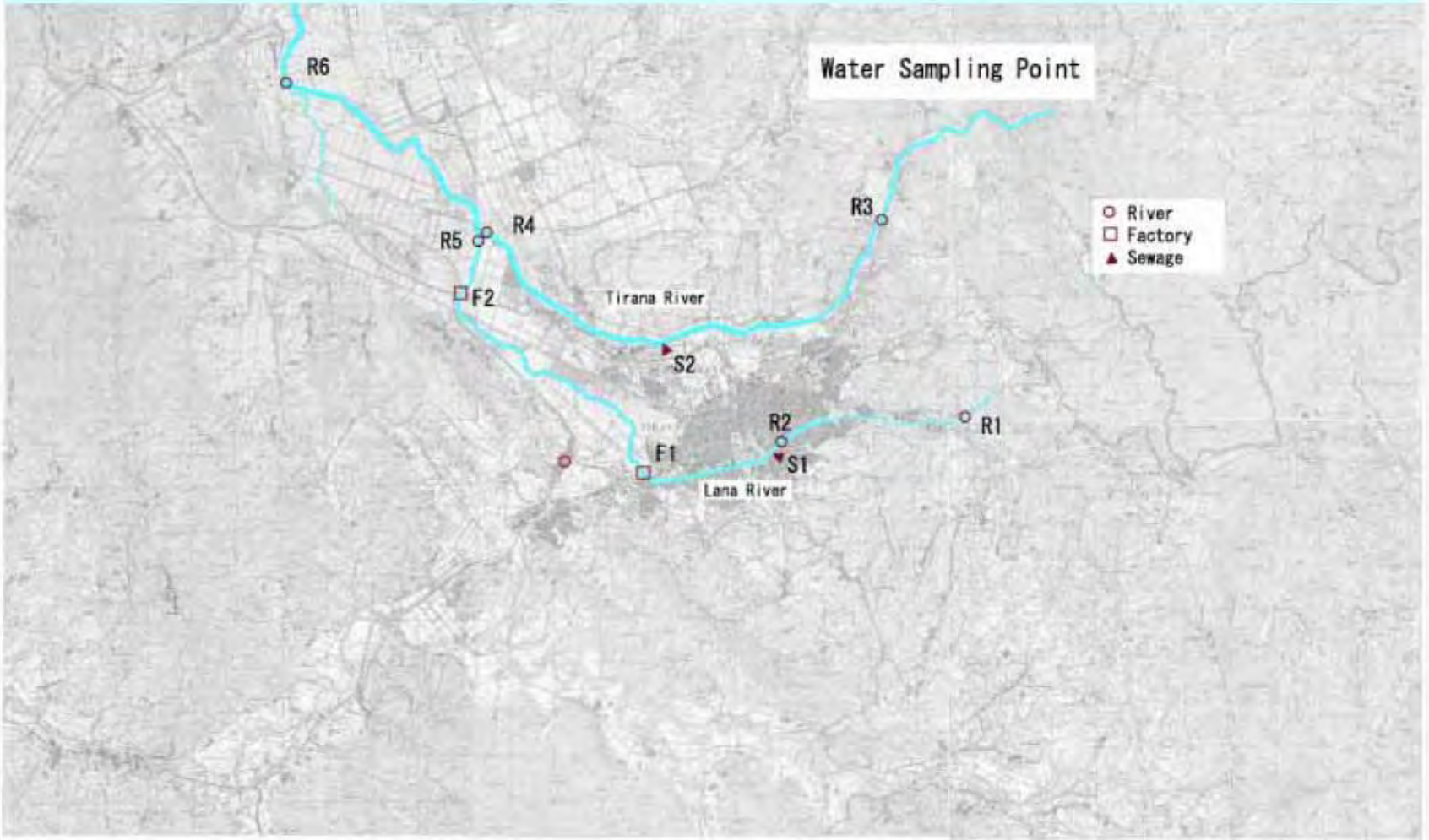

Figure 1 **Sampling Locations**

APPENDIX II

Photos

First Sampling Campaigns [wet weather condition]

Tirana River

Station R3

Station S2

Station R4

Lana River

Station R1

Station R2

Station S1

Station F1



Station F2


Station R5


Station R6


Photos

Second Sampling Campaigns [dry weather condition]

Tirana River

Station R3

Station S2

Station R4

Lana River

Station R1

Station R2

Station S1

Station F1



Station R5


Station R6




Photos on Laboratory

3.3 Future Projection for Water Quality

As mentioned in *Table 3.3.1* of Chapter 10 of the Interim Report, 5 cases are presented as alternatives, namely, Case A, Case B-1, Case B-2, CaseB-3 and CaseB-4. Among these 5 alternatives, Case B-1, Case B-2 and CaseB-3 can be regarded as identical with each other, because all of these alternatives have same collection area to be covered by the proposed STPs, and their discharge point can be regarded as same location.

Thus, simulation for projection of future water quality is conducted for following 3 cases.

- Without Project vs Case A
- Without Project vs Case B-1, Case B-2 and CaseB-3
- Without Project vs Case B-4

(1) Case A

Pollution load reaching each reference point in 2014, 2018 and 2022 can be calculated as following *Figure 3.3.1* to *Figure 3.3.3*, taking the construction schedule of Case-A into account.

Table 3.3.1 Main Features of STP sites for Sub-alternatives

Case		STP Berxull	STP Kahar (Mezezi Eger)	STP Kahar (Mezezi Kosova)	STP Kahar (Mezezi Stalla)	STP Tirana	Pri-T Tirana
B-1	Area	40 ha	60 ha				
	Features	Locates in the agricultural area. Lowest ground level among the STP sites.	Locates in agriculture area. Highest ground level among STP sites. Beautiful landscape but nearest location to the urban area can be usable for recreational purposes.				
B-2	Area	Same as Case B-1		30 ha for sewage treatment and 10 ha for sludge treatment.			
	Features	Same as Case B-1		Two separate locations. Locates near the new industrial zone. The ground level is the lowest near Tirana Municipality.			
B-3	Area	Same as Case B-1			50 ha		
	Features	Same as Case B-1			Locats near the former indusrial complex.		
B-4	Area	Same as Case B-1		20 ha		10 ha for sewage treatment and 10 ha for sludge treatment	30 ha
	Features	Same as Case B-1		Locates near the industrial zone. 2nd Lowest ground level among the STP sites.		Locates in the former airport in Tirana Municipality	Locates behind Tirana Railway Station. Higher gournd level.

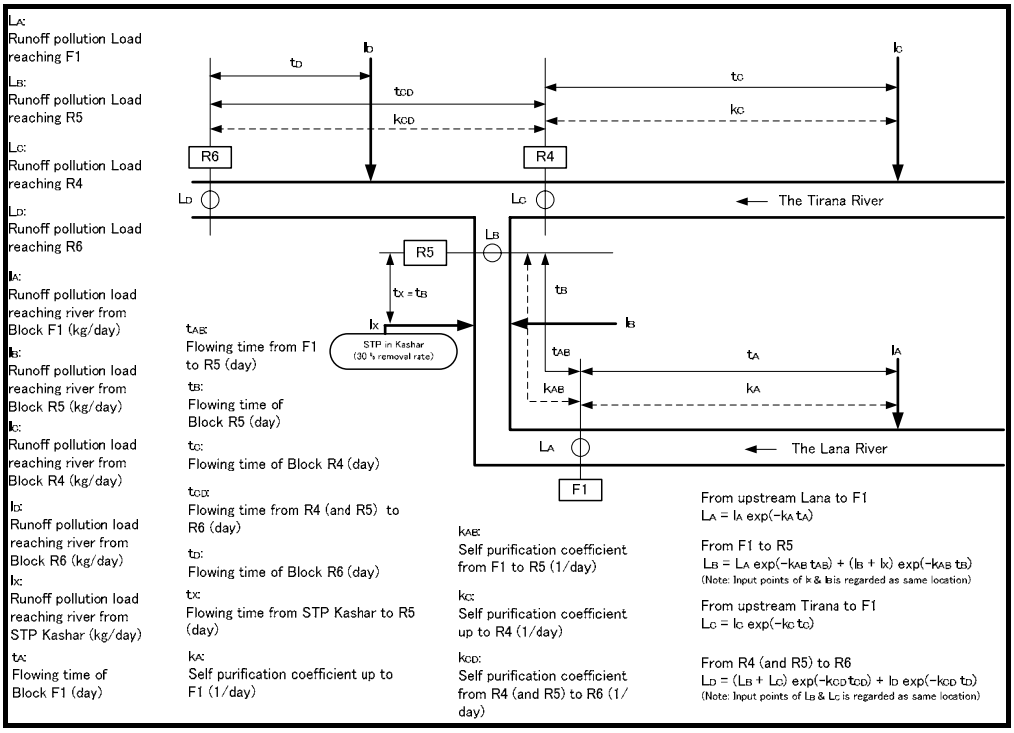

Figure 3.3.1 Schematic Diagram for Pollution Load Runoff under the Scenario of Case A (2014)

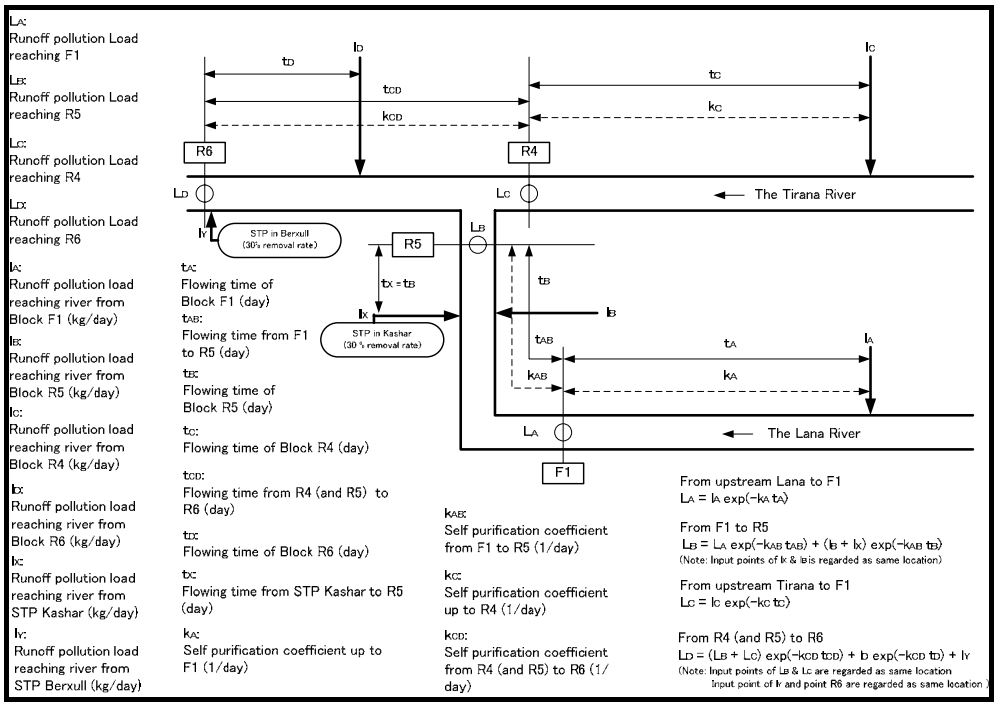

Figure 3.3.2 Schematic Diagram for Pollution Load Runoff under the Scenario of Case A (2018)

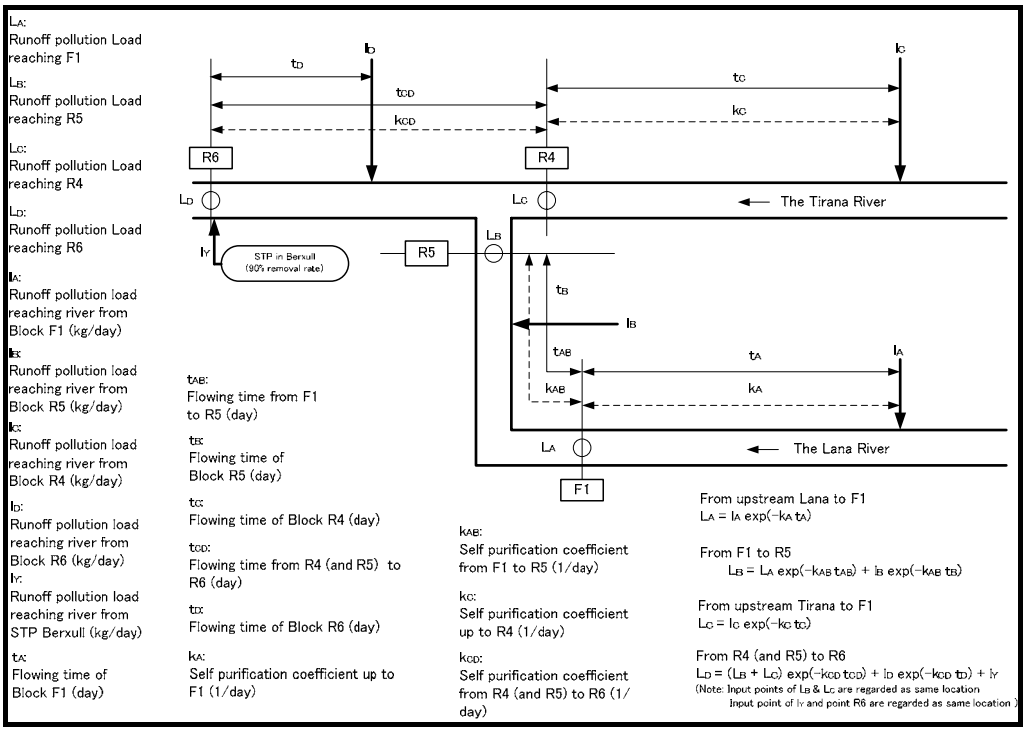

Figure 3.3.3 Schematic Diagram for Pollution Load Runoff under the Scenario of Case A (2022)

Future sewage-originated pollution load (including STP discharge) reaching river under the scenario of with and without project are summarized in the following T*able 3.3.2*

Table 3.3.2 Sewage Pollution Load Reaching River (Case A)

			Population				Generated Pollution Load (kg/d)			
			2005	2014	2018	2022	2005	2014	2018	2022
Without Project	Lana River	F1	198,715	219,482	228,712	237,941	7,949	9,941	10,897	11,897
		R5	242,187	281,917	299,574	317,232	9,687	12,769	14,273	15,862
	Tirana River	R4	221,351	280,877	307,332	336,738	8,854	12,721	14,643	16,837
		R6	56,015	83,583	95,836	108,089	2,241	3,786	4,566	5,404
	Total		718,268	865,858	931,453	1,000,000	28,731	39,216	44,378	50,000
With Project (Case A)	Lana River	F1	–	0	0	0	–	0	0	0
		R5	–	648,299	780,463	0	–	29,363	37,184	0
	Tirana River	R4	–	133,976	0	0	–	6,068	0	0
		R6	–	83,583	150,990	1,000,000	–	3,786	7,194	50,000
	Total			865,858	931,453	1,000,000		39,216	44,378	50,000

			Generated Sewage Volume and Dischage from STP (m3/d)											
			from STP				from Domestic Sewage				Total			
			2005	2014	2018	2022	2005	2014	2018	2022	2005	2014	2018	2022
Without Project	Lana River	F1	0	0	0	0	39,743	49,603	54,433	59,485	39,743	49,603	54,433	59,485
		R5	0	0	0	0	48,437	63,713	71,299	79,308	48,437	63,713	71,299	79,308
	Tirana River	R4	0	0	0	0	44,270	63,478	73,145	84,185	44,270	63,478	73,145	84,185
		R6	0	0	0	0	11,203	18,890	22,809	27,022	11,203	18,890	22,809	27,022
	Total		0	0	0	0	143,654	195,684	221,686	250,000	143,654	195,684	221,686	250,000
With Project (Case A)	Lana River	F1	–	0	0	0	–	0	0	0	–	0	0	0
		R5	–	143,563	185,750	0	–	2,953	0	0	–	146,516	185,750	0
	Tirana River	R4	–	0	0	0	–	30,279	0	0	–	30,279	0	0
		R6	–	0	24,213	250,000	–	18,890	11,723	0	–	18,890	35,936	250,000
	Total			143,563	209,963	250,000		52,121	11,723	0		195,684	221,686	250,000

			Pollution Load reaching River (kg/d)											
			from STP				from Domestic Sewage				Total			
			2005	2014	2018	2022	2005	2014	2018	2022	2005	2014	2018	2022
Without Project	Lana River	F1	0	0	0	0	6,359	7,953	8,717	9,518	6,359	7,953	8,717	9,518
		R5	0	0	0	0	7,589	9,988	11,159	12,395	7,589	9,988	11,159	12,395
	Tirana River	R4	0	0	0	0	6,629	9,455	10,857	12,453	6,629	9,455	10,857	12,453
		R6	0	0	0	0	1,215	2,056	2,481	2,938	1,215	2,056	2,481	2,938
	Total		0	0	0	0	21,793	29,452	33,214	37,303	21,793	29,452	33,214	37,303
With Project (Case A)	Lana River	F1	–	0	0	0	–	0	0	0	–	0	0	0
		R5	–	16,266	21,368	0	–	290	0	0	–	16,556	21,368	0
	Tirana River	R4	–	0	0	0	–	2,973	0	0	–	2,973	0	0
		R6	–	0	3,054	4,176	–	1,581	821	0	–	1,581	3,875	4,176
	Total			16,266	24,422	4,176		4,845	821	0		21,111	25,243	4,176

Other unspecified pollution load is regarded to be constant as time goes by. Therefore, based on the self-purification coefficient calculated in the Main Report, Part 1 Chapter 10 and modeling shown in *Figure 3.3.1* to *Figure 3.3.3*, calculation result of the future water quality under the scenario of Case-A is presented as following *Table 3.3.3* to *Table 3.3.5*.

Table 3.3.3 Future Water Quality Projection (Case A, 2014)

2014 Without Project

Name of the River	Reference Point	Section	Runoff Pollutant Reaching River (kg/d)			Flowing Time	Self-purification Coefficient	Runoff Pollutant Reaching Reference Point		Total Low Flow	BOD
			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	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			
		STP Discharge (Kashar)	0		0	0.09491	0.200	0	19,750	1.78	128
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	9,455	1,107	10,561	0.11806	2.009	8,332	8,500	2.55	39
	R6	R4 to R6			8,500	0.13503	1.446	6,993			
		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			
		STP Discharge (Berxull)	0		0	0	0.200	0	25,359	4.92	60

2014 With Project

Name of the River	Reference Point	Section	Runoff Pollutant Reaching River (kg/d)			Flowing Time	Self-purification Coefficient	Runoff Pollutant Reaching Reference Point		Total Low Flow	BOD
			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			
		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	290	3,456	3,746	0.07909	0.350	3,644			
		STP Discharge (Kashar)	16,266		16,266	0.09491	0.200	15,961	19,845	2.17	106
Tirana	R3	From R3 Block Pollutant Input Point to R3							169	1.30	1.5
	R4	R3 to R4						169			
		From R4 Block Pollutant Input Point to R4	2,973	1,107	4,080	0.11806	2.009	3,219	3,388	2.17	18
	R6	R4 to R6			3,388	0.13503	1.446	2,787			
		R5 to R6			19,845	0.13503	1.446	16,326			
		From R6 Block Pollutant Input Point to R6	1,581	280	1,862	0.06752	1.446	1,688			
		STP Discharge (Berxull)	0		0	0	0.200	0	20,801	4.92	49

Table 3.3.4 Future Water Quality Projection (Case A, 2018)

2018 Without Project

Name of the River	Reference Point	Section	Runoff Pollutant Reaching River (kg/d)			Flowing Time	Self-purification Coefficient	Runoff Pollutant Reaching Reference Point		Total Low Flow	BOD
			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			
		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			
		STP Discharge (Kashar)	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			
		From R4 Block Pollutant Input Point to R4	10,857	1,107	11,963	0.11806	2.009	9,437	9,606	2.66	42
	R6	R4 to R6			9,606	0.13503	1.446	7,903			
		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			
		STP Discharge (Berxull)	0		0	0	0.200	0	28,100	5.22	62

2018 With Project

Name of the River	Reference Point	Section	Runoff Pollutant Reaching River (kg/d)			Flowing Time	Self-purification Coefficient	Runoff Pollutant Reaching Reference Point		Total Low Flow	BOD
			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			
		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			
		STP Discharge (Kashar)	21,368		21,368	0.09491	0.200	20,966	24,569	2.62	108
Tirana	R3	From R3 Block Pollutant Input Point to R3							169	1.30	1.5
	R4	R3 to R4						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			24,569	0.13503	1.446	20,212			
		From R6 Block Pollutant Input Point to R6	821	280	1,101	0.06752	1.446	999			
		STP Discharge (Berxull)	3,054		3054	0	0.200	3,054	25,122	5.22	56

Table 3.3.5 Future Water Quality Projection (Case A, 2022)

2022 Without Project

Name of the River	Reference Point	Section	Runoff Pollutant Reaching River (kg/d)			Flowing Time	Self-purification Coefficient	Runoff Pollutant Reaching Reference Point		Total Low Flow	BOD
			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			
		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			
		STP Discharge (Kashar)	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			
		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			
		STP Discharge (Berxull)	0		0	0	0.200	0	31,072	5.54	65

2022 With Project

Name of the River	Reference Point	Section	Runoff Pollutant Reaching River (kg/d)			Flowing Time	Self-purification Coefficient	Runoff Pollutant Reaching Reference Point		Total Low Flow	BOD
			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			
		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			
		STP Discharge (Kashar)	0		0	0.09491	0.200	0	3,603	0.47	88
Tirana	R3	From R3 Block Pollutant Input Point to R3							169	1.30	1.5
	R4	R3 to R4						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			3,603	0.13503	1.446	2,964			
		From R6 Block Pollutant Input Point to R6	0	280	280	0.06752	1.446	254			
		STP Discharge (Berxull)	4,176		4176	0	0.200	4,176	8,251	5.54	17

(2) Case B-1, B-2 and B-3

Pollution load reaching each reference point in 2014, 2018 and 2022 can be calculated as following *Figure 3.3.4* to *Figure 3.3.6*, taking the construction schedule of Case-B-1, B-2 and B-3 into account.

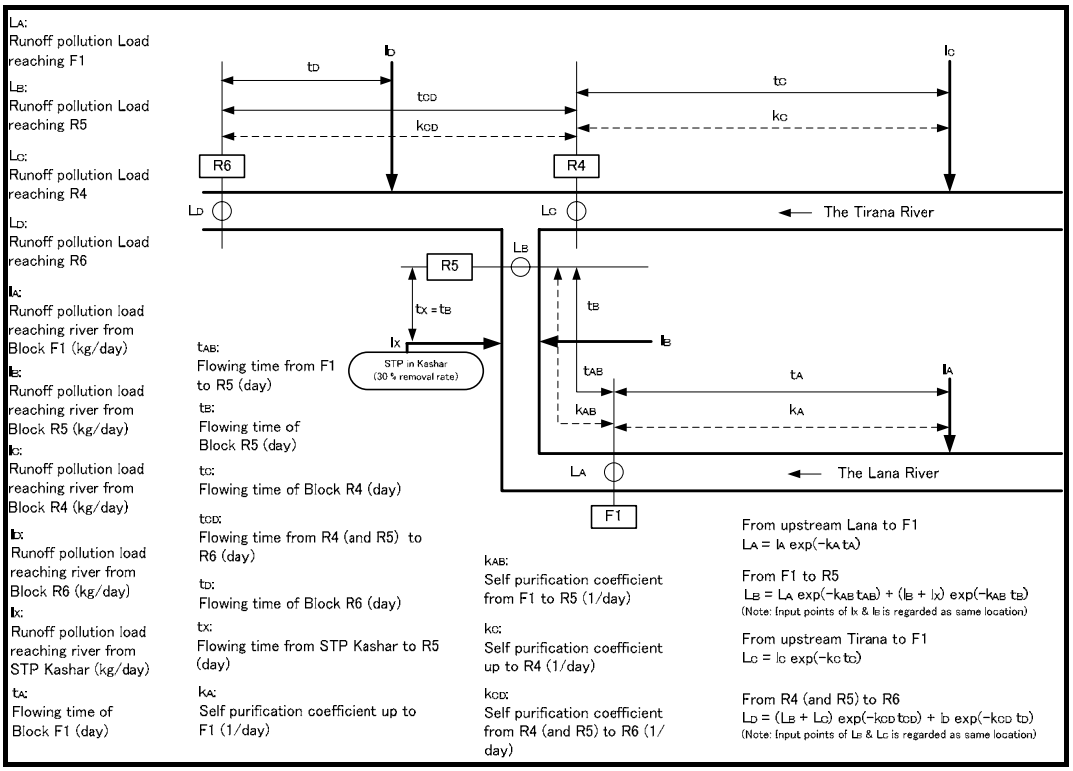

Figure 3.3.4 Schematic Diagram for Pollution Load Runoff under the Scenario of Case B-1, B-2, B-3 (2014)

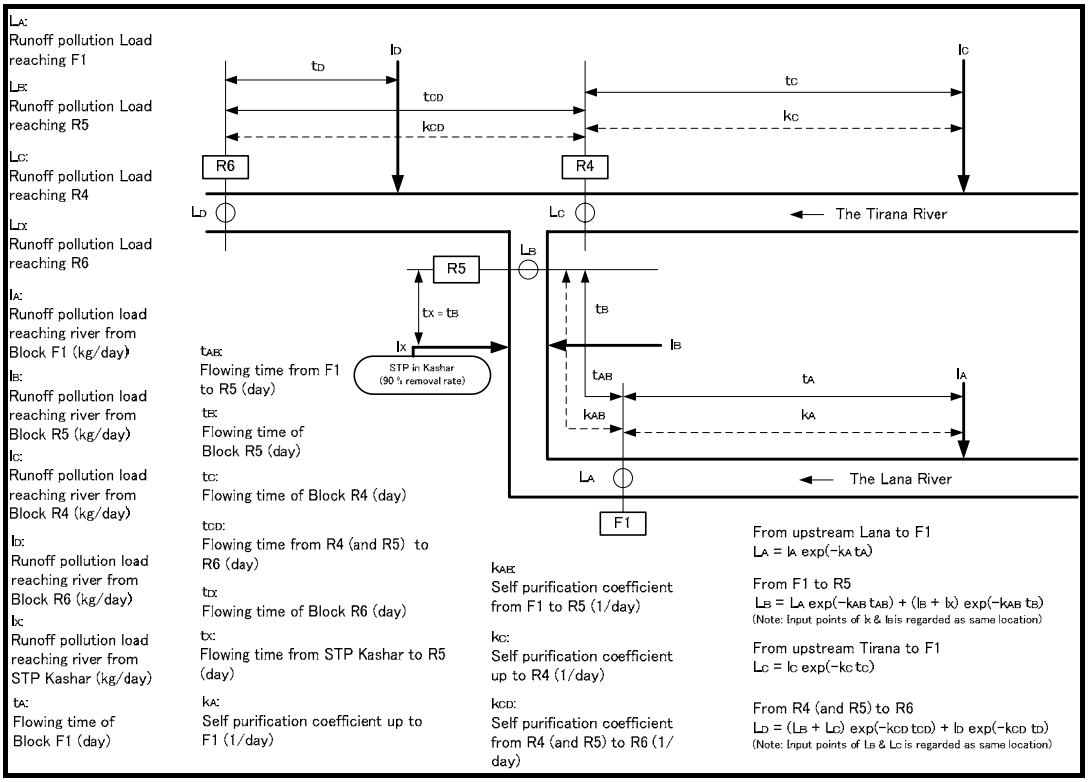

Figure 3.3.5 Schematic Diagram for Pollution Load Runoff under the Scenario of Case B-1, B-2, B-3 (2018)

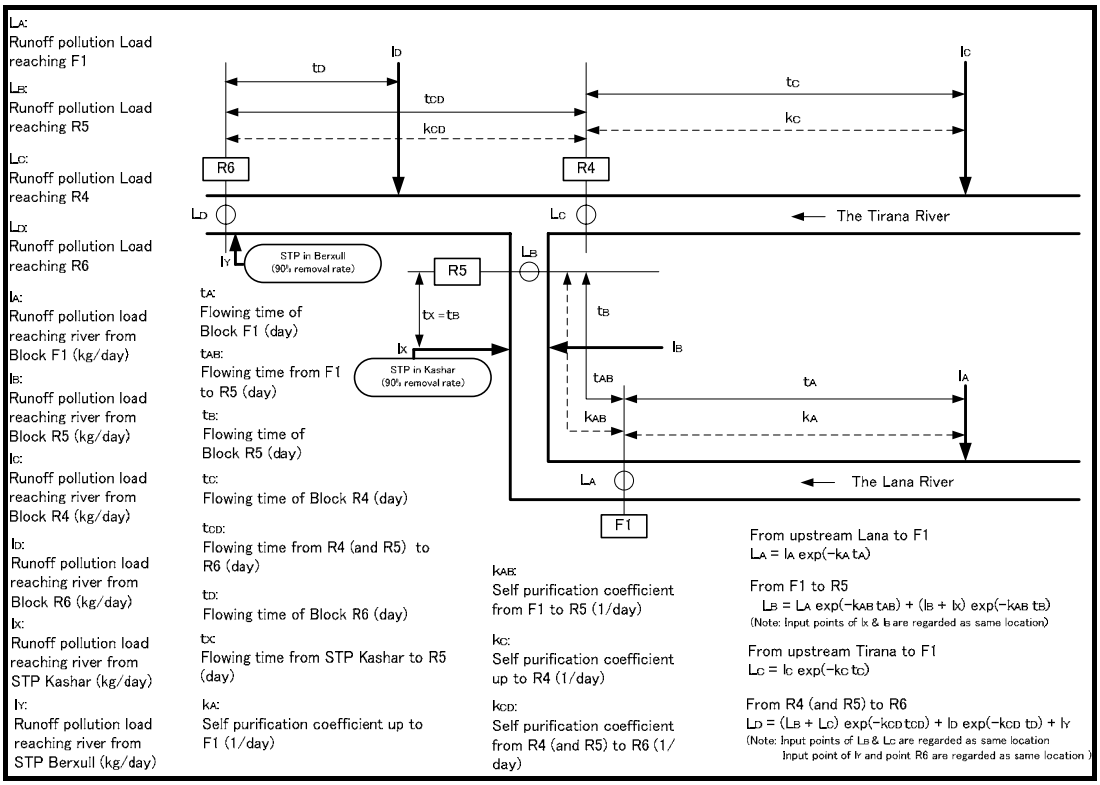

Figure 3.3.6 Schematic Diagram for Pollution Load Runoff under the Scenario of Case B-1, B-2, B-3 (2022)

Future sewage-originated pollution load (including STP discharge) reaching river under the scenario of with and without project are summarized in the following *Table 3.3.6*

Table 3.3.6 Sewage Pollution Load Reaching River (Case B-1, B-2, B-3)

			Population				*Generated Pollution Load (kg/d)*			
			2005	*2014*	*2018*	*2022*	*2005*	*2014*	*2018*	*2022*
Without Project	Lana River	F1	198,715	219,482	228,712	237,941	7,949	9,941	10,897	11,897
		R5	242,187	281,917	299,574	317,232	9,687	12,769	14,273	15,862
	Tirana River	R4	221,351	282,439	309,588	336,738	8,854	12,792	14,750	16,837
		R6	56,015	83,583	95,836	108,089	2,241	3,786	4,566	5,404
		Total	718,268	867,420	933,709	1,000,000	28,731	39,287	44,486	50,000
With Project (Case B-1, B-2, B-3)	Lana River	F1	–	0	0	0	–	0	0	0
		R5	–	654,021	782,719	829,498	–	29,622	37,292	41,475
	Tirana River	R4	–	129,816	55,154	0	–	5,880	2,628	0
		R6	–	83,583	95,836	170,502	–	3,786	4,566	8,525
		Total		867,420	933,709	1,000,000		39,287	44,486	50,000

			Generated Sewage Volume and Dischage from STP (m3/d)											
			from STP				*from Domestic Sewage*				*Total*			
			2005	*2014*	*2018*	*2022*	*2005*	*2014*	*2018*	*2022*	*2005*	*2014*	*2018*	*2022*
Without Project	Lana River	F1	0	0	0	0	39,743	49,603	54,433	59,485	39,743	49,603	54,433	59,485
		R5	0	0	0	0	48,437	63,713	71,299	79,308	48,437	63,713	71,299	79,308
	Tirana River	R4	0	0	0	0	44,270	63,831	73,682	84,185	44,270	63,831	73,682	84,185
		R6	0	0	0	0	11,203	18,890	22,809	27,022	11,203	18,890	22,809	27,022
		Total	0	0	0	0	143,654	196,037	222,223	250,000	143,654	196,037	222,223	250,000
With Project (Case B-1, B-2, B-3)	Lana River	F1	–	0	0	0	–	0	0	0	–	0	0	0
		R5	–	73,023	186,287	207,375	–	74,786	0	0	–	147,809	186,287	207,375
	Tirana River	R4	–	0	0	0	–	29,338	13,127	0	–	29,338	13,127	0
		R6	–	0	0	42,625	–	18,890	22,809	0	–	18,890	22,809	42,625
		Total		73,023	186,287	250,000		123,014	35,936	0		196,037	222,223	250,000

			Pollution Load reaching River (kg/d)											
			from STP				*from Domestic Sewage*				*Total*			
			2005	*2014*	*2018*	*2022*	*2005*	*2014*	*2018*	*2022*	*2005*	*2014*	*2018*	*2022*
Without Project	Lana River	F1	0	0	0	0	6,359	7,953	8,717	9,518	6,359	7,953	8,717	9,518
		R5	0	0	0	0	7,589	9,988	11,159	12,395	7,589	9,988	11,159	12,395
	Tirana River	R4	0	0	0	0	6,629	9,504	10,932	12,453	6,629	9,504	10,932	12,453
		R6	0	0	0	0	1,215	2,056	2,481	2,938	1,215	2,056	2,481	2,938
		Total	0	0	0	0	21,793	29,501	33,289	37,303	21,793	29,501	33,289	37,303
With Project (Case B-1, B-2, B-3)	Lana River	F1	–	0	0	0	–	0	0	0	–	0	0	0
		R5	–	8,217	3,034	3,409	–	12,265	0	0	–	20,482	3,034	3,409
	Tirana River	R4	–	0	0	0	–	4,053	1,764	0	–	4,053	1,764	0
		R6	–	0	0	767	–	2,056	2,481	0	–	2,056	2,481	767
		Total		8,217	3,034	4,176		18,375	4,245	0		26,592	7,279	4,176

Other unspecified pollution load is regarded to be constant as time goes by. Therefore, based on the self-purification coefficient calculated in the *Main Report Part 1, Chapter 10* and modeling shown in *Figure 3.3.4* to *Figure 3.3.6*, calculation result of the future water quality under the scenario of Case B-1, B-2, B-3 is presented as following *Table 3.3.7* to *Table 3.3.9*.

Table 3.3.7 Future Water Quality Projection (Case B-1, B-2, B-3, 2014)

2014 Without Project

Name of the River	Reference Point	Section	Runoff Pollutant Reaching River (kg/d)			Flowing Time	Self-purification Coefficient	Runoff Pollutant Reaching Reference Point		Total Low Flow	BOD
			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			
		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			
		STP Discharge (Kashar)	0		0	0.09491	0.200	0	19,750	1.78	128
Tirana	R3	From R3 Block Pollutant Input Point to R3							169	1.30	1.5
	R4	R3 to R4						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			
		STP Discharge (Berxull)	0		0	0	0.200	0	25,392	4.92	60

2014 With Project

Name of the River	Reference Point	Section	Runoff Pollutant Reaching River (kg/d)			Flowing Time	Self-purification Coefficient	Runoff Pollutant Reaching Reference Point		Total Low Flow	BOD
			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			
		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	12,265	3,456	15,721	0.07909	0.350	15,293			
		STP Discharge (Kashar)	8,217		8,217	0.09491	0.200	8,062	23,596	2.18	125
Tirana	R3	From R3 Block Pollutant Input Point to R3							169	1.30	1.5
	R4	R3 to R4						169			
		From R4 Block Pollutant Input Point to R4	4,053	1,107	5,160	0.11806	2.009	4,071	4,240	2.16	23
	R6	R4 to R6			4,240	0.13503	1.446	3,488			
		R5 to R6			23,596	0.13503	1.446	19,411			
		From R6 Block Pollutant Input Point to R6	2,056	280	2,336	0.06752	1.446	2,119			
		STP Discharge (Berxull)	0		0	0	0.200	0	25,018	4.92	59

Table 3.3.8 Future Water Quality Projection (Case B-1, B-2, B-3, 2018)

2018 Without Project

Name of the River	Reference Point	Section	Runoff Pollutant Reaching River (kg/d)			Flowing Time	Self-purification Coefficient	Runoff Pollutant Reaching Reference Point		Total Low Flow	BOD
			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			
		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			
		STP Discharge (Kashar)	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			
		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			
		STP Discharge (Berxull)	0		0	0	0.200	0	28,149	5.22	62

2018 With Project

Name of the River	Reference Point	Section	Runoff Pollutant Reaching River (kg/d)			Flowing Time	Self-purification Coefficient	Runoff Pollutant Reaching Reference Point		Total Low Flow	BOD
			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			
		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			
		STP Discharge (Kashar)	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			
		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			
		STP Discharge (Berxull)	0		0	0	0.200	0	9,919	5.22	22

Table 3.3.9 Future Water Quality Projection (Case B-1, B-2, B-3, 2022)

2022 Without Project

Name of the River	Reference Point	Section	Runoff Pollutant Reaching River (kg/d)			Flowing Time	Self-purification Coefficient	Runoff Pollutant Reaching Reference Point		Total Low Flow	BOD
			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			
		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			
		STP Discharge (Kashar)	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			
		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			
		STP Discharge (Berxull)	0		0	0	0.200	0	31,072	5.54	65

2022 With Project

Name of the River	Reference Point	Section	Runoff Pollutant Reaching River (kg/d)			Flowing Time	Self-purification Coefficient	Runoff Pollutant Reaching Reference Point		Total Low Flow	BOD
			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			
		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			
		STP Discharge (Kashar)	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			
		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			
		STP Discharge (Berxull)	767		767	0	0.200	767	7,594	5.54	16

(3) Case B-4

Pollution load reaching each reference point in 2014, 2018 and 2022 can be calculated as following *Figure 3.3.7* to *Figure 3.3.9*, taking the construction schedule of Case B-4 into account.

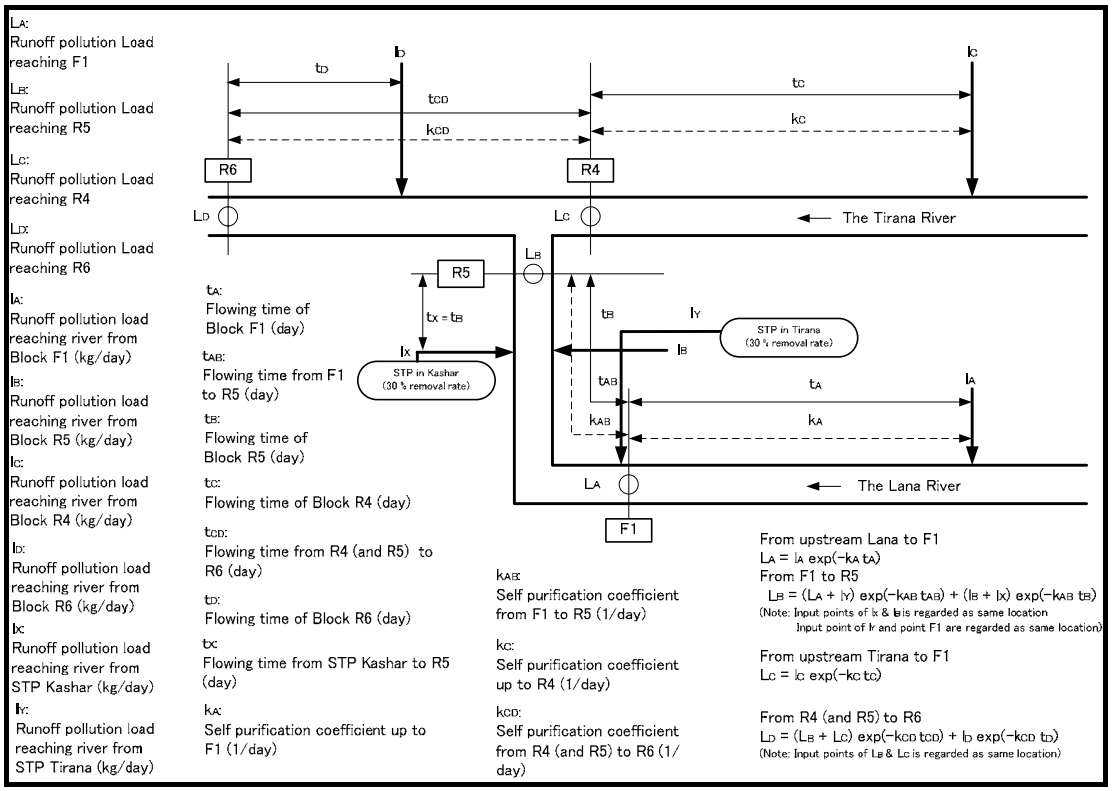

Figure 3.3.7 Schematic Diagram for Pollution Load Runoff under the Scenario of Case B-4 (2014)

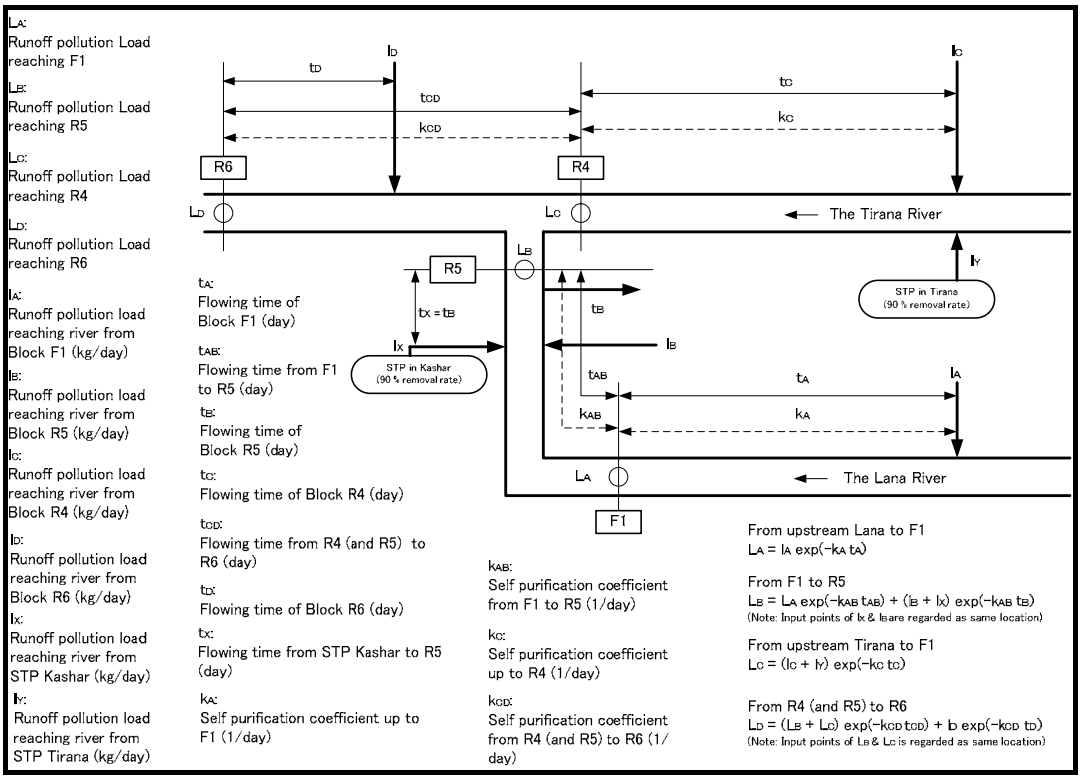

Figure 3.3.8 Schematic Diagram for Pollution Load Runoff under the Scenario of Case B-4 (2018)

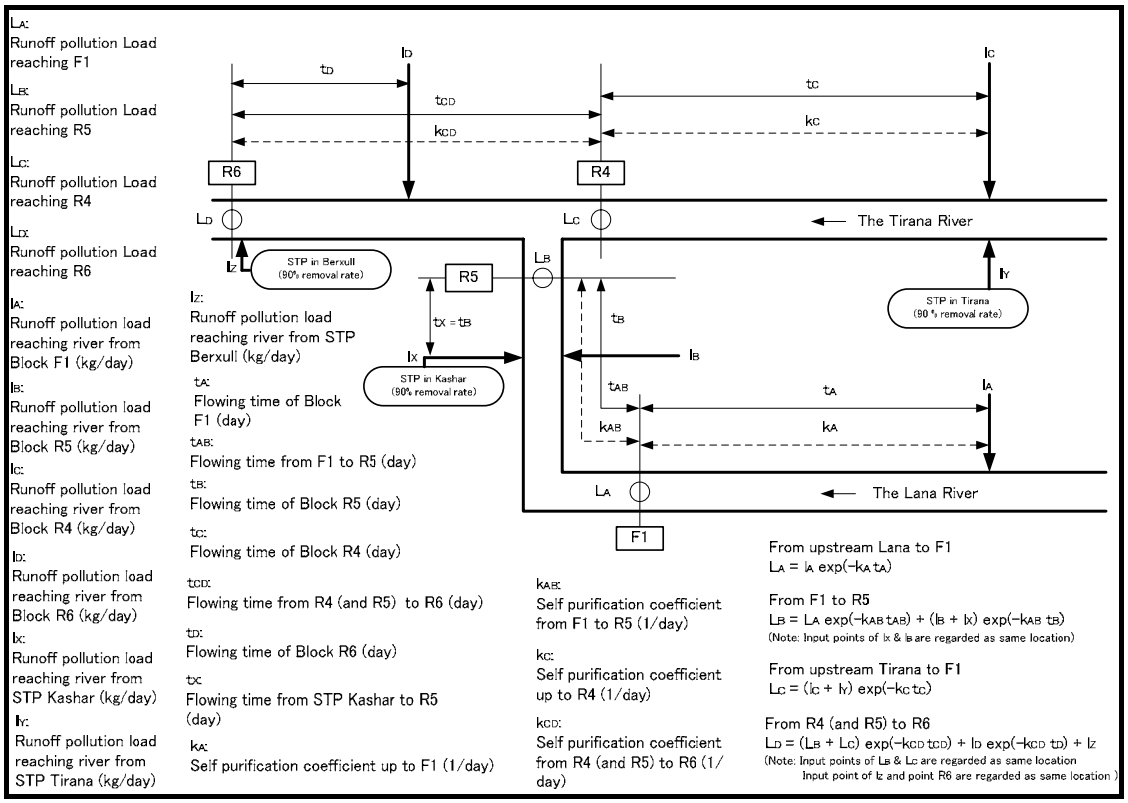

Figure 3.3.9 Schematic Diagram for Pollution Load Runoff under the Scenario of Case B-4 (2022)

Future sewage-originated pollution load (including STP discharge) reaching river under the scenario of with and without project are summarized in the following *Table 3.3.10*

Table 3.3.10 Sewage Pollution Load Reaching River (Case B-4)

			Population				Generated Pollution Load (kg/d)			
			2005	2014	2018	2022	2005	2014	2018	2022
Without Project	Lana River	F1	198,715	219,482	228,712	237,941	7,949	9,941	10,897	11,897
		R5	242,187	281,917	299,574	317,232	9,687	12,769	14,273	15,862
	Tirana River	R4	221,351	282,439	309,588	336,738	8,854	12,792	14,750	16,837
		R6	56,015	83,583	95,836	108,089	2,241	3,786	4,566	5,404
		Total	718,268	867,420	933,709	1,000,000	28,731	39,287	44,486	50,000
With Project (Case B-4)	Lana River	F1	–	0	0	0	–	0	0	0
		R5	–	654,021	143,113	158,832	–	29,622	6,818	7,942
	Tirana River	R4	–	129,816	694,760	670,666	–	5,880	33,101	33,533
		R6	–	83,583	95,836	170,502	–	3,786	4,566	8,525
		Total		867,420	933,709	1,000,000		39,287	44,486	50,000

			Generated Sewage Volume and Dischage from STP (m3/d)											
			from STP				from Domestic Sewage				Total			
			2005	2014	2018	2022	2005	2014	2018	2022	2005	2014	2018	2022
Without Project	Lana River	F1	0	0	0	0	39,743	49,603	54,433	59,485	39,743	49,603	54,433	59,485
		R5	0	0	0	0	48,437	63,713	71,299	79,308	48,437	63,713	71,299	79,308
	Tirana River	R4	0	0	0	0	44,270	63,831	73,682	84,185	44,270	63,831	73,682	84,185
		R6	0	0	0	0	11,203	18,890	22,809	27,022	11,203	18,890	22,809	27,022
		Total	0	0	0	0	143,654	196,037	222,223	250,000	143,654	196,037	222,223	250,000
With Project (Case B-4)	Lana River	F1	–	0	0	0	–	0	0	0	–	0	0	0
		R5	–	147,809	34,061	39,708	–	0	0	0	–	147,809	34,061	39,708
	Tirana River	R4	–	0	152,226	167,667	–	29,338	13,127	0	–	29,338	165,353	167,667
		R6	–	0	0	42,626	–	18,890	22,809	0	–	18,890	22,809	42,626
		Total		147,809	186,287	250,000		48,228	35,936	0		196,037	222,223	250,000

			Pollution Load reaching River (kg/d)											
			from STP				from Domestic Sewage				Total			
			2005	2014	2018	2022	2005	2014	2018	2022	2005	2014	2018	2022
Without Project	Lana River	F1	0	0	0	0	6,359	7,953	8,717	9,518	6,359	7,953	8,717	9,518
		R5	0	0	0	0	7,589	9,988	11,159	12,395	7,589	9,988	11,159	12,395
	Tirana River	R4	0	0	0	0	6,629	9,504	10,932	12,453	6,629	9,504	10,932	12,453
		R6	0	0	0	0	1,215	2,056	2,481	2,938	1,215	2,056	2,481	2,938
		Total	0	0	0	0	21,793	29,501	33,289	37,303	21,793	29,501	33,289	37,303
With Project (Case B-4)	Lana River	F1	–	0	0	0	–	0	0	0	–	0	0	0
		R5	–	16,783	614	715	–	0	0	0	–	16,783	614	715
	Tirana River	R4	–	0	2,449	2,694	–	4,260	2,214	0	–	4,260	4,663	2,694
		R6	–	0	0	767	–	2,076	2,505	0	–	2,076	2,505	767
		Total		16,783	3,062	4,176		6,337	4,719	0		23,120	7,781	4,176

Other unspecified pollution load is regarded to be constant as time goes by. Therefore, based on the self-purification coefficient calculated in the *Main Report Part 1, Chapter 10* and modeling shown in *Figure 3.3.7 to Figure 3.3.9*, calculation result of the future water quality under the scenario of Case B-4 is presented as following *Table 3.3.11 to Table 3.3.13*.

Table 3.3.11 Future Water Quality Projection (Case B-4, 2014)

2014 Without Project

Name of the River	Reference Point	Section	Runoff Pollutant Reaching River (kg/d)			Flowing Time	Self-purification Coefficient	Runoff Pollutant Reaching Reference Point		Total Low Flow	BOD
			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	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			
		STP Discharge (Tirana)	0		0	0.18981	0.200	0			
		STP Discharge (Kashar)	0		0	0.09491	0.200	0	19,750	1.78	128
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	9,504	1,107	10,611	0.11806	2.009	8,371			
		STP Discharge (Tirana)	0		0	0.11806	0.200		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			
		STP Discharge (Berxull)	0		0	0	0.200	0	25,392	4.92	60

2014 With Project

Name of the River	Reference Point	Section	Runoff Pollutant Reaching River (kg/d)			Flowing Time	Self-purification Coefficient	Runoff Pollutant Reaching Reference Point		Total Low Flow	BOD
			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			
		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			
		STP Discharge (Tirana)	1,278		1,278	0.18981	0.200	1,231			
		STP Discharge (Kashar)	15,505		15,505	0.09491	0.200	15,213	20,047	2.18	106
Tirana	R3	From R3 Block Pollutant Input Point to R3							169	1.30	1.5
	R4	R3 to R4						169			
		From R4 Block Pollutant Input Point to R4	4,260	1,107	5,367	0.11806	2.009	4,234			
		STP Discharge (Tirana)	0		0	0.11806	0.200	0	4,403	2.16	24
	R6	R4 to R6			4,403	0.13503	1.446	3,622			
		R5 to R6			20,047	0.13503	1.446	16,492			
		From R6 Block Pollutant Input Point to R6	2,076	280	2,356	0.06752	1.446	2,137			
		STP Discharge (Berxull)	0		0	0	0.200	0	22,251	4.92	52

Table 3.3.12 Future Water Quality Projection (Case B-4, 2018)

2018 Without Project

Name of the River	Reference Point	Section	Runoff Pollutant Reaching River (kg/d)			Flowing Time	Self-purification Coefficient	Runoff Pollutant Reaching Reference Point		Total Low Flow	BOD
			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			
		STP Discharge (Tirana)	0		0	0.18981	0.200	0			
		STP Discharge (Kashar)	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
		STP Discharge (Tirana)	0		0	0.11806	0.200				
	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			
		STP Discharge (Berxull)	0		0	0	0.200	0	28,149	5.22	62

2018 With Project

Name of the River	Reference Point	Section	Runoff Pollutant Reaching River (kg/d)			Flowing Time	Self-purification Coefficient	Runoff Pollutant Reaching Reference Point		Total Low Flow	BOD
			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			
		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			
		STP Discharge (Tirana)	614		614	0.18981	0.200	591			
		STP Discharge (Kashar)	0		0	0.09491	0.200	0	4,193	0.87	56
Tirana	R3	From R3 Block Pollutant Input Point to R3							169	1.30	1.5
	R4	R3 to R4						169			
		From R4 Block Pollutant Input Point to R4	2,214	1,107	3,321	0.11806	2.009	2,620			
		STP Discharge (Tirana)	2,449		2,449	0.11806	0.200	2,391	5,180	3.73	16
	R6	R4 to R6			5,180	0.13503	1.446	4,261			
		R5 to R6			4,193	0.13503	1.446	3,450			
		From R6 Block Pollutant Input Point to R6	2,505	280	2,785	0.06752	1.446	2,526			
		STP Discharge (Berxull)	0		0	0	0.200	0	10,237	5.22	23

Table 3.3.13 Future Water Quality Projection (Case B-4, 2022)

2022 Without Project

Name of the River	Reference Point	Section	Runoff Pollutant Reaching River (kg/d)			Flowing Time	Self-purification Coefficient	Runoff Pollutant Reaching Reference Point		Total Low Flow	BOD
			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			
		STP Discharge (Tirana)	0		0	0.18981	0.200	0			
		STP Discharge (Kashar)	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
		STP Discharge (Tirana)	0		0	0.11806	0.200				
	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			
		STP Discharge (Berxull)	0		0	0	0.200	0	31,072	5.54	65

2022 With Project

Name of the River	Reference Point	Section	Runoff Pollutant Reaching River (kg/d)			Flowing Time	Self-purification Coefficient	Runoff Pollutant Reaching Reference Point		Total Low Flow	BOD
			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			
		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			
		STP Discharge (Tirana)	0		0	0.18981	0.200	0			
		STP Discharge (Kashar)	715		715	0.09491	0.200	701	4,304	0.93	53
Tirana	R3	From R3 Block Pollutant Input Point to R3							169	1.30	1.5
	R4	R3 to R4						169			
		From R4 Block Pollutant Input Point to R4	0	1,107	1,107	0.11806	2.009	873			
		STP Discharge (Tirana)	2,694		2,694	0.11806	0.200	2,631	3,673	3.76	11
	R6	R4 to R6			3,673	0.13503	1.446	3,022			
		R5 to R6			4,304	0.13503	1.446	3,541			
		From R6 Block Pollutant Input Point to R6	0	280	280	0.06752	1.446	254			
		STP Discharge (Berxull)	767		767.259	0	0.200	767	7,584	5.54	16