JAPAN INTERNATIONAL COOPERATION AGENCY

MINISTRY OF PUBLIC WORKS, TOURISM AND
TERRITORY ADJUSTMENT
REPUBLIC OF ALBANIA

THE STUDY ON THE SEWERAGE SYSTEM IN METROPOLITAN TIRANA IN THE REPUBLIC OF ALBANIA

FINAL REPORT

SUPPORTING REPORT

MARCH 1998

NIPPON JOGESUIDO SEKKEI CO., LTD.
TOHMATSU & CO.

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CHAPTER 1
INTRODUCTION

Minutes of Discussion on the Inception Report for the Study on the Sewerage System in Metropolitan Tirana for The Republic of Albania

9 August 1996

Tirana, Albania

Albert BROJKA
Minister
Ministry of Public Works,
Tourism and Territorial Adjustment

Kenji HORI
JICA Study Team Leader

WITNESSED by:

Prof. Masataka SUGAHARA
Chairman
JICA Advisory Committee

Based on the results of the Preparatory Study, the Japan International Cooperation Agency (JICA) decided to conduct the Study on the Sewerage System in Metropolitan Tirana in the Republic of Albania (hereinafter referred to as "the Study") and sent to Albania a Study Team, headed by Kenji HORI (hereinafter referred to as "the Study Team"), from August 4 to August 11, 1996 in order to explain the Inception Report and confirm Scope of Work of the Study.

During their stay in Albania, the Study Team held meetings with the Directorate of the Project Management Unit, the Ministry of Public Works, Tourism and Territorial Adjustment, and other authorities concerning the Government of Albania and conducted a field survey in the study area.

In the course of the meetings and the field survey, both parties have discussed and agreed on the outline shown below. The Study Team will proceed to continue its work and to prepare the Study Report.

The list of those who attended these meetings are shown in Appendix-1.

Outline of Minutes of Discussion

1. The Study Area

   Both the Study Team and the Albanian side confirmed that the Study covers Metropolitan Tirana, which has an area of 2,700 ha and is shown in Appendix-2.

2. The Category of Wastewater

   Both sides agreed to include the wastewater from farming activities (the livestock industry) in the scope of the Study if this type of wastewater complies with the suitable effluent standards to be recommended under the scope of the Study.

3. Counterpart Agency

   Directorate of Water Supply and Sewerage (DWSS), Ministry of Public Works, Tourism and Territorial Adjustment shall act as the counterpart agency for the Study at its own expense, in order to give full support to the counterpart activities.

4. The Members of the Steering Committee

The Albanian side agreed the members of the Steering Committee will be decided by the end of August 1996.

The steering committee is to act advice and decision making at their own expense.

5. The Members of the Counterpart Team

The Study Team requested to the Albanian side to provide/nominate the members of the counterpart team for the Study so as to conduct the Study smoothly from the following sectors at their own expense.

(1) Full-time coordinator from MOPWT

(2) Planning engineer(s) for water supply and sewerage from MOPWT

(3) Mechanical/Electrical engineer

The Albanian side replied to provide to the Study Team by August 15, 1996.

6. JICA Counterpart Training

The Study Team informed the Albanian side that JICA is ready to invite a member of the counterpart team to Japan for training to help facilitate the smooth conduct of the Study.

7. Provision of an Office for the Study Team

The Study Team reminded the Albanian side to provide a suitable office with equipment, desks, chairs, and tables for planning and drawing work. The Albanian side promised to provide a suitable office space to the Study Team by August 12, 1996.

8. Land for the Sewage Treatment Plant

The Albanian side showed the Study Team a candidate site for sewage treatment plant. The Study Team, however, will prepare alternative plans taking into account of technical and economical aspects.

9. Non-interference with the Other Projects in the Field of Water Supply and Sewerage System

Both sides confirmed that the other projects do/will not interfere with the Study.
The Albanian side agreed to inform the Study Team about the contents and scope of the work of the new project(s) concerning to the water supply and sewerage/sanitation, when this kind of project commences.

10. Arrangement of the Planning Fundamentals

Both sides agreed to arrange the planning fundamentals such as water consumption per capita per day as much as possible with other concerned projects.

11. Systematic Tariff Collection

Both sides agreed that, regarding the tariff collection for the sewage works, the Study will aim to establish the most comprehensive system, which will be followed to the tariff of the water works.

12. Related Organization Chart

The Study Team requested to Albanian side to provide related organization chart concerning water works/sewerage works of Albanian government, Tirana district and Municipality of Tirana. Albanian side provided the chart to the Study Team.

Appendix-1 Attendance List

Name	Position	Place of Employment
Albert BROJKA	Minister	Ministry of Public Works, Tourism and Territorial Adjustment
Stavri RISTANI	Director	Ministry of Public Works, Tourism and Territorial Adjustment Directorate of Water Supply and Sewerage
Juli SHLLAKU	Director	Ministry of Public Works, Tourism and Territorial Adjustment Territorial Planning Department
Valdet KODRA	Desk of Japan	Council of Ministers Department of Economic Development and Foreign Aid Coordination
Kujtim HOXHA	Chief of the Sector for Public Services	Municipality of TIRANA
Merita MULLAJ	Chief Engineer	Enterprize for the Maintenance of Roads and Sewerage of TIRANA
Fahri MAHO	Specialist for Sewerage	Ministry of Public Works, Tourism and Territorial Adjustment Directorate of Water Supply and Sewerage
Mirand CAUSHI	Chief of the Sewerage Sctor	Ministry of Public Works, Tourism and Territorial Adjustment Directorate of Water Supply and Sewerage
Arben ZAJMI	Director	Ministry of Public Works, Tourism and Territorial Adjustment Project Implementation Unit for the Bovilla Part of Water and Sewerage of TIRANA
Xhorxhi BUCKA	Specialist for Water Spply	Ministry of Public Works, Tourism and Territorial Adjustment Directorate of Water Supply and Sewerage
Artan ZYLFI	Director	Water Work Company for the District of TIRANA

Appendix-2

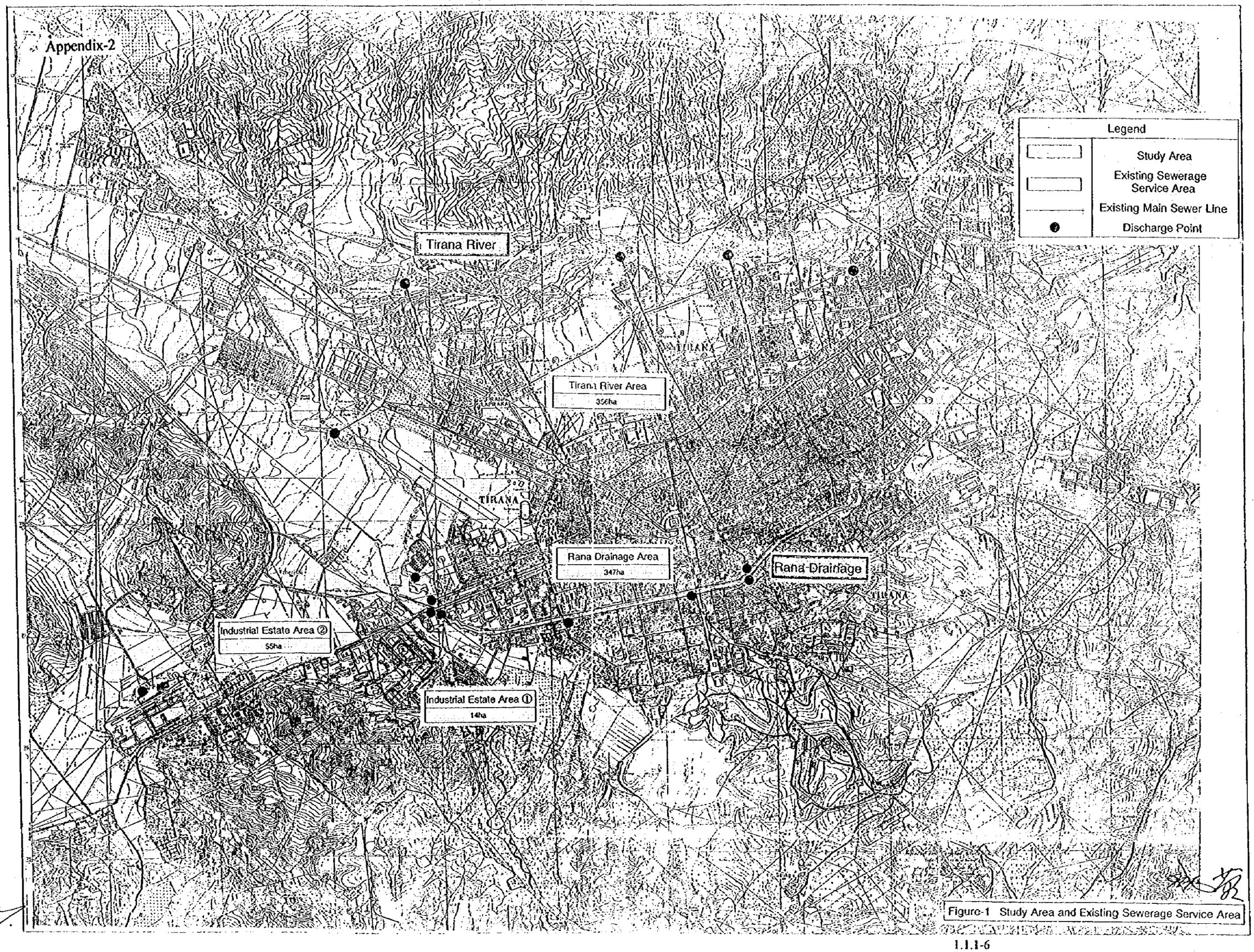

Figure-1 Study Area and Existing Sewerage Service Area

Minutes of Meeting on the Interim Report for
The Study on the Sewerage System in Metropolitan Tirana
in
The Republic of Albania

Agreed upon between
Ministry of Public Works, Territorial Adjustment and Tourism
and
Japan International Cooperation Agency

18 December 1996

Tirana, Albania

Ernest NOKA
Vice Minister
Ministry of Public Works,
Territorial Adjustment and Tourism

Kenji HORI
JICA Study Team Leader

WITNESSED by:

Prof. Masataka SUGAHARA
Chairman
JICA Advisory Committee

Based on the results of the Preparatory Study, the Japan International Cooperation Agency (JICA) decided to conduct the Study on the Sewerage System in Metropolitan Tirana in the Republic of Albania (hereinafter referred to as "the Study") and sent to Albania a Study Team, headed by Kenji HORI (hereinafter referred to as "the Study Team"), from 4 August to 27 September, 1996 as the 1st field work.

The Study Team had submitted the Progress Report (1) as the outcome of the field investigation and study on 23 September, 1996. On the basis of the discussion results on the Report, the Study Team had reviewed and developed it through a continuos home work in Japan and then submitted a report to the Government of Albania as the Interim Report on 13 December, 1996, and started the 2nd field work having a schedule for the work till 17 February, 1997 as to scrutinize the project conditions.

During their study in Albania, the Study Team held initial meetings with the Directorate of the Project Management Unit, the Ministry of Public Works, Territorial Adjustment and Tourism, and other authorities concerning the Government of Albania.

In the course of the meetings, both parties have discussed and agreed on the outline shown below. The list of those who attended these meetings are shown in Appendix.

The outline of minutes of the meeting are :

1. Fundamental Conditions for the Study

   Both the Study Team and the Albanian side confirmed that the fundamental conditions for the Study mentioned in the Interim Report, such as planned sewerage area, planned population, demand for water in target year, planned target water quality and priority area to be improved urgently the current environmental situation are satisfactory.

2. Sewage Treatment Method

   The Albanian side agreed that sewage treatment method, aerated lagoon system, recommended by the Study Team are acceptable to employ for the project.

The Albanian side requested to submit a comparison regarding construction cost including land, operation & maintenance cost and advantage/disadvantage taking into account of the operation and maintenance.

3. The Land (as a candidate land) for Construction of the Sewage Treatment Plant

The Albanian side informed that the land around Laknasi for construction of the treatment plant proposed by the Study Team will be possible to be obtained and no land problem affected by the coal mining is considered, because the mining is closed at present and mining area is not in the candidated place of the plant.

4. Improvement of the Storm Drainage

The Albanian side agreed that an improvement of the existing sewer on purpose to storm drainage should not be treated in the scope of the Study because of the reason mentioned in the Interim Report. An emergency inundation countermeasures in the urgent improvement areas, however, will be provided under this project. In connection to this matter, both parties agreed that only preliminary computer-aid calculation will be carried out to indicate the required size of sewers for improvement of the existing sewer network.

5. Regulation on the Water Pollution Control

The Albanian side informed that draft new regulation on the water pollution control is preparing and will be published in January 1997. The target BOD value for discharge of the wastewater to the river will be regulated as 25 mg/l.

6. Counterpart Training in Japan

Mr. Fahri Maho, Specialist for Sewerage, Directorate of Water Supply and Sewerage, MOPWT was nominated as a participant for the training, and an application document will be given to the JICA through general route in the Government of Albania as soon as possible.

Appendix Attendance List

Name	Position	Place of Employment
Ernest NOKA	Vice Minister	Ministry of Public Works, Territorial Adjustment and Tourism
Stavri RISTANI	Director	Ministry of Public Works, Territorial Adjustment and Tourism Directorate of Water Supply and Sewerage
Mirand CAUSHI	Chief of the Sewerage Sector	Ministry of Public Works, Territorial Adjustment and Tourism Directorate of Water Supply and Sewerage
Mariana COKU	Chief of the Water Supply Sector	Ministry of Public Works, Territorial Adjustment and Tourism Directorate of Water Supply and Sewerage
Fahri MAHO	Specialist for Sewerage	Ministry of Public Works, Territorial Adjustment and Tourism Directorate of Water Supply and Sewerage
Arian JOVANI	Specialist for Water Supply	Ministry of Public Works, Territorial Adjustment and Tourism Directorate of Water Supply and Sewerage
Etleva MILKANI	Specialist for Sewerage	Ministry of Public Works, Territorial Adjustment and Tourism Directorate of Water Supply and Sewerage
Merieta KOCA	Specialist	Council of Ministers DEDAC
Bujar REME	Sanitary Engineer	Ministry of Health and Environment
Juli SHLLAKU	Director	Municipality of TIRANA Depertment of Urban Planning
Luljeta HOXHA	Specialist for Water Supply & Sewerage	Municipality of TIRANA Depertment of Urban Plannig

Name	Position	Place of Employment
Lulezim QENAMI	Director	Municipality of TIRANA Depertment of Public Work
Xhemal CECO	Specialist	Municipality of TIRANA Depertment of Road and Sewerage
Merita MULLAJ	Chief Engineer	Enterprize for the Maintenance of Roads and Sewerage of TIRANA
Faruk TORO	Director	Water Works Enterprise of Tirana
Nazmi RUDI	Director	Hydraugeology Enterprise
Fatlinda MURTHI	Specialist for Urban Planning	Urban Planning Institute
Thoma KORINI	Director	University of Geology and Mining Depertment of Mining

Minutes of Discussions
on
the Progress Report 2
for
the Study on Sewerage System in Metropolitan Tirana
in
the Republic of Albania

The discussions on the captioned report was held at the Ministry of Public Works, Tourism and Territorial Adjustment from 11th to 12th February 1997 by the presence of officials from the Ministry of Public Works, Tourism and Territorial Adjustment, members of the project steering committee and the JICA Study Team.

The contents and each subject of the Progress Report 2 were explained by the Study Team to Albanian officials concerned and a series of discussions were held. Major subjects discussed and conclusions reached among others were given below.

1. What is the basis on revision of planned sewage quality from BOD 260 mg/l and SS 250 mg/l to 200 mg/l of both BOD and SS, respectively?

   Two factors are considered in the adjustment:

   1) Technical leakage of sewage from sewer pipes and groundwater infiltration into sewer pipes are considered at 35 % and 15 % of the planed daily average sewage flow.

   2) Water quality examination results conducted during the Stage 1 field work, especially domestic sewage and industrial wastewater.

2. What is the reason of decrease on area requirement and power consumption of the aerated lagoon from Progress Report-1 to Progress Report-2?

   This reduction owes to the revision of the planned sewage quality and quantity as mentioned above in view of BOD loading. In addition, the influence of wastewater temperature in lagoon and atmospheric temperature was reflected to decrease retention time required for the lagoon and the depth of lagoon ~~and~~ are to decrease area requirement.

3. What is the source and basis of design criteria for aerated lagoon?

   Several commonly known technical references, such as design manual issued by EPA (Environmental Protection Agency) of U.S.A, were referred. In the preliminary design, so-called "dual-power-level, multi-cellular aerated lagoon" is adopted as economical treatment process.

4. What was the outcome of water quality examination conducted during the Stage 2 field work?

   The water sampling entailed to four consecutive weeks to obtain the required number of samples. The examination results will be submitted to the Study Team on February 13 from the Institute of Public Health, Ministry of Health and Environmental Protection, and will be incorporated in the Draft Final Report together with such results obtained during the Stage 1 field work.

5. Construction cost, operation and maintenance cost, and advantage/disadvantage in operation and maintenance are taken up in the comparison of aerated lagoon method and oxidation ditch method. More precise comparison of these two methods are desired to be incorporated in the Draft Final Report.

   The method of comparison presented in the Progress Report 2 will be retained as it is. However, additional technical information on oxidation ditch method will be prepared and furnished separately. The counterpart training of JICA to be held in Japan is an another opportunity to learn more about the different engineering practices.

6. Application of PVC pipe to sewer system is desired to be considered. Quality of material and cost information can be furnished to the Study Team.

   Applicability of PVC pipe will be studied and its result will be incorporated in the Draft Final Report.

7. Please recommend final treatment and disposal of excess sludge from the sewage treatment plant.

   Not only for technical measures, but also relevant actions to be taken up for this specific subject will be contained in the Draft Final Report.

8. The JICA Study has projected the future population in the Study Area at approximately 730,000 in 2010, while other projects/studies show approximately one million.

   The said figure (730,000 persons) by the target year 2010 had been confirmed with officials concerned during the Stage I field work. It was also mentioned in our report that the future population of Metropolitan Tirana would reach one million during 2020s. It shall be noted that future population shall be projected not only in view of future land use, but also comprehensively taking into account industrial and economic development, and these frame values are subject to review prior to commence the implementation of the project.

9. Please prepare disbursement schedule by classification of foreign and local fund.

   Any cost estimate presented in the Progress Report 2 is preliminary and detailed cost estimate with their foreign and local breakdown will be prepared during the Stage 2 domestic work to incorporate in the Draft Final Report.

The discussions on the Progress Report 2 was adjourned at 1:20 p.m. on 12 February 1997. It was agreed among attendees of discussions that the above mentioned results of discussions will be thoroughly taken into consideration during the Stage 2 domestic work and reflected on the Draft Final Report of the whole Study.

This minutes of discussions was noted and confirmed on 12 February 1997 by:

Mr. Ernest NOKA Vice Minister Ministry of Public Works, Tourism and Territorial Adjustment	Mr. Kenji HORI Team Leader JICA Study Team

Attendants List

February. 11. 1997

10:00 AM

Nr	Name	Organisation / Position
1	Fahri Maho	Chief of Steering Communitty of Study on Sewerage System in Tirana
2		Technical Advision, Phare Water PMU
3	Ermira Tase	Specialist of future PMU
4	Nazmi Rudi	Director of Hydro-geology of Albania
5	Miranda Çaushi	Chief of the Sector of Sewerage
6	Eva Milkani	Specialist at the General Directory of Watersuuply and Sewerage
7	Shpresa Leka	Director at the Directory of Planning and Regulation of Territory
8	Xhemal Çeço	Municipality of Tirana (Directory of Sewerage and Roads)
9	Arjan Jovani	Specialist at the General Directory of Watersuuply and Sewerage

Attendants List

February. 12. 1997

10:00 AM

NR	Name	Organisation / Position
1	Fahri Maho	Chief of Steering Community of Study on Sewerage System in Tirana
2	Nazmi Rudi	Director of Hydro-geology of Albania
3	Lorena Kostallari	Specialist DEDAC
4	Mariana Çoku	Chief of the Sector of Watersupply
5	Arjan Jovani	Specialist at the General Directory of Watersupply and Sewerage
6	Bujar Reme	Sanitary Engineer, Ministry of Health and Environment
7	Ermira Tase	Specialist of future PMU
8	Eva Milkani	Specialist at the General Directory of Watersupply and Sewerage
9	Xhemal Çeço	Municipality of Tirana (Directory of Sewerage and Roads)

CHAPTER 4

EXISTING SEWERAGE SYSTEM

4.1.1 Evaluation of Existing Sewage Collection System

Table 4.1.1 exhibits breakdown of sewered area served by sewer lines having pipe diameter of 400 mm or larger.

Table 4.1.1 Breakdown of Sewered Area by its Catchment Area

Contents	Area (ha)	Tirana	Central	Lana North	Lana South	Kombinat	Total
Length (m)	A < 10	8,095	6,135	18,105	10,373	2,008	44,716
	A < 20	2,128	2,256	5,043	6,280	580	16,287
	A < 30	1,798	2,140	3,137	3,279	372	10,726
	A < 50	1,576	827	1,866	605	961	5,835
	A < 100	2,974	2,171	808	1,039		6,992
	A > 100	2,881	2,101	4,357	2,810		12,149
	Total	19,452	15,630	33,316	24,386	3,921	96,705
Percentage (%)	A < 10	42	39	54	43	51	46
	A < 20	11	14	15	26	15	17
	A < 30	9	14	9	13	9	11
	A < 50	8	5	6	2	25	6
	A < 100	15	14	2	4		7
	A > 100	15	13	13	12		13
	Total	100	100	100	100	100	100

Note : D≧ 400

It is verified from the above tables that about half of existing sewer lines, even having diameter of 400 mm or larger, have their respective service area of less than 10 ha, owing to its principal design as the combined system.

Evaluation procedure is as follows:

a. Flow capacity (safe ratio) is calculated as F/C(%):
   F/C=(planned sewage quantity)/(full flow capacity of sewer line) x 100%
b. Summation of total length and F/C(%) by pipe diameter as shown in each Table.

1) Flow capacity as combined system (C-1)

Sanitary Sewage Flow

Sanitary Sewage per Capita	=	440	liter/day	(Hourly Maximum)

Storm Water Flow

Rainfall Intensity Formula	=	$\frac{2750}{t + 17}$		(Return Period : 4 Year)
For Main Pipe (D≧500)				
Rainfall Intensity Formula	=	$\frac{2520}{t + 17}$		(Return Period : 2.5 Year)
For Small Pipe (D≦400)				
Runoff Coefficient	=	0.5		
Inlet Time	=	5	min	
Assumed Average Velocity	=	1.5	m/sec	

Table 4.1.2 Result of Existing Sewer Evaluation

	Dia (mm)	F/C ≦ 100%	F/C ≦ 150%	F/C ≦ 200%	F/C > 200%	Total
Length (m)	400	3,423	2,990	3,226	20,056	29,695
	500	2,877	1,419	1,236	9,837	15,369
	600	5,027	2,505	2384	11,507	21,423
	800	3,486	1,373	1,104	3,096	9,059
	1000	1,042	227	868	3,702	5,839
	700x500		316			316
	1000x500			199		199
	1500x700		1,536	210	138	1,884
	Network Total	15,855	10,366	9,227	48,336	83,784
	600	2,170	1,204			3,374
	800	452	179	242	4,364	5,237
	1000		20	421	2,739	3,180
	1000x600				1,130	1,130
	Interceptor Total	2,622	1,403	663	8,233	12,921
	Total	18,477	11,769	9,890	56,569	96,705
Percentage (%)	400	12	10	11	68	100
	500	19	9	8	64	100
	600	23	12	11	54	100
	800	38	15	12	34	100
	1000	18	4	15	63	100
	700x500		100			100
	1000x500			100		100
	1500x700		82	11	7	100
	Network Total	19	12	11	58	100
	600	64	36			100
	800	9	3	5	83	100
	1000		1	13	86	100
	1000x600				100	100
	Interceptor Total	20	11	5	64	100
	Total	19	12	10	58	100

2) Flow capacity as combined system (C-2)

Design conditions is same as C-1.

Table 4.1.3 Result of Existing Sewer Evaluation (Combined : Case-2)

	Dia (mm)	F/C≦100%	F/C≦150%	F/C≦200%	F/C>200%	Total
Lenth (m)	400	3,777	3,418	3,382	19,118	29,695
	500	3,054	1,419	1,236	9,660	15,369
	600	5,027	2,505	2,384	11,507	21,423
	800	3,486	1,373	1,104	3,096	9,059
	1000	1,042	227	868	3,702	5,839
	700x500		316			316
	1000x500			199		199
	1500x700		1,536	210	138	1,884
	Network Total	16,386	10,794	9,383	47,221	83,784
	600	2,170	1,204			3,374
	800	3,132	823	1,272		5,237
	1000	2,118	1,062			3,180
	1000x600	1,130				1,130
	Intercepter Total	8,550	3,099	1,272		12,921
	Total	24,936	13,893	10,655	47,221	96,705
Percentage (%)	400	13	12	11	64	100
	500	20	9	8	63	100
	600	23	12	11	54	100
	800	38	15	12	34	100
	1000	18	4	15	63	100
	700x500		100			100
	1000x500			100		100
	1500x700		82	11	7	100
	Network Total	20	13	11	56	100
	600	64	36			100
	800	60	16	24		100
	1000	67	33			100
	1000x600	100				100
	Intercepter Total	66	24	10		100
	Total	26	14	11	49	100

3) Flow capacity as combined system (C-3)

As reference information, the flow capacity of existing sewer for the current sanitary sewage and storm flow was evaluated.

Sanitary Sewage Flow			
Population Density	=	Exisiting Density	
Sanitary Sewage per Capita	=	150 liter/day	(Hourly Maximum)
Storm Water Flow			
Rainfall Intensity Formula	=	$\frac{1970}{t + 18}$	(Return Period : 0.5 Year)
For Main Pipe (D≧500)			
Rainfall Intensity Formula	=	$\frac{1970}{t + 18}$	(Return Period : 0.5 Year)
For Small Pipe (D≦400)			
Runoff Coefficient	=	0.4	
Inlet Time	=	10 min	
Assumed Average Velocity	=	1.5 m/sec	

Table 4.1.4 Result of Existing Sewer Evaluation

	Dia (mm)	F/C ≦ 100%	F/C ≦ 150%	F/C ≦ 200%	F/C > 200%	Total
Length (m)	400	9,639	3,788	4,105	12,163	29,695
	500	5,587	3,085	2,099	4,598	15,369
	600	9,916	713	3,420	7,374	21,423
	800	5,963	1,619	638	839	9,059
	1000	2,137	656	970	2,076	5,839
	700x500	316				316
	1000x500	199				199
	1500x700	1,746	138			1,884
	Network Total	35,503	9,999	11,232	27,050	83,784
	600	3,374				3,374
	800	2,015	763	476	1,983	5,237
	1000	441	678	447	1,614	3,180
	1000x600			1,130		1,130
	Interceptor Total	5,830	1,441	2,053	3,597	12,921
	Total	41,333	11,440	13,285	30,647	96,705
Percentage (%)	400	32	13	14	41	100
	500	36	20	14	30	100
	600	46	3	16	34	100
	800	66	18	7	9	100
	1000	37	11	17	36	100
	700x500	100				100
	1000x500	100				100
	1500x700	93	7			100
	Network Total	42	12	13	32	100
	600	100				100
	800	38	15	9	38	100
	1000	14	21	14	51	100
	1000x600			100		100
	Interceptor Total	45	11	16	28	100
	Total	43	12	14	32	100

This evaluation indicated that about half of existing sewer has flow capacity against the present swage flow.

4) Flow capacity as storm sewer of separate system

Storm Water Flow

Rainfall Intensity Formula = $\frac{2750}{t + 17}$ (Return Period : 4 Year)
For Main Pipe (D≧500)

Rainfall Intensity Formula = $\frac{2520}{t + 17}$ (Return Period : 2.5 Year)
For Small Pipe (D≦400)

Runoff Coefficient = 0.5

Inlet Time = 5 min

Assumed Average Velocity = 1.5 m/sec

Table 4.1.5 Result of Existing Sewer Evaluation

	Dia (mm)	F/C ≦ 100%	F/C ≦ 150%	F/C ≦ 200%	F/C > 200%	Total
Length (m)	400	3,423	2,990	3,544	19,738	29,695
	500	2,877	1,419	1,291	9,782	15,369
	600	8,640	2,638	2,012	11,507	24,797
	800	5,156	1,718	1,104	6,318	14,296
	1000	1,062	648	868	6,441	9,019
	700x500		316			316
	1000x500			199		199
	1000x600				1,130	1,130
	1500x700		1,536	210	138	1,884
	Total	21,158	11,265	9,228	55,054	96,705
Percentage (%)	400	12	10	12	66	100
	500	19	9	8	64	100
	600	35	11	8	46	100
	800	36	12	8	44	100
	1000	12	7	10	71	100
	700x500		100			100
	1000x500			100		100
	1000x600				100	100
	1500x700		82	11	7	100
	Total	22	12	10	57	100

This evaluation revealed that only 22% of the existing sewer could accommodate the planned sewage flow with only for storm sewer of separate system in the year 2010.

5) Flow capacity as sanitary sewer of separate system

Sanitary Sewage Flow
Sanitary Sewage per Capita = 440 liter/day (Hourly Maximum)

Table 4.1.6 Result of Existing Pipe Evaluation

	Dia (mm)	F/C ≦ 50%	F/C ≦ 100%	F/C ≦ 150%	F/C > 150%	Total
Length (m)	400	29,252	443			29,695
	500	15,369				15,369
	600	24,797				24,797
	800	12,370	1,926			14,296
	1000	8,785	234			9,019
	700x500	316				316
	1000x500	199				199
	1000x600	1,130				1,130
	1500x700	1,884				1,884
	Total	94,102	2,603			96,705
Percentage (%)	400	99	1			100
	500	100				100
	600	100				100
	800	87	13			100
	1000	97	3			100
	700x500	100				100
	1000x500	100				100
	1000x600	100				100
	1500x700	100				100
	Total	97	3			100

This evaluation revealed that almost all existing sewer could accommodate the planned sanitary sewage flow in the year 2010.

Table 4.1.7 Evaluation of Existing Sewer Capacity (For Combined Sewer : Case-1)

Sanitary Sewage Flow

Sanitary Sewage per Capita = 440 liter/day (Hourly Maximum)

Storm Water Flow

Rainfall Intensity Formula = $\frac{2750}{t + 17}$ (Return Period : 4 Year)

For Main Pipe (D≧500)

Rainfall Intensity Formula = $\frac{2520}{t + 17}$ (Return Period : 2.5 Year)

For Small Pipe (D≦400)

Runoff Coefficient = 0.5

Inlet Time = 5 min

Assumed Average Velocity = 1.5 m/sec

No.	Down Stream	Length (m)	Area (ha)		Sewage Quantity				Existing Pipe Specification				Capacity	
		Increment	Increment	Total	Sanitary Sewage	Storm Water	Remain Sewage	$Q_1(m^3/s)$	D (mm)	I (‰)	V (m/s)	$Q_2(m^3/s)$	Q_1/Q_2	Judge
1001	1004	826	9.80	9.80	0.013	1.200		1.213	600	12.4	2.42	0.684	177%	NG
1002	1003	94	4.10	4.10	0.006	0.624		0.629	300	17.0	1.78	0.126	500%	NG
1003	1004	295	6.60	10.70	0.014	1.424		1.438	400	19.1	2.29	0.288	500%	NG
1004	1009	355	5.47	25.97	0.035	2.826		2.861	600	22.0	3.22	0.910	314%	NG
1005	1006	450	7.60	7.60	0.010	1.075		1.085	600	18.6	2.96	0.837	130%	NG
1006	1008	249	8.30	15.90	0.021	2.038		2.059	600	2.0	0.97	0.274	751%	NG
1007	1008	205	2.88	2.88	0.004	0.415		0.419	400	20.9	2.40	0.302	139%	NG
1008	1009	252	3.03	21.81	0.029	2.555		2.585	600	16.6	2.80	0.792	326%	NG
1009	1011	360	6.37	54.15	0.073	5.290		5.363	600	27.2	3.58	1.012	530%	NG
1010	1011	564	4.03	4.03	0.005	0.544		0.549	600	21.9	3.21	0.908	61%	OK
Out-11								-5.676						
1011	1012	824	0.97	59.15	0.080	0.119	0.157	0.356	600	18.0	2.91	0.823	43%	OK
1012	1021	491	0.00	59.15	0.080	0.101	0.157	0.338	600	6.3	1.72	0.486	70%	OK
1013	1014	247	1.33	1.33	0.002	0.206		0.207	600	17.2	2.85	0.806	26%	OK
1014	1015	163	4.25	5.58	0.008	0.734		0.742	400	2.0	0.74	0.093	798%	NG
1015	1016	268	7.90	13.48	0.018	1.745		1.763	500	2.0	0.86	0.169	1044%	NG
1016	1017B	708	7.90	21.38	0.029	2.001		2.030	400	12.8	1.87	0.235	864%	NG
1017A	1017B	186	1.20	1.20	0.002	0.190		0.192	500	41.3	3.91	0.768	25%	OK
1017B	1020	122	1.30	23.88	0.032	2.351		2.383	500	2.6	0.98	0.192	1238%	NG
1018	1019	426	4.59	4.59	0.006	0.657		0.663	600	2.0	0.97	0.274	242%	NG
1019	1020	100	2.85	7.44	0.010	1.022		1.032	800	1.9	1.15	0.578	179%	NG
1020	1021	895	0.00	31.32	0.042	2.456		2.499	800	5.6	1.97	0.990	252%	NG
Out-12								-2.470						
1021	1060	855	0.00	90.47	0.122	0.000	0.244	0.366	600	5.2	1.57	0.444	83%	OK
1022	1023	100	0.77	0.77	0.001	0.117		0.118	400	5.9	1.27	0.160	74%	OK
1023	1024	86	0.69	1.46	0.002	0.212		0.214	400	14.0	1.96	0.246	87%	OK
1024	1025	91	0.81	2.27	0.003	0.317		0.320	400	9.8	1.64	0.206	155%	NG
1025	1027	127	0.83	3.10	0.004	0.447		0.451	500	20.4	2.75	0.540	84%	OK
1026	1027	50	0.28	0.28	0.000	0.043		0.044	400	1.9	0.72	0.090	48%	OK
1027	1028	127	0.83	4.21	0.006	0.576		0.582	500	11.8	2.09	0.410	142%	NG
1028	1035	180	1.03	5.24	0.007	0.669		0.676	600	6.1	1.70	0.481	141%	NG
1029	1031	326	2.47	2.47	0.003	0.338		0.341	400	8.2	1.50	0.188	181%	NG
1030	1031	209	1.80	1.80	0.002	0.283		0.285	600	15.3	2.69	0.761	38%	OK
1031	1034	227	2.35	6.62	0.009	0.900		0.909	500	7.6	1.68	0.330	275%	NG
1032	1034	132	1.36	1.36	0.002	0.203		0.204	400	2.0	0.74	0.093	220%	NG
1033	1034	103	1.59	1.59	0.002	0.241		0.243	400	2.0	0.74	0.093	261%	NG
1034	1035	151	1.14	10.71	0.014	1.373		1.387	500	12.5	2.15	0.422	329%	NG
1035	1037	220	2.36	18.31	0.025	2.165		2.190	500	13.6	2.24	0.440	498%	NG
1036	1037	339	2.14	2.14	0.003	0.290		0.293	400	9.4	1.61	0.202	145%	NG
1037	1041	347	4.19	24.64	0.033	2.600		2.633	500	2.0	0.86	0.169	1559%	NG
1038	1039	110	1.70	1.70	0.002	0.256		0.259	400	7.2	1.41	0.177	146%	NG
1039	1040	140	1.15	2.85	0.004	0.439		0.443	500	6.4	1.54	0.302	146%	NG
1040	1041	124	1.15	4.00	0.005	0.583		0.589	600	11.3	2.31	0.653	90%	OK
1041	1044	136	0.85	29.49	0.040	2.988		3.027	500	22.0	2.85	0.560	541%	NG
1042	1044	73	2.17	2.17	0.003	0.364		0.366	500	42.4	3.96	0.778	47%	OK
1043	1044	78	0.49	0.49	0.001	0.082		0.082	500	2.5	0.96	0.188	44%	OK
1044	1049	286	2.08	34.23	0.046	3.197		3.243	500	18.5	2.62	0.514	630%	NG

No.	Down Stream	Length (m)	Area (ha)		Sewage Quantity				Existing Pipe Specification				Capacity	
		Increment	Increment	Total	Sanitary Sewage	Storm Water	Remain Sewage	$Q_1(m^3/s)$	D (mm)	I (‰)	V (m/s)	$Q_2(m^3/s)$	Q_1/Q_2	Judge
1045	1046	283	3.12	3.12	0.004	0.435		0.439	400	12.7	1.87	0.235	187%	NG
1046	1048	125	1.70	4.82	0.007	0.695		0.701	500	10.9	2.01	0.395	178%	NG
1047	1048	123	2.35	2.35	0.003	0.384		0.387	500	16.2	2.45	0.481	80%	OK
1048	1049	156	1.80	8.97	0.012	1.211		1.223	500	4.4	1.28	0.251	487%	NG
1049	1053	274	0.90	44.10	0.060	3.837		3.896	800	2.0	1.18	0.593	657%	NG
1050	1051	56	0.80	0.80	0.001	0.135		0.136	500	2.0	0.86	0.169	81%	OK
1051	1052	149	2.65	3.45	0.005	0.542		0.547	600	2.0	0.97	0.274	199%	NG
1052	1053	157	0.85	4.30	0.006	0.632		0.637	800	1.8	1.12	0.563	113%	NG
1053	1057	121	1.08	49.48	0.067	4.172		4.239	800	2.0	1.18	0.593	715%	NG
1054	1056	325	2.64	2.64	0.004	0.394		0.397	600	16.6	2.80	0.792	50%	OK
1055	1056	373	3.30	3.30	0.004	0.483		0.487	600	12.0	2.38	0.673	72%	OK
1056	1057	296	1.30	7.24	0.010	0.941		0.950	800	2.0	1.18	0.593	160%	NG
1057	1060	444	6.15	62.87	0.085	4.783		4.868	1000	2.0	1.37	1.076	452%	NG
1058	1059	300	3.29	3.29	0.004	0.455		0.460	400	17.6	2.20	0.276	166%	NG
1059	1060	945	7.30	10.59	0.014	1.130		1.144	600	2.0	0.97	0.274	417%	NG
Out-13								-5.715			0.00	0.000		
1060	1061	722	0.00	163.93	0.221	0.000	0.442	0.664	600	8.6	2.01	0.568	117%	NG
1061	1062	482	0.00	163.93	0.221	0.000	0.442	0.664	600	7.8	1.92	0.543	122%	NG
1062	1063	280	36.20	200.13	0.270	3.591	0.442	4.304	800	17.4	3.47	1.744	247%	NG
1063	1065	267	3.45	203.58	0.275	3.649	0.442	4.366	800	3.3	1.51	0.759	575%	NG
1064	1065	149	3.83	3.83	0.005	0.617		0.622	1000	3.3	1.75	1.374	45%	OK
1065	To STP	1130	6.20	213.61	0.288	3.649	0.442	4.380	1000x600	3.8	1.93	1.042	420%	NG
Out-14								-3.803						
To STP					0.288		0.576	0.865						
2001	2002	480	14.95	14.95	0.023	1.917		1.939	400	5.8	1.26	0.158	1225%	NG
2002	2003	193	4.38	19.33	0.030	2.503		2.532	500	26.2	3.11	0.611	415%	NG
2003	2005	242	3.74	23.07	0.035	2.736		2.772	600	18.5	2.95	0.834	332%	NG
2004	2005	348	6.90	6.90	0.011	1.018		1.028	600	9.1	2.07	0.585	176%	NG
2005	2007	169	1.15	31.12	0.048	3.496		3.543	600	8.2	1.97	0.557	636%	NG
2006	2007	300	1.60	1.60	0.002	0.221		0.224	400	5.0	1.17	0.147	152%	NG
2007	2009	48	0.23	32.95	0.050	3.637		3.688	600	12.5	2.43	0.687	537%	NG
2008	2009	273	2.10	2.10	0.003	0.294		0.297	300	5.1	0.98	0.069	429%	NG
2009	2011	262	2.10	37.15	0.057	3.784		3.841	1500x700	9.5	3.67	3.468	111%	NG
2010A	2010B	50	0.54	0.54	0.001	0.084		0.084	300	11.9	1.49	0.105	80%	OK
2010B	2011	175	1.67	2.21	0.003	0.316		0.319	400	2.0	0.74	0.093	343%	NG
2011	2013	210	0.40	39.76	0.061	3.816		3.876	1500x700	4.0	2.38	2.249	172%	NG
2012	2013	218	5.20	5.20	0.008	0.746		0.754	400	14.2	1.97	0.248	305%	NG
2013	2015	138	0.80	45.76	0.070	4.222		4.292	1500x700	2.0	1.68	1.588	270%	NG
2014	2015	102	1.35	1.35	0.002	0.205		0.207	400	4.9	1.16	0.146	142%	NG
2015	2017	850	6.00	53.11	0.081	3.993		4.074	1500x700	6.3	2.99	2.826	144%	NG
2016	2017	150	1.03	1.03	0.002	0.152		0.154	400	4.0	1.05	0.132	116%	NG
2017	2019	280	1.35	55.49	0.085	3.932		4.017	1500x700	8.3	3.43	3.241	124%	NG
2018	2019	206	1.60	1.60	0.002	0.251		0.254	600	10.6	2.24	0.633	40%	OK
2019	2021	132	0.35	57.44	0.088	3.960		4.048	1000	20.2	4.34	3.409	119%	NG
2020	2021	118	2.82	2.82	0.004	0.424		0.428	400	24.5	2.59	0.325	131%	NG
2021	2025	250	1.14	61.40	0.094	4.029		4.123	1000	2.0	1.37	1.076	383%	NG
2022	2024	269	5.75	5.75	0.009	0.878		0.887	500	10.4	1.96	0.385	231%	NG
2023	2024	313	2.71	2.71	0.004	0.372		0.376	400	6.3	1.32	0.166	227%	NG
2024	2025	150	1.10	9.56	0.015	1.347		1.362	500	1.5	0.74	0.145	937%	NG
2025	2030	290	5.30	76.26	0.116	4.744		4.860	1000	4.4	2.02	1.587	306%	NG
2026	2027	253	3.12	3.12	0.005	0.440		0.445	300	11.8	1.49	0.105	423%	NG
2027	2029	193	1.85	4.97	0.008	0.644		0.652	400	15.5	2.06	0.259	252%	NG
2028	2029	341	2.99	2.99	0.005	0.406		0.410	400	13.3	1.91	0.240	171%	NG
2029	2030	175	0.54	8.50	0.013	1.123		1.136	500	4.2	1.25	0.245	463%	NG
2030	2033	144	1.20	85.96	0.131	5.211		5.343	1500x700	15.9	4.75	4.489	119%	NG
2031	2032	212	1.66	1.66	0.003	0.238		0.241	400	10.8	1.72	0.216	111%	NG
2032	2033	316	2.82	4.48	0.007	0.613		0.620	700x500	5.0	1.84	0.580	107%	NG
2033	2034	95	0.84	91.28	0.139	5.447		5.587	1000	46.3	6.57	5.160	108%	NG
2034	2044	130	0.77	92.05	0.141	5.368		5.508	800	2.0	1.18	0.593	929%	NG
2035	2037	130	0.90	0.90	0.001	0.147		0.148	600	6.1	1.70	0.481	31%	OK
2036	2037	111	1.40	1.40	0.002	0.211		0.213	400	7.2	1.41	0.177	120%	NG

No.	Down Stream	Length (m)	Area (ha)		Sewage Quantity				Existing Pipe Specification				Capacity	
		Increment	Increment	Total	Sanitary Sewage	Storm Water	Remain Sewage	$Q_1(m^3/s)$	D (mm)	I (‰)	V (m/s)	$Q_2(m^3/s)$	Q_1/Q_2	Judge
2037	2040	438	3.80	6.10	0.009	0.823		0.833	600	23.0	3.29	0.930	90%	OK
2038	2040	187	3.08	3.08	0.005	0.447		0.452	400	2.0	0.74	0.093	486%	NG
2039	2040	145	0.80	0.80	0.001	0.129		0.131	500	27.5	3.19	0.626	21%	OK
2040	2042	538	9.90	19.88	0.030	2.214		2.244	800	8.1	2.37	1.191	188%	NG
2041	2042	451	2.14	2.14	0.003	0.277		0.281	400	15.7	2.08	0.261	107%	NG
2042	2044	47	0.08	22.10	0.034	2.426		2.459	1000	2.0	1.37	1.076	229%	NG
2043	2044	102	16.60	16.60	0.025	2.745		2.770	800	16.6	3.39	1.704	163%	NG
2044	2052	302	0.00	130.75	0.200	7.259		7.458	1000	4.0	1.93	1.516	492%	NG
2045	2046	269	2.27	2.27	0.003	0.318		0.321	400	24.9	2.62	0.329	98%	OK
2046	2049	272	4.30	6.57	0.010	0.896		0.906	600	9.9	2.16	0.611	148%	NG
2047	2048	196	5.50	5.50	0.008	0.795		0.804	300	2.0	0.61	0.043	1864%	NG
2048	2049	208	3.40	8.90	0.014	1.175		1.189	400	2.0	0.74	0.093	1279%	NG
2049	2051	618	8.20	23.67	0.036	2.590		2.627	600	6.7	1.78	0.503	522%	NG
2050	2051	130	1.10	1.10	0.002	0.165		0.166	400	4.6	1.12	0.141	118%	NG
2051	2052	365	0.30	25.07	0.038	2.462		2.500	800	4.6	1.78	0.895	279%	NG
2052	2053	469	0.00	155.82	0.238	8.043		8.280	600	6.1	1.70	0.481	1723%	NG
2053	2062	930	6.33	162.15	0.248	7.338		7.585	1000	4.8	2.11	1.657	458%	NG
2054	2055	48	0.80	0.80	0.001	0.124		0.126	400	2.0	0.74	0.093	135%	NG
2055	2056	151	2.47	3.27	0.005	0.516		0.521	500	5.3	1.40	0.275	190%	NG
2056	2057	67	0.24	3.51	0.005	0.536		0.542	600	28.3	3.65	1.032	52%	OK
2057	2058	115	14.50	18.01	0.027	2.626		2.653	500	5.2	1.39	0.273	972%	NG
2058	2059	152	0.00	18.01	0.027	2.466		2.493	500	31.5	3.41	0.670	372%	NG
2059	2061	676	0.00	18.01	0.027	1.943		1.971	600	6.5	1.75	0.495	398%	NG
2060	2061	117	3.00	3.00	0.005	0.492		0.496	500	2.0	0.86	0.169	294%	NG
2061	2062	868	0.00	21.01	0.032	1.779		1.811	1000	2.0	1.37	1.076	168%	NG
2062	To STP	400	0.00	183.16	0.280	7.878		8.158	1000	2.0	1.37	1.076	758%	NG
Out-21								-7.319						
To STP					0.280		0.559	0.839						
3001	3008	725	24.00	24.00	0.043	2.791		2.833	400	18.2	2.24	0.281	1007%	NG
3002	3004	275	5.80	5.80	0.010	0.809		0.819	400	17.8	2.21	0.278	295%	NG
3003	3004	108	0.35	0.35	0.001	0.053		0.053	400	12.9	1.88	0.236	23%	OK
3004	3007	42	0.10	6.25	0.011	0.858		0.869	400	57.1	3.96	0.498	175%	NG
3005	3006	203	1.43	1.43	0.003	0.206		0.209	300	9.8	1.35	0.095	219%	NG
3006	3007	130	0.45	1.88	0.003	0.256		0.259	400	49.2	3.68	0.462	56%	OK
3007	3008	25	0.03	8.16	0.015	1.098		1.113	400	2.0	0.74	0.093	1197%	NG
3008	3009	82	1.57	33.73	0.060	4.156		4.216	500	6.7	1.57	0.308	1368%	NG
3009	3011	215	8.12	41.85	0.075	4.786		4.860	600	13.9	2.56	0.724	671%	NG
3010	3011	152	1.14	1.14	0.002	0.168		0.170	400	12.4	1.85	0.232	73%	OK
3011	3013	66	0.20	43.19	0.077	4.838		4.914	600	21.2	3.16	0.893	550%	NG
3012	3013	149	0.90	0.90	0.002	0.133		0.135	400	7.3	1.42	0.178	75%	OK
3013	3017	58	1.48	45.57	0.081	5.016		5.097	500	10.3	1.95	0.383	1331%	NG
3014	3015	221	2.25	2.25	0.004	0.321		0.325	300	20.3	1.95	0.138	236%	NG
3015	3016	278	4.27	6.52	0.012	0.830		0.841	400	3.4	0.97	0.122	690%	NG
3016	3017	180	2.94	9.46	0.017	1.122		1.139	400	2.7	0.86	0.108	1054%	NG
3017	3021	352	7.25	62.28	0.111	6.163		6.273	800	13.9	3.10	1.558	403%	NG
3018	3019	227	2.42	2.42	0.004	0.377		0.382	500	2.0	0.86	0.169	226%	NG
3019	3020	558	15.68	18.10	0.032	2.252		2.284	600	11.9	2.37	0.670	341%	NG
3020	3021	308	2.50	20.60	0.037	2.307		2.344	600	2.9	1.17	0.331	709%	NG
3021	3025	132	0.60	83.48	0.149	7.951		8.100	600	3.0	1.19	0.336	2407%	NG
3022	3023	120	1.05	1.05	0.002	0.158		0.160	400	12.5	1.85	0.232	69%	OK
3023	3024	268	1.93	2.98	0.005	0.433		0.438	500	19.0	2.65	0.520	84%	OK
3024	3025	93	0.13	3.11	0.006	0.435		0.441	600	20.4	3.10	0.877	50%	OK
3025	3026	63	0.30	86.89	0.155	8.134		8.289	600	7.9	1.93	0.546	1519%	NG
3026	3027	190	2.50	89.39	0.159	7.959		8.118	800	24.7	4.13	2.076	391%	NG
3027	3029	71	0.20	89.59	0.160	7.830		7.990	600	18.3	2.94	0.831	961%	NG
	3028		4.05	4.05	0.007			0.007						
3028	3029	543	7.00	11.05	0.020	0.955		0.975	800	14.7	3.19	1.603	61%	OK
Out-31								-9.502						
3029	3032	256	3.20	103.84	0.185	0.493	0.358	1.036	800	15.2	3.24	1.629	64%	OK
3030	3031	402	5.91	5.91	0.011	0.781		0.791	400	11.4	1.77	0.222	356%	NG
3031	3032	305	5.28	11.19	0.020	1.429		1.449	600	19.0	2.99	0.845	171%	NG

No.	Down Stream	Length (m)	Area (ha)		Sewage Quantity				Existing Pipe Specification				Capacity	
		Increment	Increment	Total	Sanitary Sewage	Storm Water	Remain Sewage	$Q_1(m^3/s)$	D (mm)	I (‰)	V (m/s)	$Q_2(m^3/s)$	Q_1/Q_2	Judge
3032	3039	370	3.85	118.88	0.212	2.402	0.358	2.972	800	7.2	2.23	1.121	265%	NG
3033	3035	142	0.92	0.92	0.002	0.149		0.151	500	2.0	0.86	0.169	89%	OK
3034	3035	83	0.81	0.81	0.001	0.124		0.125	400	2.0	0.74	0.093	135%	NG
3035	3036	85	0.94	2.67	0.005	0.381		0.386	400	10.7	1.71	0.215	180%	NG
3036	3038	169	1.35	4.02	0.007	0.582		0.589	500	8.2	1.74	0.342	172%	NG
3037	3038	278	1.60	1.60	0.003	0.243		0.246	500	10.4	1.96	0.385	64%	OK
3038	3039	166	1.15	6.77	0.012	0.917		0.929	600	28.9	3.69	1.043	89%	OK
3039	3041	113	0.65	126.30	0.225	3.245	0.358	3.829	800	10.9	2.75	1.382	277%	NG
3040	3041	155	1.46	1.46	0.003	0.216		0.218	400	27.7	2.76	0.347	63%	OK
3041	3062	365	2.30	130.06	0.232	3.276	0.358	3.866	800	2.8	1.39	0.699	553%	NG
3042	3044	410	5.20	5.20	0.009	0.747		0.756	600	13.4	2.51	0.710	107%	NG
3043	3044	98	0.77	0.77	0.001	0.117		0.118	400	2.0	0.74	0.093	127%	NG
3044	3045	221	2.45	8.42	0.015	1.109		1.124	500	9.9	1.91	0.375	300%	NG
3045	3052	454	11.51	19.93	0.035	2.232		2.268	600	12.3	2.41	0.681	333%	NG
3046	3048	263	4.73	4.73	0.008	0.665		0.673	400	2.0	0.74	0.093	724%	NG
3047	3048	167	2.87	2.87	0.005	0.420		0.425	400	4.7	1.14	0.143	297%	NG
3048	3050	58	0.70	8.30	0.015	1.135		1.150	400	2.0	0.74	0.093	1236%	NG
3049	3050	272	1.83	1.83	0.003	0.256		0.259	400	9.5	1.62	0.204	127%	NG
3050	3051	173	1.42	11.55	0.021	1.470		1.491	400	2.0	0.74	0.093	1603%	NG
3051	3052	77	0.29	11.84	0.021	1.598		1.619	600	2.0	0.97	0.274	590%	NG
3052	3055	174	1.46	33.23	0.059	3.526		3.585	600	2.0	0.97	0.274	1307%	NG
3053	3054	118	0.43	0.43	0.001	0.065		0.065	400	2.0	0.74	0.093	70%	OK
3054	3055	98	0.35	0.78	0.001	0.122		0.123	500	6.7	1.57	0.308	40%	OK
3055	3060	12	0.01	34.02	0.061	3.599		3.660	600	2.0	0.97	0.274	1334%	NG
3056	3059	287	2.82	2.82	0.005	0.427		0.432	500	13.2	2.21	0.434	100%	OK
3057	3059	203	1.29	1.29	0.002	0.203		0.205	500	17.2	2.52	0.495	41%	OK
3058	3059	111	0.46	0.46	0.001	0.069		0.070	400	2.0	0.74	0.093	76%	OK
3059	3060	235	1.18	5.75	0.010	0.790		0.800	600	8.8	2.04	0.577	139%	NG
3060	3061	114	0.45	40.22	0.072	4.107		4.179	600	2.0	0.97	0.274	1524%	NG
3061	3062	348	8.47	48.69	0.087	4.503		4.590	600	6.7	1.78	0.503	912%	NG
3062	3075	514	9.30	188.05	0.335	8.346	0.358	9.040	800	3.6	1.58	0.794	1138%	NG
3063	3065	256	1.33	1.33	0.002	0.205		0.207	600	7.8	1.92	0.543	38%	OK
3064	3065	216	1.32	1.32	0.002	0.207		0.209	600	8.3	1.98	0.560	37%	OK
3065	3067	86	0.75	3.40	0.006	0.503		0.509	600	2.0	0.97	0.274	186%	NG
3066	3067	232	2.02	2.02	0.004	0.314		0.317	600	9.0	2.06	0.582	54%	OK
3067	3075	372	2.20	7.62	0.014	0.973		0.987	600	11.2	2.30	0.650	152%	NG
3068	3070	416	4.63	4.63	0.008	0.665		0.673	500	2.0	0.86	0.169	399%	NG
3069	3070	285	3.24	3.24	0.006	0.450		0.456	400	2.8	0.88	0.111	412%	NG
3070	3072	176	1.12	8.99	0.016	1.201		1.217	500	2.1	0.88	0.173	704%	NG
3071	3072	114	0.68	0.68	0.001	0.102		0.103	400	9.6	1.62	0.204	51%	OK
3072	3074	100	0.41	10.08	0.018	1.296		1.314	500	2.9	1.04	0.204	644%	NG
3073	3074	127	0.86	0.86	0.002	0.129		0.130	400	14.9	2.02	0.254	51%	OK
3074	3075	574	3.36	14.30	0.025	1.513		1.538	500	7.1	1.62	0.318	484%	NG
3075	3077	415	0.15	210.12	0.374	9.376	0.358	10.108	800	2.0	1.18	0.593	1704%	NG
3076	3077	220	1.93	1.93	0.003	0.302		0.306	500	9.0	1.82	0.357	86%	OK
Out-32								-9.281						
3077	3079	270	2.80	214.85	0.383	0.428	0.755	1.565	800	2.0	1.18	0.593	264%	NG
3078	3079	533	5.32	5.32	0.009	0.667		0.677	300	2.0	0.61	0.043	1570%	NG
3079	3085	233	0.76	220.93	0.393	1.229	0.755	2.377	800	2.0	1.18	0.593	401%	NG
3080	3082	134	0.47	0.47	0.001	0.070		0.071	200	10.4	1.06	0.033	213%	NG
3081	3082	70	1.43	1.43	0.003	0.220		0.222	400	2.0	0.74	0.093	239%	NG
3082	3084	47	0.21	2.11	0.004	0.308		0.311	400	2.0	0.74	0.093	335%	NG
3083	3084	212	1.68	1.68	0.003	0.263		0.266	500	2.0	0.86	0.169	158%	NG
3084	3085	70	0.21	4.00	0.007	0.609		0.616	500	2.0	0.86	0.169	365%	NG
3085	3104	421	3.12	228.05	0.406	1.892	0.755	3.053	1000	5.8	2.32	1.822	168%	NG
3086	3087	290	2.72	2.72	0.005	0.378		0.383	300	6.8	1.13	0.080	479%	NG
3087	3092	95	0.30	3.02	0.005	0.402		0.407	400	27.3	2.74	0.344	118%	NG
3088	3089	52	0.36	0.36	0.001	0.056		0.056	300	2.0	0.61	0.043	131%	NG
3089	3092	220	1.25	1.61	0.003	0.225		0.228	400	20.8	2.39	0.300	76%	OK
3091	3092	199	5.17	5.17	0.009	0.748		0.757	300	3.0	0.75	0.053	1428%	NG
3092	3096	344	4.64	14.44	0.026	1.832		1.858	500	4.9	1.35	0.265	701%	NG

No.	Down Stream	Length (m) Increment	Area (ha) Increment	Area (ha) Total	Sewage Quantity Sanitary Sewage	Storm Water	Remain Sewage	$Q_1(m^3/s)$	Existing Pipe Specification D (mm)	I (‰)	V (m/s)	$Q_2(m^3/s)$	Capacity Q_1/Q_2	Judge
3093	3095	327	1.95	1.95	0.003	0.267		0.270	300	2.0	0.61	0.043	626%	NG
3094	3095	290	2.15	2.15	0.004	0.299		0.302	300	6.8	1.13	0.080	379%	NG
3095	3096	267	0.30	4.40	0.008	0.538		0.546	400	5.4	1.22	0.153	356%	NG
3096	3097	191	0.38	19.22	0.034	2.280		2.314	600	9.9	2.16	0.611	379%	NG
3097	3100	30	0.02	19.24	0.034	2.254		2.288	600	2.0	0.97	0.274	834%	NG
3098	3099	91	0.34	0.34	0.001	0.052		0.052	300	2.0	0.61	0.043	121%	NG
3099	3100	251	1.24	1.58	0.003	0.234		0.237	600	8.8	2.04	0.577	41%	OK
3100	3103	93	0.78	21.60	0.038	2.455		2.494	800	2.0	1.18	0.593	420%	NG
3101	3102	230	1.92	1.92	0.003	0.273		0.277	300	2.0	0.61	0.043	641%	NG
3102	3103	239	2.20	4.12	0.007	0.579		0.586	600	8.9	2.05	0.580	101%	NG
3103	3104	101	0.82	26.54	0.047	2.921		2.969	800	2.0	1.18	0.593	500%	NG
3104	3107	257	2.41	257.00	0.458	4.891	0.755	6.104	1000	2.0	1.37	1.076	567%	NG
3105	3106	187	1.49	1.49	0.003	0.236		0.239	800	2.1	1.21	0.608	39%	OK
3106	3107	210	1.82	3.31	0.006	0.479		0.485	500	2.0	0.86	0.169	287%	NG
3107	3109	667	11.60	271.91	0.484	5.380	0.755	6.619	1000	3.1	1.70	1.335	496%	NG
3108	3109	193	2.23	2.23	0.004	0.353		0.357	500	5.1	1.37	0.269	133%	NG
3109	3113	456	4.93	279.07	0.497	5.378	0.755	6.630	1000	2.0	1.37	1.076	616%	NG
3110	3112	491	2.69	2.69	0.005	0.374		0.378	600	5.2	1.57	0.444	85%	OK
3111	3112	181	4.18	4.18	0.007	0.610		0.617	400	7.7	1.45	0.182	339%	NG
3112	3113	489	4.41	11.28	0.020	1.310		1.330	600	2.0	0.97	0.274	485%	NG
Out-33								-6.408						
3113	3127	20	0.50	290.85	0.518		1.034	1.552	1000	2.0	1.37	1.076	144%	NG
3114	3116	579	3.68	3.68	0.007	0.495		0.501	500	4.6	1.30	0.255	196%	NG
3115	3116	67	0.44	0.44	0.001	0.068		0.069	400	8.9	1.56	0.196	35%	OK
3116	3118	68	0.32	4.44	0.008	0.581		0.589	600	10.2	2.19	0.619	95%	OK
3117	3118	70	1.40	1.40	0.002	0.215		0.217	400	2.0	0.74	0.093	234%	NG
3118	3121	199	2.38	8.22	0.015	1.000		1.015	1000x500	2.0	1.32	0.594	171%	NG
3119	3120	268	3.27	3.27	0.006	0.458		0.464	400	6.3	1.32	0.166	279%	NG
3120	3121	213	3.16	6.43	0.011	0.900		0.911	500	7.9	1.71	0.336	271%	NG
3121	3125	232	2.40	17.05	0.030	1.915		1.946	500	9.7	1.89	0.371	524%	NG
3122	3124	276	2.60	2.60	0.005	0.363		0.367	400	9.4	1.61	0.202	181%	NG
3123	3124	124	1.80	1.80	0.003	0.269		0.272	400	3.2	0.94	0.118	231%	NG
3124	3125	208	0.81	5.21	0.009	0.666		0.675	400	2.0	0.74	0.093	726%	NG
3125	3126	500	4.58	26.84	0.048	2.378		2.426	400	10.3	1.68	0.211	1149%	NG
3126	3127	1009	0.00	26.84	0.048	2.022		2.070	600	3.2	1.23	0.348	595%	NG
Out-34								-1.925						
3127	3152	97	0.05	317.74	0.566		1.131	1.697						
3128	3129	254	2.27	2.27	0.004	0.320		0.324	300	8.2	1.24	0.088	370%	NG
3129	3131	71	1.33	3.60	0.006	0.492		0.499	400	2.0	0.74	0.093	536%	NG
3130	3131	201	1.00	1.00	0.002	0.145		0.146	400	8.9	1.56	0.196	75%	OK
3131	3136	122	1.40	6.00	0.011	0.849		0.859	500	2.0	0.86	0.169	509%	NG
3132	3133	124	0.60	0.60	0.001	0.090		0.091	300	9.6	1.34	0.095	96%	OK
3133	3135	95	0.40	1.00	0.002	0.143		0.145	400	9.4	1.61	0.202	72%	OK
3134	3135	149	1.16	1.16	0.002	0.171		0.173	400	2.6	0.85	0.107	162%	NG
3135	3136	20	0.05	2.21	0.004	0.313		0.317	400	2.0	0.74	0.093	341%	NG
3136	3141	287	4.10	12.31	0.022	1.557		1.579	600	9.4	2.11	0.597	265%	NG
3137	3138	328	3.02	3.02	0.005	0.451		0.456	500	8.5	1.77	0.348	131%	NG
3138	3140	138	0.60	3.62	0.006	0.508		0.515	600	2.0	0.97	0.274	188%	NG
3139	3140	122	4.10	4.10	0.007	0.613		0.621	400	7.3	1.42	0.178	348%	NG
3140	3141	68	0.39	8.11	0.014	1.110		1.125	800	2.0	1.18	0.593	190%	NG
3141	3142	120	0.43	20.85	0.037	2.528		2.565	800	2.0	1.18	0.593	432%	NG
3142	3148	281	1.25	22.10	0.039	2.440		2.479	800	6.9	2.19	1.101	225%	NG
3143	3144	159	1.39	1.39	0.002	0.204		0.207	300	16.9	1.78	0.126	164%	NG
3144	3145	302	1.76	3.15	0.006	0.407		0.412	400	8.9	1.56	0.196	210%	NG
3145	3147	248	5.98	9.13	0.016	1.166		1.183	500	6.5	1.55	0.304	389%	NG
3146	3147	185	0.70	0.70	0.001	0.111		0.112	600	4.3	1.42	0.401	28%	OK
3147	3148	497	7.44	17.27	0.031	1.863		1.894	600	4.6	1.47	0.416	456%	NG
3148	3151	367	1.19	40.56	0.072	3.922		3.994	1000	4.6	2.07	1.626	246%	NG
3149	3150	218	0.70	0.70	0.001	0.100		0.102	300	15.1	1.68	0.119	86%	OK
3150	3151	404	3.47	4.17	0.007	0.505		0.512	400	2.7	0.86	0.108	474%	NG
3151	3152	430	2.30	47.03	0.084	4.055		4.139	1000	2.0	1.37	1.076	385%	NG

No.	Down Stream	Length (m)	Area (ha)		Sewage Quantity				Existing Pipe Specification				Capacity	
		Increment	Increment	Total	Sanitary Sewage	Storm Water	Remain Sewage	$Q_1(m^3/s)$	D (mm)	I (‰)	V (m/s)	$Q_2(m^3/s)$	Q_1/Q_2	Judge
Out-35								-3.887						
3152	3154	43	0.06	364.83	0.650		1.299	1.949						
3153	3154	464	1.32	1.32	0.002	0.170		0.172	400	2.0	0.74	0.093	185%	NG
3154	3157	22	0.01	366.16	0.652	0.170	1.299	2.121						
3155	3156	537	3.38	3.38	0.006	0.423		0.429	300	8.3	1.25	0.088	485%	NG
3156	3157	480	3.45	6.83	0.012	0.718		0.730	400	2.0	0.74	0.093	785%	NG
3157	3164	181	0.70	373.69	0.665	0.888	1.299	2.852						
3158	3159	175	1.41	1.41	0.003	0.206		0.209	300	2.8	0.72	0.051	411%	NG
3159	3161	149	0.81	2.22	0.004	0.304		0.307	400	3.3	0.95	0.119	258%	NG
3160	3161	169	1.25	1.25	0.002	0.183		0.185	400	2.0	0.74	0.093	199%	NG
3161	3163	194	5.50	8.97	0.016	1.232		1.248	600	2.0	0.97	0.274	455%	NG
3162	3163	150	2.50	2.50	0.004	0.369		0.374	400	2.0	0.74	0.093	402%	NG
3163	3164	189	0.80	12.27	0.022	1.567		1.589	600	4.2	1.41	0.399	399%	NG
Out-36								-2.380						
3164	3170	439	3.70	389.66	0.694		1.374	2.068						
3165	3166	479	4.05	4.05	0.007	0.519		0.526	300	9.1	1.31	0.093	569%	NG
3166	3167	106	0.56	4.61	0.008	0.566		0.574	300	2.0	0.61	0.043	1332%	NG
3167	3168	144	1.18	5.79	0.010	0.735		0.745	800	4.3	1.73	0.870	86%	OK
3168	3169	137	0.97	6.76	0.012	0.817		0.829	800	2.0	1.18	0.593	140%	NG
3169	3170	392	0.00	6.76	0.012	0.717		0.729	800	13.0	3.00	1.508	48%	OK
Out-37								-0.680						
3170	To STP	930	0.00	396.42	0.706		1.412	2.118						
4001	4002	24	5.70	5.70	0.010	0.895		0.904	200	41.6	2.13	0.067	1351%	NG
4002	4003	64	2.90	8.60	0.015	1.309		1.323	300	46.8	2.96	0.209	633%	NG
4003	4004	837	13.00	21.60	0.037	2.341		2.377	400	8.0	1.48	0.186	1278%	NG
4004	4006	46	0.35	21.95	0.038	2.342		2.380	300	73.1	3.70	0.262	910%	NG
	4005		10.78		0.018			0.018						
4005	4006	637	4.60	4.60	0.026	0.553		0.580	300	17.5	1.81	0.128	453%	NG
4006	4007	34	0.25	26.80	0.064	2.825		2.890	300	11.7	1.48	0.105	2762%	NG
4007	4011	295	2.42	29.22	0.068	2.810		2.878	400	8.1	1.49	0.187	1537%	NG
4009	4010	147	0.72	0.72	0.001	0.107		0.108	300	10.2	1.38	0.098	111%	NG
4010	4011	538	11.78	12.50	0.021	1.478		1.499	400	15.7	2.08	0.261	574%	NG
4011	4012	74	2.68	44.40	0.094	0.411		0.506	400	7.6	1.44	0.181	279%	NG
Out-41								-0.317						
4012	4013	162	2.25	46.65	0.098	0.331	0.189	0.618	400	9.2	1.59	0.200	309%	NG
Out-42								-0.421						
4013	4015	156	1.56	48.21	0.101	0.230	0.196	0.527	400	5.1	1.18	0.148	356%	NG
4014	4015	377	2.17	2.17	0.004	0.290		0.294	400	15.6	2.07	0.260	113%	NG
4015	4017	266	2.68	53.06	0.109	0.840	0.196	1.146	400	12.0	1.82	0.229	501%	NG
4016	4017	913	12.80	12.80	0.022	1.523		1.545	800	22.8	3.97	1.996	77%	OK
4017	4024	154	0.88	66.74	0.132	2.702	0.196	3.031	800	20.1	3.73	1.875	162%	NG
4018	4021	313	5.26	5.26	0.009	0.722		0.731	300	17.2	1.79	0.127	578%	NG
4019	4020	68	1.00	1.00	0.002	0.154		0.155	300	2.0	0.61	0.043	360%	NG
4020	4021	260	1.03	2.03	0.003	0.278		0.281	300	19.8	1.92	0.136	207%	NG
4021	4022	57	0.35	7.64	0.013	1.017		1.030	400	24.8	2.61	0.328	314%	NG
4022	4023	36	0.53	8.17	0.014	1.071		1.085	400	55.5	3.90	0.490	221%	NG
	4023		4.01		0.007			0.007						
4023	4024	446	4.60	12.77	0.029	1.414		1.443	400	9.1	1.58	0.199	727%	NG
4024	4025	170	0.88	80.39	0.163	4.253	0.196	4.612	800	10.5	2.70	1.357	340%	NG
Out-43								-4.287						
	4025		7.30		0.012			0.012						
4025	4028	196	0.97	81.36	0.177	0.153	0.325	0.655	800	22.4	3.94	1.980	33%	OK
4026	4027	976	12.24	12.24	0.021	1.306		1.327	400	30.2	2.88	0.362	367%	NG
4027	4028	305	1.50	13.74	0.023	1.450		1.473	500	7.5	1.67	0.328	449%	NG
	4028		14.00		0.024			0.024						
4028	4054	183	0.85	95.95	0.226	2.268	0.325	2.819	800	2.0	1.18	0.593	475%	NG
4029	4030	52	1.41	1.41	0.002	0.218		0.221	300	57.6	3.28	0.232	95%	OK
4030	4031	215	1.92	3.33	0.006	0.466		0.472	400	6.9	1.38	0.173	272%	NG
4031	4036	178	0.78	4.11	0.007	0.584		0.591	500	2.0	0.86	0.169	350%	NG
4032	4033	77	0.65	0.65	0.001	0.099		0.100	200	87.0	3.08	0.097	104%	NG
4033	4034	153	0.88	1.53	0.003	0.218		0.220	300	23.5	2.10	0.148	148%	NG

No.	Down Stream	Length (m)	Area (ha)		Sewage Quantity				Existing Pipe Specification				Capacity	
		Increment	Increment	Total	Sanitary Sewage	Storm Water	Remain Sewage	$Q_1(m^3/s)$	D (mm)	I (‰)	V (m/s)	$Q_2(m^3/s)$	Q_1/Q_2	Judge
4034	4035	169	4.18	5.71	0.010	0.757		0.767	400	20.1	2.35	0.295	260%	NG
4035	4036	55	0.27	5.98	0.010	0.846		0.856	500	12.7	2.17	0.426	201%	NG
4036	4045	343	2.64	12.73	0.022	1.574		1.595	500	29.5	3.30	0.648	246%	NG
4037	4038	175	2.49	2.49	0.004	0.365		0.369	300	18.2	1.85	0.131	282%	NG
4038	4041	89	0.67	3.16	0.005	0.444		0.450	400	26.9	2.72	0.342	132%	NG
4039	4040	119	0.88	0.88	0.002	0.132		0.134	300	47.0	2.97	0.210	64%	OK
4040	4041	50	0.10	0.98	0.002	0.144		0.145	400	2.0	0.74	0.093	156%	NG
4041	4042	210	0.76	4.90	0.008	0.628		0.637	400	19.5	2.31	0.290	219%	NG
4042	4045	10	0.01	4.91	0.008	0.684		0.693	500	3.4	1.12	0.220	315%	NG
4043	4044	119	0.55	0.55	0.001	0.083		0.084	300	42.5	2.82	0.199	42%	OK
4044	4045	259	0.81	1.36	0.002	0.182		0.184	400	16.9	2.15	0.270	68%	OK
4045	4053	231	1.43	20.43	0.035	2.141		2.176	400	4.3	1.09	0.137	1588%	NG
4046	4047	168	1.02	1.02	0.002	0.149		0.151	300	2.3	0.66	0.047	324%	NG
4047	4048	161	1.24	2.26	0.004	0.308		0.312	400	2.0	0.74	0.093	335%	NG
4048	4050	423	9.14	11.40	0.019	1.432		1.452	500	30.2	3.34	0.656	221%	NG
4049	4050	197	0.88	0.88	0.002	0.139		0.140	500	31.4	3.41	0.670	21%	OK
4050	4051	253	2.78	15.06	0.026	1.588		1.613	400	7.1	1.40	0.176	917%	NG
Out-44								-1.562						
4051	4052	354	6.88	21.94	0.037	0.930	0.051	1.019	400	2.8	0.88	0.111	921%	NG
	4052		21.39		0.037			0.037						
4052	4053	404	8.05	29.99	0.088	1.876		1.964	600	9.9	2.16	0.611	322%	NG
4053	4054	70	0.30	50.72	0.123	4.365		4.489	600	4.2	1.41	0.399	1126%	NG
4054	4056	115	0.31	146.98	0.349	7.157	0.377	7.883	800	2.0	1.18	0.593	1329%	NG
4055	4056	265	2.53	2.53	0.004	0.388		0.392	500	8.6	1.78	0.350	112%	NG
4056	4060	99	0.34	149.85	0.354	7.265	0.377	7.996	800	2.0	1.18	0.593	1348%	NG
4057	4059	62	0.50	0.50	0.001	0.077		0.078	400	2.0	0.74	0.093	84%	OK
4058	4059	58	1.22	1.22	0.002	0.189		0.191	400	2.0	0.74	0.093	205%	NG
4059	4060	279	7.64	9.36	0.016	1.386		1.402	500	14.9	2.35	0.461	304%	NG
4060	4062	25	0.03	159.24	0.370	8.431	0.377	9.178	800	2.0	1.18	0.593	1547%	NG
4061	4062	712	4.94	4.94	0.008	0.578		0.587	400	5.7	1.25	0.157	374%	NG
Out-45								-9.329						
4062	4064	88	0.27	164.45	0.379	0.045	0.758	1.182	800	2.0	1.18	0.593	199%	NG
4063	4064	258	2.07	2.07	0.004	0.318		0.321	600	2.0	0.97	0.274	117%	NG
4064	4068	93	0.31	166.83	0.383	0.422	0.758	1.563	800	2.0	1.18	0.593	263%	NG
4065	4068	461	3.64	3.64	0.006	0.513		0.519	600	3.6	1.30	0.368	141%	NG
Out-46								-1.303						
4068	4070	168	0.80	171.27	0.391	0.128	0.779	1.298	800	2.0	1.18	0.593	219%	NG
4069	4070	77	0.38	0.38	0.001	0.058		0.059	400	5.1	1.18	0.148	40%	OK
4070	4078	179	1.02	172.67	0.393	0.324	0.779	1.497	800	5.9	2.02	1.015	147%	NG
4071	4073	155	1.15	1.15	0.002	0.185		0.187	800	6.4	2.10	1.056	18%	OK
4072	4073	58	0.28	0.28	0.000	0.043		0.044	400	2.0	0.74	0.093	47%	OK
4073	4075	176	1.21	2.64	0.005	0.392		0.397	500	10.7	1.99	0.391	102%	NG
4074	4075	94	0.45	0.45	0.001	0.068		0.069	400	5.3	1.21	0.152	46%	OK
4075	4077	74	0.40	3.49	0.006	0.503		0.509	600	8.1	1.95	0.551	92%	OK
4076	4077	334	1.20	1.20	0.002	0.178		0.180	500	8.9	1.81	0.355	51%	OK
4077	4078	94	0.58	5.27	0.009	0.732		0.741	800	2.0	1.18	0.593	125%	NG
4078	4102	191	1.83	179.77	0.405	1.269	0.779	2.453	800	7.9	2.34	1.176	209%	NG
4079	4080	107	1.37	1.37	0.002	0.207		0.209	400	2.0	0.74	0.093	225%	NG
4080	4082	256	2.72	4.09	0.007	0.551		0.558	400	7.7	1.45	0.182	306%	NG
4081	4082	165	0.95	0.95	0.002	0.152		0.154	800	13.9	3.10	1.558	10%	OK
4082	4085	174	1.18	6.22	0.011	0.848		0.859	800	10.3	2.67	1.342	64%	OK
4083	4084	80	0.64	0.64	0.001	0.098		0.099	400	32.5	2.99	0.376	26%	OK
4084	4085	189	3.11	3.75	0.006	0.573		0.579	500	2.0	0.86	0.169	343%	NG
4085	4087	182	1.07	11.04	0.019	1.406		1.424	600	2.0	0.97	0.274	519%	NG
4086	4087	158	3.57	3.57	0.006	0.573		0.579	800	10.1	2.64	1.327	44%	OK
4087	4091	78	0.26	14.87	0.025	1.838		1.863	800	2.0	1.18	0.593	314%	NG
4090	4091	162	1.27	1.27	0.002	0.204		0.206	800	2.0	1.18	0.593	35%	OK
4091	4097	96	0.43	16.57	0.028	1.984		2.012	800	2.0	1.18	0.593	339%	NG
4092	4094	157	1.16	1.16	0.002	0.187		0.189	800	9.5	2.56	1.287	15%	OK
4093	4094	69	0.31	0.31	0.001	0.052		0.052	600	37.6	4.21	1.190	4%	OK
4094	4096	97	0.39	1.86	0.003	0.286		0.290	800	2.0	1.18	0.593	49%	OK

No.	Down Stream	Length (m) Increment	Area (ha) Increment	Area (ha) Total	Sewage Quantity Sanitary Sewage	Storm Water	Remain Sewage	$Q_1(m^3/s)$	Existing Pipe Specification D (mm)	I (‰)	V (m/s)	$Q_2(m^3/s)$	Capacity Q_1/Q_2	Judge
4095	4096	87	0.24	0.24	0.000	0.040		0.040	800	2.0	1.18	0.593	7%	OK
4096	4097	178	1.28	3.38	0.006	0.482		0.487	500	2.0	0.86	0.169	289%	NG
4097	4099	215	2.23	22.18	0.038	2.470		2.508	600	5.9	1.67	0.472	531%	NG
4098	4099	190	2.50	2.50	0.004	0.396		0.400	500	7.3	1.64	0.322	124%	NG
4099	4101	68	0.35	25.03	0.043	2.724		2.766	1000	2.9	1.64	1.288	215%	NG
4100	4101	177	1.10	1.10	0.002	0.160		0.162	400	11.2	1.75	0.220	74%	OK
4101	4102	174	1.27	27.40	0.047	2.828		2.875	1000	2.0	1.37	1.076	267%	NG
4102	4104	73	0.29	207.46	0.453	4.906	0.779	6.137	800	11.6	2.83	1.423	431%	NG
4103	4104	361	2.90	2.90	0.005	0.390		0.395	400	2.4	0.81	0.102	388%	NG
Out-47								-5.617						
4104	4110	420	2.80	213.16	0.462	0.401	0.915	1.778	800	3.8	1.62	0.814	218%	NG
4105	4106	62	0.54	0.54	0.001	0.091		0.092	500	12.9	2.18	0.428	21%	OK
4106	4107	243	4.91	5.45	0.009	0.820		0.829	600	18.5	2.95	0.834	99%	OK
4107	4110	627	4.81	10.26	0.018	1.209		1.227	800	4.7	1.80	0.905	136%	NG
4108	4109	384	5.70	5.70	0.010	0.828		0.838	500	2.3	0.92	0.181	464%	NG
4109	4110	99	0.67	6.37	0.011	0.875		0.886	600	2.0	0.97	0.274	323%	NG
4110	4118	95	0.35	230.14	0.492	2.518	0.915	3.925	1000	2.0	1.37	1.076	365%	NG
4111	4112	152	1.46	1.46	0.002	0.235		0.238	800	34.2	4.87	2.448	10%	OK
	4112		8.38					0.000						
4112	4113	358	9.88	11.34	0.034	1.564		1.597	800	13.9	3.10	1.558	103%	NG
Out-48								-1.530						
4113	4114	177	3.39	14.73	0.039	0.539	0.067	0.646	500	2.2	0.90	0.177	366%	NG
4114	4115	325	8.68	23.41	0.054	1.670		1.725	500	11.9	2.10	0.412	418%	NG
4115	4117	166	0.74	24.15	0.056	1.664		1.720	500	2.0	0.86	0.169	1018%	NG
4116	4117	289	1.68	1.68	0.003	0.233		0.236	200	2.4	0.51	0.016	1474%	NG
4117	4118	80	0.36	26.19	0.059	1.872		1.931	500	5.1	1.37	0.269	718%	NG
4118	4120	447	8.80	265.13	0.573	4.739	0.983	6.295	1000	4.2	1.98	1.555	405%	NG
4119	4120	150	0.82	0.82	0.001	0.121		0.122	400	6.6	1.35	0.370	72%	OK
4120	4122	583	2.62	268.57	0.579	4.314	0.983	5.875	1000	6.6	2.48	1.948	302%	NG
4121	4122	223	2.72	2.72	0.005	0.389		0.393	300	14.7	1.66	0.117	335%	NG
4122	4132	234	4.20	275.49	0.590	4.659	0.983	6.232	1000	2.0	1.37	1.076	579%	NG
4123	4124	110	1.10	1.10	0.002	0.166		0.168	300	2.7	0.71	0.050	334%	NG
4124	4125	548	6.00	7.10	0.012	0.848		0.860	400	6.9	1.38	0.173	496%	NG
4125	4129	368	4.50	11.60	0.020	1.327		1.346	500	18.4	2.61	0.512	263%	NG
4126	4127	473	6.90	6.90	0.012	0.885		0.896	400	9.0	1.57	0.197	454%	NG
4127	4128	341	7.50	14.40	0.025	1.626		1.650	300	7.6	1.19	0.084	1962%	NG
4128	4129	197	1.50	15.90	0.027	1.676		1.703	400	11.6	1.78	0.224	762%	NG
4129	4131	130	0.80	28.30	0.048	2.846		2.895	400	37.6	3.21	0.403	718%	NG
4130	4131	435	5.90	5.90	0.010	0.771		0.781	400	33.5	3.03	0.381	205%	NG
4131	4132	213	0.90	35.10	0.060	3.302		3.362	400	2.0	0.74	0.093	3616%	NG
Out-49								-8.294						
4132	To STP	0	0.00	310.59	0.650		1.301	1.951	1000	2.0	1.37	1.076	181%	NG
5001	5002	94	0.50	0.50	0.001	0.076		0.077	400	28.7	2.81	0.353	22%	OK
5002	5006	519	5.35	5.85	0.009	0.776		0.785	1000	7.3	2.61	2.050	38%	OK
5003	5004	100	0.50	0.50	0.001	0.076		0.077	300	7.9	1.22	0.086	89%	OK
5004	5005	350	2.70	3.20	0.005	0.415		0.420	400	11.1	1.75	0.220	191%	NG
5005	5006	179	4.15	7.35	0.011	0.968		0.979	1000	11.7	3.30	2.592	38%	OK
5006	To STP	195	1.10	14.30	0.021	1.751		1.772	1000	6.6	2.48	1.948	91%	OK
Outfall								-1.729						
To STP					0.021		0.043	0.064						
6001	6002	87	0.30	0.30	0.000	0.046		0.046	200	14.9	1.27	0.040	116%	NG
6002	6003	273	4.20	4.50	0.007	0.606		0.612	300	13.1	1.57	0.111	552%	NG
6003	6006	358	4.80	9.30	0.014	1.085		1.099	300	8.3	1.25	0.088	1244%	NG
6004	6005	216	2.40	2.40	0.004	0.344		0.348	200	14.4	1.25	0.039	886%	NG
6005	6006	396	4.60	7.00	0.010	0.851		0.861	300	25.0	2.16	0.153	564%	NG
6006	6009	225	2.30	18.60	0.028	2.003		2.031	400	16.4	2.12	0.266	762%	NG
6007	6008	117	1.10	1.10	0.002	0.165		0.167	300	2.0	0.61	0.043	387%	NG
6008	6009	290	2.40	3.50	0.005	0.462		0.467	400	2.0	0.74	0.093	503%	NG
6009	6013	48	0.20	22.30	0.033	2.365		2.398	300	2.0	0.61	0.043	5562%	NG
6010	6011	350	3.00	3.00	0.004	0.405		0.410	200	19.1	1.44	0.045	906%	NG
6011	6012	260	4.50	7.50	0.011	0.911		0.923	300	13.0	1.56	0.110	837%	NG

No.	Down Stream	Length (m)	Area (ha)		Sewage Quantity				Existing Pipe Specification				Capacity	
		Increment	Increment	Total	Sanitary Sewage	Storm Water	Remain Sewage	$Q_1(m^3/s)$	D (mm)	I (‰)	V (m/s)	$Q_2(m^3/s)$	Q_1/Q_2	Judge
6012	6013	215	1.30	8.80	0.013	0.987		1.000	400	5.5	1.23	0.155	647%	NG
6013	To STP	961	0.00	31.10	0.046	2.491		2.537	400	2.0	0.74	0.093	2728%	NG
Outfall								-2.444						
To STP					0.046		0.093	0.139						
7001	7002	451	4.08	4.08	0.006	0.529		0.535	200	23.9	1.61	0.051	1058%	NG
7002	7003	100	3.50	7.58	0.011	0.944		0.955	200	12.0	1.14	0.036	2668%	NG
7003	7004	160	3.10	10.68	0.016	1.364		1.380	600	21.8	3.21	0.908	152%	NG
7004	To STP	250	14.90	25.58	0.038	2.988		3.026	600	12.8	2.46	0.696	435%	NG
Outfall								-2.950						
To STP					0.038		0.076	0.114						