CHAPTER II BASELINE SEWERAGE EFFLUENT

2.1 Existing Baseline Sewerage Discharge and Quality

The sewerage discharge in the Prahova River Basin consists of major industrial wastewater discharge, gross domestic wastewater discharge (including net domestic, small industries, shops/restaurants, office, public facilities, etc.) and groundwater infiltration (including groundwater, rainfall, snow melt, etc.). The sewerage discharge data in King II Database of Romanian Waters presents only a total value of the above three (3) components.

For projection of the future sewerage discharge, the existing discharge of these three (3) components should be separately estimated. This separation is also necessary for estimation of the existing and future sewerage influent quality.

On the other hand, the new treatment plants of Predeal and Breaza were completed in September 1997 and October 1997 respectively. The effluent quality of these sewerage systems was much improved.

Therefore, the existing baseline sewerage discharge is estimated as follows.

2.1.1 Existing Baseline Sewerage Discharge

(1) Major Industrial Discharge

The major industrial discharge to domestic sewerage system varies by each factory and commercial establishment. The discharge data of each major factory and commercial establishment are available in King II Database. The average discharge of each factory and commercial establishment during 1995 -1997 is shown in Table D.1.2. In this study, these data are used as the existing baseline major industrial discharge to domestic sewerage system.

(2) Per Capita Gross Domestic Discharge

The gross domestic discharge of each municipality is estimated by multiplying served population by per capita gross domestic discharge. The per capita gross domestic discharge is estimated based on the per capita gross domestic water consumption of King II Database.

Table D.2.1 shows the per capita gross domestic water consumption of each municipality calculated based on King II Database. The per capita gross domestic water consumption of the municipalities is averaged as follows.

Ploiesti and Cimpina Cities	: 374 l/c/d (weighted average)
Other Towns	: 284 l/c/d (weighted average)

On the other hand, net domestic discharge (including drinking, cooking, bathing, washing, etc.) of each municipality varies to some extent depending on the level of living standard. According to the urban development plan of each municipality in the Prahova River Basin (Plan Urbanistic General si Regulament Local de Urbanism Comuna), the existing per capita net domestic water consumption in piped service area is assumed to be in the range of 155 l/c/d and 264 l/c/d as shown also in Table D.2.1.

The per capita net domestic water consumption is averaged as follows.

Ploiesti and Cimpina Cities	: 262 l/c/d (weighted average)
Other Towns	: 207 l/c/d (weighted average)

The ratio of gross domestic water consumption and net domestic water consumption in the Prahova River Basin comes to 1.4 in Ploiesti/Cimpina Cities and also 1.4 in Other Towns. This ratio is considered moderate and reasonable in comparison to the standard ratio in Japan ; 1.2 in industrial area, 1.3 in residential area, 1.5 in semi-industrial area and 1.6-1.8 in commercial area.

From the above discussions, the existing baseline daily average per capita gross domestic discharge of each municipality is determined as follows.

Ploiesti and Cimpina Cities	: 370 l/c/d
Other Towns	: 280 l/c/d

(3) Groundwater Infiltration

Groundwater infiltration is usually considerably large, especially when sewer pipeline is old and damaged. The construction period of the existing sewer networks of each municipality is shown below.

Municipality	Construction Period	Municipality	Construction Period
Predeal	1923 – Present *	Baicoi	1961 – 1966
Azuga		Plopeni	1960 – 1980
Busteni	1911 – 1956	Slanic	
Sinaia	1917 – 1996	Valenii de Munte	1963 – 1980
Comarnic	No Sewerage	Boldesti Scaieni	1973 – 1993
Breaza	1970 – present	Urlati	1950 – 1960
Cimpina	1945 – present	Ploiesti	1906 – present

*: Rehabilitation of the sewer networks has been almost completed.

As shown from the above table, the sewer networks of Ploiesti City is very old. Those in the other municipalities are comparatively new except Busteni and Sinaia. The sewer pipelines of Busteni and Sinaia are not considered to be much prone to groundwater infiltration due to their topographic advantages. On the other hand, the sewer pipelines of Ploiesti City may be much affected by groundwater infiltration since the City is located in a low-lying area.

Hence, per capita groundwater infiltration of the above municipalities is classified into two (2) groups ; Ploiesti and other city/towns.

The groundwater infiltration is estimated by deducting the baseline per capita gross domestic wastewater discharge (280 l/c/d or 370 l/c/d) from the per capita gross domestic wastewater discharge calculated based on the King II data (Table D.2.2) as shown below.

Ploiesti City	: 532 – 370 = 162 l/c/d = 160 l/c/d
Other City/Towns	: 406 – 305 = 101 l/c/d = 100 l/c/d (weighted average of municipality)

(4) Existing Baseline Sewerage Discharge

The existing baseline sewerage discharge (average daily discharge) of each city and town is determined from the above discussions. The existing baseline sewerage discharge of the two (2) communes of Floresti and Maneciu is also estimated based on

the same calculation method of 11 towns. However, per capita gross domestic water consumption of two (2) communes is smaller than those of 11 towns.

According to King II data, the average per capita gross domestic water consumption of the piped water service areas of communes in 1997 is estimated at 180 l/c/d (see, Appendix B). In this Study, this per capita gross domestic water consumption is applied for Floresti and Maneciu communes.

The above calculation method of the existing baseline sewerage discharge is summarized below.

Sewerage Discharge	Ploiest City	Cimpina City	11 Towns	2 Communes
Major Industrial Discharge	King II data	King II data	King II data	King II data
Gross Domestic Discharge	370 l/c/d x served population	370 l/c/d x served population	280 l/c/d x served population	180 l/c/d x served population
Groundwater Infiltration	160 l/c/d x served population	100 l/c/d x served population	100 l/c/d x served population	100 l/c/d x served population

The calculated results are summarized below. The calculated results of each municipality are shown in Table D.2.3.

Sewerage Discharge		Ploiesti City	Cimpina City	11 Towns	2 Communes	Total
Served Population		220,000	26,250	66,630	8,960	321,840
Major Industry	l/s	168.5	71.2	130.1	4.8	376.7
Gross Domestic	l/s	942.1	112.4	215.9	18.7	1,289.1
Groundwater Infiltration	l/s	407.4	30.4	84.8	10.4	525.3
Total	l/s	1,518.0	214.0	430.8	33.8	2,191.1

2.1.2 Existing Baseline Sewerage Quality

(1) Influent Quality

(a) Major Industrial Wastewater

The above mentioned major industrial wastewater is discharged to sewerage system mostly after pre-treatment. However, the wastewater quality discharged to sewerage system varies by each industrial establishment. Hence, the existing baseline major industrial wastewater quality to sewerage system is determined based on the average wastewater quality data of each industrial establishment during 1995-1997 in King II Database. The average wastewater quality during 1995-1997 by each industrial establishment is shown in Table D.1.2.

The existing baseline quality (BOD) of major industrial wastewater to each sewerage system is shown in Table D.1.2.

(b) Gross Domestic Wastewater

Human pollution load generation is usually estimated to be 40 – 50 g/c/d in BOD. On the other hand, the net domestic wastewater discharge in each municipality 210 – 260 l/c/d. Hence, BOD concentration of the net domestic wastewater in each municipality is assumed to be 200 mg/l.

The existing baseline gross domestic wastewater quality of each municipality is determined at 200 mg/l in BOD by assuming the wastewater quality of small industries, shop/restaurant, public, etc. is the same as the quality of net domestic wastewater.

(c) Groundwater Infiltration

It only dilutes the major industrial and gross domestic wastewater. It is assumed to generate no pollution load.

(d) Average Sewerage Influent

The average sewerage influent quality of each municipality widely varies depending on the major industrial influent quality. It is in the range of 75 mg/l of Plopeni to 156 mg/l of Urlati in BOD. The average sewerage influent quality of each municipality is shown in Table D.2.4. The sewerage influent BOD load of each municipality is also shown in Table D.2.4.

(2) Effluent Quality

The existing baseline sewerage effluent quality (BOD concentration) of each sewerage system is assumed to be the average actual effluent quality during 1995-1997 shown in Table D.1.4 except Preadeal and Breaza. Predeal and Breaza completed the new treatment plants in September 1997 and October 1997 respectively. Therefore, the existing baseline sewerage effluent quality of Predeal and Breaza is estimated based on the effluent quality treated by the new treatment plants.

The existing baseline BOD load of each sewerage system is also estimated by multiplying the above existing baseline effluent quality by the existing baseline sewerage discharge (shown in Table D.2.3).

The results are shown in Table D.2.5.

2.2 Future Baseline Sewerage Discharge and Quality

The sewerage discharge of each municipality will increase according to the population increase and industrial development in the future. The sewerage effluent quality will also increase in case of without improvement of treatment plant. The future baseline sewerage discharge and quality are defined as those in case of without sewerage development project.

2.2.1 Future Baseline Sewerage Discharge

(1) Major Industrial Wastewater

The industry of the Prahova River Basin is classified into general industry, tourism industry and livestock industry in terms of growth rate. Their industrial productions are projected to increase at the following annual growth rates (see, Appendix A). The productions of general industry, tourism industry and livestock industry in 2015 will become 1.68 times, 2.08 times and 1.00 times of the existing ones respectively.

Industrial Category	Up to 2000	2001-2015	2015/Existing
General Industry	0.0 %	3.5 %	1.68 times
Tourism Industry	0.0 %	5.0 %	2.08 times
Livestock industry	0.0 %	0.0 %	1.00 times

The industrial water source consists of recycled water inside the factory and water supplied from outside the factory.

Generally speaking, the total industrial water demand including recycle use will increase in proportion to the industrial production growth. On the other hand, recycle use inside the factory will increase in the future according to the technological development of manufacturing process. As a result, water supply from outside required for unit industrial production will gradually decrease in the future.

However, the average recycle water use rate in the industrial categories for which recycle use is applicable has already reached 85.7% in the Prahova River Basin. It is considered not easy to further increase this recycle use rate in the future. For details, see Appendix B.

From the above discussions, the industrial wastewater discharge is assumed to increase in direct proportion to the growth of the industrial production.

The future wastewater discharge to sewerage system of each industrial establishments is shown in Table D.2.6.

(2) Gross Domestic Wastewater

The population of the Prahova River Basin is projected to grow at an annual rate of 0.0 % up to 2000 and 0.5 % during 2001 to 2015 (see Appendix A). In this Study, the future population of each municipality is assumed to grow at the same rate. Then, the sewerage served population of each municipality in 2015 is assumed to increase to 1.08 times of the existing one.

On the other hand, per capita gross domestic water consumption is assumed to be the same as the existing one until 2000. However, it is assumed to increase by 1.0 % per annum during 2001 to 2015 according to the improvement of living standards (see Appendix B). Then, per capita gross domestic wastewater discharge becomes as follows.

Ploiesti and Cimpina	: 370 x 1.16 = 430 l/c/d
11 towns	: 280 x 1.16 = 320 l/c/d
2communes	: 180 x 1.16 = 210 l/c/d

(3) Groundwater Infiltration

The future groundwater infiltration is assumed to be the same as the existing one since no sewerage networks are extended.

(4) Future Baseline Sewerage Discharge

The future baseline sewerage discharge of each municipality including major industrial wastewater, gross domestic wastewater and groundwater infiltration is shown in Table D.2.7.

2.2.2 Future Baseline Sewerage Quality

(1) General

There are 15 sewerage systems in the Rrahova River Basin among which 12 systems are treated by activated sludge treatment, one (1) systems is treated only by sedimentation treatment and the remaining two (2) systems are not treated as listed below.

Treatment Method	Municipality
Activated Sludge	Predeal, Sinaia, Breaza, Cimpina, Baicoi,, Plopeni, Slanic, Valenii de Munte, Boldesti Scaieni, Urlati, Floresti, Maneciu
Sedimentation Only	Ploiesti
No Treatment	Azuga, Busteni

BOD removal efficiency of the existing treatment plants will decrease in the future according to the increase of sewerage influent discharge. The reduction of the BOD removal efficiency varies depending on the treatment method as described below.

(a) Estimate of Future BOD Removal by Activated Sludge Treatment

BOD removal rate of activated sludge treatment method is generally expressed by the following equation.

$$-dC/dt = K \cdot M \cdot T$$

Where C : BOD concentration of sewerage water (l/mg)
K : BOD removal speed constant (l/mg·hr)
M : Concentration of biomass in aeration tank (MLSS : mg/l)
t : Retention time (hr)

The above differential equation is expressed by the following formula when sewage stream in the aeration tank is assumed to be a completely mixed flow.

$$Ce/Ci = 1/(1+K \cdot M \cdot T) \quad (1)$$

Where Ce : BOD concentration of sewerage effluent (mg/l)
Ci : BOD concentration of sewerage influent (mg/l)

If sewerage discharge increases to μ times of existing discharge in the future, the future retention time becomes T/μ. Then, the future BOD concentration of sewerage effluent is obtained from the following relationship.

$$Ce'/Ci' = 1/(1+K \cdot M \cdot T') = 1/(1+1/\mu \cdot K \cdot M \cdot T) = \mu/(\mu - 1 + Ci/Ce) \quad (2)$$

Where Ce' : Future sewerage effluent BOD (mg/l)
Ci' : Future sewerage influent BOD (mg/l)
t' : Future retention time (hr)

(b) Estimate of Future BOD Removal by Sedimentation Treatment

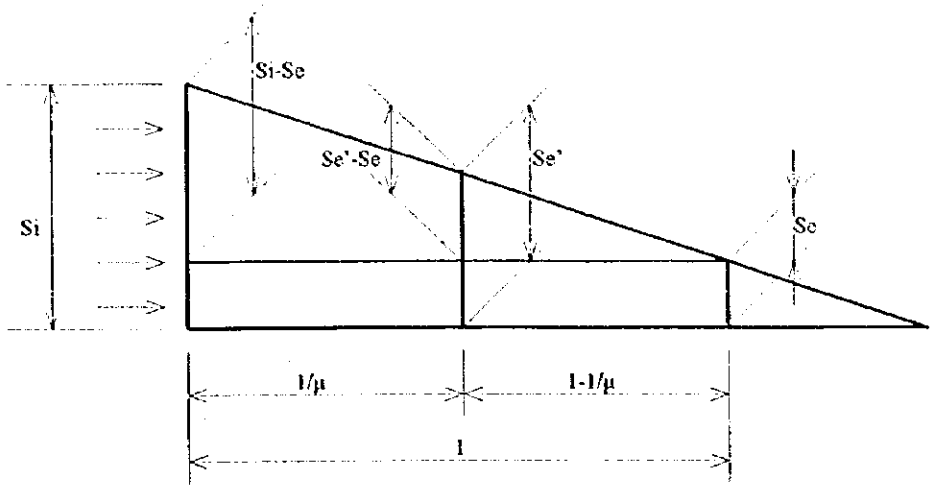
BOD contained in suspended solids is removed when suspended solids settle in the sedimentation tank. In this Study, the BOD removal rate by sedimentation treatment is assumed to be the same as the removal rate of suspended solids (SS).

The SS removal rate is generally determined by the ratio of settling velocity of particles to sewage water overflow velocity as expressed below.

SS Settling Ratio = v / (Q/A) = v/u

where v : Settling velocity of particles
u : Overflow velocity
Q : Sewerage discharge
A : Surface area of sedimentation tank

Based on the above principle, the future SS effluent concentration is obtained from the following equation when the sewerage discharge increases to μ times of the existing one and the SS influent concentration is constant (refer to the following figure).



$$Se' = (Si - Se) \cdot (1 - 1/\mu) + Se$$

Where Si : Existing influent SS (mg/l)
Se : Existing effluent SS (mg/l)
Se' : Future effluent SS (mg/l)

If the SS influent concentration also changes in the future, the future effluent SS is assumed to proportionally varies as follows.

$$Se' = Si'/Si \cdot \{(Si - Se) \cdot (1 - 1/\mu) + Se\}$$

Where Si' : Future influent SS (mg/l)

Similarly, the future effluent BOD concentration is expressed as follows when sewerage discharge increases to μ times of the existing one and the influent BOD concentration changes in the future.

$$Ce' = Ci'/Ci \cdot \{(Ci - Ce) \cdot (1 - 1/\mu) + Ce\} \quad (3)$$

WhereCi : Existing influent BOD (mg/l)
Ci' : Future influent BOD (mg/l)
Ce : Existing effluent BOD (mg/l)
Ce' : Future effluent BOD (mg/l)

(2) Influent Quality

(a) Major Industrial Wastewater

The wastewater of the major industrial establishments except 10 establishments is pre-treated by either activated sludge method or coagulation settling method before discharging to the sewerage system. The 10 industrial establishments are provided with no treatment plants.

The existing industrial establishments in the Prahova River Basin are classified by treatment method as follows.

Treatment Method	Industrial Category
Activated Sludge	food/beverage, textile, whole sale, health/social work, petroleum, construction material, hotel/restaurant
Coagulation Settling	non-metallic mineral, machinery/equipment, mining/quarrying, land transport, metal products, electrical, crude oil extraction, chemical products, wood, rubber/plastic, furniture, leather, basic metals

However, no data of influent quality to the above pre-treatment plants are available. Therefore, the future effluent quality of major industrial wastewater to the sewerage system (effluent quality of pre-treatment plant) is estimated as follows.

(Case of Activated Sludge Pre-treatment)

In the case of activated sludge pre-treatment, the future effluent quality of pre-treatment is obtained from the existing effluent quality by assuming the values of K, M and T and further by assuming the influent quality to the pre-treatment plant does not change even in the future (Ci' = Ci). The following equation is obtained from the equation (1) and (2) for the calculation of future effluent quality.

$$Ce'/Ce = \mu (1+ K \cdot M \cdot T) / (\mu + K \cdot M \cdot T) \qquad (4)$$

BOD removal speed constant (K) of the existing pre-treatment plants in the Prahova River Basin is estimated from the equation (1) : $Ce/Ci = 1/(1+ K \cdot M \cdot T)$ based on the sampling observation of inflow wastewater quality (Ci), outflow wastewater quality (Ce) and wastewater quantity (accordingly, retention time T) of the representative factories. In this estimation, M is assumed at 2,000 mg/l based on the field survey of the treatment plants. The calculated K values are shown in Table D.2.8.

From the above calculations, the design values of K, M and T are assumed to be $K=2.4 \times 10^{-4}$ l/mg·hr, M=2,000 mg/l, T=23 hours. Then, the design ratio between future BOD effluent and existing BOD effluent (Ce'/Ce) are obtained from the equation (4) : $Ce'/Ce = \mu (1+ K \cdot M \cdot T) / (\mu + K \cdot M \cdot T)$ as follows.

Case	Q'/Q	Ce'/Ce
General Industry	$\mu = 1.68$	$1.59 \fallingdotseq 1.6$
Tourism Industry	$\mu = 2.08$	$1.91 \fallingdotseq 1.9$
Livestock Industry	$\mu = 1.00$	$1.00 = 1.0$
Without Treatment		$1.00 = 1.0$

(Case of Coagulation Settling Pre-treatment)

No data are available concerning the BOD removal efficiency of coagulation settling treatment in the Prahova River Basin. Hence, the future BOD effluent from the treatment plant of coagulation settling type is estimated, referring to the two (2) sampling data in the Prahova River Basin and the typical data in Japan.

The ratio between future effluent BOD and existing effluent BOD is obtained from the equation (3) by assuming that the influent BOD does not change even in the future (Ci' = Ci) as follows.

$$R = Ce'/Ce = \{(Ci - Ce)(1 - 1/\mu) + Ce\} / Ce \qquad (5)$$

The coagulation settling treatment is applied only for general industry. The ratio (R) in case of $\mu = 1.68$ is calculated as follows.

	Factory	Ci (mg/l)	Ce (mg/l)	Q'/Q=μ	Ce'/Ce
Prahova	IRA Campina (land transport)	63.1	20.6	1.68	1.84
Prahova	Real Pleasa (basic metal)	12.5	2.7	1.68	2.47
Japan	Pulp	600	480	1.68	1.10
Japan	Paper Mill	50	35	1.68	1.17
Japan	Textile	298	140	1.68	1.46
Japan	Leather	500	175	1.68	1.75
Japan	Machinery	613	385	1.68	1.24
Average		305.2	176.9	1.68	1.58

Note : For data source of Japan, see Appendix E Chapter III.

The design ratio between future effluent BOD and existing effluent BOD is assumed as follows.

Case	Q'/Q	Ce'/Ce
General Industry	$\mu = 1.68$	1.58 ≒ 1.6
Without Treatment		1.00 = 1.0

The future effluent quality (BOD concentration) of each industrial establishment to the sewerage system is shown in Table D.2.6.

(b) Gross Domestic Wastewater ≒

Per capita water consumption quantity (l/c/d) will increase in the future according to the improvement of living standards. Per capita BOD pollution load generation (g/c/d) will also increase according to the improvement of diet. Therefore, the influent quality to the sewerage treatment plant is assumed to be the same as the existing one (BOD : 200 mg/l).

(c) Groundwater Infiltration

No BOD load is assumed.

(d) Sewerage Influent

The estimated sewerage influent quality (weighted average of major industry, gross domestic and groundwater) of each municipality is shown in Table D.2.9. The sewerage influent BOD load of each municipality is also shown in Table D.2.9.

(3) Effluent Quality

The future baseline of sewerage effluent quality of the activated sludge treatment plant is calculated by using the following equation (equation (2)).

$$Ce' = \mu \cdot Ci'/(\mu - 1 + Ci/Ce)$$

This calculation method is applied for the treatment plants in the following municipalities.

- Predeal, Sinaia, Breaza, Cimpina, Baicoi, Plopeni, Slanic, Valenii de Munte, Boldesti Scaieni, Urlati, Floresti and Maneciu

The estimated future baseline effluent quality (BOD) of the above sewerage systems are shown along with effluent BOD load in Table D.2.10.

On the other hand, the future baseline of sewerage effluent quality of the sedimentation treatment plant is calculated by using the following equation (equation (3)).

$$Ce' = Ci'/Ci \cdot \{(Ci - Ce) \cdot (1 - 1/\mu) + Ce\}$$

This calculation method is applied for the treatment plants in the following municipality.

- Ploiesti

The estimated future baseline effluent quality (BOD) of the above sewerage systems are also shown along with effluent BOD load in Table D.2.10.

2.3 Comparison of Existing and Future Baseline Sewerage Effluent

The total future baseline sewerage discharge in the Prahova River Basin will increases to 2,780.9 l/s in 2015 or 1.27 times of the existing one of 2,191.1 l/s. On the other hand, the total future baseline effluent BOD load will increase to 15,726 kg/d in 2015 or 1.79 times of the existing one of 8,808 kg/l.

The above existing and future baseline effluent BOD loads are broken down by area as follows.

Area	Existing		Future		Ratio
	BOD Load (kg/d)	(%)	BOD Load (kg/d)	(%)	
Ploiesti City	6,466	73.4	11,603	73.8	1.79
Cimpina	521	5.9	1,102	7.0	2.11
Prahova Valley	1,108	12.6	1,836	11.7	1.66
Other Area	714	8.1	1,185	7.5	1.66
	8,808	100.0	15,726	100.0	1.79

Note : Prahova Valley includes Predeal, Azuga, Busteni, Sinaia and Breaza

The existing and future baseline sewerage discharge, BOD concentration and BOD loads of each municipality are shown in Table D.2.11.

2.4 Alternative Study of Standard River Flow Rate for Water Quality Assessment

Although the standard flow rate with a 50% probability if applied for the water quality

assessment in the Prahova River Basin as discussed before, in this section the standard flow rate with a 95% probability, which is stipulated in Romanian guideline NTPA-001, will be applied as an alternative case and the baseline river water quality and the required treatment system will be studied in the following sections.

2.4.1 Water Quality Assessment and Baseline Sewerage Effluent

The required water quality of baseline sewerage effluent applies in the case of the standard flow rate with a 95 % probability is fixed at 5mg/l as a result of the water quality assessment in the objective area, see Appendix C, in detail.

2.4.2 Necessity of Advanced Water Pollution Control

The conventional activated sludge process which is currently operated in the objective area can generally control and reduce water pollution to around 20 mg/l in BOD. As mentioned above an expected baseline of sewerage effluent quality under the condition of the standard flow rate with a 95 % probability will be around 5 mg/l in BOD. To improve an effluent water quality to around 5mg/l in BOD it is necessary to install an advanced treatment system additionally after such ordinary activated sludge system.

In this study an activated carbon process comprising sand filter and activated carbon is technically selected as the most popular advanced treatment system. Table D.2.12 shows salient features of facilities required for an activated carbon process. The general diagram of wastewater flow of an activated carbon process and the typical arrangement of an advanced treatment system is illustrated in Fig.D.2.1 and D.2.2, respectively.

2.4.3 Construction Cost and O&M Cost Required for Advanced Treatment System

Construction cost and O&M cost of the activated carbon process as advanced treatment system is estimated following the basic procedure of cost estimate to be mentioned in the sections 3.3 and 3.4 of Chapter III and tabulated in Table D.2.13. For the whole project cost with advanced treatment systems these costs in Table D.2.13 must be added to the construction costs of ordinary treatment plant using activated sludge system as summarized in Table D.3.10.

2.4.4 Conclusion

As shown in Table D.2.12, to attain the target water quality with BOD 5mg/l, the construction cost required for treatment plant with an advanced treatment system is estimated at around 50% higher than that of the ordinary activated sludge system.(refer to Table D.2.10.). Further, due to high purchase cost of activated carbon with low durability such as advanced treatment system will annually require a remarkably high O&M costs as compared to that of an ordinary activated sludge system.

Consequently, adoption of an advanced water pollution control system is not evaluated to be practicable and recommendable from a financial point of view. As a result of this alternative study, the design river flow rate with a 50% probability is regarded as a reasonable level for the assessment of river water quality and has resulted in an acceptable financial aspect. Accordingly and hereinafter it will be applied for the assessment of river water quality.

CHAPTER III DEVELOPMENT OF SEWERAGE SYSTEM

3.1 Basic Plan

3.1.1 General

As discussed in Chapter II, the existing wastewater treatment plants will not be able to treat the wastewater up to the required level of BOD 20 mg/l in 2015 except Predeal, and Breaza due to the shortage of plant capacity. In addition, the existing plants do not function well due to the damage of equipment and insufficient operation/maintenance.

Hence, rehabilitation and improvement of the existing plant and development of new plant will be necessary to meet the treatment requirement in 2015.

Azuga, Busteni and Comarnic towns have no treatment plant, and Ploiesti City treats the wastewater through only mechanical process (sedimentation). In these municipalities, early installation of new treatment plants with biological process will be necessary.

Moreover, extension of the existing pipeline networks may also be necessary for reduction of the pollution load effluents to the rivers.

In this chapter, development of the sewerage system targeting the year of 2015 is planned through the following study processes.

(1) estimation of the served population by sewerage system

(2) estimation of the influent quality and quantity

(3) examination of the existing facilities' capacity

(4) specification of the main additional/new facilities

(5) estimation of the installation cost of the above additional/new facilities

(6) estimation of the rehabilitation cost of the existing facilities

(7) estimation of the annual operation and maintenance cost

The above studies are conducted for the major sewerage systems of 14 cities and towns. For the small sewerage systems of two (2) communes (Floresti, Maneciu), only the required cost is roughly estimated.

3.1.2 Land Use of the Objective Area

The condition of land use of the objective area was studied using available land use maps as well as through field reconnaissance to plan economically and technically appropriate sewerage system to meet the aforementioned treatment requirement.

In this basic plan the objective area was classified into the following categories taking account

of the future development in the target year of 2015 and consequently most extension of collecting sewer pipes is planned to concentrate on the residential area.

- Residential area
- Cultural and Commercial area
- Open Space, Sport, Recreation area
- Industrial area
- Touristic area

Land use map of each municipality is prepared and shown in Figs.D.3.2 (1/14–14/14) including existing and planned sewer networks to be mentioned in the following sections.

3.1.3 Served Population in the Objective Area

The existing sewerage service ratio of municipalities proportionally varies depending on the population density of the dwelling area. Hence, the future service ratio of the sewerage system is categorized as shown below, also considering intentional upgrowth from the existing service condition.

Category	Existing population Density (per ha)	Existing service Ratio (%)	Future Service Ratio (%)
I	above 45	above 60	90
II	30 - 45	40 – 60	60
III	below 30	below 40	40

The future service ratio and served population of each municipality by the two cases of "without sewer extension" applying the existing service ratio and "with sewer extension" applying the above future service ratio, together with their estimation process are summarized in Table D.3.1.

3.1.4 Industrial Wastewater in the Objective Area

At present, 82 industrial establishments discharge their wastewater to the domestic sewerage systems. In this study, it is assumed that no additional industrial establishments discharge the wastewater to the sewerage systems until 2015 even if any factories are located in the new extension areas of sewer networks.

The above 82 industrial establishments discharge wastewater to the sewerage system mostly after pre-treatment. According to the Romanian Standard NTPA-001, their wastewater quality to the sewerage system must be below 300 mg/l in BOD. As estimated in Table D.2.6 in the previous chapter, the future wastewater quality to the sewerage system is mostly below 300 mg/l even in case of without development of the existing pre-treatment system. Only nine (9) establishments will exceed the BOD limit as shown below.

Sewerage	Code	Establishment Name	Future without Project		Future with Project	
			Q (l/s)	BOD (mg/l)	Q (l/s)	BOD (mg/l)
Sinaia	4020	Salsi Sinaia	6.18	749.3	6.18	300
Cimpina	4554	Electroutilaj	10.92	1,555.2	10.92	300
Urlati	4217	Videlmar Sediu	2.08	749.3	2.08	300
Ploiesti	4094	Prola-Ploiesti	10.87	749.3	10.87	300
	4136	S.C. Vinalcool S A Prahova	3.51	749.3	3.51	300
	4139	Extrapan Sediu	1.86	749.3	1.86	300
	4143	I.N.C.A.F Ploiesti	10.38	1,011.2	10.38	300
	4311	Coca Cola Ploiesti	11.73	487.2	11.73	300
	4350	Agrocom Ploiesti	1.50	749.3	1.50	300

The wastewater of the above establishments will be treated up to 300 mg/l in BOD before discharging to the sewerage system also as shown in the above table. This improvement of the pre-treatment will decrease the influent wastewater quality of the above four (4) sewerage systems.

3.1.5 Design Wastewater Discharge

Three (3) kinds of design wastewater discharge are set for designing the component facilities of treatment plant as follows:

Mean daily discharge	:Sludge treatment facilities
Maximum daily discharge	:Wastewater treatment facilities (aeration and sedimentation tank)
Hourly maximum discharge	:grid chamber and pump facilities

The ratio of three (3) kinds of design wastewater discharge is as follows:

(1) Domestic Wastewater

The mean daily discharge and hourly maximum discharge are 0.7 and 1.2 times of the maximum daily discharge, respectively.

(2) Industrial Wastewater

The mean daily discharge and the maximum daily discharge is the same value, the hourly maximum discharge is 1.2 times of the maximum daily discharge.

(3) Groundwater

Groundwater infiltrates into the sewerage system through joints and breaks. Mean daily discharge, maximum daily discharge and hourly maximum discharge are assumed to be the same since the groundwater infiltration is considered constant.

The groundwater infiltration per capita from the extended new sewer networks is assumed to be half of that from the existing sewer networks.

(4) Total Wastewater Discharge

The total wastewater discharge consisting of domestic wastewater, industrial wastewater and groundwater is tabulated in Table D.3.2.

3.1.6 Design Influent and Effluent Quality of Sewerage Treatment Plant

The design influent quality to the sewerage treatment plant in 2015 in case of no extension of sewer networks is set as shown in the Table D.3.3 from the estimated future baseline influent quality shown in Table D.2.9, taking into account the pre-treatment development of the nine (9) industrial establishments. Similarly, the design influent quality in 2015 in case of extension of sewer networks is shown in Table D.3.4.

On the other hand, the Government Decision NTPA-001 stipulates the limit of the effluent quality from sewerage treatment plant to river as 20 mg/l in BOD. Hence, the design effluent quality from the sewerage plant is set to be 20 mg/l in BOD.

3.1.7 Sewer Pipe

The sewer pipes are extended to increase the sewerage service area in all the objective municipalities. The existing sewer networks of 14 cities and towns are separate type or combined one. The sewer pipe extension in each municipality is planned following the existing sewer type.

In Azuga and Busteni towns, there is no treatment plant and the wastewater is discharged to the river at several locations at present. Then, the construction of interceptors and transmission mains is necessary. Comarnic town has no sewerage system at present and then, construction of a new sewer networks is necessary.

The sewer pipes are generally planned so that the wastewater can be collected by gravity to the treatment plant as far as possible. In this study, no additional pumping station is proposed by exploiting the topographical advantages in the objective cities and towns to the maximum extent.

Although the following two types of sewer pipe, namely main sewer and secondary sewer are planned to be installed adequately following the existing sewer system, the extension length of each secondary sewer is tentatively fixed at the same length of main sewer.

	Material	Applied pipe diameter
Main sewer	R.C. Concrete pipe	more than D200mm
Secondary	PVC pipe	D100mm – D250mm

The typical cross-sections of sewer pipe installation are drawn in Fig.D.3.1. In the following network figures the alignments of main sewer only are presented.

3.1.8 Treatment Plant

(1) Site

The required open space for expansion of the existing treatment plant and sludge drying bed is considered available within the existing plant site or its neighboring land, judging from the results of field survey although the land ownership is not clear.

In Azuga, Busteni and Comarnic towns, construction of a new treatment plant is necessary respectively. The new plant site is selected in consideration of the availability

of open space and topographical advantages in collecting wastewater.

(2) Sewerage Treatment Process

The existing facilities are employed to the maximum extent with necessary rehabilitation. However, some of the existing treatment processes need to be changed to raise the treatment efficiency and decrease the operation/maintenance problems in designing the expansion of the existing plants (installation of additional plants). The following points are duly considered in designing the development and improvement of the treatment plant.

(a) Wastewater

The existing wastewater treatment plants in Breaza, Boldesti Scaieni, Urlati are provided with combined basins. In this combined basin system, the aeration and secondary sedimentation tanks are combined and return sludge is re-circulated automatically into the aeration tank. This system needs little maintenance works, however, the treated water quality is worse than that of separated basin since the way of sludge control is limited. Hence, the conventional activated sludge method with a separated system of aeration and secondary sedimentation tanks is adopted for the design of new treatment plant. The existing combined basins are still all employed with necessary rehabilitation.

All the existing aeration tanks are aerated by aerator. This existing aeration system is employed with necessary rehabilitation. However, blower system is applied instead of aerator system for new treatment plant. Because the aerator system lowers water temperature more than the blower system by increasing the evaporation of water, resulting in reduction of treatment efficiency.

The required capacity of the additional sedimentation and aeration tanks is designed to meet the future requirement together with the existing capacity. The shape of the tanks is also designed to harmonize with the existing ones.

(b) Sludge

Sludge from the sedimentation tank is directly discharged to the sludge drying bed with no mechanical dewatering or digestion processes except Cimpina and Ploiesti City. In these two (2) cities, the thickener is proposed to decrease the sludge volume since direct discharge of the sludge requires a large space of sludge drying bed.

3.2 Preliminary Design

The preliminary design for the sewerage development is prepared for the following two (2) alternative cases : (1) without extension of sewer networks and (2) with extension of sewer networks. The design includes the sewer pipe and treatment plant.

3.2.1 Predeal Town

(1) Sewer Pipe

Since the existing sewerage system with a treatment plant serves 85% of the total population, a 600m extension of main sewer with a diameter 300mm pipe will attain the target service ratio of 90%. The pipe extension will be executed in the gentle slope of highland area in the west side of the town.

The existing and planned sewer networks system is tabulated in Table D.3.5 and their distribution are shown in Fig.D.3.2.

(2) Treatment Plant

The treatment plant was improved during the period from 1996 to 1997 to meet the demand in the year of 2015. Operation of the new treatment plant started in September 1997 and the plant can treat the wastewater up to BOD 20 mg/l. Construction of major facilities is not necessary. Rehabilitation of the existing plant is also unnecessary.

The detailed specifications of the main facilities and layout of the treatment plant are shown in Table D.3.6 and Fig.D.3.3, respectively.

3.2.2 Azuga Town

(1) Sewer Pipe

In Azuga, the town is provided with the sewerage system with no treatment plant and it serves 85% of the total population of the town.

To attain the service ratio of 90% a 250m extension of main sewer with a diameter 500mm pipe of interceptors crossing the Azuga river at two points will be required, so that all the waste waters, which currently discharge to the river can be transmitted to newly planned treatment plant.

The existing and planned sewer networks system is tabulated in Table D.3.5 and their distribution are shown in Fig.D.3.2.

(2) Treatment Plant

The town has no treatment plant. A new treatment plant of standard activated sludge will be constructed at the confluence of Prahova and Azuga rivers. The dimensions of the proposed main facilities are shown below.

Main Facilities	without Extension	with Extension
Primary Sedimentation Tank	D(10 m) x H(4 m) x 2 set	D(11 m) x H(4 m) x 2 set
Aeration Tank	L(22 m) x W(12 m) x H(4m)x 1 set	L(24 m) x W(12 m) x H(4m)x 1 set
Secondary Sedimentation Tank	D(10 m) x H(4 m) x 2 set	D(11m) x H(4 m) x 2 set
Sludge Drying Bed	L(43 m) x W(20 m)	L(46 m) x W(20 m)

Note: D: Diameter, L: Length, W: Width, H: Height

The detailed specifications of the main facilities and layout of the treatment plant are

shown in Table D.3.6 and Fig.D.3.3, respectively.

3.2.3 Busteni Town

(1) Sewer Pipe

The town is provided with the sewerage system with no treatment plant and it serves 60% of the total population of the town.

Since a treatment plant is newly planned to be constructed at the left bank of the Prahova river, an interceptor crossing the river and several transmission mains (D300mm:2500m, D400mm:2000m, D600mm:2200m) will be constructed as main sewer in the relatively wide area of the town so as to attain the target service ratio of 90%.

The existing and planned sewer networks system is tabulated in Table D.3.5 and their distribution are shown in Fig.D.3.2.

(2) Treatment Plant

The town has no treatment plant. A new treatment plant of standard activated sludge will be constructed on the left bank of Prahova River in the southern part of the town. The dimensions of the proposed main facilities are shown below.

Main Facilities	without Extension	with Extension
Primary Sedimentation Tank	L(27 m) x W(11 m) x H(4.5m) x 1 set	L(27 m) x W(16 m) x H(4.5m) x 1 set
Aeration Tank	L(39 m) x W(11 m) x H(5m) x 1 set	L(39 m) x W(16 m) x H(5m) x 1 set
Secondary Sedimentation Tank	L(42 m) x W(11 m) x H(5m) x 1 set	L(42 m) x W(16 m) x H(5m) x 1 set
Sludge Drying Bed	L(45 m) x W(33 m)	L(62 m) x W(33 m)

Note: L: Length, W: Width, H: Height

The detailed specifications of the main facilities and layout of the treatment plant are shown in Table D.3.6 and Fig.D.3.3, respectively.

3.2.4 Sinaia Town

(1) Sewer Pipe

The existing sewerage system with a treatment plan serves 80% of the total population of the town. To improve the existing service ratio to 90% it is necessary that the north and south side areas of the town will be served by the main sewer extension of 1500m with a diameter 300mm pipe.

The existing and planned sewer networks system is tabulated in Table D.3.5 and their distribution are shown in Fig.D.3.2.

(2) Treatment Plant

The existing treatment plant consists of two (2) series of primary sedimentation tank, aeration tank and secondary sedimentation tank. However, only one (1) series of the

system functions and another series is not operated due to the damage of mechanical equipment.

The capacity of the existing two (2) secondary sedimentation tanks can meet the future requirement with necessary rehabilitation of mechanical equipment. On the other hand, both capacities of the two (2) primary sedimentation tanks and two (2) aeration tanks are not enough to meet the future requirement. Hence, construction of additional primary sedimentation and aeration tanks is necessary in addition to the necessary rehabilitation of mechanical equipment of the existing primary and aeration tanks. The dimensions of the proposed additional main facilities are shown below.

Additional Main Facilities	without Extension	with Extension
Primary Sedimentation Tank	-	L(21 m) x W(2.5 m) x H(4 m) x 1 set
Aeration Tank	L(35 m) x W(18 m) x H(3 m) x 1 set	L(35 m) x W(21 m) x H(3 m) x 1 set
Secondary Sedimentation Tank	-	-
Sludge Drying Bed	L(42 m) x W(30 m)	L(53 m) x W(30 m)

Note: L: Length, W: Width, H: Height

The detailed specifications of the main facilities and layout of the treatment plant are shown in Table D.3.6 and Fig.D.3.3, respectively.

3.2.5 Comarnic Town

(1) Sewer Pipe

The town does not have any public sewerage system at present. Although the target service ratio is fixed at 40% of the total population of the town, such target can be attained by the installation of main sewer pipe of 2,700m with a diameter D400mm in the limited residential area along the state road.

The existing and planned sewer networks system is tabulated in Table D.3.5 and their distribution are shown in Fig.D.3.2.

(2) Treatment Plant

The town has no treatment plant. A new treatment plant of standard activated sludge will be constructed on the left bank of Prahova River in the lowermost part of the town. The dimensions of the proposed main facilities are shown below.

Main Facilities	without Extension	with Extension
Primary Sedimentation Tank	-	D(9 m) x H(4 m) x 2 set
Aeration Tank	-	L(16 m) x W(18 m) x H(4m) x 1 set
Secondary Sedimentation Tank	-	D(9 m) x H(4m) x 2 set
Sludge Drying Bed	-	L(30 m) x W(30 m)

Note: D. Diameter, L: Length, W: Width, H: Height

The detailed specifications of the main facilities and layout of the treatment plant are shown in Table D.3.6 and Fig.D.3.3, respectively.

3.2.6 Breaza Town

(1) Sewer Pipe

The town is provided with the sewerage system with a treatment plant and it serves 47% of the total population of the town. The extension of main sewer 1300m with a diameter D300mm in the west hilly area of the middle of the town will improve the existing service ratio of 47% to the target ratio of 60%.

The existing and planned sewer networks system is tabulated in Table D.3.5 and their distribution are shown in Fig.D.3.2.

(2) Treatment Plant

A new treatment plant consisting of combined basins (combined aeration and secondary sedimentation tanks) was constructed in October in 1997. The old was abandoned except primary sedimentation tank. This new plant was designed to meet the year of 2015. The plant can treat the wastewater up to BOD 20 mg/l. However, some rehabilitation of the mechanical equipment of the primary sedimentation tank is necessary.

Hence, the additional construction of the main facilities is only extension of sludge drying bed. The required capacity of the additional sludge drying bed is shown below.

Additional Main Facilities	without Extension	with Extension
Sludge Drying Bed	L(41 m) x W(30 m)	L(54 m) x W(30 m)

Note: L: Length, W: Width, H: Height

The detailed specifications of the main facilities and layout of the treatment plant are shown in Table D.3.6 and Fig. D.3.3, respectively.

3.2.7 Cimpina City

(1) Sewer Pipe

The town is provided with the sewerage system with a treatment plant and it serves 64% of the total population of the town. Since a relatively low service ratio is provided in the north-west and the south-west areas of the city, it is necessary that those areas will be covered by the extension of main sewer pipes (D300mm:1700m, D400mm:1200m, D600mm:2000m) so as to attain the target service ratio of 90%.

The existing and planned sewer networks system is tabulated in Table D.3.5 and their distribution are shown in Fig.D.3.2.

(2) Treatment Plant

The treatment plant is old and overloaded. Rehabilitation of the existing plant and construction of additional plant is necessary to meet the future requirement. The dimensions of the proposed additional main facilities are shown below.

Additional Main Facilities	without Extension	with Extension
Primary Sedimentation Tank	D(30 m) x H(3 m) x 1 set	D(38 m) x H(3 m) x 1 set
Aeration Tank	L(50 m) x W(36 m) x H(4m) x 1 set	L(51 m) x W(36 m) x H(4m) x 1 set
Secondary Sedimentation Tank	D(30 m) x H(3.5 m) x 1 set	D(37m) x H(3.5 m) x 1 set
Sludge Drying Bed	-	L(5 m) x W(50 m)

Note: D: Diameter, L: Length, W: Width, H: Height

The detailed specifications of the main facilities and layout of the treatment plant are shown in Table D.3.6 and Fig.D.3.3, respectively.

3.2.8 Baicoi Town

(1) Sewer Pipe

The existing sewerage system with a treatment plant serves 24 % of the total population of the town. To improve the existing service ratio to 40% of the target ratio the extension of main sewer pipe of 2800m (D300mm:1300m,D400mm:1500m) will be executed in the east side and west side areas of the town.

The existing and planned sewer networks system is tabulated in Table D.3.5 and their distribution are shown in Fig.D.3.2.

(2) Treatment Plant

The treatment plant is old and overloaded. Rehabilitation of the existing plant and construction of additional plant is necessary to meet the future requirement. The dimensions of the proposed additional main facilities are shown below.

Additional Main Facilities	without Extension	with Extension
Primary Sedimentation Tank	-	D(8 m) x H(5 m) x 2 set
Aeration Tank	L(16 m) x W(9 m) x H(5 m) x 1 set	L(21 m) x W(9 m) x H(5 m) x 1 set
Secondary Sedimentation Tank	D(10 m) x H(5 m) x 1 set	D(14m) x H(5 m) x 1 set
Sludge Drying Bed	L(13 m) x W(30 m)	L(30 m) x W(30 m)

Note: D: Diameter, L: Length, W: Width, H: Height

The detailed specifications of the main facilities and layout of the treatment plant are shown in Table D.3.6 and Fig.D.3.3, respectively.

3.2.9 Plopeni Town

(1) Sewer Pipe

Since the existing service ratio of 79% of the total population is relatively high, 90% of the target service ratio will be readily attained by the extension of main sewer 600m with a diameter D300mm in the south side area of the town.

The existing and planned sewer networks system is tabulated in Table D.3.5 and their distribution are shown in Fig D.3.2.

(2) Treatment Plant

The treatment plant is old and overloaded. Rehabilitation of the existing plant and construction of additional plant is necessary to meet the future requirement. The dimensions of the proposed additional main facilities are shown below.

Additional Main Facilities	without Extension	with Extension
Primary Sedimentation Tank	-	D(12 m) x H(5 m) x 1 set
Aeration Tank	L(16 m) x W(16 m) x H(5 m) x 2 set	L(17 m) x W(16 m) x H(5 m) x 2 set
Secondary Sedimentation Tank	D(12 m) x H(5 m) x 2 set	D(13m) x H(5 m) x 2 set
Sludge Drying Bed	L(19 m) x W(11 m) x 5	L(19 m) x W(11 m) x 6

Note: D: Diameter, L: Length, W: Width, H: Height

The detailed specifications of the main facilities and layout of the treatment plant are shown in Table D.3.6 and Fig.D.3.3, respectively.

3.2.10 Slanic Town

(1) Sewer Pipe

The town is provided with the sewerage system with a treatment plant and it serves 33% of the total population of the town. Since the target service ratio of 40% is not so high, such target ratio will be easily attained by the limited extension of main sewer 2000m with a diameter D300mm along the river side residential area.

The existing and planned sewer networks system is tabulated in Table D.3.5 and their distribution are shown in Fig.D.3.2.

(2) Treatment Plant

The existing plant does not function well due to the mechanical troubles. Rehabilitation of the existing facilities is necessary. The existing primary sedimentation and aeration tanks have a sufficient capacity to meet the future requirement. However, the capacity of the secondary sedimentation tank is not enough.

Hence, additional secondary sedimentation tank will be constructed in addition to the necessary rehabilitation of the existing facilities. The dimensions of the proposed additional main facilities are shown below.

Additional Main Facilities	without Extension	with Extension
Primary Sedimentation Tank	-	-
Aeration Tank	-	-
Secondary Sedimentation Tank	D(7 m) x H(5 m) x 1 set	D(8.5 m) x H(5 m) x 1 set
Sludge Drying Bed	-	L(5 m) x W(20 m)

Note: D: Diameter, L: Length, W: Width, H: Height

The detailed specifications of the main facilities and layout of the treatment plant are shown in Table D.3.6 and Fig.D.3.3, respectively.

3.2.11 Valenii de Munte Town

(1) Sewer Pipe

The town is provided with the sewerage system with a treatment plant and it serves 23% of the total population of the town. To improve the existing service ratio to 40% of the target ratio, the extension of main sewer of 1700m with a diameter D500mm will be executed along the sub-main road in the center of the town.

The existing and planned sewer networks system is tabulated in Table D.3.5 and their distribution are shown in Fig.D.3.2.

(2) Treatment Plant

The existing plant does not function well due to the mechanical troubles and insufficient operation. Rehabilitation of the existing plant is necessary. However, the existing capacity is enough to meet the future requirement. Hence, construction of additional main facilities is unnecessary.

The detailed specifications of the main facilities and layout of the treatment plant are shown in Table D.3.6 and Fig.D.3.3.

3.2.12 Boldesti Scaieni Town

(1) Sewer Pipe

The town is provided with the sewerage system with a treatment plant and it serves 32% of the population of the town. The extension of main sewer 1600m with a diameter D300mm will be carried out in the central area of the town to attain the target service ratio of 40%, although the said area has relatively undulating topographic condition.

The existing and planned sewer networks system is tabulated in Table D.3.5 and their distribution are shown in Fig.D.3.2.

(2) Treatment Plant

The existing plant does not function well due to the mechanical troubles and insufficient operation. Rehabilitation of the existing plant is necessary. However, the existing capacity is enough to meet the future requirement except sludge drying bed. Required extension of the sludge drying bed is shown below.

Additional Main Facilities	without Extension	with Extension
Primary Sedimentation Tank	-	-
Aeration Tank	-	-
Secondary Sedimentation Tank	-	
Sludge Drying Bed	-	L(3 m) x W(30 m)

Note: L: Length, W: Width

The detailed specifications of main facilities and layout of the treatment plant are shown in Table D.3.6 and Fig.D.3.3, respectively.

3.2.13 Urlati Town

(1) Sewer Pipe

The existing sewerage system with a treatment plant serves 87 % of the total population of the town. To attain the target service ratio of 60% the main sewer 2000m of with diameters D300mm and D 600mm will be extended in the center of the town where the relatively low service ratio is still provided.

The existing and planned sewer networks system is tabulated in Table D.3.5 and their distribution are shown in Fig.D.3.2.

(2) Treatment Plant

The existing primary sedimentation tank has a sufficient capacity to meet the future requirement. However, the capacity of the aeration and secondary sedimentation tanks is not enough. Hence, additional aeration and secondary sedimentation tanks need to be constructed. The dimensions of the proposed additional main facilities are shown below.

Additional Main Facilities	without Extension	with Extension
Primary Sedimentation Tank	-	-
Aeration Tank	-	L(4 m) x W(10 m) x H(5m) x 1 set
Secondary Sedimentation Tank	-	L(8 m) x W(6.5 m) x H(5m) x 1 set
Sludge Drying Bed	L(18 m) x W(20 m)	L(35 m) x W(20 m)

Note: L: Length, W: Width, H: Height

The detailed specifications of main facilities and layout of the treatment plant are shown in Table D.3.6 and Fig.D.3.3, respectively.

3.2.14 Ploiesti City

(1) Sewer Pipe

The existing sewerage service system with a treatment plant serves 87% of the total population of the city. In the north edge and south edge areas of the city a relatively low service area is distributed, so that the main sewer 6000m with diameters D900/1200 mm or a depressed oval type pipe adjacent to ground surface will be extended to attain the target service ratio of 90%.

The existing and planned sewer networks system is tabulated in Table D.3.5 and their distribution are shown in Fig.D.3.2.

(2) Treatment Plant

The existing plant treats the wastewater through four (4) sets of sedimentation tanks only. These sedimentation tanks are old and overloaded. Rehabilitation and extension of the existing tanks are necessary to meet the future requirement. Further, construction of new aeration tank and secondary sedimentation tank is necessary to treat the wastewater up to BOD 20 mg/l. The dimensions of the proposed additional main facilities are shown below.

Additional Main Facilities	without Extension	with Extension
Primary Sedimentation Tank	D(45 m) x H(3.5 m) x 3 set	D(46 m) x H(3.5 m) x 3 set
Aeration Tank	L(110m) x W(120m) x H(5m) x 1set	L(114m) x W(120m) x H(5m) x 1set
Secondary Sedimentation Tank	D(50 m) x H(3.5 m) x 5 set	D(51m) x H(3.5 m) x 5 set
Sludge Drying Bed	L(52 m) x W(74 m)	L(58 m) x W(74 m)

Note: D: Diameter, L: Length, W: Width, H: Height

The detailed specifications of main facilities and layout of the treatment plant are shown in Table D.3.6 and Fig.D.3.3, respectively.

3.3 Cost Estimate

3.3.1 General

(1) Unit Cost

All unit costs applied in the preparation of this chapter are mostly estimated based on prevailing market prices during this study period, because officially published data on construction materials and equipment are mostly not available and not practicable so far due to the drastic and chronic inflation in Romania.

(2) Materials and Equipment

Most materials and equipment to be used at the foreseeable construction stage are expected to be manufactured and/or available in Romania fortunately. Because it should be noted that all components of existing sewerage system such as sewer pipes, pumping stations and various equipment at treatment plant are genuine Romanian domestic products.

(3) Construction Cost and Currency Conversion Rate

Each construction cost is composed of direct cost, indirect cost and value added tax. The indirect cost comprising engineering service cost, administration cost and profit is fixed at 20 % of direct cost. The value added tax of 22% is also added to the amount of direct cost and indirect cost.

All the following costs are estimated on US dollars($) basis using the currency conversion rate of 1US$=141.5Yen=8,800 Lei prevailing in August of 1998.

3.3.2 Construction Cost

The construction costs for the extension of sewer pipe and additional facilities of treatment plant by each municipality are estimated and summarized in Table D.3.7.

3.3.3 Rehabilitation Cost

Since a lots of mechanical troubles of the existing treatment plants were reported through the JICA team's inspection, various rehabilitation costs are required so as to count the existing full

operation capacities of the treatment plants. In this study the JICA team empirically and roughly estimated as shown in Table D.3.8.

3.4 Operation and Maintenance

3.4.1 Pipe Network

The operation and maintenance of the pipe network comprise operation of equipment such as pumps, patrol, check, cleanup, repair and so on. The work itself is not so difficult or sophisticated, but the most important in the effort is the preparation of the file compiling the dimensions, structure, capacity, conditions, drawings of each of the relevant facilities that can be serve as the basic data for the operation and maintenance thereof.

3.4.2 Sewerage Treatment Plant

The effluent quality depends on the maintenance considerably. Since the wastewater is treated by the activated sludge process, the staff in the treatment plant has to watch the condition of the microorganism, influent quantity and quality. He has to control the machinery according to the above wastewater condition.

The maintenance work can be classified into daily, monthly and yearly maintenance depending on the nature of the objective facilities. Such results should be recorded and compiled in forms as well as the pipe network.

Sewerage treatment plant is basically operated and maintained 24 hours without any interruption. Notable points for such operation and maintenance are enumerated herein for each of the facilities.

(1) Grit Chamber

Sand deposit in the chamber should be removed periodically. As the organic material found in such deposit causes the difficulties in the removal of sand deposit, the flow velocity through the chamber should be adjusted to avoid this. Screens should be kept clean any time with manual raking.

(2) Pump Facilities

During pump operation, the operator should watch the control panel and gauges and confirm the normality of the operation. Anytime, the operator notices heat, noise and vibration of facilities and if any, he should stop the pump operation and proceed to necessary repair. Lubricants should be changed at least once a year.

(3) Sedimentation Tank

Scum on the water surface should be removed periodically. The training walls, sidewalls and overflow sections should be cleaned with brush to prevent offensive odor and unevenness of flow caused by sludge attached therein.

(4) Aeration Tank

Air volume by aerator or blower should be controlled according to the treatment

condition. Since the odor, color and concentration are the important factors, the staff should check these factors periodically.

(5) Sludge Drying Bed

The sludge is dried by filtrating and evaporating. The dried sludge should be hauled to an adequate reclamation land for the time being.

3.4.3 Operation and Maintenance Cost

Operation and maintenance cost mainly consists of manpower cost, chemicals and electricity. In this study a manpower cost was estimated referring to the existing administration cost as mentioned in Chapter I. Chemicals and electricity were estimated on the daily treatment capacity basis applying the chlorine cost of 0.0095 us$/m^3 and the electricity consumed cost of 0.066US$/kwh.

As for operation and maintenance cost of sewer pipe, some 10% of O&M cost of treatment plant with full operation is tentatively considered from an empirical point of view.

Annual O&M cost of each sewerage system is summarized in Table D.3.9.

3.5 Project Cost

All costs of planned sewerage systems for two cases of "without sewer extension" and "with sewer extension" are tabulated in Table D.3.10 in the form of the project cost, together with annual O&M cost of each sewerage system.

CHAPTER IV IMPLEMENTATION PLAN OF SEWERAGE DEVELOPMENT

4.1 Phasing of Sewerage System Development

Based on the phased targets for the short-term plan year (2005) as the first phase, the mid - term plan year (2010) as the second phase and the master plan year (2015) as the third phase, all of the sewerage system development plans with sewer extension are prioritized as follows, taking into consideration the effectiveness of each project, the current of each municipality and relatively uniform investment during three phases.

Phasing of each sewerage system development is presented in Table D.4.1 including annual investment program of each project.

4.1.1 First Phase (2000 - 2005)

(1) Necessity of rehabilitation of existing treatment plants

To function well the damaged equipment and insufficient operation/maintenance should be rehabilitated at the early stage.

(2) Early realization of full-treatment plant in Ploiesti

To mitigate BOD load from Ploiesti which amounts to more than 70% of total BOD load in the objective area, its capacity of existing plant should be extended from the early stage. Further, since a mechanical process only is being provided, a chemical process also should be installed to improve wastewater quality. Due to large amounts of investment required a stepwise implementation should be applied up to the master plan target year of 2015 so as to facilitate smooth implementation from a financial point of view.

4.1.2 Second Phase (2006 - 2010)

(1) Extension of sewer pipe

With the increase of served population the length of sewer pipe in each municipality should be extended gradually until the aforementioned target year of 2015.

(2) Installation of treatment plants in Azuga, Busteni and Comarnic

Azuga, Busteni and Cormanic are located in the upper reaches of the Prahova River basin, which have no treatment plant at the present. From an effectiveness point of river water quality improvement view, these municipalities should have regular-treatment plants at the latest in the mid-term plan year as the second phase projects.

(3) Extension of Cimpina treatment plant

Since extension of Cimpina treatment plant requires relatively large amounts of investment to treat the existing wastewater up to the required level, such investment should be practicably and uniformly distributed during two phases of 2006 - 2015 from

a financial point of view.

4.1.3 Third phase (2010 - 2015)

The remains other than the above mentioned projects are expected to be implemented in the third phase until the master plan target year of 2015.

4.2 Phased Program of Sewerage Wastewater Reduction

With the implementation of sewerage system development as discussed in the above, an average wastewater reduction (BOD :mg/l) in the whole objective area by each phase can be estimated and summarized in the following table. The reduction processes compared to baseline features by each municipality are tabulated in Table D.4.2.

(unit mg/l)

Exsting	1st Plase (2005)		2nd Phase (2010)		3rd Phase (2015)	
Baseline	Baseline	w/ Project	Baseline	w/ Project	Baseline	w/ Project
46.5	54.5	36.7	61.7	27.6	67.2	19.7

4.3 Investment Program for Sewerage Development

Investment programs for every sewerage development together with applicable operation and maintenance costs (refer to Table D.3.10) are summarized on the phased program basis, as shown in Table D.4.3.

4.4 Impact Analysis of Economic Growth on Sewerage Development

As discussed in Chapter III, the design influent and effluent quality of sewerage treatment has been estimated based on the average economic growth rate of 0.0% until the year of 2000 and 3.5% from 2001 which is the middle of the low growth case and the high growth case applied in this study (refer to Appendix A, Section 3.3 GDP). In addition, to analyze sensitivity of the project reliability, the low growth case(2.7%) and the high growth case(4.3%) will be also examined in the following sections.

4.4.1 Water Quality Assessment and Baseline Sewerage Effluent

Applying three cases of economic growth rate, the future sewerage influent qualities for the sewerage treatment plants in 2015 with extension of sewer networks are assessed and set, as shown in Table D.4.4 (refer to Section 3.1.6. of Chapter III). As for baseline sewerage effluents, they are analyzed under the condition of adoption of an ordinary activated sludge treatment system since sewerage effluent qualities are not expected to vary drastically from the required wastewater quality level of BOD 20 (mg/l) even though ±0.8% of the fluctuation of economic growth rate is considered. Table D.4.5 shows salient features of baseline and sewerage wastewater reduction (BOD load) affected by economic growth rate.

4.4.2 Required Project Cost

Construction cost and O&M cost of each sewerage treatment plant is estimated following the basic procedure of Sections 3.3 and 3.4 in Chapter III and summarized in Table D.4.6.

4.4.3 Results of Impact Analysis by Economic Growth Rate

Effectiveness of effluent water quality improvement and required project costs applying three cases of assumed growth rate are summarized in the form of the whole objective area as shown below.

Assumed Growth Rate	%	2.7%		3.5%		4.3%	
		Baseline	w/ Project	Baseline	w/ Project	Baseline	w/ Project
Effluent BOD (2015)	mg/l	67.7	19.7	67.2	19.7	66.6	19.7
Total Construction Cost	mil US$	46.0		46.7		47.4	
Total Annual O&M Cost	mil US$	2.58		2.64		2.70	

TABLES

Table D.1.1 Existing Served Population by Sanitary System

Municipality		Total Population (1997)	Served Population (1997)			
			Sewerage	(%)	Septic Tank/ Latrine	(%)
City	Cimpina	40,900	26,250	64.2	14,650	35.8
	Ploiesti	253,410	220,000	86.8	33,410	13.2
	Sub-total	294,310	246,250	83.7	48,060	16.3
Town	Predeal	6,940	5,890	84.9	1,050	15.1
	Azuga	6,260	5,320	85.0	940	15.0
	Busteni	12,050	7,240	60.1	4,810	39.9
	Sinaia	15,060	12,000	79.7	3,060	20.3
	Comamic	13,580	-	0.0	13,580	100.0
	Breaza	19,040	9,000	47.3	10,040	52.7
	Baicoi	20,290	4,830	23.8	15,460	76.2
	Plopeni	10,320	8,100	78.5	2,220	21.5
	Slanic	7,380	2,400	32.5	4,980	67.5
	Valenii de Munte	14,010	3,190	22.8	10,820	77.2
	Boldesti Scaieni	11,580	3,660	31.6	7,920	68.4
	Urlati	11,890	5,000	42.1	6,890	57.9
	Sub-total	148,400	66,630	44.8	81,770	55.2
Commune	Floresti	7,630	6,100	80.0	1,530	20.0
	Maneciu	11,450	2,860	25.0	8,590	75.0
	Others	293,210	-	0.0	293,210	100.0
	Sub-total	312,290	8,960	2.9	303,330	97.1
Total		755,000	321,840	42.6	433,160	57.4

Data Source; Total population : Prahova Statistic Office
Sewerage served population : each municipality

Table D.1.2 Wastewater Effluents of Major Industries to Domestic Sewerage(1/2)

Municipality	Name of Establishment	Code No.	Industrial Category	Q ($10^3m^3/y$)	Q (l/s)	BOD (mg/l)	Oil (mg/l)	Remark
Predeal								
Azuga	Sinteref Azuga	4004	Non-metallic Mineral	16	0.51	6.3*	0.100	W/T
	Total/Average			16	0.51	6.3		
Busteni	Caraiman S.A.	4544	Hotel/Restaurant	116	3.68	100.0*	-	W/T
	Total/Average			116	3.68	100.0		
Sinaia	Salsi Sinaia	4020	Food/Beverage	116	3.68	468.3*	-	W/T
	Mefin Sinaia	4021	Machinery/Equipment	419	13.29	15.2	1.300	W/T
	Tabere Suzana	4225	Education	31	0.98	50.0*	-	WO/T
	International Sinaia	4331	Hotel/Restaurant	205	6.50	100.0*	-	W/T
	Montana	4541	Hotel/Restaurant	165	5.23	100.0*	-	W/T
	Palace	4545	Hotel/Restaurant	163	5.17	100.0*	-	W/T
	Total/Average			1,099	34.85	105.1		
Comarnic								
Breaza	Hidrojet Breaza	4029	Machinery/Equipment	560	17.76	35.0	22.300	W/T
	U.M. 02525 Breaza	4030	Public Administration	52	1.65	200.0*	-	WO/T
	Total/Average			612	19.41	49.0	6.775	
Cimpina	S.C. Petroutilaj S.A.	4292	Machinery/Equipment	36	1.14	22.2*	-	W/T
	Edilconst	4328	Mining/Quarrying	16	0.51	40.0*	-	W/T
	S.C.V. Prahovei Cimpina	4536	Land Transport	54	1.71	36.5*	-	W/T
	Tumatoria Cimpina	4538	Metal Products	482	15.28	39.1*	-	W/T
	S.C. Breaza S.A. Cimpina	4543	Hotel/Restaurant	57	1.81	100.0*	-	W/T
	Electroutilaj	4554	Electrical	205	6.50	972.0	-	W/T
	S.C. Petros S.A.	4555	Machinery/Equipment	16	0.51	30.5	2.000	W/T
	S.C. Sterom Campina S.A.	4558	Machinery/Equipment	340	10.78	20.1	6.833	W/T
	Neptun Campina S.A.	4559	Machinery/Equipment	380	12.05	45.7	-	W/T
	Citricim Campina	4561	Textiles	184	5.83	5.1*	-	W/T
	S.C. Palinu S.A. Cimpina	4563	Wholesale	76	2.41	50.0*	-	W/T
	GR. S.C. Cimpina	4566	Education	20	0.63	50.0*	-	WO/T
	S.C. Consertrans S.A. Cimpina	4575	Land Transport	255	8.09	70.0	-	W/T
	S.C. Electromontaj S.A.	4583	Machinery/Equipment	8	0.25	22.2*	-	W/T
	Spital Oras Cimpina	4594	Health/Social Work	116	3.68	60.3*	-	W/T
	Total/Average			2,245	71.18	125.9		
Baicoi	S.P. Baicoi	4037	Crude Oil Extraction	60	1.90	100.0*	-	W/T
	Spital Hepapita Baicoi	4515	Health/Social Work	11	0.35	60.3*	-	W/T
	F.S.H. Baicoi	4552	Machinery/Equipment	217	6.88	25.1	7.400	W/T
	Folaj Sonde Ploiesti	4557	Crude Oil Extraction	16	0.51	100.0*	-	W/T
	Camexip	4560	Machinery/Equipment	55	1.74	4.9	24.000	W/T
	Spital Baicoi	4564	Health/Social Work	35	1.11	60.3	-	W/T
	Total/Average			394	12.49	40.9		
Plopeni	U.M. Plopeni	4100	Machinery/Equipment	1,510	47.88	20.3	8.320	W/T
	Total/Average			1,510	47.88	20.3		
Slanic								
Valenii De Munte	Transport Valenii de Munte	4307	Land Transport	11	0.35	29.0	-	W/T
	S.C. Valden S.A.	4321	Chemical Products	9	0.29	80.0*	-	W/T
	Total/Average			20	0.64	52.1		
Boldesti Scaieni	Schela Boldesti	4099	Crude Oil Extraction	102	3.23	100.0*	-	W/T
	GES Scaieni	4101	Wood	166	5.26	31.7	9.500	W/T
	Foradex Scaieni	4320	Furniture	43	1.36	14.0	1.500	WO/T
	Arta Metalului Boldesti	4361	Metal Products	10	0.32	39.1*	-	WO/T
	Total/Average			321	10.17	51.3		

* : JICA estimate

Table D.1.2 Wastewater Effluents of Major Industries to Domestic Sewerage (2/2)

Municipality	Name of Establishment	Code No.	Industrial Category	Q ($10^3m^3/y$)	Q (l/s)	BOD (mg/l)	Oil (mg/l)	Remark
Urlati	Videlmar Sediu	4217	Food/Beverage	39	1.24	468.3*	-	W/T
	Filatura Urlati	4539	Textiles	41	1.30	5.1*	-	W/T
	Total/Average			80	2.54	231.2		
Ploiesti	Prola – Ploiesti	4094	Food/Beverage	204	6.47	468.3*	-	W/T
	S.C. Dero Leve Ploiesti	4124	Chemical Products	474	15.03	80.0	-	W/T
	Intex	4132	Textiles	340	10.78	5.1	8.200	W/T
	Statia Peco 2 KM. 6	4133	Petroleum	99	3.14	4.6*	-	W/T
	S.C. Vinalcool S.A. Prahova	4136	Food/Beverage	66	2.09	468.3*	-	W/T
	Extrapan Sediu	4139	Food/Beverage	35	1.11	468.3*	-	W/T
	Progresul Sectia Pigmenti	4142	Rubber/Plastic	30	0.95	6.5*	-	W/T
	I.N.C.A.F. Ploiesti	4143	Food/Beverage	195	6.18	632.0	-	W/T
	S.C. Ciprom Mecta	4144	Construction Material	156	4.95	4.3	-	W/T
	S.C. Feroemail Ploiesti S.A.	4146	Metal Products	243	7.71	62.2	0.700	W/T
	Petrotrans Ploiesti	4149	Petroleum	71	2.25	4.6*	-	W/T
	Dorobantul Ploiesti	4153	Textiles	1,070	33.93	5.1*	-	W/T
	Depoul C.F.R. – Sediu	4155	Land Transport	228	7.23	36.5*	-	W/T
	Uzuc Ploiesti	4156	Machinery/Equipment	243	7.71	13.8	3.200	W/T
	Foradex Ploiesti	4159	Furniture	20	0.63	14.0*	-	W/T
	Upetrom Ploiesti	4160	Machinery/Equipment	427	13.54	22.2*	-	W/T
	Autobaza 1 Ploiesti	4168	Land Transport	22	0.70	36.5*	-	W/T
	Hipodrom Ploiesti	4170	Recreation	7	0.22	200.0*	-	WO/T
	Progresul Sectia Oxigen	4195	Rubber/Plastic	51	1.62	6.5*	-	W/T
	Ciprom Vest	4221	Construction Material	21	0.67	10.4*	-	W/T
	Industrie Mica Moara De Mozaic	4305	Mining/Quarrying	0	0.00	40.0*	-	W/T
	Societatea Comerciala Anteco	4308	Furniture	25	0.79	14.0*	-	W/T
	Coca Cola Ploiesti	4311	Food/Beverage	220	6.98	304.5	-	W/T
	Tromet	4314	Metal Products	48	1.52	16.1	-	W/T
	Atras Gip Ploiesti	4315	Crude Oil Extraction	29	0.92	4.6	1.700	W/T
	Prahoveana Ploiesti	4318	Leather	53	1.68	62.8	53.150	W/T
	Basti Ploiesti	4319	Non-metallic Mineral	17	0.54	6.3	-	WO/T
	S.C. Umerva S.A.	4324	Land Transport	94	2.98	8.0	0.000	W/T
	U.M. 01899 Ploiesti	4325	Public Administration	61	1.93	15.0	-	WO/T
	Autobaza 6 Calatori	4330	Land Transport	19	0.60	36.5*	-	W/T
	Conpet Sectia Sirt	4343	Land Transport	12	0.38	4.3	-	W/T
	Ancostar Ploiesti	4344	Furniture	14	0.44	14.0	-	W/T
	Agrocom Ploiesti	4350	Food/Beverage	28	0.89	468.3	-	W/T
	R.A.T.C. Ploiesti	4358	Land Transport	69	2.19	49.6	2.450	W/T
	Ubemar	4512	Construction Material	105	3.33	15.6	0.000	W/T
	Liceul Barcanesti	4524	Education	18	0.57	50.0*	-	WO/T
	Rulmenti Grei	4530	Machinery/Equipment	234	7.42	10.9*	4.000	W/T
	Cablul Rom. Ploiesti	4547	Basic Metals	12	0.38	12.9*	-	W/T
	Petros Ploiesti	4550	Petroleum	51	1.62	4.6*	-	WO/T
	S.C. Flacara S.A.	4533	Metal Products	202	6.41	39.1*	-	W/T
	Total/Average			5,313	168.48	85.5		
Floresti	Victoria Floresti	4039	Petroleum	120	3.81	4.6*	2.686	W/T
	Baz. Aprov. Floresti	4549	Wholesale	31	0.98	50.0	-	W/T
	Total/Average			151	4.79	13.9	-	
Maneciu								

* : JICA estimate

Table D.1.3 Existing Average Wastewater Effluent Quantity and Quality of Sewerage System

Parameter		Q						PH		BOD (mg/l)		COD-Mn (mg/l)		SS (mg/l)		NH^{4+} (mg/l)		PO^{3-} (mg/l)		Detergent (mg/l)		Oil Products (mg/l)		Phenol (mg/l)		CN (mg/l)		Cr^{6+} (mg/l)		Treat ment
National Standards		Permitt ed	Actual					6.5-8.5		20		40		60		2.0		4.0		0.5		1.0		0.05		0.05		0.1		
Municipality	Code No.	(l/s)	(10^3m^3/y)				(l/s)	Permitt ed	Actual	Perm itted	Actual	Perm itted	Actual	Perm itted	Actual	Perm itted	Actual	Perm itted	Actual	Perm itted	Actual	Perm itted	Actual	Perm itted	Actual	Perm itted	Actual	Perm itted	Actual	
			1995	1996	1997	Average	Average																							
Predeal	4317	64.00	-	1,662	1,445	1,554	49.28	6.5-8.5	7.8 (7.5)		19.7 (9.7)		32.8 (6.1)		74.2 (66.3)		4.88 (6.66)		1.76 (1.92)		0.43 (0.34)		3.12 (5.30)		(0.00)		(0.00)		(0.00)	W/T
Azuga	4008	50.00	-	1,715	269	991	31.42	6.5-8.5	7.7	15				25	187		9.2		1.21	0.5	0.3		7.93							WO/T
Busteni	4011	90.00	-	-	794	794	25.18	6.5-8.5																						WO/T
Sinaia	4018	103.00	-	-	1,910	1,910	60.57	6.5-8.5	7.8	20	39.6		18.3	40	118.8		11.29		2.75		2.04		3.05		0.00		0.02		0.01	W/T
Comarnic	4026	0.40	-	-	-	-	-	6.5-8.5		100				200						3.0										WO/S
Breaza	4028	48.07	696	1,138	1,018	951	30.16	6.5-8.5	7.7 (8.2)	20	66.5 (9.9)	40	61.2 (8.5)	60	80.4 (91.5)	10	10. 57 (11.33)		2.39 (5.75)		3.45 (0.14)	1.0	14.51 (2.80)		0.32 (0.00)		0.32 (0.01)		0.01 (0.14)	W/T
Campina	4034	144.00	5,991	8,745	7,466	7,401	234.68	6.5-8.5	7.8	40	28.2	60	19.5	20	131.8		11.4		4.35		0.62	5.0	7.56		0.19		0.01		0.01	W/T
Baicoi	4041	25.00	-	1,508	1,675	1,592	50.48	6.5-8.5	7.7	20	63		25.3	50	97.3		0.8				0.5	2.0	1.9			0.1	0	0.1	0	W/T
Plopeni	4578	175.00	-	2,407	2,476	2,442	77.44	6.5-8.5	7.7	20	36.6		20.1	60	208		3.65		0.88		0.45	0.0	2.93		0.07				0.02	W/T
Slanic	4127	11.91	-	101	315	208	6.6	6.5-8.5	7.7	20	16.4		8.9	33	84.4		0.86		7.08		1.39	0.1	1.93							W/T
Valenii de Munte	4506	85.00	-	511	1,397	954	30.25	6.5-8.5	7.8	30	21.8		13.4	60	149.2		4.55		2.06		0.5		3.47						0.01	W/T
Boldesti Scaeni	4022	34.15	353	982	736	690	21.88	6.5-8.5	7.6	33	33.6		20.3	55	101.5	10	14.91		3.6	1.0	0.47	1.0	3.19		0.2		0.04		0.01	W/T
Urlati	4374	32.00	617	497	950	688	21.82	6.5-8.5	7.8	12	23.4	25	14.3	60	52	10	9.87		3.23	0.5	2.03	1.0	5.23							W/T
Ploiesti	4162	1,641	37,714	40,590	65,729	48,011	1,522.42	6.5-8.5	7.8	100	49.3	25	31.6	150	125.7	10	15.67	1.0	5.32	2.0	1.22	8.0	12.07		0.04		0.01		0.3	W/T
Floresti	4301		-	365	781	573	18.17			20												1.0		0.05						W/T
Manecciu	4088		-	370	306	338	10.72		7.4	5	33.1		15.8		97.3		16.71		3.72		0.63	1.0	4.46						0	W/T
Total		2,504				69,097	2,191.07	6.5-8.5																						

Note: (1) Permitted quantity and quality are the latest average ones.

(2) Actual quantity and quality (without parentheses) are average during 1995-1997.

(3) Actual quantity (with parentheses) of Predeal and Breaza are those after completion of new plant. (Predeal: after Oct. 1997 , Breaza : after Nov. 1997)

(4) National Standards: National new Standards stipulated in Nov./1997.

Data Sources: Romanian Waters

Table D.1.4 Average Pollution Load Effluent from Domestic Sewerage System During 1995-1997

Municipality	Code No.	Q		BOD		SS		Oil Products		Treatment
		($10^3m^3/y$)	(l/s)	(mg/l)	(kg/day)	(mg/l)	(kg/day)	(mg/l)	(kg/day)	
Predeal	4317	1,554	49.28	19.7	83.9	74.2	315.9	3.12	13.3	W/T
Azuga	4008	991	31.42	144.0*	390.9	187.0	507.6	7.93	21.5	WO/T
Busteni	4011	794	25.18	143.0*	311.1	187.0*	406.8	7.93*	17.3	WO/T
Sinaia	4018	1,910	60.57	39.6	207.2	118.8	621.7	3.05	16.0	W/T
Comarnic										WO/S
Breaza	4028	951	30.16	66.5	173.3	80.4	209.5	14.51	37.8	W/T
Campina	4034	7,401	234.68	28.2	571.8	131.8	2672.4	7.56	153.3	W/T
Baicoi	4041	1,592	50.48	63.0	274.8	97.3	424.4	1.90	8.3	W/T
Plopeni	4578	2,442	77.44	36.6	244.9	208.0	1391.7	2.93	19.6	W/T
Slanic	4127	208	6.60	16.4	9.4	84.4	48.1	1.93	1.1	W/T
Valenii de Munte	4506	954	30.25	21.8	57.0	149.2	389.9	3.47	9.1	W/T
Boldesti Scaeni	4022	690	21.88	33.6	63.5	101.5	191.9	3.19	6.0	W/T
Urlati	4374	688	21.82	23.4	44.1	52.0	98.0	5.23	9.9	W/T
Ploiesti	4162	48,011	1,522.42	49.3	6,484.8	125.7	16,534.2	12.07	1,587.7	W/T
Floresti	4301	573	18.17	33.1*	52.0	97.3	152.8	4.46*	7.0	W/T
Maneciu	4088	338	10.72	33.1	30.7	97.3	90.1	4.46	4.1	W/T
Total		69,097	2,191.07		8,999.2		24,055.2		1,911.9	

Note
: (1) *: JICA estimate, BOD of Azuga/Busteni/Floresti, SS of Busteni/Floresti and Oil of Busteni/Floresti are assumed as follows:
1) For BOD of Azuga and Busteni, the estimated sewerage influent quality is applied since they have no treatment plant (see, Chapter II, Table D.2.4)
2) For SS and Oil of Busteni, data of Azuga are applied.
3) For BOD, SS and Oil of Floresti, data of Maneciu are applied.
: (2) W/T : with treatment, WO/T : without treatment, WO/S : without sewerage

Table D.2.1 Domestic Water Consumption per Capita

Municipality	(A) Served Population	(B) Total Gross Consumption ($103m^3/y$)	(C)=(B)/(A) Gross Consumption per Capita (l/c/d)	(D) Assumed Net Consumption per Capita (l/c/d)
Predeal				
Azuga	5,630	950	462	155
Busteni	11,450	2,120	507	186
Sinaia				203
Comarnic	10,861	510	129	175
Breaza	13,325	1,550	319	242
Cimpina	36,814	6,060	451	249
Baicoi	18,263	2,250	338	217
Plopeni				210
Slanic	5,536*	350	173	241
Valenii de Munte	13,305	756	156	188
Boldesti Scaieni	9,266	750	222	208
Urlati	10,704	950	243	235
Ploiesti	253,414	33,600	363	264
Total				

Note:
(1) * : JICA estimate
(2) : Gross domestic use includes net domestic, public, small industrial and commercial uses.
Data Source:
(1) : Served population and total gross domestic use (1997 data) : Romanian Waters
(2) : Net domestic use : Plan Urbanistic General si Regulament Local de Urbanism Comuna

Table D.2.2 Domestic Wastewater Discharge per Capita in Sewerage System

Municipality	(A) Served Population	(B) Total Sewerage Q ($10^3m^3/y$)	(B) Total Sewerage Q (l/s)	(C) Major Industrial Q ($10^3m^3/y$)	(D)=(B-C) Gross Domestic Q ($10^3m^3/y$)	(E)=(D)/(A) Per Capita Q (l/c/d)
Predeal	5,890	1,554	49.28	0	1,554	723
Azuga	5,320	991	31.42	16	975	502
Busteni	7,240	794	25.18	116	678	257
Sinaia	12,000	1,910	60.57	1,099	811	185
Comarnic	-	-	-	-	-	-
Breaza	9,000	951	30.16	612	339	103
Cimpina	26,250	7,401	234.68	2,245	5,156	538
Baicoi	4,830	1,592	50.48	394	1,198	680
Plopeni	8,100	2,442	77.44	1,510	932	315
Slanic	2,400	208	6.60	0	208	237
Valenii de Munte	3,190	954	30.25	20	934	802
Boldesti Scaieni	3,660	690	21.88	321	369	276
Urlati	5,000	688	21.82	80	608	333
Ploiesti	220,000	48,011	1,522.42	5,313	42,698	532
Total	312,880	68,186	2,162.18	11,726	56,460	

Note:
(1): (B) and (C) : average discharge during 1995-1997.
(2): (C) : major industrial wastewater discharge to domestic sewerage system.
(3): (D) : Including small industrial/commercial establishments, administration and ground water Infiltration.
Data Source:
(1) Served population: each municipality
(2) Wastewater discharge: Romanian Waters

Table D.2.3 Existing Baseline Sewerage Discharge of Each Municipality

Municipality	Served Population	Major Industry(l/s)	Gross Domestic(l/s)	Groundwater Infiltration(l/s)	Total (l/s)
Predeal	5,890	0.0	19.1	6.8	25.9
Azuga	5,320	0.5	17.2	6.2	23.9
Busteni	7,240	3.7	23.5	8.4	35.5
Sinaia	12,000	34.9	38.9	13.9	87.7
Comarnic	-	-	-	-	-
Breaza	9,000	19.4	29.2	10.4	59.0
Cimpina	26,250	71.2	112.4	30.4	214.0
Baicoi	4,830	12.5	15.7	5.6	33.7
Plopeni	8,100	47.9	26.3	9.4	83.5
Slanic	2,400	0.0	7.8	2.8	10.6
Valenii de Munte	3,190	0.6	10.3	3.7	14.6
Boldesti Scaieni	3,660	10.2	11.9	4.2	26.3
Urlati	5,000	2.5	16.2	5.8	24.5
Ploiesti	220,000	168.5	942.1	407.4	1,518.0
Sub-total	312,880	371.9	1,270.5	514.9	2,157.3
Floresti	6,100	4.8	12.7	7.1	24.6
Maneciu	2,860	0.0	6.0	3.3	9.3
Sub-total	8,960	4.8	18.7	10.4	33.8
Grand-total	321,840	376.7	1,289.1	525.3	2,191.1

Table D.2.4 Existing Baseline Sewerage Influent Quality

Municipality	Major Industry		Gross Domestic		Groundwater		Average Quality/Load			
	Discharge	BOD	Discharge	BOD	Discharge	BOD	Total Discharge	Ave. BOD	BOD Load	
	(l/s)	(mg/l)	(l/s)	(mg/l)	(l/s)	(mg/l)	(l/s)	(mg/l)	(g/s)	(kg/d)
Predeal	0.0		19.1	200.0	6.8	0.0	25.9	147	3.8	330
Azuga	0.5	6.3	17.2	200.0	6.2	0.0	23.9	144	3.4	297
Busteni	3.7	100	23.5	200.0	8.4	0.0	35.5	143	5.1	438
Sinaia	34.9	105.1	38.9	200.0	13.9	0.0	87.7	131	11.4	989
Comarnic	-	-	-	-	-	-	-	-	-	
Breaza	19.4	49	29.2	200.0	10.4	0.0	59.0	115	6.8	587
Cimpina	71.2	125.9	112.4	200.0	30.4	0.0	214.0	147	31.4	2,717
Baicoi	12.5	40.9	15.7	200.0	5.6	0.0	33.7	108	3.7	315
Plopeni	47.9	20.3	26.3	200.0	9.4	0.0	83.5	75	6.2	538
Slanic	0.0		7.8	200.0	2.8	0.0	10.6	147	1.6	135
Valenii de Munte	0.6	52.1	10.3	200.0	3.7	0.0	14.6	143	2.1	181
Boldesti Scaieni	10.2	51.3	11.9	200.0	4.2	0.0	26.3	110	2.9	251
Urlati	2.5	231.2	16.2	200.0	5.8	0.0	24.5	156	3.8	330
Ploiesti	168.5	85.5	942.1	200.0	407.4	0.0	1,518.0	134	202.8	17,524
Floresti	4.8	13.9	12.7	200.0	7.1	0.0	24.6	106	2.6	225
Maneciu	0.0		6.0	200.0	3.3	0.0	9.3	129	1.2	104
Total	376.7		1,289.3		525.4		2,191.1		288.9	24,961

Table D.2.5 Existing Baseline Sewerage Effluent Quality

Municipality	Discharge	BOD	BOD Load		Treatment
	(l/s)	(mg/l)	(g/s)	(kg/d)	
Predeal	25.9	9.7*	0.3	22	W/T
Azuga	23.9	144.0	3.4	297	WO/T
Busteni	35.5	143.0	5.1	439	WO/T
Sinaia	87.7	39.6	3.5	300	W/T
Comarnic	-	-	-	-	WO/S
Breaza	59.0	9.9*	0.6	50	W/T
Cimpina	214.0	28.2	6.0	521	W/T
Baicoi	33.7	63.0	2.1	183	W/T
Plopeni	83.5	36.6	3.1	264	W/T
Slanic	10.6	16.4	0.2	15	W/T
Valenii de Munte	14.6	21.8	0.3	27	W/T
Boldesti Scaieni	26.3	33.6	0.9	76	W/T
Urlati	24.5	23.4	0.6	50	W/T
Ploiesti	1,518.0	49.3	74.8	6,466	W/T
Floresti	24.6	33.1	0.8	70	W/T
Maneciu	9.3	33.1	0.3	27	W/T
Total	2,191.1		101.9	8,808	

Note : (1) * : BOD concentration of Predeal and Breaza are those after completion of new treatment plant (Predeal : after Oct. 1997, Breaza : after Nov. 1997)
(2) W/T: with treatment, WO/T: without treatment, WO/S : without sewerage

Table D.2.6 Future Wastewater Effluents of Major Industries to Domestic Sewerage (1/2)

Municipality	Name of Establishment	Code No.	Industrial Category	Existing		Future (2015)		Treatment Method
				Q (l/s)	BOD (mg/l)	Q (l/s)	BOD (mg/l)	
Predeal								
Azuga	Sinteref Azuga	4004	Non-metallic Mineral	0.51	6.3	0.86	10.1	C
	Total/Average			0.51	6.3	0.86	10.1	
Busteni	Caraiman S.A.	4544	Hotel/Restaurant	3.68	100.0	7.65	190.0	A
	Total/Average			3.68	100.0	7.65	190.0	
Sinaia	Salsi Sinaia	4020	Food/Beverage	3.68	468.3	6.18	749.3	A
	Mefin Sinaia	4021	Machinery/Equipment	13.29	15.2	22.33	24.3	C
	Tabere Suzana	4225	Education	0.98	50.0	1.65	50.0	WO/T
	International Sinaia	4331	Hotel/Restaurant	6.50	100.0	13.52	190.0	A
	Montana	4541	Hotel/Restaurant	5.23	100.0	10.88	190.0	A
	Palace	4545	Hotel/Restaurant	5.17	100.0	10.75	190.0	A
	Total/Average			34.85	105.1	65.31	182.7	
Comarnic								
Breaza	Hidrojet Breaza	4029	Machinery/Equipment	17.76	35.0	29.84	56.0	C
	U.M. 02525 Breaza	4030	Public Administration	1.65	200.0	2.77	200.0	WO/T
	Total/Average			19.41	49.0	32.61	68.2	
Cimpina	S.C. Petroutilaj S.A.	4292	Machinery/Equipment	1.14	22.2	1.92	35.5	C
	Edilconst	4328	Mining/Quarrying	0.51	40.0	0.86	64.0	C
	S.C.V. Prahovei Cimpina	4536	Land Transport	1.71	36.5	2.87	58.4	C
	Turnatoria Cimpina	4538	Metal Products	15.28	39.1	25.67	62.6	C
	S.C. Breaza S.A. Cimpina	4543	Hotel/Restaurant	1.81	100.0	3.76	190.0	A
	Electroutilaj	4554	Electrical	6.50	972.0	10.92	1555.2	C
	S.C. Petros S.A.	4555	Machinery/Equipment	0.51	30.5	0.86	48.8	C
	S.C. Sterom Campina S.A.	4558	Machinery/Equipment	10.78	20.1	18.11	32.2	C
	Neptun Campina S.A.	4559	Machinery/Equipment	12.05	45.7	20.24	73.1	C
	Citricim Campina	4561	Textiles	5.83	5.1	9.79	8.2	A
	S.C. Paltinu S.A. Cimpina	4563	Wholesale	2.41	50.0	4.05	80.0	A
	GR. S.C. Cimpina	4566	Education	0.63	50.0	1.06	50.0	WO/T
	S.C. Consertrans S.A. Cimpina	4575	Land Transport	8.09	70.0	13.59	112.0	C
	S.C. Electromontaj S.A.	4583	Machinery/Equipment	0.25	22.2	0.42	34.6	C
	Spital Oras Cimpina	4594	Health/Social Work	3.68	60.3	6.18	34.6	A
	Total/Average			71.18	125.9	120.31	198.7	
Baicoi	S.P. Baicoi	4037	Crude Oil Extraction	1.90	100.0	3.19	160.0	C
	Spital Hepatita Baicoi	4515	Health/Social Work	0.35	60.3	0.59	96.5	A
	F.S.H. Baicoi	4552	Machinery/Equipment	6.88	25.1	11.56	40.2	C
	Foraj Sonde Ploiesti	4557	Crude Oil Extraction	0.51	100.0	0.86	160.0	C
	Camexip	4560	Machinery/Equipment	1.74	4.9	2.92	7.8	C
	Spital Baicoi	4564	Health/Social Work	1.11	60.3	1.86	96.5	A
	Total/Average			12.49	40.9	20.98	65.4	
Plopeni	U.M. Plopeni	4100	Machinery/Equipment	47.88	20.3	80.44	32.5	C
	Total/Average			47.88	20.3	80.44	32.5	
Slanic								
Valenii De Munte	Transport Valenii de Munte	4307	Land Transport	0.35	29.0	0.59	46.4	C
	S.C. Valden S.A.	4321	Chemical Products	0.29	80.0	0.49	128.0	C
	Total/Average			0.64	52.1	1.08	83.4	
Boldesti Scaineti	Schela Boldesti	4099	Crude Oil Extraction	3.23	100.0	5.43	160.0	C
	GES Scaieni	4101	Wood	5.26	31.7	8.84	50.7	C
	Foradex Scaieni	4320	Furniture	1.36	14.0	2.28	14.0	WO/T
	Arta Metalului Boldesti	4361	Metal Products	0.32	39.1	0.54	39.1	WO/T
	Total/Average			10.17	51.3	17.09	80.2	
Urlati	Videlmar Sediu	4217	Food/Beverage	1.24	468.3	2.08	749.3	A
	Filatura Urlati	4539	Textiles	1.30	5.1	2.18	8.2	A
	Total/Average			2.54	231.2	4.27	369.2	

Table D.2.6 Future Wastewater Effluents of Major Indutries to Domestic Sewerage(2/2)

	Name of Establishment	Code No.	Industrial Category	Existing		Future (2015)		Treatment Method
				Q (l/s)	BOD (mg/l)	Q (l/s)	BOD (mg/l)	
Ploiesti	Prola – Ploiesti	4094	Food/Beverage	6.47	468.3	10.87	749.3	A
	S.C. Dero Lever Ploiesti	4124	Chemical Products	15.03	80.0	25.25	128.0	C
	Intex	4132	Textiles	10.78	5.1	18.11	8.2	A
	Statia Peco 2 KM. 6	4133	Petroleum	3.14	4.6	5.28	7.4	A
	S.C. Vinalcool S.A. Prahova	4136	Food/Beverage	2.09	468.3	3.51	749.3	A
	Extrapan Sediu	4139	Food/Beverage	1.11	468.3	1.86	749.3	A
	Progresul Sectia Pigmenti	4142	Rubber/Plastic	0.95	6.5	1.60	10.4	C
	I.N.C.A.F. Ploiesti	4143	Food/Beverage	6.18	632.0	10.38	1011.2	A
	S.C. Ciprom Mecta	4144	Construction Material	4.95	4.3	8.32	6.9	A
	S.C. Feroemail Ploiesti S.A.	4146	Metal Products	7.71	62.2	12.95	99.5	C
	Petrotrans Ploiesti	4149	Petroleum	2.25	4.6	3.78	7.4	A
	Dorobantul Ploiesti	4153	Textiles	33.93	5.1	57.00	8.2	A
	Depoul C.F.R. – Sediu	4155	Land Transport	7.23	36.5	12.15	58.4	C
	Uzuc Ploiesti	4156	Machinery/Equipment	7.71	13.8	12.95	22.1	C
	Foradex Ploiesti	4159	Furniture	0.63	14.0	1.06	22.4	C
	Upetrom Ploiesti	4160	Machinery/Equipment	13.54	22.2	22.75	35.5	C
	Autobaza 1 Ploiesti	4168	Land Transport	0.70	36.5	1.18	58.4	C
	Hipodrom Ploiesti	4170	Recreation	0.22	200.0	0.37	200.0	WO/T
	Progresul Sectia Oxigen	4195	Rubber/Plastic	1.62	6.5	2.72	10.4	C
	Ciprom Vest	4221	Construction Material	0.67	10.4	1.13	16.6	A
	Industrie Mica Moara De Mozaic	4305	Mining/Quarrying	0.00	40.0	0.00	64.0	C
	Societatea Comerciala Anteco	4308	Furniture	0.79	14.0	1.33	22.4	C
	Coca Cola Ploiesti	4311	Food/Beverage	6.98	304.5	11.73	487.2	A
	Tromet	4314	Metal Products	1.52	16.1	2.55	25.8	C
	Atras Gip Ploiesti	4315	Crude Oil Extraction	0.92	4.6	1.55	7.4	C
	Basti Ploiesti	4319	Non-metallic Mineral	0.54	6.3	0.91	6.3	WO/T
	Prahoveana Ploiesti	4318	Leather	1.68	62.8	2.82	100.5	C
	S.C. Umerva S.A.	4324	Land Transport	2.98	8.0	5.01	12.8	C
	U.M. 01899 Ploiesti	4325	Public Administration	1.93	15.0	3.24	15.0	WO/T
	Autobaza 6 Calatori	4330	Land Transport	0.60	36.5	1.01	58.4	C
	Conpet Sectia Sirt	4343	Land Transport	0.38	4.3	0.64	6.9	C
	Ancostar Ploiesti	4344	Furniture	0.44	14.0	0.74	22.4	C
	Agrocom Ploiesti	4350	Food/Beverage	0.89	468.3	1.50	749.3	A
	R.A.T.C. Ploiesti	4358	Land Transport	2.19	49.6	3.68	79.4	C
	Ubemar	4512	Construction Material	3.33	15.6	5.59	25.0	A
	Liceul Barcanesti	4524	Education	0.57	50.0	0.96	50.0	WO/T
	Rulmenti Grei	4530	Machinery/Equipment	7.42	10.9	12.47	17.4	C
	Cablul Rom. Ploiesti	4547	Basic Metals	0.38	12.9	0.64	20.6	C
	Petros Ploiesti	4550	Petroleum	1.62	4.6	2.72	4.6	WO/T
	S.C. Flacara S.A.	4533	Metal Products	6.41	39.1	10.77	62.6	C
	Total/Average			168.48	85.5	283.05	137.0	
Floresti	Victoria Floresti	4039	Petroleum	3.81	4.6	6.40	7.4	A
	Baz. Aprov. Floresti	4549	Wholesale	0.98	50.0	1.65	80.0	A
	Total/Average			4.79	13.9	8.05	22.2	
Maneciu								

Note ; A : activated sludge method, C : coagulation settling method, WO/T: without treatment

Table D.2.7 Future Baseline Sewerage Discharge of Each Municipality

Municipality	Served Population	Major Industry(l/s)	Gross Domestic(l/s)	Groundwater Infiltration(l/s)	Total (l/s)
Predeal	6,586	0.0	23.6	6.8	30.4
Azuga	5,743	0.9	21.3	6.2	28.4
Busteni	7,823	7.7	29.0	8.4	45.1
Sinaia	12,966	65.3	48.0	13.9	127.2
Comarnic	-	-		-	
Breaza	9,724	32.6	36.0	10.4	79.0
Cimpina	28,361	120.3	141.1	30.4	291.8
Baicoi	5,216	21.0	19.3	5.6	45.9
Plopeni	8,745	80.4	32.4	9.4	122.2
Slanic	2,591	0.0	9.6	2.8	12.4
Valenii de Munte	3,449	1.1	12.8	3.7	17.6
Boldesti Scaieni	3,953	17.1	14.6	4.2	35.9
Urlati	5,407	4.3	20.0	5.8	30.1
Ploiesti	237,560	283.1	1,182.5	407.4	1,873.0
Sub-total	338,124	633.8	1,590.1	514.9	2,738.8
Floresti	6,584	8.1	16.0	7.1	31.2
Maneciu	3,092	0.0	7.5	3.3	10.8
Sub-total	9,676	8.1	23.5	10.4	42.0
Grand-total	347,800	641.9	1,613.6	525.3	2,780.8

Table D.2.8 Estimation of BOD Removal Speed Constant (K)

Factory	Industrial Category	AerationTank Volume (m3)	Influent Q (l/s)	Retention Time (hr)	BOD (mg/l)		K
					Influent	Effluent	(10^{-4} l/mg hr)
Bere Azuga	Food/Beverage	1,700	28.0	17.0	392.0	75.4	1.23
S.C. Petrobrazi S.A. (1)	Petroleum	15,400	456.2	9.4	910.0	88.5	4.96
S.C. Petrobrazi S.A. (2)	Petroleum	43,400	1,287.8	9.4	103.1	59.3	0.39
S.C. Cahiro S.A.	Paper	3,400	26.0	35.9	177.3	41.1	0.46
Matizol	Const. Material	800	12.0	19.1	168.2	15.8	2.53
Coca Cola Ploiesti	Food/Beverage			33.6	518.7	10.8	6.98
S.C. Astra Romana S.A.	Petroleum	14,900	109.0	37.9	48.1	23.1	0.14
Average				23.2	331.1	44.9	2.39

Table D.2.9 Future Baseline Sewerage Influent Quality

Municipality	Major Industry		Gross Domestic		Groundwater		Average Quality/Load			
	Discharge	BOD	Discharge	BOD	Discharge	BOD	Total Discharge	Ave. BOD	BOD Load	
	(l/s)	(mg/l)	(l/s)	(mg/l)	(l/s)	(mg/l)	(l/s)	(mg/l)	(g/s)	(kg/d)
Predeal	0.0	0.0	23.6	200.0	6.8	0.0	30.4	155.3	4.7	408
Azuga	0.9	10.1	21.3	200.0	6.2	0.0	28.4	150.3	4.3	369
Busteni	7.7	190.0	29.0	200.0	8.4	0.0	45.1	161.0	7.3	628
Sinaia	65.3	182.7	48.0	200.0	13.9	0.0	127.2	169.3	21.5	1,860
Comarnic	-	-	-	-	-	-	-	-	-	-
Breaza	32.6	68.2	36.0	200.0	10.4	0.0	79.0	119.3	9.4	814
Cimpina	120.3	198.7	141.1	200.0	30.4	0.0	291.8	178.6	52.1	4,503
Baicoi	21.0	65.4	19.3	200.0	5.6	0.0	45.9	114.0	5.2	452
Plopeni	80.4	32.5	32.4	200.0	9.4	0.0	122.2	74.4	9.1	786
Slanic	0.0	0.0	9.6	200.0	2.8	0.0	12.4	154.8	1.9	166
Valenii de Munte	1.1	83.4	12.8	200.0	3.7	0.0	17.6	150.7	2.7	229
Boldesti Scaieni	17.1	80.2	14.6	200.0	4.2	0.0	35.9	119.5	4.3	371
Urlati	4.3	369.2	20.0	200.0	5.8	0.0	30.1	185.6	5.6	483
Ploiesti	283.1	137.0	1,182.5	200.0	407.4	0.0	1,873.0	147.0	275.3	23,785
Floresti	8.1	22.2	16.0	200.0	7.1	0.0	31.2	108.3	3.4	292
Maneciu	0.0	0.0	7.5	200.0	3.3	0.0	10.8	138.9	1.5	130
Total	641.9		1,613.6		525.4		2,780.9		408.3	35,275

Table D.2.10 Future Baseline Sewerage Effluent Quality

Municipality	Discharge	BOD	BOD Load		Treatment
	(l/s)	(mg/l)	(g/s)	(kg/d)	
Predeal	30.4	11.9	0.4	31	A
Azuga	28.4	150.3	4.3	369	WO/T
Busteni	45.1	161.0	7.3	627	WO/T
Sinaia	127.2	65.3	8.3	718	A
Comarnic	-	-	-	-	WO/S
Breaza	79.0	13.4	1.1	91	A
Cimpina	291.8	43.7	12.7	1,101	A
Baicoi	45.9	74.8	3.4	297	A
Plopeni	122.2	43.3	5.3	458	A
Slanic	12.4	19.8	0.2	21	A
Valenii de Munte	17.6	26.9	0.5	41	A
Boldesti Scaieni	35.9	44.8	1.6	139	A
Urlati	30.1	33.1	1.0	86	A
Ploiesti	1,873	71.7	134.3	11,602	S
Floresti	31.2	39.6	1.2	107	A
Maneciu	10.8	39.7	0.4	37	A
Total	2,780.9		182.0	15,725	

Note : A: activated sludge method, S: sedimentation method, WO/T: without treatment, WO/S: without sewerage

Table D.2.11 Comparison of Existing and Future Baseline Sewerage Effluent

Municipality	Existing Baseline Effluent			Future Baseline Effluent			Ratio		
	Discharge (l/s)	BOD Conc. (mg/l)	BOD Load (kg/d)	Discharge (l/s)	BOD Conc. (mg/l)	BOD Load (kg/d)	Discharge (l/s)	BOD Conc. (mg/l)	BOD Load (kg/d)
Predeal	25.9	9.7	22	30.4	11.9	31	1.17	1.23	1.42
Azuga	23.9	144.0	297	28.4	150.3	369	1.19	1.04	1.24
Bustenl	35.5	143.0	439	45.1	161.0	627	1.27	1.13	1.43
Sinaia	87.7	39.6	300	127.2	65.3	718	1.45	1.65	2.39
Comarnic	-	-	-	-	-	-	-	-	-
Breaza	59.0	9.9	50	79.0	13.4	91	1.34	1.35	1.83
Cimpina	214.0	28.2	521	291.8	43.7	1,102	1.36	1.55	2.11
Baicoi	33.7	63.0	183	45.9	74.8	297	1.36	1.19	1.62
Plopeni	83.5	36.6	264	122.2	43.3	457	1.46	1.18	1.73
Slanic	10.6	16.4	15	12.4	19.8	21	1.17	1.21	1.41
Valenii de Munte	14.6	21.8	27	17.6	26.9	41	1.21	1.23	1.52
Boldesti Scaieni	26.3	33.6	76	35.9	44.8	139	1.37	1.33	1.83
Urlati	24.5	23.4	50	30.1	33.1	86	1.23	1.41	1.72
Ploiesti	1,518	49.3	6,466	1,873.0	71.7	11,603	1.23	1.45	1.79
Floresti	24.6	33.1	70	31.2	39.6	107	1.27	1.20	1.52
Maneciu	9.3	33.1	27	10.8	39.7	37	1.16	1.20	1.37
Total	2,191.1		8,808	2,780.9		15,726	1.27		1.79

Table D.2.12 Required Facilities for Activated Carbon Process

Required Facilities			unit	Municipalities												
				Predeal	Azuga	Busteni	Sinaia	Breaza	Cimpina	Baicoi	Plopeni	Slanic	Valenii	Boldesit	Urlati	Ploiesti
Sand Filter Tank	Filter Size	diameter	m	4.0	3.0	3.0	6.0	4.0	6.0	3.0	5.0	4.0	5.0	5.0	5.0	15*10[1)]
		height	m	4.8	3.6	3.6	7.2	4.8	7.2	3.6	6.0	4.8	6.0	6.0	6.0	3.5
		number	nos.	2	3	3	3	4	6	4	4	1	1	1	1	8
Activated Carbon Tank	Tower Size	diameter	m	5.0	4.0	5.0	6.0	6.0	6.0	6.0	7.0	5.0	6.0	5.0	5.0	15*20[1)]
		height	m	6.5	5.2	6.5	7.8	7.8	7.8	7.8	9.1	6.5	7.8	6.5	6.5	5.0
		number	nos.	2	3	3	6	4	12	2	4	1	1	2	2	8
Reservoir Tank	Wastewater & Backwash Size	length	m	15.0	14.0	18.0	28.0	24.0	44.0	18.0	27.0	10.0	11.0	30.0	15.0	114.0
		width	m	7.5	7.0	9.0	14.0	12.0	22.0	9.0	13.5	5.0	5.5	15.0	7.5	57.0
		depth	m	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	7.5	4.0	4.0
		number	nos.	2	2	2	2	2	2	2	2	2	2	2	2	2
Chemical Tank	PAC Size	diameter	m	1.5	1.5	2.0	2.5	2.0	3.0	2.0	2.5	1.5	1.5	1.5	1.5	4.0
		height	m	2.0	2.0	2.0	3.0	2.5	4.0	2.0	3.0	2.0	2.0	2.0	2.0	4.0
		number	nos.	1	1	1	1	1	1	1	1	1	1	1	1	4
Pump	Feed (SF & AC)	capacity	kw	11	11	15	37	22	75	15	30	3.7	5.5	11	11	50
		number	nos.	1	1	1	1	1	1	1	1	1	1	1	1	12
	Backwash (SF/AC)	capacity	kw	19	19	30	75	55	170	30	75	11	11	22	19	370
		number	nos.	1	1	1	1	1	1	1	1	1	1	1	1	10
Blower	Backwash (SF/AC)	capacity	kw	7.5	7.5	11	30	19	75	11	30	3.7	5.5	11	7.5	150
		number	nos.	1	1	1	1	1	1	1	1	1	1	1	1	10
Control Building		length	m	10	10	12	15	13	18	12	15	9	10	11	11	36
		width	m	8	8	8	8	8	8	8	8	8	8	8	8	8
		height	m	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5

Note: 1) Sand filter tank and activated carbon tank are basically planned to be of steel structures. At Ploieste, however, due to required nos. and dimensions of those tanks it may be practicably and economically advantageous to be of reinforced concrete structures.

2) SF : Sand Filter tank, AC : Activated Cabon tank

Table D.2.13 Construction Cost and O&M Cost of Activated Carbon Process

with sewer extension

Municipalities	Design Discharge	Civil Work & Building	Mechanical Work & Equipment	Electrical Work & Control System	Indirect Cost (20% of total of the left)	Sub-total of the left	VAT (22% of Sub-total)	Total	Annual O&M Cost
	(m3/day)	(1000US$)	(1000US$)	(1000US$)	(1000US$)	(1000US$)	(1000US$)	(1000US$)	(1000US$)
1 Predeal	2,851	131	152	36	64	383	84	467	160
2 Azuga	2,575	121	142	34	60	357	79	436	146
3 Busteni	5,331	210	230	52	98	590	130	720	281
4 Sinaia	11,802	380	389	84	171	1,024	225	1,250	584
5 Comarnic	2,169	107	127	30	53	317	70	387	125
6 Breaza	7,793	279	296	66	128	768	169	937	398
7 Cimpina	30,681	779	731	149	332	1,991	438	2,429	1,434
8 Baicoi	5,279	208	229	52	98	587	129	716	278
9 Plopeni	10,973	360	371	80	162	974	214	1,188	546
10 Slanic	1,287	72	90	22	37	221	49	270	79
11 Valenii de Munte	2,480	118	139	33	58	348	77	425	141
12 Boldesti Scaieni	3,499	153	174	41	74	441	97	538	192
13 Urlati	3,456	151	173	40	73	438	96	534	190
14 Ploiesti	166,009	2,763	2,228	411	1,080	6,482	1,426	7,908	7,281
Total	256,185	5,833	5,472	1,130	2,487	14,922	3,283	18,205	11,834

Table D.3.1 Future Served Population by Sewerage System

Municipality	JICA Projected Population	Dwelling Area	Population Density	without Sewer Extention		with Sewer Extension	
	Year of 2015	(ha)	(person/ha)	Future(Existing) Service Ratio (%)	Served Population	Future Service Ratio (%)	Served Population
Predeal	7,757	65	119	84.9	6,586	90.0	6,981
Azuga	6,756	90	75	85.0	5,743	90.0	6,080
Busteni	13,017	269	48	60.1	7,823	90.0	11,715
Sinaia	16,268	343	47	79.7	12,966	90.0	14,641
Comarnic	14,662	1,030	14	0.0	0	40.0	5,865
Breaza	20,558	670	31	47.3	9,724	60.0	12,335
Cimpina	44,176	590	75	64.2	28,361	90.0	39,758
Baicoi	21,915	765	29	23.8	5,216	40.0	8,766
Plopeni	11,140	72	155	78.5	8,745	90.0	10,026
Slanic	7,973	475	17	32.5	2,591	40.0	3,189
Valenii de Munte	15,125	560	27	22.8	3,449	40.0	6,050
Boldesti Scaieni	12,510	650	19	31.6	3,953	40.0	5,004
Urlati	12,844	310	41	42.1	5,407	60.0	7,706
Ploiesti	273,687	1,600	171	86.8	237,560	90.0	246,318
Total	478,388			70.7	338,123	80.4	384,436

Table D.3.2 Future Total Sewerage Influent Quantity

(unit: l/s)

Municipality	Without Extension			With Extension		
	Mean Daily Discharge	Maximum Daily Discharge	Maximum Discharge	Mean Daily Discharge	Maximum Daily Discharge	Maximum Discharge
Predeal	30.4	40.5	47.2	33.0	44.1	51.5
Azuga	28.4	37.5	43.7	29.8	39.4	46.0
Busteni	45.1	57.5	67.3	61.7	80.3	94.3
Sinaia	127.2	147.8	174.5	136.6	160.7	189.8
Comarnic	0.0	0.0	0.0	25.1	34.4	40.6
Breaza	79.0	94.4	111.3	90.2	109.8	129.4
Baicoi	45.9	54.2	63.9	61.1	75.0	88.5
Plopeni	122.2	136.1	161.4	127.0	143.6	170.3
Slanic	12.4	16.5	19.2	14.9	20.0	23.4
Valenii de Munte	17.6	23.0	26.9	28.7	38.3	44.9
Boldesti Scaieni	35.9	42.3	49.9	40.5	48.4	57.1
Urlati	30.1	38.7	45.2	40.0	52.2	61.2
Ploiesti	1,873.0	2,379.8	2,774.3	1,921.4	2,446.8	2,853.7

Table D.3.3 Future Sewerage Influent Quality without Sewer Extension

Municipality	Major Industry		Gross Domestic		Groundwater		Average Quality/Load		
	Discharge (l/s)	BOD (mg/l)	Discharge (l/s)	BOD (mg/l)	Discharge (l/s)	BOD (mg/l)	Total Discharge(l/s)	Ave.BOD (mg/l)	BOD Load (kg/d)
Predeal	0	0	23.6	200	6.8	0	30.4	155.3	407.8
Azuga	0.9	10.1	21.3	200	6.2	0	28.4	150.3	368.8
Busteni	7.7	190.0	29.0	200	8.4	0	45.1	161.0	627.5
Sinaia	65.3	140.2	48.0	200	13.9	0	127.2	147.4	1,620.4
Comarnic	0	0	0	0	0	0	0	0	0
Breaza	32.6	68.2	36.0	200	10.4	0	79.0	119.3	814.2
Cimpina	120.3	84.8	141.1	200	30.4	0	291.8	131.7	3,319.6
Baicoi	21	65.4	19.3	200	5.6	0	45.9	114.0	452.2
Plopeni	80.4	32.5	32.4	200	9.4	0	122.2	74.4	785.6
Slanic	0	0	9.6	200	2.8	0	12.4	154.8	165.9
Valenii de Munte	1.1	83.4	12.8	200	3.7	0	17.6	150.7	229.1
Boldesti Scaieni	17.1	80.2	14.6	200	4.2	0	35.9	119.5	370.8
Urlati	4.3	150.3	20.0	200	5.8	0	30.1	154.4	401.4
Ploiesti	283.1	75.0	1,182.5	200	407.4	0	1,873.0	137.6	22,268.1

Table D.3.4 Future Sewerage Influent Quality with Sewer Extension

Municipality	Major Industry		Gross Domestic		Groundwater		Average Quality/Load		
	Discharge (l/s)	BOD (mg/l)	Discharge (l/s)	BOD (mg/l)	Discharge (l/s)	BOD (mg/l)	Total Discharge(l/s)	Ave.BOD (mg/l)	BOD Load (kg/d)
Predeal	0	0	25.9	200	7.2	0	33.0	156.6	446.8
Azuga	0.9	10.1	22.5	200	6.4	0	29.8	151.6	389.9
Busteni	7.7	190.0	43.4	200	10.6	0	61.7	164.3	876.2
Sinaia	65.3	140.2	56.2	200	15.2	0	136.6	149.2	1,761.6
Comarnic	0	0	21.7	200	3.4	0	25.1	173.0	375.3
Breaza	32.6	68.2	45.7	200	11.9	0	90.2	125.9	981.5
Cimpina	120.3	84.8	197.9	200	37.0	0	355.2	140.2	4,300.6
Baicoi	21	65.4	32.5	200	7.6	0	61.1	128.7	679.7
Plopeni	80.4	32.5	37.1	200	10.1	0	127.6	78.7	867.4
Slanic	0	0	11.8	200	3.1	0	14.9	158.2	204.1
Valenii de Munte	1.1	83.4	22.4	200	5.2	0	28.7	159.3	395.1
Boldesti Scaieni	17.1	80.2	18.5	200	4.8	0	40.5	125.5	438.7
Urlati	4.3	150.3	28.5	200	7.1	0	40.0	159.0	549.0
Ploiesti	283.1	75.0	1,225.9	200	412.5	0	1,921.4	138.7	23,017.9

Table D.3.5 Existing and Planned Sewer Networks (1/3)

City/Town	Specification	Unit	Existing Quantity	Existing Remarks	Planned(Extension) Quantity	Planned(Extension) Remarks
1 Predeal						
	(1) Main sewer pipe					
	D300	m	4,000	*	600	
	D500	m	1,000	*	-	
	Sub-total		5,000		600	
	(2) Secondary sewer pipe					
	D100 (D30-50)	m	12,900	*	600	
	Sub-total		12,900		600	
	Total		17,900	*	1,200	
2 Azuga						
	(1) Main sewer pipe					
	D300	m	2,000	*	-	
	D400	m	4,000	*	-	
	D500	m	1,600	*	250	
	Sub-total		7,600		250	
	(2) Secondary sewer pipe					
	D200	m	6,500	**	250	
	Sub-toal		6,500		250	
	Total		14,100		500	
3 Busteni						
	(1) Main sewer pipe					
	D300	m	5,000	**	2,500	
	D400	m	4,000	**	2,000	
	D600	m	2,000	**	2,200	
	D1000	m	1,000	**	-	
	Sub-toal		11,000		6,700	
	(2) Secondary sewer pipe					
	D100	m	3,000	**	3,400	
	D200	m	3,000	**	3,300	
	Sub-toal		6,000		6,700	
	Total		17,000	*	13,400	
4 Sinaia						
	(1) Main sewer pipe					
	D250	m	19,500	*	-	
	D300	m	4,000	*	1,500	
	D400	m	8,000	*	-	
	Sub-toal		31,500		1,500	
	(2) Secondary sewer pipe					
	D150	m	5,700	*	1,500	
	Sub-total		5,700		1,500	
	Total		37,200	*	3,000	
5 Comarnic						
	(1) Main sewer pipe					
	D400	m	-		2,700	
			-		-	
	Sub-total		0		2,700	
	(2) Secondary sewer pipe					
	D200	m	-		2,700	
	Sub-total		0		2,700	
	Total		0	*	5,400	

Note : * presents interviewed data
** presents estimated data

Table D.3.5 Existing and Planned Sewer Networks (2/3)

City/Town	Specification	Unit	Existing		Planned(Extension)	
			Quantity	Remarks	Quantity	Remarks
6 Breaza						
	(1) Main sewer pipe					
	D300	m	1,200 **		1,300	
	D500	m	4,000 *		-	
	Sub-total		5,200		1,300	
	(2) Secondary sewer pipe					
	D200	m	5,700 **		1,300	
	Sub-total		5,700		1,300	
	Total		10,900		2,600	
7 Cimpina						
	(1) Main sewer pipe					
	D300	m	23,000 *		1,700	
	D400	m	2,500 *		1,200	
	D600	m	3,000 *		2,000	
	D800	m	500 *		-	
	Sub-total		29,000		4,900	
	(2) Secondary sewer pipe					
	D150	m	11,000 *		4,900	
	Sub-total		11,000		4,900	
	Total		40,000 *		9,800	
8 Baicoi						
	(1) Main sewer pipe					
	D300	m	3,450 *		1,300	
	D400	m	5,000 *		1,500	
	Sub-total		8,450		2,800	
	(2) Secondary sewer pipe					
	D250		1,550 *		2,800	
	Sub-total		1,550		2,800	
	Total		10,000 *		5,600	
9 Plopeni						
	(1) Main sewer pipe					
	D300	m	4,500 **		600	
	D400	m	1,800 **		-	
	D500	m	1,500 **		-	
	Sub-total		7,800		600	
	(2) Secondary sewer pipe					
	D200	m	6,100 **		600	
	Sub-total		6,100		600	
	Total		13,900 *		1,200	
10 Slanic						
	(1) Main sewer pipe					
	D300	m	4,000 *		2,000	
	Sub-total		4,000		2,000	
	(2) Secondary sewer pipe					
	D200	m	4,000 **		2,000	
	Sub-total		4,000		2,000	
	Total		8,000		4,000	

Note : * presents interviewed data
** presents estimated data

Table D.3.5 Existing and Planned Sewer Networks (3/3)

City/Town	Specification	Unit	Existing		Planned(Extension)	
			Quantity	Remarks	Quantity	Remarks
11 Valenii De Munte						
	(1) Main sewer pipe					
	D500	m	8,300	*	1,700	
	Sub-total		8,300		1,700	
	(2) Secondary sewer pipe					
	D250	m	13,000	**	1,700	
	Sub-total		13,000		1,700	
	Total		21,300		3,400	
12 Boldesti Scaeni						
	(1) Main sewer pipe					
	D300	m	4,000	*	1,600	
	D500	m	4,500	*	-	
	Sub-total		8,500		1,600	
	(2) Secondary sewer pipe					
	D200	m	2,000	*	1,600	
	Sub-total		2,000		1,600	
	Total		10,500	*	3,200	
13 Urlati						
	(1) Main sewer pipe					
	D300	m	1,500	*	1,000	
	D600	m	1,500	*	1,000	
	Sub-total		3,000		2,000	
	(2) Secondary sewer pipe					
	D250	m	4,000	*	2,000	
	Sub-total		4,000		2,000	
	Total		7,000	*	4,000	
14 Ploiesti						
	(1) Main sewer pipe					
	D900/1200	m	81,600	*	6,000	
	D3000	m	22,100	*		
	Sub-total		103,700		6,000	
	(2) Secondary sewer pipe					
	D200/400	m	172,560	*	6,000	
	Sub-total		172,560		6,000	
	Total		276,260	*	12,000	
G.Total length of main sewer pipe		m	233,050		34,650	
G.Total length of secondary sewer pipe		m	251,010		34,650	

Note : * presents interviewed data
** presents estimated data

Table D.3.6 Features of Sewerage Treatment Plant (1/14)

Predeal Town

Item	Unit	without Extension	with Extension
Influent BOD	mg/l	155.3	156.6
Mean Daily Discharge	m^3/d	2,627	2,851
Maximum Daily Discharge	m^3/d	3,499	3,810
Maximum Hourly Discharge	m^3/d	4,078	4,450
BOD Load	kg/d	407.8	446.4
Removal BOD Load	kg/d	355.3	389.3

Facilities			Existing	Additional	Additional
Primary	Size and Number	m x m x m	L21.3 x W16 x H5	-	-
Sedimentation	Area	m^2	340.8	-	-
Tank	Effective Depth	m	5.0	-	-
	Capacity	m^3	1,704.0	-	-
	Rake		with Rake	-	-
Aeration Tank	Size and Number	m x m x m	L28 x W7.15 x H4.35	-	-
	Capacity	m^3	870.9	-	-
Secondary	Size and Number	m x m x m	L28 x W3.6 x H4.4	-	-
Sedimentation	Area	m^2	100.8	-	-
Tank	Effective Depth	m	4.4	-	-
	Capacity	m^3	438.5	-	-
	Rake		with Rake	-	-
Chlorination Tank			Provided	Provided	Provided
Drying Bed	Size	m x m	L90 x W30	-	-

Table D.3.6 Features of Sewerage Treatment Plant (2/14)

Azuga Town

Item	Unit	without Extension	with Extension
Influent BOD	mg/l	150.3	151.6
Mean Daily Discharge	m^3/d	2,445	2,575
Maximum Daily Discharge	m^3/d	3,240	3,404
Maximum Hourly Discharge	m^3/d	3,776	3,974
BOD Load	kg/d	367.6	390.3
Removal BO Load	kg/d	318.6	338.8

Facilities			Existing	Additional	Additional
Primary	Size and Number	m x m x N	-	ϕ 10 x H4 x 2	ϕ 11 x H4 x 2
Sedimentation	Area	m^2	-	157.0	190.0
Tank	Effective Depth	m	-	4.0	4.0
	Capacity	m^3	-	628.0	759.9
	Rake		-	with Rake	with Rake
Aeration Tank	Size and Number	m x m x m	-	L22 x W12 x H4	L24 x W12 x H4
	Capacity	m^3	-	1,056.0	1,152.0
Secondary	Size and Number	m x m x N	-	ϕ 10 x H4 x 2	ϕ 11 x H4 x 2
Sedimentation	Area	m^2	-	157.0	190.0
Tank	Effective Depth	m	-	4.0	4.0
	Capacity	m^3	-	628.0	759.9
	Rake		-	with Rake	with Rake
Chlorination Tank			-	Provided	Provided
Drying Bed	Size	m x m	-	L43 x W20	L46 x W20

Table D.3.6 Features of Sewerage Treatment Plant (3/14)

Busteni Town

Item	Unit	without Extension	with Extension
Influent BOD	mg/l	161.0	164.3
Mean Daily Discharge	m^3/d	3,888	5,331
Maximum Daily Discharge	m^3/d	4,968	6,938
Maximum Hourly Discharge	m^3/d	5,815	8,148
BOD Load	kg/d	626.1	875.8
Removal BOD Load	kg/d	548.4	769.2

Facilities			Existing	Additional	Additional
Primary	Size and Number	m x m x m	-	L27 x W11 x H4.5	L27 x W16 x H4.5
Sedimentation	Area	m^2	-	297.0	432.0
Tank	Effective Depth	m	-	4.5	4.5
	Capacity	m^3	-	1,336.5	1,944.0
Aeration Tank	Size and Number	m x m x m	-	L39 x W11 x H5	L39 x W16 x H5
	Capacity	m^3	-	2,145.0	3,120.0
Secondary	Size and Number	m x m x m	-	L42 x W11 x H5	L42 x W16 x H5
Sedimentation	Area	m^2	-	462.0	672.0
Tank	Effective Depth	m	-	5.0	5.0
	Capacity	m^3	-	2,310.0	3,360.0
	Rake		-	with Rake	with Rake
Chlorination Tank			-	Provided	Provided
Drying Bed	Size	m x m	-	L45 x W33	L62 x W33

Table D.3.6 Features of Sewerage Treatment Plant (4/14)

Sinaia Town

Item		Unit		without Extension	with Extension
Influent BOD		mg/l		147.4	149.2
Mean Daily Discharge		m^3/d		10,990	11,802
Maximum Daily Discharge		m^3/d		12,770	13,884
Maximum Hourly Discharge		m^3/d		15,077	16,399
BOD Load		kg/d		1,620.4	1,761.2
Removal BOD Load		kg/d		1,400.6	1,525.1
Facilities			Existing	Additional	Additional
Primary	Size and Number	m x m x m x N	L21 x W10.5 x H4 x 2	-	L21 x W2.5 x H4
Sedimentation	Area	m^2	441.0	-	52.5
Tank	Effective Depth	m	4.0	-	4.0
	Capacity	m^3	1,764.0	-	210.0
Aeration Tank	Size and Number	m x m x m x N	L35 x W9 x H3 x 2	L35 x W18 x H3	L35 x W21 x H3
	Capacity	m^3	1,890.0	1,890.0	2,205.0
Secondary	Size and number	m x m x m x N	L35 x W9 x H3 x 2	-	-
Sedimentation	Area	m^2	621.0	-	-
Tank	Effective depth	m	3.0	-	-
	Capacity	m^3	1,863.0	-	-
Chlorination Tank			-	Provided	Provided
Drying Bed	Size	m x m	L50 x W50	L42 x W30	L53 x W30

Table D.3.6 Features of Sewerage Treatment Plant (5/14)

Comarnic Town

Item	Unit	without Extension	with Extension
Influent BOD	mg/l	-	173.0
Mean Daily Discharge	m^3/d	-	2,169
Maximum Daily Discharge	m^3/d	-	2,972
Maximum Hourly Discharge	m^3/d	-	3,508
BOD Load	kg/d	-	375.1
Removal BOD Load	kg/d	-	331.7

Facilities			Existing	Additional	Additional
Primary	Size and Number	m x m x N	-	-	ϕ9 x H4 x 2
Sedimentation	Area	m^2	-	-	127.2
Tank	Effective Depth	m	-	-	4.0
	Capacity	m^3	-	-	508.7
	Rake		-	-	with Rake
Aeration Tank	Size and Number	m x m x m	-	-	L16 x W18 x H4
	Capacity	m^3	-	-	1,152.0
Secondary	Size and Number	m x m x N	-	-	ϕ9 x H4 x 2
Sedimentation	Area	m^2	-	-	127.2
Tank	Effective Depth	m	-	-	4.0
	Capacity	m^3	-	-	508.7
	Rake		-	-	with Rake
Chlorination Tank			-	-	Provided
Drying Bed	Size	m x m	-	-	L30 x W30

Table D.3.6 Features of Sewerage Treatment Plant (6/14)

Breaza Town

Item	Unit	without Extension	with Extension
Influent BOD	mg/l	119.3	125.9
Mean Daily Discharge	m^3/d	6,826	7,793
Maximum Daily Discharge	m^3/d	8,156	9,487
Maximum Hourly Discharge	m^3/d	9,616	11,180
BOD Load	kg/d	814.2	981.4
Removal BOD Load	kg/d	677.7	825.5

Facilities			Existing	Additional	Additional
Primary	Size and Number	m x m x N	ϕ7.5 x H5 x 6 ϕ10 x H5 x 2	-	-
Sedimentation	Area	m^2	421.9	-	-
Tank	Effective Depth	m	5.0	-	-
	Capacity	m^3	2,109.7	-	-
	Rake		with Rake	-	-
Aeration Tank	Size and Number	m x m x m x N	L21 x W10 x H5 x 2	-	-
(Combined Basin)	Capacity	m^3	2,100.0	-	-
Secondary	Size and Number	m x m x m x N	L21 x W6.5 x H5 x 2	-	-
Sedimentation	Area	m^2	273.0	-	-
Tank	Effective Depth	m	5.0	-	-
(Combined Basin)	Capacity	m^3	1,365.0	-	-
Chlorination Tank			-	Provided	Provided
Drying Bed	Size	m x m	L30 x W20	L41 x W30	L54 x W30

Table D.3.6 Features of Sewerage Treatment Plant (7/14)

Cimpina City

Item	Unit	without Extension	with Extension
Influent BOD	mg/l	131.7	140.2
Mean Daily Discharge	m^3/d	25,212	30,681
Maximum Daily Discharge	m^3/d	30,430	38,016
Maximum Hourly Discharge	m^3/d	35,994	44,971
BOD Load	kg/d	3,319.6	4,300.0
Removal BOD Load	kg/d	2815.4	3,686.3

Facilities			Existing	Additional	Additional
Primary	Size and Number	m x m x N	ϕ25 x H3 x 1	ϕ30 x H3 x 1	ϕ38 x H3 x 1
Sedimentation	Area	m^2	490.6	706.5	1,133.5
Tank	Effective Depth	m	3.0	3.0	3.0
	Capacity	m^3	1,471.9	2,119.5	3,400.6
	Rake		with Rake	with Rake	with Rake
Aeration Tank	Size and Number	m x m x m x N	L41 x W7.5 x H3.5 x 2	L50 x W36 x H4 x 1	L51 x W36 x H4 x 1
	Capacity	m^3	2,152.5	7,200.0	7,344.0
Secondary	Size and Number	m x m x N	ϕ30 x H3.5 x 1	ϕ30 x H3.5 x 1	ϕ37 x H3.5 x 1
Sedimentation	Area	m^2	706.5	706.5	1,074.7
Tank	Effective Depth	m	3.5	3.5	3.5
	Capacity	m^3	2,472.8	2,472.8	3,761.3
	Rake		with Rake	with Rake	with Rake
Thickener	Size and Number	m x m x m	L18 x W8 x H4	-	-
Chlorination Tank			-	Provided	Provided
Drying Bed	Size	m x m	L44 x W50	-	L5 x W50

Table D.3.6 Features of Sewerage Treatment Plant (8/14)

Baicoi Town

Item		Unit		without Extension	with Extension
Influent BOD		mg/l		114.0	128.7
Mean Daily Discharge		m^3/d		3,966	5,279
Maximum Daily Discharge		m^3/d		4,683	6,480
Maximum Hourly Discharge		m^3/d		5,521	7,646
BOD Load		kg/d		452.2	679.6
Removal BOD Load		kg/d		372.9	574.0
Facilities			Existing	Additional	Additional
Primary	Size and Number	m x m x N	ϕ 8 x H5 x 4	-	ϕ 8 x H5 x 2
Sedimentation	Area	m^2	201.0	-	100.5
Tank	Effective Depth	m	5.0	-	5.0
	Capacity	m^3	1,004.8	-	502.4
	Rake		with Rake	-	with Rake
Aeration Tank	Size and Number	m x m x m	L16 x W9 x H5	L16 x W9 x H5	L21 x W9 x H5
	Capacity	m^3	720.0	720.0	907.7
Secondary	Size and Number	m x m x N	ϕ 10 x H5 x 1	ϕ 10 x H5 x 1	ϕ 14 x H5 x 1
Sedimentation	Area	m^2	78.5	78.5	153.9
Tank	Effective Depth	m	5.0	5.0	5.0
	Capacity	m^3	392.5	392.5	769.3
	Rake		with Rake	with Rake	with Rake
Chlorination Tank			-	Provided	Provided
Drying bed	Size	m x m	L30 x W20	L13 x W30	L30 x W30

Table D.3.6 Features of Sewerage Treatment Plant (9/14)

Plopent Town

Item		Unit		without Extension	with Extension
Influent BOD		mg/l		74.4	78.7
Mean Daily Discharge		m^3/d		10,558	10,973
Maximum Daily Discharge		m^3/d		11,759	12,407
Maximum Hourly Discharge		m^3/d		13,945	14,714
BOD Load		kg/d		785.6	863.0
Removal BOD Load		kg/d		574.5	643.6
Facilities			Existing	Additional	Additional
Primary	Size and Number	m x m x N	ϕ 8 x H5 x 6	-	ϕ 12 x H5 x 1
Sedimentation	Area	m^2	301.4	-	113.0
Tank	Effective Depth	m	5.0	-	5.0
	Capacity	m^3	1,507.2	-	565.2
	Rake		with Rake	-	with Rake
Aeration Tank	Size and Number	m x m x m x N	L16 x W16 x H5 x 1	L36 x W16 x H5 x 2	L17 x W16 x H5 x 2
	Capacity	m^3	1,240.0	2,480.0	2,720.0
Secondary	Size and Number	m x m x N	ϕ 12 x H5 x 2	ϕ 12 x H5 x 2	ϕ 13 x H5 x 2
Sedimentation	Area	m^2	226.1	226.1	265.3
Tank	Effective Depth	m	5.0	5.0	5.0
	Capacity	m^3	1,130.4	1,130.4	1,326.7
	Rake		with Rake	with Rake	with Rake
Chlorination Tank			-	Provided	Provided
Drying bed	Size	m x m x N	L19 x W11 x 3	L19 x W11 x 5	L19 x W11 x 6

Table D.3.6 Features of Sewerage Treatment Plant (10/14)

Slanic Town

Item	Unit	without Extension	with Extension
Influent BOD	mg/l	154.8	158.2
Mean Daily Discharge	m^3/d	1,071	1,287
Maximum Daily Discharge	m^3/d	1,426	1,728
Maximum Hourly Discharge	m^3/d	1,659	2,022
BOD Load	kg/d	165.9	203.6
Removal BOD Load	kg/d	144.5	177.9

Facilities			Existing	Additional	Additional
Primary	Size and Number	m x m x N	ϕ 10 x H5 x 2	-	-
Sedimentation	Area	m^2	157.0	-	-
Tank	Effective Depth	m	5.0	-	-
	Capacity	m^3	785.0	-	-
	Rake		with Rake	-	-
Aeration Tank	Size and Number	m x m x m	L16 x W8 x H5	-	-
	Capacity	m^3	640.0	-	-
Secondary	Size and Number	m x m x N	ϕ 7 x H5 x 1	ϕ 7 x H5 x 1	ϕ 8.5 x H5 x 1
Sedimentation	Area	m^2	38.5	38.5	56.7
Tank	Effective Depth	m	5.0	5.0	5.0
	Capacity	m^3	192.3	192.3	283.6
	Rake		with Rake	with Rake	with Rake
Chlorination Tank			-	Provided	Provided
Drying bed	Size	m x m	L20 x W20	-	L5 x W20

Table D.3.6 Features of Sewerage Treatment Plant (11/14)

Valenii de Munte Town

Item	Unit	without Extension	with Extension
Influent BOD	mg/l	150.7	159.3
Mean Daily Discharge	m^3/d	1,521	2,480
Maximum Daily Discharge	m^3/d	1,987	3,309
Maximum Hourly Discharge	m^3/d	2,324	3,879
BOD Load	kg/d	229.1	395.0
Removal BOD Load	kg/d	198.7	345.4

Facilities			Existing	Additional	Additional
Primary	Size and Number	m x m x N	ϕ25 x H4 x 1	-	-
Sedimentation	Area	m^2	490.6	-	-
Tank	Effective Depth	m	4.0	-	-
	Capacity	m^3	1,962.5	-	-
	Rake		with Rake	-	-
Aeration Tank	Size and Number	m x m x m	L24 x W14 x H4	-	-
	Capacity	m^3	1,344.0	-	-
Secondary	Size and Number	m x m x N	ϕ25 x H4 x 1	-	-
Sedimentation	Area	m^2	490.6	-	-
Tank	Effective Depth	m	4.0	-	-
	Capacity	m^3	1,962.5	-	-
	Rake		with Rake	-	-
Chlorination Tank			-	Provided	Provided
Drying bed	Size	m x m	L69.5 x W27.5	-	-

Table D.3.6 Features of Sewerage Treatment Plant (12/14)

Boldesti Scaieni Town

Item		Unit		without Extension	with Extension
Influent BOD		mg/l		119.5	125.5
Mean Daily Discharge		m^3/d		3,110	3,499
Maximum Daily Discharge		m^3/d		3,655	4,182
Maximum Hourly Discharge		m^3/d		4,311	4,933
BOD Load		kg/d		371.8	439.0
Removal BOD Load		kg/d		309.6	369.0
Facilities			Existing	Additional	Additional
Primary	Size and Number	m x m x N	ϕ8 x H5 x 4	-	-
Sedimentation	Area	m^2	201.0	-	-
Tank	Effective Depth	m	5.0	-	-
	Capacity	m^3	1,004.8	-	-
	Rake		with Rake	-	-
Aeration Tank	Size and Number	m x m x m x N	L20 x W10 x H5 x 2	-	-
(Combined Basin)	Capacity	m^3	2,000.0	-	-
Secondary	Size and Number	m x m x m x N	L20 x W6.5 x H5 x 2	-	-
Sedimentation	Area	m^2	260.0	-	-
Tank	Effective Depth	m	5.0	-	-
(Combined Basin)	Capacity	m^3	1,300.0	-	-
Chlorination Tank			-	Provided	Provided
Drying bed	Size	m x m	L30 x W30	-	L3 x W30

Table D.3.6 Features of Sewerage Treatment Plant (13/14)

Urlati Town

Item	Unit	without Extension	with Extension
Influent BOD	mg/l	154.4	159.0
Mean Daily Discharge	m^3/d	2,601	3,456
Maximum Daily Discharge	m^3/d	3,344	4,510
Maximum Hourly Discharge	m^3/d	3,905	5,288
BOD Load	kg/d	401.4	549.5
Removal BOD Load	kg/d	349.4	480.4

Facilities			Existing	Additional	Additional
Primary	Size and Number	m x m x N	ϕ9 x H5 x 4	-	-
Sedimentation	Area	m^2	254.3	-	-
Tank	Effective Depth	m	5.0	-	-
	Capacity	m^3	1,271.7	-	-
	Rake		with Rake	-	-
Aeration Tank	Size and Number	m x m x m	L20 x W10 x H5	-	L4 x W10 x H5
(Combined Basin)	Capacity	m^3	990.0	-	200.0
Secondary	Size and Number	m x m x m	L20 x W6.5 x H5	-	L8 x W6.5 x H5
Sedimentation	Area	m^2	132.0	-	52.0
Tank	Effective Depth	m	5.0	-	5.0
(Combined Basin)	Capacity	m^3	660.0	-	231.3
Chlorination Tank			-	Provided	Provided
Drying bed	Size	m x m	L29 x W20	L18 x W20	L35 x W20

Table D.3.6 Features of Sewerage Treatment Plant (14/14)

Ploiesti City

Item		Unit		without Extension	with Extension
Influent BOD		mg/l		137.6	138.7
Mean Daily Discharge		m^3/d		161,827	166,009
Maximum Daily Discharge		m^3/d		205,615	211,404
Maximum Hourly Discharge		m^3/d		239,700	246,560
BOD Load		kg/d		22,268.1	23,017.4
Removal BOD Load		kg/d		19,031.5	19,697.2
Facilities			Existing	Additional	Additional
Primary	Size and Number	m x m x N	ϕ30 x H3.5 x 4	ϕ45 x H3.5 x 3	ϕ46 x H3.5 x 3
Sedimentation	Area	m^2	2,826.0	4,768.9	4,983.2
Tank	Effective Depth	m	3.5	3.5	3.5
	Capacity	m^3	9,891.0	16,691.1	17,441.1
	Rake		with Rake	with Rake	with Rake
Aeration Tank	Size and Number	m x m x m	-	L110 x W120 x H5	L114 x W120 x H5
	Capacity	m^3	-	66,000	68,400
Secondary	Size and Number	m x m x N	-	ϕ50 x H3.5 x 5	ϕ51 x H3.5 x 5
Sedimentation	Area	m^2	-	9,812.5	10,208.9
Tank	Effective Depth	m	-	3.5	3.5
	Capacity	m^3	-	34,343.8	35,731.2
	Rake		-	with Rake	with Rake
Thickener	Size and Number	m x m x N	-	ϕ9 x H4 x 2	ϕ9 x H4 x 2
Chlorination Tank			-	Provided	Provided
Drying bed	Size	m x m	L120 x W74	L52 x W74	L58 x W74