Appendix 5

Geotechnical Investigation

Appendix 5 Geotechnical Investigation

5.1 Technical Specifications

5.1.1 Purpose

The work called for Geotechnical Investigation under this Contract (hereinafter referred to as the Work) will be conducted as a part of the JICA Study on The Development Plan for Sewerage System and Sewage Treatment Plant for Greater Tirana in the Republic of Albania. The survey results will be used by the JICA Study Team (hereinafter referred to as "the Engineer" for the preparation of a feasibility study of the priority project identified in the Sewerage Master Plan in the Study, and will serve as the basis for the preparation of preliminary designs of major sewage facilities such as trunk sewers, a pumping station and a sewage treatment plant.

5.1.2 General Requirements

The Contractor shall comply with the following requirements in undertaking the Work.

(1) All measurements and results of the survey shall be in SI units.
(2) Locations of the sites for the Work shall be confirmed by the Contractor and shall be approved by the Engineer before the commencement of the survey works in field.
(3) Prior to the commencement of the Work, the Contractor shall submit an Initiation Report prepared in English describing:
- List of equipment to be used by the Contractor
- Methods with Standards to be used by the Contractor
- Work Schedule
- Staff Assignment Schedule

(4) The Contractor shall provide, and therefore shall include the associated costs in his proposal, all equipments, personnel, transportation and others required to complete the Work.
(5) The Contractor shall not commence the Work in field without receiving a written Notice to Proceed from the Engineer.
(6) Drawings and reports to be submitted by the Contractor shall, unless otherwise specifically directed by the Engineer, be as follows, including one set of files of compact disk:
  - All drawings; One (1) sets of A 1 size and Two (2) sets of A3 size
  - All reports; Two (2) sets of A4

(7) The progress of the Work shall be described in the form of a weekly report and submitted to the designated address of the Engineer by a facsimile at the end of each week throughout the tenure of this Contract.
(8) Accuracy of the survey and investigation shall be as directed by the Engineer.

5.1.3 Scope of Works

The Work comprises the following schedules:

Schedule (1) : Boring

Schedule (2) : Standard Penetration Test (SPT) and Field Permeability Test

Schedule (3) : Sampling and Laboratory Test

Schedule (4) : Reporting

(1) Boring

Twenty (20) nos. of boring in total will be conducted at the proposed sites: six (6) boreholes for a new sewage treatment plant (STP) and a pumping station (PS), and 14 boreholes for trunk sewers, in the areas of Tirana Municipality and Kashar Commune, as shown in *Figure 5.1.1*. The detailed locations of boreholes will be instructed using 1:2500 scale maps separately prepared for the Work. And the actual location of boreholes shall be directed and confirmed by the Engineer, based on information of preliminary surveys of sites by the Contractor.

Table 5.1.1 summarizes the required depth of borehole to dig at each site. As shown in the table, the maximum depth is approximately 25 meters at the proposed STP site and the total depth to dig is about 260 m. When a bearing stratum is reached at less than specified depth in *Table 5.1.1*, boring shall be stopped at 5 meters below the top of the stratum.

Table 5.1.1 Boring Point and Borehole Depth Required

Sewerage Facility	Boring Point	Number of boreholes	Borehole Depth required	Remarks
STP	STP-11	1	25 m	
	STP-1	1	15 m	
	STP-2	1	15 m	
	STP-3	1	15 m	
	STP-4	1	10 m	
	Pump-10b	1	15 m	
	Sub-total	6	95 m	
Trunk Sewer	No.2	1	6 m	
	No.3a	1	10 m	
	No.3b	1	9 m	
	No.4a	1	13 m	
	No.4b	1	20 m	
	No.5a	1	11 m	
	No.5b	1	12 m	
	No.6	1	11 m	
	No.7	1	8 m	
	No.8a	1	15 m	
	No.8b	1	15 m	
	No.9a	1	15 m	
	No.9b	1	15 m	
	No.10a	1	5 m	
	Sub-total	14	165 m	
Total		20	260 m	

Method of boring shall be proposed by the Contractor for approval by the Engineer. The diameter of a borehole shall be sufficient to ensure that the boring can be completed to the scheduled depth and that samples of the specified diameter can be obtained.

Generally, water shall not be used to assist the advance of the borehole except in the case of dry coarse soils. Where the borehole penetrates below the water table and disturbance of the soil is likely, a positive hydrostatic pressure shall be maintained in the borehole.

The Contractor shall backfill boreholes in such a manner that no subsequent depression is formed at the ground surface due to settlement of the backfill. In some circumstances special infilling may be required by the Engineer. Unless otherwise instructed the special infilling shall be cement/bentonite (1:4) grout. Where artesian or other water conditions make normal backfilling impracticable, the Contractor shall consult with the Engineer a procedure for sealing the borehole.

(2) In-situ Test

1) Standard Penetration Test (STP)

Standard penetration tests (SPT) shall be carried out every 1.0 m interval in accordance with ASTM D 1586-99 or equivalent standards. The sample from the split barrel sampler shall be retained as a small disturbed sample. Where a sample is not retained in the split barrel or when the cutting shoe is replaced by a solid cone, a disturbed sample shall be taken from the test zone. The water level and the depth of casing in the hole at the time of the test shall be recorded.

2) In-situ Permeability Test

In-situ permeability text shall be conducted at three boreholes or excavated pits: two tests at STP and one test at PS in accordance with the ASTM D5126 or other equivalent standards. When the groundwater is observed at any borehole during boring work for Trunk sewers routes, the in-situ permeability test shall be conducted.

(3) Sampling and Laboratory Test

1) Sampling

(a) Disturbed Samples

One small disturbed sample shall be taken between each two successive SPTs. It shall weigh not less than 0.25 kg and shall be placed immediately in an airtight container, which it should fill. Samples shall be protected to ensure that their temperature does not fall below 5o C. They shall also be protected from direct heat and sunlight.

Samples shall be examined and described by a geotechnical specialist in accordance with the American Standards, the Clause 6.4.3 of American Society for Testing and Materials (hereinafter referred to as ASTM) D420, clause 41 of British Standard (hereinafter referred to as BS) 5930 or equivalent standards.

(b) Undisturbed Samples

At each borehole, undisturbed samples shall be taken as shown in *Table 5.1.2*, using open tube sampling equipment as described in the clause 2.2 of ASTM D1586, clause 19.4.4 of BS 5930 or equivalent standards.

Table 5.1.2 Undisturbed Sampling Events required for each borehole

Sewerage Facility	Boring Point	Number of samples	Sampling point in the borehole
STP	STP-11	3	upper, middle, bottom
	STP-1	2	middle and bottom
	STP-2	2	middle and bottom
	STP-3	2	middle and bottom
	STP-4	2	middle and bottom
	Pump-10b	2	middle and bottom
	Sub-total	13	
Trunk Sewer	No.2	1	bottom
	No.3a	1	bottom
	No.3b	1	bottom
	No.4a	1	bottom
	No.4b	1	bottom
	No.5a	1	bottom
	No.5b	1	bottom
	No.6	1	bottom
	No.7	1	bottom
	No.8a	1	bottom
	No.8b	1	bottom
	No.9a	1	bottom
	No.9b	1	bottom
	No.10a	1	bottom
	Sub-total	14	
Total		27	

For predominantly cohesive soils, three undisturbed samples: two samples at STP and one sample at PS, by thin-walled tube sampling methods shall be taken for laboratory tests in accordance with ASTM D1587 or equivalent standards.

Followings are major important points when the samples are taken:

Before an undisturbed sample is taken, the bottom of the hole shall be carefully cleared of loose materials and where a casing is being used the sample shall be taken below the bottom of the casing. Following a break in the work exceeding one hour, the borehole shall be advanced by 250 mm before undisturbed sampling is resumed.

Where an attempt to take an undisturbed sample is unsuccessful the hole shall be cleaned out for the full depth to which the sampling tube has penetrated and the recovered soil saved as a disturbed sample. A fresh attempt shall then be made from the level of the base of the unsuccessful attempt. Should this second attempt also prove unsuccessful the Contractor shall agree with the Engineer alternative means of sampling.

The samples shall be sealed as soon as possible on the same day to preserve their natural moisture content and in such a manner as to prevent the sealant from entering any voids in the sample.

The depths below ground level at which samples are taken shall be recorded. The level of the top of the sample and the length of sample obtained shall be recorded.

2) Laboratory Test

Undisturbed samples shall be taken to a soils laboratory approved by the Engineer and shall be subjected to the following tests. Unit shall be based on SI unit.

- Specific gravity, ASTM D854-58 or BS test 6
- Water (moisture) content, ASTM D2216-71 or BS test 1(A)
- Density, ASTM D2937-71 or BS test 15(E) or 15(F)
- Particle size distribution, ASTM D421-58 and ASTM D422-63 or BS test 7
- Unconfined compressive strength, ASTM D2166-66 or BS test 20
- Triaxial compression test, ASTM D2850, 4467 (at STP site and PS site)

Table 5.1.3 Laboratory test parameters and sample numbers

Test Parameter	Sample nos. from STP and PS	Sample nos. for Trunk Sewers	Total Sample Numbers
Particle size distribution	13	14	27
Specific gravity	13	14	27
Water (moisture) content	13	14	27
Density	13	14	27
Unconfined compressive strength	0	14	14
Triaxial compression test	13	0	13

Contractor shall prepare a schedule of tests for approval by the Engineer.

All preparation, testing and reporting shall be where applicable in accordance with the relevant American Standards, the ASTM. Where tests are not covered by the American Standards they shall be performed in accordance with the procedures given in the following references.

British Standard, Head K. H.. Manual of soil laboratory testing (vols. I-III), Pentech, London

relevant publications by the Transport and Road Research Laboratory (TRRL), and the International Journal of Rock Mechanics and Mining Sciences (IJRM).

Calibration of load-displacement or other measuring and testing equipment shall be carried out in accordance with the manufacturer's instructions. Evidence of recent calibrations shall be submitted to the Engineer.

(4) Reporting

The report shall be prepared in English. The report shall be submitted in two (2) sections, the first being the factual report, and the second the interpretative report. Both sections of the report shall begin with a cover page showing the name of the Contract and the names of the Employer (Nihon Suido Consultants Co., Ltd.) and Contractor. A draft copy of the factual report and the interpretative report shall be submitted to the Engineer for approval before submission of the final report.

The factual report shall contain the following information, where applicable

- a description of the work carried out
- exploratory hole logs
- laboratory test results
- plan with locations of exploratory holes
- site location plan

The plans shall be presented to a scale directed by the Engineer and shall include a north point.

The exploratory hole logs shall be presented to a vertical scale in the form as appropriate. The logs shall contain the following information.

- Contract title and site location
- Contractor's and operator's name
- Borehole number and location
- Dates and time
- Ground level related to the agreed datum
- Diameters and depths of borehole and casings referred to the agreed datum
- Elevation of each stratum referred to the agreed datum
- The depth at which any water was added
- Records of groundwater
- A summary of groundwater observations
- Description of each stratum in accordance with ASTM D420
- Symbolic legend of strata in accordance with ASTM D420
- Depth of samples taken for laboratory tests

The interpretative report shall contain the following information.

- a written appraisal of the ground and water conditions
- geotechnical analyses and recommendations, in particular, with respect to the depth and the type of the foundations for RC water retaining structures which weigh 10 to 15 ton/m2.

The Contractor shall supply the calculations and analyses on which his recommendations are based.

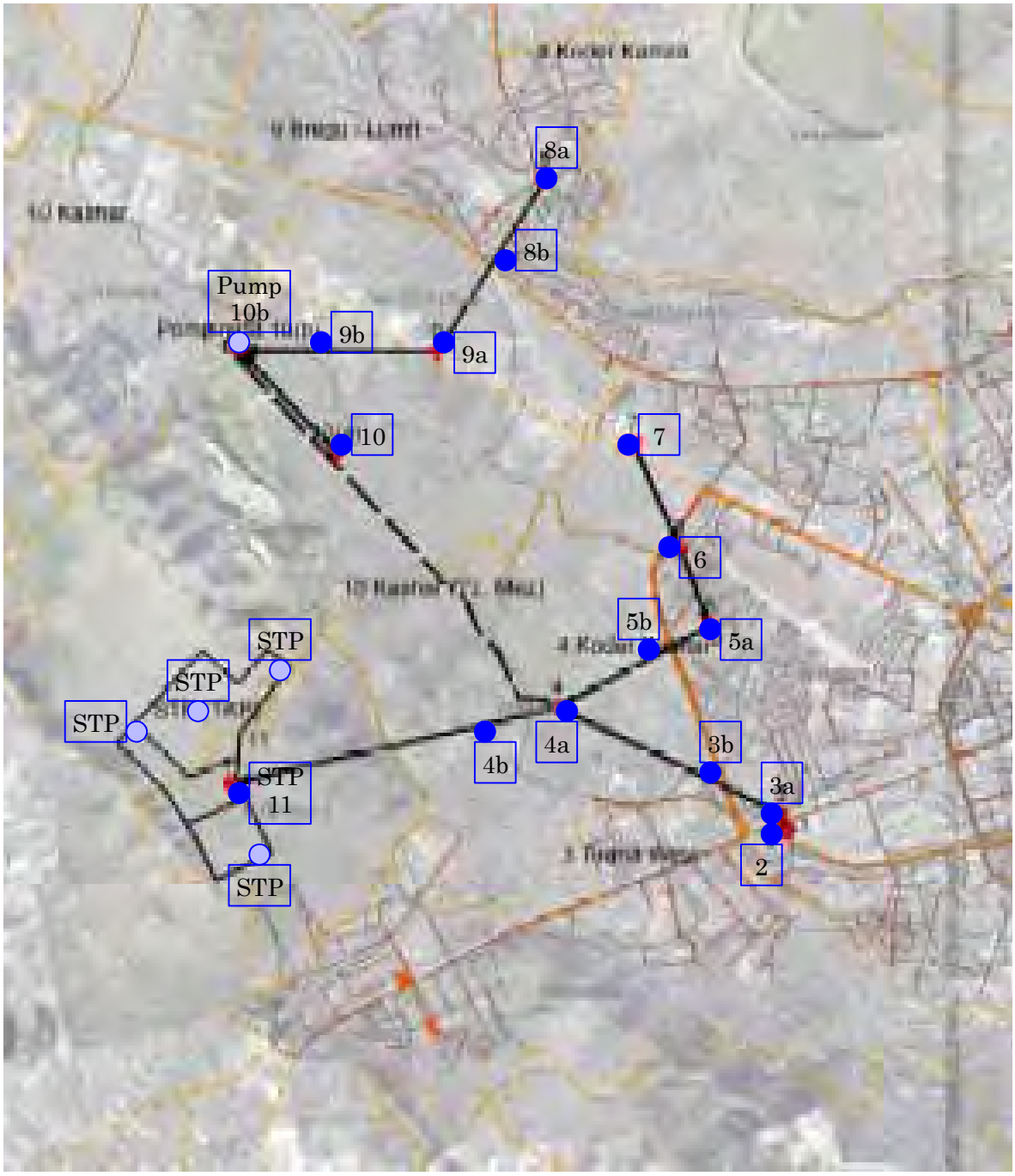


Figure 5.1.1 Locations Map showing the proposed boring test will be conducted

5.2 Result of Geotechnical Investigation

SEWERAGE SYSTEM & SEWAGE TREATEMENT PLANT TIRANA G.I.
Summary of Physical - Mechanical Characteristic of Soil

Physical characteristic															MECHANICAL CHARACTERISTIC	
Borehole	Layer	Depth of sample	Sample Type	Moisture content	Liquid Limit	Plastic Limit	Plasticity Index	Specific gravity	Bulk density	Grading					Compresive strength	in situ SPT
										Clay	Silt	Sand	Gravel	Boulders	$\Delta\sigma_v$	nr of blow
BH		m		Wo %	L.L	P.L	I.P	Gs gr/cm³	γ_n gr/cm³	<0.002 %	<0.075 %	<0.63 %	>0.63 %	>200 %	kPa	n/30cm
		1.00-1.45	U	-	-	-	-	-	-	-	-	-	-	-	-	8
		2.00-2.45	U	-	-	-	-	-	-	-	-	-	-	-	-	9
		3.00-3.45	U	-	-	-	-	-	-	-	-	-	-	-	-	7
		4.00-4.45	U	-	-	-	-	-	-	-	-	-	-	-	-	16
		5.00-5.45	U	-	-	-	-	-	-	-	-	-	-	-	-	17
		6.00-6.45	U	-	-	-	-	-	-	-	-	-	-	-	-	14
		7.00-7.45	U	-	-	-	-	-	-	-	-	-	-	-	-	18
		8.00-8.45	U	-	-	-	-	-	-	-	-	-	-	-	-	19
		8.50-9.00	U	22.95	42.77	19.80	22.97	2.714	1.959	35.50	52.00	12.50	0.00	0.00	117.366	-
		9.40-9.80	D	21.08	-	-	-	-	-	22.12		69.88	8.00	0.00	-	-
2		9.50-9.95	U	-	-	-	-	-	-	-	-	-	-	-	-	28
		1.00-1.45	U	-	-	-	-	-	-	-	-	-	-	-	-	12
		2.00-2.45	U	-	-	-	-	-	-	-	-	-	-	-	-	10
		3.00-3.45	U	-	-	-	-	-	-	-	-	-	-	-	-	7
		4.00-4.45	U	-	-	-	-	-	-	-	-	-	-	-	-	15
		5.00-5.45	U	-	-	-	-	-	-	-	-	-	-	-	-	14
		6.00-6.45	U	-	-	-	-	-	-	-	-	-	-	-	-	13
		6.50-7.00	D	23.40	-	-	-	-	-	38.47		61.53	0.00	0.00		-
		7.00-7.45	U	-	-	-	-	-	-	-	-	-	-	-	-	17
		8.00-8.45	U	-	-	-	-	-	-	-	-	-	-	-	-	14
		9.00-9.45	U	-	-	-	-	-	-	-	-	-	-	-	-	18
3a		9.50-10.0	U	26.64	36.53	17.61	18.93	2.711	1.967	34.50	54.35	10.50	1.50	0.00	159.307	-

SEWERAGE SYSTEM & SEWAGE TREATEMENT PLANT TIRANA G.I.
Summary of Physical - Mechanical Characteristic of Soil

Physical characteristic															MECHANICAL CHARACTERISTIC	
Borehole	Layer	Depth of sample	Sample Type	Moisture content	Liquid Limit	Plastic Limit	Plasticity Index	Specific gravity	Bulk density	Grading					Compresive strength	in situ SPT
										Clay	Silt	Sand	Gravel	Boulders		
				Wo	LL	PL	IP	Gs	γ_n	<0.002	<0.075	<0.63	>0.63	>200	$\Delta\sigma_v$	nr of blow
BH		m		%				gr/cm³	gr/cm³	%	%	%	%	%	kPa	n/30cm
		1.00-1.45	U	-	-	-	-	-	-	-	-	-	-	-	-	16
		2.00-2.45	U	-	-	-	-	-	-	-	-	-	-	-	-	14
		2.50-3.00	U	24.30	39.35	19.45	19.91	2.712	1.948	41.00	39.00	20.00	0.00	0.00	140.187	-
		3.00-3.45	U	-	-	-	-	-	-	-	-	-	-	-	-	15
		4.00-4.45	U	-	-	-	-	-	-	-	-	-	-	-	-	10
		4.50-5.00	U	20.15	28.64	14.25	14.39	2.702	1.981	22.00	42.50	34.50	1.00	0.00	129.822	-
		5.00-5.45	U	-	-	-	-	-	-	-	-	-	-	-	-	13
		6.00-6.45	U	-	-	-	-	-	-	-	-	-	-	-	-	15
		7.00-7.45	U	-	-	-	-	-	-	-	-	-	-	-	-	17
		8.00-8.45	U	-	-	-	-	-	-	-	-	-	-	-	-	19
		8.50-9.00	U	22.82	23.47	14.63	8.84	2.700	2.021	31.58		39.42	29.00	0.00	-	-
3b		9.00-9.45	U	-	-	-	-	-	-	-	-	-	-	-	-	21
		1.00-1.45	U	-	-	-	-	-	-	-	-	-	-	-	-	14
		1.50-2.00	U	24.76	43.76	22.20	21.56	2.713	1.925	42.00	48.50	9.50	0.00	0.00	124.350	-
		2.00-2.45	U	-	-	-	-	-	-	-	-	-	-	-	-	15
		3.00-3.45	U	-	-	-	-	-	-	-	-	-	-	-	-	19
		4.00-4.45	U	-	-	-	-	-	-	-	-	-	-	-	-	24
		4.00-4.50	D	20.37	-	-	-	-	-	12.14		85.86	2.00	0.00	-	-
		5.00-5.45	U	-	-	-	-	-	-	-	-	-	-	-	-	38
		6.00-6.45	U	-	-	-	-	-	-	-	-	-	-	-	-	54
		7.00-7.45	U	-	-	-	-	-	-	-	-	-	-	-	-	75
		8.00-8.45	U	-	-	-	-	-	-	-	-	-	-	-	-	86
		9.00-9.45	U	-	-	-	-	-	-	-	-	-	-	-	-	97
		11.00-11.45	U	-	-	-	-	-	-	-	-	-	-	-	-	98
		12.00-12.45	U	-	-	-	-	-	-	-	-	-	-	-	-	107
4a		12.50-13.00	U	17.62	42.28	22.37	19.90	2.712	2.025	38.50	49.00	12.50	0.00	0.00	1.700	-

SEWERAGE SYSTEM & SEWAGE TREATEMENT PLANT TIRANA G.I.
Summary of Physical - Mechanical Characteristic of Soil

Physical characteristic															MECHANICAL CHARACTERISTIC	
Borehole	Layer	Depth of sample	Sample Type	Moisture content	Liquid Limit	Plastic Limit	Plasticity Index	Specific gravity	Bulk density	Grading					Compresive strength	in situ SPT
										Clay	Silt	Sand	Gravel	Boulders	$\Delta\sigma_v$	
				Wo	L.L	P.L	I.P	Gs	γ_n	<0.002	<0.075	<0.63	>0.63	>200		nr of blow
BH		m		%				gr/cm³	gr/cm³	%	%	%	%	%	kPa	n/30cm
		1.00-1.45	U	-	-	-	-	-	-	-	-	-	-	-	-	18
		2.00-2.45	U	-	-	-	-	-	-	-	-	-	-	-	-	26
		3.00-3.45	U	-	-	-	-	-	-	-	-	-	-	-	-	28
		4.00-4.45	U	-	-	-	-	-	-	-	-	-	-	-	-	25
		5.00-5.45	U	-	-	-	-	-	-	-	-	-	-	-	-	31
		6.00-6.45	U	-	-	-	-	-	-	-	-	-	-	-	-	33
		7.00-7.45	U	-	-	-	-	-	-	-	-	-	-	-	-	32
		8.00-8.45	U	-	-	-	-	-	-	-	-	-	-	-	-	30
		9.00-9.45	U	-	-	-	-	-	-	-	-	-	-	-	-	34
		10.00-10.45	U	-	-	-	-	-	-	-	-	-	-	-	-	26
		11.00-11.45	U	-	-	-	-	-	-	-	-	-	-	-	-	22
		12.00-12.45	U	-	-	-	-	-	-	-	-	-	-	-	-	23
		13.00-13.45	U	-	-	-	-	-	-	-	-	-	-	-	-	25
		14.00-14.45	U	-	-	-	-	-	-	-	-	-	-	-	-	28
		15.00-15.45	U	-	-	-	-	-	-	-	-	-	-	-	-	44
		16.00-16.45	U	-	-	-	-	-	-	-	-	-	-	-	-	58
		17.00-17.45	U	-	-	-	-	-	-	-	-	-	-	-	-	67
		18.00-18.45	U	-	-	-	-	-	-	-	-	-	-	-	-	86
		19.20-19.70	D	17.15	-	-	-	-	-	29.36		64.64	6.00	0.00	1.960	-
		19.20-19.70	U	17.15	38.57	19.88	18.68	2.710	2.203	83.56		16.44	0.00	0.00	-	-
4b		19.50-19.95	U	-	-	-	-	-	-	-	-	-	-	-	-	98

SEWERAGE SYSTEM & SEWAGE TREATEMENT PLANT TIRANA G.I.
Summary of Physical - Mechanical Characteristic of Soil

Physical characteristic															MECHANICAL CHARACTERISTIC	
Borehole	Layer	Depth of sample	Sample Type	Moisture content	Liquid Limit	Plastic Limit	Plasticity Index	Specific gravity	Bulk density	Grading					Compresive strength	in situ SPT
										Clay	Silt	Sand	Gravel	Boulders		
				Wo	LL	PL	IP	Gs	γ_n	<0.002	<0.075	<0.63	>0.63	>200	$\Delta\sigma_v$	nr of blow
BH		m		%				gr/cm³	gr/cm³	%	%	%	%	%	kPa	n/30cm
		1.00-1.45	U	-	-	-	-	-	-	-	-	-	-	-	-	16
		2.00-2.45	U	-	-	-	-	-	-	-	-	-	-	-	-	20
		3.00-3.45	U	-	-	-	-	-	-	-	-	-	-	-	-	22
		3.50-4.00	U	22.47	37.46	15.51	21.95	2.713	1.943	37.00	41.00	22.00	0.00	0.00	146.461	-
		4.00-4.45	U	-	-	-	-	-	-	-	-	-	-	-	-	19
		5.00-5.45	U	-	-	-	-	-	-	-	-	-	-	-	-	16
		6.00-6.45	U	-	-	-	-	-	-	-	-	-	-	-	-	24
		7.00-7.30	D	8.42	-	-	-	-	-	4.98		7.52	24.50	63.00	-	-
		7.00-7.45	U	-	-	-	-	-	-	-	-	-	-	-	-	34
		8.00-8.45	U	-	-	-	-	-	-	-	-	-	-	-	-	36
5a		9.00-9.45	U	-	-	-	-	-	-	-	-	-	-	-	-	41
		1.00-1.45	U	-	-	-	-	-	-	-	-	-	-	-	-	13
		2.00-2.45	U	-	-	-	-	-	-	-	-	-	-	-	-	18
		3.00-3.45	U	-	-	-	-	-	-	-	-	-	-	-	-	17
		3.50-4.00	U	22.36	39.17	16.67	22.50	2.714	2.027	37.00	32.00	30.00	1.00	0.00	144.645	-
		4.00-4.45	U	-	-	-	-	-	-	-	-	-	-	-	-	20
		5.00-5.45	U	-	-	-	-	-	-	-	-	-	-	-	-	26
		6.00-6.45	U	-	-	-	-	-	-	-	-	-	-	-	-	32
		7.00-7.45	U	-	-	-	-	-	-	-	-	-	-	-	-	35
		8.00-8.45	U	-	-	-	-	-	-	-	-	-	-	-	-	34
		8.00-8.50	D	18.34	-	-	-	-	-	12.89		13.11	32.50	41.50	-	-
		9.00-9.45	U	-	-	-	-	-	-	-	-	-	-	-	-	59
		10.00-10.45	U	-	-	-	-	-	-	-	-	-	-	-	-	84
		11.00-11.45	U	-	-	-	-	-	-	-	-	-	-	-	-	89
5b		11.00-11.50	U	11.46	42.79	21.33	21.46	2.713	2.036	40.00	46.50	13.50	0.00	0.00	1.550	-

SEWERAGE SYSTEM & SEWAGE TREATEMENT PLANT TIRANA G.I.
Summary of Physical - Mechanical Characteristic of Soil

Physical characteristic															MECHANICAL CHARACTERISTIC	
Borehole	Layer	Depth of sample	Sample Type	Moisture content	Liquid Limit	Plastic Limit	Plasticity Index	Specific gravity	Bulk density	Grading					Compresive strength	in situ SPT
										Clay	Silt	Sand	Gravel	Boulders		
				Wo	LL	P.L	I.P	Gs	γ_n	<0.002	<0.075	<0.63	>0.63	>200	$\Delta\sigma_v$	nr of blow
BH		m		%				gr/cm³	gr/cm³	%	%	%	%	%	kPa	n/30cm
		1.00-1.45	U.												-	16
		1.50-2.00	U	24.27	45.02	23.84	21.19	2.716	1.943	39.50	43.00	14.50	3.00	0.00	121.342	-
		2.00-2.45	U	-	-	-	-	-	-	-	-	-	-	-	-	18
		3.00-3.45	U	-	-	-	-	-	-	-	-	-	-	-	-	15
		4.00-4.45	U	-	-	-	-	-	-	-	-	-	-	-	-	26
		5.00-5.45	U	-	-	-	-	-	-	-	-	-	-	-	-	32
		6.00-6.45	U	-	-	-	-	-	-	-	-	-	-	-	-	30
		7.00-7.45	U	-	-	-	-	-	-	-	-	-	-	-	-	34
		8.00-8.45	U	-	-	-	-	-	-	-	-	-	-	-	-	36
		9.00-9.50	D/U	10.83	26.29	15.79	10.50	-	-	21.33		17.67	38.60	22.40	-	35
		10.00-10.45	U	-	-	-	-	-	-	-	-	-	-	-	-	55
6		11.00-11.50	U	-	-	-	-	-	-	-	-	-	-	-	1.080	

SEWERAGE SYSTEM & SEWAGE TREATEMENT PLANT TIRANA G.I.
Summary of Physical - Mechanical Characteristic of Soil

Physical characteristic															MECHANICAL CHARACTERISTIC	
Borehole	Layer	Depth of sample	Sample Type	Moisture content	Liquid Limit	Plastic Limit	Plasticity Index	Specific gravity	Bulk density	Grading					Compresive strength	In situ SPT
										Clay	Silt	Sand	Gravel	Boulders		
				Wo	L.L	P.L	I.P	Gs	γ_n	<0.002	<0.075	<0.63	>0.63	>200	$\Delta\sigma_v$	nr of blow
BH		m		%				gr/cm³	gr/cm³	%	%	%	%	%	kPa	n/30cm
		1.00-1.45	U	-	-	-	-	-	-	-	-	-	-	-	-	16
		1.50-2.00	U	23.73	44.61	22.70	21.91	2.714	1.952	35.00	37.00	22.50	5.50	0.00	146.116	-
		2.00-2.45	U	-	-	-	-	-	-	-	-	-	-	-	-	15
		3.00-3.45	U	-	-	-	-	-	-	-	-	-	-	-	-	18
		4.00-4.45	U	-	-	-	-	-	-	-	-	-	-	-	-	31
		5.00-5.45	U	-	-	-	-	-	-	-	-	-	-	-	-	34
		6.00-6.45	U	-	-	-	-	-	-	-	-	-	-	-	-	35
		7.00-7.50	D/U	11.28	-	-	-	-	-	6.49		15.51	42.40	35.60	-	32
7		8.00-8.45	U	-	-	-	-	-	-	-	-	-	-	-	-	36
		1.00-1.45	U	-	-	-	-	-	-	-	-	-	-	-	-	13
		1.50-2.00	U	27.81	44.07	23.63	20.43	2.712	1.979	39.00	29.00	25.00	7.00	0.00	132.051	-
		2.00-2.45	U	-	-	-	-	-	-	-	-	-	-	-	-	28
		3.00-3.45	U	-	-	-	-	-	-	-	-	-	-	-	-	53
		4.00-4.45	U	-	-	-	-	-	-	-	-	-	-	-	-	78
		5.00-5.45	U	-	-	-	-	-	-	-	-	-	-	-	-	84
		6.00-6.45	U	-	-	-	-	-	-	-	-	-	-	-	-	87
		7.00-7.45	U	-	-	-	-	-	-	-	-	-	-	-	-	90
		8.00-8.45	U	-	-	-	-	-	-	-	-	-	-	-	-	93
		9.00-9.45	U	-	-	-	-	-	-	-	-	-	-	-	-	98
		10-10.45	U	-	-	-	-	-	-	-	-	-	-	-	-	96
		11.00-11.45	U	-	-	-	-	-	-	-	-	-	-	-	-	102
		12.00-12.45	U	-	-	-	-	-	-	-	-	-	-	-	-	104
		13.00-13.45	U	-	-	-	-	-	-	-	-	-	-	-	-	99
		14.00-14.45	U	-	-	-	-	-	-	-	-	-	-	-	-	107
8a		14.50-15.00	U	13.24	34.92	16.40	18.52	2.708	2.186	27.50	53.00	19.50	0.00	0.00	2.570	-

SEWERAGE SYSTEM & SEWAGE TREATEMENT PLANT TIRANA G.I.
Summary of Physical - Mechanical Characteristic of Soil

Physical characteristic															MECHANICAL CHARACTERISTIC	
Borehole	Layer	Depth of sample	Sample Type	Moisture content	Liquid Limit	Plastic Limit	Plasticity Index	Specific gravity	Bulk density	Grading					Compresive strength	In situ SPT
										Clay	Silt	Sand	Gravel	Boulders		
				Wo	LL	P.L	I.P	Gs	γ_n	<0.002	<0.075	<0.63	>0.63	>200	$\Delta\sigma_v$	nr of blow
BH		m		%				gr/cm³	gr/cm³	%	%	%	%	%	kPa	n/30cm
		3.00-3.45	U	-	-	-	-	-	-	-	-	-	-	-	-	18
		3.50-4.00	U	23.84	46.09	23.85	22.24	2.714	1.934	34.50	42.00	21.26	1.88	0.00	159.675	-
		4.00-4.45	U	-	-	-	-	-	-	-	-	-	-	-	-	21
		5.00-5.45	U	-	-	-	-	-	-	-	-	-	-	-	-	32
		6.00-6.45	U	-	-	-	-	-	-	-	-	-	-	-	-	36
		7.00-7.50	D	11.13	-	-	-	-	-	7.12		7.88	39.10	45.90	-	-
		8.00-8.45	U	-	-	-	-	-	-	-	-	-	-	-	-	37
		9.00-9.45	U	-	-	-	-	-	-	-	-	-	-	-	-	38
		10.00-10.45	U	-	-	-	-	-	-	-	-	-	-	-	-	37
		11.00-11.45	U	-	-	-	-	-	-	-	-	-	-	-	-	39
		12.00-12.45	U	-	-	-	-	-	-	-	-	-	-	-	-	78
		13.00-13.45	U	-	-	-	-	-	-	-	-	-	-	-	-	94
		14.00-14.45	U	-	-	-	-	-	-	-	-	-	-	-	-	98
8b		14.50-15.00	U	17.92	35.29	17.33	17.95	2.711	2.048	23.50	48.50	28.00	0.00	0.00	1.150	-
		1.00-1.45	U	-	-	-	-	-	-	-	-	-	-	-	-	16
		2.50-3.00	U	25.99	46.56	26.48	20.08	2.716	1.957	36.50	44.50	17.50	1.50	0.00	166.271	-
		3.00-3.45	U	-	-	-	-	-	-	-	-	-	-	-	-	19
		4.00-4.50	U	-	-	-	-	-	-	-	-	-	-	-	-	32
		5.00-5.45	U	-	-	-	-	-	-	-	-	-	-	-	-	33
		6.00-6.45	U	-	-	-	-	-	-	-	-	-	-	-	-	35
		7.00-7.45	U	-	-	-	-	-	-	-	-	-	-	-	-	38
		8.00-8.45	U	-	-	-	-	-	-	-	-	-	-	-	-	34
		9.00-9.45	U	-	-	-	-	-	-	-	-	-	-	-	-	39
		10.00-10.45	U	-	-	-	-	-	-	-	-	-	-	-	-	37
		10.50-11.00	D	14.77	-	-	-	-	-	16.23		15.47	37.80	30.50	-	-
		11.00-11.45	U	-	-	-	-	-	-	-	-	-	-	-	-	35
		12.00-12.45	U	-	-	-	-	-	-	-	-	-	-	-	-	36
		13.00-13.45	U	-	-	-	-	-	-	-	-	-	-	-	-	48
		14.00-14.46	U	-	-	-	-	-	-	-	-	-	-	-	-	57
		14.50-15.00	U	14.79	36.78	17.82	18.92	2.710	2.029	31.00	50.50	18.50	0.00	0.00	1.040	-

SEWERAGE SYSTEM & SEWAGE TREATEMENT PLANT TIRANA G.I.
Summary of Physical - Mechanical Characteristic of Soil

Physical characteristic															MECHANICAL CHARACTERISTIC	
Borehole	Layer	Depth of sample	Sample Type	Moisture content	Liquid Limit	Plastic Limit	Plasticity Index	Specific gravity	Bulk density	Grading					Compresive strength	In situ SPT
										Clay	Silt	Sand	Gravel	Boulders		
				Wo	LL	P.L	I.P	Gs	γ_n	<0.002	<0.075	<0.63	>0.63	>200	$\Delta\sigma_v$	nr of blow
BH		m		%				gr/cm³	gr/cm³	%	%	%	%	%	kPa	n/30cm
9a		15.00-15.45	U	-	-	-	-	-	-	-	-	-	-	-	-	59

SEWERAGE SYSTEM & SEWAGE TREATEMENT PLANT TIRANA G.I.
Summary of Physical - Mechanical Characteristic of Soil

				Physical characteristic													TRIAXIAL		MECHANICAL CHARACTERISTIC	
Borehole	Layer	Depth of sample	Sample Type	Moisture content	Liquid Limit	Plastic Limit	Plasticity Index	Specific gravity	Bulk density	Grading							Uncons./ Undrained		Compresive strength	in situ SPT
										Clay	Silt	Sand	Gravel	Boulders			ø	C_{uu}	$\Delta\sigma_v$	nr of blow
BH		m		Wo %	L.L	P.L	I.P	Gs gr/cm³	γ_n gr/cm³	<0.002 %	<0.075 %	<0.63 %	>0.63 %	>200 %			°	kPa	kPa	n/30cm
STP 1		1.00-1.45	U	-	-	-	-	-	-	-	-	-	-	-			-	-	-	14
		2.00-2.45	U	-	-	-	-	-	-	-	-	-	-	-			-	-	-	15
		2.50-3.00	U	27.52	56.70	26.50	30.19	2.713	1.907	48.50	50.00	1.50	0.00	0.00				61.23	-	
		3.00-3.45	U														-	-	-	18
		4.00-4.45	U	-	-	-	-	-	-	-	-	-	-	-				4.50-5.00	-	22
		4.50-5.00	U	17.85	38.53	14.46	24.07	2.714	1.973	50.50	46.50	3.00	0.00	0.00			-	-	-	-
		5.00-5.45	U	-	-	-	-	-	-	-	-	-	-	-			-	-	-	26
		6.00-6.45	U	-	-	-	-	-	-	-	-	-	-	-			-	-	-	21
		7.00-7.45	U	-	-	-	-	-	-	-	-	-	-	-			-	-	-	10
		8.00-8.45	U	-	-	-	-	-	-	-	-	-	-	-			-	-	-	27
		9.00-9.45	U	-	-	-	-	-	-	-	-	-	-	-			-	-	-	25
		11.00-11.45	U	-	-	-	-	-	-	-	-	-	-	-			-	-	-	29
		12.00-12.45	U	-	-	-	-	-	-	-	-	-	-	-			-	-	-	45
		13.00-13.45	U	-	-	-	-	-	-	-	-	-	-	-			-	-	-	64
		14.00-14.45	U	-	-	-	-	-	-	-	-	-	-	-			-	-	-	78
		14.50-15.00	U	13.04	35.97	17.06	18.91	2.712	2.087	34.00	53.00	13.00	0.00	0.00			-	-	-	
STP2		1.00-1.45	U	-	-	-	-	-	-	-	-	-	-	-			-	-	-	19
		2.00-2.45	U	-	-	-	-	-	-	-	-	-	-	-			-	-	-	21
		2.50-3.00	U	28.17	63.31	25.76	37.56	2.718	1.953	37.00	35.00	25.50	2.50	0.00				65.47	-	23
		3.00-3.45	U	-	-	-	-	-	-	-	-	-	-	-			-	-	-	
		4.00-4.45	U	-	-	-	-	-	-	-	-	-	-	-			-	-	-	24
		5.00-5.45	U	-	-	-	-	-	-	-	-	-	-	-			-	-	-	13
		6.00-6.45	U	-	-	-	-	-	-	-	-	-	-	-			-	-	-	15
		7.00-7.45	U	-	-	-	-	-	-	-	-	-	-	-			-	-	-	31
		8.00-8.45	U	-	-	-	-	-	-	-	-	-	-	-			-	-	-	34
		8.50-9.00	U	26.58	55.24	23.59	31.65	2.717	1.916	53.00	36.00	11.00	0.00	0.00				124.36	-	-
		9.00-9.45	U	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-
		10.00-10.45	U	-	-	-	-	-	-	-	-	-	-	-			-	-	-	58
		11.00-11.45	U	-	-	-	-	-	-	-	-	-	-	-			-	-	-	64
		12.00-12.45	U	-	-	-	-	-	-	-	-	-	-	-			-	-	-	68
		13.00-13.45	U	-	-	-	-	-	-	-	-	-	-	-			-	-	-	72
		14.00-14.45	U	-	-	-	-	-	-	-	-	-	-	-			-	-	-	78
		14.50-15.00	U	14.52	38.63	17.99	20.64	2.710	2.063	39.50	51.50	9.00	0.00	0.00			-	-	-	-

SEWERAGE SYSTEM & SEWAGE TREATEMENT PLANT TIRANA G.I.
Summary of Physical - Mechanical Characteristic of Soil

				Physical characteristic													TRIAXIAL		MECHANICAL CHARACTERISTIC	
Borehole	Layer	Depth of sample	Sample Type	Moisture content	Liquid Limit	Plastic Limit	Plasticity Index	Specific gravity	Bulk density	Grading									Compresive strength	in situ SPT
										Clay	Silt	Sand	Gravel	Boulders			Uncons./ Undrained			
				Wo	L.L	P.L	I.P	Gs	γ_n	<0.002	<0.075	<0.63	>0.63	>200	ø	C_{uu}	$\Delta\sigma_v$	nr of blow
BH		m		%				gr/cm³	gr/cm³	%	%	%	%	%	°	kPa	kPa	n/30cm
STP3		1.00-1.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14
		2.00-2.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18
		2.50-3.00	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		3.00-3.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17
		3.50-4.00	U	27.45	53.50	26.04	27.46	2.716	1.925	49.00	32.50	16.80	1.70	0.00	-	-	-	18
		4.00-4.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		5.00-5.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20
		6.00-6.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	27
		7.00-7.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28
		8.00-8.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	29
		8.50-9.00	U	21.85	46.20	20.42	25.78	2.715	2.027	38.50	38.00	22.00	1.50	0.00		130.12	-	-
		9.00-9.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	31
		10.00-10.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	36
		11.00-11.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	37
		12.00-12.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	39
		13.00-13.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	38
		14.00-14.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	42
		14.50-15.00	U	25.85	62.65	25.45	37.21	2.718	1.998	53.00	40.00	7.00	0.00	0.00	-	-	-	-
STP4		1.00-1.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10
		2.00-2.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12
		3.00-3.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14
		3.50-4.00	U	32.77	71.01	32.42	38.59	2.717	1.917	52.50	37.50	8.92	1.08	0.00		72.34	-	-
		4.00-4.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18
		5.00-5.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19
		6.00-6.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20
		7.00-7.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	22
		8.00-8.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	32
		9.00-9.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	33
		9.50-10.00	U	17.30	22.31	15.68	6.63	2.697	2.096	15.00	28.50	56.50	0.00	0.00		149.67		-

SEWERAGE SYSTEM & SEWAGE TREATEMENT PLANT TIRANA G.I.
Summary of Physical - Mechanical Characteristic of Soil

				Physical characteristic													MECHANICAL CHARACTERISTIC	
Borehole	Layer	Depth of sample	Sample Type	Moisture content	Liquid Limit	Plastic Limit	Plasticity Index	Specific gravity	Bulk density	Grading					TRIAXIAL		Compresive strength	in situ SPT
										Clay	Silt	Sand	Gravel	Boulders	Uncons./ Undrained			
				Wo	L.L	P.L	I.P	Gs	γ_n	<0.002	<0.075	<0.63	>0.63	>200	ø	C_{uu}	$\Delta\sigma_v$	nr of blow
BH		m		%				gr/cm^3	gr/cm^3	%	%	%	%	%	^{o}	kPa	kPa	n/30cm
STP11		1.00-1.45	U	-	-	-	-	-	-	-	-	-	-	-			-	12
		1.50-2.00	U	39.89	69.59	36.93	32.66	2.718	1.757	42.50	53.00	2.50	0.00	0.00		52.46	-	-
		2.00-2.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13
		3.00-3.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11
		4.00-4.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15
		5.00-5.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18
		6.00-6.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24
		7.00-7.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	26
		8.00-8.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28
		9.00-9.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12
		10.00-10.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11
		11.00-11.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15
		11.50-12.00	U	27.37	53.68	23.68	30.00	2.715	1.864	50.00	37.00	13.00	0.00	0.00		135.62	-	-
		12.00-12.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18
		13.00-13.50	D/U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15
		14.00-14.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24
		15.00-15.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	27
		16.00-16.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28
		17.00-17.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	29
		17.50-18.00	U	24.22	54.04	22.17	31.87	2.718	1.934	51.00	37.50	11.50	0.00	0.00		164.38	-	-
		18.00-18.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	22
		19.00-19.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16
		20.00-20.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	26
		21.00-21.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28
		22.00-22.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	29
		23.00-23.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	59
		24.00-24.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	76
		24.50-25.00	U	12.95	39.45	18.70	20.76	2.71	2.15	36.50	56.50	7.00	0.00	0.00	-	-	-	-

SEWERAGE SYSTEM & SEWAGE TREATEMENT PLANT TIRANA G.I.
Summary of Physical - Mechanical Characteristic of Soil

				Physical characteristic													MECHANICAL CHARACTERISTIC	
Borehole	Layer	Depth of sample	Sample Type	Moisture content	Liquid Limit	Plastic Limit	Plasticity Index	Specific gravity	Bulk density	Grading					TRIAXIAL		Compresive strength	in situ SPT
										Clay	Silt	Sand	Gravel	Boulders	Uncons./ Undrained			
				Wo	L.L	P.L	I.P	Gs	γ_n	<0.002	<0.075	<0.63	>0.63	>200	ø	C_{uu}	$\Delta\sigma_v$	nr of blow
BH		m		%				gr/cm^3	gr/cm^3	%	%	%	%	%	^{o}	kPa	kPa	n/30cm
10 b Pump Station		1.00-1.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12
		2.00-2.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13
		3.00-3.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17
		4.00-4.50	D	17.58	-	-	-	-	-	14.00	18.00	39.00	29.00	0.00	-	-	-	20
		5.00-5.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	48
		6.00-6.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	67
		7.00-7.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	75
		8.00-8.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	86
		8.50-9.00	U	14.12	33.04	15.21	17.83	2.708	2.052	23.50	41.50	35.00	0.00	0.00	-	-	-	-
		9.00-9.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	96
		10.00-10.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	102
		11.00-11.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	106
		12.00-12.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	108
		13.00-13.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	110
		14.00-14.45	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	112
		14.50-15.00	U	10.02	34.13	15.48	18.65	2.711	2.115	28.00	40.50	31.50	0.00	0.00	-	-	-	-

Appendix 6

Public Awareness and Water Usage Survey

Appendix 6 Public Awareness and Water Usage Survey

6.1 Introduction

The public awareness and water usage survey is carried out to understand the existing water supply, level of sanitation, public awareness of the water environment, needs and willingness to pay for sewerage service. The results of this survey is used to prepare the Master Plan including facility planning, O&M planning, economic analysis, tariff evaluation, environmental and social considerations and recommendations for awareness raising. The public awareness and water usage survey is done using questionnaire sheets.

6.2 Survey Sampling

6.2.1 Sampling

The ultimate sampling objective is the household residing in conventional dwellings within the study area. The sample size is 300 households and they are allocated to two municipalities and three communes proportional to each population.

Name of Municipality and Commune	Sample Number (%)
Tirana Municipality	170 (56 %)
Kamza Municipality	50 (17 %)
Kashar Commune	30 (10 %)
Paskuqan Commune	30 (10 %)
Berxulle Commune	20 (7 %)
Total	300 (100%)

The sample location is carefully selected to ensure that the sample is representative of the study area. The survey area is divided into three strata: sewerage service and non-service area within the municipality of Tirana, and the other rural area including households in the municipality of Kamza (both urban and rural areas), the communes of Kashar, Paskuqan and Berxulle.

The number of households within each area is proportional to the number of households present in the 2001 General Census of Population and Housing conducted by the Institute of Statistics (INSTAT). The sample size and distribution is shown in Annex 1.

Within the municipality of Tirana, the households are selected in two steps. Initially, 30 and 20 enumeration areas (EAs) (clusters) are randomly selected in the sewerage service and non-service areas respectively. EAs are selected based upon the list of EAs used in the 2001 General Census of Population and Housing. At a second step, two or three households are selected for each EA in the sewerage service area, and four or five households are selected for each EA in the non-service area to ensure a total of 85 households in either case. Households within each EAs are selected systematically with a random start using the lists available in INSTAT.

For other areas except Tirana Municipality, INSTAT has the list of dwellings in rural area consistent with the 2001 General Census of Population and Housing. However, their geographical distribution is unknown. Using the list of dwellings and satellite map showing the dwellings, the location is selected randomly in rural area.

6.2.2 Mapping

Upon establishing the distribution of households in the municipalities and communes, the logistical material for the surveyors is prepared. The principal document for the municipality of Tirana is the map of the enumeration area prepared specifically for this survey and the list of the households to be interviewed along with the respective topographical addresses. The preparation of the map showing the EAs is necessary since discerning and locating a particular dwelling extracted from the household list on the base map presented difficulties. Satellite maps showing the selected households are the basic documents for the surveyors in the rural area. The sampling location is shown in Annex 2.

(1) Tirana Area

Using the satellite map in conjunction with INSTAT maps, the boundary limiting the service area is defined and the distribution of the EAs indicated by the particular boundary so defined is established. Dwellings where the selected households resided are located in the map.

(2) Other Areas

The households are determined on the map in a way that ensured that a sufficient number of interviews would be conducted in the immediate vicinity of the areas of the sewage treatment plants and a homogeneous coverage of the survey area.

6.3 Implementation of the Survey

6.3.1 Preparation

(1) Questionnaire sheet

The questionnaire sheet was prepared based on expertise sourced from JICA Study Team members, counterparts and local NGO. It consists of several categories, respondent profile, socio-economic characteristics, water supply, wastewater, sanitary practice, health and hygiene, and river pollution. Prior to conducting the surveys, the questionnaire is translated to Albanian and checked by conducting pre-testing. The questionnaire sheet is shown in Annex 3.

(2) Survey Team

A manager and a social survey expert were assigned to provide guidance coordination and supervision of the fieldwork. They prepare a detailed work schedule for survey team on a daily basis, including number of questionnaires to be completed, location of households subject to interview, timing, resources to be used by interviewers (maps, households lists), and number of characters and timing for data entry

operators.

Two teams were set up to carry out the survey. The teams received training by the social survey expert to understand the specific requirements of this survey. Training introduced the nature and purpose of this survey. The social survey expert walked the interviewers through the steps of completing the questionnaire, focusing on the intricacies of each question. At the end of the training, the interviewers completed a test questionnaire to ascertain that they understood each of the questions.

A team composed of four surveyors covered the Municipality of Tirana and a second team composed of two surveyors covered the other survey area. A supervisor was assigned to each team, and he kept track of the completed questionnaires and took notes of relevant events that have occurred during the survey. Communications between teams and supervisors was established via mobile phones.

Considering the time required to locate a particular address, the time to complete a particular interview and the appropriate time of day to conduct an interview, usually the afternoon, when it was more likely to find adult members of the family, a daily rate of 4 to 5 interviews was completed within 10 working days.

(3) Data Entry

Data were entered continuously in the Excel sheet provided by JICA Study Team to ensure that data entry coincided with the completion of the fieldwork.

6.3.2 Implementation of the Survey

A local NGO (Environmental Center for Administration and Technology (ECAT)) was engaged to carry out the public awareness and water usage survey. The questionnaire survey was conducted by interview style.

6.4 Survey Results

6.4.1 Respondent's Profile

The profile of the respondent is shown in the table 6.4.1 through 6.4.3. 57.8 % of the respondents are head of the household, 30.9 % are housewives, and the remaining are children of the head of the household, retired elderly and others such as sister, wife of the son. In Berxulle area, the wives of the head of the household are interviewed more frequently in contrast to other survey areas.

The majority of the respondents were men with 60 % of the total number of persons who chose to be subjected to the interview. Survey respondents have a mean age of 47 and more than 71 % of them are over 40 years old.

Most of the respondents are Muslim (85.4 %) followed by catholic (6.6 %) and Orthodox (5.6 %).

Table 6.4.1 Profile of the Respondents (1)

Status					Age			Sex		Religion				
Head	Housewife	Retired	Children	Other	Average	Max.	Min.	Male	Female	Muslim	Catholic	Orthodox	Other	N
57.8 %	30.9 %	1.0 %	7.3 %	3.0 %	47.1	85	14	60.1 %	39.9 %	85.4 %	6.6 %	5.6 %	1.3 %	1.0 %

Note: N stands for "No answer"

31.9 % of the survey respondents are employed in the informal sector, followed by retired elderly (17.3 %) and office employees (11.3 %). Respondents employed in the informal sector occurred more frequently in the non-service area and Kamza. 16.6 % have no employment in the survey area. According to the INSTAT data of year 2005, the unemployment rate of 2004 is 14.4 % in Albania.

Table 6.4.2 Profile of the Respondents (2)

Socio-Professional Category of the Head of Household										
No employment	Informal sector	Agriculture	Commerce	Govt. officer	Office employed	Factory	Retired	Disable	Other	N
16.6 %	31.9 %	4.3 %	9.6 %	3.0 %	11.3 %	2.3 %	17.3 %	2.0 %	0.7 %	1.0 %

Note: N stands for "No answer"

Respondents with a middle school education have the highest proportion (38.2 %) followed by respondents with a high school education. Only 1.7 % have no formal education. The proportion with a high school education occurred typically in Tirana area with the middle school education respondents found in the rest of the survey area.

Table 6.4.3 Profile of the Respondents (3)

Educational Status of the Head of Household							
No education	Primary school	Middle school	High school	Technical, agricultural, vocational school	University, institute, college	Others	N
1.7%	5.6%	38.2%	36.5%	7.0%	9.0%	0.0%	2.0%

Note: N stands for "No answer"

6.4.2 Socio-Economic Characteristics of the Household

84.4 % of respondents own a house, 11.3 % own an apartment and only 4 % rent a house or an apartment. The type of dwelling is bricks (76.7 %) and concrete (18.3 %). Dwellings made of concrete are found more frequently in Kamza.

Overall, 1,462 persons were living in 301 interviewed households with a rate of 4.9 persons per household, including 523 men, 504 women, and 435 children under 16. The proportion of households with 4 or 5 people accounted for nearly half of the total number of households (48.8 %). The number of family members in a household is largest in Kamza Municipality (6 persons) followed by Berxulle Commune (5.8), Paskuqan (5.2), Kashar (4.7) and the least is Tirana Municipality (4.4 persons).

The average monthly income is 36,371 Lek per household and the average monthly expenditure is 32,701 Lek per household. In terms of the average values, the income is more than the expenditure. However, if the values of individual household are checked there are some households that the expenditure is higher than the income. In these households, they receive the remittance from their relatives and social security and do not want to declare the exact amount, or possibly made a misestimate of its values. The maximum income is 300,000 Lek per month and the minimum 3,200 Lek.

Table 6.4.4 Income Distribution

Low Income			Middle Income		High Income					Income		
0-5,000	5,001 – 15,000	15,001 – 25,000	25,001 – 35,000	35,001 – 45,000	45,001 – 55,000	55,001 – 65,000	65,001 – 75,000	75,001 –	N	Max.	Min.	Average
0.7%	8.6%	21.9%	29.9%	17.6%	8.0%	7.0%	1.3%	4.3%	0.7%	300,000	3,200	36,372
31.2 %			47.5 %		20.6 %							

N stands for "No answer"

According to "2005 Albanian in Figures" of INSTAT, the average monthly wage in public sector is 24,393 Lek in 2004 in the whole country, and according to the report of UNDP, 33,889 Lek in Tirana Municipality, and around 27,000 Lek in other municipality and communes as of 2005. Thus it indicated that this survey is some biased to higher income level.

Figure 6.4.1 shows the histograms of household income and household expenditure. The highest frequent range of the income is 25,001 to 35,000 Lek, and expenditure is 15,001 to 25,000 Lek.

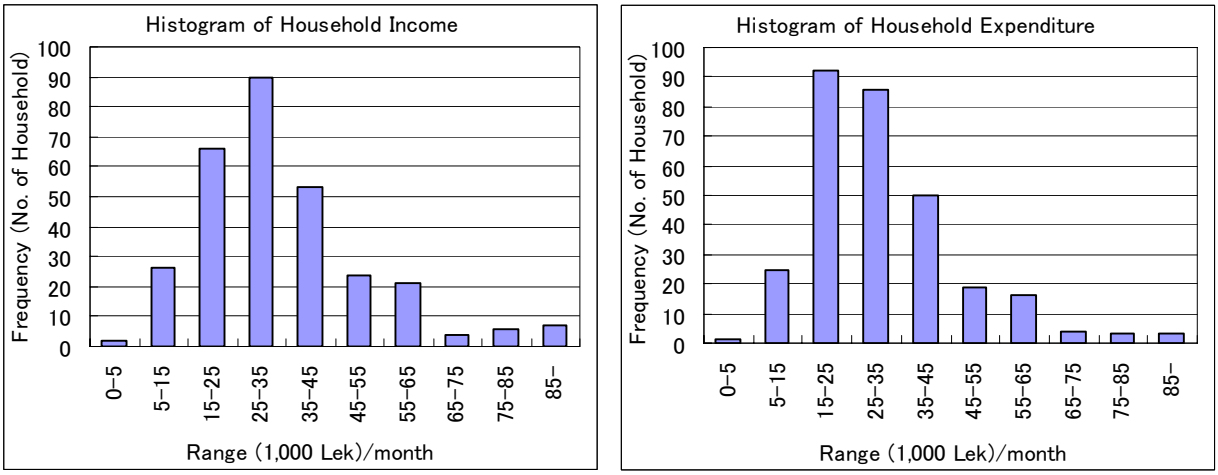


Figure 6.4.1 Histogram of Household Income and Expenditure

6.4.3 Water Supply

70.8 % of the respondents have water connection in their house, and 22.9 % use shallow / deep well. As the respondents living in Municipality of Tirana, most of the respondents (91.8 %) have house connection and only 7.1 % use shallow / deep well, on the other hand, the resident living in the other area depend house connection (43.5 %) and shallow / deep well (43.5 %) equally.

Table 6.4.5 Water Source

	House connection	Public stand post	Shallow / deep well	Others
Whole study area	213 (70.8 %)	17 (5.6 %)	69 (22.9 %)	2 (0.7 %)
Tirana	156 (91.8 %)	0 (0.0 %)	12 (7.1 %)	2 (1.2 %)
Other area	57 (43.5 %)	17 (13.0 %)	57 (43.5 %)	0 (0.0 %)

Unit: no. of households (%)

The average monthly water consumption of 166 households among 213 households with house connection is 19,419 liter, it means 133.4 liter per capita per day. That figure of 30 households of shallow / deep well is 10,766 liter, 74 liter per capita per day. As for the water cost, 166 households out of 213 with house connection pay 486 Lek per month on average, while 11.2 % (24 households out of 213) do not pay for water charge. For public stand post and shallow / deep well, most of the households do not pay for using them and only a few pay for them.

Table 6.4.6 Water Consumption and Cost

	House connection	Public stand post	Shallow/deep well
No. of Households	213 households	17 households	69 households
Average Water consumption (effective no. of households)	133.4 liter / pcpd (166 households)	32.3 liter / pcpd (2 households)	74 liter / pdpc (30 households)
Average Water cost (effective no. of households)	486 Lek / month (166 households)	225 Lek/ month (2 households)	600 Lec / month (1 household)
	0 Lek / month (24 households)	0 Lec / month (9 households)	0 Lec / month (35 households)

* pcpd = per capita per day

The table below shows the water cost and water consumption of households with house connection by income level.

Table 6.4.7 Water Consumption and Cost of House Connection by Income Level

	Low Income (43 households)	Middle Income (72 households)	High Income (50 households)
Water cost per household	372 Lek / month	462.9 Lek / month	595 Lek / month
Water consumption*	108.8 liter / pcpd**	127.7 liter / pcpd	164.4 liter / pcpd

* water consumption is calculated using actual number of family member, not using average number (4.9 members)
** pcpd = per capita per day

33.5 % of the respondents who have house connections are satisfied with current water supply and others

are not due to interruption of water supply service (37.5 %), smell (23.9 %) and supply amount is not enough (17.9 %). For the users of public stand post and shallow / deep well, 94.1 % and 81.2 % are not satisfied with current water supply. The main problems with shallow / deep wells are taste (52.2 %) and smell (15.2 %).

Table 6.4.8 Satisfaction of Water Supply Service

	Satisfactoly			Reason for dissatisfaction						
	Yes	No	N	Amount	Smell	Taste	Color	Turbidity	Interuption	No house connection
House Connection	71 33.3 %	141 66.2 %	1 0.5 %	45 17.9%	60 23.9 %	19 7.6 %	0 0.0 %	33 13.1 %	94 37.5 %	0 0.0 %
Public stand post	1 5.9 %	16 94.1 %	0 0.0 %	1 6.3 %	0 0.0 %	1 6.3 %	0 0.0 %	0 0.0 %	0 0.0 %	14 87.5 %
Shallow / deep well	13 18.8 %	56 81.2 %	0 0.0 %	6 6.5 %	14 15.2 %	48 52.2 %	11 12.0 %	11 12.0 %	1 1.1 %	1 1.1 %

Note: Upper row- no. of households, Down row- percentage, N stands for "No answer"

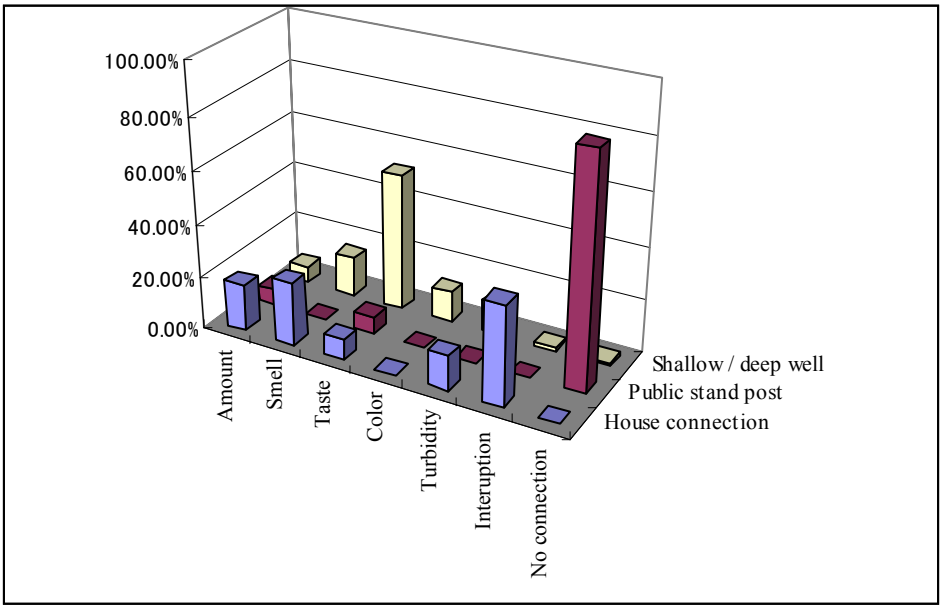


Figure 6.4.2 The Reason of Dissatisfaction by Water Source

6.4.4 Wastewater

67.8 % of the respondents are connected to the sewer line for wastewater from toilets, 26.2 % use septic tank, 5.0 % discharge into open drain or river and 0.7 % to Courtyard. Within the Municipality of Tirana, 89.4 % have the connection to sewer line.

Table 6.4.9 Disposal of Wastewater from Toilets

	Sewer Line	Septic Tank	Discharging into open drain or river	Courtyard
Whole study area	204 households	80 households	15 households	2 households

	67.8 %	26.2 %	5.0 %	0.7 %
Tirana	89.4 %	10.0 %	0.6 %	0.0 %
Other area	39.7 %	48.1 %	10.7 %	1.5 %

Among the 204 households who connect the sewer line, 61.8 % (126 households) pay the sewerage charge along with water charge, 33.8 % (69 households) do not pay the sewerage charge and the rest answered "don't know". 124 households pay 494 Lek per month for water and sewerage charge on average, maximum charge is 2,000 Lek and minimum is 130 Lek per month.

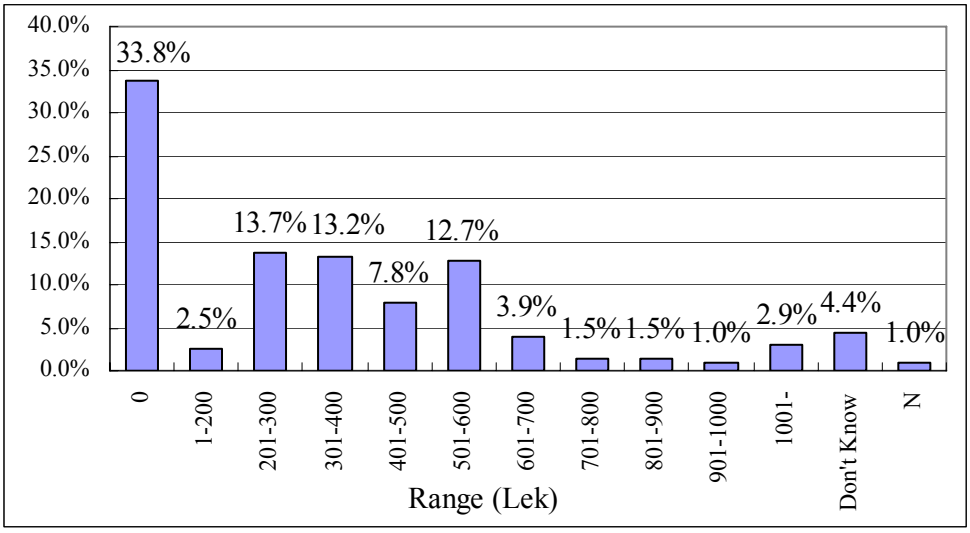


Figure 6.4.3 Histogram of Water and Sewerage Charge

The table below shows the sewerage cost of households with connection to sewer by income level. In low income level, 46.8 % do not pay for sewerage charge, middle income level 41.5 % and 10.2 % in high income level.

Table 6.4.10 Cost for Water and Sewerage by Income Level

	Low Income	Middle Income	High Income
No. of households who have connet to sewer	62 households	82 households	49 households
Wastewater disposal cost (effective no. of households)	374 Lek / month (33 households)	483 Lek / month (48 households)	594 Lek / month (44 households)
	Do not pay (29 households)	Do not pay (34 households9	Do not pay (5 households)

68. 6 % of the households who connect to sewer lines is satisfied with the current disposal of the human wastewater, 8.3 % moderately satisfied, and 23% are not satisfied at all. The reason why they are not satisfied with current system is that sewer pipelines are overflowed (58.1 %), followed by that the wastewater is not treated and discharged into the rivers (37.1 %).

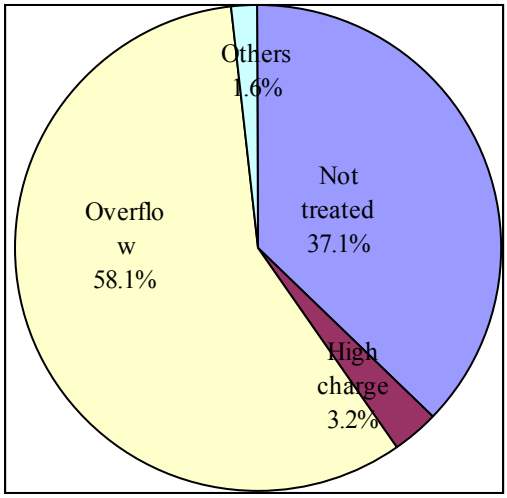


Figure 6.4.4 Reason of Dissatisfaction of Sewerage Service

75.5 % of the households have no experience of overflowing or flooding from sewer pipeline, while 24 % have the problem of overflowing or flooding. Among the respondents who are not satisfied with the sewerage service, 68.8 % have the overflowing problems. 36.7 % of them experience of overflowing or flooding three times a year, 22.4 % have twice and 14.3 % have one. When such problem occurred, 55.1 % clean up the sewer line by themselves, 26.5 % did nothing and 12.2 % asked local government to clean up.

For the improved sewerage services, 54.4 % of the respondents who connect to sewer pipelines have the willingness to pay more, while 44.6 % do not. The average cost of willingness to pay is 735 Lek per month, maximum is 3,000 Lek and minimum 100 Lek. This figure includes the households who do not pay for sewer connection at present, thus the proportion of range 1-200 increases compared with Figure 6.4.3. The average willingness to pay for improved sewerage service of the respondents who has no connection at present is 580 Lek per month.

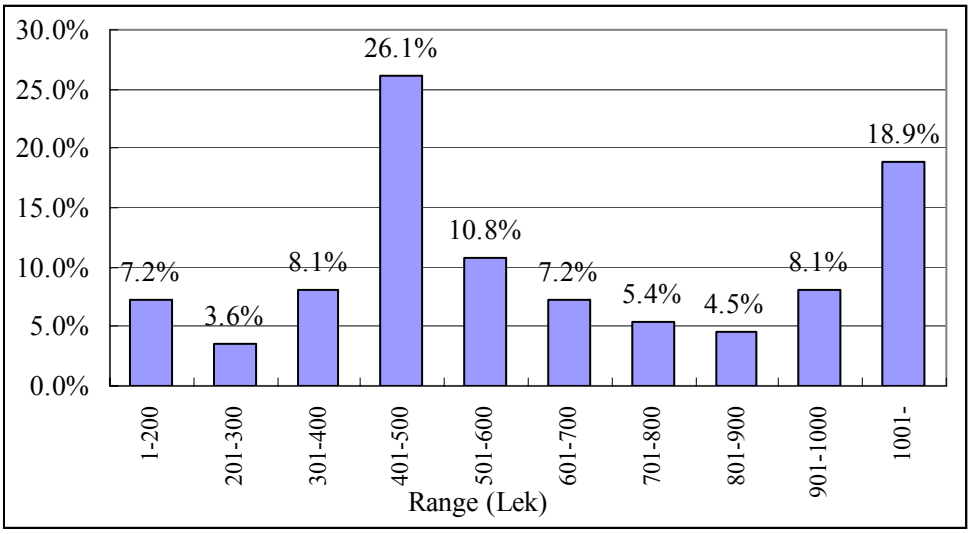


Figure 6.4.5 Willingness to Pay for Improved Sewerage Service

97 households (32.2 %) are not connected to sewer lines, and the main reason is because there is no sewer line near their house (96 %), only one household give the reason of high cost.

The payable charge if they have to connect to sewer line is 430 Lek per month, maximum is 2000 Lek, and minimum 100 Lek. There is no big difference among the income levels.

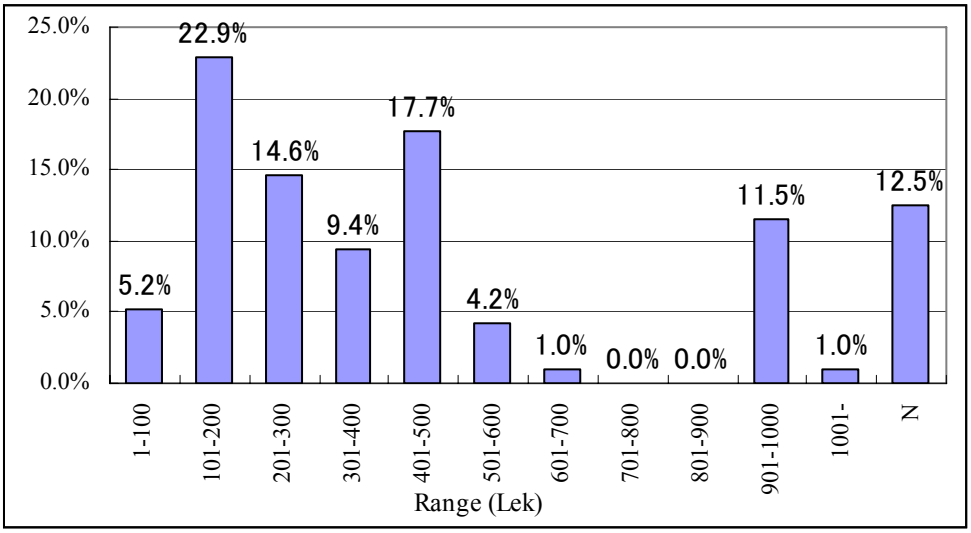


Figure 6.4.6 Payable Charge for the Respondents with No Sewerage Connection

6.4.5 Sanitary Practice

Although the majority (82.1 %) of the interviewed households dispose of the garbage at the designated place, around 18 % of them dispose of garbage to the rivers (6 %), upon the streets (4 %), or other places.

Households that did not dispose of garbage at designated places or burned the garbage said that the disposal site was far away from home.

Table 6.4.11 The location of Garbage Disposal

Designated place	Street	Drainage canal	Rivers	Incinerate	N
82.1 %	4.0 %	1.7 %	6.0 %	6.0 %	0.3 %

The toilets facilities they use when they go out are café toilets (63.8 %), and 16.3 % use open field. 233 respondents (84.7 %) would use public toilets if they are available, and 90 % of them are willing to pay for use of toilets. The average possible charge per use is 20 Lek.

Table 6.4.12 Willingness to Pay for Use of Public Toilet

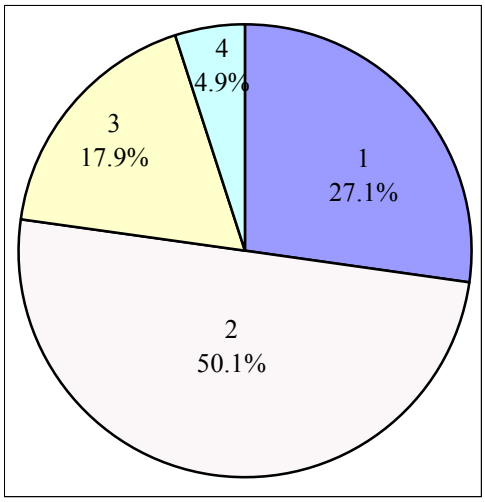
1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	More than 101
43.3%	42.5%	4.7%	0.0%	6.4%	0.0%	0.0%	0.0%	0.0%	2.6%	0.4%
101	99	11	0	15	0	0	0	0	6	1

6.4.6 Health and Hygiene

Incidence of major illnesses amongst the households was 23.3 %, mostly in Tirana and Kamza survey area, but only 6 of 61 instances (general diarrhea) were directly related to poor standards of hygiene or inadequate sanitation. When they got sick, 89 % prefer to go to nearest health center and the amount spent on health center is 1,000 Lek per month on average.

6.4.7 River Pollution

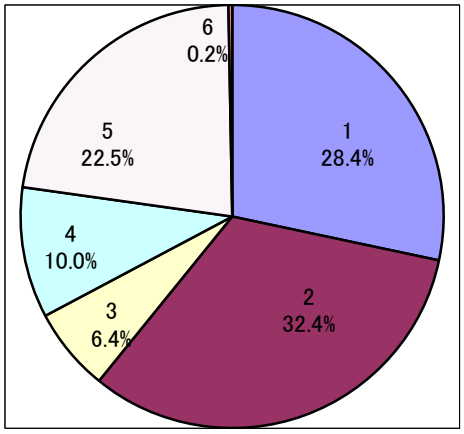
91.4 % of the respondents think that the water of the Tirana and Lana rivers are polluted, only 1 respondent think it not polluted. More than half of them believe that water of rivers has been polluted for more than 10 years, while 7 % think it is a relatively new phenomenon. The major causes of pollution of rivers are untreated sewage flowing into the rivers (50.1 %), and municipal solid waste (27.1 %). There is not much different among the municipalities and communes, but the reason of solid waste is rather outstanding in Tirana Municipality than other area and the reason of open defecation / urination is rather higher in Kamza than other area.



1: Municipal solid waste
2: Untreated sewage flowing into the rivers
3: Open defecation / urination
4: Industrial wastewater

Figure 6.4.7 Major Causes for Water Pollution of the Rivers

In the whole study area, the appropriate measures to reduce pollution of rivers' water are construction of sewer lines (32.4 %), followed by construction of sewage treatment plant (28.4 %), heightening public awareness of environment and sanitation (22.5 %).



1: Construction of sewage treatment plant
2: Construction of Sewer lines
3: construction of toilet facilities
4: Improving solid water management mechanism
5: Heightening public awareness on environmental and sanitation
6: Don't know

Figure 6.4.8 Appropriate Measures to Reduce the Pollution of the Rivers

There is difference among the municipalities and communes of appropriate measures to reduce rivers' water pollution. In Tirana Municipality, construction of sewage treatment plant comes first as measurement and second is the sewer lines, which because the sewer lines are already exist within Tirana Municipality. In other areas except Tirana, the construction of sewer lines comes first and the sewage treatment plant is next in Kamza Municipality but in other three communes, the option of sewage treatment plant is not much preferred (17.1 %).

Table 6.3.13 Appropriate Measures to Reduce the Pollution of the Rivers by Area

	Sewage treatment plant	Sewer lines	Toilet facilites	Solid waste	Awareness
Tirana	33.7 %	26.0 %	4.8 %	13.3 %	21.9 %
Kamza	27.4 %	43.8 %	1.4 %	4.1 %	23.3 %
Three Communes	17.1 %	40.7 %	12.9 %	5.7 %	23.6 %
Average	28.4 %	32.4 %	6.4 %	10.0 %	22.5 %

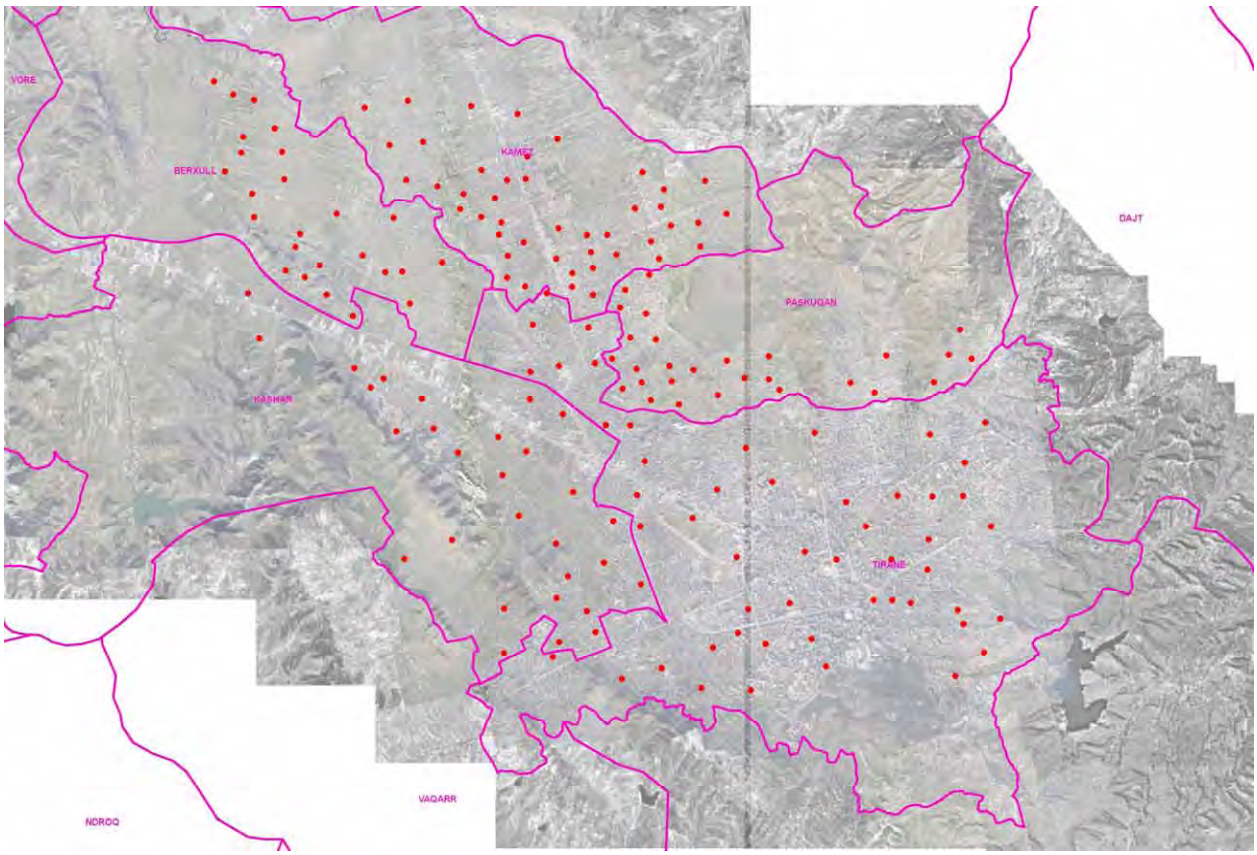
Annex 1

Annex 1. Sample size and distribution

Name of Municipality or Commune	Sample size	Village	Households	Percent of Households	Interviews
TIRANE		**Tirane**	**89,764**		**170**
TIR #EA		Service area			85
TIR #EA		Non-service area			85
KAMEZ	50	Bulçesh	181	2	1
KAM01 deri KAM50		Valias	1,042	10	5
		Kamez	1,422	14	8
		Laknas	1,056	11	5
		Zall Mener	239	2	1
		Bathore	3,866	39	20
		Frut-Kamez	2,204	22	10
			10,010	**100**	**50**
KASHAR	30	Kashar	692	19	2
KAS01 deri KAS30		Katund I Ri	492	14	4
		Mezez	879	24	9
		Yrshek	455	13	4
		Yzberish	1,097	30	11
			3,615	**100**	**30**
PASKUQAN	30	Babrru Qender	794	17	5
PAS01 deri PAS30		Paskuqan	882	19	6
		Paskuqan Fush	631	14	4
		Koder-Kuqe	573	13	4
		Fush Kercyk	409	9	3
		Paskuqan Koder	576	13	4
		Babrru Koder	184	4	1
		Babrru Shpat	496	11	3
			4,545	**100**	**30**
BERXULLE	20	Berxulle	580	42	8
BER01 deri BER20		Domje	789	58	12
			1,369	**100**	**20**
Total					**300**

Source: INSTAT, Census 2001

Annex 2 Map of Sampling Location



Annex 3 Questionnaire Sheet

Assessment of Public Awareness

Questionnaire

Study Team of Japan International Cooperation Agency (JICA) and General Directorate of Water Supply and Sewerage (DPUK) of the Ministry of Public Works, Transport and Telecommunications (MoPWTT) are executing the Study on the Development Plan for Sewerage System and Sewage Treatment Plant for Greater Tirana.

Public Awareness and Water Usage Survey is being conducted in the form of the questionnaire to collect information on household characteristics and public awareness related sanitation / sewerage. Tha data and information collected will be used to formulate sewerage plans and to evaluate sewerage projets proposed finacially, economically, and socially sounds.

To acomplish this task, the residents are kindly requested to answer the questions in the questionnaire sheet. It may be difficult to answer some ot the questions but please make the best effort to answer the all questions. It is important that you answer questions as honestly and truthfully as you can so that the actual status of survey items are obtained.

The information collected from each household will be treated confidentially with utmost and used only for the Study purpose.

JICA Study Team and DPUK of MoPWTT sincerely request all residents for their kind cooperation to make survey successful.

Code No. _____ – _____
Area No. – Serial No.

Name of the Area **Survey Site**	1. Tirana	2. Kamza	3. Kashar	4. Paskuqan	5. Berxulle
Survey Data (day / month)	/	2005	Time (AM / PM	)	
Name of Interviewers					
Questions	**Answer**				
A. Respondent Profile					
A1 Name					
A2 Status in family	1. Head of household	2. Hosewife	3. Retired Elderly	4. Children of the Head	
	5. Others (Specify.)				
A3 Sex (M/F)	1. Male	2 . Female			
A4 Age	( )				
A5 Religion	1. Muslim	2. Catholic	3. Orthodox	4. Others ( )	
A6 Socio-professional Category of the chief of household	1. No employment	2. Informal Sector	3. Agriculture	4. Commerce	
	5. Government officer	6. Office employed	7. Factory	8. Others ( )	
A7 Educational Status	1. No education	2.Primary School	3. Middle School	4. High School	
	5. Technical, agricultural, vocational school	6. University, institute, college	7. Others ( )		
B. Socio-economic Characteristics of the Household					
B1 Housing ownership (If rent, how much is it per month?)	1. Owns a house	2. Rent a house ( ) Lek	3. Own an apartment	4. Rent an apartment ( ) Lek	
	5. Others( )				
B2 Type of Dwelling	1. Concrete	2. Wood	3. Tin-shed	4. Bricks	
	5. Others( )	6. Don't know			
B3 Number of persons usually live in your household	1. Adult man ( ) persons	2. Adult women ( ) persons	3. Children (<16years) ( ) persons	4. In Total ( ) persons	
B4 Average monthly income of the household	( ) Lek / month				

B5	Average Household Expenditure/Month	( ) Lek / month			
B6	The amount spent on each item per month	Water ( ) Lek	Waste water ( ) Lek	Electricity ( ) Lek	Food ( ) Lek
		Solid waste ( ) Lek	Housing ( ) Lek		
C. Information on Water Supply					
C1	What is your water source in your household?	1. House connection	2. Public stand post	3. Shallow / deep well	4. Public water tanker
		5. Water vender	6. Others ( )		7. Don't know
C2	How much do your household use water per month?	( ) liter			
C3	How much do your household pay for water per month?	( ) Lek / month			
C4	Are you satisfied with current water supply?	1. Yes (Go to D1)	2. No (Go to C5)		
C5	If no, why? (max 2 answers)	1. The supply volume is not enough	2. Smell	3. Taste	4. Color
		5. Turbidity	6. Interuption of water supply service	7. Others ( )	
D. Information on Waste Water					
D1	Where the wastewater from toilets discharged?	1. Sewer line (go to D2)	2. Septic tank (go to D9)	3. Discharging into open drain or river (go to D9)	4. Countyard (go to D9)
		5. Others ( )		6. No toilet (go to D9)	
	For SEWERAGE system household only				
D2	How much do you pay for the charge the wastewater treatment services?	1. ( ) Lek / month	2. Pay the charge with water charge ( ) Lek/month	3. Do not pay	4. Don't know
D3	Are you satisfied with the current dispersal of your human wastewater?	1. Yes	2. Moderately	3. Not at all	
D4	If no, why? (max 2 answers)	1. The wastewater is not treated and discharged into the rivers	2. The charge is high	3. The sewer pipeline is overflowed	4. It costs too much
		5. Others( )			
D5	Do you have experience of overflowing or flooding from sewer pipeline or drainage facility?	1. Yes _____ times a year _____ days for every flooding		2. No (go to D7)	
D6	When flooding occur, what do you do?	1. Clean up sewer line / drinage by yourself	2. Ask local authority to clean up	3. Do nothing	4. Others( )
D7	Are you willing to pay more for improved sewerage service?	1. Yes	2. No		
D8	If yes, how much?	( ) Lek / month		(go to E1)	
	For NON-SEWERAGE system household only				

D9	Why you don't connect to sewer line?	1. There is no sewer line near the house	2. Too expensive to connect	3. I don't feel the necessity to connect	4. I don't want to spend money for it
		5. Others ( )	6. No reason		
D10	If you have to connect to sewer line, how much can you pay for the service?	( ) Lek / month			
E. Sanitary Practice					
E1	Where do you dispose the garbage?	1. Designated place for its collection (go to E3)	2. Street nearby house (go to E2)	3. Drainage canal (go to E2)	4. Rivers (Tirana, Lana) (go to E2)
E2	If you answer 2, 3, 4, why you don't dispose to the designated place?	1. The disposal place is far away from home	2. Because everyone dispose	3. I don't think it is not good	4. Others( )
E3	Where do you go toilets when you go outside?	1. Restaurant / café	2. Open field	3. Public toilet	4. Others( )
E4	If public toilets are constructed, do you use it?	1. Yes	2. No		
E5	Are you willing to pay for use of public toilets?	1. Yes	2. No		
E6	If yes, how much can you pay?	( ) Lek / time			
F. Health & Hygiene					
F1	Did any major illness suffered in your family in last one year?	1. Yes	2. No		
F2	If yes, which of following desease? (maximum 2)	1. Malaria	2. General Diarrhea	3.Skin disease	4.Typhoid
		5. Dysentery	6. Hepatitis	7. Others( )	
F3	When your household members get sick, what do you do? (first action)	1. Go to hospital	2. Go to the nearest health center	3. Go to a pharmacy to get medicines	4. Self medication and treatment
		5. Others( )			
F4	How much do you spend per month in average?	( ) Lek / month			
G. River Polllution					
G1	Do you think the water of Tirana and Lana Riveris polluted?	1. Yes	2. No (END)	3. Don't know (END)	
G2	Since how long have you identified that rivers' water has been polluted?	1. 3 years	2. 5 years	3. 10 years or more	4. Don't know
G3	What do you think is the major cause of pollution in the river? (maximum 2 answers)	1. Municipal solid waste	2. Untreated sewage flowing into the rivers	3. Open defecation / urination	4. Industrial waste water
		5. Don't know	6. Others ( )		
G4	What are the appropriate measures you suggest for reduction of rivers' pollution load? (maximum 2 answers)	1. Construction of sewage treatment plant	2. Construction of sewer lines	3. Construction of toilet facilities	4. Improving solid waste management mechanism
		5. Heightening public awareness on environmental & sanitation	6. Don't know	7. Others ( )	

Appendix 7

Sewerage Planning Fundamentals

Appendix 7 Sewerage Planning Fundamentals

7.1 MP Sewer Planning Fundamentals

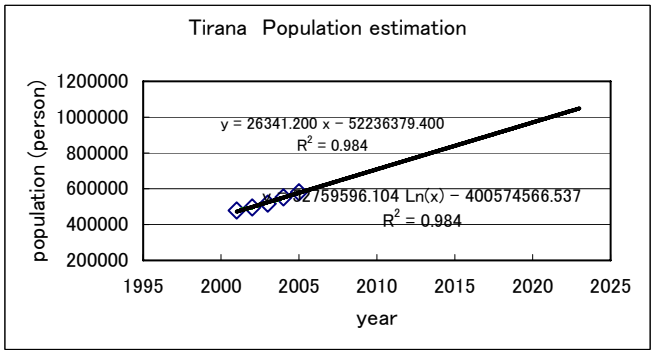
7.1.1 Population Estimation

(1) Civic Offices Register Population - 2001-2005(December) and estimation

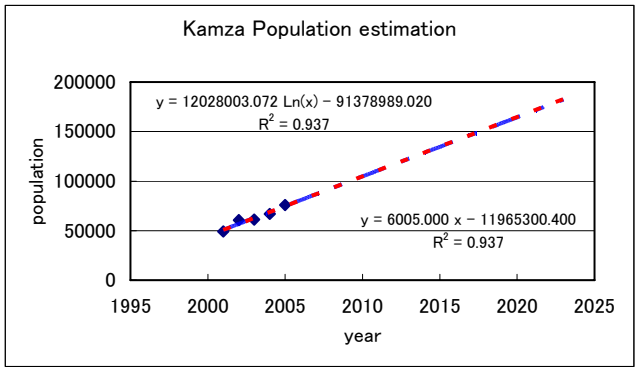
Town, Village		Static data					Estimation	WB	Estimation	
	2001 (Strategic P)	2001	2002	2003	2004	2005	2015	2017	2022	2004/2001
Tirana										
Unit 1		69,024	69,550	69,854	55,242	49,844				
Unit 2		35,845	38,480	42,050	55,317	67,780				
Unit 3		30,848	31,508	32,472	40,403	42,135				
Unit 4		55,378	56,900	57,816	63,829	65,243				
Unit 5		52,248	54,164	57,362	63,994	70,389				
Unit 6		43,676	45,386	50,085	55,652	59,444				
Unit 7		43,862	46,712	49,776	54,608	57,541				
Unit 8		34,635	35,350	36,104	35,871	36,923				
Unit 9		39,178	40,835	43,768	44,647	48,162				
Unit 10		23,361	23,755	24,287	25,000	25,592				
Unit 11		50,369	52,264	54,569	57,773	58,361				
Sub-Total	332,631	478,424	494,904	518,143	552,336	581,414	600,000	495,577	1,025,000	
Komuna Berxull										
Berxull		2,829	2,860	3,034	3,143	3,261				1.111
Domje		3,511	3,688	3,981	4,160	4,800				1.185
Mukaj		353	350	364	366	378				1.037
Sub-Total	12,041	6,693	6,898	7,379	7,669	8,439	13,000	----	16,000	
Komuna Kamez										
Qyteti Kamez		16,903	19,743	20,517	22,405	27,717				1.326
Valias 1		3,506	3,589	3,629	3,795	3,972				1.082
Valias i ri			2,559	2,593	2,794	3,433				
Laknas		5,182	7,363	6,877	7,363	7,843				1.421
Bathore		18,150	19,563	21,533	22,295	23,700				1.228
Frutikulturore		3,691	4,328	4,424	4,878	5,656				1.322
Bulcesh i ri		594	1,241	1,259	1,269	1,272				2.136
Mener		1,042	2,177	219	2,234	2,265				2.144
Sub-Total	44,552	49,068	60,563	61,051	67,033	75,858	135,000	147,494	180,000	
Komuna Kashar										
(Yzberisht)		3,614	3,581	3,403	3,225	3,141				0.892
(Yzberish 1)										
Mezez(koder)		3,825	3,944	4,090	4,230	5,095				1.106
Mezez(fushe)										
Yrshek		2,372	2,425	2,488	2,532	2,605				1.067
Katundi i ri		2,132	2,192	2,243	2,302	2,392				1.080
Kashar(1)		3,712	3,750	3,810	3,882	3,870				1.046
Kashar(2)										
Kusi		464	459	452	459	455				0.989
Mazrek		691	707	716	717	670				1.038
Sub-Total	21,029	16,810	17,058	17,202	17,347	18,228	30,000	94,095	25,000	
Komuna Paskuqan										
Paskuqan Nr.1		4,506	4,984	5,388	5,489	5,892				1.218
Babru Koder		1,811	1,903	1,968	1,974	2,073				1.090
Paskuqan i ri Fushe		4,265	4,505	4,682	4,814	5,108				1.129
Babru Qender		5,021	5,393	5,600	5,901	5,814				1.175
K.Kuqe		4,748	5,293	5,663	5,779	6,104				1.217
Shpati		2,323	2,512	2,627	2,710	2,927				1.167
F.Kercukut		2,301	2,422	2,567	2,599	2,878				1.130
Paskuqan i ri Koder		2,591	2,912	3,147	3,297	3,533				1.272
Sub-Total	21,592	27,566	29,924	31,642	32,563	34,329	40,000	95,774	84,000	
Total	431,845	578,561	609,347	635,417	676,948	718,268	818,000	832,940	1,330,000	

source data:Civic Office

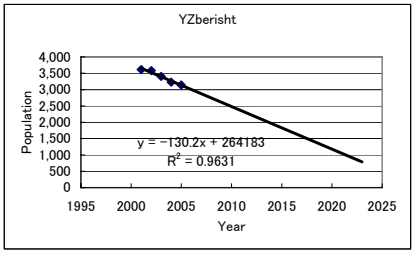
Tirana								
	2001	**2002**	**2003**	**2004**	**2005**	2015	2022	
Tirana	**478,424**	**494,904**	**518,143**	**552,336**	**581,414**			
	472,362	498,703	525,044	551,385	577,727	841,139	1,025,527	y = 26341.200 x - 52236379.400
	472,350	498,710	525,057	551,391	577,712	840,198	1,023,164	y=52759596.104 Ln(x) - 400574566.53

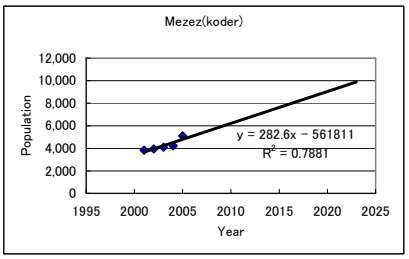


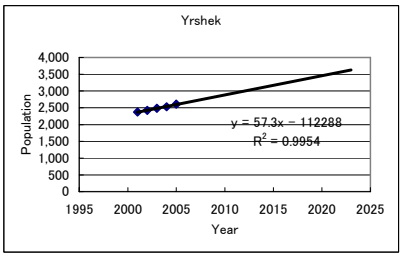
Kamza	**2001**	**2002**	**2003**	**2004**	**2005**	2015	2022	
	49068	60563	61051	67033	75858			
	50,705	56,710	62,715	68,720	74,725	134,775	176,810	y = 6005.000 x - 11965300.400
	50,702	56,711	62,718	68,721	74,722	134,563	176,275	y = 12028003.072 Ln(x) - 91378989.02

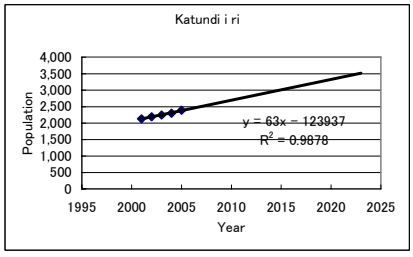


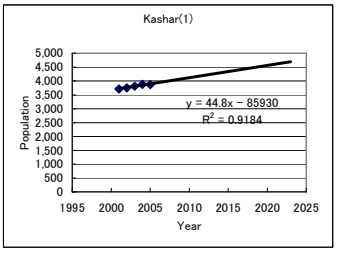
Komuna Kashar	**2001**	**2002**	**2003**	**2004**	**2005**	**2015**	**2022**			
	16,810	17,058	17,202	17,347	18,228					
	16,704	17,016	17,329	17,641	17,954	21,079	23,266		y = 312.5x - 608609	
	17,500	17,816	18,138	18,466	18,799	22,484	25,486		y = 5E-12e0.0179x	
Planning Area	**2001**	**2002**	**2003**	**2004**	**2005**	**2015**	**2022**	set population		
(Yzberisht)	3,614	3,581	3,403	3,225	3,141					
	3,653	3,523	3,392	3,262	**3,132**	1,830	919	**3,100**	y = -130.2x + 264183	keeping present population
Mezez(koder)	3,825	3,944	4,090	4,230	5,095					
	3,672	3,954	4,237	4,519	4,802	7,628	**9,606**	**9,700**	y = 282.6x - 561811	liner estimation
Yrshek	2,372	2,425	2,488	2,532	2,605					
	2,369	2,427	2,484	2,541	2,599	3,172	**3,573**	**3,600**	y = 57.3x - 112288	liner estimation
Katundi i ri	2,132	2,192	2,243	2,302	2,392					
	2,126	2,189	2,252	2,315	2,378	3,008	**3,449**	**3,500**	y = 63x - 123937	liner estimation
Kashar(1)	3,712	3,750	3,810	3,882	3,870					
	3,715	3,760	3,804	3,849	3,894	4,342	**4,656**	**4,700**	y = 44.8x - 85930	liner estimation
Kusi	464	459	452	459	455					
	461	460	458	456	454	436	**424**	**430**	y = -1.8x + 4063.2	liner estimation
Mazrek	691	707	716	717	670					
	707	703	700	697	694	662	**639**	**640**	y = -3.2x + 7109.8	liner estimation
								25,670		

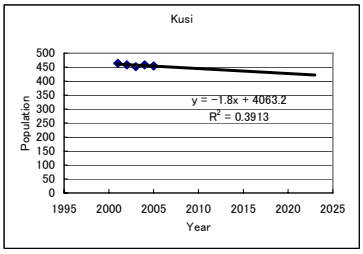


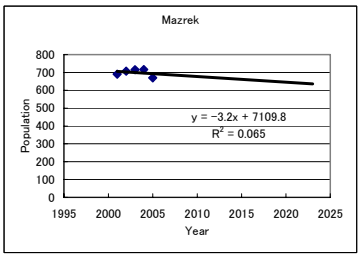




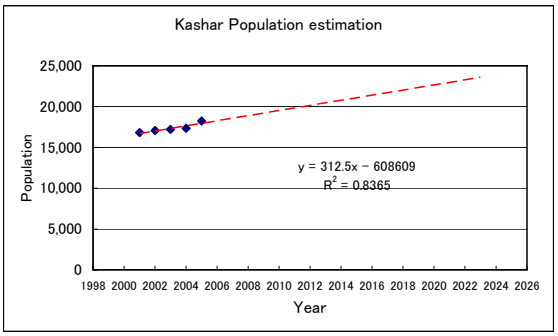


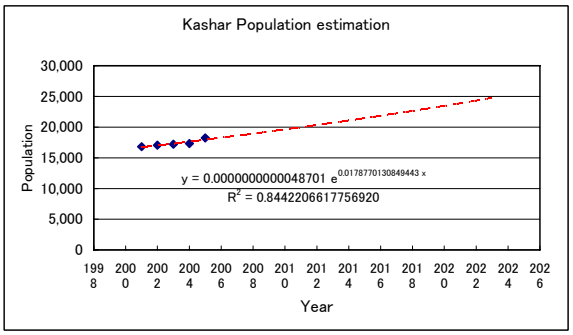






Komuna Kashar



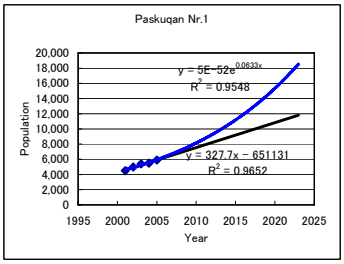


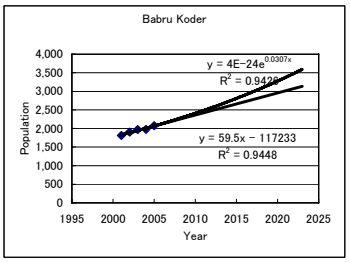
Paskuquan

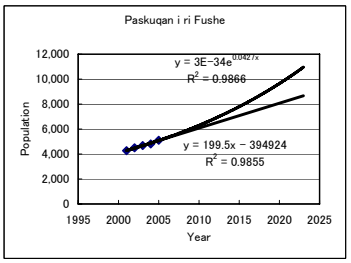
2001	2002	2003	2004	2005	2015	2022	
27,566	29,924	31,642	32,563	34,329			
27,972	29,588	31,205	32,821	34,438	50,603	61,918	y = 1616.500 x - 3206644.700
27,897	**29,394**	**30,973**	**32,636**	**34,388**	**58,015**	**83,664**	y = 9.6E-42e0.0523x

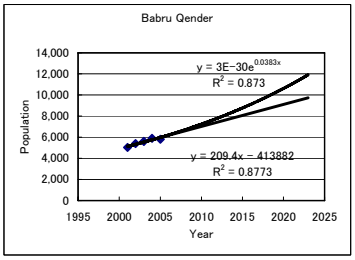
25,254 27,457 29,045 29,909 31,427

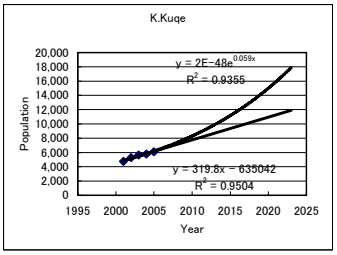
	2001	2002	2003	2004	2005	2015	2022	
Paskuqan Nr.1	4,506	4,984	5,388	5,489	5,892			Fomula
	4,600	4,900	5,300	5,600	5,900	9,200	11,500	y = 327.7x - 651131
	5,500	5,900	6,300	6,700	7,100	13,400	20,800	y = 5E-52e0.0633x
Babru Koder	1,811	1,903	1,968	1,974	2,073			Fomula
	1,800	1,900	1,900	2,000	2,100	2,700	3,100	y = 59.5x - 117233
	2,100	2,200	2,200	2,300	2,400	3,200	4,000	y = 4E-24e0.0307x
Paskuqan i ri Fushe	4,265	4,505	4,682	4,814	5,108			Fomula
	4,300	4,500	4,700	4,900	5,100	7,100	8,500	y = 199.5x - 394924
	4,400	4,500	4,700	4,900	5,200	7,900	10,700	y = 3E-34e0.0427x
Babru Qender	5,021	5,393	5,600	5,901	5,814			Fomula
	5,100	5,300	5,500	5,800	6,000	8,100	9,500	y = 209.4x - 413882
	6,500	6,800	7,100	7,300	7,600	11,200	14,600	y = 3E-30e0.0383x
K.Kuqe	4,748	5,293	5,663	5,779	6,104			Fomula
	4,900	5,200	5,500	5,800	6,200	9,400	11,600	y = 319.8x - 635042
	4,500	4,800	5,100	5,400	5,700	10,300	15,500	y = 2E-48e0.059x
Shpati	2,323	2,512	2,627	2,710	2,927			Fomula
	2,300	2,500	2,600	2,800	2,900	4,300	5,300	y = 140.6x - 279002
	2,200	2,300	2,500	2,600	2,700	4,700	6,800	y = 4E-44e0.0538x
F.Kercukut	2,301	2,422	2,567	2,599	2,878			Fomula
	2,300	2,400	2,600	2,700	2,800	4,200	5,100	y = 133.1x - 264046
	2,000	2,100	2,200	2,300	2,400	4,100	5,800	y = 2E-42e0.0518x
Paskuqan i ri Koder	2,591	2,912	3,147	3,297	3,533			Fomula
	2,600	2,900	3,100	3,300	3,500	5,800	7,400	y = 226.9x - 451385
	2,400	2,600	2,800	3,100	3,300	6,900	11,600	y = 5E-62e0.0744x
						50,800	62,000	
						61,700	**89,800**	**83,780**

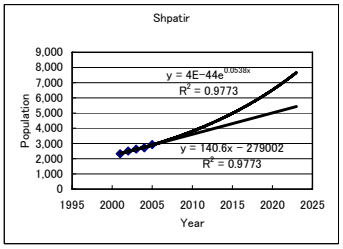


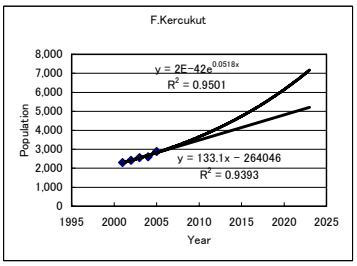


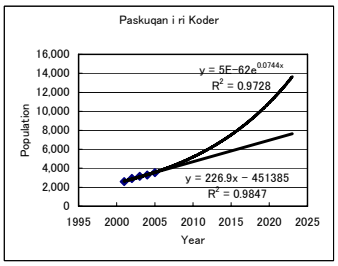


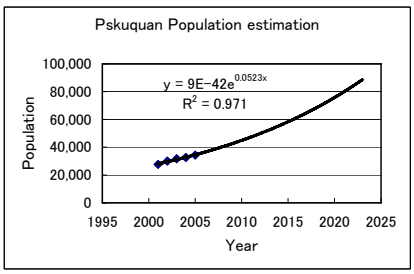


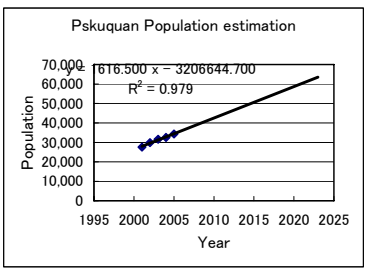


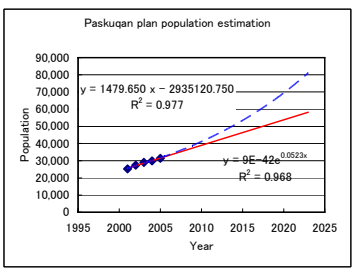








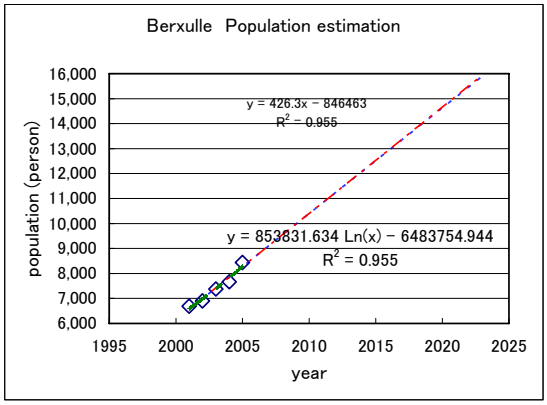


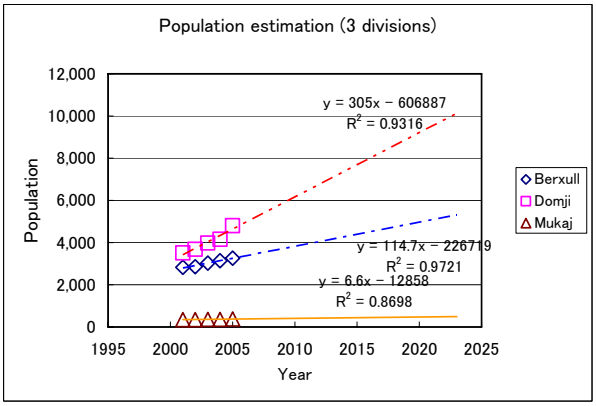


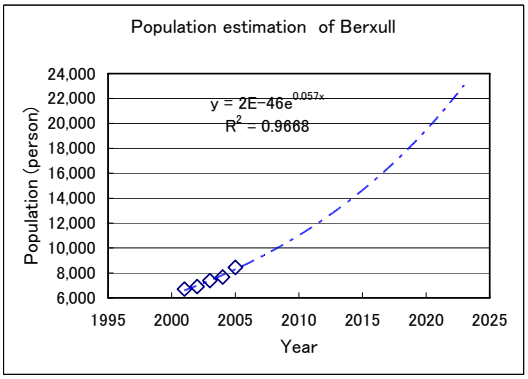
Komuna Berxull

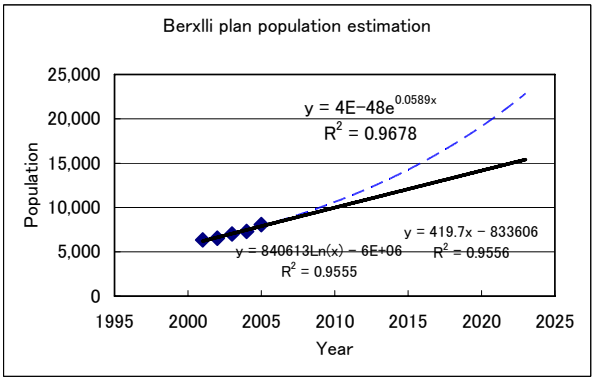
		2001	2002	2003	2004	2005	2015	2022		
Total estimation	Total	6,693	6,898	7,379	7,669	8,439				
		6,563	6,990	7,416	7,842	8,269	12,532	15,516	Liner regression	y = 426.3x - 846463
		6,566	6,992	7,419	7,845	8,271	12,519	15,480	Logarithmic regression	y = 853832Ln(x) - 6E+0
		6,845	7,246	7,671	8,121	8,598	15,203	22,657	Exponetial regression	y = 2E-46e0.057x
Total estimation		6,340	6,548	7,015	7,303	8,061				
		4,809	5,228	5,647	6,066	6,485	10,675	13,608	Liner regression	y = 419.7x - 833606
		6,131	6,503	6,897	7,316	7,760	13,985	21,121	Logarithmic regression	y = 4E-48e0.0589x
		6,193	6,613	7,033	7,452	7,872	12,054	14,969	Exponetial regression	y = 840612Ln(x) - 6383

		2001	2002	2003	2004	2005	2015	2022		
Divided estimation	Berxull	2,829	2,860	3,034	3,143	3,261	4,500	5,900		y = 114.7x - 226719
	Domje	3,511	3,688	3,981	4,160	4,800	7,700	9,900		y = 305x - 606887
		353	350	364	366	378	440	490		y = 6.6x - 12858
							12,640	16,290	**16,497**	









(2) Population estimation in Tirana, based on Strategic Plan by W.B 2001

City, Comu	neighberhood Code	Area (ha)	WB data (2001) Population	Calculated Density	2001 WB data Converted population density	popu	estimation setting density	Population	Basis for setting desity	Present condition
Tirana	C(a)	114.88	5,845	50.9	100.0	11,488	100.0	11,400	Less expectation of residential growth due to future development around Tirana railway station	Big market, old residetial area around Tirana railway station
	c(b)	50.33	0	0.0	100.0	5,033	200.0	10,000	Residential growth is progressing with houses and apartments	Commercial zone in front of Tirana Railway station, houses and low-rise aparments
	C(c)	8.49	0	0.0		0		0	Industrial area	Industrial zone
	c(d)	85.44	444	5.2	50.0	4,272	200.0	17,000	Residential growth is progressing with houses and apartments	Middle-rise and high-rise apartments and shops
	C(e)	25.78	0	0.0		0		0	Industrial area	Industrial zone
	c(f)	22.70	0	0.0		0	300.0	6,800	High rise buildings by re-development in old residential areas is	Old houses, poor houses, some new high-rise apartments
	C(g)	51.92	0	0.0	50.0	2,596	100.0	5,100	Residential growth is progressing with houses and apartments	Factories and houses
	c(h)	25.58	0	0.0		0	200.0	5,100	Future plan of development	Former airport, helicopter base at present
	C(i)	16.11	0	0.0		0		0	Industrial area	Industrial zone
	c(j)	20.92	0	0.0		0		0	Industrial area	Industrial zone
	C(k)	20.65	0	0.0		0		0	Industrial area	Industrial zone
	c1	217.74	39,182	179.9	200.0	43,548	200.0	43,000	High rise buildings by re-development in high density residential area is expected	Houses along side a main road in the east of Tirana railway station
	c10	37.98	854	22.5	30.0	1,139	30.0	1,100	Central park and official buildings are existing	Central square
	c11	102.09	38,481	**376.9**	380.0	38,794	380.0	**38,700**	Centrral zone of Tirana with high rise buildings	Central zone of Tirana, many shops, high-rise buildings and apartments
	c12	47.18	15,604	**330.7**	340.0	16,041	330.0	**15,500**	Centrral zone of Tirana with high rise buildings	Central zone of Tirana, many shops, high-rise buildings and apartments
	c13	47.55	14,967	**314.8**	320.0	15,216	320.0	**15,000**	Centrral zone of Tirana with high rise buildings	Central zone of Tirana, many shops, high-rise buildings and apartments
	c14	99.59	29,750	**298.7**	300.0	29,877	300.0	**29,800**	Centrral zone of Tirana with high rise buildings	Central zone of Tirana, many shops, high-rise buildings and apartments
	c15	67.71	22,006	**325.0**	330.0	22,344	330.0	**22,100**	Centrral zone of Tirana with high rise buildings	Central zone of Tirana, many shops, high-rise buildings and apartments
	c16	59.76	3,128	52.3	60.0	3,586	60.0	**3,500**	Centrral zone of Tirana with high rise buildings	Central zone of Tirana, many shops, high-rise buildings and apartments
	c17	88.97	40,570	**456.0**	460.0	40,926	460.0	**40,800**	Centrral zone of Tirana with high rise buildings	Central zone of Tirana, many shops, high-rise buildings and apartments
	c18	207.51	427	2.1	50.0	10,376	150.0	31,100	Residential growth is expected with houses and apartments	A large park, south of the central zone, university, small
	c19	207.93	6,660	32.0	50.0	10,397	150.0	31,100	Residential growth is expected with houses and apartments	Mountainious area, noth east of Tirana with houses
	c20	147.93	121	0.8	50.0	7,397	150.0	22,100	Residential growth is expected with houses and apartments	Mountainious area, noth east of Tirana with houses
	c2	193.40	26,628	137.7	200.0	38,680	200.0	38,600	High rise buildings by re-development in old residential areas is expected	Residential area, north east of Central Tirana at mid stream of the Lana River
	c3	280.67	6,161	22.0	50.0	14,034	150.0	42,100	Residential growth is progressing with houses and apartments	Houses in the east area of Central Tirana
	c4	227.59	15,979	70.2	100.0	22,759	150.0	34,100	Residential growth is progressing with houses and apartments	Residential area, south east of Cetral Tirana, foot of a
	c5	141.66	14,964	105.6	150.0	21,249	200.0	28,300	Expectation of higher density zoen with shops and small factories in future	Houses, south west of Central Tirana
	c6	194.90	9,858	50.6	150.0	29,235	200.0	38,900	Expectation of residential expansion until river side of the Lana River adding present high desnsity residents	Residential area, west of Central area
	c7	78.60	2,430	30.9	50.0	3,930	150.0	11,800	Expectation of increasing companies, factories, shops along side of the highway and residential area will be constructed behind them.	Houses along side of a high way
	P1	109.43	5,892	53.8	50.0	5,472	100.0	10,900		
	B1	177.07	7,852	44.3	50.0	8,854	100.0	17,700		
	c8	228.41	17,882	78.3	150.0	34,262	200.0	45,600	High rise buildings by re-development in old residential areas is	Residential area, norht west of Central Tirana
	c9	170.03	14,999	88.2	150.0	25,505	200.0	34,000	High rise buildings by re-development in old residential areas is expected	Residential area, south west of Central Tirana, south of a high way (excluding industrial zone)
	S(a)	12.00	0	0.0		0		0	Facilities	Facilities
	S(b)	14.41	0	0.0		0		0	Facilities	Facilities
	S1	488.03	5,691	11.7	50.0	24,402	150.0	49,000	Residential growth is progressing with houses and apartments	Houses existing dotted, developing area as residents
	Sub-Total	4,090.94	346,375	**84.7**	120.1	491,408	**171.2**	700,200		
			Population of statistic data in 2001			478,424				

Setting population density

50 persons/ha : Residential area with houses and low-rise apartments
100 persons/ha : High density residential area including commercial area
150 persons/ha : High-rise buildings by re-development in existing high density residential area (mainly low-rise apartments)
200 persons/ha : High-rise buildings by re-development in new areas or old residential area
300 persons/ha～ : Entral area of Tirana, high density of high-rise residential builings

(3) Population allocation to collection points

City,Comu	neighberhood Code	Area (ha)	WB data (2001) Population	Calculated Density	2001 WB data Converted population density	popu	estimation setting density	Population		Shared area No.6 Share	No.6 Area(ha)	No.1 Share	No.1 Area(ha)	No.2 Share	No.2 Area(ha)	No.3 Share	No.3 Area(ha)	No.5 Share	No.5 Area(ha)	Allocated population No.1	No.2	No.3	No.5	No.6
Tirana	C(a)	114.88	5,845	50.9	100.0	11,488	100.0	11,400	1.00	1.0	114.9									0	0	0	0	11,488
	c(b)	50.33	0	0.0	100.0	5,033	200.0	10,000	1.00	1.0	50.3									0	0	0	0	10,066
	C(c)	8.49	0	0.0		0		0	0.00											0	0	0	0	0
	c(d)	85.44	444	5.2	50.0	4,272	200.0	17,000	1.00	1.0	85.4									0	0	0	0	17,088
	C(e)	25.78	0	0.0		0		0	0.00											0	0	0	0	0
	c(f)	22.70	0	0.0		0	300.0	6,800	1.00			1.0	22.7							6,810	0	0	0	0
	C(g)	51.92	0	0.0	50.0	2,596	100.0	5,100	1.00							1.0	51.9			0	0	5,192	0	0
	c(h)	25.58	0	0.0		0	200.0	5,100	1.00	1.0	25.6									0	0	0	0	5,116
	C(i)	16.11	0	0.0		0		0	0.00											0	0	0	0	0
	c(j)	20.92	0	0.0		0		0	0.00											0	0	0	0	0
	C(k)	20.65	0	0.0		0		0	0.00											0	0	0	0	0
	c1	217.74	39,182	179.9	200.0	43,548	300.0	43,000	1.00	1.0	217.7									0	0	0	0	65,322
	c10	37.98	854	22.5	30.0	1,139	30.0	1,100	1.00	0.4	15.2			0.6	22.8					0	684	0	0	456
	c11	102.09	38,481	**376.9**	380.0	38,794	380.0	38,700	1.00			1.0	102.1							**38,794**	**0**	**0**	**0**	**0**
	c12	47.18	15,604	**330.7**	340.0	16,041	330.0	15,500	1.00	1.0	47.2									**0**	**0**	**0**	**0**	**15,569**
	c13	47.55	14,967	**314.8**	320.0	15,216	320.0	15,000	1.00	1.0	47.6									**0**	**0**	**0**	**0**	**15,216**
	c14	99.59	29,750	**298.7**	300.0	29,877	300.0	29,800	1.00	1.0	99.6									**0**	**0**	**0**	**0**	**29,877**
	c15	67.71	22,006	**325.0**	330.0	22,344	330.0	22,100	1.00	0.3	20.3	0.3	20.3	0.4	27.1					**6,703**	**8,938**	**0**	**0**	**6,703**
	c16	59.76	3,128	52.3	60.0	3,586	60.0	3,500	1.00					1.0	59.8					0	3,586	0	0	0
	c17	88.97	40,570	**456.0**	460.0	40,926	460.0	40,800	1.00					1.0	89.0					**0**	**40,926**	**0**	**0**	**0**
	c18	207.51	427	2.1	50.0	10,376	150.0	31,100	1.00					1.0	207.5					0	31,127	0	0	0
	c19	207.93	6,660	32.0	50.0	10,397	150.0	31,100	1.00	1.0	207.9									0	0	0	0	31,190
	c20	147.93	121	0.8	50.0	7,397	150.0	22,100	1.00	0.45	66.6	0.3	44.4	0.3	37.0					6,657	5,547	0	0	9,985
	c2	193.40	26,628	137.7	200.0	38,680	200.0	38,600	1.00	0.6	116.0	0.3	58.0	0.1	19.3					11,604	3,868	0	0	23,208
	c3	280.67	6,161	22.0	50.0	14,034	150.0	42,100	1.00					1.0	280.7					0	42,101	0	0	0
	c4	227.59	15,979	70.2	100.0	22,759	150.0	34,100	1.00					1.0	227.6					0	34,139	0	0	0
	c5	141.66	14,964	105.6	150.0	21,249	200.0	28,300	1.00					1.0	141.7					0	28,332	0	0	0
	c6	194.90	9,858	50.6	150.0	29,235	200.0	38,900	1.00	0.4	78.0	0.3	58.5					0.3	58.5	11,694	0	0	11,694	15,592
	c7	78.60	2,430	30.9	50.0	3,930	150	11,800	0.00											0	0	0	0	0
	P1	109.43	5,892	53.8	100.0	10,943	100	10,900																
	B1	177.07	7,852	44.3	50.0	8,854	100	17,700																
	c8	228.41	17,882	78.3	150.0	34,262	200.0	45,600	1.00	1.0	228.4									0	0	0	0	45,682
	c9	170.03	14,999	88.2	150.0	25,505	200.0	34,000	1.00					1.0	170.0					0	34,006	0	0	0
	S(a)	12.00	0	0.0		0		0	0.00											0	0	0	0	0
	S(b)	14.41	0	0.0		0		0	0.00											0	0	0	0	0
	S1	488.03	5,691	11.7	50.0	24,402	50.0	49,000	1.00					1.0	488.0					0	24,402	0	0	0
	Sub-Total	4,090.94	346,375	**84.7**	121.5	496,880	**171.2**	700,200	26.0	12.2	1,420.7	3.2	306.0	9.4	1,770.4	1.0	51.9	0.3	58.5	82,262	257,654	5,192	11,694	302,558

(4) Present population allocation to collection points

City,Comu	neighberhood Code	Area (ha)	WB data(2001) Population	Calculated Density	2001 WB data Converted population density	popu	2,005 Estimation	Estimation Setting density	Population		Shared area No.6 Share	No.6 Area(ha)	No.1 Share	No.1 Area(ha)	No.2 Share	No.2 Area(ha)	No.3 Share	No.3 Area(ha)	No.5 Share	No.5 Area(ha)	Allocated population No.1	No.2	No.3	No.5	No.6
Tirana	C(a)	114.88	5,845	50.9	100.0	11,488	15,244	132.7		1.00	1.0	114.9									0	0	0	0	15,244
	c(b)	50.33	0	0.0	100.0	5,033	0	0.0		1.00	1.0	50.3									0	0	0	0	0
	C(c)	8.49	0	0.0		0	0	0.0		0.00											0	0	0	0	0
	c(d)	85.44	444	5.2	50.0	4,272	1,800	21.1		1.00	1.0	85.4									0	0	0	0	1,800
	C(e)	25.78	0	0.0		0	0	0.0		0.00											0	0	0	0	0
	c(f)	22.70	0	0.0		0	0	0.0		1.00			1.0	22.7							0	0	0	0	0
	C(g)	51.92	0	0.0	50.0	2,596	0	0.0		1.00							1.0	51.9			0	0	0	0	0
	c(h)	25.58	0	0.0		0	0	0.0		1.00	1.0	25.6									0	0	0	0	0
	C(i)	16.11	0	0.0		0	0	0.0		0.00											0	0	0	0	0
	c(j)	20.92	0	0.0		0	0	0.0		0.00											0	0	0	0	0
	C(k)	20.65	0	0.0		0	0	0.0		0.00											0	0	0	0	0
	c1	217.74	39,182	179.9	200.0	43,548	43,550	200.0		1.00	1.0	217.7									0	0	0	0	43,550
	c10	37.98	854	22.5	30.0	1,139	1,140	30.0		1.00	0.4	15.2			0.6	22.8					0	684	0	0	456
	c11	102.09	38,481	**376.9**	380.0	38,794	38,800	380.1		1.00			1.0	102.1							**38,800**	**0**	**0**	**0**	**0**
	c12	47.18	15,604	**330.7**	340.0	16,041	16,050	340.2		1.00	1.0	47.2									**0**	**0**	**0**	**0**	**16,050**
	c13	47.55	14,967	**314.8**	320.0	15,216	15,220	320.1		1.00	1.0	47.6									**0**	**0**	**0**	**0**	**15,220**
	c14	99.59	29,750	**298.7**	300.0	29,877	29,880	300.0		1.00	1.0	99.6									**0**	**0**	**0**	**0**	**29,880**
	c15	67.71	22,006	**325.0**	330.0	22,344	22,350	330.1		1.00	0.3	20.3	0.3	20.3	0.4	27.1					**6,705**	**8,940**	**0**	**0**	**6,705**
	c16	59.76	3,128	52.3	60.0	3,586	3,590	60.1		1.00					1.0	59.8					0	3,590	0	0	0
	c17	88.97	40,570	**456.0**	460.0	40,926	40,930	460.0		1.00					1.0	89.0					**0**	**40,930**	**0**	**0**	**0**
	c18	207.51	427	2.1	50.0	10,376	2,300	11.1		1.00					1.0	207.5					0	2,300	0	0	0
	c19	207.93	6,660	32.0	50.0	10,397	17,369	83.5		1.00	1.0	207.9									0	0	0	0	17,369
	c20	147.93	121	0.8	50.0	7,397	500	3.4		1.00	0.45	66.6	0.3	44.4	0.3	37.0					150	125	0	0	225
	c2	193.40	26,628	137.7	200.0	38,680	69,446	359.1		1.00	0.6	116.0	0.3	58.0	0.1	19.3					20,834	6,945	0	0	41,668
	c3	280.67	6,161	22.0	50.0	14,034	16,068	57.2		1.00					1.0	280.7					0	16,068	0	0	0
	c4	227.59	15,979	70.2	100.0	22,759	33,340	146.5		1.00					1.0	227.6					0	33,340	0	0	0
	c5	141.66	14,964	105.6	150.0	21,249	39,026	275.5		1.00					1.0	141.7					0	39,026	0	0	0
	c6	194.90	9,858	50.6	150.0	29,235	20,570	105.5		1.00	0.4	78.0	0.3	58.5					0.3	58.5	6,171	0	0	6,171	8,228
	c7	78.60	2,430	30.9	50.0	3,930	9,510	121		0.00											0	0	0	0	0
	P1	109.43	5,892	53.8	100.0	10,943	21,520	197																	
	B1	177.07	7,852	44.3	50.0	8,854	26,630	150																	
	c8	228.41	17,882	78.3	150.0	34,262	37,310	163.3		1.00	1.0	228.4									0	0	0	0	37,310
	c9	170.03	14,999	88.2	150.0	25,505	43,030	253.1		1.00					1.0	170.0					0	43,030	0	0	0
	S(a)	12.00	0	0.0		0	0	0.0		0.00											0	0	0	0	0
	S(b)	14.41	0	0.0		0	0	0.0		0.00											0	0	0	0	0
	S1	488.03	5,691	11.7	50.0	24,402	16,240	33.3		1.00					1.0	488.0					0	16,240	0	0	0
	Sub-Total	4,090.94	346,375	**84.7**	121.5	496,880	581,414			26.0	12.2	1,420.7	3.2	306.0	9.4	1,770.4	1.0	51.9	0.3	58.5	72,660	211,218	0	6,171	233,705

7.1.2 Population estimation excluding Tirana

							Tirana11		634.6ha		1,000,000		
									42459人	-27360			
	Connection Point	Measurement data			average	set area data			Area	Weight	Allocated population	additional population	total
Tirana (outskirts)	5	33.4	33.3	33.2	33.300	33.3			33.3			11,694	11,694
	7	169.2	169.3	168.6	169.033	169.0			169.0	1.0	11,307		11,307
	9-1						Tirana1	0.3	40.2	1.0	2,689		2,689
	9-2						Tirana1	0.6	165.8	1.0	11,095		11,095
	KoderKamza	259.7	259.1	260.1	259.633	259.6			259.6	1.0	17,368		17,368
													42,459
Paskuqan	Plan populatio	84000.0											
	Area	842.4											
	8-0	60.3	60.7	60.9	60.633	60.6			60.6	1.0	6,043		6,043
	8-1	123.7	123.3	123.6	123.533	123.5			123.5	1.0	12,315		12,315
	8-2	146.9	146.5	146.6	146.667	146.7			146.7	1.0	14,628		14,628
	8-3	91.8	91.9	91.6	91.767	91.8			91.8	1.0	9,154		9,154
	8-4	308.8	309.4	308.7	308.967	309.0			309.0	1.0	30,812		30,812
	8-5	111.5	110.8	110.2	110.833	110.8			110.8	1.0	11,048		11,048
						842.4							84,000
										1.0	17,368		
Kashar	Plan populatio	50000人	Estimation	25000人									
			Development	15000人									
			Moving in	10000人									
	Area	1564.4ha							Area				
	4	143.6	143.4	143.4	143.467	143.5			143.5	1.0	2,293		2,293
	9-1	133.8	134.1	134.2	134.033	134.0	Kashar	0.7	93.8	1.0	1,499		1,499
	9-2	276.2	276.7	276.2	276.367	276.4	Kashar	0.4	110.6	1.0	1,767	15000	16,767
	10-1	241.6	241.6	242	241.733	241.7			241.7	1.0	3,862		3,862
	10-2	214.3	215.2	214.4	214.633	214.6			214.6	1.0	3,429	5000.0	8,429
	10-3	157.7	158.3	158.8	158.267	158.3			158.3	1.0	2,530	5000.0	7,530
	11	78.4	78.6	78.3	78.433	78.4			78.4	1.0	1,253		1,253
	12-1	68.4	69.1	68.5	68.667	68.7	Kashar	0.4	27.5	1.0	439		439
	12-2	44.1	44.5	44.8	44.467	44.5			44.5	1.0	711		711
	12-3	128.6	127.8	127.8	128.067	128.1			128.1	1.0	2,047		2,047
	13-1	131.7	131.3	131.1	131.367	131.4			131.4	1.0	2,100		2,100
	13-2	78.3	78.4	78.2	78.300	78.3			78.3	1.0	1,251		1,251
	20a-4	227.5	227.9	227.5	227.633	227.6	Kashar	0.5	113.8	1.0	1,819		1,819
						1554.4					25,000		50,000
Kamza													
	Plan populatio	150000.0											
	Area	2200.0											
	12-1						Kamza	0.6	41.2	1.0	2,810		2,810
	14-1	106.5	106.5	107.1	106.700	106.7			106.7	1.0	7,275		7,275
	14-2	263.5	264	264.3	263.933	263.9			263.9	1.0	17,993		17,993
	14-3	282.4	282	281.8	282.067	282.1			282.1	1.0	19,234		19,234
	15-1	119.6	119.5	119.7	119.600	119.6			119.6	1.0	8,155		8,155
	15-2	142.6	143.4	143.2	143.067	143.1			143.1	1.0	9,757		9,757
	16	39.4	39.4	39.2	39.333	39.3			39.3	1.0	2,680		2,680
	17-1	132.7	133.2	132.8	132.900	132.9			132.9	1.0	9,061		9,061
	17-2	94.3	94.1	94.9	94.433	94.4			94.4	1.0	6,436		6,436
	17-3	96	96.4	96	96.133	96.1			96.1	1.0	6,552		6,552
	17-4	121.6	121.6	121.6	121.600	121.6			121.6	1.0	8,291		8,291
	17-5	205.5	205.7	206.4	205.867	205.9			205.9	1.0	14,039		14,039
Pri-T(Km)	18	82.9	83	82.7	82.867	82.9			82.9	1.0	5,652		5,652
STP (Kamza)	19	86.6	85.9	86.9	86.467	86.5			86.5	1.0	5,898		5,898
	20a-1	151.5	151.9	151.8	151.733	151.7	Kamza	0.7	106.2	1.0	7,240		7,240
	20a-2	99.2	98.5	99.2	98.967	99.0			99.0	1.0	6,750		6,750
	20a-3	178.8	179	178.1	178.633	178.6			178.6	1.0	12,177		12,177
Berxull	Plan populatio	16000.0											150,000
	Area	450.4											
	20a-1						Berxull	0.3	45.5	1.0	1,617		1,617
	20a-4						Berxull	0.5	113.8	1.0	4,043		4,043
	20b-1	199.1	100.9	100.3	133.433	133.4			133.4	1.0	4,739		4,739
	20b-2	157.5	158	157.7	157.733	157.7			157.7	1.0	5,602		5,602
													16,000
													300,000

7.1.3 Collection area setting and flow calculation

								Unit flow 250L/d/p	310L/d/p	440L/d/p
City,comu	Connection Point	Measurement data			average	set area data	Population	Daily average (m3/d)	Daily maxmum (m3/d)	Houry maxmum (m3/d)
Kashar	**No.4**	143.6	143.4	143.4	143.467	**143.5**	**2,293**	**573**	**711**	**1,009**
Tirana	**No.5**	33.4	33.3	33.2	33.300	**33.3**	**11,694**	**2,924**	**3,625**	**5,145**
	No.7	169.2	169.3	168.6	169.033	**169.0**	**11,307**	**2,827**	**3,505**	**4,975**
Paskuqan	8-0	60.3	60.7	60.9	60.633	60.6	6,043	1,511	1,873	2,659
	8-1	123.7	123.3	123.6	123.533	123.5	12,315	3,079	3,818	5,419
	8-2	146.9	146.5	146.6	146.667	146.7	14,628	3,657	4,535	6,436
	8-3	91.8	91.9	91.6	91.767	91.8	9,154	2,288	2,838	4,028
	8-4	308.8	309.4	308.7	308.967	309.0	30,812	7,703	9,552	13,557
	8-5	111.5	110.8	110.2	110.833	110.8	11,048	2,762	3,425	4,861
						842.4	84,000	21,000	26,041	36,960
	8KoderKamza	259.7	259.1	260.1	259.633	259.6	17,368	4,342	5,384	7,642
	No.8					**1,102.0**	**101,368**	**25,342**	**31,425**	**44,602**
Kashar	9-1	133.8	134.1	134.2	134.033	134.0	4,188	1,047	1,298	1,843
	9-2	276.2	276.7	276.2	276.367	276.4	27,862	6,965	8,637	12,259
	No.9					**410.4**	**32,050**	**8,012**	**9,935**	**14,102**
	10-1	241.6	241.6	242	241.733	241.7	3,862	966	1,197	1,699
	10-2	214.3	215.2	214.4	214.633	214.6	8,429	2,107	2,613	3,709
	10-3	157.7	158.3	158.8	158.267	158.3	7,530	1,882	2,334	3,313
	No.10					**614.6**	**19,821**	**4,955**	**6,144**	**8,721**
	No.11	78.4	78.6	78.3	78.433	78.4	**1,253**	**313**	**388**	**551**
	12-1	68.4	69.1	68.5	68.667	68.7	3,250	812	1,007	1,430
	12-2	44.1	44.5	44.8	44.467	44.5	711	178	220	313
	12-3	128.6	127.8	127.8	128.067	128.1	2,047	512	635	901
	No.12					**241.3**	**6,007.8**	**1,502.0**	**1,862.0**	**2,644**
	13-1	131.7	131.3	131.1	131.367	131.4	2,100	525	651	924
	13-2	78.3	78.4	78.2	78.300	78.3	1,251	313	388	551
	No.13					**209.7**	**3,351**	**838**	**1,039**	**1,475**
Kamza	14-1	106.5	106.5	107.1	106.700	106.7	7,275	1,819	2,255	3,201
	14-2	263.5	264	264.3	263.933	263.9	17,993	4,498	5,578	7,917
	14-3	282.4	282	281.8	282.067	282.1	19,234	4,809	5,963	8,463
	No.14					**652.7**	**44,502**	**11,126**	**13,796**	**19,581**
	15-1	119.6	119.5	119.7	119.600	119.6	8,155	2,039	2,528	3,588
	15-2	142.6	143.4	143.2	143.067	143.1	9,757	2,439	3,025	4,293
	No.15					**262.7**	**17,911**	**4,478**	**5,553**	**7,881**
	No.16	39.4	39.4	39.2	39.333	**39.3**	**2,680**	**670**	**831**	**1,179**
	17-1	132.7	133.2	132.8	132.900	132.9	9,061	2,265	2,809	3,987
	17-2	94.3	94.1	94.9	94.433	94.4	6,436	1,609	1,995	2,832
	17-3	96	96.4	96	96.133	96.1	6,552	1,638	2,031	2,883
	17-4	121.6	121.6	121.6	121.600	121.6	8,291	2,073	2,570	3,648
	17-5	205.5	205.7	206.4	205.867	205.9	14,039	3,510	4,352	6,177
	No.17					**650.9**	**44,379**	**11,095**	**13,757**	**19,527**
Pri-T(Km)	**No.18**	82.9	83	82.7	82.867	**82.9**	**5,652**	**1,413**	**1,752**	**2,487**
STP	**No.19**	86.6	85.9	86.9	86.467	**86.5**	**5,898**	**1,474**	**1,828**	**2,595**
(Kamza)	20a-1	151.5	151.9	151.8	151.733	151.7	8,857	2,214	2,746	3,897
	20a-2	99.2	98.5	99.2	98.967	99.0	6,750	1,687	2,092	2,970
	20a-3	178.8	179	178.1	178.633	178.6	12,177	3,044	3,775	5,358
	20a-4	227.5	227.9	227.5	227.633	227.6	4,043	1,011	1,253	1,779
Berxull	20b-1	199.1	100.9	100.3	133.433	133.4	4,739	1,185	1,469	2,085
	20b-2	157.5	158	157.7	157.733	157.7	5,602	1,401	1,737	2,465
	No.20					**948.0**	**42,167**	**10,542**	**13,072**	**18,554**
						5,725	352,334	88,084	109,223	155,028
				Tirana(No.5,7)		202	23,001		7,130	
				N0.1,2,3,6		3,549	647,666		200,777	
				Total		9,274	1,000,000		310,000	

7.2 FS Sewer Planning Fundamentals

7.2.1 Population Estimation for Feasibility Study

(1) Population estimation of Tirana in 2013

City,Comu	Neighberhood Code	Area (ha)	WB data(2001) Population	Clculated Density	2001 WB data Converted population density	2001 WB data Converted population Population	Estimation 2022 Setting density	Estimation 2022 Population	estimation 2013 Setting density	estimation 2013 Population
	C(a)	114.88	5,845	50.9	100.0	11,488	100.0	11,400	100.0	11,400
Tirana	c(b)	50.33	0	0.0	100.0	5,033	200.0	10,000	160.0	8,000
	C(c)	8.49	0	0.0		0		0		0
	c(d)	85.44	444	5.2	50.0	4,272	200.0	17,000	140.0	11,900
	C(e)	25.78	0	0.0		0		0		0
	c(f)	22.70	0	0.0		0	300.0	6,800	170.0	3,800
	C(g)	51.92	0	0.0	50.0	2,596	100.0	5,100	80.0	4,100
	c(h)	25.58	0	0.0		0	200.0	5,100	110.0	2,800
	C(i)	16.11	0	0.0		0		0		0
	c(j)	20.92	0	0.0		0		0		0
	C(k)	20.65	0	0.0		0		0		0
	c1	217.74	39,182	179.9	200.0	43,548	200.0	43,000	200.0	43,000
	c10	37.98	854	22.5	30.0	1,139	30.0	1,100	30.0	1,100
	c11	102.09	38,481	376.9	380.0	38,794	380.0	38,700	380.0	38,700
	c12	47.18	15,604	330.7	340.0	16,041	330.0	15,500	330.0	15,500
	c13	47.55	14,967	314.8	320.0	15,216	320.0	15,000	320.0	15,000
	c14	99.59	29,750	298.7	300.0	29,877	300.0	29,800	300.0	29,800
	c15	67.71	22,006	325.0	330.0	22,344	330.0	22,100	330.0	22,100
	c16	59.76	3,128	52.3	60.0	3,586	60.0	3,500	60.0	3,500
	c17	88.97	40,570	456.0	460.0	40,926	460.0	40,800	460.0	40,800
	c18	207.51	427	2.1	50.0	10,376	150.0	31,100	110.0	22,800
	c19	207.93	6,660	32.0	50.0	10,397	150.0	31,100	110.0	22,800
	c20	147.93	121	0.8	50.0	7,397	150.0	22,100	110.0	16,200
	c2	193.40	26,628	137.7	200.0	38,680	200.0	38,600	200.0	38,600
	c3	280.67	6,161	22.0	50.0	14,034	150.0	42,100	110.0	30,800
	c4	227.59	15,979	70.2	100.0	22,759	150.0	34,100	130.0	29,500
	c5	141.66	14,964	105.6	150.0	21,249	200.0	28,300	180.0	25,400
	c6	194.90	9,858	50.6	150.0	29,235	200.0	38,900	180.0	35,000
	c7	78.60	2,430	30.9	50.0	3,930	150.0	11,800	110.0	8,600
	P1	109.43	5,892	53.8	50.0	5,472	100.0	10,900	80.0	8,700
	B1	177.07	7,852	44.3	50.0	8,854	100.0	17,700	80.0	14,100
	c8	228.41	17,882	78.3	150.0	34,262	200.0	45,600	180.0	41,100
	c9	170.03	14,999	88.2	150.0	25,505	200.0	34,000	180.0	30,600
	S(a)	12.00	0	0.0		0		0		0
	S(b)	14.41	0	0.0		0		0		0
	S1	488.03	5,691	11.7	50.0	24,402	150.0	49,000	110.0	35,900
	Sub-Tota	4,090.94	346,375	84.7	120.1	491,408	171.2	700,200	149.5	611,600
			Population of statistic data in 2001			478,424				
								C7,P1,B1,C8		C7,P1,B1,C8
			34,056			52,517		86,000		72,500
								70,300		59,300
								for "Trunk Sewe Cost Estimation -3d-FS"		

Setting population density

50 persons/ha : Residential area with houses and low-rise apartments
100 persons/ha : High density residential area including commercial area
150 persons/ha : High-rise buildings by re-development in existing high density residential area (mainly low-rise apartments)
200 persons/ha : High-rise buildings by re-development in new areas or old residential area
300 persons/ha～ : Entral area of Tirana, high density of high-rise residential builings

(2) Population allocation to collection points for Feasibility Study

City,Comu	Neighberhood Code	Area (ha)	WB data (2001) Population	Calculated Density	2001 WB data Converted population density	Converted population Population	Estimation 2013 Setting density	Population	Shared area No.6 Share	No.6 Area(ha)	No.1 Share	No.1 Area(ha)	No.2 Share	No.2 Area(ha)	No.3 Share	No.3 Area(ha)	No.5 Share	No.5 Area(ha)	Population No.1	No.2	No.3	No.5	No.6
Tirana	C(a)	114.88	5,845	50.9	100.0	11,488	100.0	11,400	1.0	114.9									0	0	0	0	11,488
	c(b)	50.33	0	0.0	100.0	5,033	160.0	8,000	1.0	50.3									0	0	0	0	8,053
	C(c)	8.49	0	0.0		0	0.0	0											0	0	0	0	0
	c(d)	85.44	444	5.2	50.0	4,272	140.0	11,900	1.0	85.4									0	0	0	0	11,962
	C(e)	25.78	0	0.0		0	0.0	0											0	0	0	0	0
	c(f)	22.70	0	0.0		0	170.0	3,800			1.0	22.7							3,859	0	0	0	0
	C(g)	51.92	0	0.0	50.0	2,596	80.0	4,100							1.0	51.9			0	0	4,154	0	0
	c(h)	25.58	0	0.0		0	110.0	2,800	1.0	25.6									0	0	0	0	2,814
	C(i)	16.11	0	0.0		0	0.0	0											0	0	0	0	0
	c(j)	20.92	0	0.0		0	0.0	0											0	0	0	0	0
	C(k)	20.65	0	0.0		0	0.0	0											0	0	0	0	0
	c1	217.74	39,182	179.9	200.0	43,548	200.0	43,000	1.0	217.7									0	0	0	0	43,548
	c10	37.98	854	22.5	30.0	1,139	30.0	1,100	0.4	15.2			0.6	22.8					0	684	0	0	456
	c11	102.09	38,481	**376.9**	380.0	38,794	380.0	38,700			1.0	102.1							**38,794**	**0**	**0**	**0**	**0**
	c12	47.18	15,604	**330.7**	340.0	16,041	330.0	15,500	1.0	47.2									**0**	**0**	**0**	**0**	**15,569**
	c13	47.55	14,967	**314.8**	320.0	15,216	320.0	15,000	1.0	47.6									**0**	**0**	**0**	**0**	**15,216**
	c14	99.59	29,750	**298.7**	300.0	29,877	300.0	29,800	1.0	99.6									**0**	**0**	**0**	**0**	**29,877**
	c15	67.71	22,006	**325.0**	330.0	22,344	330.0	22,100	0.3	20.3	0.3	20.3	0.4	27.1					**6,703**	**8,938**	**0**	**0**	**6,703**
	c16	59.76	3,128	52.3	60.0	3,586	60.0	3,500					1.0	59.8					0	3,586	0	0	0
	c17	88.97	40,570	**456.0**	460.0	40,926	460.0	40,800					1.0	89.0					**0**	**40,926**	**0**	**0**	**0**
	c18	207.51	427	2.1	50.0	10,376	110.0	22,800					1.0	207.5					0	22,826	0	0	0
	c19	207.93	6,660	32.0	50.0	10,397	110.0	22,800	1.0	207.9									0	0	0	0	22,872
	c20	147.93	121	0.8	50.0	7,397	110.0	16,200	0.45	66.6	0.3	44.4	0.3	37.0					4,882	4,068	0	0	7,323
	c2	193.40	26,628	137.7	200.0	38,680	200.0	38,600	0.6	116.0	0.3	58.0	0.1	19.3					11,604	3,868	0	0	23,208
	c3	280.67	6,161	22.0	50.0	14,034	110.0	30,800					1.0	280.7					0	30,874	0	0	0
	c4	227.59	15,979	70.2	100.0	22,759	130.0	29,500					1.0	227.6					0	29,587	0	0	0
	c5	141.66	14,964	105.6	150.0	21,249	180.0	25,400					1.0	141.7					0	25,499	0	0	0
	c6	194.90	9,858	50.6	150.0	29,235	180.0	35,000	0.4	78.0	0.3	58.5					0.3	58.5	10,525	0	0	10,525	14,033
	c7	78.60	2,430	30.9	50.0	3,930	110	8,600											0	0	0	0	0
	P1	109.43	5,892	53.8	100.0	10,943	80	8,700															
	B1	177.07	7,852	44.3	50.0	8,854	80	14,100															
	c8	228.41	17,882	78.3	150.0	34,262	180.0	**41,100**	1.0	228.4									0	0	0	0	41,114
	c9	170.03	14,999	88.2	150.0	25,505	180.0	30,600					1.0	170.0					0	30,605	0	0	0
	S(a)	12.00	0	0.0		0	0.0	0											0	0	0	0	0
	S(b)	14.41	0	0.0		0	0.0	0											0	0	0	0	0
	S1	488.03	5,691	11.7	50.0	24,402	110.0	35,900					1.0	488.0					0	53,683	0	0	0
	Sub-Total	4,090.94	346,375	**84.7**	121.5	496,880	**149.5**	611,600	12.2	1,420.7	3.2	306.0	9.4	1,770.4	1.0	51.9	0.3	58.5	76,367	255,143	4,154	10,525	254,235
		118.36	Population of statistic data in 2001			478,424												3,607.5					600,423

7.2.2 FS Population Estimation and Flow Calculation

Year 2013

	Unit sewage flow		225L/d/p	280L/d/p	400L/d/p
Connection No.	Area(ha)	Population	Sewage flow(m3/d)		
			Daily average	Daily Max	Hourly Max
1	306	76,367	17,183	21,383	30,547
2	1,770	255,143	57,407	71,440	102,057
3	52	4,154	935	1,163	1,661
10-2	215	6,812	1,533	1,907	2,725
Total-1	2,343	342,475	77,058	95,893	136,990